CD74HCT4066-Q1 汽车级高速 CMOS 逻辑四路双向开关

1 特性

- 符合汽车应用要求
- 低导通电阻：
  - 25Ω（典型值）(V_{CC} = 4.5V)
- 快速开关和传播速度
- 低关断漏电流
- 宽工作温度范围：-40°C 至 125°C
- 直接 LSTTL 输入逻辑兼容性：V_{IL} = 0.8V（最大值），V_{IH} = 2V（最小值）
- CMOS 输入兼容性：$I_I \leq 1\mu A$（电压为 V_{OL}、V_{OH} 时）

2 应用

- 模拟信号开关和多路复用：信号门控、调制器、静噪控制、解调器、斩波器、换向开关
- 数字信号开关和多路复用
- 模数和数模转换
- 频率、阻抗、相位和模拟信号增益的数字控制
- 楼宇自动化

3 说明

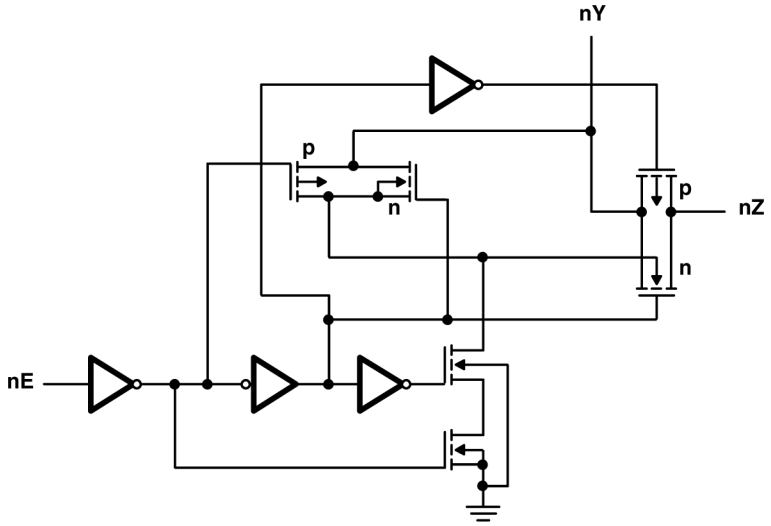
CD74HCT4066-Q1 包含四个独立的数控模拟开关，这些开关使用硅栅 CMOS 技术并借助标准 CMOS 集成电路的低功耗特性来实现与 LSTTL 接近的运行速度。

这些开关具有金属栅 CD4066B 的特有线性导通电阻。每个开关由其控制输入端的高电平电压进行开通。

封装信息

器件型号	封装(1)	封装尺寸(2)
CD74HCT4066-Q1	PW（TSSOP，14）	5mm × 6.4mm

(1) 有关更多信息，请参阅节 10
(2) 封装尺寸（长 × 宽）为标称值，并包括引脚（如适用）。



逻辑图（正逻辑）

Table of Contents

4 Pin Configuration and Functions

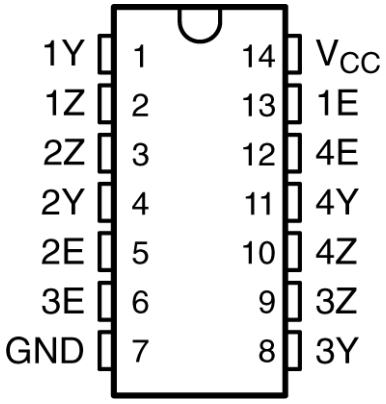


图 4-1. DW or PW Package, 14-Pin SOIC or TSSOP (Top View)

表 4-1. Pin Functions

PIN		TYPE(1)	DESCRIPTION
NAME	NO.		
1Y	1	I/O	Input/Output for Switch 1
1Z	2	I/O	Input/Output for Switch 1
2Z	3	I/O	Input/Output for Switch 2
2Y	4	I/O	Input/Output for Switch 2
2E	5	I	Control pin for Switch 2
3E	6	I	Control pin for Switch 3
GND	7	-	Ground Pin
3Y	8	I/O	Input/Output for Switch 3
3Z	9	I/O	Input/Output for Switch 3
4Z	10	I/O	Input/Output for Switch 4
4Y	11	I/O	Input/Output for Switch 4
4E	12	I	Control pin for Switch 4
1E	13	I	Control pin for Switch 1
V_{CC}	14	-	Power Pin

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

5 Specifications

5.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
V_{CC} (see (2))	Supply voltage range		−0.5	+7	V
I_{IK} (V_I < −0.5V or V_I > V_{CC} + 0.5V)	Input clamp current			±20	mA
I_{OK} (V_O < −0.5V or V_O > V_{CC} + 0.5V)	Output clamp current			±20	mA
I_O (see (3)) (V_O > −0.5V or V_O < V_{CC} + 0.5V)	Switch current			±25	mA
I_O (V_O > −0.5V or V_O < V_{CC} + 0.5V)	Output source or sink current per output pin			±25	mA
	Continuous current through V_{CC} or GND			±50	mA
T_{stg}	Storage temperature range		−65	150	°C

(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) All voltages referenced to GND unless otherwise specified.
(3) In certain applications, the external load-resistor current may include both V_{CC} and signal-line components. To avoid drawing V_{CC} current when switch current flows into the transmission gate inputs (terminals 1, 4, 8, and 11), the voltage drop across the bidirectional switch must not exceed 0.6V (calculated from r_{on} values shown in the electrical characteristics table). No V_{CC} current flows through R_L if the switch current flows into terminals 2, 3, 9, and 10.

5.2 Thermal Information

THERMAL METRIC (1)		CD74HCT4066-Q1 PW (TSSOP) 14 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance	133.9	°C/W

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

5.3 Recommended Operating Conditions

(see (1))

			MIN	MAX	UNIT
V_{CC}	Supply voltage		4.5	5.5	V
V_{IH}	High-level input voltage		2		V
V_{IL}	Low-level input voltage			0.8	V
V_I	Input voltage		0	V_{CC}	V
V_O	Output voltage		0	V_{CC}	V
t_t	Input transition (rise and fall) time	V_{CC} = 4.5V	0	500	ns
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.

5.4 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS		V_I	V_{CC}	T_A = 25°C			T_A = −40 TO 125°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
I_{IL}	Any control		V_{CC} or GND	5.5V			±0.1		±1	µA
I_{IZ}	V_{IS} = V_{CC} or GND		V_{IL}	5.5V			±0.1		±1	µA
r_{on}	I_O = 1mA, See 图 5-1	V_{IS} = V_{CC} or GND	V_{CC}	4.5V		25	80		128	Ω
		V_{IS} = V_{CC} to GND	V_{CC}	4.5V		35	95		142	
Δr_{on}	Between any two switches		V_{CC}	4.5V		1				Ω
I_{CC}			V_{CC} or GND	5.5V			2		40	µA
ΔI_{CC}	Per input pin: 1 unit load, See (1)		V_{CC} − 2.1V	4.5V to 5.5V		100	360		490	µA
C_I	Control inputs						10		10	pF

(1) For dual-supply systems, theoretical worst case (V_I = 2.4V, V_{CC} = 5.5V) specification is 1.8mA.

5.5 HCT Input Loading

INPUT	UNIT LOADS (1)
All	1

(1) Unit load is ΔI_{CC} limit specified in the electrical characteristics table, for example,., 360 µA max at 25°C.

5.6 Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see 图 6-6)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	V_{CC}	T_A = 25°C			T_A = −40°C TO 125°C		UNIT
					MIN	TYP	MAX	MIN	MAX	
t_{pd}	Y or Z	Z or Y	C_L = 15pF	5V		1.3				ns
			C_L = 50pF	4.5V			12		18	
t_{en}	E	Y or Z	C_L = 15pF	5V		5				ns
			C_L = 50pF	4.5V			24		36	
t_{dis}	E	Y or Z	C_L = 15pF	5V		5.5				ns
			C_L = 50pF	4.5V			35		53	

5.7 Operating Characteristics

V_{CC} = 5V, T_A = 25°C, input t_r, t_f = 6ns

PARAMETER		TYP	UNIT
C_{pd}	Power dissipation capacitance (see (1))	38	pF

(1) C_{pd} is used to determine the dynamic power consumption (P_D), per package.

- $P_D = (C_{pd} \times V_{CC}^2 \times f_I) + \Sigma\ (C_L + C_S) \times V_{CC}^2 \times f_O$
- f_O = output frequency
- f_I = input frequency
- C_L = output load capacitance
- C_S = switch capacitance
- V_{CC} = supply voltage

5.8 Analog Channel Characteristics

T_A = 25°C

PARAMETER		TEST CONDITIONS	V_{CC}	TYP	UNIT
f_{max}	Switch frequency response bandwidth at −3dB	See 图 6-2 and 图 5-2 and Notes 7 and 8	4.5V	200	MHz
	Crosstalk between any two switches	See 图 6-1 and 图 5-3 and Notes 8 and 9	4.5V	−72	dB
	Total harmonic distortion	See 图 6-3, 1kHz, V_{IS} = $4V_{P-P}$	4.5V	0.023	%
	Control to switch feedthrough noise	See 图 6-4	4.5V	130	mV
	Switch OFF signal feedthrough	See 图 6-5 and 图 5-3 and Notes 8 and 9	4.5V	−72	dB
C_S	Switch input capacitance			5	pF

(1) Adjust input voltage to obtain 0dBm at output, f = 1MHz.
(2) V_{IS} is centered at V_{CC}/2.
(3) Adjust input for 0dBm at V_{IS}.

5.9 Typical Characteristics

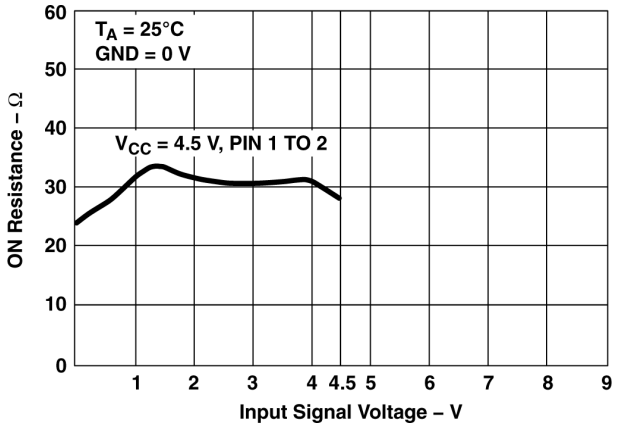


图 5-1. Typical on Resistance vs Input Signal Voltage

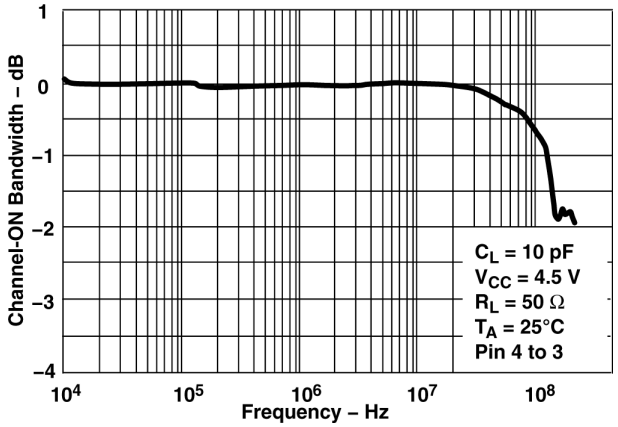


图 5-2. Switch Frequency Response, V_{CC} = 4.5V

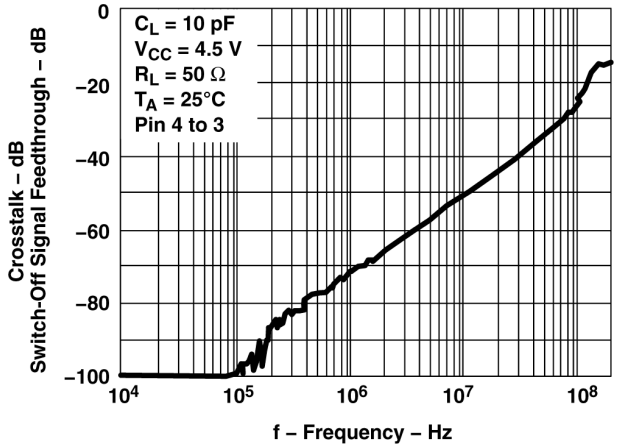


图 5-3. Switch-OFF Signal Feedthrough and Crosstalk vs Frequency, V_{CC} = 4.5V

6 Parameter Measurement Information

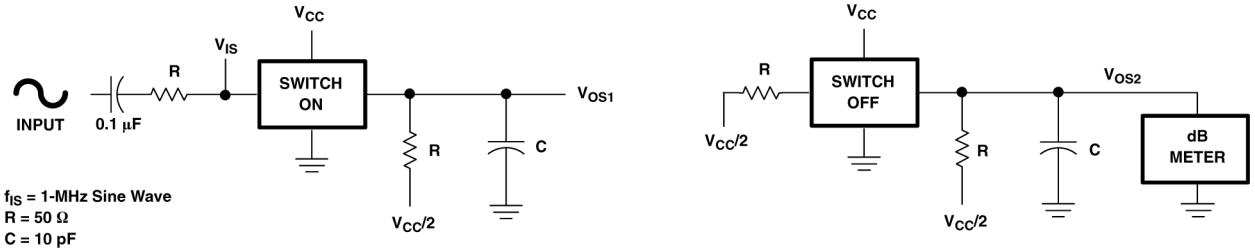


图 6-1. Crosstalk between Two Switches Test Circuit

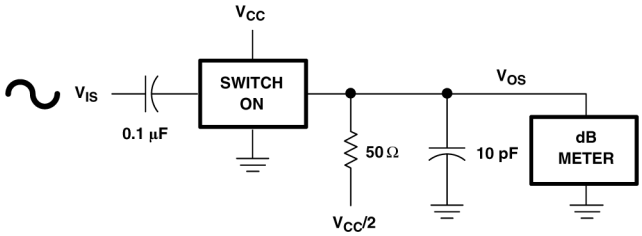


图 6-2. Frequency-Response Test Circuit

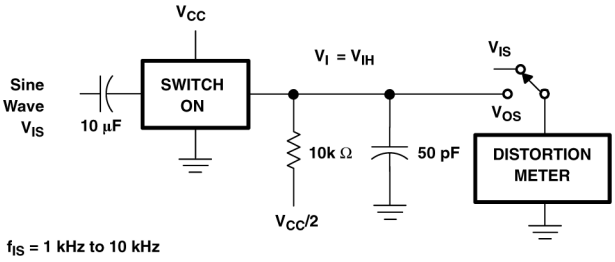


图 6-3. Total Harmonic Distortion Test Circuit

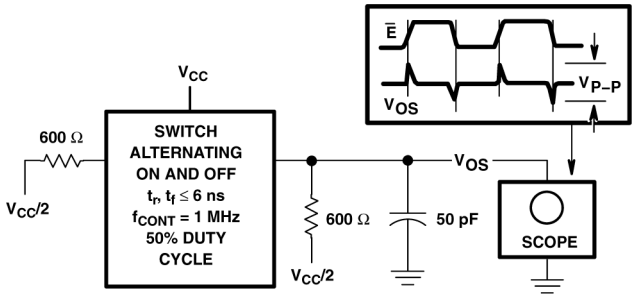


图 6-4. Control-to-Switch Feedthrough Noise Test Circuit

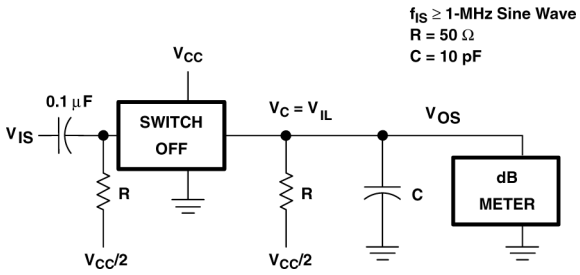
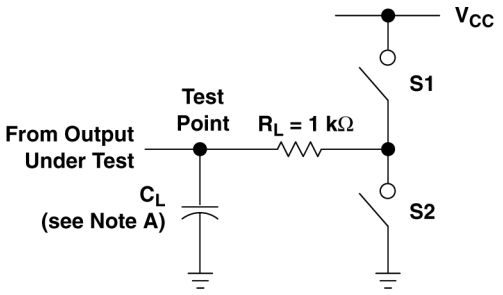
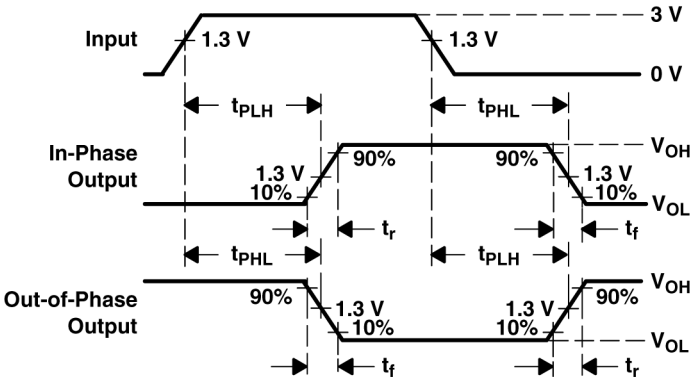


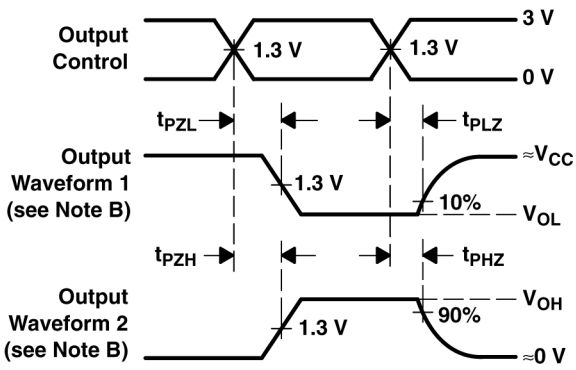
图 6-5. Switch off Signal Feedthrough Test Circuit



LOAD CIRCUIT



VOLTAGE WAVEFORMS
PROPAGATION DELAY AND OUTPUT TRANSITION TIMES



VOLTAGE WAVEFORMS
OUTPUT ENABLE AND DISABLE TIMES

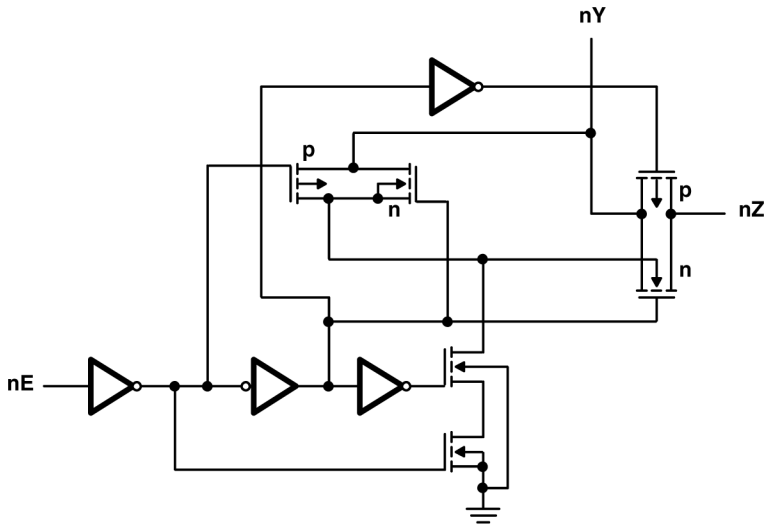
A. C_L includes probe and test-fixture capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
C. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR ⩽ 1MHz, Z_O = 50Ω, t_r = 6ns, t_f = 6ns.
D. For clock inputs, f_{max} is measured with the input duty cycle at 50%.
E. The outputs are measured one at a time, with one input transition per measurement.
F. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
G. t_{PZL} and t_{PZH} are the same as t_{en}.
H. t_{PLH} and t_{PHL} are the same as t_{pd}.

图 6-6. Load Circuit and Voltage Waveforms

PARAMETER		S1	S2
t_{en}	t_{PZH}	Open	Closed
	t_{PZL}	Closed	Open
t_{dis}	t_{PHZ}	Open	Closed
	t_{PLZ}	Closed	Open
t_{pd}		Open	Open

7 Detailed Description

7.1 Functional Block Diagram



7.2 Device Functional Modes

表 7-1. Function Table

INPUT	SWITCH
nE	
L(2)	Off
H(1)	On

(1) H = High level
(2) L = Low level

8 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.

8.1 接收文档更新通知

要接收文档更新通知，请导航至 ti.com 上的器件产品文件夹。点击*通知* 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。

8.2 支持资源

TI E2E™ 中文支持论坛是工程师的重要参考资料，可直接从专家处获得快速、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，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。

8.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.
所有商标均为其各自所有者的财产。

8.4 静电放电警告

静电放电 (ESD) 会损坏这个集成电路。德州仪器 (TI) 建议通过适当的预防措施处理所有集成电路。如果不遵守正确的处理和安装程序，可能会损坏集成电路。

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。

8.5 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。

9 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 (April 2008) to Revision C (July 2024)	Page
• 更新了整个文档中的表格、图和交叉参考的编号格式	1
• 更新了订购信息	1
• Updated thermal information and added CD74HCT4066-Q1	5
• Updated switching specifications	6

10 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 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
CD74HCT4066QM96Q1	NRND	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HCT4066Q	
CD74HCT4066QPWRQ1	ACTIVE	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HK4066Q	Samples
D24066QM96G4Q1	NRND	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HCT4066Q	
HCT4066QPWRG4Q1	OBSOLETE	TSSOP	PW	14		TBD	Call TI	Call TI	-40 to 125	HK4066Q	

(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.

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 CD74HCT4066-Q1 :

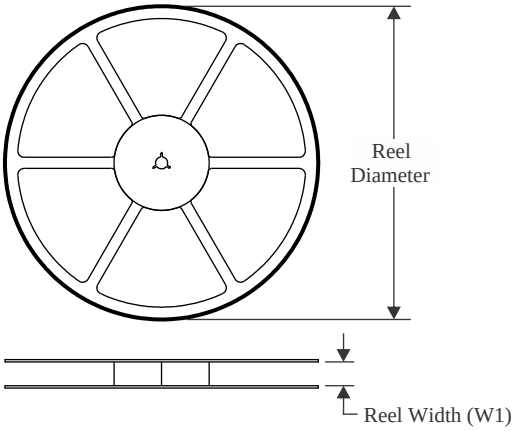
- Catalog : CD74HCT4066

NOTE: Qualified Version Definitions:

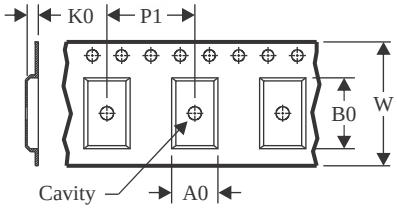
- Catalog - TI's standard catalog product

TAPE AND REEL INFORMATION

REEL DIMENSIONS

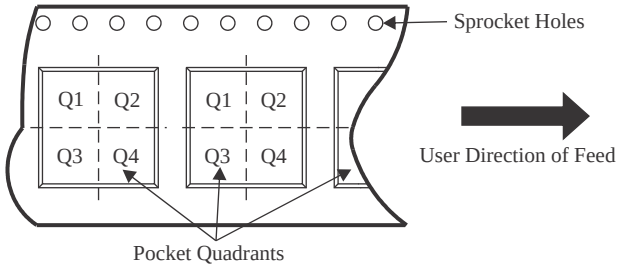


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

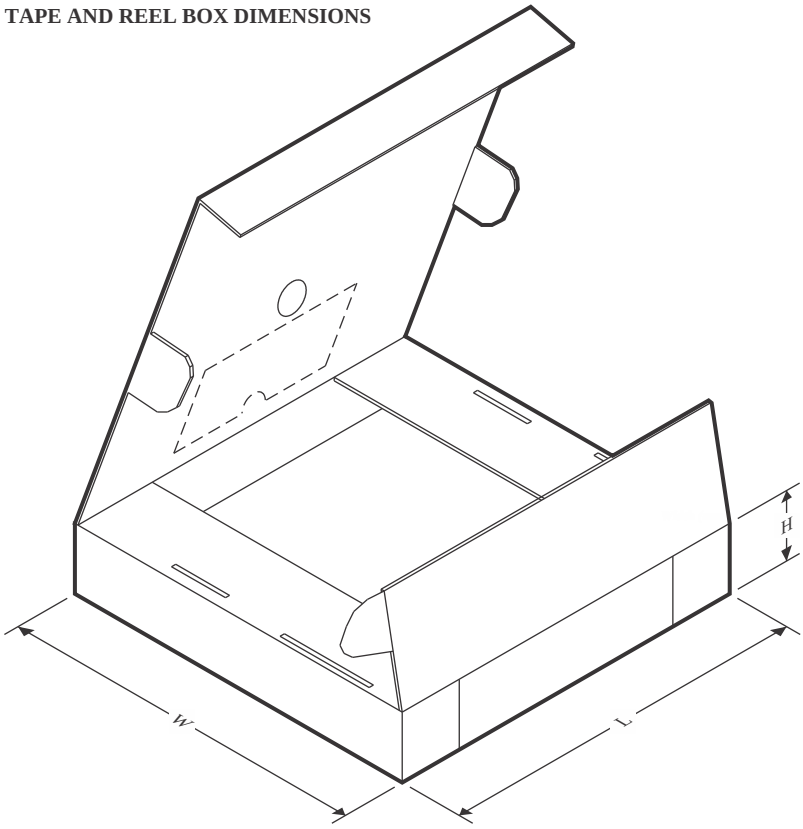
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

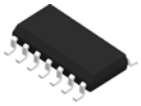
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CD74HCT4066QPWRQ1	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD74HCT4066QPWRQ1	TSSOP	PW	14	2000	367.0	367.0	35.0

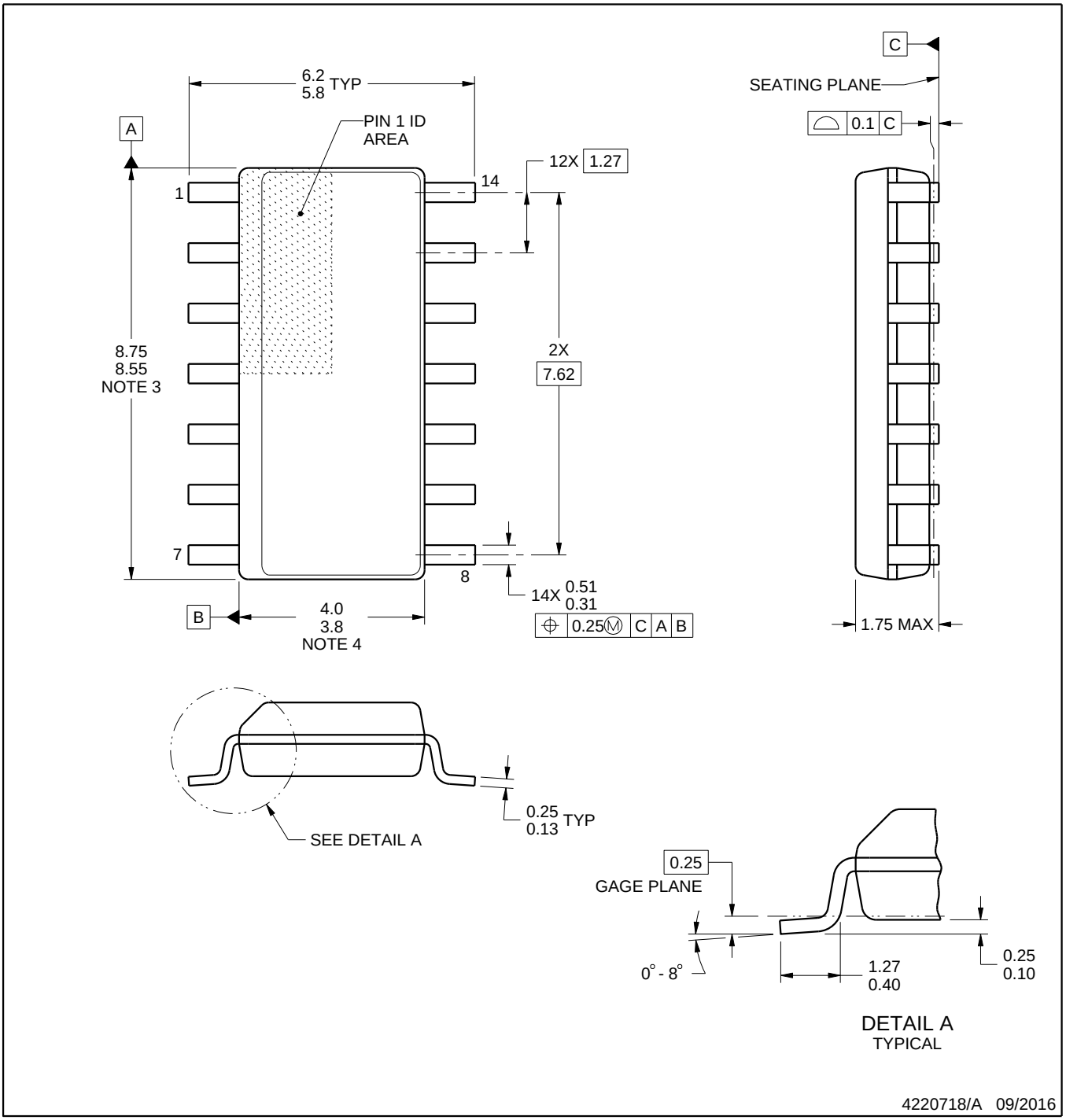


PACKAGE OUTLINE

D0014A

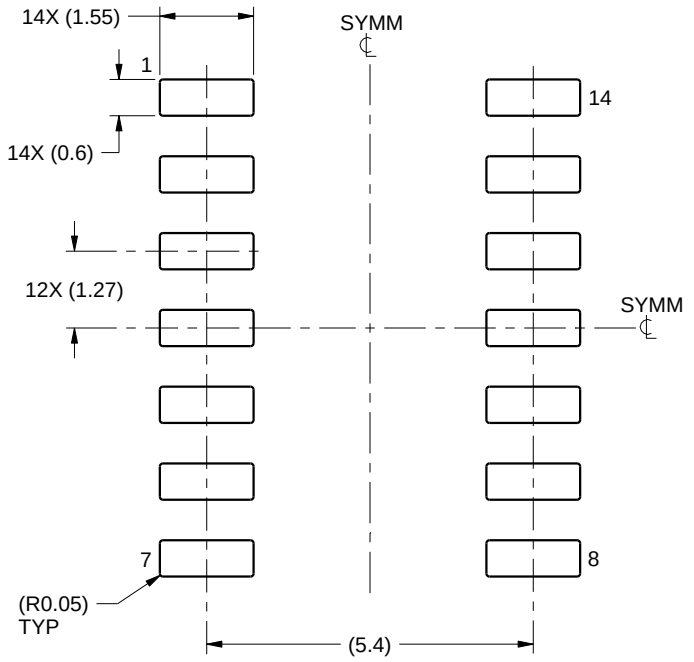
SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT

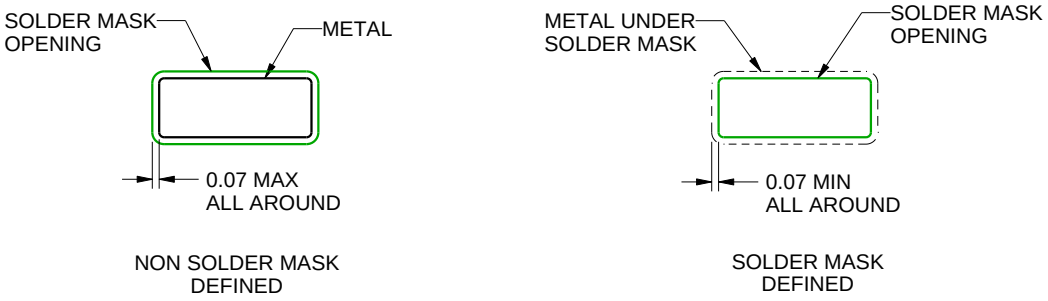


NOTES:

1. All linear dimensions are in millimeters. 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 0.43 mm, per side.
5. Reference JEDEC registration MS-012, variation AB.



LAND PATTERN EXAMPLE
SCALE:8X



SOLDER MASK DETAILS

4220718/A 09/2016

NOTES: (continued)

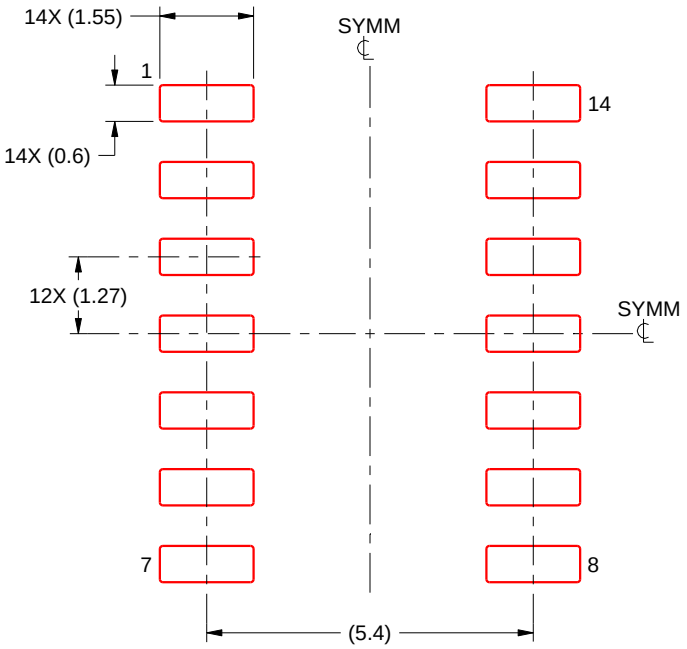
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:8X

4220718/A 09/2016

NOTES: (continued)

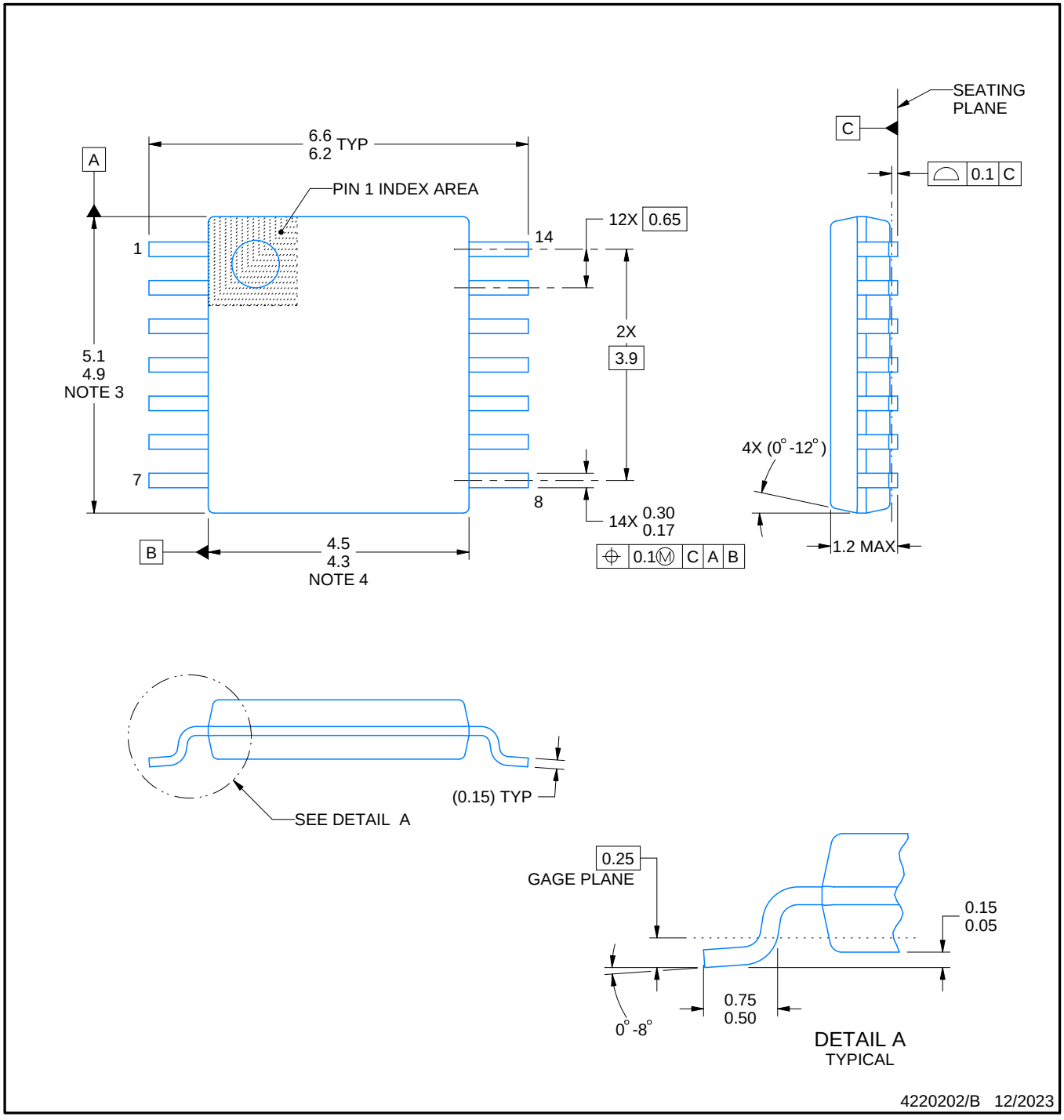
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

PACKAGE OUTLINE

PW0014A

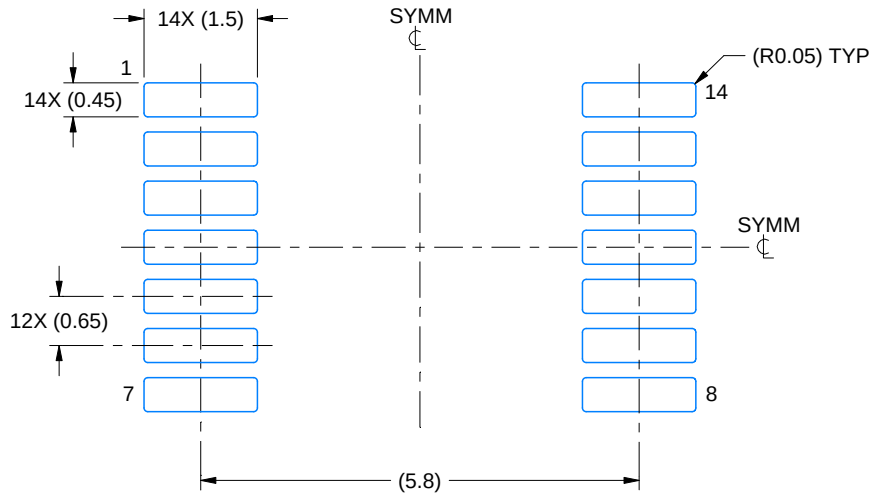
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

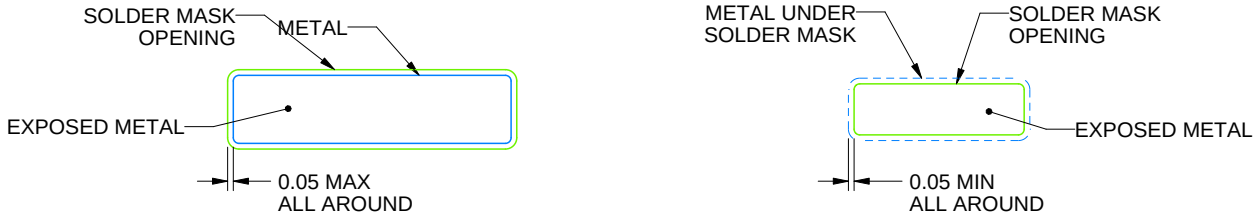


NOTES:

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.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

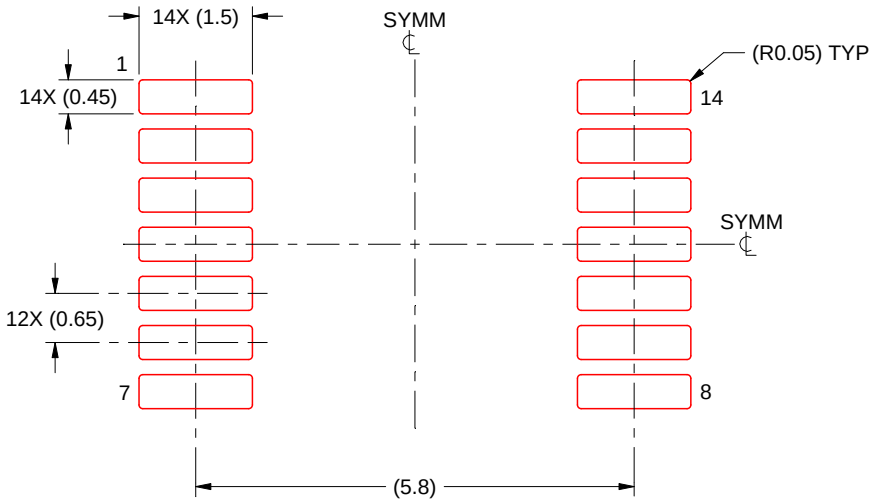


SOLDER MASK DETAILS

4220202/B 12/2023

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.



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

4220202/B 12/2023

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.

重要声明和免责声明

TI“按原样”提供技术和可靠性数据（包括数据表）、设计资源（包括参考设计）、应用或其他设计建议、网络工具、安全信息和其他资源，不保证没有瑕疵且不做出任何明示或暗示的担保，包括但不限于对适销性、某特定用途方面的适用性或不侵犯任何第三方知识产权的暗示担保。

这些资源可供使用 TI 产品进行设计的熟练开发人员使用。您将自行承担以下全部责任：(1) 针对您的应用选择合适的 TI 产品，(2) 设计、验证并测试您的应用，(3) 确保您的应用满足相应标准以及任何其他功能安全、信息安全、监管或其他要求。

这些资源如有变更，恕不另行通知。TI 授权您仅可将这些资源用于研发本资源所述的 TI 产品的应用。严禁对这些资源进行其他复制或展示。您无权使用任何其他 TI 知识产权或任何第三方知识产权。您应全额赔偿因在这些资源的使用中对 TI 及其代表造成的任何索赔、损害、成本、损失和债务，TI 对此概不负责。

TI 提供的产品受 TI 的销售条款或 ti.com 上其他适用条款/TI 产品随附的其他适用条款的约束。TI 提供这些资源并不会扩展或以其他方式更改 TI 针对 TI 产品发布的适用的担保或担保免责声明。

TI 反对并拒绝您可能提出的任何其他或不同的条款。

邮寄地址：Texas Instruments, Post Office Box 655303, Dallas, Texas 75265