

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{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°C to 125°C temperature grades
- Low power shutdown mode (<1µA Typ)
- Robust system protection
 - ±2kV EFT (IEC 61000-4-4)
 - ±8kV ESD Contact (IEC 61000-4-2)
 - ±15kV ESD HBM

Ordering Information - [page 18](#)

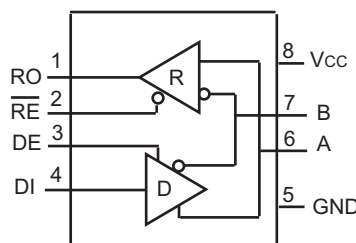


Figure 1: 8-Pin Half Duplex

Revision History

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

Table of Contents

General Description	i
Applications	i
Features	i
Specifications	1
Absolute Maximum Ratings.....	1
ESD Ratings	1
Electrical Characteristics	3
Driver Switching Characteristics—MxL83101	5
Receiver Switching Characteristics—MxL83101.....	5
Driver Switching Characteristics—MxL83102	6
Receiver Switching Characteristics—MxL83102.....	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
Fail Safe	14
Hot-Swap Capability	14
ESD Test Conditions (IEC 61000-4-2)	14
Electrical Fast Transient (IEC 61000-4-4)	15
256 Transceivers on the Bus.....	15
Reduced EMI and Reflections	15
Low Power Shutdown Mode.....	15
Driver Output Protection	15
Line Length.....	16
Typical Applications.....	16
Mechanical Dimensions	17
NSOIC8	17
Ordering Information	18

List of Figures

Figure 1: 8-Pin Half Duplex	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 Output Short Circuit Current	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 Dimension—NSOIC8	17

List of Tables

Table 1: Absolute Maximum Ratings	1
Table 2: ESD Ratings	1
Table 3: Thermal Information	1
Table 4: Power Dissipation	2
Table 5: Electrical Characteristics	3
Table 6: MxL83101 Driver Switching Characteristics	5
Table 7: MxL83101 Receiver Switching Characteristics	5
Table 8: MxL83102 Driver Switching Characteristics	6
Table 9: MxL83102 Receiver Switching Characteristics	6
Table 10: MxL8310x Tx (Half Duplex)	12
Table 11: MxL8310x Rx (Half Duplex)	12
Table 12: MxL8310x Pin Descriptions	13
Table 13: Ordering Information	18

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
θ_{JA}	Junction-to-ambient thermal resistance	96.1	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	3.7	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	59.1	°C/W
θ_{JB}	Junction-to-board thermal resistance	58.3	°C/W
θ_{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_{OD}	$R_L = 100\Omega$ (RS-422), Figure 2	2	-	V_{CC}	V	
		$R_L = 54\Omega$ (RS-485), Figure 2	1.5	-	V_{CC}		
		$R_L = 60\Omega$, $-7V \leq V_{test} \leq 12V$, Figure 4	2.1	-	V_{CC}		
Change in magnitude of differential output voltage	ΔV_{OD}	$R_L = 54\Omega$ or 100Ω , Figure 2	-	-	0.2	V	
Driver common mode output voltage	V_{OC}	$R_L = 54\Omega$ or 100Ω , Figure 2	-	$V_{CC}/2$	3	V	
Change in magnitude of common mode output voltage	$ \Delta V_{OC} $	$R_L = 54\Omega$ or 100Ω , Figure 2	-	-	± 0.2	V	
Input high voltage	V_{IH}	DE, DI, \overline{RE}	2	-	-	V	
Input low voltage	V_{IL}	DE, DI, \overline{RE}	-	-	0.8	V	
Input hysteresis	V_{HYS}	DE, DI, \overline{RE}	-	100	-	mV	
Input current	I_{IN}	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_O	DE = GND $0 \leq V_{CC} \leq 5.5V$	$V_{IN} = 12V$	-	125	μA	
			$V_{IN} = -7V$	-100	-		-
Driver short-circuit current	I_{OSD}	$-7V \leq V_{OUT} \leq 12V$, Figure 7	0	-	250	mA	
			-250	-	0		
Thermal-shutdown threshold	T_{TS}		-	170	-	$^\circ C$	
Thermal-shutdown hysteresis	T_{TSH}		-	15	-	$^\circ C$	
Receiver							
Receiver differential threshold (sensitivity)	V_{TH}	$-7V \leq V_{CM} \leq 12V$	-200	-125	-50	mV	
Receiver input hysteresis	ΔV_{TH}	$V_A + V_B = 0V$	-	30	-	mV	
RO output high voltage	V_{OH}	$I_O = -1mA$	$V_{CC} - 0.4$	$V_{CC} - 0.2$	-	V	
RO output low voltage	V_{OL}	$I_O = 1mA$	-	0.2	0.4	V	
Tri-State output current at receiver	I_{OZR}	$0 \leq V_O \leq V_{CC}$	-	-	± 1	μA	
Receiver input resistance	R_{IN}	$-7V \leq V_{CM} \leq 12V$	96	-	-	k Ω	
Input current (A & B)	$I_{A,B}$	DE = GND, $\overline{RE} = GND$ $0 \leq V_{CC} \leq 5.5V$	$V_{IN} = 12V$	-	-	125	μA
			$V_{IN} = -7V$	-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	μA

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_{DPHL}, 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_{DPHL} $		-	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_{DPHL}, 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_{DPHL} $		-	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_{DHZ}		-	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_{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

Test Circuits and Timing Diagrams

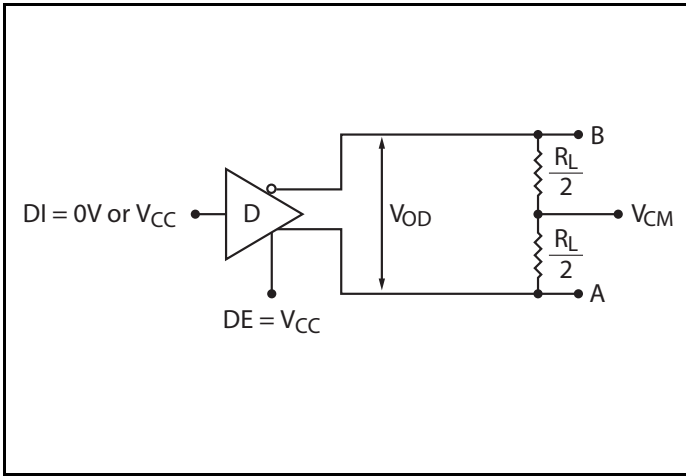


Figure 2: Driver DC Test Circuit

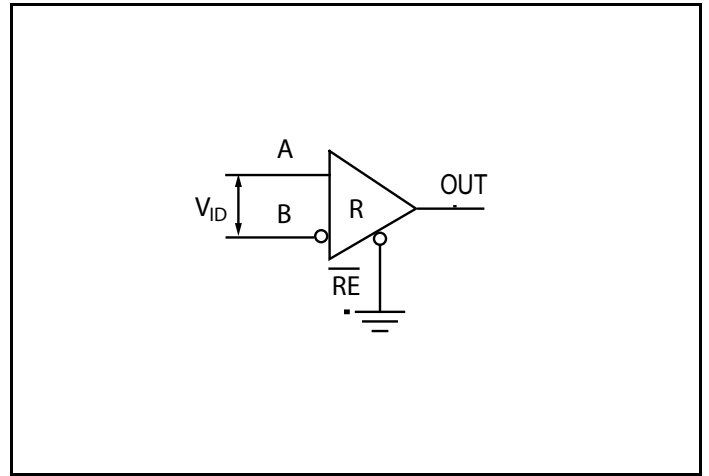


Figure 3: Receiver DC Test Circuit

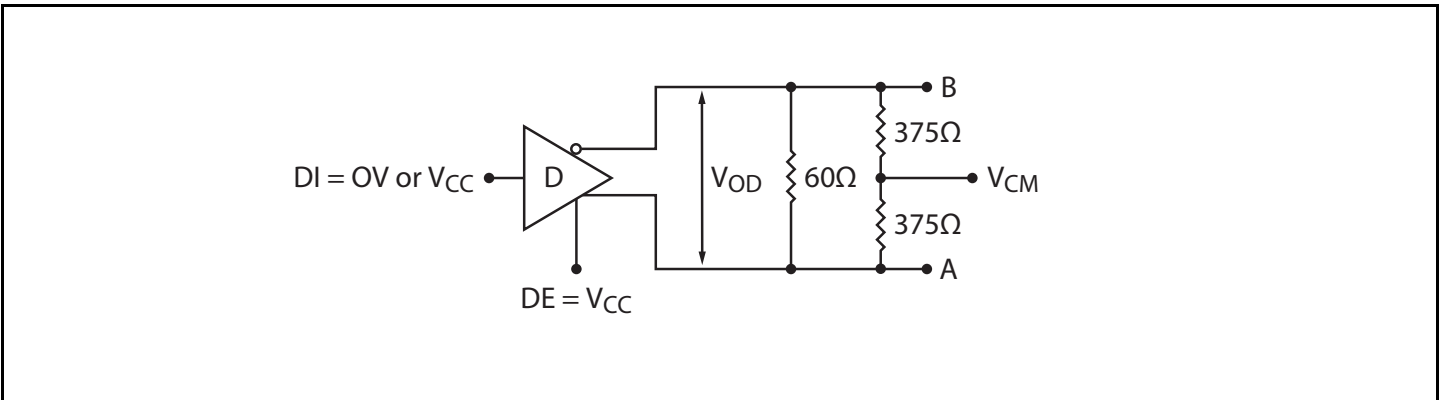


Figure 4: Differential Driver Output Voltage over Extended Common Mode

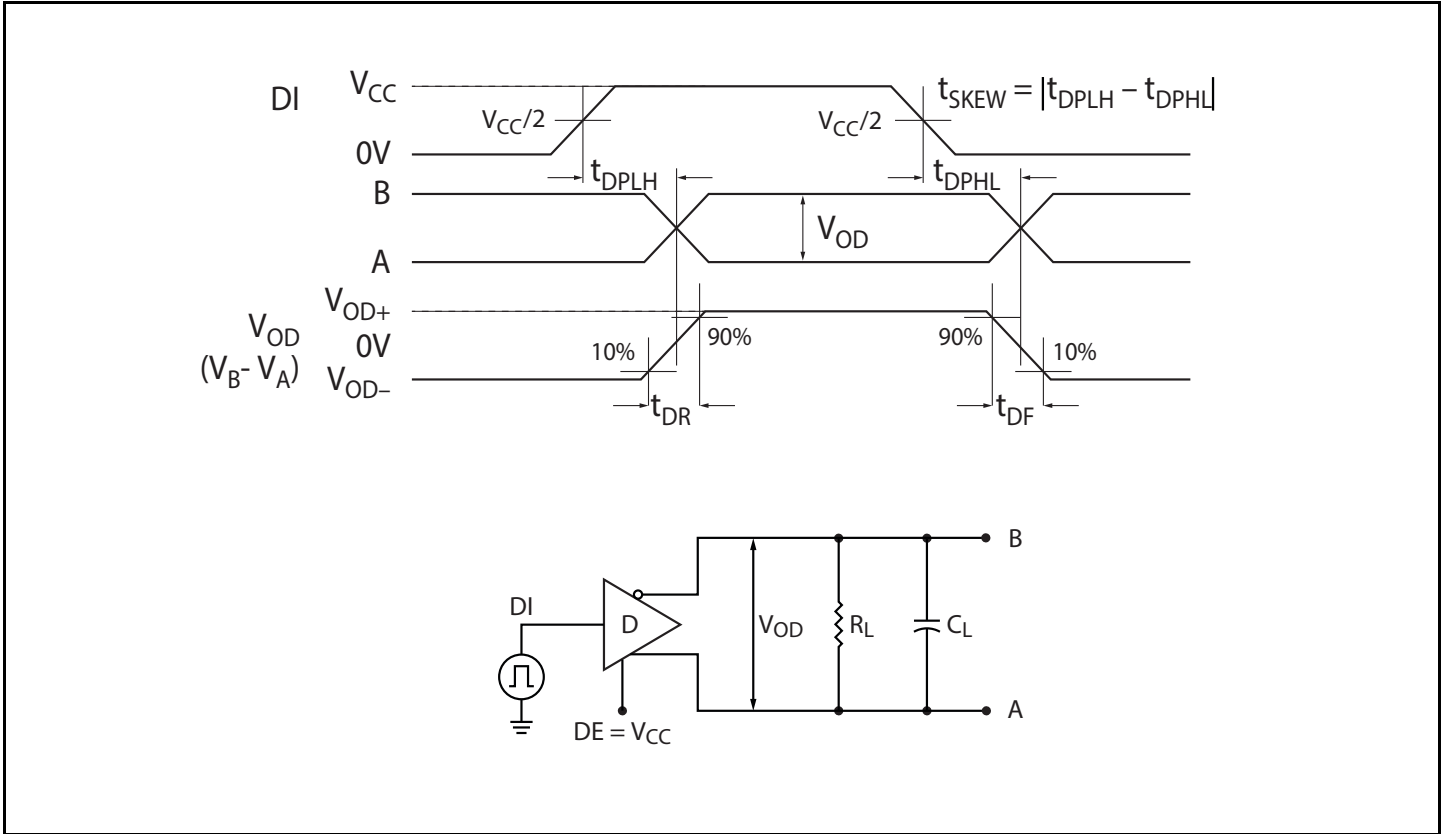


Figure 5: Driver Propagation Delay Time Test Circuit and Timing Diagram

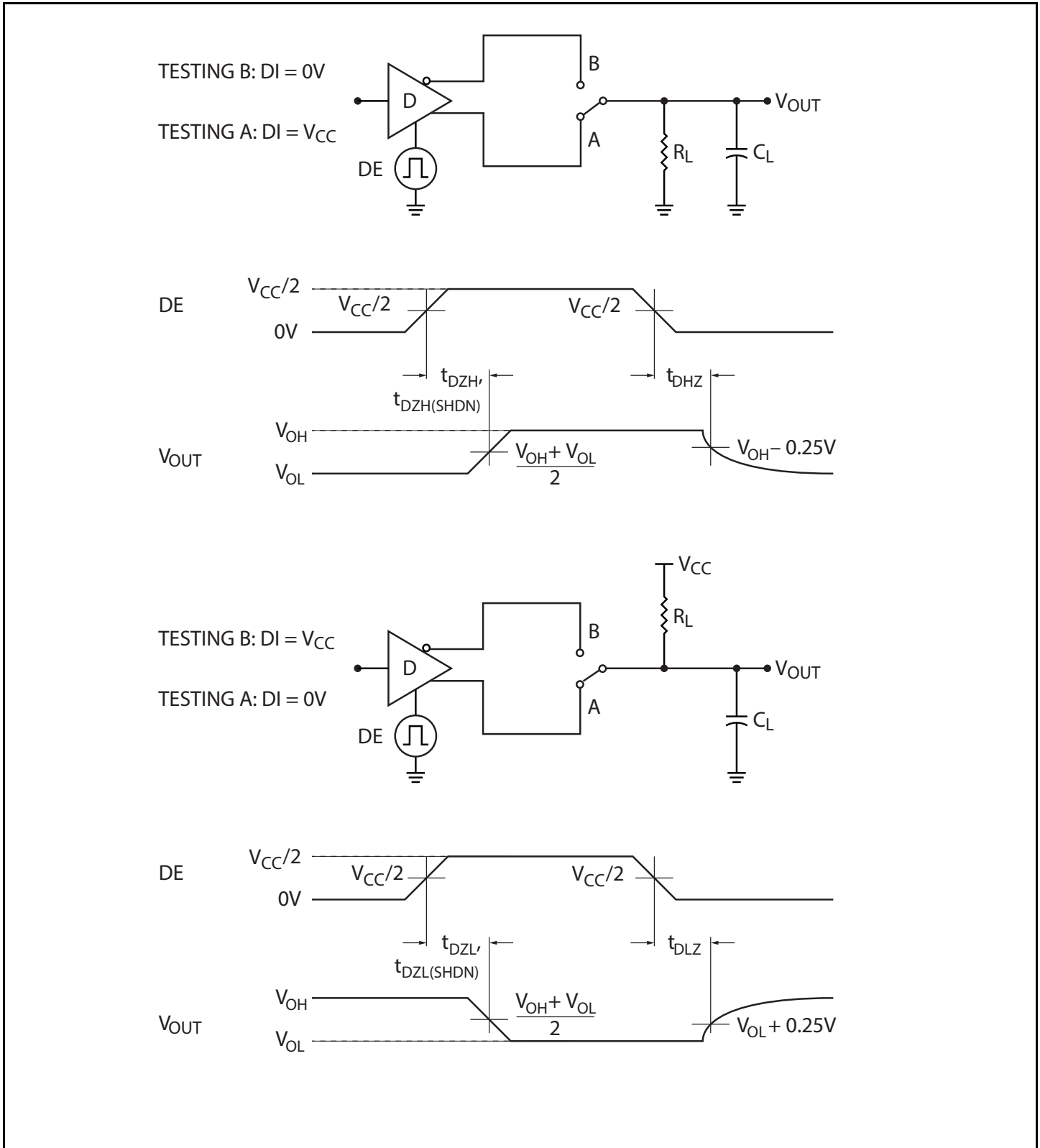


Figure 6: Driver Enable and Disable Times Test Circuit and Timing Diagram

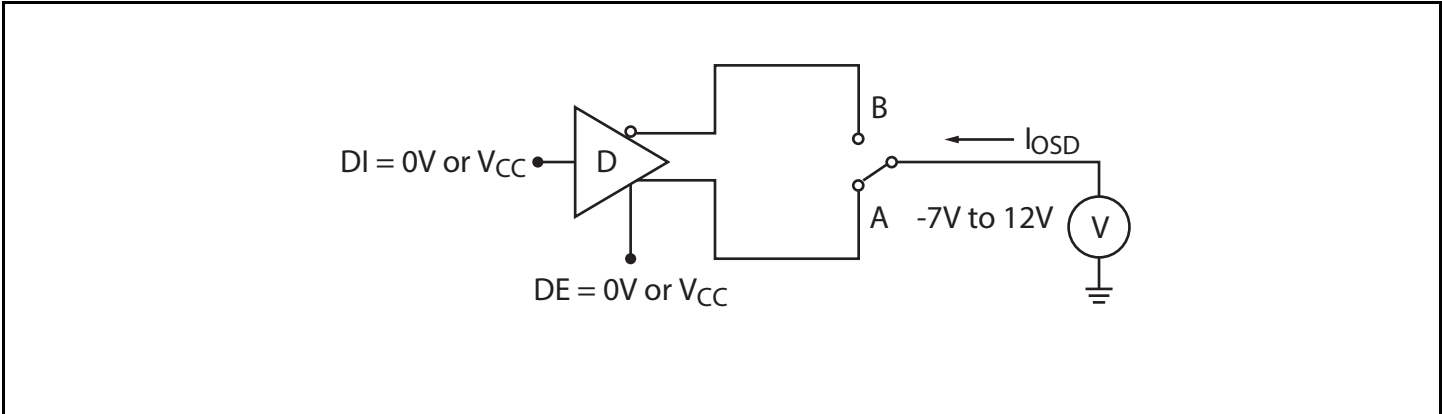


Figure 7: Driver Output Short Circuit Current

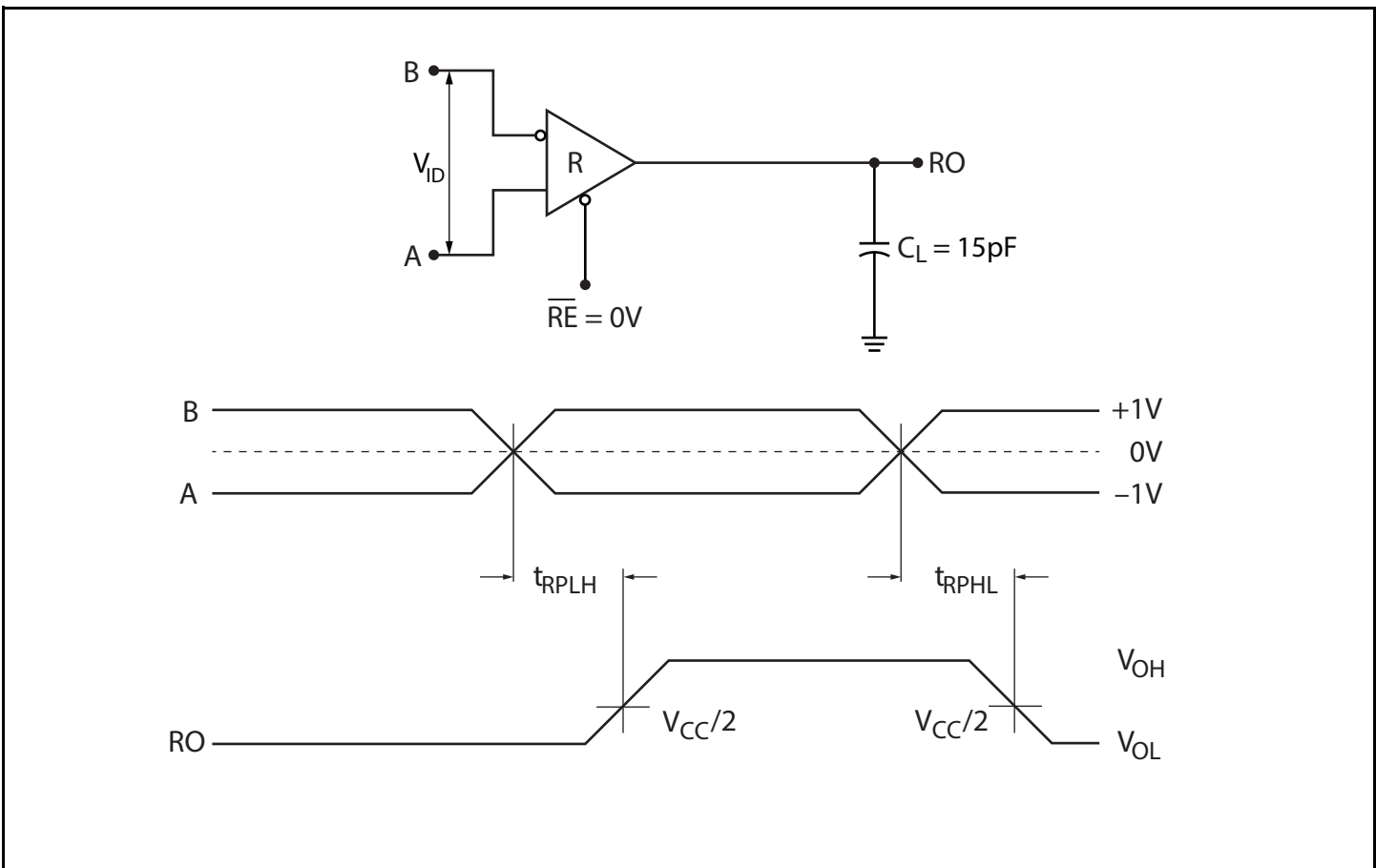


Figure 8: Receiver Propagation Delay Test Circuit and Timing Diagram

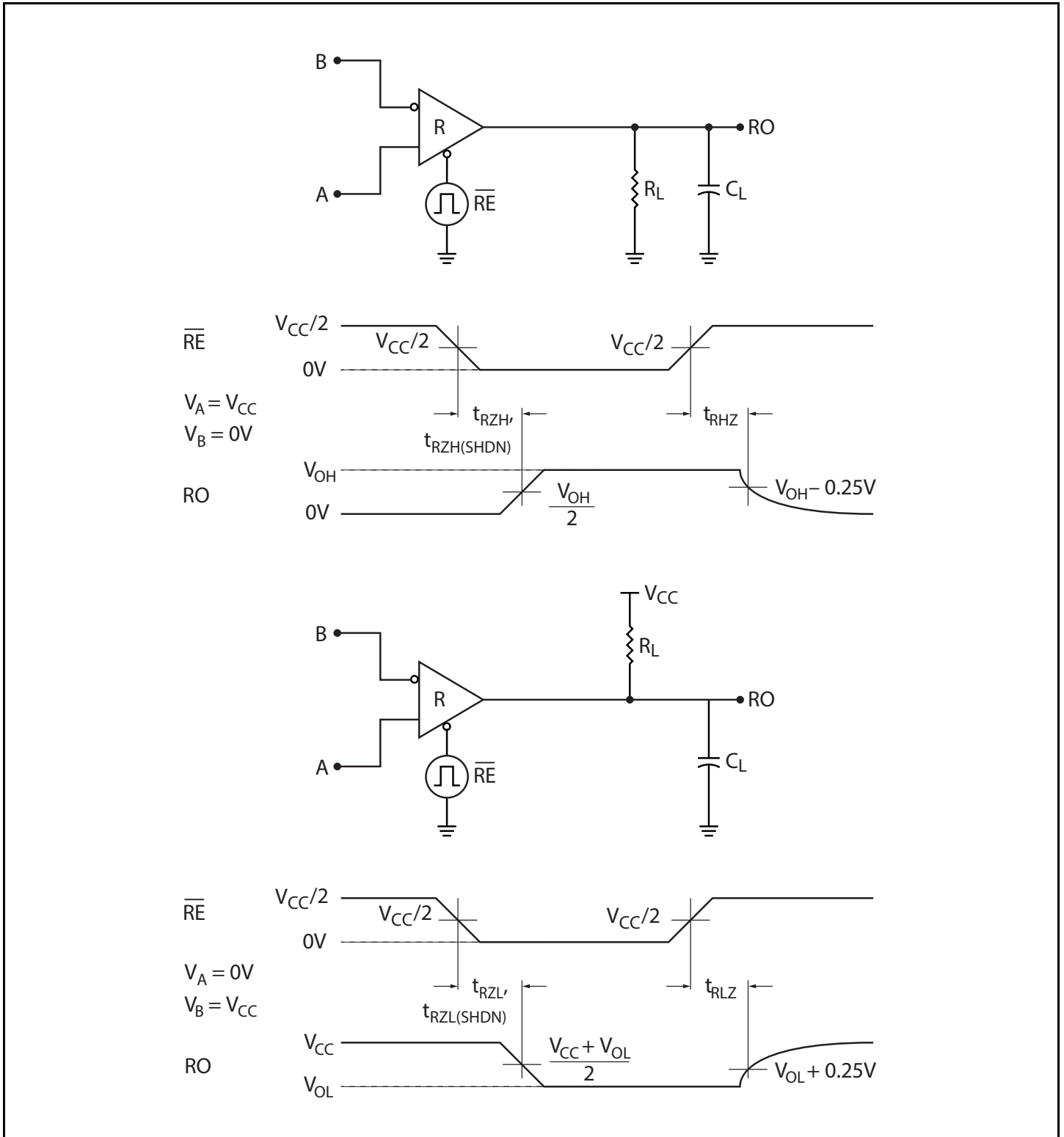


Figure 9: Receiver Enable and Disable Times Test Circuit and Timing Diagram

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
$V_{\text{ID}} = V_{\text{A}} - V_{\text{B}}$	$\overline{\text{RE}}$	DE	RO	
$-50\text{mV} \leq V_{\text{ID}}$	L	X	H	Receive valid bus high.
$-200\text{mV} \leq V_{\text{ID}} \leq -50\text{mV}$	L	X	X	Indeterminate bus state.
$V_{\text{ID}} \leq -200\text{mV}$	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

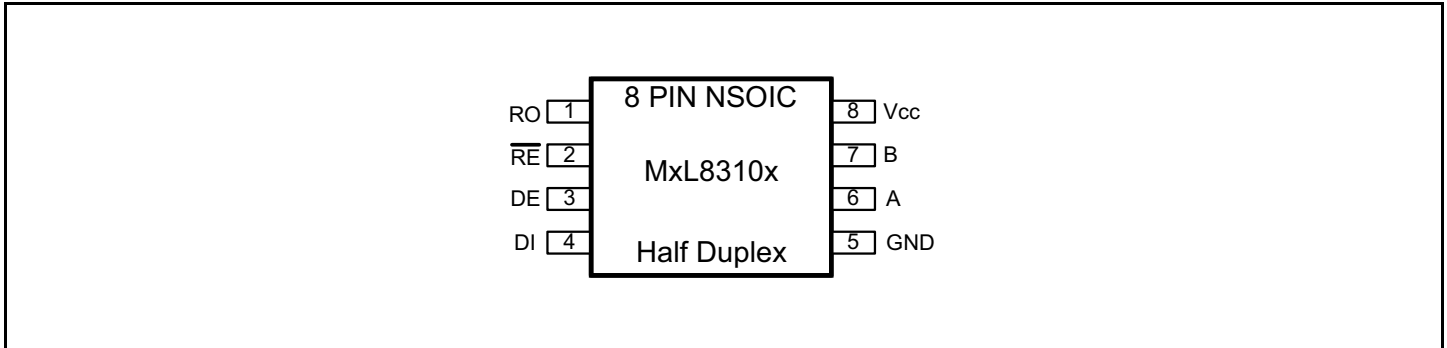


Figure 10: Pin Configurations

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 _{CC}	Positive Supply V _{CC} . Bypass V _{CC} to GND with a 0.1 μF 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 -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 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 -50mV to -200mV .

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 latching 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:

- ±15kV using the Human Body Model
- ±8kV using the Contact Discharge method specified in IEC 61000-4-2
- ±15kV 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 $12k\Omega$ (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 ($96k\Omega$), 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{RE} high and DE low. In shutdown, the devices typically draw only 50nA 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 600ns, the parts are guaranteed to enter shutdown.

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

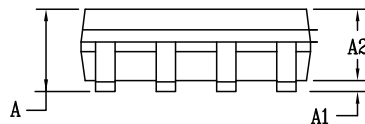
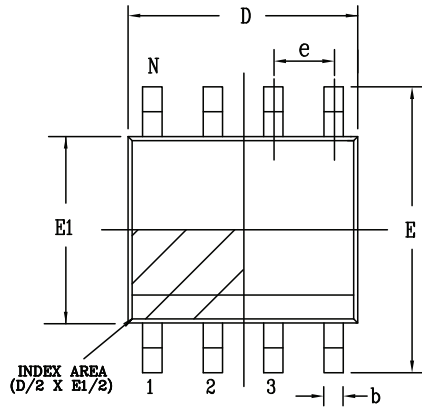
Typical Applications

The MxL8310x transceivers are designed for bidirectional data communications on multipoint bus transmission lines.

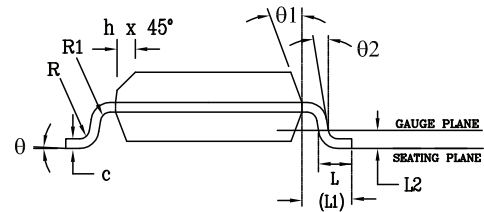
To minimize reflections, terminate the line at both ends in its characteristic impedance, and keep stub lengths off the main line as short as possible. The slew-rate-limited MxL8310x are more tolerant of imperfect termination.

Mechanical Dimensions

NSOIC8



Side View



Front View

PACKAGE OUTLINE NSOIC .150" BODY JEDEC MS-012 VARIATION AA						
SYMBOLS	COMMON DIMENSIONS IN MM (Control Unit)			COMMON 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	—	—
q	0°	—	8°	0°	—	8°
qt	5°	—	15°	5°	—	15°
q2	0°	—	—	0°	—	—
D	4.90 BSC			0.193 BSC		
N	8					

Drawing No: POD-00000108

Revision: A

Figure 11: Mechanical Dimension—NSOIC8

Ordering Information

Table 13: Ordering Information

Ordering Part Number	Date Rate (Mbps)	Package	Duplex	Packaging Method	Operating Temperature Range
MxL83101 and MxL83102					
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 and www.maxlinear.com/MxL83102.



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, any other MaxLinear trademarks (including but not limited to MxL, Full-Spectrum Capture, FSC, AirPHY, Puma, AnyWAN, VectorBoost, MXL WARE, and Panther), and the MaxLinear logo on the products sold 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 products, company names and logos are trademarks™ or registered® trademarks and remain the property 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.