

# 3-V TO 5.5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER WITH $\pm 15$ -kV ESD PROTECTION

SLLS410I – JANUARY 2000 – REVISED JANUARY 2004

- RS-232 Bus-Pin ESD Protection Exceeds  $\pm 15$  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 250 kbit/s
- Two Drivers and Two Receivers
- Low Supply Current . . . 300  $\mu$ A Typical
- External Capacitors . . .  $4 \times 0.1 \mu$ F
- Accepts 5-V Logic Input With 3.3-V Supply
- Alternative High-Speed Pin-Compatible Device (1 Mbit/s)
  - SNx5C3232
- Applications
  - Battery-Powered Systems, PDAs, Notebooks, Laptops, Palmtop PCs, and Hand-Held Equipment

## D, DB, DW, OR PW PACKAGE (TOP VIEW)

C1+	1	16	$V_{CC}$
V+	2	15	GND
C1–	3	14	DOUT1
C2+	4	13	RIN1
C2–	5	12	ROUT1
V–	6	11	DIN1
DOUT2	7	10	DIN2
RIN2	8	9	ROUT2

## description/ordering information

### ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–0°C to 70°C	SOIC (D)	Tube of 40	MAX3232CD	MAX3232C
		Reel of 2500	MAX3232CDR	
	SOIC (DW)	Tube of 40	MAX3232CDW	MAX3232C
		Reel of 2000	MAX3232CDWR	
	SSOP (DB)	Tube of 80	MAX3232CDB	MA3232C
		Reel of 2000	MAX3232CDBR	
	TSSOP (PW)	Tube of 90	MAX3232CPW	MA3232C
		Reel of 2000	MAX3232CPWR	
–40°C to 85°C	SOIC (D)	Tube of 40	MAX3232ID	MAX3232I
		Reel of 2500	MAX3232IDR	
	SOIC (DW)	Tube of 40	MAX3232IDW	MAX3232I
		Reel of 2000	MAX3232IDWR	
	SSOP (DB)	Tube of 80	MAX3232IDB	MB3232I
		Reel of 2000	MAX3232IDBR	
	TSSOP (PW)	Tube of 90	MAX3232IPW	MB3232I
		Reel of 2000	MAX3232IPWR	

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



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**TEXAS  
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

**MAX3232**  
**3-V TO 5.5-V MULTICHANNEL RS-232 LINE DRIVER/RECEIVER**  
**WITH ±15-kV ESD PROTECTION**

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**description/ordering information (continued)**

The MAX3232 device consists of two line drivers, two line receivers, and a dual charge-pump circuit with ±15-kV ESD protection pin to pin (serial-port connector pins, including GND). The device meets the requirements of TIA/EIA-232-F and 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 devices operate at data signaling rates up to 250 kbit/s and a maximum of 30-V/μs driver output slew rate.

**Function Tables**

**EACH DRIVER**

INPUT DIN	OUTPUT DOUT
L	H
H	L

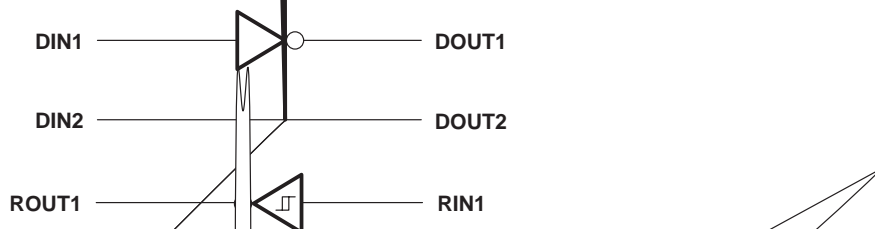
H = high level, L = low level

**EACH RECEIVER**

INPUT RIN	OUTPUT ROUT
L	H
H	L
Open	H

H = high level, L = low level, Open = input disconnected or connected driver off

**logic diagram (positive logic)**



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**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†**

Supply voltage range, $V_{CC}$ (see Note 1)	–0.3 V to 6 V
Positive output supply voltage range, $V+$ (see Note 1)	–0.3 V to 7 V
Negative output supply voltage range, $V-$ (see Note 1)	0.3 V to –7 V
Supply voltage difference, $V+ - V-$ (see Note 1)	13 V
Input voltage range, $V_I$ : Drivers	–0.3 V to 6 V
Receivers	–25 V to 25 V
Output voltage range, $V_O$ : Drivers	–13.2 V to 13.2 V
Receivers	–0.3 V to $V_{CC} + 0.3$ V
Package thermal impedance, $\theta_{JA}$ (see Notes 2 and 3): D package	73°C/W
DB package	82°C/W
DW package	57°C/W
PW package	108°C/W
Operating virtual junction temperature, $T_J$	150°C
Storage temperature range, $T_{stg}$	–65°C to 150°C

† 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.

- NOTES: 1. All voltages are with respect to network GND.  
2. Maximum power dissipation is a function of  $T_J(\max)$ ,  $\theta_{JA}$ , 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.  
3. The package thermal impedance is calculated in accordance with JESD 51-7.

**recommended operating conditions (see Note 4 and Figure 4)**

		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 high-level input voltage	DIN	$V_{CC} = 3.3$ V	2		V
			$V_{CC} = 5$ V	2.4		
$V_{IL}$	Driver low-level input voltage	DIN	0.8		V	
$V_I$	Driver input voltage	DIN	0	5.5		V
	Receiver input voltage		–25		25	
$T_A$	Operating free-air temperature	MAX3232C	0		70	°C
		MAX3232I	–40		85	

NOTE 4: Test conditions are C1–C4 = 0.1  $\mu$ F at  $V_{CC} = 3.3$  V  $\pm$  0.3 V; C1 = 0.047  $\mu$ F, C2–C4 = 0.33  $\mu$ F at  $V_{CC} = 5$  V  $\pm$  0.5 V.

**electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 4)**

PARAMETER	TEST CONDITIONS	MIN	TYP‡	MAX	UNIT
$I_{CC}$ Supply current	No load, $V_{CC} = 3.3$ V or 5 V		0.3	1	mA

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

NOTE 4: Test conditions are C1–C4 = 0.1  $\mu$ F at  $V_{CC} = 3.3$  V  $\pm$  0.3 V; C1 = 0.047  $\mu$ F, C2–C4 = 0.33  $\mu$ F at  $V_{CC} = 5$  V  $\pm$  0.5 V.



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**DRIVER SECTION**

**electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 4)**

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
V <sub>OH</sub>	High-level output voltage	DOUT at R <sub>L</sub> = 3 k $\Omega$ to GND, DIN = GND	5	5.4		V
V <sub>OL</sub>	Low-level output voltage	DOUT at R <sub>L</sub> = 3 k $\Omega$ 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>		$\pm 0.01$	$\pm 1$	$\mu$ A
I <sub>IL</sub>	Low-level input current	V <sub>I</sub> at GND		$\pm 0.01$	$\pm 1$	$\mu$ A
I <sub>OS</sub> ‡	Short-circuit output current	V <sub>CC</sub> = 3.6 V, V <sub>O</sub> = 0 V		$\pm 35$	$\pm 60$	mA
		V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 0 V				
r <sub>o</sub>	Output resistance	V <sub>CC</sub> , V <sub>+</sub> , and V <sub>-</sub> = 0 V, V <sub>O</sub> = $\pm 2$ V	300	10M		$\Omega$

† 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.

‡ 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.

NOTE 4: Test conditions are C1–C4 = 0.1  $\mu$ F at V<sub>CC</sub> = 3.3 V  $\pm$  0.3 V; C1 = 0.047  $\mu$ F, C2–C4 = 0.33  $\mu$ F at V<sub>CC</sub> = 5 V  $\pm$  0.5 V.

**switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 4)**

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
	Maximum data rate	C <sub>L</sub> = 1000 pF, R <sub>L</sub> = 3 k $\Omega$ , One DOUT switching, See Figure 1	150	250		kbit/s
t <sub>sk(p)</sub>	Pulse skew§	C <sub>L</sub> = 150 pF to 2500 pF, R <sub>L</sub> = 3 k $\Omega$ to 7 k $\Omega$ , See Figure 2		300		ns
SR(tr)	Slew rate, transition region (see Figure 1)	R <sub>L</sub> = 3 k $\Omega$ to 7 k $\Omega$ , V <sub>CC</sub> = 3.3 V		6	30	V/ $\mu$ s
				4	30	

† 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.

§ Pulse skew is defined as |t<sub>pLH</sub> - t<sub>pHL</sub>| of each channel of the same device.

NOTE 4: Test conditions are C1–C4 = 0.1  $\mu$ F at V<sub>CC</sub> = 3.3 V  $\pm$  0.3 V; C1 = 0.047  $\mu$ F, C2–C4 = 0.33  $\mu$ F at V<sub>CC</sub> = 5 V  $\pm$  0.5 V.



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**RECEIVER SECTION**

**electrical characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 4)**

PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
V <sub>OH</sub> High-level output voltage	I <sub>OH</sub> = -1 mA	V <sub>CC</sub> -0.6V	V <sub>CC</sub> -0.1V		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		1.5	2.4	V
	V <sub>CC</sub> = 5 V		1.8	2.4	
V <sub>IT-</sub> Negative-going input threshold voltage	V <sub>CC</sub> = 3.3 V	0.6	1.2		V
	V <sub>CC</sub> = 5 V	0.8	1.5		
V <sub>hys</sub> Input hysteresis (V <sub>IT+</sub> - V <sub>IT-</sub> )			0.3		V
r <sub>i</sub> Input resistance	V <sub>I</sub> = ±3 V to ±25 V	3	5	7	kΩ

† 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.

NOTE 4: 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.

**switching characteristics over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted) (see Note 4 and Figure 3)**

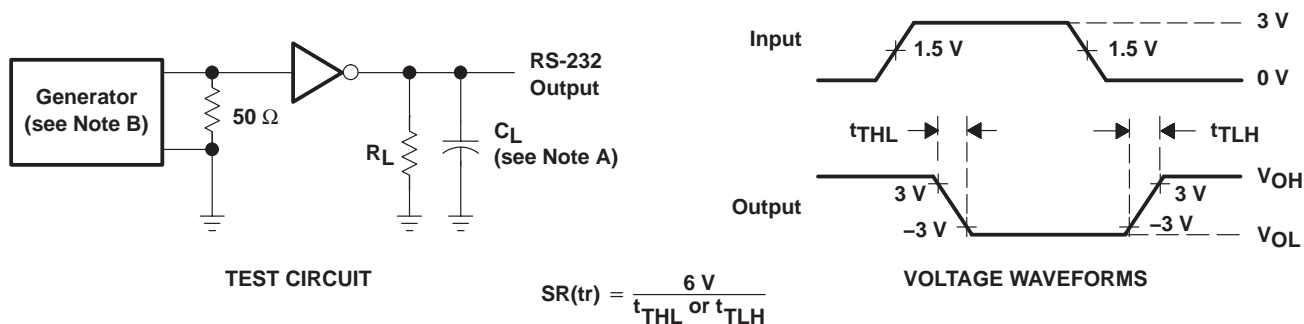
PARAMETER	TEST CONDITIONS	MIN	TYP†	MAX	UNIT
t <sub>PLH</sub> Propagation delay time, low- to high-level output	C <sub>L</sub> = 150 pF		300		ns
t <sub>PHL</sub> Propagation delay time, high- to low-level output			300		ns
t <sub>sk(p)</sub> Pulse skew‡				300	

† 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.

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

NOTE 4: 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.

**PARAMETER MEASUREMENT INFORMATION**



NOTES: A. C<sub>L</sub> includes probe and jig capacitance.

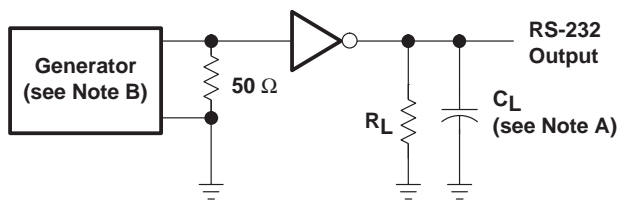
B. The pulse generator has the following characteristics: PRR = 250 kbit/s, Z<sub>O</sub> = 50 Ω, 50% duty cycle, t<sub>r</sub> ≤ 10 ns, t<sub>f</sub> ≤ 10 ns.

**Figure 1. Driver Slew Rate**

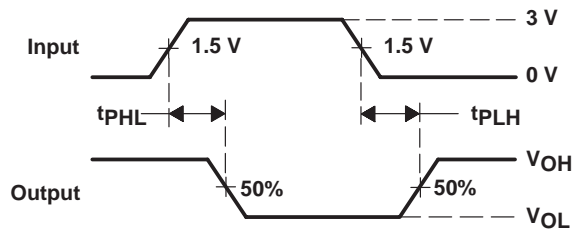
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**PARAMETER MEASUREMENT INFORMATION**



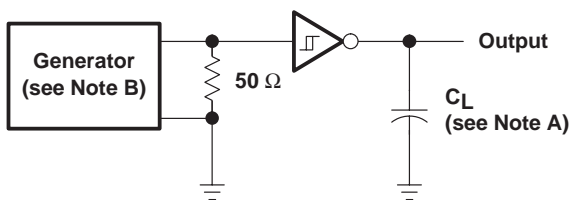
**TEST CIRCUIT**



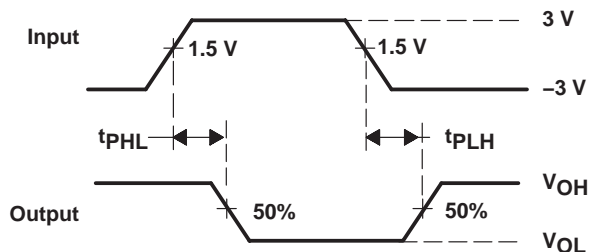
**VOLTAGE WAVEFORMS**

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

**Figure 2. Driver Pulse Skew**



**TEST CIRCUIT**



**VOLTAGE WAVEFORMS**

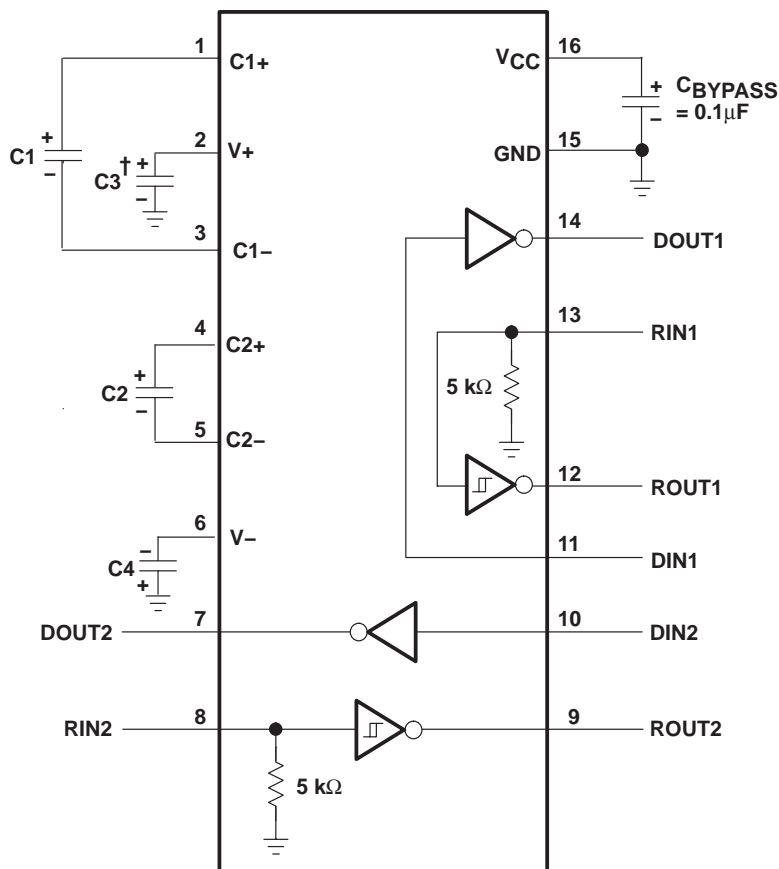
- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. The pulse generator has the following characteristics:  $Z_O = 50 \Omega$ , 50% duty cycle,  $t_r \leq 10$  ns,  $t_f \leq 10$  ns.

**Figure 3. Receiver Propagation Delay Times**

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**APPLICATION INFORMATION**



† C3 can be connected to V<sub>CC</sub> 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<sub>CC</sub> vs CAPACITOR VALUES**

V <sub>CC</sub>	C1	C2, C3, C4
3.3 V $\pm$ 0.3 V	0.1 $\mu$ F	0.1 $\mu$ F
5 V $\pm$ 0.5 V	0.047 $\mu$ F	0.33 $\mu$ F
3 V to 5.5 V	0.1 $\mu$ F	0.47 $\mu$ F

**Figure 4. Typical Operating Circuit and Capacitor Values**

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
MAX3232CD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CDB	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CDBE4	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CDBG4	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CDBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CDBRE4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CDBRG4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CDE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CDG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CDR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CDRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CDRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CDWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CDWRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CPWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CPWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232CPWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232ID	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IDB	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IDBE4	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM



Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
MAX3232IDBG4	ACTIVE	SSOP	DB	16	80	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IDBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IDBRE4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IDBRG4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IDE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IDG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IDR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IDRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IDRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IDW	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IDWE4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IDWG4	ACTIVE	SOIC	DW	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IDWR	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IDWRE4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IDWRG4	ACTIVE	SOIC	DW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IPWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IPWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
MAX3232IPWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

<sup>(1)</sup> 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.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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**OTHER QUALIFIED VERSIONS OF MAX3232 :**

- Enhanced Product: [MAX3232-EP](#)

NOTE: Qualified Version Definitions:

- Enhanced Product - Supports Defense, Aerospace and Medical Applications

**TAPE AND REEL INFORMATION**



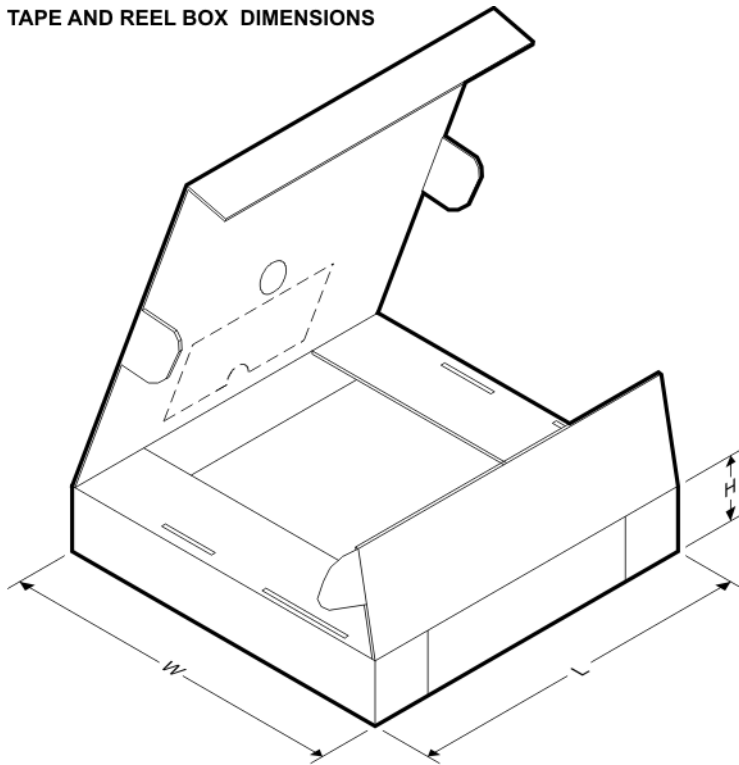
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



\*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
MAX3232CDBR	SSOP	DB	16	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
MAX3232CDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
MAX3232CDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
MAX3232CPWR	TSSOP	PW	16	2000	330.0	12.4	7.0	5.6	1.6	8.0	12.0	Q1
MAX3232IDBR	SSOP	DB	16	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
MAX3232IDR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
MAX3232IDWR	SOIC	DW	16	2000	330.0	16.4	10.75	10.7	2.7	12.0	16.0	Q1
MAX3232IPWR	TSSOP	PW	16	2000	330.0	12.4	7.0	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)
MAX3232CDBR	SSOP	DB	16	2000	346.0	346.0	33.0
MAX3232CDR	SOIC	D	16	2500	333.2	345.9	28.6
MAX3232CDWR	SOIC	DW	16	2000	346.0	346.0	33.0
MAX3232CPWR	TSSOP	PW	16	2000	346.0	346.0	29.0
MAX3232IDBR	SSOP	DB	16	2000	346.0	346.0	33.0
MAX3232IDR	SOIC	D	16	2500	333.2	345.9	28.6
MAX3232IDWR	SOIC	DW	16	2000	346.0	346.0	33.0
MAX3232IPWR	TSSOP	PW	16	2000	346.0	346.0	29.0

DB (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-150

4040065 /E 12/01

PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN

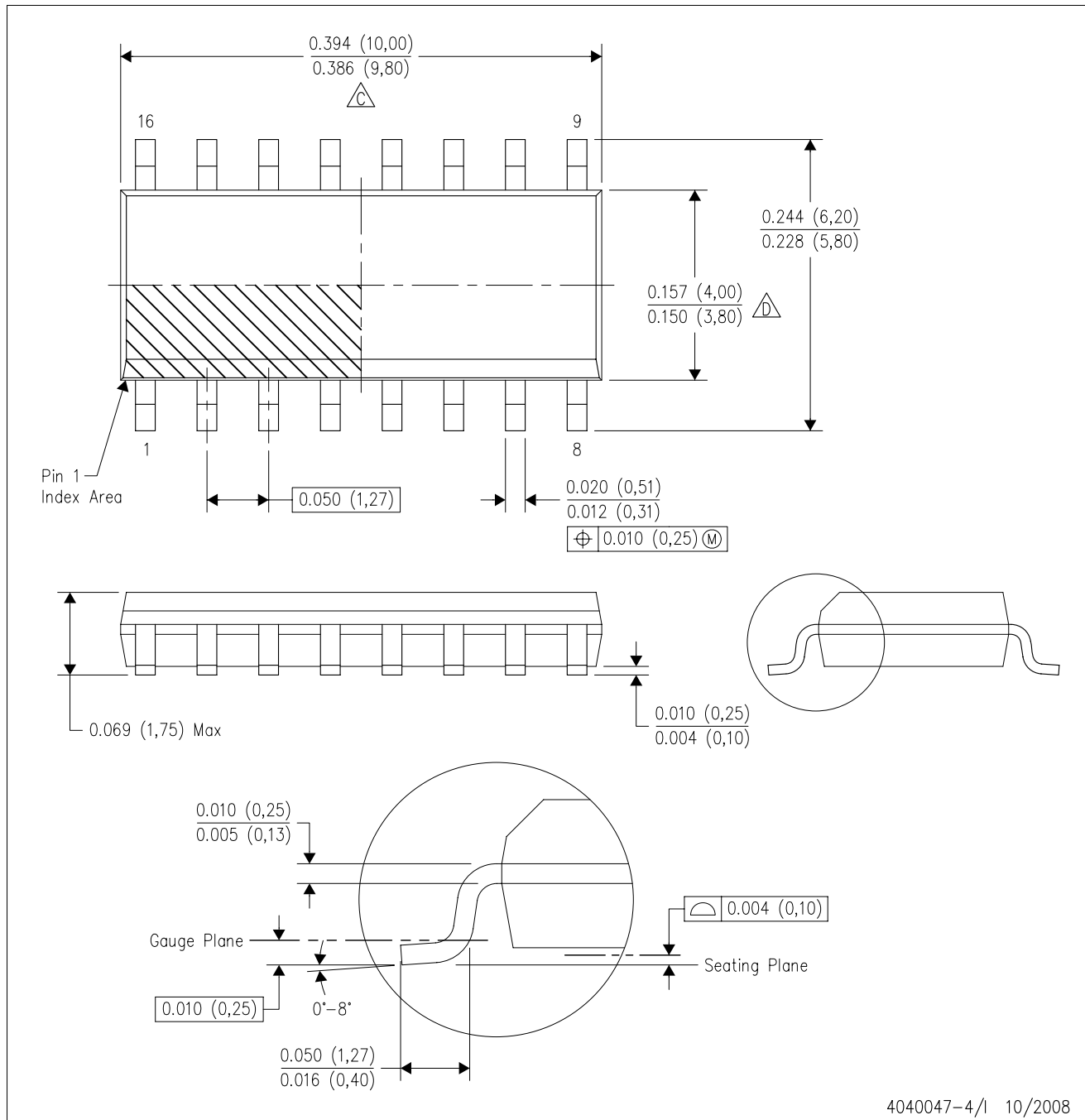


4040064/F 01/97

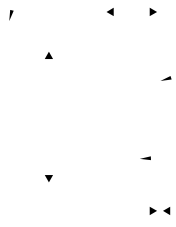
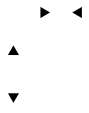
- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



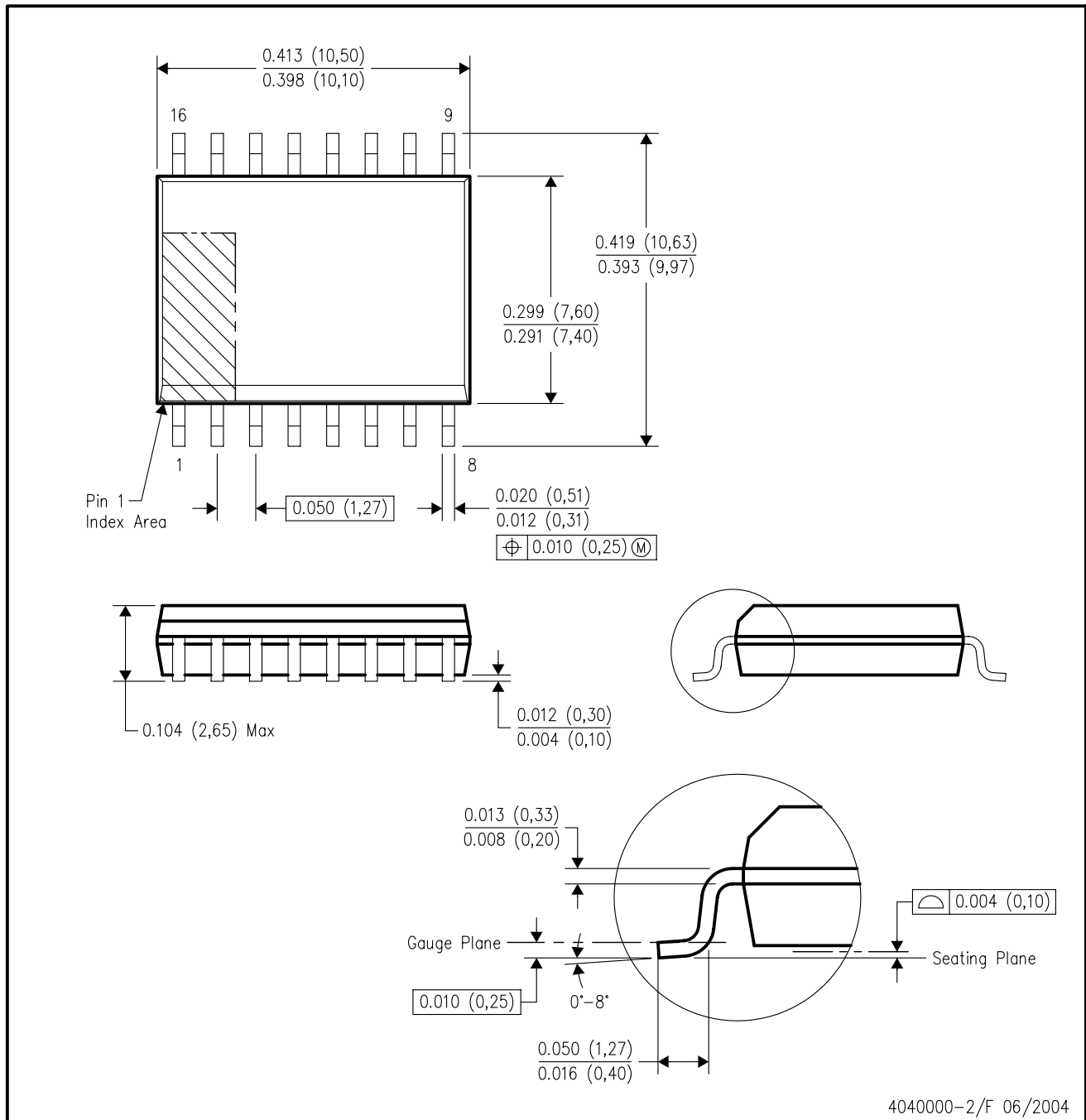
- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
  - E. Reference JEDEC MS-012 variation AC.





DW (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - 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 AA.

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