SP338E

REV. 1.0.0



GENERAL DESCRIPTION

The SP338 is an advanced multiprotocol transceiver supporting RS-232, RS-485, and RS-422 serial standards in a 40 pin QFN package. Integrated cable termination and four configuration modes allow all three protocols to be used interchangeably over a single cable or connector with no additional switching components. Full operation requires only four external charge pump capacitors.

The RS-485/422 modes feature up to two drivers and four receivers (2TX/4RX) in half, full, and mixed duplex configurations. The RS-232 mode (3TX/5RX) provides full support of all eight signals commonly used with the DB9 RS-232 connector. A dedicated diagnostic loopback mode is also provided.

The high speed drivers operate up to 20Mbps in RS-485/422 modes, and up to 1Mbps in RS-232 mode. All drivers can be slew limited to 250kbps in any mode to minimize electromagnetic interference (EMI).

All transmitter outputs and receiver inputs feature robust electrostatic discharge (ESD) protection to ±15kV Human Body Model (HBM) and ±8kV IEC-61000-4-2 Contact. Each receiver output has full failsafe protection to avoid system lockup, oscillation, or indeterminate states by defaulting to logic-high output level when the inputs are open, shorted, or terminated but undriven. No external biasing resistors are required.

The RS-232 receiver inputs include a $5k\Omega$ pull-down to ground. The RS-485/422 receiver inputs are high impedance (>96k Ω when termination is disabled), allowing up to 256 devices on a single communication bus (1/8th unit load).

The SP338 operates from a single power supply, either 3.3V or 5V, with low idle current. The shutdown mode consumes less than $10\mu A$ for low power standby operation.

FEATURES

- Pin selectable Cable Termination
- No external resistors required for RS-485/422 termination and biasing
- 3.3V or 5V Single Supply Operation
- Robust ESD Protection on bus pins
 - ±15kV Human Body Model (HBM)
 - ±8kV IEC 61000-4-2 (Contact)
- Max Data Rate of 20Mbps in RS-485/422 Modes and up to 1Mbps in RS-232 Modes
- Pin selectable 250kbps Slew Limiting
- 3 Drivers, 5 Receivers RS-232/V.28
- 2 Drivers, 4 Receivers RS-485/422
 - Full, Half, and Mixed Duplex Configurations
 - 1/8th Unit Load, up to 256 receivers on bus
- RS-485/422 Enhanced Failsafe for open, shorted, or terminated but idle inputs
- Space saving 6mm x 6mm QFN-40 Package
- Pin compatible with SP339E

TYPICAL APPLICATIONS

- Dual Protocol Serial Ports (RS-232 or RS-485/422)
- Industrial Computers
- Industrial and Process Control Equipment
- Point-Of-Sale Equipment
- Networking Equipment
- HVAC Controls Equipment
- Building Security and Automation Equipment

PACKAGE	OPERATING TEMPERATURE RANGE	DEVICE STATUS
40-pin QFN	-40°C to +85°C	Active
40-pin QFN	-40°C to +85°C	Active
40-pin QFN	0°C to +70°C	Active
40-pin QFN	0°C to +70°C	Active
	40-pin QFN 40-pin QFN 40-pin QFN	40-pin QFN -40°C to +85°C 40-pin QFN -40°C to +85°C 40-pin QFN 0°C to +70°C

ORDERING INFORMATION

Exar Corporation 48720 Kato Road, Fremont CA, 94538 • (510) 668-7000 • FAX (510) 668-7017 • www.exar.com

REV. 1.0.0

ABSOLUTE MAXIMUM RATINGS

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections to the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability and cause permanent damage to the device.

Supply Voltage V _{CC}	-0.3V to +6.0V
Receiver Input Voltage (from Ground)	±18V
Driver Output Voltage (from Ground)	±18V
Short Circuit Duration, TX out to Ground	Continuous
Voltage at TTL Input Pins	-0.3V to (V _{CC} + 0.5V)
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C
Power Dissipation 40-pin QFN (derate 17mW/°C above +70°C)	500mW

CAUTION:

ESD (ElectroStatic Discharge) sensitive device. Permanent damage may occur on unconnected devices subject to high energy electrostatic fields. Unused devices must be stored in conductive foam or shunts. Personnel should be properly grounded prior to handling this device. The protective foam should be discharged to the destination socket before devices are removed.

ESD PROTECTION

		Min.	Typ.	Max.	UNITS	
R1-R9	Tx Output & Rx Input Pins		±15		kV	Human Body Model (HBM)
11-113			±8		kV	IEC 61000-4-2 (Contact)
	All Other Pins		±2		kV	Human Body Model (HBM)



RS-232/RS-485/RS-422 TRANSCEIVER WITH INTERNAL TERMINATION

PIN DESCRIPTIONS BY MODE (MODE2, MODE1, MODE0)

Pin	Name	000,	001,	010,	011,	100,	101,	110,	111,		
PIN	Name	Figure 1	Figure 2	Figure 3	Figure 4	Figure 5	Figure 6	Figure 7	Figure 8		
1	L1	R1 0	utput	1	1	1	1	1	1		
2	L2	R2 0	utput	R1 Output	R1 Output	R1 Output	R1 Output	R1 Output	R1 Output		
3	L3	T1 li	nput	T1 Input	T1 Input	T1 Input	T1 Input	T1 Input	T1 Input		
4	L4	T2 li	nput								
5	L6	R3 0	utput	1	1	1	1	1	R2 Output		
6	L7	T3 li	nput			T2 Input			T2 Input		
7	L8	R4 0	utput	1	1	R2 Output	1	1	R3 Output		
8	L9	R5 O	utput	1	1	1	1	1	R4 Output		
9	VCC				V	cc					
10	GND		Ground								
11	SLEW			S	LEW = V _{CC} e	nables 250kb	ops slew limiti	ng			
12	DIR1			T1 Enable, R1 Disable	T1 Enable	T1 Enable	T1 Enable	T1 Enable, R1 Disable	T1 Enable, R1 Disable		
13	DIR2					T2 Enable			T2 Enable, R2 Disable		
14	MODE0	0	1	0	1	0	1	0	1		
15	MODE1	0	0	1	1	0	0	1	1		
16	MODE2	0	0	0	0	1	1	1	1		
17	TERM		Enables RS-485/422 receiver termination								
18	INVDIR			Inverts	DIR1 and DI	R2, where ap	plicable				
19	ENABLE		13	NABLE = V _{CC}	for operation	, ENABLE = (0V for shutdo	wn			
20	VCC				V	CC					



REV. 1.0.0

PIN DESCRIPTIONS BY MODE (MODE2, MODE1, MODE0)

Pin	Name	000,	001,	010,	011,	100,	101,	110,	111,		
• • • •	Name	Figure 1	Figure 2	Figure 3	Figure 4	Figure 5	Figure 6	Figure 7	Figure 8		
21	R9		R5 Input			R2 Input B	R1 Input B		R4 Input B		
22	R8		R4 Input			R2 Input A			R4 Input A		
23	GND				Gro	und					
24	R7		T3 Output			T2 Out A	R1 Input A		R3 Input A T2 Out A		
25	R6		R3 Input			T2 Out B			R3 Input B T2 Out B		
26	GND				Gro	und					
27	R4		T2 Output		R1 Input B	R1 Input B	T1 Out A	R1 Input A T1 Out A	R2 Input B		
28	R3		T1 Output		R2 Input A	R1 Input A			R2 Input A		
29	GND				Gro	und					
30	R2		R2 Input	R1 Input A T1 Out A	T1 Out A	T1 Out A			R1 Input A T1 Out A		
31	R1		R1 Input	R1 Input B T1 Out B	T1 Out B	T1 Out B	T1 Out B	R1 Input B T1 Out B	R1 Input B T1 Out B		
32	VCC				V	CC					
33	VSS		V	/ _{SS} - Charge (oump negativ	e supply, 0.1ı	IF from groun	ıd			
34	C2-			C ₂₊ - 0	Charge pump	cap 2 negativ	/e lead				
35	C1-			C ₁₋ - C	Charge pump	cap 1 negativ	ve lead				
36	GND		Ground								
37	C1+		C ₁₊ - Charge pump cap 1 positive lead, 0.1uF								
38	VCC				V	CC					
39	C2+			C ₂₊ - Cha	irge pump ca	p 2 positive le	ad, 0.1uF				
40	VDD			V _{DD} - Charge	e pump positi	ve supply, 0.1	uF to ground				



SP338E

ELECTRICAL CHARACTERISTICS

UNLESS OTHERWISE NOTED:

 V_{CC} = +3.3V ±5% or +5.0V ±5%, C1-C4 = 0.1µF; T_A = T_{MIN} to T_{MAX}. Typical values are at V_{CC} = 3.3V, T_A = +25°C.

SYMBOL	PARAMETERS	MIN.	Typ.	MAX.	UNITS	CONDITIONS
DC CHARAC	TERISTICS					
I _{CC}	Supply Current (RS-232)		2	10	mA	No load, idle inputs
I _{CC}	Supply Current (RS-485)		4	10	mA	No load, idle inputs
I _{CC}	Vcc Shutdown Current		1	10	μA	ENABLE = 0V
TRANSMITT	ER and LOGIC INPUT PINS: Pins 3, 4,	6, 11-19)			
V _{IH}	Logic Input Voltage High	2.0			V	V _{CC} = 3.3V
V _{IH}	Logic Input Voltage High	2.4			V	V _{CC} = 5.0V
V _{IL}	Logic Input Voltage Low			0.8	V	
۱ _{IL}	Logic Input Leakage Current Low			1	μA	Input Low (V _{IN} = 0V)
Ι _{ΙΗ}	Logic Input Leakage Current High			1	μA	Input High (V _{IN} = V _{CC}), pins 3, 4 and 6
I _{PD}	Logic Input Pull-down Current			50	μA	Input High (V _{IN} = V _{CC}), pins 11-19
V _{HYS}	Logic Input Hysteresis		200		mV	
RECEIVER (OUTPUTS: Pins 1, 2, 5, 7, 8	<u> </u>				
V _{OH}	Receiver Output Voltage High	V _{CC} -0.6			V	I _{OUT} = -1.5mA
V _{OL}	Receiver Output Voltage Low			0.4	V	I _{OUT} = 2.5mA
I _{OSS}	Receiver Output ShortCircuit Current		±20	±60	mA	$0 \leq V_O \leq V_{CC}$
I _{OZ}	Receiver Output Leakage Current		±0.1	±1	μA	$0 \le V_O \le V_{CC,}$ Receivers disabled



ELECTRICAL CHARACTERISTICS (Continued)

UNLESS OTHERWISE NOTED:

 V_{CC} = +3.3V ±5% or +5.0V ±5%, C1-C4 = 0.1µF; T_A = T_{MIN} to T_{MAX}. Typical values are at V_{CC} = 3.3V, T_A = +25°C.

SYMBOL	PARAMETERS	Min.	TYP.	Max.	Units	CONDITIONS
SINGLE-EN	DED RECEIVER INPUTS (RS-232	2)				
V _{IN}	Input Voltage Range	-15		+15	V	
V _{IL}	Input Threshold Low	0.6	1.2		V	V _{CC} = 3.3V
۷Ľ	Input mieshold Low	0.8	1.5		V	V _{CC} = 5.0V
V _{IH}	Input Throphold Lligh		1.5	2.0	V	V _{CC} = 3.3V
ЧН	Input Threshold High		1.8	2.4	V	V _{CC} = 5.0V
V _{HYS}	Input Hysteresis		0.3		V	
R _{IN}	Input Resistance	3	5	7	kΩ	$-15V \le V_{IN} \le +15V$
SINGLE-EN	DED DRIVER OUTPUTS (RS-232	2)				
Vo	Output Voltage Swing	±5.0	±5.5		V	Output loaded with $3k\Omega$ to Gro
•0				±7.0	V	No load output
I _{SC}	Short Circuit Current			±60	mA	V _O = 0V
R _{OFF}	Power Off Impedance	300	10M		Ω	$V_{CC} = 0V, V_{O} = \pm 2V$



REV. 1.0.0

RS-232/RS-485/RS-422 TRANSCEIVER WITH INTERNAL TERMINATION

ELECTRICAL CHARACTERISTICS (Continued)

UNLESS OTHERWISE NOTED: V_{CC} = +3.3V ±5% or +5.0V ±5%, C1-C4 = 0.1µF; T_A = T_{MIN} to T_{MAX}. Typical values are at V_{CC} = 3.3V, T_A = +25°C.

SYMBOL	PARAMETERS	Min.	Typ.	Max.	Units	CONDITIONS
DIFFERENT	IAL RECEIVER INPUTS (RS-485 / RS-4	122)				
R _{IN}	Receiver Input Resistance	96			kΩ	TERM = 0V, -7V \leq V _{IN} \leq +12V
V_{TH}	Receiver Differential Threshold Voltage	-200	-125	-50	mV	
ΔV_{TH}	Receiver Input Hysteresis		25		mV	V _{CM} = 0V
I _{IN}	Receiver Input Current			125	μA	V _{IN} = +12V
'IN	Receiver input Current			-100	μA	V _{IN} = -7V
R _{TERM}	Termination Resistance	100	120	155	Ω	TERM = V _{CC} , Figure 9 -7V \leq V _{CM} \leq +12V
R _{TERM}	Termination Resistance	100	120	140	Ω	TERM = V _{CC} , Figure 9 V _{CM} = 0V
DIFFERENT	IAL DRIVER OUTPUTS (RS-485 / RS-4	22)	•	1		
		2		V _{CC}	V	R _L = 100Ω (RS-422), Figure 10
V _{OD}	Differential Driver Output	1.5		V _{CC}	V	R_{L} = 54Ω (RS-485), Figure 10
• OD		1.5		V _{CC}	V	V _{CM} = -7V, Figure 11
		1.5		V _{CC}	V	V _{CM} = +12V, Figure 11
ΔV_{OD}	Change In Magnitude of Differential Output Voltage	-0.2		+0.2	V	R_L = 54Ω or 100Ω, Figure 10
V _{CM}	Driver CommonMode Output Voltage			3	V	$R_L = 54\Omega$ or 100 Ω , Figure 10
ΔV_{CM}	Change In Magnitude of Common Mode Output Voltage			0.2	V	R_L = 54Ω or 100Ω, Figure 10
I _{OSD}	Driver Output Short Circuit Current			±250	mA	-7V \leq V _O \leq +12V, Figure 12
Ι _Ο	Driver Output Leakage Current			±100	μΑ	ENABLE = 0V, or DIR1 = 0V and DIR2 = 0V in full duplex modes, $-7V \le V_0 \le +12V$



TIMING CHARACTERISTICS

UNLESS OTHERWISE NOTED:

 V_{CC} = +3.3V ±5% or +5.0V ±5%, C1-C4 = 0.1µF; T_A = T_{MIN} to T_{MAX}. Typical values are at V_{CC} = 3.3V, T_A = +25°C.

SYMBOL	PARAMETERS	Min.	Typ.	MAX.	Units	CONDITIONS
ALL MODES						
t _{ENABLE}	Enable from Shutdown		1000		ns	
t _{SHUTDOWN}	Enable to Shutdown		1000		ns	
RS-232, DAT	A RATE = 250kbps (SLEW = Vcc), Of	NE TRAN	SMITTER	R SWITC	HING	
	Maximum Data Rate	250			kbps	R _L = 3kΩ, C _L = 1000pF
t _{RHL} , t _{RLH}	Receiver Propagation Delay		100		ns	$C_1 = 150 pF, Figure 13$
t _{RHL} -t _{RLH}	Receiver Propagation Delay Skew			100	ns	
t _{DHL} , t _{DLH}	Driver Propagation Delay		1400		ns	R _L = 3kΩ, C _L = 2500pF,
t _{DHL} -t _{DLH}	Driver Propagation Delay Skew			600	ns	Figure 14
			1			
t _{SHL,} t _{SLH}	Transition Region Slew Rate from +3.0V to -3.0V or -3.0V to +3.0V	4		30	V/µs	V_{CC} = 3.3V, R_L = 3k Ω to 7k Ω , C_L = 150pF to 2500pF, Figure 14
t _{SHL,} t _{SLH}	Transition Region Slew Rate from +3.0V to -3.0V or -3.0V to +3.0V	6		30	V/µs	V_{CC} = 3.3V, R _L = 3kΩ to 7kΩ, C _L = 150pF to 2500pF, T _A = 25°C, Figure 14
RS-232, DAT	A RATE = 1Mbps (SLEW = 0V), ONE	TRANSM	ITTER S	witchi	NG	
,	Maximum Data Rate	1			1	R_{L} = 3kΩ, C_{L} = 250pF
t _{RHL} , t _{RLH}	Receiver Propagation Delay		100		ns	
t _{RHL} -t _{RLH}	Receiver Propagation Delay Skew			100	ns	C _L = 150pF, Figure 13
t _{DHL} , t _{DLH}	Driver Propagation Delay		300		ns	R _L = 3kΩ, C _L = 1000pF,
t _{DHL} -t _{DLH}	Driver Propagation Delay Skew			150	ns	Figure 14
t _{SHL,} t _{SLH}	Transition Region Slew Rate from +3.0V to -3.0V or -3.0V to +3.0V	15		150	V/µs	V_{CC} = 3.3V, R_L = 3k Ω to 7k Ω , C _L = 150pF to 1000pF, Figure 14
t _{SHL} , t _{SLH} Transition Region Slew Rate from +3.0V to -3.0V to +3.0V		24		150	V/µs	V_{CC} = 3.3V, R _L = 3kΩ to 7kΩ, C _L = 150pF to 1000pF, T _A = 25°C, Figure 14



REV. 1.0.0

RS-232/RS-485/RS-422 TRANSCEIVER WITH INTERNAL TERMINATION

TIMING CHARACTERISTICS (Continued)

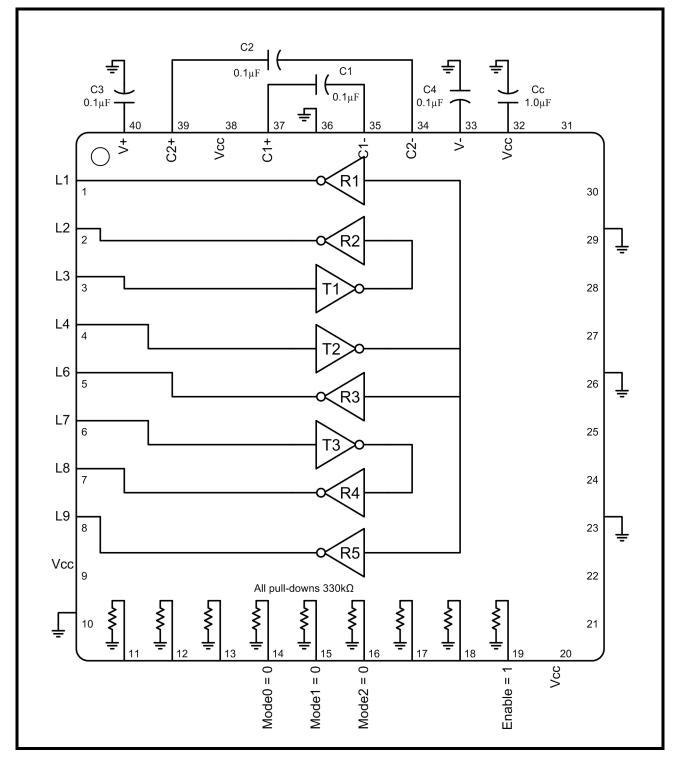
UNLESS OTHERWISE NOTED: V_{CC} = +3.3V ±5% or +5.0V ±5%, C1-C4 = 0.1µF; T_A = T_{MIN} to T_{MAX}. Typical values are at V_{CC} = 3.3V, T_A = +25°C.

SYMBOL	PARAMETERS	Min.	Typ.	Max.	UNITS	CONDITIONS
RS-485/RS-42	2, DATA RATE = 250kbps (SLEW = V	/cc), ONE		MITTER	SWITC	HING
	Maximum Data Rate	250			kbps	R_L = 54 Ω , C_L = 50pF
t _{RPHL} , t _{RPLH}	Receiver Propagation Delay		50	150	ns	
t _{RPHL} -t _{RPLH}	Receiver Propagation Delay Skew			20	ns	C _L = 15pF, Figure 15
t _{DPHL} , t _{DPLH}	Driver Propagation Delay		500	1000	ns	
t _{DPHL} -t _{DPLH}	Driver Propagation Delay Skew			100	ns	$R_L = 54\Omega$, $C_L = 50$ pF, Figure 16
t _{DR,} t _{DF}	Driver Rise and Fall Time	300	650	1200	ns	
	1		1	1	1	
t _{RZH} , t _{RZL}	Receiver Output Enable Time			200	ns	C _I = 15pF, Figure 17
t _{RHZ} , t _{RLZ}	Receiver Output Disable Time			200	ns	
t _{DZH} , t _{DZL}	Driver Output Enable Time			1000	ns	R _L = 500Ω, C _L = 50pF,
t _{DHZ} , t _{DLZ}	Driver Output Disable Time			200	ns	Figure 18
RS-485/RS-42	2, DATA RATE = 20Mbps (SLEW = 0	V), ONE 1	RANSN	IITTER S	WITCH	NG
	Maximum Data Rate	20			Mbps	$R_L = 54\Omega, C_L = 50pF$
t _{RPHL} , t _{RPLH}	Receiver Propagation Delay		50	150	ns	C _L = 15pF, Figure 15
t _{RPHL} -t _{RPLH}	Receiver Propagation Delay Skew			10	ns	
t _{DPHL} , t _{DPLH}	Driver Propagation Delay		30	100	ns	
t _{DPHL} -t _{DPLH}	Driver Propagation Delay Skew			10	ns	$R_L = 54\Omega, C_L = 50pF,$ Figure 16
t _{DR,} t _{DF}	Driver Rise and Fall Time		10	20	ns	
	1	1	T	T		1
t _{RZH} , t _{RZL}	Receiver Output Enable Time			200	ns	C ₁ = 15pF, Figure 17
t _{RHZ} , t _{RLZ}	Receiver Output Disable Time			200	ns	
t _{DZH} , t _{DZL}	Driver Output Enable Time			200	ns	R _L = 500Ω, C _L = 50pF,
t _{DHZ} , t _{DLZ}	Driver Output Disable Time			200	ns	Figure 18



BLOCK DIAGRAM BY MODE (MODE2, MODE1, MODE0)

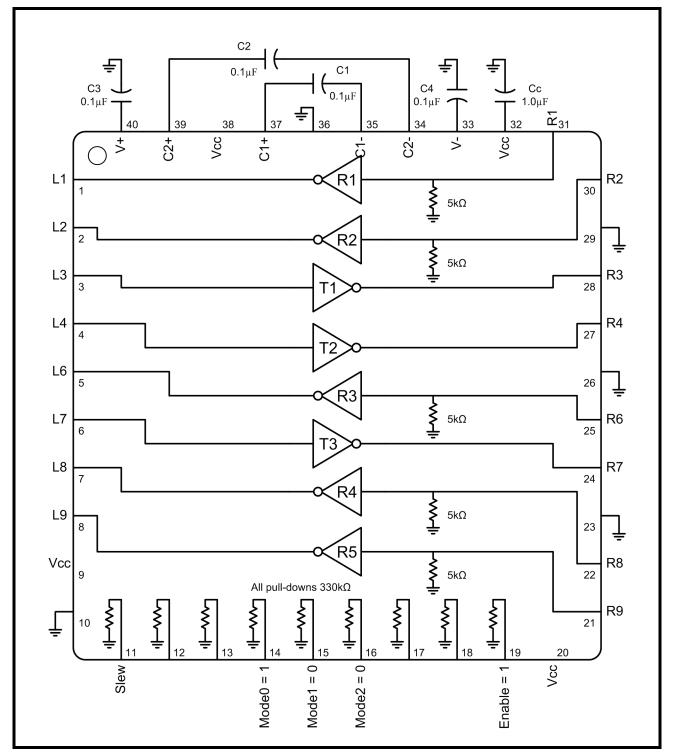
FIGURE 1. MODE 000 - LOOPBACK





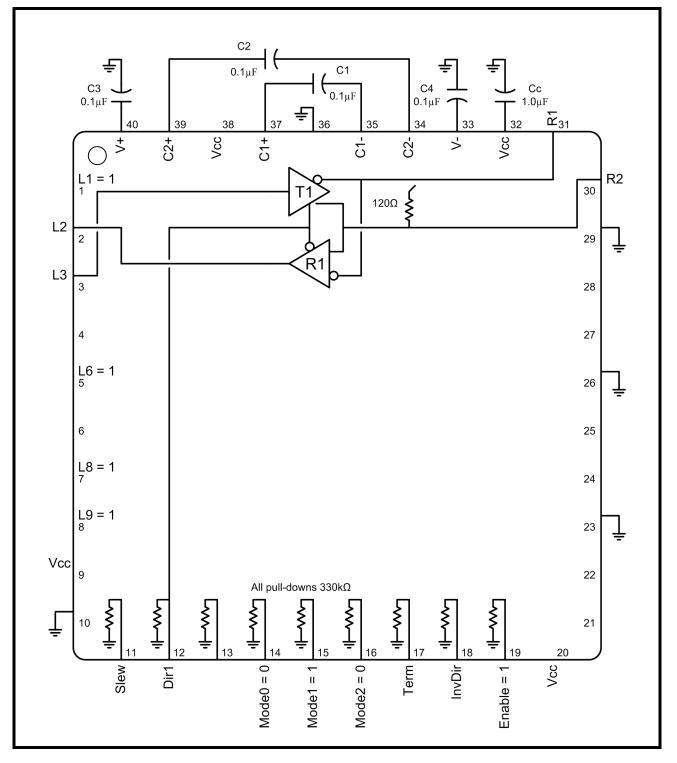
SP338E

FIGURE 2. MODE 001 - RS-232



REV. 1.0.0

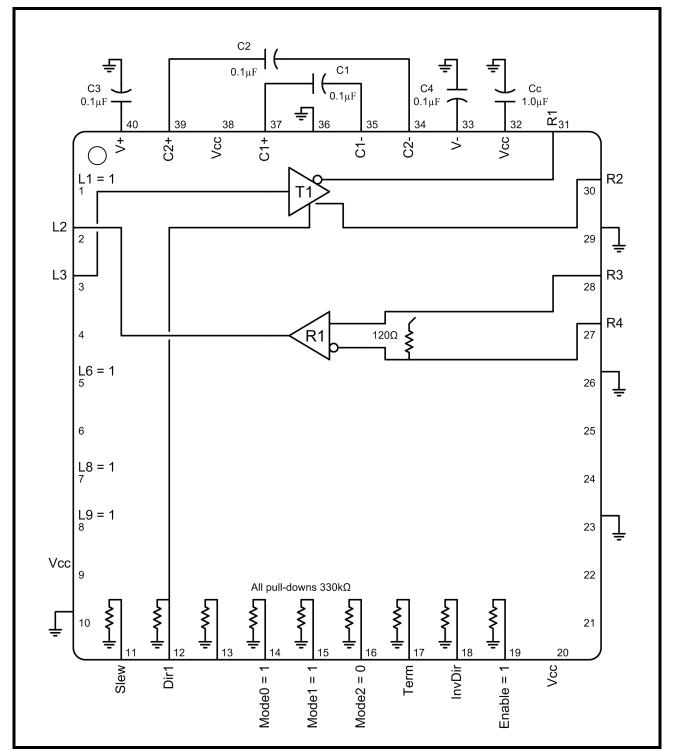
FIGURE 3. MODE 010 - RS-485 HALF DUPLEX #1





RS-232/RS-485/RS-422 TRANSCEIVER WITH INTERNAL TERMINATION

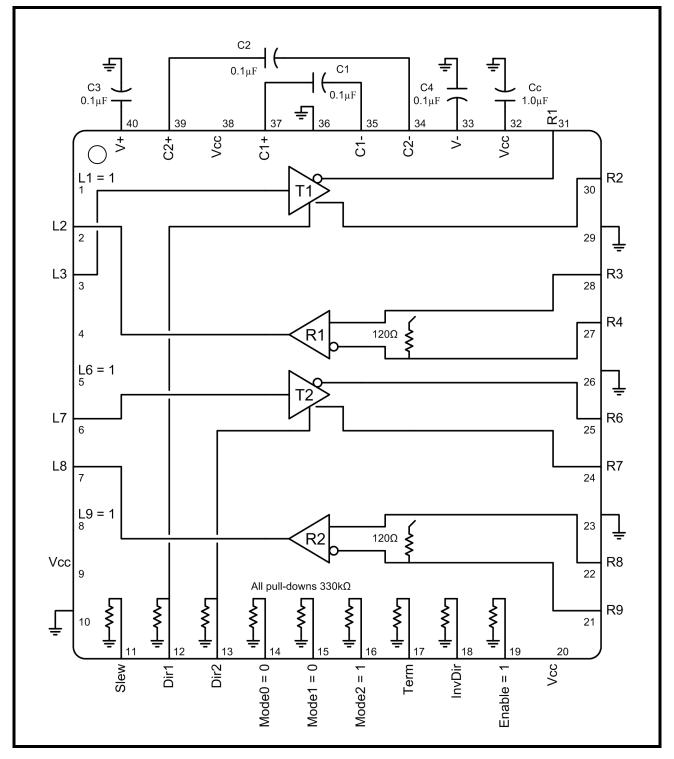




RS-232/RS-485/RS-422 TRANSCEIVER WITH INTERNAL TERMINATION

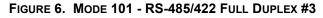
REV. 1.0.0

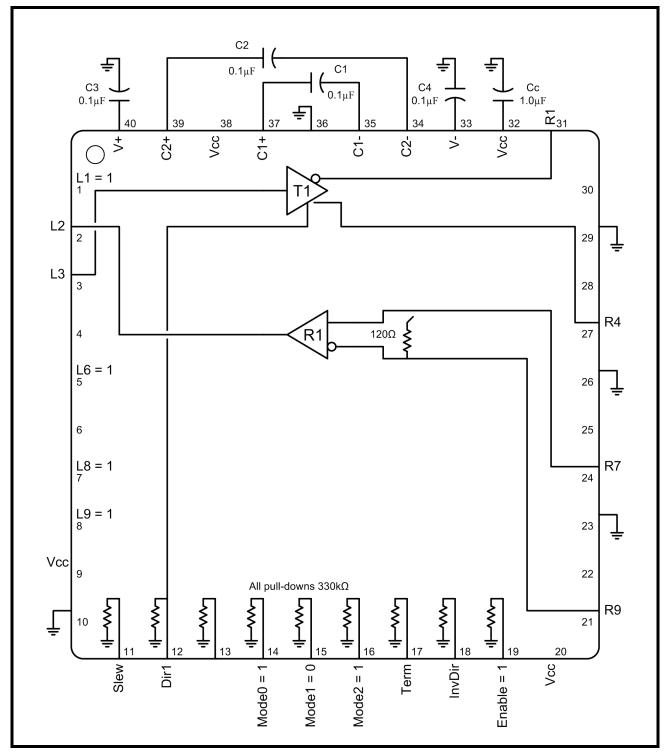
FIGURE 5. MODE 100 - RS-485/422 FULL DUPLEX #2





RS-232/RS-485/RS-422 TRANSCEIVER WITH INTERNAL TERMINATION

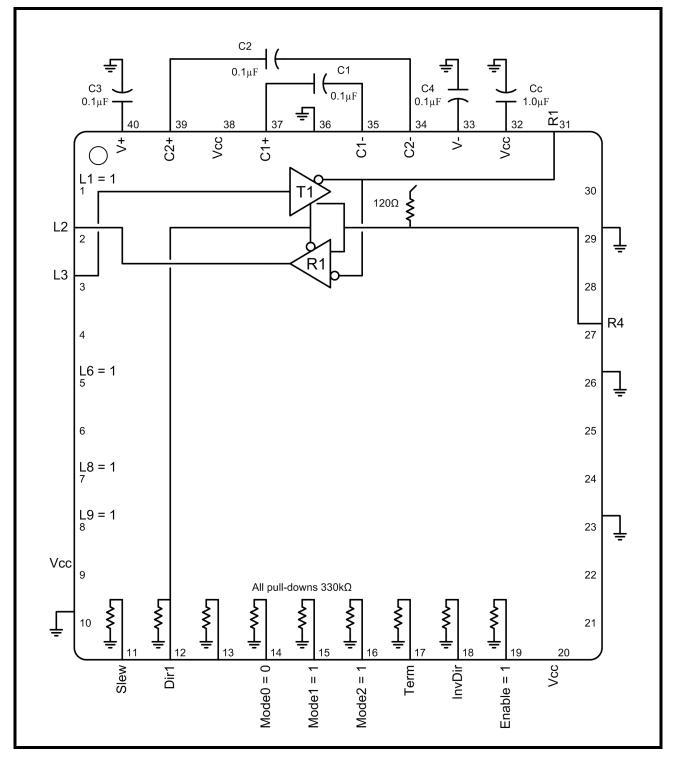




RS-232/RS-485/RS-422 TRANSCEIVER WITH INTERNAL TERMINATION

REV. 1.0.0

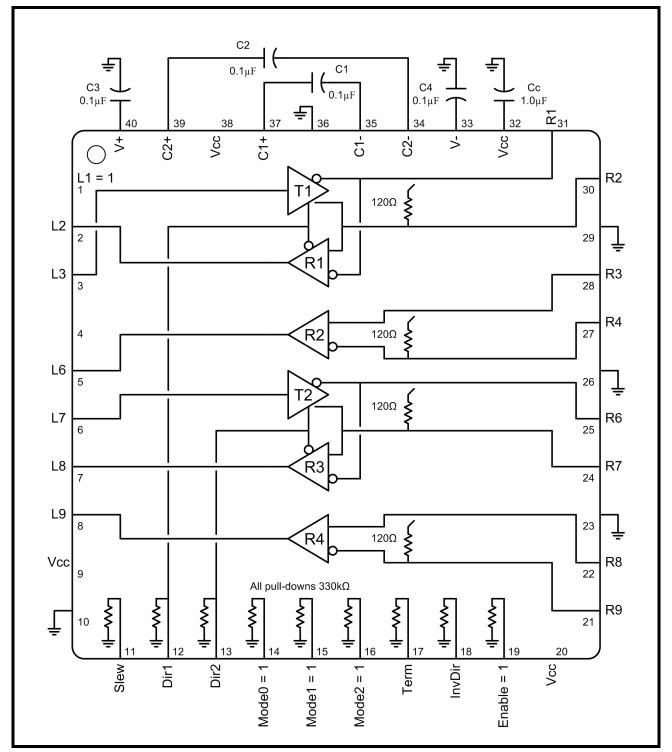
FIGURE 7. MODE 110 - RS-485 HALF DUPLEX #2





RS-232/RS-485/RS-422 TRANSCEIVER WITH INTERNAL TERMINATION





RS-232/RS-485/RS-422 TRANSCEIVER WITH INTERNAL TERMINATION



TEST FIXTURES

FIGURE 9. RS-485/422 RECEIVER TERMINATION RESISTANCE

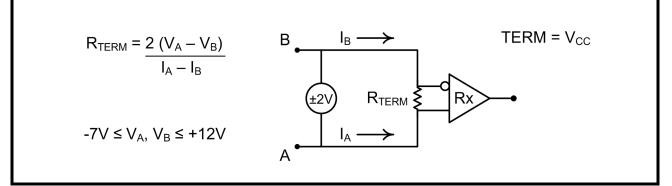
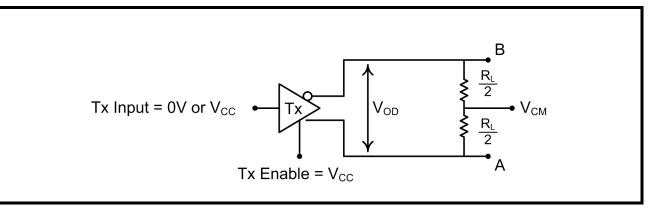
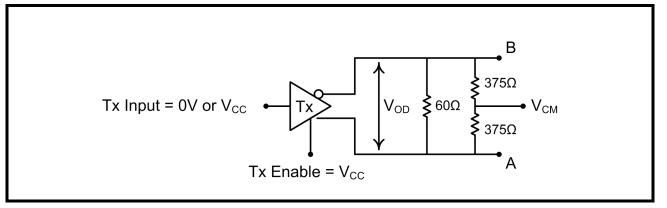


FIGURE 10. RS-485/422 DIFFERENTIAL DRIVER OUTPUT VOLTAGE





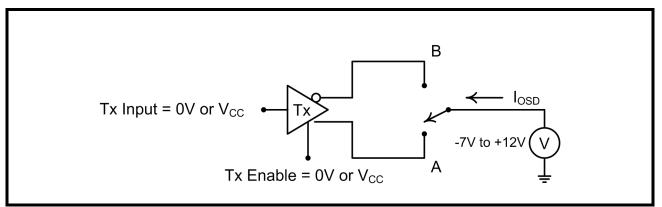




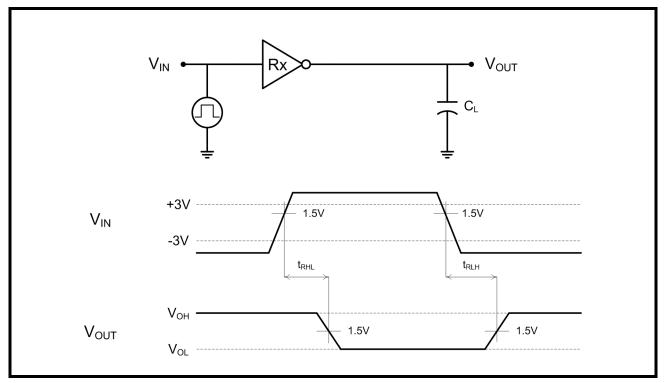
REV. 1.0.0

RS-232/RS-485/RS-422 TRANSCEIVER WITH INTERNAL TERMINATION

FIGURE 12. RS-485/422 DRIVER OUTPUT SHORT CIRCUIT CURRENT







RS-232/RS-485/RS-422 TRANSCEIVER WITH INTERNAL TERMINATION



FIGURE 14. RS-232 DRIVER PROPAGATION DELAY

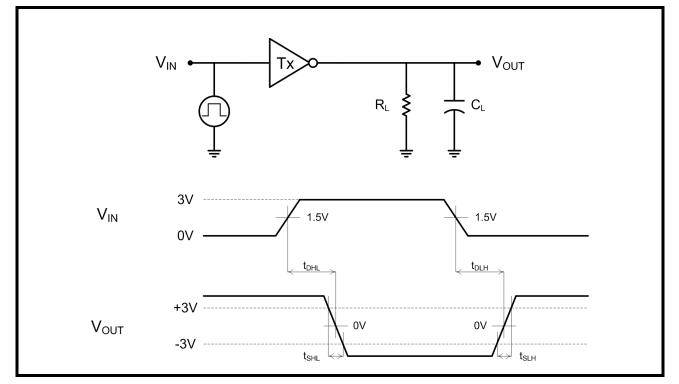
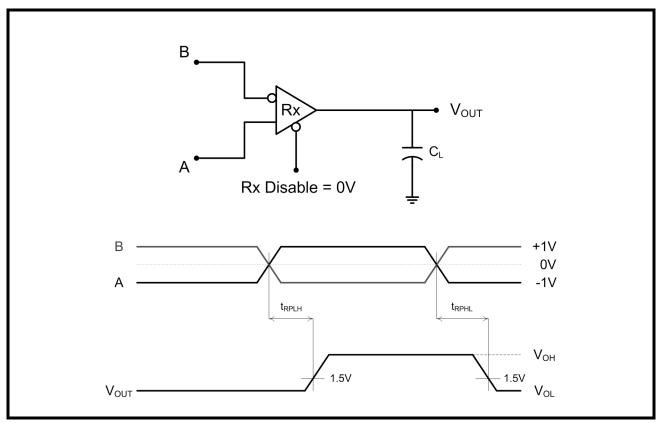


FIGURE 15. RS-485/422 RECEIVER PROPAGATION DELAY





SP338E

FIGURE 16. RS-485/422 DRIVER PROPAGATION DELAY AND RISE/FALL TIMES

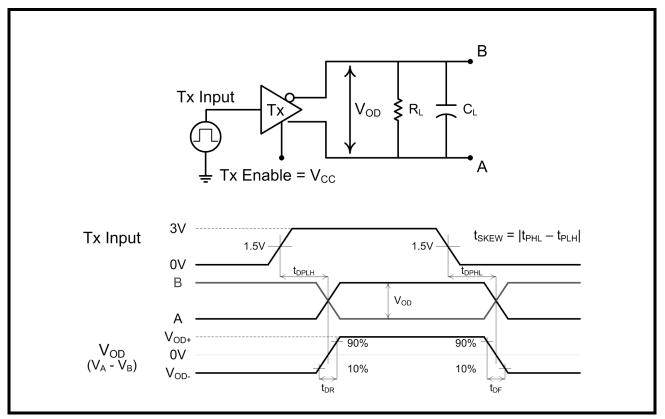


FIGURE 17. RS-485/422 RECEIVER OUTPUT ENABLE/DISABLE TIMES

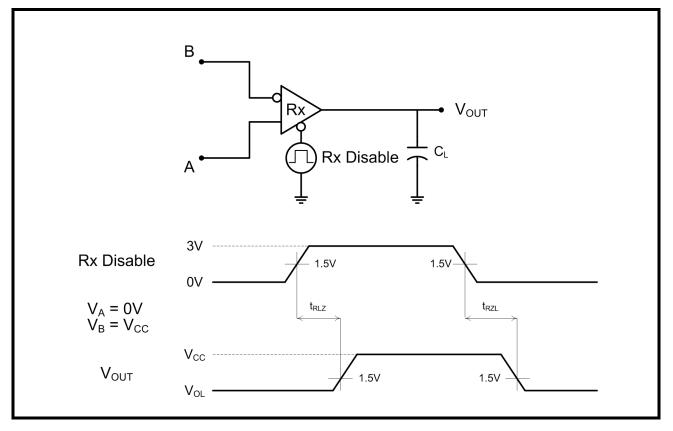
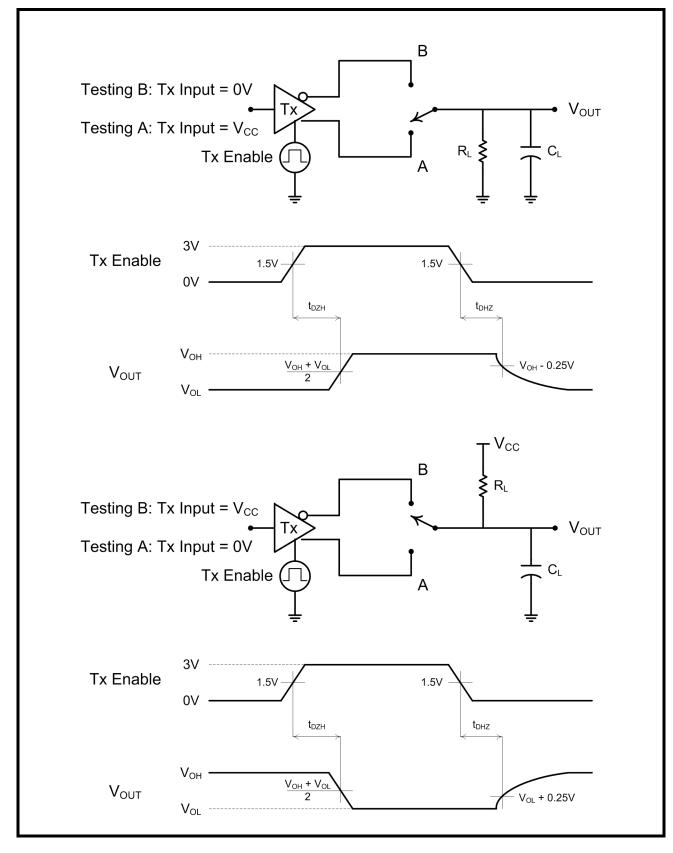




FIGURE 18. RS-485/422 DRIVER OUTPUT ENABLE/DISABLE TIMES





REV. 1.0.0

RS-232/RS-485/RS-422 TRANSCEIVER WITH INTERNAL TERMINATION

PRODUCT SUMMARY

The SP338 is an advanced multiprotocol transceiver supporting RS-232, RS-485, and RS-422 serial standards in a 40 pin QFN package. Integrated cable termination and four configuration modes allow all three protocols to be used interchangeably over a single cable or connector with no additional switching components. The RS-485/422 modes feature up to two drivers and four receivers (2TX/4RX) in half, full, and mixed duplex configurations. The RS-232 mode (3TX/5RX) provides full support of all eight signals commonly used with the DB9 RS-232 connector. A dedicated mode is also available for diagnostic loopback testing.

INTERNALLY SWITCHED CABLE TERMINATION

Enabling and disabling the RS-485/422 termination resistor is one of the largest challenges system designers face when sharing a single connector or pair of lines between multiple serial protocols. A termination resistor may be necessary for accurate RS-485/422 communication, but must be removed when the lines are used for RS-232. SP338 provides an elegant solution to this problem by integrating the termination resistor and switching control, and allowing it to be switched in and out of the circuit with a single pin. No external switching components are required.

ENHANCED FAILSAFE

Ordinary RS-485 differential receivers will be in an indeterminate state whenever the data bus is not being actively driven. The enhanced failsafe feature of the SP338 guarantees a logic-high receiver output when the receiver inputs are open, shorted, or terminated but idle/undriven. The enhanced failsafe interprets 0V differential as a logic high with a minimum 50mV noise margin, while maintaining compliance with the EIA/TIA-485 standard of ±200mV. No external biasing resistors are required, further easing the usage of multiple protocols over a single connector.

±15kV ESD PROTECTION

ESD protection structures are incorporated on all pins to protect against electrostatic discharges encountered during handling and assembly. The bus pins (driver outputs and receiver inputs) have extra protection structures, which have been tested up to ± 15 kV without damage. These structures withstand high ESD in all states: normal operation, shutdown and powered down.

ESD protection is be tested in various ways. Exar uses the following methods to qualify the protection structures designed into SP338:

- ±15kV using the Human Body Model (HBM)
- ±-8kV using IEC 61000-4-2 Contact Discharge

The IEC 61000-4-2 standard is more rigorous than HBM, resulting in lower voltage levels compared with HBM for the same level of ESD protection. Because IEC 61000-4-2 specifies a lower series resistance, the peak current is higher than HBM. The SP338 has passed both HBM and IEC 61000-4-2 testing without damage.

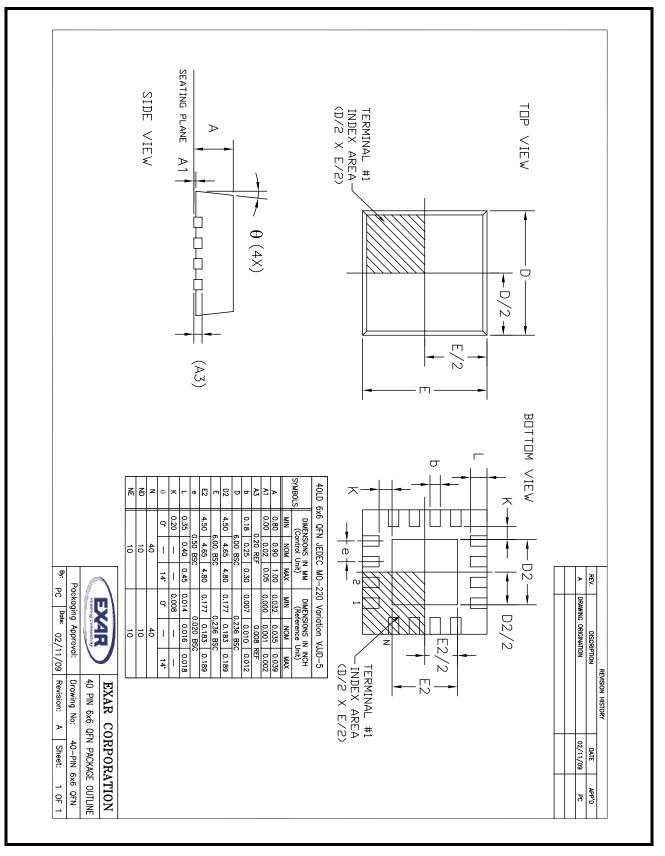
DIAGNOSTIC LOOPBACK MODE

The SP338 includes a diagnostic digital loop back mode for system testing as shown in Figure 1. The loopback mode connects the TTL driver inputs to the TTL receiver outputs, bypassing the analog driver and receiver circuitry. The analog/bus pins are internally disconnected in this mode.



PACKAGE DRAWINGS

FIGURE 19. QFN40





REVISION HISTORY

DATE	REVISION	DESCRIPTION
November 2011	1.0.0	Production Release

NOTICE

EXAR Corporation reserves the right to make changes to the products contained in this publication in order to improve design, performance or reliability. EXAR Corporation assumes no responsibility for the use of any circuits described herein, conveys no license under any patent or other right, and makes no representation that the circuits are free of patent infringement. Charts and schedules contained here in are only for illustration purposes and may vary depending upon a user's specific application. While the information in this publication has been carefully checked; no responsibility, however, is assumed for inaccuracies.

EXAR Corporation does not recommend the use of any of its products in life support applications where the failure or malfunction of the product can reasonably be expected to cause failure of the life support system or to significantly affect its safety or effectiveness. Products are not authorized for use in such applications unless EXAR Corporation receives, in writing, assurances to its satisfaction that: (a) the risk of injury or damage has been minimized; (b) the user assumes all such risks; (c) potential liability of EXAR Corporation is adequately protected under the circumstances.

Copyright 2011 EXAR Corporation

Datasheet November 2011.

For technical support please email Exar's Serial Technical Support group at: serialtechsupport@exar.com.

Reproduction, in part or whole, without the prior written consent of EXAR Corporation is prohibited.