TRSF3221

3-V TO 5.5-V SINGLE-CHANNEL RS-232 COMPATIBLE LINE DRIVER/RECEIVER

SLLS857−AUGUST 2007

FEATURES

- **Operates With 3-V to 5.5-V V$_{CC}$ Supply**
- **Operates up to 1 Mbit/s**
- **Low Standby Current . . . 1 μA Typ**
- **External Capacitors . . . 4 × 0.1 μF**
- **Accepts 5-V Logic Input With 3.3-V Supply**
- **RS-232 Bus-Pin ESD Protection Exceeds ±15 kV Using Human-Body Model (HBM)**
- **Auto-Powerdown Feature Automatically Disables Drivers for Power Savings**
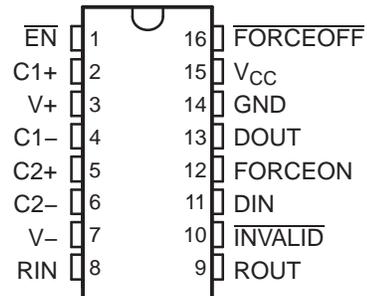
APPLICATIONS

- **Battery-Powered, Hand-Held, and Portable Equipment**
- **PDAs and Palmtop PCs**
- **Notebooks, Sub-Notebooks, and Laptops**
- **Digital Cameras**
- **Mobile Phones and Wireless Devices**

DB OR PW PACKAGE
(TOP VIEW)

$\overline{EN}$	1	16	$\overline{FORCEOFF}$
C1+	2	15	V$_{CC}$
V+	3	14	GND
C1−	4	13	DOUT
C2+	5	12	FORCEON
C2−	6	11	DIN
V−	7	10	$\overline{INVALID}$
RIN	8	9	ROUT

DESCRIPTION/ORDERING INFORMATION

The TRSF3221 consists of one line driver, one line receiver, and a dual charge-pump circuit with ±15-kV IEC ESD protection pin-to-pin (serial-port connection pins, including GND). The TRSF3221 provides the electrical interface between an asynchronous communication controller and the serial-port connector. The charge pump and four small external capacitors allow operation from a single 3-V to 5.5-V supply. The TRSF3221 operates at data signaling rates up to 1 Mbit/s and a driver output slew rate of 24 V/μs to 150 V/μs.

Flexible control options for power management are available when the serial port is inactive. The auto-powerdown feature functions when FORCEON is low and $\overline{FORCEOFF}$ is high. During this mode of operation, if the TRSF3221 does not sense a valid RS-232 signal on the receiver input, the driver output is disabled. If $\overline{FORCEOFF}$ is set low and the enable ($\overline{EN}$) input is high, both the driver and receiver are shut off, and the supply current is reduced to 1 μA. Disconnecting the serial port or turning off the peripheral drivers causes the auto-powerdown condition to occur. Auto-powerdown can be disabled when FORCEON and $\overline{FORCEOFF}$ are high. With auto-powerdown enabled, the device is activated automatically when a valid signal is applied to the receiver input. The $\overline{INVALID}$ output notifies the user if an RS-232 signal is present at the receiver input. $\overline{INVALID}$ is high (valid data) if the receiver input voltage is greater than 2.7 V or less than −2.7 V, or has been between −0.3 V and 0.3 V for less than 30 μs. $\overline{INVALID}$ is low (invalid data) if the receiver input voltage is between −0.3 V and 0.3 V for more than 30 μs. See Figure 5 for receiver input levels.

ORDERING INFORMATION

T_A	PACKAGE[1][2]		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	SSOP – DB	Reel of 2000	TRSF3221CDBR	RT21C
	TSSOP – PW	Tube of 90	TRSF3221CPW	RT21C
		Reel of 2000	TRSF3221CPWR	
−40°C to 85°C	SSOP – DB	Reel of 2000	TRSF3221IDBR	RT21I
	TSSOP – PW	Tube of 90	TRSF3221IPW	RT21I
		Reel of 2000	TRSF3221IPWR	

(1) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
(2) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at www.ti.com.

FUNCTION TABLES

Each Driver[1]

INPUTS				OUTPUT DOUT	DRIVER STATUS
DIN	FORCEON	$\overline{\text{FORCEOFF}}$	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

Each Receiver[1]

INPUTS			OUTPUT ROUT
RIN	$\overline{\text{EN}}$	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

LOGIC DIAGRAM (POSITIVE LOGIC)
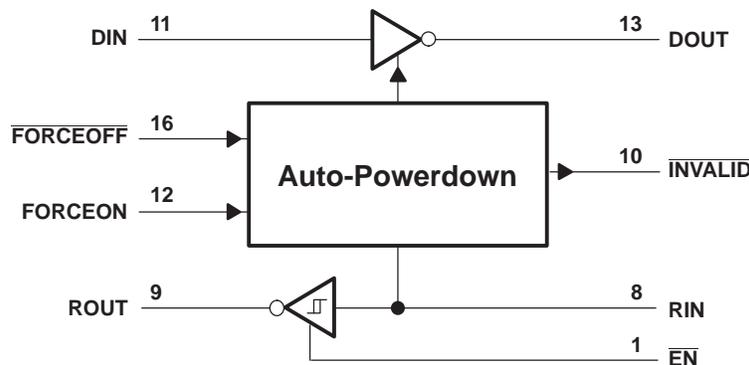
Absolute Maximum Ratings[1]

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

			MIN	MAX	UNIT
V_{CC}	Supply voltage range[2]		−0.3	6	V
V+	Positive-output supply voltage range[2]		−0.3	7	V
V−	Negative-output supply voltage range[2]		0.3	−7	V
V+ − V−	Supply voltage difference[2]			13	V
V_I	Input voltage range	Driver (FORCEOFF, FORCEON, 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	
θ_{JA}	Package thermal impedance[3][4]	DB package		82	°C/W
		PW package		108	
T_J	Operating virtual junction temperature			150	°C
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 are with respect to network GND.
(3) Maximum power dissipation is a function of T_J(max), θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) − T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
(4) The package thermal impedance is calculated in accordance with JESD 51-7.

Recommended Operating Conditions[1]

See Figure 6

				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, 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, 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		TRSF3221I	−40		85	°C
			TRSF3221C	0		70	

(1) 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.

Electrical Characteristics[1]

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 6)

PARAMETER			TEST CONDITIONS	MIN	TYP[2]	MAX	UNIT
I_I	Input leakage current	FORCEOFF, FORCEON, EN			±0.01	±1	µA
I_{CC}	Supply current (T_A = 25°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) 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.
(2) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

DRIVER SECTION

Electrical Characteristics[1]

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 6)

	PARAMETER	TEST CONDITIONS		MIN	TYP[2]	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[3]	V_O = 0 V	V_{CC} = 3.6 V		±35	±60	mA
			V_{CC} = 5.5 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	$\overline{FORCEOFF}$ = 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) 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.
(2) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.
(3) 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.

Switching Characteristics[1]

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 6)

	PARAMETER	TEST CONDITIONS			MIN	TYP[2]	MAX	UNIT
	Maximum data rate (see Figure 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[3]	C_L = 150 pF to 2500 pF,	R_L = 3 kΩ to 7 kΩ,	See Figure 2		100		ns
SR(tr)	Slew rate, transition region (see Figure 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) 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.
(2) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.
(3) Pulse skew is defined as $|t_{PLH} - t_{PHL}|$ of each channel of the same device.

ESD Protection

TERMINAL		TEST CONDITIONS	TYP	UNIT
NAME	NO.			
DOUT	13	HBM	±15	kV

Product Folder Link(s): *TRSF3221*

RECEIVER SECTION

Electrical Characteristics[1]

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 6)

PARAMETER		TEST CONDITIONS	MIN	TYP[2]	MAX	UNIT
V_{OH}	High-level output voltage	$I_{OH} = -1$ mA	$V_{CC} - 0.6$	$V_{CC} - 0.1$		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	$\overline{FORCEOFF} = 0$ V		±0.05	±10	µA
r_i	Input resistance	$V_I = \pm3$ V to ±25 V	3	5	7	kΩ

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

Switching Characteristics[1]

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Figure 6)

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

(1) 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.
(2) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.
(3) Pulse skew is defined as $|t_{PLH} - t_{PHL}|$ of each channel of the same device.

ESD Protection

TERMINAL		TEST CONDITIONS	TYP	UNIT
NAME	NO.			
RIN	8	HBM	±15	kV

AUTO-POWERDOWN SECTION

Electrical Characteristics

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

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

Switching Characteristics

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

	PARAMETER	TYP[1]	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°C.

PARAMETER MEASUREMENT INFORMATION
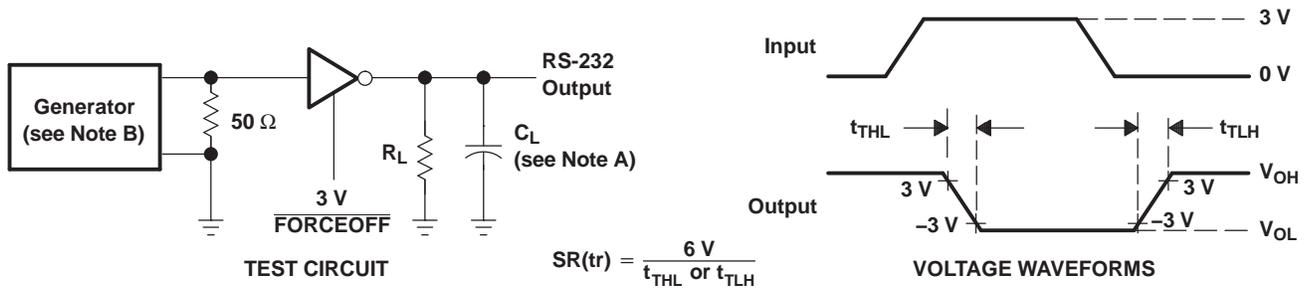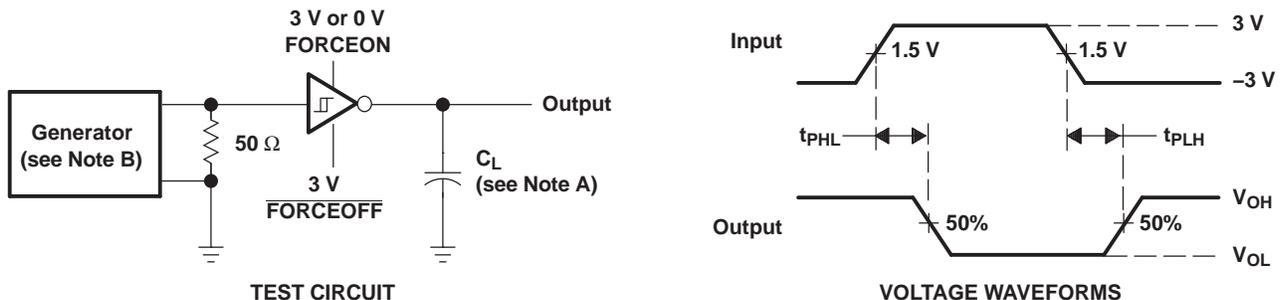
$$SR(tr) = \frac{6\,V}{t_{THL}\ or\ t_{TLH}}$$

NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: PRR = 250 kbit/s, Z_O = 50 Ω, 50% duty cycle, $t_r \le$ 10 ns, $t_f \le$ 10 ns.
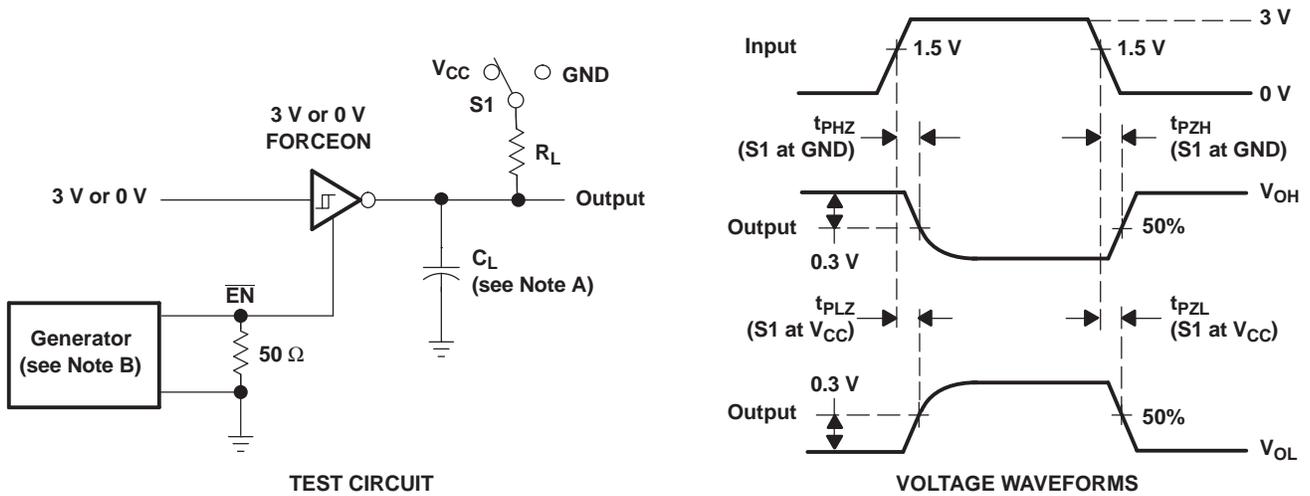
Figure 1. Driver Slew Rate
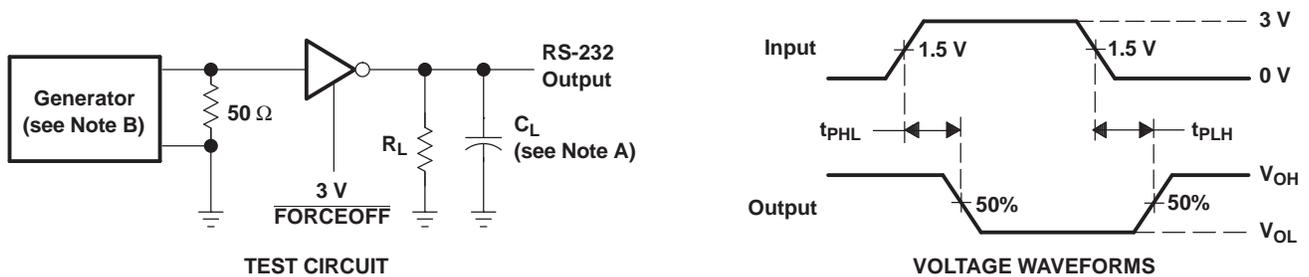
NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: PRR = 250 kbit/s, Z_O = 50 Ω, 50% duty cycle, $t_r \le$ 10 ns, $t_f \le$ 10 ns.

Figure 2. Driver Pulse Skew

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

Figure 3. Receiver Propagation Delay Times

Submit Documentation Feedback

Product Folder Link(s): *TRSF3221*

PARAMETER MEASUREMENT INFORMATION (continued)

TEST CIRCUIT

VOLTAGE WAVEFORMS

NOTES: A. C$_L$ includes probe and jig capacitance.
B. The pulse generator has the following characteristics: Z$_O$ = 50 Ω, 50% duty cycle, t$_r$ ≤ 10 ns, t$_f$ ≤ 10 ns.
C. t$_{PLZ}$ and t$_{PHZ}$ are the same as t$_{dis}$.
D. t$_{PZL}$ and t$_{PZH}$ are the same as t$_{en}$.

Figure 4. Receiver Enable and Disable Times

Product Folder Link(s): *TRSF3221*

PARAMETER MEASUREMENT INFORMATION (continued)

TEST CIRCUIT

VOLTAGE WAVEFORMS
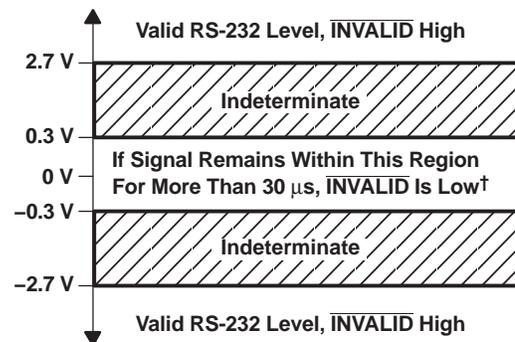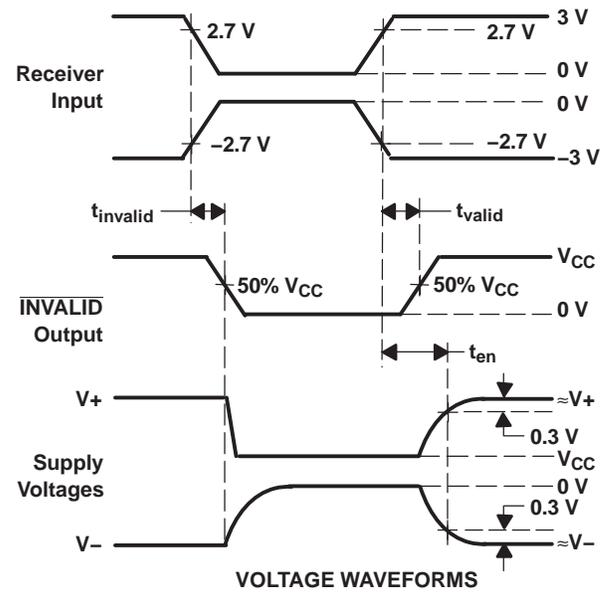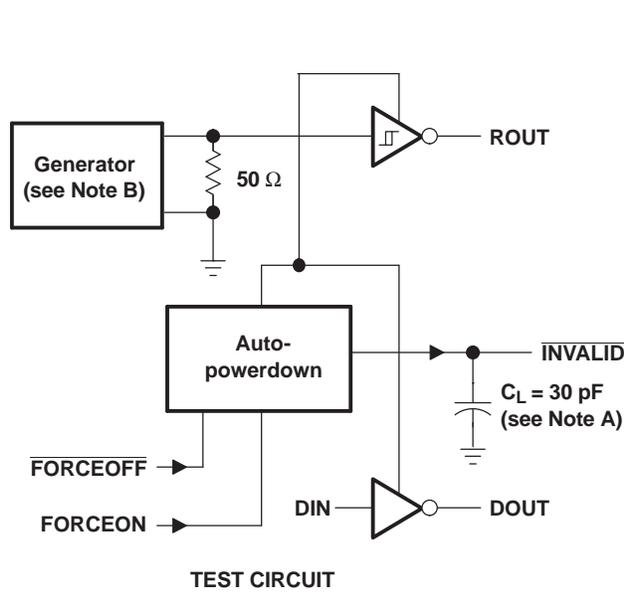
† Auto-powerdown disables drivers and reduces supply current to 1 µA.

NOTES: A. C_L includes probe and jig capacitance.
B. The pulse generator has the following characteristics: PRR = 5 kbit/s, Z_O = 50 Ω, 50% duty cycle, $t_r \leq$ 10 ns, $t_f \leq$ 10 ns.

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

TEXAS
INSTRUMENTS
www.ti.com

APPLICATION INFORMATION
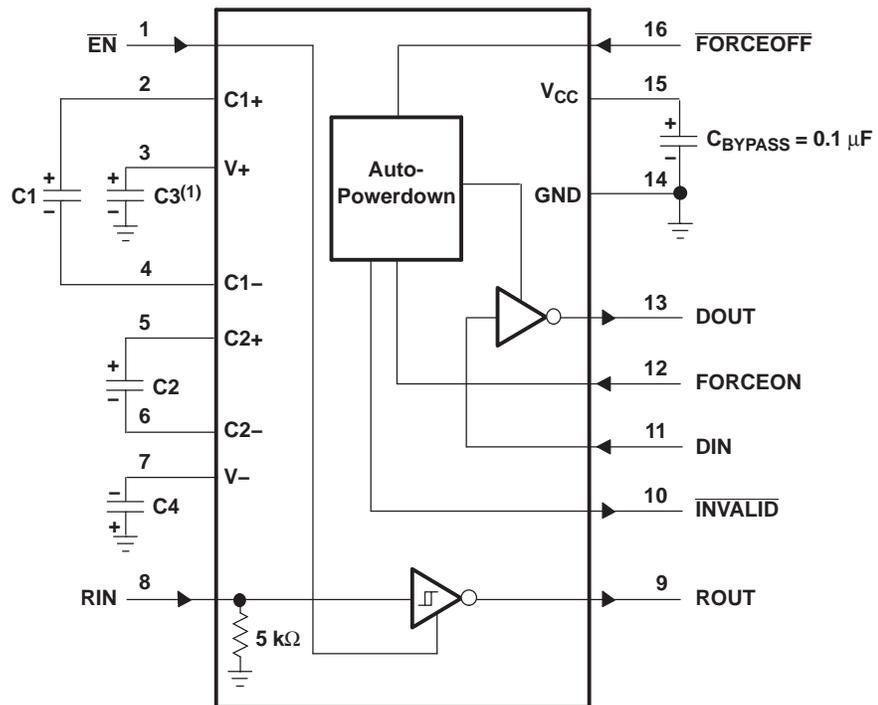
(1) C3 can be connected to V_{CC} or GND.
NOTES: A.   Resistor values shown are nominal.

V_{CC} vs CAPACITOR VALUES

V_{CC}	C1	C2, C3, and C4
3.3 V $\pm$ 0.3 V	0.1 μF	0.1 μF
5 V $\pm$ 0.5 V	0.047 μF	0.33 μF
3 V to 5.5 V	0.1 μF	0.47 μF

Figure 6. Typical Operating Circuit and Capacitor Values

Product Folder Link(s): *TRSF3221*

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
TRSF3221CDBR	LIFEBUY	SSOP	DB	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	RT21C	

(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.
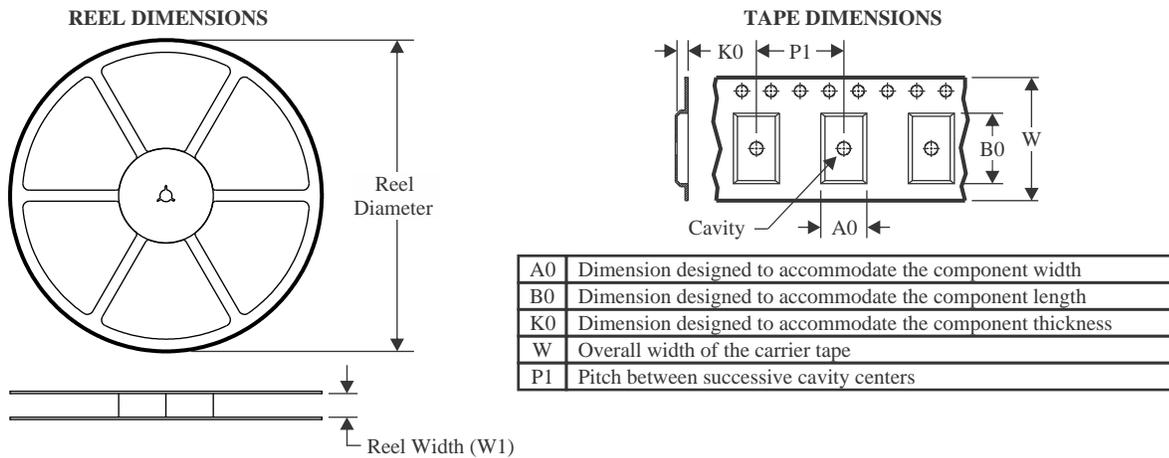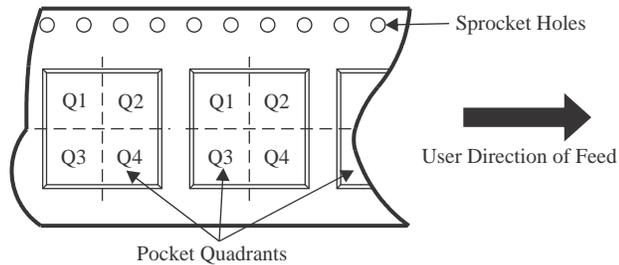
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(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.

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.

PACKAGE MATERIALS INFORMATION

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
TRSF3221CDBR	SSOP	DB	16	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS
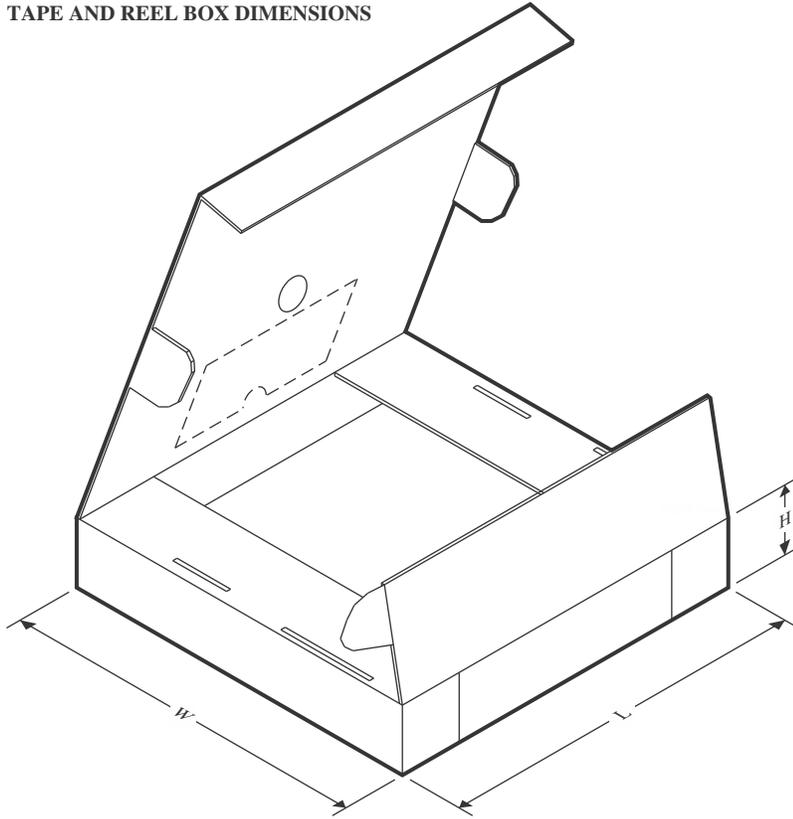
*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TRSF3221CDBR	SSOP	DB	16	2000	356.0	356.0	35.0

8.2 / 7.4 TYP

A

PIN 1 INDEX AREA

1

16

14X 0.65

2X

4.55

6.5 / 5.9
NOTE 3

8

9

16X 0.38 / 0.22

B

5.6 / 5.0
NOTE 4

C

0.1 C

SEATING PLANE

0.1 Ⓜ C A B

0.25 / 0.09

SEE DETAIL A

0.25

GAGE PLANE

0° -8°

0.95 / 0.55

2 MAX

0.05 MIN

DETAIL A
TYPICAL
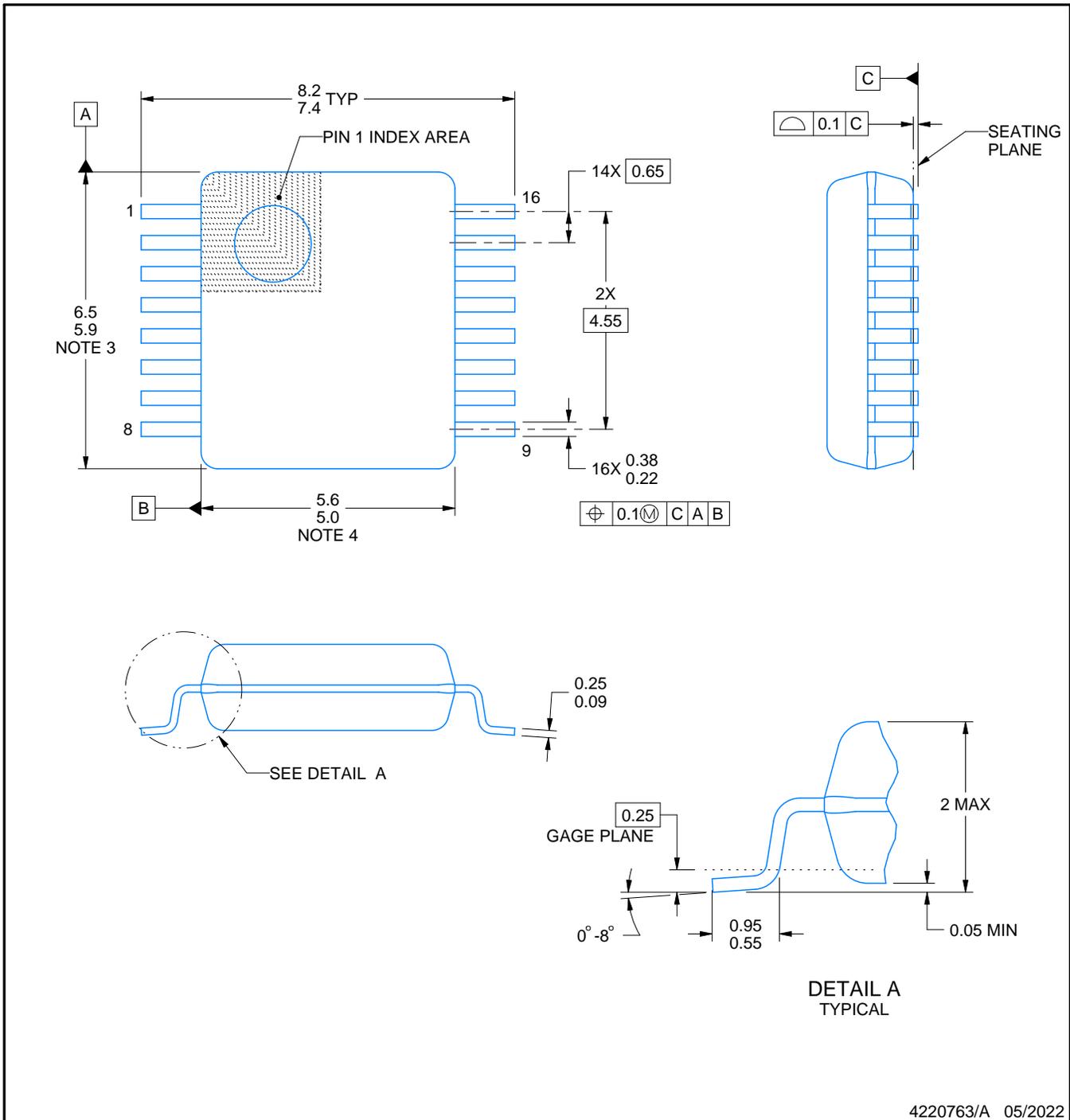
4220763/A 05/2022

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. Reference JEDEC registration MO-150.

DB0016A

16X (1.85)

16X (0.45)

1

(R0.05) TYP

16

SYMM

SYMM

14X (0.65)

8

9

(7)
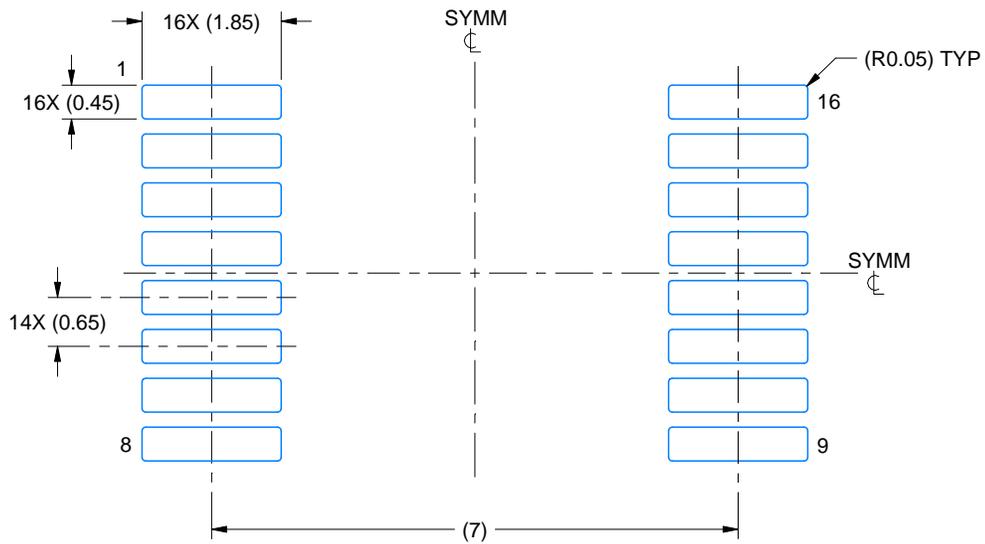
LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

SOLDER MASK
OPENING

METAL

EXPOSED METAL

0.05 MAX
ALL AROUND

NON-SOLDER MASK
DEFINED
(PREFERRED)

METAL UNDER
SOLDER MASK

SOLDER MASK
OPENING

EXPOSED METAL

0.05 MIN
ALL AROUND

SOLDER MASK
DEFINED

SOLDER MASK DETAILS
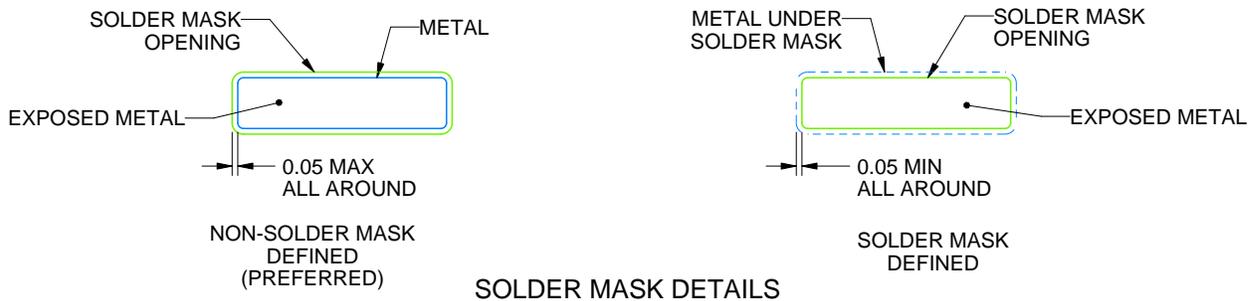
4220763/A   05/2022

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.

16X (1.85)

16X (0.45)

1

SYMM

(R0.05) TYP

16

SYMM

14X (0.65)

8

9

(7)
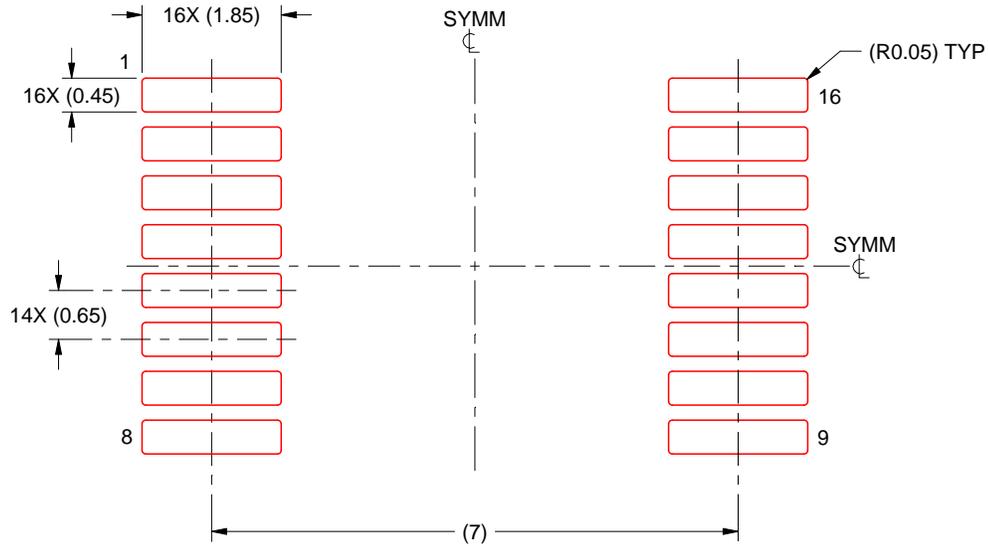
SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

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.