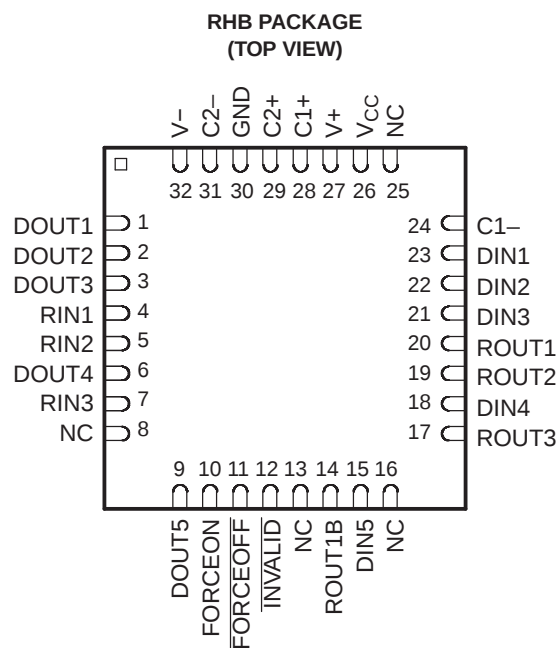
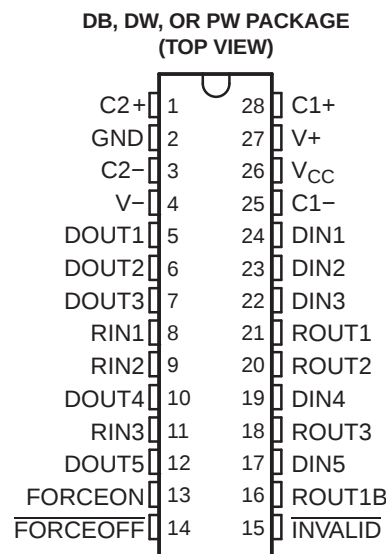


FEATURES

- RS-232 Bus-Pin ESD Protection Exceeds ± 15 kV Using Human-Body Model (HBM)
- Meets or Exceeds the Requirements of TIA/EIA-232-F and ITU v.28 Standards
- Operates With 3-V to 5.5-V V_{CC} Supply
- Operates up to 1000 kbit/s
- Five Drivers and Three Receivers
- Auto-Powerdown Plus Feature Enables Flexible Power-Down Mode
- Low Standby Current . . . 1 μ A Typical
- External Capacitors . . . $4 \times 0.1 \mu$ F
- Accept 5-V Logic Input With 3.3-V Supply
- Always-Active Noninverting Receiver Output (ROUT1B)
- ESD Protection for RS-232 Interface Pins
 - ± 15 -kV Human-Body Model (HBM)
 - ± 8 -kV IEC61000-4-2, Contact Discharge
 - ± 15 -kV IEC61000-4-2, Air-Gap Discharge

APPLICATIONS

- Battery-Powered Systems
- PDAs
- Notebooks
- Subnotebooks
- Laptops
- Palmtop PCs
- Hand-Held Equipment
- Modems
- Printers



DESCRIPTION/ORDERING INFORMATION

The TRSF3238E consists of five line drivers, three line receivers, and a dual charge-pump circuit with ± 15 -kV ESD (HBM) protection on the driver output (DOUT) and receiver input (RIN) terminals. The device meets the requirements of TIA/EIA-232-F and provides the electrical interface between notebook and subnotebook computer applications. The charge pump and four small external capacitors allow operation from a single 3-V to 5.5-V supply. In addition, the device includes an always-active noninverting output (ROUT1B), which allows applications using the ring indicator to transmit data while the device is powered down. The TRSF3238E operates at data signaling rates up to 1000 kbit/s.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

TRSF3238E
3-V TO 5.5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER
WITH ± 15 -kV ESD (HBM) PROTECTION

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DESCRIPTION/ORDERING INFORMATION (CONTINUED)

Flexible control options for power management are featured when the serial port and driver inputs are inactive. The auto-powerdown plus feature functions when $\overline{\text{FORCEON}}$ is low and $\overline{\text{FORCEOFF}}$ is high. During this mode of operation, if the device does not sense valid signal transitions on all receiver and driver inputs for approximately 30 s, the built-in charge pump and drivers are powered down, reducing the supply current to 1 μA . By disconnecting the serial port or placing the peripheral drivers off, auto-powerdown plus occurs if there is no activity in the logic levels for the driver inputs. Auto-powerdown plus can be disabled when $\overline{\text{FORCEON}}$ and $\overline{\text{FORCEOFF}}$ are high. With auto-powerdown plus enabled, the device activates automatically when a valid signal is applied to any receiver or driver input. $\overline{\text{INVALID}}$ is high (valid data) if any 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 . $\overline{\text{INVALID}}$ is low (invalid data) if all receiver input voltages are between -0.3 V and 0.3 V for more than 30 μs . Refer to Figure 5 for receiver input levels.

ORDERING INFORMATION

T_A	PACKAGE ⁽¹⁾⁽²⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	QFN – RHB	Reel of 2000	TRSF3238ECRHBR	RS38EC
		Tube of 50	TRSF3238ECDW	TRS3238EC
	SOIC – DW	Reel of 2000	TRSF3238ECDWR	
		Tube of 50	TRSF3238ECDB	TRS3238EC
	SSOP – DB	Reel of 2000	TRSF3238ECDBR	
		Tube of 50	TRSF3238ECPW	RS38EC
–40°C to 85°C	TSSOP – PW	Reel of 2000	TRSF3238ECPWR	
		Tube of 50	TRSF3238EIRHBR	RS38EI
	QFN – RHB	Reel of 2000	TRSF3238EIDW	TRS3238EI
		Tube of 50	TRSF3238EIDWR	
	SOIC – DW	Reel of 2000	TRSF3238EIDB	TRS3238EI
		Tube of 50	TRSF3238EIDBR	
	SSOP – DB	Reel of 2000	TRSF3238EIPW	RS38EI
		Tube of 50	TRSF3238EIPWR	
	TSSOP – PW	Reel of 2000		
		Tube of 50		

(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	FORCEOFF	TIME ELAPSED SINCE LAST RIN OR DIN TRANSITION		
X	X	L	X	Z	Powered off
L	H	H	X	H	Normal operation with auto-powerdown plus disabled
H	H	H	X	L	
L	L	H	<30 s	H	Normal operation with auto-powerdown plus enabled
H	L	H	<30 s	L	
L	L	H	>30 s	Z	Powered off by auto-powerdown plus feature
H	L	H	>30 s	Z	

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

Each Receiver⁽¹⁾

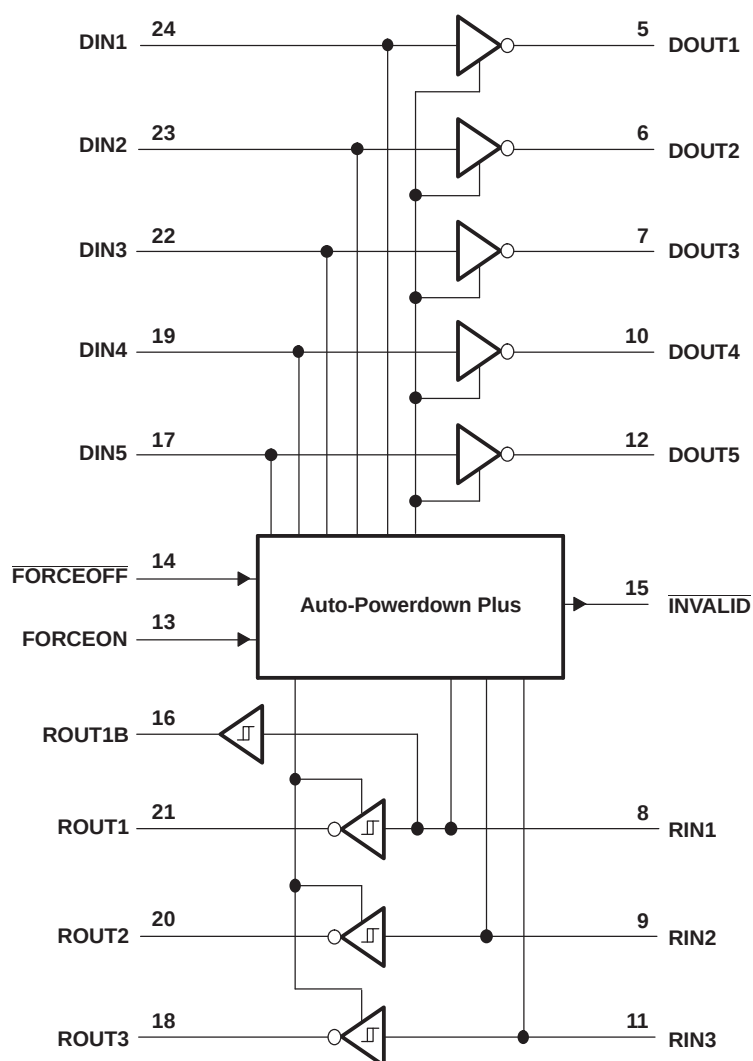
INPUTS				OUTPUTS		RECEIVER STATUS
RIN1	RIN2 AND RIN3	FORCEOFF	TIME ELAPSED SINCE LAST RIN OR DIN TRANSITION	ROUT1B	ROUT2 AND ROUT3	
L	X	L	X	L	Z	Powered off while ROUT1B is active
H	X	L	X	H	Z	
L	L	H	<30 s	L	H	Normal operation with auto-powerdown plus disabled/enabled
L	H	H	<30 s	L	L	
H	L	H	<30 s	H	H	
H	H	H	<30 s	H	L	
Open	Open	H	<30 s	L	H	

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

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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)	−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		62	°C/W
		DW package		46	
		PW package		62	
		RHB package		TBD	
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 $T_J(\text{max})$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$. 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			$V_{CC} = 3.3 \text{ V}$	3	3.3	3.6	V
			$V_{CC} = 5 \text{ V}$	4.5	5	5.5	
V_{IH}	Driver and control high-level input voltage	DIN, FORCEOFF , FORCEON	$V_{CC} = 3.3 \text{ V}$	2	5.5		V
			$V_{CC} = 5 \text{ V}$	2.4	5.5		
V_{IL}	Driver and control low-level input voltage	DIN, FORCEOFF , FORCEON			0	0.8	V
V_I	Receiver input voltage			−25		25	V
T_A	Operating free-air temperature		TRSF3238EC	0	70		°C
			TRSF3238EI	−40	85		

- (1) Testing supply conditions are C1–C4 = 0.1 μF at $V_{CC} = 3.3 \text{ V} \pm 0.15 \text{ V}$; C1–C4 = 0.22 μF at $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$; and C1 = 0.047 μF and C2–C4 = 0.33 μF at $V_{CC} = 5 \text{ V} \pm 0.5 \text{ V}$.

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		± 0.01	± 1	μA
I_{CC} Supply current ($T_A = 25^\circ\text{C}$)	Auto-powerdown plus disabled	No load, FORCEOFF and FORCEON at V_{CC} , V_{CC} at 3.3 V or 5 V		0.5	2 mA
	Powered off	No load, FORCEOFF at GND		1	10
	Auto-powerdown plus enabled	No load, FORCEOFF at V_{CC} , FORCEON at GND, All RIN are open or grounded		1	10 μA

- (1) Testing supply conditions are C1–C4 = 0.1 μF at $V_{CC} = 3.3 \text{ V} \pm 0.15 \text{ V}$; C1–C4 = 0.22 μF at $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$; and C1 = 0.047 μF and C2–C4 = 0.33 μF at $V_{CC} = 5 \text{ V} \pm 0.5 \text{ V}$.
- (2) All typical values are at $V_{CC} = 3.3 \text{ V}$ or $V_{CC} = 5 \text{ V}$, and $T_A = 25^\circ\text{C}$.

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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	All DOUT at R _L = 3 k Ω to GND	5	5.4		V
V _{OL}	Low-level output voltage	All DOUT at R _L = 3 k Ω to GND	–5	–5.4		V
I _{IH}	High-level input current	V _I = V _{CC}		± 0.01	± 1	μ A
I _{IL}	Low-level input current	V _I at GND		± 0.01	± 1	μ A
I _{OS}	Short-circuit output current ⁽³⁾	V _O = 0 V		± 35	± 60	mA
		V _{CC} = 3.6 V				
		V _{CC} = 5.5 V		± 40	± 100	
r _o	Output resistance	V _{CC} , V ₊ , and V _– = 0 V, V _O = ± 2 V	300	10M		Ω
I _{OZ}	Output leakage current	FORCEOFF = GND			± 25	μ A
		V _O = ± 12 V, V _{CC} = 3 V to 3.6 V				
		V _O = ± 10 V, V _{CC} = 4.5 V to 5.5 V			± 25	

(1) Testing supply conditions are C1–C4 = 0.1 μ F at V_{CC} = 3.3 V $\pm$ 0.15 V; C1–C4 = 0.22 μ F at V_{CC} = 3.3 V $\pm$ 0.3 V; and C1 = 0.047 μ F and C2–C4 = 0.33 μ F at V_{CC} = 5 V $\pm$ 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 k Ω , One DOUT switching	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 k Ω to 7 k Ω , See Figure 2		25		ns
SR(tr)	Slew rate, transition region (see Figure 1)	C _L = 150 pF to 1000 pF, R _L = 3 k Ω to 7 k Ω , V _{CC} = 3.3 V		18	150	V/ μ s

(1) Testing supply conditions are C1–C4 = 0.1 μ F at V_{CC} = 3.3 V $\pm$ 0.15 V; C1–C4 = 0.22 μ F at V_{CC} = 3.3 V $\pm$ 0.3 V; and C1 = 0.047 μ F and C2–C4 = 0.33 μ F at V_{CC} = 5 V $\pm$ 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

PARAMETER	TEST CONDITIONS	TYP	UNIT
DOUT	HBM	± 15	kV
	IEC 61000-4-2, Air-Gap Discharge	± 15	
	IEC 61000-4-2, Contact Discharge	± 8	

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		1.5	2.4	V
		V _{CC} = 5 V		1.8	2.4	
V _{IT–}	Negative-going input threshold voltage	V _{CC} = 3.3 V	0.6	1.2		V
		V _{CC} = 5 V	0.8	1.5		
V _{hys}	Input hysteresis (V _{IT+} – V _{IT–})			0.3		V
I _{OZ}	Output leakage current (except ROUT1B)	FORCEOFF = 0 V		±0.05	±10	μA
r _i	Input resistance	V _i = ±3 V to ±25 V	3	5	7	kΩ

(1) Testing supply conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.15 V; C1–C4 = 0.22 μF at V_{CC} = 3.3 V ± 0.3 V; and C1 = 0.047 μF and 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)

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) Testing supply conditions are C1–C4 = 0.1 μF at V_{CC} = 3.3 V ± 0.15 V; C1–C4 = 0.22 μF at V_{CC} = 3.3 V ± 0.3 V; and C1 = 0.047 μF and 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

PARAMETER	TEST CONDITIONS	TYP	UNIT
RIN	HBM	±15	kV
	IEC 61000-4-2, Air-Gap Discharge	±15	
	IEC 61000-4-2, Contact Discharge	±8	

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AUTO-POWERDOWN PLUS 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

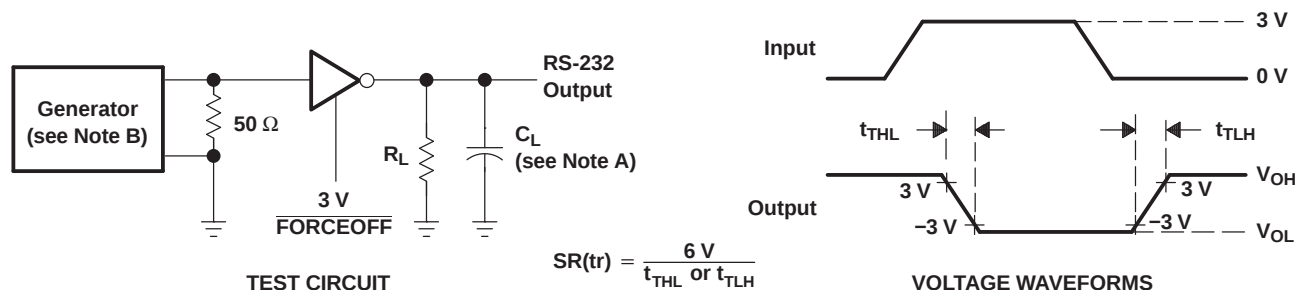
Switching Characteristics

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

PARAMETER		MIN	TYP ⁽¹⁾	MAX	UNIT
t_{valid}	Propagation delay time, low- to high-level output		0.1		μ s
$t_{invalid}$	Propagation delay time, high- to low-level output		50		μ s
t_{en}	Supply enable time		25		μ s
t_{dis}	Receiver or driver edge to auto-powerdown plus	15	30	60	s

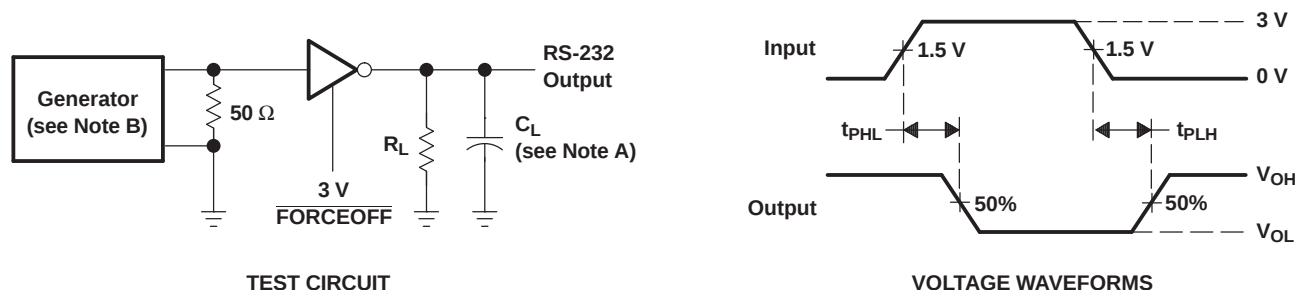
(1) All typical values are at $V_{CC} = 3.3$ V or $V_{CC} = 5$ V, and $T_A = 25^\circ\text{C}$.

PARAMETER MEASUREMENT INFORMATION



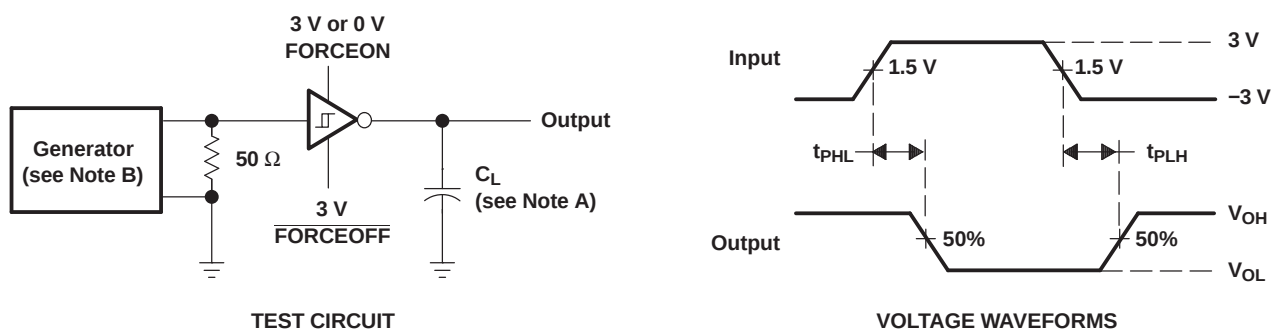
- A. C_L includes probe and jig capacitance.
- B. The pulse generator has the following characteristics: PRR = 250 kbit/s, $Z_O = 50 \Omega$, 50% duty cycle, $t_r \leq 10$ ns, $t_f \leq 10$ ns.

Figure 1. Driver Slew Rate



- 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, $t_r \leq 10$ ns, $t_f \leq 10$ ns.

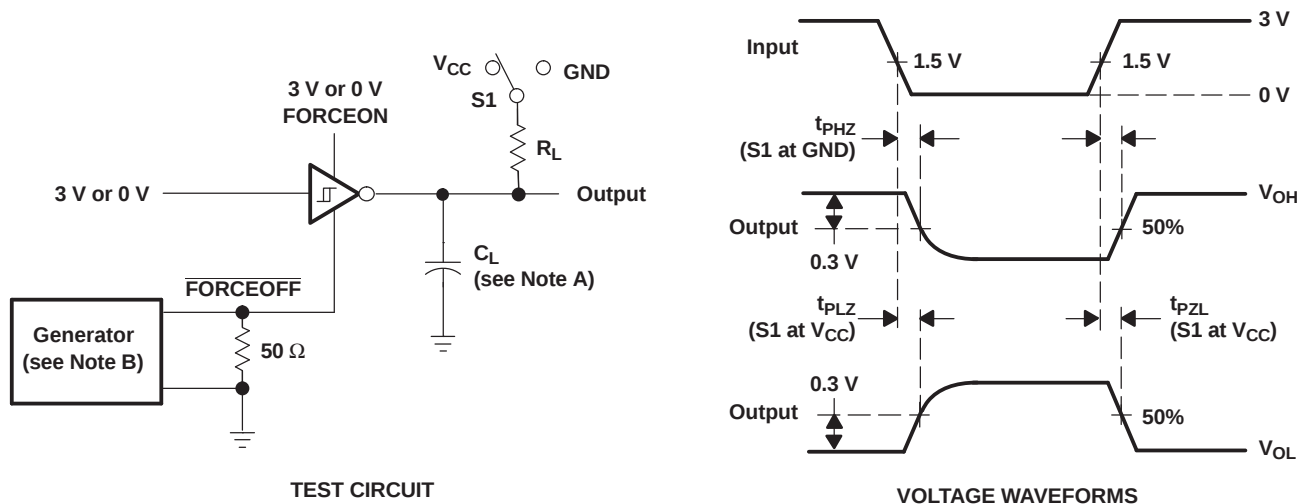
Figure 2. Driver Pulse Skew



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

Figure 3. Receiver Propagation Delay Times

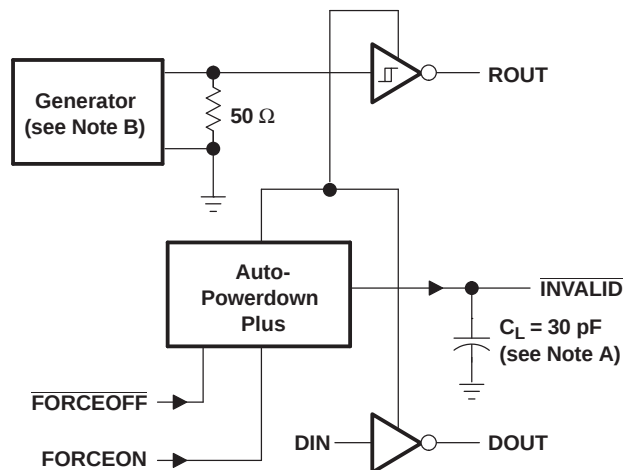
PARAMETER MEASUREMENT INFORMATION (continued)



- 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} .

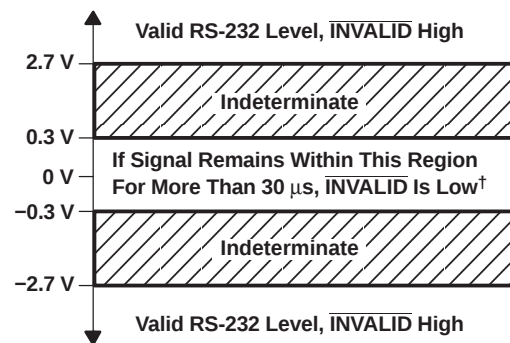
Figure 4. Receiver Enable and Disable Times

PARAMETER MEASUREMENT INFORMATION (continued)



TEST CIRCUIT

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



[†] Auto-powerdown plus disables drivers and reduces supply current to 1 μA .

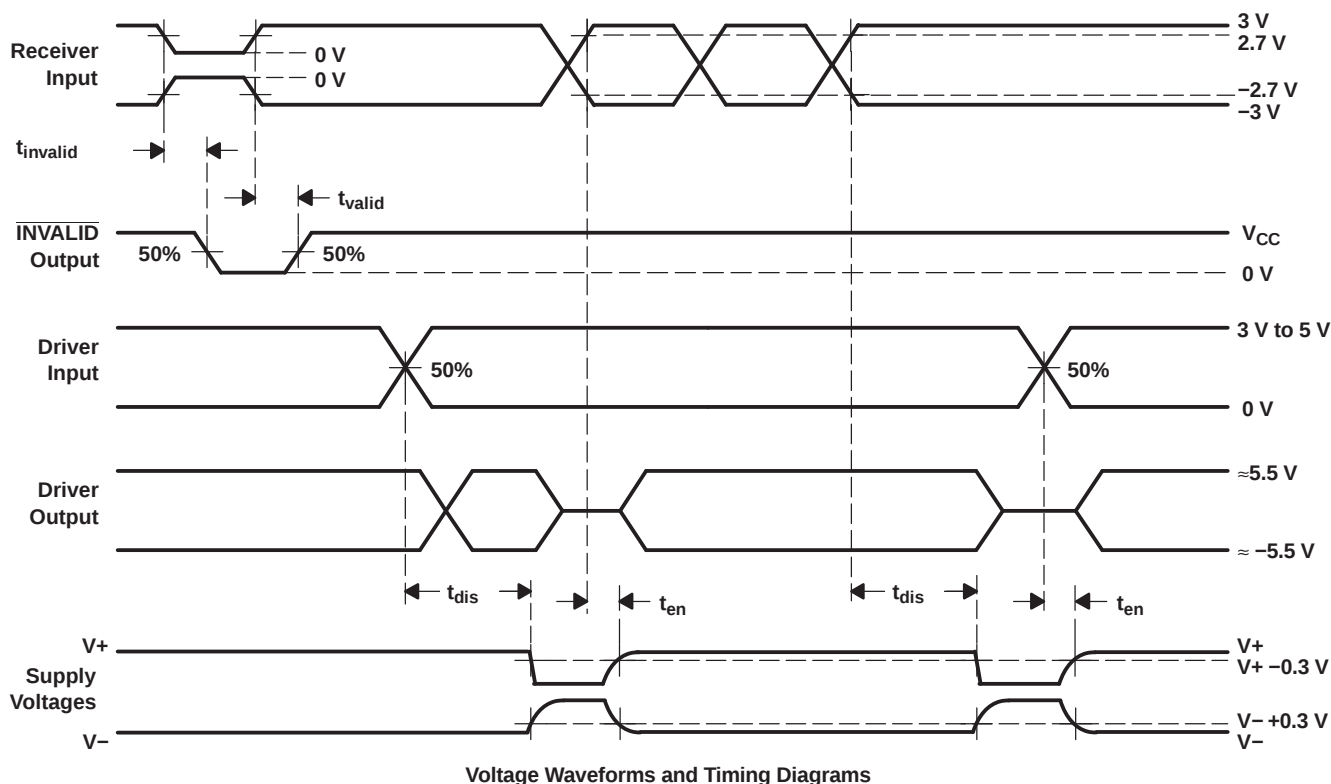


Figure 5. $\overline{\text{INVALID}}$ Propagation-Delay Times and Supply-Enabling Time

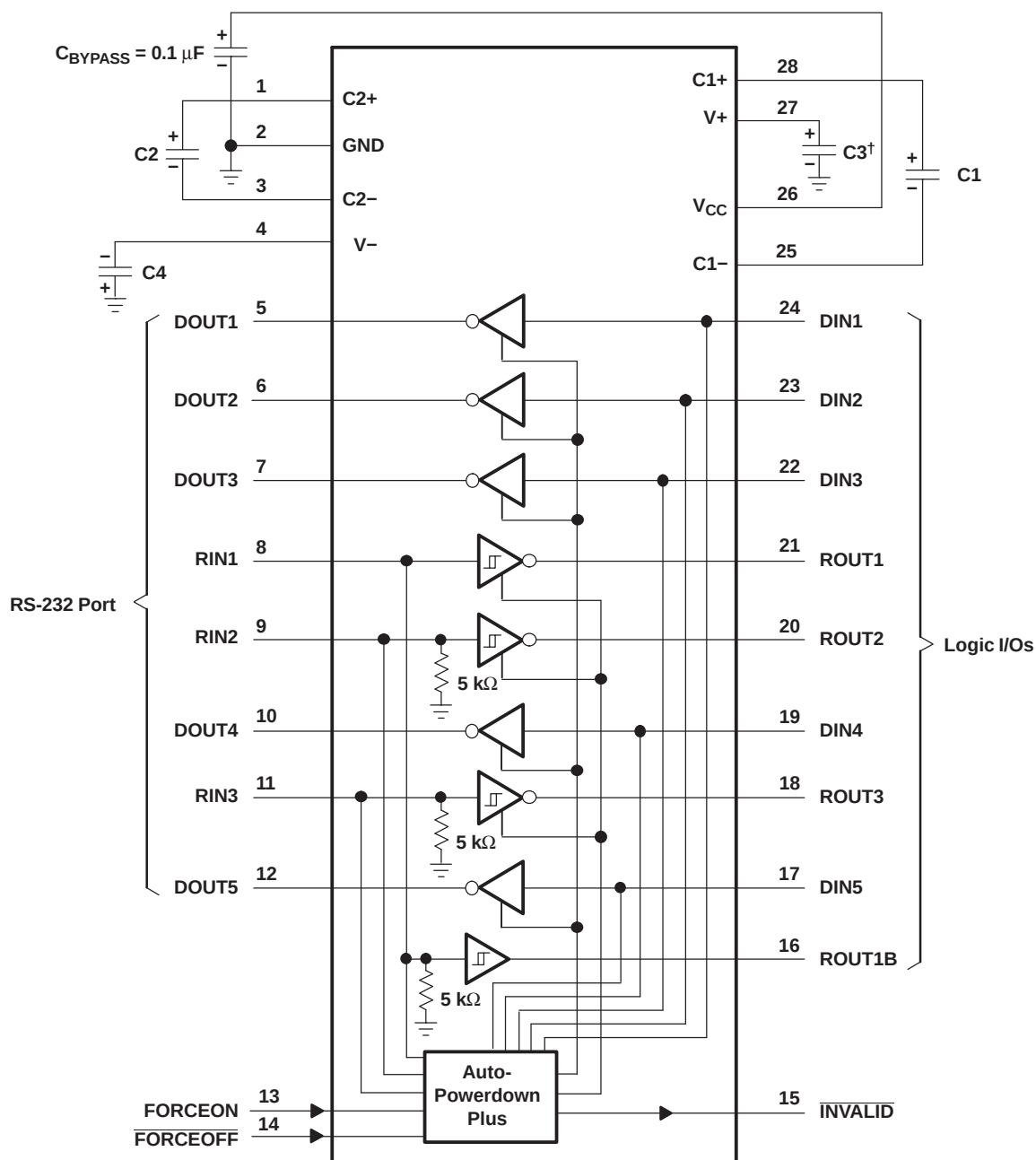
TRSF3238E

3-V TO 5.5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER

WITH ± 15 -kV ESD (HBM) PROTECTION

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APPLICATION INFORMATION



V_{CC} vs CAPACITOR VALUES

V _{CC}	C1	C2, C3, and C4
3.3 V $\pm$ 0.15 V	0.1 μ F	0.1 μ F
3.3 V $\pm$ 0.3 V	0.22 μ F	0.22 μ F
5 V $\pm$ 0.5 V	0.047 μ F	0.33 μ F
3 V to 5.5 V	0.22 μ F	1 μ F

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

NOTES: A. Resistor values shown are nominal.

B. Nonpolarized ceramic capacitors are acceptable. If polarized tantalum or electrolytic capacitors are used, they should be connected as shown.

Figure 6. Typical Operating Circuit and Capacitor Values

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)
TRSF3238EIDBR	Active	Production	SSOP (DB) 28	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TRSF3238EI
TRSF3238EIDBR.B	Active	Production	SSOP (DB) 28	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TRSF3238EI
TRSF3238EIDWR	Active	Production	SOIC (DW) 28	1000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TRSF3238EI
TRSF3238EIDWR.A	Active	Production	SOIC (DW) 28	1000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TRSF3238EI
TRSF3238EIDWR.B	Active	Production	SOIC (DW) 28	1000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TRSF3238EI

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

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

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

⁽⁴⁾ **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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

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

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

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TAPE AND REEL INFORMATION



*All dimensions are nominal

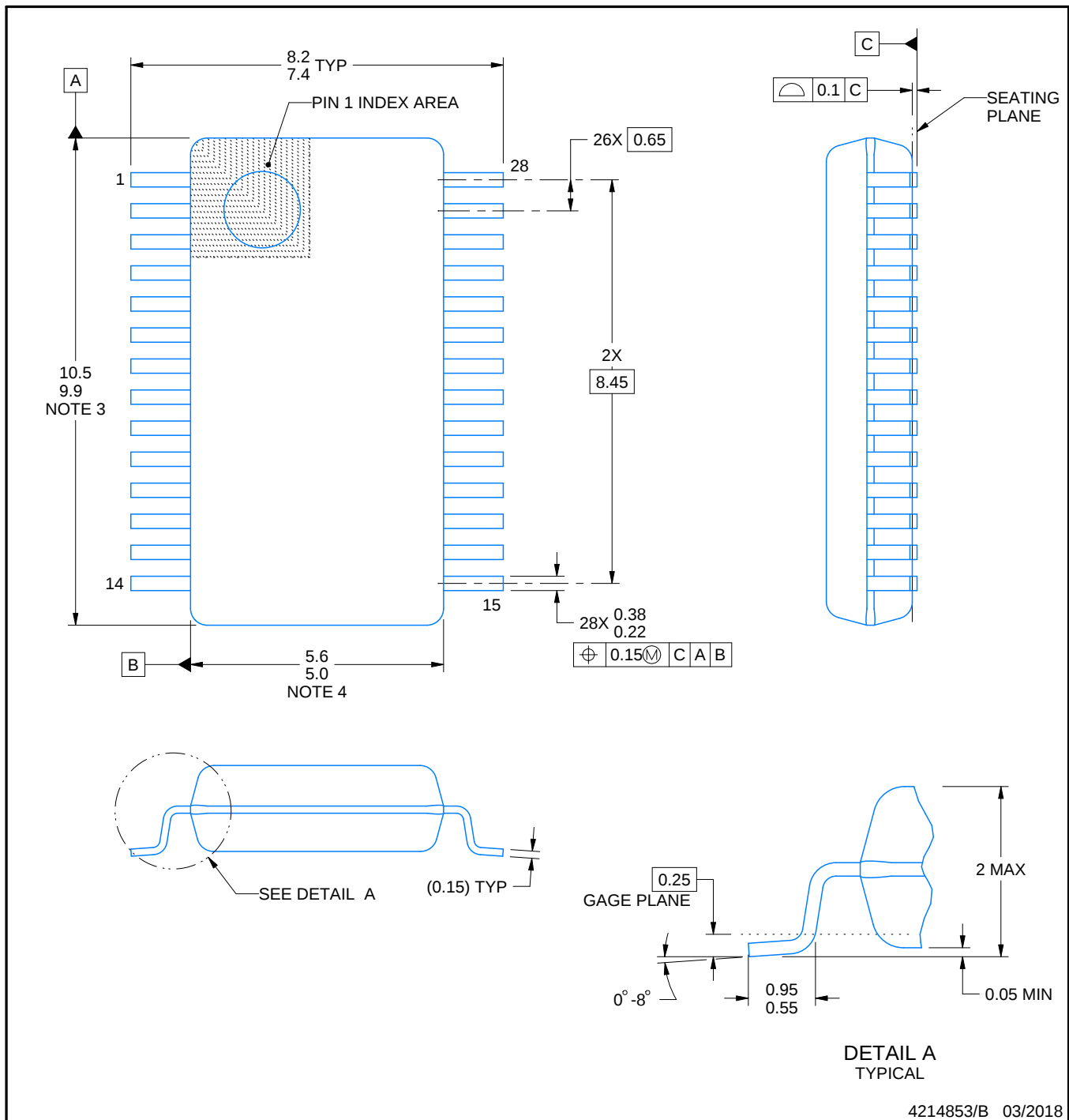
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TRSF3238EIDBR	SSOP	DB	28	2000	330.0	16.4	8.45	10.55	2.5	12.0	16.2	Q1
TRSF3238EIDWR	SOIC	DW	28	1000	330.0	32.4	11.35	18.67	3.1	16.0	32.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TRSF3238EIDBR	SSOP	DB	28	2000	353.0	353.0	32.0
TRSF3238EIDWR	SOIC	DW	28	1000	350.0	350.0	66.0

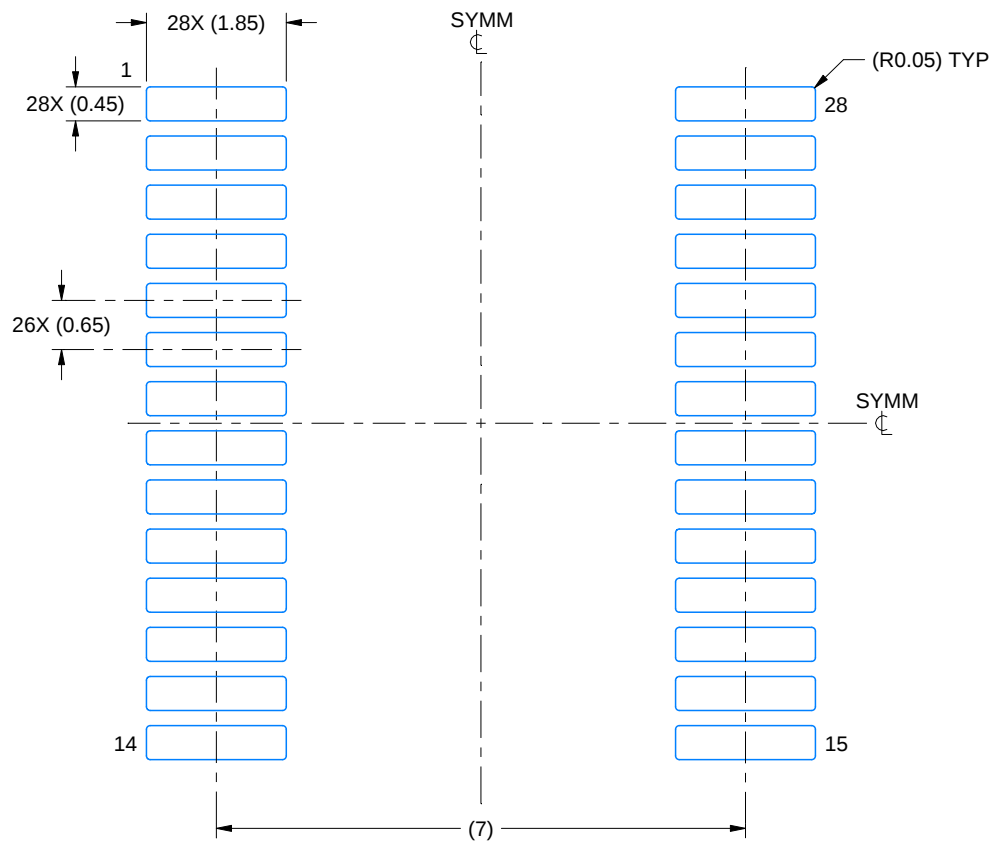


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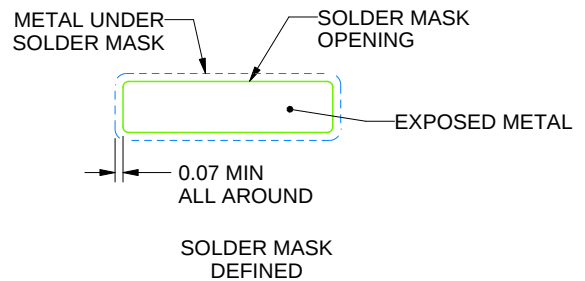
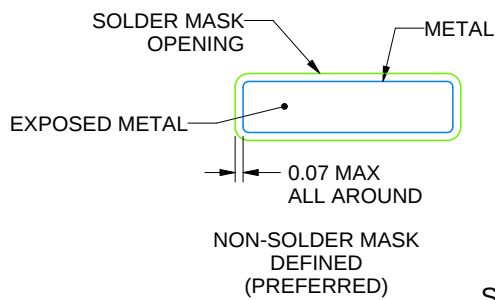
DB0028A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



SOLDER MASK DETAILS

4214853/B 03/2018

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

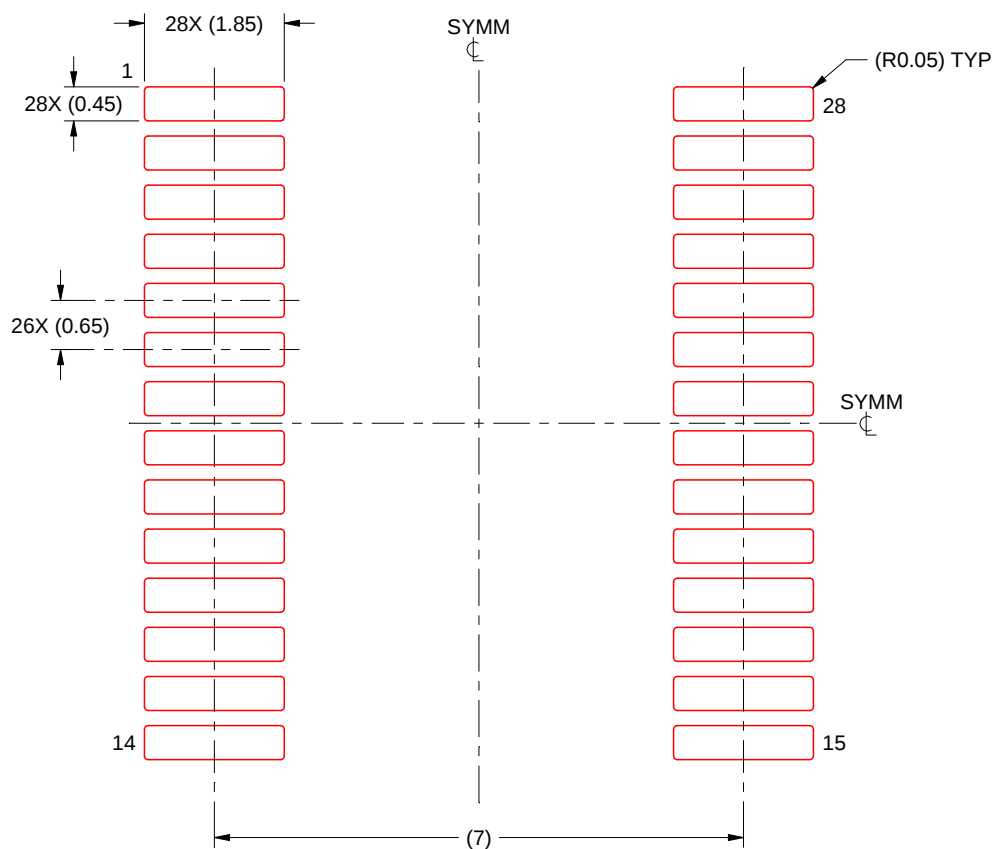
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DB0028A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



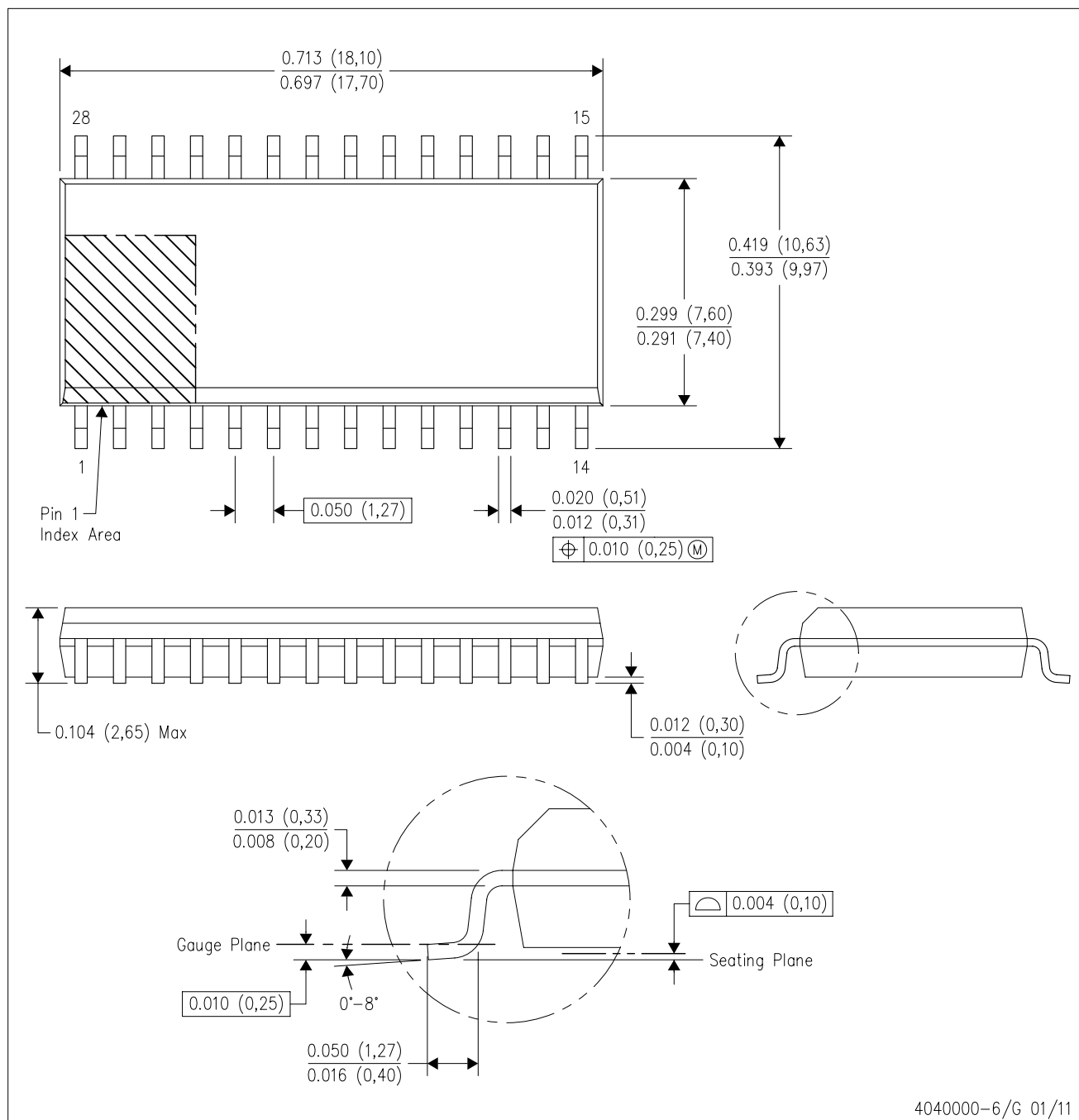
4214853/B 03/2018

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.

DW (R-PDSO-G28)

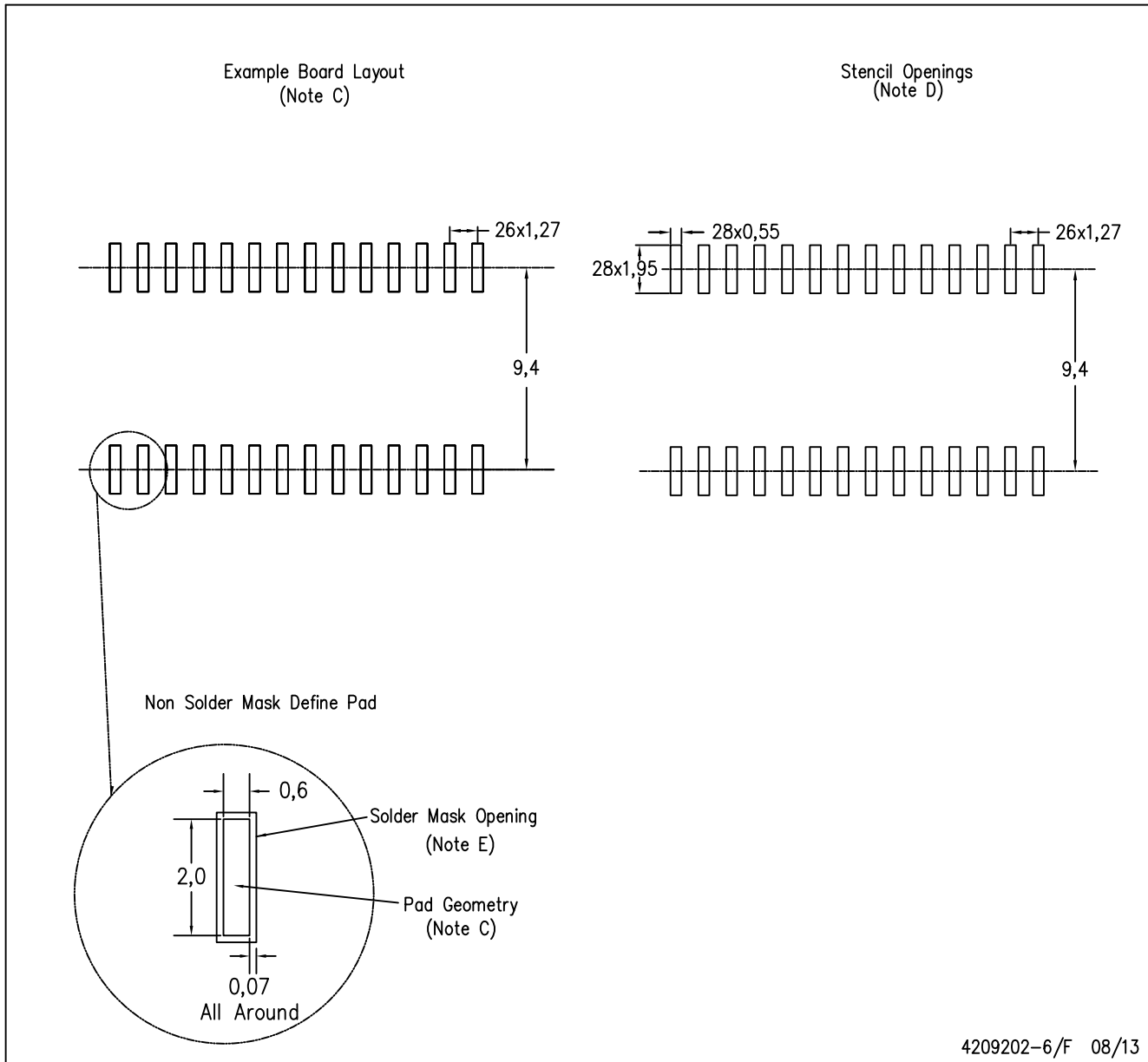
PLASTIC SMALL OUTLINE



- NOTES: A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-013 variation AE.

DW (R-PDSO-G28)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Refer to IPC7351 for alternate board design.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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