PERICOM®

PI90LV047A/PI90LVB047A

3V LVDS Quad Flow-Through Differential Line Drivers

Features

- >500 Mbps (250 MHz) switching rates
- Flow-through pinout simplifies PCB layout
- Low Voltage Differential Signaling with output voltages of ±350mV into:
  - –100-ohm load (PI90LV047)
  - –50-ohm load (PI90LVB047)
- 300ps typical differential skew
- 400ps maximum differential skew
- 1.7ns maximum propagation delay
- 3.3V power supply design
- ±350mV differential signaling
- Bus-Pin ESD protection >10kV
- Interoperable with existing 5V LVDS receivers
- High impedance on LVDS outputs on power down
- Conforms to TIA/EIA-644 LVDS Standard
- Industrial operating temperature range (–40°C to +85°C)
- Packages (Pb-free & Green Available):
  - –16-pin SOIC (S)
  - –16-pin TSSOP (L)

Description

The PI90LV047A/PI90LVB047A are quad flow-through differential line drivers designed for applications requiring ultra-low power dissipation and high data rates. The devices are designed to support data rates in excess of 400 Mbps (200 MHz) using Low Voltage Differential Signaling (LVDS) technology.

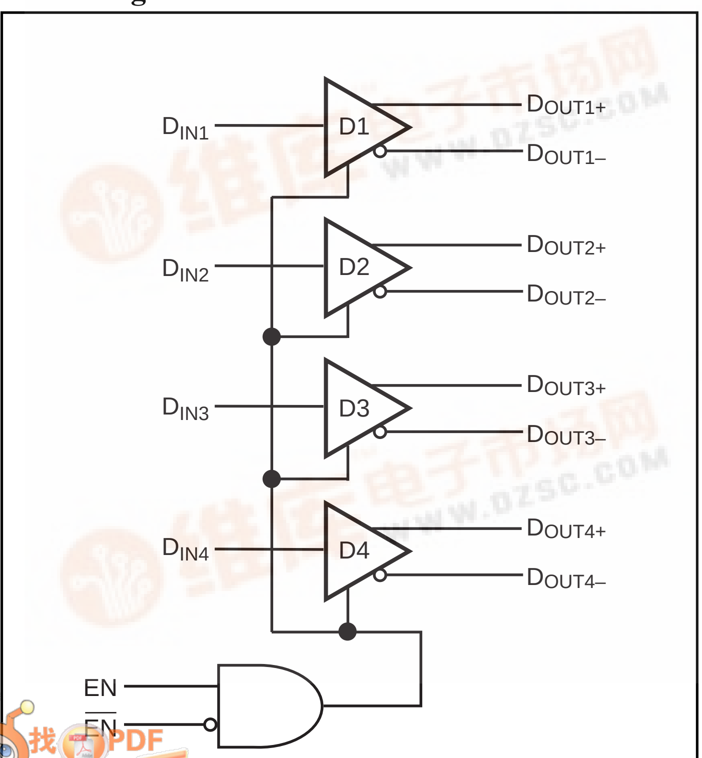
The PI90LV047A/PI90LVB047A accept low-voltage TTL/CMOS input levels and translates them to low-voltage (350 mV) differential output signals.

The PI90LVB047A doubles the output drive current to achieve Bus LVDS signaling levels with a 50-ohm load. A doubly terminated Bus LVDS line enables multipoint configurations. In addition, the driver supports a 3-state function that may be used to disable the output stage, disabling the load current, and thus dropping the device to an ultra low idle power state of 13mW typical. The devices have a flow-through pinout for easy PCB layout.

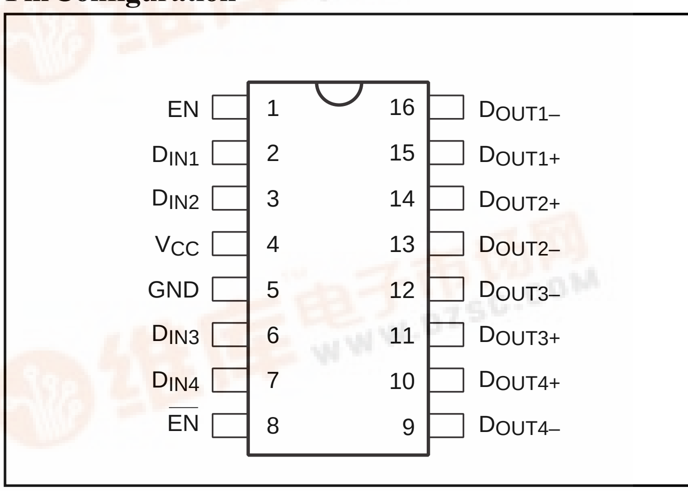
The EN and $\overline{EN}$ inputs are banded together and control the 3-state outputs. The enables are common to all four drivers.

The intended application of these devices and signaling technique is for both point-to-point baseband (PI90LV047A) and multipoint (PI90LVB047A) data transmission over controlled impedance media.

Block Diagram



Pin Configuration



Truth Table

Enables		Input	Outputs	
EN	$\overline{EN}$	DIN	DOUT+	DOUT–
H	L or Open	L	L	H
		H	H	L
All other combinations of ENABLE inputs		X	Z	Z

Absolute Maximum Ratings

Supply Voltage (V_{CC}) .... –0.3V to +4V
Input Voltage (D_{IN}) .... –0.3V to (V_{CC} + 0.3V)
Enable Input Voltage (EN, $\overline{EN}$) .... –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
Maximum Package Power Dissipation @ +25°C
M Package .... 1088 mW
MTC Package .... 866 mW
Derate M Package .... 8.5 mW/°C above +25°C
Derate MTC Package .... 6.9 mW/°C above +25°C
Storage Temperature Range .... –65°C to +150°C

Lead Temperature Range
Soldering (4 seconds) .... +260°C
Maximum Junction Temperature .... +150°C
ESD Rating[10]
(HBM, 1.5kW, 100pF) .... ≥10kV
(EIAJ, 0W, 200pF) .... ≥1200V

Recommended Operating Conditions

	Min	Typ	Max	Units
Supply Voltage (V_{CC})	+3.0	+3.3	+3.6	V
Operating Free Air Temperature (T_A)	–40	+25	+85	°C

Electrical Characteristics

Over supply voltage and operating temperature ranges, unless otherwise specified[2,3,4].

Symbol	Parameter	Test Conditions		Pin	Min.	Typ.	Max.	Units
V_{OD1}	Differential output voltage magnitude	R_L = 100 ohms (LV047A) R_L = 50 ohms (LVB047A) See Figure 1		D_{OUT-} D_{OUT+}	250	310	450	mV
ΔV_{OD1}	Change in Magnitude of V_{OD1} for complementary output states					1	35	|mV|
V_{OS}	Offset voltage		LVxxx		1.125	1.2	1.375	V
			LVBxxx		1.00	1.15	1.375	V
ΔV_{OS}	Change in magnitude of V_{OS} for complementary output states					1	25	|mV|
V_{OH}	Output high voltage					1.33	1.6	V
V_{OL}	Output low voltage				0.90	1.02		V
V_{IH}	Input high voltage			D_{IN}, EN, $\overline{EN}$	2.0		V_{CC}	V
V_{IL}	Input low voltage				GND		0.8	V
I_{IH}	Input high current	V_{IN} = V_{CC} or 2.5V			–20	2	+20	µA
I_{IL}	Input low current	V_{IN} = GND or 0.4V			–10	–2	+10	µA
V_{CL}	Input clamp voltage	I_{CL} = –18mA			–1.5	–0.8		V
I_{OS}	Output short circuit current[11]	Enabled, D_{IN} = V_{CC}, D_{OUT+} = 0V or D_{IN} = GND, D_{OUT-} = 0V	LVxxx	D_{OUT-} D_{OUT+}		–4.2	–10	mA
			LVBxxx			–9.0	–20	mA
I_{OSD}	Differential output short circuit current[11]	Enabled, V_{OD} = 0V	LVxxx			–4.2	–10	mA
			LVBxxx			–9.0	–20	mA
I_{OFF}	Power-off leakage	V_{OUT} = 0V or 3.6V, V_{CC} = 0V or Open			–20	±1	+20	µA
I_{OZ}	Output 3-State current	EN = 0.8V and $\overline{EN}$ =2.0V, V_{OUT} = 0V or V_{CC}			–10	±1	+10	µA
I_{CC}	No load supply current drivers enabled	D_{IN} = V_{CC} or GND	LV047A	V_{CC}		4.0	8.0	mA
			LVB047A			6.0	19.0	mA
I_{CCL}	Loaded supply current drivers enabled	R_L = 100 ohms, (all channels) D_{IN} = V_{CC} or GND (all inputs)	LV047A			20	30	mA
			LVB047A			35	45	mA
I_{CCZ}	No load supply current drivers disabled	D_{IN} = V_{CC} or GND, EN = GND, $\overline{EN}$ = V_{CC}	LV047A			2.2	8.0	mA
			LVB047A			3.0	8.0	mA

Switching Characteristics

V_{CC} = +3.3V ±10%, T_A = –40°C(3,9,12)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
t_{PHLD}	Differential Propagation Delay High to Low	R_L = 100ohms (LV047) R_L = 50ohms (LVB047) C_L = 15pF (Figures 2 and 3)	0.5	0.8	1.9	
t_{PLHD}	Differential Propagation Delay Low to High		0.5	1.2	1.9	
t_{SKD1}	Differential Pulse Skew t_{PHLD} t_{PLHD} (5)		0	0.3	0.4	
t_{SKD2}	Channel-to-Channel Skew(6)		0	0.4	0.5	
t_{SKD3}	Differential Part-to-Part Skew(7)		0		1.0	
t_{SKD4}	Differential Part-to-Part Skew(8)		0		1.2	
t_{TLH}	Rise Time			0.5	1.5	
t_{THL}	Fall Time			0.5	1.5	
t_{PHZ}	Disable Time High to Z	R_L = 100ohms (LV047) R_L = 50ohms (LVB047) C_L = 15pF (Figures 4 and 5)			5	
t_{PLZ}	Disable Time Low to Z				5	
t_{PZH}	Enable Time Z to High				7	
t_{PZL}	Enable Time Z to Low				7	
f_{MAX}	Maximum Operating Frequency (14)					MHz

Notes

1. "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" specifies conditions of device operation.
2. Current into device pins is defined as positive. Current out of device pins is defined as negative. All voltages are referenced to ground except: V_{OD1} and ΔV_{OD1}.
3. All typicals are given for: V_{CC} = +3.3V, T_A = +25°C.
4. The PI90LV047A is a current mode device and only functions within datasheet specifications when a resistive load is applied to the driver outputs typical range is (90 ohms to 110 ohms).
5. t_{SKD1} $|t_{PHLD} - t_{PLHD}|$ is the magnitude difference in differential propagation delay time between the positive going edge and the negative going edge of the same channel.
6. t_{SKD2} is the Differential Channel-to-Channel Skew of any event on the same device.
7. t_{SKD3}, Differential Part to Part Skew, is defined as the difference between the minimum and maximum specified differential propagation delays. This specification applies to devices at the same V_{CC} and within 5°C of each other within the operating temperature range.
8. t_{SKD4}, part to part skew, is the differential channel-to-channel skew of any event between devices. This specification applies to devices over recommended operating temperature and voltage ranges, and across process distribution. t_{SKD4} is defined as |Max – Min| differential propagation delay.
9. Generator waveform for all tests unless otherwise specified: f = 1 MHz, Z_O = 50 ohms, $t_r \leq 1$ ns, and $t_f \leq 1$ns.
10. ESD Ratings:
    HBM (1.5 kohms, 100pF) ≥10kV
    EIAJ (0 ohm, 200pF) ≥1200V
11. Output short circuit current (I_{OS}) is specified as magnitude only, minus sign indicates direction only.
12. C_L includes probe and jig capacitance.
13. All input voltages are for one channel unless otherwise specified. Other inputs are set to GND.
14. f_{MAX} generator input conditions: $t_r = t_f$ <1ns (0% to 100%), 50% duty cycle, 0V to 3V.
    Output Criteria: duty cycle = 45%/55%, V_{OD} >250mV, all channels switching.

Parameter Measurement Information

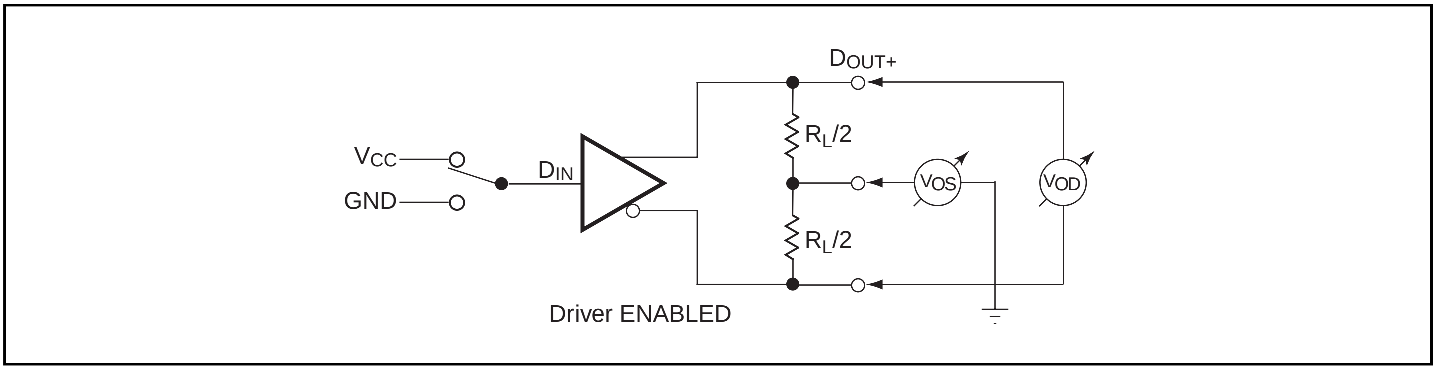


Figure 1. Driver V_{OD} and V_{OS} Test Circuit

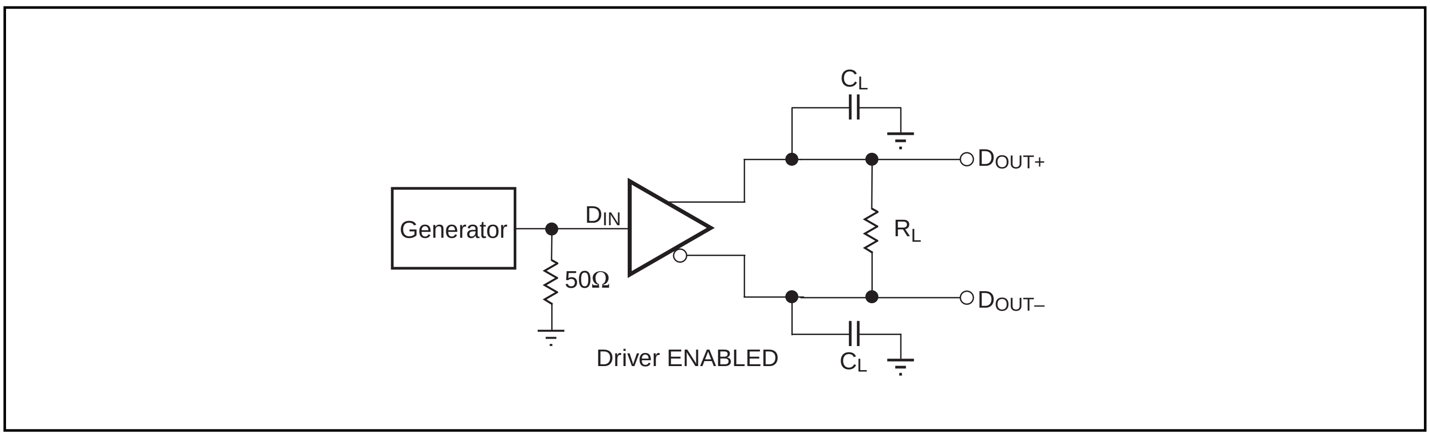


Figure 2. Driver Propagation Delay & Transition Time Test Circuit

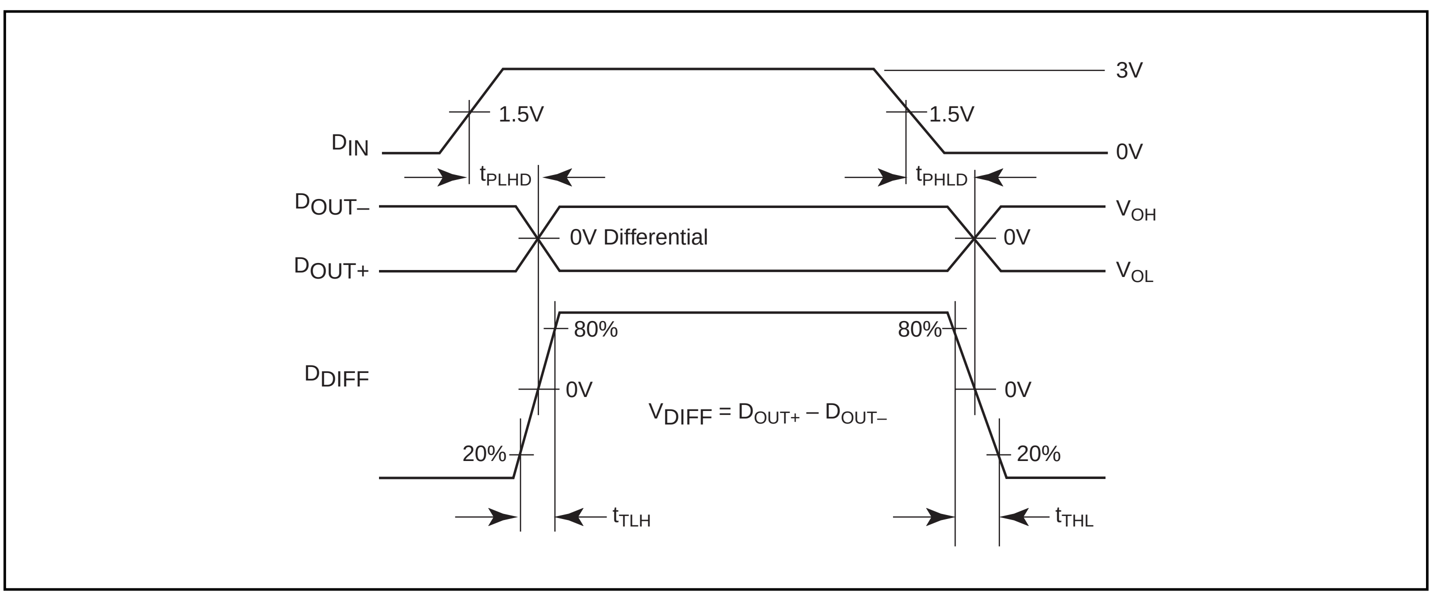


Figure 3. Driver Propogation Delay and Transition Time Waveforms

Parameter Measurement Information (continued)

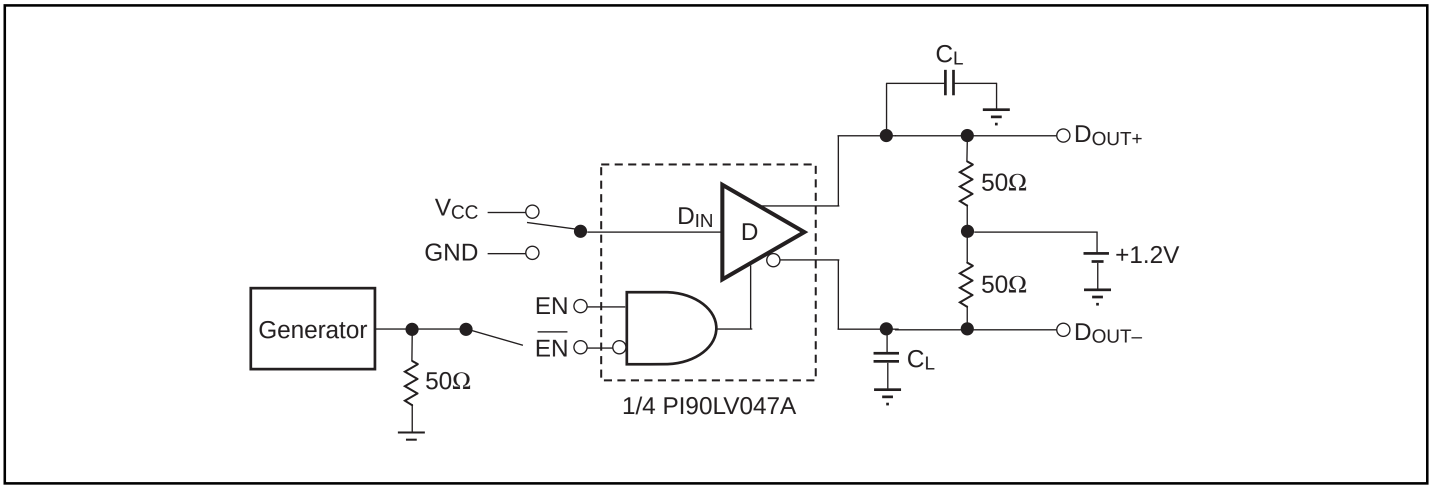


Figure 4. Drive 3-State Delay Test Circuit

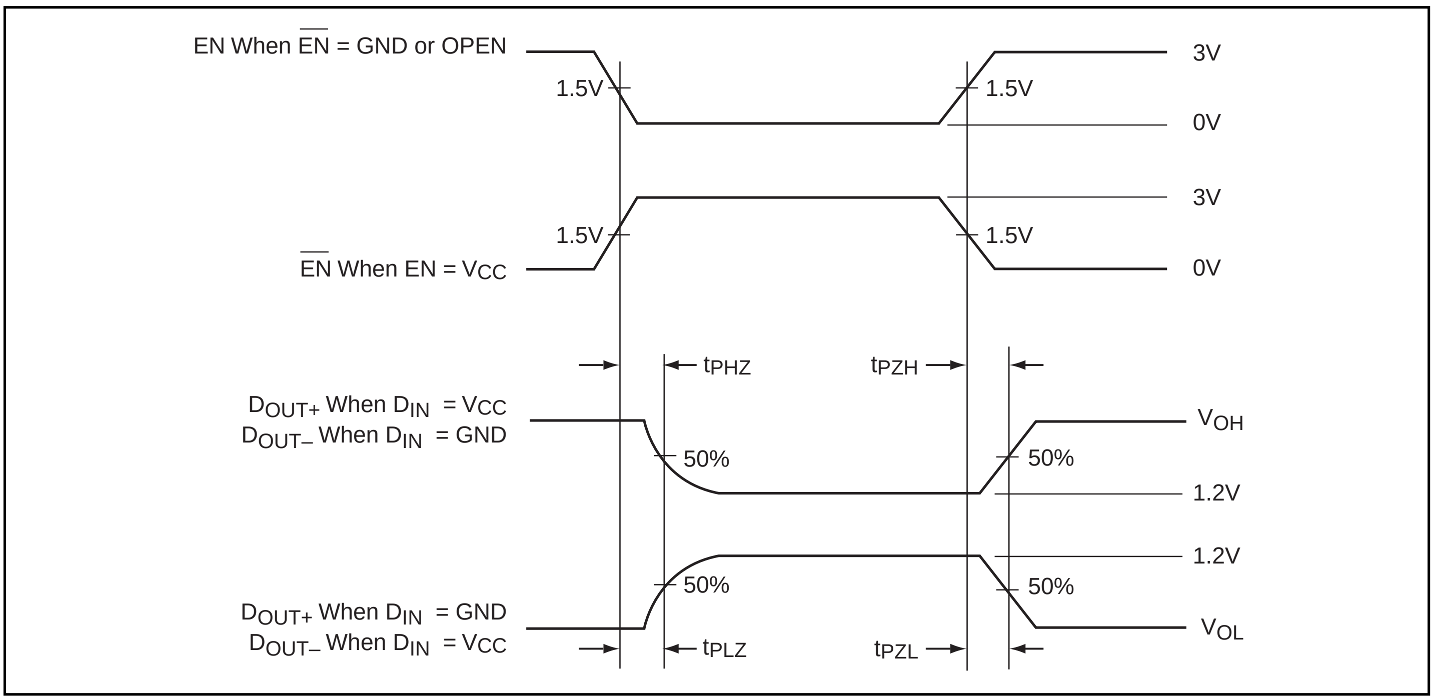


Figure 5. Driver 3-State Delay Waveform

Typical Application

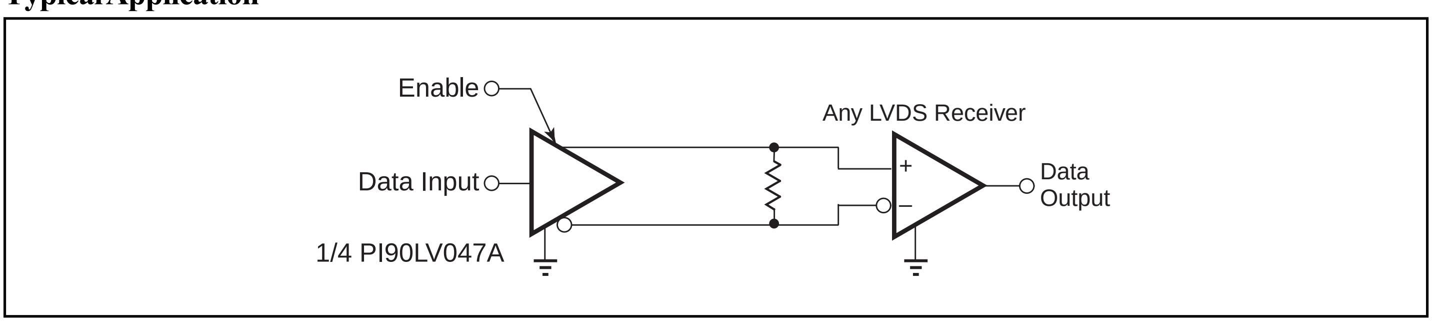
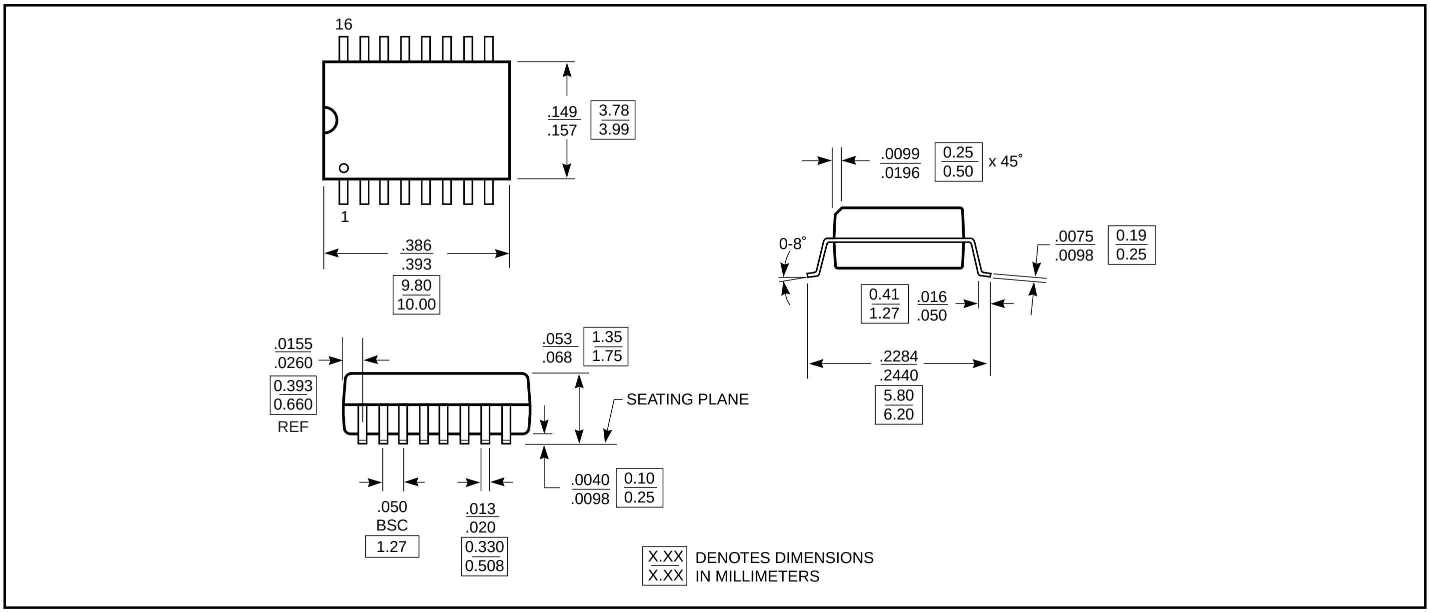
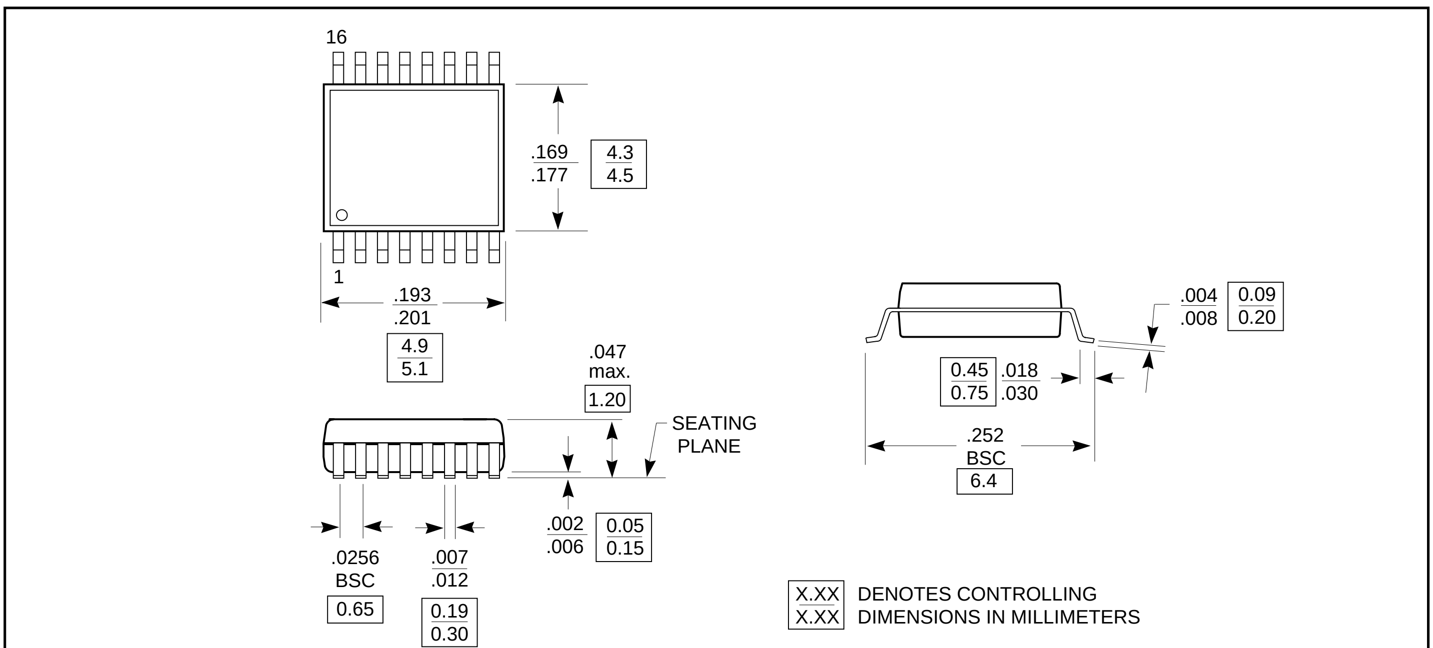


Figure 6. Point-to-Point Application

Packaging Mechanical: 16-Pin SOIC (W)



Packaging Mechanical: 16-Pin TSSOP (L)



Ordering Information

Ordering Code	Package Code	Package Type
PI90LV047AW	W	16-pin SOIC
PI90LV047AWE	W	Pb-free & Green, 16-pin SOIC
PI90LV047AL	L	16-pin TSSOP
PI90LV047ALE	L	Pb-free & Green, 16-pin TSSOP
PI90LVB047AW	W	16-pin SOIC
PI90LVB047AWE	W	Pb-free & Green, 16-pin SOIC
PI90LVB047AL	L	16-pin TSSOP
PI90LVB047ALE	L	Pb-free & Green, 16-pin TSSOP

Notes:
1. Thermal characteristics can be found on the company web site at www.pericom.com/packaging/
2. X = Tape and reel