

符合 RS-232 的 3V 至 5.5V 单通道线路驱动器和接收器

1 特性

- 由 3V 至 5.5V V_{CC} 电源供电
- 速率高达 1Mbit/s
- 低待机电流：1 μ A (典型值)
- 外部电容器：4 x 0.1 μ F
- 接受 5V 逻辑输入及 3.3V 电源
- 使用人体放电模型 (HBM) 时，RS-232 总线引脚 ESD 保护大于 ± 15 kV
- 自动断电功能可自动禁用驱动器以节省能耗

2 应用

- 工业 PC
- 有线网络
- 数据中心和企业级计算
- 电池供电型系统
- PDA
- 笔记本电脑
- 便携式计算机
- 掌上电脑
- 手持设备

3 说明

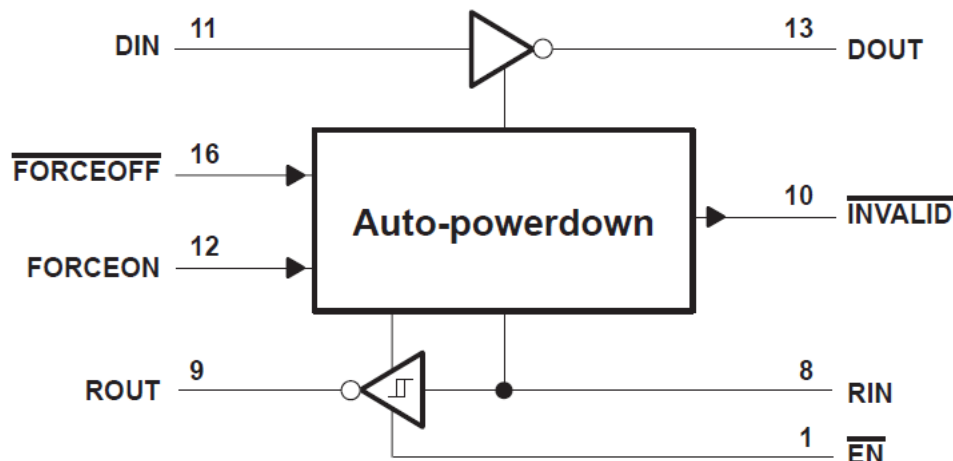
SN65C3221 和 SN75C3221 包含一个线路驱动器、一个线路接收器和一个具有引脚对引脚 (串行端口连接引脚, 包括 GND) ± 15 kV ESD 保护功能的双电荷泵电路。这些器件可在异步通信控制器和串行端口连接器之间提供电气接口。电荷泵和四个小型外部电容器支持由 3V 至 5.5V 单电源供电。这些器件以高达 1Mbit/s 的数据信号传输速率运行, 驱动器输出压摆率为 24V/ μ s 至 150V/ μ s。

串行端口处于非活动状态时, 可提供灵活的电源管理控制选项。当 FORCEON 为低电平且 FORCEOFF 为高电平时, 自动断电功能启用。在这种运行模式下, 如果器件在接收器输入端未感应到有效的 RS-232 信号, 则会禁用驱动器输出。如果 FORCEOFF 设定为低电平且 EN 为高电平, 则驱动器和接收器均关闭, 且电源电流降低至 1 μ A。断开串行端口的连接或关闭外围驱动器会导致发生自动断电情况。当 FORCEON 和 FORCEOFF 均为高电平时可禁用自动断电。启用自动断电的情况下, 向接收器输入施加有效信号时, 器件会自动激活。INVALID 输出会通知用户接收器输入端是否存在 RS-232 信号。如果接收器输入电压大于 2.7V 或小于 -2.7V, 或者介于 -0.3V 至 0.3V 之间的时间少于 30 μ s, 则 INVALID 为高电平 (有效数据)。如果接收器输入电压在 -0.3V 至 0.3V 之间的时间超过 30 μ s, 则 INVALID 为低电平 (无效数据)。有关接收器输入电平的信息, 请参阅图 7-5。

器件信息

器件型号	封装 ⁽¹⁾	封装尺寸 (标称值)
SNx5C3221	SSOP (DB) 16	6.20mm x 5.30mm
	TSSOP (PW) 16	10.3mm x 7.50mm

(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。



逻辑图 (正逻辑)



Table of Contents

1 特性	1	6.10 Switching Characteristics - Auto-Powerdown.....	7
2 应用	1	7 Parameter Measurement Information	8
3 说明	1	8 Detailed Description	11
4 Revision History	2	8.1 Device Functional Modes.....	11
5 Pin Configuration and Functions	3	9 Application and Implementation	12
6 Specifications	4	9.1 Application Information.....	12
6.1 Absolute Maximum Ratings.....	4	10 Device and Documentation Support	13
6.2 ESD Ratings.....	4	10.1 接收文档更新通知.....	13
6.3 Recommended Operating Conditions ⁽¹⁾	4	10.2 支持资源.....	13
6.4 Electrical Characteristics.....	5	10.3 Trademarks.....	13
6.5 Electrical Characteristics - Driver.....	6	10.4 Electrostatic Discharge Caution.....	13
6.6 Switching Characteristics - Driver.....	6	10.5 术语表.....	13
6.7 Electrical Characteristics - Receiver.....	6	11 Mechanical, Packaging, and Orderable Information	13
6.8 Switching Characteristics - Receiver.....	7		
6.9 Electrical Characteristics - Auto-Powerdown.....	7		

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 E (October 2004) to Revision F (July 2021)	Page
• 更改了 <i>应用</i> 列表.....	1
• 删除了“订购信息”表.....	1
• 添加了 <i>器件信息</i> 表.....	1
• Removed the thermal parameters from <i>Absolute Maximum Ratings</i> table and moved them to <i>Thermal Information</i> table.....	4
• Added <i>ESD Ratings</i> table. Moved the driver and receiver ESD specifications to this table.....	4
• Changed the thermal parameters for PW package of SN65C3221 and DB package of SN75C3221. Added additional thermal parameters for both the packages in the <i>Thermal Information</i> table.....	5
• Added the <i>Detailed Description</i> section.....	11

5 Pin Configuration and Functions

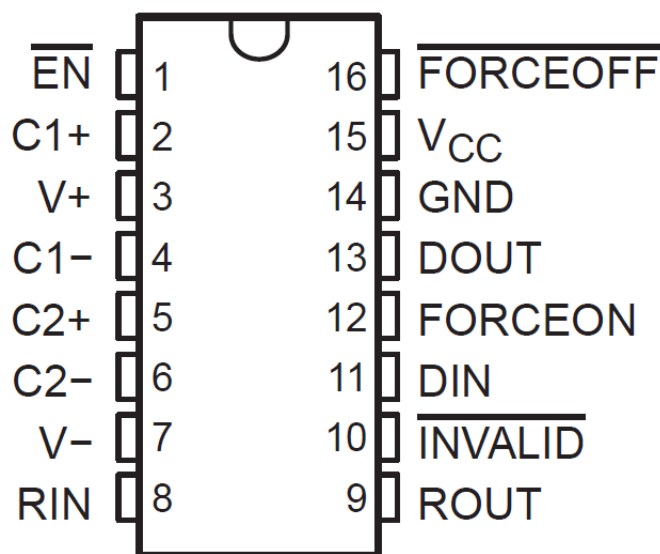


图 5-1. DB or PW Package
Top View

表 5-1. Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO.		
C1+	2	—	Positive terminals of the voltage-doubler charge-pump capacitors
C2+	5		
C1-	4	—	Negative terminals of the voltage-doubler charge-pump capacitors
C2-	6		
DIN	11	I	Driver input
DOUT	13	O	RS-232 driver output
EN	1	I	Low input enables receiver ROUT output. High input sets ROUT to high impedance.
FORCEOFF	16	I	Automatic power-down control input
FORCEON	12	I	Automatic power-down control input
GND	14	—	Ground
INVALID	10	O	Invalid output pin. Output low when all RIN inputs are unpowered.
RIN	8	I	RS-232 receiver input
ROUT	9	O	Receiver output
V _{CC}	15	—	3-V to 5.5-V supply voltage
V+	3	O	5.5-V supply generated by the charge pump
V-	7	O	-5.5-V supply generated by the charge pump

6 Specifications

6.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
V _{CC}	Supply voltage range		−0.3	6	V
V ₊	Positive output supply voltage range ⁽²⁾		−0.3	7	V
V _−	Negative output supply voltage range ⁽²⁾		−7	0.3	V
V ₊ − V _−	Supply voltage difference ⁽²⁾			13	V
V _I	Input voltage range	Driver (FORCEOFF, FORCEON, $\overline{\text{EN}}$)	−0.3	6	V
		Receiver	−25	25	
V _O	Output voltage range	Driver	−13.2	13.2	V
		Receiver (INVALID)	−0.3	V _{CC} + 0.3	
T _J	Operating virtual junction temperature			150	°C
T _{stg}	Storage temperature		−65	150	°C

- (1) Stresses beyond those listed under *absolute maximum ratings* may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under [§ 6.3](#) is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltage values are with respect to network ground terminal GND.

6.2 ESD Ratings

			VALUE	UNIT
V _(ESD) Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 ¹	RIN and DOUT Pins	±15000	V
		All other pins	±3000	
	Charged-device model (CDM), per JEDEC specification JESD22-C101 ²	All pins	±1500	

6.3 Recommended Operating Conditions⁽¹⁾

(see [Figure 9-1](#))

			MIN	NOM	MAX	UNIT
	Supply voltage	V _{CC} = 3.3 V	3	3.3	3.6	V
		V _{CC} = 5 V	4.5	5	5.5	
V _{IH}	Driver and control high-level input voltage	DIN, FORCEOFF, FORCEON, $\overline{\text{EN}}$	V _{CC} = 3.3 V	2		V
			V _{CC} = 5 V	2.4		
V _{IL}	Driver and control low-level input voltage	DIN, FORCEOFF, FORCEON, $\overline{\text{EN}}$			0.8	V
V _I	Driver and control input voltage	DIN, FORCEOFF, FORCEON	0		5.5	V
V _I	Receiver input voltage		−25		25	V
T _A	Operating free-air temperature	SN65C3221	−40		85	°C
		SN75C3221	0		70	

- (1) Test conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V $\pm$ 0.3 V; C1 = 0.047 μF , C2–C4 = 0.33 μF at V_{CC} = 5 V $\pm$ 0.5 V.

6.3.1 Thermal Information

THERMAL METRIC ¹		SN65C3221		SN75C3221		UNIT
		DB (SSOP)	PW (TSSOP)	DB (SSOP)	PW (TSSOP)	
		16 PINS	16 PINS	16 PINS	16 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	82.0	110.9	105.8	108.0	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	45.7	41.7	51.9	41.1	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	44.4	57.2	57.6	51.4	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	11.0	4.2	14.1	3.9	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	43.8	56.6	56.8	50.9	°C/W

6.4 Electrical Characteristics

over recommended operating free-air temperature ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽²⁾ (see [Figure 9-1](#))

PARAMETER			TEST CONDITIONS	MIN	TYP ⁽¹⁾	MAX	UNIT
I_I	Input leakage current	FORCEOFF, FORCEON, EN		±0.01		±1	μA
I_{CC}	Supply current ($T_A = 25^\circ\text{C}$)	Auto-powerdown disabled	No load, FORCEOFF and FORCEON at V_{CC}		0.3	1	mA
		Powered off	No load, FORCEOFF at GND		1	10	μA
		Auto-powerdown enabled	No load, FORCEOFF at V_{CC} , FORCEON at GND, All RIN are open or grounded		1	10	

(1) All typical values are at $V_{CC} = 3.3\text{ V}$ or $V_{CC} = 5\text{ V}$, and $T_A = 25^\circ\text{C}$.

(2) Test conditions are $C1-C4 = 0.1\text{ }\mu\text{F}$ at $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$; $C1 = 0.047\text{ }\mu\text{F}$, $C2-C4 = 0.33\text{ }\mu\text{F}$ at $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$.

6.5 Electrical Characteristics - Driver

over recommended ranges of supply voltage and operating free-air temperature range (unless otherwise noted)⁽³⁾ (see [Figure 9-1](#))

PARAMETER		TEST CONDITIONS		MIN	TYP ⁽¹⁾	MAX	UNIT
V _{OH}	High-level output voltage	DOUT at R _L = 3 kΩ to GND,	DIN = GND	5	5.4		V
V _{OL}	Low-level output voltage	DOUT at R _L = 3 kΩ to GND,	DIN = V _{CC}	–5	–5.4		V
I _{IH}	High-level input current	V _I = V _{CC}			±0.01	±1	μA
I _{IL}	Low-level input current	V _I at GND			±0.01	±1	μA
I _{OS}	Short-circuit output current ⁽²⁾	V _{CC} = 3.6 V,	V _O = 0 V		±35	±60	mA
		V _{CC} = 5.5 V,	V _O = 0 V		±35	±90	
r _o	Output resistance	V _{CC} , V ₊ , and V _– = 0 V,	V _O = ±2 V	300	10M		Ω
I _{off}	Output leakage current	FORCEOFF = GND	V _O = ±12 V, V _{CC} = 3 V to 3.6 V			±25	μA
			V _O = ±10 V, V _{CC} = 4.5 V to 5.5 V			±25	

(1) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

(2) Short-circuit durations should be controlled to prevent exceeding the device absolute power-dissipation ratings, and not more than one output should be shorted at a time.

(3) Test conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2–C4 = 0.33 μF at V_{CC} = 5 V ± 0.5 V.

6.6 Switching Characteristics - Driver

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽³⁾ (see [Figure 9-1](#))

PARAMETER		TEST CONDITIONS			MIN	TYP ⁽¹⁾	MAX	UNIT		
Maximum data rate (see 图 7-1)		R _L = 3 kΩ	C _L = 1000 pF		250			kbit/s		
			C _L = 250 pF,	V _{CC} = 3 V to 4.5 V	1000					
			C _L = 1000 pF,	V _{CC} = 4.5 V to 5.5 V	1000					
t _{sk(p)}	Pulse skew ⁽²⁾	C _L = 150 pF to 2500 pF	R _L = 3 kΩ to 7 kΩ,	See 图 7-2	100			ns		
SR(tr)	Slew rate, transition region (see 图 7-1)	V _{CC} = 3.3 V, R _L = 3 kΩ to 7 kΩ	C _L = 150 pF to 1000 pF			18			150	V/μs

(1) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

(2) Pulse skew is defined as |t_{PLH} – t_{PHL}| of each channel of the same device.

(3) Test conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2–C4 = 0.33 μF at V_{CC} = 5 V ± 0.5 V.

6.7 Electrical Characteristics - Receiver

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽²⁾ (see [Figure 9-1](#))

PARAMETER		TEST CONDITIONS	MIN	TYP ⁽¹⁾	MAX	UNIT
V _{OH}	High-level output voltage	I _{OH} = –1 mA	V _{CC} – 0.6 V	V _{CC} – 0.1 V		V
V _{OL}	Low-level output voltage	I _{OL} = 1.6 mA			0.4	V
V _{IT+}	Positive-going input threshold voltage	V _{CC} = 3.3 V		1.6	2.4	V
		V _{CC} = 5 V		1.9	2.4	
V _{IT–}	Negative-going input threshold voltage	V _{CC} = 3.3 V	0.6	1.1		V
		V _{CC} = 5 V	0.8	1.4		
V _{hys}	Input hysteresis (V _{IT+} – V _{IT–})			0.5		V
I _{off}	Output leakage current	FORCEOFF = 0 V		±0.05	±10	μA
r _i	Input resistance	V _I = ±3 V to ±25 V	3	5	7	kΩ

(1) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

(2) Test conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2–C4 = 0.33 μF at V_{CC} = 5 V ± 0.5 V.

6.8 Switching Characteristics - Receiver

over recommended ranges of supply voltage and operating free-air temperature range (unless otherwise noted)⁽³⁾

PARAMETER		TEST CONDITIONS		MIN	TYP ⁽¹⁾	MAX	UNIT
t_{PLH}	Propagation delay time, low- to high-level output	$C_L = 150$ pF,	See 图 7-3		150		ns
t_{PHL}	Propagation delay time, high- to low-level output	$C_L = 150$ pF,	See 图 7-3		150		ns
t_{en}	Output enable time	$C_L = 150$ pF, $R_L = 3$ k Ω ,	See 图 7-4		200		ns
t_{dis}	Output disable time	$C_L = 150$ pF, $R_L = 3$ k Ω ,	See 图 7-4		200		ns
$t_{sk(p)}$	Pulse skew ⁽²⁾	See 图 7-3			50		ns

(1) All typical values are at $V_{CC} = 3.3$ V or $V_{CC} = 5$ V, and $T_A = 25^\circ\text{C}$.

(2) Pulse skew is defined as $|t_{PLH} - t_{PHL}|$ of each channel of the same device.

(3) Test conditions are C1–C4 = 0.1 μF at $V_{CC} = 3.3$ V $\pm$ 0.3 V; C1 = 0.047 μF , C2–C4 = 0.33 μF at $V_{CC} = 5$ V $\pm$ 0.5 V.

6.9 Electrical Characteristics - Auto-Powerdown

over recommended ranges of supply voltage and operating free-air temperature range (unless otherwise noted) (see 图 7-5)

PARAMETER		TEST CONDITIONS		MIN	MAX	UNIT
$V_{T+}(\text{valid})$	Receiver input threshold for $\overline{\text{INVALID}}$ high-level output voltage	FORCEON = GND, $\overline{\text{FORCEOFF}} = V_{CC}$			2.7	V
$V_{T-}(\text{valid})$	Receiver input threshold for $\overline{\text{INVALID}}$ high-level output voltage	FORCEON = GND, $\overline{\text{FORCEOFF}} = V_{CC}$		–2.7		V
$V_{T}(\text{invalid})$	Receiver input threshold for $\overline{\text{INVALID}}$ low-level output voltage	FORCEON = GND, $\overline{\text{FORCEOFF}} = V_{CC}$		–0.3	0.3	V
V_{OH}	$\overline{\text{INVALID}}$ high-level output voltage	$I_{OH} = -1$ mA, FORCEON = GND, $\overline{\text{FORCEOFF}} = V_{CC}$		$V_{CC} - 0.6$		V
V_{OL}	$\overline{\text{INVALID}}$ low-level output voltage	$I_{OL} = 1.6$ mA, FORCEON = GND, $\overline{\text{FORCEOFF}} = V_{CC}$			0.4	V

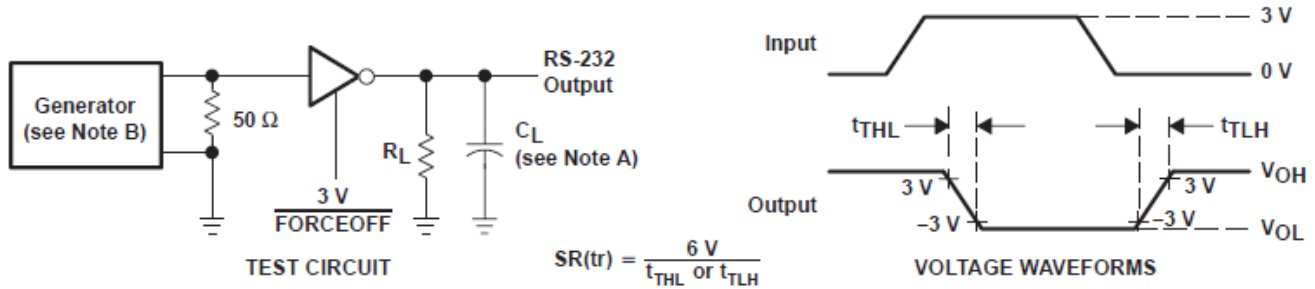
6.10 Switching Characteristics - Auto-Powerdown

over operating free-air temperature range (unless otherwise noted) (see 图 7-5)

PARAMETER		MIN	TYP ⁽¹⁾	MAX	UNIT
t_{valid}	Propagation delay time, low- to high-level output		1		μs
t_{invalid}	Propagation delay time, high- to low-level output		30		μs
t_{en}	Supply enable time		100		μs

(1) All typical values are at $V_{CC} = 3.3$ V or $V_{CC} = 5$ V, and $T_A = 25^\circ\text{C}$.

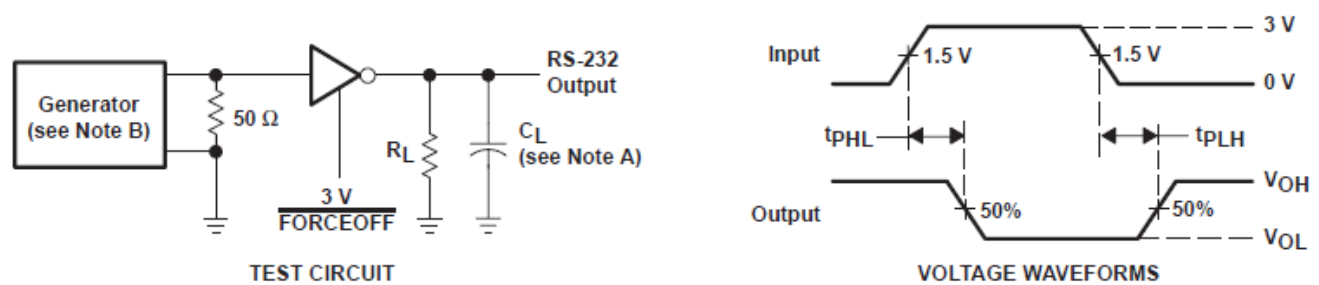
7 Parameter Measurement Information



NOTES: A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: PRR = 250 kbit/s, $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10\text{ ns}$, $t_f \leq 10\text{ ns}$.

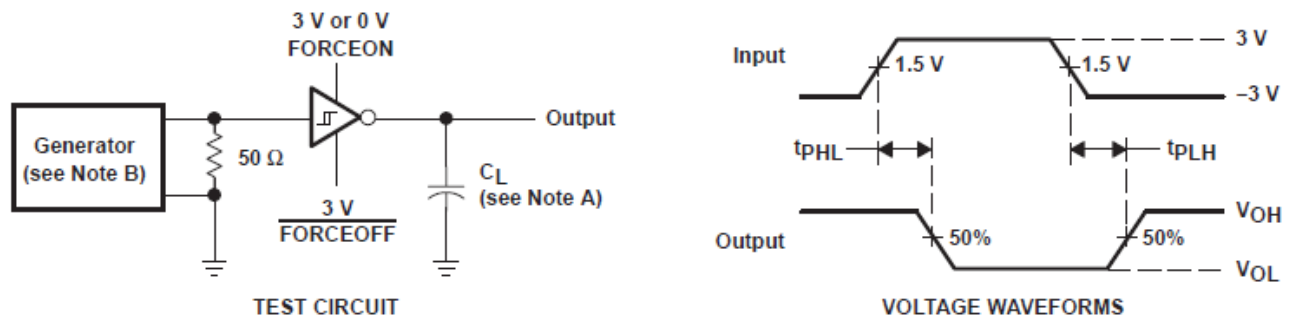
图 7-1. Driver Slew Rate



NOTES: A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: PRR = 250 kbit/s, $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10\text{ ns}$, $t_f \leq 10\text{ ns}$.

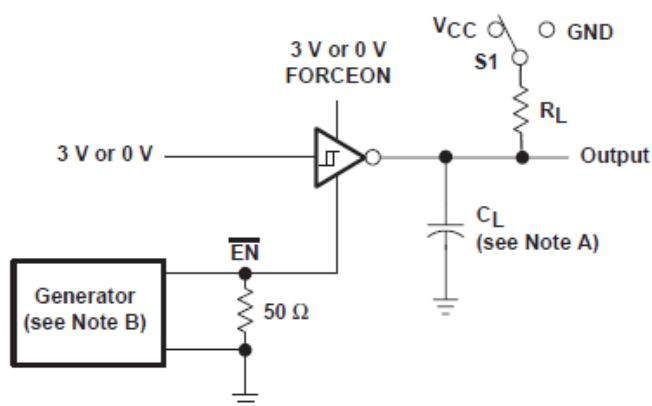
图 7-2. Driver Pulse Skew



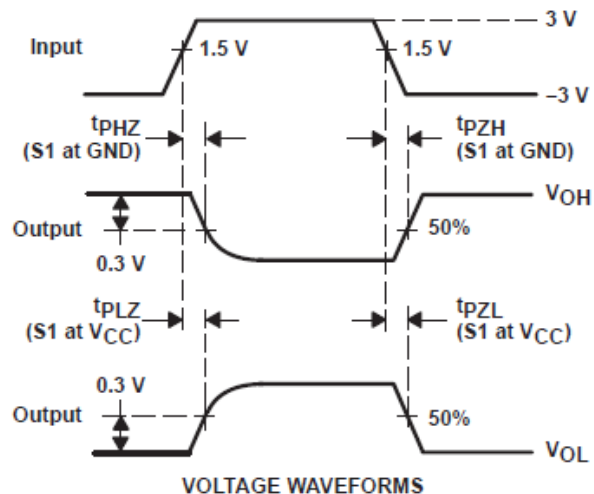
NOTES: A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10\text{ ns}$, $t_f \leq 10\text{ ns}$.

图 7-3. Receiver Propagation Delay Times

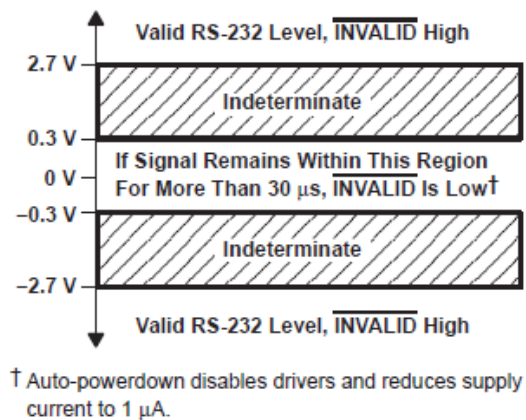
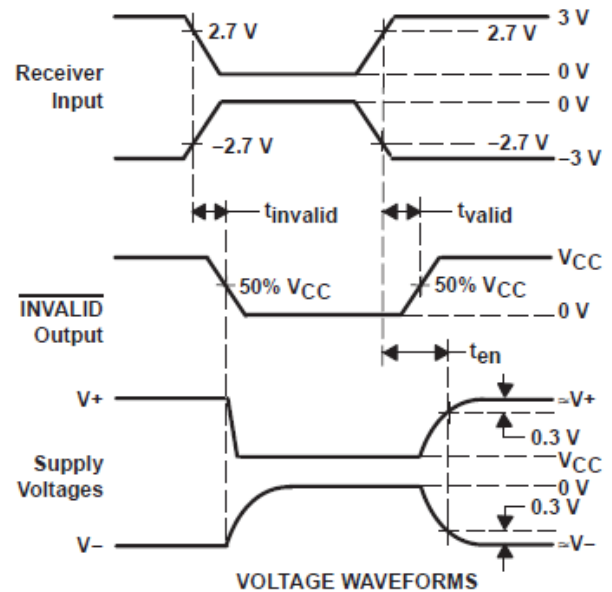
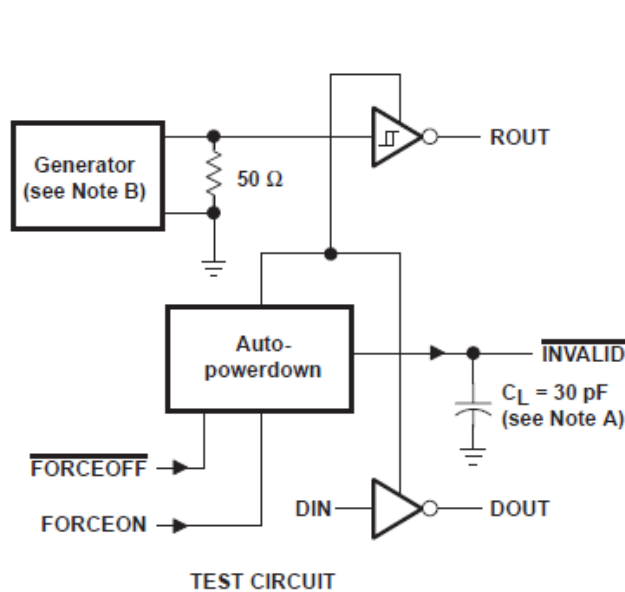


TEST CIRCUIT



- NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10\text{ ns}$, $t_f \leq 10\text{ ns}$.
C. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
D. t_{PZL} and t_{PZH} are the same as t_{en} .

图 7-4. Receiver Enable and Disable Times



NOTES: A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: PRR = 5 kbit/s, $Z_O = 50 \Omega$, 50% duty cycle, $t_r \leq 10 \text{ ns}$, $t_f \leq 10 \text{ ns}$.

图 7-5. $\overline{\text{INVALID}}$ Propagation Delay Times and Driver Enabling Time

8 Detailed Description

8.1 Device Functional Modes

表 8-1. Each Driver⁽¹⁾

INPUTS				OUTPUT DOUT	DRIVER STATUS
DIN	FORCEON	FORCEOFF	VALID RIN RS-232 LEVEL		
X	X	L	X	Z	Powered off
L	H	H	X	H	Normal operation with auto- powerdown disabled
H	H	H	X	L	
L	L	H	Yes	H	Normal operation with auto- powerdown enabled
H	L	H	Yes	L	
L	L	H	No	Z	Powered off by auto- powerdown feature
H	L	H	No	Z	

(1) H = high level, L = low level, X = irrelevant, Z = high impedance

表 8-2. Each Receiver⁽¹⁾

INPUTS			OUTPUT ROUT
RIN	EN	VALID RIN RS-232 LEVEL	
L	L	X	H
H	L	X	L
X	H	X	Z
Open	L	No	H

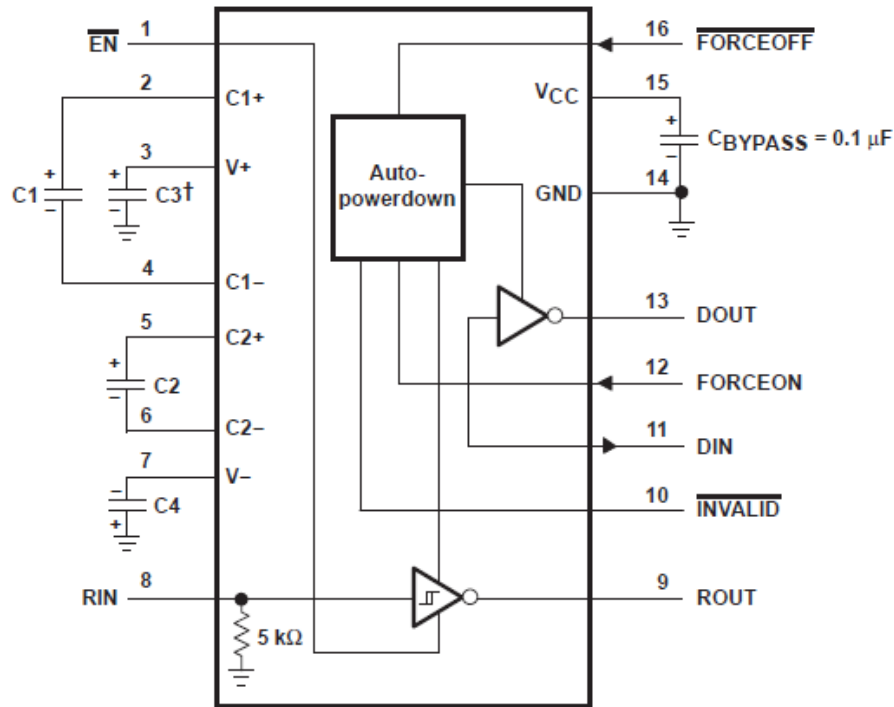
(1) H = high level, L = low level, X = irrelevant, Z = high impedance (off), Open = disconnected input or connected driver off.

9 Application and Implementation

Note

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

9.1 Application Information



† C3 can be connected to V_{CC} or GND

Resistor values shown are nominal.

图 9-1. Typical Operating Circuit and Capacitor Values

表 9-1. V_{CC} vs Capacitor Values

V _{CC}	C1	C2, C3, and C4
3.3 V ± 0.3 V	0.1 μF	0.1 μF
5 V ± 0.5 V	0.047 μF	0.33 μF
3 V to 5.5 V	0.1 μF	0.47 μF

10 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.

10.1 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 [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。

10.2 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](#)》。

10.3 Trademarks

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

10.4 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

10.5 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。

11 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.

重要声明和免责声明

TI 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安全、安保或其他要求。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 (<https://www.ti.com/legal/termsofsale.html>) 或 [ti.com](https://www.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。

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

Copyright © 2021，德州仪器 (TI) 公司

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)
SN65C3221DB	Obsolete	Production	SSOP (DB) 16	-	-	Call TI	Call TI	-40 to 85	CB3221
SN65C3221DBR	Obsolete	Production	SSOP (DB) 16	-	-	Call TI	Call TI	-40 to 85	CB3221
SN65C3221PWR	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CB3221
SN65C3221PWR.A	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CB3221
SN75C3221DBR	Active	Production	SSOP (DB) 16	2000 LARGE T&R	Yes	NIPDAU NIPDAU	Level-1-260C-UNLIM	0 to 70	CA3221
SN75C3221DBR.A	Active	Production	SSOP (DB) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	CA3221
SN75C3221DW	Preview	Production	SOIC (DW) 16	40 TUBE	-	Call TI	Call TI	0 to 70	
SN75C3221PWR	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	CA3221
SN75C3221PWR.A	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	CA3221

⁽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.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative

and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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 SN65C3221 :

- Automotive : [SN65C3221-Q1](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

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
SN65C3221PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN75C3221DBR	SSOP	DB	16	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
SN75C3221PWR	TSSOP	PW	16	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)
SN65C3221PWR	TSSOP	PW	16	2000	356.0	356.0	35.0
SN75C3221DBR	SSOP	DB	16	2000	356.0	356.0	35.0
SN75C3221PWR	TSSOP	PW	16	2000	356.0	356.0	35.0



4220204/A 02/2017

NOTES:

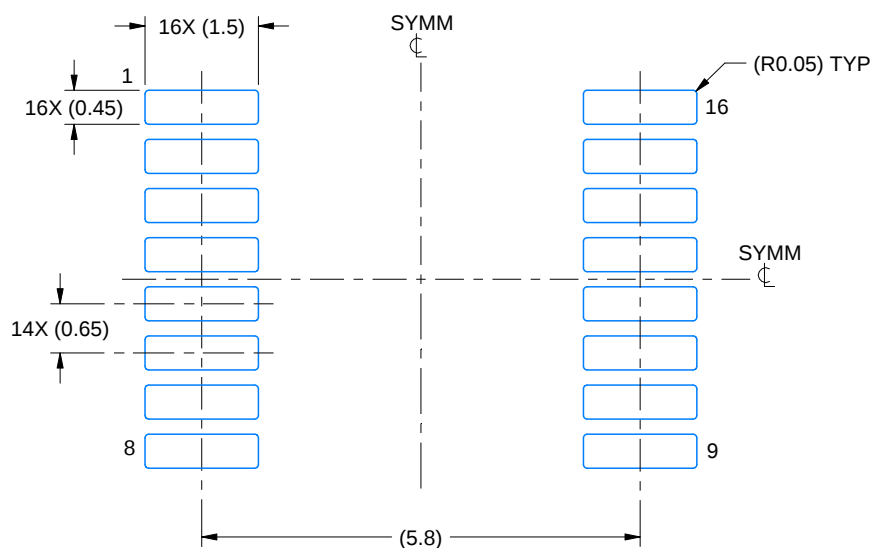
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or 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.

EXAMPLE BOARD LAYOUT

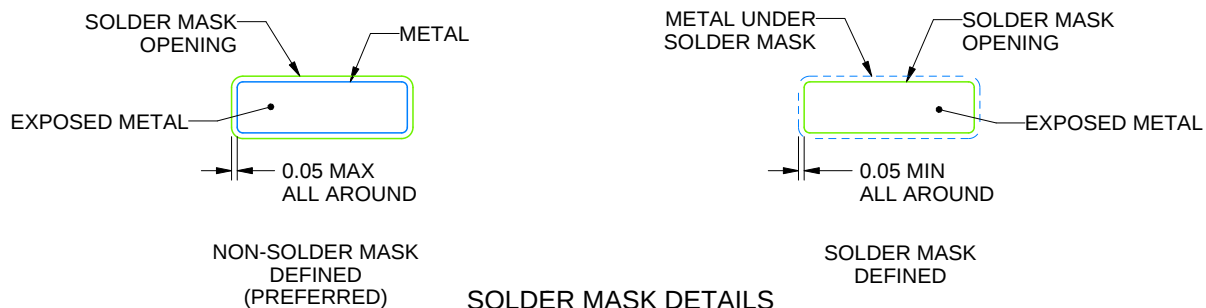
PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4220204/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

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

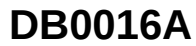


SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220204/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.



SSOP - 2 mm max height

Technical drawing of a connector housing, showing three views: Top View, Side View, and Detail A (Typical).

Top View:

- Overall Width: 8.2 TYP (8.2 typical)
- Overall Height: 6.5 (5.9) (NOTE 3)
- Pin 1 Index Area: Circular feature for pin 1 identification.
- Pin 1: Located at the top left corner.
- Pin 16: Located at the top right corner.
- Pin 8: Located at the bottom left corner.
- Pin 9: Located at the bottom right corner.
- Pin Pitch: 5.6 (5.0) (NOTE 4)
- Pin 14: Located at the top right, 14X 0.65.
- Pin 2: Located at the bottom right, 2X 4.55.
- Pin 16: Located at the bottom right, 16X 0.38 0.22.
- Feature Control Frame: $\oplus 0.1 \text{ (M)} \text{ C A B}$

Side View:

- Seating Plane: Indicated by a dashed line.
- Feature Control Frame: $\text{C} \text{ 0.1 C}$

Detail A (Typical):

- Feature Control Frame: $\text{C} \text{ 0.1 C}$
- Dimensions: 0.25, 0.09, 0.25, 0.95, 0.55, 0.05 MIN, 2 MAX.
- Gage Plane: Indicated by a dashed line.
- Angle: $0^\circ - 8^\circ$

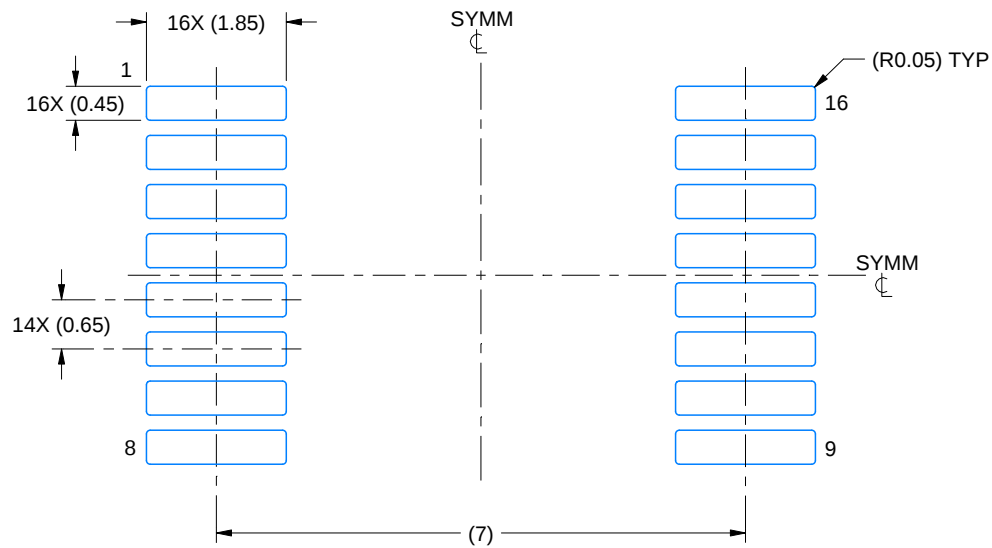
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-150.

EXAMPLE BOARD LAYOUT

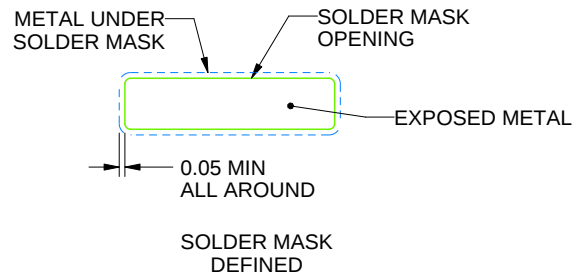
DB0016A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

4220763/A 05/2022

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

DB0016A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



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

4220763/A 05/2022

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.

重要通知和免责声明

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 产品的相关应用。严禁以其他方式对这些资源进行复制或展示。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
版权所有 © 2025，德州仪器 (TI) 公司