

具有施密特触发输入和三态输出的 SN74HCS244-Q1 汽车类八路缓冲器和线路驱动器

1 特性

- 符合面向汽车应用的 AEC-Q100 标准：
 - 器件温度等级 1：
 - 40°C 至 +125°C, T_A
 - 器件 HBM ESD 分类等级 2
 - 器件 CDM ESD 分类等级 C6
- 采用具有可湿性侧面的 QFN (WRKS) 封装
- 宽工作电压范围：2V 至 6V
- 施密特触发输入可耐受慢速或高噪声输入信号
- 低功耗
 - I_{CC} 典型值为 100nA
 - 输入泄漏电流典型值为 ± 100 nA
- 电压为 6V 时，输出驱动为 ± 7.8 mA

2 应用

- 启用或禁用数字信号
- 消除缓慢或嘈杂输入信号
- 在控制器复位期间保持信号
- 对开关进行去抖

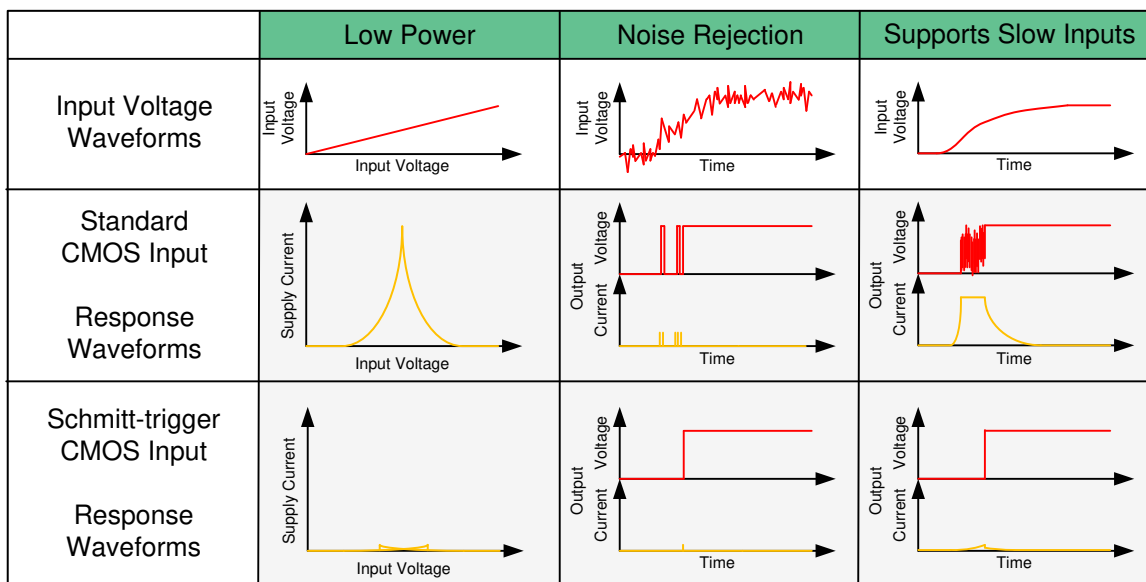
3 说明

SN74HCS244-Q1 是一款具有三态输出和施密特触发输入的八路缓冲器。该器件配置为两组，每组四个驱动器，每组都由各自的输出使能引脚进行控制。

器件信息

| 器件型号 | 封装 ⁽¹⁾ | 封装尺寸 (标称值) |
|-------------------|-------------------|-----------------|
| SN74HCS244PW-Q1 | TSSOP (20) | 4.40mm x 6.50mm |
| SN74HCS244WRKS-Q1 | VQFN (20) | 4.50mm x 2.50mm |

- (1) 如需了解所有可用封装，请参阅数据表末尾的可订购产品附录。



施密特触发输入的优势



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4 Revision History

注：以前版本的页码可能与当前版本的页码不同

Changes from Revision B (December 2021) to Revision C (February 2022) Page

| | |
|------------------------------------|----------|
| • 将 WRKS 封装从“产品预发布”更改为“量产数据” | 1 |
|------------------------------------|----------|

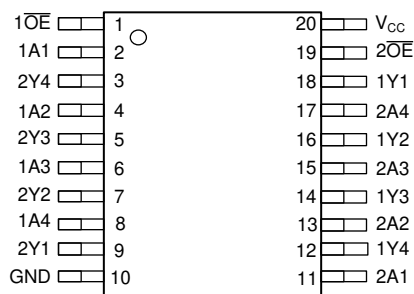
Changes from Revision A (November 2020) to Revision B (December 2021) Page

| | |
|--|-----------|
| • 向“器件信息表”添加了 WRKS 封装..... | 1 |
| • Added WRKS package pinout diagram..... | 3 |
| • Added example layout for WRKS package..... | 14 |

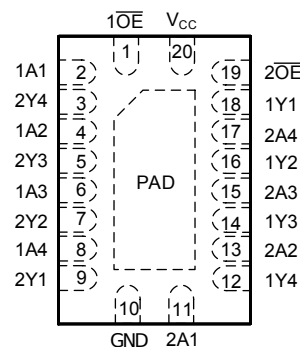
Changes from July 21, 2020 to November 11, 2020 (from Revision * (July 2020) to Revision A (November 2020)) Page

| | |
|------------------------------|----------|
| • 将数据表从“预告信息”更改为“量产数据” | 0 |
|------------------------------|----------|

5 Pin Configuration and Functions



**PW Package
20-Pin TSSOP
Top View**



**WRKS package
20-Pin VQFN
Top View**

Pin Functions

| PIN | | I/O ⁽¹⁾ | DESCRIPTION |
|----------------------------|-----------|--------------------|---|
| Name | TSSOP NO. | | |
| 1OE | 1 | I | Bank 1, output enable, active low |
| 1A1 | 2 | I | Bank 1, channel 1 input |
| 2Y4 | 3 | O | Bank 2, channel 4 output |
| 1A2 | 4 | I | Bank 1, channel 2 input |
| 2Y3 | 5 | O | Bank 2, channel 3 output |
| 1A3 | 6 | I | Bank 1, channel 3 input |
| 2Y2 | 7 | O | Bank 2, channel 2 output |
| 1A4 | 8 | I | Bank 1, channel 4 input |
| 2Y1 | 9 | O | Bank 2, channel 1 output |
| GND | 10 | — | Ground |
| 2A1 | 11 | I | Bank 2, channel 1 input |
| 1Y4 | 12 | O | Bank 1, channel 4 output |
| 2A2 | 13 | I | Bank 2, channel 2 input |
| 1Y3 | 14 | O | Bank 1, channel 3 output |
| 2A3 | 15 | I | Bank 2, channel 3 input |
| 1Y2 | 16 | O | Bank 1, channel 2 output |
| 2A4 | 17 | I | Bank 2, channel 4 input |
| 1Y1 | 18 | O | Bank 1, channel 1 output |
| 2OE | 19 | I | Bank 2, output enable, active low |
| V _{CC} | 20 | — | Positive supply |
| Thermal Pad ⁽²⁾ | | | The thermal pad can be connected to GND or left floating. Do not connect to any other signal or supply. |

(1) Signal Types: I = Input, O = Output, I/O = Input or Output.

(2) WRKS package only.

6 Specifications

6.1 Absolute Maximum Ratings

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

| | | | MIN | MAX | UNIT |
|-----------|--|--|-------|----------|------|
| V_{CC} | Supply voltage | | - 0.5 | 7 | V |
| I_{IK} | Input clamp current ⁽²⁾ | $V_I < -0.5 \text{ V}$ or $V_I > V_{CC} + 0.5 \text{ V}$ | | ± 20 | mA |
| I_{OK} | Output clamp current ⁽²⁾ | $V_O < -0.5 \text{ V}$ or $V_O > V_{CC} + 0.5 \text{ V}$ | | ± 20 | mA |
| I_O | Continuous output current | $V_O = 0$ to V_{CC} | | ± 35 | mA |
| I_{CC} | Continuous current through V_{CC} or GND | | | ± 70 | mA |
| T_J | Junction temperature ⁽³⁾ | | | 150 | °C |
| T_{stg} | Storage temperature | | - 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 briefly operating outside the *Recommended Operating Conditions* but within the *Absolute Maximum Ratings*, the device may not sustain damage, but it may not be fully functional. Operating the device in this manner may affect device reliability, functionality, performance, and shorten the device lifetime.
- (2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) Guaranteed by design.

6.2 ESD Ratings

| | | | VALUE | UNIT |
|-------------|-------------------------|---|------------|------|
| $V_{(ESD)}$ | Electrostatic discharge | Human body model (HBM), per AEC Q100-002 ⁽¹⁾ HBM ESD Classification Level 2 | ± 4000 | V |
| | | Charged device model (CDM), per AEC Q100-011 CDM ESD Classification Level C4B | ± 1000 | |

- (1) AEC Q100-002 indicate that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

6.3 Recommended Operating Conditions

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

| | | MIN | NOM | MAX | UNIT |
|----------|---------------------|------|-----|----------|------|
| V_{CC} | Supply voltage | 2 | 5 | 6 | V |
| V_I | Input voltage | 0 | | V_{CC} | V |
| V_O | Output voltage | 0 | | V_{CC} | V |
| T_A | Ambient temperature | - 55 | | 125 | °C |

6.4 Thermal Information

| THERMAL METRIC ⁽¹⁾ | | SN74HCS244-Q1 | | UNIT |
|-------------------------------|--|---------------|------------|------|
| | | WRKS (VQFN) | PW (TSSOP) | |
| | | 20 PINS | 20 PINS | |
| $R_{\theta JA}$ | Junction-to-ambient thermal resistance | 83.2 | 151.7 | °C/W |
| $R_{\theta JC(top)}$ | Junction-to-case (top) thermal resistance | 82.6 | 79.4 | °C/W |
| $R_{\theta JB}$ | Junction-to-board thermal resistance | 57.4 | 94.7 | °C/W |
| Ψ_{JT} | Junction-to-top characterization parameter | 14.5 | 25.2 | °C/W |
| Ψ_{JB} | Junction-to-board characterization parameter | 56.4 | 94.1 | °C/W |
| $R_{\theta JC(bot)}$ | Junction-to-case (bottom) thermal resistance | 40.0 | N/A | °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

over operating free-air temperature range; typical values measured at $T_A = 25^\circ\text{C}$ (unless otherwise noted).

| PARAMETER | | TEST CONDITIONS | | V_{CC} | MIN | TYP | MAX | UNIT |
|--------------|---|--------------------------------|-----------------------------|------------|--------------------------------|------------|------------|---------------|
| V_{T+} | Positive switching threshold | | | 2 V | 0.7 | | 1.5 | V |
| | | | | 4.5 V | 1.7 | | 3.15 | |
| | | | | 6 V | 2.1 | | 4.2 | |
| V_{T-} | Negative switching threshold | | | 2 V | 0.3 | | 1 | V |
| | | | | 4.5 V | 0.9 | | 2.2 | |
| | | | | 6 V | 1.2 | | 3 | |
| ΔV_T | Hysteresis ($V_{T+} - V_{T-}$) | | | 2 V | 0.2 | | 1 | V |
| | | | | 4.5 V | 0.4 | | 1.4 | |
| | | | | 6 V | 0.6 | | 1.6 | |
| V_{OH} | High-level output voltage | $V_I = V_{IH}$ or V_{IL} | $I_{OH} = -20\ \mu\text{A}$ | 2 V to 6 V | $V_{CC} - 0.1\ V_{CC} - 0.002$ | | | V |
| | | | $I_{OH} = -6\ \text{mA}$ | 4.5 V | 4 | 4.3 | | |
| | | | $I_{OH} = -7.8\ \text{mA}$ | 6 V | 5.4 | 5.75 | | |
| V_{OL} | Low-level output voltage | $V_I = V_{IH}$ or V_{IL} | $I_{OL} = 20\ \mu\text{A}$ | 2 V to 6 V | | 0.002 | 0.1 | V |
| | | | $I_{OL} = 6\ \text{mA}$ | 4.5 V | | 0.18 | 0.3 | |
| | | | $I_{OL} = 7.8\ \text{mA}$ | 6 V | | 0.22 | 0.33 | |
| I_I | Input leakage current | $V_I = V_{CC}$ or 0 | | 6 V | | ± 100 | ± 1000 | nA |
| I_{OZ} | Off-state (high-impedance state) output current | $V_O = V_{CC}$ or 0 | | 6 V | | ± 0.01 | ± 2 | μA |
| I_{CC} | Supply current | $V_I = V_{CC}$ or 0, $I_O = 0$ | | 6 V | | 0.1 | 2 | μA |
| C_i | Input capacitance | | | 2 V to 6 V | | | 5 | pF |

6.6 Switching Characteristics

over operating free-air temperature range; typical values measured at $T_A = 25^\circ\text{C}$ (unless otherwise noted). See *Parameter Measurement Information*. $C_L = 50\ \text{pF}$.

| PARAMETER | | FROM (INPUT) | TO (OUTPUT) | V_{CC} | MIN | TYP | MAX | UNIT |
|-----------|-------------------|-----------------|-------------|----------|-----|-----|-----|------|
| t_{pd} | Propagation delay | A | Y | 2 V | | 13 | 45 | ns |
| | | | | 4.5 V | | 7 | 18 | |
| | | | | 6 V | | 6 | 16 | |
| t_{en} | Enable time | \overline{OE} | Y | 2 V | | 15 | 44 | ns |
| | | | | 4.5 V | | 7 | 22 | |
| | | | | 6 V | | 6 | 18 | |
| t_{dis} | Disable time | \overline{OE} | Y | 2 V | | 12 | 30 | ns |
| | | | | 4.5 V | | 9 | 20 | |
| | | | | 6 V | | 8 | 19 | |
| t_t | Transition-time | | Any | 2 V | | 9 | 16 | ns |
| | | | | 4.5 V | | 5 | 9 | |
| | | | | 6 V | | 4 | 8 | |

6.7 Operating Characteristics

over operating free-air temperature range; typical values measured at $T_A = 25^\circ\text{C}$ (unless otherwise noted).

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|-----------|--|-----------------|-----|-----|-----|------|
| C_{pd} | Power dissipation capacitance per gate | No load | | 20 | | pF |

6.8 Typical Characteristics

$T_A = 25^\circ\text{C}$

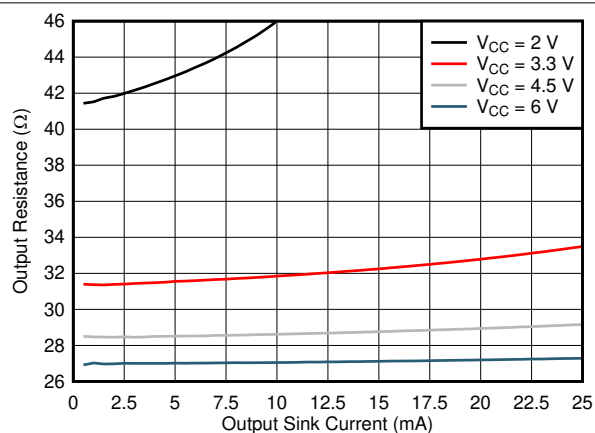


图 6-1. Output Driver Resistance in LOW State

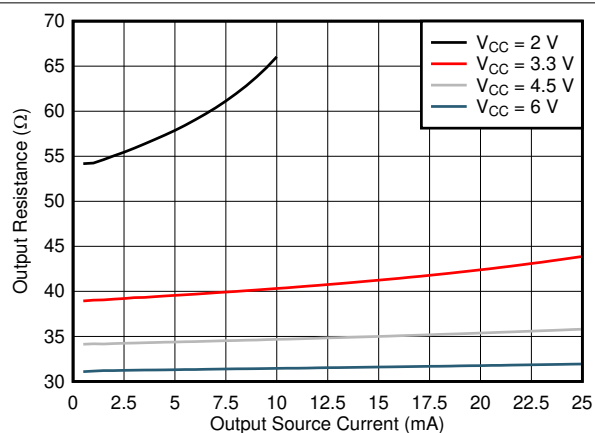


图 6-2. Output Driver Resistance in HIGH State

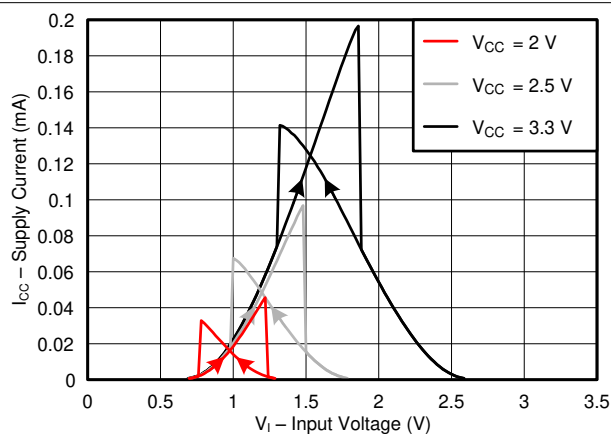


图 6-3. Supply Current Across Input Voltage, 2-, 2.5-, and 3.3-V Supply

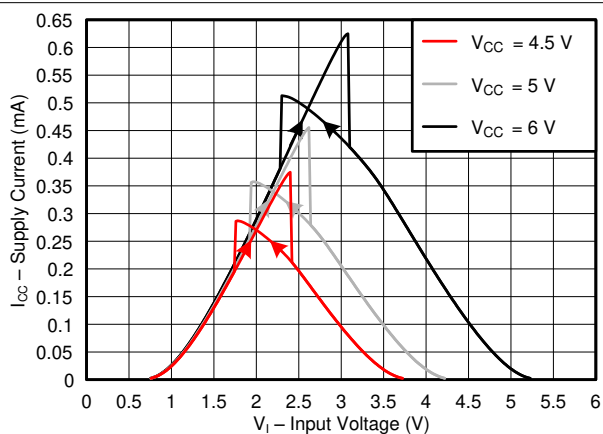


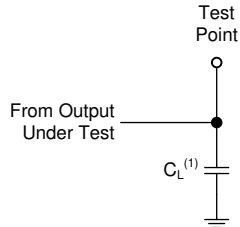
图 6-4. Supply Current Across Input Voltage, 4.5-, 5-, and 6-V Supply

7 Parameter Measurement Information

Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_f < 2.5 \text{ ns}$.

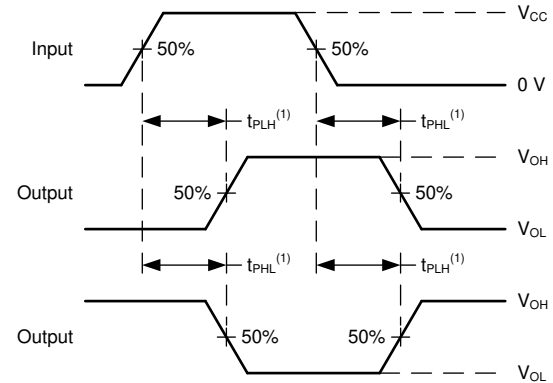
For clock inputs, f_{\max} is measured when the input duty cycle is 50%.

The outputs are measured one at a time with one input transition per measurement.



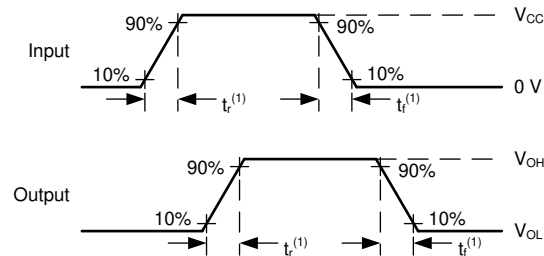
(1) C_L includes probe and test-fixture capacitance.

图 7-1. Load Circuit for Push-Pull Outputs



(1) The greater between t_{PLH} and t_{PHL} is the same as t_{pd} .

图 7-2. Voltage Waveforms Propagation Delays



(1) The greater between t_r and t_f is the same as t_t .

图 7-3. Voltage Waveforms, Input and Output Transition Times

8 Detailed Description

8.1 Overview

The SN74HCS244-Q1 contains 8 individual high speed CMOS buffers with Schmitt-trigger inputs and 3-state outputs.

Each buffer performs the boolean logic function $xY_n = xA_n$, with x being the bank number and n being the channel number.

Each output enable (\overline{xOE}) controls four buffers. When the \overline{xOE} pin is in the low state, the outputs of all buffers in the bank x are enabled. When the \overline{xOE} pin is in the high state, the outputs of all buffers in the bank x are disabled. All disabled output are placed into the high-impedance state.

To ensure the high-impedance state during power up or power down, both \overline{OE} pins should be tied to V_{CC} through a pull-up resistor; the minimum value of the resistor is determined by the current sinking capability of the driver and the leakage of the pin as defined in the *Electrical Characteristics* table.

8.2 Functional Block Diagram

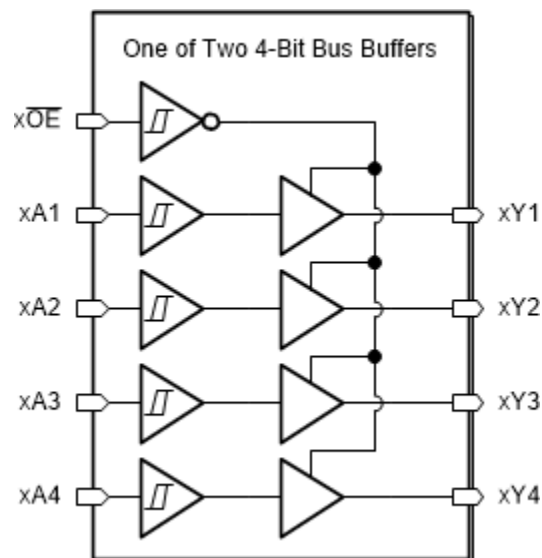


图 8-1. Logic Diagram (Positive Logic) for SN74HCS244-Q1

8.3 Feature Description

8.3.1 Balanced CMOS Push-Pull Outputs

This device includes balanced CMOS push-pull outputs. The term "balanced" indicates that the device can sink and source similar currents. The drive capability of this device may create fast edges into light loads so routing and load conditions should be considered to prevent ringing. Additionally, the outputs of this device are capable of driving larger currents than the device can sustain without being damaged. It is important for the output power of the device to be limited to avoid damage due to overcurrent. The electrical and thermal limits defined in the *Absolute Maximum Ratings* must be followed at all times.

Unused push-pull CMOS outputs should be left disconnected.

8.3.2 CMOS Schmitt-Trigger Inputs

This device includes inputs with the Schmitt-trigger architecture. These inputs are high impedance and are typically modeled as a resistor in parallel with the input capacitance given in the *Electrical Characteristics* table from the input to ground. The worst case resistance is calculated with the maximum input voltage, given in the *Absolute Maximum Ratings* table, and the maximum input leakage current, given in the *Electrical Characteristics* table, using Ohm's law ($R = V \div I$).

The Schmitt-trigger input architecture provides hysteresis as defined by ΔV_T in the *Electrical Characteristics* table, which makes this device extremely tolerant to slow or noisy inputs. While the inputs can be driven much slower than standard CMOS inputs, it is still recommended to properly terminate unused inputs. Driving the inputs with slow transitioning signals will increase dynamic current consumption of the device. For additional information regarding Schmitt-trigger inputs, please see [Understanding Schmitt Triggers](#).

8.3.3 Clamp Diode Structure

The inputs and outputs to this device have both positive and negative clamping diodes as depicted in [Electrical Placement of Clamping Diodes for Each Input and Output](#).

CAUTION

Voltages beyond the values specified in the *Absolute Maximum Ratings* table can cause damage to the device. The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.

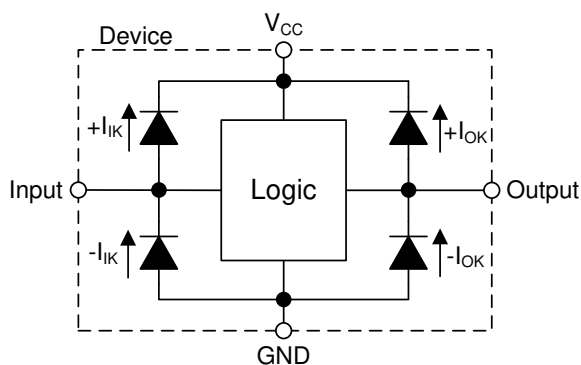


图 8-2. Electrical Placement of Clamping Diodes for Each Input and Output

8.3.4 Wettable Flanks

This device includes wettable flanks for at least one package. See the *Features* section on the front page of the data sheet for which packages include this feature.

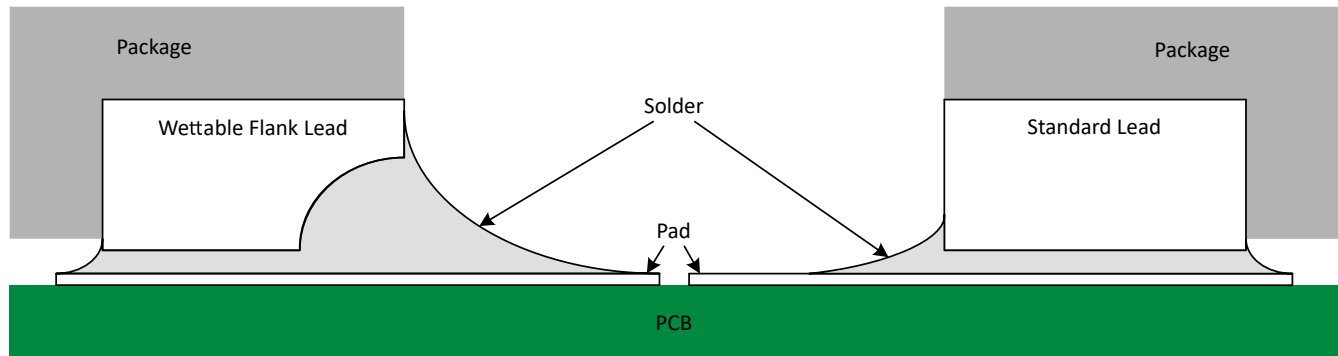


图 8-3. Simplified Cutaway View of Wettable-Flank QFN Package and Standard QFN Package After Soldering

Wettable flanks help improve side wetting after soldering which makes QFN packages easier to inspect with automatic optical inspection (AOI). A wettable flank can be dimpled or step-cut to provide additional surface area for solder adhesion which assists in reliably creating a side fillet as shown in [Simplified Cutaway View of Wettable-Flank QFN Package and Standard QFN Package After Soldering](#). Please see the mechanical drawing for additional details.

8.4 Device Functional Modes

[Function Table](#) lists the functional modes of the SN74HCS244-Q1.

表 8-1. Function Table

| INPUTS ⁽¹⁾ | | OUTPUTS |
|-----------------------|---|---------|
| OE | A | Y |
| L | L | L |
| L | H | H |
| H | X | Z |

(1) H = High Voltage Level, L = Low Voltage Level, X = Don't Care, Z = High-Impedance State

9 Application and Implementation

备注

以下应用部分中的信息不属于 TI 器件规格的范围，TI 不担保其准确性和完整性。TI 的客户应负责确定器件是否适用于其应用。客户应验证并测试其设计，以确保系统功能。

9.1 Application Information

The SN74HCS244-Q1 can be used to drive signals over relatively long traces or transmission lines. In order to reduce ringing caused by impedance mismatches between the driver, transmission line, and receiver, a series damping resistor placed in series with the transmitter's output can be used. The plot in the *Application Curve* section shows the received signal with three separate resistor values. Just a small amount of resistance can make a significant impact on signal integrity in this type of application.

9.2 Typical Application

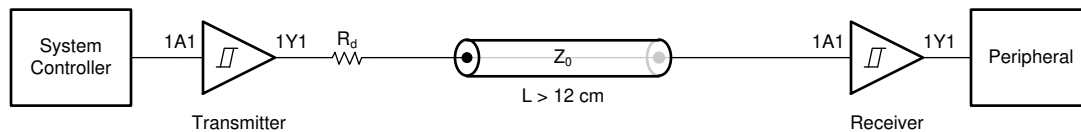


图 9-1. Typical application block diagram

9.2.1 Design Requirements

9.2.1.1 Power Considerations

Ensure the desired supply voltage is within the range specified in the *Recommended Operating Conditions*. The supply voltage sets the device's electrical characteristics as described in the *Electrical Characteristics*.

The positive voltage supply must be capable of sourcing current equal to the total current to be sourced by all outputs of the SN74HCS244-Q1 plus the maximum static supply current, I_{CC} , listed in *Electrical Characteristics* and any transient current required for switching. The logic device can only source as much current as is provided by the positive supply source. Be sure not to exceed the maximum total current through V_{CC} listed in the *Absolute Maximum Ratings*.

The ground must be capable of sinking current equal to the total current to be sunk by all outputs of the SN74HCS244-Q1 plus the maximum supply current, I_{CC} , listed in *Electrical Characteristics*, and any transient current required for switching. The logic device can only sink as much current as can be sunk into its ground connection. Be sure not to exceed the maximum total current through GND listed in the *Absolute Maximum Ratings*.

The SN74HCS244-Q1 can drive a load with a total capacitance less than or equal to 50 pF while still meeting all of the datasheet specifications. Larger capacitive loads can be applied, however it is not recommended to exceed 50 pF.

The SN74HCS244-Q1 can drive a load with total resistance described by $R_L \geq V_O / I_O$, with the output voltage and current defined in the *Electrical Characteristics* table with V_{OH} and V_{OL} . When outputting in the high state, the output voltage in the equation is defined as the difference between the measured output voltage and the supply voltage at the V_{CC} pin.

Total power consumption can be calculated using the information provided in [CMOS Power Consumption and Cpd Calculation](#).

Thermal increase can be calculated using the information provided in [Thermal Characteristics of Standard Linear and Logic \(SLL\) Packages and Devices](#).

CAUTION

The maximum junction temperature, $T_{J(max)}$ listed in the *Absolute Maximum Ratings*, is an additional limitation to prevent damage to the device. Do not violate any values listed in the *Absolute Maximum Ratings*. These limits are provided to prevent damage to the device.

9.2.1.2 Input Considerations

Input signals must cross $V_{t(min)}$ to be considered a logic LOW, and $V_{t+(max)}$ to be considered a logic HIGH. Do not exceed the maximum input voltage range found in the *Absolute Maximum Ratings*.

Unused inputs must be terminated to either V_{CC} or ground. These can be directly terminated if the input is completely unused, or they can be connected with a pull-up or pull-down resistor if the input is to be used sometimes, but not always. A pull-up resistor is used for a default state of HIGH, and a pull-down resistor is used for a default state of LOW. The resistor size is limited by drive current of the controller, leakage current into the SN74HCS244-Q1, as specified in the *Electrical Characteristics*, and the desired input transition rate. A 10-k Ω resistor value is often used due to these factors.

The SN74HCS244-Q1 has no input signal transition rate requirements because it has Schmitt-trigger inputs.

Another benefit to having Schmitt-trigger inputs is the ability to reject noise. Noise with a large enough amplitude can still cause issues. To know how much noise is too much, please refer to the $\Delta V_{T(min)}$ in the *Electrical Characteristics*. This hysteresis value will provide the peak-to-peak limit.

Unlike what happens with standard CMOS inputs, Schmitt-trigger inputs can be held at any valid value without causing huge increases in power consumption. The typical additional current caused by holding an input at a value other than V_{CC} or ground is plotted in the *Typical Characteristics*.

Refer to the *Feature Description* section for additional information regarding the inputs for this device.

9.2.1.3 Output Considerations

The positive supply voltage is used to produce the output HIGH voltage. Drawing current from the output will decrease the output voltage as specified by the V_{OH} specification in the *Electrical Characteristics*. The ground voltage is used to produce the output LOW voltage. Sinking current into the output will increase the output voltage as specified by the V_{OL} specification in the *Electrical Characteristics*.

Push-pull outputs that could be in opposite states, even for a very short time period, should never be connected directly together. This can cause excessive current and damage to the device.

Two channels within the same device with the same input signals can be connected in parallel for additional output drive strength.

Unused outputs can be left floating. Do not connect outputs directly to V_{CC} or ground.

Refer to *Feature Description* section for additional information regarding the outputs for this device.

9.2.2 Detailed Design Procedure

1. Add a decoupling capacitor from V_{CC} to GND. The capacitor needs to be placed physically close to the device and electrically close to both the V_{CC} and GND pins. An example layout is shown in the *Layout* section.
2. Ensure the capacitive load at the output is ≤ 50 pF. This is not a hard limit, however it will ensure optimal performance. This can be accomplished by providing short, appropriately sized traces from the SN74HCS244-Q1 to the receiving device(s).
3. Ensure the resistive load at the output is larger than $(V_{CC} / I_{O(max)}) \Omega$. This will ensure that the maximum output current from the *Absolute Maximum Ratings* is not violated. Most CMOS inputs have a resistive load measured in megaohms; much larger than the minimum calculated above.
4. Thermal issues are rarely a concern for logic gates, however the power consumption and thermal increase can be calculated using the steps provided in the application report, [CMOS Power Consumption and Cpd Calculation](#).

9.2.3 Application Curve

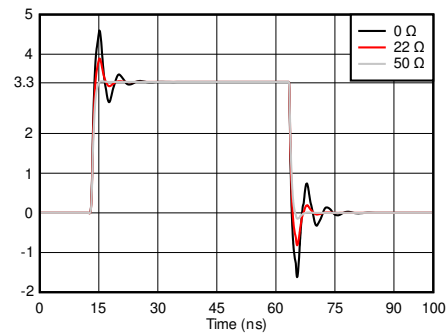


图 9-2. Simulated signal integrity at the reciever with different damping resistor (R_d) values

10 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the *Recommended Operating Conditions*. Each V_{CC} terminal should have a good bypass capacitor to prevent power disturbance. A 0.1- μ F capacitor is recommended for this device. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. The 0.1- μ F and 1- μ F capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results, as shown in given example layout image.

11 Layout

11.1 Layout Guidelines

When using multiple-input and multiple-channel logic devices inputs must not ever be left floating. In many cases, functions or parts of functions of digital logic devices are unused; for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used. Such unused input pins must not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. All unused inputs of digital logic devices must be connected to a logic high or logic low voltage, as defined by the input voltage specifications, to prevent them from floating. The logic level that must be applied to any particular unused input depends on the function of the device. Generally, the inputs are tied to GND or V_{CC} , whichever makes more sense for the logic function or is more convenient.

11.2 Layout Example

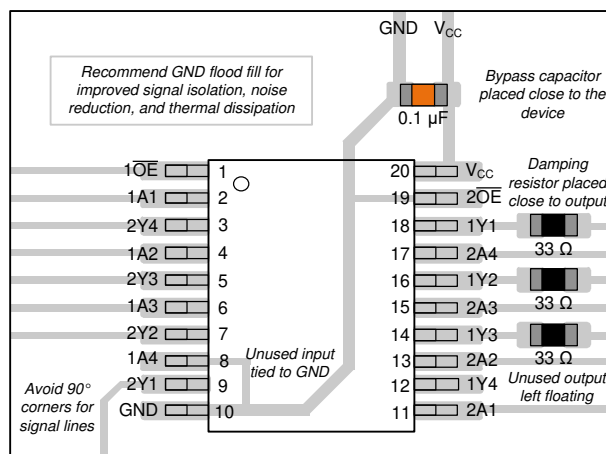


图 11-1. Example layout for the SN74HCS244-Q1 in the PW package.

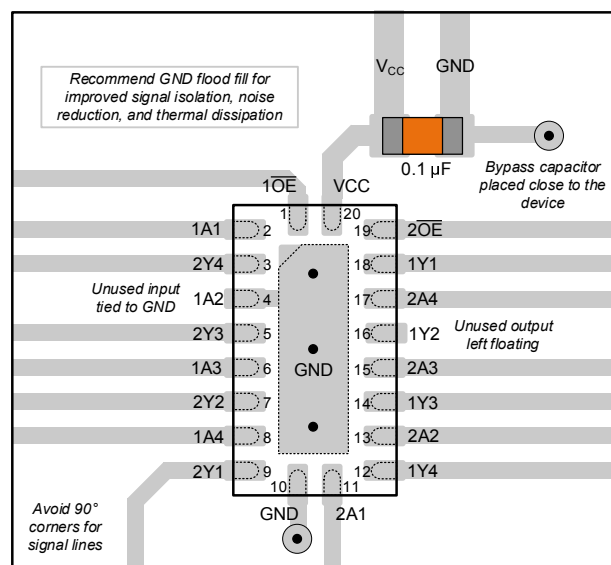


图 11-2. Example layout for the SN74HCS244-Q1 in the WRKS package

12 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

12.1 Documentation Support

12.1.1 Related Documentation

For related documentation see the following:

- Texas Instruments, [HCMOS Design Considerations application report](#) (SCLA007)
- Texas Instruments, [CMOS Power Consumption and \$C_{pd}\$ Calculation application report](#) (SDYA009)
- Texas Instruments, [Designing With Logic application report](#)

12.2 接收文档更新通知

要接收文档更新通知，请导航至 [ti.com](https://www.ti.com) 上的器件产品文件夹。点击 [订阅更新](#) 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

12.3 支持资源

TI E2E™ 支持论坛是工程师的重要参考资料，可直接从专家获得快速、经过验证的解答和设计帮助。搜索现有解答或提出自己的问题可获得所需的快速设计帮助。

链接的内容由各个贡献者“按原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的《[使用条款](#)》。

12.4 Trademarks

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12.5 静电放电警告



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ESD 的损坏小至导致微小的性能降级，大至整个器件故障。精密的集成电路可能更容易受到损坏，这是因为非常细微的参数更改都可能会导致器件与其发布的规格不相符。

12.6 术语表

TI 术语表 本术语表列出并解释了术语、首字母缩略词和定义。

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.

PACKAGING INFORMATION

| Orderable part number | Status (1) | Material type (2) | Package Pins | Package qty Carrier | RoHS (3) | Lead finish/ Ball material (4) | MSL rating/ Peak reflow (5) | Op temp (°C) | Part marking (6) |
|------------------------------------|---------------|----------------------|-----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|---------------------|
| SN74HCS244QPWRQ1 | Active | Production | TSSOP (PW) 20 | 2000 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | HCS244Q |
| SN74HCS244QPWRQ1.A | Active | Production | TSSOP (PW) 20 | 2000 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | HCS244Q |
| SN74HCS244QWRKSRQ1 | Active | Production | VQFN (RKS) 20 | 3000 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | HCS244Q |
| SN74HCS244QWRKSRQ1.A | Active | Production | VQFN (RKS) 20 | 3000 LARGE T&R | Yes | NIPDAU | Level-1-260C-UNLIM | -40 to 125 | HCS244Q |

⁽¹⁾ **Status:** For more details on status, see our [product life cycle](#).

⁽²⁾ **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

⁽³⁾ **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

⁽⁴⁾ **Lead finish/Ball material:** Parts 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.

⁽⁵⁾ **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

⁽⁶⁾ **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF SN74HCS244-Q1 :

- Catalog : [SN74HCS244](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

TAPE AND REEL INFORMATION



*All dimensions are nominal

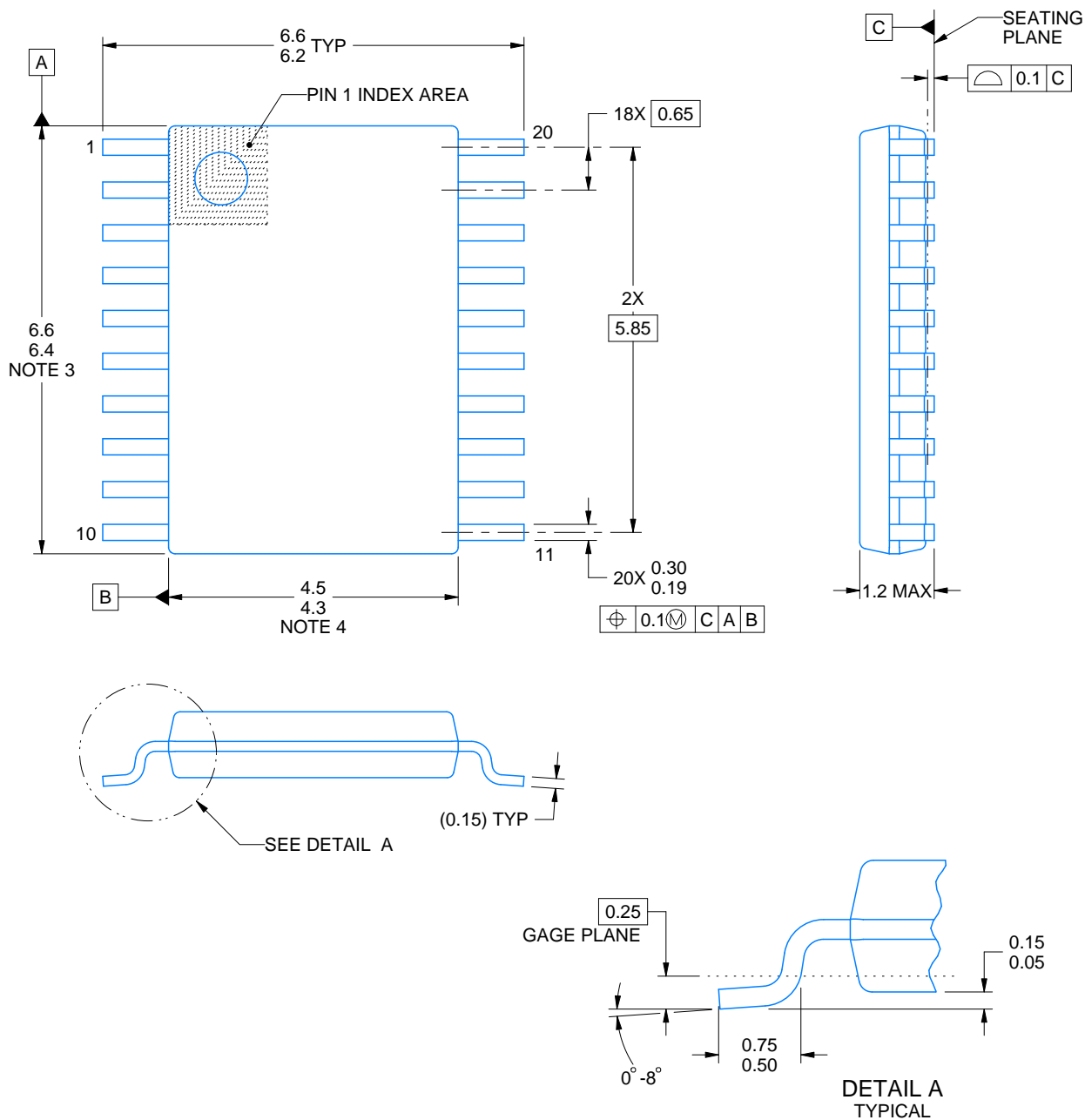
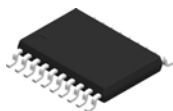
| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|--------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74HCS244QWRKSRQ1 | VQFN | RKS | 20 | 3000 | 180.0 | 12.4 | 2.8 | 4.8 | 1.2 | 4.0 | 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) |
|--------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74HCS244QWRKSRQ1 | VQFN | RKS | 20 | 3000 | 210.0 | 185.0 | 35.0 |



4220206/A 02/2017

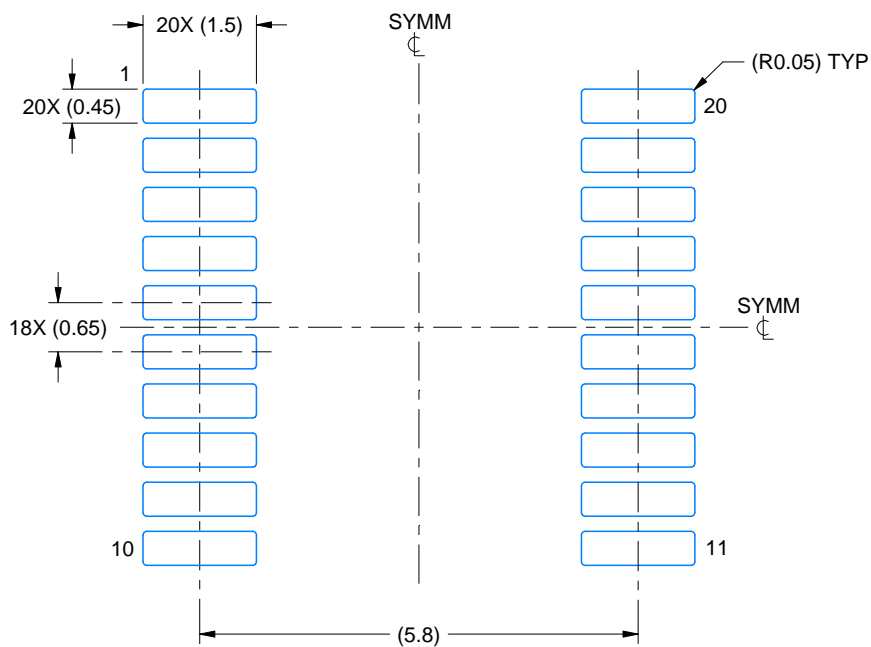
NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

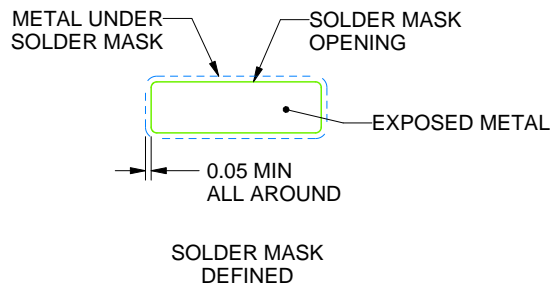
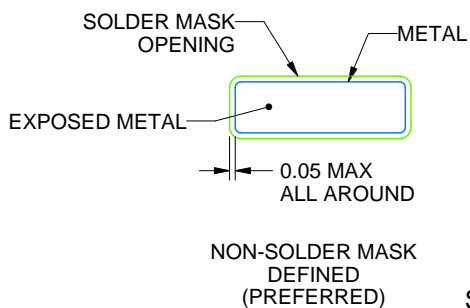
PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

4220206/A 02/2017

NOTES: (continued)

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

EXAMPLE STENCIL DESIGN

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220206/A 02/2017

NOTES: (continued)

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

GENERIC PACKAGE VIEW

RKS 20

VQFN - 1 mm max height

2.5 x 4.5, 0.5 mm pitch

PLASTIC QUAD FLATPACK - NO LEAD

This image is a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.



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