

# ESD Protection Diode

## Low Clamping Voltage

### NUP4114 Series

The NUP4114 ESD protection diode array is designed to protect high speed data lines from ESD. Ultra-low capacitance and high level of ESD protection make these devices well suited for use in USB 2.0 high speed applications.

#### Features

- Low Clamping Voltage
- Low Capacitance (<0.6 pF Typical, I/O to GND)
- Low Leakage
- Response Time is Typically < 1.0 ns
- IEC61000-4-2 Level 4 ESD Protection
- SZ Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

#### Typical Applications

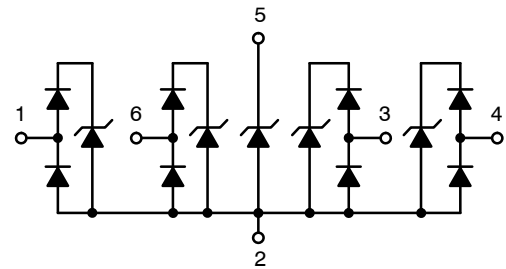
- LVDS
- USB 2.0 High Speed Data Line and Power Line Protection
- Digital Video Interface (DVI) and HDMI
- Gigabit Ethernet
- Monitors and Flat Panel Displays
- Notebook Computers

#### MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise noted)

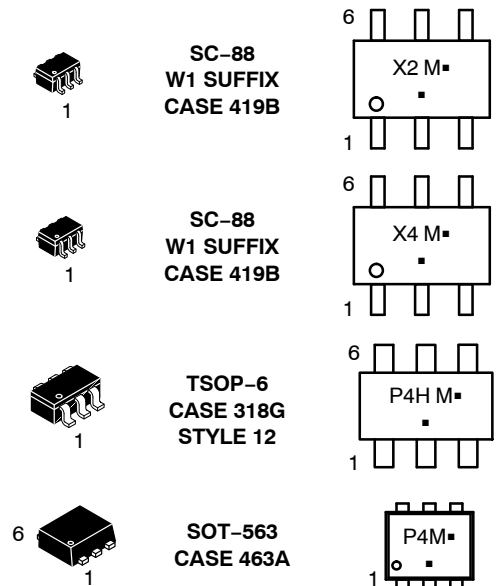
| Rating   | Symbol           | Value       | Unit |
|--|------------------|-------------|------|
| Operating Junction Temperature Range           | T <sub>J</sub>   | -40 to +125 | °C   |
| Storage Temperature Range                      | T <sub>stg</sub> | -55 to +150 | °C   |
| Lead Solder Temperature – Maximum (10 Seconds) | T <sub>L</sub>   | 260         | °C   |
| IEC 61000-4-2 Contact                          | ESD              | ±8          | kV   |
| IEC 61000-4-2 Air                              |                  | ±15         |      |
| ISO 10605 330 pF / 330 Ω Contact               |                  | ±10         |      |
| ISO 10605 330 pF / 2 kΩ Contact                |                  | ±21         |      |
| ISO 10605 150 pF / 2 kΩ Contact                |                  | ±30         |      |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

See Application Note [AND8308/D](#) for further description of survivability specs.



#### MARKING DIAGRAMS



XXX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package  
(Note: Microdot may be in either location)

#### ORDERING INFORMATION

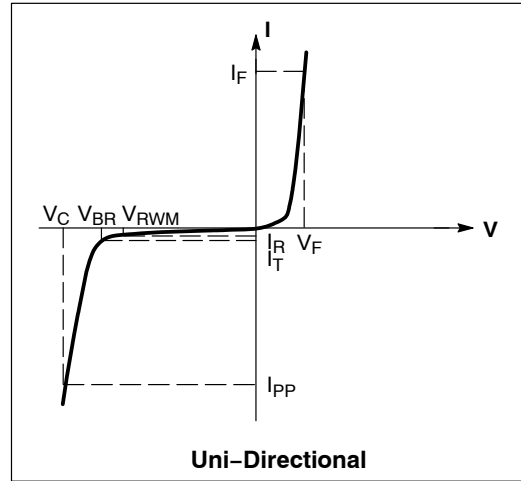
See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

# NUP4114 Series

## ELECTRICAL CHARACTERISTICS

( $T_A = 25^\circ\text{C}$  unless otherwise noted)

| Symbol    | Parameter                                   |
|-----------|---|
| $I_{PP}$  | Maximum Reverse Peak Pulse Current          |
| $V_C$     | Clamping Voltage @ $I_{PP}$                 |
| $V_{RWM}$ | Working Peak Reverse Voltage                |
| $I_R$     | Maximum Reverse Leakage Current @ $V_{RWM}$ |
| $V_{BR}$  | Breakdown Voltage @ $I_T$                   |
| $I_T$     | Test Current                                |
| $I_F$     | Forward Current                             |
| $V_F$     | Forward Voltage @ $I_F$                     |
| $P_{pk}$  | Peak Power Dissipation                      |
| C         | Capacitance @ $V_R = 0$ and $f = 1.0$ MHz   |



\*See Application Note AND8308/D for detailed explanations of datasheet parameters.

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

| Parameter                  | Symbol    | Conditions  | Min               | Typ | Max | Unit          |
|----------------------------|-----------|---|-------------------|-----|-----|---------------|
| Reverse Working Voltage    | $V_{RWM}$ |   |                   |     | 5.5 | V             |
| Breakdown Voltage          | $V_{BR}$  | $I_T = 1$ mA, (Note 1)                            | 5.5               | 6.5 |     | V             |
| Reverse Leakage Current    | $I_R$     | $V_{RWM} = 5.5$ V                                 |                   |     | 1.0 | $\mu\text{A}$ |
| Clamping Voltage           | $V_C$     | $I_{PP} = 1$ A (Note 2)                           |                   | 8.3 | 10  | V             |
|                            |           | $I_{PP} = 5$ A (Note 3)                           |                   | 8.5 | 9.0 | V             |
|                            |           | $I_{PP} = 8$ A (Note 3)                           |                   | 9.2 | 10  | V             |
| ESD Clamping Voltage       | $V_C$     | Per IEC61000-4-2 (Note 4)                         | See Figures 1 & 2 |     |     |               |
| Maximum Peak Pulse Current | $I_{PP}$  | 8/20 $\mu\text{s}$ Waveform (Note 3)              |                   |     | 12  | A             |
| Junction Capacitance       | $C_J$     | $V_R = 0$ V, $f = 1$ MHz between I/O Pins and GND |                   |     | 0.6 | pF            |
|                            |           | $V_R = 0$ V, $f = 1$ MHz between I/O Pins         |                   |     | 0.3 | pF            |

- $V_{BR}$  is measured at pulse test current  $I_T$ .
- Nonrepetitive current pulse (I/O to GND).
- Nonrepetitive current pulse (Pin 5 to Pin 2)
- For test procedure see Figures 3 and 4 and Application Note AND8307/D.

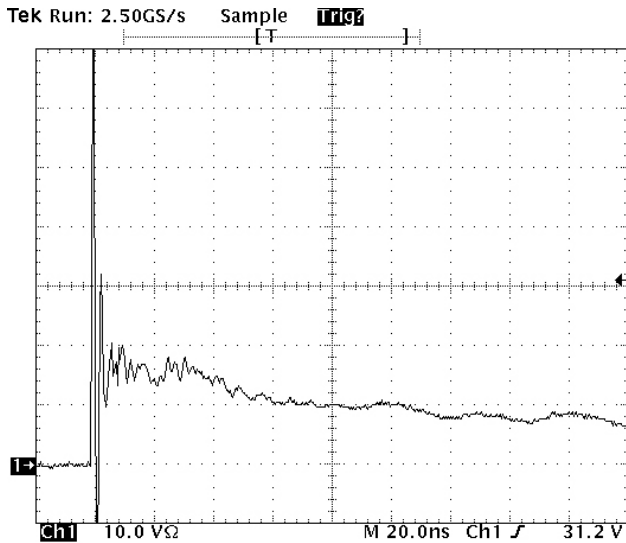


Figure 1. ESD Clamping Voltage Screenshot Positive 8 kV Contact per IEC61000-4-2

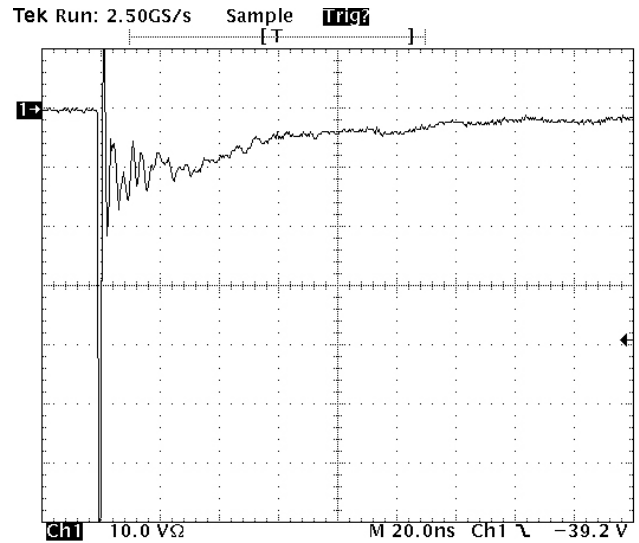


Figure 2. ESD Clamping Voltage Screenshot Negative 8 kV Contact per IEC61000-4-2

# NUP4114 Series

## IEC 61000-4-2 Spec.

| Level | Test Voltage (kV) | First Peak Current (A) | Current at 30 ns (A) | Current at 60 ns (A) |
|-------|-------------------|------------------------|----------------------|----------------------|
| 1     | 2                 | 7.5                    | 4                    | 2                    |
| 2     | 4                 | 15                     | 8                    | 4                    |
| 3     | 6                 | 22.5                   | 12                   | 6                    |
| 4     | 8                 | 30                     | 16                   | 8                    |



Figure 3. IEC61000-4-2 Spec

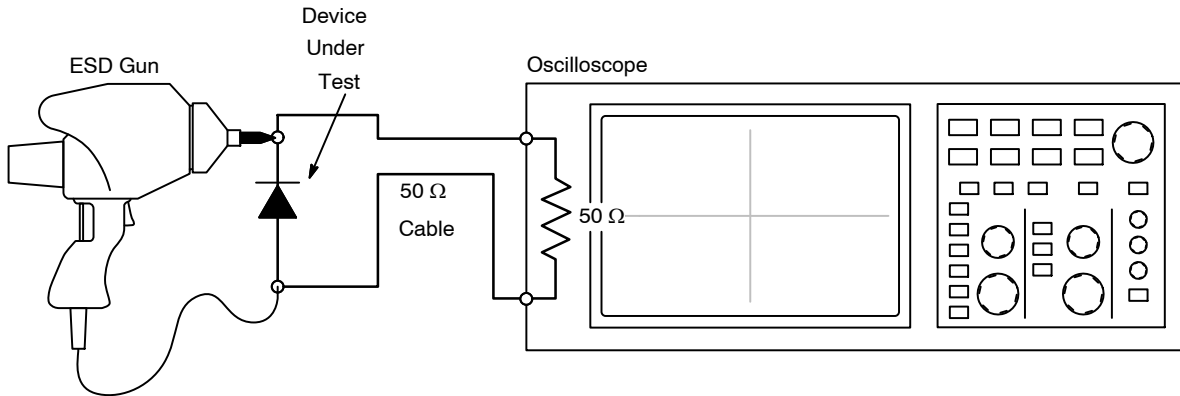


Figure 4. Diagram of ESD Test Setup

The following is taken from Application Note AND8308/D – Interpretation of Datasheet Parameters for ESD Devices.

### ESD Voltage Clamping

For sensitive circuit elements it is important to limit the voltage that an IC will be exposed to during an ESD event to as low a voltage as possible. The ESD clamping voltage is the voltage drop across the ESD protection diode during an ESD event per the IEC61000-4-2 waveform. Since the IEC61000-4-2 was written as a pass/fail spec for larger

systems such as cell phones or laptop computers it is not clearly defined in the spec how to specify a clamping voltage at the device level. ON Semiconductor has developed a way to examine the entire voltage waveform across the ESD protection diode over the time domain of an ESD pulse in the form of an oscilloscope screenshot, which can be found on the datasheets for all ESD protection diodes. For more information on how ON Semiconductor creates these screenshots and how to interpret them please refer to AND8307/D.

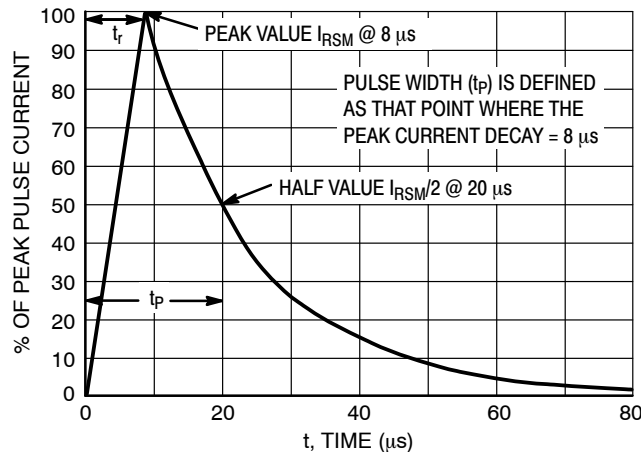


Figure 5. 8/20 μs Pulse Waveform

# NUP4114 Series

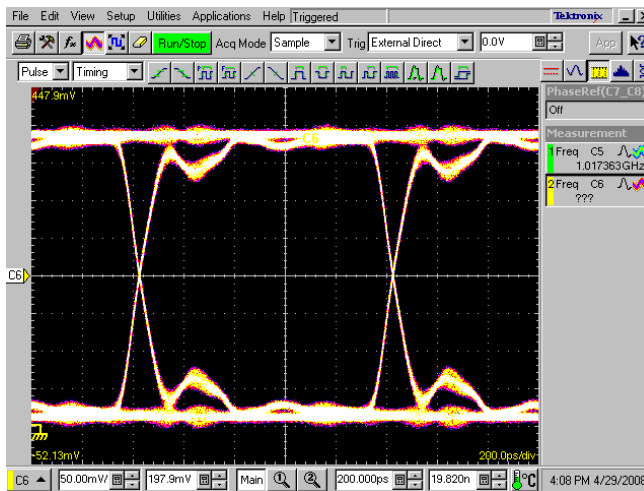


Figure 6. 500 MHz Data Pattern

## ORDERING INFORMATION

| Device           | Marking | Package              | Shipping†          |
|------------------|---------|----------------------|--------------------|
| NUP4114UCLW1T1G  | X2      | SC-88<br>(Pb-Free)   | 3000 / Tape & Reel |
| NUP4114UCLW1T2G  | X2      |                      |                    |
| SZNU4114UCLW1T2G | X2      |                      |                    |
| NUP4114UCW1T2G   | X4      |                      |                    |
| NUP4114UPXV6T1G  | P4      | SOT-563<br>(Pb-Free) | 4000 / Tape & Reel |
| NUP4114UPXV6T2G  |         |                      |                    |
| NUP4114HMR6T1G   | P4H     | TSOP-6<br>(Pb-Free)  | 3000 / Tape & Reel |
| SZNU4114HMR6T1G  | P4H     |                      |                    |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# NUP4114 Series

## APPLICATIONS INFORMATION

The new NUP4114 is a low capacitance ESD diode array designed to protect sensitive electronics such as communications systems, computers, and computer peripherals against damage due to ESD events or transient overvoltage conditions. Because of its low capacitance, it can be used in high speed I/O data lines. The integrated design of the NUP4114 offers low capacitance steering diodes and an ESD diode integrated in a single package (TSOP-6). If a transient condition occurs, the steering diodes will drive the transient to the positive rail of the power supply or to ground. This device protects the power line against overvoltage conditions to avoid damage to the power supply and any downstream components.

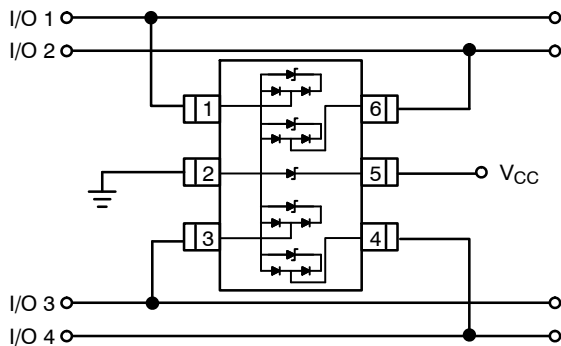
### NUP4114 Configuration Options

The NUP4114 is able to protect up to four data lines against transient overvoltage conditions by driving them to a fixed reference point for clamping purposes. The steering diodes will be forward biased whenever the voltage on the protected line exceeds the reference voltage ( $V_f$  or  $V_{CC} + V_f$ ). The diodes will force the transient current to bypass the sensitive circuit.

Data lines are connected at pins 1, 3, 4 and 6. The negative reference is connected at pin 2. This pin must be connected directly to ground by using a ground plane to minimize the PCB's ground inductance. It is very important to reduce the PCB trace lengths as much as possible to minimize parasitic inductances.

#### Option 1

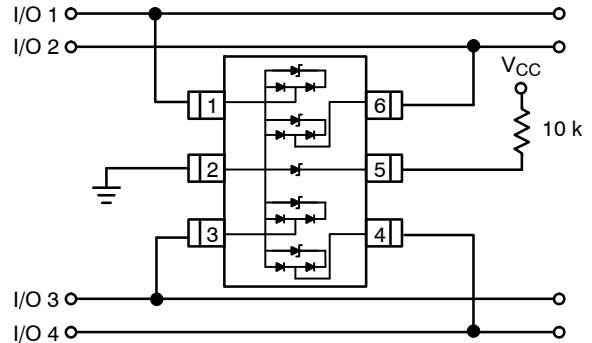
Protection of four data lines and the power supply using  $V_{CC}$  as reference.



For this configuration, connect pin 5 directly to the positive supply rail ( $V_{CC}$ ), the data lines are referenced to the supply voltage. The internal ESD diode prevents overvoltage on the supply rail.

#### Option 2

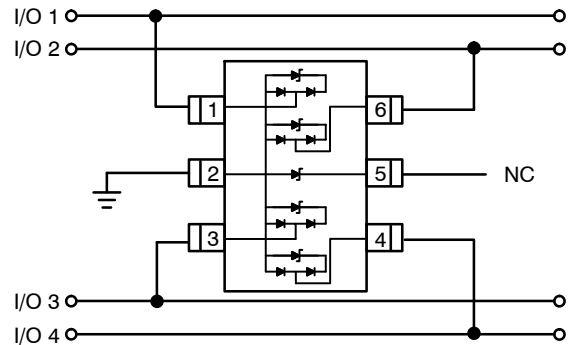
Protection of four data lines with bias and power supply isolation resistor.



The NUP4114 can be isolated from the power supply by connecting a series resistor between pin 5 and  $V_{CC}$ . A 10 kΩ resistor is recommended for this application.

#### Option 3

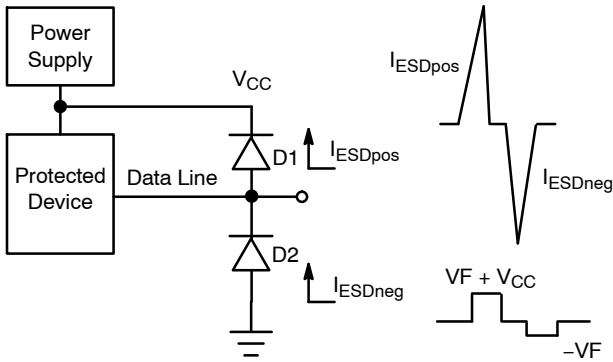
Protection of four data lines using the internal ESD diode as reference.



In applications lacking a positive supply reference or those cases in which a fully isolated power supply is required, the internal ESD can be used as the reference. For these applications, pin 5 is not connected. In this configuration, the steering diodes will conduct whenever the voltage on the protected line exceeds the working voltage of the ESD plus one diode drop ( $V_C = V_f + V_{ESD}$ ).

### ESD Protection of Power Supply Lines

When using diodes for data line protection, referencing to a supply rail provides advantages. Biasing the diodes reduces their capacitance and minimizes signal distortion. Implementing this topology with discrete devices does have disadvantages. This configuration is shown below:



Looking at the figure above, it can be seen that when a positive ESD condition occurs, diode D1 will be forward biased while diode D2 will be forward biased when a negative ESD condition occurs. For slower transient conditions, this system may be approximated as follows:

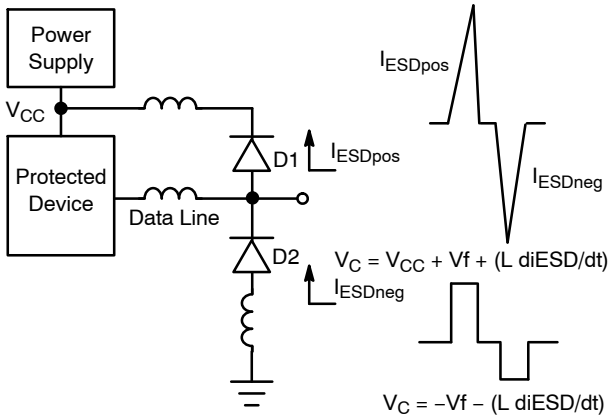
For positive pulse conditions:

$$V_c = V_{CC} + V_{fD1}$$

For negative pulse conditions:

$$V_c = -V_{fD2}$$

ESD events can have rise times on the order of some number of nanoseconds. Under these conditions, the effect of parasitic inductance must be considered. A pictorial representation of this is shown below.



An approximation of the clamping voltage for these fast transients would be:

For positive pulse conditions:

$$V_c = V_{CC} + V_f + (L \, di_{ESD}/dt)$$

For negative pulse conditions:

$$V_c = -V_f - (L \, di_{ESD}/dt)$$

As shown in the formulas, the clamping voltage ( $V_c$ ) not only depends on the  $V_f$  of the steering diodes but also on the  $L \, di_{ESD}/dt$  factor. A relatively small trace inductance can result in hundreds of volts appearing on the supply rail. This endangers both the power supply and anything attached to that rail. This highlights the importance of good board layout. Taking care to minimize the effects of parasitic

inductance will provide significant benefits in transient immunity.

Even with good board layout, some disadvantages are still present when discrete diodes are used to suppress ESD events across datalines and the supply rail. Discrete diodes with good transient power capability will have larger die and therefore higher capacitance. This capacitance becomes problematic as transmission frequencies increase. Reducing capacitance generally requires reducing die size. These small die will have higher forward voltage characteristics at typical ESD transient current levels. This voltage combined with the smaller die can result in device failure.

The **onsemi** NUP4114 was developed to overcome the disadvantages encountered when using discrete diodes for ESD protection. This device integrates an ESD diode within a network of steering diodes.

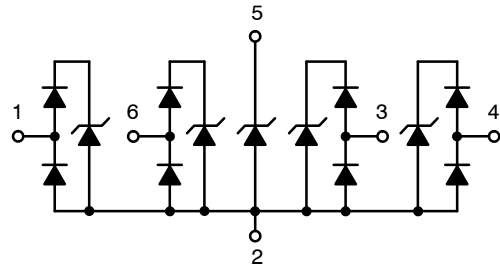
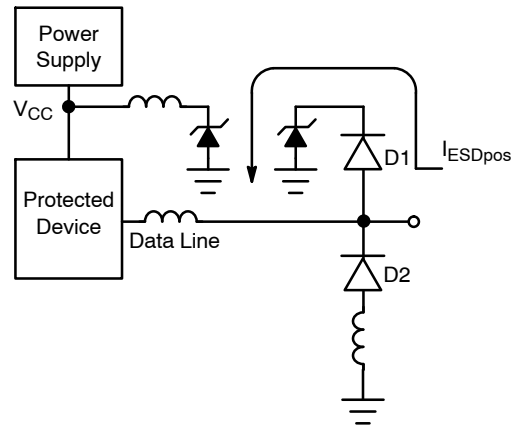


Figure 7. NUP4114 Equivalent Circuit

During an ESD condition, the ESD current will be driven to ground through the ESD diode as shown below.



The resulting clamping voltage on the protected IC will be:

$$V_c = V_f + V_{ESD}$$

The clamping voltage of the ESD diode depends on the magnitude of the ESD current. The steering diodes are fast switching devices with unique forward voltage and low capacitance characteristics.

# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

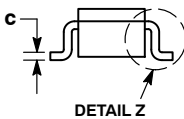
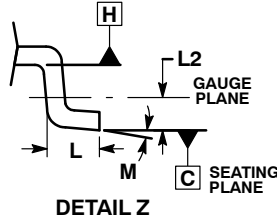
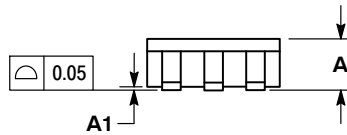
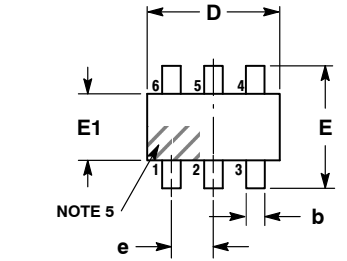
ON Semiconductor®



SCALE 2:1

### TSOP-6 CASE 318G-02 ISSUE V

DATE 12 JUN 2012



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSIONS D AND E1 ARE DETERMINED AT DATUM H.
5. PIN ONE INDICATOR MUST BE LOCATED IN THE INDICATED ZONE.

| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN         | NOM  | MAX  |
| A   | 0.90        | 1.00 | 1.10 |
| A1  | 0.01        | 0.06 | 0.10 |
| b   | 0.25        | 0.38 | 0.50 |
| c   | 0.10        | 0.18 | 0.26 |
| D   | 2.90        | 3.00 | 3.10 |
| E   | 2.50        | 2.75 | 3.00 |
| E1  | 1.30        | 1.50 | 1.70 |
| e   | 0.85        | 0.95 | 1.05 |
| L   | 0.20        | 0.40 | 0.60 |
| L2  | 0.25 BSC    |      |      |
| M   | 0°          | -    | 10°  |

STYLE 1:

1. DRAIN
2. DRAIN
3. GATE
4. SOURCE
5. DRAIN
6. DRAIN

STYLE 2:

1. EMITTER 2
2. BASE 1
3. COLLECTOR 1
4. EMITTER 1
5. BASE 2
6. COLLECTOR 2

STYLE 3:

1. ENABLE
2. N/C
3. R BOOST
4. Vz
5. V in
6. V out

STYLE 4:

1. N/C
2. V in
3. NOT USED
4. GROUND
5. ENABLE
6. LOAD

STYLE 5:

1. EMITTER 2
2. BASE 2
3. COLLECTOR 1
4. EMITTER 1
5. BASE 1
6. COLLECTOR 2

STYLE 6:

1. COLLECTOR
2. COLLECTOR
3. BASE
4. EMITTER
5. COLLECTOR
6. COLLECTOR

STYLE 7:

1. COLLECTOR
2. COLLECTOR
3. BASE
4. N/C
5. COLLECTOR
6. EMITTER

STYLE 8:

1. Vbus
2. D(in)
3. D(in)+
4. D(out)+
5. D(out)
6. GND

STYLE 9:

1. LOW VOLTAGE GATE
2. DRAIN
3. SOURCE
4. DRAIN
5. DRAIN
6. HIGH VOLTAGE GATE

STYLE 10:

1. D(OUT)+
2. GND
3. D(OUT)-
4. D(IN)-
5. VBUS
6. D(IN)+

STYLE 11:

1. SOURCE 1
2. DRAIN 2
3. DRAIN 2
4. SOURCE 2
5. GATE 1
6. DRAIN 1/GATE 2

STYLE 12:

1. I/O
2. GROUND
3. I/O
4. I/O
5. VCC
6. I/O

STYLE 13:

1. GATE 1
2. SOURCE 2
3. GATE 2
4. DRAIN 2
5. SOURCE 1
6. DRAIN 1

STYLE 14:

1. ANODE
2. SOURCE
3. GATE
4. CATHODE/DRAIN
5. CATHODE/DRAIN
6. CATHODE/DRAIN

STYLE 15:

1. ANODE
2. SOURCE
3. GATE
4. DRAIN
5. N/C
6. CATHODE

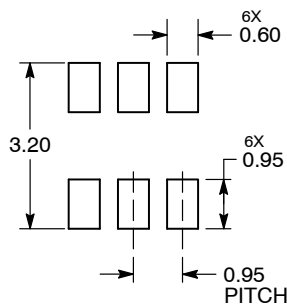
STYLE 16:

1. ANODE/CATHODE
2. BASE
3. EMITTER
4. COLLECTOR
5. ANODE
6. CATHODE

STYLE 17:

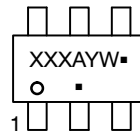
1. EMITTER
2. BASE
3. ANODE/CATHODE
4. ANODE
5. CATHODE
6. COLLECTOR

### RECOMMENDED SOLDERING FOOTPRINT\*

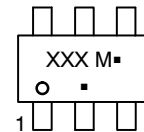


DIMENSIONS: MILLIMETERS

### GENERIC MARKING DIAGRAM\*



IC



STANDARD

- XXX = Specific Device Code
- A = Assembly Location
- Y = Year
- W = Work Week
- = Pb-Free Package

- XXX = Specific Device Code
- M = Date Code
- = Pb-Free Package

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

|                  |             |  |
|------------------|-------------|--|
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| DESCRIPTION:     | TSOP-6      | PAGE 1 OF 1  |

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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

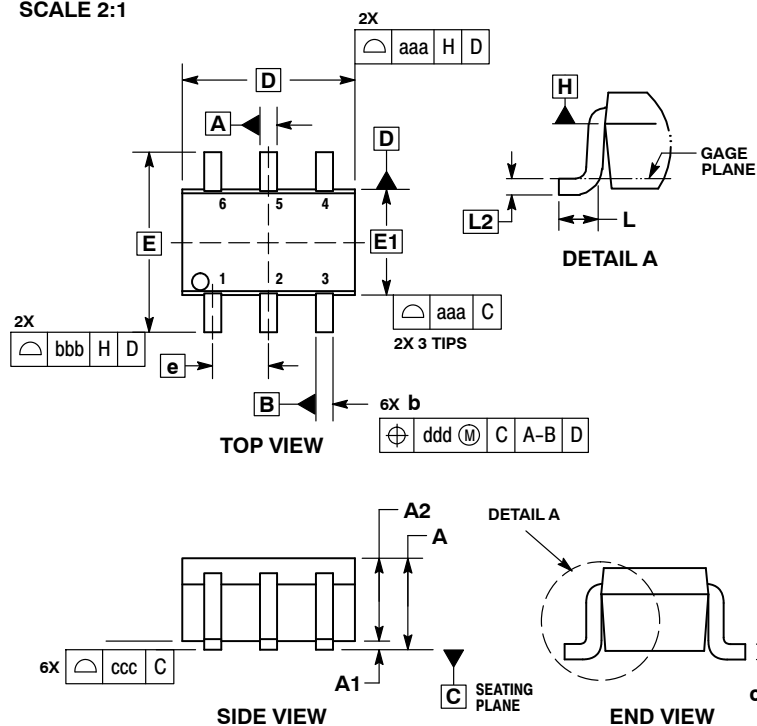
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1  
SCALE 2:1

SC-88/SC70-6/SOT-363  
CASE 419B-02  
ISSUE Y

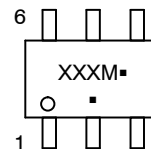
DATE 11 DEC 2012



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.20 PER END.
  4. DIMENSIONS D AND E1 AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AND DATUM H.
  5. DATUMS A AND B ARE DETERMINED AT DATUM H.
  6. DIMENSIONS b AND c APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.08 AND 0.15 FROM THE TIP.
  7. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 TOTAL IN EXCESS OF DIMENSION b AT MAXIMUM MATERIAL CONDITION. THE DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.

| DIM | MILLIMETERS |      |      | INCHES    |       |       |
|-----|-------------|------|------|-----------|-------|-------|
|     | MIN         | NOM  | MAX  | MIN       | NOM   | MAX   |
| A   | ---         | ---  | 1.10 | ---       | ---   | 0.043 |
| A1  | 0.00        | ---  | 0.10 | 0.000     | ---   | 0.004 |
| A2  | 0.70        | 0.90 | 1.00 | 0.027     | 0.035 | 0.039 |
| b   | 0.15        | 0.20 | 0.25 | 0.006     | 0.008 | 0.010 |
| C   | 0.08        | 0.15 | 0.22 | 0.003     | 0.006 | 0.009 |
| D   | 1.80        | 2.00 | 2.20 | 0.070     | 0.078 | 0.086 |
| E   | 2.00        | 2.10 | 2.20 | 0.078     | 0.082 | 0.086 |
| E1  | 1.15        | 1.25 | 1.35 | 0.045     | 0.049 | 0.053 |
| e   | 0.65 BSC    |      |      | 0.026 BSC |       |       |
| L   | 0.26        | 0.36 | 0.46 | 0.010     | 0.014 | 0.018 |
| L2  | 0.15 BSC    |      |      | 0.006 BSC |       |       |
| aaa | 0.15        |      |      | 0.006     |       |       |
| bbb | 0.30        |      |      | 0.012     |       |       |
| ccc | 0.10        |      |      | 0.004     |       |       |
| ddd | 0.10        |      |      | 0.004     |       |       |

### GENERIC MARKING DIAGRAM\*



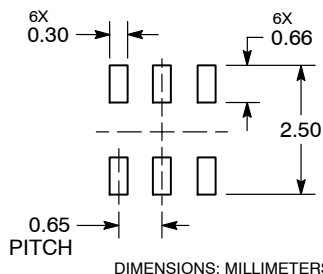
XXX = Specific Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation and/or position may vary depending upon manufacturing location.

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

### RECOMMENDED SOLDERING FOOTPRINT\*



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

### STYLES ON PAGE 2

|                  |                      |  |
|------------------|----------------------|--|
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| DESCRIPTION:     | SC-88/SC70-6/SOT-363 | PAGE 1 OF 2  |

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**SC-88/SC70-6/SOT-363**  
**CASE 419B-02**  
**ISSUE Y**

DATE 11 DEC 2012

|   |   |  |  |  |  |
|---|---|--|--|--|--|
| <b>STYLE 1:</b><br>PIN 1. EMITTER 2<br>2. BASE 2<br>3. COLLECTOR 1<br>4. EMITTER 1<br>5. BASE 1<br>6. COLLECTOR 2 | <b>STYLE 2:</b><br>CANCELLED  | <b>STYLE 3:</b><br>CANCELLED   | <b>STYLE 4:</b><br>PIN 1. CATHODE<br>2. CATHODE<br>3. COLLECTOR<br>4. EMITTER<br>5. BASE<br>6. ANODE               | <b>STYLE 5:</b><br>PIN 1. ANODE<br>2. ANODE<br>3. COLLECTOR<br>4. EMITTER<br>5. BASE<br>6. CATHODE                 | <b>STYLE 6:</b><br>PIN 1. ANODE 2<br>2. N/C<br>3. CATHODE 1<br>4. ANODE 1<br>5. N/C<br>6. CATHODE 2          |
| <b>STYLE 7:</b><br>PIN 1. SOURCE 2<br>2. DRAIN 2<br>3. GATE 1<br>4. SOURCE 1<br>5. DRAIN 1<br>6. GATE 2           | <b>STYLE 8:</b><br>CANCELLED  | <b>STYLE 9:</b><br>PIN 1. EMITTER 2<br>2. EMITTER 1<br>3. COLLECTOR 1<br>4. BASE 1<br>5. BASE 2<br>6. COLLECTOR 2  | <b>STYLE 10:</b><br>PIN 1. SOURCE 2<br>2. SOURCE 1<br>3. GATE 1<br>4. DRAIN 1<br>5. DRAIN 2<br>6. GATE 2           | <b>STYLE 11:</b><br>PIN 1. CATHODE 2<br>2. CATHODE 2<br>3. ANODE 1<br>4. CATHODE 1<br>5. CATHODE 1<br>6. ANODE 2   | <b>STYLE 12:</b><br>PIN 1. ANODE 2<br>2. ANODE 2<br>3. CATHODE 1<br>4. ANODE 1<br>5. ANODE 1<br>6. CATHODE 2 |
| <b>STYLE 13:</b><br>PIN 1. ANODE<br>2. N/C<br>3. COLLECTOR<br>4. EMITTER<br>5. BASE<br>6. CATHODE                 | <b>STYLE 14:</b><br>PIN 1. VREF<br>2. GND<br>3. GND<br>4. IOUT<br>5. VEN<br>6. VCC                            | <b>STYLE 15:</b><br>PIN 1. ANODE 1<br>2. ANODE 2<br>3. ANODE 3<br>4. CATHODE 3<br>5. CATHODE 2<br>6. CATHODE 1     | <b>STYLE 16:</b><br>PIN 1. BASE 1<br>2. EMITTER 2<br>3. COLLECTOR 2<br>4. BASE 2<br>5. EMITTER 1<br>6. COLLECTOR 1 | <b>STYLE 17:</b><br>PIN 1. BASE 1<br>2. EMITTER 1<br>3. COLLECTOR 2<br>4. BASE 2<br>5. EMITTER 2<br>6. COLLECTOR 1 | <b>STYLE 18:</b><br>PIN 1. VIN1<br>2. VCC<br>3. VOUT2<br>4. VIN2<br>5. GND<br>6. VOUT1                       |
| <b>STYLE 19:</b><br>PIN 1. IOUT<br>2. GND<br>3. GND<br>4. V CC<br>5. V EN<br>6. V REF                             | <b>STYLE 20:</b><br>PIN 1. COLLECTOR<br>2. COLLECTOR<br>3. BASE<br>4. EMITTER<br>5. COLLECTOR<br>6. COLLECTOR | <b>STYLE 21:</b><br>PIN 1. ANODE 1<br>2. N/C<br>3. ANODE 2<br>4. CATHODE 2<br>5. N/C<br>6. CATHODE 1               | <b>STYLE 22:</b><br>PIN 1. D1 (i)<br>2. GND<br>3. D2 (i)<br>4. D2 (c)<br>5. VBUS<br>6. D1 (c)                      | <b>STYLE 23:</b><br>PIN 1. Vn<br>2. CH1<br>3. Vp<br>4. N/C<br>5. CH2<br>6. N/C                                     | <b>STYLE 24:</b><br>PIN 1. CATHODE<br>2. ANODE<br>3. CATHODE<br>4. CATHODE<br>5. CATHODE<br>6. CATHODE       |
| <b>STYLE 25:</b><br>PIN 1. BASE 1<br>2. CATHODE<br>3. COLLECTOR 2<br>4. BASE 2<br>5. EMITTER<br>6. COLLECTOR 1    | <b>STYLE 26:</b><br>PIN 1. SOURCE 1<br>2. GATE 1<br>3. DRAIN 2<br>4. SOURCE 2<br>5. GATE 2<br>6. DRAIN 1      | <b>STYLE 27:</b><br>PIN 1. BASE 2<br>2. BASE 1<br>3. COLLECTOR 1<br>4. EMITTER 1<br>5. EMITTER 2<br>6. COLLECTOR 2 | <b>STYLE 28:</b><br>PIN 1. DRAIN<br>2. DRAIN<br>3. GATE<br>4. SOURCE<br>5. DRAIN<br>6. DRAIN                       | <b>STYLE 29:</b><br>PIN 1. ANODE<br>2. ANODE<br>3. COLLECTOR<br>4. EMITTER<br>5. BASE/ANODE<br>6. CATHODE          | <b>STYLE 30:</b><br>PIN 1. SOURCE 1<br>2. DRAIN 2<br>3. DRAIN 2<br>4. SOURCE 2<br>5. GATE 1<br>6. DRAIN 1    |

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

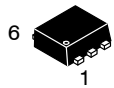
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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

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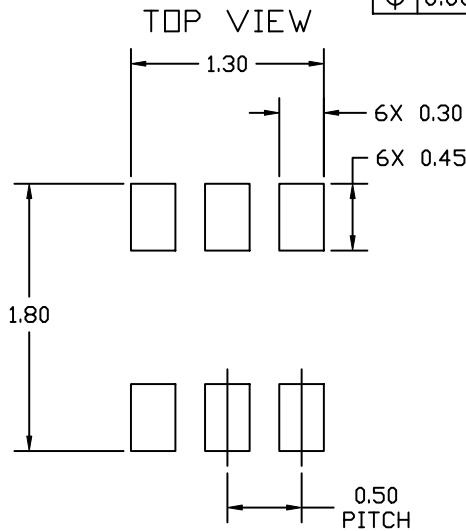
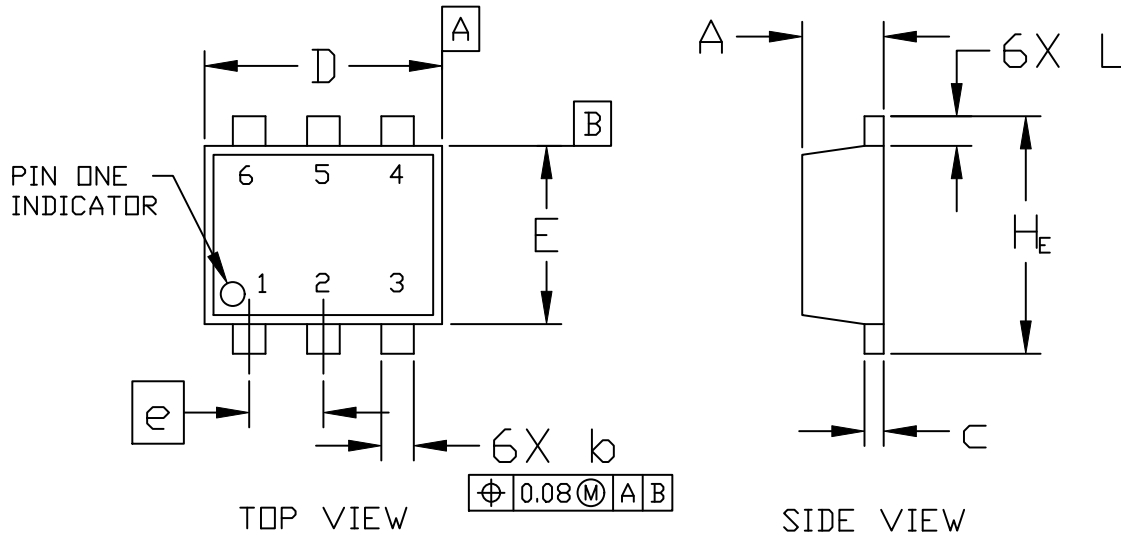
SCALE 4:1

**SOT-563, 6 LEAD**  
CASE 463A  
ISSUE H

DATE 26 JAN 2021

**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.



| DIM            | MILLIMETERS |      |      |
|----------------|-------------|------|------|
|                | MIN.        | NOM. | MAX. |
| A              | 0.50        | 0.55 | 0.60 |
| b              | 0.17        | 0.22 | 0.27 |
| c              | 0.08        | 0.13 | 0.18 |
| D              | 1.50        | 1.60 | 1.70 |
| E              | 1.10        | 1.20 | 1.30 |
| e              | 0.50 BSC    |      |      |
| L              | 0.10        | 0.20 | 0.30 |
| H <sub>E</sub> | 1.50        | 1.60 | 1.70 |

**RECOMMENDED MOUNTING FOOTPRINT\***

\* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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**SOT-563, 6 LEAD**  
CASE 463A  
ISSUE H

DATE 26 JAN 2021

STYLE 1:  
PIN 1. EMITTER 1  
2. BASE 1  
3. COLLECTOR 2  
4. EMITTER 2  
5. BASE 2  
6. COLLECTOR 1

STYLE 2:  
PIN 1. EMITTER 1  
2. EMITTER 2  
3. BASE 2  
4. COLLECTOR 2  
5. BASE 1  
6. COLLECTOR 1

STYLE 3:  
PIN 1. CATHODE 1  
2. CATHODE 1  
3. ANODE/ANODE 2  
4. CATHODE 2  
5. CATHODE 2  
6. ANODE/ANODE 1

STYLE 4:  
PIN 1. COLLECTOR  
2. COLLECTOR  
3. BASE  
4. EMITTER  
5. COLLECTOR  
6. COLLECTOR

STYLE 5:  
PIN 1. CATHODE  
2. CATHODE  
3. ANODE  
4. ANODE  
5. CATHODE  
6. CATHODE

STYLE 6:  
PIN 1. CATHODE  
2. ANODE  
3. CATHODE  
4. CATHODE  
5. CATHODE  
6. CATHODE

STYLE 7:  
PIN 1. CATHODE  
2. ANODE  
3. CATHODE  
4. CATHODE  
5. ANODE  
6. CATHODE

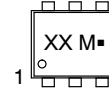
STYLE 8:  
PIN 1. DRAIN  
2. DRAIN  
3. GATE  
4. SOURCE  
5. DRAIN  
6. DRAIN

STYLE 9:  
PIN 1. SOURCE 1  
2. GATE 1  
3. DRAIN 2  
4. SOURCE 2  
5. GATE 2  
6. DRAIN 1

STYLE 10:  
PIN 1. CATHODE 1  
2. N/C  
3. CATHODE 2  
4. ANODE 2  
5. N/C  
6. ANODE 1

STYLE 11:  
PIN 1. EMITTER 2  
2. BASE 2  
3. COLLECTOR 1  
4. EMITTER 1  
5. BASE 1  
6. COLLECTOR 2

**GENERIC  
MARKING DIAGRAM\***



XX = Specific Device Code  
M = Month Code  
■ = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "■", may or may not be present. Some products may not follow the Generic Marking.

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