



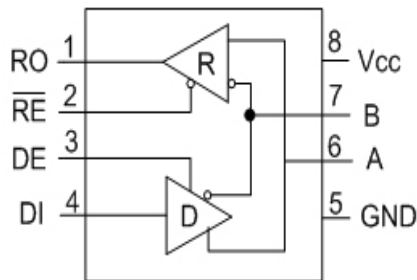
SP3485

+3.3V Low Power Half-Duplex RS-485 Transceiver with 10Mbps Data Rate

- RS-485 and RS-422 Transceiver
- Operates from a single +3.3V Supply
- Interoperable with +5.0V logic
- Driver/Receiver Enable
- -7V to +12V Common-Mode Input Voltage Range
- Allows up to 32 transceivers on the serial bus
- Compatibility with industry standard 75176 pinout
- Driver Output Short-Circuit Protection

DESCRIPTION

The **SP3485** device is a +3.3V low power half-duplex transceiver that meets the specifications of the RS-485 and RS-422 serial protocols. This device is pin-to-pin compatible with the **Exar** SP481, SP483 and SP485 devices as well as popular industry standards. The **SP3485** features the **Exar** BiCMOS process, allowing low power operation without sacrificing performance. The **SP3485** can meet the electrical specifications of the RS-485 and RS-422 serial protocols up to 10Mbps under load.

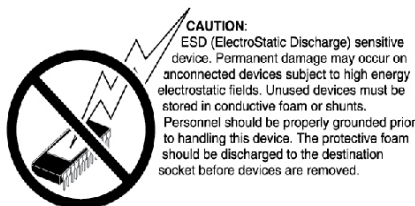


SP3485

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 of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

| | |
|--------------------------|--------------------------------|
| V _{CC} | +6.0V |
| Input Voltages | |
| Logic..... | -0.3V to +6.0V |
| Drivers..... | -0.3V to +6.0V |
| Receivers..... | +/-15V |
| Output Voltages | |
| Drivers..... | +/-15V |
| Receivers..... | -0.3V to +6.0V |
| Storage Temperature..... | -65°C to +150°C |
| Power Dissipation | |
| 8-pin NSOIC..... | 600mW |
| | (derate 6.90mW/°C above +70°C) |



ELECTRICAL CHARACTERISTICS

T_{AMB} = T_{MIN} to T_{MAX} and V_{CC} = +3.3V +/-5% unless otherwise noted.

| PARAMETERS | MIN. | TYP. | MAX. | UNITS | CONDITIONS |
|--|------|------|-----------------|-------|--|
| SP3485 DRIVER | | | | | |
| DC Characteristics | | | | | |
| Differential Output Voltage | GND | | V _{CC} | Volts | Unloaded; R = ∞Ω ; Figure 1 |
| Differential Output Voltage | 2 | | V _{CC} | Volts | With Load; R = 50Ω (RS-422); Figure 1 |
| Differential Output Voltage | 1.5 | | V _{CC} | Volts | With Load; R = 27Ω (RS-485); Figure 1 |
| Change in Magnitude of Driver Differential Output Voltage for Complimentary states | | | 0.2 | Volts | R = 27Ω or R = 50Ω; Figure 1 |
| Driver Common Mode Output Voltage | | | 3 | Volts | R = 27Ω or R = 50Ω; Figure 1 |
| Input High Voltage | 2.0 | | | Volts | Applies to DE, DI, \overline{RE} |
| Input Low Voltage | | | 0.8 | Volts | Applies to DE, DI, \overline{RE} |
| Input Current | | | +/-10 | μA | Applies to DE, DI, \overline{RE} |
| Driver Short Circuit Current V _{OUT} = HIGH | | | +/-250 | mA | -7V ≤ V _O ≤ +12V; Figure 8 |
| Driver Short Circuit Current V _{OUT} = LOW | | | +/-250 | mA | -7V ≤ V _O ≤ +12V; Figure 8 |
| SP3485 DRIVER | | | | | |
| AC Characteristics | | | | | |
| Maximum Data Rate | 10 | | | Mbps | $\overline{RE} = V_{CC}$, DE = V _{CC} |
| Driver Input to Output, t _{PLH} | 20 | 40 | 60 | ns | Figures 2 & 9 |
| Driver Input to Output, t _{PHL} | 20 | 40 | 60 | ns | Figures 2 & 9 |
| Differential Driver Skew | | 2 | 10 | ns | [t _{DO1} - t _{DO2}], Figures 2 and 10 |
| Driver Rise or Fall Time | | 5 | 20 | ns | From 10%-90%; Figures 3 and 10 |

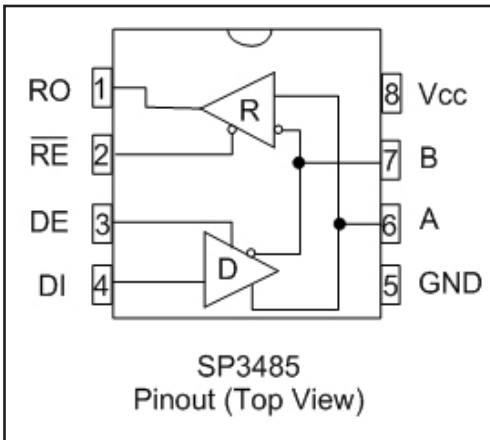
ELECTRICAL CHARACTERISTICS

$T_{AMB} = T_{MIN}$ to T_{MAX} and $V_{CC} = +3.3V \pm 5\%$ unless otherwise noted.

| PARAMETERS | MIN. | TYP. | MAX. | UNITS | CONDITIONS |
|---|--------------|------|------|------------|---|
| SP3485 DRIVER AC Characteristics continued | | | | | |
| Driver Enable to Output High | | 52 | 120 | ns | Figures 4 and 11 |
| Driver Enable to Output Low | | 60 | 120 | ns | Figures 5 and 11 |
| Driver Disable Time from Low | | 40 | 120 | ns | Figures 5 and 11 |
| Driver Disable Time from High | | 60 | 120 | ns | Figures 4 and 11 |
| SP3485 RECEIVER | | | | | |
| DC Characteristics | | | | | |
| Differential Input Threshold | -0.2 | | +0.2 | Volts | $-7V \leq V_{CM} \leq +12V$ |
| Input Hysteresis | | 20 | | mV | $V_{CM} = 0V$ |
| Output Voltage HIGH | $V_{CC}-0.4$ | | | Volts | $V_{ID} = +200mV, -1.5mA$ |
| Output Voltage LOW | | | 0.4 | Volts | $V_{ID} = -200mV, 2.5mA$ |
| Three-State (High Impedance) Output Current | | | +/-1 | μA | $0V \leq V_O \leq V_{CC}; \overline{RE} = V_{CC}$ |
| Input Resistance | 12 | 15 | | k Ω | $-7V \leq V_{CM} \leq +12V$ |
| Input Current (A, B); $V_{IN} = 12V$ | | | +1.0 | mA | $DE = 0V, V_{CC} = 0V$ or $3.6V, V_{IN} = 12V$ |
| Input Current (A, B); $V_{IN} = -7V$ | | | -0.8 | mA | $DE = 0V, V_{CC} = 0V$ or $3.6V, V_{IN} = -7V$ |
| Short Circuit Current | 7 | | 60 | mA | $0V \leq V_{CM} \leq V_{CC}$ |
| SP3485 RECEIVER | | | | | |
| AC Characteristics | | | | | |
| Maximum Data Rate | 10 | | | Mbps | $\overline{RE} = 0V, DE = 0V$ |
| Receiver Input to Output, t_{PLH} | 40 | 70 | 100 | ns | Figures 6 and 12 |
| Receiver Input to Output, t_{PLH} | | | 70 | ns | $T_{AMB} = +25^\circ C, V_{CC} = 3.3V,$ Figures 6 and 12 |
| Receiver Input to Output, t_{PHL} | 40 | 70 | 100 | ns | Figures 6 and 12 |
| Receiver Input to Output, t_{PHL} | | | 70 | ns | $T_{AMB} = +25^\circ C, V_{CC} = 3.3V,$ Figures 6 and 12 |
| Differential Receiver Skew | | 4 | | ns | $t_{RSKEW} = t_{RPHL} - t_{RPLH} ,$ Figures 6 and 12 |
| Receiver Enable to Output Low | | 35 | 60 | ns | Figures 7 and 13, S_1 closed, S_2 open |
| Receiver Enable to Output High | | 35 | 60 | ns | Figures 7 and 13, S_2 closed, S_1 open |
| Receiver Disable from Low | | 35 | 60 | ns | Figures 7 and 13, S_1 closed, S_2 open |
| Receiver Disable from High | | 35 | 60 | ns | Figures 7 and 13, S_2 closed, S_1 open |
| POWER REQUIREMENTS | | | | | |
| Supply Current , No Load | | 1000 | 2000 | μA | $\overline{RE}, DI = 0V$ or $V_{CC}; DE = V_{CC}$ |
| Supply Current , No Load | | 800 | 1500 | μA | $\overline{RE} = 0V, DI = 0V$ or $V_{CC}, DE = 0V$ |

PIN FUNCTION

Pin Function SP3485



Pin 1 - RO - Receiver output

Pin 2 - \overline{RE} - Receiver Output Enable Active LOW

Pin 3 - DE - Driver Output Enable Active HIGH

Pin 4 - DI - Driver Input

Pin 5 - GND - Ground Connection

Pin 6 - A - Non-Inverting Driver Output/Receiver Input

Pin 7 - B - Inverting Driver Output/Receiver Input

Pin 8 - Vcc - Positive Supply

TEST CIRCUITS

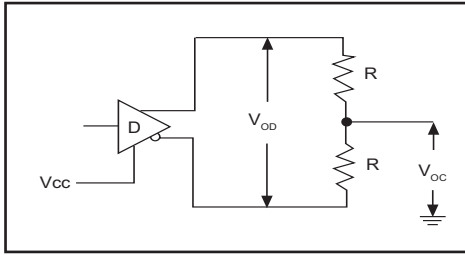


Figure 1. Driver DC Test Load Circuit

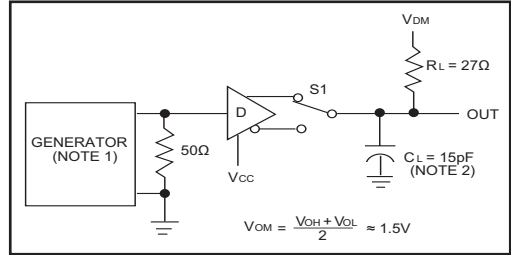


Figure 2. Driver Propagation Delay Test Circuit

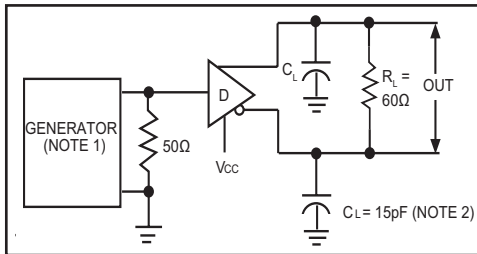


Figure 3. Driver Differential Output Delay and Transition Time Circuit.

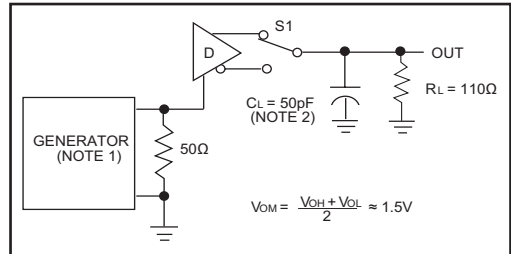


Figure 4. Driver Enable and Disable Timing Circuit, Output High

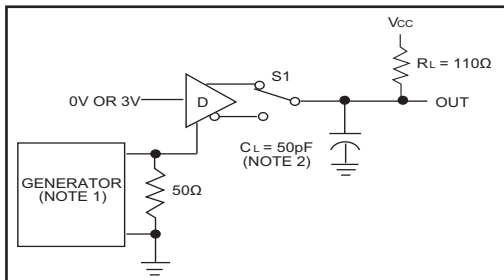


Figure 5. Driver Enable and Disable Timing Circuit, Output Low

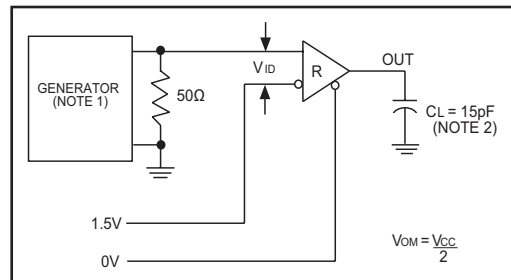


Figure 6. Receiver Propagation Delay Test Circuit

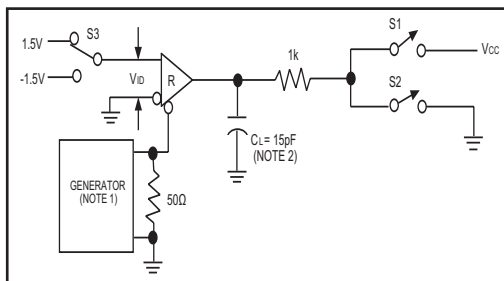


Figure 7. Receiver Enable and Disable Timing Circuit

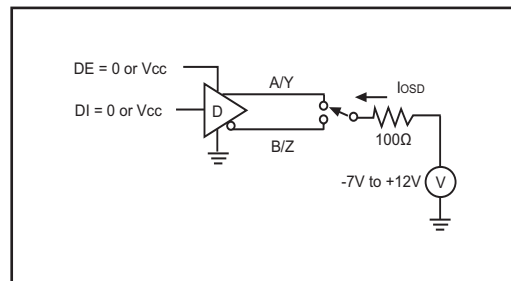


Figure 8. Driver Short Circuit Current Limit Test

NOTE 1: The input pulse is supplied by a generator with the following characteristics:
 PRR = 250kHz, 50% duty cycle, $t_r < 6.0\text{ns}$, $Z_o = 50\Omega$.
 NOTE 2: C_L includes probe and stray capacitance.

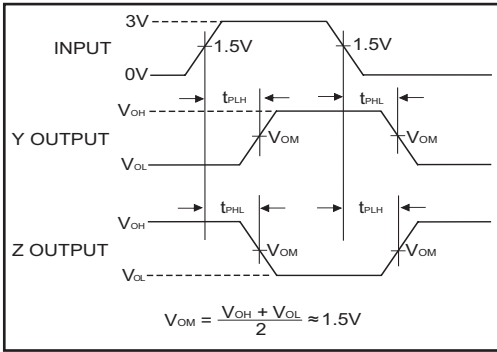


Figure 9. Driver Propagation Delay Waveforms

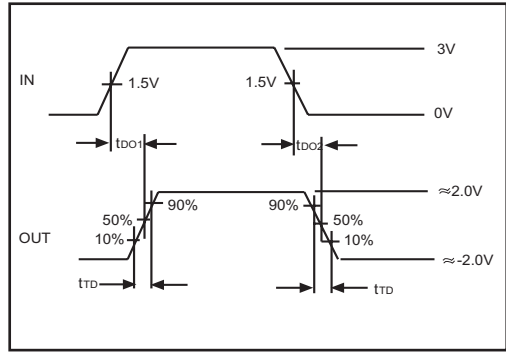


Figure 10. Driver Differential Output Delay and Transition Time Waveforms

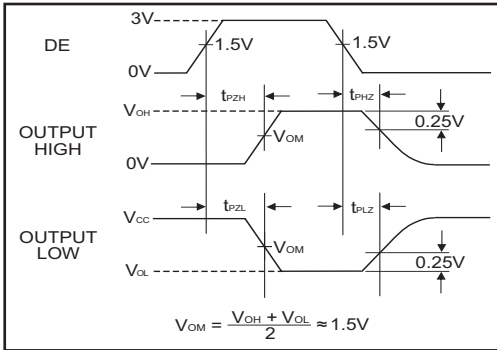


Figure 11. Driver Enable and Disable Timing Waveforms

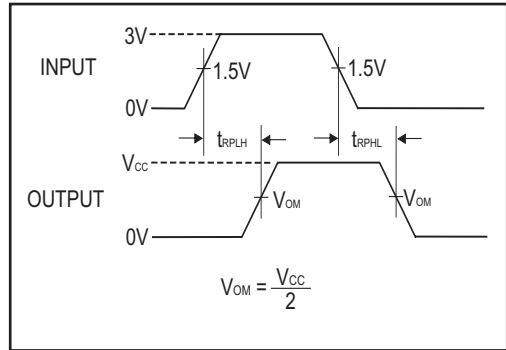


Figure 12. Receiver Propagation Delay Waveforms

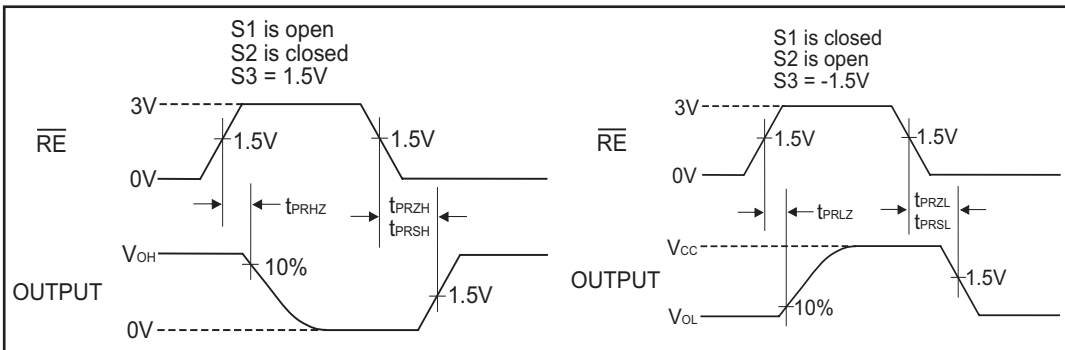


Figure 13. Receiver Enable and Disable Waveforms

The **SP3485** is a member in the family of +3.3V low power half-duplex transceivers that meet the electrical specifications of the RS-485 and RS-422 serial protocols. This device is pin-to-pin compatible with the **Exar** SP481, SP483 and SP485 devices as well as popular industry standards. The **SP3485** feature **Exar's** BiCMOS process allowing low power operation without sacrificing performance.

Driver

The driver outputs of the **SP3485** are differential outputs meeting the RS-485 and RS-422 standards. The typical voltage output swing with no load will be 0 volts to +3.3 Volts. With a load of 54Ω across the differential outputs, the drivers can maintain greater than 1.5V voltage levels.

The driver of the **SP3485** has a driver enable control line which is active HIGH. A logic HIGH on DE (pin 3) will enable the differential driver outputs. A logic LOW on the DE (pin 3) will tri-state the driver outputs.

The driver of the SP3485 operates up to 10Mbps. The 250mA I_{SC} maximum limit on the driver output allows the SP3485 to withstand an infinite short circuit over the -7.0V to +12V common mode range without catastrophic damage to the IC.

Receiver

The **SP3485** receiver has differential inputs with an input sensitivity of ±200mV. Input impedance of the receiver is typically 15kΩ (12kΩ minimum). A wide common mode range of -7V to +12V allows for large ground potential differences between systems. The receiver is equipped with a fail-safe feature that guarantees the receiver output will be in a HIGH state when the input is left unconnected. The receiver of the **SP3485** operates up to 10Mbps.

The receiver of the **SP3485** has an enable control line which is active LOW. A logic LOW on \overline{RE} (pin 2) will enable the differential receiver. A logic HIGH on RE (pin 2) of the **SP3485** will disable the receiver.

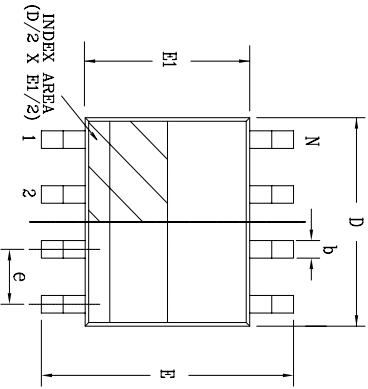
| INPUTS | | | | OUTPUTS | |
|-----------------|----|----|----------------|---------|---|
| \overline{RE} | DE | DI | LINE CONDITION | B | A |
| X | 1 | 1 | No Fault | 0 | 1 |
| X | 1 | 0 | No Fault | 1 | 0 |
| X | 0 | X | X | Z | Z |

Table 1. Transmit Function Truth Table

| INPUTS | | | | OUTPUTS |
|-----------------|----|-------------|--|---------|
| \overline{RE} | DE | A - B | | R |
| 0 | 0 | +0.2V | | 1 |
| 0 | 0 | -0.2V | | 0 |
| 0 | 0 | Inputs Open | | 1 |
| 1 | 0 | X | | Z |

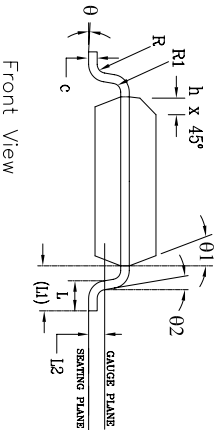
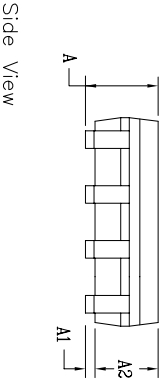
Table 2. Receive Function Truth Table

| REVISION HISTORY | | | |
|------------------|--------------------------------------|----------|--------|
| REV | DESCRIPTION | DATE | APPR'D |
| A | DRAWING ORIGINATOR | 08/16/05 | JL |
| B | DRAWING FORMAT MODIFICATION | 07/19/06 | JL |
| C | CHANGE DRAWING LOGO AND COMPANY NAME | 11/16/07 | JL |



Top View

| SYMBOLS | 8 Pin SOICN | | | JEDEC MS-012 | | | Variation AA | | |
|---------|------------------------------------|-----|------|--|-----|-------|--------------|--|--|
| | DIMENSIONS IN MM (Control Unit) | | | DIMENSIONS IN INCH (Reference Unit) | | | | | |
| | MIN | NOM | MAX | MIN | NOM | MAX | | | |
| A | 1.35 | — | 1.75 | 0.053 | — | 0.069 | | | |
| A1 | 0.10 | — | 0.25 | 0.004 | — | 0.010 | | | |
| A2 | 1.25 | — | 1.65 | 0.049 | — | 0.065 | | | |
| b | 0.31 | — | 0.51 | 0.012 | — | 0.020 | | | |
| c | 0.17 | — | 0.25 | 0.007 | — | 0.010 | | | |
| E | 6.00 BSC | | | 0.236 BSC | | | | | |
| E1 | 3.90 BSC | | | 0.154 BSC | | | | | |
| e | 1.27 BSC | | | 0.050 BSC | | | | | |
| h | 0.25 | — | 0.50 | 0.010 | — | 0.020 | | | |
| L | 0.40 | — | 1.27 | 0.016 | — | 0.050 | | | |
| L1 | 1.04 REF | | | 0.041 REF | | | | | |
| L2 | 0.25 BSC | | | 0.010 BSC | | | | | |
| R | 0.07 | — | — | 0.003 | — | — | | | |
| R1 | 0.07 | — | — | 0.003 | — | — | | | |
| θ | 0° | — | 8° | 0° | — | 8° | | | |
| θ1 | 5° | — | 15° | 5° | — | 15° | | | |
| θ2 | 0° | — | — | 0° | — | — | | | |
| D | 4.90 BSC | | | 0.193 BSC | | | | | |
| N | 8 | | | 8 | | | | | |



Side View

Front View

| | | | |
|---------------------|----------------|--|-------------|
| | | EXAR CORPORATION <i>Revolving Connectivity</i> | |
| | | | |
| Packaging Approval: | | Drawing No: | 8-PIN SOICN |
| By: JL | Date: 11/16/07 | Revision: | C |
| | | Sheet: | 1 OF 1 |

ORDERING INFORMATION

| Model | Temperature Range | Package Types |
|---------------------|----------------------|---------------|
| SP3485CN-L | 0°C to +70°C | .8-pin NSOIC |
| SP3485CN-L/TR | 0°C to +70°C | .8-pin NSOIC |
| SP3485EN-L | -40°C to +85°C | .8-pin NSOIC |
| SP3485EN-L/TR | -40°C to +85°C | .8-pin NSOIC |

Note: /TR = Tape and Reel

REVISION HISTORY

| DATE | REVISION | DESCRIPTION |
|----------|----------|---|
| 10/15/02 | -- | Legacy Sipex Datasheet |
| 06/19/12 | 1.0.0 | Convert to Exar Format. Update ordering information and add new Figure 8 - Driver Short Circuit Current Limit Test Circuit. Remove EOL device SP3481. |

Notice

EXAR Corporation reserves the right to make changes to any products contained in this publication in order to improve design, performance or reliability. EXAR Corporation assumes no representation that the circuits are free of patent infringement. Charts and schedules contained herein 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 2012 EXAR Corporation

Datasheet June 2012

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.