PERICOM

3.3V LVDS High-Speed Differential Line Drivers and Receivers

Product Features

- Signaling Rates >660 Mbps (330 MHz)
- Single 3.3V Power Supply Design
- Driver:
  — ±350mV Differential Swing into a 100-Ohm load
  — Propogation Delay of 1.5ns Typ.
  — Low Voltage TTL (LVTTL) Inputs are 5V Tolerant
  — Driver is High Impedance when Disabled or V_{CC} <1.5V
- Receiver:
  — Accepts ±50mV (min.) Differential Swing with up to 2.0V ground potential difference
  — Propagation Delay of 3.3ns Typ.
  — Low Voltage TTL (LVTTL) Outputs
  — Open, Short, and Terminated Fail Safe
- Industrial Temperature Operating Range: –40°C to 85°C
- Package Options: SOIC, TSSOP, MSOP
- Meets or Exceeds IEEE 1596.3 SCI Standard
- Meets or Exceeds ANSI/TIA/EIA-644 LVDS Standard
- Bus-Terminal ESD exceeds 12kV

Product Description

The PI90LV179, PI90LV180, PI90LV050, and PI90LV051 are differential line drivers and receivers (transceivers) that are compliant with the IEEE 1596.3 SCI and ANSI/TIA/EIA-644 LVDS standards. These devices use low-voltage differential signaling (LVDS) to achieve data rates in excess of 660 Mbps while being less susceptible to noise than single-ended transmission.

The drivers translate a low-voltage TTL/CMOS input into a low-voltage (350mV typical) differential output signal. The receivers translate a differential 350mV input signal to a 3V CMOS output level. The driver section can be independently set to a power-down and high-impedance output mode with the D_{EN} pin (active HIGH). The receiver section is controlled by the R_{EN*} pin (active LOW).

Applications

Applications include point-to-point and multidrop baseband data transmission over a controlled impedance media of approximately 100 ohms. These include intra-system connections via printed circuit board traces or cables, hubs and routers for data communications; PBXs, switches, repeaters and base stations for telecommunications and other applications such as digital cameras, printers and copiers.
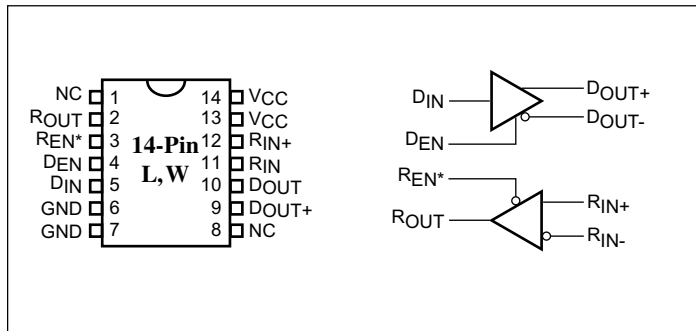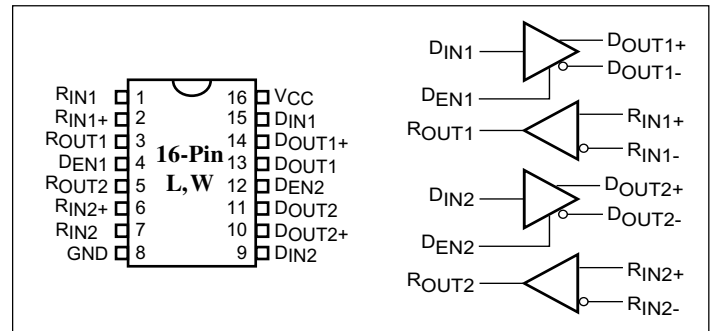
PI90LV179
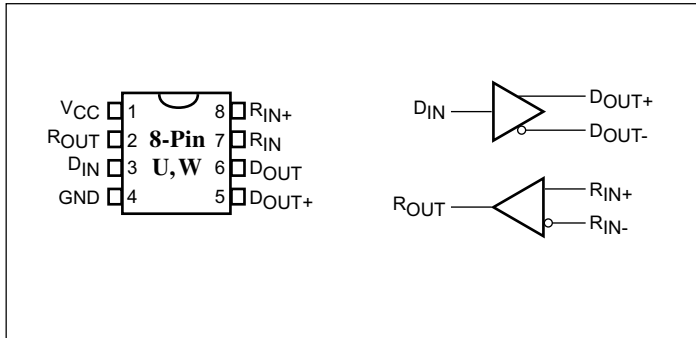
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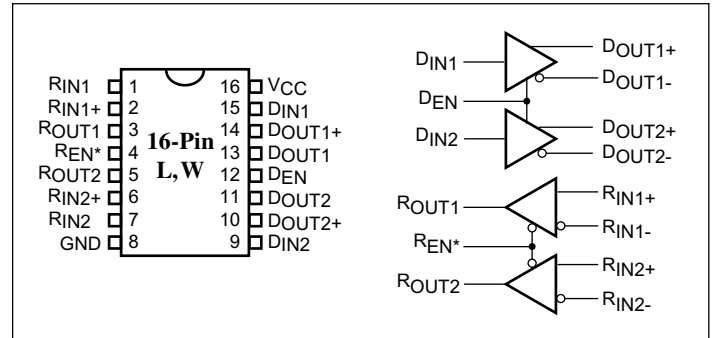
PI90LV180

PI90LV051

Function Tables

PI90LV179 Receiver

Inputs	Output
$V_{ID} = V_{RIN+} - V_{RIN-}$	R_{OUT}
$V_{ID} \geq 50mV$	H
$-50mV < V_{ID} < 50mV$	?
$V_{ID} \leq -50mV$	L
open	H

PI90LV179 Driver

Input	Output	
D_{IN}	D_{OUT+}	D_{OUT-}
L	L	H
H	H	L
open	L	H

PI90LV180/PI90LV050/PI90LV051 Receiver

Inputs		Output
$V_{ID} = V_{RIN+} - V_{RIN-}$	R_{EN*}	R_{OUT}
$V_{ID} \geq 50mV$	L	H
$-50mV < V_{ID} < 50mV$	L	?
$V_{ID} \leq -50mV$	L	L
open	L	H
X	H	Z

PI90LV180/PI90LV050/PI90LV051 Driver

Inputs		Output	
D_{IN}	D_{EN}	D_{OUT+}	D_{OUT-}
L	H	L	H
H	H	H	L
open	H	L	H
X	L	Z	Z

Notes:
H = High Level, L = Low Level, ? = Indeterminate,
Z = High-Impedance, X = Don't Care

Pin Descriptions

Name	Description
D_{IN}	TTL/CMOS driver input pins
$D_{OUT}+$	Non-inverting driver output pins
$D_{OUT}+$	Inverting driver output pins
R_{OUT}	TTL/CMOS receiver output pins
$R_{IN}+$	Non-inverting receiver input pins
R_{IN-}	Inverting receiver input pins
V_{ID}	Input Differential Signal Voltage
GND	Ground pin
V_{CC}	Positive power supply pin, +3.3V ±10%

Absolute Maximum Ratings

Supply Voltage (V_{CC}) ....−0.5V to +4.0V
Driver
 Input Voltage (D_{IN}) .... −0.3V to (V_{cc} +0.3V)
 Output Voltage ($D_{OUT}+$, $D_{OUT}-$) ....−0.3V to +3.9V
 Short Circuit Duration ($D_{OUT}+$, $D_{OUT}-$) .... Continuous
 Enable Input Voltage (D_{EN}) .... −0.3V to (V_{CC} +0.3V)
Receiver
 Input Voltage (R_{IN+}, $R_{IN}-$) .... −0.3V to +3.9V)
 Output Voltage (R_{OUT}) .... −0.3V to (V_{CC} +0.3V)
 Enable Input Voltage (R_{EN*}) .... −0.3V to (V_{CC} +0.3V)
Storage Temperature Range .... −65°C to +150°C
Lead Temperature Range Soldering (4s) .... +260°C
Maximum Junction Temperature .... +150°C
ESD Rating .... >12kV

Recommended Operating Conditions

	Min.	Typ.	Max.	Units
Supply Voltage (V_{CC})	3	3.3	3.6	
High Level Input Voltage, V_{IH}	2			
Low Level Input Voltage, V_{IL}			0.8	
Magnitude of Differential Input Voltage V_{ID}	0.1		0.6	V
Common-mode Input Voltage, V_{IC} (Fig 5)	$|V_{ID}|$ /2		2.4 − $|V_{ID}|$ /2	
			V_{CC} −0.8	
Operating Free Air Temperature T_A	−40		85	°C

Electrical Characteristics (over recommended operating conditions unless otherwise noted).

Parameter		Test Condition	Min.	Typ.†	Max.	Units
I_{CC}* Supply Current	PI90LV179	No receiver load, Driver R_L = 100 ohms		6	9	mA
	PI90LV180	Driver and receiver enabled. No receiver load, Driver R_L = 100 ohms		6	9	
		Driver disabled, Receiver disabled, R_L = 100 ohms		2.7	4	
		Driver disabled, Receiver enabled, No load		1.6	2.1	
		Disabled		1.5	2.5	
	PI90LV050	Driver and receivers enabled. No receiver loads, Driver R_L = 100 ohms		12	15	
		Drivers disabled, Receivers disabled, R_L = 100 ohms		2.5	3	
		Drivers disabled, Receivers enabled, No loads		1.0	1.2	
		Disabled		1.3	1.6	
	PI90LV051	Drivers enabled, No receiver loads, Driver R_L = 100 ohms		12.3	14.8	
		Drivers disabled, No loads		1.0	1.2	

†All typical values are at 25°C with a 3.3V supply
*I_{CC} measured with all TTL input. V_{IN} = V_{CC} or GND.

Electrical Characteristics (over recommended operating conditions unless otherwise noted).

Parameter		Test Conditions		Min.	Typ.	Max.	Units
$|V_{OD}|$	Differential output voltage magnitude	R_L = 100 ohms See Figures 1 and 2		247	420	520	mV
$\Delta|V_{OD}|$	Change in differential output voltage magnitude between logic states			−50		50	
$V_{OC(SS)}$	Steady-state common-mode output voltage	See Figure 3		1.125	1.25	1.375	V
$\Delta V_{OC(SS)}$	Change in steady-state common-mode output voltage between logic states			−50		50	mV
$V_{OC(PP)}$	Peak-to-peak common-mode output voltage				50	150	
I_{IH}	High-level input current	DE	V_{IH} = 5V		−0.5	−20	µA
		D_{IN}			2	20	
I_{IL}	Low-level input current	DE	V_{IL} = 0.8V		−0.5	−10	
		D_{IN}			2	10	
I_{OS}	Short-circuit output current	V_{OY} or V_{OZ} = 0V			−6	−8	mA
		V_{OD} = 0V			−8	−10	
I_{OZ}	High-impedance output current	V_{OD} = 600mV				±1	µA
		V_O - 0V or V_{CC}				±1	
$I_{O(OFF)}$	Power-off output current	V_{CC} = 0V, V_O = 3.6V				±1	
C_{IN}	Input capacitance				3	8.5	pF

Receiver Electrical Characteristics (over recommended operating conditions unless otherwise noted).

Parameter		Test Conditions	Min.	Typ.	Max.	Units
V_{ITH+}	Positive-going differential input voltage threshold	See Figures 5 & Table 1			50	mV
V_{ITH-}	Negative-going differential input voltage threshold		-50			mV
V_{OH}	High-level output voltage	$I_{OH} = -8$mA	2.4			V
V_{OL}	Low-level output voltage	$I_{OL} = 8$mA			0.4	V
I_I	Input current (R_{IN+} or R_{IN-})	$V_I = 0$	-2	-11	-20	μA
		$V_I = 2.4$V	-1.2	-3		
$I_{I(OFF)}$	Power-off input current (R_{IN+} or R_{IN-})	$V_{CC} = 0$			±20	
I_H	High-level input current (enables)	$V_{IH} = 2$V			±10	
I_L	Low-level input current (enables)	$V_{IL} = 0.8$V			±10	
I_{OZ}	High-impedance output current	$V_O = 0$ or 5V			±10	
C_I	Input capacitance			5		pF

†All typical values are at 25°C with a 3.3V supply

Driver Switching Characteristics (over recommended operating conditions unless otherwise noted).

Parameter		Test Conditions	Min.	Typ.†	Max.	Units
t_{PLH}	Propagation delay time, low-to-high-level output	$R_L = 100$ ohms $C_L = 10$pF See Figure 2		1.9	2.5	ns
t_{PHL}	Propagation delay time, lhigh-to-low-level output			1.9	2.4	
t_r	Differential output signal rise time			1	1.3	
t_f	Differential output signal fall time			1	1.3	
$t_{sk(p)}$	Pulse skew ($t_{PHL} - t_{PLH}$)			200		ps
$t_{sk(o)}$	Channel-to-channel output skew‡			80	170	
$t_{sk(pp)}$	Part-part-part skew**				0.9	
t_{PZH}	Propagation delay time, high-impedance-to-high-level output	See Figure 7		3.4	5	ns
t_{PZL}	Propagation delay time, high-impedance-to-low-level output			2.5	5	
t_{PHZ}	Propagation delay time, high-level-to-high-impedance output			3	5	
t_{PLZ}	Propagation delay time, low-level-to-high-impedance output			3.2	5	

†All typical values are at 25°C with a 3.3V supply.

‡$t_{sk(o)}$: maximum delay time difference between drivers on the same device.

**$t_{sk(pp)}$: magnitude of difference in propagation delay times between any specific terminals of two devices (all things being equal).

Receiver Switching Characteristics (over recommended operating conditions unless otherwise noted).

Parameter		Test Conditions	Min.	Typ.†	Max.	Units
t_{PLH}	Propagation delay time, low-to-high-level output			1.9	2.9	
t_{PHL}	Propagation delay time, lhigh-to-low-level output			2.1	3.1	ns
$t_{sk(p)}$	Pulse skew ($t_{PHL} - t_{PLH}$)	C_L = 10pF See Figure 6		0.1	0.4	
$t_{sk(pp)}$**	Part-part-part skew**				1.3	
$t_{sk(o)}$	Channel-to-channel skew			50	100	ps
t_r	Output signal rise time			1.2	1.7	
t_f	Output signal fall time			1.4	2.0	
t_{PZH}	Propagation delay time, high-level-to-high-impedance output	See Figure 7		1.5	2.7	
t_{PZL}	Propagation delay time, low-level-to-low-impedance output			4.5	6.8	ns
t_{PHZ}	Propagation delay time, high-impedance-to-high-level output			2.4	3.1	
t_{PLZ}	Propagation delay time, low-impedance-to-high-level output			6.0	7.8	

†All typical values are at 25°C with a 3.3V supply

**$t_{sk(pp)}$: magnitude of difference in propagation delay times between any specific terminals of two devices (all things being equal)

Parameter Measurement Information
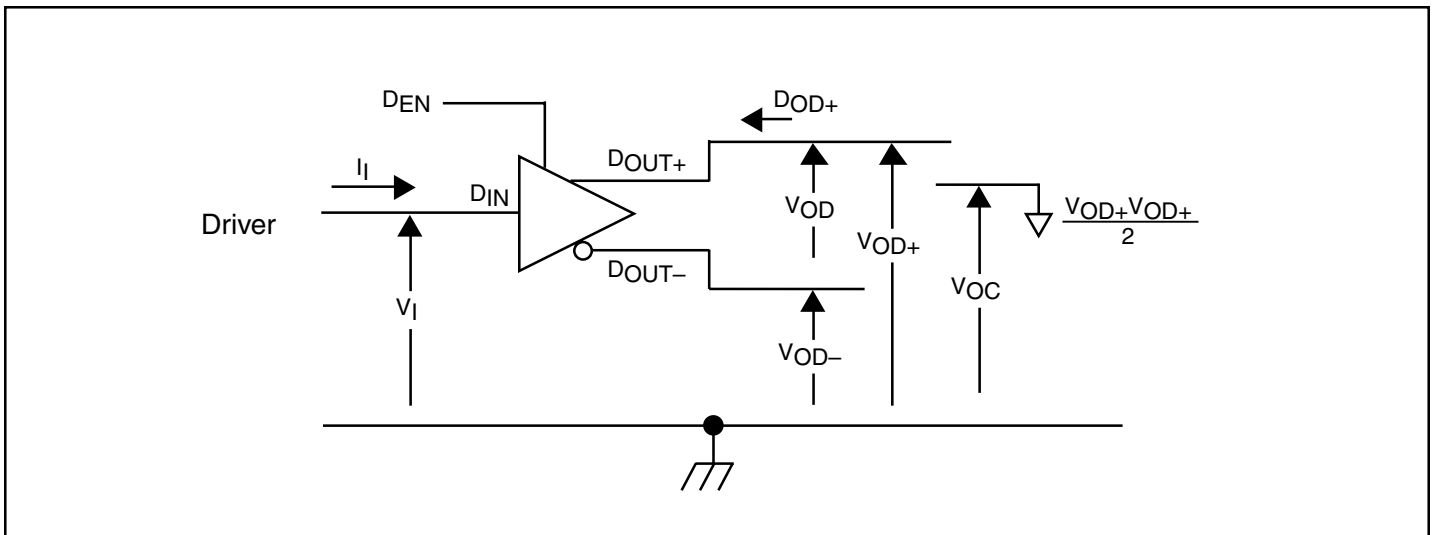
Figure 1. Driver Voltage and Current Definitions
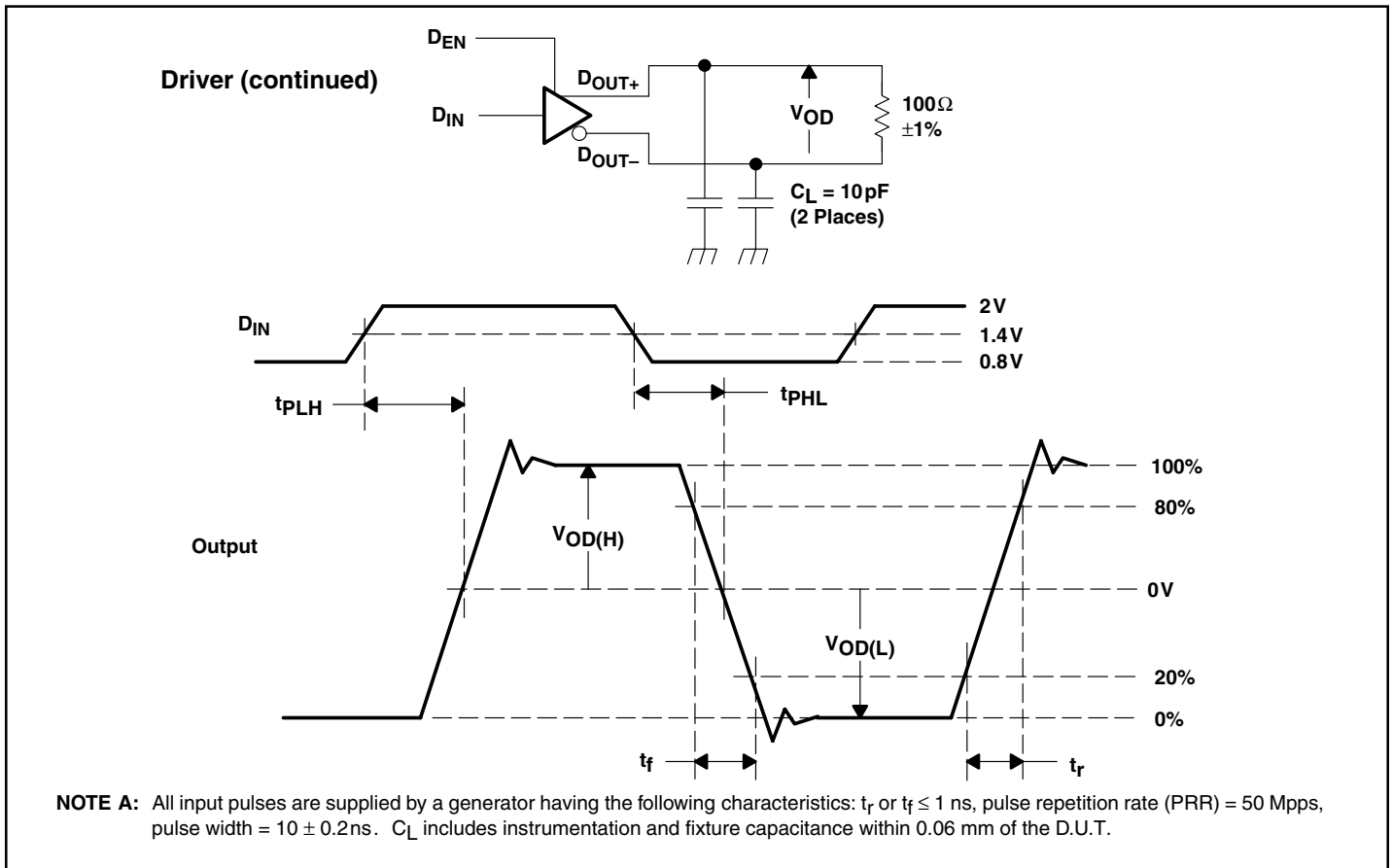
Parameter Measurement Information

Figure 2. Test Circuit, Timing, and Voltage Definitions for the Differential Output Signal
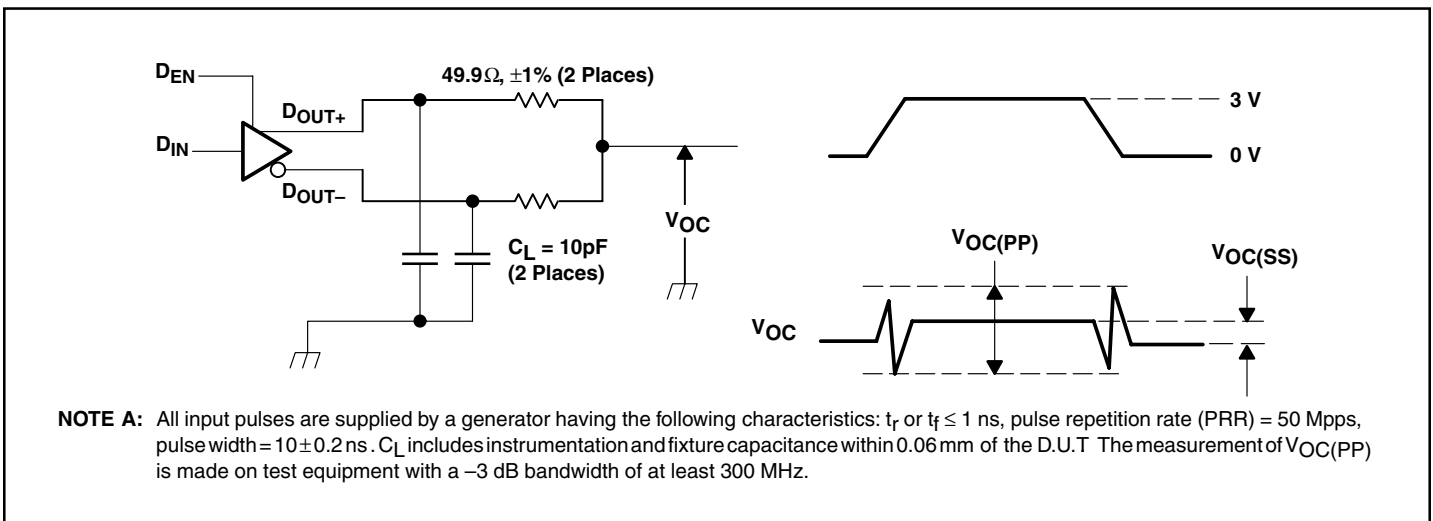
NOTE A: All input pulses are supplied by a generator having the following characteristics: t_r or $t_f \leq 1$ ns, pulse repetition rate (PRR) = 50 Mpps, pulse width = 10 ± 0.2 ns. C_L includes instrumentation and fixture capacitance within 0.06 mm of the D.U.T.

NOTE A: All input pulses are supplied by a generator having the following characteristics: t_r or $t_f \leq 1$ ns, pulse repetition rate (PRR) = 50 Mpps, pulse width = 10 ± 0.2 ns. C_L includes instrumentation and fixture capacitance within 0.06 mm of the D.U.T The measurement of $V_{OC(PP)}$ is made on test equipment with a −3 dB bandwidth of at least 300 MHz.

Figure 3. Test Circuit and Definitions for the Driver Common-Mode Output Voltage

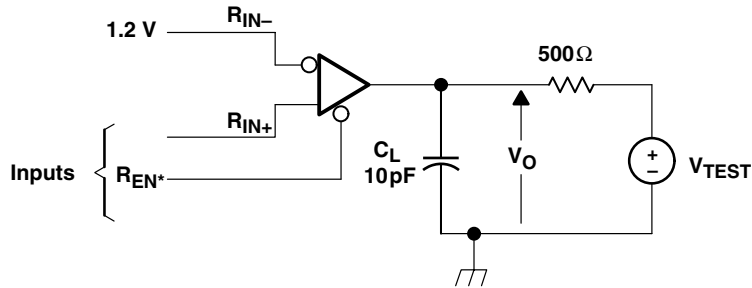## Parameter Measurement Information
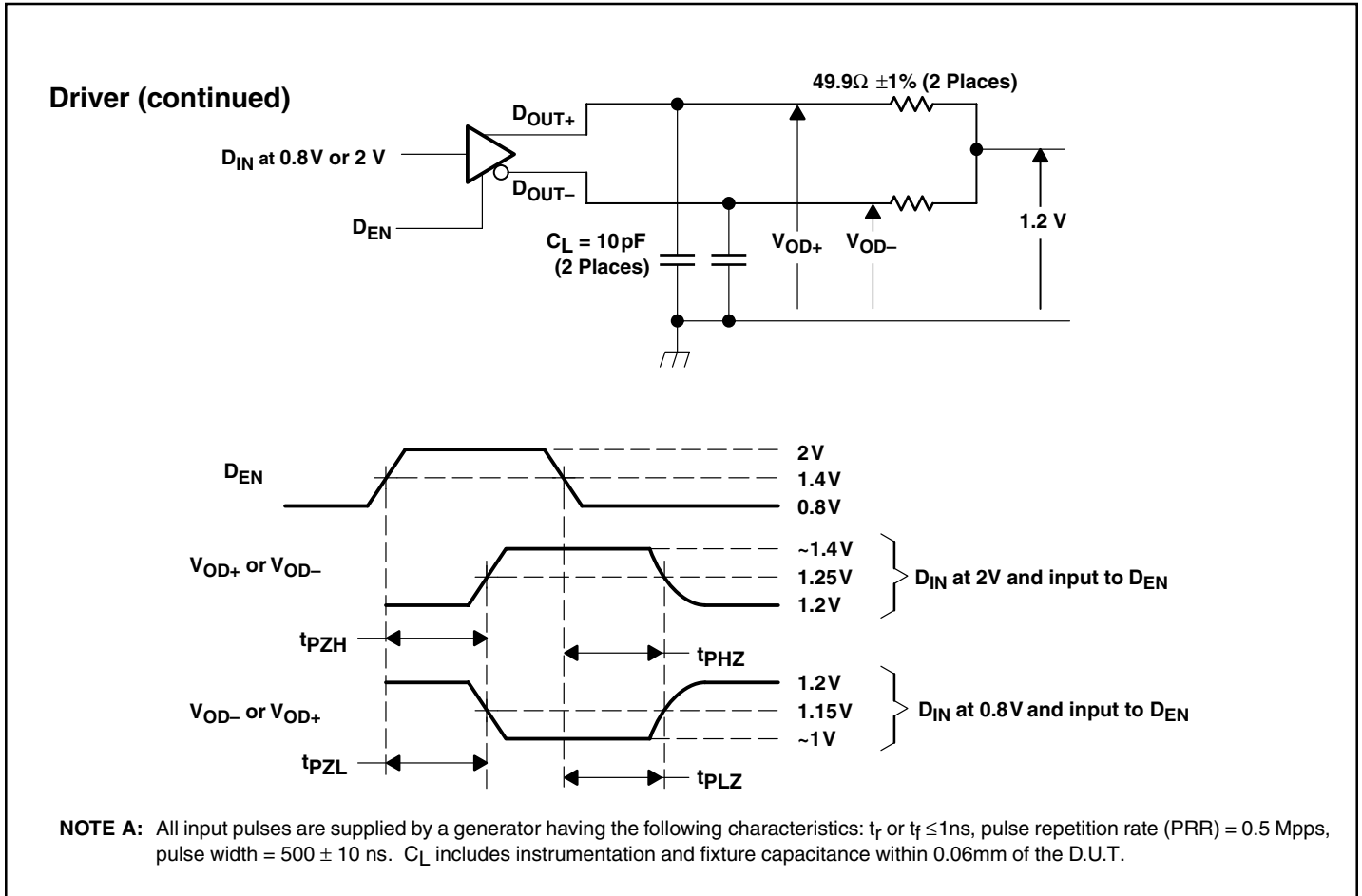
Figure 4. Enable and Disable Timing Circuit and Definitions

NOTE A: All input pulses are supplied by a generator having the following characteristics: t_r or $t_f \leq 1$ns, pulse repetition rate (PRR) = 0.5 Mpps, pulse width = 500 ± 10 ns. C_L includes instrumentation and fixture capacitance within 0.06mm of the D.U.T.

Parameter Measurement Information

Figure 5. Receiver Voltage Definitions

Table 1. Receiver Minimum and Maximum Input Threshold Test Voltages

APPLIED VOLTAGES (V)		RESULTING DIFFERENTIAL INPUT VOLTAGE (mV)	RESULTING COMMON-MODE INPUT VOLTAGE (V)
V_{IRIN+}	V_{IRIN+}	V_{ID}	V_{IC}
1.225	1.175	50	1.2
1.175	1.225	−50	1.2
2.375	2.325	50	2.35
2.325	2.375	−50	2.35
0.1	0	50	0.05
0	0.05	−50	0.05
1.5	0.9	600	1.2
0.9	1.5	−600	1.2
2.4	1.8	600	2.1
1.8	2.4	−600	2.1
0.6	0	600	0.3
0	0.6	−600	0.3

Parameter Measurement Information

PARAMETER MEASUREMENT INFORMATION
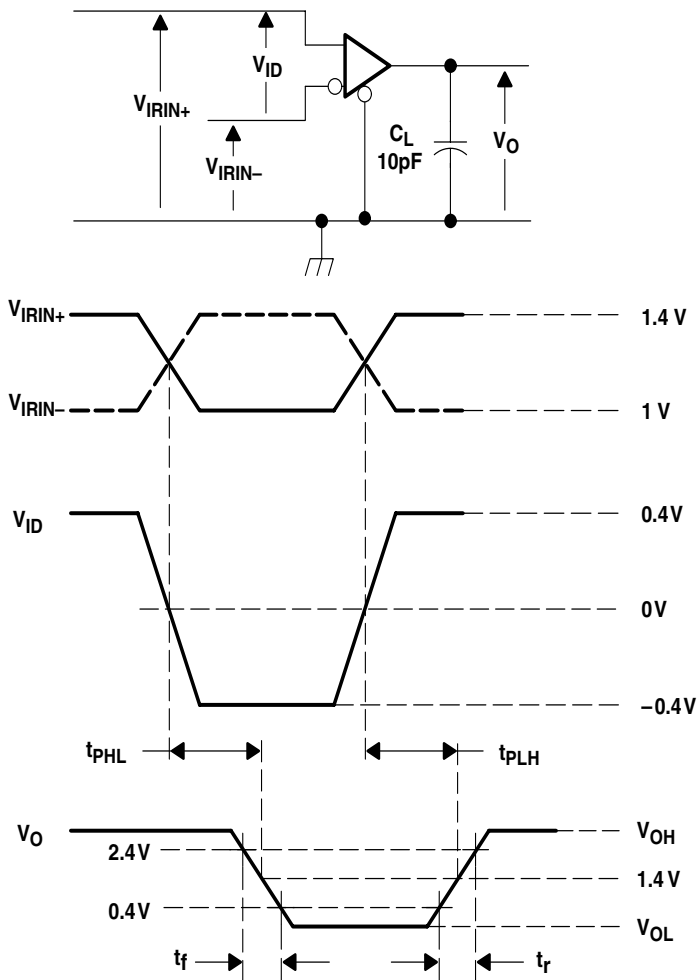
Receiver (continued)

NOTE A: All input pulses are supplied by a generator having the following characteristics: t_r or $t_f \leq$ 1 ns, pulse repetition rate (PRR) = 50 Mpps, pulse width = 10 ± 0.2 ns. C_L includes instrumentation and fixture capacitance within 0.06 m of the D.U.T.
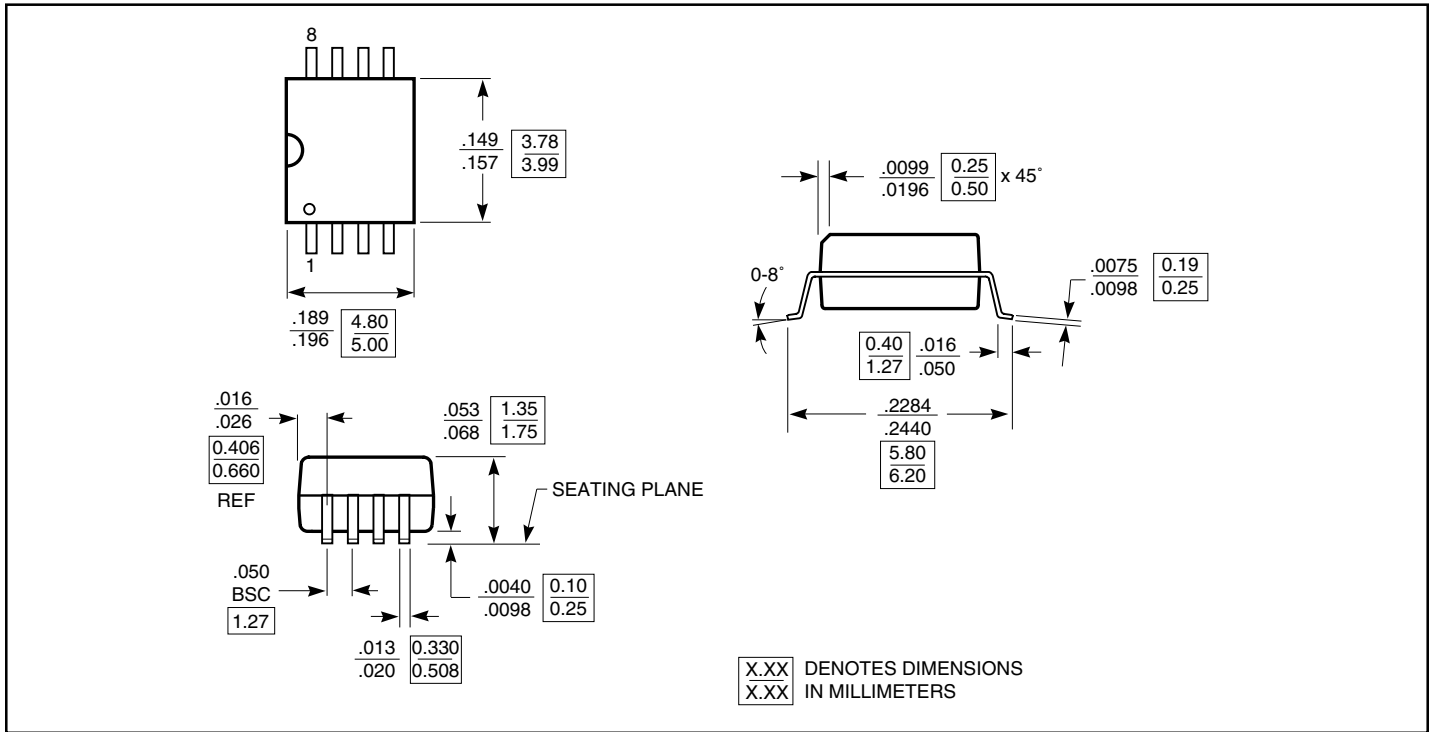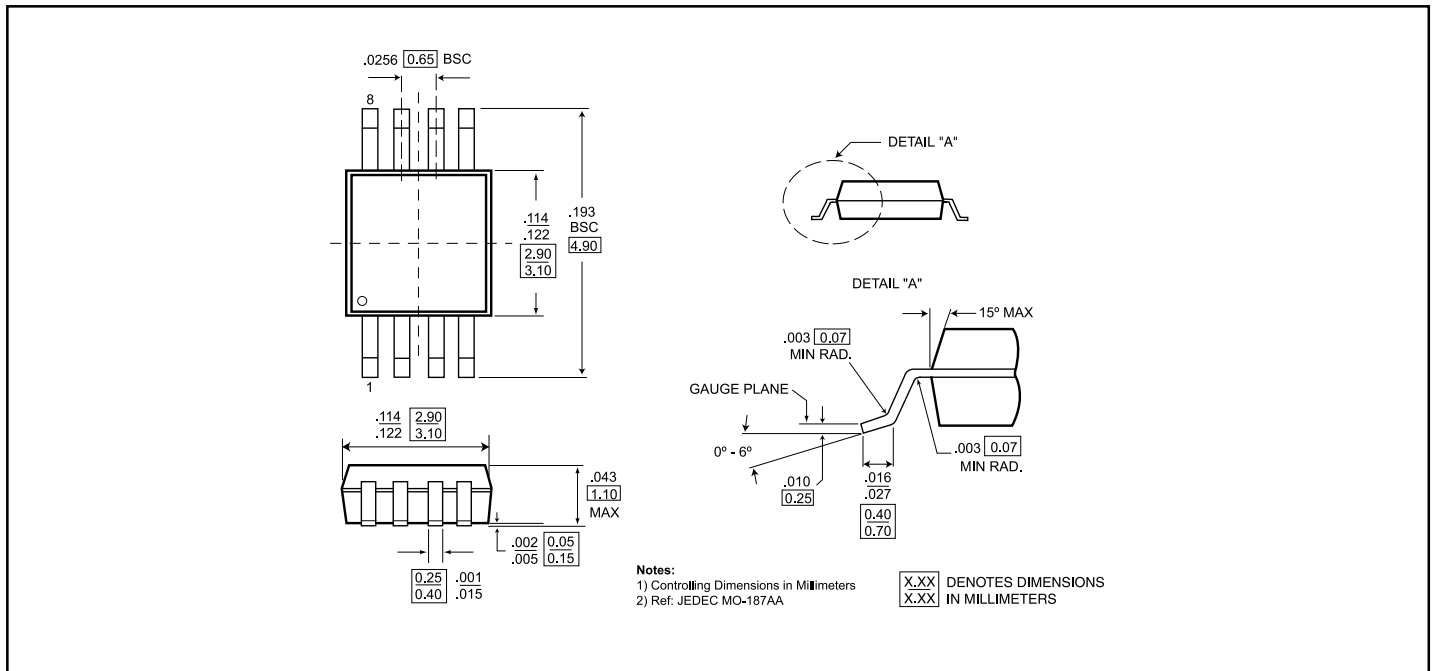
Figure 6. Timing Test Circuit and Waveforms

Figure 6. Timing Test Circuit and Waveforms

Parameter Measurement Information

Receiver (continued)

NOTE A: All input pulses are supplied by a genertor having the following characteristics: tr or tf ≤ 1ns,
pulse repetition rate (PRR) = 0.5 Mpps, pulse wide = 500 ±10ns. CL includes instrumentation
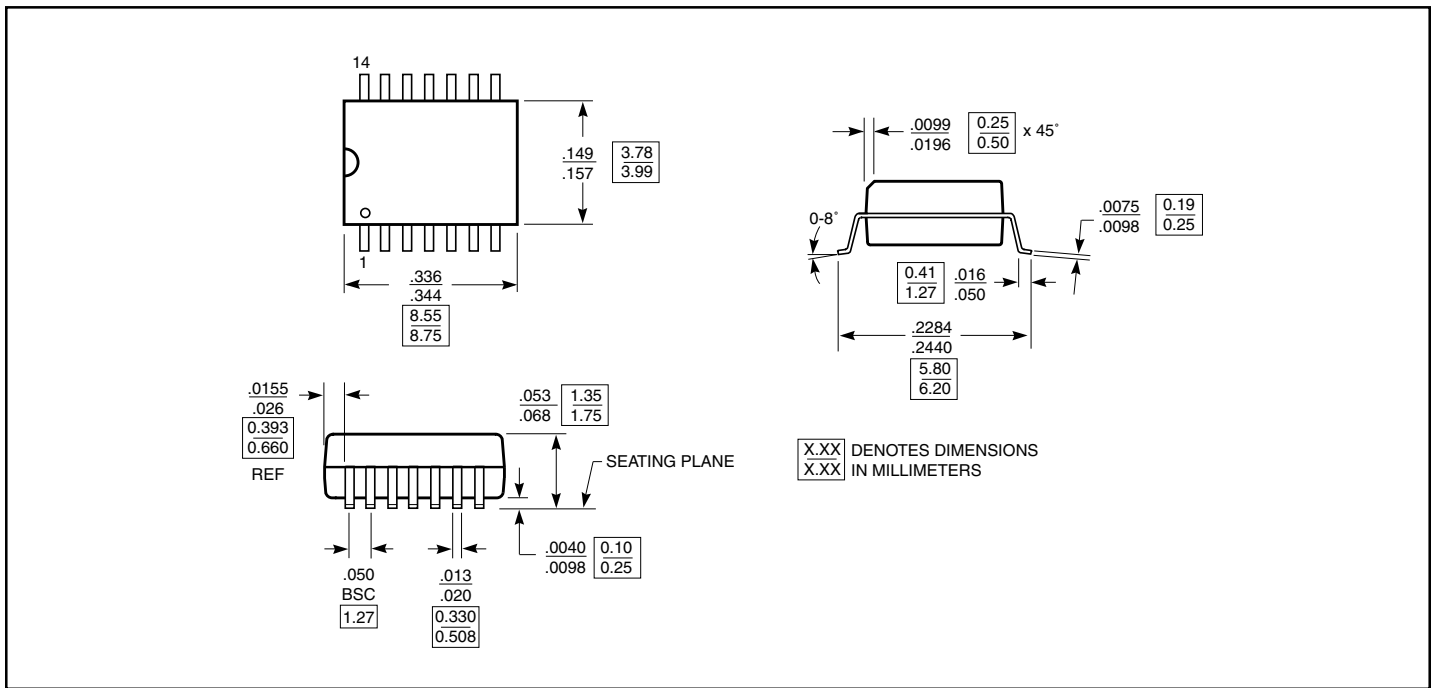and fixture capacitance within 0.06m of the D.U.T.
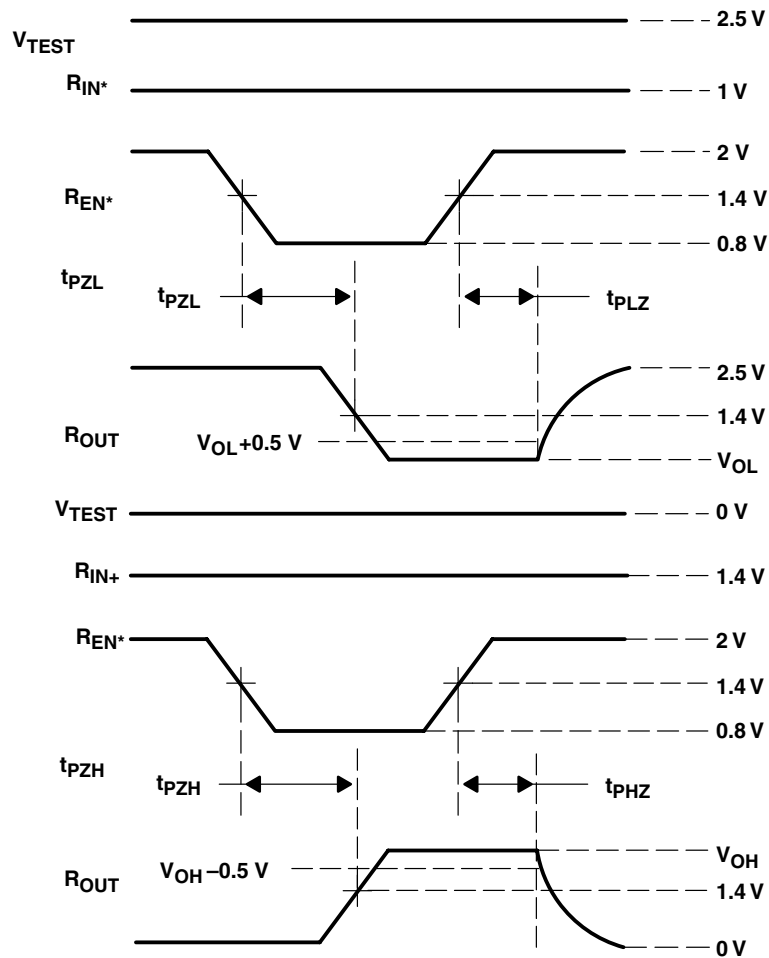
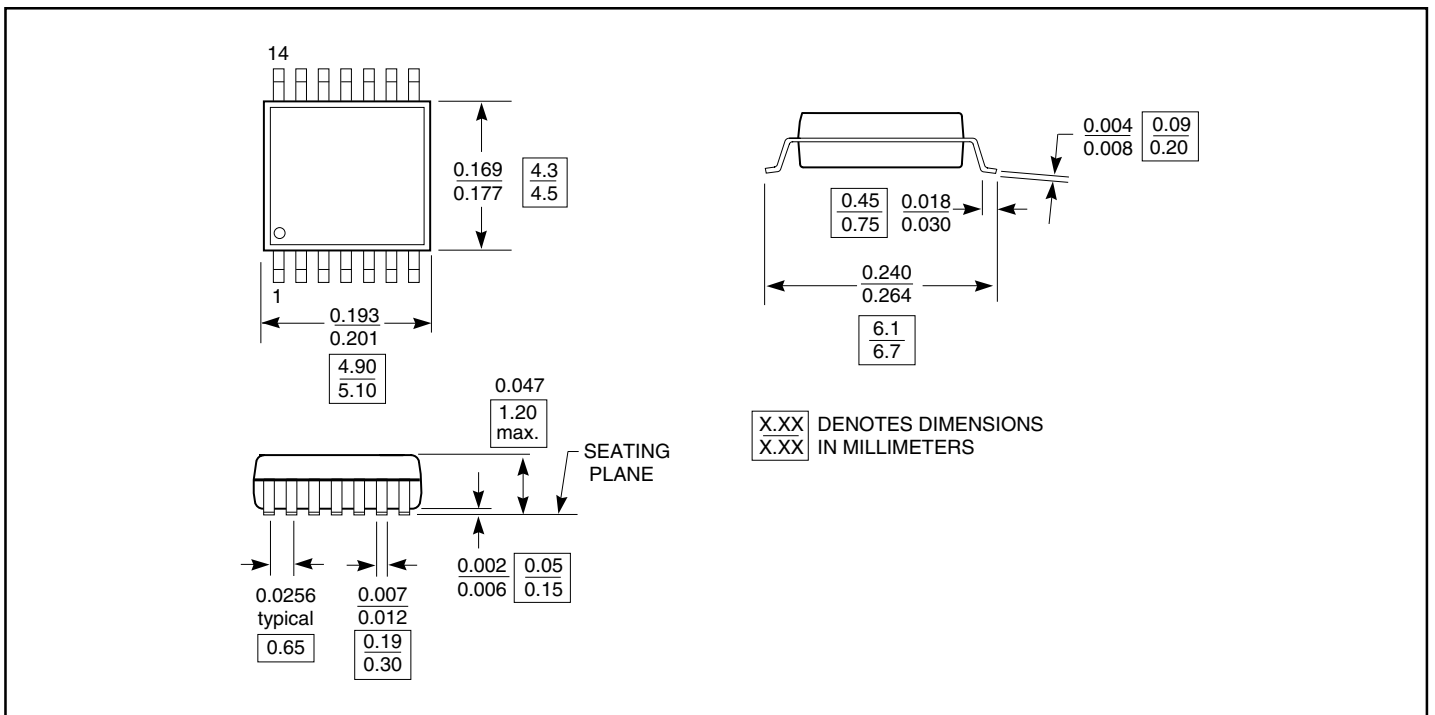
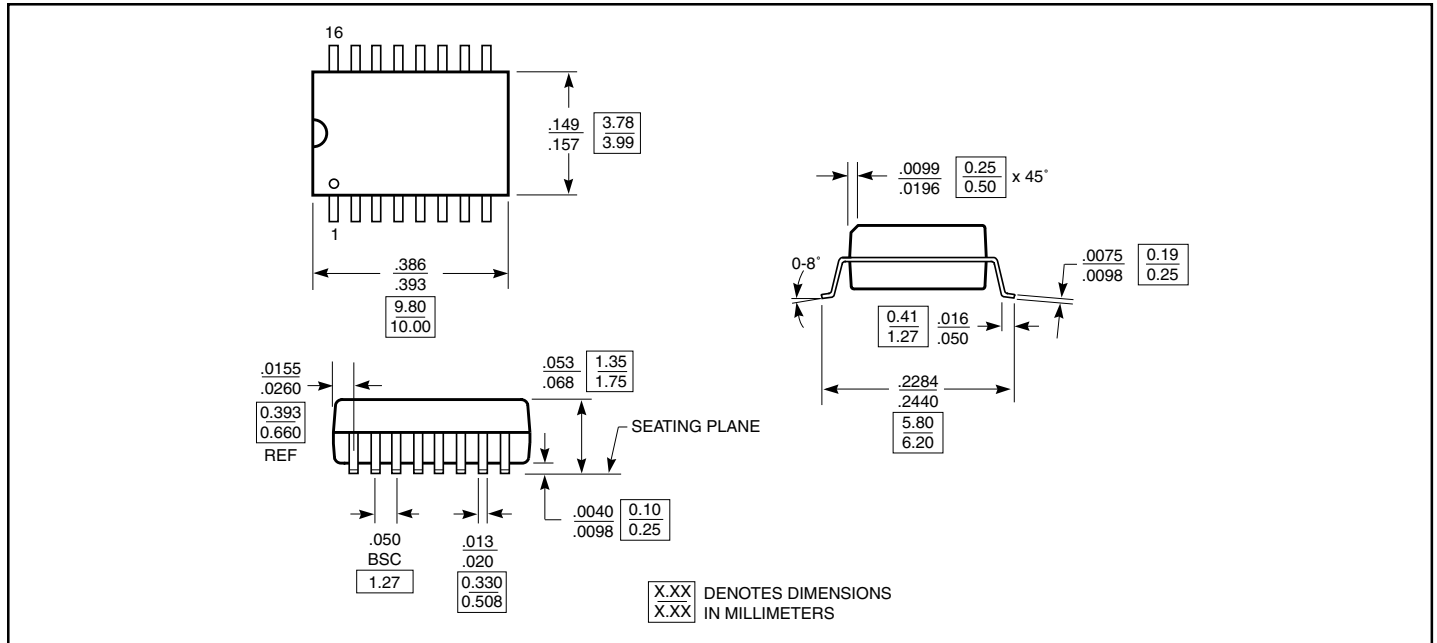**Figure 7. Enable/Disable Time Test Circuit and Waveforms**

8-Pin SOIC W Package

8-Pin Mini Small Outline U Package (MSOP)

Notes:
1) Controlling Dimensions in Millimeters
2) Ref: JEDEC MO-187AA
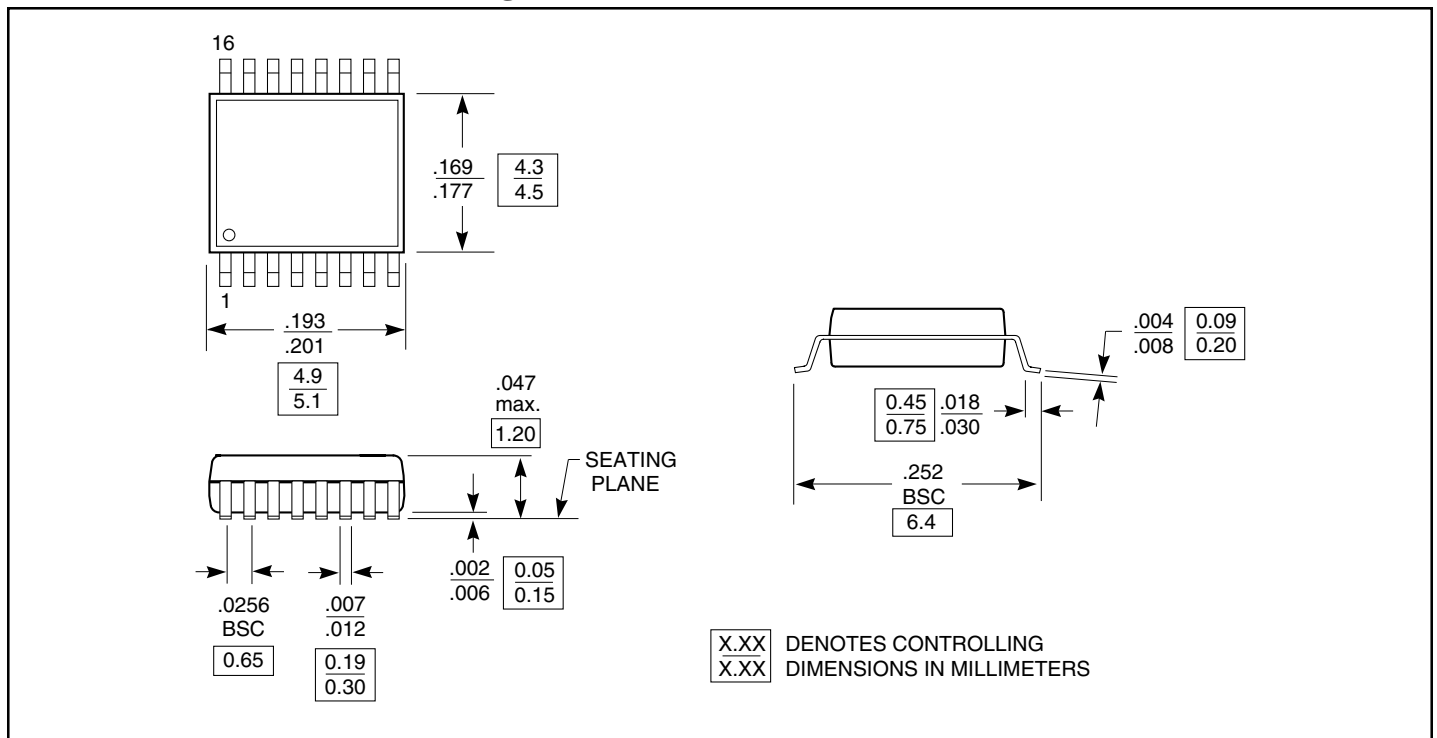
X.XX / X.XX DENOTES DIMENSIONS IN MILLIMETERS

14-Pin SOIC (150 Mil) W Package

14-Pin TSSOP (4.4mm wide) L Package

16-Pin SOIC (150 Mil) W Package

16-Pin TSSOP (4.4mm wide) L Package

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Ordering Information

Part	Pin - Package	Temperature
PI90LV179W	8-SOIC	–40°C to +85°C
PI90LV180W	14-SOIC	–40°C to +85°C
PI90LV050W	16-SOIC	–40°C to +85°C
PI90LV051W	16-SOIC	–40°C to +85°C
PI90LV179U	8-MSOP	–40°C to +85°C
PI90LV180L	14-TSSOP	–40°C to +85°C
PI90LV050L	16-TSSOP	–40°C to +85°C
PI90LV051L	16-TSSOP	–40°C to +85°C

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