

## General Description

The MxL83101 and MxL83102 (MxL8310x family) half duplex RS-485 transceivers support differential communication in harsh industrial environments. The bus pins tolerate IEC electrical fast transients (EFT), IEC electrostatic discharge (ESD), and reduce EMI transmission with slew-controlled drivers. The MxL8310x devices operate at 5V power supply.

High receiver input impedance allows 256 transceivers to share a common data bus while maintaining signal margin and without excessive loading or use of expensive repeaters.

Enhanced failsafe circuitry ensures receivers provide the expected output when the bus is shorted or left open under both terminated and unterminated conditions. Drivers include built-in short-circuit protection and a thermal-overload shutdown to protect against excessive power dissipation from bus contention. The low power shutdown mode can extend the life of batteries in applications such as industrial notebooks, sensors, and solar powered applications, while hot swap ensures a deterministic logic state upon power-up.

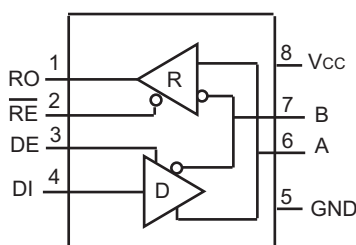
## Applications

- Industrial command and control
- Building automation
- Instrumentation and sensors

## Features

- Advanced receiver-failsafe protection for open, shorted or terminated lines
- Differential output exceeds 2.1V for PROFIBUS compatibility with a 5V supply
- 1/8 unit load (256 bus nodes)
- Hot Swap glitch protection  $\overline{\text{RE}}$  and DE
- Thermal shutdown protects against driver contention
- Slew limited 250kbps and 500kbps speeds
- Small form factor NSOIC packages
- Extended temperature range from  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  temperature grades
- Low power shutdown mode ( $<1\mu\text{A}$  Typ)
- Robust system protection
  - $\pm 2\text{kV}$  EFT (IEC 61000-4-4)
  - $\pm 8\text{kV}$  ESD Contact (IEC 61000-4-2)
  - $\pm 15\text{kV}$  ESD HBM

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**Figure 1: 8-Pin Half Duplex**

# Revision History

Document No.	Release Date	Change Description
279DSR00	May 24, 2023	Initial release.

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## Specifications

### Absolute Maximum Ratings

**Important:** 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.

**Table 1: Absolute Maximum Ratings**

Parameter	Minimum	Maximum	Units
$V_{CC}$	-0.3	6	V
Input voltage at control input pins ( $\overline{RE}$ , DE)	-0.3	6	V
Driver input voltage ( $\overline{RE}$ , DE)	-0.3	6	V
Driver output voltage (A & B)	-8	13	V
Receiver input voltage (A & B)	-8	13	V
Receiver output current	-60	60	mA
Operating temperature ranges	-40	125	°C
Junction temperature	-	150	°C
Storage temperature range	-65	150	°C

### ESD Ratings

**Table 2: ESD 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)	±2	kV

**Table 3: Thermal Information**

Thermal Metric		MxL8310x SOIC (8 Pins)	Units
$\theta_{JA}$	Junction-to-ambient thermal resistance	96.1	°C/W
$\Psi_{JT}$	Junction-to-top characterization parameter	3.7	°C/W
$\Psi_{JB}$	Junction-to-board characterization parameter	59.1	°C/W
$\theta_{JB}$	Junction-to-board thermal resistance	58.3	°C/W
$\theta_{JC}$	Junction-to-case thermal resistance	42.2	°C/W

**Table 4: Power Dissipation**

Parameter	Description	Test Condition	Minimum	Typical	Maximum	Unit
PD	Driver and receiver enabled, $V_{CC} = 5.5\text{ V}$ , $T_A = 125^\circ\text{C}$ , 50% duty cycle square wave at 250kbps signaling rate, MxL83101	Load: $R_L = 300\Omega$ , $C_L = 50\text{pF}$	-	215	-	mW
		RS-422 load: $R_L = 100\Omega$ , $C_L = 50\text{pF}$	-	295	-	mW
		RS-485 load: $R_L = 54\Omega$ , $C_L = 50\text{pF}$	-	350	-	mW
		No Load	-	170	-	mW
	Driver and receiver enabled, $V_{CC} = 5.5\text{ V}$ , $T_A = 125^\circ\text{C}$ , 50% duty cycle square wave at 500kbps signaling rate, MxL83102	Load: $R_L = 300\Omega$ , $C_L = 50\text{pF}$	-	220	-	mW
		RS-422 load: $R_L = 100\Omega$ , $C_L = 50\text{pF}$	-	300	-	mW
		RS-485 load: $R_L = 54\Omega$ , $C_L = 50\text{pF}$	-	360	-	mW
		No Load	-	170	-	mW

## Electrical Characteristics

Unless otherwise noted,  $V_{CC} = 5V \pm 0.5V$  ambient temperature  $T_{MIN} < T_A < T_{MAX}$ . Typical values are at  $V_{CC} = 5V$ , 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 5: Electrical Characteristics**

Parameter	Symbol	Test Condition		Minimum	Typical	Maximum	Units
Differential driver output	V <sub>OD</sub>	R <sub>L</sub> = 100Ω (RS-422), <b>Figure 2</b>		2	-	V <sub>CC</sub>	V
		R <sub>L</sub> = 54Ω (RS-485), <b>Figure 2</b>		1.5	-	V <sub>CC</sub>	
		R <sub>L</sub> = 60Ω, −7V ≤ V <sub>test</sub> ≤ 12V, <b>Figure 4</b>		2.1	-	V <sub>CC</sub>	
Change in magnitude of differential output voltage	ΔV <sub>OD</sub>	R <sub>L</sub> = 54Ω or 100Ω, <b>Figure 2</b>		-	-	0.2	V
Driver common mode output voltage	V <sub>OC</sub>	R <sub>L</sub> = 54Ω or 100Ω, <b>Figure 2</b>		-	V <sub>CC</sub> /2	3	V
Change in magnitude of common mode output voltage	ΔV <sub>OC</sub>	R <sub>L</sub> = 54Ω or 100Ω, <b>Figure 2</b>		-	-	±0.2	V
Input high voltage	V <sub>IH</sub>	DE, DI, $\overline{RE}$		2	-	-	V
Input low voltage	V <sub>IL</sub>	DE, DI, $\overline{RE}$		-	-	0.8	V
Input hysteresis	V <sub>HYS</sub>	DE, DI, $\overline{RE}$		-	100	-	mV
Input current	I <sub>IN</sub>	DE, DI, $\overline{RE}$		−1	-	1	μA
Input current first transition (hot swap)		DE, $\overline{RE}$ First transition will draw more current (hot swap)		-	±100	±200	μA
Output leakage (A & B)	I <sub>O</sub>	DE = GND 0 ≤ V <sub>CC</sub> ≤ 5.5V	V <sub>IN</sub> = 12V		-	125	μA
			V <sub>IN</sub> = −7V	−100	-	-	
Driver short-circuit current	I <sub>OSD</sub>	−7V ≤ V <sub>OUT</sub> ≤ 12V, <b>Figure 7</b>		0	-	250	mA
				−250	-	0	
Thermal-shutdown threshold	T <sub>TS</sub>			-	170	-	°C
Thermal-shutdown hysteresis	T <sub>TSH</sub>			-	15	-	°C
Receiver							
Receiver differential threshold (sensitivity)	V <sub>TH</sub>	−7V ≤ V <sub>CM</sub> ≤ 12V		−200	−125	−50	mV
Receiver input hysteresis	ΔV <sub>TH</sub>	V <sub>A</sub> + V <sub>B</sub> = 0V		-	30	-	mV
RO output high voltage	V <sub>OH</sub>	I <sub>O</sub> = −1mA		V <sub>CC</sub> - 0.4	V <sub>CC</sub> - 0.2	-	V
RO output low voltage	V <sub>OL</sub>	I <sub>O</sub> = 1mA		-	0.2	0.4	V
Tri-State output current at receiver	I <sub>OZR</sub>	0 ≤ V <sub>O</sub> ≤ V <sub>CC</sub>		-	-	±1	μA
Receiver input resistance	R <sub>IN</sub>	−7V ≤ V <sub>CM</sub> ≤ 12V		96	-	-	kΩ
Input current (A & B)	I <sub>A,B</sub>	DE = GND, $\overline{RE}$ = GND 0 ≤ V <sub>CC</sub> ≤ 5.5V	V <sub>IN</sub> = 12V	-	-	125	μA
			V <sub>IN</sub> = −7V	−100	-	-	



**Table 5: Electrical Characteristics**

Parameter	Symbol	Test Condition	Minimum	Typical	Maximum	Units
Supply current	$I_{CC}$	No load, $\overline{RE} = GND$ , $DE = V_{CC}$ , $DI = GND$	-	0.6	1.3	mA
		No load, $\overline{RE} = V_{CC}$ , $DE = V_{CC}$ , $DI = GND$	-	0.6	1.3	
		No load, $\overline{RE} = GND$ , $DE = GND$ , A/B open	-	0.4	1.3	
Supply current in shutdown mode	$I_{SHDN}$	$\overline{RE} = V_{CC}$ , $DE = GND$	-	0.05	2.5	$\mu A$

## Driver Switching Characteristics—MxL83101

Unless otherwise noted,  $V_{CC} = 5V \pm 0.5V$  ambient temperature  $T_{MIN} < T_A < T_{MAX}$ . Typical values are at  $V_{CC} = 5V$ , 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: MxL83101 Driver Switching Characteristics**

Driver Characteristic	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Data signaling rate	-	Duty cycle 40 to 60%	250	-	-	kbps
Driver propagation delay	$t_{DPLH}, t_{DPLH}$	$R_L = 54\Omega, C_L = 50pF$ , Figure 5	550	1100	1400	ns
Driver output rise/fall time	$t_{DR}, t_{DF}$		400	950	1500	ns
Driver differential skew	$ t_{DPLH} - t_{DPLH} $		-	20	200	ns
Driver enable to output high	$t_{DZH}$	$R_L = 500\Omega, C_L = 50pF$ , Figure 6	-	-	2000	ns
Driver enable to output low	$t_{DZL}$		-	-	2000	ns
Driver disable from output high	$t_{DZH}$		-	30	100	ns
Driver disable from output low	$t_{DLZ}$		-	30	100	ns
Driver enable from shutdown to output high	$t_{DZH}(SHDN)$	Figure 6	-	2000	4500	ns
Driver enable from shutdown to output low	$t_{DZL}(SHDN)$	Figure 6	-	2000	4500	ns
Time to shutdown	$t_{DSHDN}$	-	50	200	600	ns

## Receiver Switching Characteristics—MxL83101

Unless otherwise noted,  $V_{CC} = 5V \pm 0.5V$  ambient temperature  $T_{MIN} < T_A < T_{MAX}$ . Typical values are at  $V_{CC} = 5V$ , 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: MxL83101 Receiver Switching Characteristics**

Receiver Characteristic	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Data signaling rate	-	Duty cycle 40 to 60%	250	-	-	kbps
Receiver propagation delay	$t_{RPHL}, t_{RPLH}$	$C_L = 15pF$ , Figure 8	40	75	200	ns
Propagation delay skew	$ t_{RPLH} - t_{RPHL} $		-	15	30	ns
Receiver enable to output high	$t_{RZH}$	Figure 9	-	25	50	ns
Receiver enable to output low	$t_{RZL}$	Figure 9	-	25	50	ns
Receiver disable from output high	$t_{RHZ}$	Figure 9	-	20	50	ns
Receiver disable from output low	$t_{RLZ}$	Figure 9	-	20	50	ns
Receiver enable from shutdown to output high	$t_{RZH}(SHDN)$	Figure 9	-	2000	4000	ns
Receiver enable from shutdown to output low	$t_{RZL}(SHDN)$	Figure 9	-	2000	4000	ns
Time to shutdown	$t_{RSHDN}$	-	50	200	600	ns

## Driver Switching Characteristics—MxL83102

Unless otherwise noted,  $V_{CC} = 5V \pm 0.5V$  ambient temperature  $T_{MIN} < T_A < T_{MAX}$ . Typical values are at  $V_{CC} = 5V$ , 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: MxL83102 Driver Switching Characteristics**

Driver Characteristic	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Data signaling rate	-	Duty cycle 40 to 60%	500	-	-	kbps
Driver propagation delay	$t_{DPLH}, t_{DPLH}$	$R_L = 54\Omega, C_L = 50pF$ , Figure 5	400	550	700	ns
Driver output rise/fall time	$t_{DR}, t_{DF}$		350	400	750	ns
Driver differential skew	$ t_{DPLH} - t_{DPLH} $		-	20	100	ns
Driver enable to output high	$t_{DZH}$	$R_L = 500\Omega, C_L = 50pF$ , Figure 6	-	-	1000	ns
Driver enable to output low	$t_{DZL}$		-	-	1000	ns
Driver disable from output high	$t_{DZH}$		-	30	100	ns
Driver disable from output low	$t_{DLZ}$		-	30	100	ns
Driver enable from shutdown to output high	$t_{DZH}(SHDN)$	Figure 6	-	2000	4000	ns
Driver enable from shutdown to output low	$t_{DZL}(SHDN)$	Figure 6	-	2000	4000	ns
Time to shutdown	$t_{DSHDN}$	-	50	200	600	ns

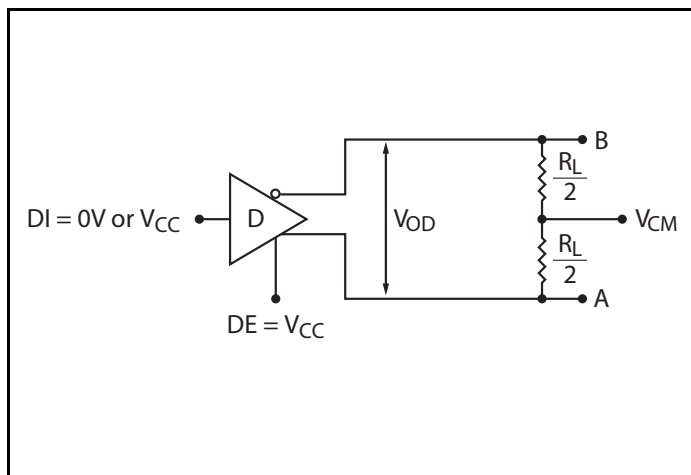
## Receiver Switching Characteristics—MxL83102

Unless otherwise noted,  $V_{CC} = 5V \pm 0.5V$  ambient temperature  $T_{MIN} < T_A < T_{MAX}$ . Typical values are at  $V_{CC} = 5V$ , 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.

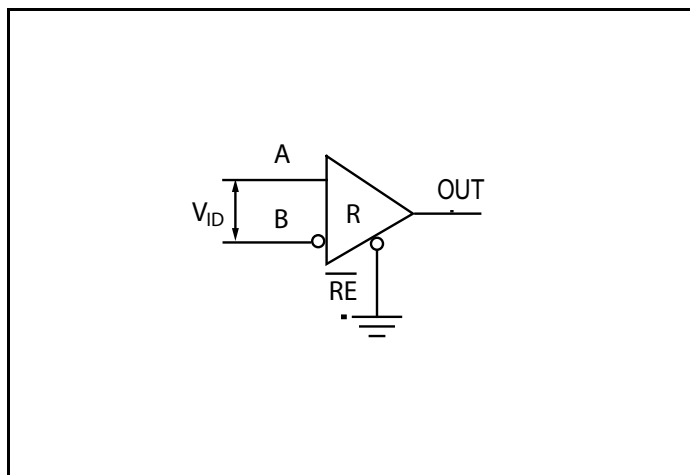
**Table 9: MxL83102 Receiver Switching Characteristics**

Receiver Characteristic	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Data signaling rate	-	Duty cycle 40 to 60%	500	-	-	kbps
Receiver propagation delay	$t_{RPHL}, t_{RPLH}$	$C_L = 15pF$ , Figure 8	40	75	200	ns
Propagation delay skew	$ t_{RPLH} - t_{RPHL} $		-	15	30	ns
Receiver enable to output high	$t_{RZH}$	Figure 9	-	25	50	ns
Receiver enable to output low	$t_{RZL}$	Figure 9	-	25	50	ns
Receiver disable from output high	$t_{RZH}$	Figure 9	-	20	50	ns
Receiver disable from output low	$t_{RLZ}$	Figure 9	-	20	50	ns
Receiver enable from shutdown to output high	$t_{RZH}(SHDN)$	Figure 9	-	2000	4000	ns
Receiver enable from shutdown to output low	$t_{RZL}(SHDN)$	Figure 9	-	2000	4000	ns
Time to shutdown	$t_{RSHDN}$	-	50	200	600	ns

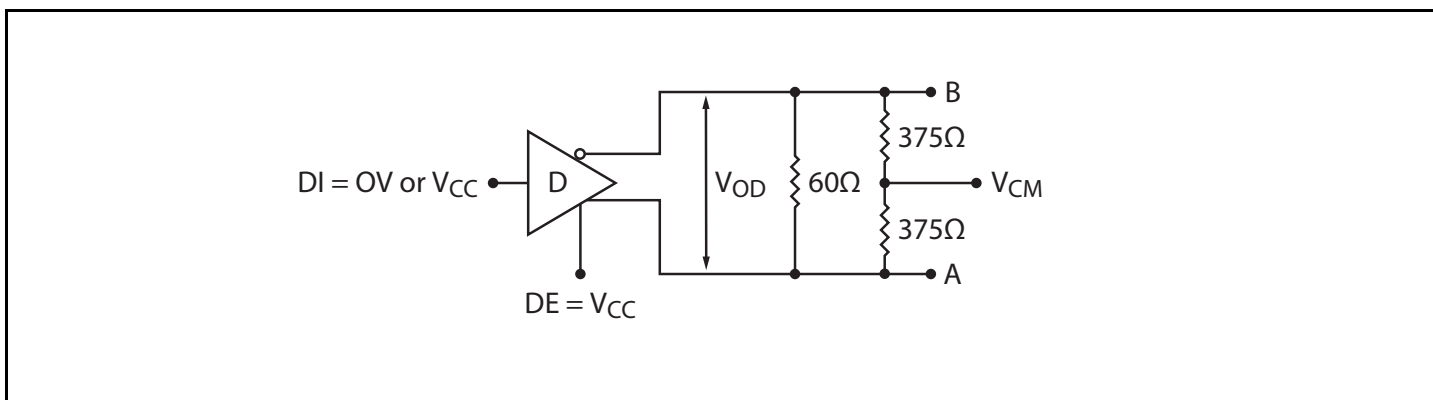
## Test Circuits and Timing Diagrams



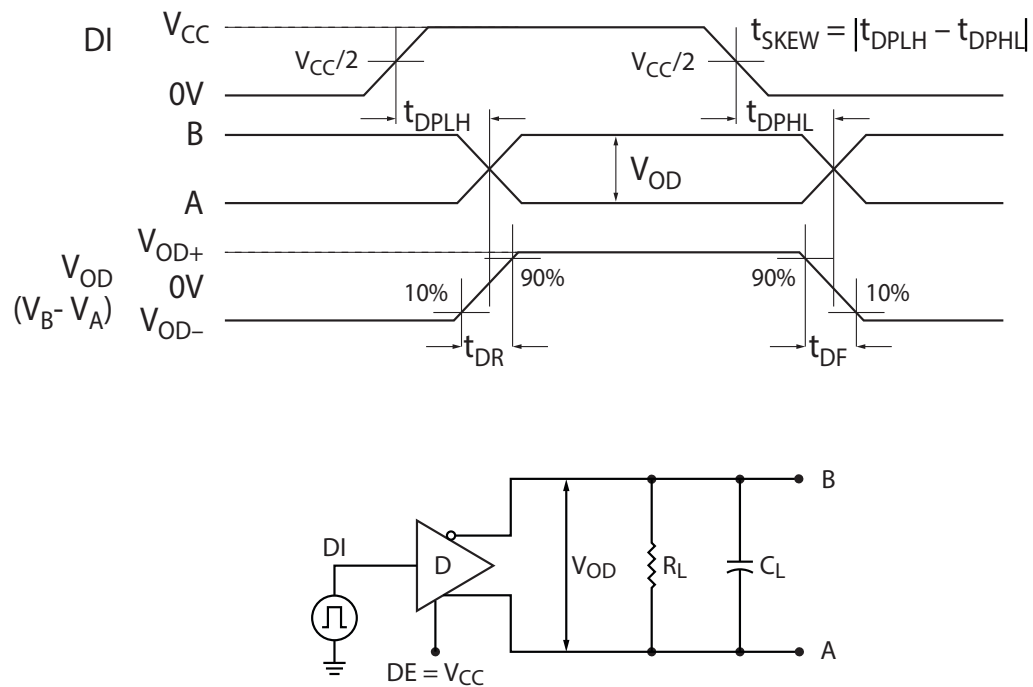
**Figure 2: Driver DC Test Circuit**



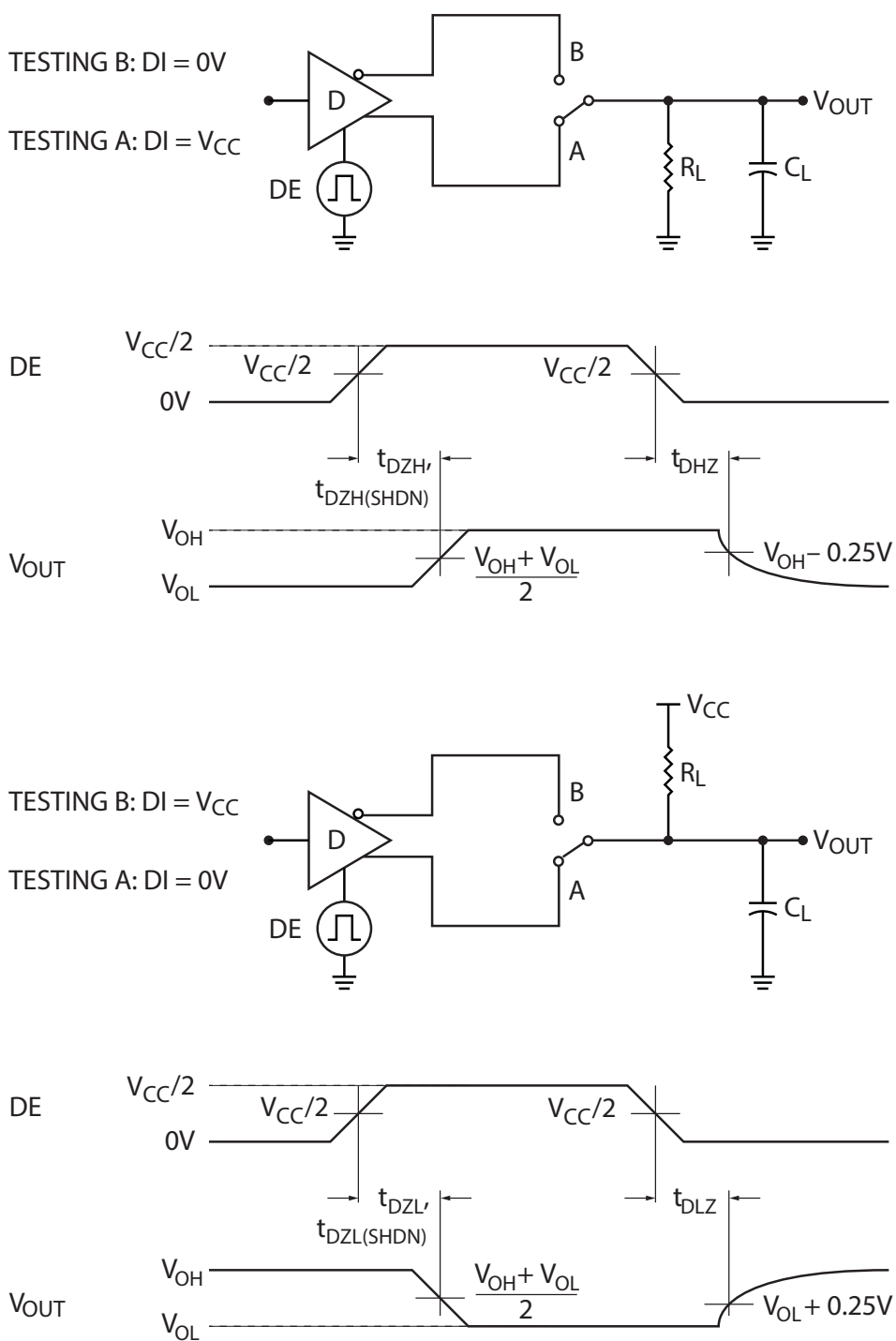
**Figure 3: Receiver DC Test Circuit**



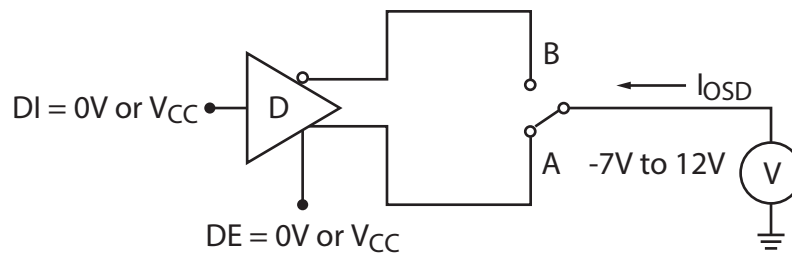
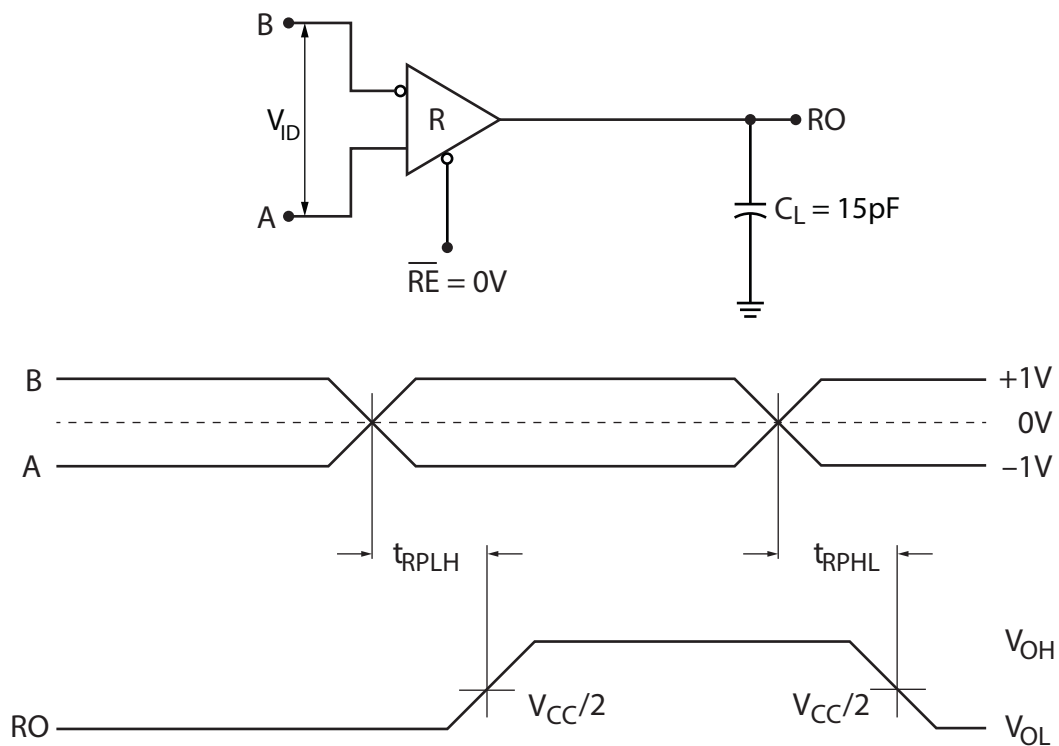
**Figure 4: Differential Driver Output Voltage over Extended Common Mode**

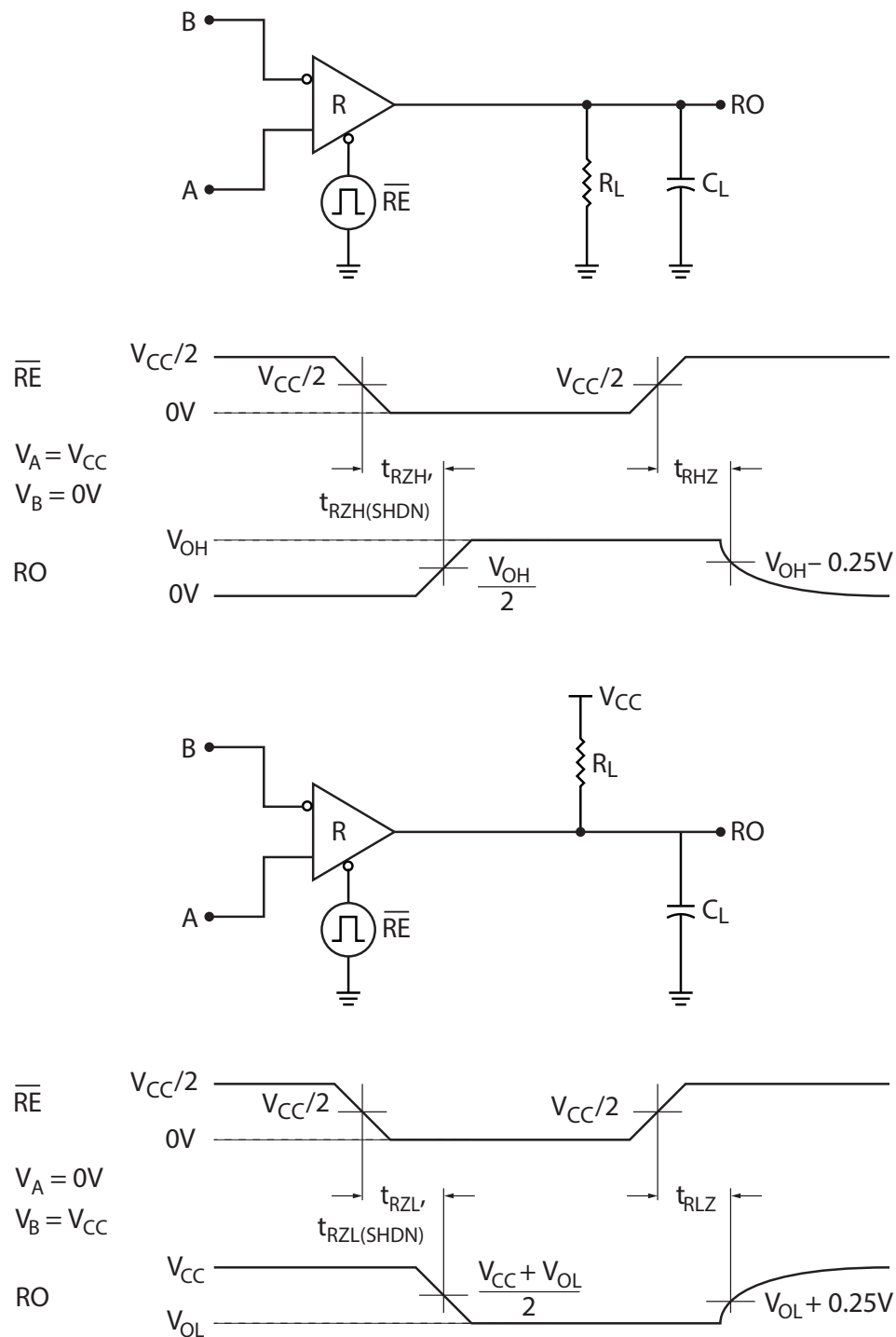


**Figure 5: Driver Propagation Delay Time Test Circuit and Timing Diagram**



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

**Figure 7: Driver Output Short Circuit Current****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 10: MxL8310x Tx (Half Duplex)**

Input	Enable		Outputs		Function
DI	DE	$\overline{\text{RE}}$	A	B	
H	H	X	H	L	Actively drive bus high.
L	H	X	L	H	Actively drive bus low.
X	L	L	Z	Z	Driver disabled.
X	L	H	Z	Z	Driver disabled/Shutdown mode.

**Table 11: MxL8310x Rx (Half Duplex)**

Differential Input	Enable		Output	Function
$V_{ID} = V_A - V_B$	$\overline{\text{RE}}$	DE	RO	
$-50\text{mV} \leq V_{ID}$	L	X	H	Receive valid bus high.
$-200\text{mV} \leq V_{ID} \leq -50\text{mV}$	L	X	X	Indeterminate bus state.
$V_{ID} \leq -200\text{mV}$	L	X	L	Receive valid bus low.
X	H	X	Z	Receiver disabled.
Open-circuit bus (terminated or unterminated)	L	X	H	Fail-safe high output.
Short-circuit bus	L	X	H	Fail-safe high output.
X	H	L	Z	Receiver disabled/ Shutdown mode.

Pin Information

Pin Configurations

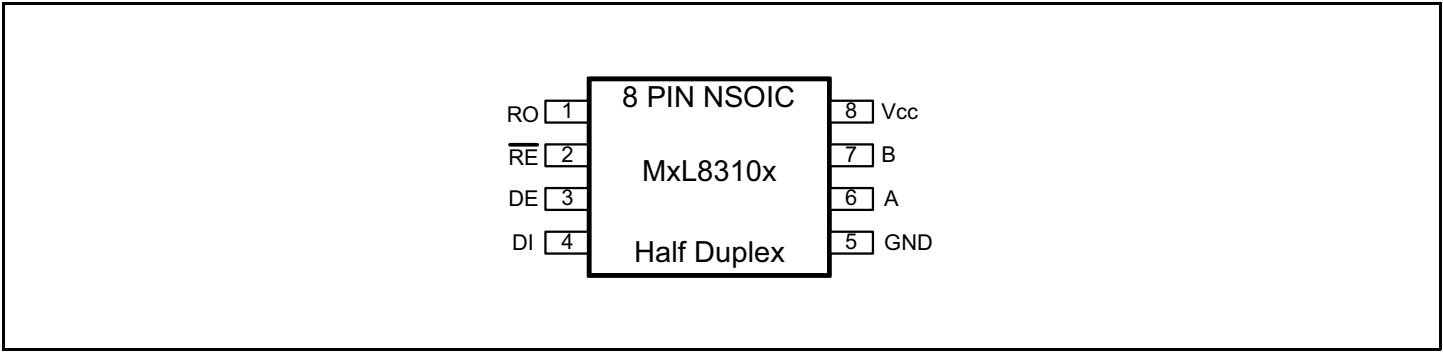


Figure 10: Pin Configurations

Pin Descriptions

Table 12: MxL8310x Pin Descriptions

Half Duplex Devices Pin#	Pin Name	Pin Function
1	RO	Receiver Output. When $\overline{RE}$ is low and if $(A-B) \geq -50\text{mV}$ , RO is high. If $(A-B) \leq -200\text{mV}$ , RO is low.
2	$\overline{RE}$	Receiver Output Enable. When $\overline{RE}$ is low, RO is enabled. When $\overline{RE}$ is high, RO is high impedance. $\overline{RE}$ should be high and DE low to enter shutdown mode. $\overline{RE}$ is a hot swap input.
3	DE	Driver Output Enable. When DE is high, outputs are enabled. When DE is low, outputs are high impedance. DE should be low and $\overline{RE}$ high to enter shutdown mode. DE is a hot-swap input.
4	DI	Driver Input. With DE high, a low level on DI forces noninverting output low and inverting output high. Similarly, a high level on DI forces noninverting output high and inverting output low.
5	GND	Ground.
6	A	Noninverting Receiver Input and Noninverting Driver Output.
7	B	Inverting Receiver Input and Inverting Driver Output.
8	V <sub>CC</sub>	Positive Supply V <sub>CC</sub> . Bypass V <sub>CC</sub> to GND with a 0.1μF capacitor.

## Detailed Description

The MxL8310x family of half-duplex transceivers for RS-485 /RS-422 communication contain one driver and one receiver. 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 MxL83101 and MxL83102 also feature a hot-swap capability allowing live insertion without error data transfer. The MxL83101 features reduced slew-rate drivers that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free data transmission up to 250kbps. The MxL83102 also offers slew-rate limits allowing transmit speeds up to 500kbps.

All devices operate from a single 4.5V to 5.5V 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.

### Receiver Input Filtering

The MxL8310x receivers incorporate input filtering in addition to input hysteresis. This filtering enhances noise immunity with differential signals that have very slow rise and fall times.

### Fail Safe

The MxL8310x family guarantees 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  $-200\text{mV}$ , 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 MxL8310x family, this results in a logic high with a 50mV minimum noise margin. In compliance with the EIA/TIA-485 standard, the MxL8310x family has a threshold range from  $-50\text{mV}$  to  $-200\text{mV}$ .

### Hot-Swap Capability

When circuit boards are inserted into a hot backplane, differential disturbances to the data bus can lead to data errors. Upon initial circuit board insertion, the data communication processor undergoes its own power-up sequence.

During this period, the processor's logic-output drivers are high impedance and are unable to drive the DE and RE inputs of these devices to a defined logic level. Leakage currents up to  $10\mu\text{A}$  from the high-impedance state of the processor's logic drivers can cause standard CMOS enable inputs of a transceiver to drift to an incorrect logic level. Additionally, parasitic circuit board capacitance can cause coupling of  $V_{CC}$  or GND to the enable inputs. Without the hot-swap capability, these factors can improperly enable the transceiver's driver or receiver.

When  $V_{CC}$  rises, an internal pulldown circuit holds DE low and RE high for approximately  $10\mu\text{s}$ . After the initial power-up sequence, the pulldown circuit becomes transparent, resetting the hot-swap tolerable input.

### 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 MxL8310x family helps 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 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 Human Body Model.

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 MxL8310x family of devices have extra protection against static electricity. MaxLinear has developed 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, the MxL8310x family keeps working without latchup or damage.

The ESD protection can be tested in various ways. The transmitter outputs and receiver inputs of the MxL8310x family is characterized for protection to the following limits:

- $\pm 15\text{kV}$  using the Human Body Model
- $\pm 8\text{kV}$  using the Contact Discharge method specified in IEC 61000-4-2
- $\pm 15\text{kV}$  Airgap

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 contractors, or heavy-duty motors can create high-frequency bursts during transition. (EFT) tests. The tests are to 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.

The recommended classification is as follows:

- 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  $12\text{k}\Omega$  (1 unit load), and the standard driver can drive up to 32 unit loads. The MxL8310x family of transceivers has a 1/8-unit load receiver input impedance ( $96\text{k}\Omega$ ), 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 MxL83101 features reduced slew-rate drivers that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free data transmission up to 250kbps. The MxL83102 offers higher driver output slew-rate limits, allowing transmit speeds up to 500kbps.

## Low Power Shutdown Mode

Low-power shutdown mode is initiated by bringing both  $\overline{\text{RE}}$  high and DE low. In shutdown, the devices typically draw only 50nA of supply current.

$\overline{\text{RE}}$  and DE can be driven simultaneously; the parts are guaranteed not to enter shutdown if  $\overline{\text{RE}}$  is high and DE is low for less than 50ns. If the inputs are in this state for at least 600ns, the parts are guaranteed to enter shutdown.

Enable times  $t_{\text{ZH}}$  and  $t_{\text{ZL}}$  assume the part was not in a low-power shutdown state. Enable times  $t_{\text{ZH}}(\text{SHDN})$  and  $t_{\text{ZL}}(\text{SHDN})$  assume the parts were shut down. It takes drivers and receivers longer to become enabled from low-power shutdown mode  $t_{\text{ZH}}(\text{SHDN})$  and  $t_{\text{ZL}}(\text{SHDN})$  than from driver or receiver disable mode ( $t_{\text{ZH}}$ ,  $t_{\text{ZL}}$ ).

## Driver Output Protection

Two mechanisms prevent excessive output current and power dissipation caused by faults or by bus contention. First, 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 MxL8310x 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 MxL8310x are more tolerant of imperfect termination.

Mechanical Dimensions

NSOIC8

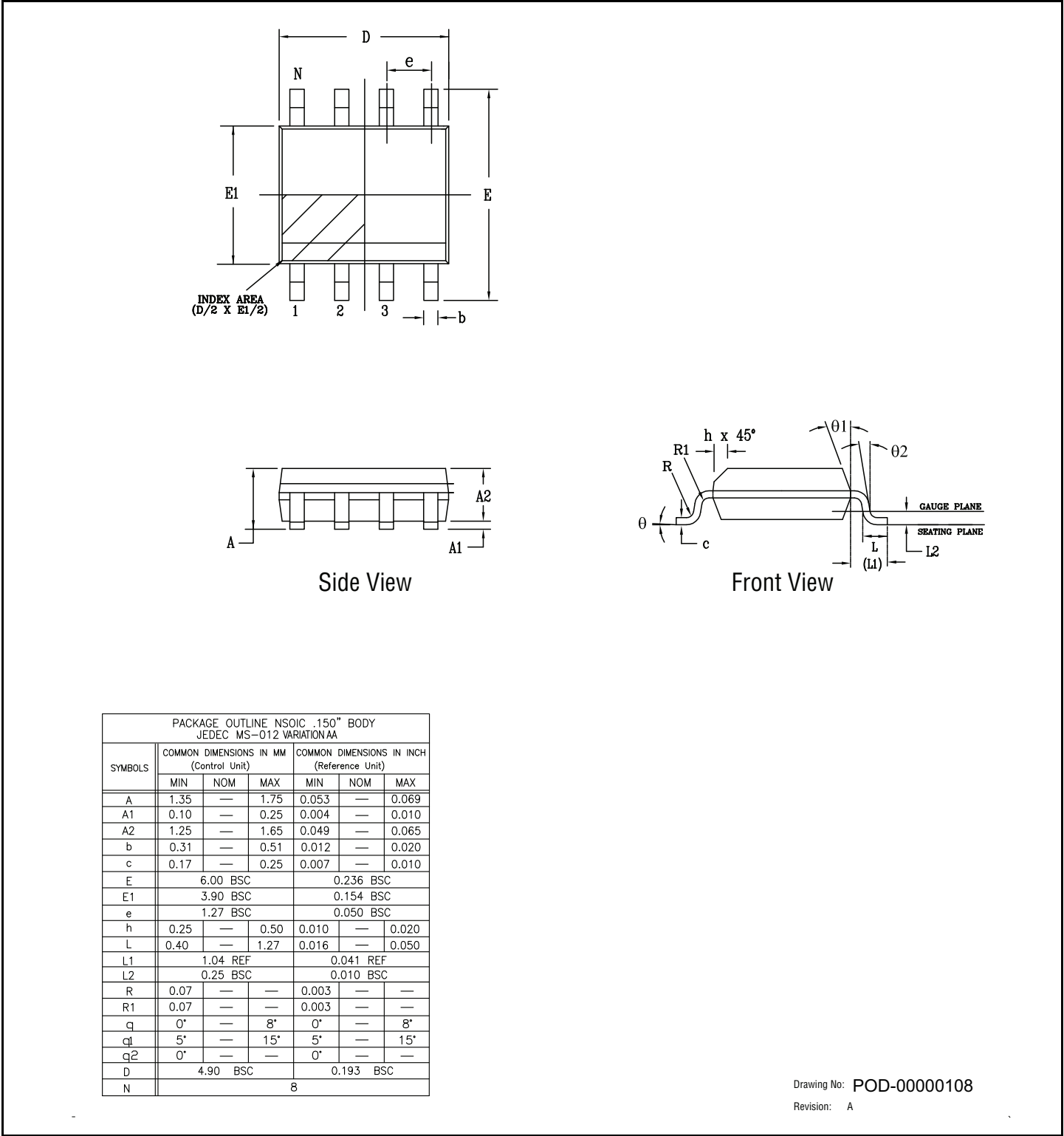


Figure 11: Mechanical Dimension—NSOIC8

## Ordering Information

**Table 13: Ordering Information**

Ordering Part Number	Data Rate (Mbps)	Package	Duplex	Packaging Method	Operating Temperature Range
<b>MxL83101 and MxL83102</b>					
MXL83101E-ADA-R	0.25	NSOIC8	Half	Reel	–40°C to 125°C
MXL83102E-ADA-R	0.5	NSOIC8	Half	Reel	–40°C to 125°C

**Note:** For more information about part numbers, as well as the most up-to-date ordering information and additional information on environment rating, go to [www.maxlinear.com/MxL83101](http://www.maxlinear.com/MxL83101) and [www.maxlinear.com/MxL83102](http://www.maxlinear.com/MxL83102).



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