



MxL83232, MxL83233, and MxL83234

High-Performance RS-485/422 Transceivers with 1.65V-5.5V
I/O Interface and Extended IEC ESD and EFT Protection
Data Sheet

General Description

The MxL83232, MxL83233, and MxL83234 are high-performance RS-485 / RS-422 transceivers designed to meet demanding system requirements. They support a wide operating supply range (from 3.0V to 5.5V) and deliver maximum data rates of 500kbps, 20Mbps, and 50Mbps, respectively. The devices feature a flexible I/O logic supply from 1.65V to 5.5V, simplifying multi-voltage system interfacing.

The receivers incorporate enhanced fail-safe circuitry, ensuring a logic-high output when inputs are open, shorted, or idle. With an input impedance of at least 96k Ω (1/8 unit load), the devices allow up to 256 nodes on the bus. The drivers include short-circuit protection, thermal shutdown, and maintain high impedance during power-off.

The devices are half-duplex and available in small MSOP and NSOIC packages makes these products suited for space-constrained applications that require robust and high-performance communication.

Applications

- Industrial control systems
- High-performance electric motor drives
- Industrial and single board computers
- Smart Grid
- Building security and automation
- Industrial and process control equipment
- HVAC Equipment
- Portable Internet of Things

Features

- Meets or exceeds the requirements of the *TIA/EIA-485A* standard
- Supports 1.65V to 5.5V I/O logic interface VL pin
- Wide supply range from 3.0V to 5.5V
- Differential output exceeds 2.1V for PROFIBUS compatibility with a 5V supply
- Extended operating temperature range from -40°C to 125°C
- Extended operational common-mode range of $\pm 15V$
- Enhanced failsafe protection for open, short, idle
- Glitch-free power-up/down capability
- 1/8 unit load (256 bus nodes)
- NSOIC and small form factor MSOP packages
- Robust system protection
 - $\pm 4kV$ EFT (*IEC 61000-4-4*)
 - $\pm 8kV$ ESD Contact (*IEC 61000-4-2*)
 - $\pm 15kV$ ESD Airgap (*IEC 61000-4-2*)
 - $\pm 15kV$ ESD Human Body Model (HBM)

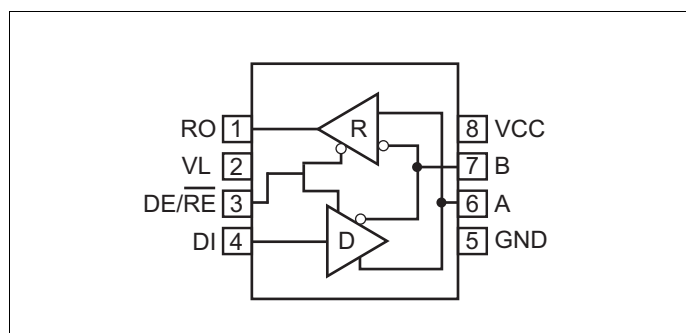


Figure 1: 8-Pin Half Duplex Diagram

Ordering Information - [page 18](#)

Revision History

Document No.	Release Date	Change Description
288-323334DSR01	December 12, 2025	Initial final release.

Table of Contents

General Description	i
Applications	i
Features	i
Specifications	1
Absolute Maximum Ratings	1
ESD and EFT Ratings	1
Thermal Information	1
Power Dissipation	2
Recommended Operating Conditions	2
Electrical Characteristics	3
Driver Switching Characteristics—MxL83232	4
Receiver Switching Characteristics—MxL83232	4
Driver Switching Characteristics—MxL83233	5
Receiver Switching Characteristics—MxL83233	5
Driver Switching Characteristics—MxL83234	6
Receiver Switching Characteristics—MxL83234	6
Test Circuits and Timing Diagrams	7
Function Tables	12
Pin Information	13
Pin Configurations	13
Pin Descriptions	13
Detailed Description	14
Receiver Input Filtering	14
Enhanced Failsafe	14
ESD Test Conditions (IEC 61000-4-2)	14
Electrical Fast Transient (IEC 61000-4-4)	14
Evaluation of Test Results	15
256 Transceivers on the Bus	15
Reduced EMI and Reflections	15
Driver Output Protection	15
Line Length	15
Typical Applications	15
Mechanical Dimensions	16
MSOP-8	16
NSOIC-8	17

Ordering Information..... 18

List of Figures

Figure 1: 8-Pin Half Duplex Diagram	i
Figure 2: Driver DC Test Circuit	7
Figure 3: Receiver DC Test Circuit.....	7
Figure 4: Differential Driver Output Voltage over Extended Common Mode.....	7
Figure 5: Driver Propagation Delay Time Test Circuit and Timing Diagram.....	8
Figure 6: Driver Enable and Disable Times Test Circuit and Timing Diagram	9
Figure 7: Driver Short Circuit Current Test	10
Figure 8: Receiver Propagation Delay Test Circuit and Timing Diagram	10
Figure 9: Receiver Enable and Disable Times Test Circuit and Timing Diagram.....	11
Figure 10: Pin Configurations	13
Figure 11: Mechanical Dimensions—MSOP-8	16
Figure 12: Mechanical Dimensions—NSOIC-8	17

List of Tables

Table 1: Absolute Maximum Ratings	1
Table 2: ESD and EFT Ratings	1
Table 3: Thermal Information	1
Table 4: Power Dissipation	2
Table 5: Operating Conditions	2
Table 6: Electrical Characteristics	3
Table 7: MxL83232 Driver Switching Characteristics	4
Table 8: MxL83232 Receiver Switching Characteristics	4
Table 9: MxL83233 Driver Switching Characteristics	5
Table 10: MxL83233 Receiver Switching Characteristics	5
Table 11: MxL83234 Driver Switching Characteristics	6
Table 12: MxL83234 Receiver Switching Characteristics	6
Table 13: MxL83232, MxL83233, MxL83234 Tx (Half-Duplex)	12
Table 14: MxL83232, MxL83233, MxL83234 Rx (Half-Duplex)	12
Table 15: MxL83232/MxL83233/MxL83234 Pin Descriptions	13
Table 16: Ordering Information	18

Specifications

Absolute Maximum Ratings

Important: The stresses above what is listed under the following table may cause permanent damage to the device. This is a stress rating only—functional operation of the device above what is listed under the following table or any other conditions beyond what MaxLinear recommends is not implied. Exposure to conditions above the recommended conditions for the extended periods of time may affect device reliability. Solder reflow profile is specified in the *IPC/JEDEC J-STD-020C* standard.

Table 1: Absolute Maximum Ratings

Parameter	Minimum	Maximum	Units
Supply voltage (V_{CC})	−0.3	6	V
Bus voltage (Pin A and B)	−18	18	V
Logic interface voltage (Pin V_L) ($V_L \leq V_{CC}$)	−0.3	6	V
TTL input voltage (Pin DI, $\overline{DE}/\overline{RE}$)	−0.3	$V_L + 0.3$	V
Receiver output voltage (Pin RO)	−0.3	$V_L + 0.3$	V
Receiver output current (Pin RO)	−24	24	mA
Driver output current (Pin A and B)	−250	250	mA
Storage temperature	−65	150	°C
Operating Junction Temperature (T_J)	−40	150	°C

ESD and EFT Ratings

Table 2: ESD and EFT Ratings

Parameter	Limit	Units
HBM—Human Body Model (pins A, B)	±15	kV
IEC 61000-4-2 Airgap Discharge (pins A, B)	±15	kV
IEC 61000-4-2 Contact Discharge (pins A, B)	±8	kV
IEC 61000-4-4 Electrical Fast Transient (pins A, B)	±4	kV

Thermal Information

Table 3: Thermal Information

Symbol	Thermal Metric	MxL83232, MxL83233, MxL83234		Units
		MSOP-8	NSOIC-8	
θ_{JA}	Junction-to-Ambient Thermal Resistance	154	96.1	°C/W
Ψ_{JT}	Junction-to-Top Characterization Parameter	3	3.7	°C/W
Ψ_{JB}	Junction-to-Board Characterization Parameter	118.2	59.1	°C/W
θ_{JB}	Junction-to-Board Thermal Resistance	111	58.3	°C/W
θ_{JC}	Junction-to-Case Thermal Resistance	54	42.2	°C/W

Power Dissipation

Table 4: Power Dissipation

Parameter	Description	Test Condition	Minimum	Typical	Maximum	Unit
PD	Driver enabled and receiver disabled, $V_{CC} = 5.5V$, $V_L = V_{CC}$, $T_A = 125^\circ C$, 50% duty cycle square wave at 0.5Mbps signaling rate, MxL83232	Load: $R_L = 300\Omega$, $C_L = 50pF$	-	102	-	mW
		RS-422 load: $R_L = 100\Omega$, $C_L = 50pF$	-	120	-	mW
		RS-485 load: $R_L = 54\Omega$, $C_L = 50pF$	-	175	-	mW
		No Load	-	100	-	mW
	Driver enabled and receiver disabled, $V_{CC} = 5.5V$, $V_L = V_{CC}$, $T_A = 125^\circ C$, 50% duty cycle square wave at 20Mbps signaling rate, MxL83233	Load: $R_L = 300\Omega$, $C_L = 50pF$	-	265	-	mW
		RS-422 load: $R_L = 100\Omega$, $C_L = 50pF$	-	275	-	mW
		RS-485 load: $R_L = 54\Omega$, $C_L = 50pF$	-	315	-	mW
		No Load	-	270	-	mW
	Driver enabled and receiver disabled, $V_{CC} = 5.5V$, $V_L = V_{CC}$, $T_A = 125^\circ C$, 50% duty cycle square wave at 50Mbps signaling rate, MxL83234	Load: $R_L = 300\Omega$, $C_L = 50pF$	-	310	-	mW
		RS-422 load: $R_L = 100\Omega$, $C_L = 50pF$	-	305	-	mW
		RS-485 load: $R_L = 54\Omega$, $C_L = 50pF$	-	325	-	mW
		No Load	-	225	-	mW
	Driver disabled and receiver enabled, $V_{CC} = 5.5V$, $V_L = V_{CC}$, $T_A = 125^\circ C$, 50% duty cycle square wave at 0.5Mbps signaling rate, MxL83232	$C_L = 15pF$	-	4.83	-	mW
	Driver disabled and receiver enabled, $V_{CC} = 5.5V$, $V_L = V_{CC}$, $T_A = 125^\circ C$, 50% duty cycle square wave at 20Mbps signaling rate, MxL83233	$C_L = 15pF$	-	14.25	-	mW
	Driver disabled and receiver enabled, $V_{CC} = 5.5V$, $V_L = V_{CC}$, $T_A = 125^\circ C$, 50% duty cycle square wave at 50 Mbps signaling rate, MxL83234	$C_L = 15pF$	-	26.50	-	mW

Recommended Operating Conditions

Table 5: Operating Conditions

Parameter	Minimum	Maximum	Units
Supply Voltage (V_{CC})	3	5.5	V
Control Supply Voltage (V_L), $V_L \leq V_{CC}$	1.65	5.5	V
Common Mode Voltage	-15	15	V
Input Bus Voltage (A, B)	-15	15	V
Input Differential Bus Voltage (V_{ID})	-15	15	V
Operating ambient temperature range (T_A)	-40	125	$^\circ C$

Electrical Characteristics

Unless otherwise noted, $V_{CC} = 3V$ to $5.5V$, ambient temperature $T_{MIN} < T_A < T_{MAX}$. Typical values are at $V_{CC} = 3.3V$, $V_L = V_{CC}$, ambient temperature $T_A = 25^{\circ}C$. The specifications apply over the full operating range from $-40^{\circ}C$ to $125^{\circ}C$, unless otherwise noted.

Table 6: Electrical Characteristics

Symbol	Parameter	Test Condition	Minimum	Typical	Maximum	Units
V_{OD}	Differential Driver Output	$R_L = 100\Omega$ (RS-422)	2	-	V_{CC}	V
		$R_L = 54\Omega$ (RS-485)	1.5	-	V_{CC}	
		$R_L = 60\Omega$, $-15V \leq V_{CM} \leq 15V$	1.5	-	V_{CC}	
		$R_L = 60\Omega$, $-15V \leq V_{CM} \leq 15V$, $4.5 \leq V_{CC} \leq 5.5V$	2.1	-	V_{CC}	
$ \Delta V_{OD} $	Change in Magnitude of Differential Output Voltage	$R_L = 54\Omega$ or 100Ω	-0.2	-	0.2	V
V_{OC}	Driver Common Mode Output Voltage	$R_L = 54\Omega$ or 100Ω	1	$V_{CC}/2$	3	V
$ \Delta V_{OC} $	Change in Steady State of Common Mode Output Voltage	$R_L = 54\Omega$ or 100Ω	-0.2	-	0.2	V
V_{IH}	Input High Voltage	$DE/\overline{RE}$, DI	$2/3 \times V_L$	-	-	V
V_{IL}	Input Low Voltage	$DE/\overline{RE}$, DI	-	-	$1/3 \times V_L$	V
V_{HYS}	Input Hysteresis	$DE/\overline{RE}$, DI	-	100	-	mV
I_{IN}	Input Current	$DE/\overline{RE}$, DI	-1	-	1	μA
I_{OSD}	Driver Short-Circuit Current	$-15V \leq V_{OUT} \leq 15V$	-250	-	250	mA
T_{TS}	Thermal-Shutdown Threshold		-	175	-	$^{\circ}C$
T_{TSH}	Thermal-Shutdown Hysteresis		-	15	-	$^{\circ}C$
Receiver						
V_{TH}	Receiver Differential Threshold (Sensitivity)	$-15V \leq V_{CM} \leq 15V$	-200	-125	-20	mV
V_{HYS}	Receiver Input Hysteresis	$-15V \leq V_{CM} \leq 15V$	-	65	-	mV
V_{OH}	RO Output High Voltage	$I_O = -8mA$	$V_L - 0.4$	-	-	V
V_{OL}	RO Output Low Voltage	$I_O = 8mA$	-	-	0.4	V
I_{OZR}	Tri-State Output Current at Receiver	$0 \leq V_O \leq V_L$	-1	-	1	μA
R_{IN}	Receiver Input Resistance	$-15V \leq V_{CM} \leq 15V$	96	-	-	k Ω
$I_{A,B}$	Input Current (A, B)	$DE/\overline{RE} = GND$ $0 \leq V_{CC} \leq 5.5V$	$V_{IN} = 12V$	-	50	μA
			$V_{IN} = -7V$	-100	-65	
			$V_{IN} = 15V$	-	60	
			$V_{IN} = -15V$	-167	-130	
I_{CC}	Supply Current	No load, $DE/\overline{RE} = V_L$, DI = GND	-	1	2	mA
		No load, $DE/\overline{RE} = GND$, A/B open	-	0.7	1.1	

Note: Voltages are measured with respect to the device ground, unless otherwise noted.

Driver Switching Characteristics—MxL83232

Unless otherwise noted, $V_{CC} = 3V$ to $5.5V$ ambient temperature $T_{MIN} < T_A < T_{MAX}$. Typical values are at $V_{CC} = 3.3V$, $V_L = V_{CC}$, ambient temperature $T_A = 25^\circ C$. The specifications apply over the full operating range from $-40^\circ C$ to $125^\circ C$, unless otherwise noted.

Table 7: MxL83232 Driver Switching Characteristics

Symbol	Driver Characteristic	Conditions	Minimum	Typical	Maximum	Unit
-	Data signaling rate	Duty cycle 40 to 60%	500	-	-	kbps
t_{DPLH} , t_{DPLH}	Driver propagation delay	$R_L = 54\Omega$, $C_L = 50pF$	180	440	1000	ns
t_{DR} , t_{DF}	Driver output rise/fall time		200	285	850	ns
$ t_{DPLH} - t_{DPLH} $	Driver differential skew		-	20	70	ns
t_{DZH}	Driver enable to output high	$R_L = 500\Omega$, $C_L = 50pF$	-	110	1000	ns
t_{DZL}	Driver enable to output low		-	130	1000	ns
t_{DHZ}	Driver disable from output high		-	27	100	ns
t_{DLZ}	Driver disable from output low		-	27	100	ns

Receiver Switching Characteristics—MxL83232

Unless otherwise noted, $V_{CC} = 3V$ to $5.5V$ ambient temperature $T_{MIN} < T_A < T_{MAX}$. Typical values are at $V_{CC} = 3.3V$, $V_L = V_{CC}$, ambient temperature $T_A = 25^\circ C$. The specifications apply over the full operating range from $-40^\circ C$ to $125^\circ C$, unless otherwise noted.

Table 8: MxL83232 Receiver Switching Characteristics

Symbol	Receiver Characteristic	Conditions	Minimum	Typical	Maximum	Unit
-	Data signaling rate	Duty cycle 40 to 60%	500	-	-	kbps
t_{RPHL} , t_{RPLH}	Receiver propagation delay	$C_L = 15pF$	-	50	200	ns
t_{RR} , t_{RF}	Receiver output rise/fall time		-	3	15	ns
$ t_{RPLH} - t_{RPHL} $	Propagation delay skew		-	3	30	ns
t_{RZH}	Receiver enable to output high	$R_L = 1k\Omega$, $C_L = 50pF$	-	11	50	ns
t_{RZL}	Receiver enable to output low		-	11	50	ns
t_{RHZ}	Receiver disable from output high		-	12	50	ns
t_{RLZ}	Receiver disable from output low		-	12	50	μs

Driver Switching Characteristics—MxL83233

Unless otherwise noted, $V_{CC} = 3V$ to $5.5V$ ambient temperature $T_{MIN} < T_A < T_{MAX}$. Typical values are at $V_{CC} = 3.3V$, $V_L = V_{CC}$, ambient temperature $T_A = 25^\circ C$. The specifications apply over the full operating range from $-40^\circ C$ to $125^\circ C$, unless otherwise noted.

Table 9: MxL83233 Driver Switching Characteristics

Symbol	Driver Characteristic	Conditions	Minimum	Typical	Maximum	Unit
-	Data signaling rate	Duty cycle 40 to 60%	20	-	-	Mbps
t_{DPLH} , t_{DPLH}	Driver propagation delay	$R_L = 54\Omega$, $C_L = 50pF$	-	15	30	ns
t_{DR} , t_{DF}	Driver output rise/fall time		5	9	17	ns
$ t_{DPLH} - t_{DPLH} $	Driver differential skew		-	0.8	4	ns
t_{DZH}	Driver enable to output high	$R_L = 500\Omega$, $C_L = 50pF$	-	17	50	ns
t_{DZL}	Driver enable to output low		-	17	50	ns
t_{DHZ}	Driver disable from output high		-	25	50	ns
t_{DLZ}	Driver disable from output low		-	23	50	ns

Receiver Switching Characteristics—MxL83233

Unless otherwise noted, $V_{CC} = 3V$ to $5.5V$ ambient temperature $T_{MIN} < T_A < T_{MAX}$. Typical values are at $V_{CC} = 3.3V$, $V_L = V_{CC}$, ambient temperature $T_A = 25^\circ C$. The specifications apply over the full operating range from $-40^\circ C$ to $125^\circ C$, unless otherwise noted.

Table 10: MxL83233 Receiver Switching Characteristics

Symbol	Receiver Characteristic	Conditions	Minimum	Typical	Maximum	Unit
-	Data signaling rate	Duty cycle 40 to 60%	20	-	-	Mbps
t_{RPHL} , t_{RPLH}	Receiver propagation delay	$C_L = 15pF$	-	11	50	ns
t_{RR} , t_{RF}	Receiver output rise/fall time		-	2	6	ns
$ t_{RPLH} - t_{RPHL} $	Propagation delay skew		-	0.8	4	ns
t_{RZH}	Receiver enable to output high	$R_L = 1k\Omega$, $C_L = 50pF$	-	11	50	ns
t_{RZL}	Receiver enable to output low		-	11	50	ns
t_{RHZ}	Receiver disable from output high		-	12	50	ns
t_{RLZ}	Receiver disable from output low		-	12	50	ns

Driver Switching Characteristics—MxL83234

Unless otherwise noted, $V_{CC} = 3V$ to $5.5V$, ambient temperature $T_{MIN} < T_A < T_{MAX}$. Typical values are at $V_{CC} = 3.3V$, $V_L = V_{CC}$, ambient temperature $T_A = 25^\circ C$. The specifications apply over the full operating range from $-40^\circ C$ to $125^\circ C$, unless otherwise noted.

Table 11: MxL83234 Driver Switching Characteristics

Symbol	Driver Characteristic	Conditions	Minimum	Typical	Maximum	Unit
-	Data signaling rate	Duty cycle 40 to 60%	50	-	-	Mbps
t_{DPLH} , t_{DPLH}	Driver propagation delay	$R_L = 54\Omega$, $C_L = 50pF$	-	8	20	ns
t_{DR} , t_{DF}	Driver output rise/fall time		-	4	6.7	ns
$ t_{DPLH} - t_{DPLH} $	Driver differential skew		-	0.8	3.5	ns
t_{DZH}	Driver enable to output high	$R_L = 500\Omega$, $C_L = 50pF$	-	15	50	ns
t_{DZL}	Driver enable to output low		-	15	50	ns
t_{DHZ}	Driver disable from output high		-	20	50	ns
t_{DLZ}	Driver disable from output low		-	17	50	ns

Receiver Switching Characteristics—MxL83234

Unless otherwise noted, $V_{CC} = 3V$ to $5.5V$, ambient temperature $T_{MIN} < T_A < T_{MAX}$. Typical values are at $V_{CC} = 3.3V$, $V_L = V_{CC}$, ambient temperature $T_A = 25^\circ C$. The specifications apply over the full operating range from $-40^\circ C$ to $125^\circ C$, unless otherwise noted.

Table 12: MxL83234 Receiver Switching Characteristics

Symbol	Receiver Characteristic	Conditions	Minimum	Typical	Maximum	Unit
-	Data signaling rate	Duty cycle 40 to 60%	50	-	-	Mbps
t_{RPHL} , t_{RPLH}	Receiver propagation delay	$C_L = 15pF$	-	12	40	ns
t_{RR} , t_{RF}	Receiver output rise/fall time		-	2	6	
$ t_{RPLH} - t_{RPHL} $	Propagation delay skew		-	0.5	3.5	ns
t_{RZH}	Receiver enable to output high	$R_L = 1k\Omega$, $C_L = 50pF$	-	11	50	ns
t_{RZL}	Receiver enable to output low		-	11	50	ns
t_{RHZ}	Receiver disable from output high		-	12	50	ns
t_{RLZ}	Receiver disable from output low		-	12	50	ns

Test Circuits and Timing Diagrams

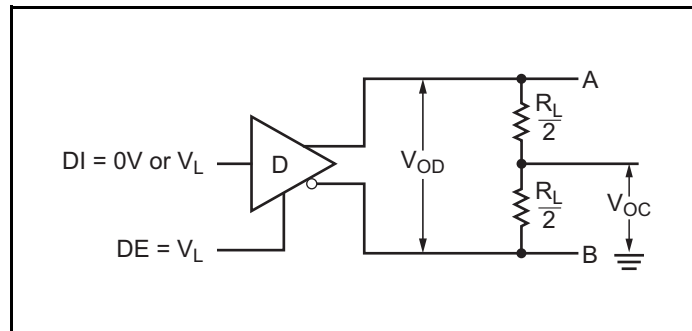


Figure 2: Driver DC Test Circuit

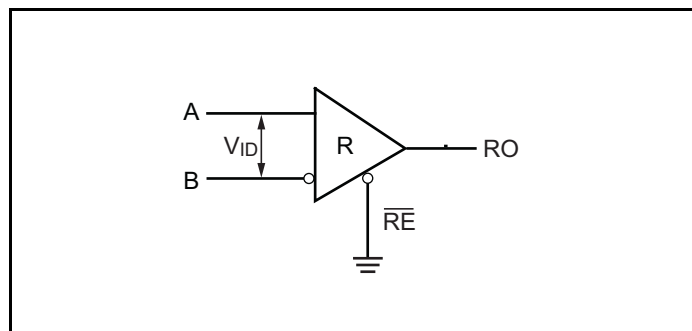


Figure 3: Receiver DC Test Circuit

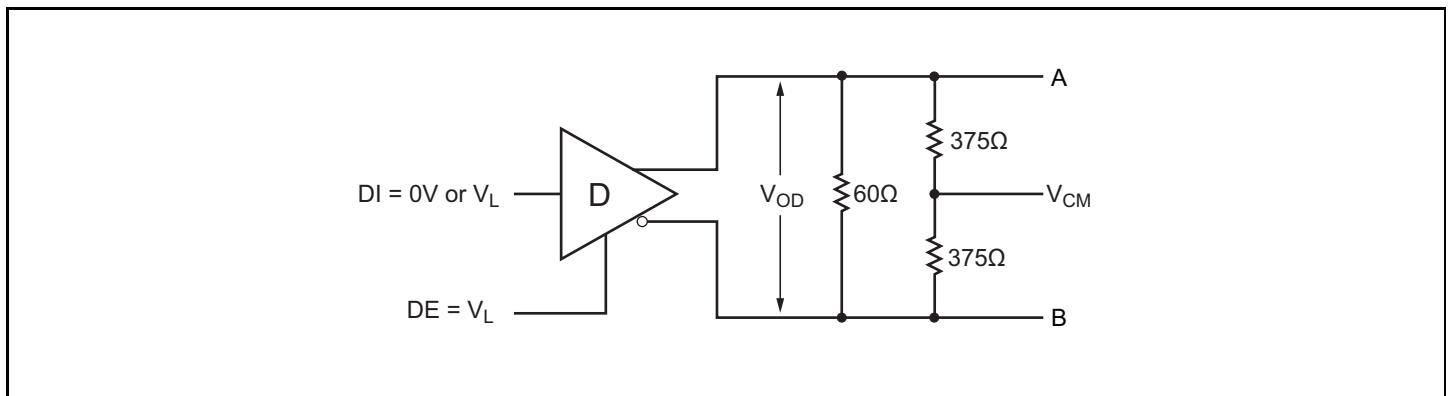


Figure 4: Differential Driver Output Voltage over Extended Common Mode

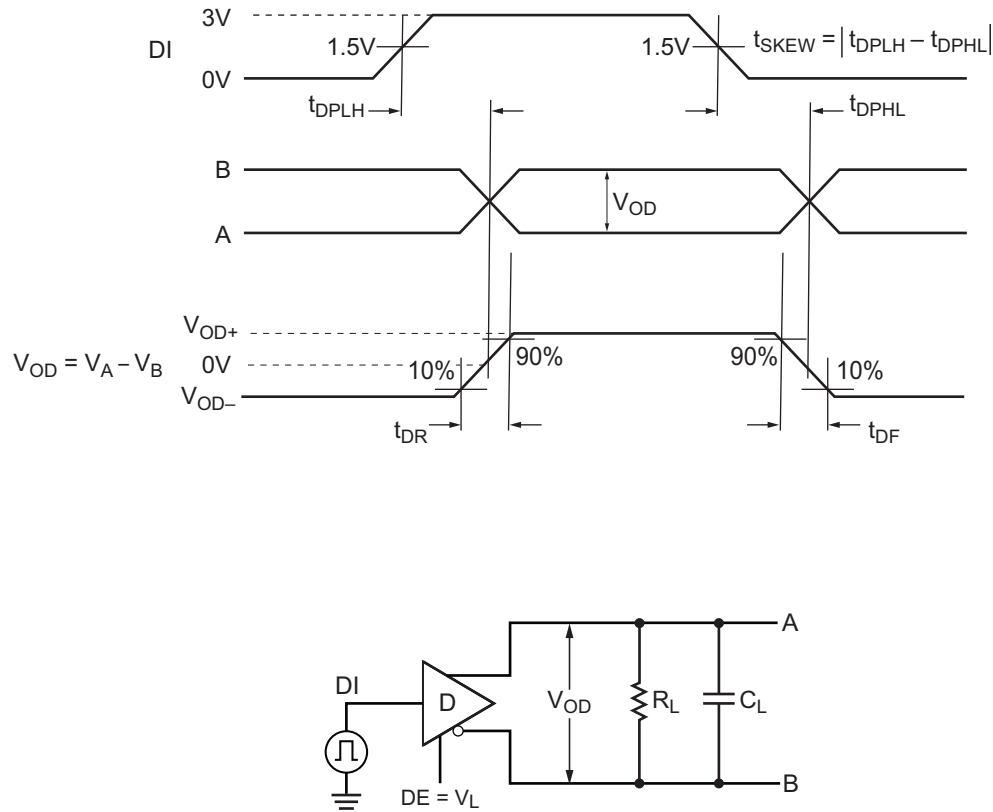


Figure 5: Driver Propagation Delay Time Test Circuit and Timing Diagram

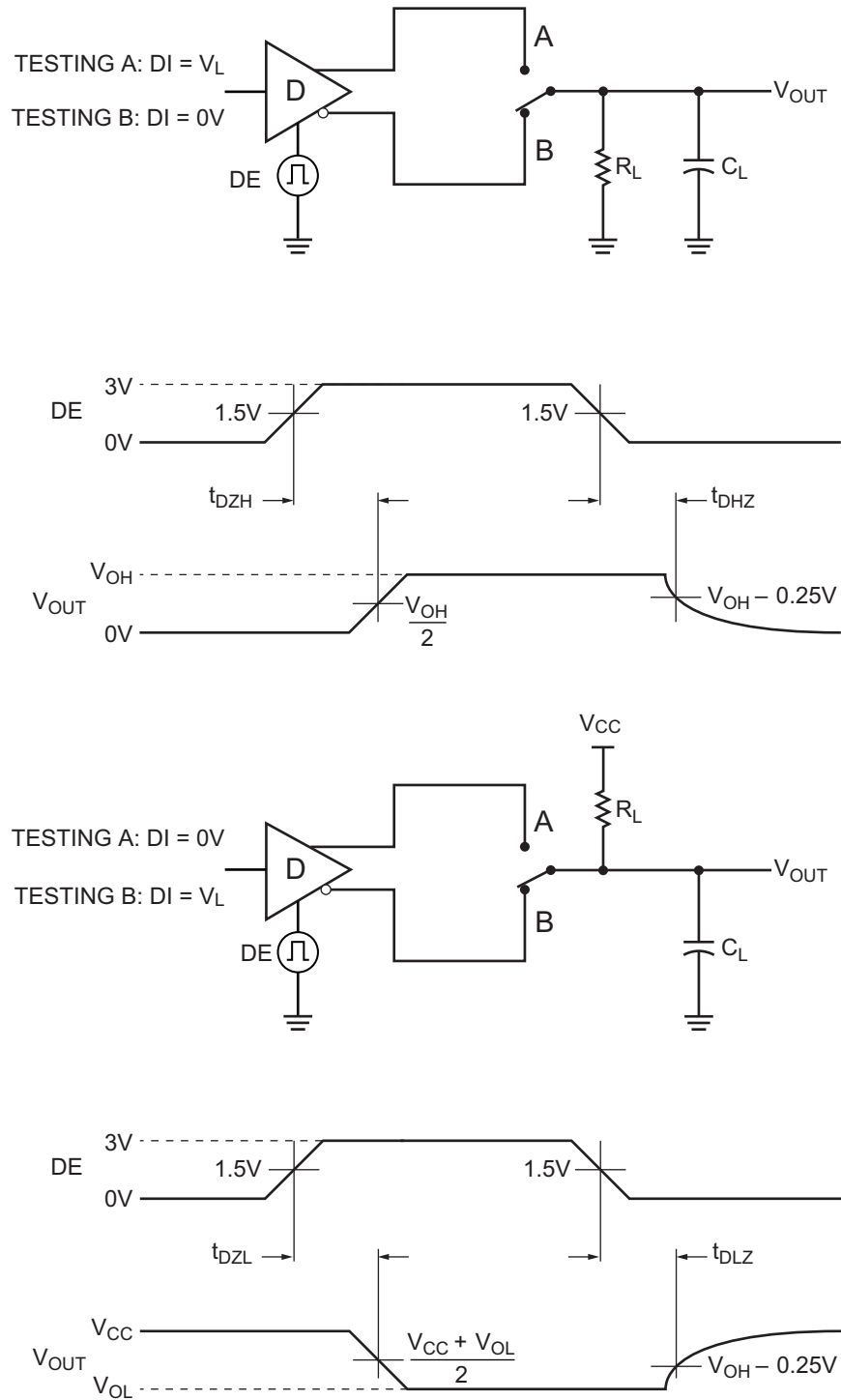
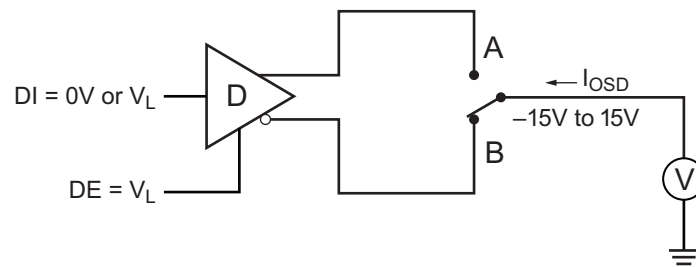
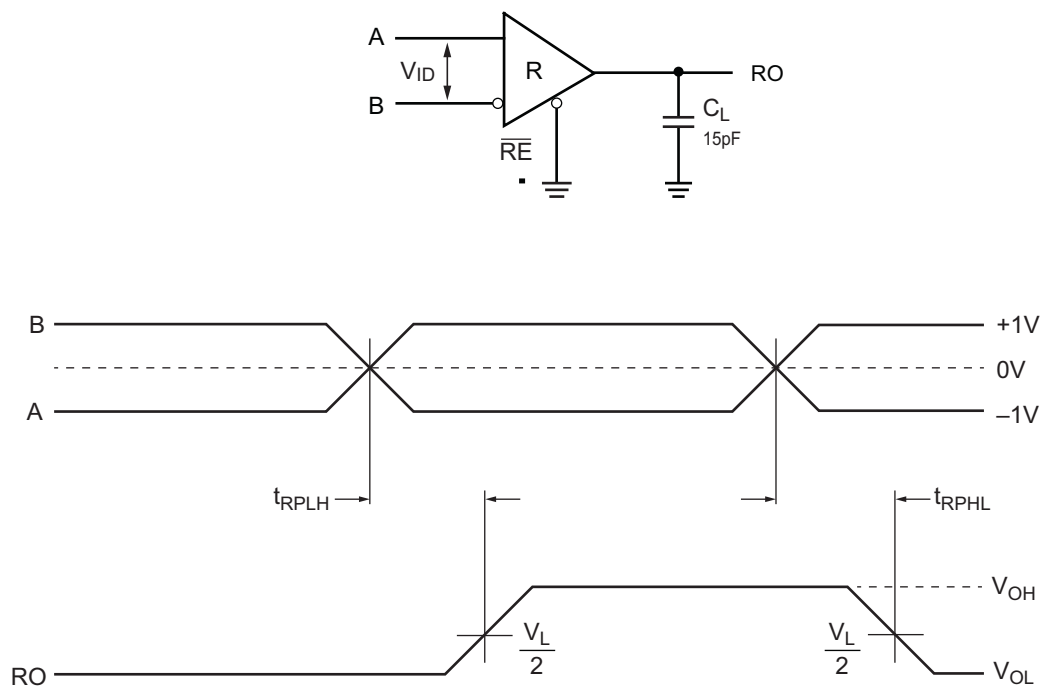


Figure 6: Driver Enable and Disable Times Test Circuit and Timing Diagram

**Figure 7: Driver Short Circuit Current Test****Figure 8: Receiver Propagation Delay Test Circuit and Timing Diagram**

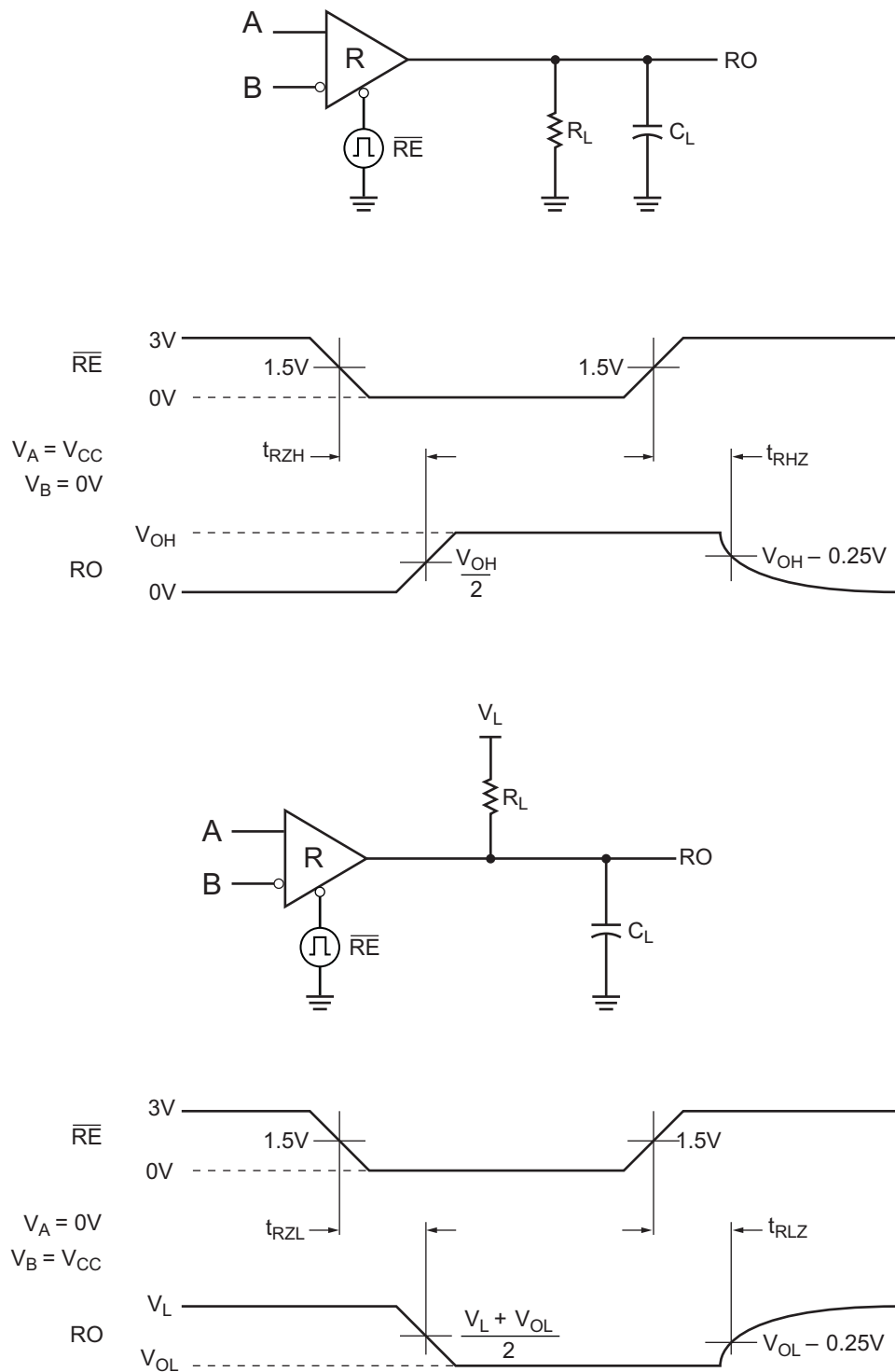


Figure 9: Receiver Enable and Disable Times Test Circuit and Timing Diagram

Function Tables

Table 13: MxL83232, MxL83233, MxL83234 Tx (Half-Duplex)

Input	Enable	Outputs		Function
DI	DE/RE	A	B	
H	H	H	L	Actively drive bus high.
L	H	L	H	Actively drive bus low.
X	L	Z	Z	Driver disabled and receiver enable.

Table 14: MxL83232, MxL83233, MxL83234 Rx (Half-Duplex)

Differential Input	Input	Output	Function
$V_{ID} = V_A - V_B$	DE/RE	RO	
$-20\text{mV} \leq V_{ID}$	L	H	Receive valid bus high.
$-200\text{mV} \leq V_{ID} \leq -20\text{mV}$	L	X	Indeterminate bus state.
$V_{ID} \leq -200\text{mV}$	L	L	Receive valid bus low.
X	H	Z	Receiver disabled.
Open-Circuit bus (Unterminated)	L	H	Fail-safe high output.
Short-Circuit bus	L	H	Fail-safe high output.
Idle (terminated) bus	L	H	Fail-safe high output.

Pin Information

Pin Configurations

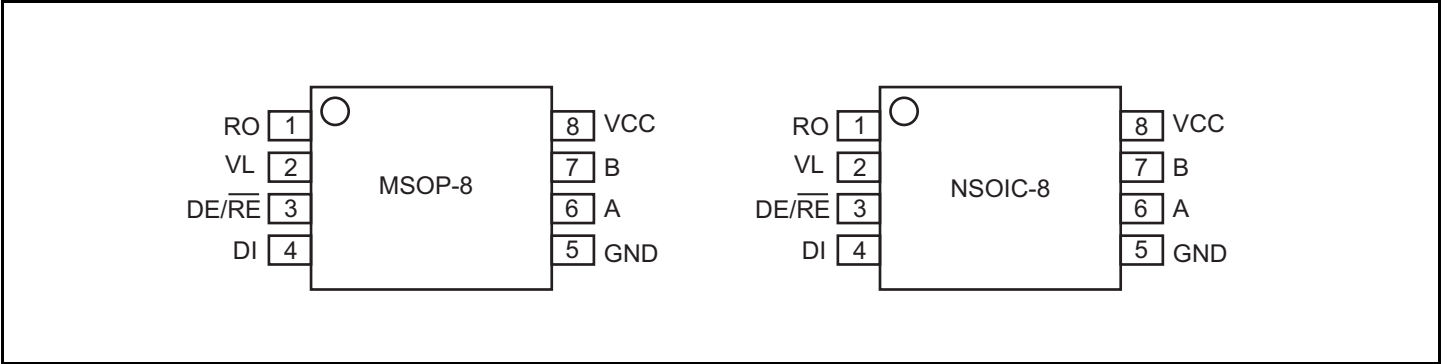


Figure 10: Pin Configurations

Pin Descriptions

Table 15: MxL83232/MxL83233/MxL83234 Pin Descriptions

Pin#	Pin Name	Pin Function
1	RO	Receiver Output.
2	VL	V _L logic input supply voltage. Bypassed with a 0.1μF as close as possible to pin.
3	DE/RE	Driver enable/Receiver enable. DE/RE = High to enable Driver Outputs A/B and disable Receiver (high impedance). DE/RE = Low to enable Receiver Input A/B and disable Driver (high impedance). No shutdown mode.
4	DI	Driver input.
5	GND	Ground.
6	A	Non-inverting Driver Output/Non-inverting Receiver Input.
7	B	Inverting Driver Output/Inverting Receiver Input.
8	VCC	Input supply voltage. Bypassed with a 0.1μF as close as possible to pin.

Detailed Description

The MxL83232, MxL83233, and MxL83234 are a family of half-duplex transceivers for RS-485 / RS-422 communication. It contains one driver and one receiver, and can be configured either as a driver or receiver at a time. These devices feature 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. The MxL83232 feature reduced slew-rate drivers that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free data transmission up to 500kbps. The MxL83233 allows transmit speeds up to 20Mbps. The MxL83234 driver slew rates are not limited, making transmit speeds up to 50Mbps possible.

All devices operate with two independent power supplies V_{CC} and V_L . The V_{CC} supply power the internal core circuitry and logic functions and in the range from 3V to 5.5V. The V_L provides power to the input/output pins, defining the logic levels for the external interfaces, in the range from 1.65V to 5.5V. 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.

Receiver Input Filtering

The MxL83232 receiver incorporates input filtering in addition to input hysteresis. This filtering enhances noise immunity with differential signals that have very slow rise and fall times.

Enhanced Failsafe

The MxL83232, MxL83233, and MxL83234 devices guarantee a logic-high receiver output when the receiver inputs are shorted, open, or when they are connected to a terminated transmission line with all drivers disabled. If A-B is less than or equal to -200mV, the 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 these devices, it results in a logic high with a 65mV typical noise margin. In compliance with the *EIA/TIA-485* standard, this family has a threshold range from -20mV to -200mV.

ESD Test Conditions (IEC 61000-4-2)

The *IEC 61000-4-2* standard covers the ESD testing and performance of finished equipment. However, it does not refer to integrated circuits. The MxL83232, MxL83233, and MxL83234 devices help you design equipment to meet *IEC 61000-4-2* without the need for additional ESD-protection components. The major difference between tests done using the *Human Body Model (HBM)* and *IEC 61000-4-2* is higher peak current in *IEC 61000-4-2*, because series resistance is lower in the *IEC 61000-4-2* model. Hence, the ESD withstand voltage measured to *IEC 61000-4-2* is generally lower than that measured using the *HBM*. The air-gap test involves approaching the device with a charged probe. The contact discharge method connects the probe to the device before the probe is energized. As with all MaxLinear devices, the ESD-protection structures are incorporated on all pins to protect against electrostatic discharges encountered during handling and assembly. The driver output and receiver inputs of the MxL83232, MxL83233, and MxL83234 devices have extra protection against static electricity. MaxLinear develops state-of-the-art structures to protect these pins against ESD without damage. The ESD structures withstand high ESD in all states: normal operation, shutdown, and powered down. After an ESD event, MxL83232, MxL83233, and MxL83234 devices keep working without latchup or damage. The ESD performance depends on a variety of conditions. For more information about reliability report that documents test setup, methodology, and results, contact MaxLinear Customer Technical Support.

Electrical Fast Transient (IEC 61000-4-4)

Inductive loads such as relays, switch contactors, or heavy-duty motors can create high-frequency bursts during transition. The electrical fast transient (EFT) tests evaluate immunity of electrical and electronic equipment when subjected to repetitive electrical fast transient/bursts on supply, signal, control and earth ports. The *IEC 61000-4-4* test simulates the transients created by such switching of inductive loads on AC power lines.

Evaluation of Test Results

The test results shall be classified in terms of the loss of function or degradation of performance of the equipment under test, relative to a performance level defined by its manufacturer of the requestor of the test or agreed between the manufacturer and the purchaser of the product.

MaxLinear recommends the following classification:

- a. Normal performance within the specification limits.
- b. Temporary loss of function or degradation of performance which is self-recoverable.
- c. Temporary loss of function or degradation of performance which requires operator intervention or system reset.
- d. Loss of function or degradation of performance which is not recoverable due to damage of equipment (components) or software, or loss of data.

For device-level pass or fail test, a) to c) can be considered passing results, and d) can be considered failing results.

256 Transceivers on the Bus

The standard RS-485 receiver input impedance is 12k Ω (1 unit load), and the standard driver can drive up to 32-unit loads. The MxL83232, MxL83233, and MxL83234 family of transceivers has a $\frac{1}{8}$ -unit load receiver input impedance (96k Ω), allowing up to 256 transceivers to be connected in parallel on one communication line. Any combination of these devices as well as other RS-485 transceivers with a total of 32 unit loads or fewer can be connected to the line.

Reduced EMI and Reflections

The MxL83232 features reduced slew-rate drivers that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free data transmission up to 500kbps.

Driver Output Protection

Two mechanisms prevent excessive output current and power dissipation caused by faults or by bus contention. First, a current limit on the output stage provides immediate protection against short circuits over the whole common-mode voltage range.

Second, a thermal-shutdown circuit forces the driver outputs into a high-impedance state if the die temperature becomes excessive.

Line Length

The RS-485/RS422 standard covers line lengths up to 4000ft. For design recommendations, refer to the *RS-485 Cable Lengths against Data Signaling Rate Application Note* (292AN).

Typical Applications

The MxL83232, MxL83233 and MxL83234 transceivers are designed for bidirectional data communications on multipoint bus transmission lines.

To minimize reflections, terminate the line at both ends in its characteristic impedance, and keep stub lengths off the main line as short as possible. The slew-rate-limited MxL83232 is more tolerant of imperfect termination.

For design recommendations on cable termination, refer to the *A.1.2 Cable Termination section in the TIA/EIA-422-B specification*.

MaxLinear recommends that you consider the overall system behavior during operation. A common failure of RS-485 circuits occurs when multiple drivers transmit data simultaneously on the same bus, causing bus contention. Allow appropriate idle time for the bus line to reach normal common-mode voltage when switching between bus drivers to ensure reliability and proper functionality of the system.

Mechanical Dimensions

MSOP-8

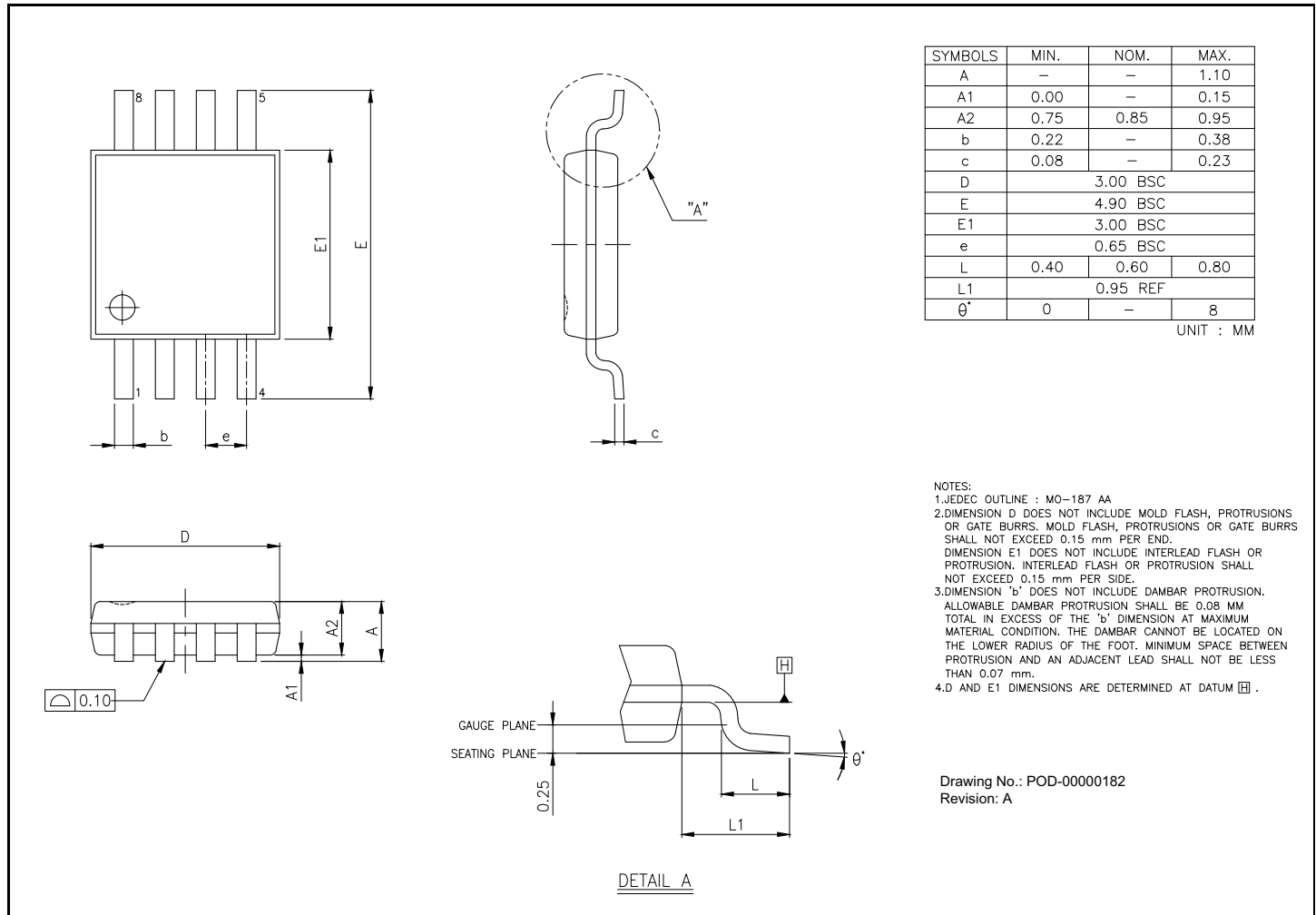


Figure 11: Mechanical Dimensions—MSOP-8

NSOIC-8

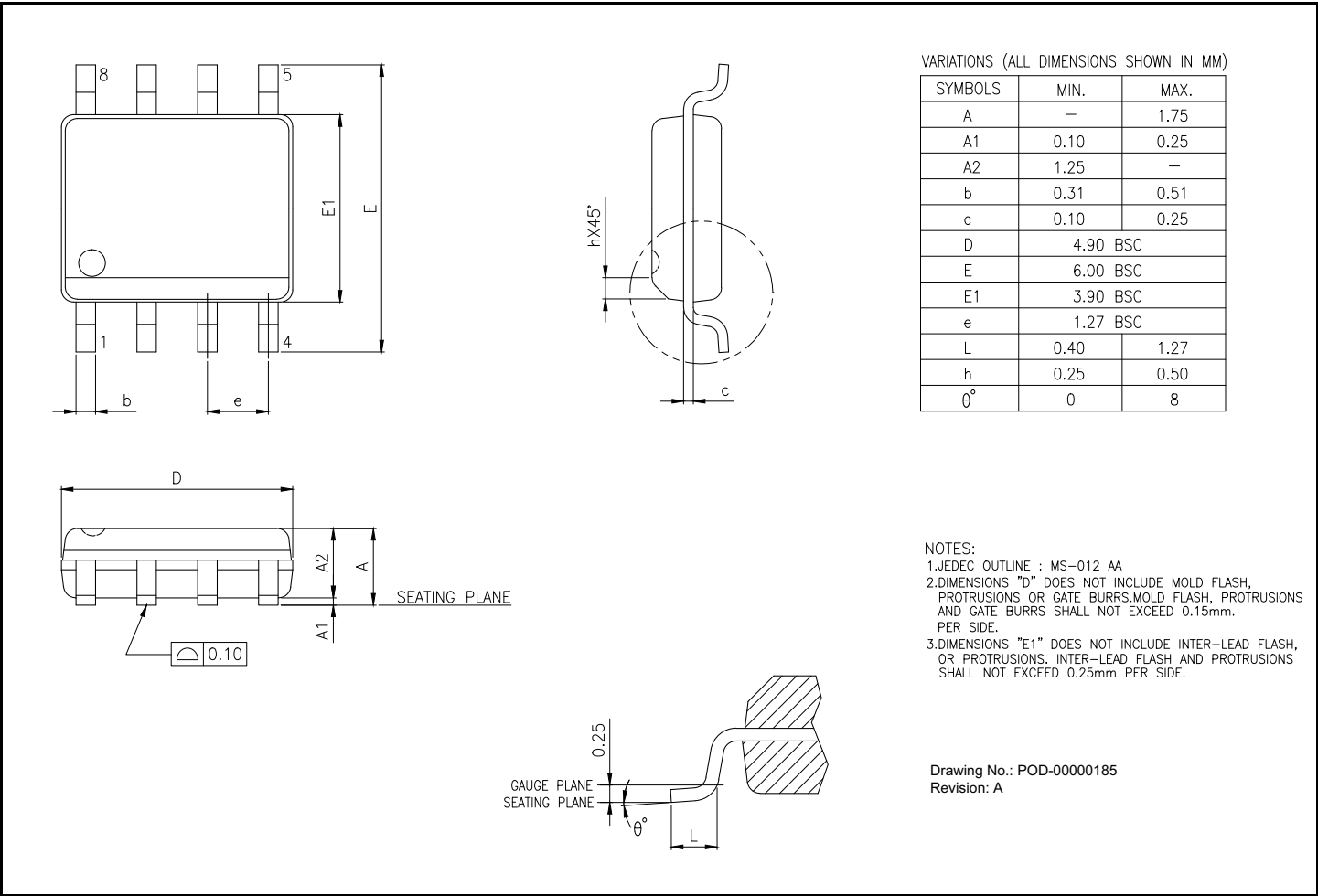


Figure 12: Mechanical Dimensions—NSOIC-8

Ordering Information

Table 16: Ordering Information

Ordering Part Number	Data Rate (Mbps)	Package	Packaging Method	Operating Temperature Range
MXL83232E-ARA-R	0.5	MSOP-8	Reel	–40°C to 125°C
MXL83232E-ADA-R	0.5	NSOIC-8	Reel	–40°C to 125°C
MXL83233E-ARA-R	20	MSOP-8	Reel	–40°C to 125°C
MXL83233E-ADA-R	20	NSOIC-8	Reel	–40°C to 125°C
MXL83234E-ARA-R	50	MSOP-8	Reel	–40°C to 125°C
MXL83234E-ADA-R	50	NSOIC-8	Reel	–40°C to 125°C
MXL83233E-ADA-EVK-1	MxL83233 Evaluation Kit			

Note:

- For more information about part numbers, as well as the most up-to-date ordering information and additional information on environmental rating, go to www.maxlinear.com/MxL83232, www.maxlinear.com/MxL83233, and www.maxlinear.com/MxL83234.
- For more information about the EVKs, refer to the *MxL83233 EVK User Manual* (040UM).



MaxLinear, Inc.
 5966 La Place Court, Suite 100
 Carlsbad, CA 92008
 Tel.: +1 (760) 692-0711
 Fax: +1 (760) 444-8598
www.maxlinear.com

The content of this document is furnished for informational use only, is subject to change without notice, and should not be construed as a commitment by MaxLinear, Inc. MaxLinear, Inc. assumes no responsibility or liability for any errors or inaccuracies that may appear in the informational content contained in this document. Complying with all applicable copyright laws is the responsibility of the user. Without limiting the rights under copyright, no part of this document may be reproduced into, stored in, or introduced into a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise), or for any purpose, without the express written permission of MaxLinear, Inc.

EXCEPT AS OTHERWISE PROVIDED EXPRESSLY IN WRITING BY MAXLINEAR, AND TO THE MAXIMUM EXTENT PERMITTED BY LAW: (A) THE MAXLINEAR PRODUCTS ARE PROVIDED ON AN "AS IS" BASIS WITHOUT REPRESENTATIONS OR WARRANTIES OF ANY KIND, INCLUDING WITHOUT LIMITATION ANY IMPLIED OR STATUTORY WARRANTIES AND ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NON-INFRINGEMENT, OR TITLE; AND (B) MAXLINEAR DOES NOT GUARANTEE THAT THE PRODUCTS WILL BE FREE OF ERRORS OR DEFECTS. MAXLINEAR PRODUCTS SHOULD NOT BE USED IN ANY EMERGENCY, SECURITY, MILITARY, LIFE-SAVING, OR OTHER CRITICAL USE CASE WHERE A FAILURE OR MALFUNCTION COULD CAUSE PERSONAL INJURY OR DEATH, OR DAMAGE TO OR LOSS OF PROPERTY. USERS ASSUME ALL RISK FOR USING THE MAXLINEAR PRODUCTS IN SUCH USE CASE. CUSTOMERS AND USERS ARE SOLELY RESPONSIBLE FOR USING THEIR OWN SKILL AND JUDGMENT TO DETERMINE WHETHER MAXLINEAR PRODUCTS ARE SUITABLE FOR THE INTENDED USE CASE.

MaxLinear, Inc. may have patents, patent applications, trademarks, copyrights, or other intellectual property rights covering subject matter in this document. Except as expressly provided in any written license agreement from MaxLinear, Inc., the furnishing of this document does not give you any license to these patents, trademarks, copyrights, or other intellectual property.

MaxLinear, the MaxLinear logo, and any other MaxLinear trademarks (including but not limited to MxL, Full-Spectrum Capture, FSC, AirPHY, Puma, AnyWAN, VectorBoost, MXL WARE, and Panther) are all property of MaxLinear, Inc. or one of MaxLinear's subsidiaries in the U.S.A. and other countries. All rights reserved.

All third-party marks and logos are trademarks™ or registered® trademarks of their respective holders/owners. Use of such marks does not imply any affiliation with, sponsorship or endorsement by the owners/holders of such trademarks. All references by MaxLinear to third party trademarks are intended to constitute nominative fair use under applicable trademark laws.

The URLs provided are for informational purposes only; they do not constitute an endorsement or an approval by MaxLinear of any of the products or services of the corporation or organization or individual. MaxLinear bears no responsibility for the accuracy, legality or content of the external site or for that of subsequent links. Contact the external site for answers to questions regarding its content.