

±15kV ESD-Protected, 0.5µA, +3V to +5.5V, 1.5Mbps RS-232 Receivers in SOT23-5

ABSOLUTE MAXIMUM RATINGS

V_{CC} to GND-0.3V to +6V
 R_{IN} to GND±25V
 EN, R_{OUT}, $\overline{\text{INVALID}}$ to GND-0.3V to (V_{CC} + 0.3V)
 Continuous Power Dissipation (T_A = +70°C)
 SOT23-5 (derate 7.1mW/°C above +70°C).....571mW

Operating Temperature Range-40°C to +85°C
 Storage Temperature Range-65°C to +150°C
 Lead Temperature (soldering, 10sec)+300°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 in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

(V_{CC} = +3.0V to +5.5V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V_{CC} = +5.0V, T_A = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC CHARACTERISTICS						
Supply Voltage	V _{CC}		3.0		5.5	V
Supply Current	I _{CC}	V _{CC} = 3.3V or 5V, R _{IN} = V _{CC} or GND, no load		0.5	5.0	µA
LOGIC INPUT ($\overline{\text{EN}}$)						
Logic Threshold Low	V _{IL}				0.8	V
Logic Threshold High	V _{IH}	V _{CC} = 3.3V	2.0			V
		V _{CC} = 5.0V	2.4			
Leakage Current	I $\overline{\text{EN}}$			±0.01	±1.0	µA
LOGIC OUTPUT						
$\overline{\text{INVALID}}$ Output Voltage Low	V _{IOL}	I _{SINK} = 1.6mA			0.4	V
$\overline{\text{INVALID}}$ Output Voltage High	V _{IOH}	I _{SOURCE} = 1.0mA	V _{CC} - 0.6			V
RECEIVER INPUT						
Input Voltage Range	V _{RIN}		-25		25	V
Input Threshold Low	V _{ITL}	V _{CC} = 3.3V	0.6	1.2		V
		V _{CC} = 5.0V	0.8	1.5		
Input Threshold High	V _{ITH}	V _{CC} = 3.3V		1.5	2.4	V
		V _{CC} = 5.0V		1.8	2.7	
Input Hysteresis	V _{HYST}			300		mV
R _{IN} Threshold to $\overline{\text{INVALID}}$ Output High	V _{ITOH}	Positive threshold			2.7	V
		Negative threshold	-2.7			
R _{IN} Threshold to $\overline{\text{INVALID}}$ Output Low	V _{ITOL}		-0.3		0.3	V
Input Resistance	R _{RIN}		3	5	7	kΩ
RECEIVER OUTPUT						
Output Leakage Current	I _{ROUT}	Receiver disabled		±0.05	±10	µA
Output Voltage Low	V _{OL}	I _{SINK} = 1.6mA			0.4	V
Output Voltage High	V _{OH}	I _{SOURCE} = 1.0mA	V _{CC} - 0.6	V _{CC} - 0.1		V

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ELECTRICAL CHARACTERISTICS (continued)

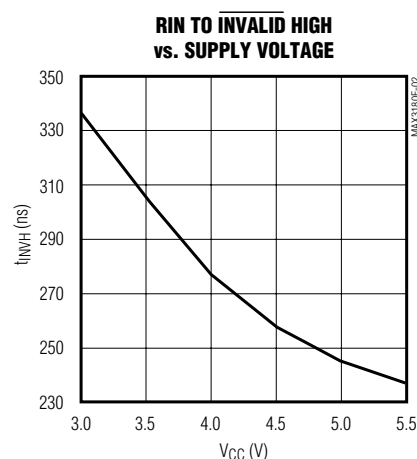
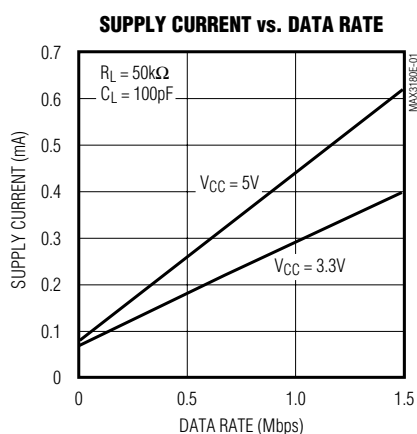
(V_{CC} = +3.0V to +5.5V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V_{CC} = +5.0V, T_A = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
TIMING CHARACTERISTICS						
Maximum Data Rate		C _L = 50pF	1.5			Mbps
Receiver Propagation Delay, High-to-Low	t _{PHL}	R _{IN} to R _{OUT} ; C _L = 150pF		0.15		μs
Receiver Propagation Delay, Low-to-High	t _{PLH}	R _{IN} to R _{OUT} ; C _L = 150pF		0.15		μs
Receiver Skew	t _{RS}	t _{PHL} - t _{PLH} , Figure 1		50		ns
Receiver Output Enable Time	t _{ROE}			200		ns
Receiver Output Disable Time	t _{ROD}			200		ns
Receiver Positive or Negative Threshold to <u>INVALID</u> High	t _{INVH}			250		ns
Receiver Positive or Negative Threshold to <u>INVALID</u> Low	t _{INVL}			30		μs

Note 1: Specifications are 100% tested at T_A = +25°C. Limits over temperature are guaranteed by design.

Typical Operating Characteristics

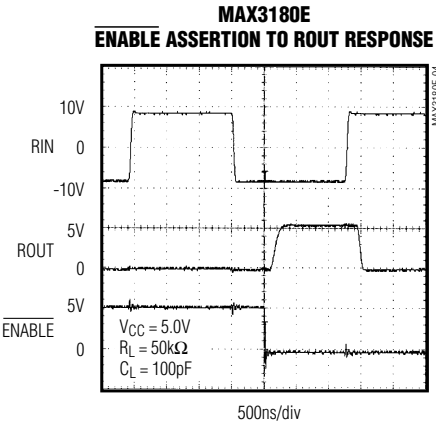
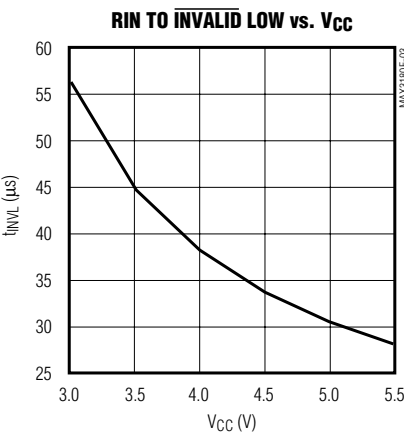
(V_{CC} = +5V, T_A = +25°C, unless otherwise noted.)



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Typical Operating Characteristics (continued)

($V_{CC} = +5\text{V}$, $T_A = +25^\circ\text{C}$, unless otherwise noted.)



Pin Description

PIN	NAME				FUNCTION
	MAX3180E	MAX3181E	MAX3182E	MAX3183E	
1	$\overline{\text{EN}}$	—	$\overline{\text{EN}}$	—	Receiver Output Enable
	—	$\overline{\text{INVALID}}$	—	$\overline{\text{INVALID}}$	Output of the Valid Input Detector
2	GND	GND	GND	GND	Ground
3	ROUT	ROUT	—	—	Inverting Receiver Output
	—	—	ROUT	ROUT	Noninverting Receiver Output
4	RIN	RIN	RIN	RIN	Receiver Input
5	V_{CC}	V_{CC}	V_{CC}	V_{CC}	Supply Voltage

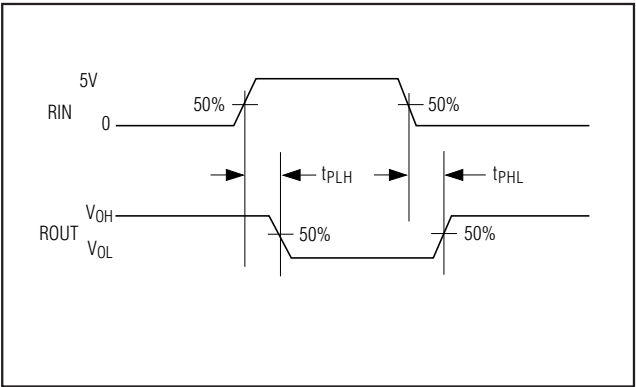


Figure 1. Receiver Propagation-Delay Timing

Detailed Description

The MAX3180E-MAX3183E are EIA/TIA-232 and V.28/V.24 communications receivers that convert RS-232 signals to CMOS logic levels. They operate on a $+3\text{V}$ to $+5.5\text{V}$ supply, have 1.5Mbps data rate capability, and feature enhanced electrostatic discharge (ESD) protection (see *ESD Protection*). All of these devices achieve a typical supply current of $0.5\mu\text{A}$. The MAX3180E/MAX3182E have a receiver enable control ($\overline{\text{EN}}$). The MAX3181E/MAX3183E contain a signal invalid output ($\overline{\text{INVALID}}$). The MAX3180E/MAX3181E invert the ROUT signal relative to RIN (standard RS-232). The MAX3182E/MAX3183E outputs are not inverted. The devices come in tiny SOT23-5 packages.

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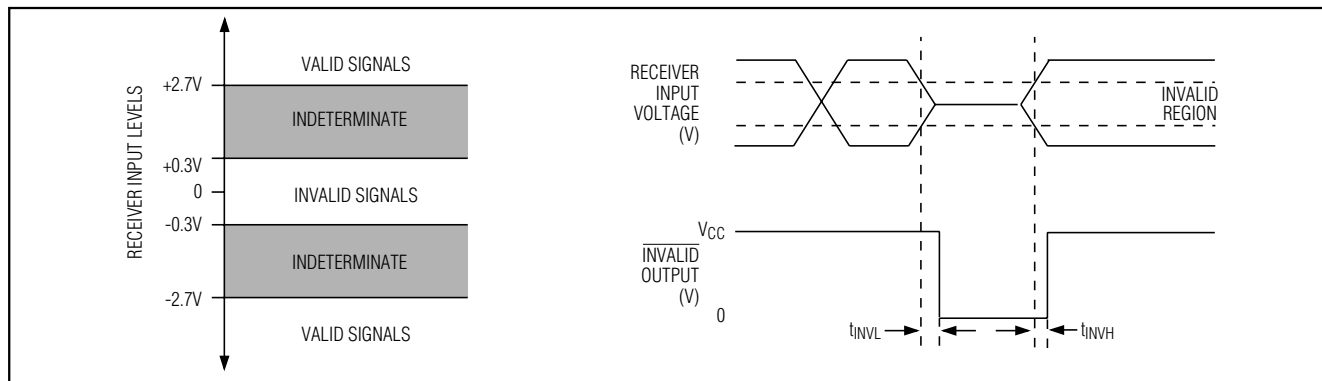


Figure 2. Input Levels and $\overline{\text{INVALID}}$ Timing

Signal Invalid Detector

If no valid signal levels appear on RIN for $30\mu\text{s}$ (typ), $\overline{\text{INVALID}}$ goes low. This event typically occurs if the RS-232 cable is disconnected, or if the connected peripheral transmitter is turned off. $\overline{\text{INVALID}}$ goes high when a valid level is applied to the RS-232 receiver input. Figure 2 shows the input levels and timing diagram for $\overline{\text{INVALID}}$ operation.

Enable Input

The MAX3180E/MAX3182E feature an enable input (EN). Drive EN high to force ROUT into a high-impedance state. In this state, the devices ignore incoming RS-232 signals. Pull EN low for normal operation.

ESD Protection

As with all Maxim devices, ESD protection structures are incorporated on all pins to protect against ESD encountered during handling and assembly. The receiver inputs of the MAX3180E-MAX3183E have extra protection against static electricity. Maxim's engineers have developed state-of-the-art structures enabling these pins to withstand ESD up to $\pm 15\text{kV}$ without damage or latchup. The receiver inputs of the MAX3180E-MAX3183E are characterized for protection to the following limits:

- $\pm 15\text{kV}$ using the Human Body Model
- $\pm 8\text{kV}$ using the Contact Discharge method specified in IEC 1000-4-2
- $\pm 15\text{kV}$ using the Air-Gap Discharge method specified in IEC 1000-4-2

Human Body Model

Figure 3 shows the Human Body Model, and Figure 4 shows the current waveform it generates when discharged into a low impedance. This model consists of

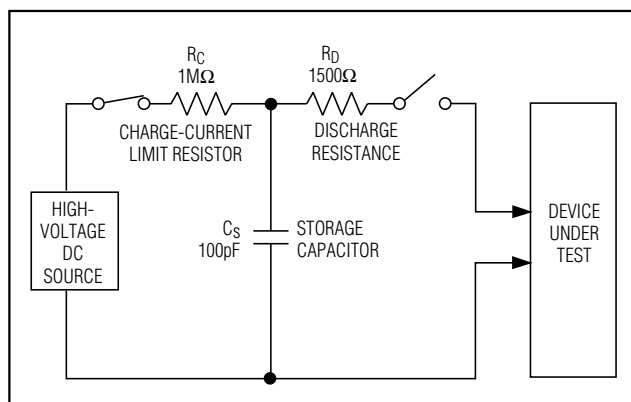


Figure 3. Human Body ESD Test Model

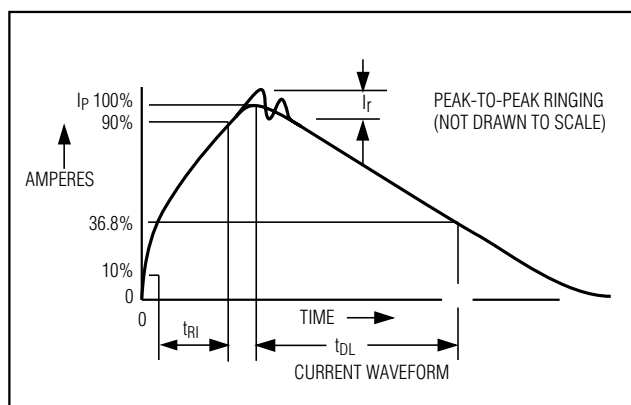


Figure 4. Human Body Model Current Waveform

a 100pF capacitor charged to the ESD voltage of interest, and then discharged into the test device through a $1.5\text{k}\Omega$ resistor.

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IEC 1000-4-2

The IEC 1000-4-2 standard covers ESD testing and performance of finished equipment; it does not specifically refer to ICs. The MAX3180E-MAX3183E enable the design of equipment that meets the highest level (Level 4) of IEC 1000-4-2 without the need for additional ESD-protection components.

The major difference between tests done using the Human Body Model and IEC 1000-4-2 is higher peak current in IEC 1000-4-2. Because series resistance is lower in the IEC 1000-4-2 model, the ESD withstand voltage measured to this standard is generally lower than that measured using the Human Body. Figure 5 shows the IEC 1000-4-2 model, and Figure 6 shows the

current waveform for the ±8kV IEC 1000-4-2 Level 4 ESD Contact Discharge test.

The Air-Gap test involves approaching the device with a charged probe. The Contact Discharge method connects the probe to the device before the probe is energized.

Power-Supply Decoupling

In most circumstances, a 0.1μF V_{CC} bypass capacitor is adequate. Connect the bypass capacitor as close to the IC as possible.

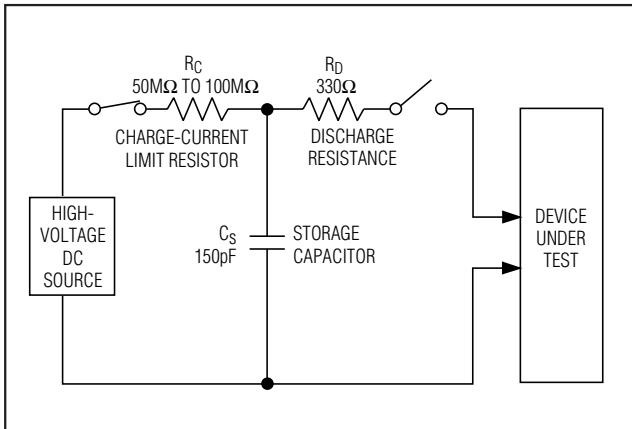


Figure 5. IEC 1000-4-2 ESD Test Model

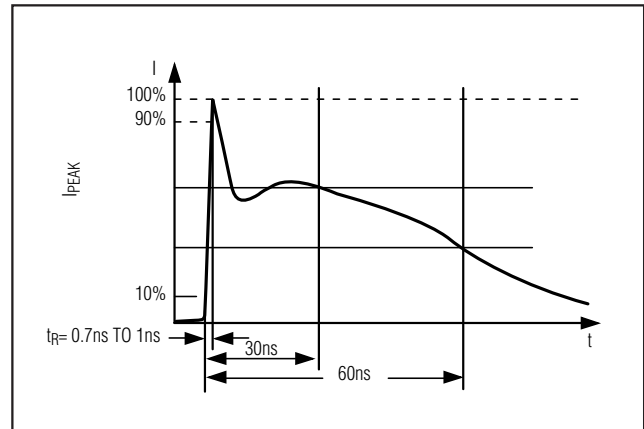
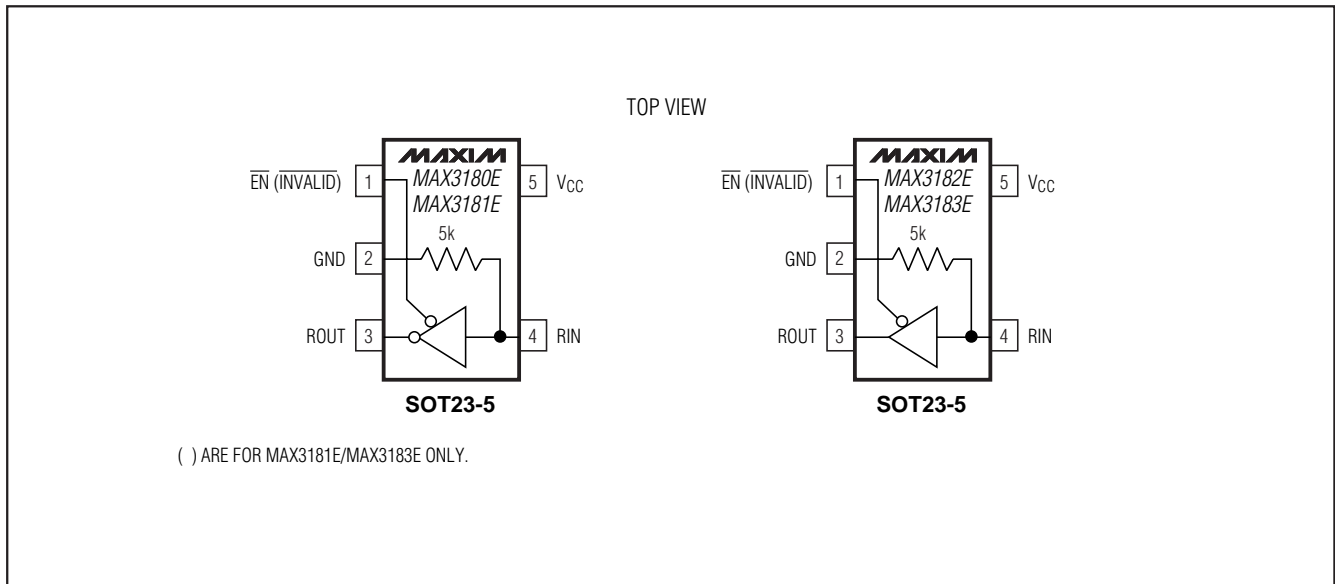


Figure 6. IEC 1000-4-2 ESD Generator Current Waveform

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Pin Configurations/Functional Diagrams



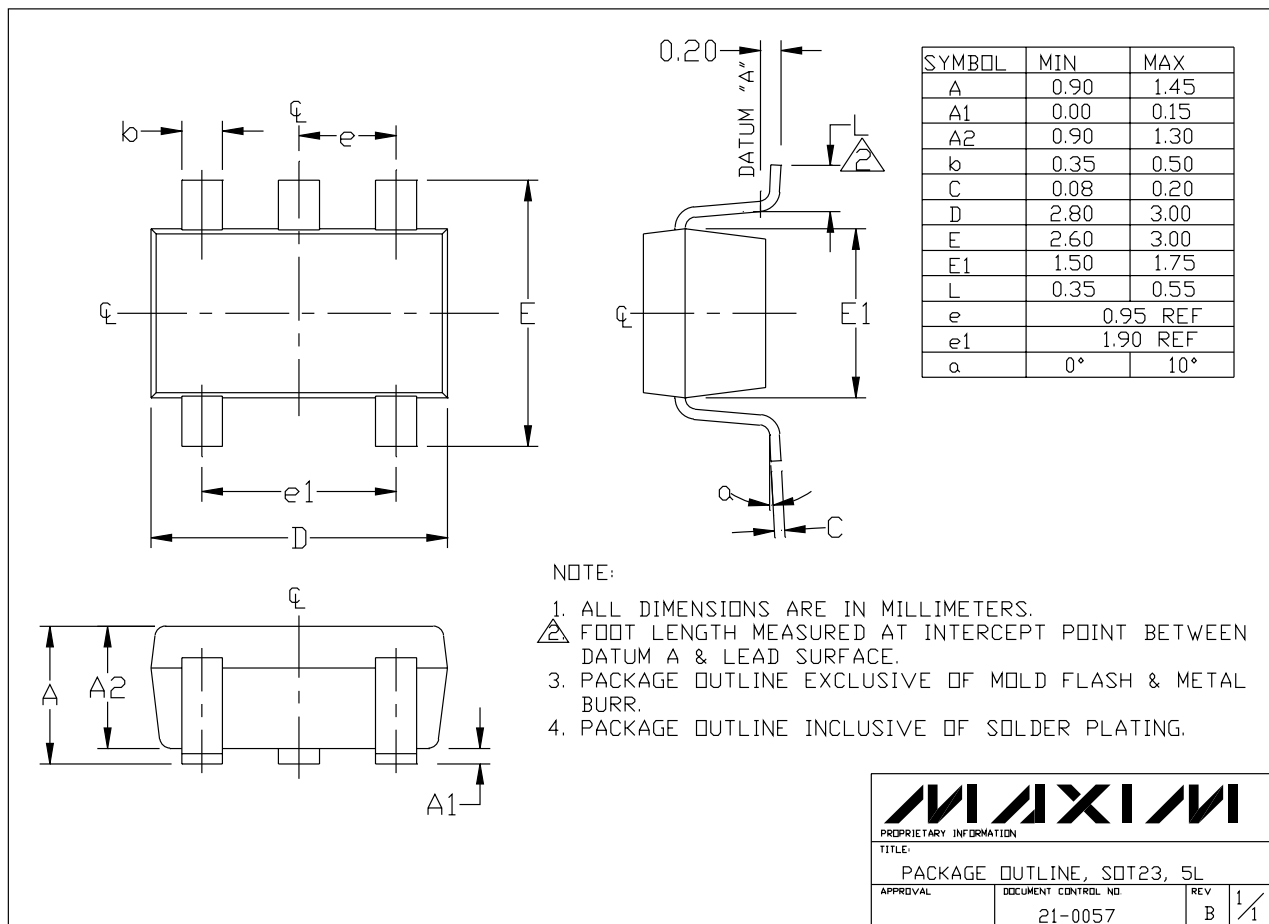
MAX3180E-MAX3183E

Chip Information

TRANSISTOR COUNT: 41

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Package Information



Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.

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