

# DP83822 堅牢、低消費電力 10/100Mbps イーサネット物理層トランシーバ

## 1 特長

- 極めて堅牢な 10/100Mbps PHY
  - IEC 61000-4-2 ESD: +/- 8KV 接触放電
  - IEC 61000-4-4 EFT: クラス A, 4kV
  - CISPR 22 伝導エミッション: クラス B
  - CISPR 22 放射エミッション: クラス B
  - 動作温度: -40°C ~ 125°C
- MAC インターフェイス: RGMII / RMII / MII
- IEEE 802.3u 準拠: 100BASE-FX, 100BASE-TX, 10BASE-Te
- フレキシブルな電源オプション
  - 低消費電力の単電源オプション
    - 1.8V AVD < 120mW
    - 3.3V AVD < 220mW
  - 利用可能な I/O 電圧: 3.3V/2.5V/1.8V
- 省電力機能
  - Energy Efficient Ethernet (EEE) IEEE 802.3az
  - WoL (Wake-on-LAN) サポートとマジック・パケット検出
  - 複数の省エネ・モードをプログラム可能
- IEEE 1588 のタイム・スタンプに対応するフレーム開始検出
- 診断ツール: ケーブル診断、BIST (組み込みセルフテスト)、ループバック、高速リンク・ダウン検出
- 強制モードでの自動クロスオーバー

## 2 アプリケーション

- モーター・ドライブ
- ファクトリ・オートメーション、ロボットおよびモーション制御
- グリッド・インフラストラクチャ
- ビル・オートメーション
- 産業用イーサネット・フィールドバス
- PROFINET® などのリアルタイム産業用イーサネット・アプリケーション

## 3 概要

DP83822 は、過酷な産業用環境に設計された、極めて堅牢で低消費電力のシングル・ポート 10/100Mbps イーサネット PHY です。DP83822 には、標準のツイストペア・ケーブルを介してデータを送受信したり、外部の光ファイバ・トランシーバに接続するために必要なすべての物理層機能が搭載されています。さらに、DP83822 は、標準の MII, RMII, RGMII インターフェイスを介して MAC に接続できる柔軟性を提供します。

DP83822 には、ケーブル診断ツール、組み込みセルフテスト、ループバック機能が内蔵されており、簡単に使用できます。本デバイスは、高速リンクダウン検出機能付きの複数の産業用フィールドバス、および強制モードの Auto-MDIX をサポートします。

DP83822 は、優れた、かつ堅牢な手法により、EEE、WoL、その他プログラム可能な省エネ・モードを使用して消費電力を削減します。

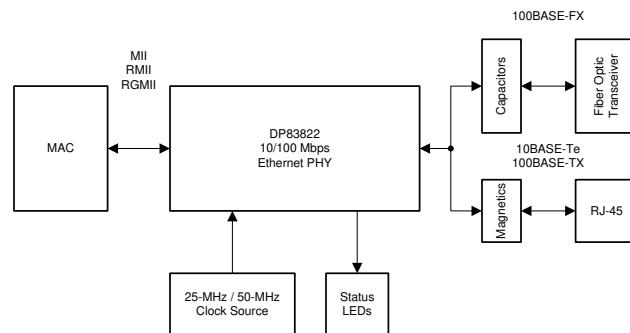
DP83822 は、豊富な機能を持ち、ピンごとにアップグレード可能な、TLK105、TLK106、TLK105L、TLK106L 10/100Mbps イーサネット PHY 向けのオプションです。

DP83822 は、32 ピン、5.00mm × 5.00mm の VQFN パッケージで供給されます。

### 製品情報

| 部品番号      | パッケージ <sup>(1)</sup> | 本体サイズ (公称)      |
|-----------|----------------------|-----------------|
| DP83822HF | VQFN (32)            | 5.00mm × 5.00mm |
| DP83822H  | VQFN (32)            | 5.00mm × 5.00mm |
| DP83822IF | VQFN (32)            | 5.00mm × 5.00mm |
| DP83822I  | VQFN (32)            | 5.00mm × 5.00mm |

(1) 利用可能なパッケージについては、データシートの末尾にある注文情報を参照してください。



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### 概略回路図



## Table of Contents

|  |    |  |     |
|--|----|--|-----|
| <b>1 特長</b> .....  | 1  | 7.19 10BASE-Te Jabber Timing.....  | 16  |
| <b>2 アプリケーション</b> .....  | 1  | 7.20 100BASE-TX Transmit Latency Timing.....                             | 16  |
| <b>3 概要</b> .....  | 1  | 7.21 100BASE-TX Receive Latency Timing.....                              | 16  |
| <b>4 Revision History</b> .....                                  | 2  | 7.22 Timing Diagrams.....  | 17  |
| <b>5 Device Comparison Table</b> .....                           | 5  | 7.23 Typical Characteristics.....  | 24  |
| <b>6 Pin Configuration and Functions</b> .....                   | 5  | <b>8 Detailed Description</b> .....                                      | 25  |
| <b>7 Specifications</b> .....                                    | 10 | 8.1 Overview.....  | 25  |
| 7.1 Absolute Maximum Ratings.....                                | 10 | 8.2 Functional Block Diagram.....  | 26  |
| 7.2 ESD Ratings.....   | 10 | 8.3 Feature Description.....   | 27  |
| 7.3 Recommended Operating Conditions.....                        | 10 | 8.4 Device Functional Modes.....   | 30  |
| 7.4 Thermal Information.....                                     | 11 | 8.5 Programming.....   | 48  |
| 7.5 Electrical Characteristics.....                              | 11 | 8.6 Register Maps.....   | 54  |
| 7.6 Timing Requirements, Power-Up Timing.....                    | 12 | <b>9 Application and Implementation</b> .....                            | 105 |
| 7.7 Timing Requirements, Power-Up With Unstable<br>XI Clock..... | 13 | 9.1 Application Information.....   | 105 |
| 7.8 Timing Requirements, Reset Timing.....                       | 13 | 9.2 Typical Applications.....  | 105 |
| 7.9 Timing Requirements, Serial Management Timing... ..          | 13 | <b>10 Power Supply Recommendations</b> .....                             | 111 |
| 7.10 Timing Requirements, 100 Mbps MII Transmit<br>Timing.....   | 13 | 10.1 Power Supply Characteristics.....                                   | 111 |
| 7.11 Timing Requirements, 100 Mbps MII Receive<br>Timing.....    | 13 | <b>11 Layout</b> .....   | 116 |
| 7.12 Timing Requirements, 10 Mbps MII Transmit<br>Timing.....    | 14 | 11.1 Layout Guidelines.....  | 116 |
| 7.13 Timing Requirements, 10 Mbps MII Receive<br>Timing.....     | 14 | 11.2 Layout Example.....   | 119 |
| 7.14 Timing Requirements, RMII Transmit Timing.....              | 15 | <b>12 Device and Documentation Support</b> .....                         | 120 |
| 7.15 Timing Requirements, RMII Receive Timing.....               | 15 | 12.1 Related Links.....  | 120 |
| 7.16 Timing Requirements, RGMII.....                             | 15 | 12.2 ドキュメントの更新通知を受け取る方法.....   | 120 |
| 7.17 Normal Link Pulse Timing.....                               | 16 | 12.3 サポート・リソース.....  | 120 |
| 7.18 Auto-Negotiation Fast Link Pulse (FLP) Timing.....          | 16 | 12.4 Trademarks.....   | 120 |
|  |    | 12.5 静電気放電に関する注意事項.....  | 120 |
|  |    | 12.6 用語集.....  | 120 |
|  |    | <b>13 Mechanical, Packaging, and Orderable<br/>    Information</b> ..... | 121 |
|  |    | 13.1 Package Option Addendum.....  | 122 |

## 4 Revision History

資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

| <b>Changes from Revision F (June 2021) to Revision G (August 2023)</b>                         | <b>Page</b> |
|--|-------------|
| • IEC 6100 を IEC 61000 に訂正.....  | 1           |
| • Changed Language in LED pins from 'Mode' to 'Function'.....                                  | 5           |
| • Changed 'Other Inputs' Max rating from 3.8 to 'VDDIO + 0.3V'.....                            | 10          |
| • Added last sentence and register write list. "After enabling/setting the RX_SFD..." etc..... | 29          |
| • Third & fourth paragraph added. ....   | 40          |
| • Added LED_1 . ....   | 48          |
| • Changed details of register 0x0018 to say LED instead of LED_0 for bits 10:9 .....           | 54          |
| • Changed the details of register 0x0027 to include Harmonics Compliance Test note.....        | 54          |
| • Updated details of register 0x0040; added bit 13 description.....                            | 54          |
| • Changed Pin 1 Quadrant from Q2 to Q1.....  | 124         |

| <b>Changes from Revision E (March 2019) to Revision F (June 2021)</b>                   | <b>Page</b> |
|---|-------------|
| • 文書全体にわたって表、図、相互参照の採番方法を更新.....  | 1           |
| • 主な機能を強調するために特長セクションを更新。.....  | 1           |
| • 商標を追加.....  | 1           |
| • Added clarification on Tx_CLK state in reset in pin function table.....               | 5           |
| • Added clarification on TX_CLK state in reset in IO Pins State During Reset table..... | 5           |
| • Added 100BASE-FX output parameters .....  | 11          |

|   |     |
|---|-----|
| • Added AVO footnote.....   | 12  |
| • Added timing requirement for reset after stabilization of XI clock. ....  | 13  |
| • Added RMII transmit latency number .....  | 16  |
| • Added RGMII transmit latency number .....   | 16  |
| • Added RMII receive latency number.....  | 16  |
| • Added RGMII receive latency number.....   | 16  |
| • Updated details of earlier "reserved" bits of register 0x000B and 0x003F.....   | 54  |
| • Updated description for register 0x0015 and 0x001C.....   | 54  |
| • Added register description of following registers:<br>0x101,0x0106,0x0107,0x0126,0x04D4,0x0121,0x0122,0x0124,0x010F,0x0111,0x0129,0x0130,0x0410,0x041<br>6,0x0418,0x0450,0x040D ,0x041F,0x0421..... | 54  |
| • Added further information to registers 0x0000,0x0001,0x0469,0x0703C.....  | 54  |
| • Updated default values for registers<br>:0x0008,0x000A,0x0010,0x0017,0x001E,0x0155,0x0215,0x0462,0x3000,0x3001,0x3014,0x3016.....   | 54  |
| • Changed TPI network diagram to include optional ferrite bead for EMC improvement.....   | 106 |

**Changes from Revision D (March 2019) to Revision E (March 2019) Page**

|   |   |
|---|---|
| • Changed to fix typos on Table 1 ..... | 5 |
|---|---|

**Changes from Revision C (April 2018) to Revision D (March 2019) Page**

|  |     |
|--|-----|
| • Changed the description for LED_1 in Pin Functions table.....  | 5   |
| • Changed reset pin state for RX_D[3:0] and LED_1 pins in IO Pins State During Reset.....                          | 5   |
| • Added XO and XI capacitance.....   | 11  |
| • Added Test Conditions to PMD OUTPUT section of the Electrical Characteristics Table.....                         | 11  |
| • Changed Parameter descriptions and units in Reset Timing Requirements table to match device<br>performance.....  | 13  |
| • Changed NOTE for 100BASE-FX Signal Detect pin polarity from Active LOW to Active HIGH.....                       | 41  |
| • Changed LED_0 strap modes to remove Mode 2 and Mode 3. ....  | 48  |
| • Changed strap description for SD_EN pin from Active LOW to Active HIGH.....                                      | 48  |
| • Deleted LED_0 configuration table.....   | 48  |
| • Changed LED_1 Configuration table to merge LED_0 and LED_1 configuration into a single table for<br>clarity..... | 48  |
| • Changed note in <a href="#">セクション 8.5.2</a> section to clarify LED connections.....                              | 53  |
| • Added registers 0x0106, 0x0107, 0x010F, 0x0114, 0x0116, 0x0126, 0x04D4, 0x04D5, and 0x04D6 .....                 | 54  |
| • Added 100Base-TX MII power consumption data for -40°C and 125°C.....   | 111 |

**Changes from Revision B (March 2018) to Revision C (April 2018) Page**

|  |    |
|--|----|
| • Changed TX_D[1:0] back to TX_D[3:0]..... | 30 |
| • Changed RX_D[1:0] back to RX_D[3:0]..... | 30 |

**Changes from Revision A (August 2016) to Revision B (March 2018) Page**

|  |    |
|--|----|
| • テキサス・インスツルメンツの最新のドキュメントおよび翻訳基準に合わせて、データシートのテキストおよびフォーマットを更新.....                             | 1  |
| • Updated description of pin 24 and changed pin type from: I/O, PD to: I/O .....               | 5  |
| • Added <i>MII: 100BASE-TX Transmit Latency Timing</i> table .....                             | 16 |
| • Added <i>MII: 100BASE-TX Receive Latency Timing</i> table .....                              | 16 |
| • Device Power-Up Timing diagram modified to include start voltage limits.....                 | 17 |
| • Added the <i>100BASE-TX Transmit Latency Timing</i> graphic .....                            | 17 |
| • Added the <i>100BASE-TX Receive Latency Timing</i> graphic .....                             | 17 |
| • Changed the <i>Functional Block Diagram</i> .....  | 26 |
| • Changed TX_D[3:0] to TX_D[1:0].....  | 30 |
| • Changed RX_D[3:0] to RX_D[1:0].....  | 30 |
| • Added note to the <i>100BASE-FX Receive</i> section and changed the SD_DIS pin to SD_EN..... | 41 |

|   |     |
|---|-----|
| • Changed RX_ER strap function from: AMDIX_EN (SD_DIS) to: AMDIX_EN (SD_EN).....                          | 48  |
| • Added the <i>Detailed Design Procedure</i> section for the TPI Network Circuit typical application..... | 106 |
| • Switched the order of the typical applications.....   | 107 |
| • Added note to the <i>Oscillator</i> section .....   | 107 |
| • Changed the <i>Power Connections</i> graphic .....  | 111 |

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| <b>Changes from Revision * (August 2016) to Revision A (August 2016)</b> | <b>Page</b> |
|--|-------------|

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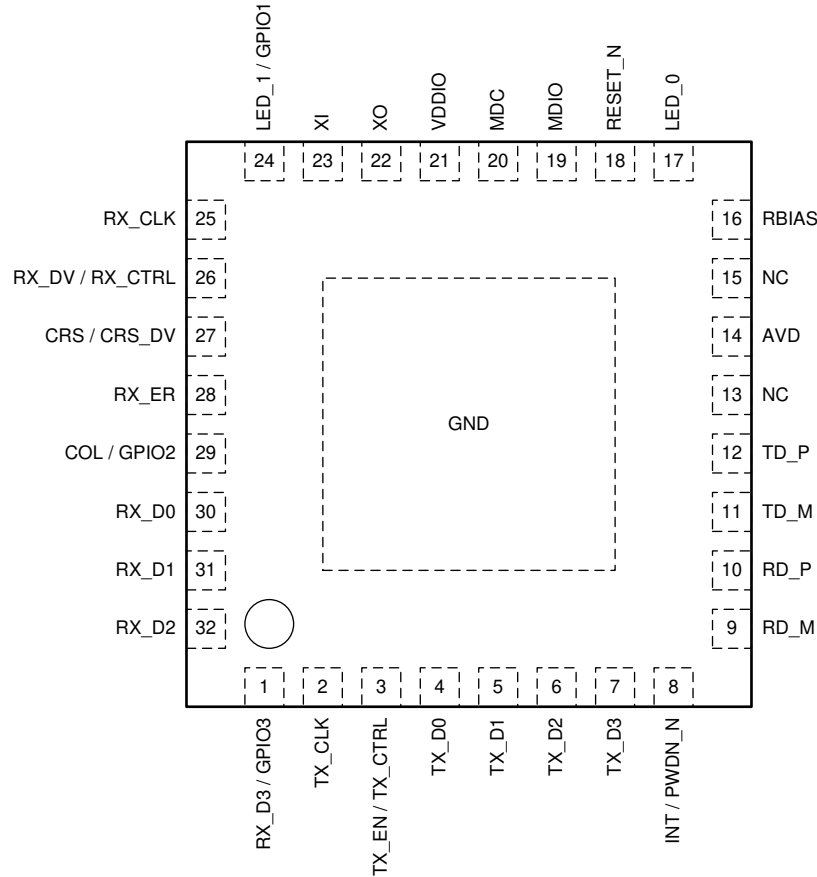
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| • 「製品プレビュー」から「量産データ」に変更..... | 1 |
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## 5 Device Comparison Table

| PART NUMBER | 100BASE-FX SUPPORT | OPERATING TEMPERATURE |
|-------------|--------------------|-----------------------|
| DP83822HF   | Yes                | -40°C to 125°C        |
| DP83822H    | No                 | -40°C to 125°C        |
| DP83822IF   | Yes                | -40°C to 85°C         |
| DP83822I    | No                 | -40°C to 85°C         |

## 6 Pin Configuration and Functions



**6-1. RHB Package  
32-Pin VQFN  
Top View**

表 6-1. Pin Functions

| PIN                  |     | TYPE <sup>(1)</sup> | DESCRIPTION   |
|----------------------|-----|---------------------|---|
| NAME                 | NO. |                     |   |
| <b>MAC INTERFACE</b> |     |                     |   |
| TX_CLK               | 2   | O, Hi-Z             | <b>MII Transmit Clock:</b> MII Transmit Clock provides a 25-MHz reference clock for 100-Mbps speed and a 2.5-MHz reference clock for 10-Mbps speed. Note that in MII mode, this clock has constant phase referenced to the reference clock. Applications requiring such constant phase may use this feature.  |
|                      |     | Hi-Z                | <b>Unused in RMII Mode</b>  |
|                      |     | I, PD               | <b>RGMIITransmit Clock:</b> The clock is sourced from the MAC layer to the PHY. When operating at 100-Mbps speed, this clock must be 25-MHz. When operating at 10-Mbps speed, this clock must be 2.5-MHz. Note : When in reset, TX_CLK is an output pin and low value is driven on it. Only once device is out of reset, TX_CLK is configured as input.   |
| TX_EN / TX_CTRL      | 3   | I, PD               | <b>Transmit Enable:</b> TX_EN is presented on the rising edge of the TX_CLK. TX_EN indicates the presence of valid data inputs on TX_D[3:0] in MII mode and on TX_D[1:0] in RMII mode. TX_EN is an active high signal.<br><b>RGMIITransmit Control:</b> TX_CTRL combines transmit enable and transmit error signals. TX_EN is presented on the rising edge of TX_CLK and TX_ER on the falling edge of TX_CLK.   |
| TX_D0                | 4   | I, PD               | <b>Transmit Data:</b> In MII mode, the transmit data nibble received from the MAC is synchronous to the rising edge of TX_CLK. In RMII mode, TX_D[1:0] received from the MAC is synchronous to the rising edge of the reference clock. In RGMII mode, the transmit data nibble received from the MAC is synchronous to the rising edge of TX_CLK.   |
| TX_D1                | 5   |                     |   |
| TX_D2                | 6   |                     |   |
| TX_D3                | 7   |                     |   |
| RX_CLK               | 25  | O                   | <b>MII Receive Clock:</b> MII Receive Clock provides a 25-MHz reference clock for 100-Mbps speed and a 2.5-MHz reference clock for 10-Mbps speed, which is derived from the received data stream.<br><b>Unused in RMII Mode</b><br><b>RGMIITransmit Clock:</b> RGMIITransmit Clock provides a 25-MHz reference clock for 100-Mbps speed and a 2.5-MHz reference clock for 10-Mbps speed, which is derived from the receive data stream.   |
| RX_DV / RX_CTRL      | 26  | O, S-PD             | <b>Receive Data Valid:</b> This pin indicates valid data is present on the RX_D[3:0] for MII mode and on RX_D[1:0] in RMII mode, independent from Carrier Sense.<br><b>RGMIITransmit Control:</b> RX_CTRL combines receive data valid and receive error signals. RX_DV is presented on the rising edge of RX_CLK and RX_ER on the falling edge of RX_CLK.   |
| RX_ER                | 28  | O, S-PU             | <b>Receive Error:</b> This pin indicates that an error symbol has been detected within a received packet in both MII and RMII mode. In MII mode, RX_ER is asserted high synchronously to the rising edge of RX_CLK. In RMII mode, RX_ER is asserted high synchronously to the rising edge of the reference clock. This pin is not required to be used by the MAC in MII or RMII because the PHY is corrupting data on a receive error.<br><b>Unused in RGMII Mode</b>   |
| RX_D0                | 30  | O, S-PD             | <b>Receive Data:</b> Symbols received on the cable are decoded and presented on these pins synchronous to the rising edge of RX_CLK. They contain valid data when RX_DV is asserted. A nibble RX_D[3:0] is received in MII and RGMII modes. 2-bits RX_D[1:0] is received in RMII Mode. PHY address pins PHY_AD[4:1] are multiplexed with RX_D[3:0], and are pulled-down. PHY_AD[0] (LSB of the address) is multiplexed with COL on pin 29, and is pulled up. If no external pullup or pulldown is present, the default PHY address is 0x01. |
| RX_D1                | 31  |                     |   |
| RX_D2                | 32  |                     |   |
| RX_D3 / GPIO3        | 1   |                     |   |
| CRS / CRS_DV         | 27  | O, S-PU             | <b>Carrier Sense:</b> In MII mode this pin is asserted high when the receive or transmit medium is non-idle.<br><b>Carrier Sense / Receive Data Valid:</b> In RMII mode, this pin combines the RMII Carrier and Receive Data Valid indications.<br><b>Unused in RGMII Mode</b>  |

**表 6-1. Pin Functions (continued)**

| PIN                                |     | TYPE <sup>(1)</sup> | DESCRIPTION  |
|------------------------------------|-----|---------------------|--|
| NAME                               | NO. |                     |  |
| COL / GPIO2                        | 29  | I/O, S-PU           | <b>Collision Detect:</b> For Full-Duplex mode, this pin is always LOW. In Half-Duplex mode, this pin is asserted HIGH only when both transmit and receive media are non-idle.<br><b>Unused in RMII Mode</b>  |
| <b>SERIAL MANAGEMENT INTERFACE</b> |     |                     |  |
| MDC                                | 20  | I                   | <b>Management Data Clock:</b> Synchronous clock to the MDIO serial management input/output data. This clock may be asynchronous to the MAC transmit and receive clocks. The maximum clock rate is 25 MHz. There is no minimum clock rate.  |
| MDIO                               | 19  | I/O                 | <b>Management Data I/O:</b> Bidirectional management data signal that may be sourced by the management station or the PHY. This pin requires a 2.2-kΩ pullup resistor.   |
| INT/PWDN                           | 8   | I/O, OD             | <b>Interrupt / Power Down:</b> Register access is required for this pin to be configured either as power down or as an interrupt. The default function of this pin is power down. When this pin is configured for a power down function, an active low signal on this pin places the device in power-down mode.<br>When this pin is configured as an interrupt pin, this pin is asserted low when an interrupt condition occurs. The pin has an open-drain output with a weak internal pullup. Some applications may require an external pullup resistor.  |
| RESET                              | 18  | I, PU               | <b>RESET:</b> This pin is an active low reset input that initializes or re-initializes all the internal registers of the PHY. Asserting this pin low for at least 10 μs will force a reset process to occur.   |
| <b>CLOCK INTERFACE</b>             |     |                     |  |
| XI                                 | 23  | I                   | <b>Crystal / Oscillator Input</b><br><b>MII reference clock:</b> Reference clock 25-MHz ±100 ppm-tolerance crystal or oscillator input. The device supports either an external crystal resonator connected across pins XI and XO, or an external CMOS-level oscillator connected to pin XI only.<br><b>RMII reference clock:</b> Reference clock 50-MHz ±100 ppm-tolerance CMOS-level oscillator in RMII Slave mode. Reference clock 25-MHz ±100 ppm-tolerance crystal or oscillator in RMII Master mode.<br><b>RGMII reference clock:</b> Reference clock 25-MHz ±100 ppm-tolerance crystal or oscillator input. The device supports either an external crystal resonator connected across pins XI and XO, or an external CMOS-level oscillator connected to pin XI only. |
| XO                                 | 22  | O                   | <b>Crystal Output:</b> Reference Clock output. XO pin is used for crystal only. This pin should be left floating when a CMOS-level oscillator is connected to XI.  |
| <b>GPIO AND LED INTERFACE</b>      |     |                     |  |
| LED_0                              | 17  | O, S-PU             | <b>Function 1 (Default):</b> LINK Indication, LED indicates the status of the link. When the link is good, LED is ON. When the link is down, LED is OFF.<br><b>Function 2:</b> ACT Indication, LED indicates transmit and receive activity in addition to the status of the link. The LED is ON when link is good. The LED blinks when the transmitter or receiver is active.  |
| LED_1 / GPIO1                      | 24  | I/O, S-PD           | <b>Function 1 (Default):</b> This pin is tri-state.<br><b>Function 2:</b> SPEED Indication, LED indicates the speed of the link. If speed is 100 Mbps, LED is ON. If speed is 10 Mbps, LED is OFF. External Pull resistors are required when LED is connected to this pin.<br><b>GPIO1:</b> This pin can be used as a GPIO when using register access.<br><b>Signal Detect:</b> This pin acts as Signal Detect in 100BASE-FX mode and shall be connected with Optical Transceiver. Signal Detect high level will be the VDDIO voltage level.   |



表 6-1. Pin Functions (continued)

| PIN                              |            | TYPE <sup>(1)</sup> | DESCRIPTION  |
|----------------------------------|------------|---------------------|--|
| NAME                             | NO.        |                     |  |
| COL / GPIO2                      | 29         | I/O, S, PU          | <b>MII Mode:</b> COL pin can be used to drive an LED when operating in Full-Duplex mode. Register access is required for LED configuration.<br><b>RMII Mode:</b> This pin can be used as an LED when using register access.<br><b>RGMII Mode:</b> This pin can be used as an LED when using register access.<br><b>GPIO2:</b> This pin can be used as a GPIO when using register access. |
| RX_D3 / GPIO3                    | 1          | I/O, S-PD           | <b>MII Mode:</b> RX_D3 will remain as RX_D3 because it is required for MII mode.<br><b>RMII Mode:</b> RX_D3 pin can be configured to drive an LED. Register access is required for LED configuration.<br><b>RGMII Mode:</b> RX_D3 will remain as RX_D3 because it is required for RGMII mode.<br><b>GPIO3:</b> This pin can be used as a GPIO when using register access.                |
| <b>MEDIA DEPENDENT INTERFACE</b> |            |                     |  |
| TD_M                             | 11         | A                   | <b>Differential Transmit Output (PMD):</b> These differential outputs can be automatically configured to either 10BASE-Te, 100BASE-TX, or 100BASE-FX signaling or forced into a specific signaling mode.   |
| TD_P                             | 12         |                     |  |
| RD_M                             | 9          | A                   | <b>Differential Receive Input (PMD):</b> These differential inputs are automatically configured to accept either 10BASE-Te, 100BASE-TX, or 100BASE-FX signaling or forced into a specific signaling mode.  |
| RD_P                             | 10         |                     |  |
| <b>POWER AND GROUND PINS</b>     |            |                     |  |
| VDDIO                            | 21         | P                   | <b>I/O Supply:</b> 3.3 V, 2.5 V, or 1.8 V  |
| AVD                              | 14         | P                   | <b>Analog Supply:</b> 3.3 V or 1.8 V   |
| GND                              | Ground Pad | P                   | <b>Ground</b>  |
| RBIAS                            | 16         | I                   | <b>Bias Resistor Connection.</b> A 4.87-kΩ ±1% resistor must be connected from RBIAS to GND.   |
| <b>OTHER PINS</b>                |            |                     |  |
| NC                               | 13         | NC                  | <b>Leave Floating</b>  |
| NC                               | 15         | NC                  | <b>Leave Floating</b>  |
| LED_1 / GPIO1                    | 24         | I/O, S-PD           | This pin can be left floating when not in used. External Pull resistors are required when LED is connected to this pin.  |

- (1) The definitions below define the functionality of the I/O cells for each pin.
- Type: I - Input
  - Type: O - Output
  - Type: I/O - Input/Output
  - Type OD - Open Drain
  - Type: PD, PU - Internal Pulldown/Pullup
  - Type: S-PU, S-PD - Strapping Pin (All strap pins have weak internal pullups or pulldowns. If the default strap value is needed to be changed then an external 2.2-kΩ resistor should be used)



**表 6-2. IO Pins State During Reset**

| PIN NAME              | NO. | TYPE  | PU/PD/HiZ |
|-----------------------|-----|-------|-----------|
| MDIO                  | 19  | I     | Hi-Z      |
| MDC                   | 20  | I     | PD        |
| INT_N                 | 8   | I     | PU        |
| RESET_N               | 18  | —     | —         |
| TX_CLK <sup>(1)</sup> | 2   | O     | PD        |
| TX_EN                 | 3   | I     | PD        |
| TX_D3                 | 7   | I     | PD        |
| TX_D2                 | 6   | I     | PD        |
| TX_D1                 | 5   | I     | PD        |
| TX_D0                 | 4   | I     | PD        |
| LED_0                 | 17  | Strap | PU        |
| LED_1                 | 24  | Strap | PD        |
| CRS                   | 27  | Strap | PU        |
| COL                   | 29  | Strap | PU        |
| RX_ER                 | 28  | Strap | PU        |
| RX_DV                 | 26  | Strap | PD        |
| RX_D3                 | 1   | Strap | PD        |
| RX_D2                 | 32  | Strap | PD        |
| RX_D1                 | 21  | Strap | PD        |
| RX_D0                 | 30  | Strap | PD        |
| RX_CLK                | 25  | O     | PD        |

- (1) When in reset, TX\_CLK is an output pin and low value is driven on it. In RGMII mode, once device is out of reset, Tx\_CLK is configured as input.

## 7 Specifications

### 7.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

|                   |                                | MIN  | MAX          | UNIT |
|-------------------|--------------------------------|------|--------------|------|
| Input voltage     | AVD                            | -0.5 | 3.8          | V    |
|                   | VDDIO                          | -0.5 | 3.8          |      |
|                   | TD-, TD+, RD-, RD+             | -0.5 | 6            |      |
|                   | Other Inputs                   | -0.5 | VDDIO + 0.3V |      |
| DC output voltage | All pins                       | -0.5 | 3.8          | V    |
| T <sub>J</sub>    | Operating junction temperature |      | 135          | °C   |
| T <sub>stg</sub>  | Storage temperature            | -65  | 150          | °C   |

- (1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under [セクション 7.3](#). Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

### 7.2 ESD Ratings

|  |  |  | VALUE                  | UNIT |
|--|--|--|------------------------|------|
| V <sub>(ESD)</sub> Electrostatic discharge | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>(1)</sup>              | All pins except pins 9, 10, 11, and 12 | ±3000                  | V    |
|  |  | Pins 9, 10, 11, and 12                 | ±16000                 |      |
|  | Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>(2)</sup> | All pins                               | ±1500                  |      |
|  |  | IEC 61000-4-2 <sup>(3)</sup>           | Pins 9, 10, 11, and 12 |      |

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.  
 (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.  
 (3) IEC61000-4-2; 150 pF and 330 Ω, Contact Discharge, Class B.

### 7.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

|                                   |  | MIN   | NOM | MAX   | UNIT |
|-----------------------------------|--|-------|-----|-------|------|
| VDDIO                             | Supply Voltage I/O (1.8-V Option)                                      | 1.71  | 1.8 | 1.89  | V    |
|                                   | Supply Voltage I/O (2.5-V Option)                                      | 2.375 | 2.5 | 2.625 |      |
|                                   | Supply Voltage I/O (3.3-V Option)                                      | 3.15  | 3.3 | 3.45  |      |
| AVD <sup>(1)</sup>                | Supply Voltage Analog (3.3-V Option)                                   | 3.15  | 3.3 | 3.45  | V    |
|                                   | Supply Voltage Analog (1.8-V Option)                                   | 1.71  | 1.8 | 1.89  |      |
| Center Tap (CT)<br><sup>(1)</sup> | Supply Voltage Center Tap (3.3-V Option)<br><i>Magnetic Center Tap</i> | 3.15  | 3.3 | 3.45  | V    |
|                                   | Supply Voltage Analog (1.8V Option)<br><i>Magnetic Center Tap</i>      | 1.71  | 1.8 | 1.89  |      |
| T <sub>A</sub>                    | Ambient Temperature: DP83822I and DP83822IF                            | -40   |     | 85    | °C   |
|                                   | Ambient Temperature: DP83822H and DP83822HF                            | -40   |     | 125   |      |

- (1) Analog supply (AVD) and magnetic center tap must be at the same potential.

## 7.4 Thermal Information

| THERMAL METRIC <sup>(1)</sup> |  | DP83822    | UNIT |
|-------------------------------|--|------------|------|
|                               |  | RHB (VQFN) |      |
|                               |  | 32 PINS    |      |
| R <sub>θJA</sub>              | Junction-to-ambient thermal resistance       | 41.0       | °C/W |
| R <sub>θJC(top)</sub>         | Junction-to-case (top) thermal resistance    | 35.5       | °C/W |
| R <sub>θJB</sub>              | Junction-to-board thermal resistance         | 14.1       | °C/W |
| ψ <sub>JT</sub>               | Junction-to-top characterization parameter   | 0.9        | °C/W |
| ψ <sub>JB</sub>               | Junction-to-board characterization parameter | 14.0       | °C/W |
| R <sub>θJC(bot)</sub>         | Junction-to-case (bottom) thermal resistance | 5.4        | °C/W |

(1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC Package Thermal Metrics](#) application report.

## 7.5 Electrical Characteristics

over operating free-air temperature range (unless otherwise noted)

| PARAMETER                 | TEST CONDITIONS   | MIN            | TYP | MAX | UNIT |
|---------------------------|---|----------------|-----|-----|------|
| <b>3.3-V VDDIO</b>        |   |                |     |     |      |
| V <sub>OH</sub>           | High level output voltage<br>I <sub>OH</sub> = -4 mA<br>VDDIO = 3.3-V ±5% | 2.4            |     |     | V    |
| V <sub>OL</sub>           | Low level output voltage<br>I <sub>OL</sub> = 4 mA<br>VDDIO = 3.3-V ±5%   |                |     | 0.4 | V    |
| V <sub>IH</sub>           | High level input voltage<br>VDDIO = 3.3-V ±5%                             | 1.7            |     |     | V    |
| V <sub>IL</sub>           | Low level input voltage<br>VDDIO = 3.3-V ±5%                              |                |     | 0.8 | V    |
| <b>2.5-V VDDIO</b>        |   |                |     |     |      |
| V <sub>OH</sub>           | High level output voltage<br>I <sub>OH</sub> = -4 mA<br>VDDIO = 2.5-V ±5% | VDDIO × 0.8    |     |     | V    |
| V <sub>OL</sub>           | Low level output voltage<br>I <sub>OL</sub> = 4 mA<br>VDDIO = 2.5-V ±5%   |                |     | 0.4 | V    |
| V <sub>IH</sub>           | High level input voltage<br>VDDIO = 2.5-V ±5%                             | 1.5            |     |     | V    |
| V <sub>IL</sub>           | Low level input voltage<br>VDDIO = 2.5-V ±5%                              |                |     | 0.7 | V    |
| <b>1.8-V VDDIO</b>        |   |                |     |     |      |
| V <sub>OH</sub>           | High level output voltage<br>I <sub>OH</sub> = -2 mA<br>VDDIO = 1.8-V ±5% | VDDIO - 0.4    |     |     | V    |
| V <sub>OL</sub>           | Low level output voltage<br>I <sub>OL</sub> = 2 mA<br>VDDIO = 1.8-V ±5%   |                |     | 0.4 | V    |
| V <sub>IH</sub>           | High level input voltage<br>VDDIO = 1.8-V ±5%                             | 1.3            |     |     | V    |
| V <sub>IL</sub>           | Low level input voltage<br>VDDIO = 1.8-V ±5%                              |                |     | 0.5 | V    |
| <b>DC CHARACTERISTICS</b> |   |                |     |     |      |
| I <sub>IH</sub>           | Input high current (VIN = VCC)  | -40°C to 85°C  | -10 | 10  | μA   |
|                           |   | 85°C to 125°C  | -20 | 20  |      |
| I <sub>IL</sub>           | Input low current (VIN = GND)   | -40°C to 125°C | -10 | 10  | μA   |
| I <sub>OZ</sub>           | TRI-STATE output current<br>(VOUT = VCC, VOUT = GND)                      | -40°C to 85°C  | -10 | 10  | μA   |
|                           |   | 85°C to 125°C  | -20 | 20  |      |
| C <sub>XI/XO</sub>        | XO and XI capacitance <sup>(1)</sup>                                      |                | 0.8 |     | pF   |
| C <sub>IN</sub>           | Input capacitance <sup>(1)</sup>  |                | 5   |     | pF   |
| C <sub>OUT</sub>          | Output capacitance <sup>(1)</sup>   |                | 5   |     | pF   |

## 7.5 Electrical Characteristics (continued)

over operating free-air temperature range (unless otherwise noted)

| PARAMETER              |   | TEST CONDITIONS   | MIN  | TYP  | MAX   | UNIT               |
|------------------------|---|---|------|------|-------|--------------------|
| R <sub>Pu-POR</sub>    | Integrated pullup resistance during latch-in (RESET and Power-Up) | Pins: RX_ER, LED_0, CRS, and COL  | 37.5 | 50   | 62.5  | kΩ                 |
| R <sub>Pull-Up</sub>   | Integrated pullup resistance                                      |   | 6.75 | 9    | 11.25 | kΩ                 |
| R <sub>Pull-Down</sub> | Integrated pulldown resistance                                    |   | 6.75 | 9    | 11.25 | kΩ                 |
| <b>PMD OUTPUTS</b>     |   |   |      |      |       |                    |
| V <sub>OD</sub>        | MDI 10BASE-Te swing   | VOD can be controlled through #unique_21/<br>unique_21_Connect_42_X3379 | 1.54 | 1.75 | 1.96  | V <sub>peak</sub>  |
| V <sub>OD</sub>        | MDI 100BASE-TX swing  | VOD can be controlled through #unique_21/<br>unique_21_Connect_42_X3379 | 0.95 | 1    | 1.05  | V <sub>peak</sub>  |
| V <sub>ODsym</sub>     | MDI 100BASE-TX voltage symmetry                                   |   | 98%  | 100% | 102%  |                    |
| V <sub>OD</sub>        | MDI 100BASE-FX transmitter swing <sup>(1)</sup>                   | Differential output voltage pk-pk <sup>(2)</sup>                        | 0.9  | 1    | 1.1   | V <sub>pk-pk</sub> |
| Tr/f                   | MDI 100BASE-FX transmitter rise/fall time <sup>(1)</sup>          | 10%-90% Rise/Fall Time  | 0.5  | 1    | 1.5   | ns                 |
| T <sub>J_out</sub>     | MDI 100BASE-FX transmitter total jitter <sup>(1)</sup>            |   |      |      | 1.4   | ns                 |
| V <sub>in</sub>        | MDI 100BASE-FX receiver input swing requirement <sup>(1)</sup>    | Input differential voltage pk-pk  | 0.22 |      | 1.8   | V <sub>pk-pk</sub> |
| T <sub>J_in</sub>      | MDI 100BASE-FX receiver input jitter requirement <sup>(1)</sup>   | Input jitter tolerance pk-pk  |      |      | 0.45  | UI                 |

(1) Ensured by production test, characterization or design.

(2) Configurable through register 0x0403. Output variance is in range of +/-10%

## 7.6 Timing Requirements, Power-Up Timing

See (1) (2).

| PARAMETER |   | TEST CONDITIONS   | MIN  | TYP | MAX | UNIT |
|-----------|---|---|------|-----|-----|------|
| T1        | AVD (analog supply) ramp delay post VDDIO (digital supply) ramp. AVD and VDDIO potential must not exceed 0.3 V prior to supply ramp. <sup>(3)</sup>   | Time from start of supply ramp                                  | -100 |     | 100 | ms   |
|           | VDDIO ramp time   |   |      |     | 100 | ms   |
|           | AVD ramp time   |   |      |     | 100 | ms   |
| T2        | Post power-up stabilization time prior to MDC preamble for register accesses. MDC preamble coming in any time after this max wait time will be valid. | MDIO is pulled high for 32-bit serial management initialization |      |     | 200 | ms   |
| T3        | Hardware configuration latch-in time for power up   |   |      |     | 200 | ms   |
| T4        | Hardware configuration pins transition to output drivers  |   |      | 64  |     | ns   |
| T5        | Fast Link Pulse transmission delay post power up  |   |      | 1.5 |     | s    |

(1) Ensured by production test, characterization or design.

(2) See [7-1](#).

(3) AVD ramping up after VDDIO ramp completion is preferred to avoid false detection of lower level of VDDIO in any corner case.

## 7.7 Timing Requirements, Power-Up With Unstable XI Clock

See (1).

| PARAMETER |  | MIN | NOM | MAX | UNIT |
|-----------|--|-----|-----|-----|------|
| T1        | Reset application after XI stabilization | 1   |     |     | us   |
| T2        | Reset pulse width                        | 10  |     |     | us   |

(1) See [7-2](#)

## 7.8 Timing Requirements, Reset Timing

See (1) (2).

| PARAMETER | TEST CONDITIONS   | MIN  | TYP | MAX | UNIT    |
|-----------|---|--|-----|-----|---------|
| T1        | RESET pulse width   | XI clock must be stable for a minimum of 1 $\mu$ s during RESET pulse low time |     | 10  | $\mu$ s |
| T2        | Post RESET stabilization time prior to MDC preamble for register accesses | MDIO is pulled high for 32-bit serial management initialization                |     | 2   | ms      |
| T3        | Hardware configuration latch-in time for RESET                            |  | 120 |     | ns      |
| T4        | Hardware configuration pins transition to output drivers                  |  | 64  |     | ns      |
| T5        | Fast Link Pulse transmission delay post RESET                             |  | 1.5 |     | s       |

(1) Ensured by production test, characterization or design.

(2) See [7-3](#).

## 7.9 Timing Requirements, Serial Management Timing

See (1) (2).

| PARAMETER | MIN                             | TYP | MAX | UNIT |     |
|-----------|---------------------------------|-----|-----|------|-----|
| T1        | MDC to MDIO (Output) Delay Time | 0   |     | 10   | ns  |
| T2        | MDIO (Input) to MDC Setup Time  | 10  |     |      | ns  |
| T3        | MDIO (Input) to MDC Hold Time   | 10  |     |      | ns  |
| T4        | MDC Frequency                   |     | 2.5 | 25   | MHz |

(1) Ensured by production test, characterization or design.

(2) See [7-4](#).

## 7.10 Timing Requirements, 100 Mbps MII Transmit Timing

See (1) (2).

| PARAMETER | MIN                                    | TYP | MAX | UNIT |    |
|-----------|--|-----|-----|------|----|
| T1        | TX_CLK High / Low Time                 | 16  | 20  | 24   | ns |
| T2        | TX_D[3:0], TX_EN Data Setup to TX_CLK  | 10  |     |      | ns |
| T3        | TX_D[3:0], TX_EN Data Hold from TX_CLK | 0   |     |      | ns |

(1) Ensured by production test, characterization or design.

(2) See [7-5](#).

## 7.11 Timing Requirements, 100 Mbps MII Receive Timing

See (1) (2).

| PARAMETER | MIN   | TYP | MAX | UNIT |    |
|-----------|---|-----|-----|------|----|
| T1        | RX_CLK High / Low Time                              | 16  | 20  | 24   | ns |
| T2        | RX_D[3:0], RX_DV and RX_ER Delay from RX_CLK rising | 10  |     | 30   | ns |

(1) Ensured by production test, characterization or design.

(2) See [7-6](#).

## 7.12 Timing Requirements, 10 Mbps MII Transmit Timing

See (1) (2).

| PARAMETER |  | MIN | TYP | MAX | UNIT |
|-----------|--|-----|-----|-----|------|
| T1        | TX_CLK High / Low Time                 | 190 | 200 | 210 | ns   |
| T2        | TX_D[3:0], TX_EN Data Setup to TX_CLK  | 25  |     |     | ns   |
| T3        | TX_D[3:0], TX_EN Data Hold from TX_CLK | 0   |     |     | ns   |

- (1) Ensured by production test, characterization or design.  
 (2) See [7-7](#).

## 7.13 Timing Requirements, 10 Mbps MII Receive Timing

See (1) (2).

| PARAMETER |   | MIN | TYP | MAX | UNIT |
|-----------|---|-----|-----|-----|------|
| T1        | RX_CLK High / Low Time                              | 160 | 200 | 240 | ns   |
| T2        | RX_D[3:0], RX_DV and RX_ER Delay from RX_CLK rising | 100 |     | 300 | ns   |

- (1) Ensured by production test, characterization or design.  
 (2) See [7-8](#).

## 7.14 Timing Requirements, RMII Transmit Timing

See (1) (2).

| PARAMETER |   | MIN | TYP | MAX | UNIT |
|-----------|---|-----|-----|-----|------|
| T1        | XI Clock Period   |     | 20  |     | ns   |
| T2        | TX_D[1:0] and TX_EN Data Setup to XI rising                 | 1.4 |     |     | ns   |
| T3        | TX_D[1:0] and TX_EN Data Hold from XI rising                | 2   |     |     | ns   |
| T1        | RMII Master Clock (RX_D3 Clock) Period                      |     | 20  |     | ns   |
|           | RMII Master Clock (RX_D3 Clock) Duty Cycle                  | 35% |     | 65% |      |
| T2        | TX_D[1:0] and TX_EN Data Setup to RMII Master Clock rising  | 4   |     |     | ns   |
| T3        | TX_D[1:0] and TX_EN Data Hold from RMII Master Clock rising | 2   |     |     | ns   |

- (1) Ensured by production test, characterization or design.  
 (2) See [7-9](#).

## 7.15 Timing Requirements, RMII Receive Timing

See (1) (2).

| PARAMETER |   | MIN | TYP | MAX | UNIT |
|-----------|---|-----|-----|-----|------|
| T1        | XI Clock Period   |     | 20  |     | ns   |
| T2        | RX_D[1:0], CRS_DV, RX_DV and RX_ER Delay from XI rising   | 4   |     | 14  | ns   |
| T1        | RX_CLK Clock Period   |     | 20  |     | ns   |
| T2        | RX_D[1:0], CRS_DV, RX_DV and RX_ER Delay from RX_CLK rising<br><b>Note:</b> While working in 'RMII Receive Clock' mode, bit[0] in register 0x000A | 4   | 10  | 14  | ns   |
| T1        | RMII Master Clock (RX_D3 Clock) Period  |     | 20  |     | ns   |
|           | RMII Master Clock (RX_D3 Clock) Duty Cycle  | 35% |     | 65% |      |
| T2        | RX_D[1:0], CRS_DV, RX_DV and RX_ER Delay from RMII Master Clock rising  | 4   | 10  | 14  | ns   |

- (1) Ensured by production test, characterization or design.  
 (2) See [7-10](#).

## 7.16 Timing Requirements, RGMII

See (1) (5).

| PARAMETER |   | MIN  | TYP | MAX | UNIT |
|-----------|---|------|-----|-----|------|
| SkewT     | Data to Clock output Skew (at Transmitter) <sup>(2)</sup>                     | -500 | 0   |     | ps   |
| SkewR     | Data to Clock input Skew (at Receiver) <sup>(2)</sup>                         | 1    | 1.8 |     | ns   |
| SetupT    | Data to Clock output Setup (at Transmitter - integrated delay) <sup>(3)</sup> | 1.2  | 2   |     | ns   |
| HoldT     | Data to Clock output Hold (at Transmitter - integrated delay) <sup>(3)</sup>  | 1.2  | 2   |     | ns   |
| SetupR    | Data to Clock input Setup (at Receiver - integrated delay) <sup>(3)</sup>     | 1    | 2   |     | ns   |
| HoldR     | Data to Clock input Hold (at Receiver - integrated delay) <sup>(3)</sup>      | 1    | 2   |     | ns   |
| Tcyc_10   | Clock Cycle Duration 10 Mbps  | 360  | 400 | 440 | ns   |
| Tcyc_100  | Clock Cycle Duration 100 Mbps   | 36   | 40  | 44  | ns   |
| Duty_T    | Duty Cycle for 10/100 Mbps <sup>(4)</sup>                                     | 40%  | 50% | 60% |      |
| Tr / Tf   | Rise / Fall Time (20-80%)   |      |     | 750 | ps   |

- (1) Ensured by production test, characterization or design.  
 (2) When operating without RGMII internal delay, the PCB design requires clocks to be routed such that an additional trace delay of greater than 1.5 ns is added to the associated clock signal.  
 (3) Device may operate with or without internal delay.  
 (4) The duty cycle may be stretched or shrunk during speed changes or while transitioning to a received packet's clock domain as long as minimum duty cycle is not violated and stretching occurs for no more than three Tcyc of the lowest speed transitioned between.  
 (5) See [7-11](#) and [7-12](#).



## 7.17 Normal Link Pulse Timing

See (1) (2).

| PARAMETER |              | MIN | TYP | MAX | UNIT |
|-----------|--------------|-----|-----|-----|------|
| T1        | Pulse Period |     | 16  |     | ms   |
| T2        | Pulse Width  |     | 100 |     | ns   |

- (1) Ensured by production test, characterization or design.  
 (2) See [7-13](#).

## 7.18 Auto-Negotiation Fast Link Pulse (FLP) Timing

See (1) (2).

| PARAMETER |                                   | MIN | TYP | MAX | UNIT |
|-----------|-----------------------------------|-----|-----|-----|------|
| T1        | Clock Pulse to Clock Pulse Period |     | 125 |     | μs   |
| T2        | Clock Pulse to Data Pulse Period  |     | 62  |     | μs   |
| T3        | Clock / Data Pulse Width          |     | 114 |     | ns   |
| T4        | FLP Burst to FLP Burst Period     |     | 16  |     | ms   |
| T5        | FLP Burst Width                   |     | 2   |     | ms   |

- (1) Ensured by production test, characterization or design.  
 (2) See [7-14](#).

## 7.19 10BASE-Te Jabber Timing

See (1) (2).

| PARAMETER |                          | MIN | TYP | MAX | UNIT |
|-----------|--------------------------|-----|-----|-----|------|
| T1        | Jabber activation time   |     | 100 |     | ms   |
| T2        | Jabber deactivation time |     | 500 |     | ms   |

- (1) Ensured by production test, characterization or design.  
 (2) See [7-15](#).

## 7.20 100BASE-TX Transmit Latency Timing

See [7-16](#).

| PARAMETER |   | MIN                  | TYP | MAX | UNIT |
|-----------|---|----------------------|-----|-----|------|
| T1        | TX_CLK rising edge with TX_EN asserted to MDI start of /J/ symbol | MII                  | 48  | 56  | ns   |
|           |   | RMII <sup>(1)</sup>  | 102 |     | ns   |
|           |   | RGMII <sup>(2)</sup> | 170 |     | ns   |

- (1) With FAST\_RXDV enabled. Register<0x0009>=0x0002.  
 (2) With FAST\_RXDV enabled. Register<0x0009>=0x0002. and Register<0x0457>=0x0410

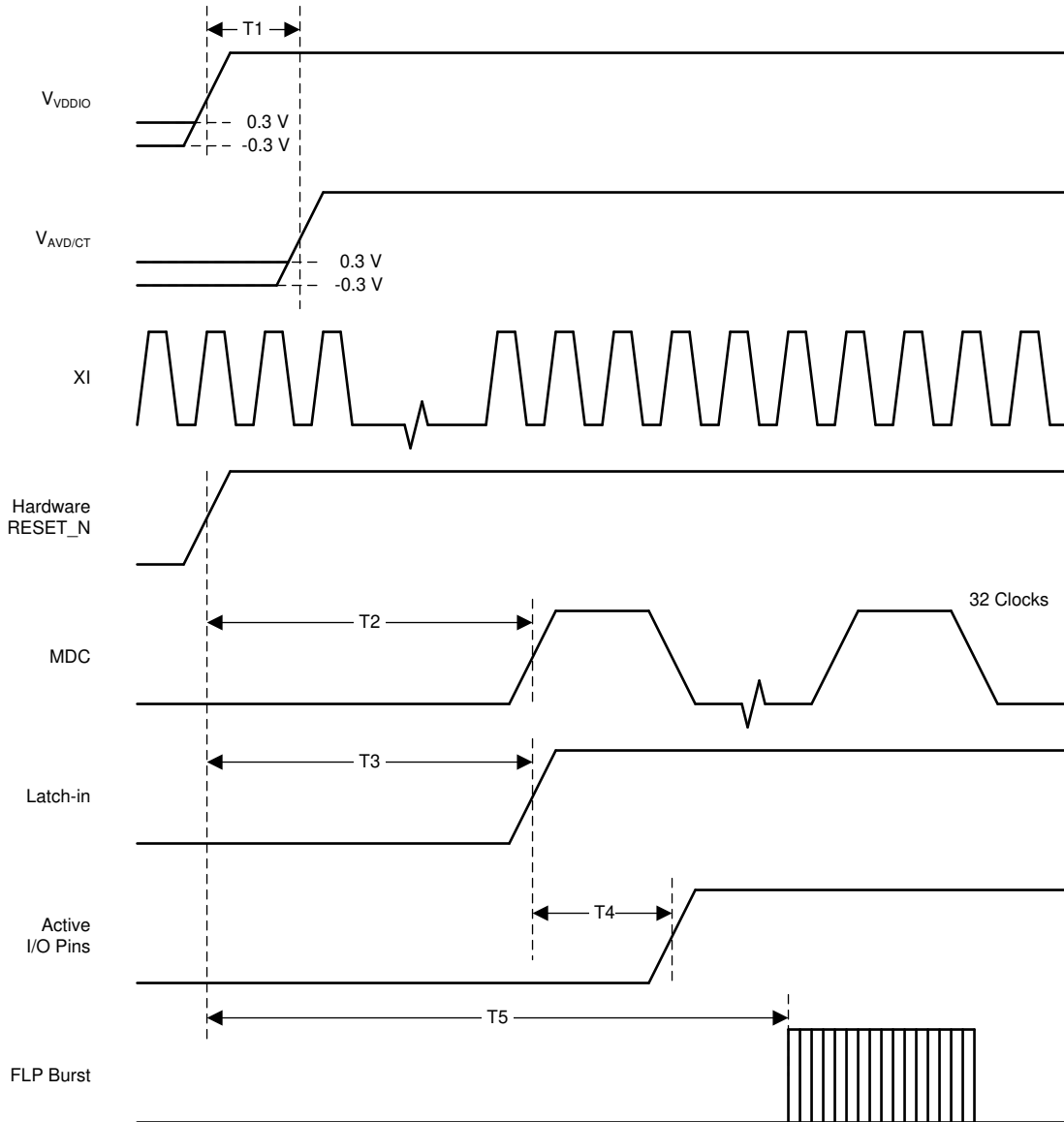
## 7.21 100BASE-TX Receive Latency Timing

See [7-17](#).

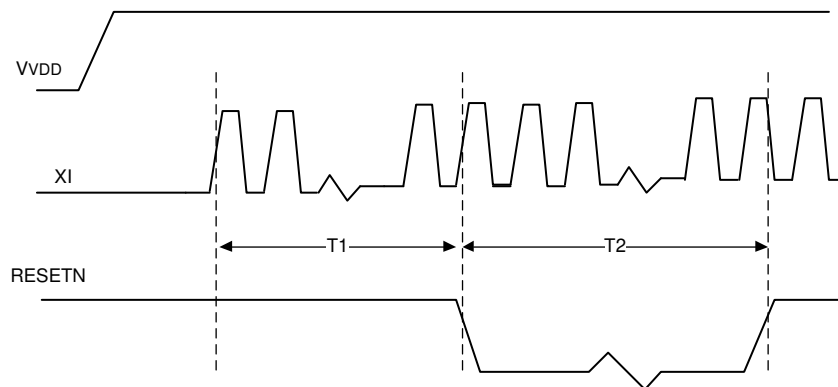
| PARAMETER |   | MIN                  | TYP | MAX | UNIT |
|-----------|---|----------------------|-----|-----|------|
| T2        | MDI start of /J/ symbol to RX_CLK rising edge with RX_DV asserted | MII <sup>(1)</sup>   | 194 | 218 | ns   |
|           |   | RMII <sup>(1)</sup>  | 272 |     | ns   |
|           |   | RGMII <sup>(2)</sup> | 159 |     | ns   |

- (1) With FAST\_RXDV enabled. Register<0x0009>=0x0002.  
 (2) With FAST\_RXDV enabled. Register<0x0009>=0x0002. and Register<0x0457>=0x0410

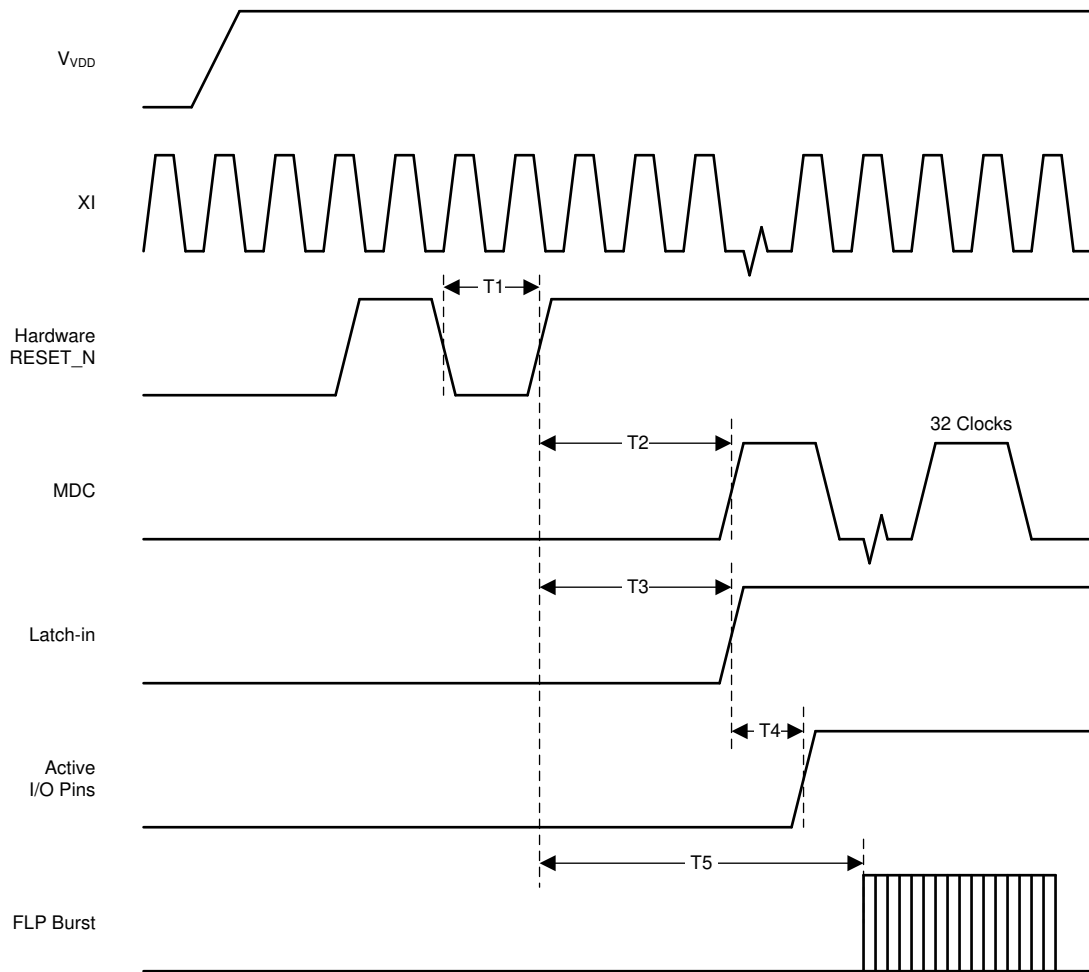
## 7.22 Timing Diagrams



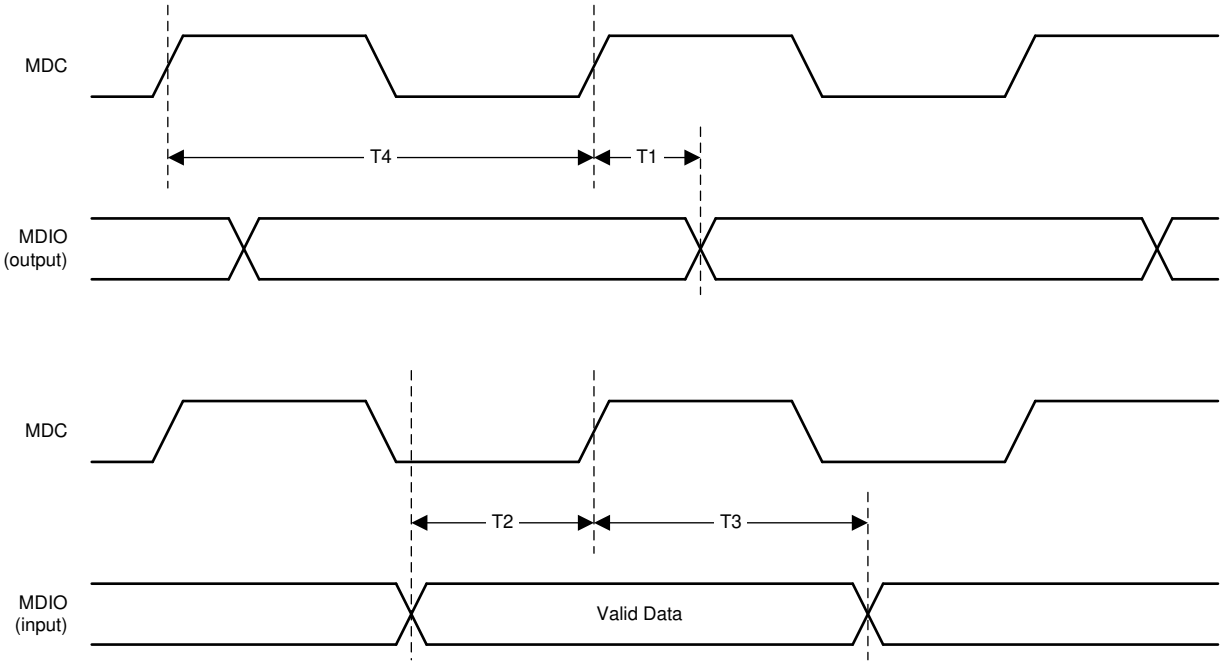
**7-1. Power-Up Timing**



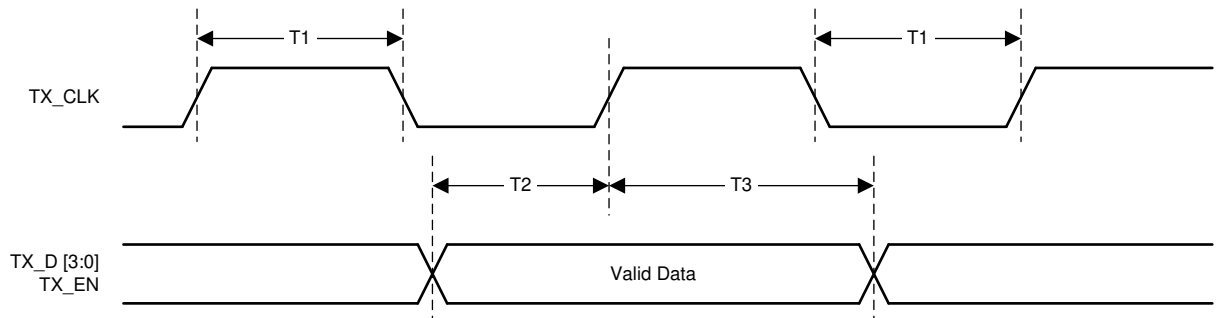
**7-2. Power-Up With Unstable XI Input**



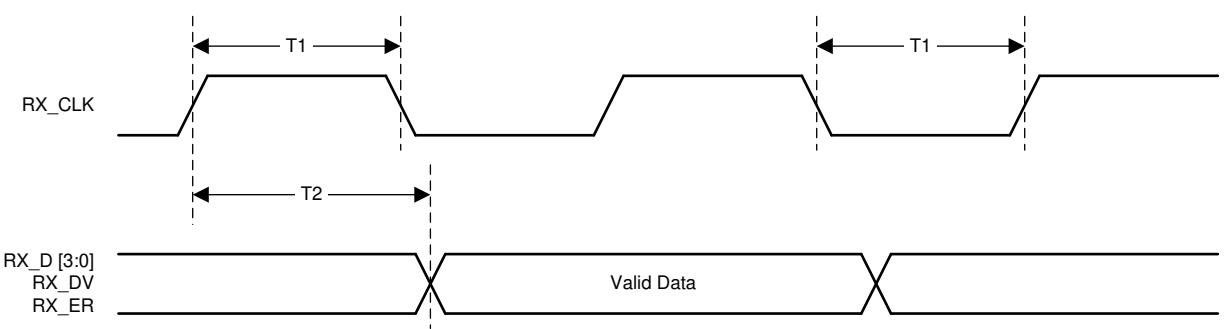
**7-3. Reset Timing**



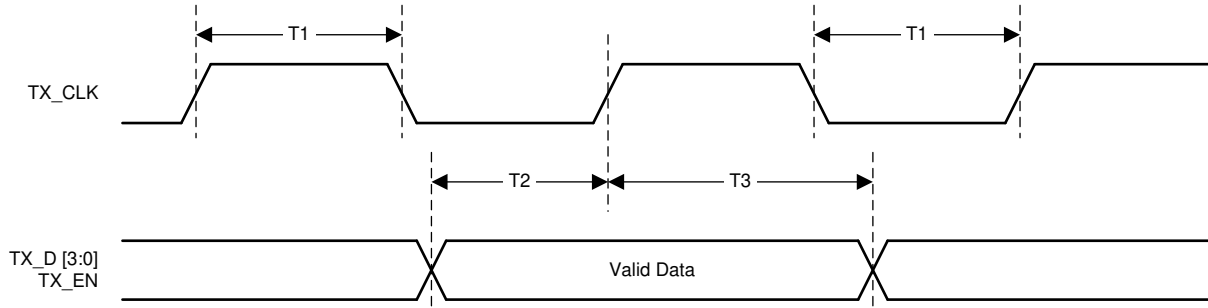
**7-4. Serial Management Timing**



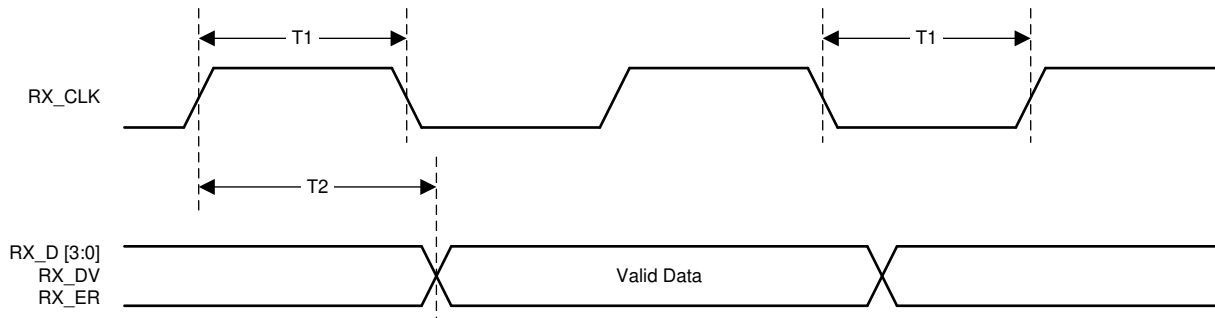
**7-5. 100-Mbps Transmit Timing**



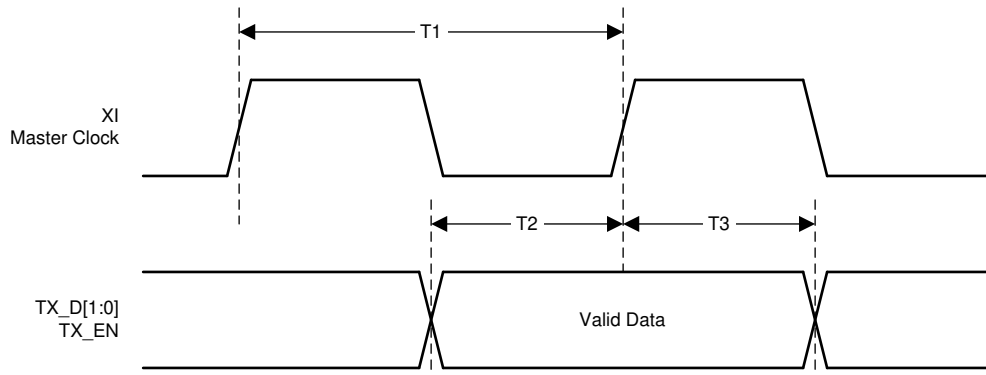
**7-6. 100-Mbps Receive Timing**



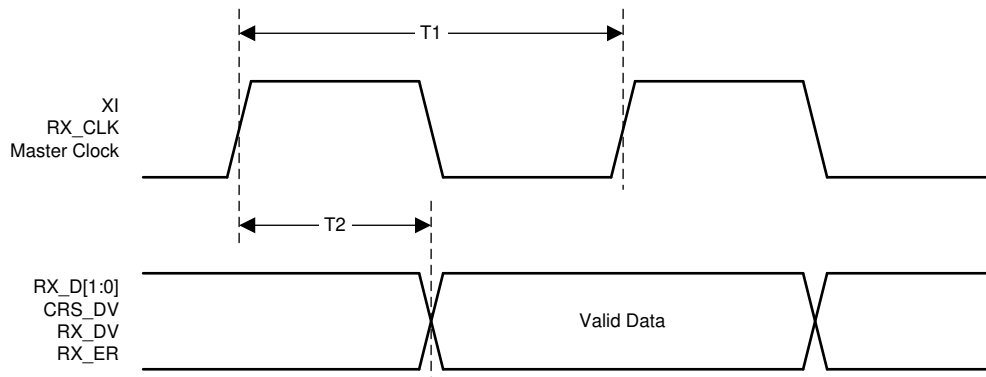
**7-7. 10-Mbps Transmit Timing**



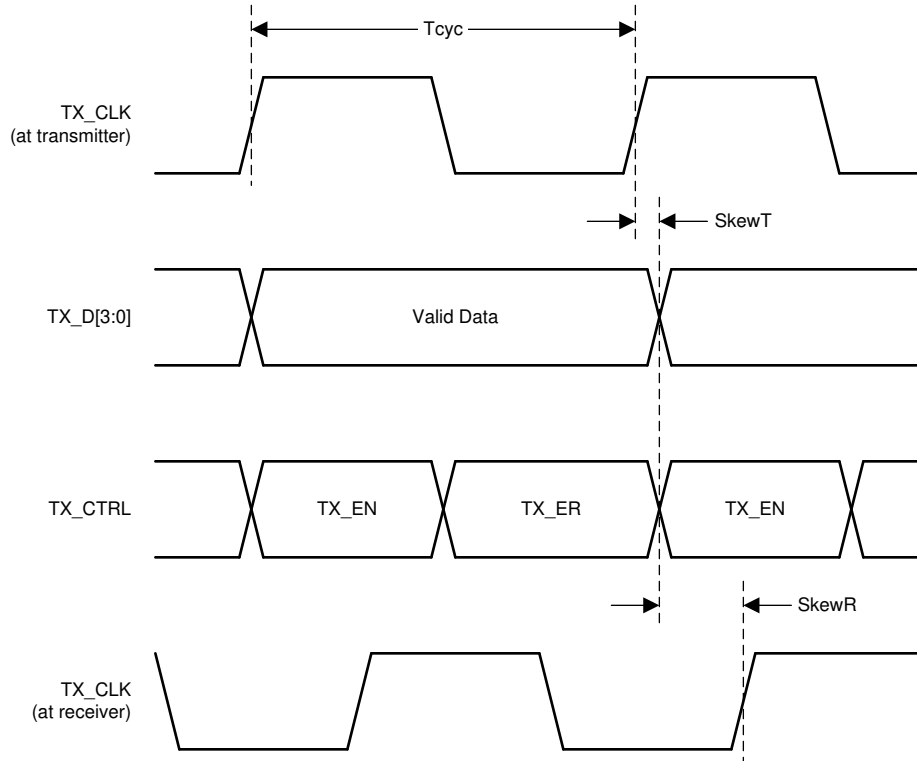
**7-8. 10-Mbps Receive Timing**



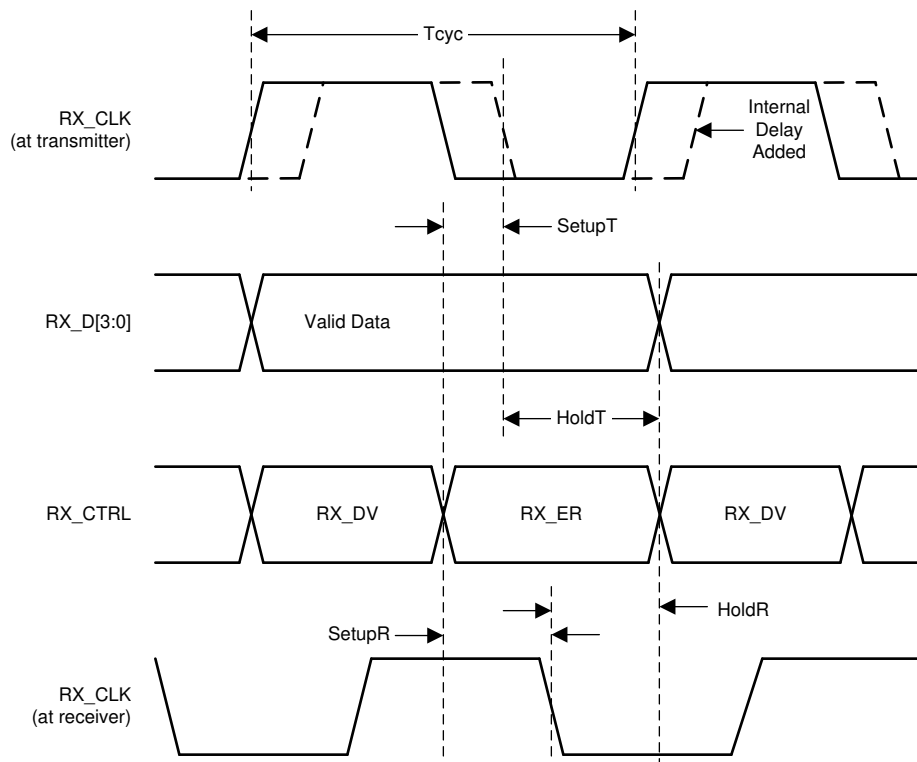
**7-9. RMII Transmit Timing**



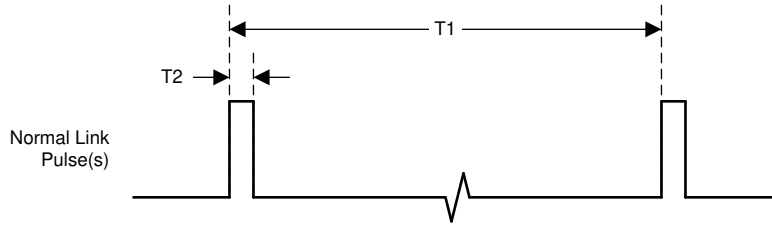
**7-10. RMII Receive Timing**



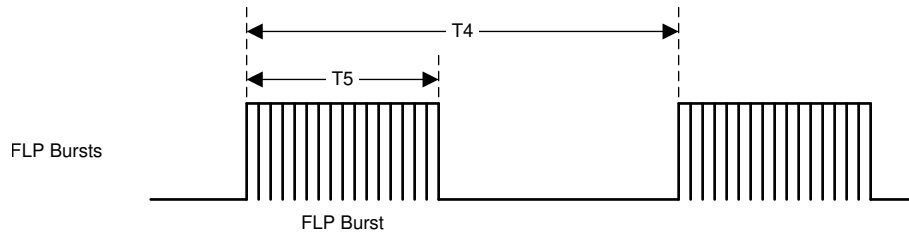
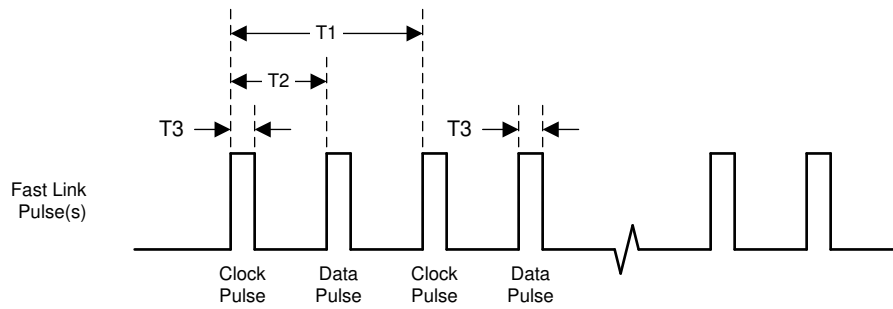
**7-11. RGMII Transmit Timing**



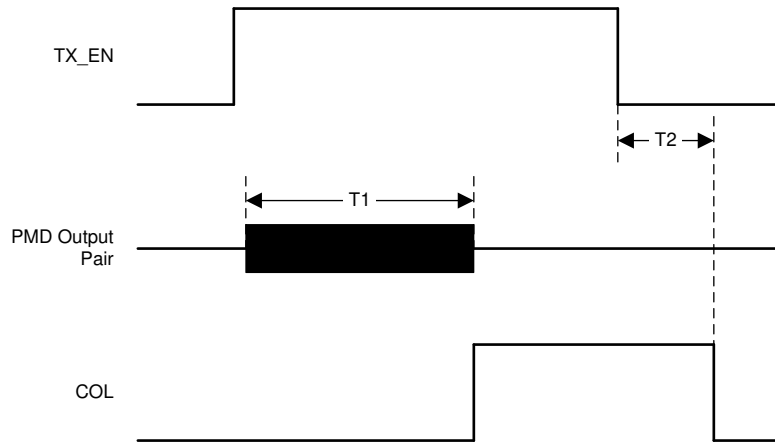
**7-12. RGMII Receive Timing**



**7-13. Normal Link Pulse(s) Timing**

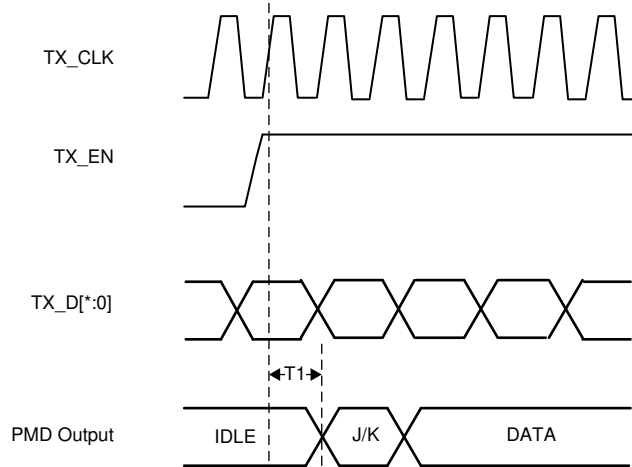


**7-14. Fast Link Pulse Timing**

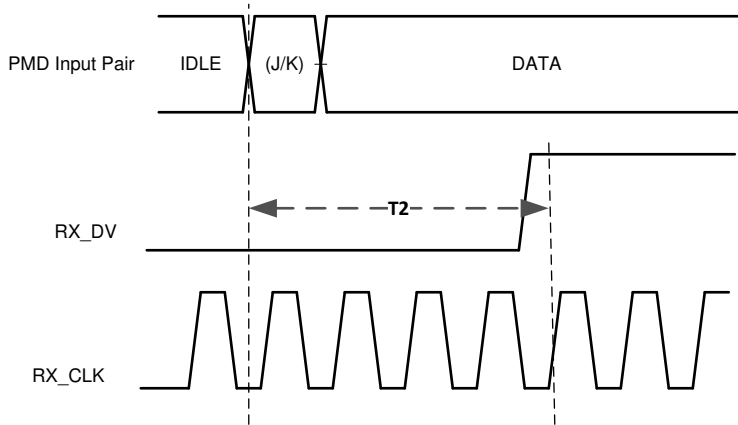


**7-15. 10BASE-Te Jabber Timing**



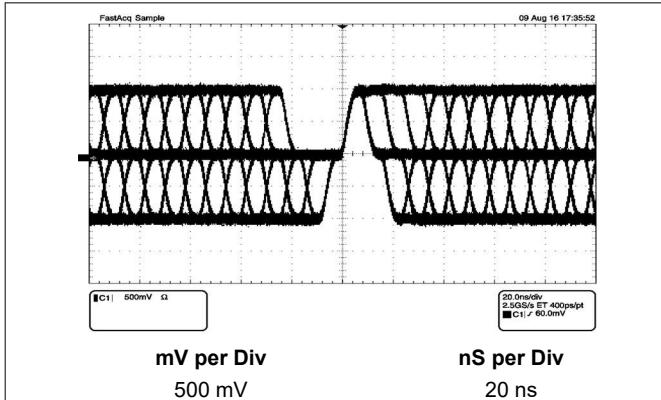


**图 7-16. 100BASE-TX Transmit Latency Timing**

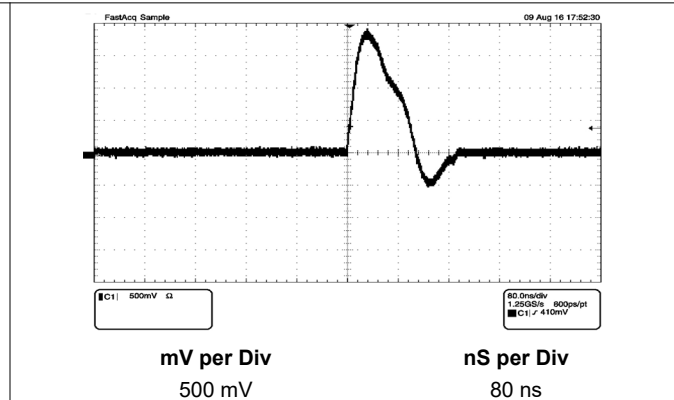


**图 7-17. 100BASE-TX Receive Latency Timing**

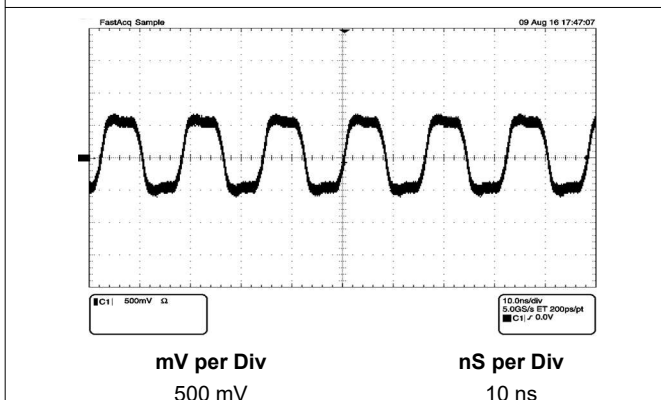
## 7.23 Typical Characteristics



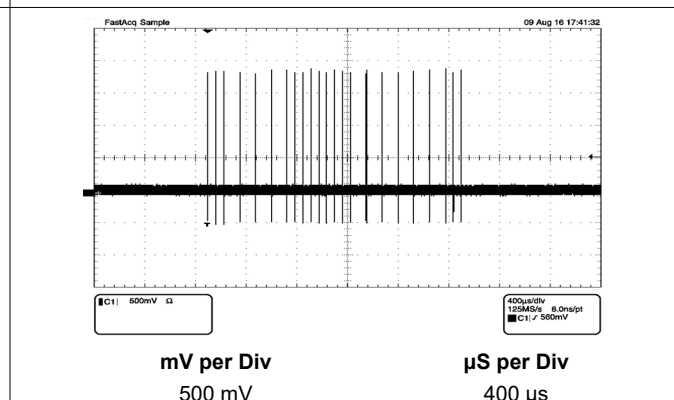
 7-18. 100BASE-TX PMD Eye Waveform



 7-19. 10BASE-Te Link Pulse Waveform



 7-20. 100BASE-FX Waveform



 7-21. Auto-Negotiation Fast Link Pulses Waveform

## 8 Detailed Description

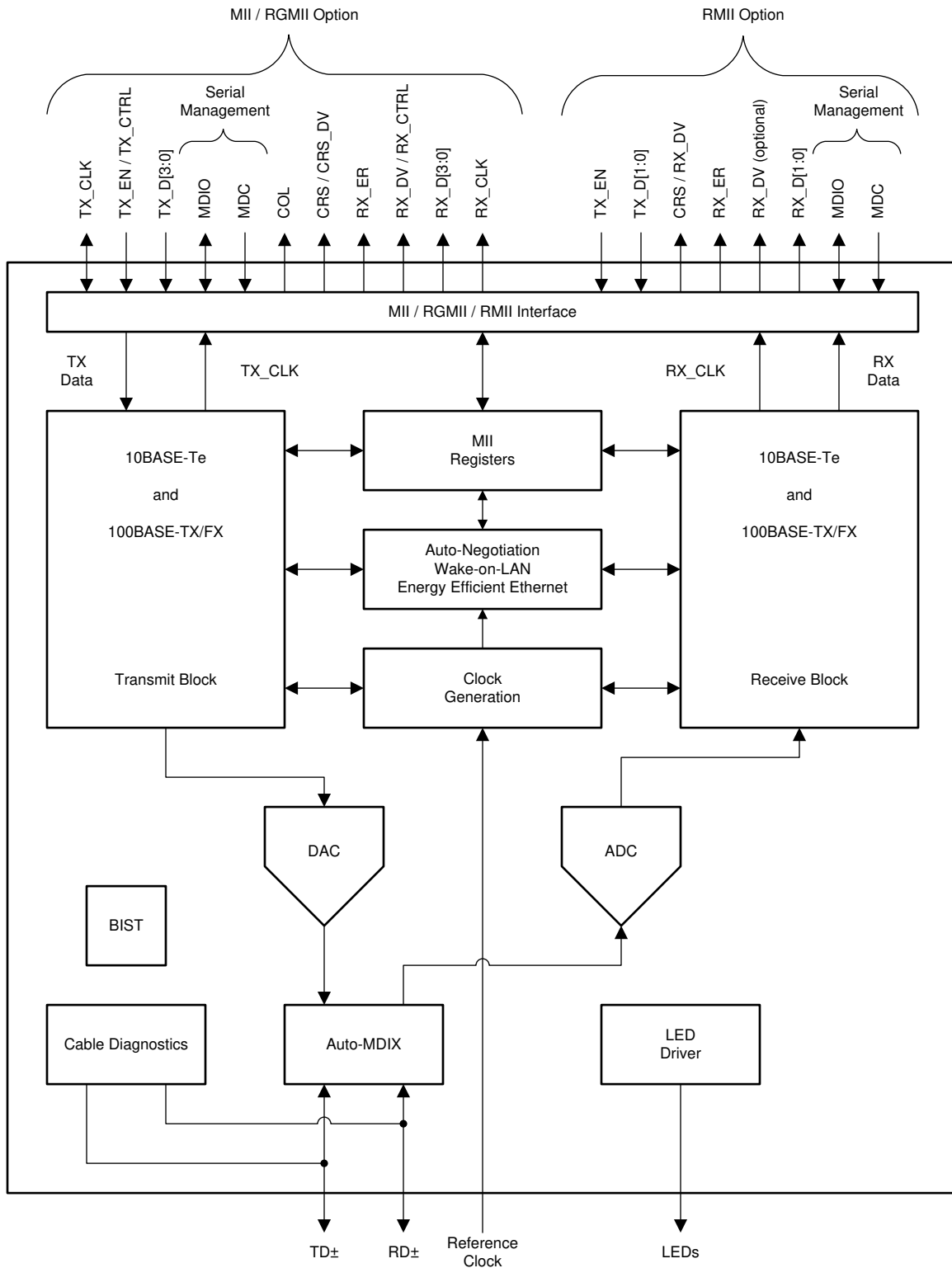
### 8.1 Overview

The DP83822 is a fully-featured, single-port Physical Layer transceiver for 10BASE-Te, 100BASE-TX and 100BASE-FX signaling. The device supports the standard Media Independent Interface (MII), Reduced Media Independent Interface (RMII), and Reduced Gigabit Media Independent Interface (RGMI) for direct connection to a Media Access Controller (MAC).

The device is designed for power supply flexibility by allowing for a range of I/O voltage interfaces (3.3 V, 2.5 V, or 1.8 V) and options for analog voltage (1.8 V or 3.3 V) to reduce power consumption. Automatic supply configuration within the DP83822 allows for any combination of VDDIO supply and AVD supply without the need for additional configuration settings. The DP83822 uses mixed-signal processing to perform equalization, data recovery, and error correction to achieve robust operation over CAT5 twisted-pair cable. The DP83822 not only meets the requirements of IEEE 802.3u, but maintains high margins in terms of crosstalk and alien noise.

The DP83822 is also a pin-to-pin upgradeable option for the TLK105, TLK106, TLK105L, and TLK106L 10/100 Mbps Ethernet PHYs.

## 8.2 Functional Block Diagram



**8-1. DP83822 Functional Block Diagram**

## 8.3 Feature Description

### 8.3.1 Energy Efficient Ethernet

#### 8.3.1.1 EEE Overview

Energy Efficient Ethernet (EEE), defined by IEEE 802.3az, is a capability integrated into Layer 1 (Physical Layer) and Layer 2 (Data Link Layer) to operate in Low Power Idle (LPI) mode. In LPI mode, power is saved during periods of low packet utilization. EEE defines the protocol to enter and exit LPI mode without dropping the link or corrupting packets. The transition time into and out of LPI mode is short enough to be transparent to the upper layers within the OSI model.

The DP83822 EEE supports 100 Mbps and 10 Mbps speeds. In 10BASE-T<sub>e</sub> operation, EEE operates with a reduced transmit amplitude that is fully interoperable with a 10BASE-T PHY.

#### 8.3.1.2 EEE Negotiation

EEE is advertised during Auto-Negotiation. Auto-Negotiation is performed at power up, on management command, after link failure, or due to user intervention. EEE is supported if and only if both link partners advertise EEE capabilities. If EEE is not supported, all EEE functions are disabled and the MAC should not assert LPI. To advertise EEE capabilities, the PHY needs to exchange an additional formatted next page and unformatted next page in sequence.

EEE Negotiation can be activated in two ways:

- Hardware Bootstrapping
- Register Access

EEE Negotiation Advertisements can be activated using RX\_D1 pin bootstrap. When RX\_D1 is set to strap mode 2 or mode 3, EEE capabilities will be advertised during the Auto-Negotiation process. EEE Negotiation Advertisements can also be activated using register access through the SMI. The DP83822 offers two different ways of accessing EEE control registers within the PHY register set. IEEE 802.3az defines MMD3 and MMD7 as the locations for EEE control and status registers. The MMD3 and MMD7 registers 0x3000, 0x3001, 0x3016, 0x703C, and 0x703D contain all the required controls and status indications for operating EEE. Additionally, the DP83822 supports an EEE configuration bypass option that enables EEE control registers within Texas Instruments' Vendor Specific DEVAD. This helps simplify configuration by allowing for a single DEVAD to be used. The Energy Efficient Ethernet Configuration Register #2 (EEECFG2, address 0x04D0) contains controls for enabling and selecting the pin allocation for TX\_ER, which is part of the MAC transmit LPI command. The Energy Efficient Ethernet Configuration Register #3 (EEECFG3, address 0x04D1) contains controls for EEE configuration bypass.

#### 8.3.2 Wake-on-LAN Packet Detection

Wake-on-LAN provides a mechanism to detect specific frames and notify the connected controller through either register status change, GPIO indication or an interrupt flag. The WoL feature within the DP83822 allows for connected devices residing above the Physical Layer to remain in a low power state until frames with the qualifying credentials are detected. Supported WoL frame types include: Magic Packet, Magic Packet with Secure-ON and Custom Pattern Match. When a qualifying WoL frame is received, the DP83822 WoL logic circuit is able to generate a user defined event (either pulses or level change) through any of the GPIO pins or a status interrupt flag to inform a connected controller that a wake event has occurred. Additionally, the DP83822 includes a CRC Gate to prevent invalid packets from triggering a wake-up event.

The Wake-on-LAN feature set includes:

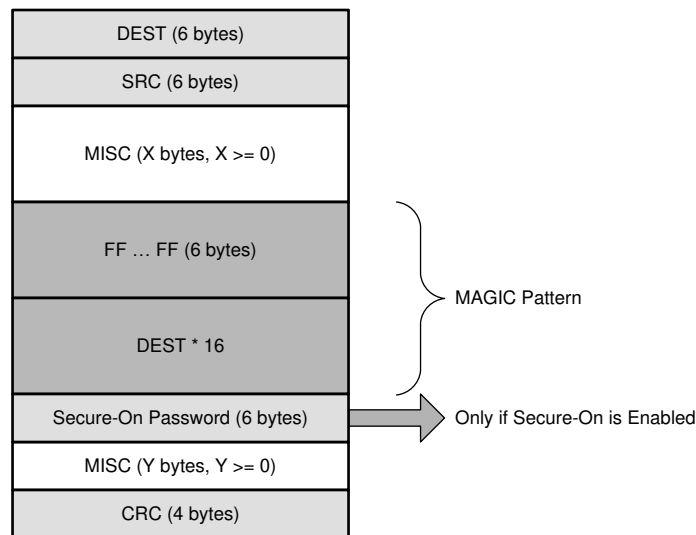
- Identification of WoL frames in all supported speeds (100BASE-FX, 100BASE-TX and 10BASE-T<sub>e</sub>).
- Wakeup interrupt generation upon reception of a WoL frame.
- CRC error checking of WoL frames to prevent interrupt generation from invalid frames.
- Magic Packets with Secure-ON password and 64-byte Custom Pattern Match for security.

### 8.3.2.1 Magic Packet Structure

When configured for Magic Packet detection, the DP83822 scans all incoming frames addressed to the node for a specific data sequence. This sequence identifies the frame as a Magic Packet frame.

A Magic Packet frame must also meet the basic requirements for the LAN technology chosen, such as SOURCE ADDRESS, DESTINATION ADDRESS (which may be the receiving station's IEEE address or a BROADCAST ADDRESS), and CRC.

The specific Magic Packet sequence consists of 16 duplications of the MAC address of this node, with no breaks or interruptions, followed by Secure-ON password if security is enabled. This sequence can be located anywhere within the packet, but must be preceded by a synchronization stream. The synchronization stream is defined as 6-bytes of 0xFF.



**8-2. Magic Packet Structure**

### 8.3.2.2 Magic Packet Example

The following is an example Magic Packet for a Destination Address of 11h 22h 33h 44h 55h 66h and a secure-on password 2Ah 2Bh 2Ch 2Dh 2Eh 2Fh:

```

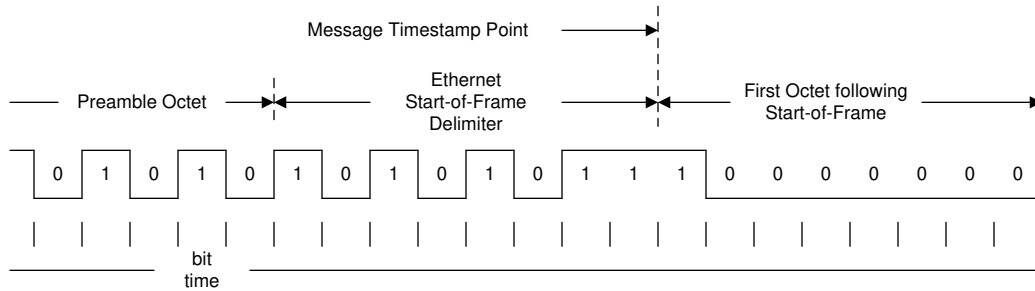
DESTINATION SOURCE MISC FF FF FF FF FF FF
11 22 33 44 55 66 11 22 33 44 55 66 11 22 33 44 55 66
11 22 33 44 55 66 11 22 33 44 55 66 11 22 33 44 55 66
11 22 33 44 55 66 11 22 33 44 55 66 11 22 33 44 55 66
11 22 33 44 55 66 11 22 33 44 55 66 11 22 33 44 55 66
11 22 33 44 55 66 11 22 33 44 55 66 11 22 33 44 55 66
11 22 33 44 55 66 2A 2B 2C 2D 2E 2F MISC CRC
    
```

### 8.3.2.3 Wake-on-LAN Configuration and Status

Wake-on-LAN functionality is configured through the Receive Configuration Register (RXFCFG, address 0x04A0). Wake-on-LAN status is reported in the Recieve Status Register (RXFS, address 0x04A1). Wake-on-LAN interrupt flag configuration and status is located in the MII Interrupt Status Register #2 (MISR2, address 0x0013).

### 8.3.3 Start of Frame Detect for IEEE 1588 Time Stamp

The DP83822 supports an IEEE 1588 indication pulse at the SFD (start frame delimiter) for receive and transmit paths. The pulse can be delivered to any of the following pins: LED\_0, LED\_1 (GPIO1), COL (GPIO2), RX\_D3 (GPIO3), INT/PWDN\_N and CRS. The 1588 Time Stamp pulse indicates the actual time the symbol is presented on the lines (for transmit), or the first symbol received (for receive). The exact timing of the pulse can be adjusted via the IEEE 1588 PTP Configuration Register (PTPCFG, address 0x003F). Each increment of phase value is an 8-ns step.



**图 8-3. IEEE 1588 Message Timestamp Point**

There are three registers that are able to control the routing of the IEEE 1588 transmit and receive indications. The IEEE 1588 PTP Pin Select Register (PTPSEL, address 0x003E) is able to route both transmit and receive indications to LED\_0 (GPIO1), COL (GPIO2), CRS and INT/PWDN\_N, which is also found in the TLK105L and TLK106L PHYs. Two additional registers in the DP83822 allow for additional pin selections and a centralized location for GPIO controls through the use of the IO MUX GPIO Control Register #1 and #2 (IOCTRL1 and IOCTRL2, address 0x0462 and address 0x0463). After enabling/setting the RX\_SFD and TX\_SFD pins in register IOCTRLx, please write the following two registers:

- Program (Register 0x0456 = value 0x000A)
- Program (Register 0x04A0 = value 0x1080)
  - Please note register 0x04A0 is enabling "bit 7: WOL". This helps improve the accuracy of SFD detection and is not a must change. This will not cause PHY to detect WoL packets, as WoL function needs additional register configurations.

Note: A software reset has to be performed to load these register values (Register 0x001F = value 0x4000)

### 8.3.4 Clock Output

The DP83822 has several clock configuration options. An external crystal or CMOS-level oscillator provides the stimulus for the internal PHY reference clock. The local reference clock acts as the central source for all clocking within the device, excluding the pass-through clock option.

All clock configuration options are enabled using the DP83822 IO MUX GPIO Control Register #1 and #2 (IOCTRL1 IOCTRL2, address 0x0462 bits[14:12] for RX\_D3 (GPIO3), address 0x0462 bits[6:4] for LED\_1 (GPIO1), address 0x0463 bits[6:4] for COL (GPIO2)).

Clock options supported by the DP83822 include:

- MAC IF Clock
- XI Clock
- Free-Running Clock
- Recovered Clock

MAC IF Clock will operate at the same rate as the MAC interface selected. For MII operation, MAC IF Clock frequency is 25 MHz. For RMII operation, MAC IF Clock frequency is 50 MHz. For RGMII operation, MAC IF Clock frequency is 25 MHz. XI Clock is a pass-through option, which allows for the XI pin clock to be passed to a GPIO pin. Please note that the clock is buffered prior to transmission out of the GPIOs, and output clock amplitude will be at the selected VDDIO level. Free-Running Clock is an internally generated 125-MHz free-running clock. Recovered Clock is a 125-MHz recovered clock from a connected link partner.



## 8.4 Device Functional Modes

### 8.4.1 MAC Interfaces

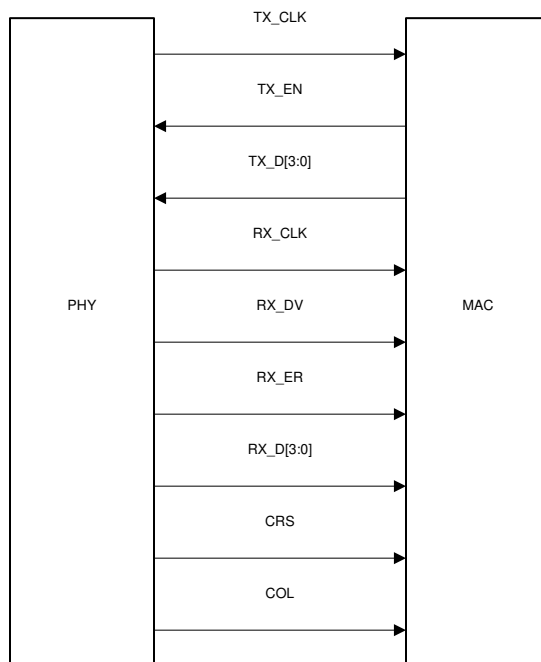
#### 8.4.1.1 Media Independent Interface (MII)

The Media Independent Interface is a synchronous 4-bit wide nibble data interface that connects the PHY to the MAC in 100BASE-FX, 100BASE-TX and 10BASE-Te modes. The MII is fully compliant with IEEE 802.3-2002 clause 22.

The MII signals are summarized below:

**表 8-1. MII Signals**

| FUNCTION                     | PINS      |
|------------------------------|-----------|
| Data Signals                 | TX_D[3:0] |
|                              | RX_D[3:0] |
| Transmit and Receive Signals | TX_EN     |
|                              | RX_DV     |
| Line-Status Signals          | CRS       |
|                              | COL       |



**图 8-4. MII Signaling**

Additionally, the MII interface includes the carrier sense signal (CRS), as well as a collision detect signal (COL). The CRS signal asserts to indicate the reception or transmission of data. The COL signal asserts as an indication of a collision which can occur during Half-Duplex mode when both transmit and receive operations occur simultaneously.

### 8.4.1.2 Reduced Media Independent Interface (RMII)

The DP83822 incorporates the Reduced Media Independent Interface (RMII) as specified in the RMII specification from the RMII consortium. The purpose of this interface is to provide a reduced pin count alternative to the IEEE 802.3u MII as specified in Clause 22. Architecturally, the RMII specification provides an additional reconciliation layer on either side of the MII, but can be implemented in the absence of an MII. The DP83822 offers two types of RMII operations: RMII Slave and RMII Master. In RMII Slave operation, the DP83822 operates off of a 50-MHz CMOS-level oscillator connected to the XI pin and shares the same clock as the MAC. In RMII Master operation, the DP83822 operates off of either a 25-MHz CMOS-level oscillator connected to XI pin or a 25-MHz crystal connected across XI and XO pins. A 50-MHz output clock referenced from any of the three DP83822 GPIOs is connected to the MAC.

#### 注

If RMII Master mode is configured through bootstraps, a 50-MHz output clock will automatically be enabled on RX\_D3 (GPIO3).

The RMII specification has the following characteristics:

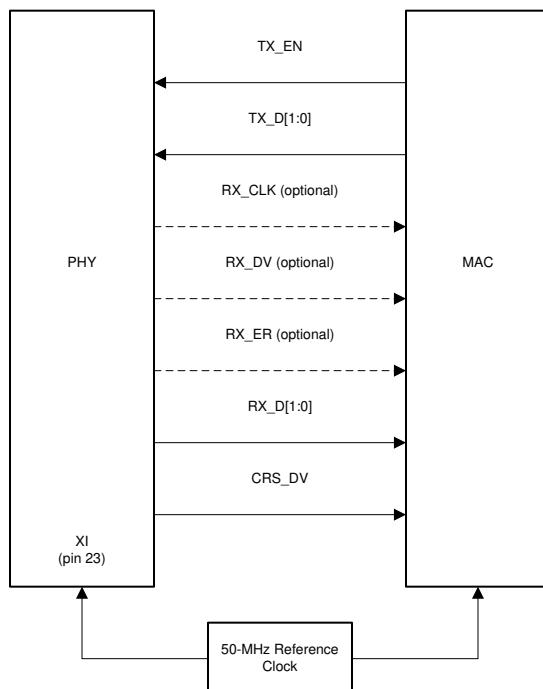
- Supports 100BASE-FX, 100BASE-TX and 10BASE-Te.
- Single clock reference sourced from the MAC to PHY (or from an external source)
- Provides independent 2-bit wide transmit and receive data paths
- Uses CMOS signal levels, the same levels as the MII interface

In this mode, data transfers are two bits for every clock cycle using the internal 50-MHz reference clock for both transmit and receive paths.

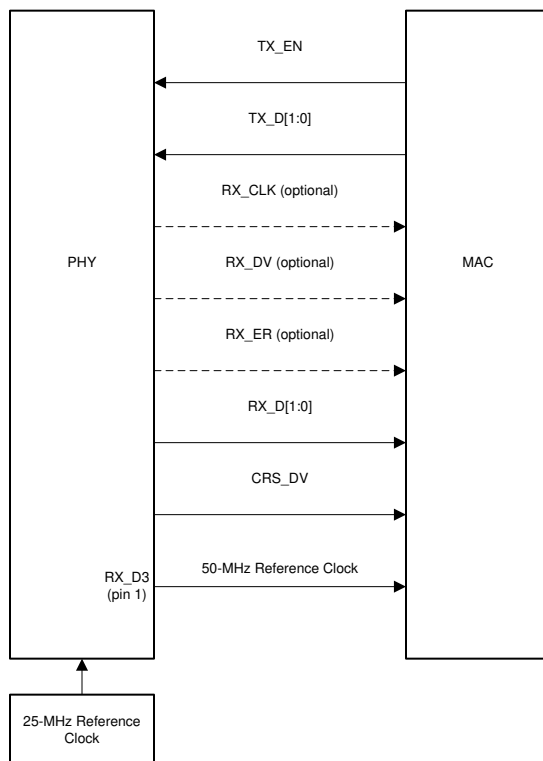
The RMII signals are summarized below:

**表 8-2. RMII Signals**

| FUNCTION                     | PINS      |
|------------------------------|-----------|
| Data Signals                 | TX_D[1:0] |
|                              | RX_D[1:0] |
| Transmit and Receive Signals | TX_EN     |
|                              | CRS_DV    |



**8-5. RMI Slave Signaling**



**8-6. RMI Master Signaling**

Data on TX\_D[1:0] are latched at the PHY with reference to the clock edges on the XI pin. Data on RX\_D[1:0] are latched at the MAC with reference to the same clock edges on the XI pin. RMI operates at the same speed in 10BASE-Te, 100BASE-TX and 100BASE-FX. In 10BASE-Te the data is 10 times slower than the reference

clock, so transmit data is sampled every 10 clock cycles. Likewise, receive data is generated on every 10th clock so that an attached MAC device can sample the data every 10 clock cycles.

In addition, RMII mode supplies an RX\_DV signal that allows a simpler method of recovering receive data without the need to separate RX\_DV from the CRS\_DV indication. RX\_ER is also supported even though it is not required by the RMII specification.

RMII includes a programmable elastic buffer to adjust for the frequency differences between the reference clock and the recovered receive clock. The programmable elastic buffer minimizes internal propagation delay based on expected maximum packet size and clock accuracy.

Table below indicates how to program the buffer FIFO based on the expected maximum packet size and clock accuracy. It assumes that the RMII reference clock and the far-end transmitter clock have the same accuracy.

**表 8-3. Recommended RMII Packet Sizes**

| START THRESHOLD<br>RBR[1:0] | LATENCY<br>TOLERANCE | RECOMMENDED PACKET SIZE<br>AT ±50 ppm | RECOMMENDED PACKET SIZE<br>AT ±100 ppm |
|-----------------------------|----------------------|---------------------------------------|--|
| 1 (4-bits)                  | 2 bits               | 2400 bytes                            | 1200 bytes                             |
| 2 (8-bits)                  | 6 bits               | 7200 bytes                            | 3600 bytes                             |
| 3 (12-bits)                 | 10 bits              | 12000 bytes                           | 6000 bytes                             |
| 4 (16-bits)                 | 14 bits              | 16800 bytes                           | 8400 bytes                             |

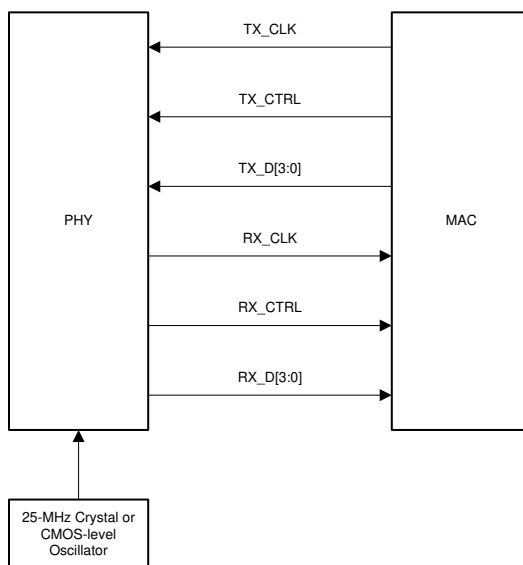
### 8.4.1.3 Reduced Gigabit Media Independent Interface (RGMI)

The DP83822 also supports Reduced Gigabit Media Independent Interface (RGMI) as specified by RGMI version 2.0. RGMI is designed to reduce the number of pins required to connect the MAC and PHY. To accomplish this goal, the control signals are multiplexed. Both rising and falling edges of the clock are used to sample the control signal pin on the transmit and receive paths. For 10-Mbps operation, RX\_CLK and TX\_CLK operate at 2.5 MHz. For 100-Mbps operation, RX\_CLK and TX\_CLK operate at 25 MHz.

The RGMI signals are summarized below:

**表 8-4. RGMI Signals**

| FUNCTION                     | PINS      |
|------------------------------|-----------|
| Data Signals                 | TX_D[3:0] |
|                              | RX_D[3:0] |
| Transmit and Receive Signals | TX_CTRL   |
|                              | RX_CTRL   |



**图 8-7. RGMI Signaling**

During packet reception, RX\_CLK may be stretched on either the positive or negative pulse to accommodate the transition from the internal free running clock to a recovered clock (data synchronous). Additionally, when the speed of the PHY changes, a similar clock stretching of the positive or negative pulses is allowed to prevent clock glitches. Data may be duplicated on the falling edge of the clock because double data rate (DDR) is only required for 1-Gbps operation, which is not supported by the DP83822.

The DP83822 supports in-band status indication. To help simplify detection of link status, speed and duplex, the DP83822 provides inter-frame signals on RX\_D[3:0] pins as specified in 表 8-5 below.

**表 8-5. RGMI In-Band Status**

| RX_DV   | RX_D3  | RX_D[2:1]   | RX_D0  |
|---|--|---|--|
| 0<br><b>Note:</b> In-band status only valid when RX_DV is low | Duplex Status:<br>1 = Full-Duplex<br>0 = Half-Duplex | RX_CLK Clock Speed:<br>00 = 2.5-MHz (10 Mbps)<br>01 = 25-MHz (100 Mbps)<br>10 = Reserved<br>11 = Reserved | Link Status:<br>1 = Valid link established<br>0 = Link not established |

### 8.4.2 Serial Management Interface

The Serial Management Interface provides access to the DP83822 internal register space for status information and configuration. The SMI is compatible with IEEE 802.3 clause 22 and clause 45. The implemented register set consists of the registers required by the IEEE 802.3 plus several others to provide additional visibility and controllability of the DP83822.

The SMI includes the management clock (MDC) and the management input/output data pin (MDIO). MDC is sourced by the external management entity, also called Station (STA), and can run at a maximum clock rate of 25 MHz. MDC is not expected to be continuous, and can be turned off by the external management entity when the bus is idle.

MDIO is sourced by the external management entity and by the PHY. The data on the MDIO pin is latched on the rising edge of the MDC. MDIO pin requires a pullup resistor (2.2 KΩ), which pulls MDIO high during IDLE and turnaround.

Up to 32 PHYs can share a common SMI bus. To distinguish between the PHYs, a 5-bit address is used. During power up or hardware reset, the DP83822 latches the PHY\_AD[4:0] configuration pins to determine its address.

The management entity must not start an SMI transaction in the first cycle after power up or hardware reset. To maintain valid operation, the SMI bus must remain inactive at least one MDC cycle after reset is deasserted. In normal MDIO transactions, the register address is taken directly from the management-frame reg\_addr field, thus allowing direct access to 32 16-bit registers (including those defined in IEEE 802.3 and vendor specific). The data field is used for both reading and writing. The Start code is indicated by a <01> pattern. This pattern makes sure that the MDIO line transitions from the default idle line state. Turnaround is defined as an idle bit time inserted between the Register Address field and the Data field. To avoid contention during a read transaction, no device may actively drive the MDIO signal during the first bit of Turnaround. The addressed DP83822 drives the MDIO with a zero for the second bit of turnaround and follows this with the required data.

For write transactions, the station-management entity writes data to the addressed DP83822, thus eliminating the requirement for MDIO Turnaround. The Turnaround time is filled by the management entity by inserting <10>.

**表 8-6. SMI Protocol**

| SMI PROTOCOL    | <idle><start><op code><device addr><reg addr><turnaround><data><idle> |
|-----------------|---|
| Read Operation  | <idle><01><10><AAAA><RRRRR><Z0><XXXX XXXX XXXX XXXX><idle>            |
| Write Operation | <idle><01><01><AAAA><RRRRR><10><XXXX XXXX XXXX XXXX><idle>            |

### 8.4.2.1 Extended Register Space Access

The DP83822 SMI function supports read and write access to the extended register set using the Register Control Register (REGCR, address 0x000D), the Data Register (ADDAR, address 0x000E), and the MDIO Manageable Device (MMD) indirect method defined in IEEE 802.3ah Draft for Clause 22 for accessing the Clause 45 extended register set.

The standard register set, MDIO registers 0 to 31, is accessed using the normal direct-MDIO access or the indirect method, except for register REGCR and register ADDAR, which are accessed only using the normal MDIO transaction. The SMI function will ignore indirect access to these registers.

REGCR is the MMD access control. In general, register REGCR[4:0] is the device address DEVAD that directs any accesses of the ADDAR register to the appropriate MMD.

The DP83822 supports three MMD device addresses:

1. The Vendor-Specific device address DEVAD[4:0] = 11111 is used for general MMD register accesses.
2. DEVAD[4:0] = 00011 is used for Energy Efficient Ethernet MMD register accesses. Register names for registers accessible at this device address are preceded by MMD3.
3. DEVAD[4:0] = 00111 is used for Energy Efficient Ethernet MMD registers accesses. Register names for registers accessible at this device address are preceded by MMD7.

All accesses through register REGCR and ADDAR must use the correct DEVAD. Transactions with other DEVAD are ignored. REGCR[15:14] holds the access function: address (00), data with no post increment (01), data with post increment on writes only (11). Address (10) is not valid.

- ADDAR is the address/data MMD register. ADDAR is used in conjunction with REGCR to provide the access to the extended register set. If register REGCR[15:14] is (00), then ADDAR holds the address of the extended address space register. Otherwise, ADDAR holds the data as indicated by the contents of its address register. When REGCR[15:14] is set to (00), accesses to register ADDAR modify the extended register set address register. This address register must always be initialized in order to access any of the registers within the extended register set.
- When REGCR[15:14] is set to (01), accesses to register ADDAR access the register within the extended register set selected by the value in the address register.
- When REGCR[15:14] set to (10) is not a valid option.
- When REGCR[15:14] is set to (11), access to register ADDAR access the register within the extended register set selected by the value in the address register. After that access is complete, for write access only, the value in the address register is incremented. For read accesses, the value of the address register remains unchanged.

The following sections describe how to perform operations on the extended register set using register REGCR and ADDAR. The descriptions use the device address for general MMD register accesses (DEVAD[4:0] = 11111). For register accesses to the MMD3 or MMD7 registers the corresponding device address would be used.

#### **8.4.2.2 Write Address Operation**

To set the address register:

1. Write the value 0x001F (address function field = 00, DEVAD = 31) to register REGCR.
2. Write the register address to register ADDAR.

Subsequent writes to register ADDAR (step 2) continue to write the address register.

#### **8.4.2.3 Read Address Operation**

To read the address register:

1. Write the value 0x001F (address function field = 00, DEVAD = 31) to register REGCR.
2. Read the register address from register ADDAR.

Subsequent reads to register ADDAR (step 2) continue to read the address register.

#### **8.4.2.4 Write (No Post Increment) Operation**

To write a register in the extended register set:

1. Write the value 0x001F (address function field = 00, DEVAD = 31) to register REGCR.
2. Write the desired register address to register ADDAR.
3. Write the value 0x401F (data, no post increment function field = 01, DEVAD = 31) to register REGCR.
4. Write the content of the desired extended register set to register ADDAR.

Subsequent writes to register ADDAR (step 4) continue to rewrite the register selected by the value in the address register.

---

注

Steps (1) and (2) can be skipped if the address register was previously configured.

---

#### **8.4.2.5 Read (No Post Increment) Operation**

To read a register in the extended register set:

1. Write the value 0x001F (address function field = 00, DEVAD = 31) to register REGCR.
2. Write the desired register address to register ADDAR.
3. Write the value 0x401F (data, no post increment function field = 01, DEVAD = 31) to register REGCR.
4. Read the content of the desired extended register set in register ADDAR.

Subsequent reads to register ADDAR (step 4) continue to reading the register selected by the value in the address register.

---

注

Steps (1) and (2) can be skipped if the address register was previously configured.

---

#### **8.4.2.6 Write (Post Increment) Operation**

1. Write the value 0x001F (address function field = 00, DEVAD = 31) to register REGCR.
2. Write the desired register address to register ADDAR.
3. Write the value 0x801F (data, post increment function field = 10, DEVAD = 31) or the value 0xC01F (data, post increment on writes function field = 11, DEVAD = 31) to register REGCR.
4. Write the content of the desired extended register set to register ADDAR.

Subsequent writes to register ADDAR (step 4) write the next higher addressed data register selected by the value of the address register; the address register is incremented after each access.



#### 8.4.2.7 Read (Post Increment) Operation

To read a register in the extended register set and automatically increment the address register to the next higher value following the write operation:

1. Write the value 0x001F (address function field = 00, DEVAD = 31) to register REGCR.
2. Write the desired register address to register ADDAR.
3. Write the value 0x801F (data, post increment function field = 10, DEVAD = 31) to register REGCR.
4. Read the content of the desired extended register set in register ADDAR.

Subsequent reads to register ADDAR (step 4) read the next higher addressed data register selected by the value of the address register; the address register is incremented after each access.

#### 8.4.2.8 Example Write Operation (No Post Increment)

The following example will demonstrate a write operation with no post increment. In this example, the MAC impedance will be adjusted to 99.25  $\Omega$  using the IO MUX GPIO Control Register (IOCTRL, address 0x0461).

1. Write the value 0x001F to register 0x000D.
2. Write the value 0x0461 to register 0x000E. (Sets desired register to the IOCTRL)
3. Write the value 0x401F to register 0x000D.
4. Write the value 0x0400 to register 0x000E. (Sets MAC impedance to 99.25  $\Omega$ )

#### 8.4.2.9 Example Read Operation (No Post Increment)

The following example will demonstrate a read operation with no post increment. In this example, the MMD7 Energy Efficient Ethernet Link Partner Ability Register (MMD7\_EEE\_LP\_ABILITY, address 0x703D) will be read.

1. Write the value 0x0007 to register 0x000D.
2. Write the value 0x003D to register 0x000E. (Sets desired register to the MMD7\_EEE\_LP\_ABILITY)
3. Write the value 0x4007 to register 0x000D.
4. Read the value of register 0x000E. (Data read is the value contained within the MMD7\_EEE\_LP\_ABILITY)

### 8.4.3 100BASE-TX

#### 8.4.3.1 100BASE-TX Transmitter

The 100BASE-TX transmitter consists of several functional blocks which convert synchronous 4-bit nibble data, as provided by the MII, to a scrambled MLT-3 125 Mbps serial data stream on the MDI. 4B5B encoding and decoding is detailed in [表 8-7](#) below.

The transmitter section consists of the following functional blocks:

1. Code-Group Encoder and Injection Block
2. Scrambler Block with Bypass Option
3. NRZ to NRZI Encoder Block
4. Binary to MLT-3 Converter / Common Driver Block

The bypass option for the functional blocks within the 100BASE-TX transmitter provides flexibility for applications where data conversion is not always required. The DP83822 implements the 100BASE-TX transmit state machine diagram as specified in the IEEE 802.3u Standard, Clause 24.

**表 8-7. 4B5B Code-Group Encoding / Decoding**

| NAME  | PCS 5B CODE-GROUP | MII 4B NIBBLE CODE            |
|---|-------------------|-------------------------------|
| <b>DATA CODES</b>                           |                   |                               |
| 0   | 11110             | 0000                          |
| 1   | 01001             | 0001                          |
| 2   | 10100             | 0010                          |
| 3   | 10101             | 0011                          |
| 4   | 01010             | 0100                          |
| 5   | 01011             | 0101                          |
| 6   | 01110             | 0110                          |
| 7   | 01111             | 0111                          |
| 8   | 10010             | 1000                          |
| 9   | 10011             | 1001                          |
| A   | 10110             | 1010                          |
| B   | 10111             | 1011                          |
| C   | 11010             | 1100                          |
| D   | 11011             | 1101                          |
| E   | 11100             | 1110                          |
| F   | 11101             | 1111                          |
| <b>IDLE AND CONTROL CODES<sup>(1)</sup></b> |                   |                               |
| H   | 00100             | HALT code-group - Error code  |
| I   | 11111             | Inter-Packet IDLE - 0000      |
| J   | 11000             | First Start of Packet - 0101  |
| K   | 10001             | Second Start of Packet - 0101 |
| T   | 01101             | First End of Packet - 0000    |
| R   | 00111             | Second End of Packet - 0000   |
| P   | 00000             | EEE LPI - 0001 <sup>(2)</sup> |
| <b>INVALID CODES</b>                        |                   |                               |
| V   | 00001             |                               |
| V   | 00010             |                               |
| V   | 00011             |                               |
| V   | 00101             |                               |
| V   | 00110             |                               |
| V   | 01000             |                               |
| V   | 01100             |                               |
| V   | 10000             |                               |
| V   | 11001             |                               |

(1) Control code-groups I, J, K, T and R in data fields will be mapped as invalid codes, together with RX\_ER asserted.

(2) Energy Efficient Ethernet LPI must also have TX\_ER / RX\_ER asserted and TX\_EN / RX\_DV deasserted.

#### 8.4.3.1.1 Code-Group Encoding and Injection

The code-group encoder converts 4-bit (4B) nibble data generated by the MAC into 5-bit (5B) code-groups for transmission. This conversion is required to allow control data to be combined with packet data code-groups. Refer to 表 8-7 for 4B to 5B code-group mapping details.

The code-group encoder substitutes the first 8-bits of the MAC preamble with a J/K code-group pair (11000 10001) upon transmission. The code-group encoder continues to replace subsequent 4B preamble and data nibbles with corresponding 5B code-groups. At the end of the transmit packet, upon the deassertion of transmit enable (TX\_EN) signal from the MAC, the code-group encoder injects the T/R code-group pair (01101 00111) indicating the end of the frame.

After the T/R code-group pair, the code-group encoder continuously injects IDLEs into the transmit data stream until the next transmit packet is detected (reassertion of transmit enable).

#### 8.4.3.1.2 Scrambler

The scrambler is required to control the radiated emissions at the media connector and on the twisted-pair cable. By scrambling the data, the total energy launched onto the cable is randomly distributed over a wide frequency range. Without the scrambler, energy levels at the MDI and on the cable could peak beyond FCC limitations at frequencies related to repeating 5B sequences (that is, continuous transmission of IDLEs).

The scrambler is configured as a closed loop linear feedback shift register (LFSR) with an 11-bit polynomial. The output of the closed loop LFSR is X-ORd with the serial NRZ data from the code-group encoder. The result is a scrambled data stream with sufficient randomization to decrease radiated emissions at certain frequencies by as much as 20 dB.

A serial descrambler is used to de-scramble the received MLT3 decoded data. The descrambler has to generate an identical data scrambling sequence (N) in order to recover the original unscrambled data (UD) from the scrambled data (SD) as represented in the equations:

$$SD = (UD \oplus N) \quad (1)$$

$$UD = (SD \oplus N) \quad (2)$$

Synchronization of the descrambler to the original scrambling sequence (N) is achieved based on the knowledge that the incoming scrambled data stream consists of scrambled IDLE data (which is continuous stream of 1's). After the descrambler has recognized 88 consecutive IDLE symbols (or ~18 5-bit IDLE codes) where an IDLE symbol is bit decoded as 'b1 after de-scrambling, it will synchronize to the receive data stream and generate unscrambled data in the form of unaligned 5B code-groups. In order to maintain synchronization, the descrambler must continuously monitor the validity of the unscrambled data that it generates. To ensure this the received symbols are continuously monitored to check for any non-IDLE symbols received before start of packet i.e. /J/K/. If 3 consecutive errors occur i.e. descrambled bits are received as 'b0 but don't represent /J/ symbol the scrambler is forced to unlock state and reset to reacquire a synchronization. Similarly, if the symbol following /J/ doesn't match /K/ (i.e. the 2nd SSD symbol) the scrambler is forced to unlock state and reset to reacquire a synchronization.

#### 8.4.3.1.3 NRZ to NRZI Encoder

After the transmit data stream has been serialized and scrambled, the data must be NRZI encoded in order to comply with the TP-PMD standard for 100BASE-TX transmission over Category-5 Unshielded twisted pair cable. There is no ability to bypass this block within the DP83822. The NRZI data is sent to the 100 Mbps Driver.

#### 8.4.3.1.4 Binary to MLT-3 Converter

The Binary to MLT-3 conversion is accomplished by converting the serial binary data stream output from the NRZI encoder into two binary data streams with alternately phased logic one events. These two binary streams are then fed to the twisted pair output driver which converts the voltage to current and alternately drives either side of the transmit transformer primary winding, resulting in a minimal current MLT-3 signal.

The 100BASE-TX MLT-3 signal sourced by the PMD Output Pair common driver is slew rate controlled. This should be considered when selecting AC coupling magnetics to ensure TP-PMD Standard compliant transition times ( $3 \text{ ns} < \text{Trise/fall} < 5 \text{ ns}$ ).

The 100BASE-TX transmit TP-PMD function within the DP83822 is capable of sourcing only MLT-3 encoded data. Binary output from the PMD Output Pair is not possible in 100 Mbps mode. Fully encoded MLT-3 on both Tx+ and Tx- and can be configured by configuring Register 0x0404h (for example, in transformer-less designs).

#### **8.4.3.2 100BASE-TX Receiver**

The 100BASE-TX receiver consists of several functional blocks which convert the scrambled MLT-3 125 Mbps serial data stream to synchronous 4-bit nibble data that is provided to the MII.

The receive section consists of the following functional blocks:

1. Input and BLW Compensation
2. Signal Detect
3. Digital Adaptive Equalization
4. MLT-3 to Binary Decoder
5. Clock Recovery Module
6. NRZI to NRZ Decoder
7. Serial to Parallel
8. Descrambler
9. Code-Group Alignment
10. 4B/5B Decoder
11. Link Integrity Monitor
12. Bad SSD Detection

#### **8.4.4 100BASE-FX**

The DP83822 provides IEEE 802.3 compliant 100BASE-FX operation. Hardware bootstrap or register configuration can be used to enable 100BASE-FX operation.

##### **8.4.4.1 100BASE-FX Transmit**

In 100BASE-FX mode, the DP83822 transmit pins connect to an industry standard fiber transceiver through a capacitively coupled circuit. During 100BASE-FX operation, the DP83822 transmit path will bypass the scrambler and MLT-3 encoder so that only serialized 4B5B encoded NRZI data is transmitted at 125-MHz.

##### **8.4.4.2 100BASE-FX Receive**

In 100BASE-FX mode, the DP83822 receive pins connect to an industry standard fiber transceiver through a capacitively coupled circuit. During 100BASE-FX operation, the DP83822 receive path will bypass the MLT-3 decoder and scrambler. This allows for reception of serialized 4B5B encoded NRZI data at 125 MHz.

The DP83822 also has the added feature of a signal detection pin for direct connection to an industry standard fiber transceiver. When enabling 100BASE-FX operation using the FX\_EN bootstrap, AMDIX\_EN bootstrap turns into SD\_EN bootstrap. If 100BASE-FX operation is enabled by setting FX\_EN to either bootstrap mode 2 or 3, SD\_EN will enable signal detection pin, LED\_1, when SD\_EN is set to either bootstrap mode 3 or 4. Please see [表 8-10](#) for mode information regarding hardware bootstraps.

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#### 注

100BASE-FX signal detect pin (LED\_1) polarity is controlled by bit[0] in the Fiber General Configuration Register (FIBER GENCFG, address 0x0465). By default, signal detect is an active HIGH polarity.

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## 注

TI recommends connecting Signal Detect pin from the Optical Transceiver to the LED\_1 pin and enable it using SD\_EN bootstrap pin in 100BASE-FX mode. The LED\_1 pin is not used in design and that, if the electrical link between the fiber module and the DP83822 is broken, disconnected or otherwise disrupted, the link will recover only by initiating a soft reset through MDIO/MDC interface.

### 8.4.5 10BASE-Te

The 10BASE-Te transceiver module is IEEE 802.3 compliant. It includes the receiver, transmitter, collision, heartbeat, loopback, jabber, and link integrity functions, as defined in the standard.

#### 8.4.5.1 Squelch

Squelch is responsible for determining when valid data is present on the differential receive inputs. The squelch circuitry employs a combination of amplitude and timing measurements (as specified in the IEEE 802.3 10BASE-Te standard) to determine the validity of data on the twisted-pair inputs.

The signal at the start of a packet is checked by the squelch, and any pulses not exceeding the squelch level (either positive or negative, depending upon polarity) are rejected. When this first squelch level is exceeded correctly, the opposite squelch level must then be exceeded no earlier than 50ns. Finally, the signal must again exceed the original squelch level no earlier than 50ns to qualify as a valid input waveform, and not be rejected. This checking procedure results in the typical loss of three preamble bits at the beginning of each packet. When the transmitter is operating, five consecutive transitions are checked before indicating that valid data is present. At this time, the squelch circuitry is reset.

#### 8.4.5.2 Normal Link Pulse Detection and Generation

The link pulse generator produces pulses as defined in the IEEE 802.3 10BASE-Te standard. Each link pulse is nominally 100 ns in duration and transmitted every 16 ms in the absence of transmit data. Link pulses are used to check the integrity of the connection with the remote end.

#### 8.4.5.3 Jabber

Jabber is a condition in which a station transmits for a period of time longer than the maximum permissible packet length, usually due to a fault condition. The jabber function monitors the DP83822 output and disables the transmitter if it attempts to transmit a packet of longer than legal size. A jabber timer monitors the transmitter and disables the transmission if the transmitter is active for approximately 100ms. When disabled by the Jabber function, the transmitter stays disabled for the entire time that the module's internal transmit enable is asserted. This signal must be de-asserted for approximately 500ms (unjab time) before the Jabber function re-enables the transmit outputs. The Jabber function is only available and active in 10BASE-Te mode.

#### 8.4.5.4 Active Link Polarity Detection and Correction

Swapping the wires within the twisted-pair causes polarity errors. Wrong polarity affects 10BASE-Te connections. 100BASE-TX is immune to polarity problems because it uses MLT-3 encoding. 10BASE-Te receive block automatically detects reversed polarity.

### 8.4.6 Auto-Negotiation (Speed / Duplex Selection)

Auto-Negotiation provides a mechanism for exchanging configuration information between the two ends of a link segment. This mechanism is implemented by exchanging Fast Link Pulses (FLP). FLPs are burst pulses that provide the information used to communicate the abilities between two devices at each end of a link segment. The DP83822 supports 100BASE-TX and 10BASE-Te modes of operation for Auto-Negotiation. 100BASE-FX is not included in the Auto-Negotiation process. Auto-Negotiation ensures that the highest performance protocol is selected based on the advertised abilities of the Link Partner and the local device. Auto-Negotiation can be enabled or disabled in hardware, using the AN\_EN bootstrap, or by register configuration, using bit[12] in the Basic Mode Control Register (BMCR, address 0x0000). For further details regarding Auto-Negotiation, refer to Clause 28 of the IEEE 802.3 specification.

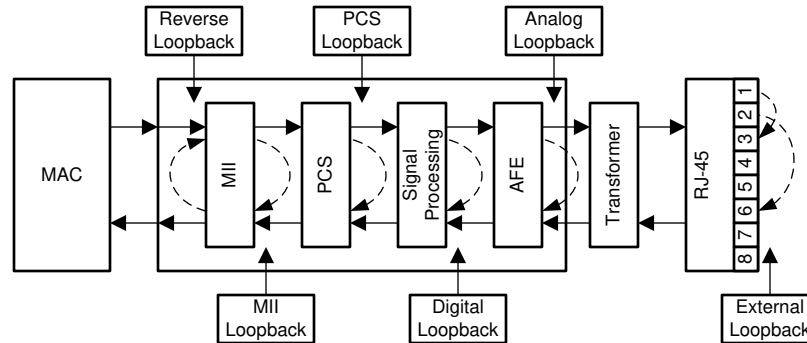
### 8.4.7 Auto-MDIX Resolution

The DP83822 can determine if a “straight” or “crossover” cable is used to connect to the Link Partner. It can automatically re-assign channel A and B to establish link with the Link Partner. Auto-MDIX resolution precedes the actual Auto-Negotiation process that involves exchange of FLPs to advertise capabilities. Automatic MDI/MDIX is described in IEEE 802.3 Clause 40, section 40.8.2. It is not a required implementation for 10BASE-T<sub>e</sub> and 100BASE-TX. Auto-MDIX can also be used when operating the PHY in Forced modes.

Auto-MDIX can be enabled or disabled in hardware, using the AMDIX bootstrap, or by register configuration, using bit[15] of the PHY Control Register (PHYCR, address 0x0019). When Auto-MDIX is disabled, the PMA is forced to either MDI (“straight”) or MDIX (“crossover”). Manual configuration of MDI or MDIX can also be accomplished in hardware, using the AMDIX bootstrap, or by register configuration, using bit[14] of the PHYCR. Additionally, the DP83822 supports Fast Auto-MDIX configuration via register configuration to enable faster MDIX resolution for link establishment. Fast Auto-MDIX can be enabled using bit[6] in the Control Register #1 (CR1, address 0x0009).

## 8.4.8 Loopback Modes

There are several loopback options within the DP83822 that test and verify various functional blocks within the PHY. Enabling loopback modes allow for in-circuit testing of the digital and analog data paths. The DP83822 may be configured to any one of the Near-End Loopback modes or to the Far-End (reverse) Loopback mode. MII Loopback is configured using the Basic Mode Control Register (BMCR, address 0x0000). All other loopback modes are enabled using the BIST Control Register (BISCR, address 0x0016). Except where otherwise noted, loopback modes are supported for all speeds (10/100 Mbps and all MAC interfaces).



**8-8. Loopback Test Modes**

### 8.4.8.1 Near-End Loopback

Near-End Loopback provides the ability to loop the transmitted data back to the receiver via the digital or analog circuitry. The point at which the signal is looped back is selected using loopback control bits[3:0] in the BISCR register. Auto-Negotiation and Auto-MDIX should be disabled before selecting the Near-End Loopback modes. This constraint does not apply for external-loopback mode.

### 8.4.8.2 MII Loopback

MII Loopback is the shallowest loop through the PHY. It is a useful test mode to validate communications between the MAC and the PHY. When in MII Loopback, data transmitted from a connected MAC on the TX path is internally looped back in the DP83822 to the RX pins where it can be checked by the MAC.

MII Loopback is enabled by setting bit[14] in the BMCR.

### 8.4.8.3 PCS Loopback

PCS Loopback occurs in the PCS layer of the PHY. No signal processing is performed when using PCS Loopback.

PCS Input Loopback is enabled by setting bit[0] in the BISCR.

PCS Output Loopback is enabled by setting bit[1] in the BISCR.

### 8.4.8.4 Digital Loopback

Digital Loopback includes the entire digital transmit and receive paths. Data is looped back prior to the analog circuitry.

Digital Loopback is enabled by setting bit[2] in the BISCR.

### 8.4.8.5 Analog Loopback

When operating in 10BASE-Te or 100BASE-TX mode, signals can be looped back after the analog front-end. Analog Loopback requires 100-Ω terminations across pins #1 and #2 as well as 100-Ω terminations across pins #3 and #6 at the RJ45.

Analog Loopback is enabled by setting bit[3] in the BISCR.



#### 8.4.8.6 Far-End (Reverse) Loopback

Far-End (Reverse) loopback is a special test mode to allow PHY testing with a link partner. In this mode, data that is received from the Link Partner passes through the PHY's receiver, is looped back at the MAC interface and then transmitted back to the Link Partner. While in Reverse Loopback mode, all data signals that come from the MAC are ignored.

Reverse Loopback is enabled by setting bit[4] in the BISCR.

#### 8.4.9 BIST Configurations

The DP83822 incorporates an internal PRBS Built-in Self-Test (BIST) circuit to accommodate in-circuit testing and diagnostics. The BIST circuit can be used to test the integrity of transmit and receive data paths. The BIST can be performed using both internal loopbacks (digital or analog) or external loopback using a cable fixture. The BIST simulates pseudo-random data transfer scenarios in format of real packets and Inter-Packet Gap (IPG) on the lines. The BIST allows full control of the packet lengths and the IPG.

The BIST Packet Length is controlled using bits[10:0] in the BIST Control and Status Register #2 (BICSR2, address 0x001C). The BIST IPG Length is controlled using bits[7:0] in the BIST Control and Status Register #1 (BICSR1, address 0x001B).

The BIST is implemented with independent transmit and receive paths, with the transmit clock generating a continuous stream of a pseudo-random sequence. The device generates a 15-bit pseudo-random sequence for BIST. Received data is compared to the generated pseudo-random data to determine pass/fail status. The number of error bytes that the PRBS checker received is stored in bits[15:8] of the BICSR1. PRBS lock status and sync can be read from the BIST Control Register (BISCR, address 0x0016).

The PRBS test can be put in a continuous mode by using bit[14] in the BISCR. In continuous mode, when the BIST error counter reaches the maximum value, the counter starts counting from zero again. To read the BIST error count, bit[15] in the BICSR1 must be set to '1'. This will lock the current value of the BIST errors for reading. Please note that setting bit[15] also clears the BIST Error Counter.



#### 8.4.10 Cable Diagnostics

With the vast deployment of Ethernet devices, the need for a reliable, comprehensive and user-friendly cable diagnostic tool is more important than ever. The wide variety of cables, topologies and connectors deployed results in the need to non-intrusively identify and report cable faults. The TI cable-diagnostic unit provides extensive information about cable integrity. The DP83822 offers the following capabilities in its Cable Diagnostic tool kit:

- Time Domain Reflectometry (TDR)

##### 8.4.10.1 TDR

The DP83822 uses Time Domain Reflectometry (TDR) to determine the quality of the cables, connectors and terminations in addition to estimating the cable length. Some of the possible problems that can be diagnosed include opens, shorts, cable impedance mismatch, bad connectors, termination mismatches, cross faults, cross shorts and any other discontinuities along the cable.

The DP83822 transmits a test pulse of known amplitude (1 V) down each of the two pairs of an attached cable. The transmitted signal continues down the cable and reflects from each cable imperfection, fault, connector and from the end of the cable itself. After the pulse transmission, the DP83822 measures the return time and amplitude of all these reflected pulses. This technique enables measuring the distance and magnitude (impedance) of non-terminated cables (open or short), discontinuities (bad connectors) and improperly terminated cables with  $\pm 1\text{m}$  accuracy.

For all TDR measurements, the transformation between time of arrival and physical distance is done by the external host using minor computations (such as multiplication, addition and lookup tables). The host must know the expected propagation delay of the cable, which depends, among other things, on the cable category (for example, CAT5, CAT5e, or CAT6).

TDR measurement is allowed in the following scenarios:

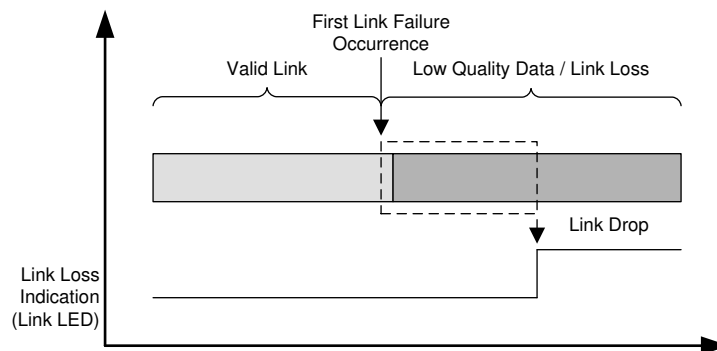
- While the Link Partner is disconnected – cable is unplugged at the other side
- Link Partner is connected but remains “quiet” (for example, in power down mode)
- TDR could be automatically activated when the link fails or is dropped

TDR Auto-Run can be enabled by using bit[8] in the Control Register #1 (CR1, address 0x0009). When a link drops, TDR will automatically execute and store the results in the respective TDR Cable Diagnostic Location Result Registers #1 - #5 (CDLRR, addresses 0x0180 to 0x0184) and the Cable Diagnostic Amplitude Result Registers #1 - #5 (CDLAR, addresses 0x0185 to 0x0189). TDR can also be run manually using bit[15] in the Cable Diagnostic Control Register (CDCR, address 0x001E). Cable diagnostic status is obtained by reading bits[1:0] in the CDCR. Additional TDR functions including cycle averaging, bypass channel and crossover disable can be found in the Cable Diagnostic Specific Control Register (CDSCR, address 0x0170).

### 8.4.11 Fast Link Down Functionality

The DP83822 includes advanced link-down capabilities that support various real-time applications. The link-down mechanism is configurable and includes enhanced modes that allow extremely fast link-drop reaction times.

The DP83822 supports an enhanced link drop mechanism, also called Fast Link Drop (FLD), which shortens the observation window for determining link. There are multiple ways of determining link status, which can be enabled or disabled based on user preference. Fast Link Drop can be enabled in hardware with bootstrapping or in software using register configuration. RX\_D2 when strapped to either mode 2 or mode 3 will enable FLD at power up or hardware reset. Additionally, FLD can be configured using the Control Register #3 (CR3, address 0x000B). Bits[3:0] and bit[10] allow for various FLD conditions to be enabled. When link drop occurs, indication of a particular fault condition can be read from the Fast Link Down Status Register (FLDS, address 0x000F).



**8-9. Fast Link Down**

Fast Link Down criteria include:

- RX Error Count - when a predefined number of 32 RX\_ERs occur in a 10 $\mu$ s window, the link will be dropped.
- MLT3 Error Count - when a predefined number of 20 MLT3 errors occur in a 10 $\mu$ s window, the link will be dropped.
- Low SNR Threshold - when a predefined number of 20 threshold crossings occur in a 10 $\mu$ s window, the link will be dropped.
- Signal/Energy Loss - when the energy detector indicates energy loss, the link will be dropped.

The Fast Link Down functionality allows the use of each of these options separately or in any combination.

注

Because this mode enables extremely quick reaction time, it is more exposed to temporary bad link-quality scenarios.

## 8.5 Programming

### 8.5.1 Hardware Bootstrap Configurations

The DP83822 uses the receive path functional pins as bootstrap options to place the device into specific modes of operation. The values of these pins are sampled at power up or hardware reset, through either the RESET pin or bit[15] in the PHY Reset Control Register (PHYRCCR, address 0x001F).

The DP83822 bootstrap pins are 4-level, which are described in greater detail below.

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Because bootstrap pins may have alternate functions after reset is de-asserted, they should not be connected directly to VCC or GND. pullup and pulldown resistors are required for proper operation.

Pins: COL, LED\_0, CRS and RX\_ER have internal pullup resistors. All other pins with bootstraps have internal pulldown resistors. To account for the difference between the internal pullup and pulldown, please reference 表 8-8 and 表 8-9 below for proper implementation.

LED\_0 and LED\_1 require parallel pullup or pulldown resistors when using the pin in conjunction with an LED and current limiting resistor.

Configuration of the device may be done via 4-level strapping or via serial management interface. A pullup resistor and a pulldown resistor of suggested values should be used to set the voltage ratio of the bootstrap pin input and the supply to select one of the possible modes.

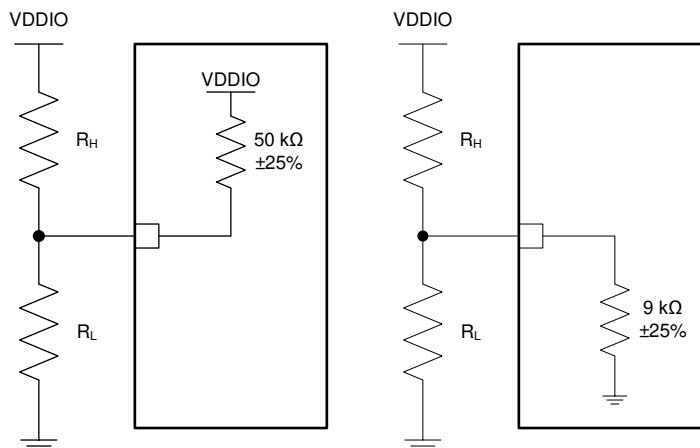


图 8-10. Bootstrap Circuits

**表 8-8. Recommended 4-Level Strap Resistor Ratios<sup>(1)</sup>**

| MODE                        | IDEAL R <sub>H</sub> (kΩ) | IDEAL R <sub>L</sub> (kΩ) |
|-----------------------------|---------------------------|---------------------------|
| <b>PULLDOWN PINS (9 kΩ)</b> |                           |                           |
| <b>1 (Default)</b>          | <b>OPEN</b>               | <b>OPEN</b>               |
| 2                           | 10                        | 2.49                      |
| 3                           | 5.76                      | 2.49                      |
| 4                           | 2.49                      | OPEN                      |
| <b>PULLUP PINS (50 kΩ)</b>  |                           |                           |
| 1                           | OPEN                      | 1.96                      |
| 2                           | 13                        | 1.96                      |
| 3                           | 6.2                       | 1.96                      |
| <b>4 (Default)</b>          | <b>OPEN</b>               | <b>OPEN</b>               |

(1) Strap resistors with 1% tolerance are recommended.

**表 8-9. 4-Level Strap Voltage Ratios<sup>(1)</sup>**

| TARGET VOLTAGE       | MODE 1        | MODE 2        | MODE 3        | MODE 4        |
|----------------------|---------------|---------------|---------------|---------------|
| V <sub>max</sub> (V) | 0.098 x VDDIO | 0.181 x VDDIO | 0.277 x VDDIO | VDDIO         |
| V <sub>typ</sub> (V) | 0             | 0.165 x VDDIO | 0.252 x VDDIO | VDDIO         |
| V <sub>min</sub> (V) | 0             | 0.148 x VDDIO | 0.227 x VDDIO | 0.694 x VDDIO |

(1) Ensured by production test, characterization or design.

表 8-10 describes the DP83822 configuration bootstraps:

**表 8-10. 4-Level Strap Pins**

| PIN NAME | PIN # | DEFAULT | STRAP FUNCTION |                           |                           | DESCRIPTION   |
|----------|-------|---------|----------------|---------------------------|---------------------------|---|
|          |       |         | MODE           | FX_EN                     | PHY_AD0                   |   |
| COL      | 29    | [01]    | MODE           | FX_EN                     | PHY_AD0                   | <b>FX_EN:</b><br>Enables 100BASE-FX when set to '1'<br><b>PHY_AD0:</b><br>PHY Address bit[0]  |
|          |       |         | 1              | 0                         | 0                         |   |
|          |       |         | 2              | 1                         | 0                         |   |
|          |       |         | 3              | 1                         | 1                         |   |
|          |       |         | 4 (Default)    | 0                         | 1                         |   |
| RX_D0    | 30    | [10]    | MODE           | AN_1                      | PHY_AD1                   | <b>AN_1:</b><br>See 表 8-11 below<br><b>PHY_AD1:</b><br>PHY Address bit[1]   |
|          |       |         | 1 (Default)    | 1                         | 0                         |   |
|          |       |         | 2              | 0                         | 0                         |   |
|          |       |         | 3              | 0                         | 1                         |   |
|          |       |         | 4              | 1                         | 1                         |   |
| RX_D1    | 31    | [00]    | MODE           | EEE_EN                    | PHY_AD2                   | <b>EEE_EN:</b><br>Enables EEE operation when set to '1'<br><b>PHY_AD2:</b><br>PHY Address bit [2]   |
|          |       |         | 1 (Default)    | 0                         | 0                         |   |
|          |       |         | 2              | 1                         | 0                         |   |
|          |       |         | 3              | 1                         | 1                         |   |
|          |       |         | 4              | 0                         | 1                         |   |
| RX_D2    | 32    | [00]    | MODE           | FLD_EN                    | PHY_AD3                   | <b>FLD_EN:</b><br>Enables Fast Link Drop when set to '1'.<br>Energy Detection, Low SNR threshold and<br>RX_ER will be enabled.<br><b>PHY_AD3:</b><br>PHY Address bit[3] |
|          |       |         | 1 (Default)    | 0                         | 0                         |   |
|          |       |         | 2              | 1                         | 0                         |   |
|          |       |         | 3              | 1                         | 1                         |   |
|          |       |         | 4              | 0                         | 1                         |   |
| RX_D3    | 1     | [10]    | MODE           | AN_EN                     | PHY_AD4                   | <b>AN_EN:</b><br>See 表 8-11 below<br><b>PHY_AD4:</b><br>PHY Address bit[4]  |
|          |       |         | 1 (Default)    | 1                         | 0                         |   |
|          |       |         | 2              | 0                         | 0                         |   |
|          |       |         | 3              | 0                         | 1                         |   |
|          |       |         | 4              | 1                         | 1                         |   |
| LED_0    | 17    | [X1]    | MODE           | RESERVED                  | AN_0                      | <b>AN_0:</b><br>See 表 8-11 below  |
|          |       |         | 1              | X                         | 0                         |   |
|          |       |         | 2              | X                         | Do Not Use <sup>(1)</sup> |   |
|          |       |         | 3              | X                         | Do Not Use <sup>(1)</sup> |   |
|          |       |         | 4 (Default)    | X                         | 1                         |   |
| LED_1    | 24    | [1X]    | Mode           | RESERVED                  |                           | No added functionality.<br>Do not use Mode 2 & 3  |
|          |       |         | 1 (Default)    | 0                         |                           |   |
|          |       |         | 2              | Do Not Use <sup>(1)</sup> |                           |   |
|          |       |         | 3              | Do Not Use <sup>(1)</sup> |                           |   |
|          |       |         | 4              | 1                         |                           |   |
| CRS      | 27    | [01]    | MODE           | LED_SPEED                 | LED_CFG                   | <b>LED_CFG:</b><br>See below<br><b>LED_SPEED:</b><br>See 表 8-12 below   |
|          |       |         | 1              | 0                         | 0                         |   |
|          |       |         | 2              | 1                         | 0                         |   |
|          |       |         | 3              | 1                         | 1                         |   |
|          |       |         | 4 (Default)    | 0                         | 1                         |   |

**表 8-10. 4-Level Strap Pins (continued)**

| PIN NAME | PIN # | DEFAULT | STRAP FUNCTION |          |                     | DESCRIPTION   |
|----------|-------|---------|----------------|----------|---------------------|---|
|          |       |         | MODE           | RGMII_EN | AMDIX_EN<br>(SD_EN) |   |
| RX_ER    | 28    | [01]    | MODE           | RGMII_EN | AMDIX_EN<br>(SD_EN) | <b>AMDIX_EN:</b><br>Enables Auto-MDIX when set to '1'<br><b>RGMII_EN:</b><br>See 表 8-13 below<br><b>SD_EN:</b><br>Enables 100BASE-FX Signal Detection on LED_1 when set to '1'. FX_EN strap must be enabled for SD_EN strap to be functional. Signal Detection is Active HIGH, but polarity can be changed using the Fiber General Configuration Register (FIBER_GENCFG, address 0x0465). |
|          |       |         | 1              | 0        | 0                   |   |
|          |       |         | 2              | 1        | 0                   |   |
|          |       |         | 3              | 1        | 1                   |   |
|          |       |         | 4 (Default)    | 0        | 1                   |   |
| RX_DV    | 26    | [00]    | MODE           | XI_50    | RMII_EN             | <b>XI_50:</b><br>See 表 8-13 below<br><b>RMII_EN:</b><br>See 表 8-13 below  |
|          |       |         | 1 (Default)    | 0        | 0                   |   |
|          |       |         | 2              | 1        | 0                   |   |
|          |       |         | 3              | 0        | 1                   |   |
|          |       |         | 4              | 1        | 1                   |   |

(1) Makes the phy go into test mode. Should not be used in functional mode.

**表 8-11. Modes of Operation**

| FX_EN            | AN_EN | AN_1 | AN_0 | Description   |
|------------------|-------|------|------|---|
| Force Modes      |       |      |      |   |
| 0                | 0     | 0    | 0    | 10BASE-Te, Half-Duplex                                      |
| 0                | 0     | 0    | 1    | 10BASE-Te, Full-Duplex                                      |
| 0                | 0     | 1    | 0    | 100BASE-TX, Half-Duplex                                     |
| 0                | 0     | 1    | 1    | 100BASE-TX, Full-Duplex                                     |
| Advertised Modes |       |      |      |   |
| 0                | 1     | 0    | 0    | 10BASE-Te, Half-Duplex                                      |
| 0                | 1     | 0    | 1    | 10BASE-Te, Half/Full-Duplex                                 |
| 0                | 1     | 1    | 0    | 10BASE-Te, Half-Duplex<br>100BASE-TX, Half-Duplex           |
| 0                | 1     | 1    | 1    | 10BASE-Te, Half/Full-Duplex<br>100BASE-TX, Half/Full-Duplex |
| Fiber Modes      |       |      |      |   |
| 1                | X     | X    | 0    | 100BASE-FX, Half Duplex                                     |
| 1                | X     | X    | 1    | 100BASE-FX, Full Duplex                                     |

**表 8-12. LED Configuration**

| CRS Strap Mode | LED_SPEED | LED_CFG[0] | LED_0  | LED_1  |
|----------------|-----------|------------|--|--|
| 1              | 0         | 0          | ON for Good Link<br>BLINK for TX/RX Activity | LED_1 in Tri-State                             |
| 2              | 1         | 0          | ON for Good Link<br>BLINK for TX/RX Activity | ON for 100 Mbps SPEED<br>OFF for 10 Mbps SPEED |
| 3              | 1         | 1          | ON for Good Link<br>OFF for No Link          | ON for 100 Mbps SPEED<br>OFF for 10 Mbps SPEED |
| 4              | 0         | 1          | ON for Good Link<br>OFF for No Link          | LED_1 in Tri-State                             |

**表 8-13. MAC Interface Configuration**

| RGMII_EN | RMII_EN | XI_50 | Description                 |
|----------|---------|-------|-----------------------------|
| 0        | 0       | 0     | MII, 25-MHz Reference Clock |

**表 8-13. MAC Interface Configuration (continued)**

| RGMII_EN | RMII_EN | XI_50 | Description                   |
|----------|---------|-------|-------------------------------|
| 0        | 0       | 1     | <b>Reserved</b>               |
| 0        | 1       | 0     | RMII, 25-MHz Reference Clock  |
| 0        | 1       | 1     | RMII, 50-MHz Reference Clock  |
| 1        | X       | 0     | RGMII, 25-MHz Reference Clock |
| 1        | X       | 1     | <b>Reserved</b>               |

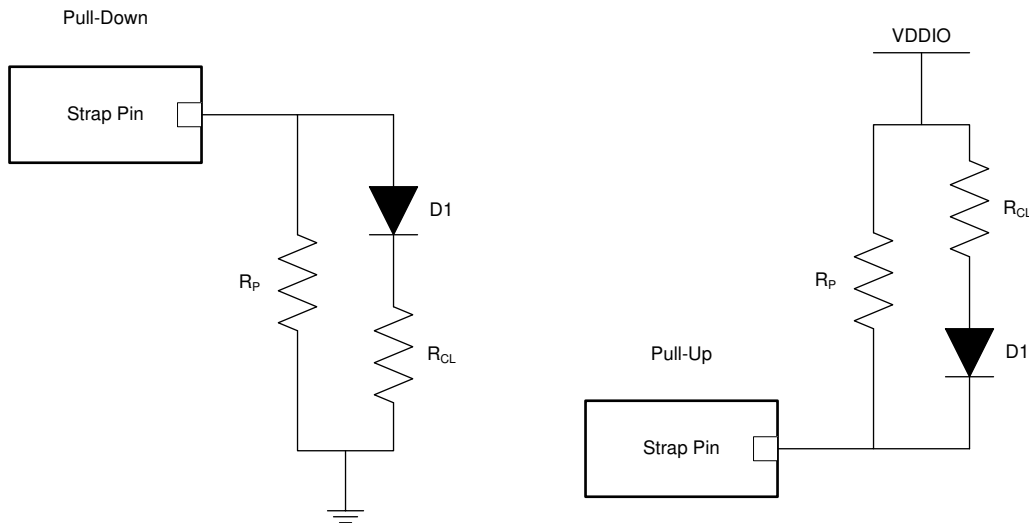
### 8.5.2 LED Configuration

The DP83822 supports up to three configurable Light Emitting Diode (LED) pins: LED\_0, LED\_1 (GPIO1), COL (GPIO2) and RX\_D3 (GPIO3). Several functions can be multiplexed onto the LEDs for different modes of operation. The LED configuration modes are selected using the LEDs Configuration Register (LEDCFG1, register 0x0460) and the Multi-LED Control Register (MLEDCR, register 0x0025). LED\_0 and COL (GPIO2) use the MLED function found in register 0x0025. MLED can be routed to only one of these two pins at a time. MLED routing is determined by bits[1:0] in register 0x0025.

Because LED pins are also used as bootstrap pins, external components must be considered in order to avoid contention. LED pins are automatically configured for the proper polarity based on the bootstrap configuration at power up or hardware reset. If an LED pin is resistively pulled low, the corresponding output will be configured as an active high driver. Conversely, if a given bootstrap input is resistively pulled high, the corresponding output will be configured as an active low driver.

An example below shows proper bootstrap connections for LED pins using either pullup or pulldown configurations.

**Note:** LED\_0 and LED\_1 require parallel pullup or pulldown resistors when using the pin in conjunction with an LED and current limiting resistor. A 1.96k $\Omega$  to 2.49k $\Omega$  resistor should be used as the parallel pull resistor. When LED pins are not used, they can be left floating.



**8-11. Example Strap Connections**

### 8.5.3 PHY Address Configuration

The DP83822 can be configured for any of the 32 possible PHY addresses available through bootstrap configuration. The PHY address is latched into the device upon power up or hardware reset. Each DP83822 or port sharing PHY on the serial management bus in the system must have a unique PHY address. The DP83822 supports PHY address strapping values 0x0000 (0b00000) through 0x001F (0b11111).

By default, the DP83822 will latch-in PHY address 0x0001 (0b00001). This address can be changed by adding the required pullup or pulldown resistors defined in the bootstrap section above.



## 8.6 Register Maps

In the register definitions under the “TYPE” heading, the following definitions apply:

|               |   |
|---------------|---|
| <b>COR</b>    | Clear on Read   |
| <b>Strap</b>  | Default value loads from bootstrap pin after reset                |
| <b>LH</b>     | Latched high and held until read                                  |
| <b>LL</b>     | Latched low and held until read                                   |
| <b>RO</b>     | Read Only Access  |
| <b>RO/COR</b> | Read Only, Clear on Read  |
| <b>RO/P</b>   | Read Only, Permanently set to a default value                     |
| <b>RW</b>     | Read Write access   |
| <b>RW/SC</b>  | Read Write access, Self Clearing bit                              |
| <b>SC</b>     | Register sets on event occurrence and Self-Clears when event ends |

**表 8-14. 0x0000 Basic Mode Control Register (BMCR)**

| BIT | NAME                    | TYPE      | DEFAULT | FUNCTION   |
|-----|-------------------------|-----------|---------|--|
| 15  | Reset                   | RW, SC    | 0       | <b>PHY Software Reset:</b><br>1 = Initiate software Reset / Reset in Progress<br>0 = Normal Operation<br>Writing a 1 to this bit resets the PHY PCS registers. When the reset operation is done, this bit is cleared to 0 automatically. PHY Vendor Specific registers (with MMD = 1F) will not be cleared. Straps are not re-latched with this reset. Straps are re-latched only during power up and pin reset.   |
| 14  | MII Loopback            | RW        | 0       | <b>MII Loopback:</b><br>1 = MII Loopback enabled<br>0 = Normal Operation<br>When MII loopback mode is activated, the transmitted data presented on MII TXD is looped back to MII RXD internally.   |
| 13  | Speed Selection         | RW, Strap | 1       | <b>Speed Select:</b><br>1 = 100 Mbps<br>0 = 10 Mbps<br>When Auto-Negotiation is disabled (bit[12] = 0 in Register 0x0000), writing to this bit allows the port speed to be selected.   |
| 12  | Auto-Negotiation Enable | RW, Strap | 1       | <b>Auto-Negotiation Enable:</b><br>1 = Enable Auto-Negotiation<br>0 = Disable Auto-Negotiation<br>If Auto-Negotiation is disabled, bit[8] and bit[13] of this register determine the port speed and duplex mode.   |
| 11  | IEEE Power Down         | RW        | 0       | <b>Power Down:</b><br>1 = IEEE Power Down<br>0 = Normal Operation<br>The PHY is powered down after this bit is set. Only register access is enabled during this power down condition. To control the power down mechanism, this bit is OR'ed with the input from the INT/PWDN_N pin. When the active low INT/PWDN_N is asserted, this bit is set. Programmed register are not reset to default in power down. Since all state machines undergo reset so status bits (RO) may show a change in value. |

**表 8-14. 0x0000 Basic Mode Control Register (BMCR) (continued)**

| BIT | NAME                     | TYPE      | DEFAULT | FUNCTION   |
|-----|--------------------------|-----------|---------|--|
| 10  | Isolate                  | RW        | 0       | <b>Isolate:</b><br>1 = Isolates the port from the MII with the exception of the SMI<br>0 = Normal Operation  |
| 9   | Restart Auto-Negotiation | RW, SC    | 0       | <b>Restart Auto-Negotiation:</b><br>1 = Restarts Auto-Negotiation<br>0 = Normal Operation<br>If Auto-Negotiation is disabled (bit[12] = 0), bit[9] is ignored. This bit is self-clearing and will return a value of 1 until Auto-Negotiation is initiated, whereupon it will self-clear. Operation of the Auto-Negotiation process is not affected by the management entity clearing this bit. |
| 8   | Duplex Mode              | RW, Strap | 1       | <b>Duplex Mode:</b><br>1 = Full-Duplex<br>0 = Half-Duplex<br>When Auto-Negotiation is disabled, writing to this bit allows the port Duplex capability to be selected.  |
| 7   | Collision Test           | RW        | 0       | <b>Collision Test:</b><br>1 = Enable COL Signal Test<br>0 = Normal Operation<br>When set, this bit causes the COL signal to be asserted in response to the assertion of TX_EN within 512 bit times. The COL signal is de-asserted within 4 bit times in response to the de-assertion to TX_EN.   |
| 6:0 | Reserved                 | RO        | 0       | Reserved   |

**表 8-15. 0x0001 Basic Mode Status Register (BMSR)**

| BIT  | NAME                     | TYPE | DEFAULT | FUNCTION   |
|------|--------------------------|------|---------|--|
| 15   | 100Base-T4               | RO   | 0       | <b>100Base-T4 Capable:</b><br>This protocol is not available. Always reads as 0.   |
| 14   | 100Base-TX Full-Duplex   | RO   | 1       | <b>100Base-TX Full-Duplex Capable:</b><br>1 = Device able to perform Full-Duplex 100Base-TX<br>0 = Device not able to perform Full-Duplex 100Base-TX   |
| 13   | 100Base-TX Half-Duplex   | RO   | 1       | <b>100Base-TX Half-Duplex Capable:</b><br>1 = Device able to perform Half-Duplex 100Base-TX<br>0 = Device not able to perform Half-Duplex 100Base-TX   |
| 12   | 10Base-Te Full-Duplex    | RO   | 1       | <b>10Base-Te Full-Duplex Capable:</b><br>1 = Device able to perform Full-Duplex 10Base-Te<br>0 = Device not able to perform Full-Duplex 10Base-Te  |
| 11   | 10Base-Te Half-Duplex    | RO   | 1       | <b>10Base-Te Half-Duplex Capable:</b><br>1 = Device able to perform Half-Duplex 10Base-Te<br>0 = Device not able to perform Half-Duplex 10Base-Te  |
| 10:7 | Reserved                 | RO   | 0       | Reserved   |
| 6    | SMI Preamble Suppression | RO   | 1       | <b>Preamble Suppression Capable:</b><br>1 = Device able to perform SMI transaction with preamble suppressed<br>0 = Device not able to perform SMI transaction with preamble suppressed<br>If this bit is set to 1, 32-bits of preamble needed only once after reset, invalid opcode or invalid turnaround. |

**表 8-15. 0x0001 Basic Mode Status Register (BMSR) (continued)**

| BIT | NAME                      | TYPE   | DEFAULT | FUNCTION  |
|-----|---------------------------|--------|---------|---|
| 5   | Auto-Negotiation Complete | RO     | 0       | <b>Auto-Negotiation Complete:</b><br>1 = Auto-Negotiation process completed<br>0 = Auto Negotiation process not completed (either still in process, disabled or reset)  |
| 4   | Remote Fault              | RO, LH | 0       | <b>Remote Fault:</b><br>1 = Remote fault condition detected<br>0 = No remote fault condition detected<br>Far End Fault indication or notification from Link Partner of Remote Fault. This bit is cleared on read or reset.  |
| 3   | Auto-Negotiation Ability  | RO     | 1       | <b>Auto-Negotiation Ability:</b><br>1 = Device is able to perform Auto-Negotiation<br>0 = Device is not able to perform Auto-Negotiation  |
| 2   | Link Status               | RO, LL | 0       | <b>Link Status:</b><br>1 = Valid link established (for either 10 Mbps or 100 Mbps operation)<br>0 = Link not established<br>If link goes low anytime, this bit value will read 0 on first read after link down event. Will get cleared to 1 only if status is read second time after link-up. |
| 1   | Jabber Detect             | RO, LH | 0       | <b>Jabber Detect:</b><br>1 = Jabber condition detected<br>0 = No jabber condition detected<br>This bit only has meaning for 10Base-Te operation.  |
| 0   | Extended Capability       | RO     | 1       | <b>Extended Capability:</b><br>1 = Extended register capabilities<br>0 = Basic register set capabilities only   |

**表 8-16. 0x0002 PHY Identifier Register #1 (PHYIDR1)**

| BIT  | NAME   | TYPE | DEFAULT                | FUNCTION |
|------|--|------|------------------------|----------|
| 15:0 | Organizationally Unique Identifier Bits 21:6 | RO   | 0010 0000<br>0000 0000 |          |

**表 8-17. 0x0003 PHY Identifier Register #2 (PHYIDR2)**

| BIT   | NAME  | TYPE | DEFAULT | FUNCTION   |
|-------|---|------|---------|--|
| 15:10 | Organizationally Unique Identifier Bits 5:0 | RO   | 1010 00 |  |
| 9:4   | Model Number                                | RO   | 10 0100 | <b>Vendor Model Number:</b><br>The six bits of vendor model number are mapped from bits [9] to [4]   |
| 3:0   | Revision Number                             | RO   | 0000    | <b>Model Revision Number:</b><br>Four bits of the vendor model revision number are mapped from bits [3:0]. This field is incremented for all major device changes. |

**表 8-18. 0x0004 Auto-Negotiation Advertisement Register (ANAR)**

| BIT | NAME      | TYPE | DEFAULT | FUNCTION   |
|-----|-----------|------|---------|--|
| 15  | Next Page | RW   | 0       | <b>Next Page Indication:</b><br>1 = Next Page Transfer desired<br>0 = Next Page Transfer not desired |
| 14  | Reserved  | RO   | 0       | Reserved   |

**表 8-18. 0x0004 Auto-Negotiation Advertisement Register (ANAR) (continued)**

| BIT | NAME                   | TYPE      | DEFAULT | FUNCTION  |
|-----|------------------------|-----------|---------|---|
| 13  | Remote Fault           | RW        | 0       | <b>Remote Fault:</b><br>1 = Advertises that this device has detected a Remote Fault<br>0 = No Remote Fault detected                               |
| 12  | Reserved               | RO        | 0       | Reserved  |
| 11  | Asymmetric Pause       | RW        | 0       | <b>Asymmetric Pause Support For Full-Duplex Links:</b><br>1 = Advertise asymmetric pause ability<br>0 = Do not advertise asymmetric pause ability |
| 10  | Pause                  | RW        | 0       | <b>Pause Support for Full-Duplex Links:</b><br>1 = Advertise pause ability<br>0 = Do not advertise pause ability                                  |
| 9   | 100Base-T4             | RO        | 0       | <b>100Base-T4 Support:</b><br>1 = Advertise 100Base-T4 ability<br>0 = Do not advertise 100Base-T4 ability   |
| 8   | 100Base-TX Full-Duplex | RW, Strap | 1       | <b>100Base-TX Full-Duplex Support:</b><br>1 = Advertise 100Base-TX Full-Duplex ability<br>0 = Do not advertise 100Base-TX Full-Duplex ability     |
| 7   | 100Base-TX Half-Duplex | RW, Strap | 1       | <b>100Base-TX Half-Duplex Support:</b><br>1 = Advertise 100Base-TX Half-Duplex ability<br>0 = Do not advertise 100Base-TX Half-Duplex ability     |
| 6   | 10Base-Te Full-Duplex  | RW, Strap | 1       | <b>10Base-Te Full-Duplex Support:</b><br>1 = Advertise 10Base-Te Full-Duplex ability<br>0 = Do not advertise 10Base-Te Full-Duplex ability        |
| 5   | 10Base-Te Half-Duplex  | RW, Strap | 1       | <b>10Base-Te Half-Duplex Support:</b><br>1 = Advertise 10Base-Te Half-Duplex ability<br>0 = Do not advertise 10Base-Te Half-Duplex ability        |
| 4:0 | Selector Field         | RW        | 0 0001  | <b>Protocol Selection Bits:</b><br>Technology selector field (IEEE802.3u <00001>)   |

**表 8-19. 0x0005 Auto-Negotiation Link Partner Ability Register (ANLPAR)**

| BIT | NAME             | TYPE | DEFAULT | FUNCTION  |
|-----|------------------|------|---------|---|
| 15  | Next Page        | RO   | 0       | <b>Next Page Indication:</b><br>1 = Link partner desires Next Page Transfer<br>0 = Link partner does not desire Next Page Transfer                    |
| 14  | Acknowledge      | RO   | 0       | <b>Acknowledge:</b><br>1 = Link partner acknowledges reception of link code word<br>0 = Link partner does not acknowledge reception of link code word |
| 13  | Remote Fault     | RO   | 0       | <b>Remote Fault:</b><br>1 = Link partner advertises remote fault event detection<br>0 = Link partner does not advertise remote fault event detection  |
| 12  | Reserved         | RO   | 0       | Reserved  |
| 11  | Asymmetric Pause | RO   | 0       | <b>Asymmetric Pause:</b><br>1 = Link partner advertises asymmetric pause ability<br>0 = Link partner does not advertise asymmetric pause ability      |
| 10  | Pause            | RO   | 0       | <b>Pause:</b><br>1 = Link partner advertises pause ability<br>0 = Link partner does not advertise pause ability                                       |

**表 8-19. 0x0005 Auto-Negotiation Link Partner Ability Register (ANLPAR) (continued)**

| BIT | NAME                   | TYPE | DEFAULT | FUNCTION   |
|-----|------------------------|------|---------|--|
| 9   | 100Base-T4             | RO   | 0       | <b>100Base-T4 Support:</b><br>1 = Link partner advertises 100Base-T4 ability<br>0 = Link partner does not advertise 100Base-T4 ability                                     |
| 8   | 100Base-TX Full-Duplex | RO   | 0       | <b>100Base-TX Full-Duplex Support:</b><br>1 = Link partner advertises 100Base-TX Full-Duplex ability<br>0 = Link partner does not advertise 100Base-TX Full-Duplex ability |
| 7   | 100Base-TX Half-Duplex | RO   | 0       | <b>100Base-TX Half-Duplex Support:</b><br>1 = Link partner advertises 100Base-TX Half-Duplex ability<br>0 = Link partner does not advertise 100Base-TX Half-Duplex ability |
| 6   | 10Base-Te Full-Duplex  | RO   | 0       | <b>10Base-Te Full-Duplex Support:</b><br>1 = Link partner advertises 10Base-Te Full-Duplex ability<br>0 = Link partner does not advertise 10Base-Te Full-Duplex ability    |
| 5   | 10Base-Te Half-Duplex  | RO   | 0       | <b>10Base-Te Half-Duplex Support:</b><br>1 = Link partner advertises 10Base-Te Half-Duplex ability<br>0 = Link partner does not advertise 10Base-Te Half-Duplex ability    |
| 4:0 | Selector Field         | RO   | 0 0000  | <b>Protocol Selection Bits:</b><br>Technology selector field (IEEE802.3 <00001>)   |

**表 8-20. 0x0006 Auto-Negotiation Expansion Register (ANER)**

| BIT  | NAME                               | TYPE   | DEFAULT | FUNCTION  |
|------|------------------------------------|--------|---------|---|
| 15:5 | Reserved                           | RO     | 0       | Reserved  |
| 4    | Parallel Detection Fault           | RO, LH | 0       | <b>Parallel Detection Fault:</b><br>1 = A fault has been detected during the parallel detection process<br>0 = No fault detected                  |
| 3    | Link Partner Next Page Able        | RO     | 0       | <b>Link Partner Next Page Ability:</b><br>1 = Link partner is able to exchange next pages<br>0 = Link partner is not able to exchange next pages  |
| 2    | Local Device Next Page Able        | RO     | 1       | <b>Next Page Ability:</b><br>1 = Local device is able to exchange next pages<br>0 = Local device is not able to exchange next pages               |
| 1    | Page Received                      | RO, LH | 0       | <b>Link Code Word Page Received:</b><br>1 = A new page has been received<br>0 = A new page has not been received                                  |
| 0    | Link Partner Auto-Negotiation Able | RO     | 0       | <b>Link Partner Auto-Negotiation Ability:</b><br>1 = Link partner supports Auto-Negotiation<br>0 = Link partner does not support Auto-Negotiation |

**表 8-21. 0x0007 Auto-Negotiation Next Page Register (ANNPTR)**

| BIT | NAME         | TYPE | DEFAULT | FUNCTION  |
|-----|--------------|------|---------|---|
| 15  | Next Page    | RW   | 0       | <b>Next Page Indication:</b><br>1 = Advertise desire to send additional next pages<br>0 = Do not advertise desire to send additional next pages |
| 14  | Reserved     | RO   | 0       | Reserved  |
| 13  | Message Page | RW   | 1       | <b>Message Page:</b><br>1 = Current page is a message page<br>0 = Current page is an unformatted page   |

**表 8-21. 0x0007 Auto-Negotiation Next Page Register (ANNPTR) (continued)**

| BIT  | NAME          | TYPE | DEFAULT          | FUNCTION   |
|------|---------------|------|------------------|--|
| 12   | Acknowledge 2 | RW   | 0                | <b>Acknowledge2:</b><br>1 = Will comply with message<br>0 = Cannot comply with message<br>Acknowledge2 is used by the next page function to indicate that Local Device has the ability to comply with the message received.  |
| 11   | Toggle        | RO   | 0                | <b>Toggle:</b><br>1 = Toggle bit in previously transmitted Link Code Word was 0<br>0 = Toggle bit in previously transmitted Link Code Word was 1<br>Toggle is used by the Arbitration function within Auto-Negotiation to synchronize with the Link Partner during Next Page exchange. This bit always takes the opposite value of the Toggle bit in the previously exchanged Link Code Word.                                      |
| 10:0 | CODE          | RW   | 000 0000<br>0001 | This field represents the code field of the next page transmission. If the Message Page bit is set (bit [13] of this register), then the code is interpreted as a Message Page, as defined in annex 28C of IEEE 802.3u. Otherwise, the code is interpreted as an Unformatted Page, and the interpretation is application specific.<br>The default value of the CODE represents a Null Page as defined in Annex 28C of IEEE 802.3u. |

**表 8-22. 0x0008 Auto-Negotiation Link Partner Ability Next Page Register (ANLNPTR)**

| BIT | NAME          | TYPE | DEFAULT | FUNCTION  |
|-----|---------------|------|---------|---|
| 15  | Next Page     | RO   | 0       | <b>Next Page Indication:</b><br>1 = Advertise desire to send additional next pages<br>0 = Do not advertise desire to send additional next pages   |
| 14  | Acknowledge   | RO   | 0       | <b>Acknowledge:</b><br>1 = Link partner acknowledges reception of link code word<br>0 = Link partner does not acknowledge reception of link code work   |
| 13  | Message Page  | RO   | 0       | <b>Message Page:</b><br>1 = Current page is a message page<br>0 = Current page is an unformatted page   |
| 12  | Acknowledge 2 | RO   | 0       | <b>Acknowledge2:</b><br>1 = Will comply with message<br>0 = Cannot comply with message<br>Acknowledge2 is used by the next page function to indicate that Local Device has the ability to comply with the message received.   |
| 11  | Toggle        | RO   | 0       | <b>Toggle:</b><br>1 = Toggle bit in previously transmitted Link Code Word was 0<br>0 = Toggle bit in previously transmitted Link Code Word was 1<br>Toggle is used by the Arbitration function within Auto-Negotiation to synchronize with the Link Partner during Next Page exchange. This bit always takes the opposite value of the Toggle bit in the previously exchanged Link Code Word. |

**表 8-22. 0x0008 Auto-Negotiation Link Partner Ability Next Page Register (ANLNPTN) (continued)**

| BIT  | NAME                       | TYPE | DEFAULT        | FUNCTION   |
|------|----------------------------|------|----------------|--|
| 10:0 | Message/ Unformatted Field | RO   | 0 0000<br>0000 | This field represents the code field of the next page transmission. If the Message Page bit is set (bit 13 of this register), then the code is interpreted as a Message Page, as defined in annex 28C of IEEE 802.3u. Otherwise, the code is interpreted as an Unformatted Page, and the interpretation is application specific.<br>The default value of the CODE represents a Null Page as defined in Annex 28C of IEEE 802.3u. |

**表 8-23. 0x0009 Control Register #1 (CR1)**

| BIT   | NAME               | TYPE | DEFAULT | FUNCTION  |
|-------|--------------------|------|---------|---|
| 15:10 | Reserved           | RO   | 0       | Reserved  |
| 9     | RMII Enhanced Mode | RW   | 0       | <b>RMII Enhanced Mode:</b><br>1 = Enable RMII Enhanced Mode<br>0 = RMII operated in normal mode<br>In normal RMII mode, if the line is not idle, CRS_DV goes high. As soon as the False Carrier is detected, RX_ER is asserted and RXD is set to "2" (0010). This situation remains for the duration of the receive event. While in enhanced mode, CRS_DV is disqualified and de-asserted when the False Carrier is detected. This status also remains for the duration of the receive event. In addition, in normal mode, the start of the packet is intact. Each symbol error is indicated by setting RX_ER high. The data on RXD is replaced with "1" starting with the first symbol error. While in enhanced mode, the CRS_DV is de-asserted with the first symbol error. |
| 8     | TDR Auto-Run       | RW   | 0       | <b>TDR Auto-Run at Link Down:</b><br>1 = Enable execution of TDR procedure after link down event<br>0 = Disable automatic execution of TDR  |
| 7     | Link Loss Recovery | RW   | 0       | <b>Link Loss Recovery:</b><br>1 = Enable Link Loss Recovery mechanism<br>0 = Normal Link Loss operation<br>This mode allows recovery from short interference and continue to hold the link up for a few additional mSec until the short interference is gone and the signal is OK. Under Normal Link Loss operation, Link status will go down approximately 250µs from signal loss.   |
| 6     | Fast Auto MDIX     | RW   | 0       | <b>Fast Auto-MDIX:</b><br>1 = Enable Fast Auto-MDIX<br>0 = Normal Auto-MDIX<br>If both link partners are configured to work in Force 100Base-TX mode (Auto-Negotiation disabled), this mode enables Automatic MDI/MDIX resolution in a shortened time.  |
| 5     | Robust Auto MDIX   | RW   | 0       | <b>Robust Auto-MDIX:</b><br>1 = Enable Robust Auto-MDIX<br>0 = Disable Auto-MDIX<br>If link partners are configured for operational modes that are not supported by normal Auto-MDIX, Robust Auto-MDIX allows MDI/MDIX resolution and prevents deadlock.<br>When the DP83822 is strapped for 100 Mbps operation with Auto-MDIX capabilities, Robust Auto-MDIX will be automatically set to aid in MDI/MDIX resolution and deadlock prevention.  |

**表 8-23. 0x0009 Control Register #1 (CR1) (continued)**

| BIT                          | NAME                         | TYPE                    | DEFAULT                     | FUNCTION  |                              |                  |                         |                             |      |    |    |    |      |     |    |    |      |     |     |     |      |    |    |    |
|------------------------------|------------------------------|-------------------------|-----------------------------|---|------------------------------|------------------|-------------------------|-----------------------------|------|----|----|----|------|-----|----|----|------|-----|-----|-----|------|----|----|----|
| 4                            | Fast Auto-Negotiation Enable | RW                      | 0                           | <p><b>Fast Auto-Negotiation Enable:</b><br/>1 = Enable Fast Auto-Negotiation<br/>0 = Disable Fast Auto-Negotiation<br/>The PHY Auto-Negotiates using timer setting according to Fast Auto-Negotiation Select bits (bits[3:2] in this register).</p>   |                              |                  |                         |                             |      |    |    |    |      |     |    |    |      |     |     |     |      |    |    |    |
| 3:2                          | Fast Auto-Negotiation Select | RW                      | 0                           | <p><b>Fast Auto-Negotiation Select Bits:</b><br/>Adjusting these bits reduces the time it takes to Auto-Negotiate between two PHYs. In Fast Auto-Negotiation, both PHYs should be set to the same configuration. These 2 bits define the duration for each state of the Auto-Negotiation process according to the table above. The new duration time must be enabled by setting "Fast Auto Negotiation Enable" (bit [4] of this register). Note: Using this mode in cases where both link partners are not configured to the same Fast-Autonegotiation configuration might produce scenarios with unexpected behavior.</p> <table border="1"> <thead> <tr> <th>Fast Auto-Negotiation Select</th> <th>Break Link Timer</th> <th>Link Fail Inhibit Timer</th> <th>Auto-Negotiation Wait Timer</th> </tr> </thead> <tbody> <tr> <td>&lt;00&gt;</td> <td>80</td> <td>50</td> <td>35</td> </tr> <tr> <td>&lt;01&gt;</td> <td>120</td> <td>75</td> <td>50</td> </tr> <tr> <td>&lt;10&gt;</td> <td>240</td> <td>150</td> <td>100</td> </tr> <tr> <td>&lt;11&gt;</td> <td>NA</td> <td>NA</td> <td>NA</td> </tr> </tbody> </table> | Fast Auto-Negotiation Select | Break Link Timer | Link Fail Inhibit Timer | Auto-Negotiation Wait Timer | <00> | 80 | 50 | 35 | <01> | 120 | 75 | 50 | <10> | 240 | 150 | 100 | <11> | NA | NA | NA |
| Fast Auto-Negotiation Select | Break Link Timer             | Link Fail Inhibit Timer | Auto-Negotiation Wait Timer |   |                              |                  |                         |                             |      |    |    |    |      |     |    |    |      |     |     |     |      |    |    |    |
| <00>                         | 80                           | 50                      | 35                          |   |                              |                  |                         |                             |      |    |    |    |      |     |    |    |      |     |     |     |      |    |    |    |
| <01>                         | 120                          | 75                      | 50                          |   |                              |                  |                         |                             |      |    |    |    |      |     |    |    |      |     |     |     |      |    |    |    |
| <10>                         | 240                          | 150                     | 100                         |   |                              |                  |                         |                             |      |    |    |    |      |     |    |    |      |     |     |     |      |    |    |    |
| <11>                         | NA                           | NA                      | NA                          |   |                              |                  |                         |                             |      |    |    |    |      |     |    |    |      |     |     |     |      |    |    |    |
| 1                            | Fast RX_DV Detection         | RW                      | 0                           | <p><b>Fast RX_DV Detection:</b><br/>1 = Enable Fast RX_DV detection<br/>0 = Diable Fast RX_DV detection<br/>When Fast RX_DV is enabled, RX_DV will assert high on receive packet due to detection of the /J/ symbol only. If a consecutive /K/ does not appear, RX_ER is generated. In normal mode, RX_DV will only be asserted after detection of /JK/.</p>  |                              |                  |                         |                             |      |    |    |    |      |     |    |    |      |     |     |     |      |    |    |    |
| 0                            | Reserved                     | RO                      | 0                           | <b>Reserved</b>   |                              |                  |                         |                             |      |    |    |    |      |     |    |    |      |     |     |     |      |    |    |    |

**表 8-24. 0x000A Control Register #2 (CR2)**

| BIT  | NAME                               | TYPE      | DEFAULT   | FUNCTION  |
|------|------------------------------------|-----------|-----------|---|
| 15   | 100Base-TX Force Far-End Link drop | RW        | 0         | <p><b>100Base-TX Force Far-End Link Drop:</b><br/>Writing a 1 asserts the 100Base-TX Force Far-End link drop mode. In this mode (only valid for 100 Mbps), the PHY disables the TX upon link drop to allow the far-end peer to drop its link as well, thus allowing both link partners to be aware of the system link failure. This mode exceeds the standard definition of force 100 Mbps.</p> |
| 14   | 100Base-FX Enable                  | RW, Strap | 0         | <p><b>100Base-FX Enable:</b><br/>1 = 100Base-FX mode enabled<br/>0 = 100Base-FX mode disabled</p>   |
| 13:7 | Reserved                           | RW        | 00 0001 0 | <b>Reserved</b>   |



**表 8-24. 0x000A Control Register #2 (CR2) (continued)**

| BIT | NAME   | TYPE | DEFAULT | FUNCTION   |
|-----|--|------|---------|--|
| 6   | Fast Link-Up in Parallel Detect                    | RW   | 0       | <b>Fast Link-Up in Parallel Detect Mode:</b><br>1 = Enable Fast Link-Up time during Parallel Detection<br>0 = Normal Parallel Detection Link establishment<br>In Fast Auto MDIX and in Robust Auto-MDIX modes (bit[6] and bit[5] in register CR1), this bit is automatically set.  |
| 5   | Extended Full-Duplex Ability                       | RW   | 0       | <b>Extended Full-Duplex Ability:</b><br>1 = Enable Extended Full-Duplex Ability<br>0 = Disable Extended Full-Duplex Ability<br>In Extended Full-Duplex ability, when the PHY is set to Auto-Negotiation or Force 100Base-TX and the link partner is operated in Force 100Base-TX, the link is always Full-Duplex. When disabled, the decision to work in Full-Duplex or Half-Duplex mode follows IEEE specification. |
| 4   | Enhanced LED Link                                  | RW   | 0       | <b>Enhanced LED Link:</b><br>1 = LED ON only when link is 100Base-TX Full-Duplex mode<br>0 = LED ON when link is established<br>In Enhanced LED Link mode, TX/RX BLINK on activity is disabled for this LED pin. LED will only indicate LINK for established 100Base-TX Full-Duplex links.   |
| 3   | Isolate MII in 100Base-TX Half-Duplex or 10Base-Te | RW   | 0       | <b>Isolate MII:</b><br>1 = Isolate MII Enabled<br>0 = Normal MII output operation<br>In Isolate MII, MII outputs are isolated when Half-Duplex link established for 100Base-TX or when Half-Duplex or Full-Duplex link established for 10Base-Te.  |
| 2   | RX_ER During IDLE                                  | RW   | 0       | <b>Detection of Receive Symbol Error During IDLE State:</b><br>1 = Enable detection of Receive symbol error during IDLE state<br>0 = Disable detection of Receive symbol error during IDLE state   |
| 1   | Odd-Nibble Detection Disable                       | RW   | 0       | <b>Detection of Transmit Error:</b><br>1 = Disable detection of transmit error in odd-nibble boundary<br>0 = Enable detection of transmit error in odd-nibble boundary<br>Detection of odd-nibble will extend TX_EN by one additional TX_CLK cycle and behaves as if TX_ER were asserted during that additional cycle  |
| 0   | RMII Receive Clock                                 | RW   | 0       | <b>RMII Receive Clock:</b><br>1 = RMII Data (RXD[1:0]) is sampled and referenced to RX_CLK<br>0 = RMII Data (RXD[1:0]) is sampled and referenced to XI   |

**表 8-25. 0x000B Control Register #3 (CR3)**

| BIT   | NAME                             | TYPE | DEFAULT | FUNCTION  |
|-------|----------------------------------|------|---------|---|
| 15:13 | Reserved                         | RW   | 000     | <b>Reserved</b>   |
| 12    | Bypass Digital Equalizer Error   | RW   | 1       | 1 = Ignores the intermittent error output of digital equalizer  |
| 10    | De-scrambler Fast Link Down Mode | RW   | 0       | <b>Descrambler Fast Link Drop:</b><br>1 = Drop the link on descrambler link loss<br>0 = Do not drop the link on descrambler link loss<br>This option can be enabled in parallel to the other fast link down modes in bits[3:0]. |

**表 8-25. 0x000B Control Register #3 (CR3) (continued)**

| BIT | NAME                                 | TYPE | DEFAULT | FUNCTION   |
|-----|--------------------------------------|------|---------|--|
| 9   | Bypass Digital Equalizer Coefficient | RW   | 0       | 1 = Bypass 0th coefficient of digital equalizer  |
| 8:7 | Reserved                             | RW   | 00      | <b>Reserved</b>  |
| 6   | Polarity Swap                        | RW   | 0       | <b>Polarity Swap:</b><br>1 = Inverted polarity on both pairs: TD+ and TD-, RD+ and RD-<br>0 = Normal polarity<br><b>Port Mirror Function:</b><br>To enable port mirroring, set this bit and bit [5] high.  |
| 5   | MDI/MDIX Swap                        | RW   | 0       | <b>MDI/MDIX Swap:</b><br>1 = Swap MDI pairs (Receive on TD pair, Transmit on RD pair)<br>0 = MDI pairs normal (Receive on RD pair, Transmit on TD pair)<br><b>Port Mirror Function:</b><br>To enable port mirroring, set this bit and bit[6] high.   |
| 4   | Reserved                             | RW   | 0       | <b>Reserved</b>  |
| 3:0 | Fast Link Down Mode                  | RW   | 0000    | <b>Fast Link Down Modes:</b><br><b>Bit 3</b> Drop the link based on <b>RX Error count</b> of the MII interface. When a predefined number of 32 RX Error occurrences in a 10µs interval is reached, the link will be dropped.<br><b>Bit 2</b> Drop the link based on <b>MLT3 Error count</b> (Violation of the MLT3 coding in the DSP output). When a predefined number of 20 MLT3 Error occurrences in a 10µs interval is reached, the link will be dropped.<br><b>Bit 1</b> Drop the link based on <b>Low SNR Threshold</b> . When a predefined number of 20 Threshold crossing occurrences in a 10µs interval is reached, the link will be dropped.<br><b>Bit 0</b> Drop the link based on <b>Signal/Energy Loss</b> indication. When the Energy detector indicates Energy Loss, the link will be dropped. Typical reaction time is 10µs.<br>The Fast Link Down function is an OR of all 5 options (bit[10] and bits[3:0]), the designer can enable any combination of these conditions. |

**表 8-26. 0x000D Register Control Register (REGCR)**

| BIT   | NAME                      | TYPE | DEFAULT | FUNCTION  |
|-------|---------------------------|------|---------|---|
| 15:14 | Extended Register Command | RW   | 0       | <b>Extended Register Command:</b><br>00 = Address<br>01 = Data, no post increment<br>10 = Data, post increment on read and write<br>11 = Data, post increment on write only |
| 13:5  | Reserved                  | RO   | 0       | <b>Reserved</b>   |

**表 8-26. 0x000D Register Control Register (REGCR) (continued)**

| BIT | NAME  | TYPE | DEFAULT | FUNCTION  |
|-----|-------|------|---------|---|
| 4:0 | DEVAD | RW   | 0       | <b>Device Address:</b><br>Bits[4:0] are the device address, DEVAD, that directs any accesses of ADDAR register (0x000E) to the appropriate MMD. Specifically, the DP83822 uses the vendor specific DEVAD [4:0] = "11111" for accesses to registers 0x04D1 and lower. For MMD3 access, the DEVAD[4:0] = '00011'. For MMD7 access, the DEVAD[4:0] = '00111'. All accesses through registers REGCR and ADDAR should use the DEVAD for either MMD, MMD3 or MMD7. Transactions with other DEVAD are ignored. |

**表 8-27. 0x000E Data Register (ADDAR)**

| BIT  | NAME         | TYPE | DEFAULT | FUNCTION  |
|------|--------------|------|---------|---|
| 15:0 | Address/Data | RW   | 0       | If REGCR register bits[15:14] = '00', holds the MMD DEVAD's address register, otherwise holds the MMD DEVAD's data. |

**表 8-28. 0x000F Fast Link Down Status Register (FLDS)**

| BIT  | NAME                  | TYPE   | DEFAULT | FUNCTION   |
|------|-----------------------|--------|---------|--|
| 15:9 | Reserved              | RO     | 0       | <b>Reserved</b>  |
| 8:4  | Fast Link Down Status | RO, LH | 0       | <b>Fast Link Down Status:</b><br>1 0000 = Descrambler Loss Sync<br>0 1000 = RX Errors<br>0 0100 = MLT3 Errors<br>0 0010 = SNR Level<br>0 0001 = Signal/Energy Lost<br>Status Registers that latch high each time a given Fast Link Down mode is activated and causes a link drop (assuming the modes were enabled) |
| 3:0  | Reserved              | RO     | 0       | <b>Reserved</b>  |

**表 8-29. 0x0010 PHY Status Register (PHYSTS)**

| BIT | NAME                | TYPE   | DEFAULT | FUNCTION  |
|-----|---------------------|--------|---------|---|
| 15  | Reserved            | RO     | 0       | <b>Reserved</b>   |
| 14  | MDI/MDIX Mode       | RO     | 0       | <b>MDI/MDIX Mode Status:</b><br>1 = MDI Pairs swapped (Receive on TD pair, Transmit on RD pair)<br>0 = MDI Pairs normal (Receive on RD pair, Transmit on TD pair)   |
| 13  | Receive Error Latch | RO, LH | 0       | <b>Receive Error Latch:</b><br>1 = Receive error event has occurred<br>0 = No receive error event has occurred<br>Receive error event has occurred since last read of RECR register (address 0x0015). This bit will be cleared upon a read of the RECR register.                      |
| 12  | Polarity Status     | RO, LH | 0       | <b>Polarity Status:</b><br>1 = Inverted Polarity detected<br>0 = Correct Polarity detected<br>This bit is a duplication of bit[4] in the 10BTSCR register (address 0x001A). This bit will be cleared upon a read of the 10BTSCR register, but not upon a read of the PHYSTS register. |

**表 8-29. 0x0010 PHY Status Register (PHYSTS) (continued)**

| BIT | NAME                      | TYPE   | DEFAULT | FUNCTION  |
|-----|---------------------------|--------|---------|---|
| 11  | False Carrier Sense Latch | RO, LH | 0       | <b>False Carrier Sense Latch:</b><br>1 = False Carrier event has occurred<br>0 = No False Carrier event has occurred<br>False Carrier event has occurred since last read of FCSCR register (address 0x0014). This bit will be cleared upon a read of the FCSR register.             |
| 10  | Signal Detect             | RO, LL | 0       | <b>Signal Detect:</b><br>Active high 100Base-TX unconditional Signal Detect indication from PMD<br><b>Note:</b> During EEE_LPI the value of this register bit should be ignored   |
| 9   | Descrambler Lock          | RO, LL | 0       | <b>Descrambler Lock:</b><br>Active high 100Base-TX Descrambler Lock indication from PMD<br><b>Note:</b> During EEE_LPI the value of this register bit should be ignored   |
| 8   | Page Received             | RO     | 0       | <b>Link Code Word Page Received:</b><br>1 = A new Link Code Word Page has been received<br>0 = Link Code Word Page has not been received<br>This bit is a duplicate of Page Received (bit[1]) in the ANER register and it is cleared on read of the ANER register (address 0x0006). |
| 7   | MII Interrupt             | RO, LH | 0       | <b>MII Interrupt Pending:</b><br>1 = Indicates that an internal interrupt is pending<br>0 = No interrupt pending<br>Interrupt source can be determined by reading the MISR register (0x0012). Reading the MISR will clear this interrupt bit indication.                            |
| 6   | Remote Fault              | RO     | 0       | <b>Remote Fault:</b><br>1 = Remote Fault condition detected<br>0 = No Remote Fault condition detected<br>Fault criteria: notification from link partner of Remote Fault via Auto-Negotiation. Cleared on read of BMSR register (address 0x0001) or by reset.                        |
| 5   | Jabber Detect             | RO     | 0       | <b>Jabber Detection:</b><br>1 = Jabber condition detected<br>0 = No Jabber This bit is only for 10 Mbps operation.<br>This bit is a duplicate of the Jabber Detect bit in the BMSR register (address 0x0001) and will not be cleared upon a read of the PHYSTS register.            |
| 4   | Auto-Negotiation Status   | RO     | 0       | <b>Auto-Negotiation Status:</b><br>1 = Auto-Negotiation complete<br>0 = Auto-Negotiation not complete   |
| 3   | MII Loopback Status       | RO     | 0       | <b>MII Loopback Status:</b><br>1 = Loopback enabled<br>0 = Normal operation   |
| 2   | Duplex Status             | RO     | 0       | <b>Duplex Status:</b><br>1 = Full-Duplex mode<br>0 = Half-Duplex mode   |
| 1   | Speed Status              | RO     | 1       | <b>Speed Status:</b><br>1 = 10 Mbps mode<br>0 = 100 Mbps mode   |

**表 8-29. 0x0010 PHY Status Register (PHYSTS) (continued)**

| BIT | NAME        | TYPE | DEFAULT | FUNCTION   |
|-----|-------------|------|---------|--|
| 0   | Link Status | RO   | 0       | <b>Link Status:</b><br>1 = Valid link established (for either 10 Mbps or 100 Mbps)<br>0 = No link established<br>This bit is duplicated from the Link Status bit in the BMSR register (address 0x0001) and will not be cleared upon a read of the PHYSTS register. |

**表 8-30. 0x0011 PHY Specific Control Register (PHYSCR)**

| BIT   | NAME                   | TYPE  | DEFAULT | FUNCTION   |            |   |             |      |        |   |      |          |          |      |              |   |      |               |  |
|-------|------------------------|---|---------|--|------------|---|-------------|------|--------|---|------|----------|----------|------|--------------|---|------|---------------|--|
| 15    | Disable PLL            | RW  | 0       | <b>Disable PLL:</b><br>1 = Disable internal clocks circuitry<br>0 = Normal operation<br><b>Note:</b> clock circuitry can be disabled only in IEEE power down mode.   |            |   |             |      |        |   |      |          |          |      |              |   |      |               |  |
| 14    | Power Save Mode Enable | RW  | 0       | <b>Power Save Mode Enable:</b><br>1 = Enable power save modes<br>0 = Normal operation  |            |   |             |      |        |   |      |          |          |      |              |   |      |               |  |
| 13:12 | Power Save Modes       | RW  | 00      | <b>Power Saving Modes Selection Field:</b><br>Power Save Mode Enable (bit[14]) must be set to '1' for power save modes to be enabled.  |            |   |             |      |        |   |      |          |          |      |              |   |      |               |  |
|       |                        |   |         | <table border="1"> <thead> <tr> <th>Power Mode</th> <th>Name</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>&lt;00&gt;</td> <td>Normal</td> <td>Normal operation mode. PHY is fully functional.</td> </tr> <tr> <td>&lt;01&gt;</td> <td>Reserved</td> <td>Reserved</td> </tr> <tr> <td>&lt;10&gt;</td> <td>Active Sleep</td> <td>Low Power Active Energy Saving mode that shuts down all internal circuitry besides SMI and energy detect functionalities. In this mode the PHY sends NLP every 1.4 seconds to wake up link partner. Automatic power-up is done when link partner is detected.</td> </tr> <tr> <td>&lt;11&gt;</td> <td>Passive Sleep</td> <td>Low Power Passive Energy Saving mode that shuts down all internal circuitry besides SMI and energy detect functionalities. Automatic power-up is done when link partner is detected.</td> </tr> </tbody> </table> | Power Mode | Name  | Description | <00> | Normal | Normal operation mode. PHY is fully functional. | <01> | Reserved | Reserved | <10> | Active Sleep | Low Power Active Energy Saving mode that shuts down all internal circuitry besides SMI and energy detect functionalities. In this mode the PHY sends NLP every 1.4 seconds to wake up link partner. Automatic power-up is done when link partner is detected. | <11> | Passive Sleep | Low Power Passive Energy Saving mode that shuts down all internal circuitry besides SMI and energy detect functionalities. Automatic power-up is done when link partner is detected. |
|       |                        |   |         | Power Mode   | Name       | Description                                     |             |      |        |   |      |          |          |      |              |   |      |               |  |
|       |                        |   |         | <00>   | Normal     | Normal operation mode. PHY is fully functional. |             |      |        |   |      |          |          |      |              |   |      |               |  |
|       |                        |   |         | <01>   | Reserved   | Reserved  |             |      |        |   |      |          |          |      |              |   |      |               |  |
| <10>  | Active Sleep           | Low Power Active Energy Saving mode that shuts down all internal circuitry besides SMI and energy detect functionalities. In this mode the PHY sends NLP every 1.4 seconds to wake up link partner. Automatic power-up is done when link partner is detected. |         |  |            |   |             |      |        |   |      |          |          |      |              |   |      |               |  |
| <11>  | Passive Sleep          | Low Power Passive Energy Saving mode that shuts down all internal circuitry besides SMI and energy detect functionalities. Automatic power-up is done when link partner is detected.  |         |  |            |   |             |      |        |   |      |          |          |      |              |   |      |               |  |
| <00>  | Normal                 | Normal operation mode. PHY is fully functional.   |         |  |            |   |             |      |        |   |      |          |          |      |              |   |      |               |  |
| <01>  | Reserved               | Reserved  |         |  |            |   |             |      |        |   |      |          |          |      |              |   |      |               |  |
| <10>  | Active Sleep           | Low Power Active Energy Saving mode that shuts down all internal circuitry besides SMI and energy detect functionalities. In this mode the PHY sends NLP every 1.4 seconds to wake up link partner. Automatic power-up is done when link partner is detected. |         |  |            |   |             |      |        |   |      |          |          |      |              |   |      |               |  |
| <11>  | Passive Sleep          | Low Power Passive Energy Saving mode that shuts down all internal circuitry besides SMI and energy detect functionalities. Automatic power-up is done when link partner is detected.  |         |  |            |   |             |      |        |   |      |          |          |      |              |   |      |               |  |
| 11    | Scrambler Bypass       | RW  | 0       | <b>Scrambler Bypass:</b><br>1 = Scrambler bypass enabled<br>0 = Scrambler bypass disabled  |            |   |             |      |        |   |      |          |          |      |              |   |      |               |  |
| 10    | Reserved               | RW  | 0       | <b>Reserved</b>  |            |   |             |      |        |   |      |          |          |      |              |   |      |               |  |

**表 8-30. 0x0011 PHY Specific Control Register (PHYSCR) (continued)**

| BIT | NAME                    | TYPE | DEFAULT | FUNCTION   |
|-----|-------------------------|------|---------|--|
| 9:8 | Loopback FIFO Depth     | RW   | 01      | <b>Far-End Loopback FIFO Depth:</b><br>00 = 4 nibbles FIFO<br>01 = 5 nibbles FIFO<br>10 = 6 nibbles FIFO<br>11 = 8 nibbles FIFO<br>This FIFO is used to adjust RX (receive) clock rate to TX clock rate. FIFO depth needs to be set based on expected maximum packet size and clock accuracy. Default value sets to 5 nibbles. |
| 7:5 | Reserved                | RO   | 0       | <b>Reserved</b>  |
| 4   | COL Full-Duplex Enable  | RW   | 0       | <b>Collision in Full-Duplex Mode:</b><br>1 = Enable Collision generation signaling in Full-Duplex mode<br>0 = Disable Collision in Full-Duplex mode<br><b>Note:</b> When in Half-Duplex mode, Collision will always be active.   |
| 3   | Interrupt Polarity      | RW   | 1       | <b>Interrupt Polarity:</b><br>1 = Normal operation is 1 logic and during interrupt is 0 logic<br>0 = Normal operation is 0 logic and during interrupt is 1 logic   |
| 2   | Test Interrupt          | RW   | 0       | <b>Test Interrupt:</b><br>1 = Generate an interrupt<br>0 = Do not generate interrupt<br>Forces the PHY to generate an interrupt to facilitate interrupt testing. Interrupts will continue to be generated as long as this bit remains set.   |
| 1   | Interrupt Enable        | RW   | 0       | <b>Interrupt Enable:</b><br>1 = Enable event based interrupts<br>0 = Disable event based interrupts<br>Enable interrupt dependent on the event enables in the MISR register (address 0x0012).  |
| 0   | Interrupt Output Enable | RW   | 0       | <b>Interrupt Output Enable:</b><br>1 = INT/PWDN_N is an interrupt output<br>0 = INT/PWDN_N is a Power Down pin<br>Enable active low interrupt events via the INT/PWDN_N pin by configuring the INT/PWDN_N pin as an output.  |

**表 8-31. 0x0012 MII Interrupt Status Register #1 (MISR1)**

| BIT | NAME                          | TYPE   | DEFAULT | FUNCTION   |
|-----|-------------------------------|--------|---------|--|
| 15  | Link Quality Interrupt        | RO, LH | 0       | <b>Change of Link Quality Status Interrupt:</b><br>1 = Change of link quality when link is ON<br>0 = Link quality is Good    |
| 14  | Energy Detect Interrupt       | RO, LH | 0       | <b>Change of Energy Detection Status Interrupt:</b><br>1 = Change of energy detected<br>0 = No change of energy detected     |
| 13  | Link Status Changed Interrupt | RO, LH | 0       | <b>Change of Link Status Interrupt:</b><br>1 = Change of link status interrupt is pending<br>0 = No change of link status    |
| 12  | Speed Changed Interrupt       | RO, LH | 0       | <b>Change of Speed Status Interrupt:</b><br>1 = Change of speed status interrupt is pending<br>0 = No change of speed status |

**表 8-31. 0x0012 MII Interrupt Status Register #1 (MISR1) (continued)**

| BIT | NAME                                      | TYPE   | DEFAULT | FUNCTION   |
|-----|---|--------|---------|--|
| 11  | Duplex Mode Changed Interrupt             | RO, LH | 0       | <b>Change of Duplex Status Interrupt:</b><br>1 = Change of duplex status interrupt is pending<br>0 = No change of duplex status  |
| 10  | Auto-Negotiation Completed Interrupt      | RO, LH | 0       | <b>Auto-Negotiation Complete Interrupt:</b><br>1 = Auto-Negotiation complete interrupt is pending<br>0 = No Auto-Negotiation complete event is pending   |
| 9   | False Carrier Counter Half-Full Interrupt | RO, LH | 0       | <b>False Carrier Counter Half-Full Interrupt:</b><br>1 = False Carrier HF interrupt is pending<br>0 = False Carrier HF event is not pending<br>False Carrier counter (Register FCSCR, address 0x0014) exceeds half-full interrupt is pending.  |
| 8   | Receive Error Counter Half-Full Interrupt | RO, LH | 0       | <b>Receiver Error Counter Half-Full Interrupt:</b><br>1 = Receive Error HF interrupt is pending<br>0 = Receive Error HF event is not pending<br>Receiver Error counter (Register RECR, address 0x0015) exceeds half-full interrupt is pending. |
| 7   | Link Quality Interrupt Enable             | RW     | 0       | <b>Enable</b> interrupt on change of link quality  |
| 6   | Energy Detect Interrupt Enable            | RW     | 0       | <b>Enable</b> interrupt on change of energy detection  |
| 5   | Link Status Changed Enable                | RW     | 0       | <b>Enable</b> interrupt on change of link status   |
| 4   | Speed Changed Interrupt Enable            | RW     | 0       | <b>Enable</b> Interrupt on change of speed status  |
| 3   | Duplex Mode Changed Interrupt Enable      | RW     | 0       | <b>Enable</b> Interrupt on change of duplex status   |
| 2   | Auto-Negotiation Completed Enable         | RW     | 0       | <b>Enable</b> Interrupt on Auto-negotiation complete event   |
| 1   | False Carrier HF Enable                   | RW     | 0       | <b>Enable</b> Interrupt on False Carrier Counter Register half-full event  |
| 0   | Receive Error HF Enable                   | RW     | 0       | <b>Enable</b> Interrupt on Receive Error Counter Register half-full event  |

**表 8-32. 0x0013 MII Interrupt Status Register #2 (MISR2)**

| BIT | NAME                                | TYPE   | DEFAULT | FUNCTION  |
|-----|-------------------------------------|--------|---------|---|
| 15  | EEE Error Interrupt                 | RO, LH | 0       | <b>Energy Efficient Ethernet Error Interrupt:</b><br>1 = EEE error has occurred<br>0 = EEE error has not occurred   |
| 14  | Auto-Negotiation Error Interrupt    | RO, LH | 0       | <b>Auto-Negotiation Error Interrupt:</b><br>1 = Auto-Negotiation error interrupt is pending<br>0 = No Auto-Negotiation error event pending                      |
| 13  | Page Received Interrupt             | RO, LH | 0       | <b>Page Receiver Interrupt:</b><br>1 = Page has been received<br>0 = Page has not been received   |
| 12  | Loopback FIFO OF/UF Event Interrupt | RO, LH | 0       | <b>Loopback FIFO Overflow/Underflow Event Interrupt:</b><br>1 = FIFO Overflow/Underflow event interrupt pending<br>0 = No FIFO Overflow/Underflow event pending |
| 11  | MDI Crossover Change Interrupt      | RO, LH | 0       | <b>MDI/MDIX Crossover Status Change Interrupt:</b><br>1 = MDI crossover status changed interrupt is pending<br>0 = MDI crossover status has not changed         |

**表 8-32. 0x0013 MII Interrupt Status Register #2 (MISR2) (continued)**

| BIT | NAME  | TYPE   | DEFAULT | FUNCTION  |
|-----|---|--------|---------|---|
| 10  | Sleep Mode Interrupt  | RO, LH | 0       | <b>Sleep Mode Event Interrupt:</b><br>1 = Sleep mode event interrupt is pending<br>0 = No Sleep mode event pending  |
| 9   | Polarity Changed Interrupt /<br>WoL Packet Received Interrupt | RO, LH | 0       | <b>Polarity Change Interrupt / WoL Packet Received Interrupt:</b><br>1 = Data polarity interrupt pending / WoL packet was received<br>0 = No Data polarity pending / No WoL packet received |
| 8   | Jabber Detect Interrupt                                       | RO, LH | 0       | <b>Jabber Detect Event Interrupt:</b><br>1 = Jabber detect event interrupt pending<br>0 = No Jabber detect event pending  |
| 7   | EEE Error Interrupt Enable                                    | RW     | 0       | <b>Enable</b> interrupt on EEE Error  |
| 6   | Auto-Negotiation Error Interrupt<br>Enable                    | RW     | 0       | <b>Enable</b> Interrupt on Auto-Negotiation error event   |
| 5   | Page Received Interrupt Enable                                | RW     | 0       | <b>Enable</b> Interrupt on page receive event   |
| 4   | Loopback FIFO OF/UF Enable                                    | RW     | 0       | <b>Enable</b> Interrupt on loopback FIFO Overflow/Underflow event   |
| 3   | MDI Crossover Change Enable                                   | RW     | 0       | <b>Enable</b> Interrupt on change of MDI/X status   |
| 2   | Sleep Mode Event Enable                                       | RW     | 0       | <b>Enable</b> Interrupt on sleep mode event   |
| 1   | Polarity Changed / WoL Packet<br>Enable                       | RW     | 0       | <b>Enable</b> Interrupt on change of polarity status  |
| 0   | Jabber Detect Enable  | RW     | 0       | <b>Enable</b> Interrupt on Jabber detection event   |

**表 8-33. 0x0014 False Carrier Sense Counter Register (FCSCR)**

| BIT  | NAME                        | TYPE    | DEFAULT | FUNCTION  |
|------|-----------------------------|---------|---------|---|
| 15:8 | Reserved                    | RO      | 0       | <b>Reserved</b>   |
| 7:0  | False Carrier Event Counter | RO, COR | 0       | <b>False Carrier Event Counter:</b><br>This 8-bit counter increments on every false carrier event. This counter stops when it reaches its maximum count (FFh). When the counter exceeds half-full (7Fh), an interrupt event is generated. This register is cleared on read. |

**表 8-34. 0x0015 Receive Error Count Register (RECR)**

| BIT  | NAME                  | TYPE    | DEFAULT | FUNCTION  |
|------|-----------------------|---------|---------|---|
| 15:0 | Receive Error Counter | RO, COR | 0       | <b>RX_ER Counter:</b><br>When a valid carrier is presented (only while RXDV is set), and there is at least one occurrence of an invalid data symbol, this 16-bit counter increments for each receive error detected. The RX_ER counter does not count in MII loopback mode. The counter stops when it reaches its maximum count (FFFFh). When the counter exceeds half-full (7Fh), an interrupt is generated. This register is cleared on read. |

**表 8-35. 0x0016 BIST Control Register (BISCR)**

| BIT | NAME     | TYPE | DEFAULT | FUNCTION        |
|-----|----------|------|---------|-----------------|
| 15  | Reserved | RO   | 0       | <b>Reserved</b> |



**表 8-35. 0x0016 BIST Control Register (BISCR) (continued)**

| BIT | NAME                     | TYPE   | DEFAULT | FUNCTION  |
|-----|--------------------------|--------|---------|---|
| 14  | BIST Error Counter Mode  | RW     | 0       | <b>BIST Error Counter Mode:</b><br>1 = Continuous mode<br>0 = Single mode<br>Continuous mode, when the BIST Error counter reaches its max value, a pulse is generated and the counter starts counting from zero again. When in Single mode, if the BIST Error Counter reaches its max value, PRBS checker will stop counting.   |
| 13  | PRBS Checker             | RW     | 0       | <b>PRBS Checker:</b><br>1 = PRBS Checker Enabled<br>0 = PRBS Checker Disabled<br>When PRBS checker is enabled, DP83822 will check PRBS data received.   |
| 12  | Packet Generation Enable | RW     | 0       | <b>Packet Generation Enable:</b><br>1 = Enable packet generator with PRBS data<br>0 = Disable packet generator  |
| 11  | PRBS Checker Lock/Sync   | RO     | 0       | <b>PRBS Checker Lock/Sync Indication:</b><br>1 = PRBS checker is locked and synced on received bit stream<br>0 = PRBS checker is not locked   |
| 10  | PRBS Checker Sync Loss   | RO, LH | 0       | <b>PRBS Checker Sync Loss Indication:</b><br>1 = PRBS checker has lost sync<br>0 = PRBS checker has not lost sync   |
| 9   | Packet Generator Status  | RO     | 0       | <b>Packet Generation Status Indication:</b><br>1 = Packet Generator is active and generating packets<br>0 = Packet Generator is off   |
| 8   | Power Mode               | RO     | 1       | <b>Sleep Mode Indication:</b><br>1 = Indicates that the PHY is in normal power mode<br>0 = Indicates that the PHY is in one of the sleep modes  |
| 7   | Reserved                 | RO     | 0       | <b>Reserved</b>   |
| 6   | Transmit in MII Loopback | RW     | 0       | <b>Transmit Data in MII Loopback Mode (valid only at 100 Mbps):</b><br>1 = Enable transmission<br>0 = Disable transmission<br>When enabled, data received from the MAC on the TX pins will be routed to the MDI in parallel to the MII loopback (to RX pins). This bit may be set only in MII Loopback mode - setting bit[14] in in BMCR register (address 0x0000). When disabled, data from the MAC is not transmitted to the MDI.   |
| 5   | Reserved                 | RO     | 0       | <b>Reserved</b>   |
| 4:0 | Loopback Mode            | RW     | 0       | <b>Loopback Mode Select:</b><br>The PHY provides several options for loopback that test and verify various functional blocks within the PHY. Enabling loopback mode allows in-circuit testing of the DP83822 digital and analog data paths<br><b>Near-end Loopback</b><br>00001 = PCS Input Loopback<br>00010 = PCS Output Loopback<br>00100 = Digital Loopback<br>01000 = Analog Loopback (requires 100-Ω termination) <b>Far-end Loopback</b><br>10000 = Reverse Loopback |

**表 8-36. 0x0017 RMI and Status Register (RCSR)**

| BIT   | NAME                                   | TYPE      | DEFAULT | FUNCTION  |
|-------|--|-----------|---------|---|
| 15:13 | Reserved                               | RO        | 0       | <b>Reserved</b>   |
| 12    | RGMII RX Clock Shift                   | RW        | 0       | <b>RGMII RX Clock Shift:</b><br>1 = Receive path internal clock shift is enabled<br>0 = Receive path internal clock shift is disabled<br>When enabled, receive path internal clock (RX_CLK) is delayed by 3.5ns relative to receive data. When disabled, data and clock are in align mode.  |
| 11    | RGMII TX Clock Shift                   | RW        | 0       | <b>RGMII TX Clock Shift:</b><br>1 = Transmit path internal clock shift is disabled<br>0 = Transmit path internal clock shift is enabled<br>When enabled, transmit path internal clock (TX_CLK) is delayed by 3.5ns relative to transmit data.   |
| 10    | RGMII TX Synced                        | RW        | 0       | <b>RGMII TX Clock Sync:</b><br>1 = PHY and MAC share same clock reference<br>0 = PHY operates from same or independent clock source as MAC<br>This mode, when enabled, reduces latency since both MAC and PHY are synchronized to the same clock source. This mode can also be used when enabling the PHY Clock Output by connecting the MAC to the PHY Output Clock. |
| 9     | RGMII Mode                             | RW, Strap | 0       | <b>RGMII Mode Enable:</b><br>1 = Enable RGMII mode of operation<br>0 = Mode determined by bit[5]  |
| 8     | RMII TX Clock Shift                    | RW        | 0       | <b>RMII TX Clock Shift:</b><br>1 = Transmit path internal clock shift is enabled<br>0 = Transmit path internal clock shift is disabled  |
| 7     | RMII Clock Select                      | RW, Strap | 0       | <b>RMII Reference Clock Select:</b><br>Strap XI_50 determines the clock reference requirement.<br>1 = 50-MHz clock reference, CMOS-level oscillator<br>0 = 25-MHz clock reference, crystal or CMOS-level oscillator   |
| 6     | RMII Recovered Clock Async FIFO Bypass | RW        | 1       | <b>RMII Recovered Clock Async FIFO Bypass:</b><br>0 = Bypass Asynchronous FIFO<br>1 = Normal operation<br>When in RMII Recovered Clock mode, the asynchronous FIFO can be bypassed to reduce the receive path latency within the DP83822. 50-MHz clock is outputted on RX_CLK when in Async fifo bypass   |
| 5     | RMII Mode                              | RW        | 0       | <b>RMII Mode Enable:</b><br>1 = Enable RMII mode of operation<br>0 = Enable MII mode of operation   |
| 4     | RMII Revision Select                   | RW        | 0       | <b>RMII Revision Select:</b><br>1 = RMII revision 1.0<br>0 = RMII revision 1.2<br>RMII revision 1.0, CRS_DV will remain asserted until final data is transferred. CRS_DV will not toggle at the end of a packet.<br>RMII revision 1.2, CRS_DV will toggle at the end of a packet to indicate de-assertion of CRS.   |
| 3     | RMII Overflow Status                   | RO, COR   | 0       | <b>RX FIFO Overflow Status:</b><br>1 = Overflow detected<br>0 = Normal  |

**表 8-36. 0x0017 RMI and Status Register (RCSR) (continued)**

| BIT | NAME                           | TYPE    | DEFAULT | FUNCTION   |
|-----|--------------------------------|---------|---------|--|
| 2   | RMI Underflow Status           | RO, COR | 0       | <b>RX FIFO Underflow Status:</b><br>1 = Underflow detected<br>0 = Normal   |
| 1:0 | Receive Elasticity Buffer Size | RW      | 01      | <b>Receive Elasticity Buffer Size:</b><br>This field controls the Receive Elasticity Buffer which allows for frequency variation tolerance between the 50-MHz RMI clock and the recovered data. The following values indicate the tolerance in bits for a single packet. The minimum setting allows for standard Ethernet frame sizes at $\pm 50$ ppm accuracy. For greater frequency tolerance, the packet lengths may be scaled (for $\pm 100$ ppm), divide the packet lengths by 2). 00 = 14 bit tolerance (up to 16800 byte packets)<br>01 = 2 bit tolerance (up to 2400 byte packets)<br>10 = 6 bit tolerance (up to 7200 byte packets)<br>11 = 10 bit tolerance (up to 12000 byte packets) |

**表 8-37. 0x0018 LED Control Register (LEDCR)**

| BIT   | NAME                 | TYPE      | DEFAULT | FUNCTION  |
|-------|----------------------|-----------|---------|---|
| 15:11 | Reserved             | RO        | 0       | <b>Reserved</b>   |
| 10:9  | Blink Rate           | RW        | 10      | <b>LED Blinking Rate (ON/OFF duration):</b><br>00 = 20Hz (50 ms)<br>01 = 10Hz (100 ms)<br>10 = 5Hz (200 ms)<br>11 = 2Hz (500 ms)  |
| 8     | Reserved             | RW        | 0       | <b>Reserved</b>   |
| 7     | LED_0 Polarity       | RW, Strap | 0       | <b>LED_0 Link Polarity Setting:</b><br>1 = Active High polarity setting<br>0 = Active Low polarity setting<br>LED_0 polarity defined by strapping value of this pin. This register allows for override of this strap value. |
| 6:5   | Reserved             | RW        | 0       | <b>Reserved</b>   |
| 4     | Drive LED_0          | RW        | 0       | <b>Drive Link LED_0 Select:</b><br>1 = Drive value of ON/OFF bit[1] onto LED_0 output pin<br>0 = Normal operation   |
| 3:2   | Reserved             | RW        | 0       | <b>Reserved</b>   |
| 1     | LED_0 ON/OFF Setting | RW        | 0       | Value to force LED_0 output   |
| 0     | Reserved             | RW        | 0       | <b>Reserved</b>   |

**表 8-38. 0x0019 PHY Control Register (PHYCR)**

| BIT | NAME              | TYPE      | DEFAULT | FUNCTION  |
|-----|-------------------|-----------|---------|---|
| 15  | Auto MDI/X Enable | RW, Strap | 0       | <b>Auto-MDIX Enable:</b><br>1 = Enable Auto-Negotiation Auto-MDIX capability<br>0 = Disable Auto-Negotiation Auto-MDIX capability |

**表 8-38. 0x0019 PHY Control Register (PHYCR) (continued)**

| BIT  | NAME                  | TYPE      | DEFAULT | FUNCTION  |                |   |
|------|-----------------------|-----------|---------|---|----------------|---|
| 14   | Force MDI/X           | RW        | 0       | <b>Force MDIX:</b><br>1 = Force MDI pairs to cross (MDIX)<br>0 = Normal operation (MDI)<br>When Force MDI/X is enabled, receive data is on the TD pair and transmit data is on the RD pair. When disabled, receive data is on the RD pair and transmit data is on the TD pair.  |                |   |
| 13   | Pause RX Status       | RO        | 0       | <b>Pause Receive Negotiation Status:</b><br>Indicates that pause receive should be enabled in the MAC. Based on bits[11:10] in ANAR register and bits[11:10] in ANLPAR register settings. The function shall be enabled according to IEEE 802.3 Annex 28B Table 28B-3, "Pause Resolution", only if the Auto-Negotiation highest common denominator is a Full-Duplex technology. |                |   |
| 12   | Pause TX Status       | RO        | 0       | <b>Pause Transmit Negotiated Status:</b><br>Indicates that pause should be enabled in the MAC. Based on bits[11:10] in ANAR register and bits[11:10] in ANLPAR register settings. This function shall be enabled according to IEEE 802.3 Annex 28B Table 28B-3, "Pause Resolution", only if the Auto-Negotiation highest common denominator is a Full-Duplex technology.        |                |   |
| 11   | MII Link Status       | RO        | 0       | <b>MII Link Status:</b><br>1 = 100Base-TX Full-Duplex link is active<br>0 = No active 100Base-TX Full-Duplex link   |                |   |
| 10:8 | Reserved              | RO        | 0       | <b>Reserved</b>   |                |   |
| 7    | Bypass LED Stretching | RW        | 0       | <b>Bypass LED Stretching:</b><br>1 = Bypass LED stretching<br>0 = Normal LED operation<br>Set this bit to '1' to bypass the LED stretching, the LED reflects the internal value.  |                |   |
| 6    | Reserved              | RW        | 0       | <b>Reserved</b>   |                |   |
| 5    | LED Configuration     | RW, Strap | 1       | <b>Configuration</b>  | <b>LED_CFG</b> | <b>LED_0</b>                            |
|      |                       |           |         | 1   | 1              | ON for LINK<br>OFF for no LINK          |
|      |                       |           |         | 2   | 0              | ON for LINK<br>BLINK for TX/RX Activity |
| 4:0  | PHY Address           | RO, Strap | 0000 1  | <b>PHY Address:</b><br>Strapping configuration for PHY Address  |                |   |

**表 8-39. 0x001A 10Base-Te Status/Control Register (10BTSCR)**

| BIT   | NAME                      | TYPE | DEFAULT | FUNCTION   |
|-------|---------------------------|------|---------|--|
| 15:14 | Reserved                  | RO   | 0       | <b>Reserved</b>  |
| 13    | Receiver Threshold Enable | RW   | 0       | <b>Lower Receiver Threshold Enable:</b><br>1 = Enable 10Base-Te lower receiver threshold<br>0 = Normal 10Base-Te operation<br>When enabled, receiver threshold is lowered to allow for operation with longer cables. |

**表 8-39. 0x001A 10Base-Tc Status/Control Register (10BTSCR) (continued)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 12:9 | Squelch         | RW   | 0000    | <b>Squelch Configuration:</b> Used to set the Peak Squelch 'ON' threshold for the 10Base-Tc receiver. Starting from 200mV to 600mV, step size of 50mV with some overlapping as shown below: 0000 = 200mV<br>0001 = 250mV<br>0010 = 300mV<br>0011 = 350mV<br>0100 = 400mV<br>0101 = 450mV<br>0110 = 500mV<br>0111 = 550mV<br>1000 = 600mV |
| 8    | Reserved        | RW   | 0       | <b>Reserved</b>  |
| 7    | NLP Disable     | RW   | 0       | <b>NLP Transmission Control:</b><br>1 = Disable transmission of NLPs<br>0 = Enable transmission of NLPs  |
| 6:5  | Reserved        | RO   | 0       | <b>Reserved</b>  |
| 4    | Polarity Status | RO   | 0       | <b>Polarity Status:</b><br>1 = Inverted Polarity detected<br>0 = Correct Polarity detected<br>This bit is a duplication of bit[12] in the PHYSTS register (0x0010). Both bits will be cleared upon a read of 10BTSCR register, but not upon a read of the PHYSTS register.   |
| 3:1  | Reserved        | RO   | 0       | <b>Reserved</b>  |
| 0    | Jabber Disable  | RW   | 0       | <b>Jabber Disable:</b><br>1 = Jabber function disabled<br>0 = Jabber function enabled<br><b>Note:</b> This function is only applicable in 10Base-Tc operation.   |

**表 8-40. 0x001B BIST Control and Status Register #1 (BICSR1)**

| BIT  | NAME             | TYPE | DEFAULT   | FUNCTION   |
|------|------------------|------|-----------|--|
| 15:8 | BIST Error Count | RO   | 0x0       | <b>BIST Error Count:</b><br>Holds number of errored bytes received by the PRBS checker. Value in this register is locked and cleared when write is done to bit[15]. When BIST Error Counter Mode is set to '0', count stops on 0xFF (see register 0x0016)<br><b>Note:</b> Writing '1' to bit[15] will lock the counter's value for successive read operation and clear the BIST Error Counter. |
| 7:0  | BIST IPG Length  | RW   | 0111 1101 | <b>BIST IPG Length:</b><br>Inter Packet Gap (IPG) Length defines the size of the gap (in bytes) between any 2 successive packets generated by the BIST. Default value is 0x7D (equal to 500 bytes).  |

**表 8-41. 0x001C BIST Control and Status Register #2 (BICSR2)**

| BIT   | NAME     | TYPE | DEFAULT | FUNCTION        |
|-------|----------|------|---------|-----------------|
| 15:11 | Reserved | RO   | 0       | <b>Reserved</b> |

**表 8-41. 0x001C BIST Control and Status Register #2 (BICSR2) (continued)**

| BIT  | NAME               | TYPE | DEFAULT          | FUNCTION  |
|------|--------------------|------|------------------|---|
| 10:0 | BIST Packet Length | RW   | 101 1110<br>1110 | <b>BIST Packet Length:</b><br>Length of the generated BIST packets. The value of this register defines the size (in bytes) of every packet that is generated by the BIST. Default value is 0x5EE, which is equal to 1518 bytes. |

**表 8-42. 0x001E Cable Diagnostic Control Register (CDCR)**

| BIT  | NAME                       | TYPE | DEFAULT             | FUNCTION   |
|------|----------------------------|------|---------------------|--|
| 15   | Cable Diagnostic Start     | RW   | 0                   | <b>Cable Diagnostic Process Start:</b><br>1 = Start cable measurement<br>0 = Cable Diagnostic is disabled<br>Diagnostic Start bit is cleared once Diagnostic Done indication bit is triggered. |
| 14:2 | Reserved                   | RO   | 000 0001<br>0000 00 | <b>Reserved</b>  |
| 1    | Cable Diagnostic Status    | RO   | 1                   | <b>Cable Diagnostic Process Done:</b><br>1 = Indication that cable measurement process is complete<br>0 = Cable Diagnostic had not completed   |
| 0    | Cable Diagnostic Test Fail | RO   | 0                   | <b>Cable Diagnostic Process Fail:</b><br>1 = Indication that cable measurement process failed<br>0 = Cable Diagnostic has not failed   |

**表 8-43. 0x001F PHY Reset Control Register (PHYRCR)**

| BIT  | NAME            | TYPE   | DEFAULT | FUNCTION  |
|------|-----------------|--------|---------|---|
| 15   | Software Reset  | RW, SC | 0       | <b>Software Reset:</b><br>1 = Reset PHY<br>0 = Normal Operation<br>This bit is self cleared and has the same effect as Hardware reset pin.                |
| 14   | Digital Restart | RW, SC | 0       | <b>Digital Restart:</b><br>1 = Restart PHY<br>0 = Normal Operation<br>This bit is self cleared and resets all PHY digital circuitry except the registers. |
| 13:0 | Reserved        | RW     | 0       | <b>Reserved</b>   |

**表 8-44. 0x0025 Multi-LED Control Register (MLEDCR)**

| BIT   | NAME               | TYPE | DEFAULT | FUNCTION  |
|-------|--------------------|------|---------|---|
| 15:10 | Reserved           | RW   | 0       | <b>Reserved</b>   |
| 9     | MLED Polarity Swap | RW   | Strap   | <b>MLED Polarity Swap:</b><br>The polarity of MLED depends on the routing configuration. If the pin strap is Pull-Up then polarity is active low. If the pin strap is Pull-Down then polarity is active high.<br>0 = Active Low (default when pin strapped HIGH)<br>1 = Active High (default when pin strapped LOW) |
| 8:7   | Reserved           | RW   | 0       | <b>Reserved</b>   |

**表 8-44. 0x0025 Multi-LED Control Register (MLEDCR) (continued)**

| BIT | NAME                | TYPE | DEFAULT | FUNCTION   |
|-----|---------------------|------|---------|--|
| 6:3 | MLED Configuration  | RW   | 000 0   | <b>MLED Configurations:</b><br>000 0 = LINK OK<br>000 1 = RX/TX Activity<br>001 0 = TX Activity<br>001 1 = RX Activity<br>010 0 = Collision<br>010 1 = Speed, High for 100Base-TX<br>011 0 = Speed, High for 10Base-Te<br>011 1 = Full-Duplex<br>100 0 = LINK OK / BLINK on TX/RX Activity<br>100 1 = Active Stretch Signal<br>101 0 = MII LINK (100BT+FD)<br>101 1 = LPI Mode (EEE)<br>110 0 = TX/RX MII Error<br>110 1 = Link Lost<br>111 0 = Blink for PRBS error<br>111 1 = Reserved<br>Link Lost, LED remains ON until BMCR register (address 0x0001) is read.<br>Blink for PRBS Errors, LED remains ON for single error and remains until BICSR1 register (address 0x001B) is cleared. |
| 2   | Reserved            | RW   | 0       | <b>Reserved</b>  |
| 1:0 | MLED Route to LED_0 | RW   | 00      | <b>MLED Route to LED_0:</b><br>00 = MLED routed to COL<br>01 = Reserved<br>10 = Reserved<br>11 = MLED routed to LED_0  |

**表 8-45. 0x0027 Compliance Test Register (COMPT)**

| BIT  | NAME                           | TYPE | DEFAULT | FUNCTION  |
|------|--------------------------------|------|---------|---|
| 15:5 | Reserved                       | RW   | 0       | <b>Reserved</b>   |
| 4    | 10Base-Te Test Patterns Enable | RW   | 0       | <b>10Base-Te Test Pattern Enable:</b><br>1 = Enable 10Base-Te Test Patterns<br>0 = Disable 10Base-Te Test Patterns<br>Note: Repetitive 1 and 0 for 10Base-Te test pattern cannot be used for harmonics Compliance test. |

**表 8-45. 0x0027 Compliance Test Register (COMPT) (continued)**

| BIT | NAME                          | TYPE | DEFAULT | FUNCTION  |
|-----|-------------------------------|------|---------|---|
| 3:0 | Compliance Test Configuration | RW   | 0000    | <p><b>Compliance Test Configuration Select:</b><br/>           Bit[4] in Register 0x0027 = 1, Enables 10Base-Te Test Patterns.<br/>           Bit[4] in Register 0x0428 = 1, Enables 100Base-TX Test Modes<br/>           Bits[3:0] select the <b>10Base-Te</b> test pattern, as follows:<br/>           0000 = Single NLP<br/>           0001 = Single Pulse 1<br/>           0010 = Single Pulse 0<br/>           0011 = Repetitive 1<br/>           0100 = Repetitive 0<br/>           0101 = Preamble (repetitive '10')<br/>           0110 = Single 1 followed by TP_IDLE<br/>           0111 = Single 0 followed by TP_IDLE<br/>           1000 = Repetitive '1001' sequence<br/>           1001 = Random 10Base-Te data<br/>           1010 = TP_IDLE_00<br/>           1011 = TP_IDLE_01<br/>           1100 = TP_IDLE_10<br/>           1101 = TP_IDLE_11</p> <p><b>100Base-TX</b> Test Mode is determined by bits [[5] in register 0x0428, [3:0] in register 0x0027]. The bits determine the number of 0's to follow a '1'.<br/>           0,0001 = Single '0' after a '1'<br/>           0,0010 = Two '0' after a '1'<br/>           0,0011 = Three '0' after a '1'<br/>           0,0100 = Four '0' after a '1'<br/>           0,0101 = Five '0' after a '1'<br/>           0,0110 = Six '0' after a '1'<br/>           0,0111 = Seven '0' after a '1'<br/>           ...<br/>           1,1111 = Thirty one '0' after a '1'<br/>           0,0000 = Clears the shift register</p> <p><b>Note 1:</b> To reconfigure the 100Base-TX Test Mode, bit[4] must be cleared in register 0x0428 and then reset to '1' to configure the new pattern.</p> <p><b>Note 2:</b> When performing 100Base-TX or 10Base-Te tests modes, the speed must be forced using the Basic Mode Control Register (BMCR), address 0x0000.</p> |

**表 8-46. 0x003E IEEE 1588 PTP Pin Select Register (PTPPSEL)**

| BIT  | NAME                    | TYPE | DEFAULT | FUNCTION   |
|------|-------------------------|------|---------|--|
| 15:7 | Reserved                | RO   | 0       | <b>Reserved</b>  |
| 6:4  | IEEE 1588 TX Pin Select | RW   | 000     | <p><b>IEEE 1588 TX Pin Select:</b><br/>           Assigns transmit SFD pulse indication to pin selected by value<br/>           001 = Reserved<br/>           010 = Reserved<br/>           011 = LED_0 Pin<br/>           100 = CRS Pin<br/>           101 = COL Pin<br/>           110 = INT/PWDN_N Pin<br/>           111 = No pulse output</p> |
| 3    | Reserved                | RO   | 0       | <b>Reserved</b>  |



**表 8-46. 0x003E IEEE 1588 PTP Pin Select Register (PTPPSEL) (continued)**

| BIT | NAME                    | TYPE | DEFAULT | FUNCTION   |
|-----|-------------------------|------|---------|--|
| 2:0 | IEEE 1588 RX Pin Select | RW   | 000     | <b>IEEE 1588 RX Pin Select:</b><br>Assigns receive SFD pulse indication to pin selected by value<br>001 = Reserved<br>010 = Reserved<br>011 = LED_0 Pin<br>100 = CRS Pin<br>101 = COL Pin<br>110 = INT/PWDN_N Pin<br>111 = No pulse output |

**表 8-47. 0x003F IEEE 1588 PTP Configuration Register IEEE 1588 Precision Timing Configuration Register (PTPCFG)**

| BIT   | NAME  | TYPE | DEFAULT | FUNCTION   |
|-------|---|------|---------|--|
| 15:13 | PTP Transmit Timing                           | RW   | 101     | <b>PTP Transmit Timing:</b><br>Set IEEE 1588 indication for TX path (8ns step)   |
| 12:10 | PTP Receive Timing                            | RW   | 101     | <b>PTP Receive Timing:</b><br>Set IEEE 1588 indication for RX path (8ns step)  |
| 9:8   | TX Error Input Pin                            | RW   | 00      | <b>Configure TX Error Input Pin:</b><br>00 = No TX Error<br>01 = Reserved<br>10 = Use INT/PWDN_N pin as TX error<br>11 = Use COL pin as TX error |
| 7:4   | Timer For De-scrambler Unlock Based Link-Down | RW   | 1111    |  |
| 3:0   | Reserved                                      | RW   | 1111    | Reserved   |

**表 8-48. 0x0040 Fiber Far-End Fault Generation/Detection Force**

| BIT   | NAME                       | TYPE | DEFAULT  | FUNCTION   |
|-------|----------------------------|------|----------|--|
| 15:14 | Reserved                   | RW   | 11       | Reserved   |
| 13    | Force 100 Mbps Link Enable | RW   | 0        | Forces PHY to enable Link at 100 Mbps regardless of link partner |
| 12:7  | Reserved                   | RW   | 0 0001 0 | Reserved   |
| 6     | FEF Gen Disable            | RW   | 0        | 1=Far end fault generation is disabled                           |
| 5     | FEF Detect Disable         | RW   | 0        | 1=Disable detection of far end fault                             |
| 4:0   | Reserved                   | RW   | 1 1101   | Reserved   |

**表 8-49. 0x0042 TX\_CLK Phase Shift Register (TXCPSR)**

| BIT  | NAME               | TYPE   | DEFAULT | FUNCTION   |
|------|--------------------|--------|---------|--|
| 15:5 | Reserved           | RO     | 0       | Reserved   |
| 4    | Phase Shift Enable | RW, SC | 0       | <b>TX Clock Phase Shift Enable:</b><br>1 = Perform Phase Shift to TX_CLK<br>0 = No change in TX_CLK phase<br>When enabled, TX_CLK phase shift is according to the value written to TX Clock Phase Shift Value (bits[4:0]). |

**表 8-49. 0x0042 TX\_CLK Phase Shift Register (TXCPSR) (continued)**

| BIT | NAME              | TYPE | DEFAULT | FUNCTION   |
|-----|-------------------|------|---------|--|
| 3:0 | Phase Shift Value | RW   | 0000    | <b>TX Clock Phase Shift Value:</b><br>The value of this register represents the current phase shift between Reference clock at XI and MII transmit clock at TX_CLK. Any different value that will be written to these bits will shift TX_CLK by 4 times the difference (in ns).<br>Example: If the value of the register is 0x0002, writing 0x0009 to this register will shift TX_CLK by 28ns. (4 times 7ns) |

**表 8-50. 0x0101 DSP Configuration Register 1 (DSPCR1)**

| BIT  | NAME                    | TYPE | DEFAULT   | FUNCTION   |
|------|-------------------------|------|-----------|--|
| 15:8 | Reserved                | RW   | 0010 0000 | Reserved   |
| 7    | Internal Filter Disable | RW   | 0         | 1 = Disable internal filter during a phase of link-up training |

**表 8-51. 0x0106 Digital Filter Configuration Register 1 (DFCR1)**

| BIT   | NAME                          | TYPE | DEFAULT | FUNCTION  |
|-------|-------------------------------|------|---------|---|
| 15:12 | Internal Threshold For Filter | RW   | 1011    | Internal threshold to activate filter coefficients set1 for short cables. |
| 11    | Reserved                      |      | 0       | <b>Reserved</b>   |
| 10    | Enable Filter Coefficient     | RW   | 0       | 1= Enable internal filter coefficient in steady state                     |
| 9:8   | Reserved                      | RW   | 00      | Reserved  |
| 7:6   | Filter Coefficients           | RW   | 10      | Filter coefficient values for long cables                                 |
| 5:4   | Reserved                      | RW   | 11      | Reserved  |
| 3:0   | Internal Threshold For Filter | RW   | 1011    | Internal threshold to activate filter coefficients set0 for short cables. |

**表 8-52. 0x0107 Digital Filter Configuration Register 2 (DFCR2)**

| BIT  | NAME     | TYPE | DEFAULT                | FUNCTION        |
|------|----------|------|------------------------|-----------------|
| 15:0 | Reserved | RW   | 0000 0110<br>0000 0101 | <b>Reserved</b> |

**表 8-53. 0x010F DSP Configuration Register 2 (DSPCR2)**

| BIT  | NAME           | TYPE | DEFAULT   | FUNCTION   |
|------|----------------|------|-----------|--|
| 15:9 | Reserved       | RW   | 0000 001  | <b>Reserved</b>  |
| 8    | DSP Loop Input | RW   | 1         | Selects the type of input for the gain correction loop |
| 7:0  | Reserved       | RW   | 0000 0000 | <b>Reserved</b>  |

**表 8-54. 0x0111 DSP Configuration Register 3 (DSPCR3)**

| BIT  | NAME                | TYPE | DEFAULT        | FUNCTION                    |
|------|---------------------|------|----------------|-----------------------------|
| 15:4 | Reserved            | RW   | 0110 0000 0000 | Reserved                    |
| 3:0  | Starting Gain Index | RW   | 011            | Initial value of gain index |

**表 8-55. 0x0114 Digital Feedback Equalizer Control Register (DFEQR)**

| BIT  | NAME     | TYPE | DEFAULT                | FUNCTION        |
|------|----------|------|------------------------|-----------------|
| 15:0 | Reserved | RW   | 0100 0000<br>0000 1010 | <b>Reserved</b> |

**表 8-56. 0x0116 AGC Bandwidth Control Register (AGBCR)**

| BIT  | NAME     | TYPE | DEFAULT                | FUNCTION |
|------|----------|------|------------------------|----------|
| 15:0 | Reserved | RW   | 0000 0001<br>0100 1010 | Reserved |

**表 8-57. 0x0121 MSE Threshold To Enter Recovery State From Steady State**

| BIT  | NAME              | TYPE | DEFAULT            | FUNCTION                   |
|------|-------------------|------|--------------------|----------------------------|
| 15   | Reserved          | RO   | 0                  | Ignore on read             |
| 14:0 | Bad MSE Threshold | RW   | 001 1001 1001 1010 | Bad MSE threshold for 100M |

**表 8-58. 0x0122 MSE Threshold For Timing Loop**

| BIT  | NAME                | TYPE | DEFAULT            | FUNCTION                     |
|------|---------------------|------|--------------------|------------------------------|
| 15   | Reserved            | RO   | 0                  | Ignore on read               |
| 14:0 | Good MSE1 Threshold | RW   | 001 0000 0010 0111 | Good MSE1 threshold for 100M |

**表 8-59. 0x0123 MSE Threshold For Link-up**

| BIT  | NAME                | TYPE | DEFAULT            | FUNCTION                     |
|------|---------------------|------|--------------------|------------------------------|
| 15   | Reserved            | RO   | 0                  | Ignore on read               |
| 14:0 | Good MSE2 Threshold | RW   | 000 0101 0001 1100 | Good MSE2 threshold for 100M |

**表 8-60. 0x0126 Digital Equalizer Timer Register (DETR)**

| BIT   | NAME             | TYPE | DEFAULT | FUNCTION                             |
|-------|------------------|------|---------|--------------------------------------|
| 15    | Reserved         | RW   | 0       | Reserved                             |
| 14:12 | Training Timer 1 | RW   | 100     | Timer value used for DSP state shift |
| 11:6  | Training Timer 2 | RW   | 0110 00 | Timer value used in timing loop      |
| 5:3   | Training Timer 3 | RW   | 011     | Timer value used in gain loop        |
| 2:0   | Training Timer 4 | RW   | 011     | Timer value used in gain loop        |

**表 8-61. 0x0129 DSP Configuration Register 4 (DSPCR4)**

| BIT  | NAME           | TYPE | DEFAULT   | FUNCTION                |
|------|----------------|------|-----------|-------------------------|
| 15:8 | Reserved       | RW   | 0000 0000 | Reserved                |
| 7:4  | Max Gain Index | RW   | 0000      | Limit of max gain index |
| 3:0  | Min Gain Index | RW   | 1111      | Limit of min gain index |

**表 8-62. 0x0130 DSP Configuration Register 5 (DSPCR5)**

| BIT   | NAME                 | TYPE | DEFAULT       | FUNCTION                    |
|-------|----------------------|------|---------------|-----------------------------|
| 15:12 | Reserved             | RW   | 0000          | Reserved                    |
| 11    | Disable Gain Retrain | RW   | 0             | 1 = Disable Gain Retraining |
| 10:0  | Reserved             | RW   | 000 0000 0001 | Reserved                    |

**表 8-63. 0x0155 ALCD Control and Results 1 Register (ALCDRR1)**

| BIT   | NAME            | TYPE | DEFAULT | FUNCTION  |
|-------|-----------------|------|---------|---|
| 15    | ALCD Start Test | SC   | 0       | <b>Active Link Cable Diagnostic Start:</b><br>1 = Start ALCD test<br>0 = Do not start ALCD test |
| 14:13 | Reserved        | RO   | 00      | Reserved  |

**表 8-63. 0x0155 ALCD Control and Results 1 Register (ALCDRR1) (continued)**

| BIT  | NAME             | TYPE | DEFAULT   | FUNCTION  |
|------|------------------|------|-----------|---|
| 12   | ALCD Test Status | RO   | 0         | <b>Active Link Cable Diagnostic Status:</b><br>1 = ALCD is not complete<br>0 = ALCD is complete |
| 11:4 | ALCD Sum Out     | RO   | 0000 0000 |   |
| 3:0  | Reserved         | RW   | 0001      | <b>Reserved</b>   |

**表 8-64. 0x0170 Cable Diagnostic Specific Control Register (CDSCR)**

| BIT  | NAME                            | TYPE | DEFAULT   | FUNCTION  |
|------|---------------------------------|------|-----------|---|
| 15   | Reserved                        | RO   | 0         | <b>Reserved</b>   |
| 14   | Cable Diagnostic Cross Disable  | RW   | 0         | <b>Cross TDR Diagnostic Mode:</b><br>1 = Disable TDR Cross Mode<br>0 = Enable TDR Cross Mode<br>When enabled, the TDR mechanism is looking for reflection on the other pair to check for shorts between pairs.        |
| 13   | Cable Diagnostic TD Bypass      | RW   | 0         | <b>TD Diagnostic Bypass:</b><br>1 = Bypass TD pair diagnostic<br>0 = TDR is executed on TD pair<br>When enabled, TDR on TD pair will not be executed.   |
| 12   | Cable Diagnostic RD Bypass      | RW   | 0         | <b>RD Diagnostic Bypass:</b><br>1 = Bypass RD pair diagnostic<br>0 = TDR is executed on RD pair<br>When enabled, TDR on RD pair will not be executed.   |
| 11   | Reserved                        | RW   | 1         | <b>Reserved</b>   |
| 10:8 | Cable Diagnostic Average Cycles | RW   | 110       | <b>Number of TDR Cycles to Average:</b><br>000 = 1 TDR cycle<br>001 = 2 TDR cycles<br>010 = 4 TDR cycles<br>011 = 8 TDR cycles<br>100 = 16 TDR cycles<br>101 = 32 TDR cycles<br>110 = 64 TDR cycles<br>111 = Reserved |
| 7:0  | Reserved                        | RW   | 0101 0010 | <b>Reserved</b>   |

**表 8-65. 0x0171 Cable Diagnostic Specific Control Register 2 (CDSCR2)**

| BIT  | NAME              | TYPE | DEFAULT           | FUNCTION                                  |
|------|-------------------|------|-------------------|---|
| 15:4 | Reserved          | RW   | 1100 1000<br>0101 | <b>Reserved</b>                           |
| 3:0  | TDR Pulse Control | RW   | 1100              | Configure expected self reflection in TDR |

**表 8-66. 0x0173 Cable Diagnostic Specific Control Register 3 (CDSCR3)**

| BIT  | NAME                       | TYPE | DEFAULT   | FUNCTION   |
|------|----------------------------|------|-----------|--|
| 15:8 | Cable Length Configuration | RW   | 1111 1111 | Configure duration of listening to detect long cable reflections |
| 7:0  | Reserved                   | RW   | 0001 1110 | <b>Reserved</b>  |

**表 8-67. 0x0177 Cable Diagnostic Specific Control Register 4 (CDSCR4)**

| BIT   | NAME                   | TYPE | DEFAULT   | FUNCTION   |
|-------|------------------------|------|-----------|--|
| 15:13 | Reserved               | RW   | 000       | Reserved   |
| 12:8  | Short Cables Threshold | RW   | 1 1000    | Threshold to compensate for strong reflections in short cables |
| 7:0   | Reserved               | RW   | 1001 1011 | Reserved   |

**表 8-68. 0x0180 Cable Diagnostic Location Result Register #1 (CDLRR1)**

| BIT  | NAME               | TYPE | DEFAULT   | FUNCTION   |
|------|--------------------|------|-----------|--|
| 15:8 | TD Peak Location 2 | RO   | 0000 0000 | Location of the <b>Second</b> peak discovered by the TDR mechanism on Transmit Channel (TD). The value of these bits need to be translated into distance from the PHY. |
| 7:0  | TD Peak Location 1 | RO   | 0000 0000 | Location of the <b>First</b> peak discovered by the TDR mechanism on Transmit Channel (TD). The value of these bits need to be translated into distance from the PHY.  |

**表 8-69. 0x0181 Cable Diagnostic Location Result Register #2 (CDLRR2)**

| BIT  | NAME               | TYPE | DEFAULT   | FUNCTION   |
|------|--------------------|------|-----------|--|
| 15:8 | TD Peak Location 4 | RO   | 0000 0000 | Location of the <b>Fourth</b> peak discovered by the TDR mechanism on Transmit Channel (TD). The value of these bits need to be translated into distance from the PHY. |
| 7:0  | TD Peak Location 3 | RO   | 0000 0000 | Location of the <b>Third</b> peak discovered by the TDR mechanism on Transmit Channel (TD). The value of these bits need to be translated into distance from the PHY.  |

**表 8-70. 0x0182 Cable Diagnostic Location Result Register #3 (CDLRR3)**

| BIT  | NAME               | TYPE | DEFAULT   | FUNCTION  |
|------|--------------------|------|-----------|---|
| 15:8 | RD Peak Location 1 | RO   | 0000 0000 | Location of the <b>First</b> peak discovered by the TDR mechanism on Receive Channel (RD). The value of these bits need to be translated into distance from the PHY.  |
| 7:0  | TD Peak Location 5 | RO   | 0000 0000 | Location of the <b>Fifth</b> peak discovered by the TDR mechanism on Transmit Channel (TD). The value of these bits need to be translated into distance from the PHY. |

**表 8-71. 0x0183 Cable Diagnostic Location Result Register #4 (CDLRR4)**

| BIT  | NAME               | TYPE | DEFAULT   | FUNCTION  |
|------|--------------------|------|-----------|---|
| 15:8 | RD Peak Location 3 | RO   | 0000 0000 | Location of the <b>Third</b> peak discovered by the TDR mechanism on Receive Channel (RD). The value of these bits need to be translated into distance from the PHY.  |
| 7:0  | RD Peak Location 2 | RO   | 0000 0000 | Location of the <b>Second</b> peak discovered by the TDR mechanism on Receive Channel (RD). The value of these bits need to be translated into distance from the PHY. |

**表 8-72. 0x0184 Cable Diagnostic Location Result Register #5 (CDLRR5)**

| BIT  | NAME               | TYPE | DEFAULT   | FUNCTION   |
|------|--------------------|------|-----------|--|
| 15:8 | RD Peak Location 5 | RO   | 0000 0000 | Location of the <b>Fifth</b> peak discovered by the TDR mechanism on Receive Channel (RD). The value of these bits need to be translated into distance from the PHY. |

**表 8-72. 0x0184 Cable Diagnostic Location Result Register #5 (CDLRR5) (continued)**

| BIT | NAME               | TYPE | DEFAULT   | FUNCTION  |
|-----|--------------------|------|-----------|---|
| 7:0 | RD Peak Location 4 | RO   | 0000 0000 | Location of the <b>Fourth</b> peak discovered by the TDR mechanism on Receive Channel (RD). The value of these bits need to be translated into distance from the PHY. |

**表 8-73. 0x0185 Cable Diagnostic Amplitude Result Register #1 (CDLAR1)**

| BIT  | NAME                | TYPE | DEFAULT  | FUNCTION  |
|------|---------------------|------|----------|---|
| 15   | Reserved            | RO   | 0        | <b>Reserved</b>   |
| 14:8 | TD Peak Amplitude 2 | RO   | 000 0000 | Amplitude of the <b>Second</b> peak discovered by the TDR mechanism on Transmit Channel (TD). The value of these bits is translated into type of cable fault and/or interference. |
| 7    | Reserved            | RO   | 0        | <b>Reserved</b>   |
| 6:0  | TD Peak Amplitude 1 | RO   | 000 0000 | Amplitude of the <b>First</b> peak discovered by the TDR mechanism on Transmit Channel (TD). The value of these bits is translated into type of cable fault and/or interference.  |

**表 8-74. 0x0186 Cable Diagnostic Amplitude Result Register #2 (CDLAR2)**

| BIT  | NAME                | TYPE | DEFAULT  | FUNCTION  |
|------|---------------------|------|----------|---|
| 15   | Reserved            | RO   | 0        | <b>Reserved</b>   |
| 14:8 | TD Peak Amplitude 4 | RO   | 000 0000 | Amplitude of the <b>Fourth</b> peak discovered by the TDR mechanism on Transmit Channel (TD). The value of these bits is translated into type of cable fault and/or interference. |
| 7    | Reserved            | RO   | 0        | <b>Reserved</b>   |
| 6:0  | TD Peak Amplitude 3 | RO   | 000 0000 | Amplitude of the <b>Third</b> peak discovered by the TDR mechanism on Transmit Channel (TD). The value of these bits is translated into type of cable fault and/or interference.  |

**表 8-75. 0x0187 Cable Diagnostic Amplitude Result Register #3 (CDLAR3)**

| BIT  | NAME                | TYPE | DEFAULT  | FUNCTION   |
|------|---------------------|------|----------|--|
| 15   | Reserved            | RO   | 0        | <b>Reserved</b>  |
| 14:8 | RD Peak Amplitude 1 | RO   | 000 0000 | Amplitude of the <b>First</b> peak discovered by the TDR mechanism on Receive Channel (RD). The value of these bits is translated into type of cable fault and/or interference.  |
| 7    | Reserved            | RO   | 0        | <b>Reserved</b>  |
| 6:0  | TD Peak Amplitude 5 | RO   | 000 0000 | Amplitude of the <b>Fifth</b> peak discovered by the TDR mechanism on Transmit Channel (TD). The value of these bits is translated into type of cable fault and/or interference. |

**表 8-76. 0x0188 Cable Diagnostic Amplitude Result Register #4 (CDLAR4)**

| BIT  | NAME                | TYPE | DEFAULT  | FUNCTION  |
|------|---------------------|------|----------|---|
| 15   | Reserved            | RO   | 0        | <b>Reserved</b>   |
| 14:8 | RD Peak Amplitude 3 | RO   | 000 0000 | Amplitude of the <b>Third</b> peak discovered by the TDR mechanism on Receive Channel (RD). The value of these bits is translated into type of cable fault and/or interference. |
| 7    | Reserved            | RO   | 0        | <b>Reserved</b>   |

**表 8-76. 0x0188 Cable Diagnostic Amplitude Result Register #4 (CDLAR4) (continued)**

| BIT | NAME                | TYPE | DEFAULT  | FUNCTION   |
|-----|---------------------|------|----------|--|
| 6:0 | RD Peak Amplitude 2 | RO   | 000 0000 | Amplitude of the <b>Second</b> peak discovered by the TDR mechanism on Receive Channel (RD). The value of these bits is translated into type of cable fault and/or interference. |

**表 8-77. 0x0189 Cable Diagnostic Amplitude Result Register #5 (CDLAR5)**

| BIT  | NAME                | TYPE | DEFAULT  | FUNCTION   |
|------|---------------------|------|----------|--|
| 15   | Reserved            | RO   | 0        | <b>Reserved</b>  |
| 14:8 | RD Peak Amplitude 5 | RO   | 000 0000 | Amplitude of the <b>Fifth</b> peak discovered by the TDR mechanism on Receive Channel (RD). The value of these bits is translated into type of cable fault and/or interference.  |
| 7    | Reserved            | RO   | 0        | <b>Reserved</b>  |
| 6:0  | RD Peak Amplitude 4 | RO   | 000 0000 | Amplitude of the <b>Fourth</b> peak discovered by the TDR mechanism on Receive Channel (RD). The value of these bits is translated into type of cable fault and/or interference. |

**表 8-78. 0x018A Cable Diagnostic General Result Register (CDLGR)**

| BIT | NAME               | TYPE | DEFAULT | FUNCTION   |
|-----|--------------------|------|---------|--|
| 15  | TD Peak Polarity 5 | RO   | 0       | Polarity of the <b>Fifth</b> peak discovered by the TDR mechanism on Transmit Channel (TD).  |
| 14  | TD Peak Polarity 4 | RO   | 0       | Polarity of the <b>Fourth</b> peak discovered by the TDR mechanism on Transmit Channel (TD). |
| 13  | TD Peak Polarity 3 | RO   | 0       | Polarity of the <b>Third</b> peak discovered by the TDR mechanism on Transmit Channel (TD).  |
| 12  | TD Peak Polarity 2 | RO   | 0       | Polarity of the <b>Second</b> peak discovered by the TDR mechanism on Transmit Channel (TD). |
| 11  | TD Peak Polarity 1 | RO   | 0       | Polarity of the <b>First</b> peak discovered by the TDR mechanism on Transmit Channel (TD).  |
| 10  | RD Peak Polarity 5 | RO   | 0       | Polarity of the <b>Fifth</b> peak discovered by the TDR mechanism on Receive Channel (RD).   |
| 9   | RD Peak Polarity 4 | RO   | 0       | Polarity of the <b>Fourth</b> peak discovered by the TDR mechanism on Receive Channel (RD).  |
| 8   | RD Peak Polarity 3 | RO   | 0       | Polarity of the <b>Third</b> peak discovered by the TDR mechanism on Receive Channel (RD).   |
| 7   | RD Peak Polarity 2 | RO   | 0       | Polarity of the <b>Second</b> peak discovered by the TDR mechanism on Receive Channel (RD).  |
| 6   | RD Peak Polarity 1 | RO   | 0       | Polarity of the <b>First</b> peak discovered by the TDR mechanism on Receive Channel (RD).   |
| 5   | Cross Detect on TD | RO   | 0       | Cross Reflections were detected on TD. Indicate on Short between TD and TD                   |
| 4   | Cross Detect on RD | RO   | 0       | Cross Reflections were detected on RD. Indicate on Short between TD and RD                   |
| 3   | Above 5 TD Peaks   | RO   | 0       | More than 5 reflections were detected on TD  |
| 2   | Above 5 RD Peaks   | RO   | 0       | More than 5 reflections were detected on RD  |
| 1:0 | Reserved           | RO   | 0       | <b>Reserved</b>  |

**表 8-79. 0x0215 ALCD Control and Results 2 Register (ALCDRR2)**

| BIT  | NAME        | TYPE | DEFAULT           | FUNCTION                   |
|------|-------------|------|-------------------|----------------------------|
| 15:4 | Reserved    | RO   | 0000 0000<br>0000 | Reserved                   |
| 3:0  | PGA Control | RO   | 1111              | Control word to analog PGA |

**表 8-80. 0x021D ALCD Control and Results 3 Register (ALCDRR3)**

| BIT   | NAME             | TYPE | DEFAULT           | FUNCTION         |
|-------|------------------|------|-------------------|------------------|
| 15:12 | Reserved         | RO   | 0                 | Reserved         |
| 11:0  | FAGC Accumulator | RW   | 0110 0000<br>0000 | FAGC Accumulator |

**表 8-81. 0x0403 Line Driver Control Register (LDCTRL)**

| BIT   | NAME                                | TYPE | DEFAULT | FUNCTION   |
|-------|-------------------------------------|------|---------|--|
| 15:12 | Reserved                            | RW   | 1001    | Reserved   |
| 11:8  | 100Base-FX Line Driver Swing Select | RW   | 1111    | <b>100Base-FX Line Driver Swing Select (peak-to-peak):</b><br>0000 = 0.533-V<br>0001 = 0.567-V<br>0010 = 0.600-V<br>0011 = 0.633-V<br>0100 = 0.667-V<br>0101 = 0.700-V<br>0110 = 0.733-V<br>0111 = 0.767-V<br>1000 = 0.800-V<br>1001 = 0.833-V<br>1010 = 0.867-V<br>1011 = 0.900-V<br>1100 = 0.933-V<br>1101 = 0.976-V<br>1110 = 1.000-V<br>1111 = 1.033-V (Default Setting) |
| 7:4   | 100Base-TX Line Driver Swing Select | RW   | 1100    | <b>100Base-TX Line Driver Swing Select (peak-to-peak):</b><br>0000 = 1.600-V<br>0001 = 1.633-V<br>0010 = 1.667-V<br>0011 = 1.700-V<br>0100 = 1.733-V<br>0101 = 1.767-V<br>0110 = 1.800-V<br>0111 = 1.833-V<br>1000 = 1.867-V<br>1001 = 1.900-V<br>1010 = 1.933-V<br>1011 = 1.967-V<br>1100 = 2.000-V (Default Setting)<br>1101 = 2.033-V<br>1110 = 2.067-V<br>1111 = 2.100-V |



**表 8-81. 0x0403 Line Driver Control Register (LDCTRL) (continued)**

| BIT | NAME                               | TYPE | DEFAULT | FUNCTION   |
|-----|------------------------------------|------|---------|--|
| 3:0 | 10Base-Te Line Driver Swing Select | RW   | 1111    | <b>10Base-Te Line Driver Swing Select:</b><br>0000 = 3.200-V<br>0001 = 3.233-V<br>0010 = 3.267-V<br>0011 = 3.300-V<br>0100 = 3.333-V<br>0101 = 3.367-V<br>0110 = 3.400-V<br>0111 = 3.433-V<br>1000 = 3.467-V<br>1001 = 3.500-V<br>1010 = 3.533-V<br>1011 = 3.567-V<br>1100 = 3.600-V<br>1101 = 3.633-V<br>1110 = 3.667-V<br>1111 = 3.700-V (Default Setting) |

**表 8-82. 0x0404 Line Driver Class Selection (LDCSEL)**

| BIT  | NAME                        | TYPE | DEFAULT | FUNCTION   |
|------|-----------------------------|------|---------|--|
| 15:0 | Line Driver Class Selection | RW   | 0020    | 0x0020 : Reduced MLT-3 (Class B)<br>0x0024 : To program full MLT-3 on both Tx+ and Tx- (Class A) |

**表 8-83. 0x040D Auto-neg Energy Threshold Register**

| BIT   | NAME                            | TYPE | DEFAULT       | FUNCTION  |
|-------|---------------------------------|------|---------------|---|
| 15: 5 | Reserved                        | RW   | 0000 0000 000 |   |
| 4:0   | Auto-neg Energy Threshold Value | RW   | 0 1000        | Decides threshold of energy detection during auto-negotiation |

**表 8-84. 0x0410 DC Correction Control Register**

| BIT  | NAME                       | TYPE | DEFAULT           | FUNCTION                                |
|------|----------------------------|------|-------------------|---|
| 15   | Reserved                   | RW   | 0                 | Reserved                                |
| 14   | Enable Fixed DC Correction | RW   | 0                 | 1 = Enable Fixed Value of DC Correction |
| 13:0 | Reserved                   | RW   | 10 0000 0000 0000 |   |

**表 8-85. 0x0416 Analog Filter Control Register 1**

| BIT   | NAME             | TYPE | DEFAULT   | FUNCTION                                   |
|-------|------------------|------|-----------|--|
| 15:13 | Reserved         | RW   | 000       | Reserved                                   |
| 12:8  | Filter 1 cut-off | RW   | 01000     | Controls the cut-off frequency of filter 1 |
| 7:0   | Reserved         | RW   | 0111 0000 | Reserved                                   |

**表 8-86. 0x0418 Analog Equalizer Control Register**

| BIT   | NAME                     | TYPE | DEFAULT | FUNCTION   |
|-------|--------------------------|------|---------|--|
| 15:14 | Reserved                 | RW   | 00      | Reserved   |
| 13:8  | Analog Equalizer Control | RW   | 0000 00 | Analog equalizer controls useful for short shielded cables |

表 8-86. 0x0418 Analog Equalizer Control Register (continued)

| BIT | NAME     | TYPE | DEFAULT   | FUNCTION |
|-----|----------|------|-----------|----------|
| 7:0 | Reserved | RW   | 0000 0000 | Reserved |

表 8-87. 0x041F Analog Power Detect Control

| BIT   | NAME                | TYPE | DEFAULT      | FUNCTION   |
|-------|---------------------|------|--------------|--|
| 15:13 | Reserved            | RW   | 000          | Reserved   |
| 12    | Force AVDD Detect   | RW   | 0            | Force AVDD to be detected as 3.3V<br>1=Force AVDD to be detected as 3.3V<br>0=Internal circuit detects the AVDD supply level             |
| 11:10 | Force AVDDIO Detect | RW   | 00           | Force AVDDIO to be detected as 3.3V<br>11 = Force AVDDIO to be detected as 3.3V<br>00 = Internal circuit detects the AVDDIO supply level |
| 9:0   | Reserved            | RW   | 00 0000 0000 | Reserved   |

- A. For specific applications which require bypassing auto supply detection, registers 0x0421 and 0x041F can be used to program specific supply levels

表 8-88. 0x0421 Analog Power Detect Status

| BIT  | NAME        | TYPE | DEFAULT   | FUNCTION               |
|------|-------------|------|---|------------------------|
| 15:3 | Reserved    | RO   | 0   | Reserved               |
| 2    | AVDD Level  | RO   | 1 for 3.3V AVDD<br>0 for 1.8V AVDD                          | AVDD level indication  |
| 1:0  | VDDIO Level | RO   | 11 for 3.3V VDDIO<br>00 for 1.8V VDDIO<br>01 for 2.5V VDDIO | VDDIO level indication |

表 8-89. 0x0428 Deep Power Down Control Register (DPDWN)

| BIT  | NAME                        | TYPE | DEFAULT | FUNCTION  |
|------|-----------------------------|------|---------|---|
| 15:6 | Reserved                    | RO   | 0       | Reserved  |
| 5    | MSB 100Base-TX Idle Pattern | RW   | 0       | <b>MSB 100Base-TX Idle Pattern:</b><br>100Base-TX Test Mode is determined by bits {[5] in register 0x0428, [3:0] in register 0x0027}. The bits determine the number of 0's to follow a '1'.<br>0,0001 = Single '0' after a '1'<br>0,0010 = Two '0' after a '1'<br>0,0011 = Three '0' after a '1'<br>0,0100 = Four '0' after a '1'<br>0,0101 = Five '0' after a '1'<br>0,0110 = Six '0' after a '1'<br>0,0111 = Seven '0' after a '1' .<br>..<br>1,1111 = Thirty one '0' after a '1'<br>0,0000 = Clears the shift register |

**表 8-89. 0x0428 Deep Power Down Control Register (DPDWN) (continued)**

| BIT | NAME                              | TYPE | DEFAULT | FUNCTION  |
|-----|-----------------------------------|------|---------|---|
| 4   | 100Base-TX Idle Pattern Test Mode | RW   | 0       | <b>100Base-TX Idle Pattern Test Mode:</b><br>1 = 100Base-TX Idle Pattern Enable<br>0 = Normal operation<br>When enabled, 100Base-TX Idle Pattern is determined by bit[5] in register 0x0428 and bits[3:0] in register 0x0027.   |
| 3   | Deep Power Down Speed             | RW   | 0       | <b>Deep Power Down Speed Selection:</b><br>1 = 50ms duration to exit Deep Power Down<br>0 = 100ms duration to exit Deep Power Down  |
| 2   | Deep Power Down Enable            | RW   | 0       | <b>Deep Power Down Enable:</b><br>1 = Deep Power Down activated<br>0 = Normal operation<br><b>Note:</b> If set, the DP83822 enters into deep power down mode. Deep power down mode requires that IEEE Power Down be enabled first by either register access (set bit[11] = '1' in register 0x0000) or using INT/PWDN pin. |
| 1:0 | Reserved                          | RW   | 0       | <b>Reserved</b>   |

**表 8-90. 0x0450 DSP Configuration Register 6 (DSPCR6)**

| BIT   | NAME                         | TYPE | DEFAULT          | FUNCTION                         |
|-------|------------------------------|------|------------------|----------------------------------|
| 15:14 | Reserved                     | RW   | 00               | Reserved                         |
| 13    | Equalizer Calibration Bypass | RW   | 0                | 1 = Bypass equalizer calibration |
| 12:0  | Reserved                     | RW   | 0 0001 0100 0001 | Reserved                         |

**表 8-91. 0x0456 General Configuration Register (GENCFG)**

| BIT  | NAME           | TYPE | DEFAULT | FUNCTION  |
|------|----------------|------|---------|---|
| 15:4 | Reserved       | RW   | 0       | <b>Reserved</b>   |
| 3    | Min IPG Enable | RW   | 1       | <b>Min IPG Enable:</b><br>1 = Enable Minimum Inter-Packet Gap (IPG is set to 120ns)<br>0 = IPG set to 0.20μs<br><b>Note:</b><br>IPGs <200ns should only be used when operating with a MII MAC IF configuration. |
| 2:0  | Reserved       | RW   | 0       | <b>Reserved</b>   |

**表 8-92. 0x0460 LEDs Configuration Register #1 (LEDCFG1)**

| BIT   | NAME     | TYPE | DEFAULT | FUNCTION        |
|-------|----------|------|---------|-----------------|
| 15:12 | Reserved | RO   | 0       | <b>Reserved</b> |

**表 8-92. 0x0460 LEDs Configuration Register #1 (LEDCFG1) (continued)**

| BIT  | NAME                  | TYPE | DEFAULT | FUNCTION  |
|------|-----------------------|------|---------|---|
| 11:8 | LED_1 Control         | RW   | 0101    | <b>LED_1 Control:</b><br>Selects the source for LED_1.<br>0000 = LINK OK<br>0001 = RX/TX Activity<br>0010 = TX Activity<br>0011 = RX Activity<br>0100 = Collision<br>0101 = Speed, High for 100Base-TX<br>0110 = Speed, High for 10Base-Te<br>0111 = Full-Duplex<br>1000 = LINK OK / BLINK on TX/RX Activity<br>1001 = Active Stretch Signal<br>1010 = MII LINK (100BT+FD)<br>1011 = LPI Mode (EEE)<br>1100 = TX/RX MII Error<br>1101 = Link Lost<br>1110 = Blink for PRBS error<br>1111 = Reserved<br>Link Lost, LED remains ON until BMCR register (address 0x0001) is read.<br>Blink for PRBS Errors, LED remains ON for single error and remains until BICSR1 register (address 0x001B) is cleared. |
| 7:4  | LED_3 Control (RX_D3) | RW   | 0101    | <b>LED_3 Control:</b><br>Selects the source for RX_D3. Please reference bits[11:8] for list of sources.   |
| 3:0  | Reserved              | RW   | 0001    | <b>Reserved</b>   |

**表 8-93. 0x0461 IO MUX GPIO Control Register (IOCTRL)**

| BIT  | NAME                  | TYPE | DEFAULT          | FUNCTION   |
|------|-----------------------|------|------------------|--|
| 15:5 | Reserved              | RW   | 0000 0100<br>000 | <b>Reserved</b>  |
| 4:1  | MAC Impedance Control | RW   | 1 000            | <b>MAC Impedance Control:</b><br>MAC interface impedance control sets the series termination for the digital pins.<br>0 000 = 99.25 Ω<br>0 001 = 91.13 Ω<br>0 010 = 84.24 Ω<br>0 011 = 78.31 Ω<br>0 100 = 73.17 Ω<br>0 101 = 68.65 Ω<br>0 110 = 64.66 Ω<br>0 111 = 61.11 Ω<br>1 000 = 58.07 Ω (Default Setting)<br>1 001 = 55.18 Ω<br>1 010 = 52.57 Ω<br>1 011 = 50.20 Ω<br>1 100 = 48.03 Ω<br>1 101 = 46.04 Ω<br>1 110 = 44.20 Ω<br>1 111 = 42.51 Ω |

**表 8-93. 0x0461 IO MUX GPIO Control Register (IOCTRL) (continued)**

| BIT | NAME     | TYPE | DEFAULT | FUNCTION |
|-----|----------|------|---------|----------|
| 0   | Reserved | RW   | 0       | Reserved |

**表 8-94. 0x0462 IO MUX GPIO Control Register #1 (IOCTRL1)**

| BIT   | NAME                        | TYPE | DEFAULT | FUNCTION   |
|-------|-----------------------------|------|---------|--|
| 15    | Reserved                    | RO   | 0       | Reserved   |
| 14:12 | RX_D3 / GPIO_3 Clock Source | RW   | 000     | <p><b>Clock Source:</b><br/>                     If RX_D3 is configured as a clock source from bits[10:8] the following field determines the reference<br/>                     000 = MAC IF Clock<br/>                     001 = XI Clock (Pass-Through Clock from XI pin)<br/>                     010 = Internal Reference Clock: 25-MHz<br/>                     011 = Reserved<br/>                     100 = RMI Master Mode Reference Clock: 50-MHz<br/>                     101 = Reserved<br/>                     110 = Free Running Clock: 125-MHz<br/>                     111 = Recovered Clock: 125-MHz<br/>                     MAC IF Clock: MII Mode the clock frequency is 25-MHz, RMI Mode the clock frequency is 50-MHz; RGMII Mode the clock frequency is 25-MHz.<br/>                     RMI Master Mode Reference Clock: Identical to MAC IF Clock in RMI Master Mode.</p> |
| 11    | Reserved                    | RO   | 0       | Reserved   |
| 10:8  | RX_D3 / GPIO_3 Control      | RW   | 000     | <p><b>RX_D3 GPIO Configuration:</b><br/>                     000 = Normal operation<br/>                     001 = LED_3 (Default: Speed, High for 100Base-TX)<br/>                     010 = WoL<br/>                     011 = Clock reference according to bits[14:12]<br/>                     100 = IEEE 1588 TX Indication<br/>                     101 = IEEE 1588 RX Indication<br/>                     110 = Constant '0'<br/>                     111 = Constant '1'</p>  |
| 7     | Reserved                    | RO   | 0       | Reserved   |
| 6:4   | LED_1 / GPIO_1 Clock Source | RW   | 000     | <p><b>Clock Source:</b><br/>                     If LED_1 is configured as a clock source from bits[2:0] the following field determines the reference<br/>                     000 = MAC IF Clock<br/>                     001 = XI Clock (Pass-Through Clock from XI pin)<br/>                     010 = Internal Reference Clock: 25-MHz<br/>                     011 = Reserved<br/>                     100 = RMI Master Mode Reference Clock: 50-MHz<br/>                     101 = Reserved<br/>                     110 = Free Running Clock: 125-MHz<br/>                     111 = Recovered Clock: 125-MHz<br/>                     MAC IF Clock: MII Mode the clock frequency is 25-MHz, RMI Mode the clock frequency is 50-MHz; RGMII Mode the clock frequency is 25-MHz.<br/>                     RMI Master Mode Reference Clock: Identical to MAC IF Clock in RMI Master Mode.</p>  |
| 3     | Reserved                    | RO   | 0       | Reserved   |

**表 8-94. 0x0462 IO MUX GPIO Control Register #1 (IOCTRL1) (continued)**

| BIT | NAME                   | TYPE      | DEFAULT | FUNCTION  |
|-----|------------------------|-----------|---------|---|
| 2:0 | LED_1 / GPIO_1 Control | RW, Strap | 000     | <b>LED_1 GPIO Configuration:</b><br>000 = Tri-state<br>001 = LED_1 (Default: Speed, High for 100Base-TX)<br>010 = WoL<br>011 = Clock reference according to bits[6:4]<br>100 = IEEE 1588 TX Indication<br>101 = IEEE 1588 RX Indication<br>110 = Constant '0'<br>111 = Constant '1' |

**表 8-95. 0x0463 IO MUX GPIO Control Register #2 (IOCTRL2)**

| BIT  | NAME                      | TYPE | DEFAULT | FUNCTION   |
|------|---------------------------|------|---------|--|
| 15:7 | Reserved                  | RO   | 0       | <b>Reserved</b>  |
| 6:4  | COL / GPIO_2 Clock Source | RW   | 000     | <b>Clock Source:</b><br>If COL is configured as a clock source from bits[2:0] the following field determines the reference<br>000 = MAC IF Clock<br>001 = XI Clock (Pass-Through Clock from XI pin)<br>010 = Internal Reference Clock: 25-MHz<br>011 = Reserved<br>100 = RMIIMaster Mode Reference Clock: 50-MHz<br>101 = Reserved<br>110 = Free Running Clock: 125-MHz<br>111 = Recovered Clock: 125-MHz<br>MAC IF Clock: MII Mode the clock frequency is 25-MHz, RMIIMode the clock frequency is 50-MHz; RGMII Mode the clock frequency is 25-MHz.<br>RMIIMaster Mode Reference Clock: Identical to MAC IF Clock in RMIIMaster Mode. |
| 3    | Reserved                  | RO   | 0       | <b>Reserved</b>  |
| 2:0  | COL / GPIO_2 Control      | RW   | 000     | <b>COL GPIO Configuration:</b><br>000 = Normal operation<br>001 = MLED (Register 0x0025)<br>010 = WoL<br>011 = Clock reference according to bits[6:4]<br>100 = IEEE 1588 TX Indication<br>101 = IEEE 1588 RX Indication<br>110 = Constant '0'<br>111 = Constant '1'  |

**表 8-96. 0x0465 Fiber General Configuration Register (FIBER GENCFG)**

| BIT  | NAME     | TYPE | DEFAULT               | FUNCTION        |
|------|----------|------|-----------------------|-----------------|
| 15:1 | Reserved | RW   | 1111 1111<br>0000 000 | <b>Reserved</b> |

**表 8-96. 0x0465 Fiber General Configuration Register (FIBER GENCFG) (continued)**

| BIT | NAME                              | TYPE | DEFAULT | FUNCTION  |
|-----|-----------------------------------|------|---------|---|
| 0   | 100Base-FX Signal Detect Polarity | RW   | 0       | <p><b>100Base-FX Signal Detect Polarity:</b><br/>                     1 = Signal Detect is Active LOW<br/>                     0 = Signal Detect is Active HIGH<br/>                     When set to Active HIGH, Link drop will occur if SD pin senses a LOW state (SD = '0').<br/>                     When set to Active LOW, Link drop will occur if SD pin senses a HIGH state (SD = '1').<br/> <b>Note:</b> To enable 100Base-FX Signal Detection on LED_1 (pin #24), strap SD_EN = '1'</p> |

**表 8-97. 0x0467 Strap Latch-In Register #1 (SOR1)**

| BIT   | NAME             | TYPE      | DEFAULT | FUNCTION  |
|-------|------------------|-----------|---------|---|
| 15:14 | RX_D1 Strap Mode | RO, Strap | 00      | <p><b>RX_D1 Strap Mode:</b><br/>                     00 = Mode 1<br/>                     01 = Mode 2<br/>                     10 = Mode 3<br/>                     11 = Mode 4<br/>                     Please refer to the strap section in the datasheet for information regarding PHY configuration.<br/> <b>Note:</b> Bit values ('00', '01', '10', '11') are just used to indicate the Strap Mode and do not reflect the same bit sequence that is defined in the strap section of the datasheet.</p>     |
| 13:12 | RX_D0 Strap Mode | RO, Strap | 00      | <p><b>RX_D0 Strap Mode:</b><br/>                     Use same reference as defined by bits[15:14] in this register.</p>   |
| 11:10 | COL Strap Mode   | RO, Strap | 11      | <p><b>COL Strap Mode:</b><br/>                     Use same reference as defined by bits[15:14] in this register.</p>   |
| 9:8   | RX_ER Strap Mode | RO, Strap | 11      | <p><b>RX_ER Strap Mode:</b><br/>                     Use same reference as defined by bits[15:14] in this register.</p>   |
| 7:6   | CRS Strap Mode   | RO, Strap | 11      | <p><b>CRS Strap Mode:</b><br/>                     Use same reference as defined by bits[15:14] in this register.</p>   |
| 5:4   | RX_DV Strap Mode | RO, Strap | 00      | <p><b>RX_DV Strap Mode:</b><br/>                     Use same reference as defined by bits[15:14] in this register.</p>   |
| 3:2   | Reserved         | RO        | 00      | <b>Reserved</b>   |
| 1:0   | LED_0 Strap Mode | RO, Strap | 11      | <p><b>LED_0 Strap Mode:</b><br/>                     00 = Mode 1<br/>                     01 = Reserved<br/>                     10 = Reserved<br/>                     11 = Mode 4<br/>                     Please refer to the strap section in the datasheet for information regarding PHY configuration.<br/> <b>Note:</b> Bit values ('00', '01', '10', '11') are just used to indicate the Strap Mode and do not reflect the same bit sequence that is defined in the strap section of the datasheet.</p> |

**表 8-98. 0x0468 Strap Latch-In Register #2 (SOR2)**

| BIT  | NAME     | TYPE | DEFAULT | FUNCTION        |
|------|----------|------|---------|-----------------|
| 15:4 | Reserved | RO   | 0       | <b>Reserved</b> |

**表 8-98. 0x0468 Strap Latch-In Register #2 (SOR2) (continued)**

| BIT | NAME             | TYPE      | DEFAULT | FUNCTION   |
|-----|------------------|-----------|---------|--|
| 3:2 | RX_D3 Strap Mode | RO, Strap | 00      | <b>RX_D3 Strap Mode:</b><br>Use same reference as defined by bits[15:14] in register 0x0467. |
| 1:0 | RX_D2 Strap Mode | RO, Strap | 00      | <b>RX_D2 Strap Mode:</b><br>Use same reference as defined by bits[15:14] in register 0x0467. |

**表 8-99. 0x0469 LEDs Configuration Register #2 (LEDCFG2)**

| BIT   | NAME                        | TYPE | DEFAULT | FUNCTION   |
|-------|-----------------------------|------|---------|--|
| 15:11 | Reserved                    | RO   | 0       | <b>Reserved</b>  |
| 10    | LED_1 Polarity              | RW   | 0       | <b>LED_1 Polarity:</b><br>1 = Active High<br>0 = Active Low<br>Value depends upon pull configuration on LED_1 pin.   |
| 9     | LED_1 Force Override Value  | RW   | 0       | <b>LED_1 Force Override Value:</b><br>1 = LED_1 forced High<br>0 = LED_1 forced Low  |
| 8     | LED_1 Force Override Enable | RW   | 0       | <b>LED_1 Force Override Enable:</b><br>1 = Enable Force Override<br>0 = Disable Force Override<br>When enabled, bit[9] in this register determines state of LED_1. |
| 7     | Reserved                    | RO   | 0       | <b>Reserved</b>  |
| 6     | LED_3 Polarity              | RW   | 1       | <b>LED_3 Polarity:</b><br>1 = Active High<br>0 = Active Low  |
| 5     | LED_3 Force Override Value  | RW   | 0       | <b>LED_3 Force Override Value:</b><br>1 = RX_D3 forced High<br>0 = RX_D3 forced Low  |
| 4     | LED_3 Force Override Enable | RW   | 0       | <b>LED_3 Force Override Enable:</b><br>1 = Enable Force Override<br>0 = Disable Force Override<br>When enabled, bit[5] in this register determines state of RX_D3. |
| 3:0   | Reserved                    | RO   | 0       | <b>Reserved</b>  |

**表 8-100. 0x04A0 Receive Configuration Register (RXFCFG)**

| BIT   | NAME            | TYPE | DEFAULT | FUNCTION   |
|-------|-----------------|------|---------|--|
| 15:14 | Bit Nibble Swap | RW   | 00      | <b>Bit Nibble Swap:</b><br>00 = Normal order, no swap (RXD[3:0])<br>01 = Swap bits order (RXD[0:3])<br>10 = Swap nibbles order (RXD[3:0] , RXD[7:4])<br>11 = Swap bits order in each nibble (RXD[4:7] , RXD[0:3])                              |
| 13    | SFD Byte        | RW   | 0       | <b>SFD Byte Search:</b><br>1 = SFD is 0x5D (i.e. Receive module searches for 0x5D)<br>0 = SFD is 0xD5 (i.e. Receive module searches for 0xD5)  |
| 12    | CRC Gate        | RW   | 1       | <b>CRC Gate:</b><br>1 = Bad CRC gates Magic Packet and Pattern Indications<br>0 = Bad CRC does not gate Magic Packet or Pattern Indications<br>If Magic Packet has Bad CRC there will be no indication (status, interrupt, GPIO) when enabled. |



**表 8-100. 0x04A0 Receive Configuration Register (RXFCFG) (continued)**

| BIT  | NAME                              | TYPE  | DEFAULT | FUNCTION   |
|------|-----------------------------------|-------|---------|--|
| 11   | WoL Level Change Indication Clear | W, SC | 0       | <b>WoL Level Change Indication Clear:</b><br>If WoL Indication is set for Level change mode, this bit clears the level upon a write.   |
| 10:9 | WoL Pulse Indication Select       | RW    | 00      | <b>WoL Pulse Indication Select:</b><br>Only valid when WoL Indication is set for Pulse mode.<br>00 = 8 clock cycles (of 125-MHz clock)<br>01 = 16 clock cycles<br>10 = 32 clock cycles<br>11 = 64 clock cycles |
| 8    | WoL Indication Select             | RW    | 0       | <b>WoL Indication Select:</b><br>1 = Level change mode<br>0 = Pulse mode   |
| 7    | WoL Enable                        | RW    | 0       | <b>WoL Enable:</b><br>1 = Enable Wake-on-LAN (WoL)<br>0 = Normal operation   |
| 6    | Bit Mask Flag                     | RW    | 0       | <b>Bit Mask Flag</b>   |
| 5    | Secure-ON Enable                  | RW    | 0       | <b>Enable</b> Secure-ON password for Magic Packets   |
| 4:2  | Reserved                          | RW    | 0       | <b>Reserved</b>  |
| 1    | WoL Pattern Enable                | RW    | 0       | <b>Enable</b> Interrupt upon reception of packet with configured pattern   |
| 0    | WoL Magic Packet Enable           | RW    | 0       | <b>Enable</b> Interrupt upon reception of Magic Packet   |

**表 8-101. 0x04A1 Receive Status Register (RXFS)**

| BIT   | NAME                 | TYPE       | DEFAULT | FUNCTION   |
|-------|----------------------|------------|---------|--|
| 15:13 | Reserved             | RO         | 0       | <b>Reserved</b>  |
| 12    | WoL Interrupt Source | RW         | 0       | <b>WoL Interrupt Source:</b><br>Source of Interrupt for bit[1] of register 0x0013.<br>1 = WoL Interrupt<br>0 = Data Polarity Interrupt<br>When enabling WoL, this bit is automatically set to WoL Interrupt. |
| 11:8  | Reserved             | RO         | 0       | <b>Reserved</b>  |
| 7     | SFD Error            | RO, LH, SC | 0       | <b>SFD Error:</b><br>1 = Packet with SFD error<br>0 = No SFD error   |
| 6     | Bad CRC              | RO, LH, SC | 0       | <b>Bad CRC:</b><br>1 = Bad CRC was received<br>0 = No bad CRC received   |
| 5     | Secure-On Hack Flag  | RO, LH, SC | 0       | <b>Secure-ON Hack Flag:</b><br>1 = Invalid Password detected in Magic Packet<br>0 = Valid Secure-ON Password   |
| 4:2   | Reserved             | RO, LH, SC | 0       | <b>Reserved</b>  |
| 1     | WoL Pattern Status   | RO, LH, SC | 0       | <b>WoL Pattern Status:</b><br>1 = Valid packet with configured pattern received<br>0 = No valid packet with configured pattern received  |

**表 8-101. 0x04A1 Receive Status Register (RXFS) (continued)**

| BIT | NAME                    | TYPE       | DEFAULT | FUNCTION   |
|-----|-------------------------|------------|---------|--|
| 0   | WoL Magic Packet Status | RO, LH, SC | 0       | <b>WoL Magic Packet Status:</b><br>1 = Valid Magic Packet received<br>0 = No valid Magic Packet received |

**表 8-102. 0x04A2 Receive Perfect Match Data Register #1 (RXFPMD1)**

| BIT  | NAME                              | TYPE | DEFAULT | FUNCTION   |
|------|-----------------------------------|------|---------|--|
| 15:8 | MAC Destination Address Byte<br>4 | RW   | 0       | <b>Perfect Match Data:</b><br>Configured for MAC Destination Address |
| 7:0  | MAC Destination Address Byte<br>5 | RW   | 0       | <b>Perfect Match Data:</b><br>Configured for MAC Destination Address |

**表 8-103. 0x04A3 Receive Perfect Match Data Register #2 (RXFPMD2)**

| BIT  | NAME                              | TYPE | DEFAULT | FUNCTION   |
|------|-----------------------------------|------|---------|--|
| 15:8 | MAC Destination Address Byte<br>2 | RW   | 0       | <b>Perfect Match Data:</b><br>Configured for MAC Destination Address |
| 7:0  | MAC Destination Address Byte<br>3 | RW   | 0       | <b>Perfect Match Data:</b><br>Configured for MAC Destination Address |

**表 8-104. 0x04A4 Receive Perfect Match Data Register #3 (RXFPMD3)**

| BIT  | NAME                              | TYPE | DEFAULT | FUNCTION   |
|------|-----------------------------------|------|---------|--|
| 15:8 | MAC Destination Address Byte<br>0 | RW   | 0       | <b>Perfect Match Data:</b><br>Configured for MAC Destination Address |
| 7:0  | MAC Destination Address Byte<br>1 | RW   | 0       | <b>Perfect Match Data:</b><br>Configured for MAC Destination Address |

**表 8-105. 0x04A5 Receive Secure-ON Password Register #1 (RXFSOP1)**

| BIT  | NAME                      | TYPE | DEFAULT | FUNCTION  |
|------|---------------------------|------|---------|---|
| 15:8 | Secure-ON Password Byte 1 | RW   | 0       | <b>Secure-ON Password Select:</b><br>Secure-ON password for Magic Packets |
| 7:0  | Secure-ON Password Byte 0 | RW   | 0       | <b>Secure-ON Password Select:</b><br>Secure-ON password for Magic Packets |

**表 8-106. 0x04A6 Receive Secure-ON Password Register #2 (RXFSOP2)**

| BIT  | NAME                      | TYPE | DEFAULT | FUNCTION  |
|------|---------------------------|------|---------|---|
| 15:8 | Secure-ON Password Byte 3 | RW   | 0       | <b>Secure-ON Password Select:</b><br>Secure-ON password for Magic Packets |
| 7:0  | Secure-ON Password Byte 2 | RW   | 0       | <b>Secure-ON Password Select:</b><br>Secure-ON password for Magic Packets |

**表 8-107. 0x04A7 Receive Secure-ON Password Register #3 (RXFSOP3)**

| BIT  | NAME                      | TYPE | DEFAULT | FUNCTION  |
|------|---------------------------|------|---------|---|
| 15:8 | Secure-ON Password Byte 5 | RW   | 0       | <b>Secure-ON Password Select:</b><br>Secure-ON password for Magic Packets |
| 7:0  | Secure-ON Password Byte 4 | RW   | 0       | <b>Secure-ON Password Select:</b><br>Secure-ON password for Magic Packets |

**表 8-108. 0x04A8 Receive Pattern Register #1 (RXFPAT1)**

| BIT  | NAME           | TYPE | DEFAULT | FUNCTION  |
|------|----------------|------|---------|---|
| 15:8 | Pattern Byte 1 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 1 of the pattern |
| 7:0  | Pattern Byte 0 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 0 of the pattern |

**表 8-109. 0x04A9 Receive Pattern Register #2 (RXFPAT2)**

| BIT  | NAME           | TYPE | DEFAULT | FUNCTION  |
|------|----------------|------|---------|---|
| 15:8 | Pattern Byte 3 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 3 of the pattern |
| 7:0  | Pattern Byte 2 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 2 of the pattern |

**表 8-110. 0x04AA Receive Pattern Register #3 (RXFPAT3)**

| BIT  | NAME           | TYPE | DEFAULT | FUNCTION  |
|------|----------------|------|---------|---|
| 15:8 | Pattern Byte 5 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 5 of the pattern |
| 7:0  | Pattern Byte 4 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 4 of the pattern |

**表 8-111. 0x04AB Receive Pattern Register #4 (RXFPAT4)**

| BIT  | NAME           | TYPE | DEFAULT | FUNCTION  |
|------|----------------|------|---------|---|
| 15:8 | Pattern Byte 7 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 7 of the pattern |
| 7:0  | Pattern Byte 6 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 6 of the pattern |

**表 8-112. 0x04AC Receive Pattern Register #5 (RXFPAT5)**

| BIT  | NAME           | TYPE | DEFAULT | FUNCTION  |
|------|----------------|------|---------|---|
| 15:8 | Pattern Byte 9 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 9 of the pattern |
| 7:0  | Pattern Byte 8 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 8 of the pattern |

**表 8-113. 0x04AD Receive Pattern Register #6 (RXFPAT6)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 11 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 11 of the pattern |
| 7:0  | Pattern Byte 10 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 10 of the pattern |

**表 8-114. 0x04AE Receive Pattern Register #7 (RXFPAT7)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 13 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 13 of the pattern |

**表 8-114. 0x04AE Receive Pattern Register #7 (RXFPAT7) (continued)**

| BIT | NAME            | TYPE | DEFAULT | FUNCTION   |
|-----|-----------------|------|---------|--|
| 7:0 | Pattern Byte 12 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 12 of the pattern |

**表 8-115. 0x04AF Receive Pattern Register #8 (RXFPAT8)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 15 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 15 of the pattern |
| 7:0  | Pattern Byte 14 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 14 of the pattern |

**表 8-116. 0x04B0 Receive Pattern Register #9 (RXFPAT9)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 17 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 17 of the pattern |
| 7:0  | Pattern Byte 16 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 16 of the pattern |

**表 8-117. 0x04B1 Receive Pattern Register #10 (RXFPAT10)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 19 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 19 of the pattern |
| 7:0  | Pattern Byte 18 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 18 of the pattern |

**表 8-118. 0x04B2 Receive Pattern Register #11 (RXFPAT11)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 21 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 21 of the pattern |
| 7:0  | Pattern Byte 20 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 20 of the pattern |

**表 8-119. 0x04B3 Receive Pattern Register #12 (RXFPAT12)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 23 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 23 of the pattern |
| 7:0  | Pattern Byte 22 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 22 of the pattern |

**表 8-120. 0x04B4 Receive Pattern Register #13 (RXFPAT13)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 25 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 25 of the pattern |
| 7:0  | Pattern Byte 24 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 24 of the pattern |

**表 8-121. 0x04B5 Receive Pattern Register #14 (RXFPAT14)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 27 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 27 of the pattern |
| 7:0  | Pattern Byte 26 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 26 of the pattern |

**表 8-122. 0x04B6 Receive Pattern Register #15 (RXFPAT15)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 29 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 29 of the pattern |
| 7:0  | Pattern Byte 28 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 28 of the pattern |

**表 8-123. 0x04B7 Receive Pattern Register #16 (RXFPAT16)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 31 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 31 of the pattern |
| 7:0  | Pattern Byte 30 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 30 of the pattern |

**表 8-124. 0x04B8 Receive Pattern Register #17 (RXFPAT17)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 33 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 33 of the pattern |
| 7:0  | Pattern Byte 32 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 32 of the pattern |

**表 8-125. 0x04B9 Receive Pattern Register #18 (RXFPAT18)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 35 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 35 of the pattern |
| 7:0  | Pattern Byte 34 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 34 of the pattern |

**表 8-126. 0x04BA Receive Pattern Register #19 (RXFPAT19)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 37 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 37 of the pattern |
| 7:0  | Pattern Byte 36 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 36 of the pattern |

**表 8-127. 0x04BB Receive Pattern Register #20 (RXFPAT20)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 39 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 39 of the pattern |

**表 8-127. 0x04BB Receive Pattern Register #20 (RXFPAT20) (continued)**

| BIT | NAME            | TYPE | DEFAULT | FUNCTION   |
|-----|-----------------|------|---------|--|
| 7:0 | Pattern Byte 38 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 38 of the pattern |

**表 8-128. 0x04BC Receive Pattern Register #21 (RXFPAT21)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 41 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 41 of the pattern |
| 7:0  | Pattern Byte 40 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 40 of the pattern |

**表 8-129. 0x04BD Receive Pattern Register #22 (RXFPAT22)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 43 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 43 of the pattern |
| 7:0  | Pattern Byte 42 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 42 of the pattern |

**表 8-130. 0x04BE Receive Pattern Register #23 (RXFPAT23)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 45 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 45 of the pattern |
| 7:0  | Pattern Byte 44 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 44 of the pattern |

**表 8-131. 0x04BF Receive Pattern Register #24 (RXFPAT24)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 47 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 47 of the pattern |
| 7:0  | Pattern Byte 46 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 46 of the pattern |

**表 8-132. 0x04C0 Receive Pattern Register #25 (RXFPAT25)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 49 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 49 of the pattern |
| 7:0  | Pattern Byte 48 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 48 of the pattern |

**表 8-133. 0x04C1 Receive Pattern Register #26 (RXFPAT26)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 51 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 51 of the pattern |
| 7:0  | Pattern Byte 50 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 50 of the pattern |

**表 8-134. 0x04C2 Receive Pattern Register #27 (RXFPAT27)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 53 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 53 of the pattern |
| 7:0  | Pattern Byte 52 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 52 of the pattern |

**表 8-135. 0x04C3 Receive Pattern Register #28 (RXFPAT28)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 55 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 55 of the pattern |
| 7:0  | Pattern Byte 54 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 54 of the pattern |

**表 8-136. 0x04C4 Receive Pattern Register #29 (RXFPAT29)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 57 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 57 of the pattern |
| 7:0  | Pattern Byte 56 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 56 of the pattern |

**表 8-137. 0x04C5 Receive Pattern Register #30 (RXFPAT30)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 59 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 59 of the pattern |
| 7:0  | Pattern Byte 58 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 58 of the pattern |

**表 8-138. 0x04C6 Receive Pattern Register #31 (RXFPAT31)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 61 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 61 of the pattern |
| 7:0  | Pattern Byte 60 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 60 of the pattern |

**表 8-139. 0x04C7 Receive Pattern Register #32 (RXFPAT32)**

| BIT  | NAME            | TYPE | DEFAULT | FUNCTION   |
|------|-----------------|------|---------|--|
| 15:8 | Pattern Byte 63 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 63 of the pattern |
| 7:0  | Pattern Byte 62 | RW   | 0       | <b>Pattern Configuration:</b><br>Configures byte 62 of the pattern |

**表 8-140. 0x04C8 Receive Pattern Byte Mask Register #1 (RXFPBM1)**

| BIT  | NAME               | TYPE | DEFAULT | FUNCTION  |
|------|--------------------|------|---------|---|
| 15:0 | Mask Bytes 0 to 15 | RW   | 0       | <b>Pattern Byte Mask Configuration:</b><br>Configures masks for bytes 0 to 15.<br>For each byte '1' means it is masked. |

**表 8-141. 0x04C9 Receive Pattern Byte Mask Register #2 (RXFPBM2)**

| BIT  | NAME                | TYPE | DEFAULT | FUNCTION   |
|------|---------------------|------|---------|--|
| 15:0 | Mask Bytes 16 to 31 | RW   | 0       | <b>Pattern Byte Mask Configuration:</b><br>Configures masks for bytes 16 to 31.<br>For each byte '1' means it is masked. |

**表 8-142. 0x04CA Receive Pattern Byte Mask Register #3 (RXFPBM3)**

| BIT  | NAME                | TYPE | DEFAULT | FUNCTION   |
|------|---------------------|------|---------|--|
| 15:0 | Mask Bytes 32 to 47 | RW   | 0       | <b>Pattern Byte Mask Configuration:</b><br>Configures masks for bytes 32 to 47.<br>For each byte '1' means it is masked. |

**表 8-143. 0x04CB Receive Pattern Byte Mask Register #4 (RXFPBM4)**

| BIT  | NAME                | TYPE | DEFAULT | FUNCTION   |
|------|---------------------|------|---------|--|
| 15:0 | Mask Bytes 48 to 63 | RW   | 0       | <b>Pattern Byte Mask Configuration:</b><br>Configures masks for bytes 48 to 63.<br>For each byte '1' means it is masked. |

**表 8-144. 0x04CC Receive Pattern Control Register (RXFPATC)**

| BIT  | NAME                | TYPE | DEFAULT | FUNCTION  |
|------|---------------------|------|---------|---|
| 15:6 | Reserved            | RO   | 0       | <b>Reserved</b>   |
| 5:0  | Pattern Start Point | RW   | 01100   | <b>Pattern Start Point:</b><br>Number of bytes after SFD where comparison begins on RX packets to the configured pattern.<br>00000 = Start compare on 1st byte after SFD<br>00001 = Start compare on 2nd byte after SFD<br>...<br>01100 = Start compare on 13th byte (Default)<br>Default setting is 0xC, which means the pattern comparison will begin after source and destination addresses since they are each 6 bytes. |

**表 8-145. 0x04D0 Energy Efficient Ethernet Configuration Register #2 (EEEECFG2)**

| BIT  | NAME                  | TYPE | DEFAULT   | FUNCTION   |
|------|-----------------------|------|-----------|--|
| 15   | Reserved              | RO   | 0         | <b>Reserved</b>  |
| 14   | TX_ER for LPI Request | RW   | 0         | <b>TX_ER for LPI Request:</b><br>1 = TX_ER used for LPI Request<br>0 = TX_ER not used for LPI Request      |
| 13:7 | Reserved              | RO   | 00 0011 0 | <b>Reserved</b>  |
| 6:5  | TX_ER Pin Select      | RW   | 00        | <b>TX_ER Pin Select:</b><br>00 = No Pin Selected<br>01 = INT/PWDN<br>10 = COL/GPIO<br>11 = No Pin Selected |
| 4:0  | Reserved              | RO   | 0 0010    | <b>Reserved</b>  |

**表 8-146. 0x04D1 Energy Efficient Ethernet Configuration Register #2 (EEEECFG3)**

| BIT  | NAME     | TYPE | DEFAULT           | FUNCTION        |
|------|----------|------|-------------------|-----------------|
| 15:4 | Reserved | RW   | 0000 0001<br>1000 | <b>Reserved</b> |



**表 8-146. 0x04D1 Energy Efficient Ethernet Configuration Register #2 (EEECFG3) (continued)**

| BIT | NAME                    | TYPE      | DEFAULT | FUNCTION   |
|-----|-------------------------|-----------|---------|--|
| 3   | EEE Capabilities Bypass | RW        | 1       | <b>EEE Advertise Bypass:</b><br>1 = Bit [0] determines EEE Auto-Negotiation Abilities<br>0 = MMD3 and MMD7 determine EEE Auto-Negotiation Abilities<br>Allows for EEE Advertisement during Auto-Negotiation to be determined by bit[0] in register 0x04D1 rather than the Next Page Registers (Register 0x003C and Register 0x003D in MMD7).   |
| 2   | EEE Next Page Disable   | RW        | 0       | <b>EEE Next Page Disable:</b><br>1 = Reception of EEE Next Pages is disabled<br>0 = Reception of EEE Next Pages is enabled   |
| 1   | EEE RX Path Shutdown    | RW        | 1       | <b>EEE RX Path Shutdown:</b><br>1 = Enable shutdown of Analog RX path at LPI_Quiet<br>0 = Analog RX path is active during LPI_Quiet  |
| 0   | EEE Capabilities Enable | RW, Strap | 1       | <b>EEE Capabilities Enable:</b><br>1 = PHY supports EEE capabilities<br>0 = PHY does not support EEE<br>When enabled, Auto-Negotiation will negotiate to EEE as defined by register 0x003C and register 0x003D in MMD7.<br>When disabled, register 0x0014 in MMD3, register 0x003C and register 0x003D in MMD7 are ignored.<br>Bit should be written to 0 (irrespective of strap used) to disable EEE. |

**表 8-147. 0x04D4 TLOOP Bandwidth Control Register 1 (TLBCR1)**

| BIT  | NAME     | TYPE | DEFAULT                | FUNCTION |
|------|----------|------|------------------------|----------|
| 15:0 | Reserved | RW   | 0111 0010<br>0010 0000 | Reserved |

**表 8-148. 0x04D5 TLOOP Bandwidth Control Register 2 (TLBCR2)**

| BIT  | NAME     | TYPE | DEFAULT                | FUNCTION |
|------|----------|------|------------------------|----------|
| 15:0 | Reserved | RW   | 1111 1011<br>1100 0001 | Reserved |

**表 8-149. 0x04D6 TLOOP Bandwidth Control Register 3 (TLBCR3)**

| BIT  | NAME     | TYPE | DEFAULT                | FUNCTION |
|------|----------|------|------------------------|----------|
| 15:0 | Reserved | RW   | 0000 0001<br>1100 0001 | Reserved |

**表 8-150. 0x3000 MMD3 PCS Control Register #1 (MMD3\_PCS\_CTRL\_1)**

| BIT   | NAME               | TYPE   | DEFAULT | FUNCTION   |
|-------|--------------------|--------|---------|--|
| 15    | PCS Reset          | RW, SC | 0       | <b>PCS Reset:</b><br>1 = Soft Reset of MMD3, MMD7 and PCS registers<br>0 = Normal operation<br>Reset clears MMD3, MMD7 and PCS registers. Reset does not clear Vendor Specific Registers (DEVAD = 31). |
| 14:11 | Reserved           | RO     | 000 0   | Reserved   |
| 10    | RX Clock Stoppable | RW     | 1       | <b>RX Clock Stoppable:</b><br>1 = Receive Clock stoppable during LPI<br>0 = Receive Clock not stoppable  |

**表 8-150. 0x3000 MMD3 PCS Control Register #1 (MMD3\_PCS\_CTRL\_1) (continued)**

| BIT | NAME     | TYPE | DEFAULT         | FUNCTION |
|-----|----------|------|-----------------|----------|
| 9:0 | Reserved | RO   | 00 0000<br>0000 | Reserved |

**表 8-151. 0x3001 MMD3 PCS Status Register #1 (MMD3\_PCS\_STATUS\_1)**

| BIT   | NAME               | TYPE | DEFAULT | FUNCTION  |
|-------|--------------------|------|---------|---|
| 15:12 | Reserved           | RO   | 0       | Reserved  |
| 11    | TX LPI Received    | RO   | 0       | <b>TX LPI Received:</b><br>1 = TX PCS has received LPI<br>0 = LPI not received                                  |
| 10    | RX LPI Received    | RO   | 0       | <b>RX LPI Received:</b><br>1 = RX PCS has received LPI<br>0 = LPI not received                                  |
| 9     | TX LPI Indication  | RO   | 0       | <b>TX LPI Indication:</b><br>1 = TX PCS is currently receiving LPI<br>0 = TX PCS is not currently receiving LPI |
| 8     | RX LPI Indication  | RO   | 0       | <b>RX LPI Indication:</b><br>1 = RX PCS is currently receiving LPI<br>0 = RX PCS is not currently receiving LPI |
| 7     | Reserved           | RO   | 0       | Reserved  |
| 6     | TX Clock Stoppable | RO   | 1       | <b>TX Clock Stoppable:</b><br>1 = MAC may stop clock during LPI<br>0 = TX Clock is not stoppable                |
| 5:0   | Reserved           | RO   | 0       | Reserved  |

**表 8-152. 0x3014 MMD3 Energy Efficient Ethernet Capability Register (MMD3\_EEE\_CAPABILITY)**

| BIT  | NAME               | TYPE | DEFAULT | FUNCTION   |
|------|--------------------|------|---------|--|
| 15:3 | Reserved           | RO   | 0       | Reserved   |
| 2    | EEE 1Gbps Enable   | RO   | 0       | <b>EEE 1Gbps Enable:</b><br>1 = EEE is supported for 1000Base-T<br>0 = EEE is not supported for 1000Base-T   |
| 1    | EEE 100Mbps Enable | RO   | 1       | <b>EEE 100Mbps Enable:</b><br>1 = EEE is supported for 100Base-TX<br>0 = EEE is not supported for 100Base-TX |
| 0    | Reserved           | RO   | 0       | Reserved   |

**表 8-153. 0x3016 MMD3 Wake Error Counter Register (MMD3\_WAKE\_ERR\_CNT)**

| BIT  | NAME                   | TYPE   | DEFAULT | FUNCTION   |
|------|------------------------|--------|---------|--|
| 15:0 | EEE Wake Error Counter | RO, LH | 0       | <b>EEE Wake Error Counter:</b><br>This register counts the wake time faults where the PHY fails to complete its normal wake sequence within the time required for the specific PHY type.<br>This counter is cleared after a read and holds at all ones in the case of overflow. PCS Reset also clears this register. |

**表 8-154. 0x703C MMD7 Energy Efficient Ethernet Advertisement Register (MMD7\_EEE\_ADVERTISEMENT)**

| BIT  | NAME                     | TYPE     | DEFAULT | FUNCTION  |
|------|--------------------------|----------|---------|---|
| 15:2 | Reserved                 | RO       | 0       | <b>Reserved</b>   |
| 1    | Advertise 100Base-TX EEE | RW,Strap | 1       | <b>Advertise 100Base-TX EEE:</b><br>1 = Energy Efficient Ethernet is advertised for 100Base-TX<br>0 = Energy Efficient Ethernet is not advertised |
| 0    | Reserved                 | RO       | 0       | <b>Reserved</b>   |

**表 8-155. 0x703D MMD7 Energy Efficient Ethernet Link Partner Ability Register (MMD7\_EEE\_LP\_ABILITY)**

| BIT  | NAME                        | TYPE | DEFAULT | FUNCTION  |
|------|-----------------------------|------|---------|---|
| 15:2 | Reserved                    | RO   | 0       | <b>Reserved</b>   |
| 1    | Link Partner EEE Capability | RO   | 0       | <b>Link Partner EEE Capability:</b><br>1 = Link Partner is advertising EEE capability for 100Base-TX<br>0 = Link Partner is not advertising EEE capability for 100Base-TX |
| 0    | Reserved                    | RO   | 0       | <b>Reserved</b>   |

## 9 Application and Implementation

### 注

以下のアプリケーション情報は、TI の製品仕様に含まれるものではなく、TI ではその正確性または完全性を保証いたしません。個々の目的に対する製品の適合性については、お客様の責任で判断していただくこととなります。お客様は自身の設計実装を検証しテストすることで、システムの機能を確認する必要があります。

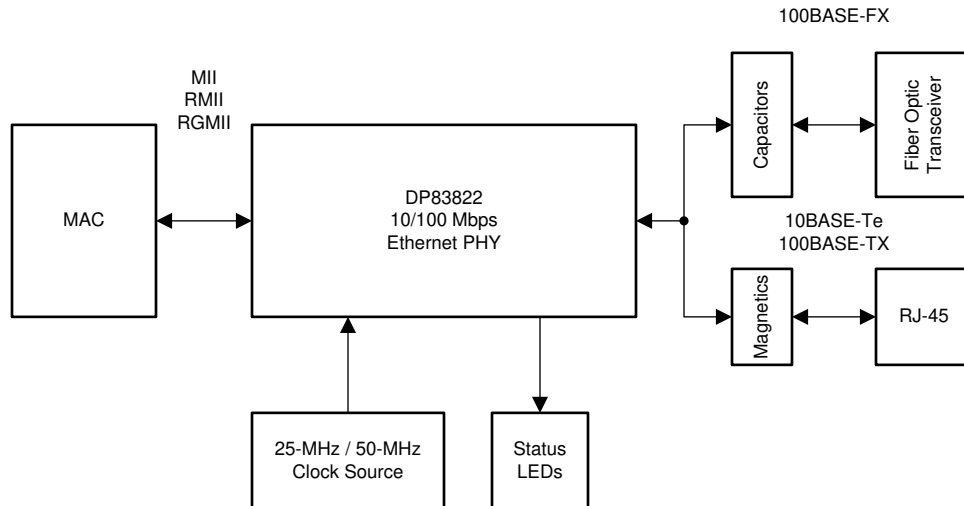
### 9.1 Application Information

The DP83822 is a single-port 10/100 Mbps Ethernet PHY. It supports connections to an Ethernet MAC through MII, RMII, or RGMII. Connections to the Ethernet media are made via the IEEE 802.3 defined Media Dependent Interface.

When using the device for Ethernet applications, it is necessary to meet certain requirements for normal operation. The following subsections are intended to assist in appropriate component selection and required circuit connections.

### 9.2 Typical Applications

図 9-1 shows a typical application for the DP83822. More typical application examples are given in this section.



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図 9-1. Typical DP83822 Application

## 9.2.1 TPI Network Circuit

Figure 9-2 shows the recommended twisted-pair interface network circuit for 10/100 Mbps. Variations with PCB and component characteristics require that the application be tested to verify that the circuit meets the requirements of the intended application.

Center tap of the transformer must be connected to analog supply rail (AVD) with decoupling capacitors close to the transformer. All resistors and capacitors must be placed as close to the device as possible.

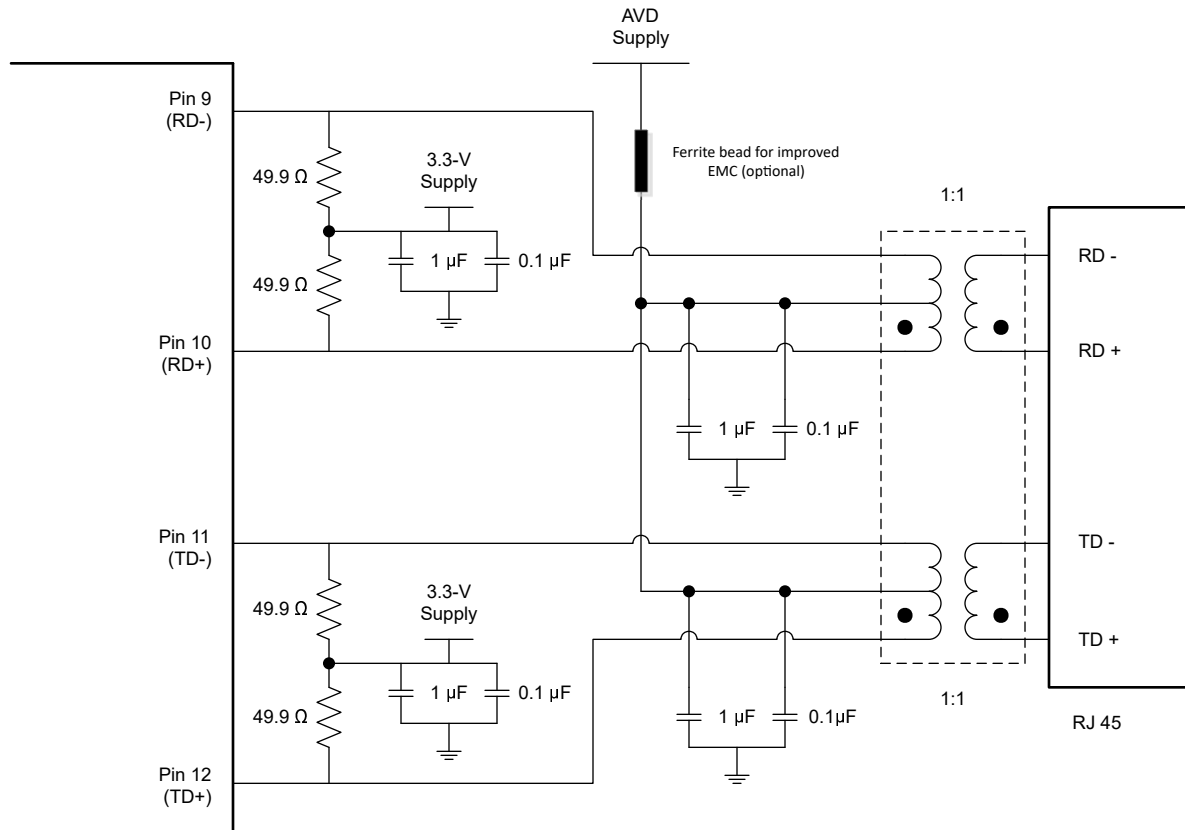


Figure 9-2. TPI Network Circuit

### 9.2.1.1 Design Requirements

The design requirements for the DP83822 in TPI operation (100BASE-TX or 10BASE-Te) are:

1. AVD Supply = 3.3 V or 1.8 V
2. Center Tap Supply = AVD Supply
3. VDDIO Supply = 3.3 V, 2.5 V, or 1.8 V
4. Reference Clock Input = 25-MHz or 50-MHz (RMII Slave)


### 9.2.1.2 Detailed Design Procedure

For the detailed design procedure of the TPI network circuit, see [セクション 9.2.2.2](#).

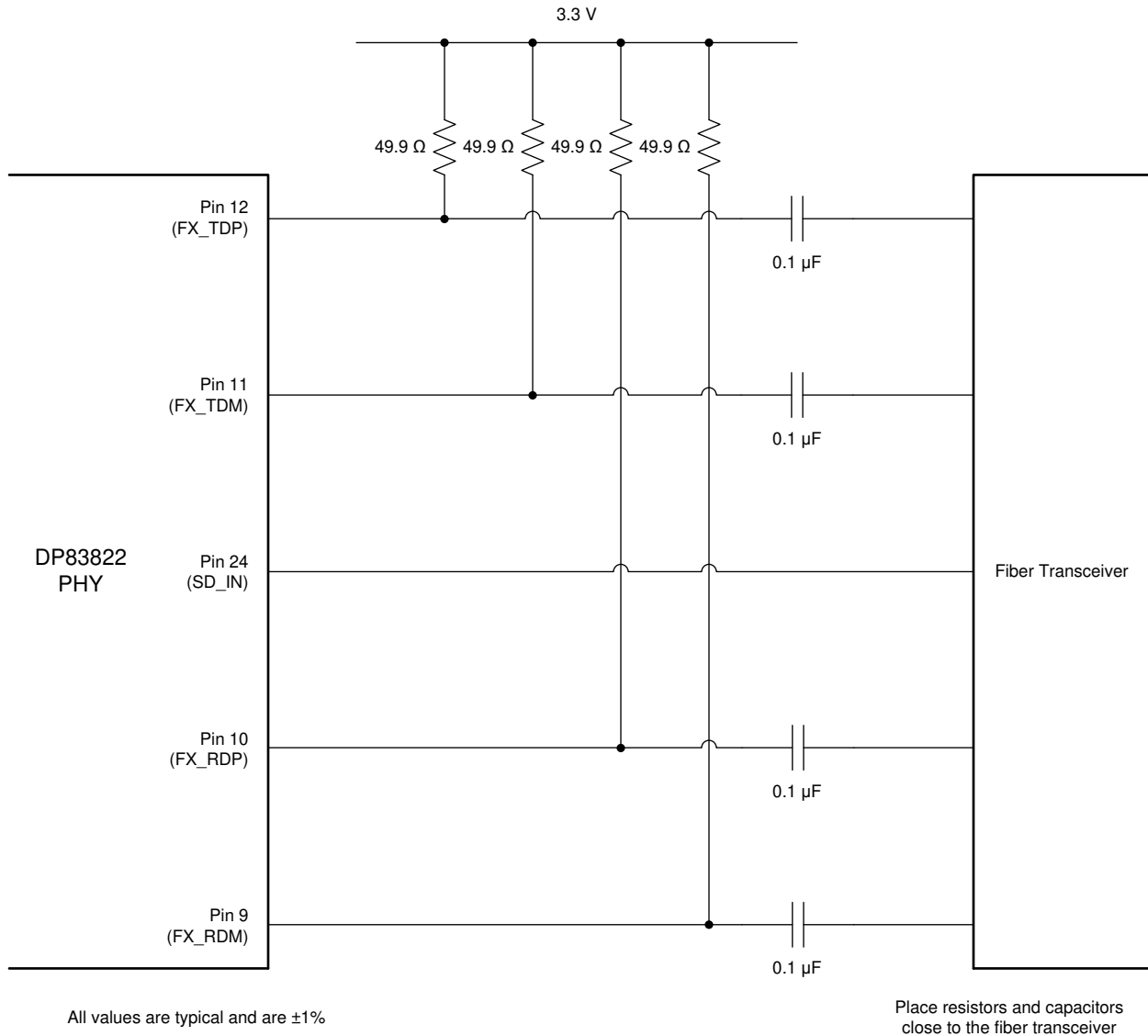
### 9.2.1.3 Application Curves

For expected TPI network MDI curves, see [Figure 7-18](#) and [Figure 7-19](#) and [Figure 7-21](#).

## 9.2.2 Fiber Network Circuit


**9-3** shows the recommended circuit for a 100-Mbps fiber network. Variations with PCB and component characteristics require that the application be tested to verify that the circuit meets the requirements of the intended application.

All resistors and capacitors should be placed as close to the fiber transceiver as possible.



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### 9-3. Fiber Network Circuit

#### 9.2.2.1 Design Requirements

##### 9.2.2.1.1 Clock Requirements

The DP83822 supports an external CMOS-level oscillator source or an internal oscillator with an external crystal.

##### 9.2.2.1.1.1 Oscillator

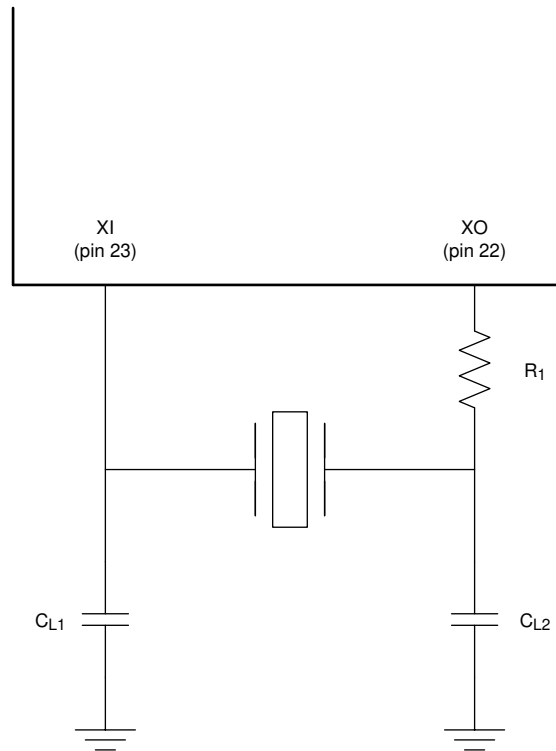
If an external clock source is used, XI should be tied to the clock source and XO should be left floating. The amplitude of the oscillator should be a nominal voltage of VDDIO.

注

The DP83822 requires Clock to be present at PoR. In case clock is delayed, pull-down on XI is recommended to avoid spurious signal latch-up.

**9.2.2.1.1.2 Crystal**

The use of a 25-MHz, parallel, 20-pF load crystal is recommended if operating with a crystal. A typical connection diagram is shown below for a crystal resonator circuit. The load capacitor values will vary with the crystal vendors; check with the vendor for the recommended loads.



**9-4. Crystal Oscillator Circuit**

**表 9-1. 25-MHz Oscillator Specification**

| PARAMETER           | TEST CONDITIONS  | MIN  | TYP | MAX | UNIT |
|---------------------|--|------|-----|-----|------|
| Frequency           |  |      | 25  |     | MHz  |
| Frequency Tolerance | Including operational temperature, aging and other factors | -100 |     | 100 | ppm  |
| Rise / Fall Time    | 10% - 90%  |      |     | 8   | nsec |
| Jitter (Short Term) | Cycle-to-cycle   |      | 50  | 100 | psec |
| Jitter (Long Term)  | Accumulative over 10 ms                                    |      |     | 1   | nsec |
| Symmetry            | Duty Cycle   | 40   |     | 60  | %    |
| Load Capacitance    |  |      | 15  | 30  | pF   |

**表 9-2. 50-MHz Oscillator Specification**

| PARAMETER           | TEST CONDITIONS  | MIN  | TYP | MAX | UNIT |
|---------------------|--|------|-----|-----|------|
| Frequency           |  |      | 50  |     | MHz  |
| Frequency Tolerance | Including operational temperature, aging and other factors | -100 |     | 100 | ppm  |
| Rise / Fall Time    | 10% - 90%  |      |     | 8   | nsec |
| Jitter (Short Term) | Cycle-to-cycle   |      | 50  |     | psec |
| Jitter (Long Term)  | Accumulative over 10 ms                                    |      |     | 1   | nsec |
| Symmetry            | Duty Cycle   | 40   |     | 60  | %    |
| Load Capacitance    |  |      | 15  | 30  | pF   |

**表 9-3. 25-MHz Crystal Specification**

| PARAMETER           | TEST CONDITIONS  | MIN  | TYP | MAX | UNIT |
|---------------------|--|------|-----|-----|------|
| Frequency           |  |      | 25  |     | MHz  |
| Frequency Tolerance | Including operational temperature, aging and other factors | -100 |     | 100 | ppm  |
| Load Capacitance    |  | 10   |     | 40  | pF   |



### 9.2.2.2 Detailed Design Procedure

The Media Independent Interface (MII / RMII / RGMII) connects the DP83822 to the Media Access Controller (MAC). The MAC may in-fact be a discrete device or integrated into a microprocessor, CPU, FPGA, or ASIC. The Media Dependent Interface (MDI) connects the DP83822 to the transformer of the Ethernet network or to AC isolation capacitors when interfacing with a fiber transceiver.

#### 9.2.2.2.1 MII Layout Guidelines

1. MII signals are single-ended signals
2. Traces should be routed with 50- $\Omega$  impedance to ground
3. Keep trace lengths as short as possible, less than two inches is recommended and less than six inches maximum

#### 9.2.2.2.2 RMII Layout Guidelines

1. RMII signals are single-ended signals
2. Traces should be routed with 50- $\Omega$  impedance to ground
3. Keep trace lengths as short as possible, less than two inches is recommended and less than six inches maximum

#### 9.2.2.2.3 RGMII Layout Guidelines

1. RGMII signals are single-ended signals
2. Traces should be routed with 50- $\Omega$  impedance to ground
3. Keep trace lengths as short as possible, less than two inches is recommended and less than six inches maximum
4. Internal Clock Delay can be enabled on the transmit and receive path independently within the DP83822 using register access

#### 9.2.2.2.4 MDI Layout Guidelines

1. MDI signals are differential
2. Traces should be routed with 50- $\Omega$  impedance to ground and 100- $\Omega$  differential controlled impedance
3. Route MDI traces to the transformer on the same layer
4. Use a metal shielded RJ-45 connector and electrically connect the shield to chassis ground
5. Avoid supplies and ground beneath the magnetics
6. Do not overlap the circuit ground and chassis ground planes. Keep chassis ground and circuit ground isolated by turning chassis ground into an isolated island by leaving a gap between the planes. Connecting a 1206 (size) capacitor between chassis ground and circuit ground is recommended to avoid floating metal. Capacitors less than 805 (size) can create an arching path for ESD due to a small air-gap.

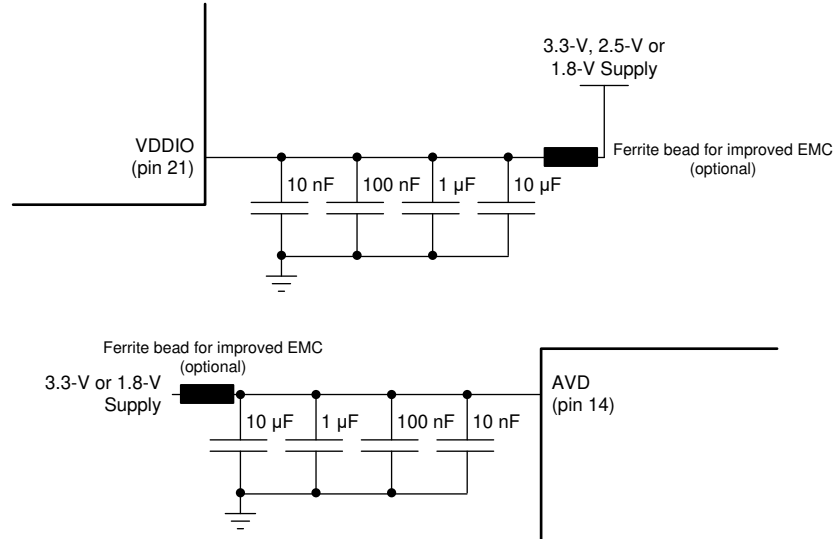
### 9.2.2.3 Application Curves

For expected Fiber network MDI curve, see [Figure 7-20](#).

## 10 Power Supply Recommendations

The DP83822 is capable of operating with a wide range of I/O supply voltages (3.3 V, 2.5 V, or 1.8 V) along with any of the two analog supply options (3.3 V or 1.8 V).

The recommended power supply de-coupling network is shown below:



A. The smallest value is placed closest to the pin

**图 10-1. Power Connections**

注

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

### 10.1 Power Supply Characteristics

The following data was measured using a DP83822 evaluation module. All the power dissipation numbers are measured at nominal voltage under typical temperature of 25°C. Center tap must be connected to the same potential as the analog supply rail (AVD).

**表 10-1. Power Supply Characteristics<sup>(1)</sup>**

| PARAMETER                    | TEST CONDITIONS | MAGNETIC SUPPLY (mA) | AVD SUPPLY (mA) | VDDIO SUPPLY (mA) | TOTAL POWER (mW) |
|------------------------------|-----------------|----------------------|-----------------|-------------------|------------------|
| 3.3-V AVD/CT AND 3.3-V VDDIO |                 |                      |                 |                   |                  |

**表 10-1. Power Supply Characteristics<sup>(1)</sup> (continued)**

| PARAMETER                           | TEST CONDITIONS   | MAGNETIC SUPPLY (mA) | AVD SUPPLY (mA) | VDDIO SUPPLY (mA) | TOTAL POWER (mW) |
|-------------------------------------|---|----------------------|-----------------|-------------------|------------------|
| 100BASE-TX                          | MII, Link-Up, No Traffic  | 22                   | 36              | 15                | 241              |
|                                     | MII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets, 25°C    | 22                   | 36              | 21                | 261              |
|                                     | MII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets, -40°C   | 22                   | 25              | 20                | 221              |
|                                     | MII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets, 125°C   | 22                   | 52              | 22                | 317              |
|                                     | RMII, Link-Up, No Traffic   | 22                   | 36              | 6                 | 211              |
|                                     | RMII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets         | 22                   | 36              | 7                 | 215              |
|                                     | RGMII, Link-Up, No Traffic  | 22                   | 36              | 8                 | 218              |
|                                     | RGMII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets        | 22                   | 36              | 9                 | 221              |
| 10BASE-Te                           | MII, Link-Up, No Traffic  | 2                    | 18              | 7                 | 89               |
|                                     | MII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets          | 49                   | 18              | 7                 | 244              |
|                                     | RMII, Link-Up, No Traffic   | 2                    | 18              | 6                 | 86               |
|                                     | RMII, Link-Up, 960ns IPG (100% Utilization), 1514-byte Packets          | 49                   | 18              | 6                 | 241              |
|                                     | RGMII, Link-Up, No Traffic  | 2                    | 18              | 7                 | 89               |
|                                     | RGMII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets        | 49                   | 18              | 7                 | 244              |
| Passive Sleep                       | RMII, bits[15:12] = 0b0111 in register 0x0011                           | 2                    | 16              | 6                 | 79               |
| Active Sleep                        | RMII, bits[15:12] = 0b0110 in register 0x0011                           | 2                    | 16              | 6                 | 79               |
| IEEE Power Down                     | RMII, bits[11] = 1 in register 0x0000                                   | 2                    | 4               | 6                 | 40               |
| Deep Power Down                     | RMII, bits[11] = 1 in register 0x0000 and bit[2] = 1 in register 0x0428 | 2                    | 3               | 6                 | 36               |
| Energy Efficient Ethernet           | TX and RX LPI, RMII   | 2                    | 17              | 6                 | 83               |
| <b>3.3-V AVD/CT AND 1.8-V VDDIO</b> |   |                      |                 |                   |                  |
| 100BASE-TX                          | MII, Link-Up, No Traffic  | 22                   | 36              | 10                | 209              |
|                                     | MII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets          | 22                   | 36              | 12                | 213              |
|                                     | RMII, Link-Up, No Traffic   | 22                   | 36              | 3                 | 197              |
|                                     | RMII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets         | 22                   | 36              | 4                 | 199              |
|                                     | RGMII, Link-Up, No Traffic  | 22                   | 36              | 5                 | 200              |
|                                     | RGMII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets        | 22                   | 36              | 5                 | 200              |
| 10BASE-Te                           | MII, Link-Up, No Traffic  | 2                    | 18              | 4                 | 73               |
|                                     | MII, Link-Up, 960ns IPG (100% Utilization), 1514-byte Packets           | 49                   | 18              | 4                 | 228              |
|                                     | RMII, Link-Up, No Traffic   | 2                    | 18              | 3                 | 71               |
|                                     | RMII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets         | 49                   | 18              | 3                 | 227              |
|                                     | RGMII, Link-Up, No Traffic  | 2                    | 18              | 4                 | 73               |
|                                     | RGMII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets        | 49                   | 18              | 4                 | 228              |

**表 10-1. Power Supply Characteristics<sup>(1)</sup> (continued)**

| PARAMETER                 | TEST CONDITIONS   | MAGNETIC SUPPLY (mA) | AVD SUPPLY (mA) | VDDIO SUPPLY (mA) | TOTAL POWER (mW) |
|---------------------------|---|----------------------|-----------------|-------------------|------------------|
| Passive Sleep             | RMII, bits[15:12] = 0b0111 in register 0x0011                           | 2                    | 16              | 3                 | 65               |
| Active Sleep              | RMII, bits[15:12] = 0b0110 in register 0x0011                           | 2                    | 16              | 3                 | 65               |
| IEEE Power Down           | RMII, bits[11] = 1 in register 0x0000                                   | 2                    | 4               | 3                 | 25               |
| Deep Power Down           | RMII, bits[11] = 1 in register 0x0000 and bit[2] = 1 in register 0x0428 | 2                    | 3               | 3                 | 22               |
| Energy Efficient Ethernet | TX and RX LPI, RMII   | 2                    | 17              | 3                 | 68               |

**表 10-1. Power Supply Characteristics<sup>(1)</sup> (continued)**

| PARAMETER                           | TEST CONDITIONS   | MAGNETIC SUPPLY (mA) | AVD SUPPLY (mA) | VDDIO SUPPLY (mA) | TOTAL POWER (mW) |
|-------------------------------------|---|----------------------|-----------------|-------------------|------------------|
| <b>1.8-V AVD/CT AND 3.3-V VDDIO</b> |   |                      |                 |                   |                  |
| 100BASE-TX                          | MII, Link-Up, No Traffic  | 22                   | 36              | 15                | 154              |
|                                     | MII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets          | 22                   | 36              | 21                | 174              |
|                                     | RMII, Link-Up, No Traffic   | 22                   | 36              | 6                 | 124              |
|                                     | RMII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets         | 22                   | 36              | 7                 | 128              |
|                                     | RGMII, Link-Up, No Traffic  | 22                   | 36              | 8                 | 131              |
|                                     | RGMII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets        | 22                   | 36              | 9                 | 134              |
| 10BASE-Te                           | MII, Link-Up, No Traffic  | 1                    | 17              | 7                 | 56               |
|                                     | MII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets          | 49                   | 17              | 7                 | 142              |
|                                     | RMII, Link-Up, No Traffic   | 1                    | 17              | 6                 | 52               |
|                                     | RMII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets         | 49                   | 17              | 6                 | 139              |
|                                     | RGMII, Link-Up, No Traffic  | 1                    | 17              | 7                 | 56               |
|                                     | RGMII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets        | 49                   | 17              | 7                 | 142              |
| Passive Sleep                       | RMII, bits[15:12] = 0b0111 in register 0x0011                           | 1                    | 16              | 6                 | 50               |
| Active Sleep                        | RMII, bits[15:12] = 0b0110 in register 0x0011                           | 1                    | 16              | 6                 | 50               |
| IEEE Power Down                     | RMII, bits[11] = 1 in register 0x0000                                   | 1                    | 4               | 6                 | 29               |
| Deep Power Down                     | RMII, bits[11] = 1 in register 0x0000 and bit[2] = 1 in register 0x0428 | 1                    | 3               | 6                 | 27               |
| Energy Efficient Ethernet           | TX and RX LPI, RMII   | 1                    | 17              | 6                 | 52               |

**表 10-1. Power Supply Characteristics<sup>(1)</sup> (continued)**

| PARAMETER                           | TEST CONDITIONS   | MAGNETIC SUPPLY (mA) | AVD SUPPLY (mA) | VDDIO SUPPLY (mA) | TOTAL POWER (mW) |
|-------------------------------------|---|----------------------|-----------------|-------------------|------------------|
| <b>1.8-V AVD/CT AND 1.8-V VDDIO</b> |   |                      |                 |                   |                  |
| 100BASE-TX                          | MII, Link-Up, No Traffic  | 22                   | 36              | 10                | 122              |
|                                     | MII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets          | 22                   | 36              | 12                | 126              |
|                                     | RMII, Link-Up, No Traffic   | 22                   | 36              | 3                 | 110              |
|                                     | RMII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets         | 22                   | 36              | 4                 | 112              |
|                                     | RGMII, Link-Up, No Traffic  | 22                   | 36              | 5                 | 113              |
|                                     | RGMII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets        | 22                   | 36              | 5                 | 113              |
| 10BASE-Te                           | MII, Link-Up, No Traffic  | 1                    | 17              | 4                 | 40               |
|                                     | MII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets          | 49                   | 17              | 4                 | 126              |
|                                     | RMII, Link-Up, No Traffic   | 1                    | 17              | 3                 | 38               |
|                                     | RMII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets         | 49                   | 17              | 3                 | 124              |
|                                     | RGMII, Link-Up, No Traffic  | 1                    | 17              | 4                 | 40               |
|                                     | RGMII, Link-Up, 960-ns IPG (100% Utilization), 1514-byte Packets        | 49                   | 17              | 4                 | 126              |
| Passive Sleep                       | RMII, bits[15:12] = 0b0111 in register 0x0011                           | 1                    | 16              | 3                 | 36               |
| Active Sleep                        | RMII, bits[15:12] = 0b0110 in register 0x0011                           | 1                    | 16              | 3                 | 36               |
| IEEE Power Down                     | RMII, bits[11] = 1 in register 0x0000                                   | 1                    | 4               | 3                 | 14               |
| Deep Power Down                     | RMII, bits[11] = 1 in register 0x0000 and bit[2] = 1 in register 0x0428 | 1                    | 3               | 3                 | 13               |
| Energy Efficient Ethernet           | TX and RX LPI, RMII   | 1                    | 17              | 3                 | 38               |

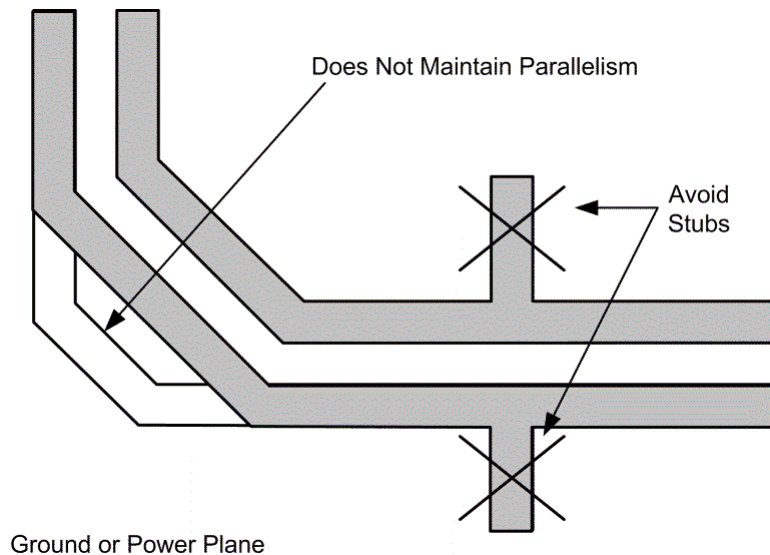
(1) Ensured by production test, characterization, or design.

## 11 Layout

### 11.1 Layout Guidelines

#### 11.1.1 Signal Traces

PCB traces are lossy and long traces can degrade signal quality. Traces should be kept short as possible. Unless mentioned otherwise, all signal traces should be 50- $\Omega$  single-ended impedance. Differential traces should be 50- $\Omega$  single-ended and 100- $\Omega$  differential. Take care to ensure impedance is controlled throughout. Impedance discontinuities will cause reflections leading to emissions and signal integrity issues. Stubs should be avoided on all signal traces, especially differential signal pairs.



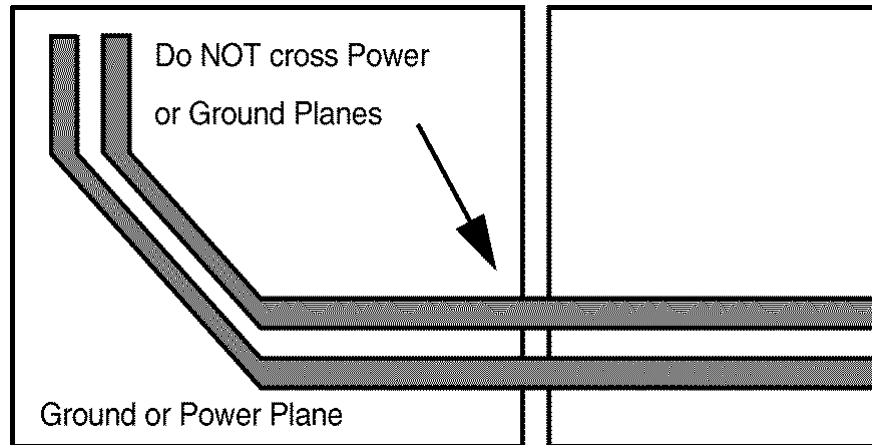
#### ☒ 11-1. Differential Signal Traces

Within the differential pairs, trace lengths should be run parallel to each other and matched in length. Matched lengths minimize delay differences, avoiding an increase in common mode noise and emissions. Length matching is also important for MAC interface connections. All transmit signal traces should be length matched to each other and all receive signal traces should be length matched to each other.

Ideally, there should be no crossover or vias on signal path traces. Vias present impedance discontinuities and should be minimized when possible. Route trace pairs on the same layer. Signals on different layers should not cross each other without at least one return path plane between them. Differential pairs should always have a constant coupling distance between them. For convenience and efficiency, TI recommends routing critical signals first (that is, MDI differential pairs, reference clock, and MAC IF traces).

### 11.1.2 Return Path

A general best practice is to have a solid return path beneath all signal traces. This return path can be a continuous ground or DC power plane. Reducing the width of the return path can potentially affect the impedance of the signal trace. This effect is more prominent when the width of the return path is comparable to the width of the signal trace. Breaks in return path between the signal traces should be avoided at all cost. A signal crossing a split plane may cause unpredictable return path currents and could impact signal quality and result in emissions issues.



☒ 11-2. Differential Signal Pair and Plane Crossing



### 11.1.3 Transformer Layout

There must be no metal layer running beneath the transformer. Transformers can inject noise into metal beneath them, which can affect the performance of the system. Because the DP83822 is a current mode line driver design, the center tap pin on the device side of the transformer must be tied to the analog supply rail (AVD). Decoupling capacitors must be placed near the center tap pin of the transformer as shown in [Figure 9-2](#).

#### 11.1.3.1 Transformer Recommendations

The following magnetics have been tested with the DP83822 using the DP83822EVM.

**表 11-1. Recommended Transformers**

| MANUFACTURER      | PART NUMBER |
|-------------------|-------------|
| Pulse Electronics | HX1198FNL   |
|                   | HX1188NL    |
|                   | HX1188FNL   |
|                   | H2019NL     |
|                   | H1102NL     |
| Abracon           | ALAN101     |
| Bel Fuse          | S5585999J1F |
| Sumida            | CLP0612     |
| Würth Electronics | 7490120110  |
|                   | 733330      |
|                   | 7490100111a |

**表 11-2. Transformer Electrical Specifications**

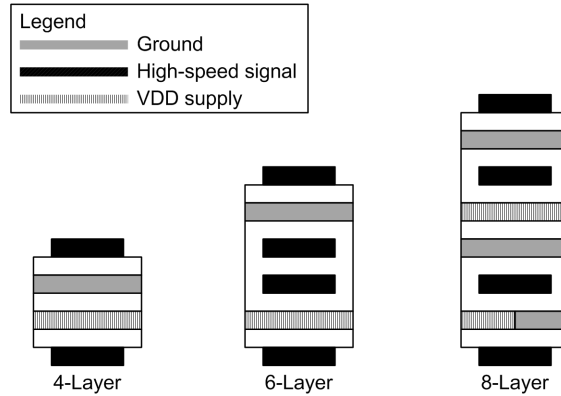
| PARAMETER                              | TEST CONDITIONS | TYP  | UNIT |
|--|-----------------|------|------|
| Turn Ratio                             | ±2%             | 1:1  | -    |
| Insertion Loss                         | 1 - 100 MHz     | -1   | dB   |
| Return Loss                            | 1 - 30 MHz      | -16  | dB   |
|  | 30 - 60 MHz     | -12  | dB   |
|  | 60 - 80 MHz     | -10  | dB   |
| Differential to Common Rejection Ratio | 1 - 50 MHz      | -30  | dB   |
|  | 50 - 150 MHz    | -20  | dB   |
| Crosstalk                              | 30 MHz          | -35  | dB   |
|  | 60 MHz          | -30  | dB   |
| Isolation                              | HPOT            | 1500 | Vrms |

### 11.1.4 Metal Pour

All metal pours that are not signals or power must be tied to ground. There must be no floating metal in the system, and there must be no metal between differential traces.

### 11.1.5 PCB Layer Stacking

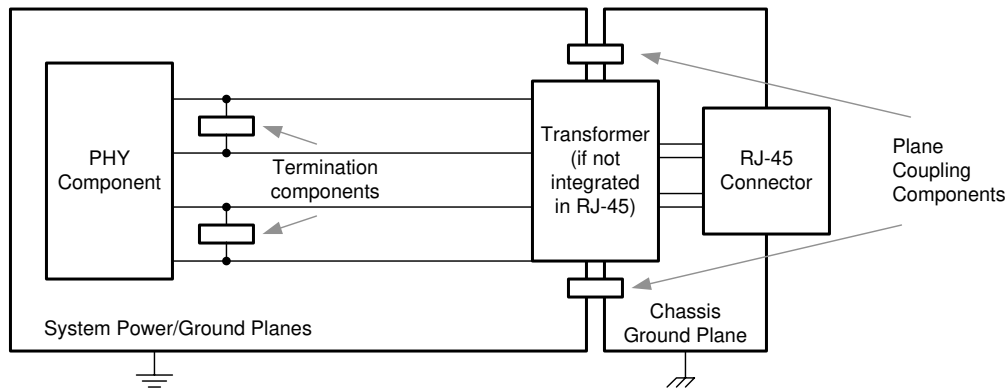
To meet signal integrity and performance requirements, a minimum four-layer PCB is recommended. However, a six-layer PCB should be used when possible.



☒ 11-3. Recommended Layer Stack-Up

## 11.2 Layout Example

See the DP83822EVM for more information regarding layout.



☒ 11-4. Layout Example

## 12 Device and Documentation Support

### 12.1 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

表 12-1. Related Links

| PARTS     | PRODUCT FOLDER             | ORDER NOW                  | TECHNICAL DOCUMENTS        | TOOLS & SOFTWARE           | SUPPORT & COMMUNITY        |
|-----------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| DP83822HF | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |
| DP83822IF | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |
| DP83822H  | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |
| DP83822I  | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |

#### 注

These devices can not be differentiated by register reads. These devices are distinguished by production tests of the corresponding functionalities.

### 12.2 ドキュメントの更新通知を受け取る方法

ドキュメントの更新についての通知を受け取るには、[ti.com](#) のデバイス製品フォルダを開いてください。「更新の通知を受け取る」をクリックして登録すると、変更されたすべての製品情報に関するダイジェストを毎週受け取れます。変更の詳細については、修正されたドキュメントに含まれている改訂履歴をご覧ください。

### 12.3 サポート・リソース

[TI E2E™ サポート・フォーラム](#)は、エンジニアが検証済みの回答と設計に関するヒントをエキスパートから迅速かつ直接得ることができる場所です。既存の回答を検索したり、独自の質問をしたりすることで、設計に必要な支援を迅速に得ることができます。

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### 12.4 Trademarks

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ESD による破損は、わずかな性能低下からデバイスの完全な故障まで多岐にわたります。精密な IC の場合、パラメータがわずかに変化するだけで公表されている仕様から外れる可能性があるため、破損が発生しやすくなっています。

### 12.6 用語集

[テキサス・インスツルメンツ用語集](#)

この用語集には、用語や略語の一覧および定義が記載されています。

## 13 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

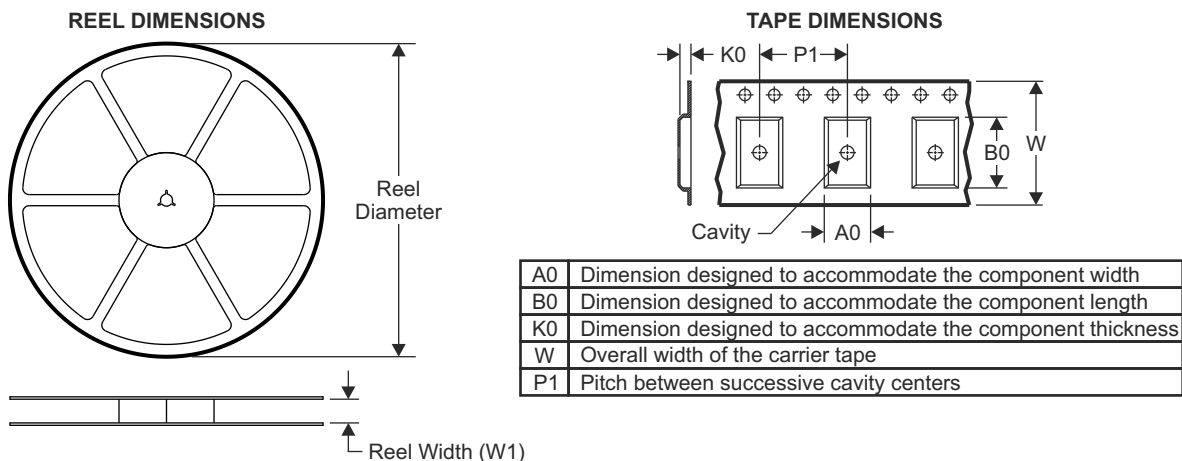
## 13.1 Package Option Addendum

### 13.1.1 Packaging Information

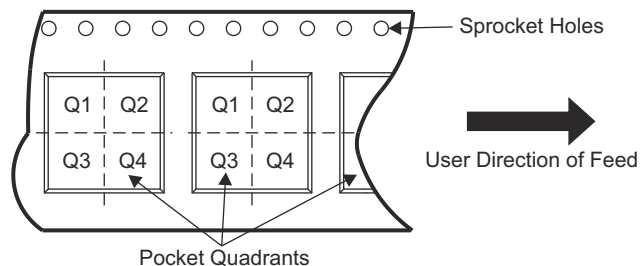
| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> | Op Temp (°C) | Device Marking <sup>(4) (5)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|--------------|-----------------------------------|
| DP83822HFRHBR    | ACTIVE                | VQFN         | RHB             | 32   | 3000        | RoHS & Green            | NIPDAU           | Level-2-260C-1 YEAR          | -40 to 125   | 822HF                             |
| DP83822HFRHBT    | ACTIVE                | VQFN         | RHB             | 32   | 250         | RoHS & Green            | NIPDAU           | Level-2-260C-1 YEAR          | -40 to 125   | 822HF                             |
| DP83822HRHBR     | ACTIVE                | VQFN         | RHB             | 32   | 3000        | RoHS & Green            | NIPDAU           | Level-2-260C-1 YEAR          | -40 to 125   | 822H                              |
| DP83822HRHBT     | ACTIVE                | VQFN         | RHB             | 32   | 250         | RoHS & Green            | NIPDAU           | Level-2-260C-1 YEAR          | -40 to 125   | 822H                              |
| DP83822IFRHBR    | ACTIVE                | VQFN         | RHB             | 32   | 3000        | RoHS & Green            | NIPDAU           | Level-2-260C-1 YEAR          | -40 to 85    | 822IF                             |
| DP83822IFRHBT    | ACTIVE                | VQFN         | RHB             | 32   | 250         | RoHS & Green            | NIPDAU           | Level-2-260C-1 YEAR          | -40 to 85    | 822IF                             |
| DP83822IRHBR     | ACTIVE                | VQFN         | RHB             | 32   | 3000        | RoHS & Green            | NIPDAU           | Level-2-260C-1 YEAR          | -40 to 85    | 822I                              |
| DP83822IRHBT     | ACTIVE                | VQFN         | RHB             | 32   | 250         | RoHS & Green            | NIPDAU           | Level-2-260C-1 YEAR          | -40 to 85    | 822I                              |

- (1) The marketing status values are defined as follows:  
**ACTIVE:** Product device recommended for new designs.  
**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.  
**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.  
**PRE\_PROD** Unannounced device, not in production, not available for mass market, nor on the web, samples not available.  
**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.  
**OBSOLETE:** TI has discontinued the production of the device.
- (2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.  
**TBD:** The Pb-Free/Green conversion plan has not been defined.  
**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.  
**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.  
**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)
- (3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.
- (4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device
- (5) Multiple Device markings will be inside parentheses. Only on Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.  
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### 13.1.2 Tape and Reel Information

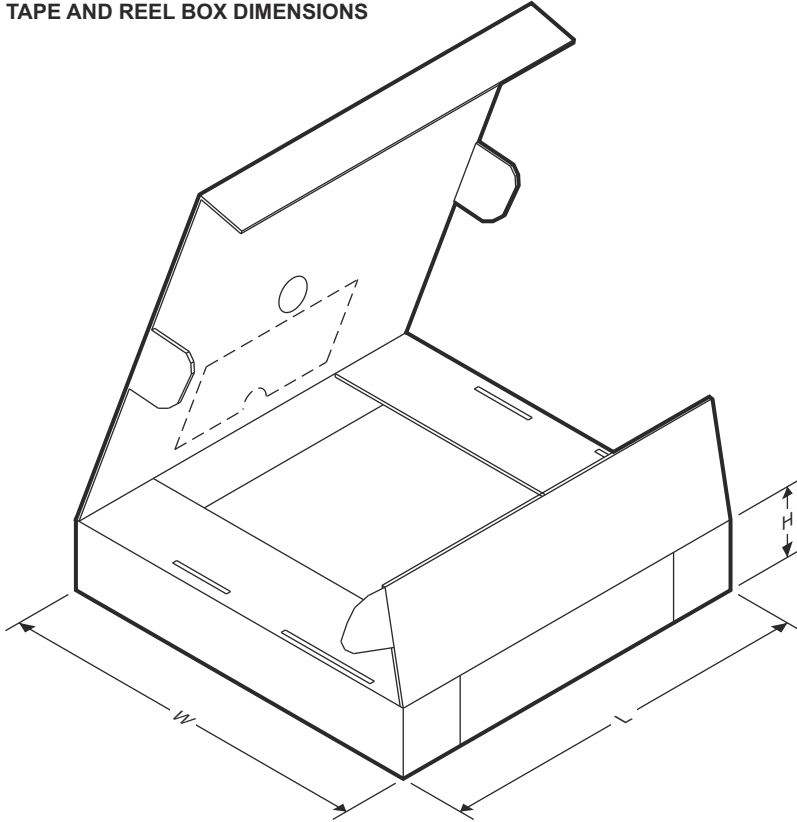


#### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



| Device        | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| DP83822HFRHBR | VQFN         | RHB             | 32   | 3000 | 330.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822HFRHBT | VQFN         | RHB             | 32   | 250  | 178.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822HRHBR  | VQFN         | RHB             | 32   | 3000 | 330.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822HRHBT  | VQFN         | RHB             | 32   | 250  | 178.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822IFRHBR | VQFN         | RHB             | 32   | 3000 | 330.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822IFRHBT | VQFN         | RHB             | 32   | 250  | 178.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822IRHBR  | VQFN         | RHB             | 32   | 3000 | 330.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822IRHBT  | VQFN         | RHB             | 32   | 250  | 178.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |

**TAPE AND REEL BOX DIMENSIONS**



| Device        | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| DP83822HFRHBR | VQFN         | RHB             | 32   | 3000 | 367.0       | 367.0      | 35.0        |
| DP83822HFRHBT | VQFN         | RHB             | 32   | 250  | 210.0       | 185.0      | 35.0        |
| DP83822HRHBR  | VQFN         | RHB             | 32   | 3000 | 367.0       | 367.0      | 35.0        |
| DP83822HRHBT  | VQFN         | RHB             | 32   | 250  | 213.0       | 191.0      | 55.0        |
| DP83822IFRHBR | VQFN         | RHB             | 32   | 3000 | 367.0       | 367.0      | 35.0        |
| DP83822IFRHBT | VQFN         | RHB             | 32   | 250  | 213.0       | 191.0      | 55.0        |
| DP83822IRHBR  | VQFN         | RHB             | 32   | 3000 | 367.0       | 367.0      | 35.0        |
| DP83822IRHBT  | VQFN         | RHB             | 32   | 250  | 213.0       | 191.0      | 55.0        |



**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| DP83822HFRHBR    | ACTIVE        | VQFN         | RHB             | 32   | 3000        | RoHS & Green    | NIPDAU                               | Level-2-260C-1 YEAR  | -40 to 125   | 822HF                   | <a href="#">Samples</a> |
| DP83822HFRHBT    | ACTIVE        | VQFN         | RHB             | 32   | 250         | RoHS & Green    | NIPDAU                               | Level-2-260C-1 YEAR  | -40 to 125   | 822HF                   | <a href="#">Samples</a> |
| DP83822HRHBR     | ACTIVE        | VQFN         | RHB             | 32   | 3000        | RoHS & Green    | NIPDAU                               | Level-2-260C-1 YEAR  | -40 to 125   | 822H                    | <a href="#">Samples</a> |
| DP83822HRHBT     | ACTIVE        | VQFN         | RHB             | 32   | 250         | RoHS & Green    | NIPDAU                               | Level-2-260C-1 YEAR  | -40 to 125   | 822H                    | <a href="#">Samples</a> |
| DP83822IFRHBR    | ACTIVE        | VQFN         | RHB             | 32   | 3000        | RoHS & Green    | NIPDAU                               | Level-2-260C-1 YEAR  | -40 to 85    | 822IF                   | <a href="#">Samples</a> |
| DP83822IFRHBT    | ACTIVE        | VQFN         | RHB             | 32   | 250         | RoHS & Green    | NIPDAU                               | Level-2-260C-1 YEAR  | -40 to 85    | 822IF                   | <a href="#">Samples</a> |
| DP83822IRHBR     | ACTIVE        | VQFN         | RHB             | 32   | 3000        | RoHS & Green    | NIPDAU                               | Level-2-260C-1 YEAR  | -40 to 85    | 822I                    | <a href="#">Samples</a> |
| DP83822IRHBT     | ACTIVE        | VQFN         | RHB             | 32   | 250         | RoHS & Green    | NIPDAU                               | Level-2-260C-1 YEAR  | -40 to 85    | 822I                    | <a href="#">Samples</a> |

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

<sup>(6)</sup> Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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## TAPE AND REEL INFORMATION



### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| DP83822HFRHBR | VQFN         | RHB             | 32   | 3000 | 330.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822HFRHBR | VQFN         | RHB             | 32   | 3000 | 330.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822HFRHBT | VQFN         | RHB             | 32   | 250  | 180.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822HFRHBT | VQFN         | RHB             | 32   | 250  | 180.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822HRHBR  | VQFN         | RHB             | 32   | 3000 | 330.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822HRHBR  | VQFN         | RHB             | 32   | 3000 | 330.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822HRHBT  | VQFN         | RHB             | 32   | 250  | 180.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822HRHBT  | VQFN         | RHB             | 32   | 250  | 180.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822IFRHBR | VQFN         | RHB             | 32   | 3000 | 330.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822IFRHBR | VQFN         | RHB             | 32   | 3000 | 330.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822IFRHBT | VQFN         | RHB             | 32   | 250  | 180.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822IFRHBT | VQFN         | RHB             | 32   | 250  | 180.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822IRHBR  | VQFN         | RHB             | 32   | 3000 | 330.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822IRHBR  | VQFN         | RHB             | 32   | 3000 | 330.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822IRHBT  | VQFN         | RHB             | 32   | 250  | 180.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |
| DP83822IRHBT  | VQFN         | RHB             | 32   | 250  | 180.0              | 12.4               | 5.3     | 5.3     | 1.1     | 8.0     | 12.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device        | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|---------------|--------------|-----------------|------|------|-------------|------------|-------------|
| DP83822HFRHBR | VQFN         | RHB             | 32   | 3000 | 367.0       | 367.0      | 35.0        |
| DP83822HFRHBR | VQFN         | RHB             | 32   | 3000 | 346.0       | 346.0      | 33.0        |
| DP83822HFRHBT | VQFN         | RHB             | 32   | 250  | 210.0       | 185.0      | 35.0        |
| DP83822HFRHBT | VQFN         | RHB             | 32   | 250  | 210.0       | 185.0      | 35.0        |
| DP83822HRHBR  | VQFN         | RHB             | 32   | 3000 | 367.0       | 367.0      | 35.0        |
| DP83822HRHBR  | VQFN         | RHB             | 32   | 3000 | 346.0       | 346.0      | 33.0        |
| DP83822HRHBT  | VQFN         | RHB             | 32   | 250  | 210.0       | 185.0      | 35.0        |
| DP83822HRHBT  | VQFN         | RHB             | 32   | 250  | 210.0       | 185.0      | 35.0        |
| DP83822IFRHBR | VQFN         | RHB             | 32   | 3000 | 346.0       | 346.0      | 33.0        |
| DP83822IFRHBR | VQFN         | RHB             | 32   | 3000 | 367.0       | 367.0      | 35.0        |
| DP83822IFRHBT | VQFN         | RHB             | 32   | 250  | 210.0       | 185.0      | 35.0        |
| DP83822IFRHBT | VQFN         | RHB             | 32   | 250  | 210.0       | 185.0      | 35.0        |
| DP83822IRHBR  | VQFN         | RHB             | 32   | 3000 | 367.0       | 367.0      | 35.0        |
| DP83822IRHBR  | VQFN         | RHB             | 32   | 3000 | 346.0       | 346.0      | 33.0        |
| DP83822IRHBT  | VQFN         | RHB             | 32   | 250  | 210.0       | 185.0      | 35.0        |
| DP83822IRHBT  | VQFN         | RHB             | 32   | 250  | 210.0       | 185.0      | 35.0        |

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