

# NTJS3157N

## MOSFET – Power, Single, N-Channel, Trench, SC-88

20 V, 4.0 A

### Features

- Leading Trench Technology for Low  $R_{DS(ON)}$  Extending Battery Life
- Fast Switching for Increased Circuit Efficiency
- SC-88 Small Outline (2 x 2 mm) for Maximum Circuit Board Utilization, Same as SC-70-6
- These are Pb-Free Devices

### Applications

- DC-DC Conversion
- Low Side Load Switch
- Cell Phones, Computing, Digital Cameras, MP3s and PDAs

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise stated)

| Parameter                                                         |              |                        | Symbol                               | Value      | Unit |
|-------------------------------------------------------------------|--------------|------------------------|--------------------------------------|------------|------|
| Drain-to-Source Voltage                                           |              |                        | V <sub>DSS</sub>                     | 20         | V    |
| Gate-to-Source Voltage                                            |              |                        | V <sub>GS</sub>                      | ±8.0       | V    |
| Continuous Drain Current (Note 1)                                 | Steady State | T <sub>A</sub> = 25 °C | I <sub>D</sub>                       | 3.2        | A    |
|                                                                   |              | T <sub>A</sub> = 85 °C |                                      | 2.3        |      |
|                                                                   | t ≤ 5 s      | T <sub>A</sub> = 25 °C |                                      | 4.0        |      |
| Power Dissipation (Note 1)                                        | Steady State | T <sub>A</sub> = 25 °C | P <sub>D</sub>                       | 1.0        | W    |
| Pulsed Drain Current                                              |              | t <sub>p</sub> = 10 μs | I <sub>DM</sub>                      | 10         | A    |
| Operating Junction and Storage Temperature                        |              |                        | T <sub>J</sub> ,<br>T <sub>STG</sub> | -55 to 150 | °C   |
| Source Current (Body Diode)                                       |              |                        | I <sub>S</sub>                       | 1.6        | A    |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) |              |                        | T <sub>L</sub>                       | 260        | °C   |

### THERMAL RESISTANCE RATINGS (Note 1)

| Parameter                                 | Symbol          | Max | Unit               |
|-------------------------------------------|-----------------|-----|--------------------|
| Junction-to-Ambient – Steady State        | $R_{\theta JA}$ | 125 | $^\circ\text{C/W}$ |
| Junction-to-Ambient – $t \leq 5\text{ s}$ | $R_{\theta JA}$ | 80  |                    |
| Junction-to-Lead – Steady State           | $R_{\theta JL}$ | 45  |                    |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. Surface mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).

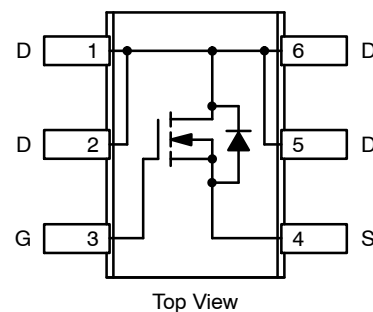


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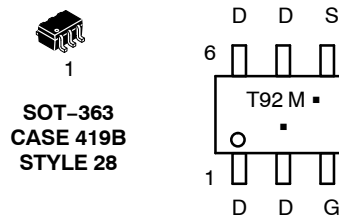
<http://onsemi.com>

| $V_{(BR)DSS}$ | $R_{DS(on)}$ Typ      | $I_D$ Max |
|---------------|-----------------------|-----------|
| 20 V          | 45 m $\Omega$ @ 4.5 V | 4.0 A     |
|               | 55 m $\Omega$ @ 2.5 V |           |
|               | 70 m $\Omega$ @ 1.8 V |           |

### SC-88 (SOT-363)



### MARKING DIAGRAM & PIN ASSIGNMENT



T92 = 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 5 of this data sheet.

# NTJS3157N

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

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|-----------|--------|----------------|-----|-----|-----|------|
|-----------|--------|----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|                                                           |                   |                                                     |                          |    |           |                      |
|-----------------------------------------------------------|-------------------|-----------------------------------------------------|--------------------------|----|-----------|----------------------|
| Drain-to-Source Breakdown Voltage                         | $V_{(BR)DSS}$     | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 20                       |    |           | V                    |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ |                          | 12 |           | mV/ $^\circ\text{C}$ |
| Zero Gate Voltage Drain Current                           | $I_{DSS}$         | $V_{GS} = 0\text{ V}, V_{DS} = 16\text{ V}$         | $T_J = 25^\circ\text{C}$ |    | 1.0       | $\mu\text{A}$        |
|                                                           |                   |                                                     | $T_J = 85^\circ\text{C}$ |    | 5.0       |                      |
| Gate-to-Source Leakage Current                            | $I_{GSS}$         | $V_{DS} = 0\text{ V}, V_{GS} = \pm 8.0\text{ V}$    |                          |    | $\pm 100$ | nA                   |

### ON CHARACTERISTICS (Note 2)

|                                            |                  |                                                 |      |      |     |                      |
|--------------------------------------------|------------------|-------------------------------------------------|------|------|-----|----------------------|
| Gate Threshold Voltage                     | $V_{GS(TH)}$     | $V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$ | 0.40 |      | 1.0 | V                    |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ |                                                 |      | -4.0 |     | mV/ $^\circ\text{C}$ |
| Drain-to-Source On Resistance              | $R_{DS(on)}$     | $V_{GS} = 4.5\text{ V}, I_D = 4.0\text{ A}$     |      | 45   | 60  | m $\Omega$           |
|                                            |                  | $V_{GS} = 2.5\text{ V}, I_D = 3.6\text{ A}$     |      | 55   | 70  |                      |
|                                            |                  | $V_{GS} = 1.8\text{ V}, I_D = 2.0\text{ A}$     |      | 70   | 85  |                      |
| Forward Transconductance                   | $g_{FS}$         | $V_{GS} = 10\text{ V}, I_D = 3.2\text{ A}$      |      | 9.0  |     | S                    |

### CHARGES AND CAPACITANCES

|                              |              |                                                                   |  |     |    |    |
|------------------------------|--------------|-------------------------------------------------------------------|--|-----|----|----|
| Input Capacitance            | $C_{ISS}$    | $V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = 10\text{ V}$   |  | 500 |    | pF |
| Output Capacitance           | $C_{OSS}$    |                                                                   |  | 75  |    |    |
| Reverse Transfer Capacitance | $C_{RSS}$    |                                                                   |  | 60  |    |    |
| Total Gate Charge            | $Q_{G(TOT)}$ | $V_{GS} = 4.5\text{ V}, V_{DS} = 10\text{ V}, I_D = 3.2\text{ A}$ |  | 6.9 | 15 | nC |
| Gate-to-Source Charge        | $Q_{GS}$     |                                                                   |  | 1.0 |    |    |
| Gate-to-Drain Charge         | $Q_{GD}$     |                                                                   |  | 1.8 |    |    |

### SWITCHING CHARACTERISTICS (Note 3)

|                     |              |                                                                                            |  |     |    |    |
|---------------------|--------------|--------------------------------------------------------------------------------------------|--|-----|----|----|
| Turn-On Delay Time  | $t_{d(on)}$  | $V_{GS} = 4.5\text{ V}, V_{DD} = 10\text{ V}, I_D = 0.5\text{ A}, R_G = 6.0\text{ }\Omega$ |  | 6.0 | 15 | ns |
| Rise Time           | $t_r$        |                                                                                            |  | 12  | 25 |    |
| Turn-Off Delay Time | $t_{d(off)}$ |                                                                                            |  | 21  | 45 |    |
| Fall Time           | $t_f$        |                                                                                            |  | 11  | 25 |    |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|                         |                 |                                                                                  |                       |  |     |     |    |
|-------------------------|-----------------|----------------------------------------------------------------------------------|-----------------------|--|-----|-----|----|
| Forward Diode Voltage   | V <sub>SD</sub> | V <sub>GS</sub> = 0 V,<br>I <sub>S</sub> = 1.6 A                                 | T <sub>J</sub> = 25°C |  | 0.7 | 1.0 | V  |
| Reverse Recovery Time   | t <sub>RR</sub> | V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 100 A/μs,<br>I <sub>S</sub> = 1.6 A |                       |  | 15  |     | ns |
| Charge Time             | T <sub>a</sub>  |                                                                                  |                       |  | 12  |     |    |
| Discharge Time          | T <sub>b</sub>  |                                                                                  |                       |  | 3.0 |     |    |
| Reverse Recovery Charge | Q <sub>RR</sub> |                                                                                  |                       |  | 5.0 |     | nC |

2. Pulse Test: pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

3. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

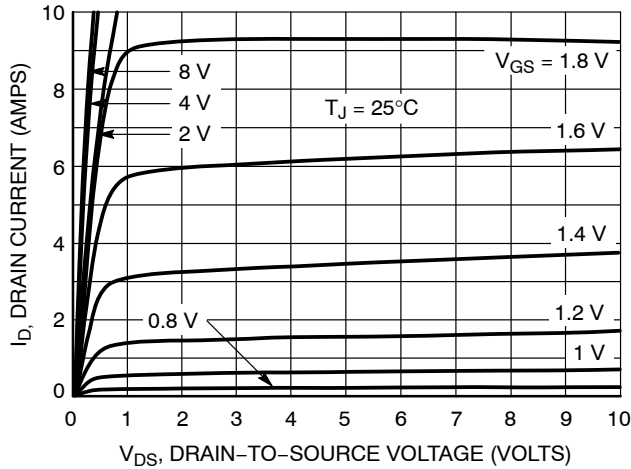


Figure 1. On-Region Characteristics

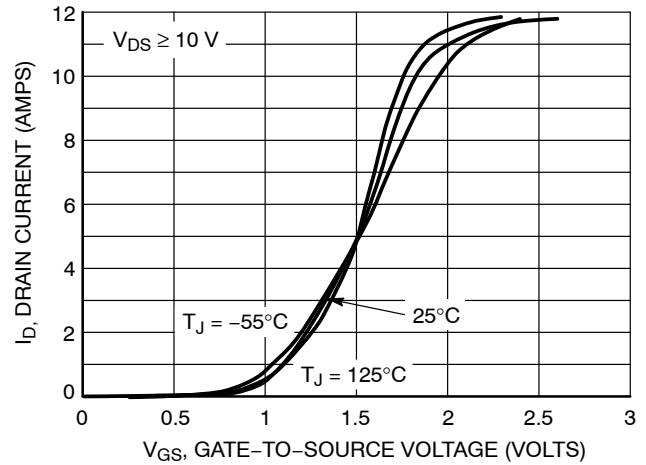


Figure 2. Transfer Characteristics

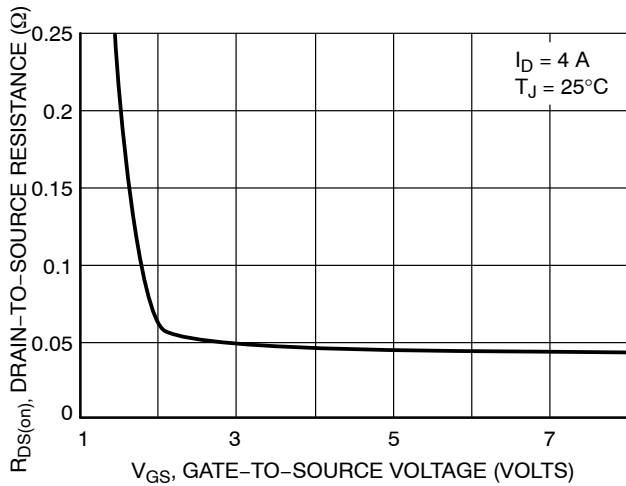


Figure 3. On-Resistance vs. Gate-to-Source Voltage

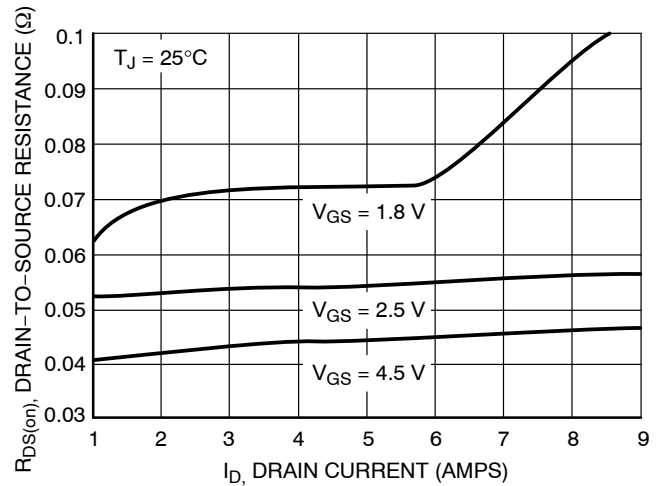


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

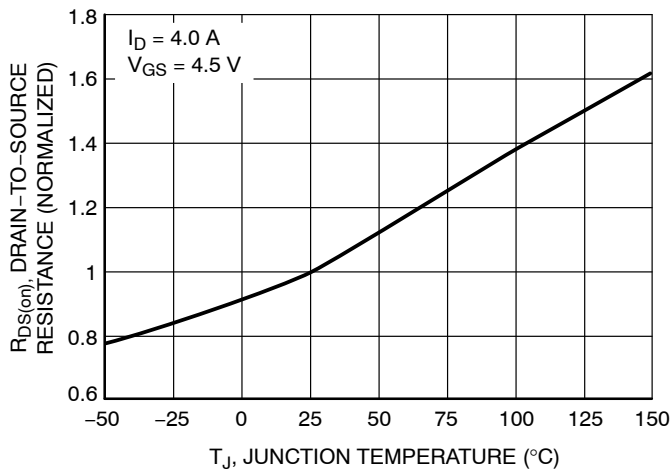


Figure 5. On-Resistance Variation with Temperature

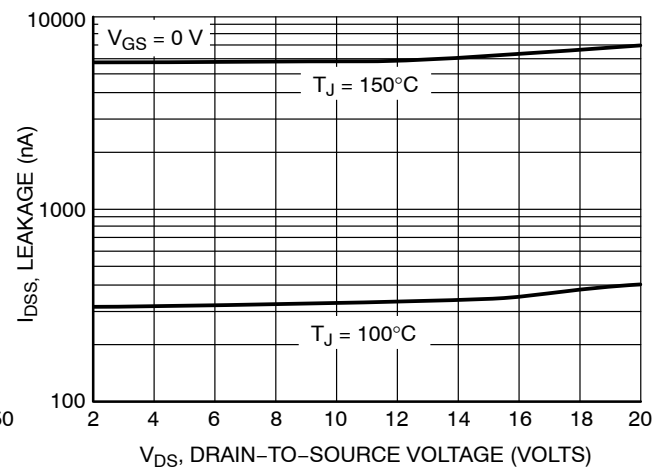
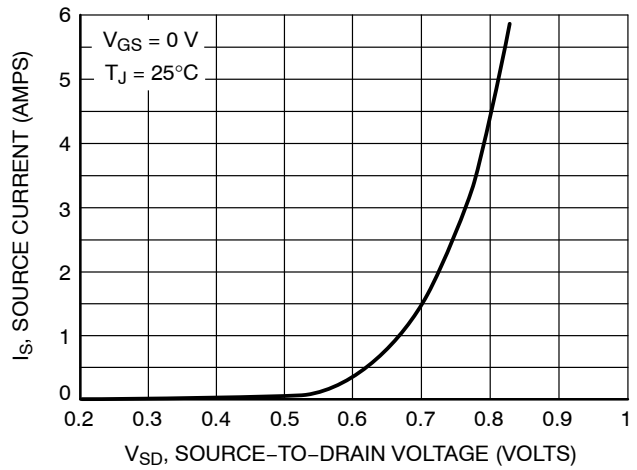
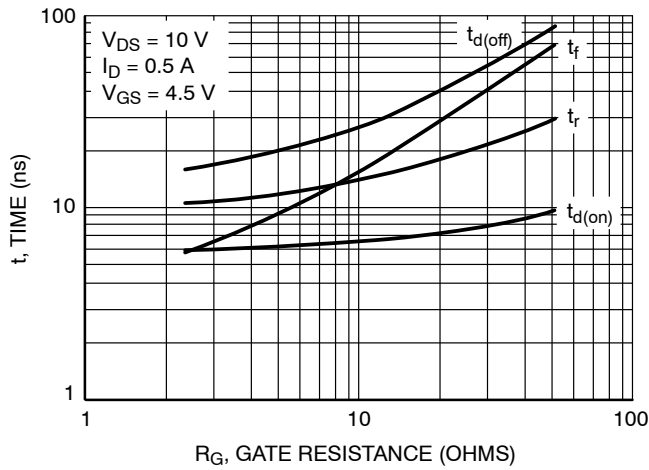
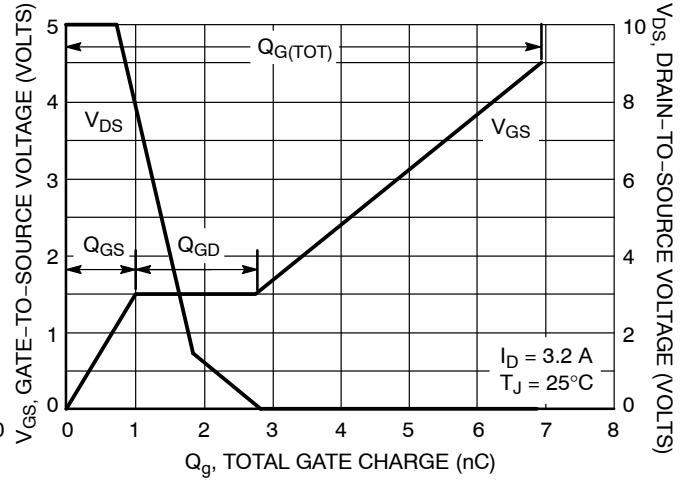
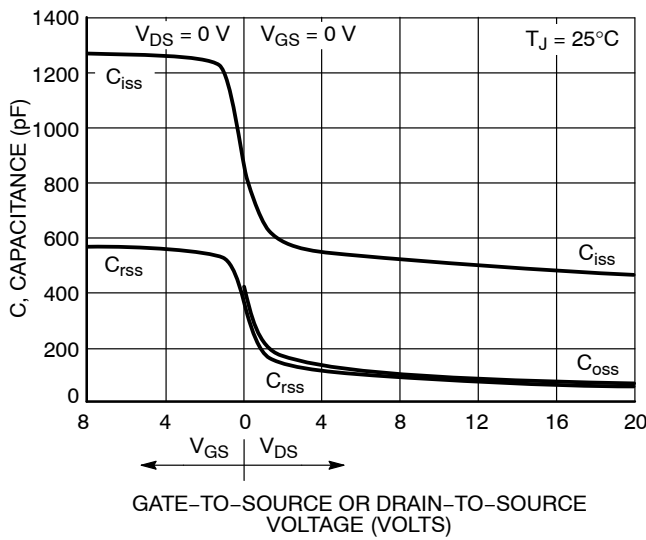


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES ( $T_J = 25^\circ\text{C}$  unless otherwise noted)



## NTJS3157N

### ORDERING INFORMATION

| Device       | Package            | Shipping†          |
|--------------|--------------------|--------------------|
| NTJS3157NT1G | SC-88<br>(Pb-Free) | 3000 / Tape & Reel |
| NTJS3157NT2G | SC-88<br>(Pb-Free) | 3000 / Tape & Reel |

†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.

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

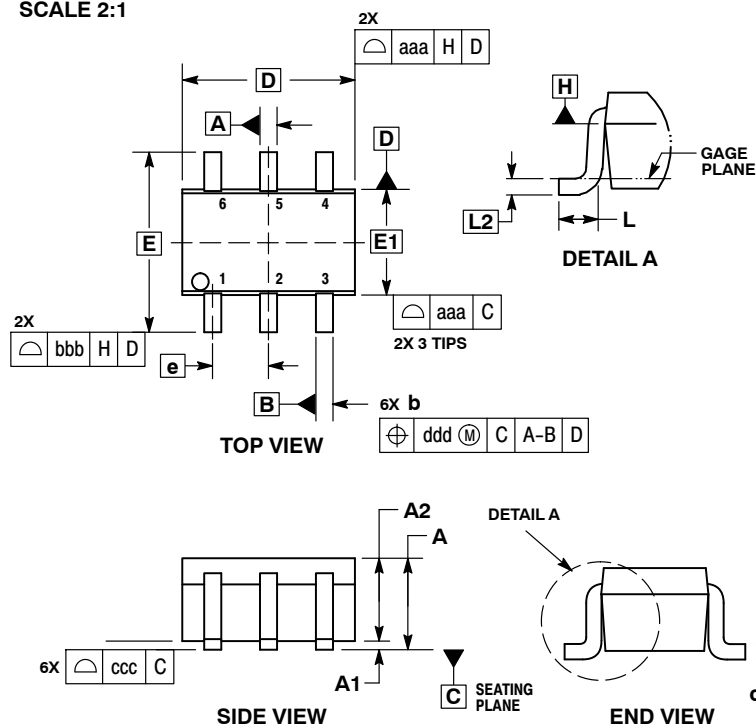
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SCALE 2:1

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

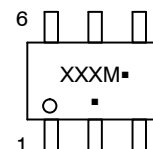
DATE 11 DEC 2012



- 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\*



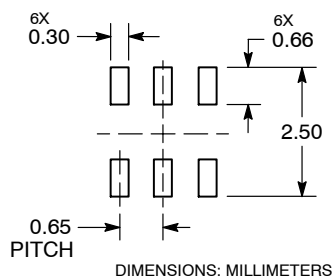
XXX = Specific Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(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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**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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