19-2217; Rev 1; 2/03

MAXIM

+5V, Fail-Safe, 20Mbps, Profibus RS-485/ RS-422 Transceivers

General Description

The MAX3460–MAX3464 are high-speed differential bus transceivers for RS-485 and RS-422 communications. They are designed to meet TIA/EIA-422-B, TIA/EIA-485-A, V.11, and X.27 standards. The transceiver complies with the Profibus specification providing +2.1V output level with a 54Ω load, 20Mbps data rate, and output skew less than 2ns. Each part contains one three-state differential line driver and one differential input line receiver. The devices operate from a +5V supply and feature true fail-safe circuitry, which guarantees a logic-high receiver output when the receiver inputs are open or shorted. This enables all receiver outputs on a terminated bus to output logic highs when all transmitters are disabled.

All devices feature a 1/4 standard unit load receiver input impedance that allows 128 transceivers on the bus. Driver and receiver propagation delays are guaranteed under 20ns for multidrop, clock distribution applications. Drivers are short-circuit current limited and are protected against excessive power dissipation by thermal shutdown circuitry. The driver and receiver feature active-high and active-low enables, respectively, that can be connected together externally to serve as a direction control.

Features

- ♦ **Recommended for Profibus Applications**
- ♦ **Guaranteed 20Mbps Data Rate**
- ♦ **20ns Transmitter and Receiver Propagation Delay**
- ♦ **2ns Transmitter and Receiver Skew**
- ♦ **High Differential Driver Output Level (2.1V on 54Ω)**
- ♦ **Hot-Swap Versions**
- ♦ **1µA Shutdown Supply Current**
- ♦ **Low Supply Current Requirements (2.5mA typ)**
- ♦ **Allow Up to 128 Transceivers on the Bus**
- ♦ **True Fail-Safe Receiver while Maintaining EIA/TIA-485 Compatibility**
- ♦ **Designed for Multipoint Transmissions on Long or Noisy Bus Lines**
- ♦ **Full Duplex and Half Duplex Versions Available**
- ♦ **Phase Controls to Correct for Twisted-Pair Reversal for 14-Pin Versions**
- ♦ **Current-Limiting and Thermal Shutdown for Driver Overload Protection**

Applications

High-Speed RS-485 Communications

High-Speed RS-422 Communications

Level Translators

Industrial-Control Local Area Networks

Profibus Applications

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX3460CSD	0°C to +70°C	14 SO
MAX3460CPD	0°C to +70°C	14 Plastic DIP
MAX3460ESD	-40°C to +85°C	14 SO
MAX3460EPD	-40°C to +85°C	14 Plastic DIP

Ordering Information continued at end of data sheet.

Pin Configurations appear at end of data sheet.

Selector Guide

PART NUMBER	HALF/FULL DUPLEX	RECEIVER/ DRIVER ENABLE	LOW-POWER SHUTDOWN	HOT SWAP	RECEIVER/ DRIVER PHASE SELECT	INDEPENDENT SHDN PIN	PIN COUNT
MAX3460	Full	Yes	Yes	Yes	Yes	Yes	14
MAX3461	Full	Yes	Yes	No	Yes	Yes	14
MAX3462	Full	No	No	No	No	No	8
MAX3463	Half	Yes	Yes	Yes	No	No	8
MAX3464	Half	Yes	Yes	No	No	No	8

+5V, Fail-Safe, 20Mbps, Profibus RS-485/ RS-422 Transceivers

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) to GND .....-0.3V to +6V
Control Input Voltage ($\overline{RE}$, DE, DI, SHDN, TXP, RXP) to GND.....-0.3V to (V_{CC} + 0.3V)
Driver Output Voltage (Y, Z) to GND.....-8V to +13V
Receiver Input Voltage (A, B) to GND.....-8V to +13V
Differential Driver Output Voltage (Y - Z).....±8V
Differential Receiver Input (A - B).....±8V
Receiver Output Voltage (RO) to GND.....-0.3V to (V_{CC} + 0.3V)
Output Driver Current (Y, Z) .....±250mA

Continuous Power Dissipation (T_A = +70°C)
8-Pin SO (derate 5.88mW/°C above +70°C).....471mW
8-Pin DIP (derate 9.09mW/°C above +70°C).....727mW
14-Pin SO (derate 8.33mW/°C above +70°C).....667mW
14-Pin DIP (derate 10mW/°C above +70°C).....800mW
Operating Temperature Range
MAX346_C__ .....0°C to +70°C
MAX346_E__.....-40°C to +85°C
Junction Temperature.....+150°C
Storage Temperature Range .....-65°C to +150°C
Lead Temperature (soldering, 10s) .....+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} = +5V ±5%, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V_{CC} = +5V and T_A = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Power-Supply Range	V_{CC}			4.75		5.25	V
DRIVER							
Differential Driver Output (no load)	V_{OD}	Figure 5, R = ∞				V_{CC}	V
Differential Driver Output	V_{OD}	Figure 5, R = 27Ω		2.1			V
Change in Magnitude of Differential Output Voltage	ΔV_{OD}	Figure 5, R = 50Ω or 27Ω (Note 2)				0.2	V
Driver Common-Mode Output Voltage	V_{OC}	Figure 5, R = 50Ω or 27Ω				3	V
Change in Magnitude of Common-Mode Voltage	ΔV_{OC}	Figure 5, R = 50Ω or 27Ω (Note 2)				0.2	V
Input High Voltage	V_{IH}	DE, DI, $\overline{RE}$, SHDN		2.0			V
Input Low Voltage	V_{IL}	DE, DI, $\overline{RE}$, SHDN				0.8	V
Input Hysteresis	V_{HYS}	DE, DI, $\overline{RE}$, SHDN			50		mV
Output Leakage (Y and Z) Full Duplex	I_O	DE = GND, V_{CC} = GND or +5.25V	V_{IN} = +12V			+125	µA
			V_{IN} = -7V	-100			
Input Current	I_{IN}	DI, $\overline{RE}$, DE, SHDN				±1	µA
Pulldown Current		RXP = TXP = V_{CC}		5	15	30	µA
Driver Short-Circuit Output Current (Note 3)	I_{OSD}	0 ≤ V_{OUT} ≤ 12V, output low				+250	mA
		-7V ≤ V_{OUT} ≤ V_{CC}, output high		-250			
Driver Short-Circuit Foldback Output Current (Note 3)	I_{OSFD}	(V_{CC} - 1V) ≤ V_{OUT} ≤ 12V, output low		+25			mA
		-7V ≤ V_{OUT} ≤ 1V, output high				-25	
Thermal Shutdown Threshold					140		°C
RECEIVER							
Differential Input Capacitance	$C_{A, B}$				8		pF
Input Current (A and B) Full Duplex	$I_{A, B}$	DE = GND, V_{CC} = GND or 5.25V	V_{IN} = +12V			250	µA
			V_{IN} = -7V	-200			
Receiver Differential Threshold Voltage	V_{TH}	-7V ≤ V_{CM} ≤ 12V		-200	-125	-50	mV

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = +5V ±5%, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V_{CC} = +5V and T_A = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Receiver Input Hysteresis	ΔV_{TH}	$V_A + V_B = 0$		20		mV
Receiver Output High Voltage	V_{OH}	I_O = -4mA, $V_A - V_B = V_{TH}$	V_{CC} - 1.5			V
Receiver Output Low Voltage	V_{OL}	I_O = 4mA, $V_B - V_A = V_{TH}$			0.4	V
Three-State Output Current at Receiver	I_{OZR}	$0 \le V_O \le V_{CC}$			±1	µA
Receiver Input Resistance	R_{IN}	$-7V \le V_{CM} \le 12V$	48			kΩ
Receiver Output Short-Circuit Current	I_{OSR}	$0 \le V_{RO} \le V_{CC}$	±7		±95	mA
SUPPLY CURRENT						
Normal Operation (static condition)	I_Q	No load, DI = V_{CC} or DI = GND		2.5	4	mA
Supply Current in SHDN	I_{SHDN}	DE = GND and $\overline{RE}$ = V_{CC}, or SHDN = V_{CC}		1	10	µA
SWITCHING CHARACTERISTICS						
Driver Propagation Delay	t_{PLH} t_{PHL}	Figures 6 and 7, R_{DIFF} = 54Ω, C_L = 50pF			20	ns
Driver Differential Output Rise or Fall Time	t_R t_F	Figures 6 and 7, R_{DIFF} = 54Ω, C_L = 50pF			20	ns
Driver Output Skew $\lvert t_{PLH} - t_{PHL} \rvert$	t_{SKEW}	Figures 6 and 7, R_{DIFF} = 54Ω, C_L = 50pF, TXP = GND or floating			2	ns
Maximum Data Rate			20			Mbps
Driver Enable to Output High	t_{ZH}	Figures 8 and 9, S2 closed, R_L = 500Ω, C_L = 50pF			100	ns
Driver Enable to Output Low	t_{ZL}	Figures 8 and 9, S1 closed, R_L = 500Ω, C_L = 50pF			100	ns
Driver Disable Time from Low	t_{LZ}	Figures 8 and 9, S1 closed, R_L = 500Ω, C_L = 50pF			100	ns
Driver Disable Time from High	t_{HZ}	Figures 8 and 9, S2 closed, R_L = 500Ω, C_L = 50pF			100	ns
Receiver Propagation Delay	t_{PLH} t_{PHL}	Figure 10, C_L = 15pF (Note 4)			20	ns
Receiver Output Skew $\lvert t_{PLH} - t_{PHL} \rvert$	t_{SKEW}	Figure 10, C_L = 15pF, RXP = GND or floating (Note 4)			2	ns
Receiver Enable to Output Low	t_{ZL}	Figures 8 and 11, R_L = 1kΩ, C_L = 15pF, S1 closed (Note 4)			100	ns
Receiver Enable to Output High	t_{ZH}	Figures 8 and 11, R_L = 1kΩ, C_L = 15pF, S2 closed (Note 4)			100	ns
Receiver Disable Time from Low	t_{LZ}	Figures 8 and 11, R_L = 1kΩ, C_L = 15pF, S1 closed (Note 4)			100	ns
Receiver Disable Time from High	t_{HZ}	Figures 8 and 11, R_L = 1kΩ, C_L = 15pF, S2 closed (Note 4)			100	ns

+5V, Fail-Safe, 20Mbps, Profibus RS-485/ RS-422 Transceivers

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = +5V ±5%, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at V_{CC} = +5V and T_A = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Time to Shutdown	t_{SHDN}	(Note 5)	50		800	ns
Driver Enable from Shutdown to Output High	$t_{ZH\ (SHDN)}$	Figures 8 and 9, R_L = 500Ω, C_L = 50pF, S2 closed (Note 5)			4	µs
Driver Enable from Shutdown to Output Low	$t_{ZL\ (SHDN)}$	Figures 8 and 9, R_L = 500Ω, C_L = 50pF, S1 closed (Note 5)			4	µs
Receiver Enable from Shutdown to Output High	$t_{ZH\ (SHDN)}$	Figures 8 and 11, R_L = 1kΩ, C_L = 15pF, S2 closed (Notes 4, 5)			4	µs
Receiver Enable from Shutdown to Output Low	$t_{ZL\ (SHDN)}$	Figures 8 and 11, R_L = 1kΩ, C_L = 15pF, S1 closed (Notes 4, 5)			4	µs

Note 1: All currents into the device are positive; all currents out of the device are negative. All voltages are referenced to device ground, unless otherwise noted.

Note 2: ΔV_{OD} and ΔV_{OC} are the changes in V_{OD} and V_{OC}, respectively, when the DI input changes state.

Note 3: The short-circuit output current applies to peak current just prior to foldback-current limiting; the short-circuit foldback output current applies during current limiting to allow a recovery from bus contention.

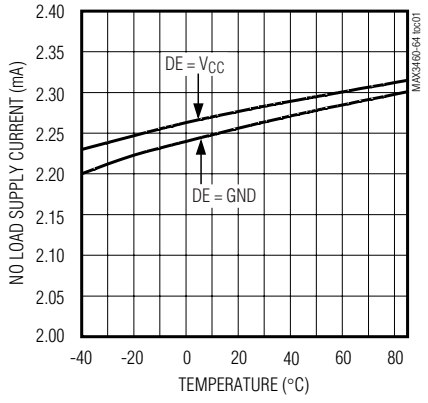
Note 4: Capacitive load includes test probe and fixture capacitance.

Note 5: Shutdown is enabled by bringing $\overline{RE}$ high and DE low or by bringing SHDN high. If the enable inputs are in this state for less than 50ns, the device is guaranteed not to enter shutdown. If the enable inputs are in this state for at least 800ns, the device is guaranteed to have entered shutdown.

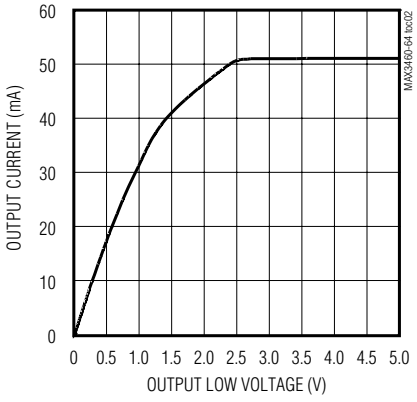
Typical Operating Characteristics

(V_{CC} = +5V, T_A = +25°C, unless otherwise noted.)

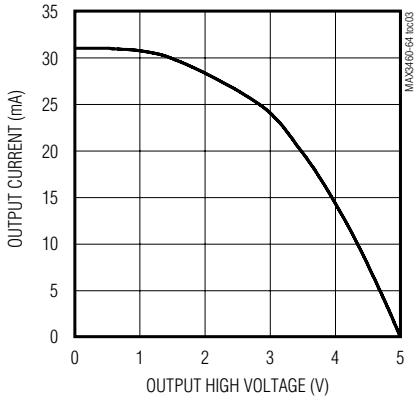
NO LOAD SUPPLY CURRENT vs. TEMPERATURE



OUTPUT CURRENT vs. RECEIVER OUTPUT LOW VOLTAGE



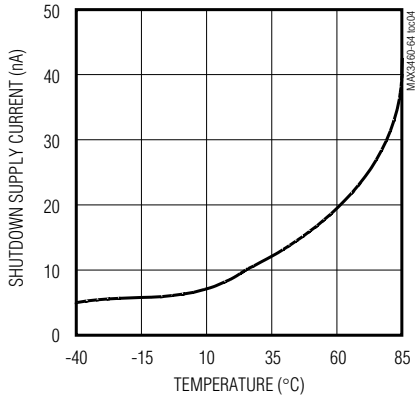
OUTPUT CURRENT vs. RECEIVER OUTPUT HIGH VOLTAGE



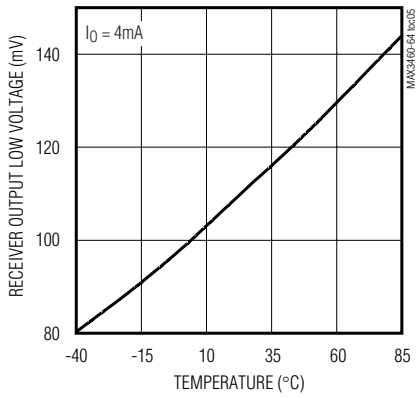
Typical Operating Characteristics (continued)

(V_{CC} = +5V, T_A = +25°C, unless otherwise noted.)

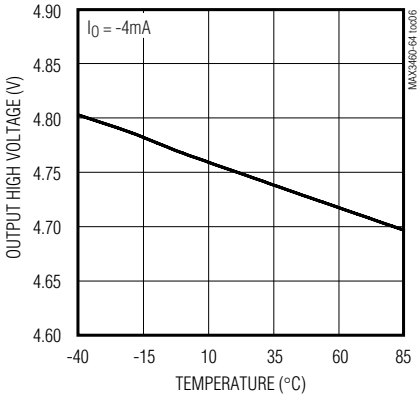
SHUTDOWN SUPPLY CURRENT vs. TEMPERATURE



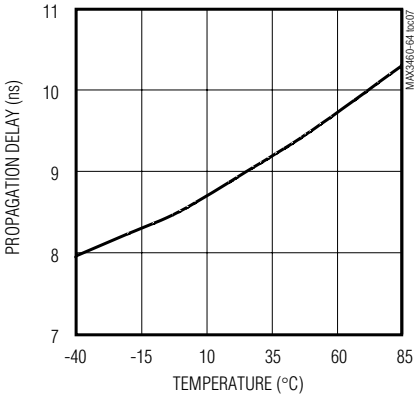
RECEIVER OUTPUT LOW VOLTAGE vs. TEMPERATURE



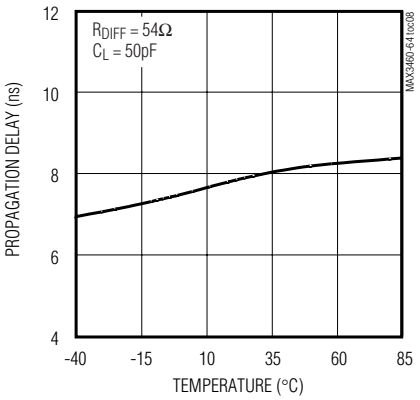
RECEIVER OUTPUT HIGH VOLTAGE vs. TEMPERATURE



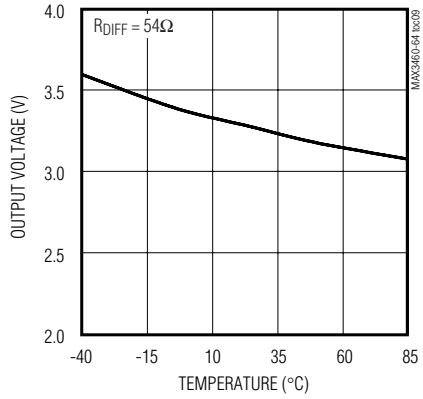
RECEIVER PROPAGATION DELAY vs. TEMPERATURE



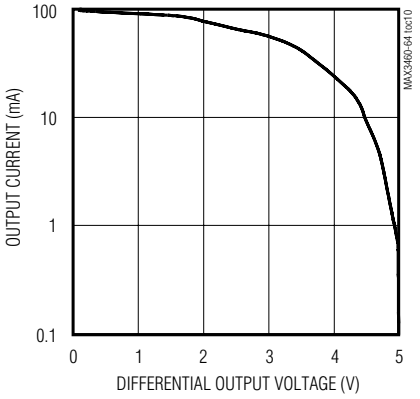
DRIVER PROPAGATION DELAY vs. TEMPERATURE



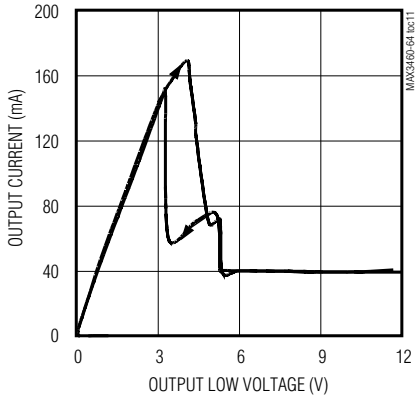
DRIVER DIFFERENTIAL OUTPUT VOLTAGE vs. TEMPERATURE



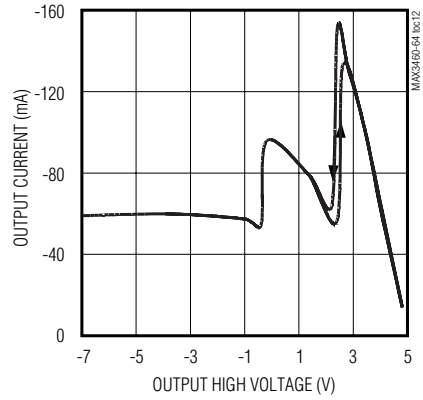
DRIVER OUTPUT CURRENT vs. DIFFERENTIAL OUTPUT VOLTAGE



OUTPUT CURRENT vs. DRIVER OUTPUT LOW VOLTAGE



OUTPUT CURRENT vs. DRIVER OUTPUT HIGH VOLTAGE

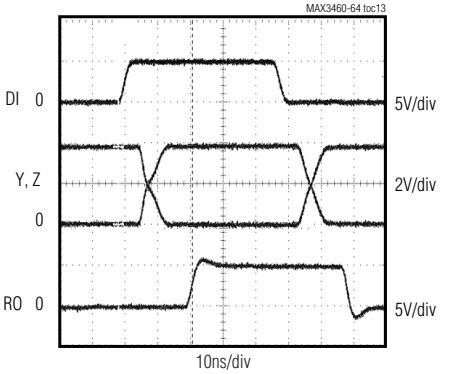


+5V, Fail-Safe, 20Mbps, Profibus RS-485/ RS-422 Transceivers

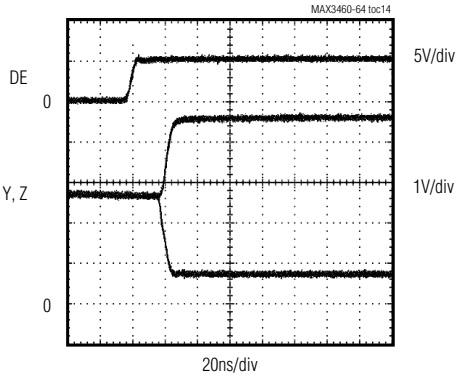
Typical Operating Characteristics (continued)

(V_{CC} = +5V, T_A = +25°C, unless otherwise noted.)

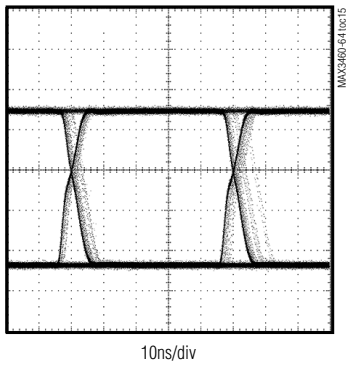
DRIVER AND RECEIVER PROPAGATION DELAYS



ENABLE RESPONSE TIME



EYE DIAGRAM



Pin Description

PIN			NAME	FUNCTION
MAX3460/ MAX3461	MAX3462	MAX3463/ MAX3464		
FULL DUPLEX		HALF DUPLEX		
1	—	—	SHDN	Shutdown. Drive SHDN high to enter low-power shutdown mode.
2	2	1	RO	Receiver Output. When $\overline{RE}$ is low and (A - B) ≥ -50mV, RO is high; if (A - B) ≤ -200mV, RO is low.
3	—	2	$\overline{RE}$	Receiver Output Enable. Drive $\overline{RE}$ low to enable RO; RO is high impedance when $\overline{RE}$ is high. Drive $\overline{RE}$ high and DE low to enter low-power shutdown mode.
4	—	3	DE	Driver Output Enable. Drive DE high to enable driver output. These outputs are high impedance when DE is low. Drive $\overline{RE}$ high and DE low to enter low-power shutdown mode.
5	3	4	DI	Driver Input. With DE high, a low on DI forces the noninverting output low and the inverting output high. Similarly, a high on DI forces the noninverting output high and the inverting output low.
6, 7	4	5	GND	Ground
8	—	—	TXP	Transmitter Phase. Connect TXP to GND, or leave unconnected for normal transmitter phase/polarity. Connect TXP to V_{CC} to invert the transmitter phase/polarity. TXP has an internal 15µA pulldown.
9	5	—	Y	Noninverting Driver Output
10	6	—	Z	Inverting Driver Output
11	7	—	B	Inverting Receiver Input
12	8	—	A	Noninverting Receiver Input
13	—	—	RXP	Receiver Phase. Connect RXP to GND, or leave unconnected for normal receiver phase/polarity. Connect RXP to V_{CC} to invert the receiver phase/polarity. RXP has an internal 15µA pulldown.
14	1	8	V_{CC}	Positive Supply: +4.75V ≤ V_{CC} ≤ +5.25V. Bypass V_{CC} to GND with a 0.1µF capacitor.
—	—	7	B	Inverting Receiver Input and Inverting Driver Output
—	—	6	A	Noninverting Receiver Input and Noninverting Driver Output

Function Tables

MAX3460/MAX3461

TRANSMITTING					
INPUTS				OUTPUTS	
$\overline{RE}$	DE	DI	SHDN	Z	Y
X	1	1	0	0	1
X	1	0	0	1	0
0	0	X	0	High-Z	High-Z
1	0	X	X	Shutdown	
X	X	X	1	Shutdown	

RECEIVING				
INPUTS				OUTPUT
$\overline{RE}$	DE	A–B	SHDN	RO
0	X	≥ -0.05V	0	1
0	X	≤ -0.2V	0	0
0	X	Open/Shorted	0	1
1	1	X	0	High-Z
1	0	X	X	Shutdown
X	X	X	1	Shutdown

MAX3462

TRANSMITTING		
INPUT	OUTPUTS	
DI	Z	Y
1	0	1
0	1	0

RECEIVING	
INPUTS	OUTPUT
A–B	RO
≥ -0.05V	1
≤ -0.2V	0
Open/Shorted	1

MAX3463/MAX3464

TRANSMITTING				
INPUTS			OUTPUTS	
$\overline{RE}$	DE	DI	B	A
X	1	1	0	1
X	1	0	1	0
0	0	X	High-Z	High-Z
1	0	X	Shutdown	

RECEIVING			
INPUTS			OUTPUT
$\overline{RE}$	DE	A–B	RO
0	X	≥ -0.05V	1
0	X	≤ -0.2V	0
0	X	Open/Shorted	1
1	1	X	High-Z
1	0	X	Shutdown

+5V, Fail-Safe, 20Mbps, Profibus RS-485/ RS-422 Transceivers

Pin Configurations and Typical Operating Circuit

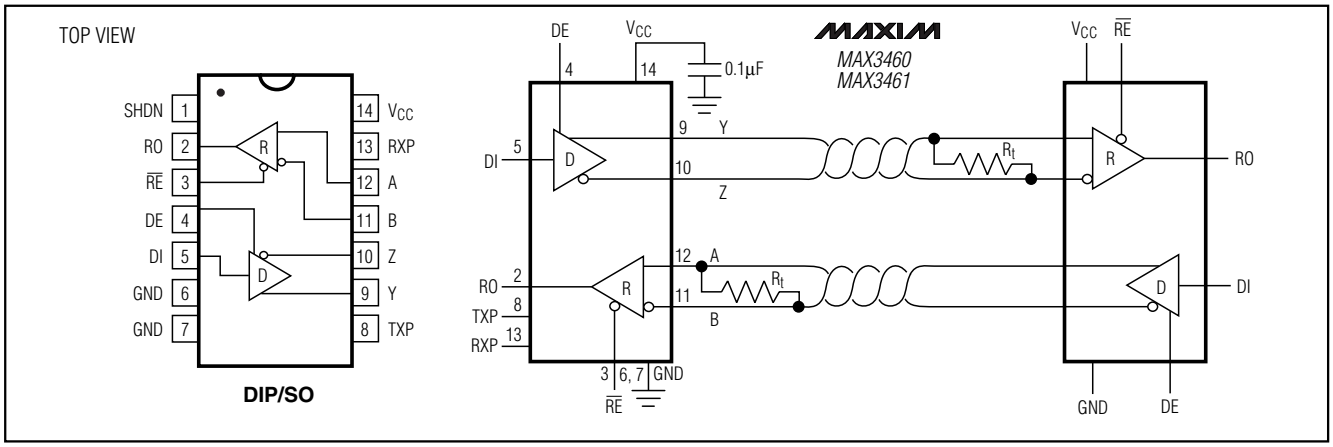


Figure 1. MAX3460/MAX3461 Pin Configuration and Typical Full-Duplex Operating Circuit

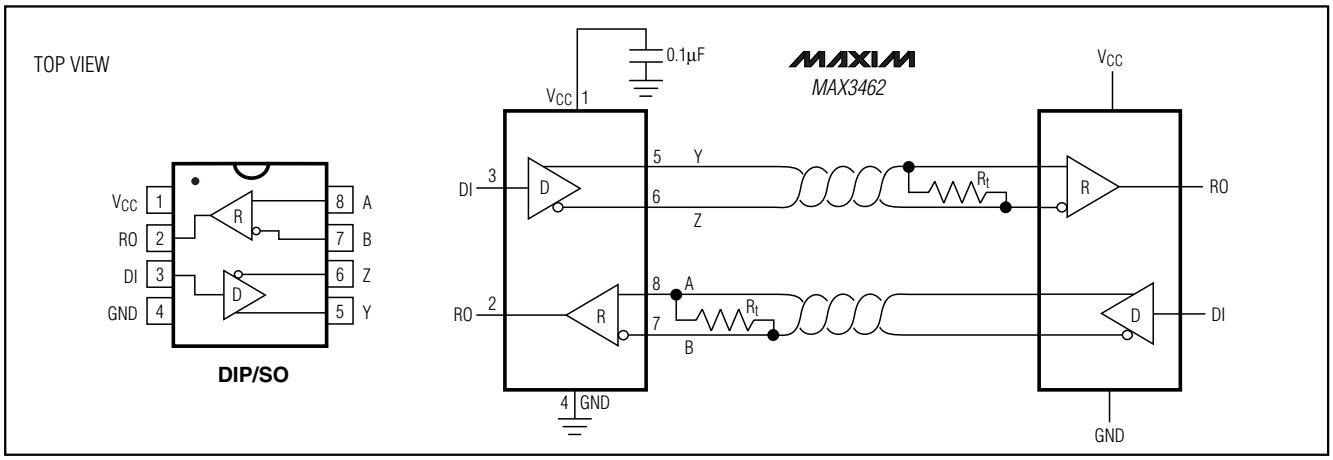


Figure 2. MAX3462 Pin Configuration and Typical Full-Duplex Operating Circuit

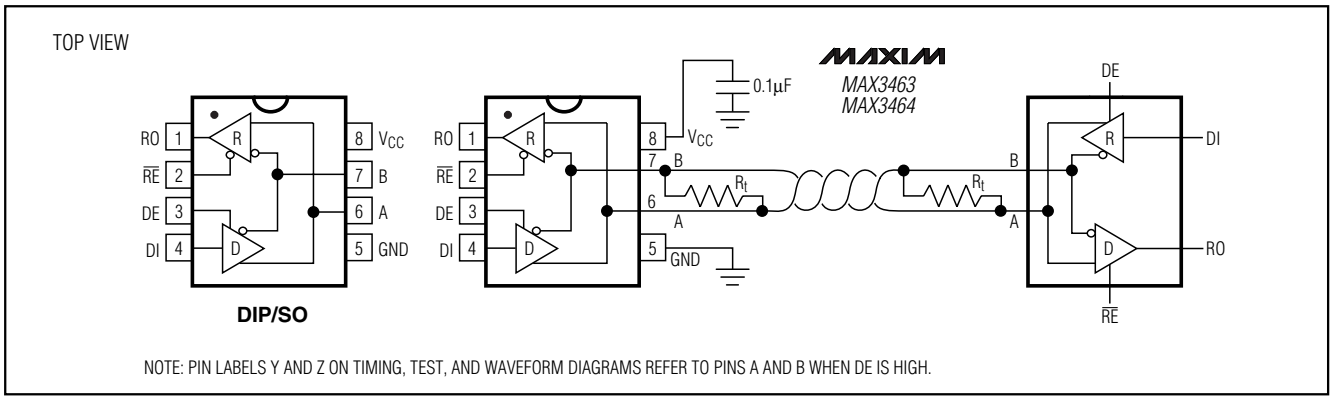


Figure 3. MAX3463/MAX3464 Pin Configuration and Typical Full-Duplex Operating Circuit

Detailed Description

The MAX3460–MAX3464 high-speed transceivers for RS-485/RS-422 communication contain one driver and one receiver. These devices feature true fail-safe circuitry, which guarantees a logic-high receiver output when the receiver inputs are open or shorted, or when they are connected to a terminated transmission line with all drivers disabled (see the *True Fail-Safe* section). The MAX3460–MAX3464's driver slew rates allow transmit speeds up to 20Mbps.

The MAX3463 and MAX3464 are half-duplex transceivers, while the MAX3460, MAX3461, and MAX3462 are full-duplex transceivers. All of these parts operate from a single +5V supply. Drivers are output short-circuit current limited. Thermal shutdown circuitry protects drivers against excessive power dissipation. When activated, the thermal shutdown circuitry places the driver outputs into a high-impedance state. The MAX3460 and MAX3463 devices have a hot-swap input structure that prevents disturbances on the differential signal lines when a circuit board is plugged into a "hot" backplane (see *Hot Swap* section). All devices have output levels that are compatible with Profibus standards.

True Fail-Safe

The MAX3460–MAX3464 guarantee a logic-high receiver output when the receiver inputs are shorted or open, or when they are connected to a terminated transmission line with all drivers disabled. This is done by setting the receiver threshold between -50mV and -200mV. If the differential receiver input voltage (A - B) is greater than or equal to -50mV, RO is logic high. If A - B is less than or equal to -200mV, RO is logic low. In the case of a terminated bus with all transmitters disabled, the receiver's differential input voltage is pulled to 0V by the termination. With the receiver thresholds of the MAX3460–MAX3464, this results in a logic high with a 50mV minimum noise margin. Unlike previous true fail-safe devices, the -50mV to -200mV threshold complies with the ±200mV EIA/TIA-485 standard.

Hot-Swap Capability

Hot-Swap Inputs

When circuit boards are inserted into a "hot" or powered backplane, disturbances to the enable and differential receiver inputs can lead to data errors. Upon initial circuit board insertion, the processor undergoes its power-up sequence. During this period, the output drivers are high impedance and are unable to drive the DE input of the MAX3460/MAX3463 to a defined logic level. Leakage currents up to 10µA from the high-impedance output could cause DE to drift to an incorrect logic state. Additionally, parasitic circuit board capacitance could cause coupling of V_{CC} or GND to DE. These factors could improperly enable the driver.

When V_{CC} rises, an internal pulldown circuit holds DE low for around 15µs. After the initial power-up sequence, the pulldown circuit becomes transparent, resetting the hot-swap tolerable input.

Hot-Swap Input Circuitry

The MAX3460/MAX3463 enable inputs feature hot-swap capability. At the input there are two NMOS devices, M1 and M2 (Figure 4). When V_{CC} ramps from 0, an internal 15µs timer turns on M2 and sets the SR latch, which also turns on M1. Transistors M2, a 2mA current sink, and M1, a 100µA current sink, pull DE to GND through a 5.6kΩ resistor. M2 is designed to pull DE to the disabled state against an external parasitic capacitance up to 100pF that can drive DE high. After 15µs, the timer deactivates M2 while M1 remains on, holding DE low against three-state leakages that can drive DE high. M1 remains on until an external source overcomes the required input current. At this time, the SR latch resets and M1 turns off. When M1 turns off, DE reverts to a standard, high-impedance CMOS input. Whenever V_{CC} drops below 1V, the hot-swap input is reset.

For $\overline{RE}$ there is a complimentary circuit employing two PMOS devices pulling $\overline{RE}$ to V_{CC}.

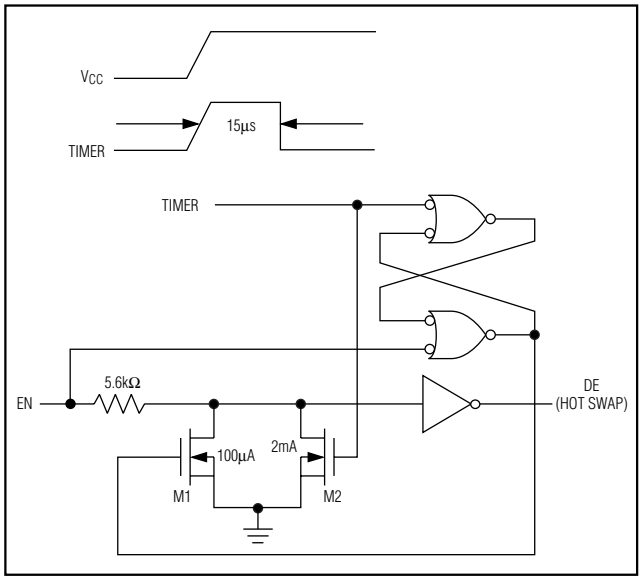


Figure 4. Simplified Structure of the Driver Enable Pin (DE)

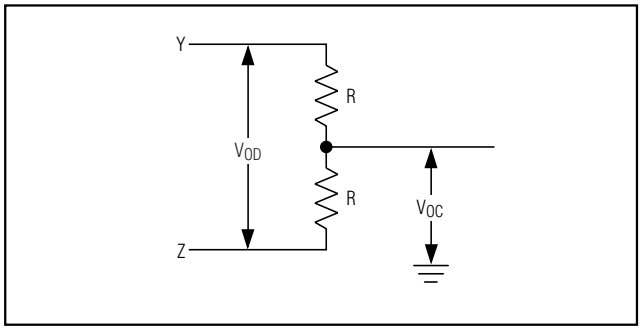


Figure 5. Driver DC Test Load

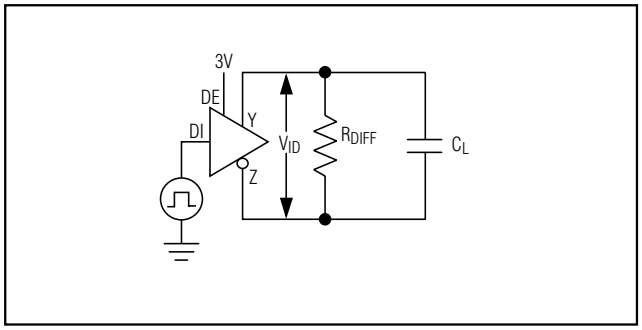


Figure 6. Driver Timing Test Circuit

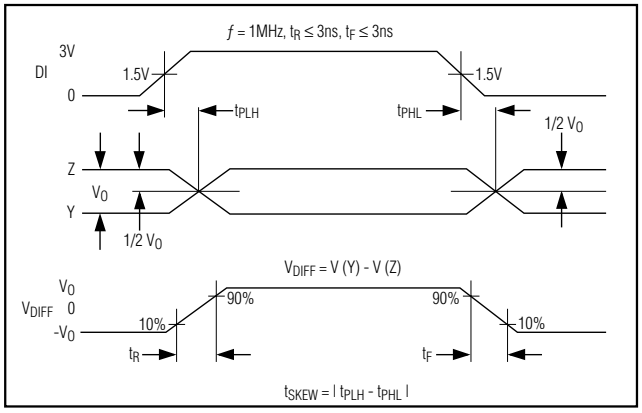


Figure 7. Driver Propagation Delays

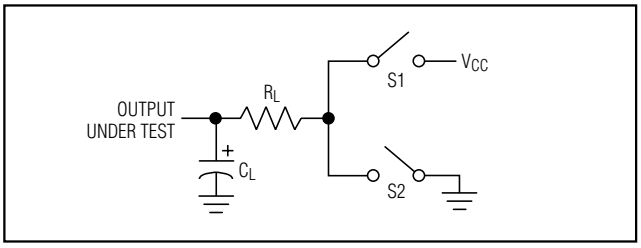


Figure 8. Enable/Disable Timing Test Load

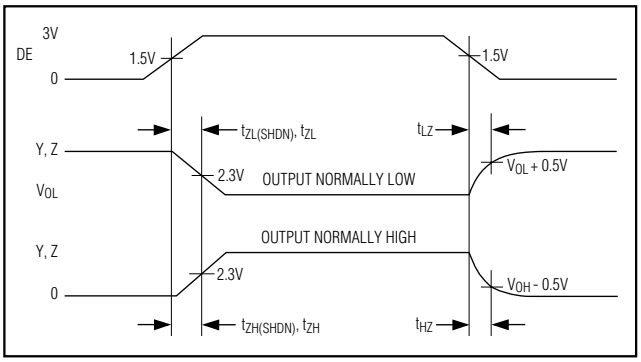


Figure 9. Driver Enable and Disable Times

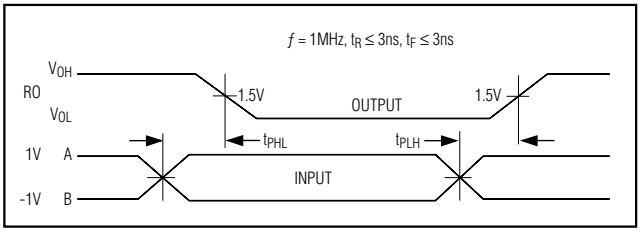


Figure 10. Receiver Propagation Delays

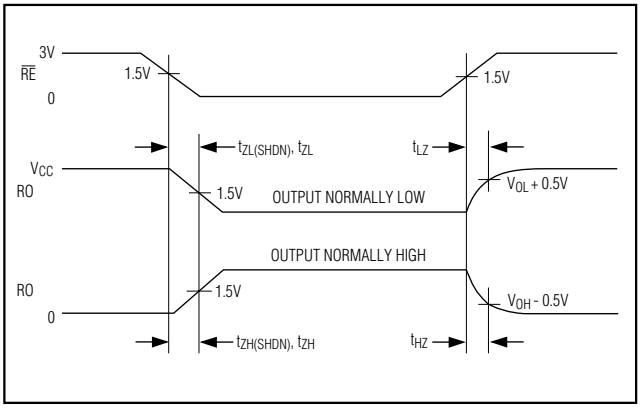


Figure 11. Receiver Enable and Disable Times

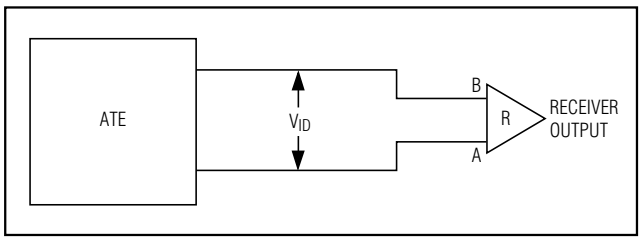


Figure 12. Receiver Propagation Delay Test Circuit

Applications Information

128 Transceivers on the Bus

The standard RS-485 receiver input impedance is 12kΩ (one-unit load), and the standard driver can drive up to 32 unit loads. The MAX3460–MAX3464 family of transceivers has a 1/4-unit-load receiver input impedance (48kΩ), allowing up to 128 transceivers to be connected in parallel on one communication line. Any combination of these devices and/or other RS-485 transceivers with a total of 32 unit loads or less can be connected to the line.

Low-Power Shutdown Mode (except MAX3462)

Low-power shutdown mode is initiated by bringing SHDN high (MAX3460/MAX3461), or both $\overline{RE}$ high and DE low. In shutdown, the devices typically draw only 1µA of supply current. $\overline{RE}$ and DE can be driven simultaneously; the parts are guaranteed not to enter shutdown if $\overline{RE}$ is high and DE is low for less than 50ns. If the inputs are in this state for at least 800ns, the parts are guaranteed to enter shutdown.

Driver Output Protection

Two mechanisms prevent excessive output current and power dissipation caused by faults or by bus contention. The first, a foldback current limit on the output stage, provides immediate protection against short circuits over the whole common-mode voltage range (see *Typical Operating Characteristics*). The second, a thermal shutdown circuit, forces the driver outputs into a high-impedance state if the die temperature exceeds +140°C.

Propagation Delay

Many digital encoding schemes depend on the difference between the driver and receiver propagation delay times. Typical propagation delays are shown in the *Typical Operating Characteristics*. The difference in receiver delay times, $|t_{PLH} - t_{PHL}|$, is a maximum of 2ns. The driver skew time $|t_{PLH} - t_{PHL}|$ is also a maximum of 2ns.

Typical Applications

The MAX3460–MAX3464 transceivers are designed for bidirectional data communications on multipoint bus transmission lines. Figures 13 and 14 show typical network applications circuits. To minimize reflections, the line should be terminated at both ends in its characteristic impedance, and stub lengths off the main line should be kept as short as possible.

Profibus Termination

The MAX3460–MAX3464 are designed for driving Profibus termination networks. With a worst-case loading of two termination networks with 220Ω termination impedance and 390Ω pullups and pulldowns, the drivers can drive V_{A-B}> 2.1V output.

Chip Information

TRANSISTOR COUNT: 610

PROCESS: BiCMOS

Ordering Information (continued)

PART	TEMP RANGE	PIN-PACKAGE
MAX3461CSD	0°C to +70°C	14 SO
MAX3461CPD	0°C to +70°C	14 Plastic DIP
MAX3461ESD	-40°C to +85°C	14 SO
MAX3461EPD	-40°C to +85°C	14 Plastic DIP
MAX3462CSA	0°C to +70°C	8 SO
MAX3462CPA	0°C to +70°C	8 Plastic DIP
MAX3462ESA	-40°C to +85°C	8 SO
MAX3462EPA	-40°C to +85°C	8 Plastic DIP
MAX3463CSA	0°C to +70°C	8 SO
MAX3463CPA	0°C to +70°C	8 Plastic DIP
MAX3463ESA	-40°C to +85°C	8 SO
MAX3463EPA	-40°C to +85°C	8 Plastic DIP
MAX3464CSA	0°C to +70°C	8 SO
MAX3464CPA	0°C to +70°C	8 Plastic DIP
MAX3464ESA	-40°C to +85°C	8 SO
MAX3464EPA	-40°C to +85°C	8 Plastic DIP

+5V, Fail-Safe, 20Mbps, Profibus RS-485/ RS-422 Transceivers

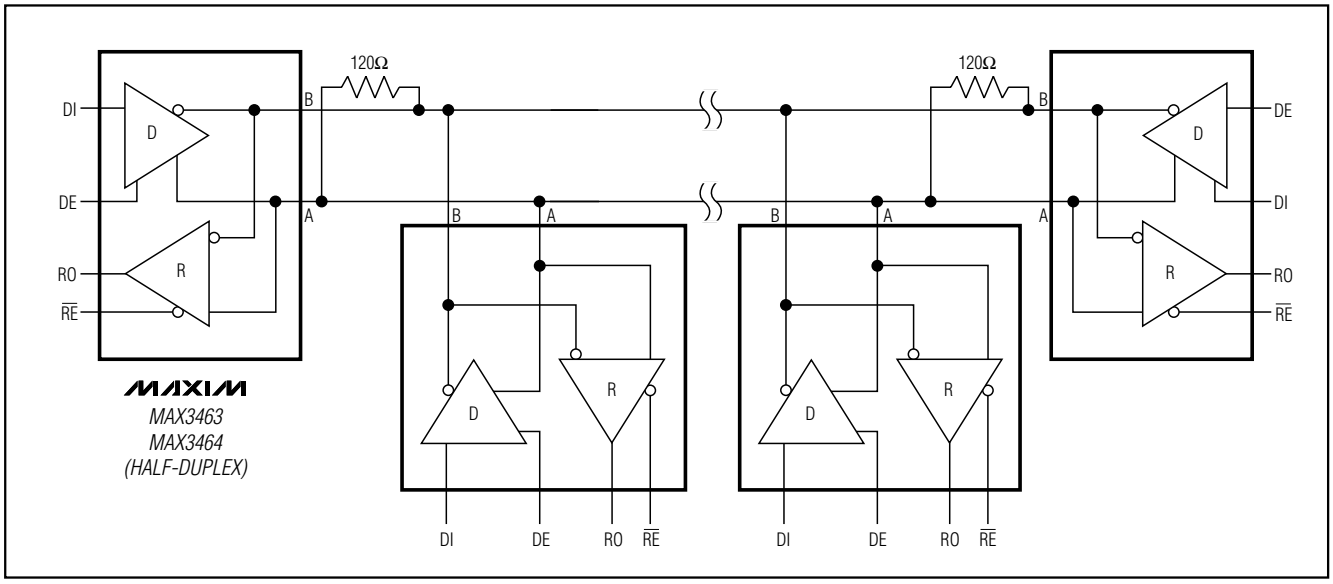


Figure 13. Typical Half-Duplex RS-485 Network

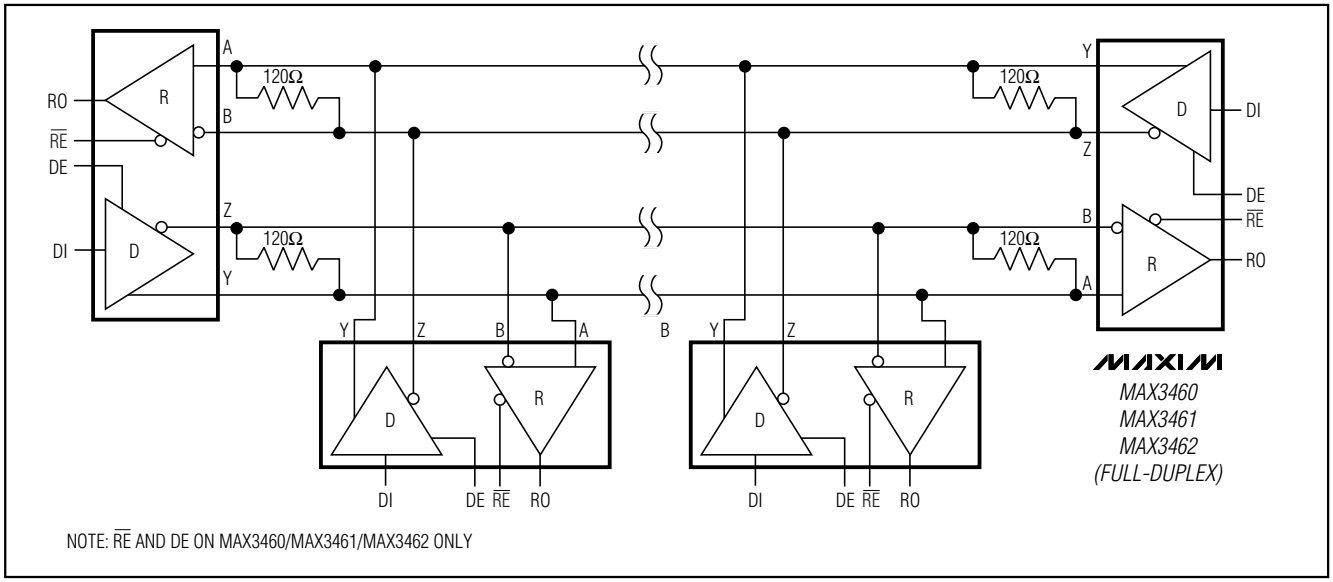
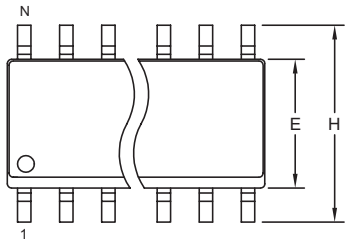


Figure 14. Typical Full-Duplex RS-485 Network

Package Information

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)

SOICN .EPS

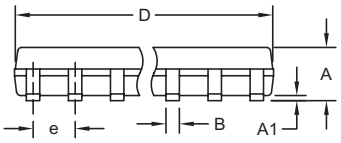


TOP VIEW

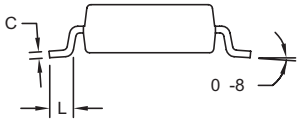
DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
B	0.014	0.019	0.35	0.49
C	0.007	0.010	0.19	0.25
e	0.050 BSC		1.27 BSC	
E	0.150	0.157	3.80	4.00
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27

VARIATIONS:

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX	N	MS012
D	0.189	0.197	4.80	5.00	8	AA
D	0.337	0.344	8.55	8.75	14	AB
D	0.386	0.394	9.80	10.00	16	AC



FRONT VIEW



SIDE VIEW

NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH.
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED 0.15mm (.006").
3. LEADS TO BE COPLANAR WITHIN 0.10mm (.004").
4. CONTROLLING DIMENSION: MILLIMETERS.
5. MEETS JEDEC MS012.
6. N = NUMBER OF PINS.

DALLAS SEMICONDUCTOR MAXIM

PROPRIETARY INFORMATION

TITLE: PACKAGE OUTLINE, .150" SOIC

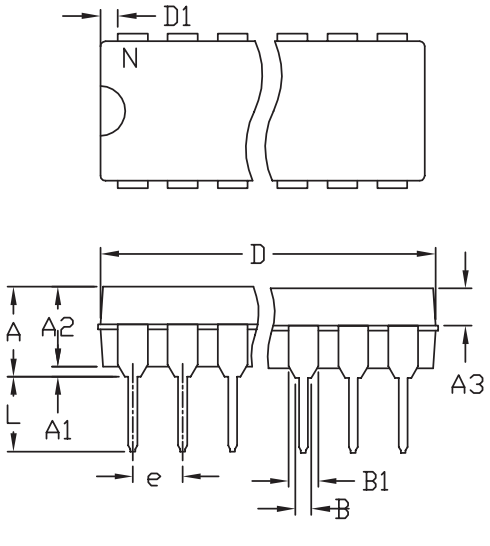
APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0041	B	1/1

+5V, Fail-Safe, 20Mbps, Profibus RS-485/ RS-422 Transceivers

Package Information (continued)

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)

PDIPN.EPS



	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	---	0.180	---	4.572
A1	0.015	---	0.38	---
A2	0.125	0.175	3.18	4.45
A3	0.055	0.080	1.40	2.03
B	0.015	0.022	0.381	0.56
B1	0.045	0.065	1.14	1.65
C	0.008	0.014	0.2	0.355
D1	0.005	0.080	0.13	2.03
E	0.300	0.325	7.62	8.26
E1	0.240	0.310	6.10	7.87
e	0.100 BSC.		2.54 BSC.	
eA	0.300 BSC.		7.62 BSC.	
eB	0.400 BSC.		10.16 BSC.	
L	0.115	0.150	2.921	3.81

	INCHES		MILLIMETERS			
	MIN	MAX	MIN	MAX	N	MS001
D	0.348	0.390	8.84	9.91	8	AB
D	0.735	0.765	18.67	19.43	14	AC
D	0.745	0.765	18.92	19.43	16	AA
D	0.885	0.915	22.48	23.24	18	AD
D	1.015	1.045	25.78	26.54	20	AE
D	1.14	1.265	28.96	32.13	24	AF
D	1.360	1.380	34.54	35.05	28	*5

NOTES:
1. D&E DO NOT INCLUDE MOLD FLASH
2. MOLD FLASH OR PROTRUSIONS NOT TO EXCEED .15mm (.006")
3. CONTROLLING DIMENSION: MILLIMETER
4. MEETS JEDEC MS001-XX AS SHOWN IN ABOVE TABLE
5. SIMILIAR TO JEDEC MO-058AB
6. N = NUMBER OF PINS

MAXIM 120 SAN GABRIEL DR SUNNYVALE CA 94086 FAX (408) 737 7194 PROPRIETARY INFORMATION | TITLE: PACKAGE FAMILY OUTLINE: PDIP .300" | 1/1 | 21-0043 D DOCUMENT CONTROL NUMBER REV

Mouser Electronics

Authorized Distributor

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Analog Devices Inc.:

MAX3463CSA+ MAX3463ESA+ MAX3463CPA+ MAX3463ESA+T