A Product Line of
Diodes Incorporated

**PI90LV01A**

# SOTiny™ LVDS High-Speed Differential Line Driver

## Features

- Meets or Exceeds ANSI TIA/EIA-644-1955 Standard
- Signaling Rates Up to 660 Mbps
- Bus-Terminal ESD exceeds 2kV
- Low-Voltage Differential Signaling with typical Output Voltages of 350mV:
  - 100Ω load
- Typical Propagation Delay Times of 1.5ns
- Typical Power Dissipation of 20mW @200 MHz
- Low-Voltage TTL (LVTTL) Level is 5V Tolerant
- Operates from a 3.3V supply
- Extended Industrial Temperature Operating Range: –40°C to 105°C
- Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)
- Halogen and Antimony Free. "Green" Device (Note 3)
- For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative.
  https://www.diodes.com/quality/product-definitions/
- Packaging (Pb-free & Green available):
  - 5-pin space-saving SOT23 (T)

## Description

The DIODES™ PI90LV01A is differential line driver that uses low-voltage differential signaling (LVDS) to support data rates up to 660 Mbps. This device is designed for applications requiring high-speed, low-power consumption, low-noise generation, and a small package.

The TIA/EIA-644 standard compliant electrical interface provides a minimum differential output voltage magnitude of 247mV into a 100- ohm load and receipt of 100mV signals with up to 1V of ground potential difference between a transmitter and receiver.

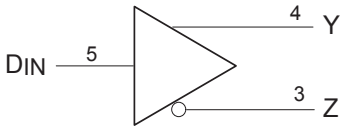
A low-voltage TTL/CMOS input level is translated by the device into a low-voltage (350mV) differential output signal.

## Application(s)

Applications include point-to-point (single termination) and multi-point (double termination) baseband data transmissions over controlled impedance media. The transmission media can be printed circuit board traces, backplanes, or cables.

The PI90LV01A and companion line receivers (The DIODES™ PI90LV02A) provide new alternatives to RS-232, PECL and ECL devices for high-speed, point-to-point interface applications.

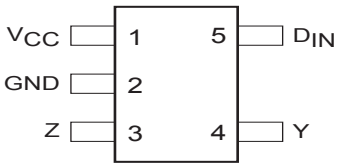
## Logic Diagram




**Notes:**

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

## Pin Configuration




## Function Table

| Inputs | Outputs | |
|---|---|---|
| $D_{IN}$ | **Y** | **Z** |
| H | H | L |
| L | L | H |
| Open | L | H |

**Notes:**
H = High
L = Low
X = High or Low
High Z = High Impedance

## Absolute Maximum Ratings

(Over Operating Free-Air Temperature, unless otherwise noted)†

Supply Voltage Range, VCC(1) ..... –0.5V to 4V
Input Voltage Range (DIN) ..... –0.5 to 6V
(Y or Z) .....–0.5 to 4V
ESD Rating (HBM, 1.5KΩ, 100pF)..... ≥ 2KV
Continuous Total Power Dissipation ..... See Dissipation Rating Table
Storage Temperature Range .....–65°C to 150°C
Lead Temperature 1.6 mm (1/16 inch) from case for 10 seconds .. 250°C

**Note:**

Stresses greater than those listed under MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

1. All voltage values, except differential I/O bus voltages, are with respect to ground terminal.

### Dissipation Rating Table

| Package | $T_A \leq 25°C$ Power Rating | Derating Factor Above $T_A = 25°C$* | $T_A = 85°C$ Power Rating |
|---|---|---|---|
| T | 385mW | 3.1mW/°C | 200mW |

*This is the inverse of the junction-to-ambient thermal resistance when board-mounted (low-K) and with no air flow.

### Recommended Operating Conditions

| Symbol | Parameter | Min. | Nom. | Max. | Units |
|---|---|---|---|---|---|
| $V_{CC}$ | Supply Voltage | 3.0 | 3.3 | 3.6 | V |
| $V_{IH}$ | High-Level Input Voltage | 2 | | 3.8 | |
| $V_{IL}$ | Low-Level Input Voltage | | | 0.8 | |
| $T_A$ | Operating free-air temperature | –40 | | 105 | °C |

## Electrical Characteristics (Over Operating Free-Air Temperature, unless otherwise noted)

| Symbol | Parameter | Test Conditions | Min. | Typ.(1) | Max. | Units |
|---|---|---|---|---|---|---|
| $\|V_{OD}\|$ | Differential output voltage magnitude | $R_L$ = 100Ω<br>See Figure 1 | 247 | 350 | 454 | 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 2 | 1.125 | | 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 | | | 25 | 100 | |
| $I_{CC}$ | Supply current | $V_I$ = 0V or $V_{CC}$, No Load | | 2 | 5.5 | mA |
| | | $V_I$ = 0V or $V_{CC}$, $R_L$ = 100Ω | | 5.5 | 8 | |
| $I_{IH}$ | High-level input current | $V_{IH}$ = 5V | | 2 | 20 | µA |
| $I_{IL}$ | Low-level input current | $V_{IL}$ = 0.8V | | 2 | 10 | |
| $I_{OS}$ | Short-circuit output current | $V_{ODOUT+}$ or $V_{ODOUT-}$ = 0V | | 3 | 10 | mA |
| | | $V_{OD}$ = 0V | | | 10 | mA |
| $I_{O(OFF)}$ | Power-off output current | $V_{CC}$ = 0V, $V_O$ = 3.6V | | | ±1 | µA |
| $C_{IN}$ | Input capacitance | | | 3 | | pF |

**Note:**
1. All typical values are at 25°C and with a 3.3V

## Switching Characteristics, $V_{CC}$ = 3V to 3.6V (Over Operating Free-Air Temperature, unless otherwise noted)

| Symbol | Parameter | Test Conditions | Min | Typ.(1) | Max. | Units |
|---|---|---|---|---|---|---|
| $t_{PLH}$ | Propagation delay time, low-to-high level output | $R_L$ = 100Ω, $C_L$ = 10pF<br>See Figure 3 | | 1.5 | 2.7 | ns |
| $t_{PHL}$ | Propogation delay time, high-to-low level output | | | 1.8 | 2.7 | ns |
| $t_r$ | Transition, low-to-high | | | 0.6 | 1.5 | ns |
| $t_f$ | Transition, high-to-low | | | 0.7 | 1.5 | ns |
| $t_{sk(p)}$ | Pulse skew ($\|t_{PHL} - t_{PLH}\|$)(2) | | | 0.3 | | ns |

**Notes:**
1. All typical values are at 25°C and with a 3.3V supply
2. $t_{sk(p)}$ is the magnitude of the time difference between the high-to-low and low-to-high propagation delay times at an output
3. $f_{max}$ generator input conditions: 50% duty cycle, 0V to 3V. Output criteria: 45% to 55% duty cycle, $V_{OD}$ = 250mV

## Parameter Measurement Information

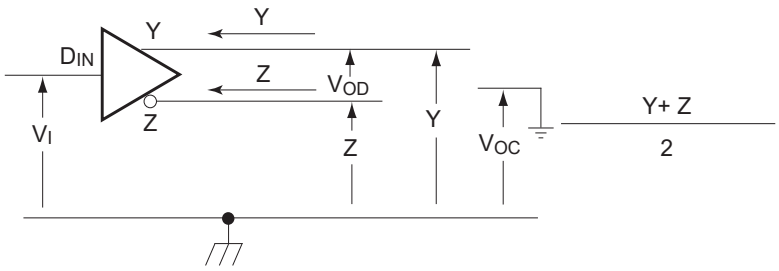



**Figure 1. Driver Voltage and Current Definitions**

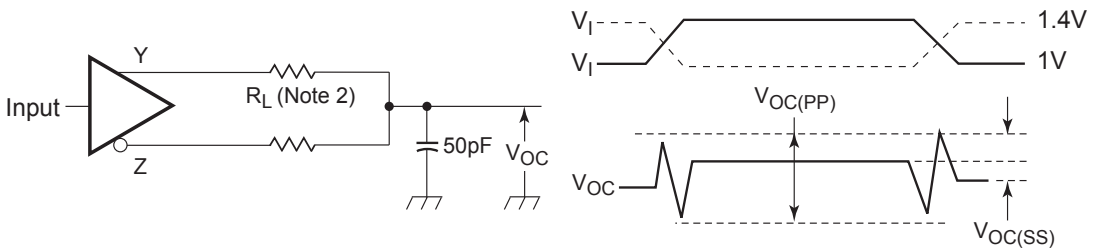
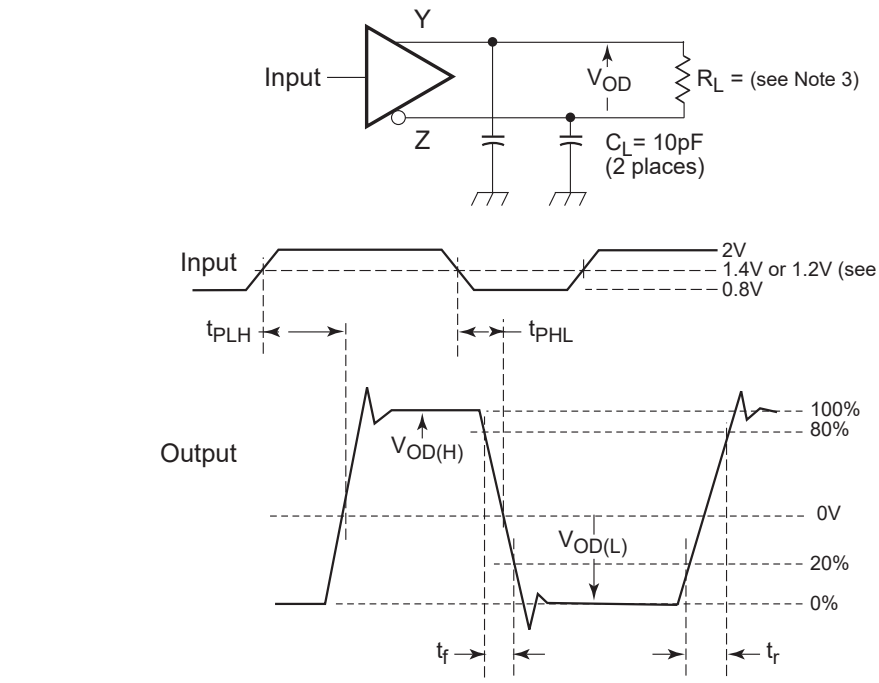



**Figure 2. Test Circuit and Definitions for the Driver Common-Mode Output Voltage**

**Note:**

1. 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 ±10ns. $C_L$ includes instrumentation and fixture capacitance within 0.06mm of the D.U.T. The measurement of $V_{OC(PP)}$ is made on test equipment with a –3dB bandwidth of at least 300MHz.
2. $R_L = 49.9\Omega \pm 1\%$




Note:
1. All input pulses are supplied by a generator having the following characteristics: tr or tf ≤ 1ns, Pulse Repetition Rate (PRR) = 50 Mpps, Pulse width = 10 ±0.2ns. CL includes instrumentation and fixture capacitance within 0.06m of the D.U.T.
2. This point is 1.4V with VCC = 3.3V
3. RL = 100 ohms for PI90LV01A .

**Figure 3. Test Circuit, Timing, & Voltage Definitions for the Differential Output Signal**

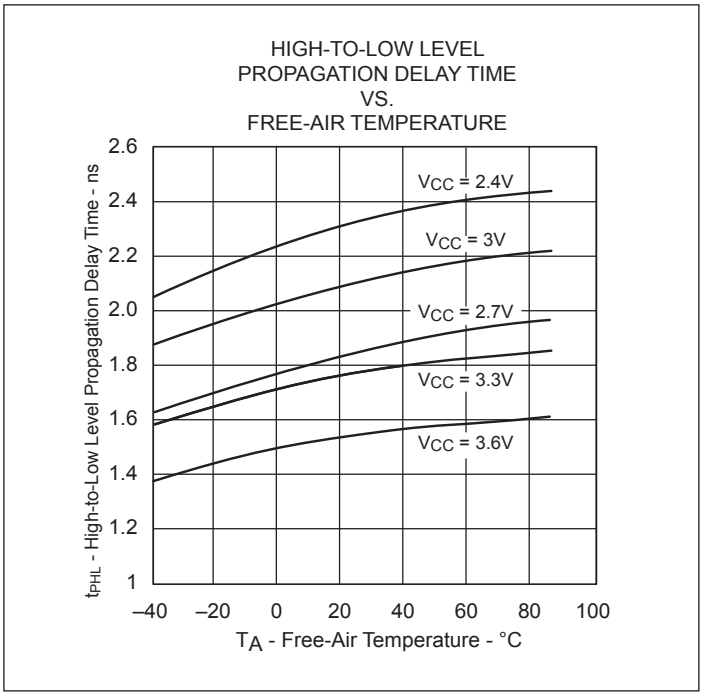



**Figure 4.**

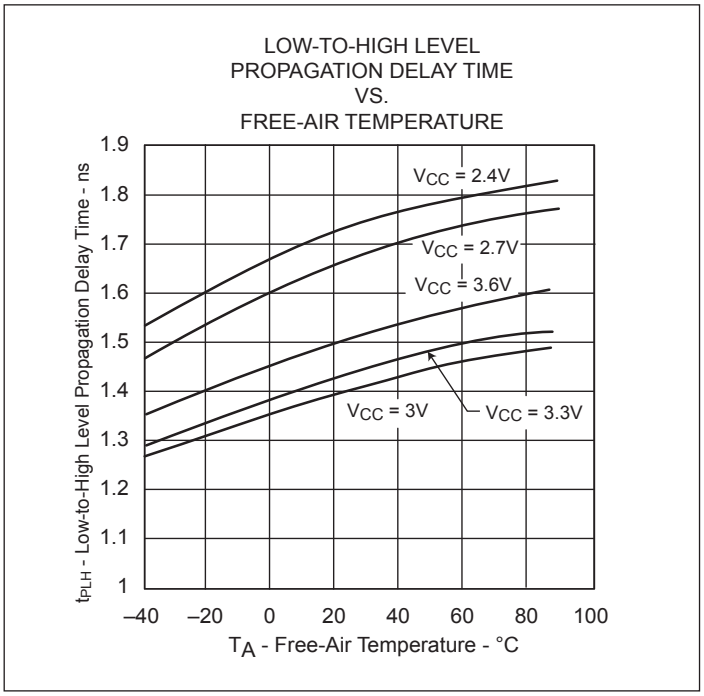


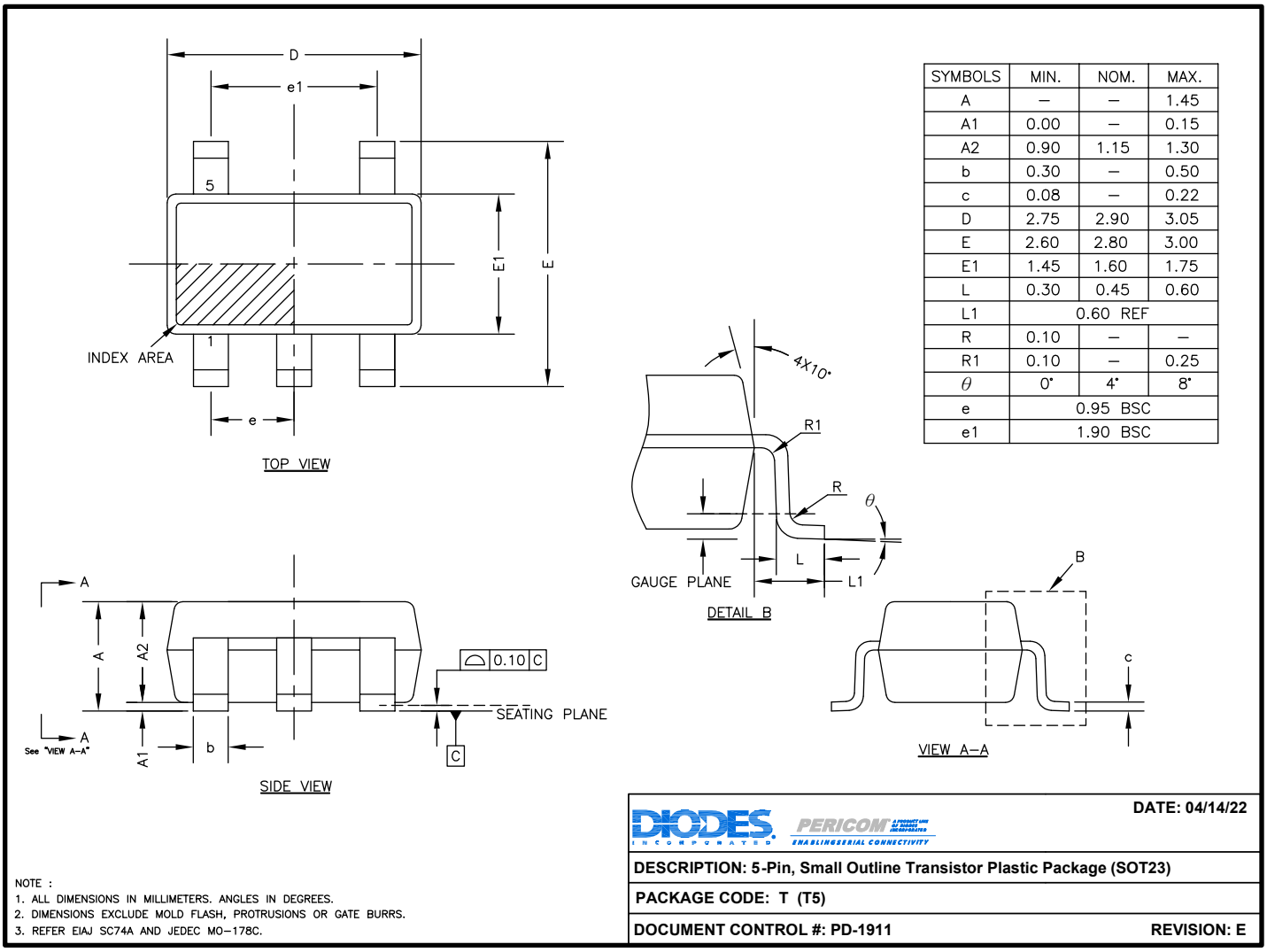

**Figure 5.**

## Part Marking


GA: PI90LV01ATE
Y: Date Code (Year)
W: Date Code (Workweek)
Line above “G” denotes Pb-free and green

## Packaging Mechanical

### 5-SOT23 (T)




| SYMBOLS | MIN. | NOM. | MAX. |
|---|---|---|---|
| A | – | – | 1.45 |
| A1 | 0.00 | – | 0.15 |
| A2 | 0.90 | 1.15 | 1.30 |
| b | 0.30 | – | 0.50 |
| c | 0.08 | – | 0.22 |
| D | 2.75 | 2.90 | 3.05 |
| E | 2.60 | 2.80 | 3.00 |
| E1 | 1.45 | 1.60 | 1.75 |
| L | 0.30 | 0.45 | 0.60 |
| L1 | 0.60 REF | | |
| R | 0.10 | – | – |
| R1 | 0.10 | – | 0.25 |
| θ | 0° | 4° | 8° |
| e | 0.95 BSC | | |
| e1 | 1.90 BSC | | |

NOTE :
1. ALL DIMENSIONS IN MILLIMETERS. ANGLES IN DEGREES.
2. DIMENSIONS EXCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
3. REFER EIAJ SC74A AND JEDEC MO–178C.

DATE: 04/14/22

DESCRIPTION: 5-Pin, Small Outline Transistor Plastic Package (SOT23)

PACKAGE CODE: T (T5)

DOCUMENT CONTROL #: PD-1911 REVISION: E

**For latest package info.**

please check: http://www.diodes.com/design/support/packaging/pericom-packaging/packaging-mechanicals-and-thermal-characteristics/

## Ordering Information

| Ordering Number | Package Code | Package Description | Top Marking |
|---|---|---|---|
| PI90LV01ATEX | T | 5-Pin, Small Outline Transistor Plastic Package (SOT23) | $\overline{G}A$ |

**Notes:**

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. E = Pb-free and Green
5. X suffix = Tape/Reel