MAXIM

±15kV ESD-Protected, EMC-Compliant, 230kbps, Dual RS-232 Serial Port for Motherboards/Desktops

MAX3187

_____General Description

The MAX3187 complete, dual DTE RS-232 serial port meets the stringent ESD requirements of the European Community. All transmitter outputs and receiver inputs are protected to ±15kV using IEC 1000-4-2 Air-Gap Discharge, ±8kV using IEC 1000-4-2 Contact Discharge, and ±15kV using the Human Body Model.

The MAX3187's six RS-232 transmitters and ten RS-232 receivers require no charge pump. Guaranteed to run at data rates up to 230kbps, the MAX3187 is optimized for desktop PC and motherboard applications, and is compatible with popular software for PC communications. Power-supply current is less than 1mA for I_{DD} and I_{SS}, and less than 3mA for I_{CC}.

The MAX3187 is available in a space-saving 36-pin SSOP package.

_____Applications

Desktop PC

Motherboards

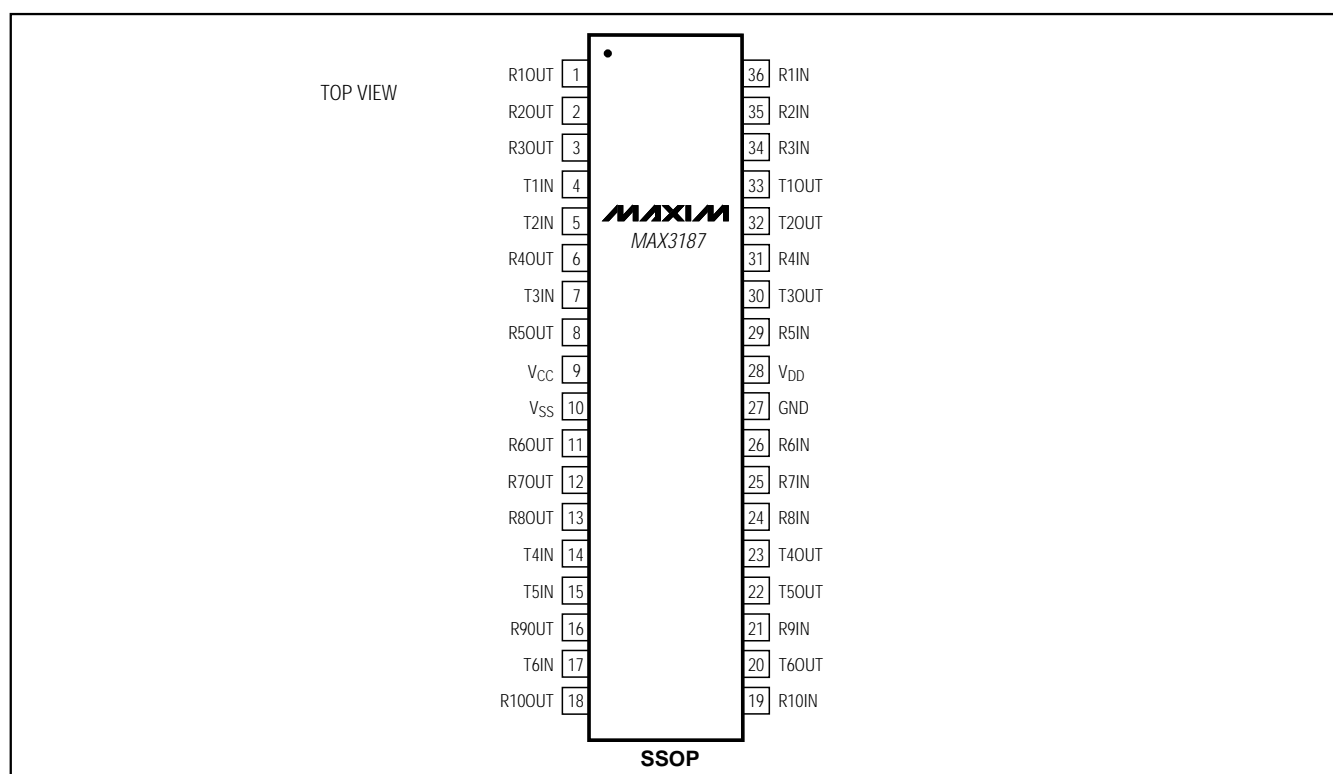Instruments

Equipment Meeting IEC 1000-4-2

_____Features

♦ **Enhanced ESD Protection:**
   ±15kV—Human Body Model
   ±8kV—IEC 1000-4-2, Contact Discharge
   ±15kV—IEC 1000-4-2, Air-Gap Discharge

♦ **Latchup Free During an ESD Event**

♦ **36-Pin SSOP Package**

♦ **Guaranteed 230kbps Data Rate**

♦ **Flow-Through Pinout**

♦ **Two Complete DTE Serial Ports**

♦ **6 RS-232 Drivers and 10 RS-232 Receivers**

_____Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
MAX3187CAX	0°C to +70°C	36 SSOP
MAX3187EAX	-40°C to +85°C	36 SSOP

Typical Operating Circuit appears at end of data sheet.

_____Pin Configuration

TOP VIEW

R1OUT	1	36	R1IN
R2OUT	2	35	R2IN
R3OUT	3	34	R3IN
T1IN	4	33	T1OUT
T2IN	5	32	T2OUT
R4OUT	6	31	R4IN
T3IN	7	30	T3OUT
R5OUT	8	29	R5IN
V_{CC}	9	28	V_{DD}
V_{SS}	10	27	GND
R6OUT	11	26	R6IN
R7OUT	12	25	R7IN
R8OUT	13	24	R8IN
T4IN	14	23	T4OUT
T5IN	15	22	T5OUT
R9OUT	16	21	R9IN
T6IN	17	20	T6OUT
R10OUT	18	19	R10IN

MAXIM
MAX3187

SSOP

MAXIM _____ **Maxim Integrated Products** 1

MAX3187

ABSOLUTE MAXIMUM RATINGS

V_{CC} ....-0.3V to +7V	Short-Circuit Duration
V_{DD} ....-0.3V to +14V	T_OUT (one at a time) ....Continuous
V_{SS}.. +0.3V to -14V	R_OUT (one at a time)...Continuous
Input Voltages	Continuous Power Dissipation (T_A = +70°C)
T_IN ....-0.3V to +6V	SSOP (derate 11.76mW/°C above +70°C) 762mW
R_IN ....±30V	Operating Temperature Ranges
Output Voltages	MAX3187CAX ....0°C to +70°C
T_OUT...±15V	MAX3187EAX ....-40°C to +85°C
R_OUT ....-0.3V to (V_{CC} + 0.3V)	Storage Temperature Range ....-65°C to +160°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} = +4.5V to +5.5V, V_{DD} = +10.8V to +13.2V, V_{SS} = -10.8V to -13.2V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C.)

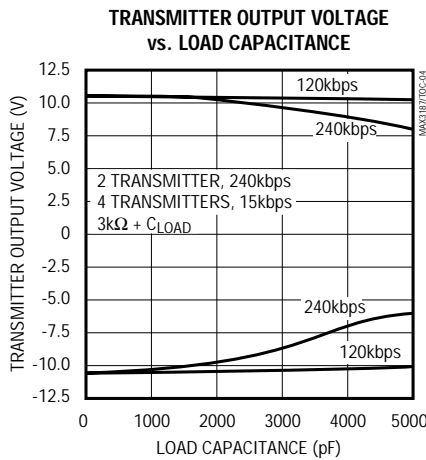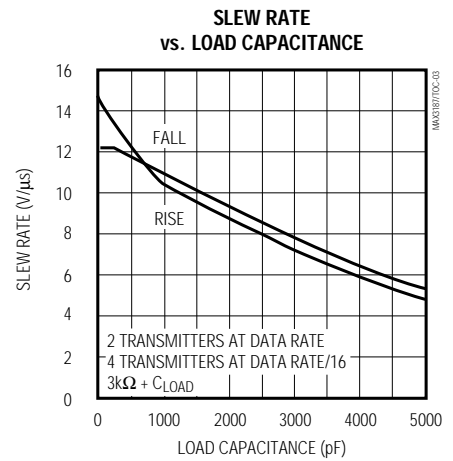| PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC CHARACTERISTICS						
Operating Voltage Range	V_{CC}		4.5		5.5	V
	V_{DD}		10.8		13.2	
	V_{SS}		-13.2		-10.8	
Supply Current	I_{CC}	No load		750	3000	mA
	I_{DD}	No load		370	1000	
	I_{SS}	No load		370	1000	
LOGIC						
Input Logic Threshold Low	V_{ILT}	T_IN			0.8	V
Input Logic Threshold High	V_{IHT}	T_IN	2.0			V
Input Leakage Current				0.01	1	µA
Output Voltage Low	V_{OLR}	R_OUT; I_{SINK} = 3.2mA			0.4	V
Output Voltage High	V_{OHR}	R_OUT; I_{SOURCE} = 1mA	V_{CC} - 0.6			V
TRANSMITTER OUTPUTS						
Output Voltage Swing		V_{DD} = 7.0V, V_{SS} = -7.0V, R_L = 3kΩ	±5.0			V
		V_{DD} = 12V, V_{SS} = -12V, R_L = 3kΩ	±9.5			
Transmitter Output Resistance		V_{CC} = V_{DD} = V_{SS} = 0V, V_{T_OUT} = ±2V	300			Ω
RS-232 Output Short-Circuit Current				±35	±60	mA
RECEIVER INPUTS						
Receiver Input Voltage Range			-25		25	V
RS-232 Input Threshold Low			0.75			V
RS-232 Input Threshold High					2.4	V
RS-232 Input Hysteresis				0.65		V
RS-232 Input Resistance			3	5	7	kΩ
Receiver Output Short-Circuit Current				±10		mA

MAXIM

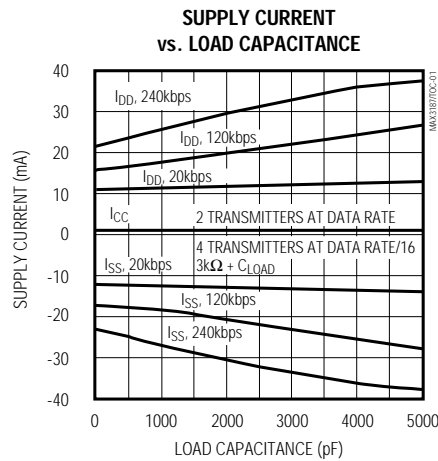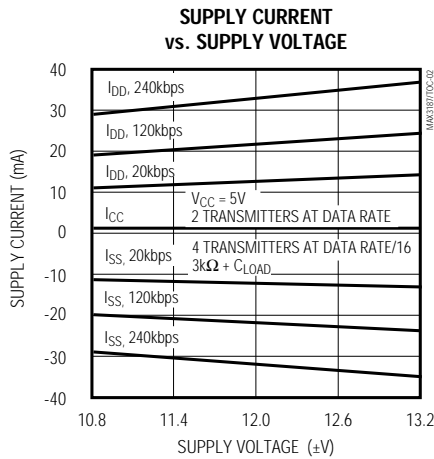## ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = +4.5V to +5.5V, V_{DD} = +10.8V to +13.2V, V_{SS} = -10.8V to -13.2V, 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
ESD CHARACTERISTICS							
ESD Protection		Human Body Model			±15		kV
		IEC 1000-4-2 (Contact Discharge)			±8		
		IEC 1000-4-2 (Air-Gap Discharge)			±15		
TIMING CHARACTERISTICS							
Transmitter Output Propagation Delay, Low to High	t_{PLHT}	V_{DD} = 12V, V_{SS} = -12V, R_L = 3kΩ, C_L = 1000pF, T_A = +25°C				4	μs
Transmitter Output Propagation Delay, High to Low	t_{PHLT}	V_{DD} = 12V, V_{SS} = -12V, R_L = 3kΩ, C_L = 1000pF, T_A = +25°C				4	μs
Transmitter Propagation Delay Skew, $\mid t_{PLHT} - t_{PHLT} \mid$	t_{SKT}	V_{DD} = 12V, V_{SS} = -12V, R_L = 3kΩ, C_L = 1000pF, T_A = +25°C				0.4	μs
Transition Output Slew Rate	SR	V_{DD} = 12V, V_{SS} = -12V, R_L = 3kΩ to 7kΩ, measured from +3V to -3V or -3V to +3V, Figure 1, T_A = +25°C	C_L = 150pF to 2500pF	4		30	V/μs
			C_L = 50pF to 1000pF	8		30	
Receiver Output Propagation Delay, Low to High	t_{PLHR}	V_{CC} = 5V, C_L = 50pF, T_A = +25°C				4.0	μs
Receiver Output Propagation Delay, High to Low	t_{PHLR}	V_{CC} = 5V, C_L = 50pF, T_A = +25°C				4.0	μs
Receiver Propagation Delay Skew, $\mid t_{PLHR} - t_{PHLR} \mid$	t_{SKR}	V_{CC} = 5V, C_L = 50pF, T_A = +25°C				0.4	μs
Guaranteed Data Rate	DR	V_{CC} = 5V, V_{DD} = 12V, V_{SS} = -12V, R_L = 3kΩ to 7kΩ, T_A = +25°C, any two transmitters switching	C_L = 50pF to 2500pF	120			kbps
			C_L = 50pF to 1000pF	230			
Mouse Driveability		T3OUT = -5mA, T1OUT = T2OUT = 5mA		±7.5			V

MAXIM _____ 3

±15kV ESD-Protected, EMC-Compliant, 230kbps, Dual RS-232 Serial Port for Motherboards/Desktops

_____Typical Operating Characteristics

(V$_{CC}$ = +5V, V$_{DD}$ = +12V, V$_{SS}$ = -12V, T$_A$ = +25°C, unless otherwise noted.)
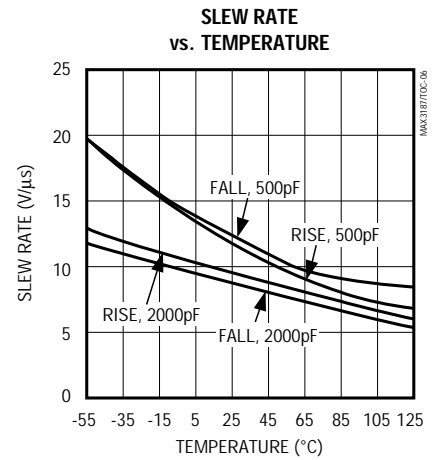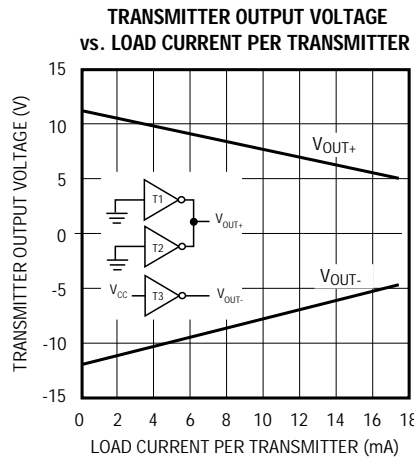
SUPPLY CURRENT
vs. SUPPLY VOLTAGE

SUPPLY CURRENT
vs. LOAD CAPACITANCE

SLEW RATE
vs. LOAD CAPACITANCE

TRANSMITTER OUTPUT VOLTAGE
vs. LOAD CAPACITANCE

TRANSMITTER OUTPUT VOLTAGE
vs. LOAD CURRENT PER TRANSMITTER

SLEW RATE
vs. TEMPERATURE

MAXIM

MAX3187

_____**Pin Description**

PIN	NAME	FUNCTION
1, 2, 3, 6, 8, 11, 12, 13, 16, 18	R1OUT–R10OUT	Receiver Outputs, swing between GND and V_{CC}
4, 5, 7, 14, 15, 17	T1IN–T6IN	Transmitter Inputs
9	V_{CC}	Supply-Voltage Input, 4.5V to 5.5V
10	V_{SS}	Supply-Voltage Input, -10.8V to -13.2V
27	GND	Ground. Connect system to ground.
28	V_{DD}	Supply-Voltage Input, 10.8V to 13.2V
19, 21, 24, 25, 26, 29, 31, 34, 35, 36	R10IN–R1IN	Receiver Inputs
20, 22, 23, 30, 32, 33	T6OUT–T1OUT	Transmitter Outputs, swing between V_{DD} and V_{SS}
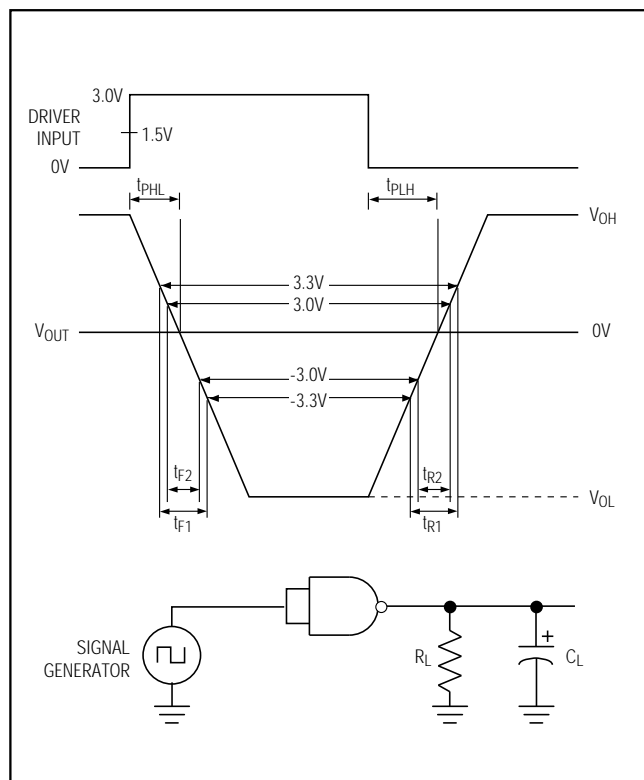
Figure 1. Slew-Rate Test Circuit and Timing Diagram

_____**Detailed Description**

±15kV ESD Protection

As with all Maxim devices, ESD-protection structures are incorporated on all pins to protect against electrostatic discharges (ESD) encountered during handling and assembly. The MAX3187 driver outputs and receiver inputs have extra protection against static electricity found in normal operation. Maxim's engineers developed state-of-the-art structures to protect these pins against ±15kV ESD, without damage. After an ESD event, the MAX3187 continues working without latchup.

ESD protection can be tested in several ways. The transmitter outputs and receiver inputs are characterized for protection to the following:

1) ±15kV using the Human Body Model

2) ±8kV using the Contact-Discharge Method specified in IEC 1000-4-2 (formerly IEC 801-2)

3) ±15kV using the Air-Gap Method specified in IEC 1000-4-2 (formerly IEC 801-2)

ESD Test Conditions

ESD performance depends on a number of conditions. Contact Maxim for a reliability report that documents test setup, methodology, and results.
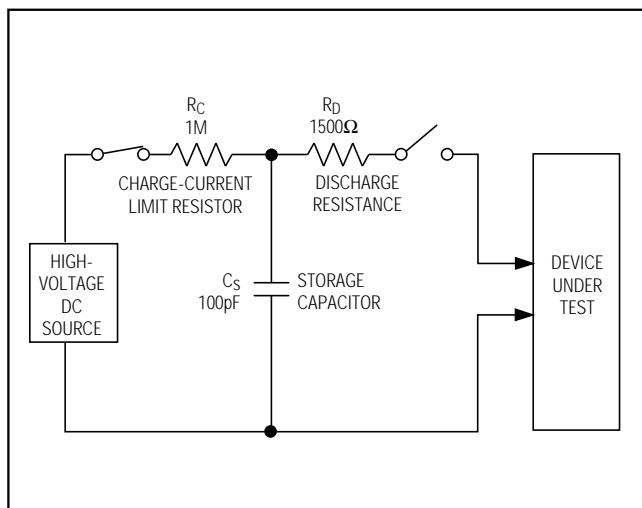
MAX3187

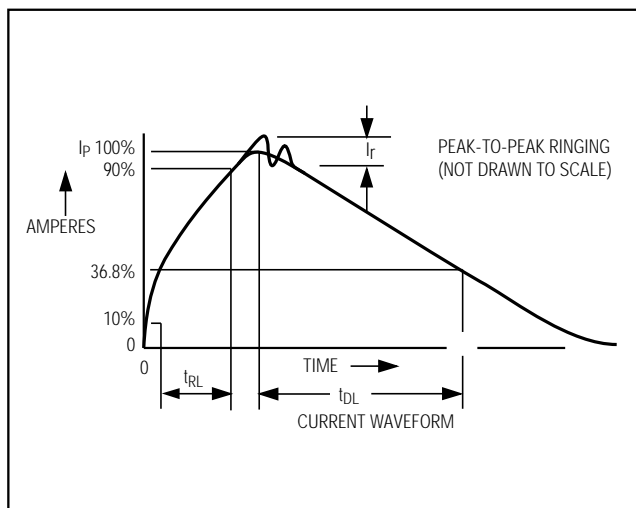Figure 2a. Human Body ESD Test Model

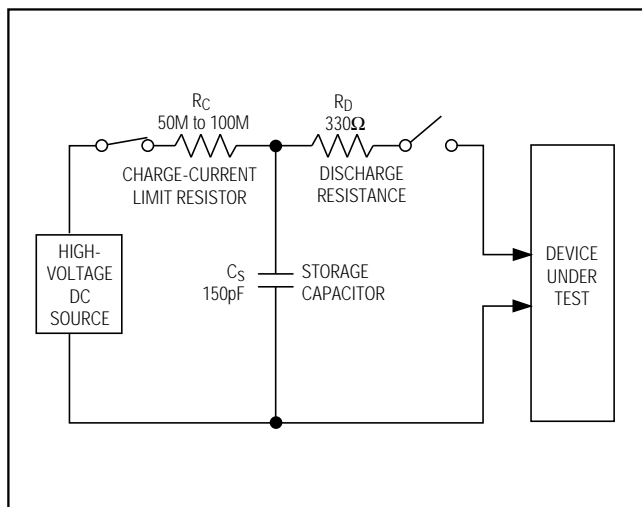Figure 2b. Human Body Model Current Waveform

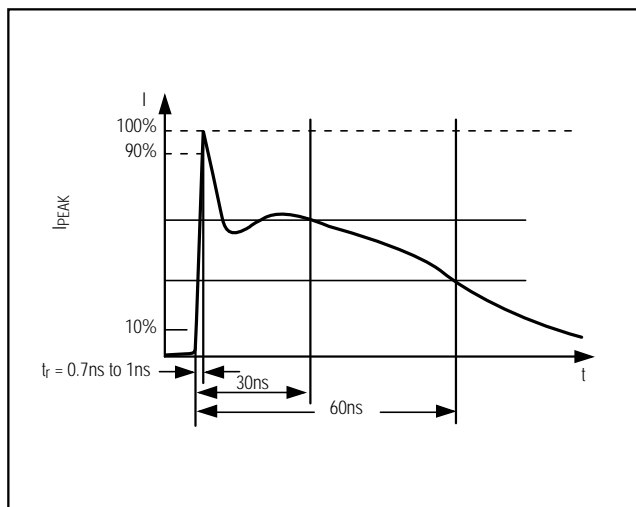Figure 3a. IEC 1000-4-2 ESD Test Model

Figure 3b. IEC 1000-4-2 ESD-Generator Current Waveform

Human Body Model

Figure 2a shows the Human Body Model, and Figure 2b 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 device through a 1.5kΩ resistor.

IEC 1000-4-2

Since January 1996, all equipment manufactured and/or sold in the European community has been required to meet the stringent IEC 1000-4-2 specification. The IEC 1000-4-2 standard covers ESD testing and performance of finished equipment; it does not specifically refer to integrated circuits. The MAX3187

helps you design equipment that meets Level 4 (the highest level) of IEC 1000-4-2, without additional ESD-protection components.

The main 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 ESD test model (Figure 3a), the ESD withstand voltage measured to this standard is generally lower than that measured using the Human Body Model. Figure 3b 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 charge probe. The Contact-Discharge method connects the probe to the device before the probe is energized.

MAXIM

±15kV ESD-Protected, EMC-Compliant, 230kbps, Dual RS-232 Serial Port for Motherboards/Desktops

Machine Model

The Machine Model for ESD testing uses a 200pF storage capacitor and zero-discharge resistance. It mimics the stress caused by handling during manufacturing and assembly. Of course, all pins (not just RS-232 inputs and outputs) require this protection during manufacturing. Therefore, the Machine Model is less relevant to the I/O ports than are the Human Body Model and IEC 1000-4-2.
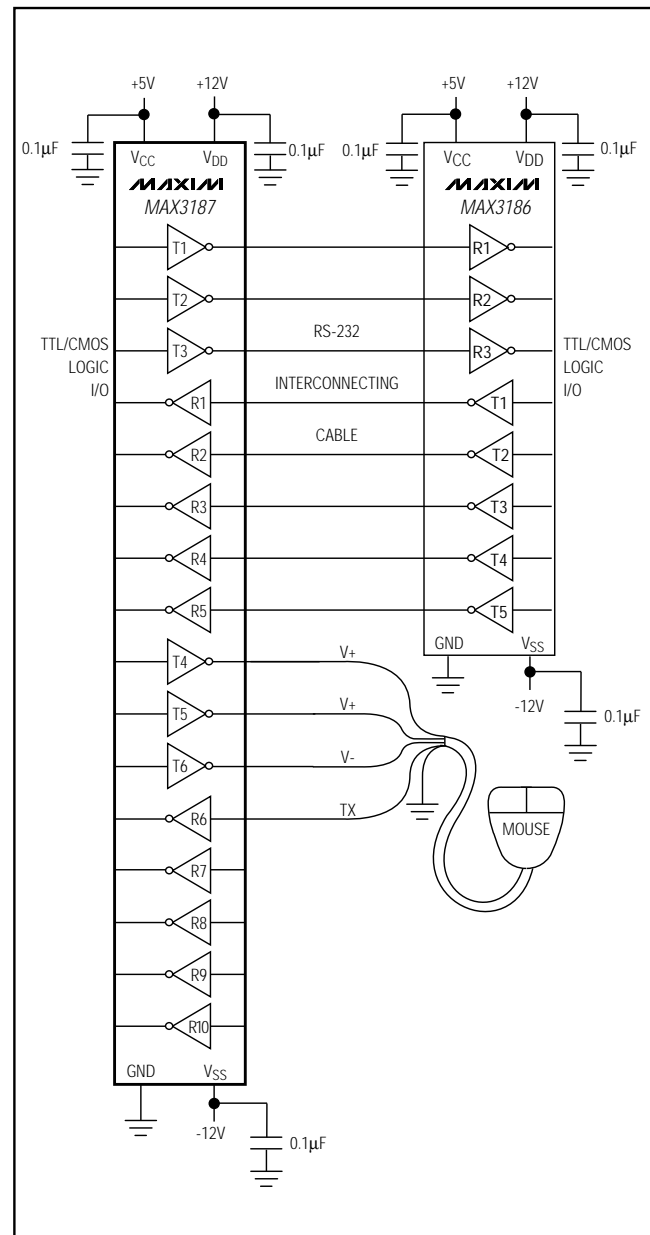
_____Applications Information

Use proper layout to ensure other devices on your board are not damaged in an ESD strike. Currents as high as 60A can instantaneously pass into ground, so be sure to minimize the ground-lead return path to the power supply. A separate return path to the power supply is recommend. Trace widths should be greater than 40 mils. Bypass V_{CC}, V_{DD}, and V_{SS} with 0.1µF capacitors as close to the part as possible to ensure maximum ESD protection.

Connect any unused transmitter inputs to GND or V_{CC}. The MAX3187 is not sensitive to power-supply sequencing, and therefore requires no external protection diodes.

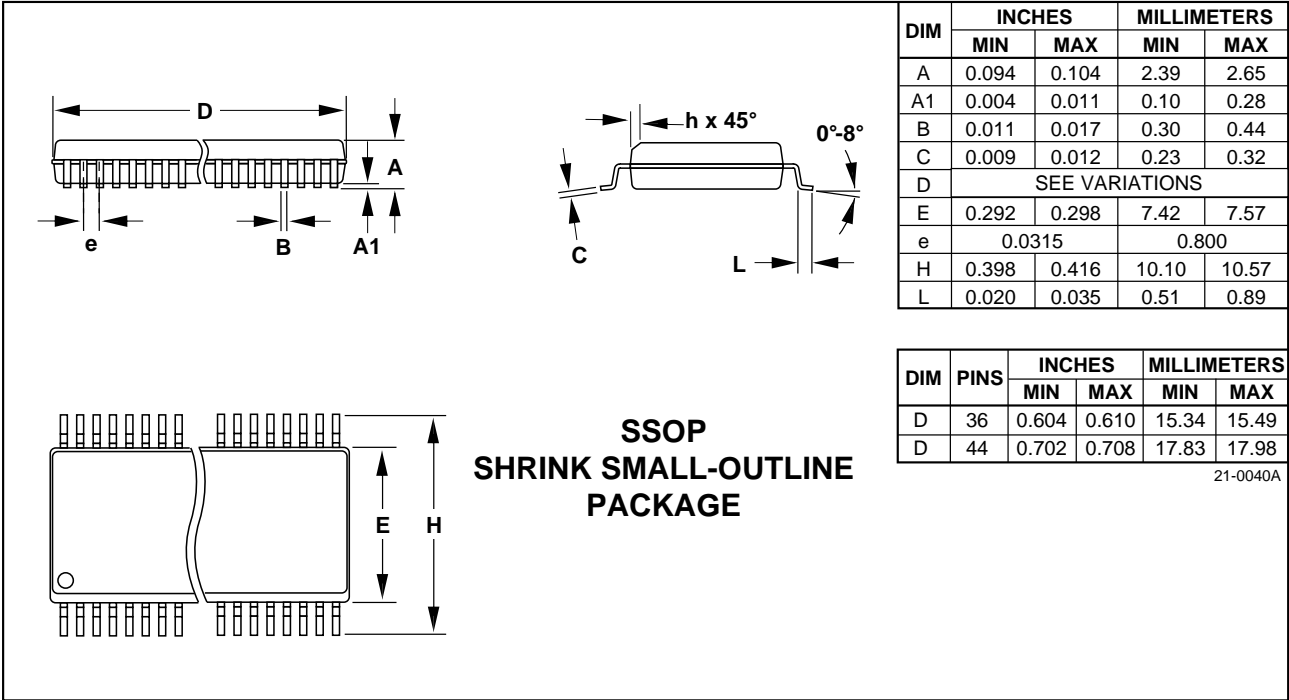## _____Chip Information

TRANSISTOR COUNT: 419

_____Typical Operating Circuit

MAX3187

Package Information

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.094	0.104	2.39	2.65
A1	0.004	0.011	0.10	0.28
B	0.011	0.017	0.30	0.44
C	0.009	0.012	0.23	0.32
D	SEE VARIATIONS			
E	0.292	0.298	7.42	7.57
e	0.0315		0.800	
H	0.398	0.416	10.10	10.57
L	0.020	0.035	0.51	0.89

DIM	PINS	INCHES		MILLIMETERS	
		MIN	MAX	MIN	MAX
D	36	0.604	0.610	15.34	15.49
D	44	0.702	0.708	17.83	17.98

21-0040A

**SSOP
SHRINK SMALL-OUTLINE
PACKAGE**