MAXIM

2.5V, ±15kV ESD-Protected RS-232 Transceivers for PDAs and Cell Phones

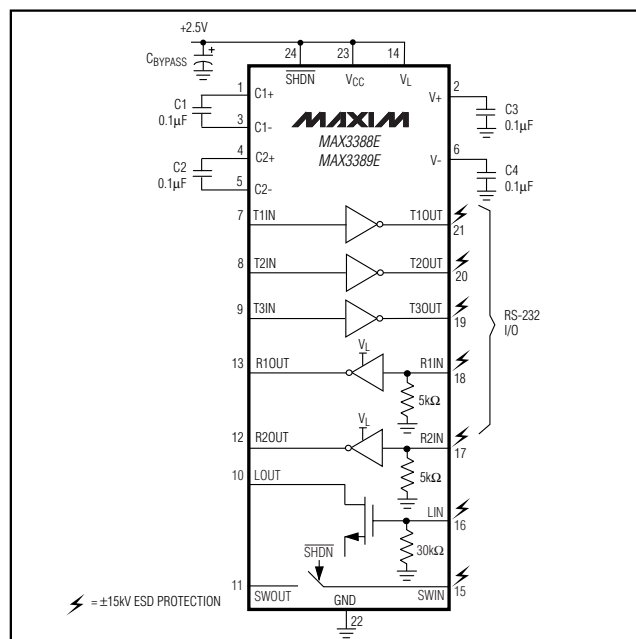**MAX3388E/MAX3389E**

General Description

The MAX3388E/MAX3389E are 2.5V-powered EIA/TIA-232 and V.28/V.24 communications interfaces with low power requirements, high data-rate capabilities, and enhanced electrostatic discharge (ESD) protection. The MAX3388E/MAX3389E have two receivers and three transmitters. All RS-232 inputs and outputs are protected to ±15kV using the IEC 1000-4-2 Air-Gap Discharge method, ±8kV using the IEC 1000-4-2 Contact Discharge method, and ±15kV using the Human Body Model.

In addition to the traditional RS-232 I/O, these devices have dedicated logic-level I/O pins for additional device-to-device handshaking. During shutdown the logic-level I/O pins are active for the MAX3389E. An internal 62Ω switch is provided to switch power to external circuitry or modules.

A proprietary low-dropout transmitter output stage enables RS-232 compatible performance from a +2.35V to +3.0V supply with a dual charge pump. The charge pump requires only four small 0.1µF capacitors for operation from a +2.5V supply. The MAX3388E/MAX3389E are capable of running at data rates up to 460kbps while maintaining RS-232-compatible output levels.

The MAX3388E/MAX3389E have a unique V_L pin that allows interoperation in mixed-logic voltage systems. Both input and output logic levels are pin programmable through the V_L pin. The MAX3388E/MAX3389E are available in a space-saving TSSOP package.

Features

♦ **V_L Pin for Compatibility with Mixed-Voltage Systems**

♦ **Additional I/O for Hot-Sync Applications**

♦ **±15kV ESD Protection on Rx Inputs, Tx Outputs, LIN, and SWIN**

♦ **Low 300µA Supply Current**

♦ **Guaranteed 460kbps Data Rate**

♦ **1µA Low-Power Shutdown**

♦ **Integrated Switch for Powering Remote Circuitry**

♦ **Flow-Through Pinout**

♦ **L_{OUT} Active During Shutdown (MAX3389E)**

Applications

Subnotebook/Palmtop Computers

PDAs and PDA Cradles

Cell Phone Data Cables

Battery-Powered Equipment

Hand-Held Equipment

Peripherals

Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
MAX3388ECUG	0°C to +70°C	24 TSSOP
MAX3388EEUG	-40°C to +85°C	24 TSSOP
MAX3389ECUG	0°C to +70°C	24 TSSOP
MAX3389EEUG	-40°C to +85°C	24 TSSOP

Typical Operating Circuit

Pin Configuration

MAXIM _____ **Maxim Integrated Products** 1
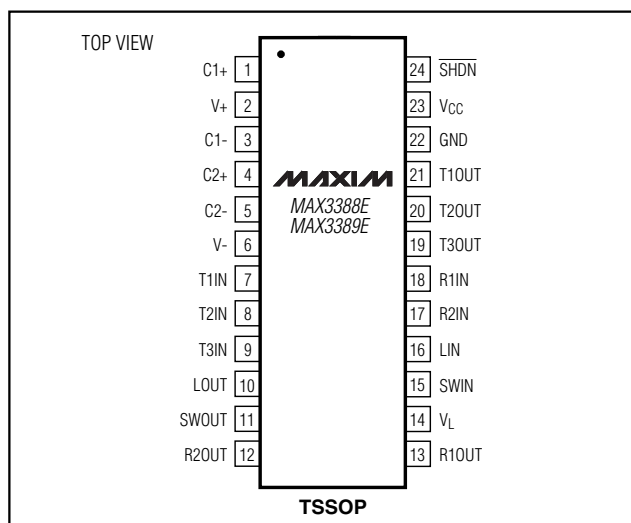
2.5V, ±15kV ESD-Protected RS-232 Transceivers for PDAs and Cell Phones

ABSOLUTE MAXIMUM RATINGS

V_{CC} to GND ....-0.3V to +6V
V_L to GND..-0.3V to (V_{CC} + 0.3V)
V+ to GND ....-0.3V to +7V
V- to GND ....+0.3V to -7V
V+ + |V-| (Note 1) .... +13V
Input Voltages
   T_IN, $\overline{SHDN}$, LIN to GND.....................................-0.3V to +6V
   R_IN to GND ....±25V
   SWIN to GND...-0.3V to (V_{CC} + 0.3V)
Output Voltages
   T_OUT to GND...±13.2V
   R_OUT, SWOUT, LOUT to GND ....-0.3V to (V_L + 0.3V)

Short-Circuit Duration T_OUT to GND........................Continuous
Continuous Power Dissipation (T_A = +70°C)
   24-Pin TSSOP (derate 12.2mW/°C above +70°C) 975mW
Operating Temperature Ranges
   MAX338_ECUG ....0°C to +70°C
   MAX338_EEUG...-40°C to +85°C
Junction Temperature ....+150°C
Storage Temperature Range ....-65°C to +150°C
Lead Temperature (soldering, 10s) ....+300°C

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.

DC ELECTRICAL CHARACTERISTICS

(V_{CC} = V_L = +2.35V to +3.0V, C1–C4 = 0.1µF, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V_{CC} = V_L = +2.5V, T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC CHARACTERISTICS (V_{CC} = +2.5V, T_A = +25°C)						
Shutdown Supply Current		$\overline{SHDN}$ = GND, all inputs at GND		1	10	µA
Supply Current		$\overline{SHDN}$ = V_{CC}, no load		0.3	1	mA
LOGIC INPUTS (T_IN, $\overline{SHDN}$)						
Input Logic Low		V_L = +2.5V			0.6	V
Input Logic High		V_L = +2.5V	1.5			V
Transmitter Input Hysteresis				0.4		V
Input Leakage Current				±0.01	±1	µA
RECEIVER OUTPUTS						
Output Leakage Current		R_OUT, $\overline{SHDN}$ = 0		±0.05	±10	µA
Output Voltage Low		I_{OUT} = 1.6mA			0.4	V
Output Voltage High		I_{OUT} = -1mA	V_L - 0.6	V_L - 0.13		V
RECEIVER INPUTS						
Input Voltage Range			-25		+25	V
Input Threshold Low		T_A = +25°C, V_L = +2.5V	0.6	1.1		V
Input Threshold High		T_A = +25°C, V_L = +2.5V		1.8	2.4	V
Input Hysteresis				0.7		V
Input Resistance		T_A = +25°C	3	5	7	kΩ
TRANSMITTER OUTPUTS						
Output Voltage Swing		All transmitter outputs loaded with 3kΩ to ground	±3.7	±4.2		V
Output Resistance		V_{CC} = 0, transmitter output = ±2V	300	10M		Ω
Output Short-Circuit Current		V_{T_OUT} = 0			±60	mA

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DC ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = V_L = +2.35V to +3.0V, C1–C4 = 0.1µF, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V_{CC} = V_L = +2.5V, T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Leakage Current		V_{T_OUT} = ±12V, transmitters disabled, V_{CC} = 0 or +2.5V			±25	µA
HANDSHAKING I/O (LIN, LOUT)						
Input Voltage Range			0		V_{CC}	V
Input Threshold Low		LIN, V_L = +2.5V, T_A = +25°C	0.6	1.1		V
Input Threshold High		LIN, V_L = +2.5V, T_A = +25°C		1.7	2	V
Input Hysteresis				0.6		V
Input Resistance		T_A = +25°C	20		40	kΩ
Output Voltage Low		LOUT, I_{SINK} = 1.6mA			0.4	V
Output Leakage Current		LOUT = V_L, LIN = low or float			±10	µA
SWITCH (SWIN, SWOUT)						
Input Voltage Range			0		V_{CC}	V
On-Resistance				62	100	Ω
Off-Leakage Current		$\overline{SHDN}$ = 0			±1	µA
Turn-On Time				0.18		µs
Turn-Off Time				0.7		µs
ESD PROTECTION						
R_IN, T_OUT, LIN, SWIN ESD Protection		Human Body Model		±15		kV
		IEC 1000-4-2 Air-Gap Discharge method		±15		
		IEC 1000-4-2 Contact Discharge method		±8		

TIMING CHARACTERISTICS

(V_{CC} = V_L = +2.35V to +3.0V, C1–C4 = 0.1µF, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V_{CC} = V_L = +2.5V, T_A = +25°C.)

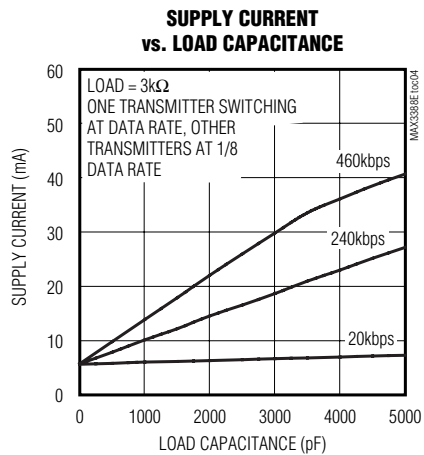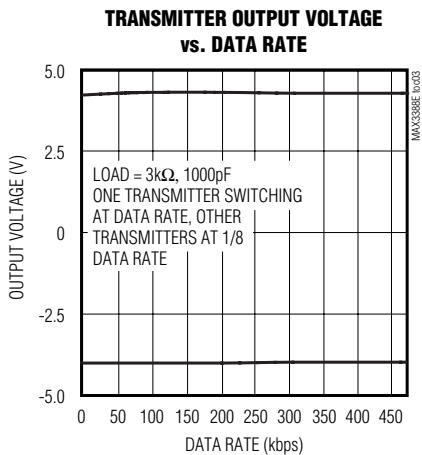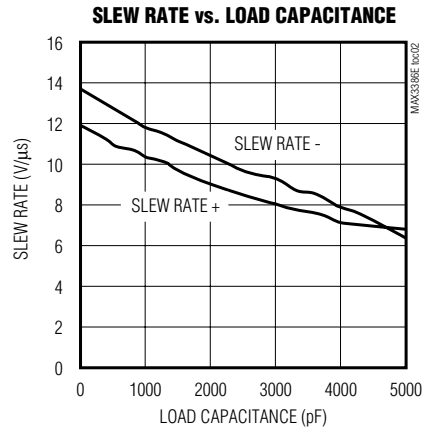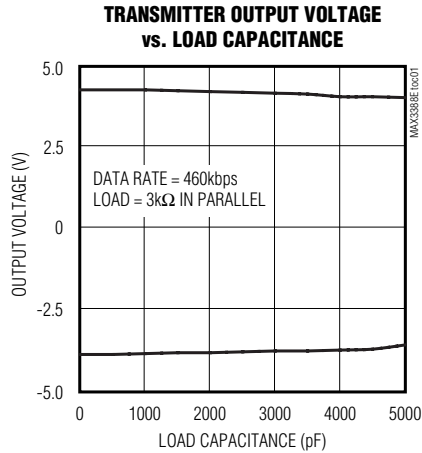| PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Maximum Data Rate		R_L = 3kΩ, C_L = 1000pF, one transmitter switching		250			kbps
		R_L = 3kΩ, C_L = 150pF, one transmitter switching (Note 2)		460			
Receiver Propagation Delay	t_{PHL}	Receiver input to receiver output, C_L = 150pF			0.15		µs
	t_{PLH}				0.15		
Receiver Output Enable Time					200		ns
Receiver Output Disable Time					200		ns
Time to Exit Shutdown		$\lvert V_{T\_OUT} \rvert$ > 3.7V			30		µs
Transmitter Skew	$\lvert t_{PHL} - t_{PLH} \rvert$	R_L = 3kΩ, C_L = 1000pF (Note 3)			100		ns
Receiver Skew	$\lvert t_{PHL} - t_{PLH} \rvert$				50		ns
Transition-Region Slew Rate		V_{CC} = +2.5V, T_A = +25°C, R_L = 3kΩ to 7kΩ, measured from +3V to -3V or -3V to +3V, one transmitter switching	C_L = 150pF to 1000pF	6		30	V/µs
			C_L = 150pF to 2500pF	4		30	

Note 2: Guaranteed by correlation.
Note 3: Transmitter skew is measured at the transmitter zero crosspoint.

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$(V_{CC} = V_L = +2.5V, T_A = +25°C,$ unless otherwise noted.)

**TRANSMITTER OUTPUT VOLTAGE
vs. LOAD CAPACITANCE**

DATA RATE = 460kbps
LOAD = 3kΩ IN PARALLEL

OUTPUT VOLTAGE (V)

LOAD CAPACITANCE (pF)

SLEW RATE vs. LOAD CAPACITANCE

SLEW RATE -

SLEW RATE +

SLEW RATE (V/µs)

LOAD CAPACITANCE (pF)

**TRANSMITTER OUTPUT VOLTAGE
vs. DATA RATE**

LOAD = 3kΩ, 1000pF
ONE TRANSMITTER SWITCHING
AT DATA RATE, OTHER
TRANSMITTERS AT 1/8
DATA RATE

OUTPUT VOLTAGE (V)

DATA RATE (kbps)

**SUPPLY CURRENT
vs. LOAD CAPACITANCE**

LOAD = 3kΩ
ONE TRANSMITTER SWITCHING
AT DATA RATE, OTHER
TRANSMITTERS AT 1/8
DATA RATE

460kbps

240kbps

20kbps

SUPPLY CURRENT (mA)

LOAD CAPACITANCE (pF)

LIN TO LOUT t_{PD}

LIN

1V/div

LOUT

R_{PULLUP} = 1kΩ

200ns/div

**ON-RESISTANCE
vs. SWIN VOLTAGE**

T_A = +85°C

T_A = +25°C

T_A = -40°C

R_{ON} (Ω)

V_{SWIN} (V)

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Pin Description

PIN	NAME	FUNCTION
1	C1+	Positive Terminal of the Voltage-Doubler Charge-Pump Capacitor
2	V+	+4.2V Supply Generated by the Charge Pump
3	C1-	Negative Terminal of the Voltage-Doubler Charge-Pump Capacitor
4	C2+	Positive Terminal of the Inverting Charge-Pump Capacitor
5	C2-	Negative Terminal of the Inverting Charge-Pump Capacitor
6	V-	-4.2V Supply Generated by the Charge Pump
7, 8, 9	T1IN, T2IN, T3IN	CMOS Transmitter Inputs
10	LOUT	Handshaking Output. This output is active during shutdown for the MAX3389E.
11	SWOUT	Switch Output
12, 13	R2OUT, R1OUT	CMOS Receiver Outputs. Swing between 0 and V_L.
14	V_L	Logic-Level Supply. All CMOS inputs and outputs are referred to this supply. V_L = +1.8V to +3.0V.
15	SWIN	Switch Input.
16	LIN	Handshaking Input. This input is active during shutdown for the MAX3389E.
17, 18	R2IN, R1IN	RS-232 Receiver Inputs
19, 20, 21	T3OUT, T2OUT, T1OUT	RS-232 Transmitter Outputs
22	GND	Ground
23	V_{CC}	+2.35V to +3V Supply Voltage
24	$\overline{SHDN}$	Shutdown Input. 0 = shutdown, switch open; 1 = normal operation, switch closed.

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Table 1. Shutdown Logic Truth Table

$\overline{SHDN}$	TRANSMITTER OUTPUTS	RECEIVER OUTPUTS	CHARGE PUMP	SWITCH	LOUT	
					MAX3388E	MAX3389E
L	High-Z	High-Z	Inactive	Open	High-Z	$\overline{LIN}$
H	Active	Active	Active	Closed	$\overline{LIN}$	$\overline{LIN}$
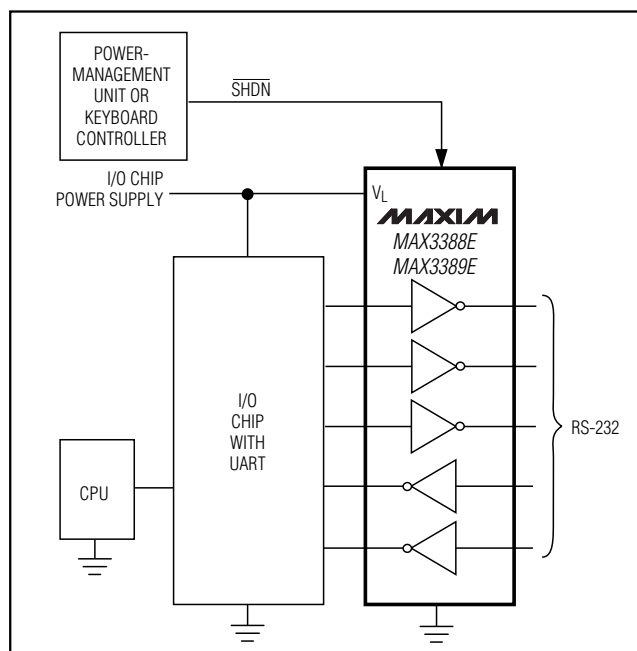
Figure 1. Interface Under Control of PMU

Figure 2. Transmitter Outputs when Exiting Shutdown

Detailed Description

Dual Charge-Pump Voltage Converter

The MAX3388E/MAX3389E's internal power supply consists of a regulated dual charge pump that provides output voltages of +4.2V (doubling charge pump) and -4.2V (inverting charge pump), regardless of the input voltage (V_{CC}) over a +2.5V to +3.0V range. The charge pumps operate in a discontinuous mode: if the output voltages are less than 4.2V, the charge pumps are enabled; if the output voltages exceed 4.2V, the charge pumps are disabled. Each charge pump requires flying capacitors (C1, C2) and reservoir capacitors (C3, C4) to generate the V+ and V- supplies.

RS-232 Transmitters

The transmitters are inverting level translators that convert CMOS-logic levels to ±3.7V EIA/TIA-232-compatible levels.

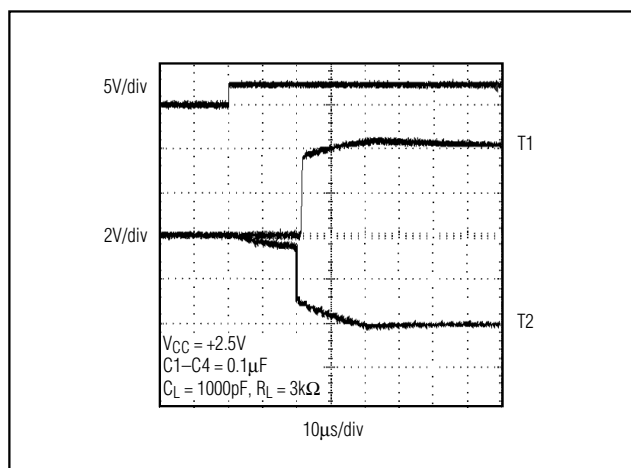The MAX3388E/MAX3389E's transmitters guarantee a 250kbps data rate with loads of 3kΩ in parallel with 1000pF and 460kbps data rate with loads of 3kΩ in parallel with 150pF. Figure 1 shows a complete system connection.

These RS-232 output stages are turned off (high impedance) when the devices are in shutdown mode. When the power is off, the MAX3388E/MAX3389E permit the outputs to be driven up to ±12V.

The transmitter inputs do not have pullup resistors. Connect unused inputs to GND or V_L.

RS-232 Receivers

The receivers convert RS-232 signals to CMOS-logic output levels. The MAX3388E/MAX3389E's receivers have inverting outputs. The outputs are high impedance in shutdown.

Shutdown Mode

Supply current falls to less than 1µA when the MAX3388E/MAX3389E are placed in shutdown mode ($\overline{SHDN}$ logic low). When shut down, the device's charge pumps are turned off, V+ decays to V_{CC}, V- is pulled to ground, the switch is opened, and the transmitter outputs are disabled (high impedance). The time required to exit

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shutdown is typically 30µs, as shown in Figure 2. Connect $\overline{SHDN}$ to V_{CC} if the shutdown mode is not used. In shutdown mode, the receiver outputs are high impedance (Table 1).

V_L Logic Supply Input
Unlike other RS-232 interface devices where the receiver outputs swing between 0 and V_{CC}, the MAX3388E/ MAX3389E feature a separate logic supply input (V_L) that sets V_{OH} for the receiver outputs and sets thresholds for the transmitter inputs. This feature allows a great deal of flexibility in interfacing to many different types of systems with different logic levels. Connect this input to the host logic supply ($1.8V \leq V_L \leq V_{CC}$). Also see the *Typical PDA/Cell-Phone Application* section.

±15kV ESD Protection
As with all Maxim devices, ESD-protection structures are incorporated on all pins to protect against ESDs encountered during handling and assembly. The MAX3388E/ MAX3389E's driver outputs, receiver inputs, the handshaking input LIN, and the switch terminal SWIN have extra protection against static electricity. Maxim has developed state-of-the-art structures to protect these pins against an ESD of ±15kV without damage. The ESD structures withstand high ESD in all states: normal operation, shutdown, and powered down. After an ESD event, Maxim's "E" version devices keep working without latchup, whereas competing RS-232 products can latch and must be powered down to remove latchup. ESD protection can be tested in various ways. The transmitter outputs and receiver inputs of this product family are characterized for protection to the following limits:

1) ±15kV using the Human Body Model

2) ±8kV using the Contact Discharge method specified in IEC 1000-4-2

3) ±15kV using IEC 1000-4-2's Air-Gap Discharge method

ESD Test Conditions
ESD performance depends on a variety of conditions. Contact Maxim for a reliability report that documents test setup, methodology, and results.

Human Body Model
Figure 3a shows the Human Body Model, and Figure 3b shows the current waveform it generates when discharged into a low impedance. This model consists of a 100pF capacitor charged to the ESD voltage of interest, which is then discharged into the test device through a 1.5kΩ resistor.
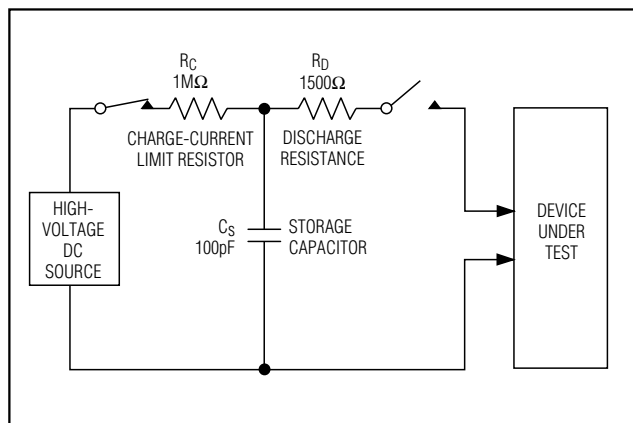

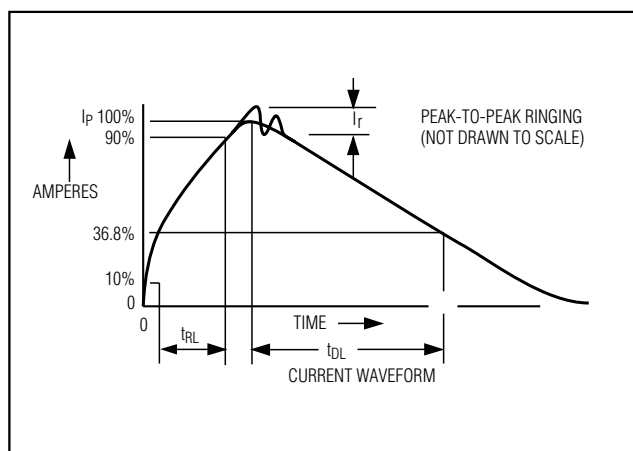*Figure 3a. Human Body ESD Test Model*

Figure 3b. Human Body Current Waveform

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 MAX3388E/MAX3389E helps you design equipment that meets Level 4 (the highest level) 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. Hence, the ESD withstand voltage measured to IEC 1000-4-2 is generally lower than that measured using the Human Body Model. Figure 4a shows the IEC 1000-4-2 model, and Figure 4b shows the current waveform for the ±8kV IEC 1000-4-2 Level 4 ESD Contact Discharge test.

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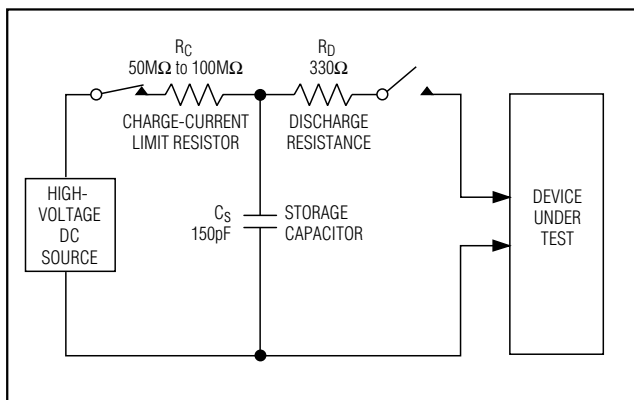# 2.5V, ±15kV ESD-Protected RS-232 Transceivers for PDAs and Cell Phones
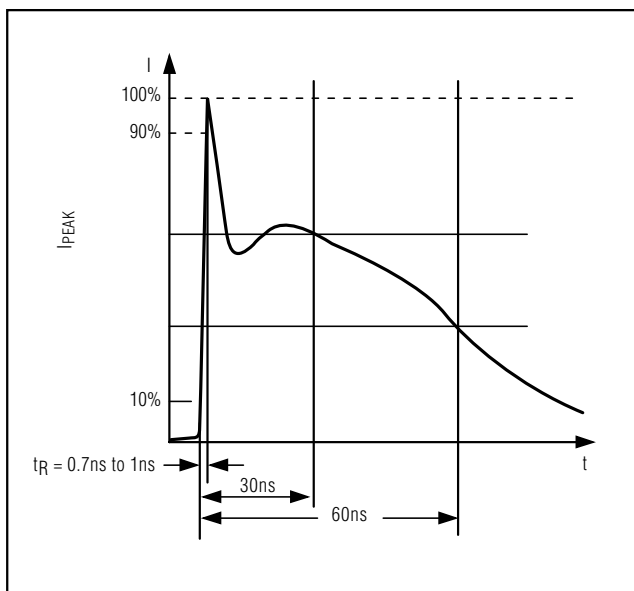

Figure 4a. IEC 1000-4-2 ESD Test Model

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

Table 2. Minimum Required Capacitor Values

V_{CC} (V)	C1–C4 (µF)
2.5 to 3.0	0.1

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.

Machine Model
The Machine Model for ESD tests all pins using a 200pF storage capacitor and zero discharge resistance. Its objective is to emulate the stress caused by contact that occurs with handling and assembly during manufacturing. All pins require this protection during manufacturing, not just RS-232 inputs and outputs. Therefore, after PC board assembly, the Machine Model is less relevant to I/O ports.

Applications Information

Capacitor Selection
The capacitor type used for C1–C4 is not critical for proper operation; polarized or nonpolarized capacitors can be used. The charge pump requires 0.1µF capacitors for 2.5V operation (Table 2). Do not use values smaller than those listed in Table 2. Increasing the capacitor values (e.g., by a factor of 2) reduces ripple on the transmitter outputs and slightly reduces power consumption. C2, C3, and C4 can be increased without changing C1's value. However, do not increase C1 without also increasing the values of C2, C3, and C4 to maintain the proper ratios (C1 to the other capacitors).

When using the minimum required capacitor values, make sure the capacitor value does not degrade excessively with temperature. If in doubt, use capacitors with a larger nominal value. The capacitor's equivalent series resistance (ESR), which usually rises at low temperatures, influences the amount of ripple on V+ and V-.

Power-Supply Decoupling
In most circumstances, a 0.1µF bypass capacitor is adequate. In applications that are sensitive to power-supply noise, decouple V_{CC} to ground with a capacitor of the same value as charge-pump capacitor C1. Connect bypass capacitors as close to the IC as possible.

Transmitter Outputs when Exiting Shutdown
Figure 2 shows two transmitter outputs when exiting shutdown mode. As they become active, the two transmitter outputs are shown going to opposite RS-232 levels (one transmitter input is high; the other is low). Each transmitter is loaded with 3kΩ in parallel with 1000pF. The transmitter outputs display no ringing or undesirable transients as they come out of shutdown. Note that the transmitters are enabled only when the magnitude of V- exceeds approximately 2.5V.

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High Data Rates

The MAX3388E/MAX3389E maintain RS-232-compatible transmitter output voltages even at high data rates. Figure 5 shows a transmitter loopback test circuit. Figure 6 shows a loopback test result at 250kbps, and Figure 7 shows the same test at 460kbps. For Figure 6, all transmitters were driven simultaneously at 250kbps into RS-232 loads in parallel with 1000pF. For Figure 7, a single transmitter was driven at 460kbps, and all transmitters were loaded with an RS-232 receiver in parallel with 150pF.

Power Switch

The MAX3388E/MAX3389E contain an internal switch for powering external circuitry. This can be used to power hot-sync circuitry or other low-power circuitry. The switch on- resistance is typically 62Ω. The SWIN side of the switch is ESD protected to ±15kV.

Logic-Level I/O

In addition to the traditional RS-232 I/O, the MAX3388E/MAX3389E have a logic-level transceiver from the RS-232 connector side to the CMOS-logic side. The input impedance is typically 30kΩ, and the output is open drain. The logic level I/O is active during shutdown for the MAX3389E.

This I/O transceiver is useful for hot syncing or other dedicated communication capability. The input is ESD protected to ±15kV.

Typical PDA/Cell-Phone Application

The MAX3388E/MAX3389E designed with PDA applications in mind. Two transmitters and two receivers handle standard full-duplex communication protocol, while an extra transmitter allows a ring indicator (RI) signal to alert the UART on the PC. Without the ring indicator transmitter, solutions for these applications would require software-intensive polling of the cradle inputs.

The RI signal is generated when a PDA, cellular phone, or other "cradled" device is plugged into its cradle. This generates a logic-low signal to RI transmitter input, creating +3.7V at the ring indicate pin. The PC's UART RI input is the only pin that can generate an interrupt from signals arriving through the RS-232 port. The interrupt routine for this UART will then service the RS-232 full-duplex communication between the PDA and the PC.

As cell phone design becomes more like that of PDAs, cell phones will require similar docking ability and communication protocol. Cell phones operate on a single lithium-ion (Li+) battery and generate a regulated output voltage of +2.35V to +3V from the phone connector. The baseband logic coming from the phone connector can be as low as 1.8V at the transceivers. To prevent forward biasing of a device internal to the cell phone, the MAX3388E/MAX3389E come with a logic power-supply pin (V_L) that limits the logic levels presented to
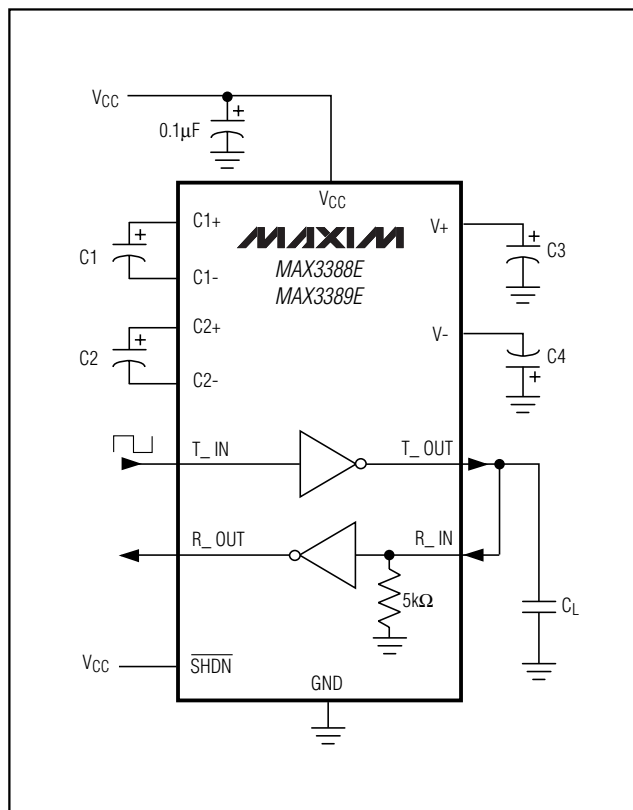
Figure 5. Loopback Test Circuit
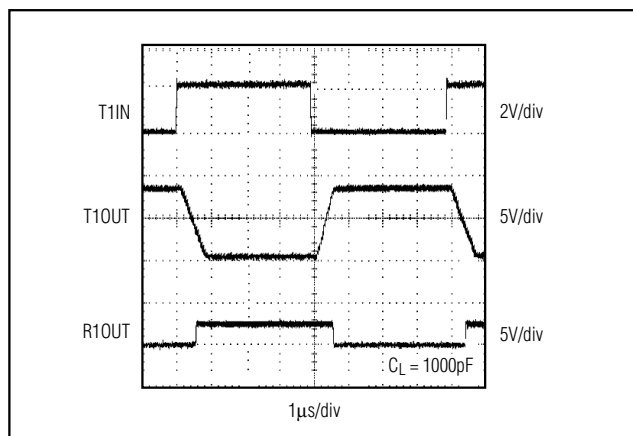
Figure 6. Loopback Test Results at 250kbps
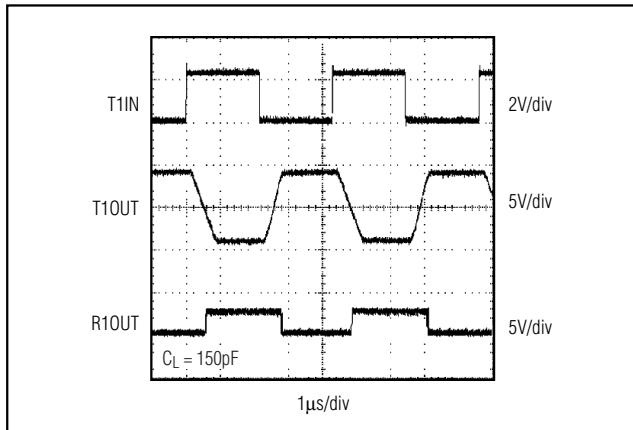
Figure 7. Loopback Test Results at 460kbps

the phone. The receiver outputs will sink to zero for low outputs, but will not exceed V_L for logic highs. The input logic levels for the transmitters are also altered, scaled by the magnitude of the V_L input. The devices will work with V_L as low as 1.8V. This is useful with cell phones and other power-efficient devices with core logic voltage levels that go as low as 1.8V.

_____Chip Information

TRANSISTOR COUNT: 1323

MAX3388E/MAX3389E

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Package Information

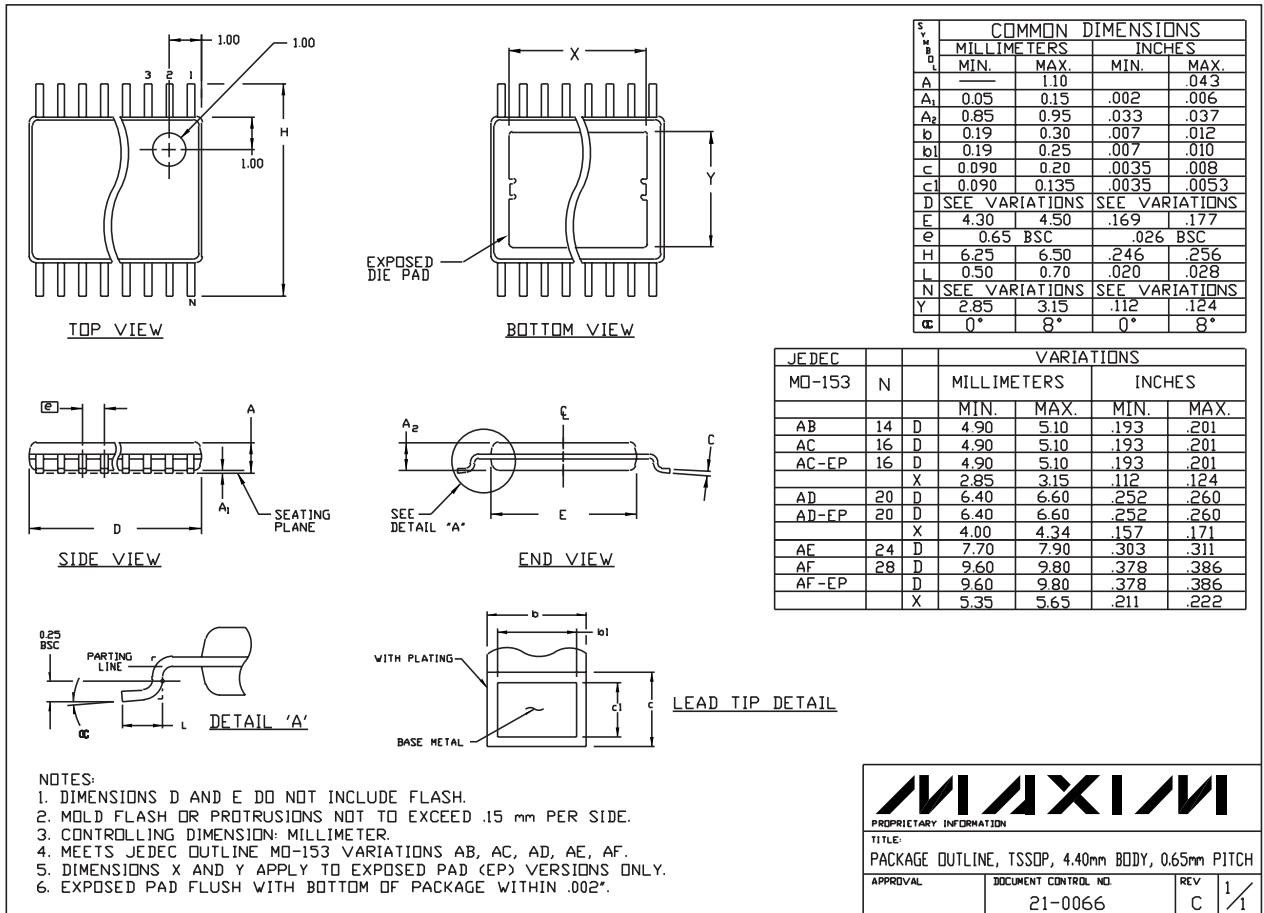| S y m b o l	COMMON DIMENSIONS			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	———	1.10		.043
A₁	0.05	0.15	.002	.006
A₂	0.85	0.95	.033	.037
b	0.19	0.30	.007	.012
b1	0.19	0.25	.007	.010
c	0.090	0.20	.0035	.008
c1	0.090	0.135	.0035	.0053
D	SEE VARIATIONS		SEE VARIATIONS	
E	4.30	4.50	.169	.177
e	0.65 BSC		.026 BSC	
H	6.25	6.50	.246	.256
L	0.50	0.70	.020	.028
N	SEE VARIATIONS		SEE VARIATIONS	
Y	2.85	3.15	.112	.124
α	0°	8°	0°	8°

JEDEC		VARIATIONS			
MO-153	N	MILLIMETERS		INCHES	
		MIN.	MAX.	MIN.	MAX.
AB	14 D	4.90	5.10	.193	.201
AC	16 D	4.90	5.10	.193	.201
AC-EP	16 D	4.90	5.10	.193	.201
	X	2.85	3.15	.112	.124
AD	20 D	6.40	6.60	.252	.260
AD-EP	20 D	6.40	6.60	.252	.260
	X	4.00	4.34	.157	.171
AE	24 D	7.70	7.90	.303	.311
AF	28 D	9.60	9.80	.378	.386
AF-EP	D	9.60	9.80	.378	.386
	X	5.35	5.65	.211	.222

NOTES:
1. DIMENSIONS D AND E DO NOT INCLUDE FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED .15 mm PER SIDE.
3. CONTROLLING DIMENSION: MILLIMETER.
4. MEETS JEDEC OUTLINE MO-153 VARIATIONS AB, AC, AD, AE, AF.
5. DIMENSIONS X AND Y APPLY TO EXPOSED PAD (EP) VERSIONS ONLY.
6. EXPOSED PAD FLUSH WITH BOTTOM OF PACKAGE WITHIN .002".

MAXIM
PROPRIETARY INFORMATION
TITLE:
PACKAGE OUTLINE, TSSOP, 4.40mm BODY, 0.65mm PITCH

APPROVAL	DOCUMENT CONTROL NO.	REV	
	21-0066	C	1/1

TSSOP.EPS

MAX3388E/MAX3389E