

MAX3232E 3-V to 5.5-V Multichannel RS-232 Line Driver/Receiver With ± 15 -kV IEC ESD Protection

Check for Samples: [MAX3232E](#)

FEATURES

- **ESD Protection for RS-232 Bus Pins**
 - ± 15 kV (HBM)
 - ± 8 kV (IEC61000-4-2, Contact Discharge)
 - ± 15 kV (IEC61000-4-2, Air-Gap Discharge)
- **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 μ A Typ**
- **External Capacitors: 4 \times 0.1 μ F**
- **Accepts 5-V Logic Input With 3.3-V Supply**
- **Pin Compatible to Alternative High-Speed Devices (1 Mbit/s)**
 - SN65C3232E (-40°C to 85°C)
 - SN75C3232E (0°C to 70°C)

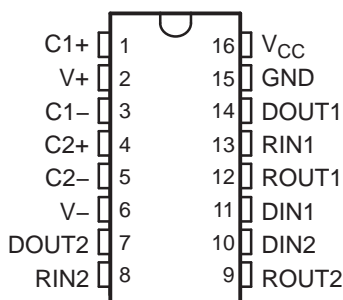
DESCRIPTION

The MAX3232E device consists of two line drivers, two line receivers, and a dual charge-pump circuit with ± 15 -kV IEC ESD protection pin to pin (serial-port connection 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/ μ s driver output slew rate.

APPLICATIONS

- **Battery-Powered Systems**
- **PDA's**
- **Notebooks**
- **Laptops**
- **Palmtop PCs**
- **Hand-Held Equipment**

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



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.

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This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

Function Tables

Each Driver⁽¹⁾

| INPUT DIN | OUTPUT DOUT |
|--------------|----------------|
| L | H |
| H | L |

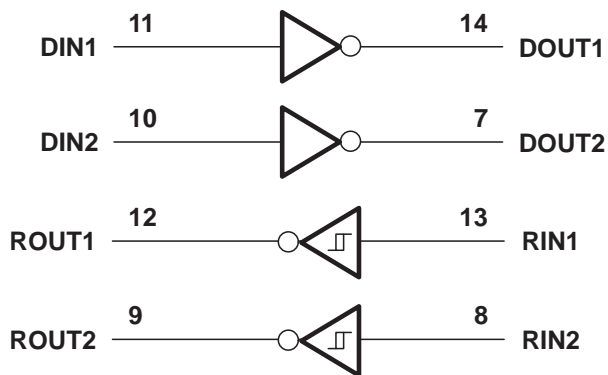
(1) H = high level, L = low level

Each Receiver⁽¹⁾

| INPUT RIN | OUTPUT ROUT |
|--------------|----------------|
| L | H |
| H | L |
| Open | H |

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

Logic Diagram (Positive Logic)



Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)⁽¹⁾

| | | 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 | Drivers | -0.3 | 6 | V |
| | | Receivers | -25 | 25 | V |
| V _O | Output voltage range | Drivers | -13.2 | 13.2 | V |
| | | Receivers | -0.3 | V _{CC} + 0.3 | V |
| θ _{JA} | Package thermal impedance ⁽³⁾⁽⁴⁾ | D package | | 73 | °C/W |
| | | DB package | | 82 | |
| | | DW package | | 57 | |
| | | 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)/θ_{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.

THERMAL INFORMATION

| THERMAL METRIC ⁽¹⁾ | MAX3232E | | | | UNITS | |
|-------------------------------|--|---------|---------|---------|-------|------|
| | PW | D | DB | DW | | |
| | 16 PINS | 16 PINS | 16 PINS | 16 PINS | | |
| θ _{JA} | Junction-to-ambient thermal resistance | 99.3 | 76.1 | 90.9 | 72.3 | °C/W |
| θ _{JCtop} | Junction-to-case (top) thermal resistance | 20.8 | 36.7 | 36.2 | 33.5 | |
| θ _{JB} | Junction-to-board thermal resistance | 45.1 | 33.6 | 43.8 | 37.1 | |
| ψ _{JT} | Junction-to-top characterization parameter | 0.6 | 4.2 | 4.2 | 7.5 | |
| ψ _{JB} | Junction-to-board characterization parameter | 45.1 | 33.3 | 42.9 | 37.1 | |
| θ _{JCbot} | Junction-to-case (bottom) thermal resistance | – | – | – | – | |

- (1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](#).

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Recommended Operating Conditions

 (See [Figure 4](#))⁽¹⁾

| | | | 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 high-level input voltage | DIN | $V_{CC} = 3.3\text{ V}$ | | 2 | 5.5 | V |
| | | | $V_{CC} = 5\text{ V}$ | | 2.4 | 5.5 | |
| V_{IL} | Driver low-level input voltage | DIN | | | 0 | 0.8 | V |
| V_I | Receiver input voltage | RIN | | | -25 | 25 | V |
| T_A | Operating free-air temperature | | MAX3232EC | | 0 | 70 | °C |
| | | | MAX3232EI | | -40 | 85 | |

 (1) Test conditions are C1–C4 = 0.1 μF at $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$; C1 = 0.047 μF , C2–C4 = 0.33 μF at $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$.

Electrical Characteristics

 over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽¹⁾ (see [Figure 4](#))

| PARAMETER | TEST CONDITIONS | MIN | TYP ⁽²⁾ | MAX | UNIT |
|-------------------------|--|-----|--------------------|-----|------|
| I_{CC} Supply current | No load, $V_{CC} = 3.3\text{ V}$ or 5 V | | 0.3 | 1 | mA |

 (1) Test conditions are C1–C4 = 0.1 μF at $V_{CC} = 3.3\text{ V} \pm 0.3\text{ V}$; C1 = 0.047 μF , C2–C4 = 0.33 μF at $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$.

 (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

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽¹⁾ (see [Figure 4](#))

| 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} ⁽³⁾ | Short-circuit output current | V _{CC} = 3.6 V, | V _O = 0 V | | ±35 | ±60 | mA |
| | | V _{CC} = 5.5 V, | V _O = 0 V | | | | |
| r _O | Output resistance | V _{CC} , V+, and V– = 0 V, | V _O = ±2 V | 300 | 10M | | Ω |

(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

over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽¹⁾ (see [Figure 4](#))

| PARAMETER | | TEST CONDITIONS | | MIN | TYP ⁽²⁾ | MAX | UNIT |
|--------------------|---|--|---|-----|--------------------|-----|--------|
| Maximum data rate | | R _L = 3 kΩ, One DOUT switching, | C _L = 1000 pF, See Figure 1 | 150 | 250 | | kbit/s |
| t _{sk(p)} | Pulse skew ⁽³⁾ | R _L = 3 kΩ to 7 kΩ, See Figure 2 | C _L = 150 pF to 2500 pF, | | 300 | | ns |
| SR(tr) | Slew rate, transition region (see Figure 1) | R _L = 3 kΩ to 7 kΩ, V _{CC} = 3.3 V | C _L = 150 pF to 1000 pF | 6 | | 30 | V/μs |
| | | | C _L = 150 pF to 2500 pF | 4 | | 30 | |

(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

| | | TYP | UNIT |
|------------------------|---------------------------------|-----|------|
| Driver outputs (DOUTx) | Human-Body Model (HBM) | ±15 | kV |
| | IEC61000-4-2, Air-Gap Discharge | ±15 | |
| | IEC61000-4-2, Contact Discharge | ±8 | |

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Receiver Section

Electrical Characteristics

 over recommended ranges of supply voltage and operating free-air temperature (unless otherwise noted)⁽¹⁾ (see [Figure 4](#))

| 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 |
| r _i | Input resistance | V _I = ±3 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

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

| PARAMETER | | TEST CONDITIONS | TYP ⁽²⁾ | UNIT |
|--------------------|---|-------------------------|--------------------|------|
| t _{PLH} | Propagation delay time, low- to high-level output | C _L = 150 pF | 300 | ns |
| t _{PHL} | Propagation delay time, high- to low-level output | | 300 | ns |
| t _{sk(p)} | Pulse skew ⁽³⁾ | | 300 | 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.

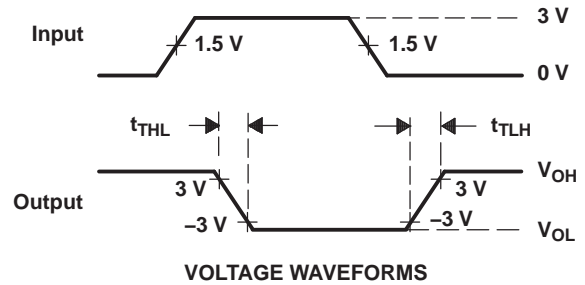
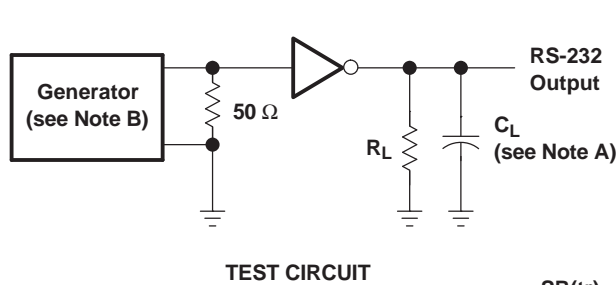
 (2) All typical values are at V_{CC} = 3.3 V or V_{CC} = 5 V, and T_A = 25°C.

 (3) Pulse skew is defined as |t_{PLH} - t_{PHL}| of each channel of the same device.

ESD Protection

| | | TYP | UNIT |
|------------------------|---------------------------------|-----|------|
| Receiver inputs (RINx) | Human-Body Model (HBM) | ±15 | kV |
| | IEC61000-4-2, Air-Gap Discharge | ±15 | |
| | IEC61000-4-2, Contact Discharge | ±8 | |

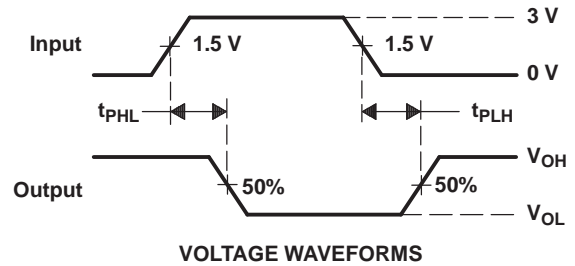
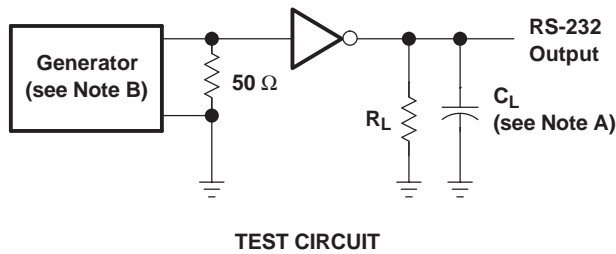
Parameter Measurement Information



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

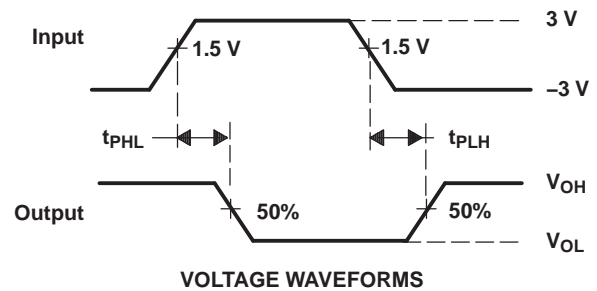
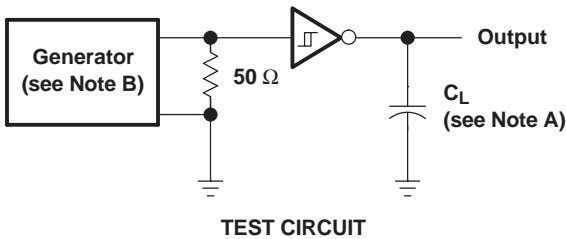
- NOTES: A. C_L includes probe and jig capacitance.
 B. The pulse generator has the following characteristics: PRR = 250 kbit/s, $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10\text{ ns}$, $t_f \leq 10\text{ ns}$.

Figure 1. Driver Slew Rate



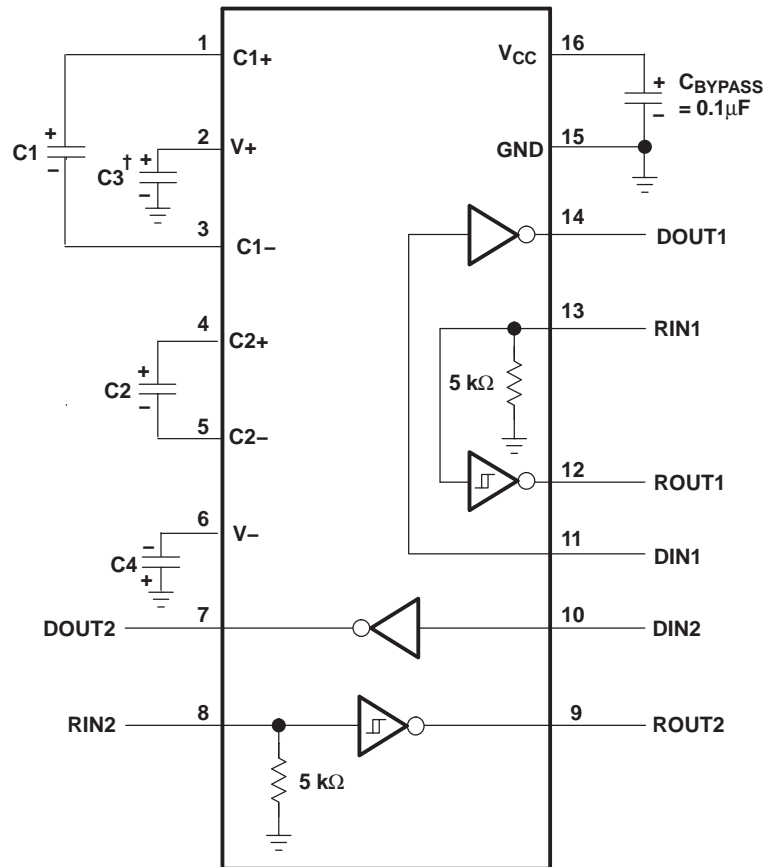
- NOTES: A. C_L includes probe and jig capacitance.
 B. The pulse generator has the following characteristics: PRR = 250 kbit/s, $Z_O = 50\ \Omega$, 50% duty cycle, $t_r \leq 10\text{ ns}$, $t_f \leq 10\text{ ns}$.

Figure 2. Driver Pulse Skew



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

Figure 3. Receiver Propagation Delay Times

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, C4 |
|---------------|---------------|--------------|
| 3.3 V ± 0.3 V | 0.1 μ F | 0.1 μ F |
| 5 V ± 0.5 V | 0.047 μ F | 0.33 μ F |
| 3 V to 5.5 V | 0.1 μ F | 0.47 μ F |

Figure 4. Typical Operating Circuit and Capacitor Values

REVISION HISTORY

| Changes from Revision A (April 2007) to Revision B | Page |
|---|-------------------|
| • Updated document to new TI data sheet format. | 1 |
| • Deleted Ordering Information table. | 1 |
| • Added ESD warning. | 2 |
| • Added Thermal Information table. | 3 |

PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish | MSL Peak Temp (3) | Op Temp (°C) | Top-Side Markings (4) | Samples |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|------------------|----------------------|--------------|--------------------------|-------------------------|
| MAX3232ECD | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3232EC | Samples |
| MAX3232ECDB | ACTIVE | SSOP | DB | 16 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MP232EC | Samples |
| MAX3232ECDBE4 | ACTIVE | SSOP | DB | 16 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MP232EC | Samples |
| MAX3232ECDBG4 | ACTIVE | SSOP | DB | 16 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MP232EC | Samples |
| MAX3232ECDBR | ACTIVE | SSOP | DB | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MP232EC | Samples |
| MAX3232ECDBRE4 | ACTIVE | SSOP | DB | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MP232EC | Samples |
| MAX3232ECDBRG4 | ACTIVE | SSOP | DB | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MP232EC | Samples |
| MAX3232ECDE4 | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3232EC | Samples |
| MAX3232ECDG4 | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3232EC | Samples |
| MAX3232ECDR | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3232EC | Samples |
| MAX3232ECDRE4 | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3232EC | Samples |
| MAX3232ECDRG4 | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3232EC | Samples |
| MAX3232ECDW | ACTIVE | SOIC | DW | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3232EC | Samples |
| MAX3232ECDWG4 | ACTIVE | SOIC | DW | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3232EC | Samples |
| MAX3232ECDWR | ACTIVE | SOIC | DW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3232EC | Samples |
| MAX3232ECDWRG4 | ACTIVE | SOIC | DW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MAX3232EC | Samples |
| MAX3232ECPW | ACTIVE | TSSOP | PW | 16 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MP232EC | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish | MSL Peak Temp (3) | Op Temp (°C) | Top-Side Markings (4) | Samples |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|------------------|----------------------|--------------|--------------------------|-------------------------|
| MAX3232ECPWE4 | ACTIVE | TSSOP | PW | 16 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MP232EC | Samples |
| MAX3232ECPWG4 | ACTIVE | TSSOP | PW | 16 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MP232EC | Samples |
| MAX3232ECPWR | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MP232EC | Samples |
| MAX3232ECPWRE4 | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MP232EC | Samples |
| MAX3232ECPWRG4 | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | 0 to 70 | MP232EC | Samples |
| MAX3232EID | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3232EI | Samples |
| MAX3232EIDB | ACTIVE | SSOP | DB | 16 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MP232EI | Samples |
| MAX3232EIDBE4 | ACTIVE | SSOP | DB | 16 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MP232EI | Samples |
| MAX3232EIDBG4 | ACTIVE | SSOP | DB | 16 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MP232EI | Samples |
| MAX3232EIDBR | ACTIVE | SSOP | DB | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MP232EI | Samples |
| MAX3232EIDBRE4 | ACTIVE | SSOP | DB | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MP232EI | Samples |
| MAX3232EIDBRG4 | ACTIVE | SSOP | DB | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MP232EI | Samples |
| MAX3232EIDE4 | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3232EI | Samples |
| MAX3232EIDG4 | ACTIVE | SOIC | D | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3232EI | Samples |
| MAX3232EIDR | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3232EI | Samples |
| MAX3232EIDRE4 | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3232EI | Samples |
| MAX3232EIDRG4 | ACTIVE | SOIC | D | 16 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3232EI | Samples |
| MAX3232EIDW | ACTIVE | SOIC | DW | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3232EI | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish | MSL Peak Temp (3) | Op Temp (°C) | Top-Side Markings (4) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|------------------|----------------------|--------------|--------------------------|-------------------------|
| MAX3232EIDWG4 | ACTIVE | SOIC | DW | 16 | 40 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3232EI | Samples |
| MAX3232EIDWR | ACTIVE | SOIC | DW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3232EI | Samples |
| MAX3232EIDWRG4 | ACTIVE | SOIC | DW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MAX3232EI | Samples |
| MAX3232EIPW | ACTIVE | TSSOP | PW | 16 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MP232EI | Samples |
| MAX3232EIPWE4 | ACTIVE | TSSOP | PW | 16 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MP232EI | Samples |
| MAX3232EIPWG4 | ACTIVE | TSSOP | PW | 16 | 90 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MP232EI | Samples |
| MAX3232EIPWR | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MP232EI | Samples |
| MAX3232EIPWRE4 | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MP232EI | Samples |
| MAX3232EIPWRG4 | ACTIVE | TSSOP | PW | 16 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | MP232EI | 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.

OBSELETE: TI has discontinued the production of the device.

(2) 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)

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

⁽⁴⁾ Multiple Top-Side Markings will be inside parentheses. Only one Top-Side 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 Top-Side Marking for that device.

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OTHER QUALIFIED VERSIONS OF MAX3232E :

- Automotive: [MAX3232E-Q1](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

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 |

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 |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| MAX3232ECDBR | SSOP | DB | 16 | 2000 | 330.0 | 16.4 | 8.2 | 6.6 | 2.5 | 12.0 | 16.0 | Q1 |
| MAX3232ECDR | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.1 | 8.0 | 16.0 | Q1 |
| MAX3232ECDWR | SOIC | DW | 16 | 2000 | 330.0 | 16.4 | 10.75 | 10.7 | 2.7 | 12.0 | 16.0 | Q1 |
| MAX3232ECPWR | TSSOP | PW | 16 | 2000 | 330.0 | 12.4 | 6.9 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |
| MAX3232EIDBR | SSOP | DB | 16 | 2000 | 330.0 | 16.4 | 8.2 | 6.6 | 2.5 | 12.0 | 16.0 | Q1 |
| MAX3232EIDR | SOIC | D | 16 | 2500 | 330.0 | 16.4 | 6.5 | 10.3 | 2.1 | 8.0 | 16.0 | Q1 |
| MAX3232EIDWR | SOIC | DW | 16 | 2000 | 330.0 | 16.4 | 10.75 | 10.7 | 2.7 | 12.0 | 16.0 | Q1 |
| MAX3232EIPWR | TSSOP | PW | 16 | 2000 | 330.0 | 12.4 | 6.9 | 5.6 | 1.6 | 8.0 | 12.0 | Q1 |

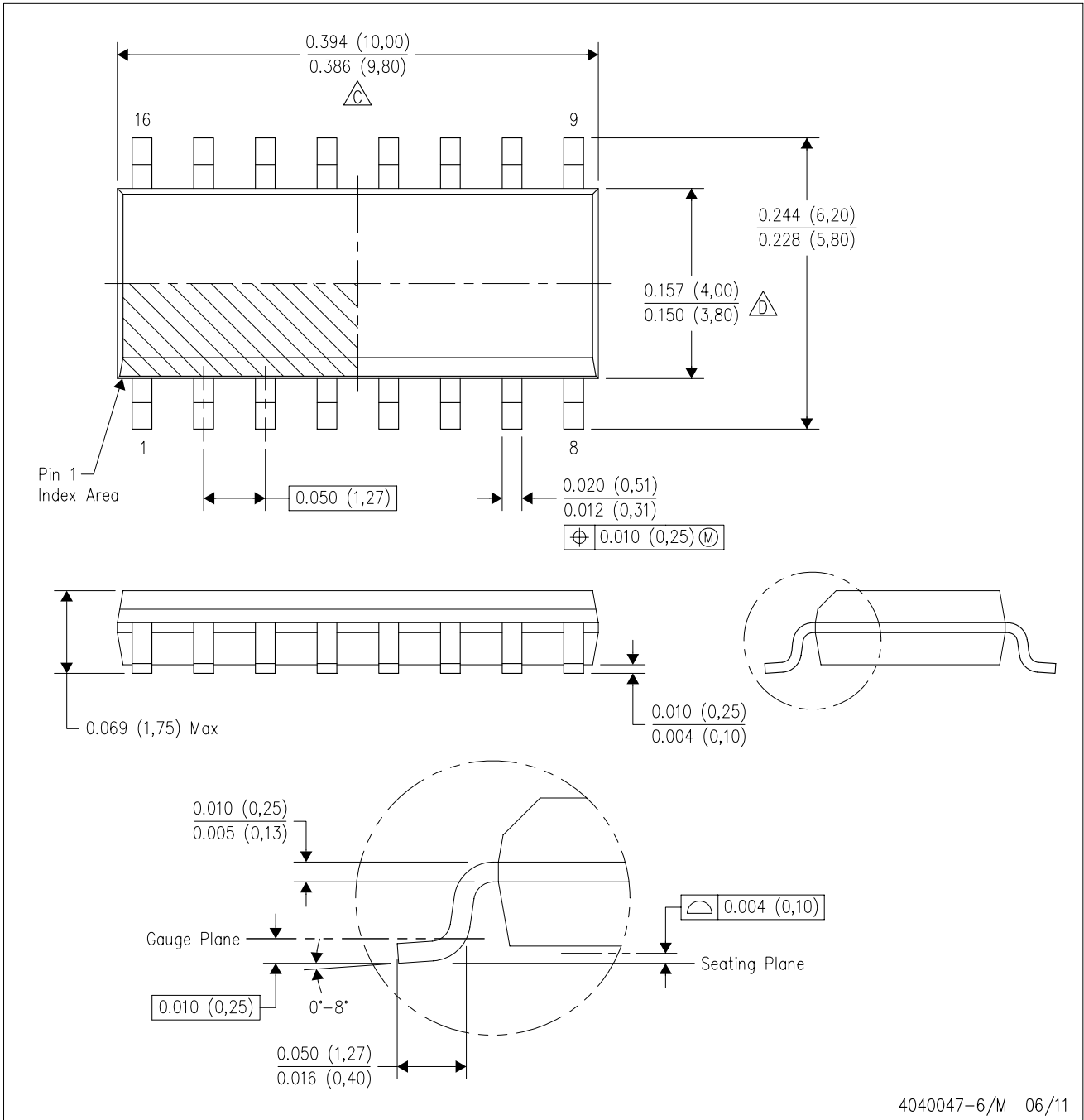
TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| MAX3232ECDBR | SSOP | DB | 16 | 2000 | 367.0 | 367.0 | 38.0 |
| MAX3232ECDR | SOIC | D | 16 | 2500 | 367.0 | 367.0 | 38.0 |
| MAX3232ECDWR | SOIC | DW | 16 | 2000 | 367.0 | 367.0 | 38.0 |
| MAX3232ECPWR | TSSOP | PW | 16 | 2000 | 367.0 | 367.0 | 35.0 |
| MAX3232EIDBR | SSOP | DB | 16 | 2000 | 367.0 | 367.0 | 38.0 |
| MAX3232EIDR | SOIC | D | 16 | 2500 | 367.0 | 367.0 | 38.0 |
| MAX3232EIDWR | SOIC | DW | 16 | 2000 | 367.0 | 367.0 | 38.0 |
| MAX3232EIPWR | TSSOP | PW | 16 | 2000 | 367.0 | 367.0 | 35.0 |

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



- 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 0.006 (0,15) each side.
 D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
 E. Reference JEDEC MS-012 variation AC.

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4211283-4/E 08/12

- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - 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.

PW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040064-4/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.
 -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
 -  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-G16)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - 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.

DW (R-PDSO-G16)

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 AA.

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

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