

SINGLE BIT DUAL POWER SUPPLY TRANSLATING TRANSCEIVER WITH 3 STATE OUTPUTS

Description

The 74LVC1T45 is a single-bit, dual-supply transceiver with tri-state outputs suitable for transmitting a single logic bit across different voltage domains. The A input/output pin is designed to track V_{CCA} while the B input/output tracks V_{CCB} . This arrangement allows for universal low-voltage translation between any voltages from 1.65V to 5.5V. The Direction pin (DIR) controls the direction of the transceiver and in a logic voltage related to V_{CCA} . When a high logic level is applied to DIR, the A pin becomes an input, and the B pin becomes the output. Conversely, the roles of A and B are reversed when DIR is asserted low.

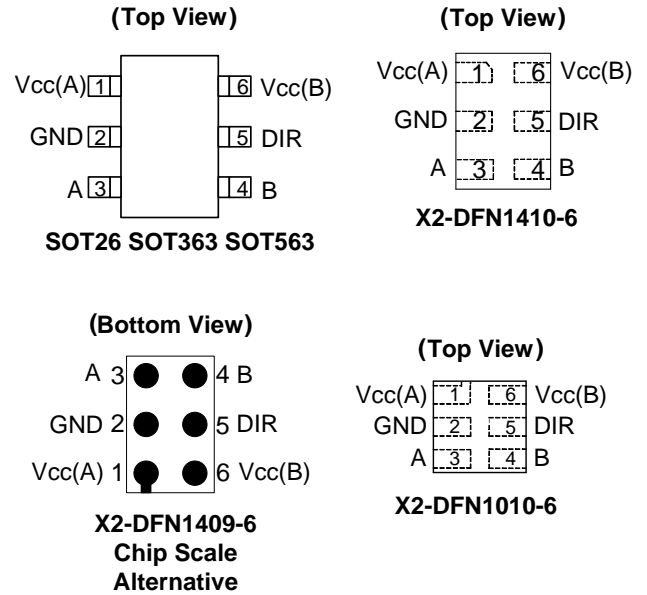
The tri-state feature occurs when either of the power supply voltages are zero. This is also an Ioff feature and allows for the output to remain in a high impedance state with both power supplies at 0V, which prevents and damages backflow currents and provides power-down electrical isolation up to 5.5V as not to interfere with any logic activity on pin A or B.

Features

- Wide Supply Voltage Range:
 - $V_{CC(A)}$: from 1.65V to 5.5V
 - $V_{CC(B)}$: from 1.65V to 5.5V
- ± 24 mA Output Drive at 3.3V
- CMOS Low Power Consumption 16 μ A Maximum I_{CC}
- High Noise Immunity—(100mV Hysteresis Typical)
- I_{OFF} Supports Partial-Power-Down Mode Operation
- I_{OFF} Controlled by Either V_{CC} Being at 0 V
- Inputs Accept up to 5.5V
- ESD Protection Exceeds JESD 22
 - 200-V Machine Model (A115)
 - 2000-V Human Body Model (A114)
 - 1000 V Charged Device Model (C101)
- Latch-up Exceeds 100mA per JESD 78, Class I
- X2-DFN1409-6 Package Designed as a Direct Replacement for Chip Scale Packaging.
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

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 Assignments



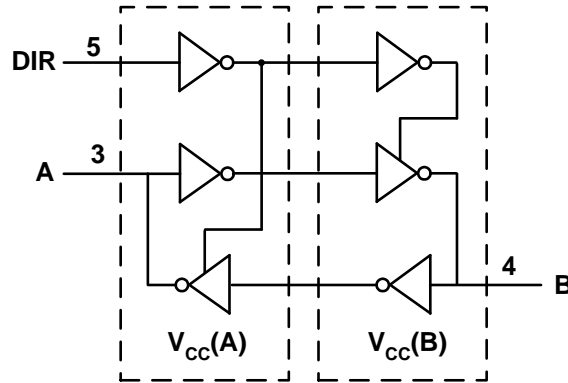
Applications

- Voltage Level Translation
Well-Suited to Join Logic Types Operating at Different Voltages
- Power-Down Signal Isolation
If Either Voltage Domain is Turned Off the Signal is Isolated and There is No Loading on Signal Lines
- Wide Array of Products, such as:
 - Cell Phones, Tablets, E-Readers
 - PCs, Notebooks, Netbooks, Ultrabooks
 - Networking, Routers, Gateways
 - Computer Peripherals, Hard Drives, CD/DVD ROM
 - TV, DVD, DVR, Set-Top Box
 - Personal Navigation / GPS
 - MP3 Players, Cameras, Video Recorders

Pin Descriptions

| Pin Name | Pin | Function |
|----------|-----|---|
| VCC(A) | 1 | Supply for I/O Pin A; Reference for DIR |
| GND | 2 | Ground |
| A | 3 | Data Input/Output |
| B | 4 | Data Input/Output |
| DIR | 5 | Direction Control |
| VCC(B) | 6 | Supply for I/O Pin B |

Logic Diagram



Function Tables

| Input DIR (Direction Pin) | Operation |
|------------------------------|--------------------|
| L | B Data to A Output |
| H | A Data to B Output |

| Inputs | | | Outputs | |
|--------|--------|-----|---------|--------|
| A | B | DIR | A | B |
| Note 4 | L | L | L | Note 4 |
| Note 4 | H | L | H | Note 4 |
| L | Note 4 | H | Note 4 | L |
| H | Note 4 | H | Note 4 | H |

Note: 4. Pin condition not applicable as defined by DIR.

Absolute Maximum Ratings (Note 5) (@T_A = +25°C, unless otherwise specified.)

| Symbol | Parameter | Rating | Unit |
|---|---|--------------|---------------------------------|
| ESD HBM | Human Body Model ESD Protection | 2 | KV |
| ESD CDM | Charged Device Model ESD Protection | 1 | KV |
| ESD MM | Machine Model ESD Protection | 200 | V |
| V _{CC(A)} , V _{CC(B)} | Supply Voltage Range | -0.5 to +6.5 | V |
| V _I | Input Voltage Range | -0.5 to +6.5 | V |
| V _O | Voltage Applied to Output in High Impedance or I _{OFF} State | -0.5 to +6.5 | V |
| V _O | Voltage Applied to Output in High or Low State | A Pin | -0.3 to V _{CC(A)} +0.5 |
| | | B Pin | -0.3 to V _{CC(B)} +0.5 |
| I _{IK} | Input Clamp Current V _I <0 | -50 | mA |
| I _{OK} | Output Clamp Current | -50 | mA |
| I _O | Continuous Output Current | ±50 | mA |
| — | Continuous Current Through V _{CC} or GND | ±100 | mA |
| T _J | Operating Junction Temperature | -40 to +150 | °C |
| T _{STG} | Storage Temperature | -65 to +150 | °C |

Note: 5. Stresses beyond the absolute maximum may result in immediate failure or reduced reliability. These are stress values and device operation should be within recommend values.

Recommended Operating Conditions (Note 6) (@T_A = +25°C, unless otherwise specified.)

| Symbol | Parameter | | V _{CC} Inputs | V _{CC} Outputs | Min | Max | Units |
|--------------------|--|----------------|----------------------------------|----------------------------------|---------------------------|---------------------------|-------|
| V _{CC(A)} | Operating Voltage | | — | — | 1.65 | 5.5 | V |
| V _{CC(B)} | | | — | — | 1.65 | 5.5 | V |
| V _{IH} | High-Level Input Voltage Pin A or DIR Referenced to V _{CC(A)} | | V _{CC} = 1.65V to 1.95V | — | 0.65 X V _{CC(A)} | — | V |
| | | | V _{CC} = 2.3V to 2.7V | — | 1.7 | — | |
| | | | V _{CC} = 3V to 3.6V | — | 2 | — | |
| | | | V _{CC} = 4.5V to 5.5V | — | 0.7 X V _{CC(A)} | — | |
| V _{IL} | Low-Level Input Voltage Pin A or DIR Referenced to V _{CC(A)} | | V _{CC} = 1.65V to 1.95V | — | — | 0.35 X V _{CC(A)} | V |
| | | | V _{CC} = 2.3V to 2.7V | — | — | 0.7 | |
| | | | V _{CC} = 3V to 3.6V | — | — | 0.8 | |
| | | | V _{CC} = 4.5V to 5.5V | — | — | 0.3 X V _{CC(A)} | |
| V _{IH} | High-Level Input Voltage Pin B Referenced to V _{CC(B)} | | V _{CC} = 1.65V to 1.95V | — | 0.65 X V _{CC(B)} | — | V |
| | | | V _{CC} = 2.3V to 2.7V | — | 1.7 | — | |
| | | | V _{CC} = 3V to 3.6V | — | 2 | — | |
| | | | V _{CC} = 4.5V to 5.5V | — | 0.7 X V _{CC(B)} | — | |
| V _{IL} | Low-Level Input Voltage Pin B Referenced to V _{CC(B)} | | V _{CC} = 1.65V to 1.95V | — | — | 0.35 X V _{CC(B)} | V |
| | | | V _{CC} = 2.3V to 2.7V | — | — | 0.7 | |
| | | | V _{CC} = 3V to 3.6V | — | — | 0.8 | |
| | | | V _{CC} = 4.5V to 5.5V | — | — | 0.3 X V _{CC(B)} | |
| V _I | Input Voltage | | — | — | 0 | 5.5 | V |
| V _O | Output Voltage | | — | — | 0 | V _{CC} | V |
| I _{OH} | High-Level Output Current | | — | V _{CC} = 1.65V to 1.95V | — | -4 | mA |
| | | | — | V _{CC} = 2.3V to 2.7V | — | -8 | |
| | | | — | V _{CC} = 3V to 3.6V | — | -24 | |
| | | | — | V _{CC} = 4.5V to 5.5V | — | -32 | |
| I _{OL} | Low-Level Output Current | | — | V _{CC} = 1.65V to 1.95V | — | 4 | mA |
| | | | — | V _{CC} = 2.3V to 2.7V | — | 8 | |
| | | | — | V _{CC} = 3V to 3.6V | — | 24 | |
| | | | — | V _{CC} = 4.5V to 5.5V | — | 32 | |
| Δt/ΔV | Input Transition Rise or Fall Rate | Data Inputs | V _{CC} = 1.65V to 1.95V | — | — | 20 | ns/V |
| | | | V _{CC} = 2.3V to 2.7V | — | — | 20 | |
| | | | V _{CC} = 3V to 3.6V | — | — | 10 | |
| | | | V _{CC} = 4.5V to 5.5V | — | — | 5 | |
| | | Control Inputs | V _{CC} = 1.65V to 5.5V | — | — | 5 | |
| T _A | Operating Free-Air Temperature | | — | — | -40 | +125 | °C |

Note: 6. Unused inputs should be held at V_{CC} or Ground.

Electrical Characteristics (@T_A = +40°C to +85°C, unless otherwise specified.)

| Symbol | Parameter | Test Conditions | | V _{CC} (A) | V _{CC} (B) | T _A = +25°C | | | T _A = -40°C to +85°C | | Unit |
|-------------------------------------|----------------------------|--|--|---------------------|---------------------|------------------------|-----|-----|---------------------------------|------|------|
| | | | | | | Min | Typ | Max | Min | Max | |
| V _{OH} | High Level Output Voltage | I _{OH} = -100μA | | 1.65V to 5.5V | 1.65V to 5.5V | — | — | — | V _{CC} - 0.1 | — | V |
| | | I _{OH} = -4mA | | 1.65V | 1.65V | — | — | — | 1.2 | — | |
| | | I _{OH} = -8mA | | 2.3V | 2.3V | — | — | — | 1.9 | — | |
| | | I _{OH} = -24mA | | 3V | 3V | — | — | — | 2.4 | — | |
| | | I _{OH} = -32mA | | 4.5V | 4.5V | — | — | — | 3.8 | — | |
| V _{OL} | Low-Level Output Voltage | I _{OL} = 100μA | | 1.65V to 5.5V | 1.65V to 5.5V | — | — | — | — | 0.1 | V |
| | | I _{OL} = 4mA | | 1.65V | 1.65V | — | — | — | — | 0.45 | |
| | | I _{OL} = 8mA | | 2.3V | 2.3V | — | — | — | — | 0.3 | |
| | | I _{OL} = 24mA | | 3V | 3V | — | — | — | — | 0.55 | |
| | | I _{OL} = 32mA | | 4.5V | 4.5V | — | — | — | — | 0.55 | |
| I _I | Input Current | DIR | V _I = V _{CC} (A) or GND | 0 to 5.5V | 0 to 5.5V | — | — | ±1 | — | ±2 | μA |
| I _{OFF} | Power Down Leakage Current | A Pin | V _I or V _O = 0 to 5.5V | 0 | 0V to 5.5V | — | — | ±1 | — | ±2 | μA |
| | | B Pin | | 0 to 5.5V | 0 | — | — | ±1 | — | ±2 | |
| I _{OZ} | 3-State Leakage Current | A Pin | V _O = V _{CC} (A) | 1.65V to 5.5V | 1.65V to 5.5V | — | — | ±1 | — | ±2 | μA |
| | | B Pin | V _O = V _{CC} (B) | 1.65V to 5.5V | 1.65V to 5.5V | — | — | ±1 | — | ±2 | |
| I _{CCA} | Supply Current | V _I = 5.5V or GND I _O = 0 | | 1.65V to 5.5V | 1.65V to 5.5V | — | — | — | — | 3 | μA |
| | | | | 5.5V | 0 | — | — | — | — | 2 | |
| | | | | 0 | 5.5V | — | — | — | — | -2 | |
| I _{CCB} | Supply Current | V _I = 5.5V or GND I _O = 0 | | 1.65V to 5.5V | 1.65V to 5.5V | — | — | — | — | 3 | μA |
| | | | | 0V | 5.5V | — | — | — | — | 2 | |
| | | | | 5.5V | 0V | — | — | — | — | -2 | |
| I _{CCA} + I _{CCB} | Supply Current | V _I = 5.5V or GND I _O = 0 | | 1.65V to 5.5V | 1.65V to 5.5V | — | — | — | — | 4 | μA |
| ΔI _{CCA} | Additional Supply Current | A Pin | A = V _{CC} (A) - 0.6V DIR = V _{CC} (A) B = Open | 3V to 5.5V | 3V to 5.5V | — | — | — | — | 50 | μA |
| | | DIR | DIR = V _{CC} (A) - 0.6V A = V _{CC} (A) or GND B = Open | | | | | | | 50 | |
| ΔI _{CCB} | Additional Supply Current | B Pin | B = V _{CC} (B) - 0.6V DIR = GND A = Open | 3V to 5.5V | 3V to 5.5V | — | — | — | — | 50 | μA |
| C _I | Input Capacitance | DIR | V _I = V _{CC} (A) or GND | 3.3V | 3.3V | — | 2.5 | — | — | — | pF |
| C _{IO} | Input/Output Capacitance | A or B Pin | V _I = V _{CC} (A)/(B) or GND | 3.3V | 3.3V | — | 6.0 | — | — | — | pF |

Electrical Characteristics (@T_A = +40°C to +125°C, unless otherwise specified.)

| Symbol | Parameter | Test Conditions | | V _{CC(A)} | V _{CC(B)} | T _A = -40°C to +125°C | | Unit |
|-------------------------------------|----------------------------|--|---|--------------------|--------------------|----------------------------------|------|------|
| | | | | | | Min | Max | |
| V _{OH} | High Level Output Voltage | I _{OH} = -100µA | | 1.65V to 5.5V | 1.65V to 5.5V | V _{CC} - 0.1 | — | V |
| | | I _{OH} = -4mA | | 1.65V | 1.65V | 1.2 | — | |
| | | I _{OH} = -8mA | | 2.3V | 2.3V | 1.9 | — | |
| | | I _{OH} = -24mA | | 3V | 3V | 2.4 | — | |
| | | I _{OH} = -32mA | | 4.5V | 4.5V | 3.8 | — | |
| V _{OL} | High-Level Input Voltage | I _{OL} = 100µA | | 1.65V to 5.5V | 1.65V to 5.5V | — | 0.1 | V |
| | | I _{OL} = 4mA | | 1.65V | 1.65V | — | 0.45 | |
| | | I _{OL} = 8mA | | 2.3V | 2.3V | — | 0.3 | |
| | | I _{OL} = 24mA | | 3V | 3V | — | 0.55 | |
| | | I _{OL} = 32mA | | 4.5V | 4.5V | — | 0.55 | |
| I _I | Input Current | DIR | V _I = V _{CC(A)} or GND | 0 to 5.5V | 0 to 5.5V | — | ± 2 | µA |
| I _{OFF} | Power Down Leakage Current | A Pin | V _I or V _O = 0 to 5.5V | 0 | 1.65V to 5.5V | — | ± 2 | µA |
| | | B Pin | | 1.65V to 5.5V | 0V | — | ± 2 | |
| I _{oz} | 3-State Leakage Current | B Pin V _O = V _{CC} (B) DIR = 0 V | V _I = 0 to 5.5V | 1.65V to 5.5V | 1.65V to 5.5V | — | ± 2 | µA |
| | | A Pin V _O = V _{CC} (A) DIR = V _{CC} (A) | | 1.65V to 5.5V | 1.65V to 5.5V | — | ± 2 | |
| I _{CCA} | Supply Current | V _I = 5.5V or GND I _O = 0 | | 1.65V to 5.5V | 1.65V to 5.5V | — | 3 | µA |
| | | | | 5.5V | 0 | — | 2 | |
| | | | | 0 | 5.5V | — | -2 | |
| I _{CCB} | Supply Current | V _I = 5.5V or GND I _O = 0 | | 1.65V to 5.5V | 1.65V to 5.5V | — | 3 | µA |
| | | | | 5.5V | 0 | — | 2 | |
| | | | | 0 | 5.5V | — | -2 | |
| I _{CCA} + I _{CCB} | Supply Current | V _I = 5.5V or GND I _O = 0 | | 1.65V to 5.5V | 1.65V to 5.5V | — | 4 | µA |
| ΔI _{CCA} | Additional Supply Current | A Pin | A = V _{CC} (A) -0.6V DIR = V _{CC} (A) B = Open | 3V to 5.5V | 3V to 5.5V | — | 50 | µA |
| | | DIR | DIR = V _{CC} (A) -0.6V A = V _{CC} (A) or GND B = Open | | | | 50 | |
| ΔI _{CCB} | Additional Supply Current | B Pin | B = V _{CC} (B) -0.6V DIR = GND A = Open | 3V to 5.5V | 3V to 5.5V | — | 50 | µA |

Package Characteristics ($V_{CC} = 3.3V$, $T_A = +25^{\circ}C$, unless otherwise specified.)

| Symbol | Parameter | Package | Test Conditions | Min | Typ | Max | Unit |
|---------------|--|---------|-----------------|-----|-----|-----|---------------|
| Θ_{JA} | Thermal Resistance Junction-to-Ambient | SOT26 | Note 7 | — | 166 | — | $^{\circ}C/W$ |
| | | SOT363 | | — | 371 | — | |
| | | SOT563 | | — | 290 | — | |
| | | DFN1410 | | — | 430 | — | |
| | | DFN1409 | | — | 450 | — | |
| | | DFN1010 | | — | 510 | — | |
| Θ_{JC} | Thermal Resistance Junction-to-Case | SOT26 | Note 7 | — | 46 | — | $^{\circ}C/W$ |
| | | SOT363 | | — | 143 | — | |
| | | SOT563 | | — | 96 | — | |
| | | DFN1410 | | — | 190 | — | |
| | | DFN1409 | | — | 200 | — | |
| | | DFN1010 | | — | 250 | — | |

Note: 7. Test condition for SOT26, SOT363, DFN1410, DFN1409 and DFN1010: Device mounted on FR-4 substrate PCB, 2oz copper with minimum recommended pad layout.

Switching Characteristics ($V_{CC(A)} = 1.8V \pm 0.15V$, $T_A = -40^{\circ}C$ to $+85^{\circ}C$, see Figure 1)

| Parameter | From (Input) | To (Output) | $V_{CC(B)} = 1.8V \pm 0.15V$ | | $V_{CC(B)} = 2.5V \pm 0.2V$ | | $V_{CC(B)} = 3.3V \pm 0.3V$ | | $V_{CC(B)} = 5V \pm 0.5V$ | | Unit |
|-----------|--------------|-------------|------------------------------|------|-----------------------------|------|-----------------------------|------|---------------------------|------|------|
| | | | Min | Max | Min | Max | Min | Max | Min | Max | |
| t_{pLH} | A | B | 3 | 17.7 | 2.2 | 10.3 | 1.7 | 8.3 | 1.4 | 7.5 | ns |
| t_{pHL} | | | 2.8 | 14.3 | 2.2 | 8.5 | 1.8 | 8.1 | 1.7 | 7.5 | |
| t_{pLH} | B | A | 3 | 17.7 | 2.3 | 16 | 2.1 | 15.5 | 1.9 | 15.1 | ns |
| t_{pHL} | | | 2.8 | 14.3 | 2.1 | 12.9 | 2 | 12.6 | 1.8 | 12.2 | |
| t_{pHZ} | DIR | A | 5.2 | 19.4 | 4.8 | 18.5 | 4.7 | 18.4 | 5.1 | 17.1 | ns |
| t_{pLZ} | | | 2.3 | 10.5 | 2.1 | 10.5 | 2.4 | 10.7 | 3.1 | 10.9 | |
| t_{pHZ} | DIR | B | 6.4 | 21.9 | 4.9 | 11.5 | 4.6 | 10.3 | 2.8 | 8.2 | ns |
| t_{pLZ} | | | 4.2 | 17 | 3.7 | 9.6 | 3.3 | 8.8 | 2.4 | 8.0 | |
| t_{pZH} | DIR | A | — | 33.7 | — | 25.2 | — | 23.9 | — | 21.5 | ns |
| t_{pZL} | | | — | 36.2 | — | 24.4 | — | 22.9 | — | 20.4 | |
| t_{pZH} | DIR | B | — | 28.2 | — | 20.8 | — | 19 | — | 18.1 | ns |
| t_{pZL} | | | — | 33.7 | — | 27 | — | 25.5 | — | 24.1 | |

Switching Characteristics (continued) ($V_{CC(A)} = 2.5V \pm 0.2V$, $T_A = -40^{\circ}C$ to $+85^{\circ}C$, see Figure 1)

| Parameter | From (Input) | To (Output) | $V_{CC(B)} = 1.8V \pm 0.15V$ | | $V_{CC(B)} = 2.5V \pm 0.2V$ | | $V_{CC(B)} = 3.3V \pm 0.3V$ | | $V_{CC(B)} = 5V \pm 0.5V$ | | Unit |
|-----------|--------------|-------------|------------------------------|------|-----------------------------|------|-----------------------------|------|---------------------------|------|------|
| | | | Min | Max | Min | Max | Min | Max | Min | Max | |
| t_{pLH} | A | B | 2.3 | 16 | 1.5 | 8.5 | 1.3 | 6.4 | 1.1 | 5.1 | ns |
| t_{pHL} | | | 2.1 | 12.9 | 1.4 | 7.5 | 1.3 | 5.4 | 0.9 | 4.6 | |
| t_{pLH} | B | A | 2.2 | 10.3 | 1.5 | 8.5 | 1.4 | 8 | 1 | 7.5 | ns |
| t_{pHL} | | | 2.2 | 8.5 | 1.4 | 7.5 | 1.3 | 7 | 0.9 | 6.2 | |
| t_{pHZ} | DIR | A | 3 | 8.1 | 3.1 | 8.1 | 2.8 | 8.1 | 3.2 | 8.1 | ns |
| t_{pLZ} | | | 1.3 | 5.9 | 1.3 | 5.9 | 1.3 | 5.9 | 1 | 5.8 | |
| t_{pHZ} | DIR | B | 5.5 | 23.7 | 3.6 | 11.4 | 3.5 | 10.2 | 2.4 | 7.1 | ns |
| t_{pLZ} | | | 3.9 | 18.9 | 3.2 | 9.6 | 2.8 | 8.4 | 1.8 | 5.3 | |
| t_{pZH} | DIR | A | — | 29.2 | — | 18.1 | — | 16.4 | — | 12.8 | ns |
| t_{pZL} | | | — | 32.2 | — | 18.9 | — | 17.2 | — | 13.3 | |
| t_{pZH} | DIR | B | — | 21.9 | — | 14.4 | — | 12.3 | — | 10.9 | ns |

Switching Characteristics (continued) ($V_{CC}(A) = 3.3V \pm 0.3V$, $T_A = -40^\circ C$ to $+85^\circ C$, see Figure 1)

| Parameter | From (Input) | To (Output) | $V_{CC}(B) = 1.8V \pm 0.15V$ | | $V_{CC}(B) = 2.5V \pm 0.2V$ | | $V_{CC}(B) = 3.3V \pm 0.3V$ | | $V_{CC}(B) = 5V \pm 0.5V$ | | Unit |
|-----------|--------------|-------------|------------------------------|------|-----------------------------|------|-----------------------------|------|---------------------------|------|------|
| | | | Min | Max | Min | Max | Min | Max | Min | Max | |
| t_{pLH} | A | B | 2.1 | 15.5 | 1.4 | 8 | 0.7 | 5.8 | 0.7 | 4.4 | ns |
| t_{pHL} | | | 2 | 12.6 | 1.3 | 7 | 0.8 | 5 | 0.7 | 4 | |
| t_{pLH} | B | A | 1.7 | 8.3 | 1.3 | 6.4 | 0.7 | 5.8 | 0.6 | 5.4 | ns |
| t_{pHL} | | | 1.8 | 7.1 | 1.3 | 5.4 | 0.8 | 5 | 0.7 | 4.5 | |
| t_{pHZ} | DIR | A | 2.9 | 7.3 | 3 | 7.3 | 2.8 | 7.3 | 3.4 | 7.3 | ns |
| t_{pLZ} | | | 1.8 | 5.6 | 1.6 | 5.6 | 2.2 | 5.7 | 2.2 | 5.7 | |
| t_{pHZ} | DIR | B | 4.0 | 20.5 | 3.5 | 10.1 | 2.9 | 8.8 | 2.4 | 6.8 | ns |
| t_{pLZ} | | | 3.3 | 14.5 | 2.9 | 7.8 | 2.4 | 7.1 | 1.7 | 4.9 | |
| t_{pZH} | DIR | A | — | 22.8 | — | 14.2 | — | 12.9 | — | 10.3 | ns |
| t_{pZL} | | | — | 27.6 | — | 15.5 | — | 13.8 | — | 11.3 | |
| t_{pZH} | DIR | B | — | 21.1 | — | 13.6 | — | 11.5 | — | 10.1 | ns |
| t_{pZL} | | | — | 19.9 | — | 14.3 | — | 12.3 | — | 11.3 | |

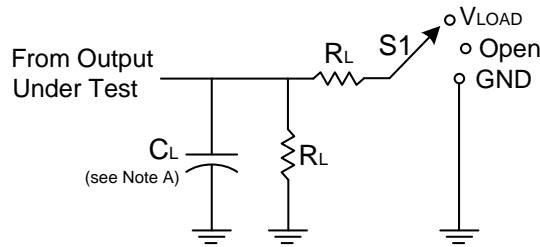
Switching Characteristics (continued) ($V_{CC}(A) = 5V \pm 0.5V$, $T_A = -40^\circ C$ to $+85^\circ C$, see Figure 1)

| Parameter | From (Input) | To (Output) | $V_{CC}(B) = 1.8V \pm 0.15V$ | | $V_{CC}(B) = 2.5V \pm 0.2V$ | | $V_{CC}(B) = 3.3V \pm 0.3V$ | | $V_{CC}(B) = 5V \pm 0.5V$ | | Unit |
|-----------|--------------|-------------|------------------------------|------|-----------------------------|------|-----------------------------|------|---------------------------|-----|------|
| | | | Min | Max | Min | Max | Min | Max | Min | Max | |
| t_{pLH} | A | B | 1.9 | 15.1 | 1 | 7.5 | 0.6 | 5.4 | 0.5 | 3.9 | ns |
| t_{pHL} | | | 1.8 | 12.2 | 0.9 | 6.2 | 0.7 | 4.5 | 0.5 | 3.5 | |
| t_{pLH} | B | A | 1.4 | 8.5 | 1 | 5.1 | 0.7 | 4.4 | 0.5 | 3.9 | ns |
| t_{pHL} | | | 1.7 | 8.5 | 0.9 | 4.6 | 0.7 | 4 | 0.5 | 3.5 | |
| t_{pHZ} | DIR | A | 2.1 | 5.4 | 2.2 | 5.4 | 2.2 | 5.5 | 2.2 | 5.4 | ns |
| t_{pLZ} | | | 0.9 | 3.8 | 1 | 3.8 | 1 | 3.7 | 0.9 | 3.7 | |
| t_{pHZ} | DIR | B | 4.8 | 20.2 | 2.5 | 9.8 | 1 | 8.5 | 2.2 | 6.5 | ns |
| t_{pLZ} | | | 4.2 | 14.8 | 2.5 | 7.4 | 2.5 | 7 | 1.6 | 4.5 | |
| t_{pZH} | DIR | A | — | 22 | — | 12.5 | — | 11.4 | — | 8.4 | ns |
| t_{pZL} | | | — | 27.2 | — | 14.4 | — | 12.5 | — | 10 | |
| t_{pZH} | DIR | B | — | 18.9 | — | 11.3 | — | 9.1 | — | 7.6 | ns |

Operating Characteristics ($T_A = +25^\circ C$, unless otherwise specified.)

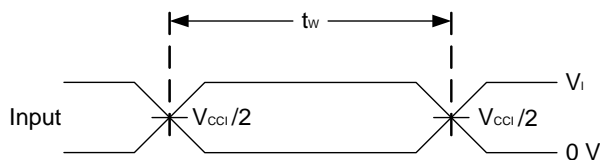
| Parameter | | Test Conditions | $V_{CC}(A) = V_{CC}(B) = 1.8V$ | $V_{CC}(A) = V_{CC}(B) = 2.5V$ | $V_{CC}(A) = V_{CC}(B) = 3.3V$ | $V_{CC}(A) = V_{CC}(B) = 5V$ | Unit |
|-------------------------------|---------------------|--|--------------------------------|--------------------------------|--------------------------------|------------------------------|------|
| Power Dissipation Capacitance | | | Typ | Typ | Typ | Typ | |
| $C_{pd}(A)$ | A- Input, B- Output | $C_L = 0 pF$ $f = 10 MHz$ $t_r = t_f = 1 ns$ | 3 | 4 | 4 | 4 | pF |
| | B- Input, A- Output | | 18 | 19 | 20 | 21 | |
| $C_{pd}(B)$ | A- Input, B- Output | $C_L = 0 pF$ $f = 10 MHz$ $t_r = t_f = 1 ns$ | 18 | 19 | 20 | 21 | pF |
| | B- Input, A- Output | | 3 | 4 | 4 | 4 | |

Parameter Measurement Information

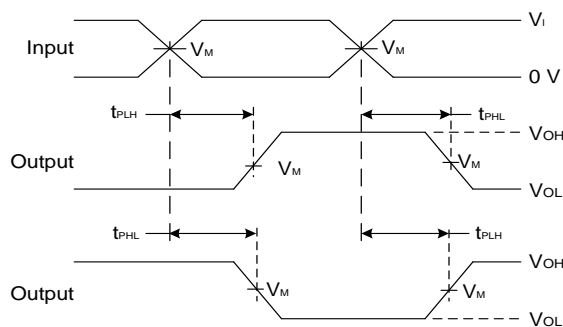


| TEST | S1 |
|-------------------|------------|
| t_{PLH}/t_{PHL} | Open |
| t_{PLZ}/t_{PZL} | V_{LOAD} |
| t_{PHZ}/t_{PZH} | GND |

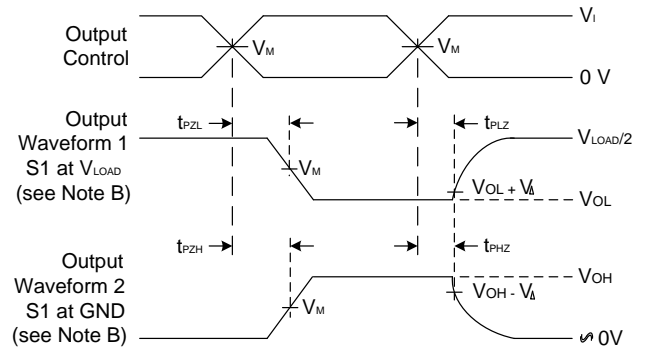
| V_{CC} | Inputs | | V_M | V_{LOAD} | C_L | R_L | V_{Δ} |
|------------------|-----------|--------------|-------------|--------------------|-------|-------------|--------------|
| | V_I | t_r/t_f | | | | | |
| $1.8V \pm 0.15V$ | V_{CCI} | $\leq 2ns$ | $V_{CCO}/2$ | $2 \times V_{CCO}$ | 15pF | 2K Ω | 0.15V |
| $2.5V \pm 0.2V$ | V_{CC} | $\leq 2ns$ | $V_{CCO}/2$ | $2 \times V_{CCO}$ | 15pF | 2K Ω | 0.15V |
| $3.3V \pm 0.3V$ | 3V | $\leq 2.5ns$ | $V_{CCO}/2$ | $2 \times V_{CCO}$ | 15pF | 2K Ω | 0.3V |
| $5V \pm 0.5V$ | V_{CC} | $\leq 2.5ns$ | $V_{CCO}/2$ | $2 \times V_{CCO}$ | 15pF | 2K Ω | 0.3V |



Voltage Waveform Pulse Duration



**Voltage Waveform Propagation Delay Times
Inverting and Non Inverting Outputs**

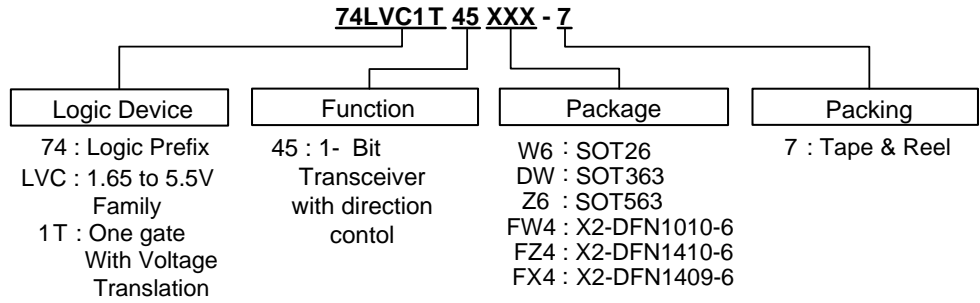


**Voltage Waveform Enable and Disable Times
Low and High Level Enabling**

Figure 1 Load Circuit and Voltage Waveforms

- Notes:
- Includes test lead and test apparatus capacitance.
 - Waveform 1 is for an output with input set up as a low and device coming out or into 3-state via DIR control. Waveform 2 is for an output with input set up as a high and device coming out or into 3-state via DIR control.
 - All pulses are supplied at pulse repetition rate ≤ 10 MHz.
 - t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - t_{PZL} and t_{PZH} are the same as t_{EN} .
 - t_{PLH} and t_{PHL} are the same as t_{PD} .
 - V_{CCI} is the V_{CC} associated with the input.
 - V_{CCO} is the V_{CC} associated with the output.

Ordering Information

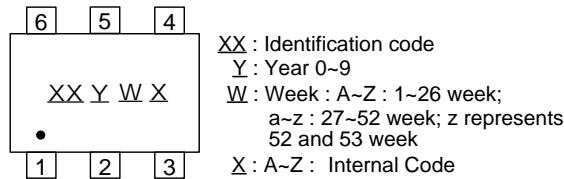


| Part Number | Package Code | Packaging | 7" Tape and Reel (Note 7) | |
|----------------|--------------|--------------|---------------------------|--------------------|
| | | | Quantity | Part Number Suffix |
| 74LVC1T45W6-7 | W6 | SOT26 | 3000/Tape & Reel | -7 |
| 74LVC1T45DW-7 | DW | SOT363 | 3000/Tape & Reel | -7 |
| 74LVC1T45Z6-7 | Z6 | SOT563 | 4000/Tape & Reel | -7 |
| 74LVC1T45FW4-7 | FW4 | X2-DFN1010-6 | 5000/Tape & Reel | -7 |
| 74LVC1T45FZ4-7 | FZ4 | X2-DFN1410-6 | 5000/Tape & Reel | -7 |
| 74LVC1T45FX4-7 | FX4 | X2-DFN1409-6 | 5000/Tape & Reel | -7 |

Note: 16. The taping orientation is located on our website at <http://www.diodes.com/package-outlines.html>.

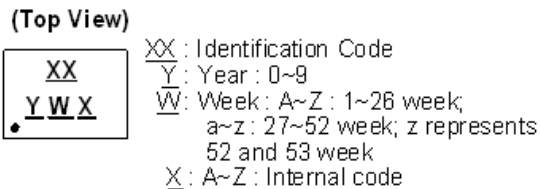
Marking Information

(1) SOT363, SOT563



| Part Number | Package | Identification Code |
|-------------|---------|---------------------|
| 74LVC1T45W6 | SOT26 | TT |
| 74LVC1T45DW | SOT363 | TR |
| 74LVC1T45Z6 | SOT563 | TS |

(2) X2-DFN1010-6, X2-DFN1410-6, and X2-DFN1409-6

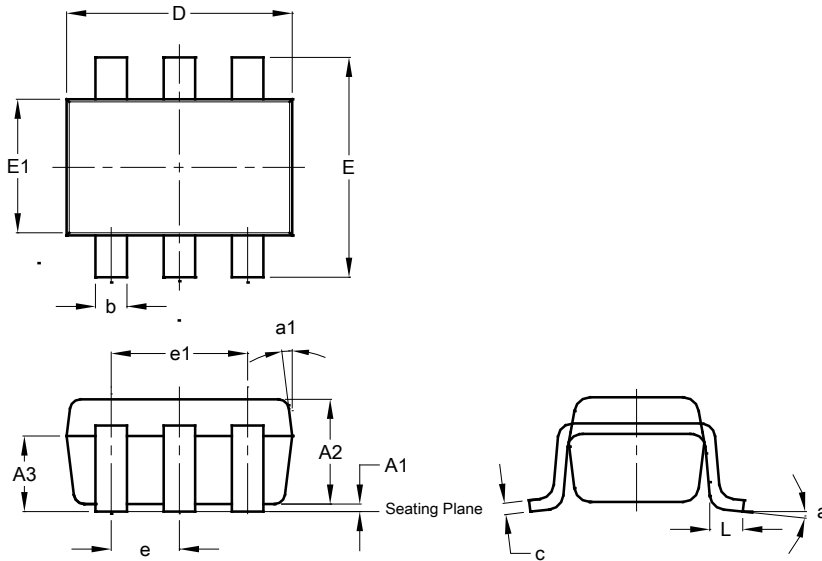


| Part Number | Package | Identification Code |
|--------------|--------------|---------------------|
| 74LVC1T45FW4 | X2-DFN1010-6 | TR |
| 74LVC1T45FX4 | X2-DFN1409-6 | TT |
| 74LVC1T45FZ4 | X2-DFN1410-6 | TS |

Package Outline Dimensions (All dimensions in mm.)

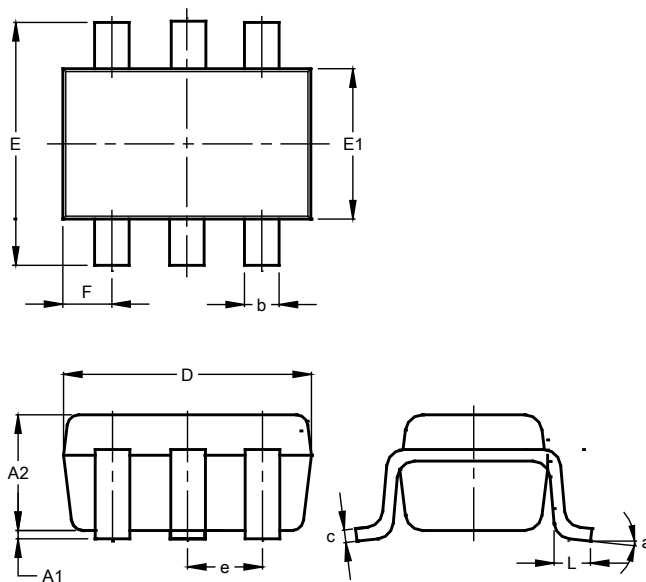
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(1) Package Type: SOT26



| SOT26 (SC74R) | | | |
|----------------------|-------|------|------|
| Dim | Min | Max | Typ |
| A1 | 0.013 | 0.10 | 0.05 |
| A2 | 1.00 | 1.30 | 1.10 |
| A3 | 0.70 | 0.80 | 0.75 |
| b | 0.35 | 0.50 | 0.38 |
| c | 0.10 | 0.20 | 0.15 |
| D | 2.90 | 3.10 | 3.00 |
| e | — | — | 0.95 |
| e1 | — | — | 1.90 |
| E | 2.70 | 3.00 | 2.80 |
| E1 | 1.50 | 1.70 | 1.60 |
| L | 0.35 | 0.55 | 0.40 |
| a | — | — | 8° |
| a1 | — | — | 7° |
| All Dimensions in mm | | | |

(2) Package Type: SOT363

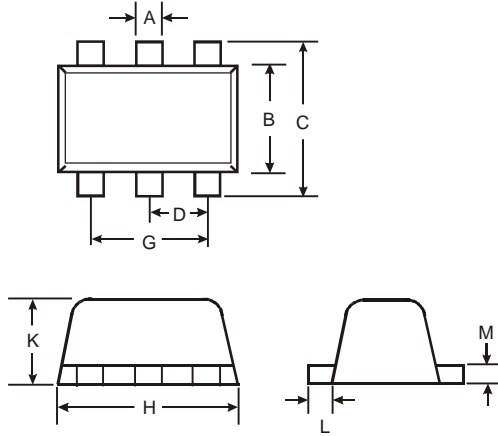


| SOT363 | | | |
|----------------------|-----------|------|-------|
| Dim | Min | Max | Typ |
| A1 | 0.00 | 0.10 | 0.05 |
| A2 | 0.90 | 1.00 | 0.95 |
| b | 0.10 | 0.30 | 0.25 |
| c | 0.10 | 0.22 | 0.11 |
| D | 1.80 | 2.20 | 2.15 |
| E | 2.00 | 2.20 | 2.10 |
| E1 | 1.15 | 1.35 | 1.30 |
| e | 0.650 BSC | | |
| F | 0.40 | 0.45 | 0.425 |
| L | 0.25 | 0.40 | 0.30 |
| a | 0° | 8° | — |
| All Dimensions in mm | | | |

Package Outline Dimensions (All dimensions in mm.)

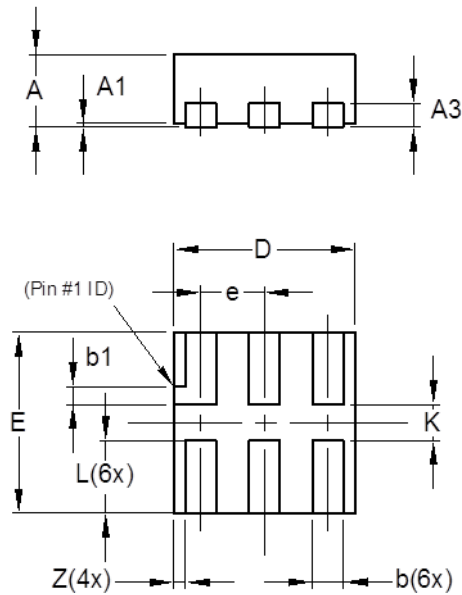
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(3) Package Type: SOT563



| SOT563 | | | |
|----------------------|------|------|------|
| Dim | Min | Max | Typ |
| A | 0.15 | 0.30 | 0.20 |
| B | 1.10 | 1.25 | 1.20 |
| C | 1.55 | 1.70 | 1.60 |
| D | — | — | 0.50 |
| G | 0.90 | 1.10 | 1.00 |
| H | 1.50 | 1.70 | 1.60 |
| K | 0.55 | 0.60 | 0.60 |
| L | 0.10 | 0.30 | 0.20 |
| M | 0.10 | 0.18 | 0.11 |
| All Dimensions in mm | | | |

(4) Package Type X2-DFN1010-6

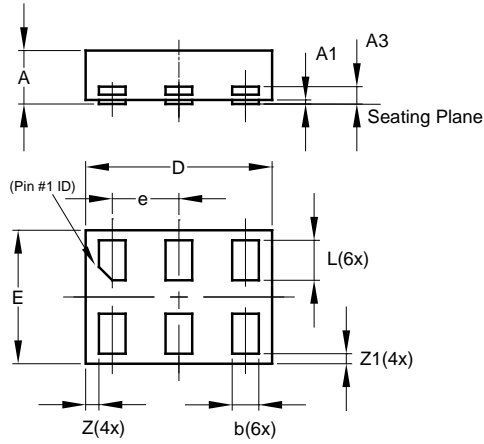


| X2-DFN1010-6 | | | |
|----------------------|------|------|-------|
| Dim | Min | Max | Typ |
| A | — | 0.40 | 0.39 |
| A1 | 0.00 | 0.05 | 0.02 |
| A3 | — | — | 0.13 |
| b | 0.14 | 0.20 | 0.17 |
| b1 | 0.05 | 0.15 | 0.10 |
| D | 0.95 | 1.05 | 1.00 |
| E | 0.95 | 1.05 | 1.00 |
| e | — | — | 0.35 |
| L | 0.35 | 0.45 | 0.40 |
| K | 0.15 | — | — |
| Z | — | — | 0.065 |
| All Dimensions in mm | | | |

Package Outline Dimensions (All dimensions in mm.)

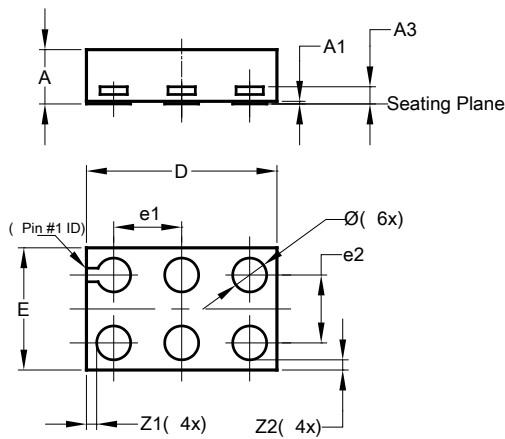
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(5) Package Type: X2-DFN1410-6



| X2-DFN1410-6 | | | |
|----------------------|-------|-------|-------|
| Dim | Min | Max | Typ |
| A | — | 0.40 | 0.39 |
| A1 | 0.00 | 0.05 | 0.02 |
| A3 | — | — | 0.13 |
| b | 0.15 | 0.25 | 0.20 |
| D | 1.35 | 1.45 | 1.40 |
| E | 0.95 | 1.05 | 1.00 |
| e | — | — | 0.50 |
| L | 0.25 | 0.35 | 0.30 |
| Z | — | — | 0.10 |
| Z1 | 0.045 | 0.105 | 0.075 |
| All Dimensions in mm | | | |

(6) Package Type: X2-DFN1409-6

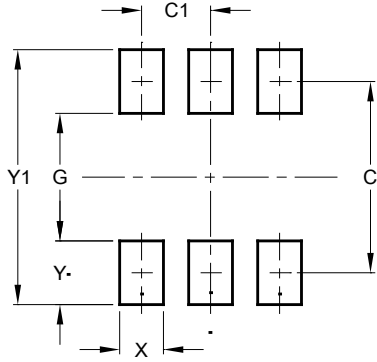


| X2-DFN1409-6 | | | |
|----------------------|------|------|-------|
| Dim | Min | Max | Typ |
| A | - | 0.40 | 0.39 |
| A1 | 0 | 0.05 | 0.02 |
| A3 | - | - | 0.13 |
| Ø | 0.20 | 0.30 | 0.25 |
| D | 1.35 | 1.45 | 1.40 |
| E | 0.85 | 0.95 | 0.90 |
| e1 | - | - | 0.50 |
| e2 | - | - | 0.50 |
| Z1 | - | - | 0.075 |
| Z2 | - | - | 0.075 |
| All Dimensions in mm | | | |

Suggested Pad Layout

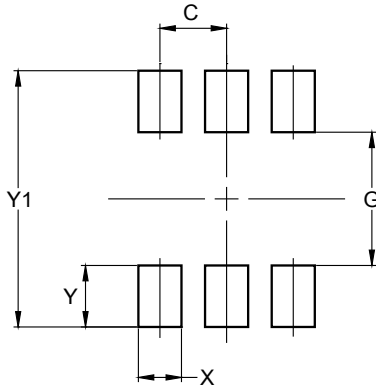
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(1) Package Type: SOT26



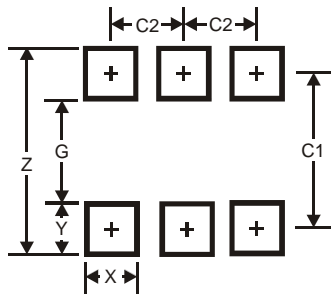
| Dimensions | Value (in mm) |
|------------|---------------|
| C | 2.40 |
| C1 | 0.95 |
| G | 1.60 |
| X | 0.55 |
| Y | 0.80 |
| Y1 | 3.20 |

(2) Package Type: SOT363



| Dimensions | Value (in mm) |
|------------|---------------|
| C | 0.650 |
| G | 1.300 |
| X | 0.420 |
| Y | 0.600 |
| Y1 | 2.500 |

(3) Package Type: SOT563

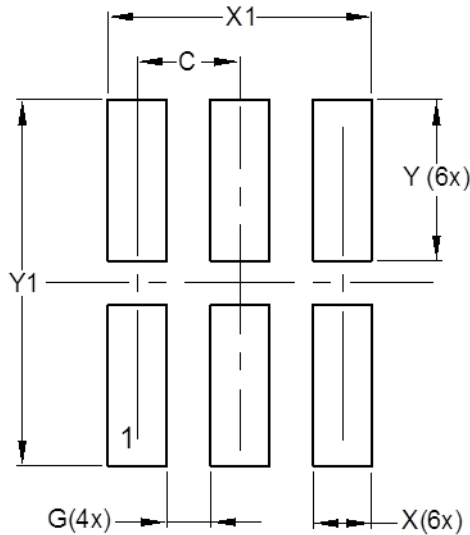


| Dimensions | SOT563 |
|------------|--------|
| Z | 2.2 |
| G | 1.2 |
| X | 0.375 |
| Y | 0.5 |
| C1 | 1.7 |
| C2 | 0.5 |

Suggested Pad Layout

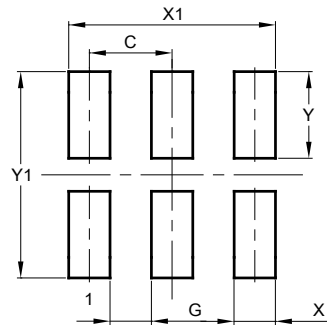
Please see <http://www.diodes.com/package-outlines.html> for the latest version.

(4) Package Type X2-DFN1010-6



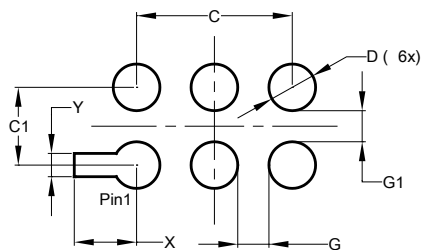
| Dimensions | Value (in mm) |
|------------|---------------|
| C | 0.350 |
| G | 0.150 |
| X | 0.200 |
| X1 | 0.900 |
| Y | 0.550 |
| Y1 | 1.250 |

(5) Package Type: X2-DFN1410-6



| Dimension s | Value (in mm) |
|-------------|---------------|
| C | 0.500 |
| G | 0.250 |
| X | 0.250 |
| X1 | 1.250 |
| Y | 0.525 |
| Y1 | 1.250 |

(6) Package Type: X2-DFN1409-6



| Dimensions | Value (in mm) |
|------------|---------------|
| C | 1.000 |
| C1 | 0.500 |
| D | 0.300 |
| G | 0.200 |
| G1 | 0.200 |
| X | 0.400 |
| Y | 0.150 |

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