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XL3483 SOP8
XL3485 SOP8
XD3485 DIP8

True RS-485/RS-422 Transceivers

General Description

3483 and 3485, 3.3V, low-power transceivers for RS-485 and RS-422 communication. Each part contains one driver and one receiver. The 3483 feature slew-rate-limited drivers that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free data transmission at data rates up to 250kbps. 2.5Mbps. 3485, transmit at up to 10Mbps. Drivers are short-circuit current limited and are protected against excessive power dissipation by thermal shutdown circuitry that places the driver outputs into a high-impedance state. The receiver input has a fail-safe feature that guarantees a logic-high output if both inputs are open circuit.

Features

Operate from a Single 3.3V Supply—No Charge Pump!

- **Interoperable with +5V Logic**
- **8ns Max Skew 3485**
- **Slew-Rate Limited for Errorless Data Transmission 3483**
- **2nA Low-Current Shutdown Mode 3483/3485**
- **-7V to +12V Common-Mode Input Voltage Range**
- **Allows up to 32 Transceivers on the Bus**
- **Full-Duplex and Half-Duplex Versions Available**
- **Current-Limiting and Thermal Shutdown for Driver Overload Protection**

Applications

Low-Power RS-485/RS-422 Transceivers
Telecommunications
Transceivers for EMI-Sensitive Applications
Industrial-Control Local Area Networks

Ordering Information

PART	PIN-PACKAGE	TEMP. RANGE
XL3483	SOP8	0°C to +70°C
XL3485	SOP8	0°C to +70°C
XD3485	DIP8	0°C to +70°C

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) 7V
Control Input Voltage ($\overline{RE}$, DE) ..... -0.3V to 7V
Driver Input Voltage (DI) ..... -0.3V to 7V
Driver Output Voltage (A, B, Y, Z) ..... -7.5V to 12.5V
Receiver Input Voltage (A, B) ..... -7.5V to 12.5V
Receiver Output Voltage (RO) ..... -0.3V to (V_{CC} + 0.3V)
Continuous Power Dissipation (T_A = +70°C)
8-Pin Plastic DIP (derate 9.09mW/°C above +70°C) 727mW
8-Pin SO (derate 5.88mW/°C above +70°C) 471mW
14-Pin Plastic DIP (derate 10mW/°C above +70°C) 800mW
14-Pin SO (derate 8.33mW/°C above +70°C) 667mW
Operating Temperature Ranges
3483/3485 ..... 0°C to +70°C
Storage Temperature Range ..... -65°C to +160°C
Lead Temperature (soldering, 10sec) ..... +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.

DC ELECTRICAL CHARACTERISTICS

(V_{CC} = 3.3V ±0.3V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Differential Driver Output	V_{OD}	R_L = 100Ω (RS-422), Figure 2		2.0			V
		R_L = 54Ω (RS-485), Figure 2		1.5			
		R_L = 60Ω (RS-485), V_{CC} = 3.3V, Figure 3		1.5			
Change in Magnitude of Driver Differential Output Voltage for Complementary Output States (Note 1)	ΔV_{OD}	R_L = 54Ω or 100Ω, Figure 4				0.2	V
Driver Common-Mode Output Voltage	V_{OC}	R_L = 54Ω or 100Ω, Figure 4				3	V
Change in Magnitude of Common-Mode Output Voltage (Note 1)	ΔV_{OC}	R_L = 54Ω or 100Ω, Figure 4				0.2	V
Input High Voltage	V_{IH}	DE, DI, $\overline{RE}$		2.0			V
Input Low Voltage	V_{IL}	DE, DI, $\overline{RE}$				0.8	V
Logic Input Current	I_{IN1}	DE, DI, $\overline{RE}$				±2	µA
Input Current (A, B)	I_{IN2}	DE = 0V, V_{CC} = 0V or 3.6V	V_{IN} = 12V			1.0	mA
			V_{IN} = -7V			-0.8	
Receiver Differential Threshold Voltage	V_{TH}	-7V ≤ V_{CM} ≤ 12V		-0.2		0.2	V
Receiver Input Hysteresis	ΔV_{TH}	V_{CM} = 0V			50		mV
Receiver Output High Voltage	V_{OH}	I_{OUT} = -1.5mA, V_{ID} = 200mV, Figure 4		V_{CC} - 0.4			V
Receiver Output Low Voltage	V_{OL}	I_{OUT} = 2.5mA, V_{ID} = 200mV, Figure 4				0.4	V
Three-State (High Impedance) Output Current at Receiver	I_{OZR}	V_{CC} = 3.6V, 0V ≤ V_{OUT} ≤ V_{CC}				±1	µA
Receiver Input Resistance	R_{IN}	-7V ≤ V_{CM} ≤ 12V		12			kΩ

DC ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = 3.3V ±0.3V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted. Typical values are at T_A = +25°C)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Supply Current	I_{CC}	No load, DI = 0V or V_{CC}	DE = V_{CC}, $\overline{RE}$ = 0V or V_{CC}		1.1	2.2	mA
			DE = 0V, $\overline{RE}$ = 0V		0.95	1.9	
Supply Current in Shutdown Mode	I_{SHDN}	DE = 0V, $\overline{RE}$ = V_{CC}, DI = V_{CC} or 0V			0.002	1	µA
Driver Short-Circuit Output Current	I_{OSD}	V_{OUT} = -7V				-250	mA
		V_{OUT} = 12V				250	
Receiver Short-Circuit Output Current	I_{OSR}	0V ≤ V_{RO} ≤ V_{CC}		±8		±60	mA

DRIVER SWITCHING CHARACTERISTICS—3485

(V_{CC} = 3.3V, T_A = +25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver Differential Output Delay	t_{DD}	R_L = 60Ω, Figure 5	1	22	35	ns
Driver Differential Output Transition Time	t_{TD}	R_L = 60Ω, Figure 5	3	8	25	ns
Driver Propagation Delay, Low-to-High Level	t_{PLH}	R_L = 27Ω, Figure 6	7	22	35	ns
Driver Propagation Delay, High-to-Low Level	t_{PHL}	R_L = 27Ω, Figure 6	7	22	35	ns
$\lvert t_{PLH} - t_{PHL} \rvert$ Driver Propagation Delay Skew (Note 2)	t_{PDS}	R_L = 27Ω, Figure 6			8	ns
DRIVER OUTPUT ENABLE/DISABLE TIMES (3485)						
Driver Output Enable Time to Low Level	t_{PZL}	R_L = 110Ω, Figure 8		45	90	ns
Driver Output Enable Time to High Level	t_{PZH}	R_L = 110Ω, Figure 7		45	90	ns
Driver Output Disable Time from High Level	t_{PHZ}	R_L = 110Ω, Figure 7		40	80	ns
Driver Output Disable Time from Low Level	t_{PLZ}	R_L = 110Ω, Figure 8		40	80	ns

DRIVER SWITCHING CHARACTERISTICS—3483

(V_{CC} = 3.3V, T_A = +25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Driver Differential Output Delay	t_{DD}	R_L = 60Ω, Figure 7	600	900	1400	ns
Driver Differential Output Transition Time	t_{TD}	R_L = 60Ω, Figure 7	400	700	1200	ns
Driver Propagation Delay, Low-to-High Level	t_{PLH}	R_L = 27Ω, Figure 8	700	1000	1500	ns
Driver Propagation Delay, High-to-Low Level	t_{PHL}	R_L = 27Ω, Figure 8	700	1000	1500	ns
$\lvert t_{PLH} - t_{PHL} \rvert$ Driver Propagation Delay Skew (Note 2)	t_{PDS}	R_L = 27Ω, Figure 8		100		ns
DRIVER OUTPUT ENABLE/DISABLE TIMES (3483 only)						
Driver Output Enable Time to Low Level	t_{PZL}	R_L = 110Ω, Figure 10		900	1300	ns
Driver Output Enable Time to High Level	t_{PZH}	R_L = 110Ω, Figure 9		600	800	ns
Driver Output Disable Time from High Level	t_{PHZ}	R_L = 110Ω, Figure 9		50	80	ns
Driver Output Disable Time from Low Level	t_{PLZ}	R_L = 110Ω, Figure 10		50	80	ns
Driver Output Enable Time from Shutdown to Low Level	t_{PSL}	R_L = 110Ω, Figure 10		1.9	2.7	µs
Driver Output Enable Time from Shutdown to High Level	t_{PSH}	R_L = 110Ω, Figure 9		2.2	3.0	µs

RECEIVER SWITCHING CHARACTERISTICS

(V_{CC} = 3.3V, T_A = +25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Time to Shutdown	t_{SHDN}	3483/3485 (Note 3)	80	190	300	ns
Receiver Propagation Delay, Low-to-High Level	t_{RPLH}	V_{ID} = 0V to 3.0V, C_L = 15pF, Figure 9	25	65	90	ns
		3483	25	75	120	
Receiver Propagation Delay, High-to-Low Level	t_{RPHL}	V_{ID} = 0V to 3.0V, C_L = 15pF, Figure 9	25	65	90	ns
		3483	25	75	120	
$\lvert t_{PLH} - t_{PHL} \rvert$ Receiver Propagation Delay Skew	t_{RPDS}	V_{ID} = 0V to 3.0V, C_L = 15pF, Figure 9			10	ns
		3483			20	
Receiver Output Enable Time to Low Level	t_{PRZL}	C_L = 15pF, Figure 10, 3483/3485		25		ns
Receiver Output Enable Time to High Level	t_{PRZH}	C_L = 15pF, Figure 10, 3483/3485		25		ns
Receiver Output Disable Time from High Level	t_{PRHZ}	C_L = 15pF, Figure 10, 3483/3485		25		ns
Receiver Output Disable Time from Low Level	t_{PRLZ}	C_L = 15pF, Figure 10, 3483/3485		25		ns
Receiver Output Enable Time from Shutdown to Low Level	t_{PRSL}	C_L = 15pF, Figure 10, 3483/3485		720		ns
Receiver Output Enable Time from Shutdown to High Level	t_{PRSH}	C_L = 15pF, Figure 10, 3483/3485		720		ns

Note 1: ΔV_{OD} and ΔV_{OC} are the changes in V_{OD} and V_{OC}, respectively, when the DI input changes state.

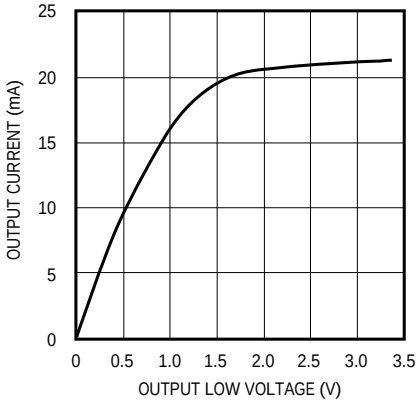
Note 2: Measured on $\lvert t_{PLH}$ (Y) - t_{PHL} (Y)$\rvert$ and $\lvert t_{PLH}$ (Z) - t_{PHL} (Z)$\rvert$.

Note 3: The transceivers are put into shutdown by bringing $\overline{RE}$ high and DE low. If the inputs are in this state for less than 80ns, the parts are guaranteed not to enter shutdown. If the inputs are in this state for at least 300ns, the parts are guaranteed to have entered shutdown. See *Low-Power Shutdown Mode* section.

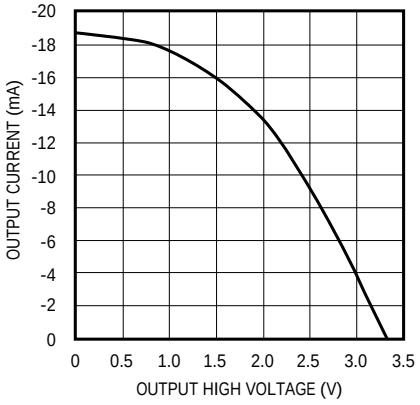
Typical Operating Characteristics

(V_{CC} = 3.3V, T_A = +25°C, unless otherwise noted.)

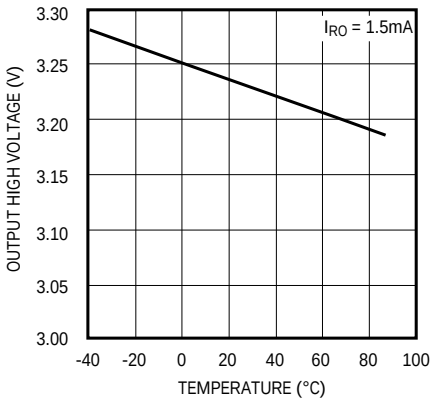
OUTPUT CURRENT vs. RECEIVER OUTPUT LOW VOLTAGE



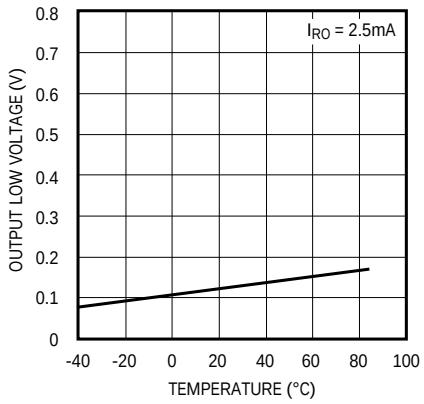
OUTPUT CURRENT vs. RECEIVER OUTPUT HIGH VOLTAGE



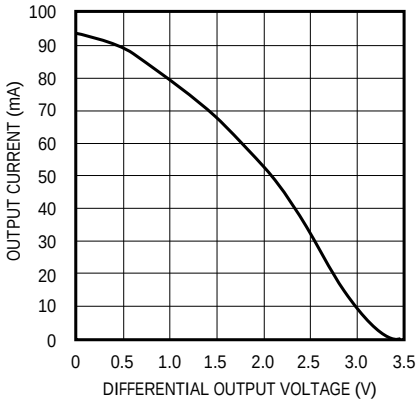
RECEIVER OUTPUT HIGH VOLTAGE vs. TEMPERATURE



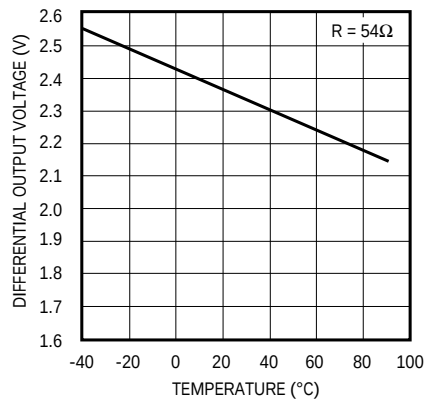
RECEIVER OUTPUT LOW VOLTAGE vs. TEMPERATURE



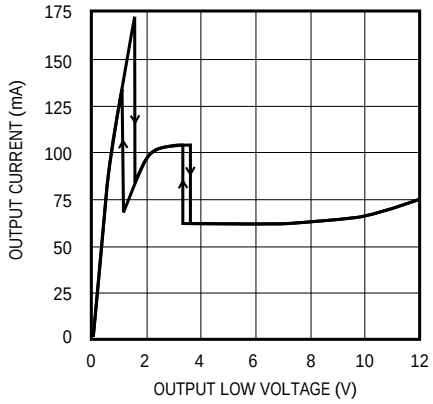
DRIVER OUTPUT CURRENT vs. DIFFERENTIAL OUTPUT VOLTAGE



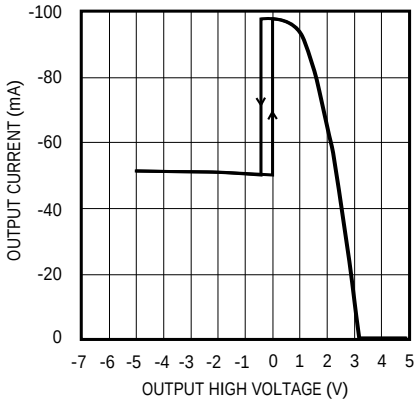
DRIVER DIFFERENTIAL OUTPUT VOLTAGE vs.TEMPERATURE



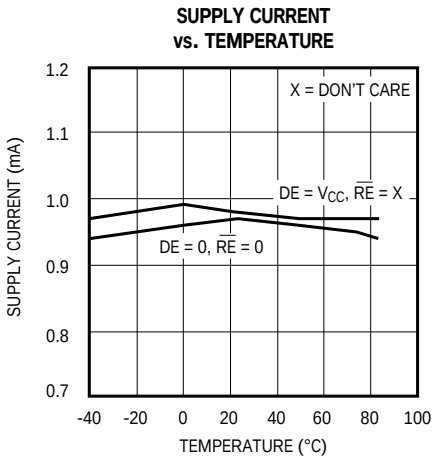
OUTPUT CURRENT vs. DRIVER OUTPUT LOW VOLTAGE

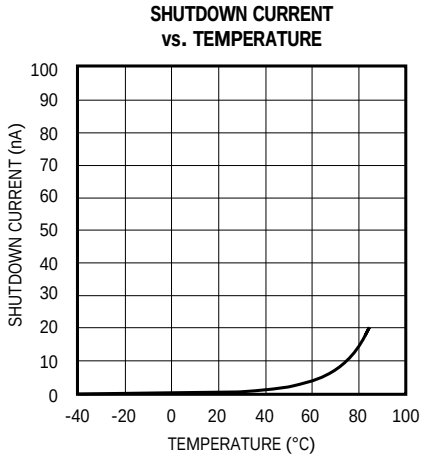


OUTPUT CURRENT vs. DRIVER OUTPUT HIGH VOLTAGE



Typical Operating Characteristics (continued)





Pin Description

PIN	NAME	FUNCTION
3483/3485		
1	RO	Receiver Output. If A > B by 200mV, RO will be high; if A < B by 200mV, RO will be low.
2	$\overline{RE}$	Receiver Output Enable. RO is enabled when $\overline{RE}$ is low; RO is high impedance when $\overline{RE}$ is high. If $\overline{RE}$ is high and DE is low, the device will enter a low-power shutdown mode.
3	DE	Driver Output Enable. The driver outputs are enabled by bringing DE high. They are high impedance when DE is low. If $\overline{RE}$ is high and DE is low, the device will enter a low-power shutdown mode. If the driver outputs are enabled, the parts function as line drivers. While they are high impedance, they function as line receivers if $\overline{RE}$ is low.
4	DI	Driver Input. A low on DI forces output Y low and output Z high. Similarly, a high on DI forces output Y high and output Z low.
5	GND	Ground
—	Y	Noninverting Driver Output
—	Z	Inverting Driver Output
6	A	Noninverting Receiver Input and Noninverting Driver Output
—	A	Noninverting Receiver Input
7	B	Inverting Receiver Input and Inverting Driver Output
—	B	Inverting Receiver Input
8	V_{CC}	Positive Supply: $3.0V \le V_{CC} \le 3.6V$
—	N.C.	No Connect—not internally connected

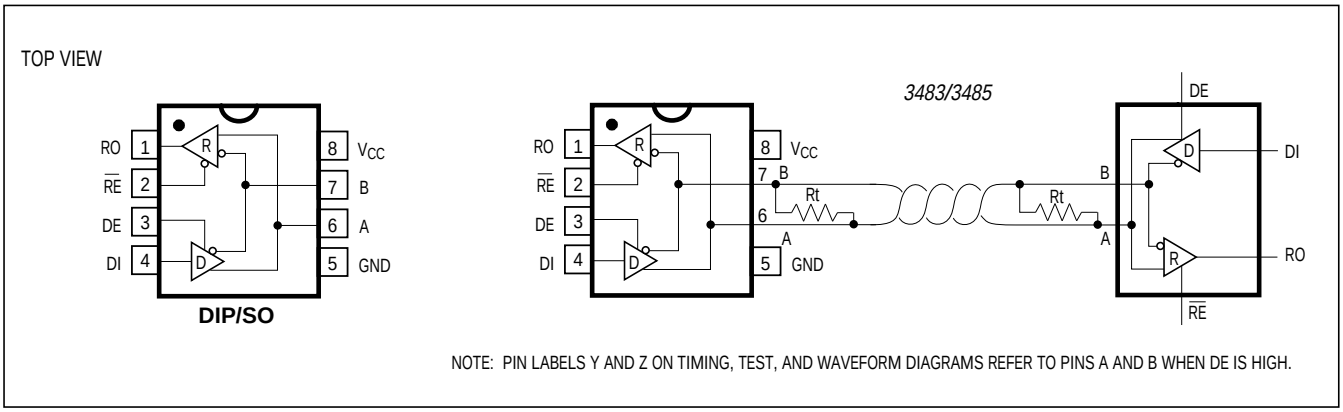


Figure 1. 3483/3485 Pin Configuration and Typical Operating Circuit

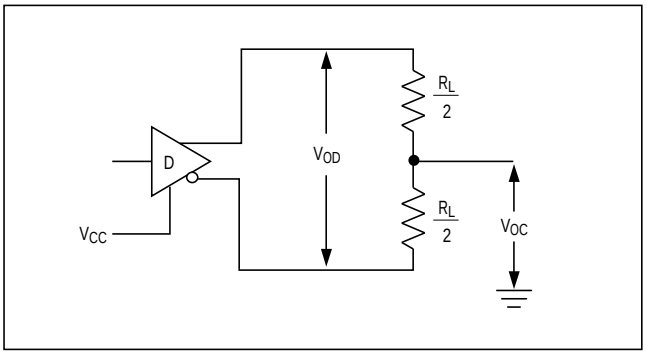


Figure 2. Driver V_{OD} and V_{OC}

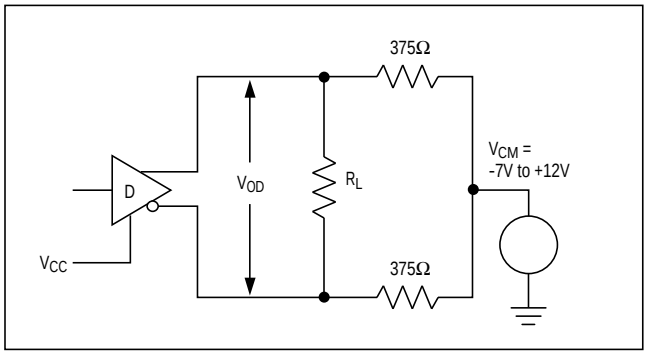


Figure 3. Driver V_{OD} with Varying Common-Mode Voltage

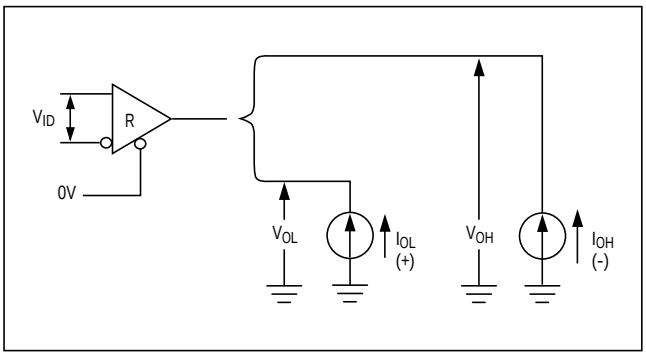


Figure 4. Receiver V_{OH} and V_{OL}

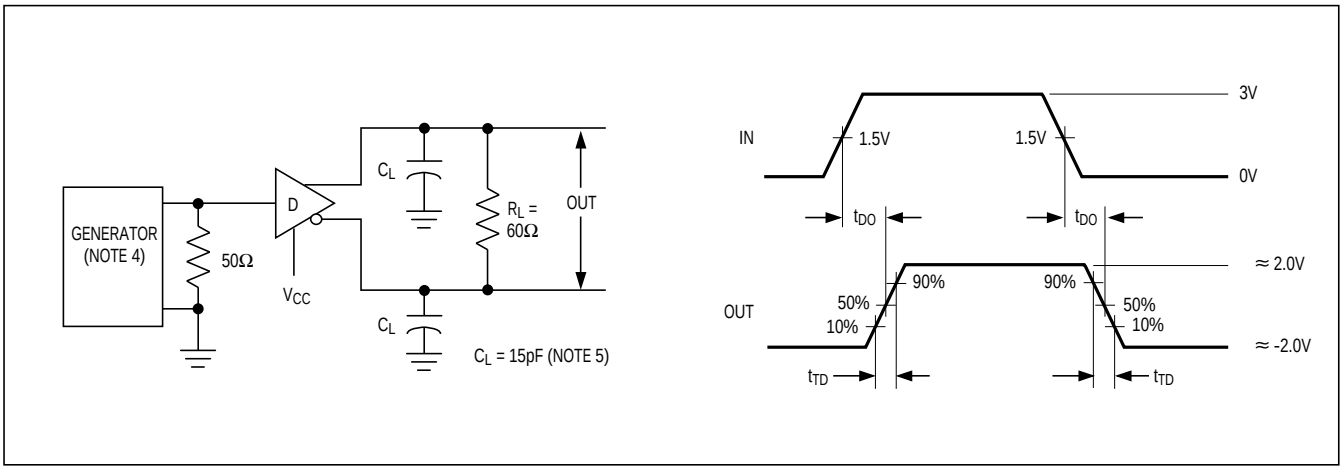


Figure 5. Driver Differential Output Delay and Transition Times

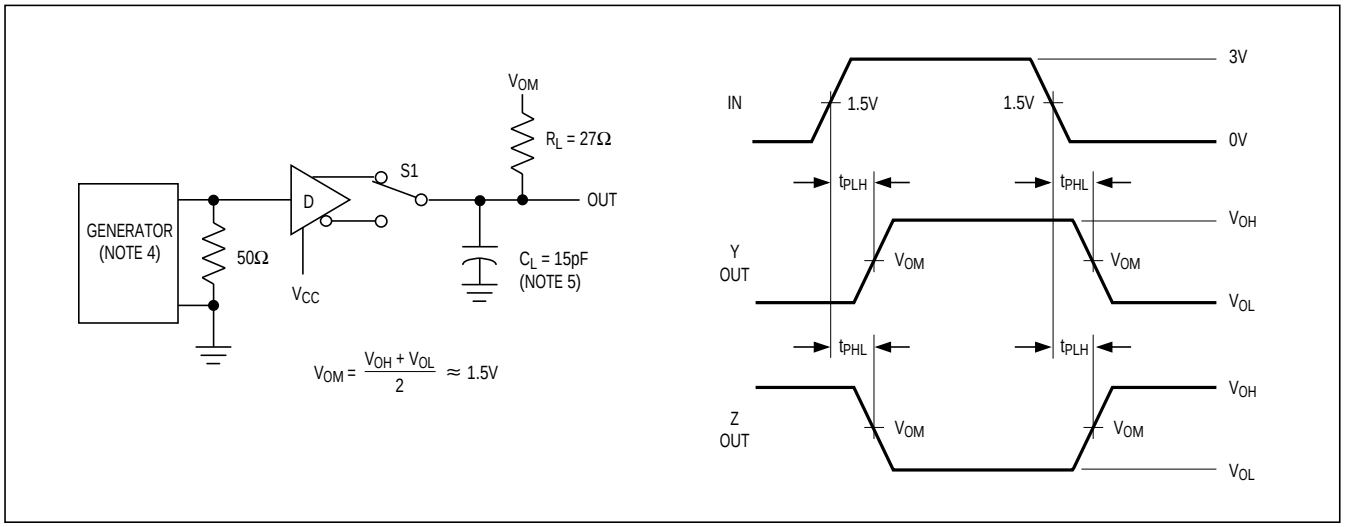


Figure 6. Driver Propagation Times

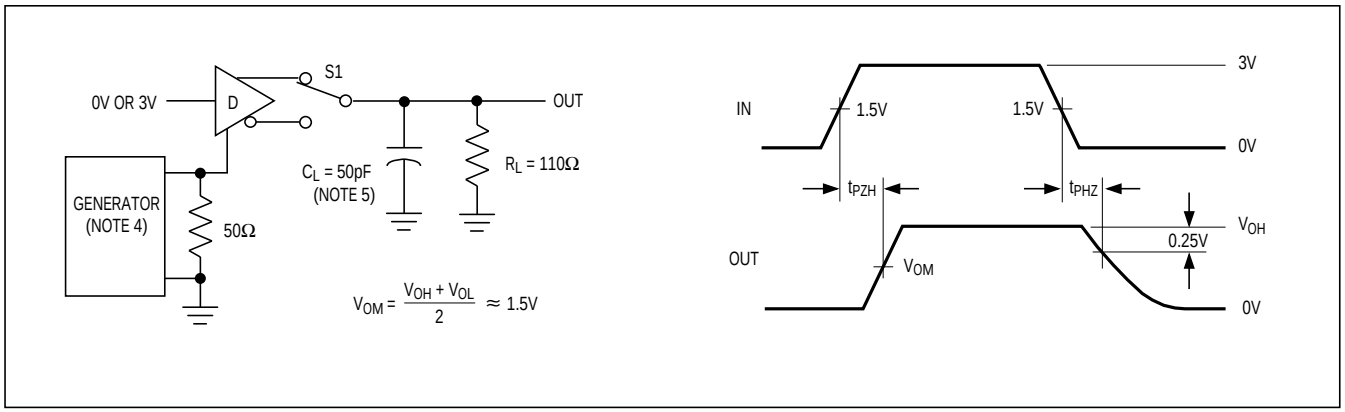


Figure 7. Driver Enable and Disable Times (t_{PZH}, t_{PSH}, t_{PHZ})

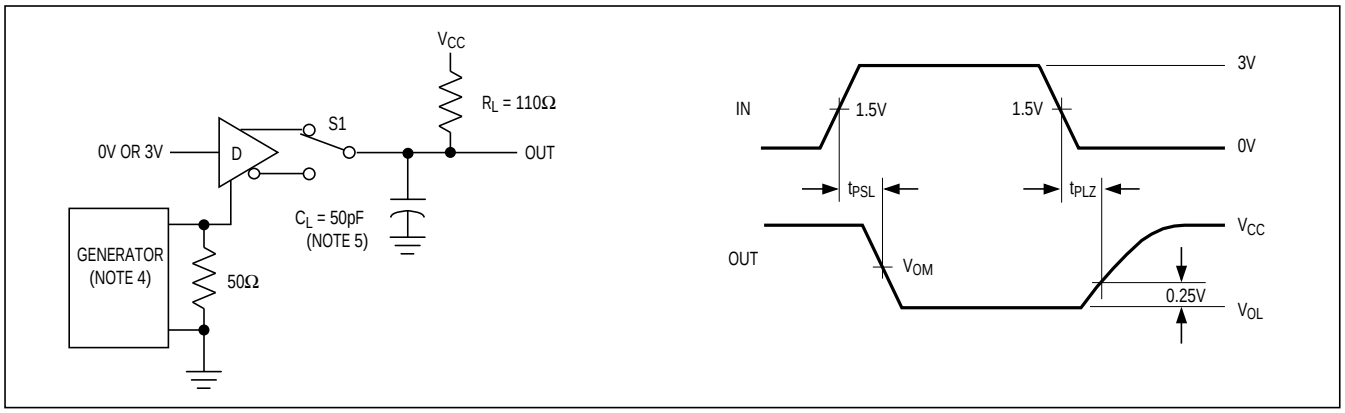


Figure 8. Driver Enable and Disable Times (t_{PZL}, t_{PSL}, t_{PLZ})

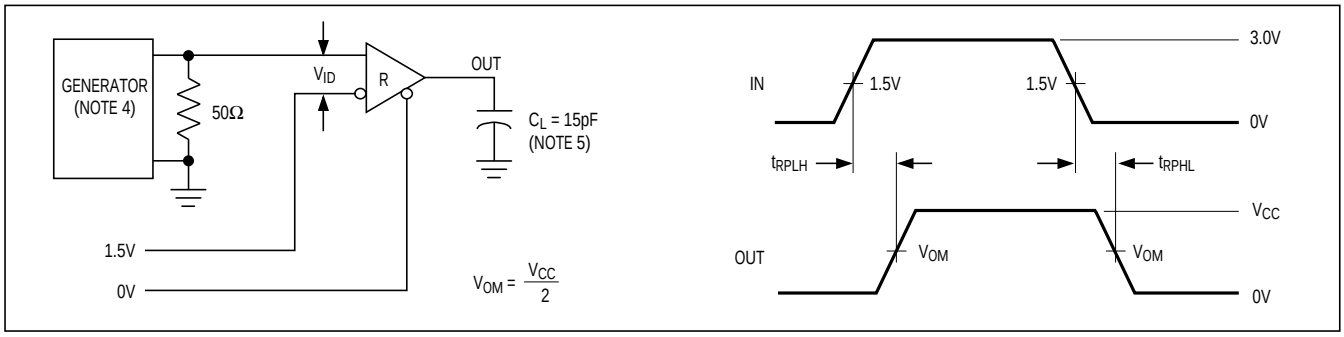


Figure 9. Receiver Propagation Delay

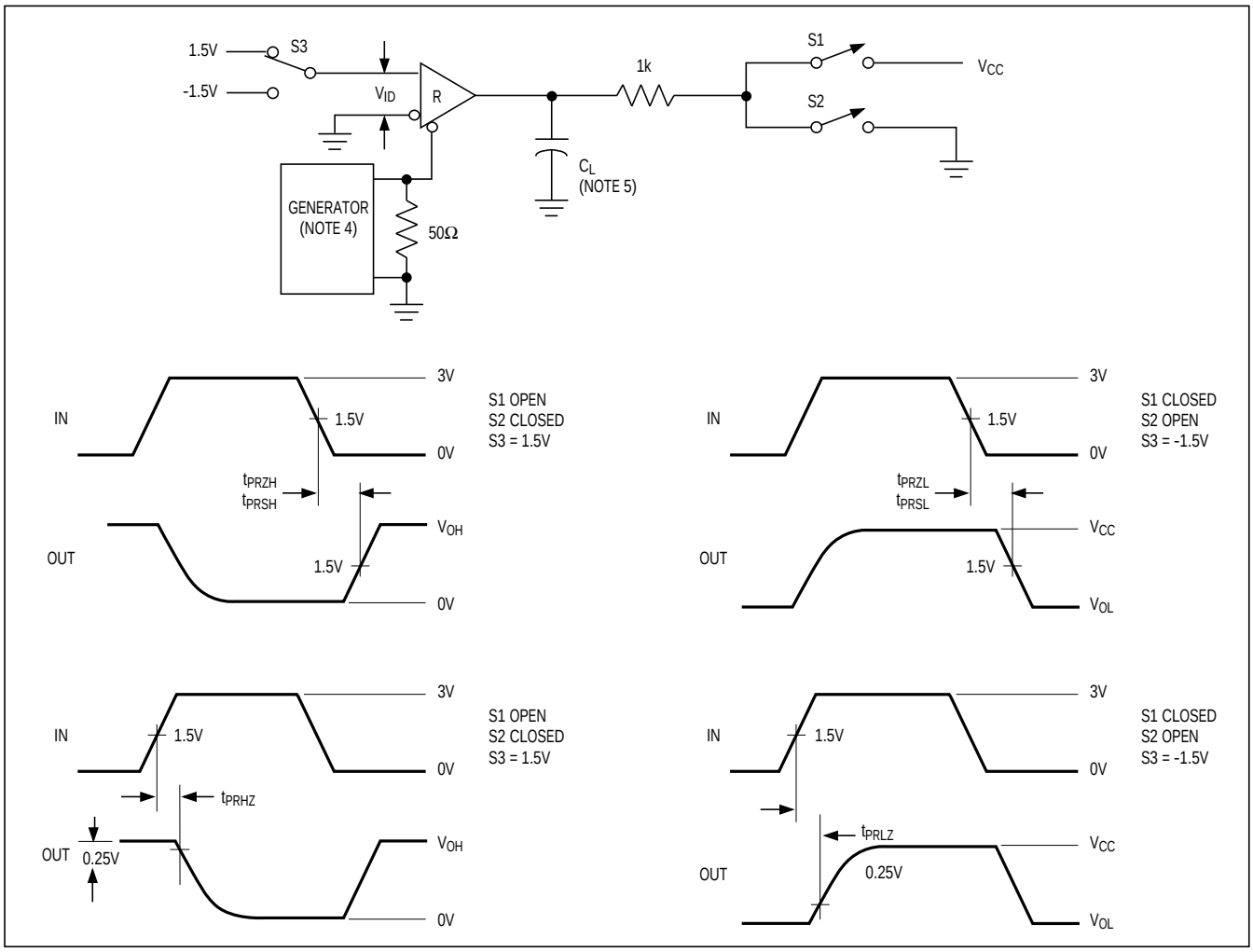
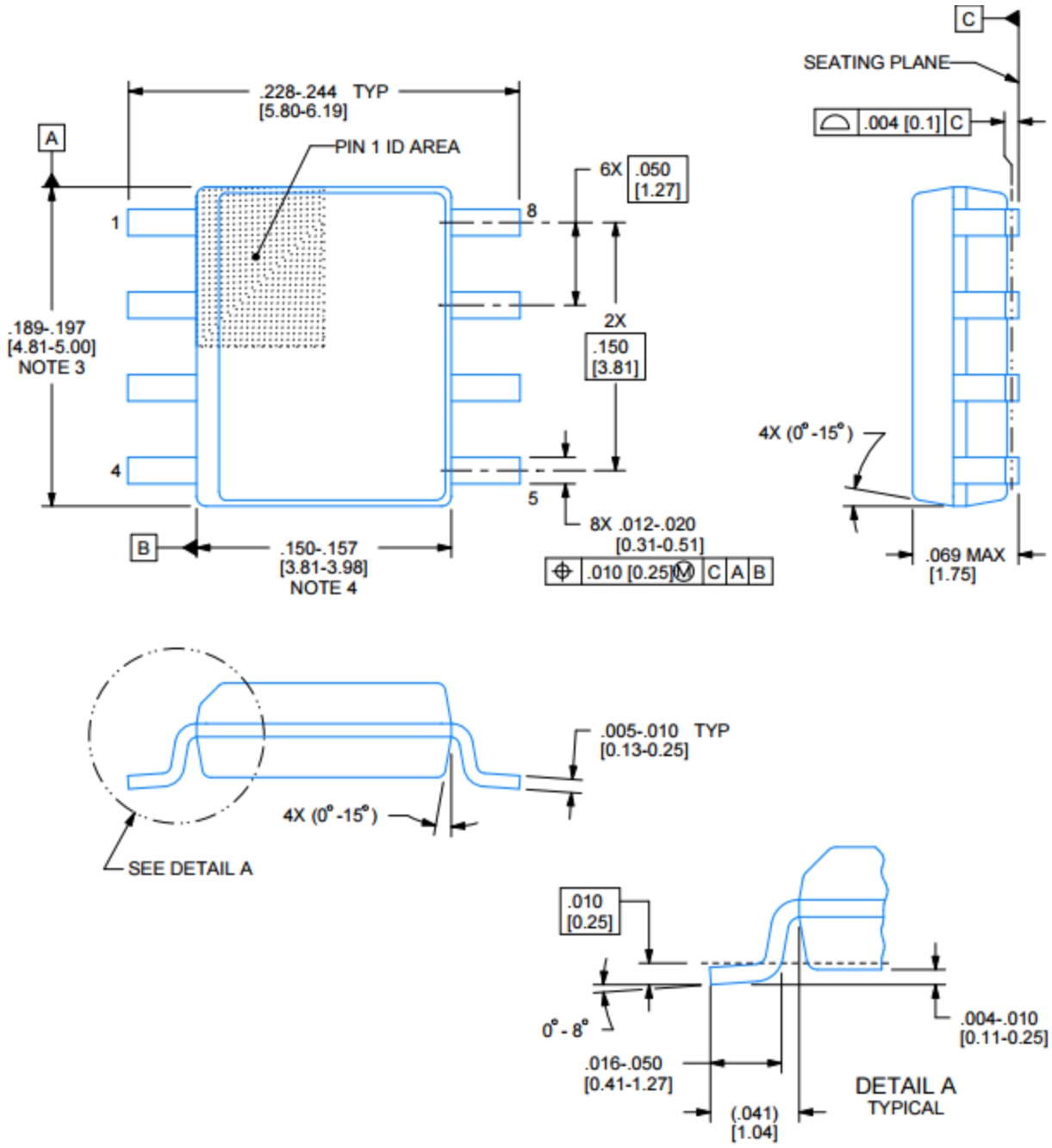
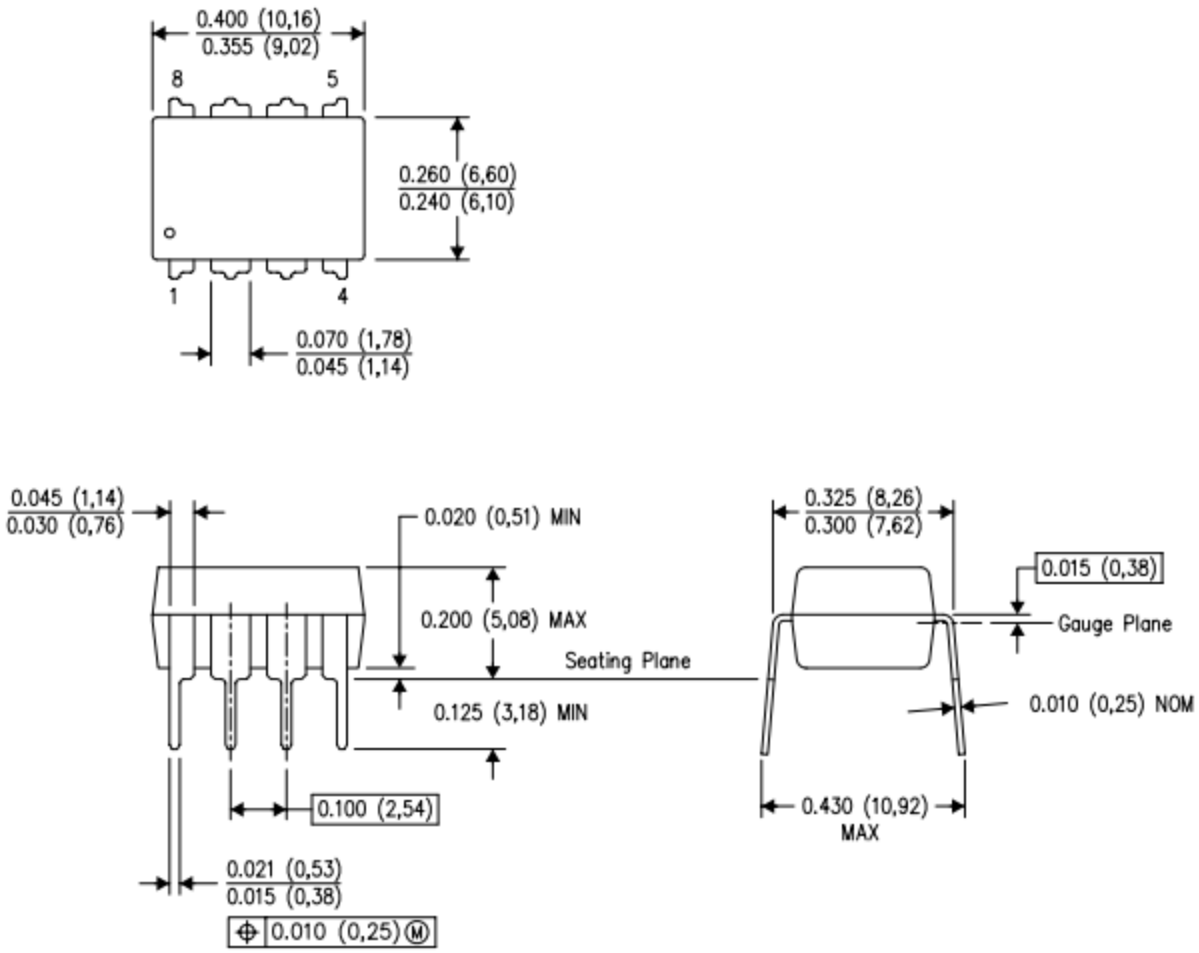


Figure 10. Receiver Enable and Disable Times

Note 4: The input pulse is supplied by a generator with the following characteristics: PRR = 250kHz, 50% duty cycle, $t_r \leq 6.0$ns, $Z_O = 50\Omega$.
Note 5: C_L includes probe and stray capacitance.


.228-.244 TYP
[5.80-6.19]
PIN 1 ID AREA
A
B
1
4
8
5
6X .050
[1.27]
2X
.150
[3.81]
.189-.197
[4.81-5.00]
NOTE 3
.150-.157
[3.81-3.98]
NOTE 4
8X .012-.020
[0.31-0.51]
.010 [0.25] M C A B
C
SEATING PLANE
.004 [0.1] C
4X (0°-15°)
.069 MAX
[1.75]
.005-.010 TYP
[0.13-0.25]
4X (0°-15°)
SEE DETAIL A
.010
[0.25]
0°-8°
.016-.050
[0.41-1.27]
(.041)
[1.04]
.004-.010
[0.11-0.25]
DETAIL A
TYPICAL



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