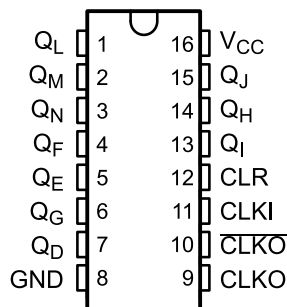


14级异步二进制计数器和振荡器

 查询样品: [SN74HC4060-Q1](#)

特性

- 符合汽车应用要求
- **2V至6V**的宽运行电压范围
- 输出可驱动多达**10**个低功耗肖特基晶体管逻辑电路(LSTTL)负载
- 低功耗, I_{CC} 最大**80 μ A**
- t_{pd} 典型值 = **14 ns**
- **$\pm 4mA$** 输出驱动 (在 **5V** 时)
- 低输出电流, 最大值**1 μ A**
- 实现相移振荡电路(RC)-或者晶体振荡器电路的设计

SN74HC4060-Q1 (D 封装)
(顶视图)


说明

HC4060-Q1器件包含一个振荡器部分和14个纹波进位二进制计数器级。此振荡器配置可实现RC-或者晶体振荡器电路设计。时钟(CLKI)输入上的高到低转换增加了计数器的值。清除(CLR)输入上的高电平会关闭振荡器 (CLKO变为高电平而CLKO变为低电平) 并且将计数器复位清零 (所有的Q输出为低电平)。

订购信息

| T_A | 封装 ⁽¹⁾ | | 可订购部件号 | 正面标记 |
|---------------|-------------------|---------|-----------------|---------|
| -40°C 至 125°C | 小尺寸集成电路(SOIC) - D | 2500 卷带 | SN74HC4060QDRQ1 | HC4060Q |

(1) 封装图示, 标准包装数量, 散热数据, 符号以及 PCB 设计指南: 。

PRODUCT PREVIEW


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

SN74HC4060-Q1

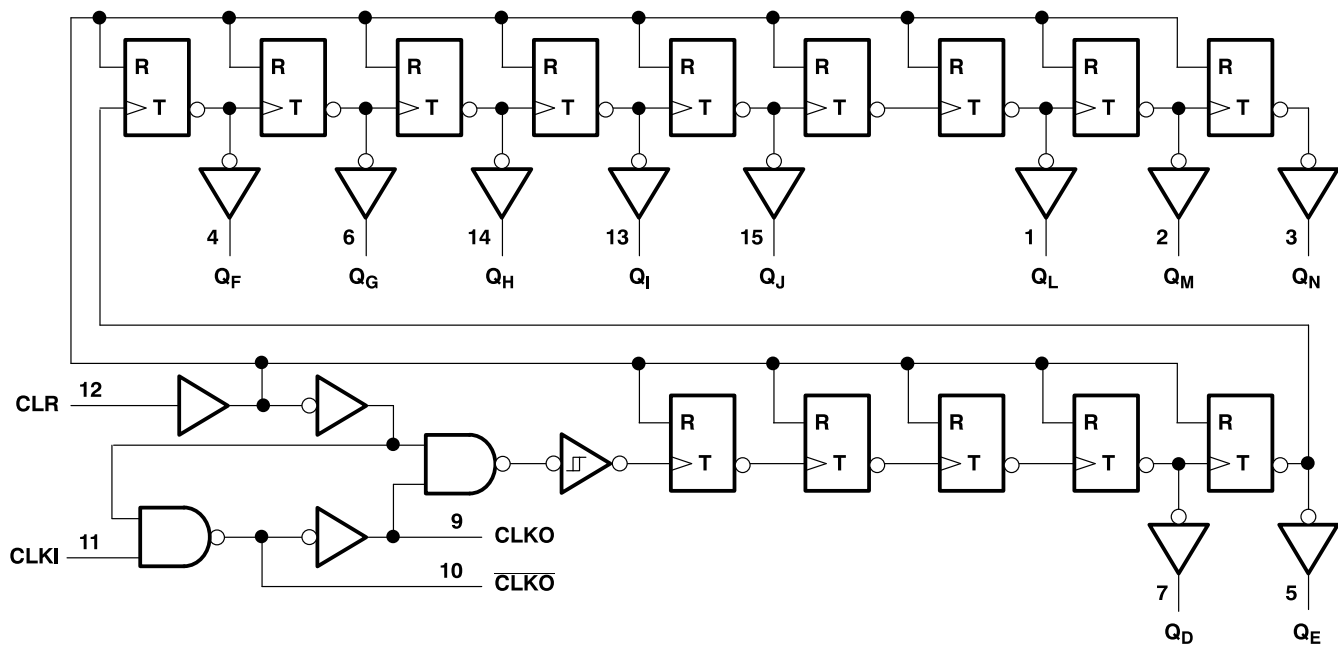
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These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Table 1. FUNCTION TABLE
(each buffer)

| INPUTS | | FUNCTION |
|--------|-----|-----------------------|
| CLK | CLR | |
| ↑ | L | No change |
| ↓ | L | Advance to next stage |
| X | H | All outputs L |

LOGIC DIAGRAM (POSITIVE LOGIC)


Pin numbers shown are for the D package.

PRODUCT PREVIEW

ABSOLUTE MAXIMUM RATINGS

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

| | | VALUE | UNIT |
|---------------|----------------------------|--|-----------------|
| V_{CC} | Supply voltage range | –0.5 to 7 | V |
| I_{IK} | Input clamp current | $V_I < 0$ or $V_I > V_{CC}$ ⁽²⁾ | ±20 mA |
| I_{OK} | Output clamp current | $V_O < 0$ or $V_O > V_{CC}$ ⁽²⁾ | ±20 mA |
| I_O | Continuous output current | $V_O < 0$ | ±25 mA |
| θ_{JA} | Package thermal impedance | D package ⁽³⁾ | 73 °C/W |
| T_{stg} | Storage temperature range | | 65 to 150 °C |
| ESD rating: | Human Body Model (HBM) | | 2000 V |
| | Charged Device Model (CDM) | | 1000 V |
| | Machine Model (MM) | | 200 V |

- (1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The package thermal impedance is calculated in accordance with JESD 51-7.

SN74HC4060-Q1

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RECOMMENDED OPERATING CONDITIONS⁽¹⁾

| | | MIN | NOM | MAX | UNIT |
|---------------------|---------------------------------|-------------------------|----------|-----|------|
| V_{CC} | Supply voltage | 2 | 5 | 6 | V |
| V_{IH} | High-level input voltage | $V_{CC} = 2\text{ V}$ | 1.5 | | V |
| | | $V_{CC} = 4.5\text{ V}$ | 3.5 | | |
| | | $V_{CC} = 6\text{ V}$ | 4.2 | | |
| V_{IL} | Low-level input voltage | $V_{CC} = 2\text{ V}$ | 0.5 | | V |
| | | $V_{CC} = 4.5\text{ V}$ | 1.35 | | |
| | | $V_{CC} = 6\text{ V}$ | 1.8 | | |
| V_I | Input voltage | 0 | V_{CC} | | V |
| V_O | Output voltage | 0 | V_{CC} | | V |
| $\Delta t/\Delta v$ | Input transition rise/fall time | $V_{CC} = 2\text{ V}$ | 1000 | | ns |
| | | $V_{CC} = 4.5\text{ V}$ | 500 | | |
| | | $V_{CC} = 6\text{ V}$ | 400 | | |
| T_A | Operating free-air temperature | -40 | 125 | | °C |

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number [SCBA004](#).

ELECTRICAL CHARACTERISTICS

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

| PARAMETER | TEST CONDITIONS | | V_{CC} | $T_A = 25^\circ\text{C}$ | | | 'HC4060-Q1 | | UNIT | |
|-----------|-----------------|--|--|--------------------------|-------|-----------|------------|-----|---------------|---|
| | | | | MIN | TYP | MAX | MIN | MAX | | |
| V_{OH} | All output | $V_I = V_{IH}$ or V_{IL} , $I_{OH} = -20\ \mu\text{A}$ | 2 V | 1.9 | 1.998 | 1.9 | | V | | |
| | | | 4.5 V | 4.4 | 4.499 | 4.4 | | | | |
| | | | 6 V | 5.9 | 5.999 | 5.9 | | | | |
| | Q outputs | $V_I = V_{IH}$ or V_{IL} | $I_{OH} = -4.5\text{ mA}$ $I_{OH} = -5.2\text{ mA}$ | 4.5 V | 3.98 | 4.3 | 3.7 | | V | |
| | | | 6 V | 5.48 | 5.8 | 5.2 | | | | |
| V_{OL} | All output | $V_I = V_{IH}$ or V_{IL} , $I_{OL} = 20\ \mu\text{A}$ | 2 V | 0.002 | | 0.1 | 0.1 | | V | |
| | | | 4.5 V | 0.001 | | 0.1 | 0.1 | | | |
| | | | 6 V | 0.001 | | 0.1 | 0.1 | | | |
| | Q outputs | $V_I = V_{IH}$ or V_{IL} | $I_{OL} = 4\text{ mA}$ | 4.5 V | 0.17 | | 0.26 | 0.4 | | V |
| | | | $I_{OL} = 5.2\text{ mA}$ | 6 V | 0.15 | | 0.26 | 0.4 | | |
| I_I | | $V_I = V_{CC}$ or 0 | 6 V | ± 0.1 | | ± 100 | ± 1000 | | nA | |
| I_{CC} | | $V_I = V_{CC}$ or 0, $I_O = 0$ | 6 V | | | 8 | 160 | | μA | |
| C_i | | | 2 V to 6 V | 3 | | 10 | 10 | | pF | |

TIMING REQUIREMENTS

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

| | | V_{CC} | $T_A = 25^\circ\text{C}$ | | 'HC4060-Q1 | | UNIT |
|--------------------|---------------------------------------|------------------|--------------------------|-----|------------|-----|------|
| | | | MIN | MAX | MIN | MAX | |
| f_{clock} | Clock frequency | 2 V | 5.5 | | 3.7 | | MHz |
| | | 4.5 V | 28 | | 19 | | |
| | | 6 V | 33 | | 22 | | |
| t_w | Pulse duration | CLKI high or low | 2 V | 90 | 135 | | ns |
| | | | 4.5 V | 18 | 27 | | |
| | | | 6 V | 15 | 23 | | |
| | CLR high | 2 V | 90 | 135 | | ns | |
| | | 4.5 V | 18 | 27 | | | |
| | | 6 V | 15 | 23 | | | |
| t_{su} | Setup time, CLR inactive before CLKI↓ | 2 V | 160 | 240 | | ns | |
| | | 4.5 V | 32 | 48 | | | |
| | | 6 V | 27 | 41 | | | |

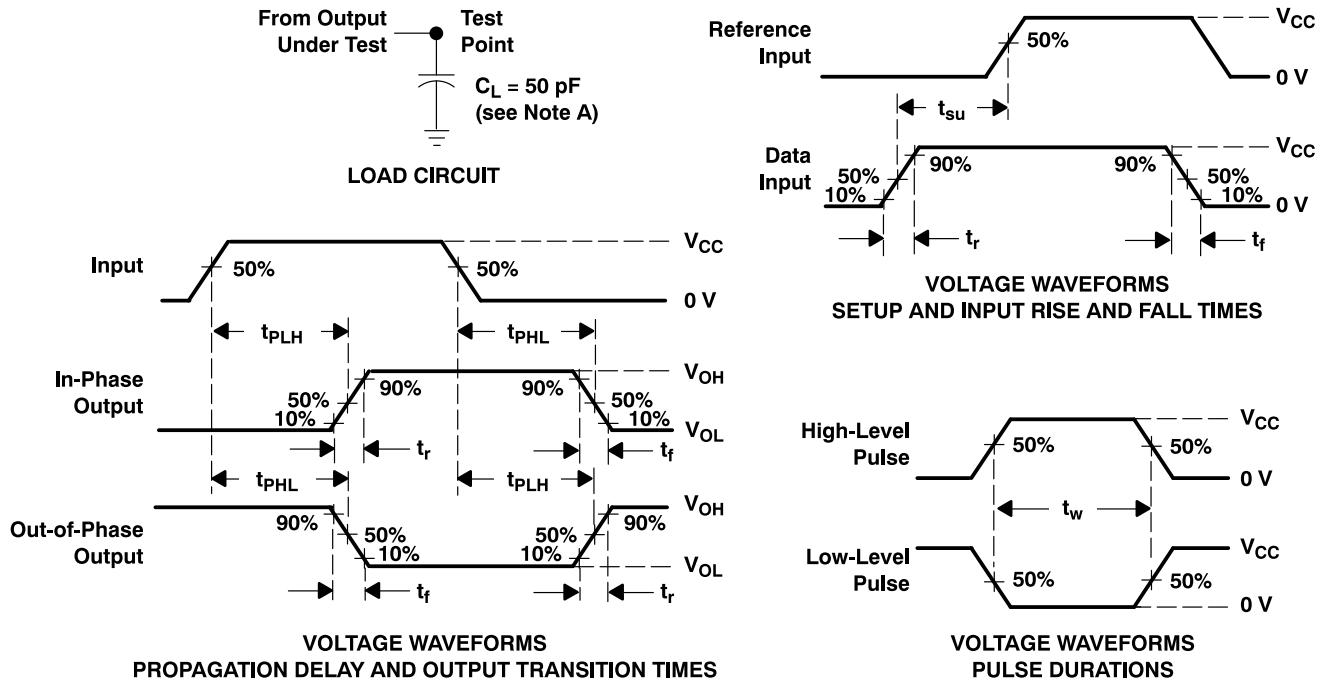
SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range, $C_L = 50$ pF (unless otherwise noted) (see [Figure 1](#))

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V_{CC} | $T_A = 25^\circ\text{C}$ | | | 'HC4060-Q1 | | UNIT |
|------------------|--------------|-------------|----------|--------------------------|-----|-----|------------|-----|------|
| | | | | MIN | TYP | MAX | MIN | MAX | |
| f_{max} | | | 2 V | 5.5 | 10 | | 3.7 | | MHz |
| | | | 4.5 V | 28 | 45 | | 19 | | |
| | | | 6 V | 33 | 53 | | 22 | | |
| t_{pd} | CLKI | QD | 2 V | | 240 | 490 | 735 | | ns |
| | | | 4.5 V | | 58 | 98 | 147 | | |
| | | | 6 V | | 42 | 83 | 125 | | |
| t_{PHL} | CLR | Any Q | 2 V | | 66 | 140 | 210 | | ns |
| | | | 4.5 V | | 18 | 28 | 42 | | |
| | | | 6 V | | 14 | 24 | 36 | | |
| t_t | | Any | 2 V | | 28 | 75 | 110 | | ns |
| | | | 4.5 V | | 8 | 15 | 22 | | |
| | | | 6 V | | 6 | 30 | 19 | | |

OPERATING CHARACTERISTICS, $T_A = 25^\circ\text{C}$

| PARAMETER | TEST CONDITIONS | TYP | UNIT |
|---|-----------------|-----|------|
| C_{pd} Power dissipation capacitance | No load | 88 | pF |

PARAMETER MEASUREMENT INFORMATION


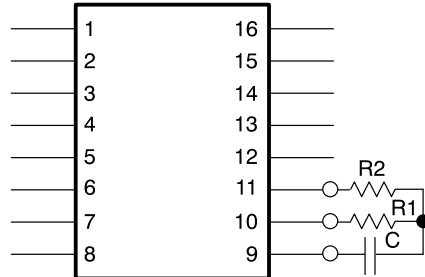
- A. C_L includes probe and test-fixture capacitance.
- B. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: $\text{PRR} \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r = 6 \text{ ns}$, $t_f = 6 \text{ ns}$.
- C. For clock inputs, f_{max} is measured when the input duty cycle is 50%.
- D. The outputs are measured one at a time with one input transition per measurement.
- E. t_{PLH} and t_{PHL} are the same as t_{pd} .

Figure 1. Load Circuit and Voltage Waveforms

CONNECTING AN RC-OSCILLATOR CIRCUIT TO THE 'HC4060-Q1 DEVICE

The 'HC4060-Q1 devices consist of an oscillator section and 14 ripple-carry binary counter stages. The oscillator configuration allows design of either RC- or crystal-oscillator circuits.

When an RC-oscillator circuit is implemented, two resistors and a capacitor are required. The components are attached to the terminals as shown:



To determine the values of capacitance and resistance necessary to obtain a specific oscillator frequency (f), use this formula:

$$f = \frac{1}{2(R1)(C) \left(\frac{0.405 R2}{R1 + R2} + 0.693 \right)}$$

If $R2 \gg R1$ (i.e., $R2 = 10R1$), the above formula simplifies to:

$$f = \frac{0.455}{RC}$$

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 |
|------------------|---------------|--------------|--------------------|------|----------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|---------|
| SN74HC4060QDRQ1 | ACTIVE | SOIC | D | 16 | 2500 | RoHS & Green | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | HC4060Q | 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.

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.

(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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D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 - E. Reference JEDEC MS-012 variation AC.

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