

TMAG5131-Q1 車載用、低消費電力、高精度、ホール効果スイッチ

1 特長

- 車載アプリケーション用に AEC-Q100 認定済み:
 - 温度グレード 1: $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$, T_A
- Z 軸ホール効果スイッチ
- 非常に低い消費電力 (標準値 $I_{CC(AVG)}$):
 - 10Hz バージョン: 3V で $1.25\mu\text{A}$
 - 20Hz バージョン: 3V で $1.37\mu\text{A}$
- 動作 V_{CC} 範囲: $1.65\text{V} \sim 5.5\text{V}$
- 高精度磁気スレッシュホールド (標準値 B_{OP}):
 - 1.8mT , 0.6mT のヒステリシス
 - 3mT , 1.2mT または 1.5mT のヒステリシス
 - 15mT , 6.5mT のヒステリシス
 - 37mT , 7mT のヒステリシス
- オムニポーラまたはユニポーラの磁気応答
- プッシュプルまたはオープンドレインの出力オプション
- アクティブ LOW またはアクティブ HIGH の出力オプション
- 業界標準の SOT-23 (DBZ) パッケージ

2 アプリケーション

- ドア ハンドルと E ラッチ
- ステアリング コラム シフトレバー
- バイザー、バニティミラー、またはグローブ ボックスの照明
- トランク開閉センサー
- ワイパー モーター位置センサ
- ブレーキ ペダルまたはリア ライト アクチュエータ
- サンルーフおよびテールゲート
- パワー シートおよびロッカー スイッチ
- 車載ボディ モーターの位置フィードバック

3 概要

TMAG5131-Q1 は、低消費電力、高精度のホール効果センサで、最もコンパクトでバッテリー駆動が重要な車載アプリケーション向けに設計されています。このデバイスは、各種のアプリケーションに適合できるように、複数の磁気スレッシュホールド、サンプリング レート、出力タイプで提供されます。

印加されている磁束密度が動作ポイント (B_{OP}) のスレッシュホールドを超えると、LOW 電圧を出力します (アクティブ LOW バージョンの場合)。出力は、磁束密度がリリースポイント (B_{RP}) より低下するまで LOW 電圧のまま維持され、その後は HIGH 電圧が出力されます。アクティブ HIGH バージョンでは、出力 (LOW/HIGH) の動作が反転します。オムニポーラ磁気応答では、デバイスの出力は、パッケージ Z 軸の正方向および負方向の磁束に対して反応しますが、ユニポーラ バージョンは正方向の磁束に対してのみ反応します。

TMAG5131-Q1 は内部で電源のオン / オフの切り替えを行い、低い消費電流で動作します。3V のとき、10Hz バージョンの平均消費電流は $1.25\mu\text{A}$ 、20Hz バージョンの平均消費電流は $1.37\mu\text{A}$ です。

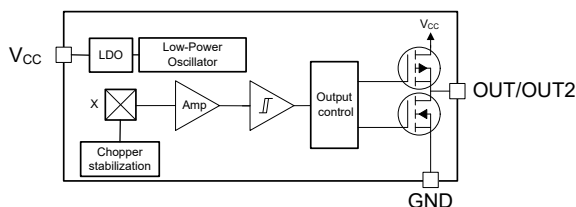
TMAG5131-Q1 は、業界標準の SOT-23 パッケージおよびピン配置で供給されます。

$1.65\text{V} \sim 5.5\text{V}$ の V_{CC} 範囲および $-40^{\circ}\text{C} \sim 125^{\circ}\text{C}$ の拡張温度範囲で動作します。

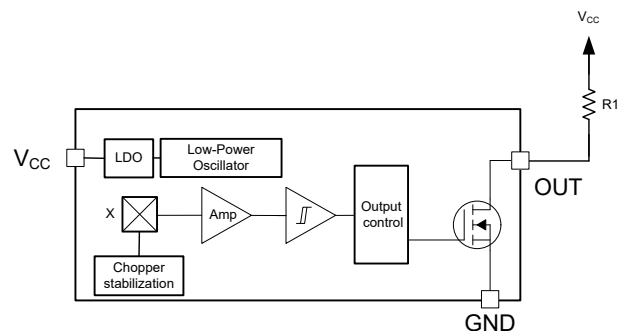
パッケージ情報

部品番号	パッケージ (1) (2)	パッケージ サイズ(3)
TMAG5131-Q1	DBZ (SOT-23, 3)	2.92mm × 2.37mm

- 利用可能なすべての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。
- 「製品比表」表を参照してください。
- パッケージ サイズ (長さ × 幅) は公称値で、該当する場合はピンも含まれます。



ブロック図 (プッシュプル)



ブロック図 (オープン ドレイン)



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4 Device Comparison

表 4-1. Device Comparison

VERSION	TYPICAL B _{OP} THRESHOLD	TYPICAL HYSTERESIS	MAGNETIC RESPONSE	OUTPUT TYPE	SENSOR ORIENTATION	SAMPLING RATE	PACKAGES AVAILABLE
TMAG5131A1C	1.8mT	0.6mT	Omnipolar Active Low	Push-pull	Z	10Hz	SOT-23
TMAG5131C1D	3mT	1.5mT	Omnipolar Active Low	Push-pull	Z	20Hz	SOT-23
TMAG5131C5D	3mT	1.2mT	Unipolar Active High	Push-pull	Z	20Hz	SOT-23
TMAG5131C7D	3mT	1.5mT	Omnipolar Active Low	Open-drain	Z	20Hz	SOT-23
TMAG5131G1D	15mT	6.5mT	Omnipolar Active Low	Push-pull	Z	20Hz	SOT-23
TMAG5131H1D	37mT	7mT	Omnipolar Active Low	Push-pull	Z	20Hz	SOT-23

5 Pin Configuration and Functions

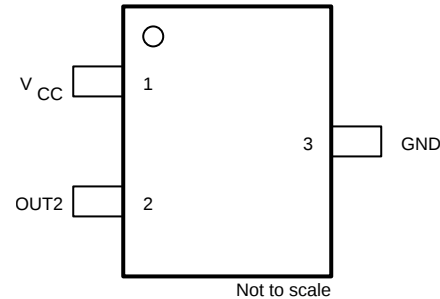
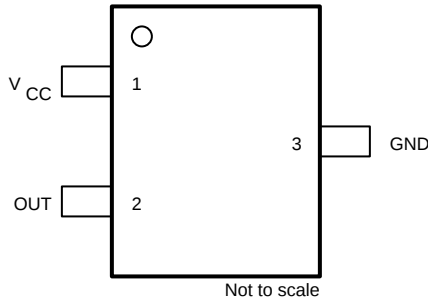


図 5-1. DBZ Package 3-Pin SOT-23 (Top View): A1C, 図 5-2. DBZ Package 3-Pin SOT-23 (Top View): C5D Version
C1D, C7D, G1D, H1D Versions

表 5-1. Pin Functions

NAME	PIN		TYPE ⁽¹⁾	DESCRIPTION
	SOT-23 (A1C, C1D, C7D, G1D, H1D)	SOT-23 (C5D)		
V _{CC}	1	1	—	1.65V to 5.5V power supply. TI recommends connecting this pin to a ceramic capacitor to ground with a value of at least 0.1µF.
OUT	2		O	Omnipolar output that responds to north and south magnetic poles near the top of the package
OUT2		2	O	Unipolar output that responds to south magnetic poles near the top of the package
GND	3	3	—	Ground reference

(1) O = output

6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

		MIN	MAX	UNIT
Power supply voltage	V _{CC}	-0.3	5.5	V
Output pin voltage	OUT, OUT2	GND - 0.3	V _{CC} + 0.3	V
Output pin current	OUT, OUT2	-5	5	mA
Magnetic flux density, B _{MAX}		Unlimited		T
Junction temperature, T _J			150	°C
Storage temperature, T _{stg}		-65	150	°C

- (1) Operation outside the Absolute Maximum Ratings may cause permanent device damage. Absolute Maximum Ratings do not imply functional operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions. If used outside the Recommended Operating Conditions but within the Absolute Maximum Ratings, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.

6.2 ESD Ratings

			VALUE	UNIT
V _(ESD)	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins ⁽¹⁾	±2000	V
		Charged device model (CDM), per ANSI/ESDA/JEDEC JS-002, all pins ⁽²⁾	± 500	

- (1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.
 (2) JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

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

		MIN	MAX	UNIT
V _{CC}	Power supply voltage	1.65	5.5	V
V _O	Output voltage	0	5.5	V
I _O	Output current	-5	5	mA
T _A	Ambient temperature	-40	125	°C

6.4 Thermal Information

THERMAL METRIC ⁽¹⁾		TMAG5131-Q1	UNIT
		SOT-23 (DBZ)	
		3 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	227.4	°C/W
R _{θJC(top)}	Junction-to-case (top) thermal resistance	122.7	°C/W
R _{θJB}	Junction-to-board thermal resistance	61.2	°C/W
Ψ _{JT}	Junction-to-top characterization parameter	21.3	°C/W
Ψ _{JB}	Junction-to-board characterization parameter	60.8	°C/W

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

6.5 Electrical Characteristics

for $V_{CC} = 1.65V$ to $5.5V$, over operating free-air temperature range (unless otherwise noted)

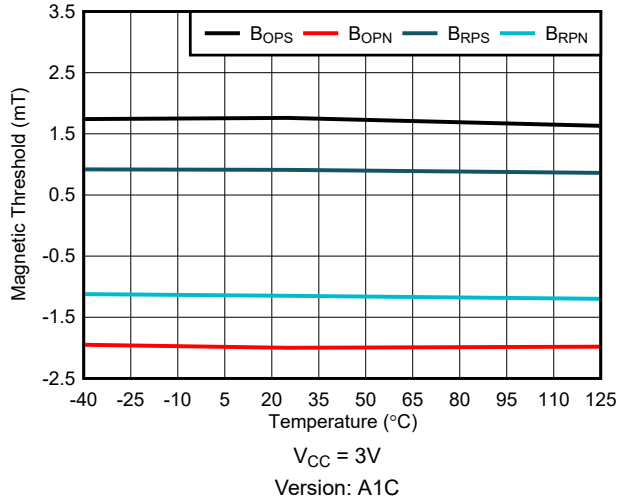
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
OPEN-DRAIN OUTPUT						
I_{OZ}	High impedance output leakage current	$V_{CC} = 5.5V, OUT = 5.5V$		5	100	nA
V_{OL}	Low-level output voltage	$I_{OUT} = 1mA$		0.1	0.3	V
PUSH-PULL OUTPUT DRIVER						
V_{OH}	High-level output voltage	$I_{OUT} = -0.5mA$	$V_{CC}-0.35$	$V_{CC}-0.1$		V
V_{OL}	Low-level output voltage	$I_{OUT} = 0.5mA$		0.1	0.3	V
A1C VERSION						
f_s	Frequency of magnetic sampling		7	10	14.5	Hz
t_s	Period of magnetic sampling		68	100	143	ms
$I_{CC(AVG)}$	Average current consumption	$V_{CC} = 3V$ $T_A = 25^\circ C$		1.25	1.6	μA
		$V_{CC} = 3V$		1.25	2.2	
C1D, C5D, C7D, G1D, H1D VERSIONS						
f_s	Frequency of magnetic sampling		13	20	29	Hz
t_s	Period of magnetic sampling		35	50	77	ms
$I_{CC(AVG)}$	Average current consumption	$V_{CC} = 3V$ $T_A = 25^\circ C$		1.37	2.1	μA
		$V_{CC} = 3V$		1.37	2.7	
ALL VERSIONS						
$I_{CC(PK)}$	Peak current consumption		0.8	1.25	2	mA
$I_{CC(SLP)}$	Sleep current consumption			0.8	1.4	μA
t_{ON}	Power-on time			55	100	μs
t_{ACTIVE}	Active time period		20	30	40	μs

6.6 Magnetic Characteristics

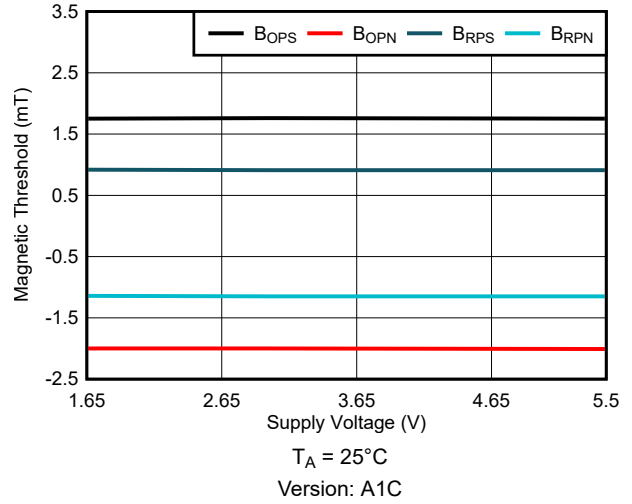
for VCC = 1.65V to 5.5V, over operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
A1C VERSION						
B _{OP}	Magnetic operate point	T _A = 25°C	±1.2	±1.8	±2.5	mT
			±0.9	±1.8	±2.7	
B _{RP}	Magnetic release point	T _A = 25°C	±0.5	±1.2	±1.5	mT
			±0.3	±1.2	±2	
B _{HYS}	Magnetic hysteresis	T _A = 25°C	±0.3	±0.6	±1.4	mT
			±0.2	±0.6	±1.4	
C1D, C7D VERSIONS						
B _{OP}	Magnetic operate point	T _A = 25°C	±2.4	±3	±3.8	mT
			±2	±3	±4	
B _{RP}	Magnetic release point	T _A = 25°C	±0.8	±1.5	±1.9	mT
			±0.5	±1.5	±2.4	
B _{HYS}	Magnetic hysteresis	T _A = 25°C	±1.2	±1.5	±2.4	mT
			±1	±1.5	±2.5	
C5D VERSION						
B _{OP}	Magnetic operate point	T _A = 25°C	2.4	3	3.6	mT
			2	3	3.8	
B _{RP}	Magnetic release point	T _A = 25°C	1.2	1.8	2.3	mT
			1	1.8	2.6	
B _{HYS}	Magnetic hysteresis	T _A = 25°C	0.7	1.2	1.7	mT
			0.6	1.2	2	
G1D Version						
B _{OP}	Magnetic threshold operate point	T _A = 25°C	±12	±15	±18	mT
			±11	±15	±19	
B _{RP}	Magnetic threshold release point	T _A = 25°C	±6.4	±8.5	±10.4	mT
			±6	±8.5	±11	
B _{HYS}	Magnetic hysteresis	T _A = 25°C	±4.5	±6.5	±8.6	mT
			±3.7	±6.5	±9.2	
H1D Version						
B _{OP}	Magnetic threshold operate point	T _A = 25°C	±29	±37	±48	mT
			±28	±37	±49	
B _{RP}	Magnetic threshold release point	T _A = 25°C	±24	±30	±40	mT
			±23	±30	±42	
B _{HYS}	Magnetic hysteresis	T _A = 25°C	±4.7	±7	±10.1	mT
			±4	±7	±11	

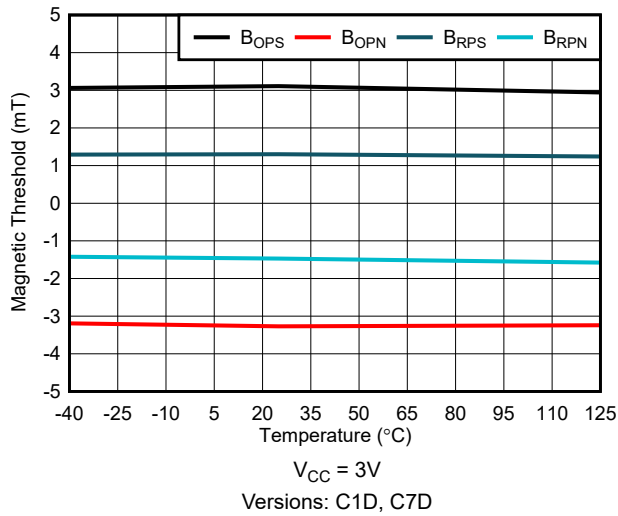
6.7 Typical Characteristics



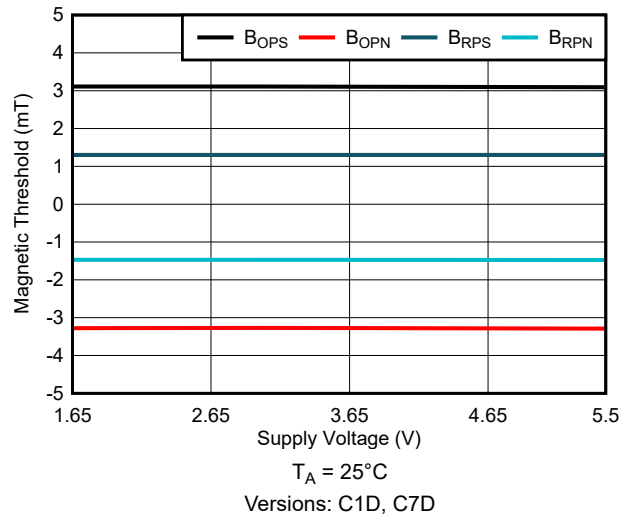
6-1. 1.8mT B_{OP} : Thresholds vs Temperature



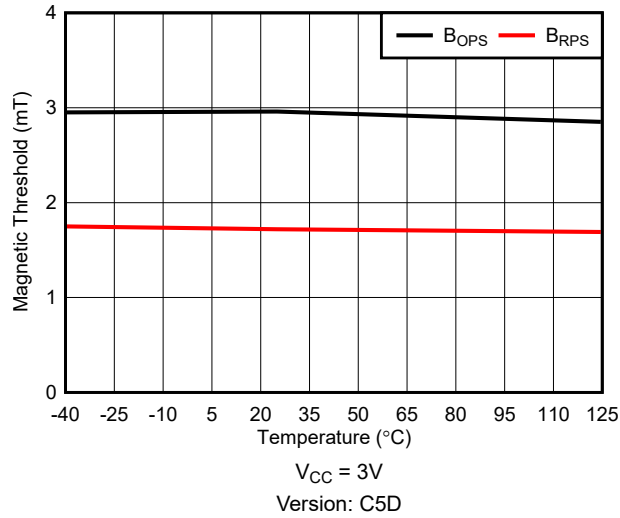
6-2. 1.8mT B_{OP} : Thresholds vs Supply Voltage



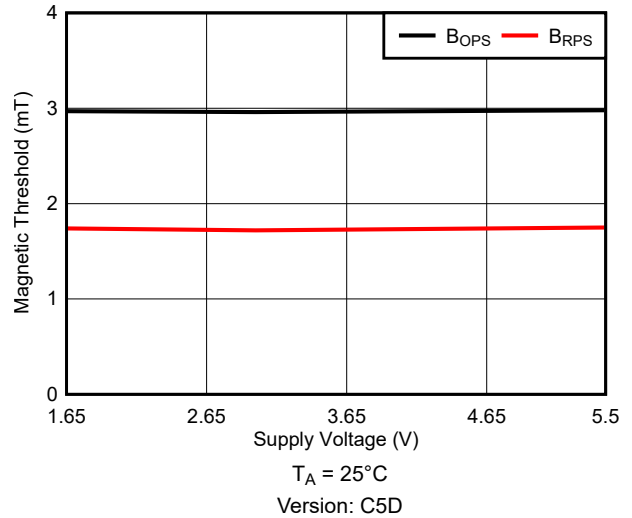
6-3. 3mT B_{OP} , 1.5mT B_{HYS} : Thresholds vs Temperature



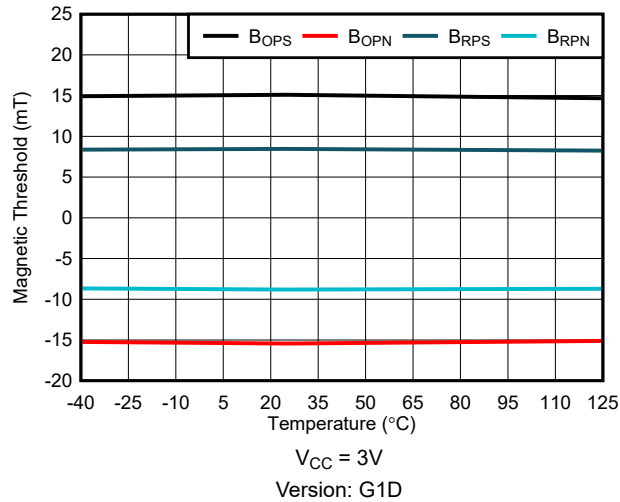
6-4. 3mT B_{OP} , 1.5mT B_{HYS} : Thresholds vs Supply Voltage



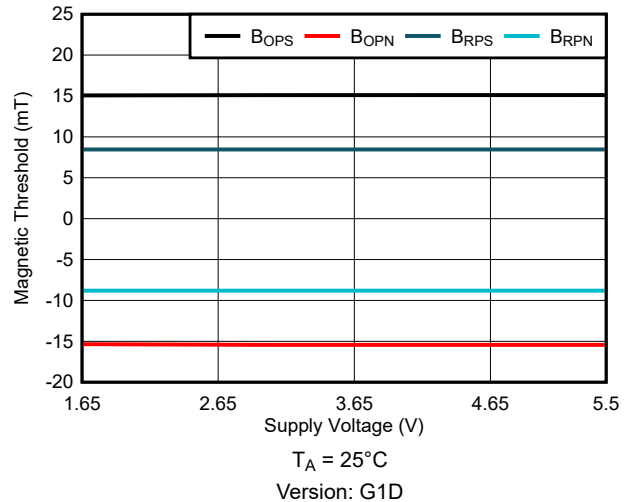
6-5. 3mT B_{OP}, 1.2mT B_{HYS}: Thresholds vs Temperature



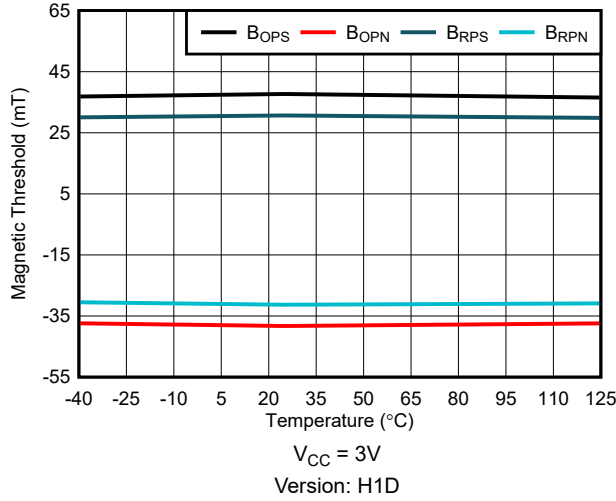
6-6. 3mT B_{OP}, 1.2mT B_{HYS}: Thresholds vs Supply Voltage



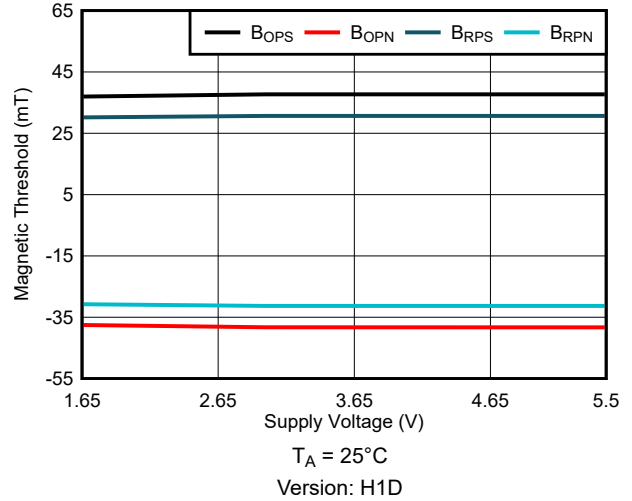
6-7. 15mT B_{OP}: Thresholds vs Temperature



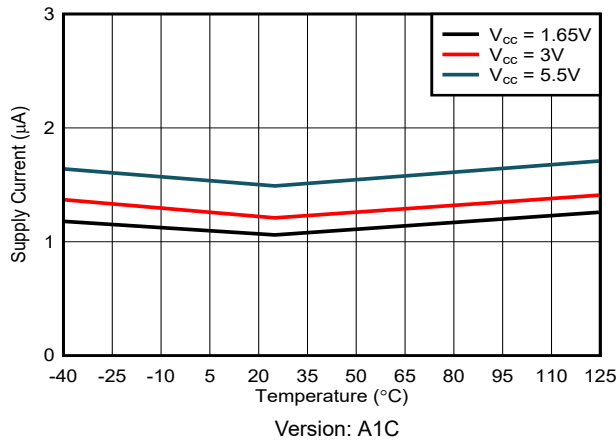
6-8. 15mT B_{OP}: Thresholds vs Supply Voltage



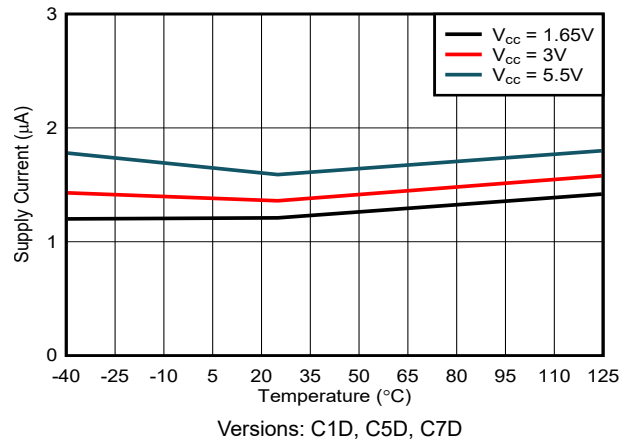
6-9. 37mT B_{Op} : Thresholds vs Temperature



6-10. 37mT B_{Op} : Thresholds vs Supply Voltage



6-11. 10Hz: Average I_{CC} vs Temperature



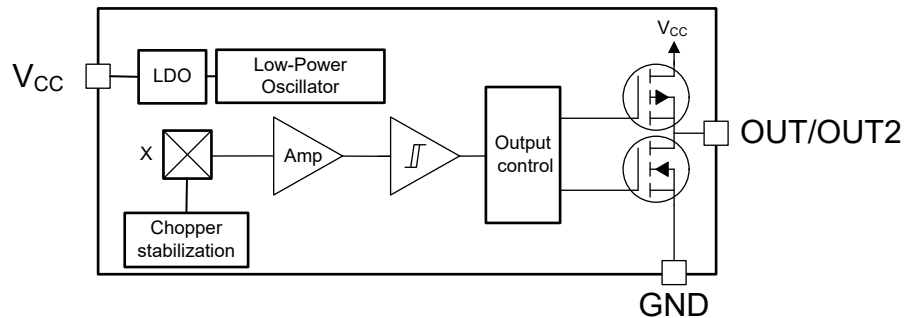
6-12. 20Hz: Average I_{CC} vs Temperature

7 Detailed Description

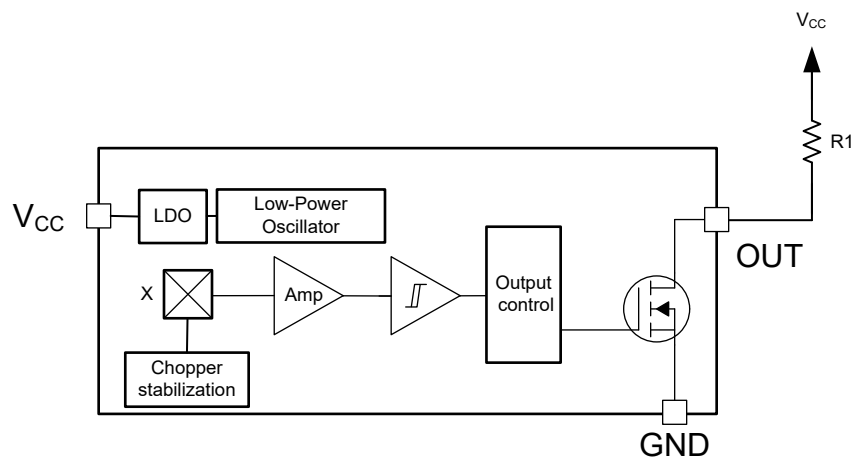
7.1 Overview

The TMAG5131-Q1 device is a Z-axis Hall-effect sensor with a digital output that indicates when the magnetic flux density threshold has been crossed. The output type is available in a push-pull or open-drain configuration, and can be either active-low (outputs low when B_{OP} has been crossed) or active-high (outputs high when B_{OP} has been crossed). The magnetic output response of the device is available as an omnipolar or unipolar switch. The device integrates a Hall-effect element, analog signal conditioning, and a low-frequency oscillator that enables ultra-low power consumption. To achieve this low power consumption, the device periodically measures the magnetic flux density, updates its output, and then enters into a low-power sleep state in between measurements. With a temperature range of -40°C to 125°C and a supply range of 1.65V to 5.5V, the TMAG5131-Q1 is designed for a wide range of applications, including those that require low power operation.

7.2 Functional Block Diagrams




☒ 7-1. Block Diagram (Push-Pull)

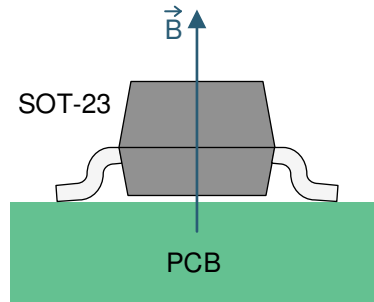


☒ 7-2. Block Diagram (Open-Drain)

7.3 Feature Description

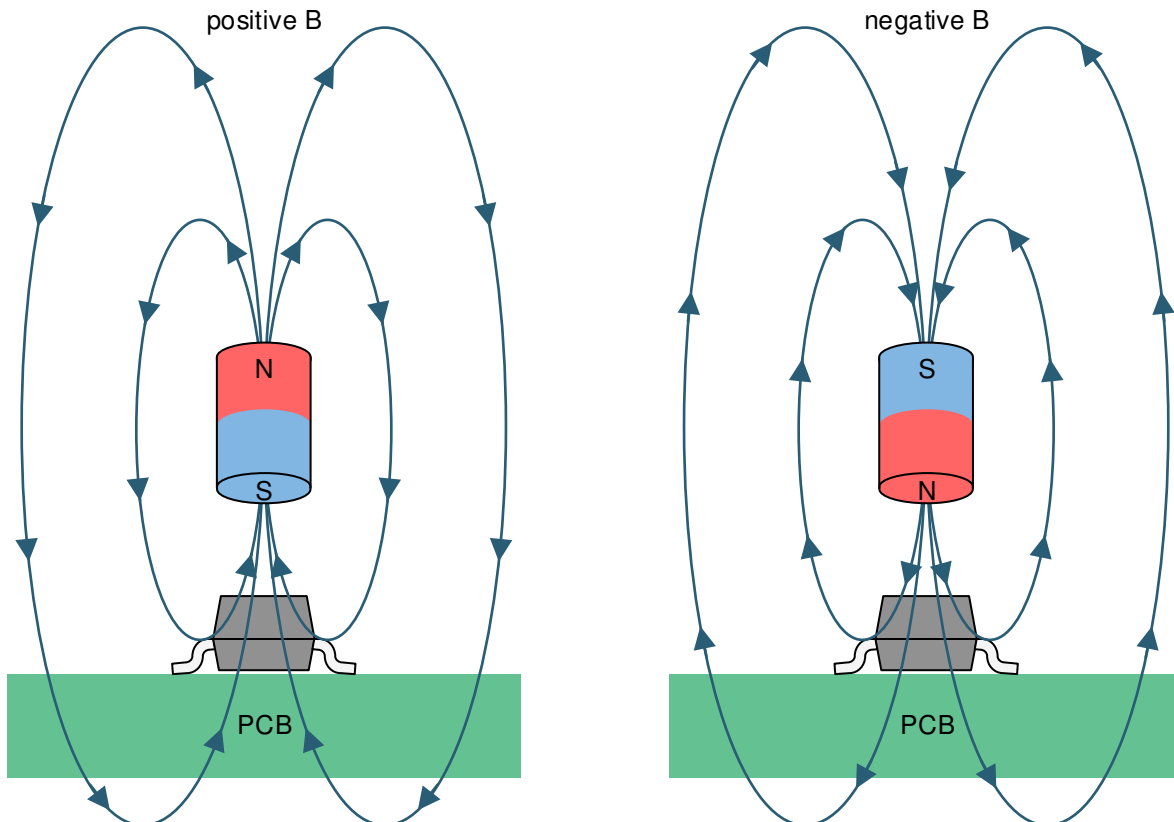
7.3.1 Magnetic Flux Direction

 **7-3** shows that the TMAG5131-Q1 device is sensitive to the magnetic field component that is perpendicular to the top of the package.




 **7-3. Direction of Sensitivity**

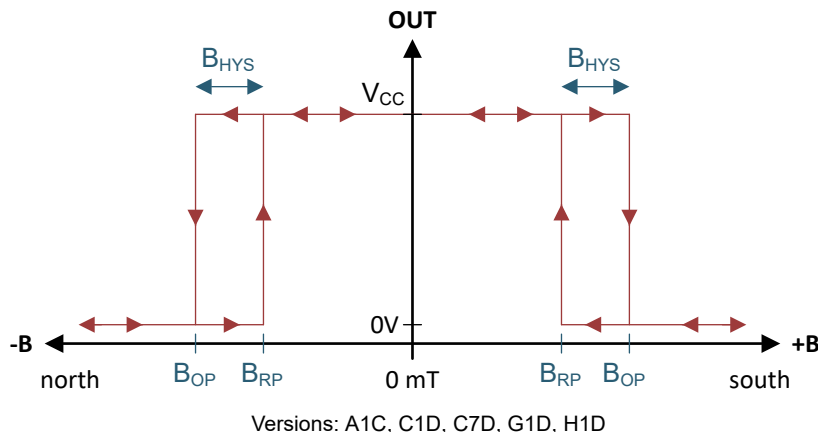
Magnetic flux that travels from the bottom to the top of the package is considered positive in this data sheet. This condition exists when a south magnetic pole is near the top of the package. Magnetic flux that travels from the top to the bottom of the package is considered negative in this data sheet. This condition exists when a north magnetic pole is near the top of the package.




 **7-4. Flux Direction Polarity**

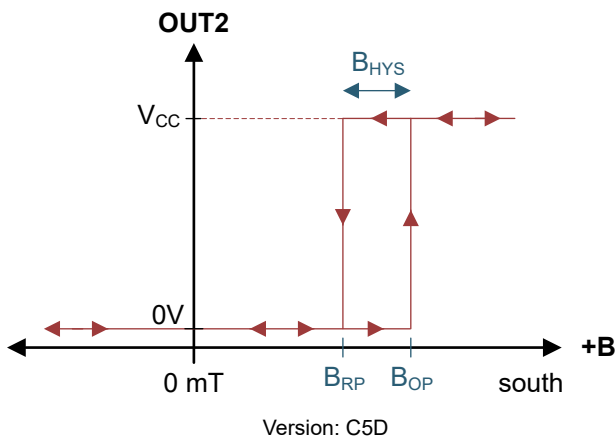
7.3.2 Magnetic Response

The TMAG5131-Q1 A1C, C1D, C7D, G1D, and H1D versions have an omnipolar magnetic response and an active low output.  7-5 shows that the omnipolar output responds to both positive and negative magnetic flux, and goes low when B_{OP} is crossed.



 7-5. Omnipolar Active Low Functionality

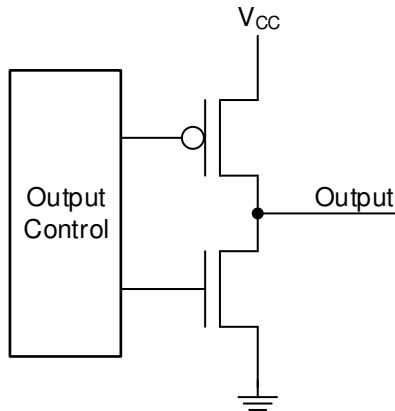
The TMAG5131-Q1 C5D version has a unipolar magnetic response and an active high output.  7-6 shows that the unipolar output responds to a positive magnetic flux, and goes high when B_{OP} is crossed.



 7-6. Unipolar Active High Functionality

7.3.3 Output Type

The TMAG5131-Q1 A1C, C1D, C5D, G1D, and H1D versions have a push-pull CMOS output which can drive a V_{CC} or ground voltage level.

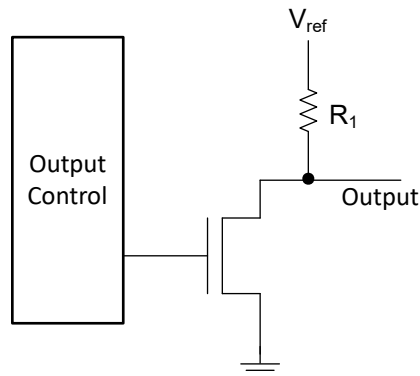


Versions: A1C, C1D, C5D, G1D, H1D

7-7. Push-Pull Output (Simplified)

The C7D version has an open-drain output. For this open-drain output version, an external pullup resistor must be used. Use 式 1 to calculate the minimum resistance value required for this pullup resistor. Use 1mA as the I_{OL} maximum for this device to achieve the V_{OL} maximum specification listed in the data sheet. Generally, TI recommends to use a resistor with a 10k Ω nominal value.

$$R_1 > \frac{V_{ref}}{I_{OL\ max}} \quad (1)$$

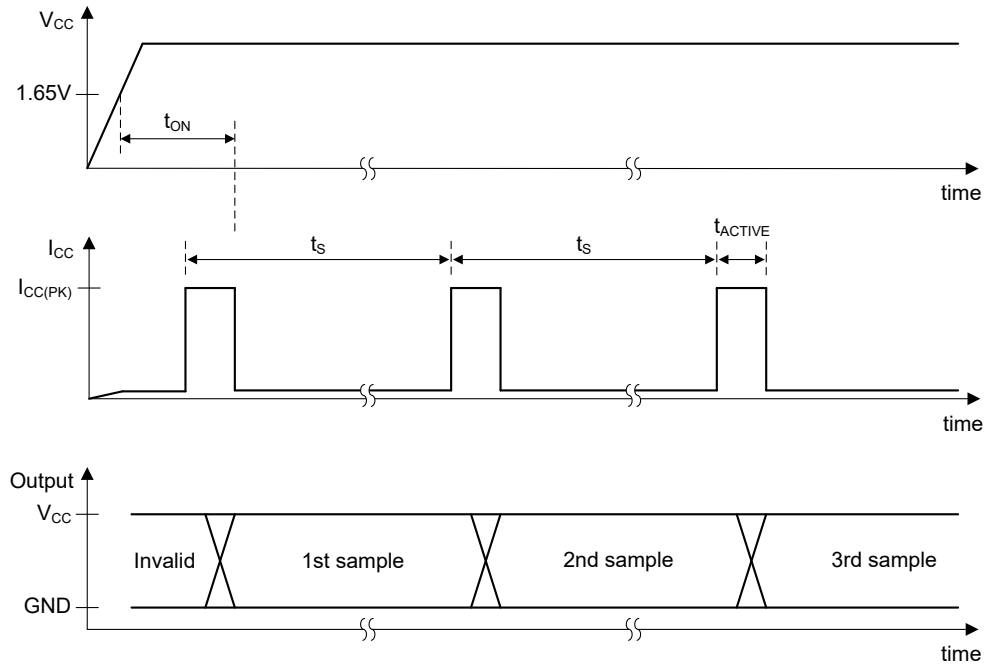


Version: C7D

7-8. Open-Drain Output (Simplified)

7.3.4 Sampling Rate

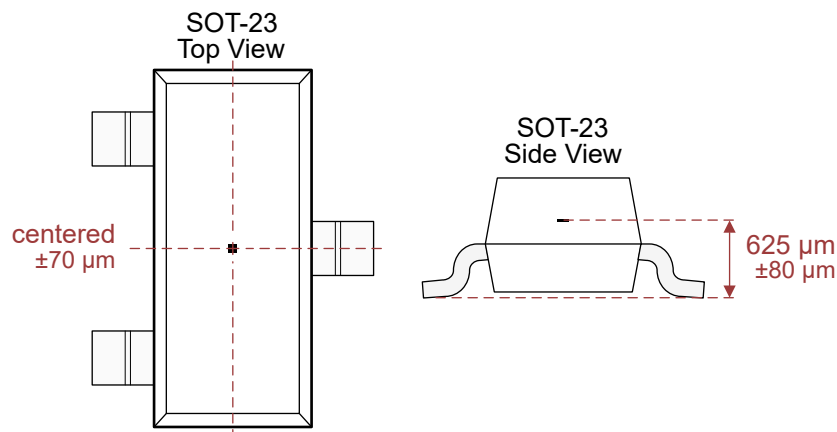
When the TMAG5131-Q1 powers up, the device measures the first magnetic sample and sets the output within the t_{ON} time. The output is latched, and the device enters an ultra low power sleep state. After each t_S time has passed, the device measures a new sample and updates the output if necessary. If the magnetic field has not changed between periods, the output also does not change.



7-9. Timing Diagram

7.3.5 Hall Element Location

The sensing element inside the device is in the center of the SOT-23 package when viewed from the top. 7-10 shows the tolerances and side-view dimensions.



7-10. Hall Element Location

7.4 Device Functional Modes

The TMAG5131-Q1 device has one mode of operation that applies when operated within the *Recommended Operating Conditions*.

8 Application and Implementation

注

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8.1 Application Information

The TMAG5131-Q1 device is typically used to detect the proximity of a magnet. The magnet is often attached to a movable component in the system.

8.1.1 Defining the Design Implementation

The first step of the design is identifying the general design implementation. Define whether the magnet that needs to be detected is sliding past the sensor, moving head-on toward the sensor, or swinging toward the sensor on a hinge. [図 8-1](#) shows examples for each of the aforementioned design implementations.

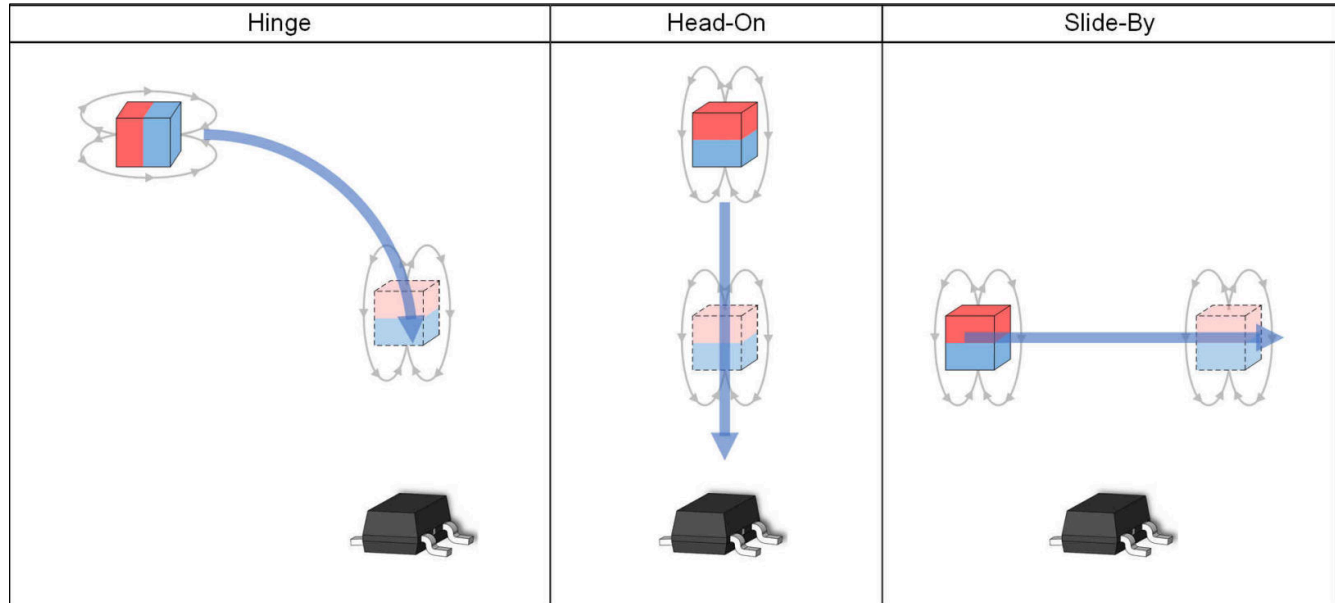
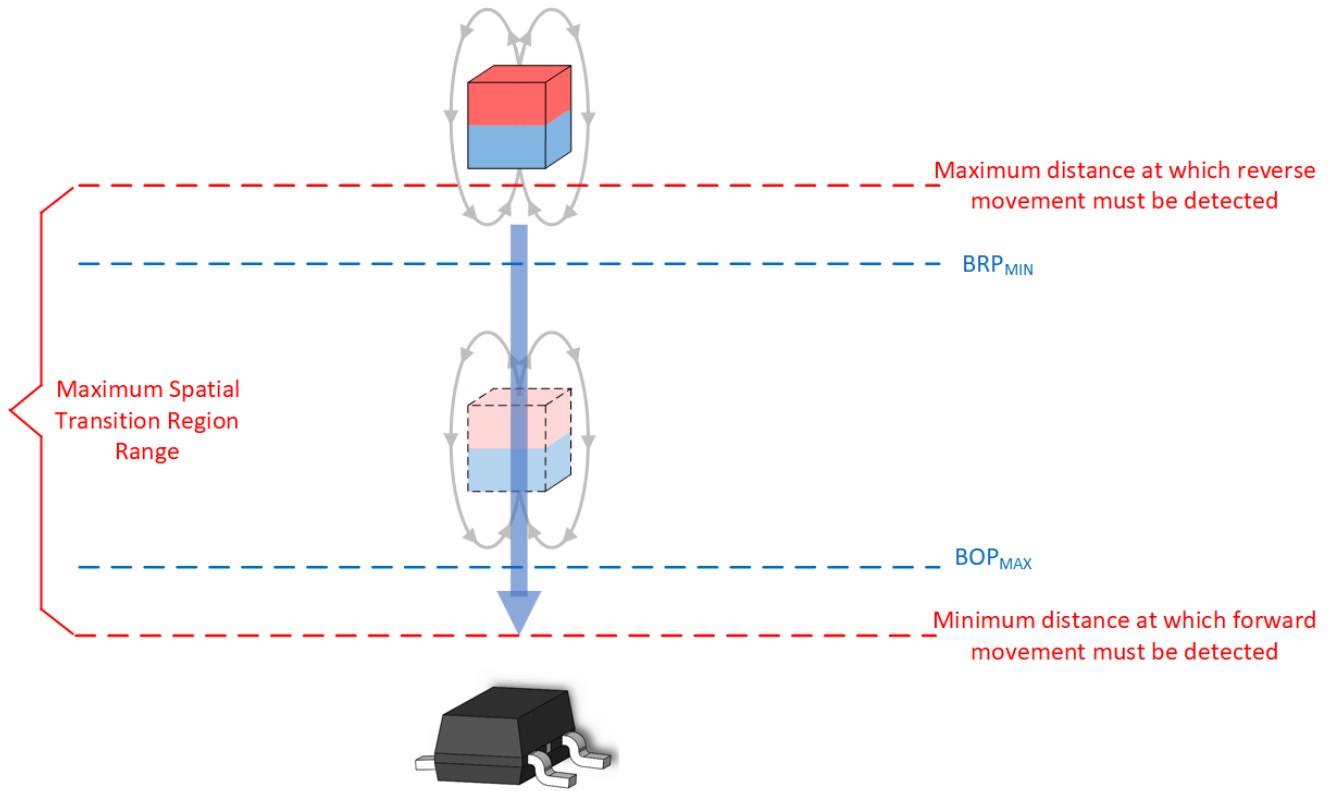


図 8-1. Design Implementations

With each implementation, the objective is to design the system such that the spatial coordinates of the transition region fall within the spatial coordinates associated with the B_{OP} maximum and B_{RP} minimum specifications. [図 8-2](#) shows a head-on example that shows how the location corresponding to the device B_{OPMAX} and B_{RPMIN} fall within the desired transition region. To facilitate rapid design iteration, TI's [Magnetic Sense Simulator \(TIMSS\)](#) webtool is leveraged in the following design examples.



8-2. Head-On Example

8.2 Typical Applications

8.2.1 Hinge

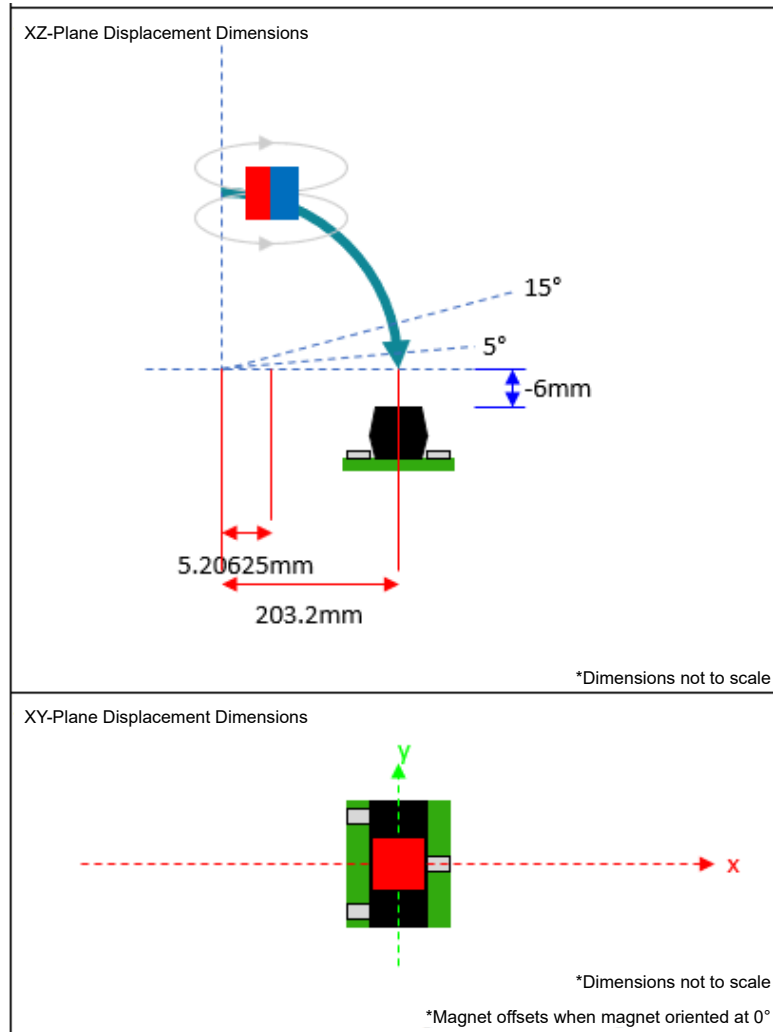


図 8-3. Typical Application Diagram

8.2.1.1 Design Requirements

表 8-1 lists the design parameters for this example.

表 8-1. Design Parameters

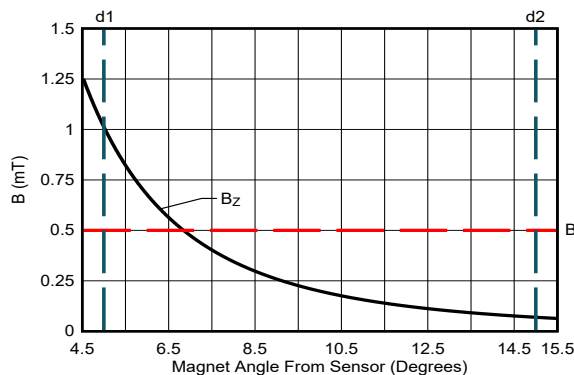
DESIGN PARAMETER	EXAMPLE VALUE
V_{CC}	3.3V
Switch Region	5° to 15°
Max Magnet Height	9.525mm (3/8 inch)
Max Magnet Width or Length	25.4mm (1 inches)
Fixture Width	304.8mm (12 inches)
Fixture Length	228.6mm (9 inches)
Sensor Distance from Hinge Origin	6mm (0.23622 inch)
Center of Magnet Offset from Hinge Origin	$\geq (6\text{mm} - \text{Magnet Height}/2)$

8.2.1.2 Detailed Design Procedure

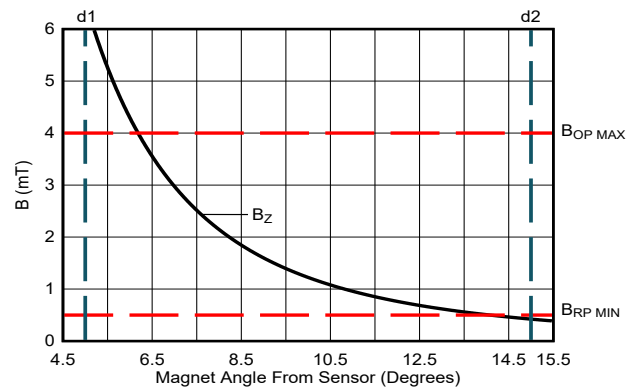
Due to the complex non-linear behavior magnets and the number of variables that can influence it, some experimentation is required to solve for a design that will work. This application uses a simple axial, dipole, block magnet. Users can consider other shapes for different field strengths or prices. A neodymium type of magnet (N52) is used. At the time of this writing, N52 can be commonly found with heights of 1/16", 1/8", 3/16", and 1/4". As price often increases with size, the first design attempt will be with a 1/16" thick magnet, which has a width and length equal to 0.25". Based on the sensor distance from hinge origin and fixture dimension constraints, there is a lot of flexibility on where the sensor can be placed. Due to other hardware within the fixture, the TMAG5131C1DQDBZRQ1 sensor is placed 203.2mm (8") from the origin. From there, the user can assess a design with the following displacement dimensions.

☒ 8-4 shows that the b-field magnitude for the TMAG5131C1DQDBZRQ1 is not adequate for the spatial constraints of 5° and 15°, as the B_z magnitude only surpasses the B_{RP} minimum. There are a few options on how to proceed. As the $B_{OP(Max)}$ does not fall within our range, the user must increase field strength. This can be accomplished with a thicker magnet or by adjusting sensor and magnet z-offsets. The magnet cannot get any closer due to enclosure constraints, therefore the only option allowed is to increase the magnet thickness. After a few more iterations with the tool, a 0.25" × 0.25" × 0.375" magnet can work (see ☒ 8-5 and ☒ 8-6).

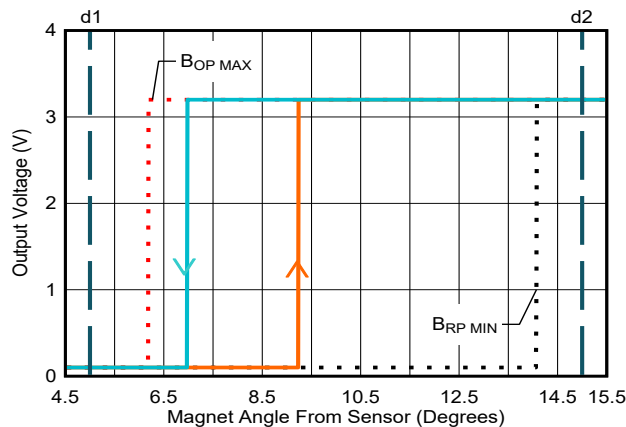
8.2.1.3 Application Curves



☒ 8-4. B-Field Hypothesis One



☒ 8-5. B-Field Hypothesis Two



☒ 8-6. Thresholds From Hypothesis Two

8.2.2 Head-On

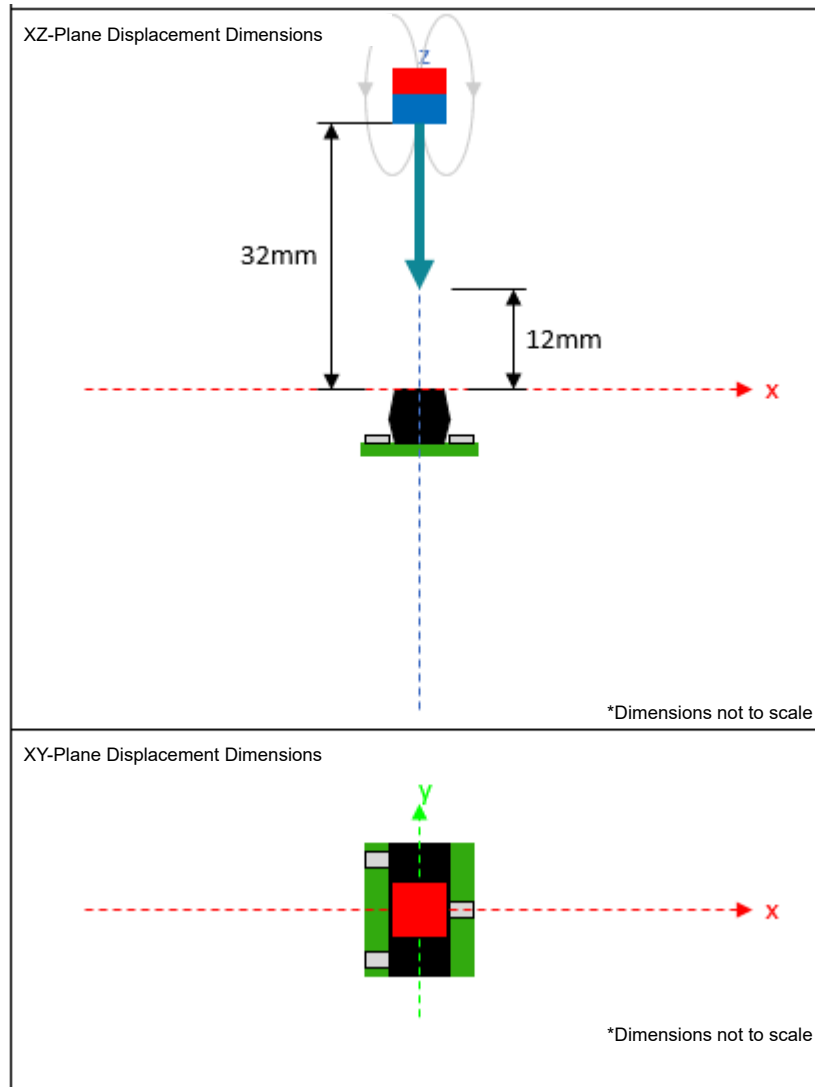


図 8-7. Typical Application Diagram

8.2.2.1 Design Requirements

表 8-2 lists the design parameters for this example.

表 8-2. Design Parameters

DESIGN PARAMETER	EXAMPLE VALUE
V_{CC}	3.3V
Switch Region	Between 10mm and 30mm from sensor fixture surface
Sensor Distance from Equipment Outer Surface	2mm (0.0787 inch)
Magnet Length	25.4mm (< 1 inch)
Magnet Width	25.4mm (< 1 inch)
Magnet Height	6.35mm (< 1/4 inch)
Magnet Type	N42

8.2.2.2 Detailed Design Procedure

In this particular case, there are several N42 magnets available from prior projects. As the desired transition region is where the magnet surface is at least 12mm (10mm + 2mm) away from the sensor, we try an initial design with one of our larger magnets (3/8" × 3/16" × 3/16"). [Figure 8-8](#) shows the respective curve for this magnet along the movement along with the magnetic thresholds of the TMAG5131C1DQDBZRQ1.

While the B_z magnitude adequately exceeds the B_{OPMAX} , the B_z does not quite reach the B_{RPMIN} . Therefore, the user must make some adjustments so that B_z falls below B_{RPMIN} within the desired operating range. To reduce B_z , there are a few options. The user can offset the magnet or choose a smaller magnet. After iterating through increasing x-offsets and y-offsets as well as decreasing magnet thicknesses, the user can eventually find a solution that works. In this case, a 3/8" × 3/16" × 1/16" N42 magnet with no x or y offset from the sensor center is used. [Figure 8-9](#) and [Figure 8-10](#) shows the curves corresponding to the final magnet parameters.

8.2.2.3 Application Curve

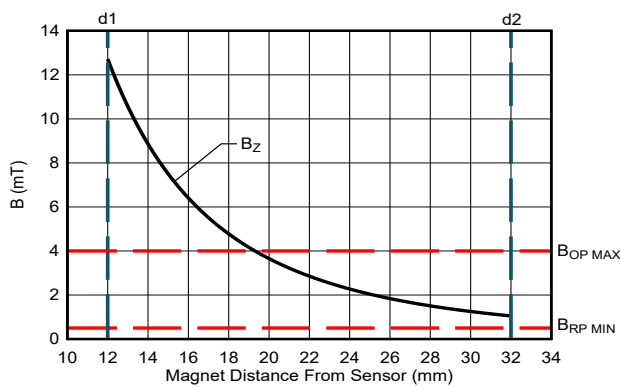


Figure 8-8. B-Field Hypothesis One

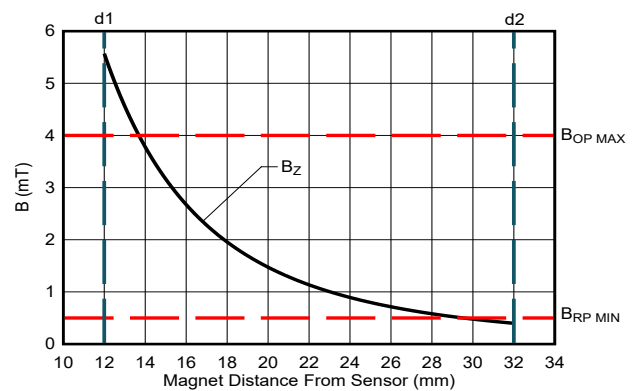


Figure 8-9. B-Field Hypothesis Two

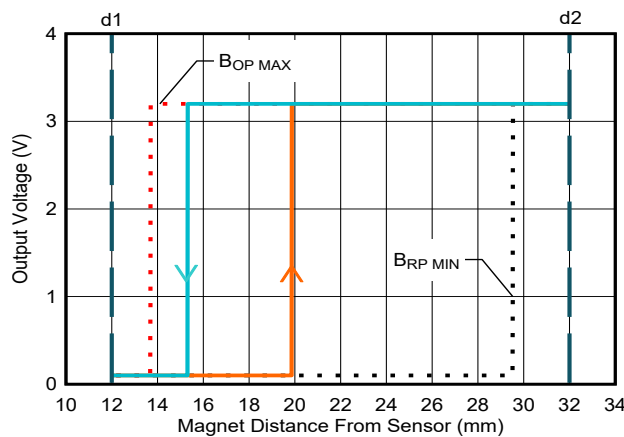


Figure 8-10. Thresholds From Hypothesis Two

8.2.3 Slide-By

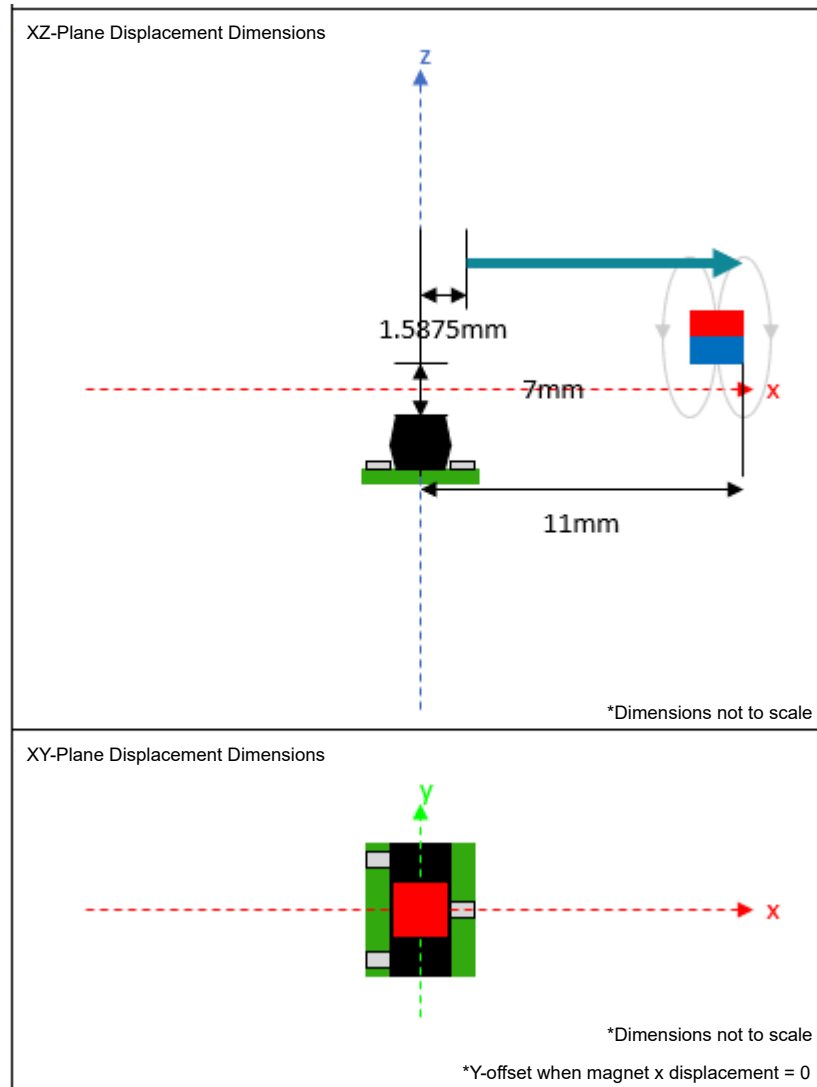


図 8-11. Typical Application Diagram

8.2.3.1 Design Requirements

表 8-3 lists the sign parameters for this example.

表 8-3. Design Parameters

DESIGN PARAMETER	EXAMPLE VALUE
V_{CC}	3.3V
Magnet Range of Motion	11mm (< 0.433 inch)
Sensor Distance from Equipment Outer Surface	6mm (> 0.236 inch)
Magnet Length	12.7mm (< 1/2 inch)
Magnet Width	12.7mm (< 1/2 inch)
Magnet Height	3.175mm (< 1/8 inch)
Magnet Type	N42

8.2.3.2 Detailed Design Procedure

For this particular case involving the TMAG5131C1DQDBZRQ1, the user can arbitrarily start with a 1/8" × 1/8" × 1/16" magnet, a z-offset of 7mm (>6mm), and an initial displacement of one half of the magnet length (1/8"/2 = 1/16") and serendipitously get something that works (see [Figure 8-12](#) and [Figure 8-13](#)). The right edge of the magnet cannot exceed 11mm, meaning the center of the magnet cannot exceed 9.4125mm (11 - 1.5875). Had the B-field not exceeded B_{OPMAX} , the user can try moving the magnet closer on the z-axis, made the magnet larger, or changed the magnet to one with higher permeability. Alternatively, if the b-field was too large, the magnet can be moved further away in each axis or a smaller magnet can be used.

8.2.3.3 Application Curve

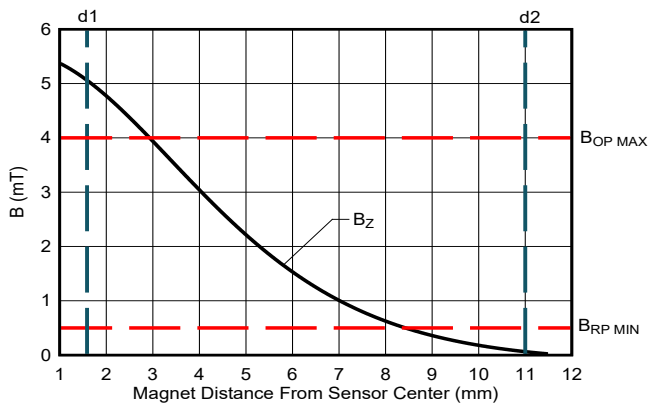


Figure 8-12. B-Field Hypothesis One

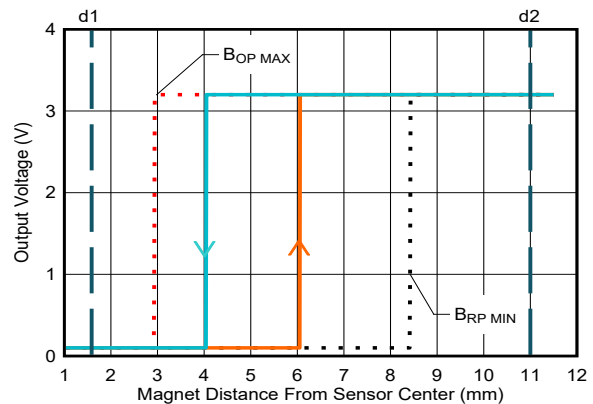


Figure 8-13. Thresholds From Hypothesis One

8.3 Power Supply Recommendations

The TMAG5131-Q1 device is powered from 1.65V to 5.5V DC power supplies. A decoupling capacitor close to the device must be used to provide local energy with minimal inductance. TI recommends using a ceramic capacitor with a value of at least 0.1µF.

8.4 Layout

8.4.1 Layout Guidelines

Magnetic fields pass through most non-ferromagnetic materials with no significant disturbance. Embedding Hall effect sensors within plastic or aluminum enclosures and sensing magnets on the outside is common practice. Magnetic fields also easily pass through most printed circuit boards (PCBs), which makes the placement of the magnet on the opposite side possible.

8.4.2 Layout Example

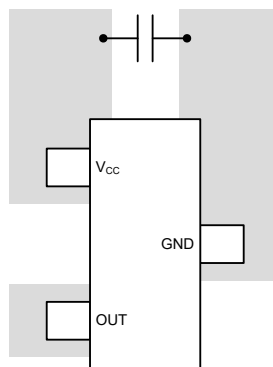


Figure 8-14. SOT-23 Layout Example

9 Device and Documentation Support

9.1 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、www.tij.co.jp のデバイス製品フォルダを開いてください。[通知] 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ることができます。変更の詳細については、改訂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。

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9.5 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。

10 Revision History

Changes from Revision B (February 2024) to Revision C (June 2024)	Page
• TI の最新の記述およびブランディング標準に準拠するようにコンテンツを更新.....	1
• G1D および H1D デバイス バージョンをデータシートに追加.....	1

Changes from Revision A (February 2024) to Revision B (February 2024)	Page
• Changed  7-10	14

Changes from Revision * (April 2023) to Revision A (February 2024)	Page
• データシートのステータスを「事前情報」から「量産データ」へ変更.....	1
• A1C および C5D デバイス バージョンをデータシートに追加.....	1

11 Mechanical and Packaging 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.

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PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TMAG5131A1CQDBZRQ1	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 125	33EH	Samples
TMAG5131C1DQDBZRQ1	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 125	32ZH	Samples
TMAG5131C5DQDBZRQ1	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 125	33BH	Samples
TMAG5131C7DQDBZRQ1	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 125	33AH	Samples
TMAG5131G1DQDBZRQ1	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 125	33CH	Samples
TMAG5131H1DQDBZRQ1	ACTIVE	SOT-23	DBZ	3	3000	RoHS & Green	SN	Level-1-260C-UNLIM	-40 to 125	33DH	Samples

(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.

OBSELETE: 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.

(6) 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
TMAG5131A1CQDBZRQ1	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TMAG5131C1DQDBZRQ1	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TMAG5131C5DQDBZRQ1	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TMAG5131C7DQDBZRQ1	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TMAG5131G1DQDBZRQ1	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TMAG5131H1DQDBZRQ1	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3

TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TMAG5131A1CQDBZRQ1	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TMAG5131C1DQDBZRQ1	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TMAG5131C5DQDBZRQ1	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TMAG5131C7DQDBZRQ1	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TMAG5131G1DQDBZRQ1	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TMAG5131H1DQDBZRQ1	SOT-23	DBZ	3	3000	210.0	185.0	35.0

EXAMPLE BOARD LAYOUT

DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



LAND PATTERN EXAMPLE
SCALE:15X



SOLDER MASK DETAILS

4214838/F 08/2024

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DBZ0003A

SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



SOLDER PASTE EXAMPLE
BASED ON 0.125 THICK STENCIL
SCALE:15X

4214838/F 08/2024

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

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