



±15kV ESD-Protected, 1µA, 3.0V to 5.5V, 250kbps, RS-232 Transceivers with AutoShutdown

General Description

The MAX3221E/MAX3223E/MAX3243E are 3V-powered EIA/TIA-232 and V.28/V.24 communications interfaces with automatic shutdown/wakeup features, high data-rate capabilities, and enhanced electrostatic discharge (ESD) protection. All transmitter outputs and receiver inputs are protected to ±15kV using IEC 1000-4-2 Air-Gap Discharge, to ±8kV using IEC 1000-4-2 Contact Discharge, and to ±15kV using the Human Body Model.

The MAX3221E/MAX3223E/MAX3243E achieve a 1µA supply current with Maxim's revolutionary AutoShutdown™ feature. They save power without changes to the existing BIOS or operating system by entering low-power shutdown mode when the RS-232 cable is disconnected, or when the transmitters of the connected peripherals are off.

The transceivers have a proprietary low-dropout transmitter output stage, delivering true RS-232 performance from a +3.0V to +5.5V supply with a dual charge pump. The charge pump requires only four small 0.1µF capacitors for operation from a +3.3V supply. Each device is guaranteed to run at data rates of 250kbps while maintaining RS-232 output levels.

The MAX3221E contains just one driver and one receiver, making it the smallest single-supply RS-232 transceiver. The MAX3223E has two drivers and two receivers. The MAX3243E is a complete 3-driver/5-receiver serial port ideal for notebook or subnotebook computers. It also includes two noninverting receiver outputs that are always active, allowing external devices to be monitored without forward biasing the protection diodes in circuitry that may be powered down.

The MAX3221E, MAX3223E, and MAX3243E are available in space-saving SSOP and TSSOP packages.

Applications

Notebook, Subnotebook, and Palmtop Computers
Cellular Phones
Battery-Powered Equipment
Hand-Held Equipment
Peripherals
Printers

Next Generation Device Features

- ◆ **For Space-Constrained Applications:**
MAX3228E/MAX3229E: ±15kV ESD-Protected, +2.5V to +5.5V RS-232 Transceivers in UCSP™
MAX3222E/MAX3232E/MAX3237E/MAX3241E/
MAX3246E: ±15kV ESD-Protected Down to 10nA, +3.0V to +5.5V, Up to 1Mbps, True RS-232 Transceivers (MAX3246E Available in a UCSP Package)
- ◆ **For Data Cable Applications:**
MAX3380E/MAX3381E: +2.35V to +5.5V, 1µA, 2Tx/2Rx RS-232 Transceivers with ±15kV ESD-Protected I/O and Logic Pins

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX3221ECAE	0°C to +70°C	16 SSOP
MAX3221EEAE	-40°C to +85°C	16 SSOP
MAX3223ECP	0°C to +70°C	20 Plastic DIP
MAX3223ECAP	0°C to +70°C	20 SSOP
MAX3223ECUP	0°C to +70°C	20 TSSOP
MAX3223EEPP	-40°C to +85°C	20 Plastic DIP
MAX3223EEAP	-40°C to +85°C	20 SSOP
MAX3223EEUP	-40°C to +85°C	20 TSSOP
MAX3243ECWI	0°C to +70°C	28 Wide SO
MAX3243ECAI	0°C to +70°C	28 SSOP
MAX3243ECUI	0°C to +70°C	28 TSSOP
MAX3243EEWI	-40°C to +85°C	28 Wide SO
MAX3243EEAI	-40°C to +85°C	28 SSOP
MAX3243EEUI	-40°C to +85°C	28 TSSOP
MAX3243ECTJ	0°C to +70°C	32 Thin QFN
MAX3243EETJ	-40°C to +85°C	32 Thin QFN

Selector Guide

PART	NO. OF DRIVERS/RECEIVERS	V _{CC} RANGE (V)	AutoShutdown
MAX3221E	1/1	+3.0 to +5.5	✓
MAX3223E	2/2	+3.0 to +5.5	✓
MAX3243E	3/5	+3.0 to +5.5	✓

Pin Configurations appear at end of data sheet.

Typical Operating Circuits appear at end of data sheet.

AutoShutdown and UCSP are trademarks of Maxim Integrated Products, Inc.

†Covered by U.S. Patent numbers 4,636,930; 4,679,134; 4,777,577; 4,797,899; 4,809,152; 4,897,774; 4,999,761; 5,649,210; and other patents pending.



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For pricing, delivery, and ordering information, please contact Maxim/Dallas Direct! at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

MAX3221E/MAX3223E/MAX3243E†

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ABSOLUTE MAXIMUM RATINGS

V _{CC} to GND	-0.3V to +6V	Continuous Power Dissipation (T _A = +70°C)
V ₊ to GND (Note 1)	-0.3V to +7V	16-Pin SSOP (derate 7.14mW/°C above +70°C)
V ₋ to GND (Note 1)	+0.3V to -7V	20-Pin Plastic DIP (derate 11.11mW/°C above +70°C)
V ₊ + V ₋ (Note 1)	+13V	20-Pin SSOP (derate 8.00mW/°C above +70°C)
Input Voltages		20-Pin TSSOP (derate 10.9mW/°C above +70°C)
T _{IN} , $\overline{\text{EN}}$, FORCEON, $\overline{\text{FORCEOFF}}$ to GND	-0.3V to +6V	28-Pin SSOP (derate 9.52mW/°C above +70°C)
R _{IN} to GND	±25V	28-Pin TSSOP (derate 12.8mW/°C above +70°C)
Output Voltages		Operating Temperature Ranges
T _{OUT} to GND	±13.2V	MAX32_ _EC_ _
R _{OUT} , R2OUTB, INVALID to GND	-0.3V to (V _{CC} + 0.3V)	MAX32_ _EE_ _
Short-Circuit Duration		Storage Temperature Range
T _{OUT} to GND	Continuous	Lead Temperature (soldering, 10s)

Note 1: V₊ and V₋ can have maximum magnitudes of 7V, but their absolute difference cannot exceed 13V.

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, C1–C4 = 0.1µF (Note 2), T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC CHARACTERISTICS (V _{CC} = 3.3V or 5.0V, T _A = +25°C)						
Supply Current, AutoShutdown		FORCEON = GND, FORCEOFF = V _{CC} , all R _{IN} open		1.0	10	µA
Supply Current, Shutdown		FORCEOFF = GND, all R _{IN} = GND		1.0	10	µA
Supply Current, AutoShutdown Disabled		FORCEON = FORCEOFF = V _{CC} , no load		0.3	1	mA
LOGIC INPUTS						
Input Logic Threshold Low		T _{IN} , $\overline{\text{EN}}$, FORCEON, $\overline{\text{FORCEOFF}}$			0.8	V
Input Logic Threshold High		T _{IN} , $\overline{\text{EN}}$, FORCEON, FORCEOFF	V _{CC} = 3.3V	2.0		V
			V _{CC} = 5.0V	2.4		
Transmitter Input Hysteresis				0.5		V
Input Leakage Current		T _{IN} , $\overline{\text{EN}}$, FORCEON, $\overline{\text{FORCEOFF}}$		±0.01	±1	µA
RECEIVER OUTPUTS						
Output Leakage Current		R _{OUT} receivers disabled		±0.05	±10	µA
Output Voltage Low		I _{OUT} = 1.6mA			0.4	V
Output Voltage High		I _{OUT} = -1.0mA	V _{CC} - 0.6	V _{CC} - 0.1		V
AutoShutdown (FORCEON = GND, FORCEOFF = V _{CC})						
Receiver Input Threshold to INVALID Output High		Figure 5a	Positive threshold		2.7	V
			Negative threshold	-2.7		
Receiver Input Threshold to INVALID Output Low		Figure 5a	-0.3		0.3	V
INVALID Output Voltage Low		I _{OUT} = 1.6mA			0.4	V
INVALID Output Voltage High		I _{OUT} = -1.0mA	V _{CC} - 0.6			V

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MAX3221E/MAX3223E/MAX3243E

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = +3.0V to +5.5V, C1–C4 = 0.1µF (Note 2), T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	
Receiver Positive or Negative Threshold to INVALID High	t _{INVH}	V _{CC} = 5V, Figure 5b		1		µs	
Receiver Positive or Negative Threshold to INVALID Low	t _{INVL}	V _{CC} = 5V, Figure 5b		30		µs	
Receiver or Transmitter Edge to Transmitters Enabled	t _{WU}	V _{CC} = 5V, Figure 5b		100		µs	
RECEIVER INPUTS							
Input Voltage Range			-25		25	V	
Input Threshold Low		T _A = +25°C	V _{CC} = 3.3V	0.6	1.2	V	
			V _{CC} = 5.0V	0.8	1.5		
Input Threshold High		T _A = +25°C	V _{CC} = 3.3V		1.5	2.4	V
			V _{CC} = 5.0V		1.8	2.4	
Input Hysteresis				0.5		V	
Input Resistance			3	5	7	kΩ	
TRANSMITTER OUTPUTS							
Output Voltage Swing		All transmitter outputs loaded with 3kΩ to ground	±5	±5.4		V	
Output Resistance		V _{CC} = V ₊ = V ₋ = 0, T _{OUT} = ±2V	300	10M		Ω	
Output Short-Circuit Current					±60	mA	
Output Leakage Current		V _{OUT} = ±12V, V _{CC} = 0 or 3V to 5.5V, transmitters disabled			±25	µA	
MOUSE DRIVEABILITY (MAX3243E)							
Transmitter Output Voltage		T1IN = T2IN = GND, T3IN = V _{CC} , T3OUT loaded with 3kΩ to GND, T1OUT and T2OUT loaded with 2.5mA each	±5.0			V	
ESD PROTECTION							
R _{IN} , T _{OUT}		IEC 1000-4-2 Air-Gap Discharge		±15		kV	
		IEC 1000-4-2 Contact Discharge		±8			
		Human Body Model		±15			

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TIMING CHARACTERISTICS—MAX3221E/MAX3223E/MAX3243E

(V_{CC} = +3.0V to +5.5V, C₁–C₄ = 0.1µF (Note 2), T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Maximum Data Rate		R _L = 3kΩ, C _L = 1000pF, one transmitter switching	250			kbps
Receiver Propagation Delay	t _{PHL}	C _L = 150pF		0.15		µs
	t _{PLH}			0.15		
Receiver Output Enable Time		Normal operation		200		ns
Receiver Output Disable Time		Normal operation		200		ns
Transmitter Skew	t _{PHL} - t _{PLH}	(Note 3)		100		ns
Receiver Skew	t _{PHL} - t _{PLH}			50		ns
Transition-Region Slew Rate		V _{CC} = 3.3V, R _L = 3kΩ to 7kΩ, T _A = +25°C, measured from +3V to -3V or -3V to +3V, one transmitter switching	6		30	V/µs

Note 3: Transmitter skew is measured at the transmitter zero cross points.

Typical Operating Characteristics

(V_{CC} = +3.3V, 250kbps data rate, 0.1µF capacitors, all transmitters loaded with 3kΩ and C_L, T_A = +25°C, unless otherwise noted.)

