19-1289; Rev 0; 10/97

MAXIM

1µA Supply Current, 3.0V to 5.5V, 1Mbps RS-232 Transceiver with AutoShutdown Plus

General Description

The MAX3244/MAX3245 are 3V-powered EIA/TIA-232 and V.28/V.24 communications interfaces with automatic shutdown/wakeup features and high data-rate capabilities.

The transceivers have a proprietary low-dropout transmitter output stage enabling true RS-232 performance from a 3.0V to 5.5V supply with a dual charge pump. The MAX3244 is guaranteed to run at a data rate of 250kbps while maintaining RS-232 output levels. The MAX3245 is guaranteed to run at a data rate of 1Mbps using Maxim's MegaBaud™ feature. The devices are complete serial ports (3 drivers, 5 receivers) intended for notebook or subnotebook computers.

The MAX3244/MAX3245 achieve a 1µA supply current using Maxim's revolutionary AutoShutdown Plus™ feature, which automatically saves power without changes to the existing BIOS or operating system. They shut down after 30sec if the RS-232 cable is disconnected or if the transmitters of the connected peripherals are idle. The devices turn on again when a valid edge is applied to any transmitter or receiver input.

Applications

Notebook, Subnotebook, and Palmtop Computers

Battery-Powered Equipment

Hand-Held Equipment

Peripherals

Printers

Typical Operating Circuit appears at end of data sheet.

AutoShutdown Plus and MegaBaud are trademarks of Maxim Integrated Products.

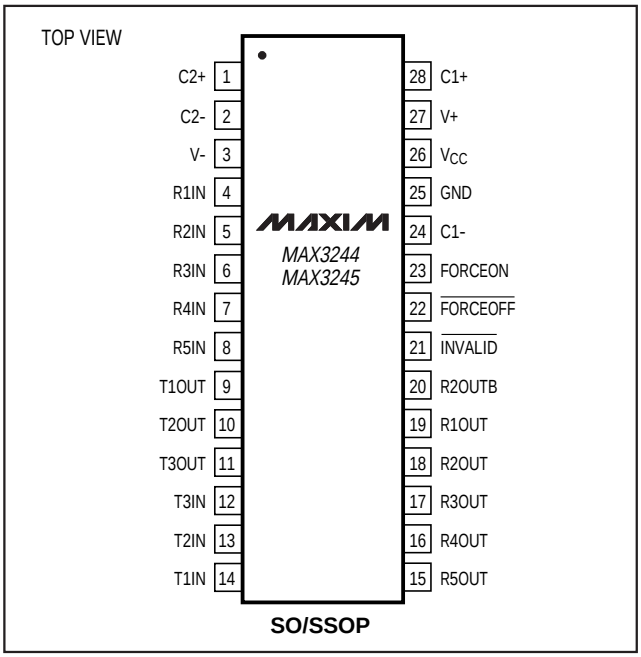
Features

- ♦ **1µA Supply Current Achieved with AutoShutdown Plus**
- ♦ **Guaranteed Data Rate:**
  250kbps (MAX3244)
  1Mbps (MAX3245)
- ♦ **Meets EIA/TIA-232 Specifications Down to 3.0V**
- ♦ **Guaranteed Slew Rate:**
  6V/µs (MAX3244)
  24V/µs (MAX3245)
- ♦ **Guaranteed Mouse Driveability**
- ♦ **Small, 0.1µF Capacitors**

Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
MAX3244CWI	0°C to +70°C	28 SO
MAX3244CAI	0°C to +70°C	28 SSOP
MAX3244EWI	-40°C to +85°C	28 SO
MAX3244EAI	-40°C to +85°C	28 SSOP
MAX3245CWI	0°C to +70°C	28 SO
MAX3245CAI	0°C to +70°C	28 SSOP
MAX3245EWI	-40°C to +85°C	28 SO
MAX3245EAI	-40°C to +85°C	28 SSOP

Pin Configuration



SO/SSOP

1µA Supply Current, 3.0V to 5.5V, 1Mbps RS-232 Transceiver with AutoShutdown Plus

ABSOLUTE MAXIMUM RATINGS

V_{CC} .....-0.3V to +6V
V+ .....-0.3V to +7V
V- .....+0.3V to -7V
V+ + |V-| .....+13V
Input Voltages
  T_IN, FORCEON, $\overline{FORCEOFF}$ .....-0.3V to +6V
  R_IN .....±25V
Output Voltages
  T_OUT .....±13.2V
  R_OUT, R2OUTB, $\overline{INVALID}$ .....-0.3V to (V_{CC} + 0.3V)
Short-Circuit Duration
  T_OUT (one at a time) .....Continuous
Continuous Power Dissipation (T_A = +70°C)
  SO (derate 12.5mW/°C above +70°C) 1000mW
  SSOP (derate 9.52mW/°C above +70°C) 762mW
Operating Temperature Ranges
  MAX324_C_ I .....0°C to +70°C
  MAX324_E_ I .....-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; C1–C4 = 0.1µF, tested at 3.3V ±10%; C1 = 0.047µF, C2–C4 = 0.33µF, tested at 5.0V ±10%; T_A = T_{MIN} to T_{MAX}; unless otherwise noted. Typical values are at T_A = +25°C.)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
DC CHARACTERISTICS (V_{CC} = 3.3V or 5.0V, T_A = +25°C, no load)						
Supply Current	FORCEON = $\overline{FORCEOFF}$ = V_{CC}			0.3	1.0	mA
Shutdown Supply Current	$\overline{FORCEOFF}$ = GND			1.0	10.0	µA
AutoShutdown Plus Supply Current	FORCEON = GND, $\overline{FORCEOFF}$ = V_{CC}, all R_IN idle, all T_IN idle			1.0	10.0	µA
LOGIC INPUTS AND RECEIVER OUTPUTS						
Input Logic Threshold Low	T_IN, FORCEON, $\overline{FORCEOFF}$				0.8	V
Input Logic Threshold High	T_IN, FORCEON, $\overline{FORCEOFF}$	V_{CC} = 3.3V	2.0			V
		V_{CC} = 5.0V	2.4			
Transmitter Input Hysteresis				0.5		V
Input Leakage Current	T_IN, FORCEON, $\overline{FORCEOFF}$			±0.01	±1.0	µA
Output Leakage Current	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
RECEIVER INPUTS						
Input Voltage Range			-25		25	V
Input Threshold Low	V_{CC} = 3.3V		0.6	1.1		V
	V_{CC} = 5.0V		0.8	1.4		
Input Threshold High	V_{CC} = 3.3V			1.6	2.4	V
	V_{CC} = 5.0V			1.9	2.4	
Input Hysteresis				0.5		V
Input Resistance	T_A = +25°C		3	5	7	kΩ
TRANSMITTER OUTPUTS						
Output Voltage Swing	All transmitter outputs loaded with 3kΩ to ground		±5.0	±5.4		V
Output Resistance	V_{CC} = V+ = V- = 0V, transmitter output = ±2V		300	10M		Ω
Output Short-Circuit Current				±35	±60	mA
Output Leakage Current	V_{CC} = 0V to 5.5V, transmitter output = ±12V, transmitters disabled				±25	µA

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = +3.0V to +5.5V; C1–C4 = 0.1µF, tested at 3.3V ±10%; C1 = 0.047µF, C2–C4 = 0.33µF, tested at 5.0V ±10%; T_A = T_{MIN} to T_{MAX}; unless otherwise noted. Typical values are at T_A = +25°C.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
MOUSE DRIVEABILITY					
Transmitter Output Voltage	T1IN = T2IN = GND, T3IN = V_{CC}, T3OUT loaded with 3kΩ to ground, T1OUT and T2OUT loaded with 2.5mA each	±5			V
AUTOSHUTDOWN PLUS (FORCEON = GND, $\overline{FORCEOFF}$ = V_{CC})					
Receiver Input Threshold to $\overline{INVALID}$ Output Voltage High	Positive threshold			2.7	V
	Negative threshold	-2.7			
Receiver Input Threshold to $\overline{INVALID}$ Output Voltage Low		-0.3		0.3	V
$\overline{INVALID}$ Output Voltage Low	I_{OUT} = 1.6mA			0.4	V
$\overline{INVALID}$ Output Voltage High	I_{OUT} = -1.0mA	V_{CC} - 0.6			V
Receiver Positive or Negative Threshold to $\overline{INVALID}$ High, t_{INVH}	Figure 3		1		µs
Receiver Positive or Negative Threshold to $\overline{INVALID}$ Low, t_{INVL}	Figure 3		30		µs
Receiver or Transmitter Edge to Transmitters Enabled, t_{WU}	Figure 3		100		µs
Receiver or Transmitter Edge to Transmitters Shut Down, $t_{AUTOSHDN}$	Figure 3	15	30	60	sec

TIMING CHARACTERISTICS—MAX3244

(V_{CC} = +3.0V to +5.5V; C1–C4 = 0.1µF, tested at 3.3V ±10%; C1 = 0.047µF, C2–C4 = 0.33µF, tested at 5.0V ±10%; T_A = T_{MIN} to T_{MAX}; unless otherwise noted. Typical values are at T_A = +25°C.)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Maximum Data Rate	R_L = 3kΩ, C_L = 1000pF, one transmitter switching		250			kbps
Receiver Propagation Delay	R_IN to R_OUT, C_L = 150pF	t_{PHL}		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} |			100		ns
Receiver Skew	| t_{PHL} - t_{PLH} |			50		ns
Transition-Region Slew Rate	V_{CC} = 3.3V, T_A = +25°C, R_L = 3kΩ to 7kΩ, measured from +3V to -3V or -3V to +3V	C_L = 150pF to 1000pF	6		30	V/µs
		C_L = 150pF to 2500pF	4		30	

TIMING CHARACTERISTICS—MAX3245

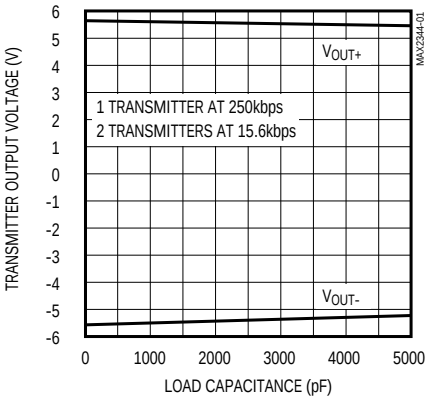
(V_{CC} = +3.0V to +5.5V; C1–C4 = 0.1µF, tested at 3.3V ±10%; C1 = 0.047µF, C2–C4 = 0.33µF, tested at 5.0V ±10%; T_A = T_{MIN} to T_{MAX}; unless otherwise noted. Typical values are at T_A = +25°C.)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
Maximum Data Rate	R_L = 3kΩ, C_L = 1000pF, one transmitter switching		250			kbps
	V_{CC} = 3.0V to 4.5V, R_L = 3kΩ, C_L = 250pF, one transmitter switching		1000			
	V_{CC} = 4.5V to 5.5V, R_L = 3kΩ, C_L = 1000pF, one transmitter switching		1000			
Receiver Propagation Delay	R_IN to R_OUT, C_L = 150pF	t_{PHL}		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} |			25		ns
Receiver Skew	| t_{PHL} - t_{PLH} |			50		ns
Transition-Region Slew Rate	V_{CC} = 3.3V, T_A = +25°C, R_L = 3kΩ to 7kΩ, C_L = 150pF to 1000pF, measured from +3V to -3V or -3V to +3V		24		150	V/µs

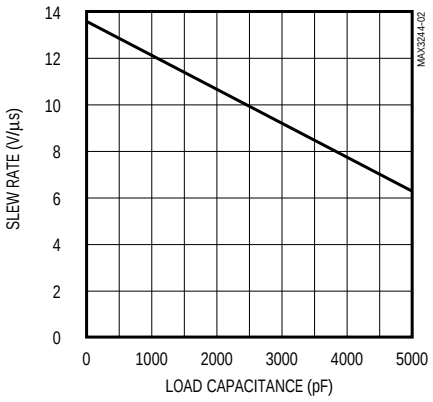
Typical Operating Characteristics

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

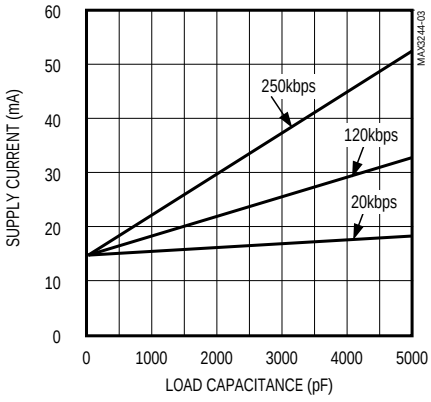
TRANSMITTER OUTPUT VOLTAGE vs. LOAD CAPACITANCE



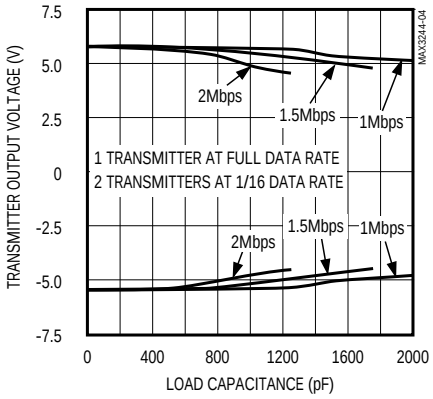
MAX3244 SLEW RATE vs. LOAD CAPACITANCE



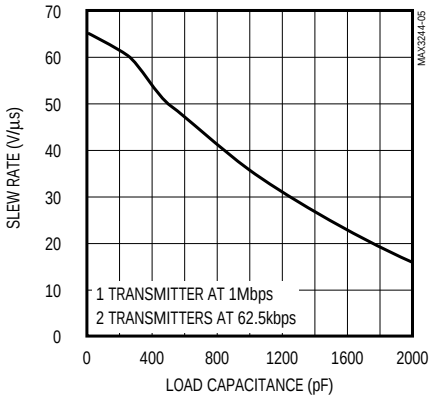
MAX3244 SUPPLY CURRENT vs. LOAD CAPACITANCE



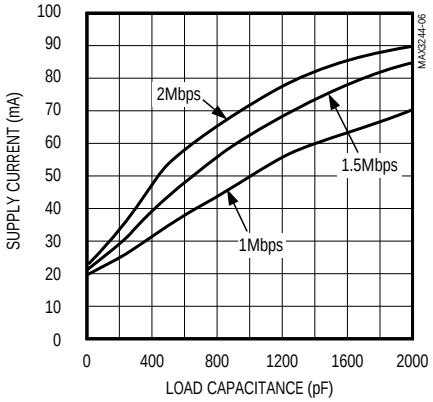
MAX3245 TRANSMITTER OUTPUT VOLTAGE vs. LOAD CAPACITANCE



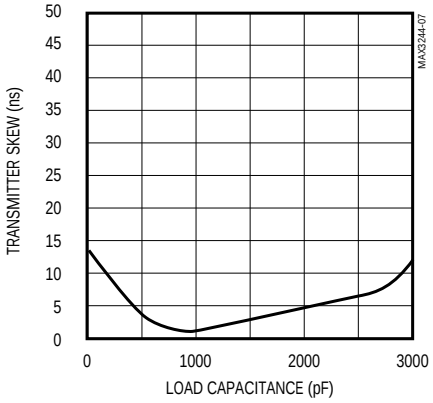
MAX3245 SLEW RATE vs. LOAD CAPACITANCE



MAX3245 SUPPLY CURRENT vs. LOAD CAPACITANCE



MAX3245 TRANSMITTER SKEW vs. LOAD CAPACITANCE



1µA Supply Current, 3.0V to 5.5V, 1Mbps RS-232 Transceiver with AutoShutdown Plus

Pin Description

PIN	NAME	FUNCTION
1	C2+	Positive Terminal of Inverting Charge-Pump Capacitor
2	C2-	Negative Terminal of Inverting Charge-Pump Capacitor
3	V-	-5.5V Generated by the Charge Pump
4–8	R1IN–R5IN	RS-232 Receiver Inputs
9, 10, 11	T1OUT, T2OUT, T3OUT	RS-232 Transmitter Outputs
12, 13, 14	T3IN, T2IN, T1IN	TTL/CMOS Transmitter Inputs
15–19	R5OUT–R1OUT	TTL/CMOS Receiver Outputs
20	R2OUTB	Noninverting Complementary Receiver Output, always active
21	$\overline{\text{INVALID}}$	Active-Low Output of the Valid Signal Detector. A logic high indicates that a valid RS-232 level is present on a receiver input.
22	$\overline{\text{FORCEOFF}}$	Active-Low Force-Off Input. Drive low to shut down transmitters, receivers (except R2OUTB), and on-board supply. This overrides AutoShutdown Plus and FORCEON (Table 1).
23	FORCEON	Force-On Input. Drive high to override AutoShutdown Plus, keeping transmitters and receivers on ($\overline{\text{FORCEOFF}}$ must be high) (Table 1).
24	C1-	Negative Terminal of Voltage-Doubler Charge-Pump Capacitor
25	GND	Ground
26	V_{CC}	+3.0V to +5.5V Supply Voltage
27	V+	+5.5V Generated by the Charge Pump
28	C1+	Positive Terminal of Voltage-Doubler Charge-Pump Capacitor

Detailed Description

Dual Charge-Pump Voltage Converter

The MAX3244/MAX3245's internal power supply consists of a regulated dual charge pump that provides output voltages of +5.5V (doubling charge pump) and -5.5V (inverting charge pump) for input voltages (V_{CC}) over the 3.0V to 5.5V range. The charge pumps operate in a discontinuous mode: if the output voltages are less than 5.5V, the charge pumps are enabled; if the output voltages exceed 5.5V, the charge pumps are disabled. Each charge pump requires a flying capacitor (C1, C2) and a reservoir capacitor (C3, C4) to generate the V+ and V- supplies.

RS-232 Transmitters

The transmitters are inverting level translators that convert CMOS-logic levels to 5.0V EIA/TIA-232 levels. The MAX3244 transmitters guarantee a 250kbps data rate (1Mbps for the MAX3245) with worst-case loads of 3kΩ in parallel with 1000pF, providing compatibility with PC-to-PC communication software (such as LapLink™). Transmitters can be paralleled to drive multiple receivers.

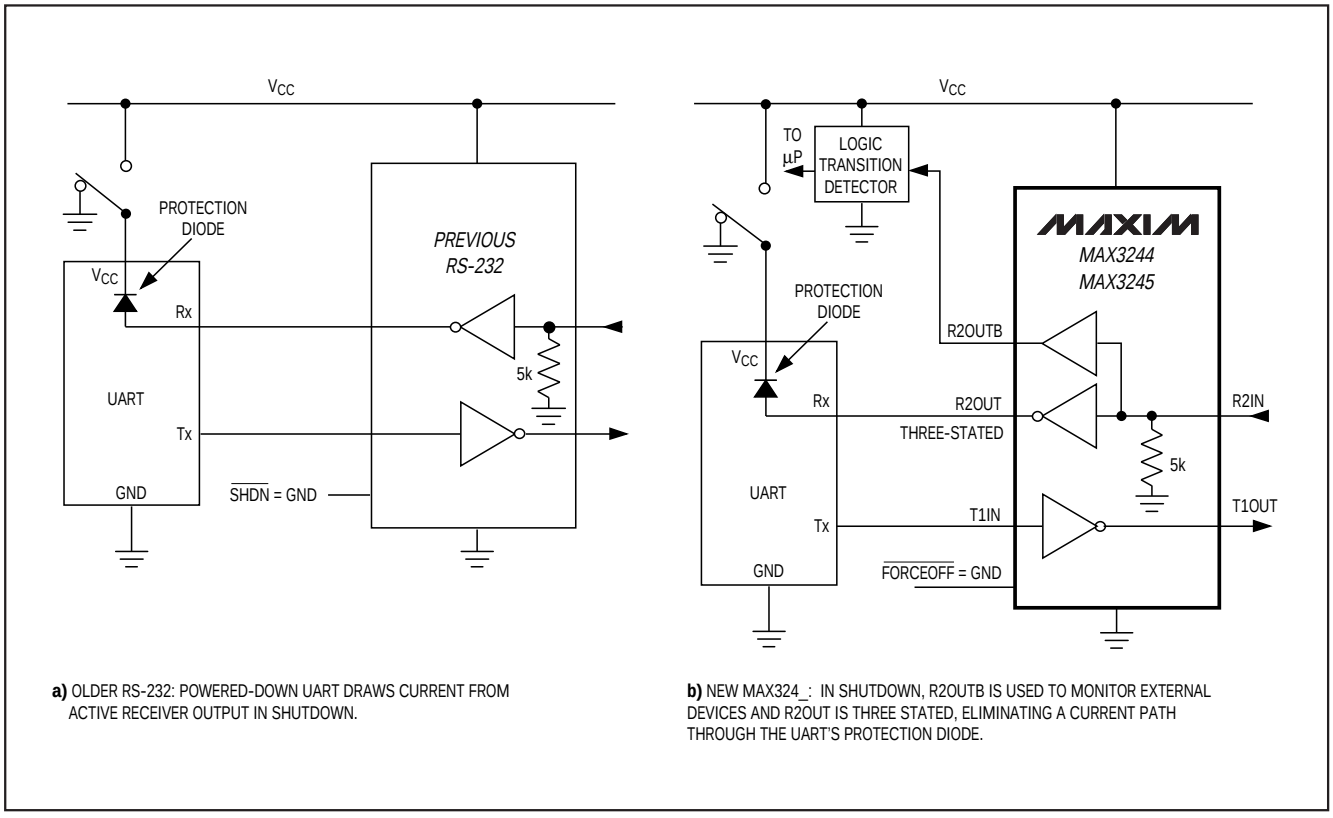
When FORCEON = GND and $\overline{\text{FORCEOFF}}$ = V_{CC}, if the AutoShutdown Plus circuitry does not sense a valid transition on any receiver or transmitter for 30sec, the part shuts down and the transmitter outputs are high impedance.

When powered off or shut down, the MAX3244/MAX3245 permit the outputs to be driven up to ±12V. The transmitter inputs do not have pull-up resistors. Connect unused inputs to GND or V_{CC}.

RS-232 Receivers

The receivers convert RS-232 signals to CMOS-logic output levels. All receivers have inverting three-state outputs, and can be active or inactive (Table 1). The devices feature an extra, always-active noninverting output, R2OUTB. This allows ring indicator applications to be monitored without forward biasing other devices connected to the receiver outputs. This is ideal for systems where V_{CC} is set to 0V in shutdown to accommodate peripherals, such as UARTs (Figure 1).

LapLink is a trademark of Traveling Software.



a) OLDER RS-232: POWERED-DOWN UART DRAWS CURRENT FROM ACTIVE RECEIVER OUTPUT IN SHUTDOWN.

b) NEW MAX324_: IN SHUTDOWN, R2OUTB IS USED TO MONITOR EXTERNAL DEVICES AND R2OUT IS THREE STATED, ELIMINATING A CURRENT PATH THROUGH THE UART'S PROTECTION DIODE.

Figure 1. Detection of RS-232 Activity when the UART and Interface are Shut Down

Table 1. Output Control Truth Table

FORCEON	$\overline{\text{FORCEOFF}}$	TRANSMITTER OR RECEIVER EDGE WITHIN 30sec	OPERATION STATUS	T_OUT	R_OUT	R2OUTB
X	0	X	Shutdown (Forced Off)	High-Z	High-Z	Active
1	1	X	Normal Operation (Forced On)	Active	Active	Active
0	1	Yes	Normal Operation (AutoShutdown Plus)	Active	Active	Active
0	1	No	Shutdown (AutoShutdown Plus)	High-Z	Active	Active

1µA Supply Current, 3.0V to 5.5V, 1Mbps RS-232 Transceiver with AutoShutdown Plus

Table 2. $\overline{\text{INVALID}}$ Truth Table

RS-232 SIGNAL PRESENT AT ANY RECEIVER INPUT	$\overline{\text{INVALID}}$ OUTPUT
Yes	H
No	L

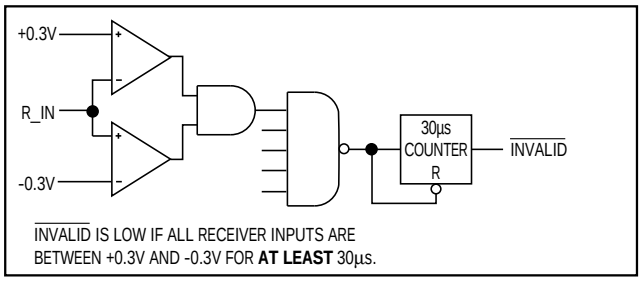


Figure 2a. Invalid Receiver Levels

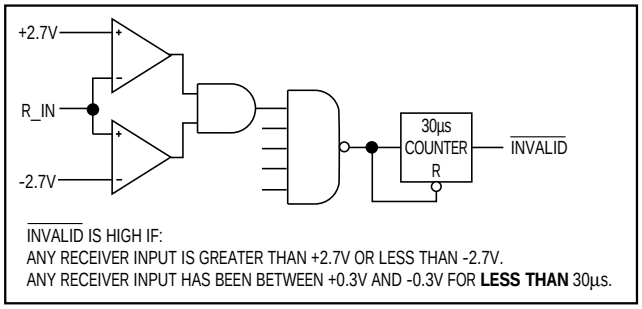


Figure 2b. Valid Receiver Levels

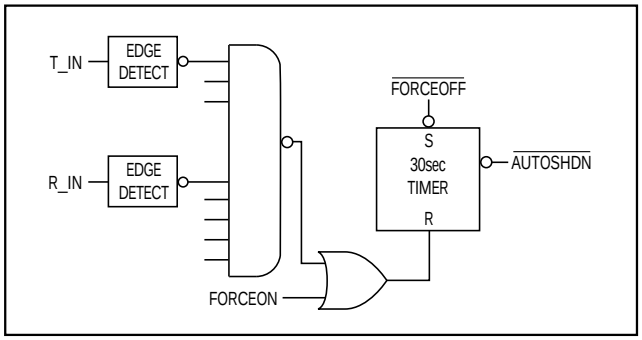


Figure 2c. AutoShutdown Plus Edge Detection

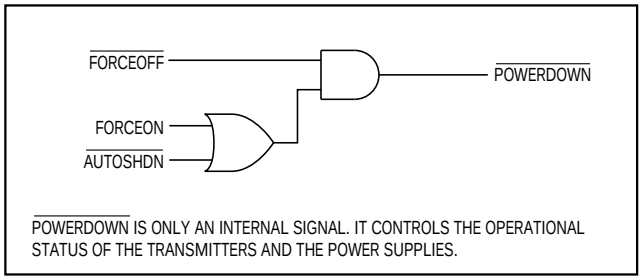


Figure 2d. AutoShutdown Plus Logic

AutoShutdown Plus Mode

The MAX3244/MAX3245 achieve a 1µA supply current with Maxim's AutoShutdown Plus feature, which operates when FORCEON is low and $\overline{\text{FORCEOFF}}$ is high. When the MAX3244/MAX3245 do not sense a valid signal transition on any receiver or transmitter input for 30sec, the on-board power supply and drivers are shut off, reducing supply current to 1µA. This occurs if all transmitter and receiver inputs are idle. The system turns on again when a valid transition is applied to any receiver or transmitter input. As a result, the system saves power without changes to the existing BIOS or operating system.

Figures 2a and 2b depict valid and invalid RS-232 receiver levels. $\overline{\text{INVALID}}$ indicates the receiver inputs' condition, and it is independent of the FORCEON and $\overline{\text{FORCEOFF}}$ states. Figure 2 and Tables 1 and 2 summarize the MAX3244/MAX3245 operating modes. FORCEON and $\overline{\text{FORCEOFF}}$ override the AutoShutdown Plus circuitry. When neither control is asserted, the IC selects between these states automatically based on the last receiver or transmitter input edge received. Figure 3 shows a timing diagram for AutoShutdown Plus operation. The time required to exit shutdown is typically 100µs (Figure 4).

When shut down, the device's charge pumps are turned off, V+ is pulled to V_{CC}, V- is pulled to ground, and the transmitter outputs are disabled (high impedance).

By connecting $\overline{\text{INVALID}}$ to FORCEON, the MAX3244/MAX3245 shut down when no valid receiver level and no receiver or transmitter edge is detected for 30sec, and wake up when a valid receiver level or receiver or transmitter edge is detected.

By connecting $\overline{\text{INVALID}}$ to FORCEON and $\overline{\text{FORCEOFF}}$, the MAX3244/MAX3245 shut down when no valid receiver level is detected, and wake up when a valid receiver level is detected.

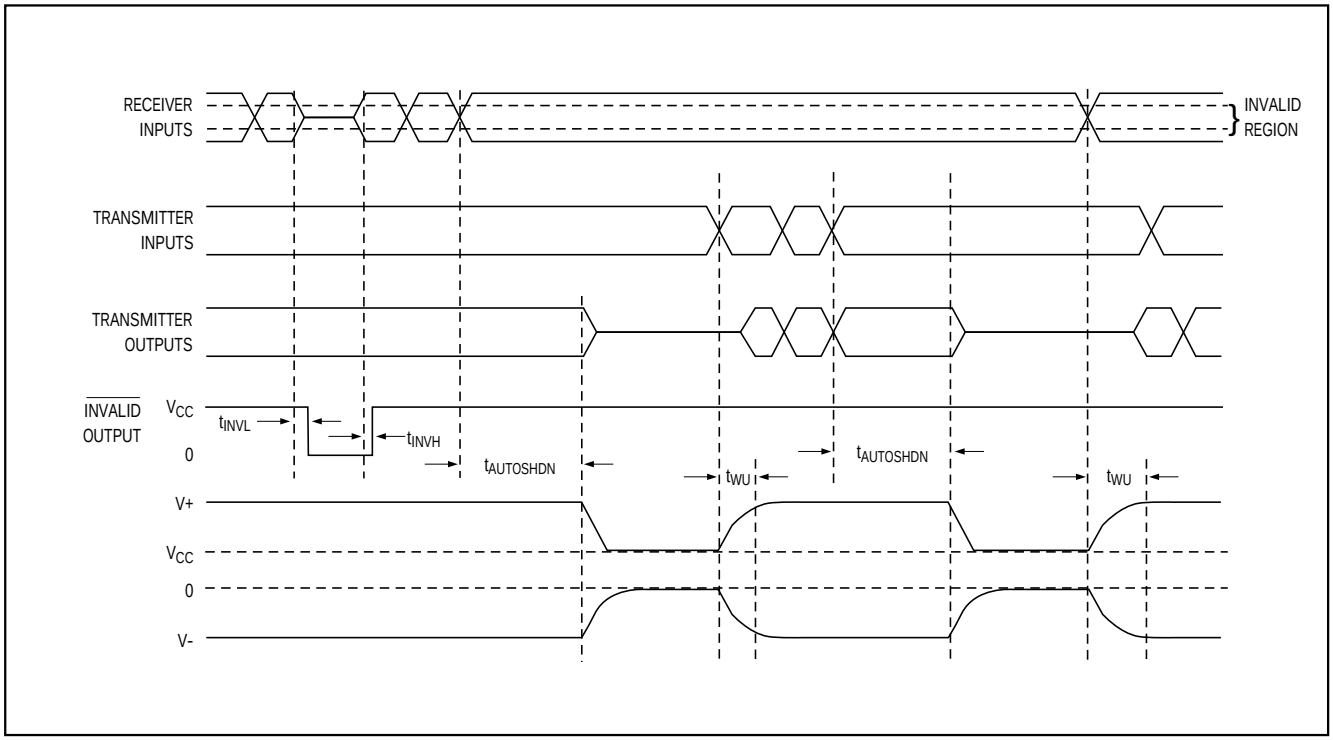


Figure 3. AutoShutdown Plus and INVALID Timing Diagram

Software-Controlled Shutdown

If direct software control is desired, INVALID can be used to indicate DTR or ring indicator signal. Tie FORCEOFF and FORCEON together to bypass AutoShutdown so the line acts like a SHDN input.

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 3.3V operation. For other supply voltages, refer to Table 3 for required capacitor values. Do not use values smaller than those listed in Table 3. Increasing the capacitor values 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, C4, and C_{BYPASS}, to maintain the proper ratios (C1 to the other capacitors).**

Table 3. Required Minimum Capacitance Values

SUPPLY VOLTAGE (V)	C1 (µF)	C2, C3, C4, C_{BYPASS} (µF)
3.0 to 3.6	0.1	0.1
4.5 to 5.5	0.047	0.33
3.0 to 5.5	0.1	0.47

When using the minimum required capacitor values, make sure the capacitance 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 applications that are sensitive to power-supply noise, decouple V_{CC} to ground with a capacitor of the same value as reservoir capacitors C2, C3, and C4. Connect the bypass capacitor as close to the IC as possible.

1µA Supply Current, 3.0V to 5.5V, 1Mbps RS-232 Transceiver with AutoShutdown Plus

Transmitter Outputs when Exiting Shutdown

Figure 4 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 V- exceeds approximately -3V.

High Data Rates

The MAX3244 maintains the RS-232 ±5.0V minimum transmitter output voltage even at high data rates. Figure 5 shows a transmitter loopback test circuit. Figure 6 shows a loopback test result at 120kbps, and Figure 7 shows the same test at 250kbps. For Figure 6, all transmitters were driven simultaneously at 120kbps into RS-232 loads in parallel with 1000pF. For Figure 7, a single transmitter was driven at 250kbps, and all transmitters were loaded with an RS-232 receiver in parallel with 1000pF.

The MAX3245 maintains the RS-232 ±5.0V minimum transmitter output voltage with data rates up to 1Mbps (MegaBaud). Figure 8 shows a loopback test result with a single transmitter driven at 1Mbps, and all transmitters loaded with an RS-232 receiver in parallel with 250pF.

Interconnection with 3V and 5V Logic

The MAX3244/MAX3245 can directly interface with various 5V logic families, including ACT and HCT CMOS. See Table 4 for more information on possible combinations of interconnections.

Mouse Driveability

The MAX3244/MAX3245 have been specifically designed to power serial mice while operating from low-voltage power supplies. They have been tested with leading mouse brands from manufacturers such as Microsoft and Logitech. The MAX3244/MAX3245 successfully drove all serial mice tested and met their respective current and voltage requirements. Figure 9a shows the transmitter outputs under increasing load current. The MAX3244/MAX3245 switching regulator ensures the transmitters will supply at least ±5V under worst-case conditions. Figure 9b shows a typical mouse connection.

The AutoShutdown Plus feature does not work with a mouse; connect FORCEON and $\overline{\text{FORCEOFF}}$ to V_{CC}.

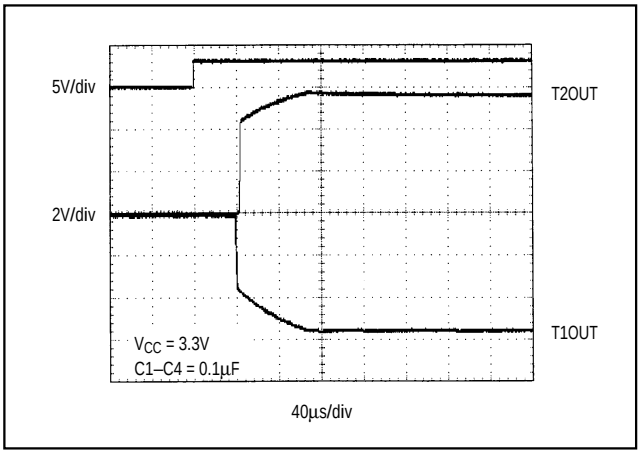


Figure 4. Transmitter Outputs Exiting Shutdown or Powering Up

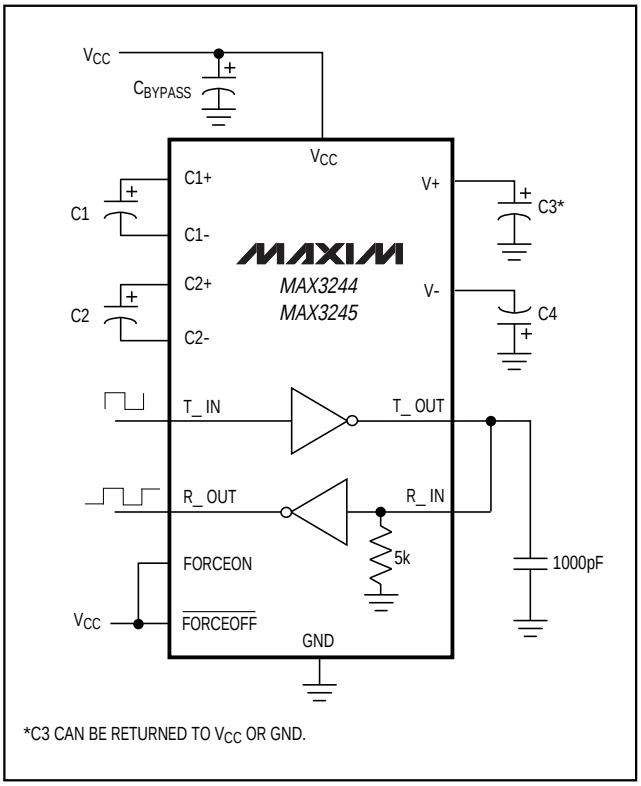


Figure 5. Loopback Test Circuit

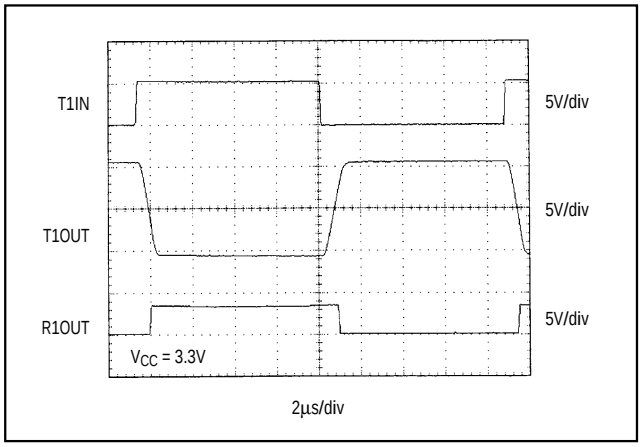


Figure 6. MAX3244 Loopback Test Result at 120kbps

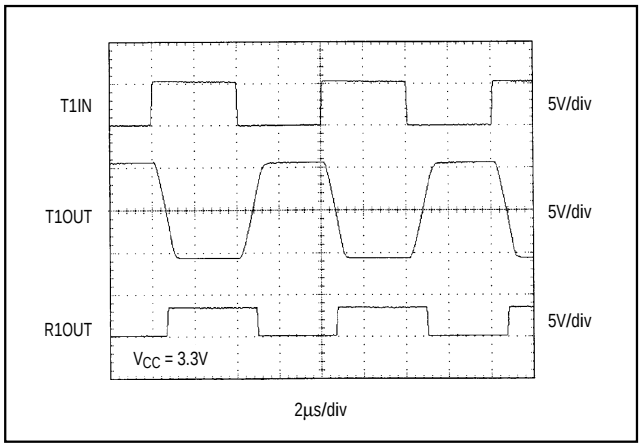


Figure 7. MAX3244 Loopback Test Result at 250kbps

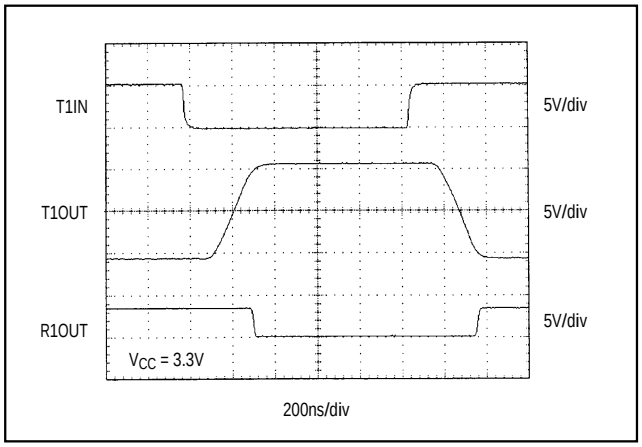


Figure 8. MAX3245 Loopback Test Result at 1Mbps

Table 4. Logic Family Compatibility with Various Supply Voltages

SYSTEM POWER-SUPPLY VOLTAGE (V)	VCC SUPPLY VOLTAGE (V)	COMPATIBILITY
3.3	3.3	Compatible with all CMOS families.
5	5	Compatible with all TTL and CMOS families
5	3.3	Compatible with ACT and HCT CMOS, and with AC, HC, or CD4000 CMOS.

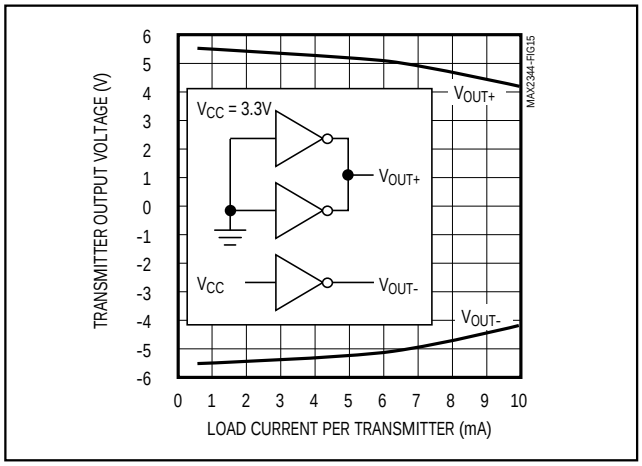


Figure 9a. MAX324_ Transmitter Output Voltage vs. Load Current per Transmitter

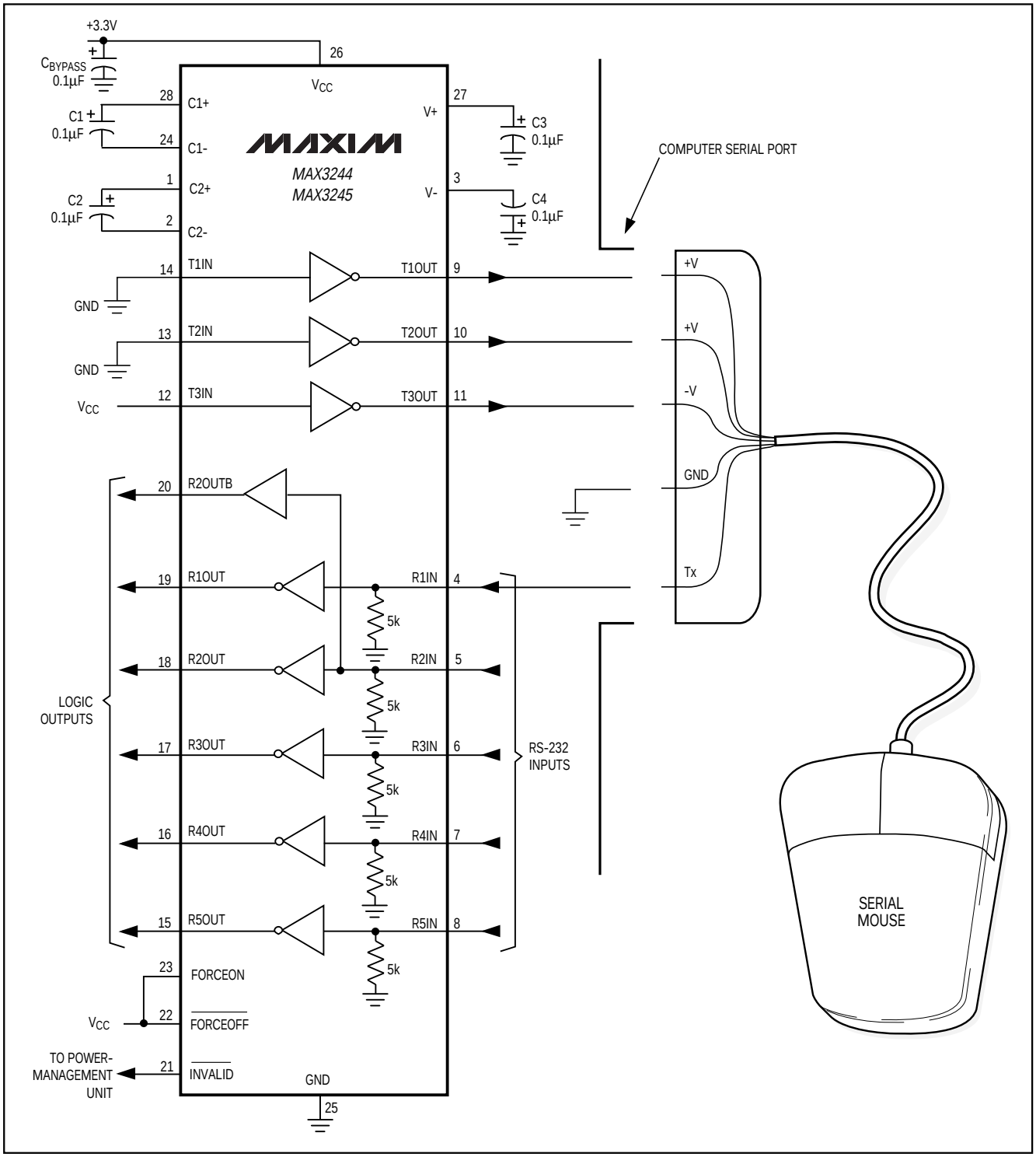
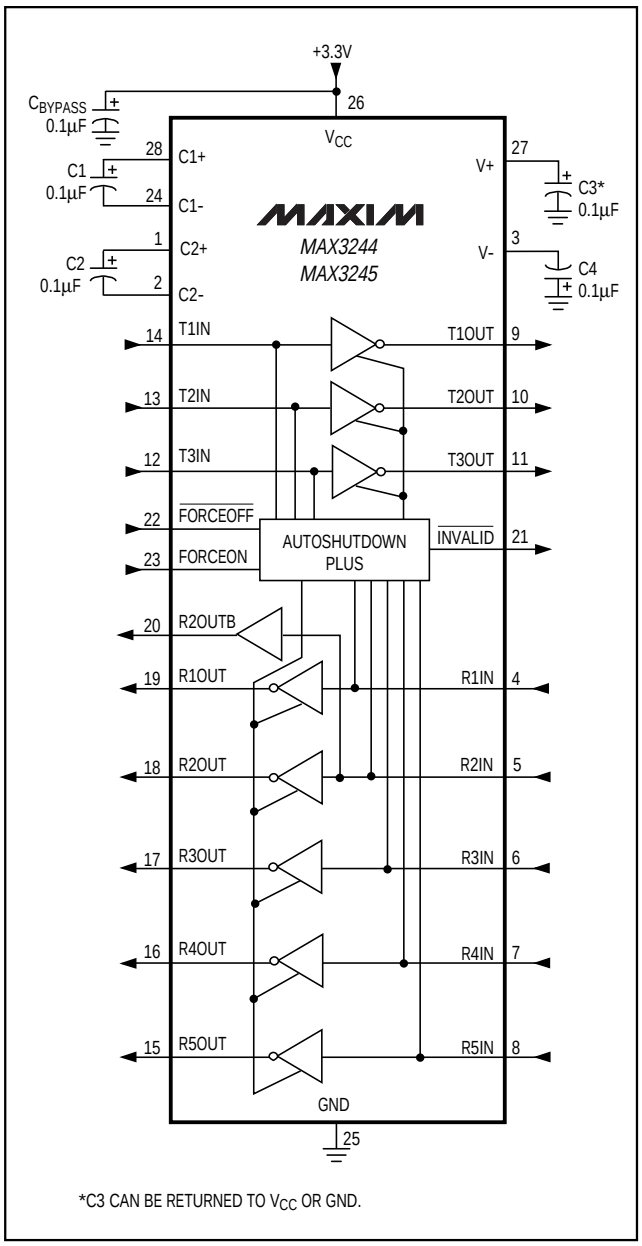


Figure 9b. Mouse Driver Test Circuit

Typical Operating Circuit



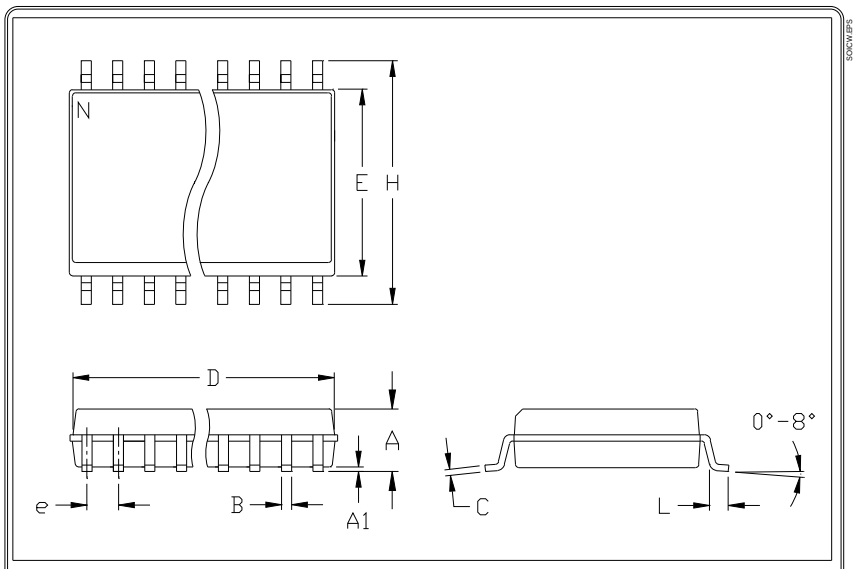
*C3 CAN BE RETURNED TO V_{CC} OR GND.

Chip Information

TRANSISTOR COUNT: 1335

1µA Supply Current, 3.0V to 5.5V, 1Mbps RS-232 Transceiver with AutoShutdown Plus

Package Information



	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.093	0.104	2.35	2.65
A1	0.004	0.012	0.10	0.30
B	0.014	0.019	0.35	0.49
C	0.009	0.013	0.23	0.32
e	0.050		1.27	
E	0.291	0.299	7.40	7.60
H	0.394	0.419	10.00	10.65
h	0.010	0.030	0.25	0.75
L	0.016	0.050	0.40	1.27

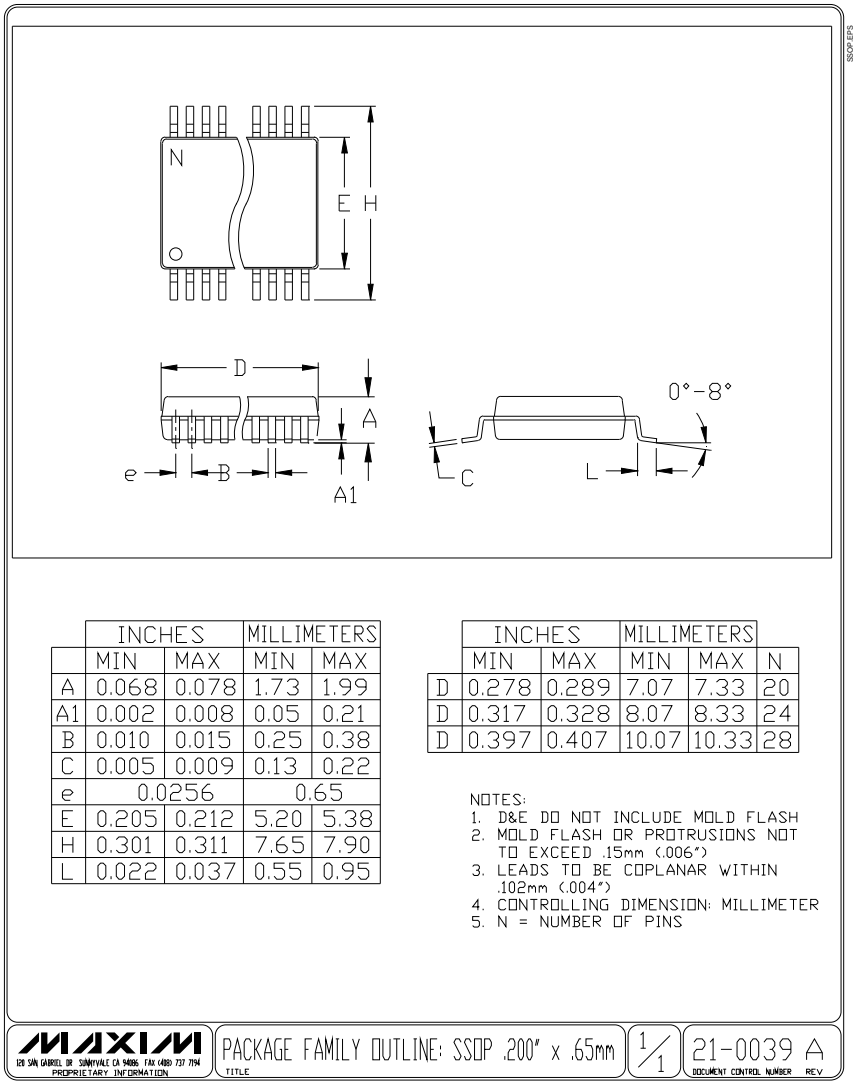
	INCHES		MILLIMETERS			
	MIN	MAX	MIN	MAX	N	MS013
D	0.398	0.413	10.10	10.50	16	AA
D	0.447	0.463	11.35	11.75	18	AB
D	0.496	0.512	12.60	13.00	20	AC
D	0.598	0.614	15.20	15.60	24	AD
D	0.697	0.713	17.70	18.10	28	AE

NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED .15mm (.006")
3. LEADS TO BE COPLANAR WITHIN .102mm (.004")
4. CONTROLLING DIMENSION: MILLIMETER
5. MEETS JEDEC MS013-XX AS SHOWN IN ABOVE TABLE
6. N = NUMBER OF PINS

MAXIM — 120 SAN GABRIEL DR SUNNYVALE CA 94086 FAX (408) 737 7194 PROPRIETARY INFORMATION

PACKAGE FAMILY OUTLINE: SOIC .300" (TITLE) | 1/1 | 21-0042 A (DOCUMENT CONTROL NUMBER — REV.)

Package Information (continued)



	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.068	0.078	1.73	1.99
A1	0.002	0.008	0.05	0.21
B	0.010	0.015	0.25	0.38
C	0.005	0.009	0.13	0.22
e	0.0256		0.65	
E	0.205	0.212	5.20	5.38
H	0.301	0.311	7.65	7.90
L	0.022	0.037	0.55	0.95

	INCHES		MILLIMETERS		
	MIN	MAX	MIN	MAX	N
D	0.278	0.289	7.07	7.33	20
D	0.317	0.328	8.07	8.33	24
D	0.397	0.407	10.07	10.33	28

NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED .15mm (.006")
3. LEADS TO BE COPLANAR WITHIN .102mm (.004")
4. CONTROLLING DIMENSION: MILLIMETER
5. N = NUMBER OF PINS

MAXIM 120 SAN GABRIEL DR SUNNYVALE CA 94086 FAX (408) 737 7194
PROPRIETARY INFORMATION

PACKAGE FAMILY OUTLINE: SSOP .200" x .65mm
TITLE

1/1

21-0039 A
DOCUMENT CONTROL NUMBER REV

NOTES