

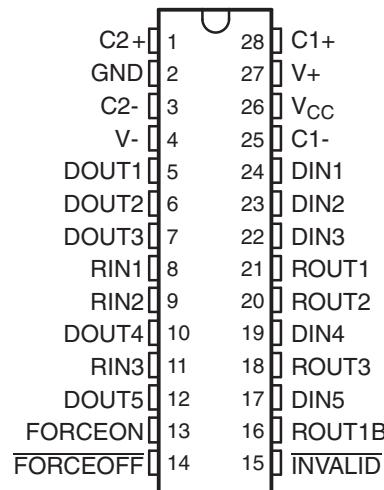
FEATURES

- RS-232 Bus-Pin ESD Protection Exceeds $\pm 15\text{ kV}$ 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 400 kbit/s
- Five Drivers and Three Receivers
- Auto-Powerdown Plus Feature Enables Flexible Power-Down Mode
- Low Standby Current . . . 1 μA Typical
- External Capacitors . . . $4 \times 0.1\text{ }\mu\text{F}$
- Accepts 5-V Logic Input With 3.3-V Supply
- Always-Active Noninverting Receiver Output (ROUT1B)
- Alternative High-Speed Pin-Compatible Device (1 Mbit/s) for TRSF3238
- ESD Protection for RS-232 Interface Pins
 - $\pm 15\text{ kV}$ – Human-Body Model (HBM)
 - $\pm 8\text{ kV}$ – IEC61000-4-2, Contact Discharge
 - $\pm 15\text{ kV}$ – IEC61000-4-2, Air-Gap Discharge

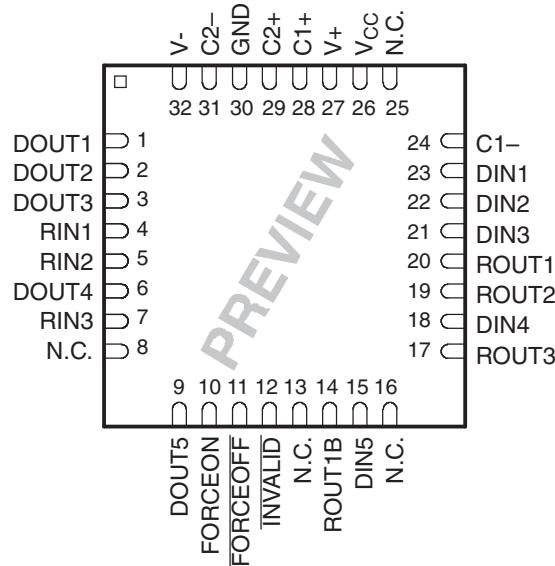
APPLICATIONS

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

**DB, DW, OR PW PACKAGE
(TOP VIEW)**



**RHB PACKAGE
(TOP VIEW)**



N.C. - Not inter nally connected

DESCRIPTION/ORDERING INFORMATION

The TRS3238E consists of five line drivers, three line receivers, and a dual charge-pump circuit with $\pm 15\text{-kV}$ 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. This device operates at data signaling rates up to 250 kbit/s and a maximum of 30-V/ μs driver output slew rate.



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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 FORCEON is low and 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 FORCEON and FORCEOFF are high. With auto-powerdown plus enabled, the device activates automatically when a valid signal is applied to any receiver or driver input. 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 . 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	SSOP – DB	Tube of 50	TRS3238ECDB
		Reel of 2000	TRS3238ECDBR
	TSSOP – PW	Tube of 50	TRS3238ECPW
		Reel of 2000	TRS3238ECPWR
	SOIC – DW	Reel of 2000	TRS3238ECDWR
	QFN – RHB	Reel of 2000	TRS3238ECRHBR
	SSOP – DB	Tube of 50	TRS3238EIDB
		Reel of 2000	TRS3238EIDBR
-40°C to 85°C	TSSOP – PW	Tube of 50	TRS3238EIPW
		Reel of 2000	TRS3238EIPWR
	SOIC – DW	Reel of 2000	TRS3238ICDWR
	QFN – RHB	Reel of 2000	TRS3238EIRHBR
			PREVIEW

(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

(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			TIME ELAPSED SINCE LAST RIN OR DIN TRANSITION	OUTPUT DOUT	DRIVER STATUS
DIN	FORCEON	FORCEOFF			
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	

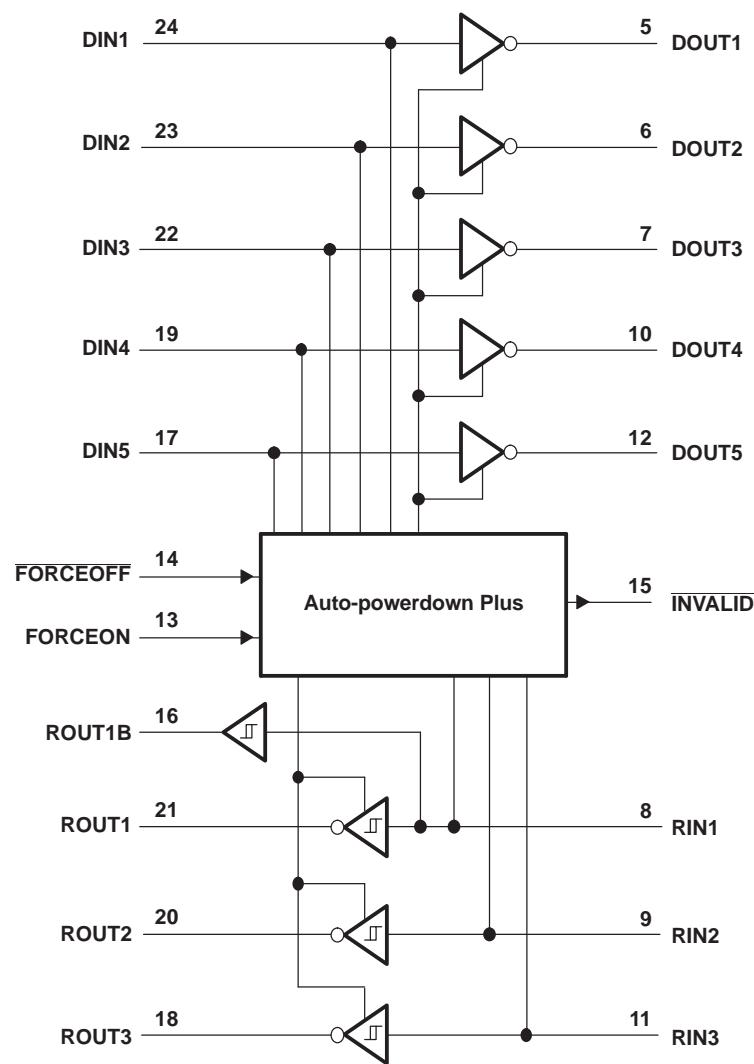
(1) H = high level, L = low level, X = irrelevant, Z = high impedance

 Each Receiver⁽¹⁾

INPUTS			TIME ELAPSED SINCE LAST RIN OR DIN TRANSITION	OUTPUTS		RECEIVER STATUS
RIN1	RIN2–RIN3	FORCEOFF		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	
L	H	H	<30 s	L	L	Normal operation with auto-powerdown plus disabled/enabled
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

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
		Receiver	-25	25
V_O	Output voltage range	Driver	-13.2	13.2
		Receiver (INVALID)	-0.3	$V_{CC} + 0.3$
θ_{JA}	Package thermal impedance ⁽³⁾⁽⁴⁾	DB package		62
		DW package		46
		PW package		62
		RHB package		PREVIEW
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	$V_{CC} = 3.3\text{ V}$	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	TRS3238EC	0	70	°C
		TRS3238EI	-40	85	

(1) Testing supply conditions are $C1-C4 = 0.1\text{ }\mu\text{F}$ at $V_{CC} = 3.3\text{ V} \pm 0.15\text{ V}$; $C1-C4 = 0.22\text{ }\mu\text{F}$ at $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$; and $C1 = 0.047\text{ }\mu\text{F}$ and $C2-C4 = 0.33\text{ }\mu\text{F}$ 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}	Auto-powerdown plus disabled	No load, FORCEOFF and FORCEON at V_{CC}		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 $C1-C4 = 0.1\text{ }\mu\text{F}$ at $V_{CC} = 3.3\text{ V} \pm 0.15\text{ V}$; $C1-C4 = 0.22\text{ }\mu\text{F}$ at $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$; and $C1 = 0.047\text{ }\mu\text{F}$ and $C2-C4 = 0.33\text{ }\mu\text{F}$ 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 $T_A = 25^\circ\text{C}$.

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 $R_L = 3\text{ k}\Omega$ to GND	5	5.4		V
V_{OL} Low-level output voltage	All DOUT at $R_L = 3\text{ k}\Omega$ to GND	-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⁾	$V_{CC} = 3.6\text{ V}$, $V_O = 0\text{ V}$		± 35	± 60	mA
	$V_{CC} = 5.5\text{ V}$, $V_O = 0\text{ V}$		± 40	± 100	
r_o Output resistance	V_{CC} , V_+ , and $V_- = 0\text{ V}$, $V_O = \pm 2\text{ V}$	300	10M		Ω
I_{OZ} Output leakage current	FORCEOFF = GND	$V_O = \pm 12\text{ V}$, $V_{CC} = 3\text{ V to }3.6\text{ V}$		± 25	μA
		$V_O = \pm 10\text{ V}$, $V_{CC} = 4.5\text{ V to }5.5\text{ V}$		± 25	

(1) Testing supply conditions are $C1\text{--}C4 = 0.1\text{ }\mu\text{F}$ at $V_{CC} = 3.3\text{ V} \pm 0.15\text{ V}$; $C1\text{--}C4 = 0.22\text{ }\mu\text{F}$ at $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$; and $C1 = 0.047\text{ }\mu\text{F}$ and $C2\text{--}C4 = 0.33\text{ }\mu\text{F}$ 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 $T_A = 25^\circ\text{C}$.

(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	$C_L = 1000\text{ pF}$, One DOUT switching, See Figure 1	250	400		kbit/s
$t_{sk(p)}$ Pulse skew ⁽³⁾	$C_L = 150\text{ pF to }2500\text{ pF}$, See Figure 2		100		ns
SR(tr) (see Figure 1)	$V_{CC} = 3.3\text{ V}$, $R_L = 3\text{ k}\Omega$ to $7\text{ k}\Omega$	$C_L = 150\text{ pF to }1000\text{ pF}$	6	30	V/ μs
		$C_L = 150\text{ pF to }2500\text{ pF}$	4	30	

(1) Testing supply conditions are $C1\text{--}C4 = 0.1\text{ }\mu\text{F}$ at $V_{CC} = 3.3\text{ V} \pm 0.15\text{ V}$; $C1\text{--}C4 = 0.22\text{ }\mu\text{F}$ at $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$; and $C1 = 0.047\text{ }\mu\text{F}$ and $C2\text{--}C4 = 0.33\text{ }\mu\text{F}$ 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 $T_A = 25^\circ\text{C}$.

(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	$I_{OH} = -1\text{ mA}$	$V_{CC} = 0.6$	$V_{CC} = 0.1$		V
V_{OL} Low-level output voltage	$I_{OL} = 1.6\text{ mA}$			0.4	V
V_{IT+} Positive-going input threshold voltage	$V_{CC} = 3.3\text{ V}$		1.5	2.4	V
	$V_{CC} = 5\text{ V}$		1.8	2.4	
V_{IT-} Negative-going input threshold voltage	$V_{CC} = 3.3\text{ V}$	0.6	1.2		V
	$V_{CC} = 5\text{ V}$	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	$V_I = \pm 3\text{ V}$ to $\pm 25\text{ V}$	3	5	7	$\text{k}\Omega$

(1) Testing supply conditions are $C1-C4 = 0.1\text{ }\mu\text{F}$ at $V_{CC} = 3.3\text{ V} \pm 0.15\text{ V}$; $C1-C4 = 0.22\text{ }\mu\text{F}$ at $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$; and $C1 = 0.047\text{ }\mu\text{F}$ and $C2-C4 = 0.33\text{ }\mu\text{F}$ 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 $T_A = 25^\circ\text{C}$.

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	$C_L = 150\text{ pF}$, See Figure 3	150	ns
t_{PHL} Propagation delay time, high- to low-level output	$C_L = 150\text{ pF}$, See Figure 3	150	ns
t_{en} Output enable time	$C_L = 150\text{ pF}$, $R_L = 3\text{ k}\Omega$, See Figure 4	200	ns
t_{dis} Output disable time	$C_L = 150\text{ pF}$, $R_L = 3\text{ k}\Omega$, See Figure 4	200	ns
$t_{sk(p)}$ Pulse skew ⁽³⁾	See Figure 3	50	ns

(1) Testing supply conditions are $C1-C4 = 0.1\text{ }\mu\text{F}$ at $V_{CC} = 3.3\text{ V} \pm 0.15\text{ V}$; $C1-C4 = 0.22\text{ }\mu\text{F}$ at $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$; and $C1 = 0.047\text{ }\mu\text{F}$ and $C2-C4 = 0.33\text{ }\mu\text{F}$ 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 $T_A = 25^\circ\text{C}$.

(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	

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

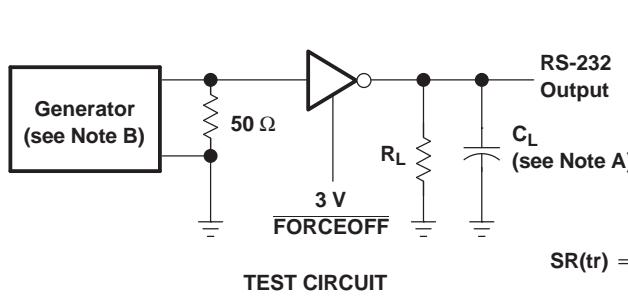
Switching Characteristics

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

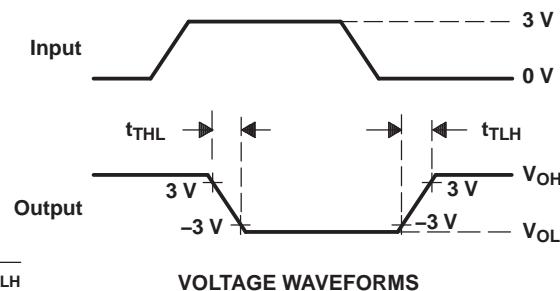
PARAMETER	MIN	TYP ⁽¹⁾	MAX	UNIT
t_{valid}		0.1		μs
t_{invalid}		50		μs
t_{en}		25		μs
t_{dis}	15	30	60	s

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

PARAMETER MEASUREMENT INFORMATION

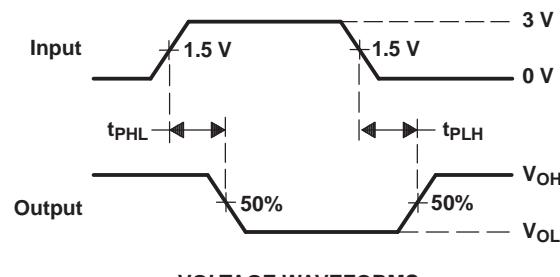
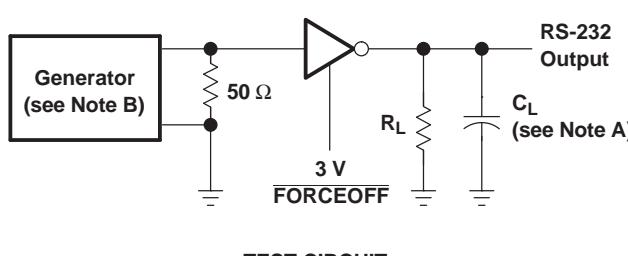


$$SR(tr) = \frac{6\text{ V}}{t_{THL} \text{ or } t_{TLH}}$$



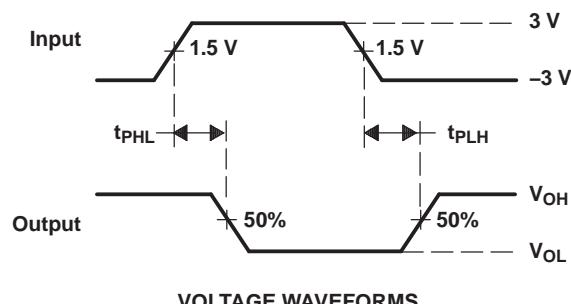
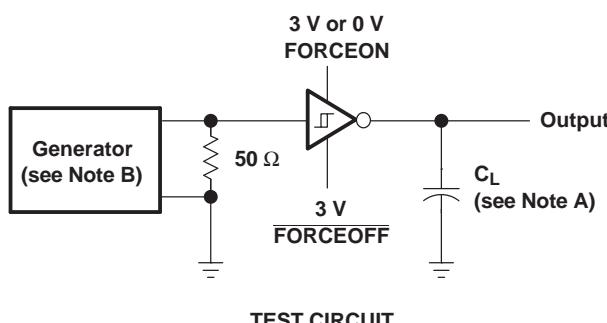
- A. C_L includes probe and jig capacitance.
- B. The pulse generator has the following characteristics: PRR = 250 kbit/s, $Z_O = 50 \Omega$, 50% duty cycle, $t_r \leq 10 \text{ ns}$, $t_f \leq 10 \text{ ns}$.

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

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

Figure 3. Receiver Propagation Delay Times

PARAMETER MEASUREMENT INFORMATION (continued)

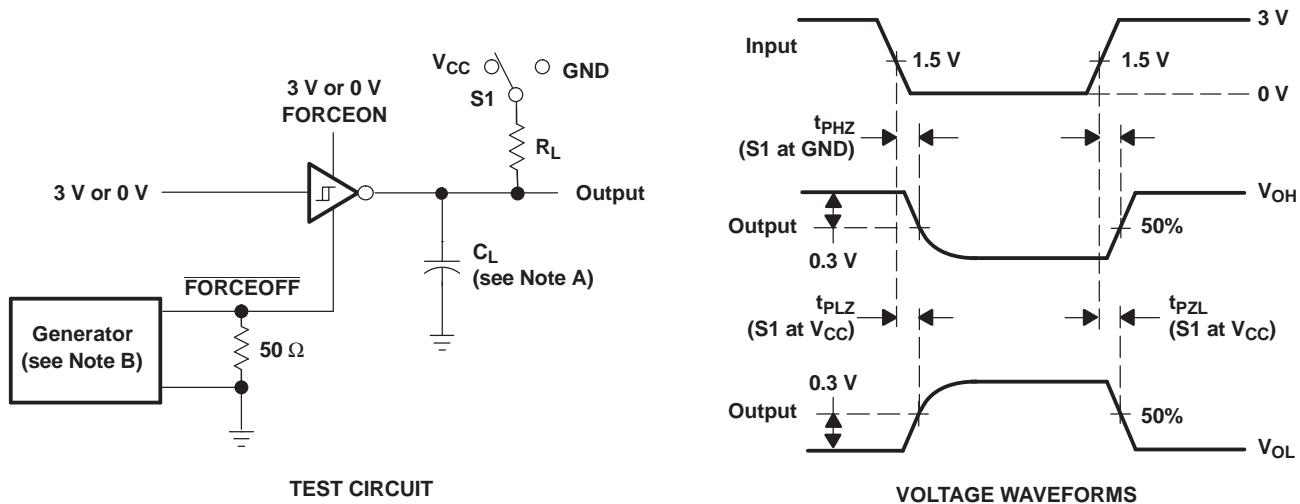
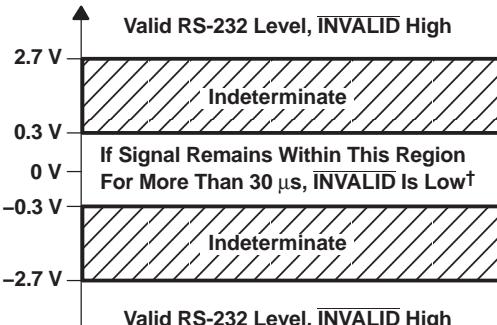
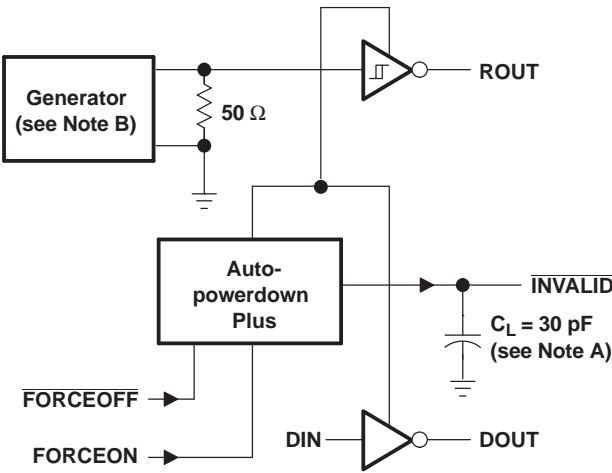


Figure 4. Receiver Enable and Disable Times

- 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} .

PARAMETER MEASUREMENT INFORMATION (continued)



† Auto-powerdown plus disables drivers and reduces supply current to 1 μ A.

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

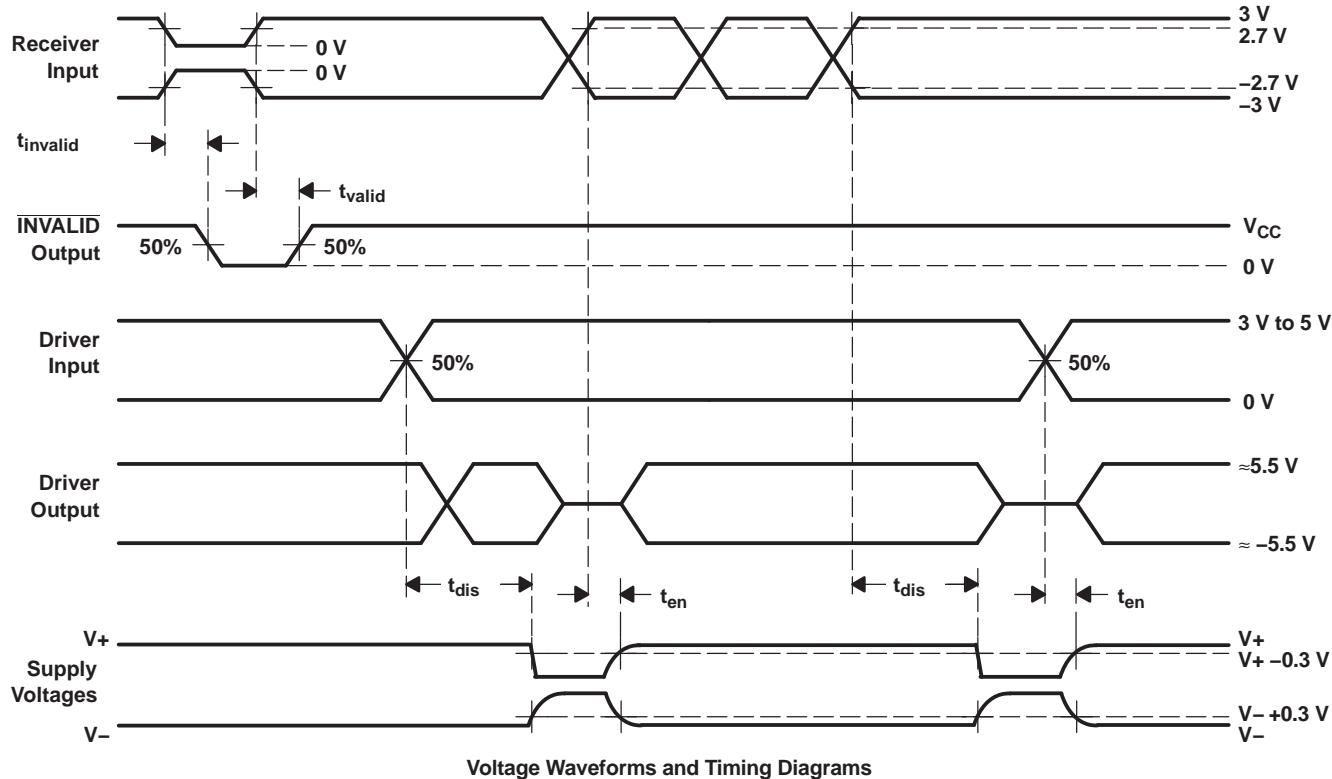
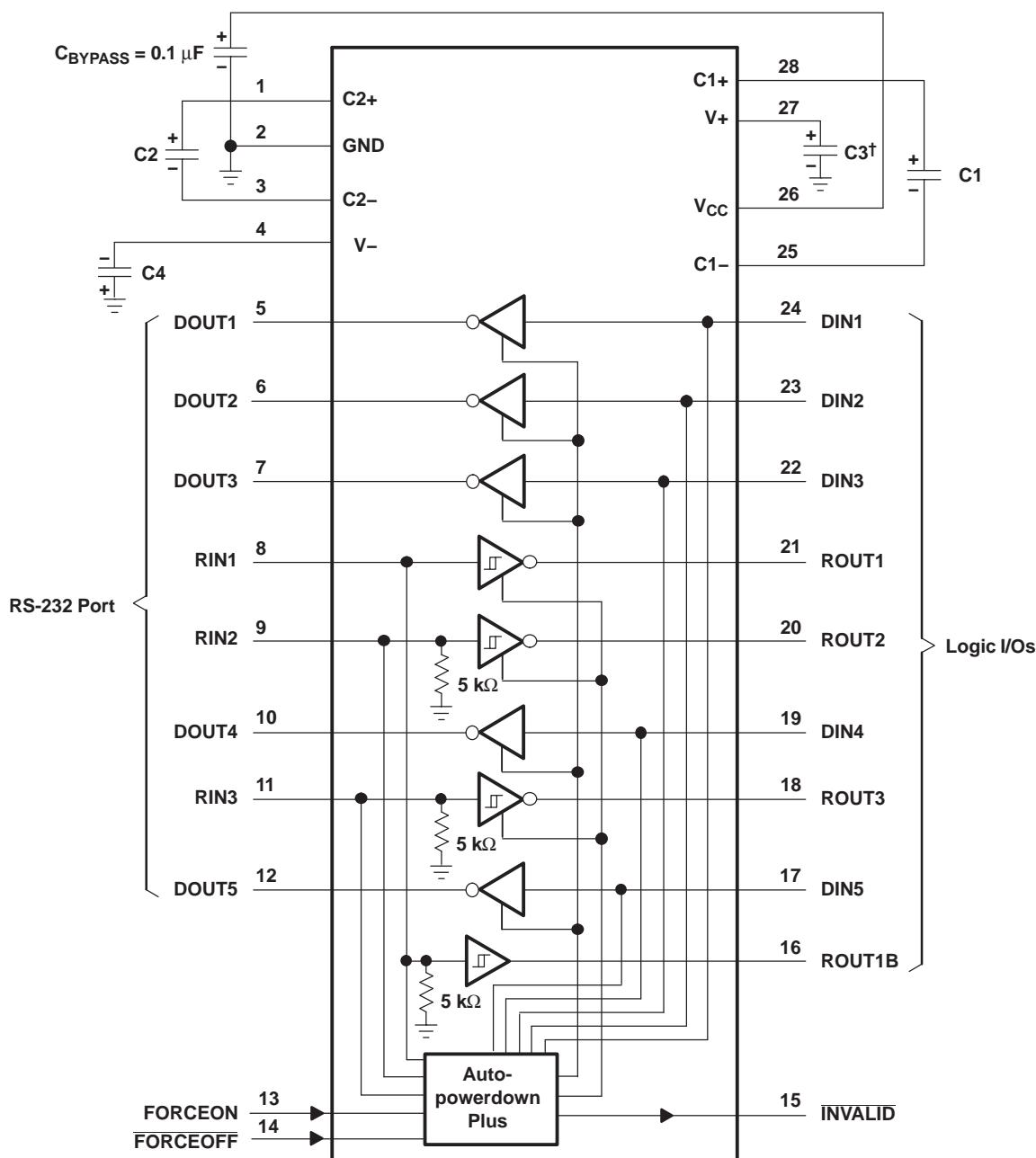


Figure 5. INVALID Propagation-Delay Times and Supply-Enabling Time

APPLICATION INFORMATION



† 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.

V_{CC} vs CAPACITOR VALUES

V _{CC}	C1	C2, C3, and C4
3.3 V ± 0.15 V	0.1 μF	0.1 μF
3.3 V ± 0.3 V	0.22 μF	0.22 μF
5 V ± 0.5 V	0.047 μF	0.33 μF
3 V to 5.5 V	0.22 μF	1 μF

Figure 6. Typical Operating Circuit and Capacitor Values

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
TRS3238ECDB	ACTIVE	SSOP	DB	28	50	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	TRS3238EC	Samples
TRS3238ECDBR	ACTIVE	SSOP	DB	28	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	TRS3238EC	Samples
TRS3238ECPWR	ACTIVE	TSSOP	PW	28	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	0 to 70	RS38EC	Samples
TRS3238EIDB	ACTIVE	SSOP	DB	28	50	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TRS3238EI	Samples
TRS3238EIDBR	ACTIVE	SSOP	DB	28	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TRS3238EI	Samples
TRS3238EIPW	ACTIVE	TSSOP	PW	28	50	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	RS38EI	Samples
TRS3238EIPWR	ACTIVE	TSSOP	PW	28	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	RS38EI	Samples

(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.



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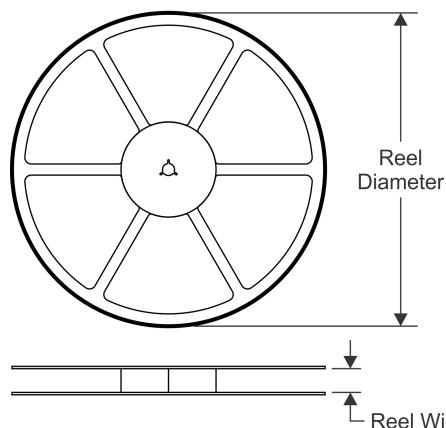
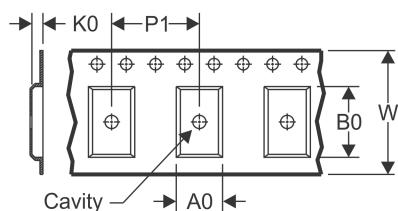
PACKAGE OPTION ADDENDUM

10-Dec-2020

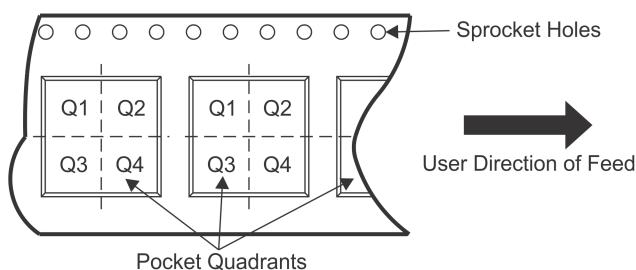
(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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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


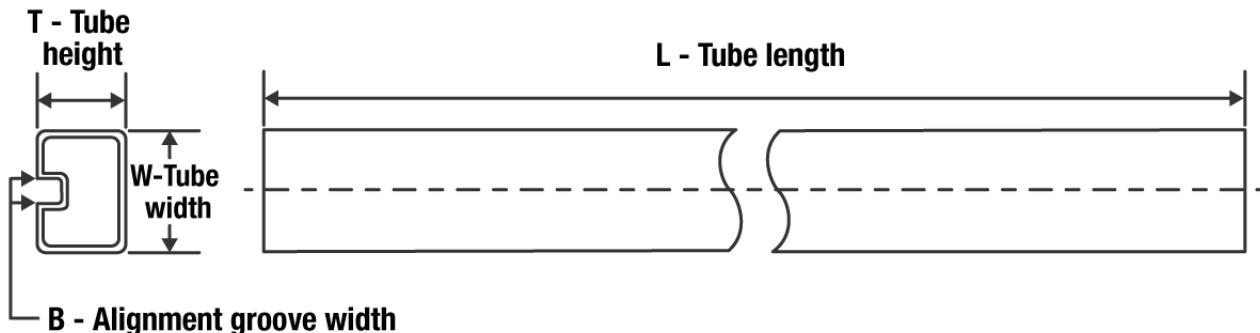
*All dimensions are nominal

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
TRS3238ECDBR	SSOP	DB	28	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
TRS3238ECPWR	TSSOP	PW	28	2000	330.0	16.4	6.9	10.2	1.8	12.0	16.0	Q1
TRS3238EIDBR	SSOP	DB	28	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
TRS3238EIPWR	TSSOP	PW	28	2000	330.0	16.4	6.9	10.2	1.8	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)
TRS3238ECDBR	SSOP	DB	28	2000	853.0	449.0	35.0
TRS3238ECPWR	TSSOP	PW	28	2000	853.0	449.0	35.0
TRS3238EIDBR	SSOP	DB	28	2000	853.0	449.0	35.0
TRS3238EIPWR	TSSOP	PW	28	2000	853.0	449.0	35.0

TUBE


*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
TRS3238ECDB	DB	SSOP	28	50	530	10.5	4000	4.1
TRS3238EIDB	DB	SSOP	28	50	530	10.5	4000	4.1
TRS3238EIPW	PW	TSSOP	28	50	530	10.2	3600	3.5

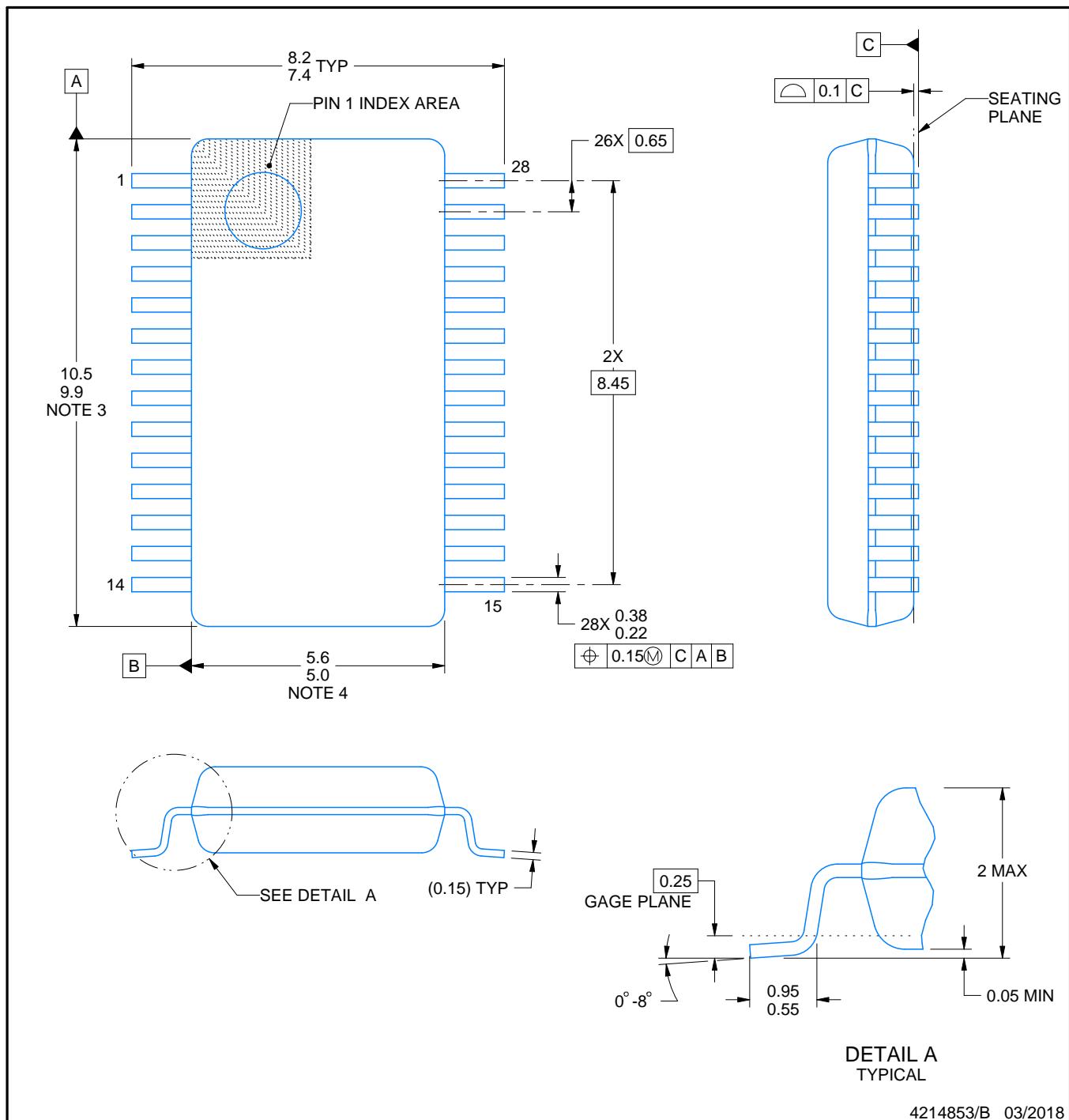
PACKAGE OUTLINE

DB0028A



SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



NOTES:

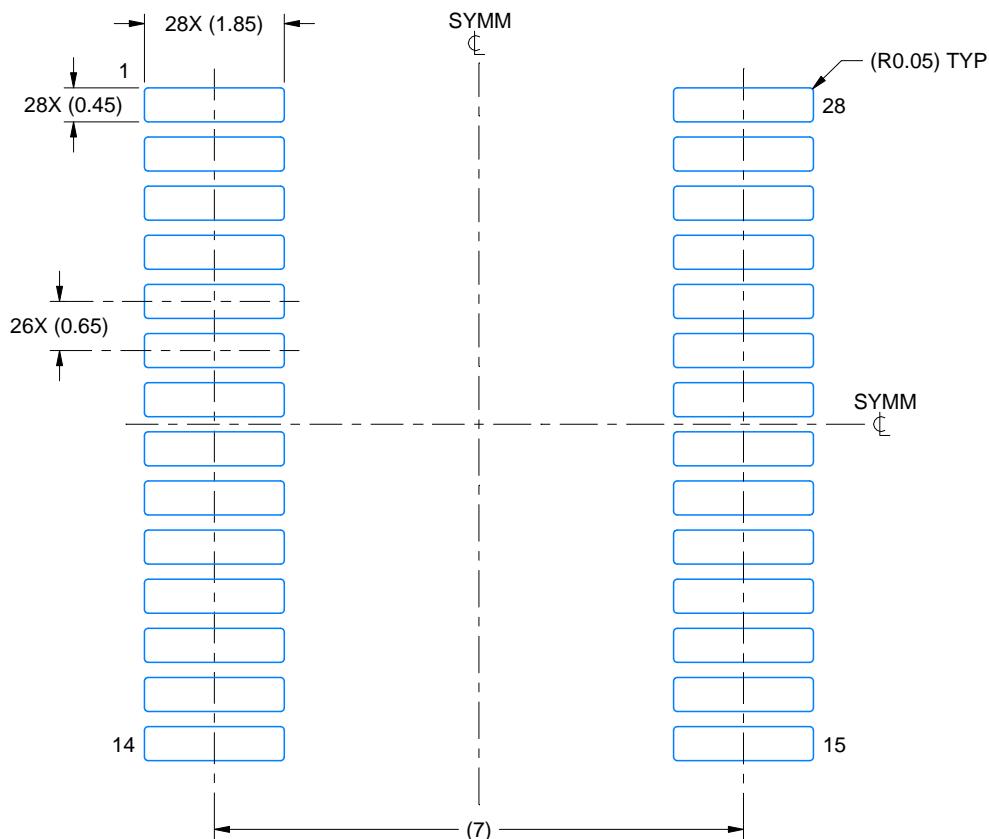
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-150.

EXAMPLE BOARD LAYOUT

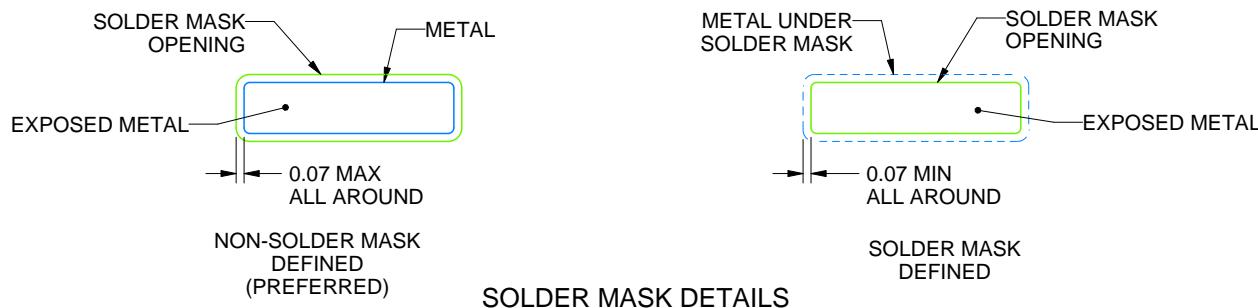
DB0028A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4214853/B 03/2018

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

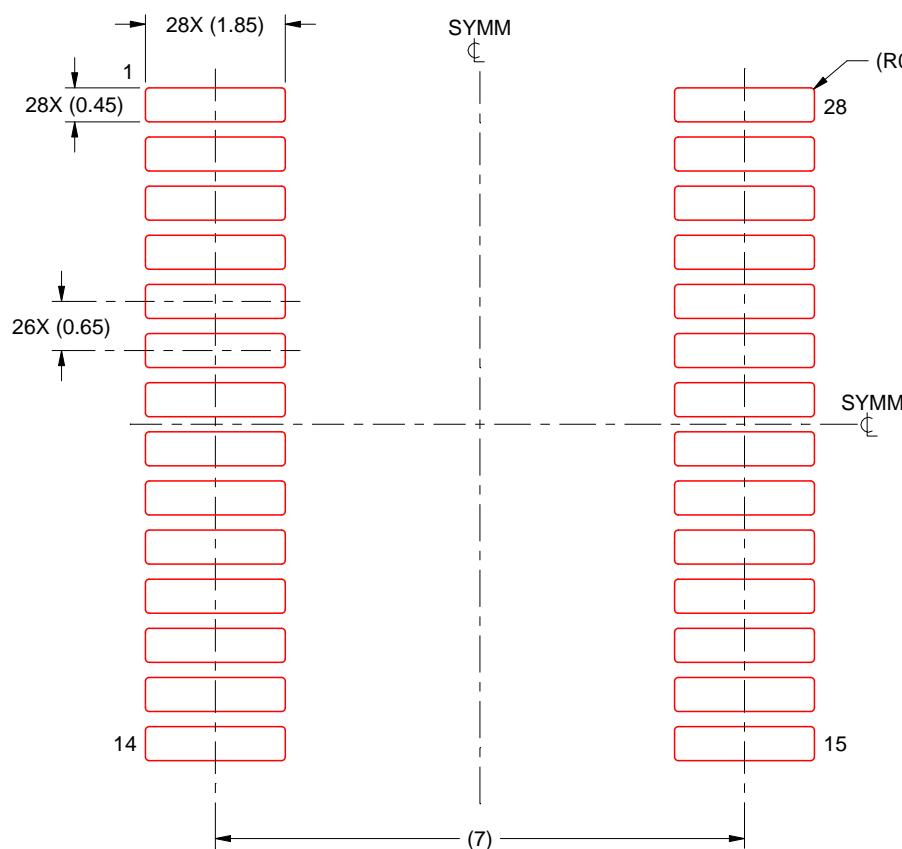
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DB0028A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



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

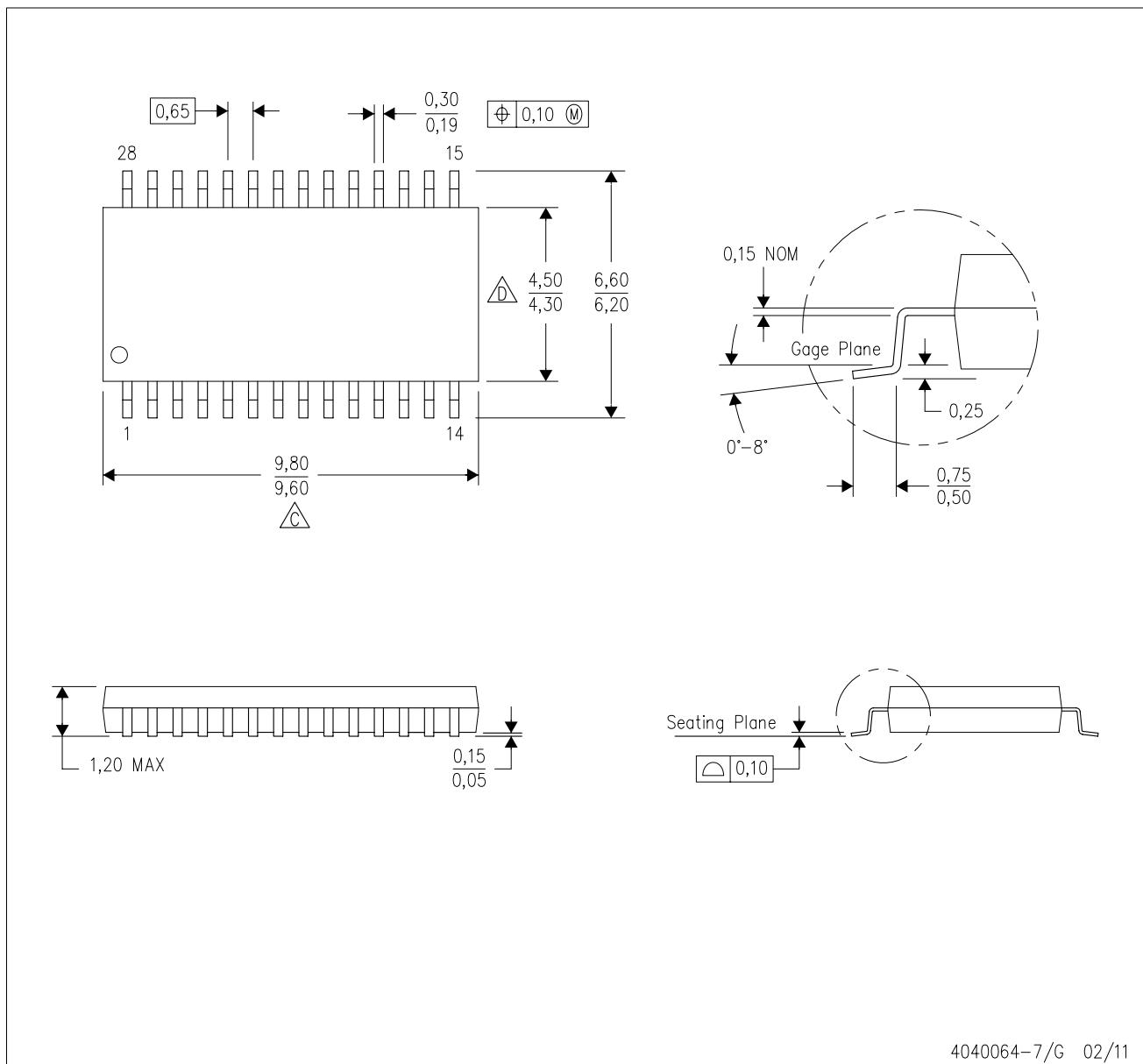
4214853/B 03/2018

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.

PW (R-PDSO-G28)

PLASTIC SMALL OUTLINE



4040064-7/G 02/11

NOTES: A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.

B. This drawing is subject to change without notice.

Symbol C: Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.

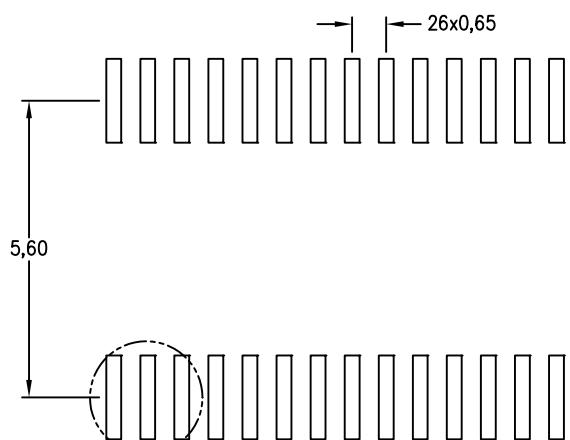
Symbol D: Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.

E. Falls within JEDEC MO-153

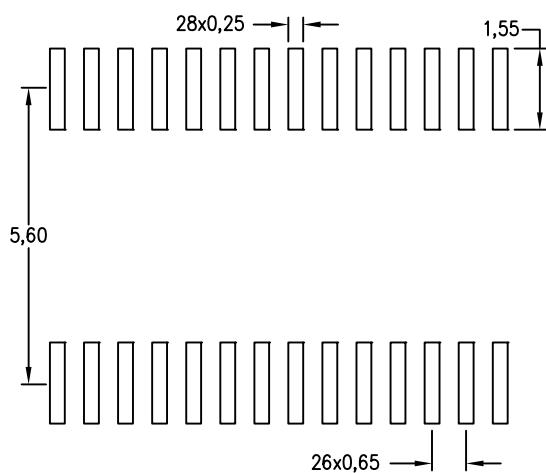
PW (R-PDSO-G28)

PLASTIC SMALL OUTLINE

Example Board Layout

Example
Non Soldermask Defined Pad

Stencil Openings
Based on a stencil thickness
of .127mm (.005inch).

Example
Solder Mask Opening
(See Note E)

Pad Geometry
0,07 All Around
1,6
0,3

4211284-6/G 08/15

NOTES:

- All linear dimensions are in millimeters.
- This drawing is subject to change without notice.
- Publication IPC-7351 is recommended for alternate design.
- 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 for other stencil recommendations.
- Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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