

## 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 $\mu$ A (典型值)
- 外部电容器：4 x 0.1 $\mu$ 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  $\pm 15$ 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

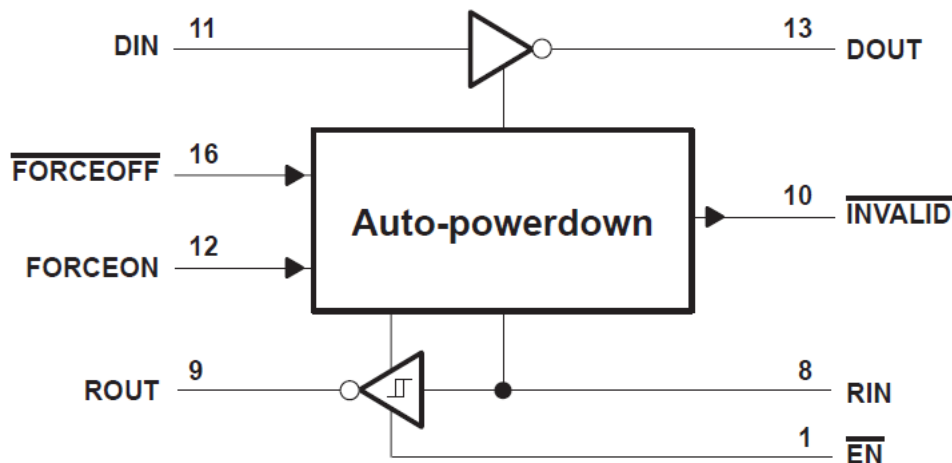
SN65C3221 和 SN75C3221 包含一个线路驱动器、一个线路接收器和一个具有引脚对引脚 ( 串行端口连接引脚，包括 GND )  $\pm 15$ kV ESD 保护功能的双电荷泵电路。这些器件可在异步通信控制器和串行端口连接器之间提供电气接口。电荷泵和四个小型外部电容器支持由 3V 至 5.5V 单电源供电。这些器件以高达 1Mbit/s 的数据信号传输速率运行，驱动器输出电压摆率为 24V/ $\mu$ s 至 150V/ $\mu$ s。

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 $\mu$ 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 $\mu$ 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 $\mu$ 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 <sup>(1)</sup>	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)



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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 E (October 2004) to Revision F (July 2021)

Page

• 更改了应用列表.....	1
• 删除了“订购信息”表.....	1
• 添加了器件信息表.....	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

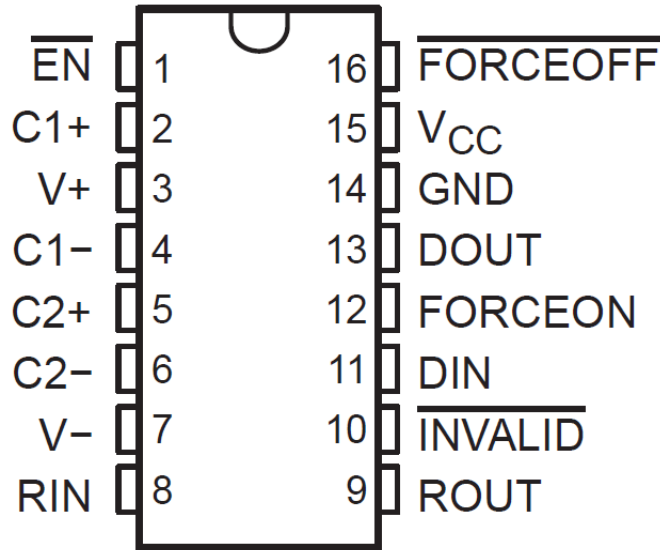


图 5-1. DB or PW Package  
Top View

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		
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 <sub>CC</sub>	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)<sup>(1)</sup>

		MIN	MAX	UNIT	
V <sub>CC</sub>	Supply voltage range	-0.3	6	V	
V <sub>+</sub>	Positive output supply voltage range <sup>(2)</sup>	-0.3	7	V	
V <sub>-</sub>	Negative output supply voltage range <sup>(2)</sup>	-7	0.3	V	
V <sub>+</sub> – V <sub>-</sub>	Supply voltage difference <sup>(2)</sup>		13	V	
V <sub>I</sub>	Input voltage range	Driver (FORCEOFF, FORCEON, $\overline{\text{EN}}$ )	-0.3	6	V
		Receiver	-25	25	
V <sub>O</sub>	Output voltage range	Driver	-13.2	13.2	V
		Receiver (INVALID)	-0.3	V <sub>CC</sub> + 0.3	
T <sub>J</sub>	Operating virtual junction temperature		150	°C	
T <sub>stg</sub>	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 <sub>(ESD)</sub>	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001 <sup>1</sup>	RIN and DOUT Pins	±15000	V
			All other pins	±3000	
		Charged-device model (CDM), per JEDEC specification JESD22-C101 <sup>2</sup>	All pins	±1500	

### 6.3 Recommended Operating Conditions<sup>(1)</sup>

(see [图 9-1](#))

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

- (1) Test conditions are C1–C4 = 0.1 μF at V<sub>CC</sub> = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2–C4 = 0.33 μF at V<sub>CC</sub> = 5 V ± 0.5 V.

### 6.3.1 Thermal Information

THERMAL METRIC <sup>1</sup>		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
$\Psi_{JT}$	Junction-to-top characterization parameter	11.0	4.2	14.1	3.9	°C/W
$\Psi_{JB}$	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)<sup>(2)</sup> (see [Figure 9-1](#))

PARAMETER		TEST CONDITIONS	MIN	TYP <sup>(1)</sup>	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	
		Auto-powerdown enabled	No load, FORCEOFF at $V_{CC}$ , FORCEON at GND, All RIN are open or grounded	1	10	µA

(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 µF at  $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$ ; C1 = 0.047 µF, C2–C4 = 0.33 µF 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)<sup>(3)</sup> (see [Figure 9-1](#))

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

(1) All typical values are at V<sub>CC</sub> = 3.3 V or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 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<sub>CC</sub> = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2–C4 = 0.33 μF at V<sub>CC</sub> = 5 V ± 0.5 V.

## 6.6 Switching Characteristics - Driver

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

PARAMETER		TEST CONDITIONS		MIN	TYP <sup>(1)</sup>	MAX	UNIT
Maximum data rate (see <a href="#">Figure 7-1</a> )	R <sub>L</sub> = 3 kΩ	C <sub>L</sub> = 1000 pF		250			kbit/s
		C <sub>L</sub> = 250 pF,	V <sub>CC</sub> = 3 V to 4.5 V	1000			
		C <sub>L</sub> = 1000 pF,	V <sub>CC</sub> = 4.5 V to 5.5 V	1000			
t <sub>sk(p)</sub>	Pulse skew <sup>(2)</sup>	C <sub>L</sub> = 150 pF to 2500 pF	R <sub>L</sub> = 3 kΩ to 7 kΩ, See <a href="#">Figure 7-2</a>	100			ns
SR(tr)	Slew rate, transition region (see <a href="#">Figure 7-1</a> )	V <sub>CC</sub> = 3.3 V, R <sub>L</sub> = 3 kΩ to 7 kΩ	C <sub>L</sub> = 150 pF to 1000 pF	18		150	V/μs

(1) All typical values are at V<sub>CC</sub> = 3.3 V or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.

(2) Pulse skew is defined as |t<sub>PLH</sub> - t<sub>PHL</sub>| of each channel of the same device.

(3) Test conditions are C1–C4 = 0.1 μF at V<sub>CC</sub> = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2–C4 = 0.33 μF at V<sub>CC</sub> = 5 V ± 0.5 V.

## 6.7 Electrical Characteristics - Receiver

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

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

(1) All typical values are at V<sub>CC</sub> = 3.3 V or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.

(2) Test conditions are C1–C4 = 0.1 μF at V<sub>CC</sub> = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2–C4 = 0.33 μF at V<sub>CC</sub> = 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)<sup>(3)</sup>

PARAMETER		TEST CONDITIONS		MIN	TYP <sup>(1)</sup>	MAX	UNIT
t <sub>PLH</sub>	Propagation delay time, low- to high-level output	C <sub>L</sub> = 150 pF,	See <a href="#">图 7-3</a>		150		ns
t <sub>PHL</sub>	Propagation delay time, high- to low-level output	C <sub>L</sub> = 150 pF,	See <a href="#">图 7-3</a>		150		ns
t <sub>en</sub>	Output enable time	C <sub>L</sub> = 150 pF, R <sub>L</sub> = 3 kΩ,	See <a href="#">图 7-4</a>		200		ns
t <sub>dis</sub>	Output disable time	C <sub>L</sub> = 150 pF, R <sub>L</sub> = 3 kΩ,	See <a href="#">图 7-4</a>		200		ns
t <sub>sk(p)</sub>	Pulse skew <sup>(2)</sup>	See <a href="#">图 7-3</a>			50		ns

(1) All typical values are at V<sub>CC</sub> = 3.3 V or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.

(2) Pulse skew is defined as |t<sub>PLH</sub> - t<sub>PHL</sub>| of each channel of the same device.

(3) Test conditions are C1-C4 = 0.1 μF at V<sub>CC</sub> = 3.3 V ± 0.3 V; C1 = 0.047 μF, C2-C4 = 0.33 μF at V<sub>CC</sub> = 5 V ± 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 <sub>T+(valid)</sub>	Receiver input threshold for $\overline{\text{INVALID}}$ high-level output voltage	FORCEON = GND,	$\overline{\text{FORCEOFF}} = V_{CC}$		2.7	V
V <sub>T-(valid)</sub>	Receiver input threshold for $\overline{\text{INVALID}}$ high-level output voltage	FORCEON = GND,	$\overline{\text{FORCEOFF}} = V_{CC}$	-2.7		V
V <sub>T(invalid)</sub>	Receiver input threshold for $\overline{\text{INVALID}}$ low-level output voltage	FORCEON = GND,	$\overline{\text{FORCEOFF}} = V_{CC}$	-0.3	0.3	V
V <sub>OH</sub>	$\overline{\text{INVALID}}$ high-level output voltage	I <sub>OH</sub> = -1 mA, FORCEON = GND,	$\overline{\text{FORCEOFF}} = V_{CC}$	V <sub>CC</sub> -0.6		V
V <sub>OL</sub>	$\overline{\text{INVALID}}$ low-level output voltage	I <sub>OL</sub> = 1.6 mA, FORCEON = GND,	$\overline{\text{FORCEOFF}} = V_{CC}$		0.4	V

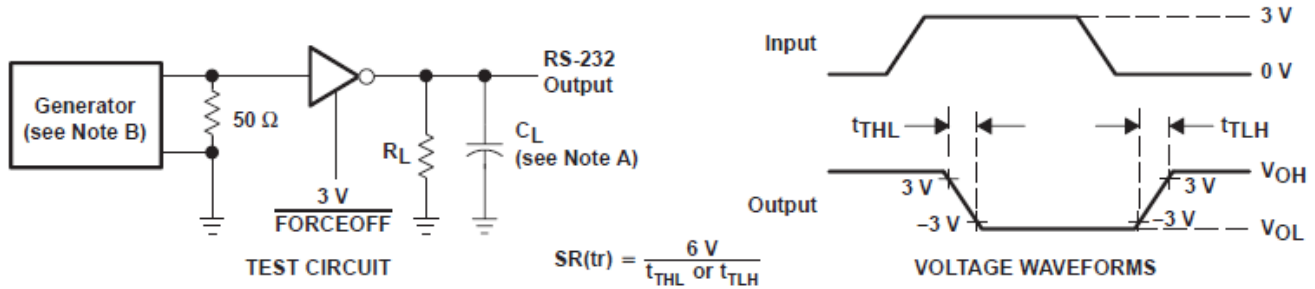
## 6.10 Switching Characteristics - Auto-Powerdown

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

PARAMETER		MIN	TYP <sup>(1)</sup>	MAX	UNIT
t <sub>valid</sub>	Propagation delay time, low- to high-level output		1		μs
t <sub>invalid</sub>	Propagation delay time, high- to low-level output		30		μs
t <sub>en</sub>	Supply enable time		100		μs

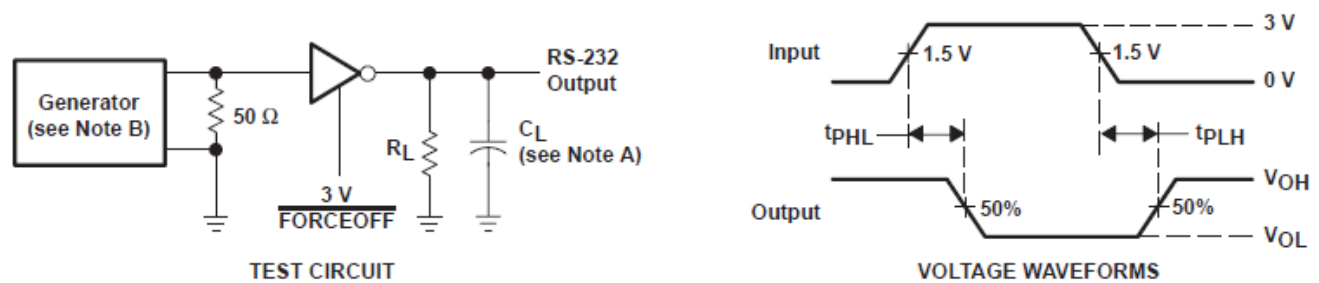
(1) All typical values are at V<sub>CC</sub> = 3.3 V or V<sub>CC</sub> = 5 V, and T<sub>A</sub> = 25°C.

## 7 Parameter Measurement Information



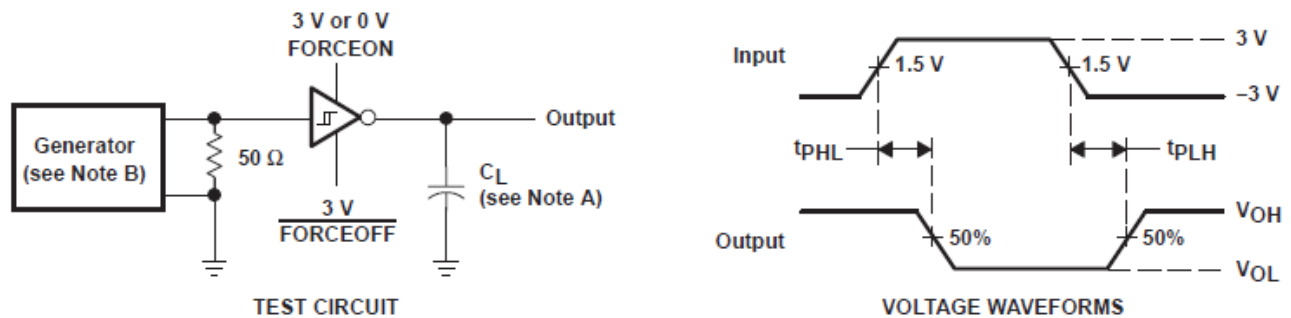
NOTES: A.  $C_L$  includes probe and jig capacitance.  
B. The pulse generator has the following characteristics: PRR = 250 kbit/s,  $Z_O = 50\ \Omega$ , 50% duty cycle,  $t_r \leq 10\text{ ns}$ ,  $t_f \leq 10\text{ ns}$ .

**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,  $t_r \leq 10\text{ ns}$ ,  $t_f \leq 10\text{ ns}$ .

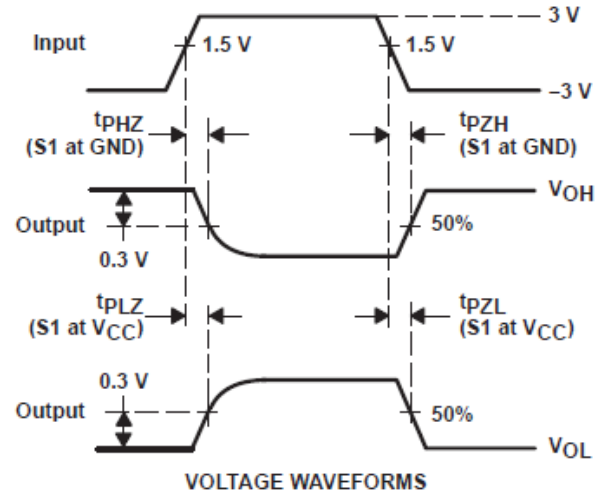
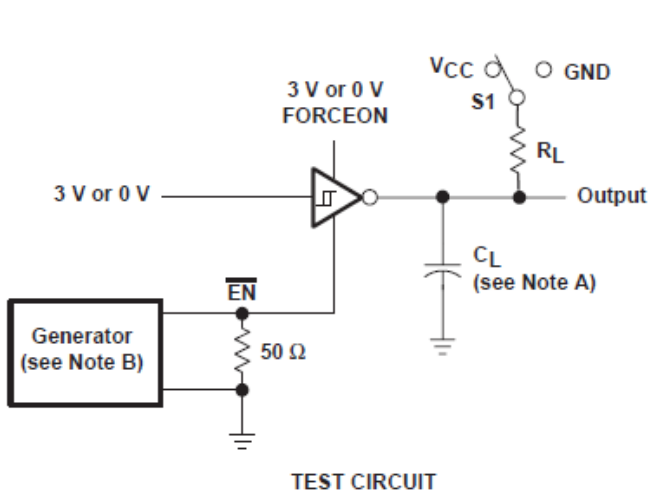
**图 7-2. Driver Pulse Skew**



NOTES: A.  $C_L$  includes probe and jig capacitance.  
B. The pulse generator has the following characteristics:  $Z_O = 50\ \Omega$ , 50% duty cycle,  $t_r \leq 10\text{ ns}$ ,  $t_f \leq 10\text{ ns}$ .

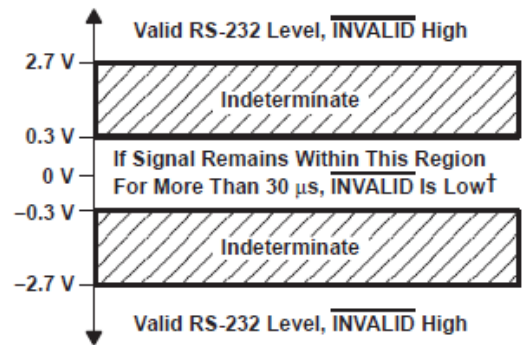
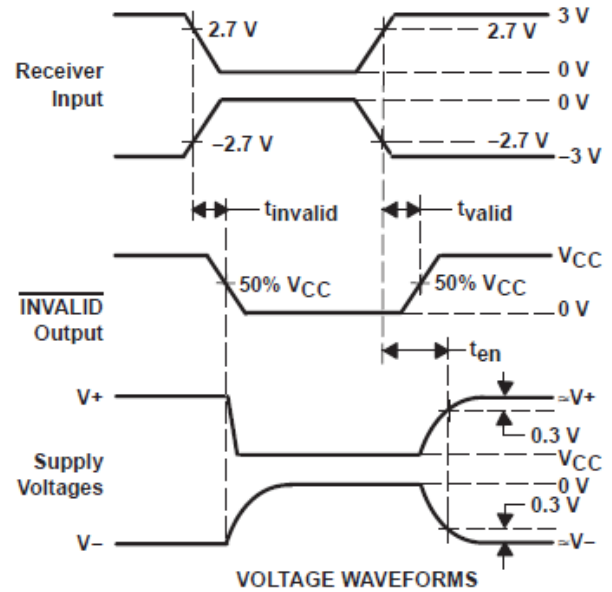
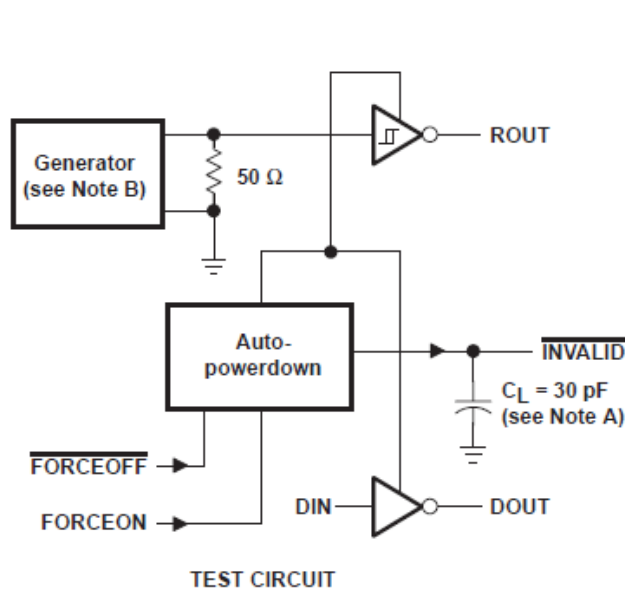
**图 7-3. Receiver Propagation Delay Times**





- 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**



† Auto-powerdown disables drivers and reduces supply current to 1  $\mu$ A.

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,  $t_r \leq 10$  ns,  $t_f \leq 10$  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<sup>(1)</sup>**

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<sup>(1)</sup>**

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

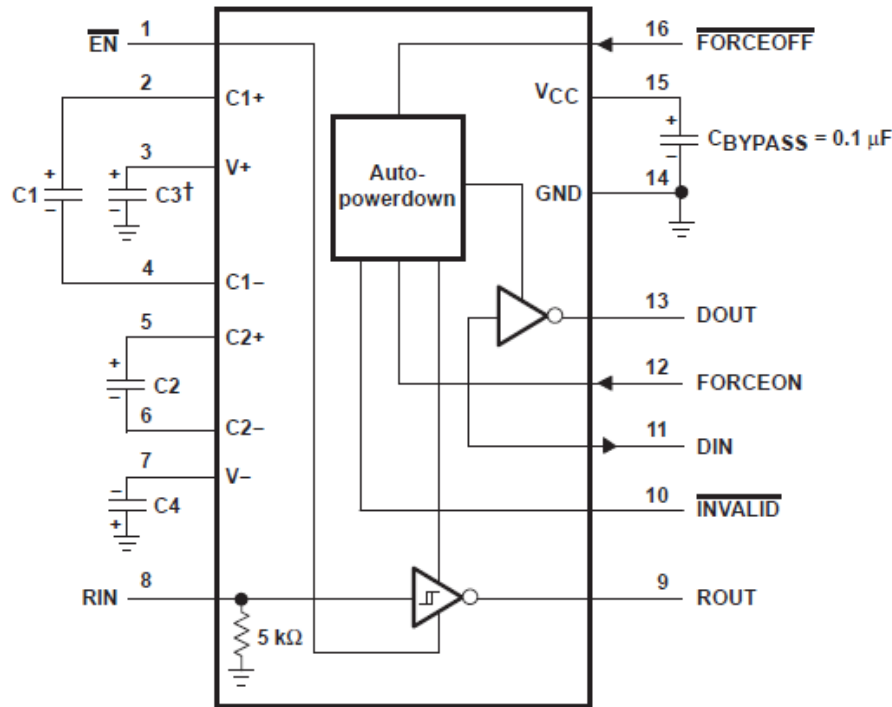
(1) H = high level, L = low level, X = irrelevant, Z = high impedance (off), Open = disconnected input or connected driver off.

## 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<sub>CC</sub> or GND

Resistor values shown are nominal.

图 9-1. Typical Operating Circuit and Capacitor Values

表 9-1. V<sub>CC</sub> vs Capacitor Values

V <sub>CC</sub>	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](http://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.  
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### 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.

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## PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN65C3221DB	ACTIVE	SSOP	DB	16	80	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CB3221	<a href="#">Samples</a>
SN65C3221DBR	ACTIVE	SSOP	DB	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CB3221	<a href="#">Samples</a>
SN65C3221PWR	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	CB3221	<a href="#">Samples</a>
SN75C3221DBR	ACTIVE	SSOP	DB	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	CA3221	<a href="#">Samples</a>
SN75C3221DW	PREVIEW	SOIC	DW	16	40	TBD	Call TI	Call TI	0 to 70		
SN75C3221PWR	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	CA3221	<a href="#">Samples</a>

(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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**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**

**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
SN65C3221DBR	SSOP	DB	16	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
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)
SN65C3221DBR	SSOP	DB	16	2000	356.0	356.0	35.0
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

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN65C3221DB	DB	SSOP	16	80	530	10.5	4000	4.1



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.

# DB0016A



# PACKAGE OUTLINE

## SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



4220763/A 05/2022

### NOTES:

- All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- 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.
- 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



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.

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