

# MOSFET – N-Channel, POWERTRENCH®

100 V

## FDC3612

### General Description

This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for low gate charge, low  $R_{DS(ON)}$  and fast switching speed.

### Features

- 2.6 A, 100 V  
 $R_{DS(ON)} = 125 \text{ m}\Omega @ V_{GS} = 10 \text{ V}$   
 $R_{DS(ON)} = 135 \text{ m}\Omega @ V_{GS} = 6 \text{ V}$
- High Performance Trench Technology for Extremely Low  $R_{DS(ON)}$
- Low Gate Charge (14 nC Typical)
- High Power and Current Handling Capability
- Fast Switching Speed
- This is a Pb-Free Device

### Applications

- DC/DC Converter

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

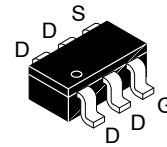
| Symbol         | Parameter                               | Ratings              | Unit             |
|----------------|---|----------------------|------------------|
| $V_{DSS}$      | Drain-Source Voltage                    | 100                  | V                |
| $V_{GSS}$      | Gate-Source Voltage                     | $\pm 20$             | V                |
| $I_D$          | Drain Current                           | Continuous (Note 1a) | 2.6 A            |
|                |   | Pulsed               | 20 A             |
| $E_{AS}$       | Single Pulse Avalanche Energy (Note 3)  | 37                   | mJ               |
| $P_D$          | Maximum Power Dissipation               | (Note 1a)            | 1.6 W            |
|                |   | (Note 1b)            | 0.8 W            |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range | -55 to +150          | $^\circ\text{C}$ |

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.

### THERMAL CHARACTERISTICS

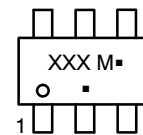
| Symbol          | Parameter   | Ratings | Unit               |
|-----------------|---|---------|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 1a) | 78      | $^\circ\text{C/W}$ |
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case (Note 1)     | 30      | $^\circ\text{C/W}$ |

| $V_{DSS}$ | $R_{DS(ON)}$ MAX      | $I_D$ MAX |
|-----------|-----------------------|-----------|
| 100 V     | 125 m $\Omega$ @ 10 V | 2.6 A     |
|           | 135 m $\Omega$ @ 6 V  |           |



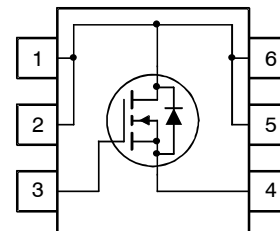
TSOT23 6-Lead  
(SUPERSOT™ -6)  
CASE 419BL

### MARKING DIAGRAM



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

### PINOUT



### ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

# FDC3612

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

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

### DRAIN-SOURCE AVALANCHE RATINGS (Note 2)

|                  |                                |  |   |   |     |    |
|------------------|--------------------------------|--|---|---|-----|----|
| W <sub>DSS</sub> | Drain-Source Avalanche Energy  | Single Pulse, V <sub>DD</sub> = 50 V, I <sub>D</sub> = 2.6 A | - | - | 90  | mJ |
| I <sub>AR</sub>  | Drain-Source Avalanche Current |  | - | - | 2.6 | A  |

### OFF CHARACTERISTICS

|                                      |   |  |     |    |      |       |
|--------------------------------------|---|--|-----|----|------|-------|
| BV <sub>DSS</sub>                    | Drain-Source Breakdown Voltage            | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA | 100 | -  | -    | V     |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | I <sub>D</sub> = 250 μA, Referenced to 25°C    | -   | 99 | -    | mV/°C |
| I <sub>DSS</sub>                     | Zero Gate Voltage Drain Current           | V <sub>DS</sub> = 80 V, V <sub>GS</sub> = 0 V  | -   | -  | 10   | μA    |
| I <sub>GSSF</sub>                    | Gate-Body Leakage, Forward                | V <sub>GS</sub> = 20 V, V <sub>DS</sub> = 0 V  | -   | -  | 100  | nA    |
| I <sub>GSSR</sub>                    | Gate-Body Leakage, Reverse                | V <sub>GS</sub> = -20 V, V <sub>DS</sub> = 0 V | -   | -  | -100 | nA    |

### ON CHARACTERISTICS (Note 2)

|  |  |   |    |                 |                   |       |
|--|--|---|----|-----------------|-------------------|-------|
| V <sub>GS(th)</sub>                    | Gate Threshold Voltage                         | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA   | 2  | 2.3             | 4                 | V     |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate Threshold Voltage Temperature Coefficient | I <sub>D</sub> = 250 μA, Referenced to 25°C   | -  | -6              | -                 | mV/°C |
| R <sub>DS(on)</sub>                    | Static Drain-Source On Resistance              | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 2.6 A<br>V <sub>GS</sub> = 6 V, I <sub>D</sub> = 2.5 A<br>V <sub>GS</sub> = 10 V, I <sub>D</sub> = 2.6 A, T <sub>J</sub> = 125°C | -  | 86<br>91<br>157 | 125<br>135<br>240 | mΩ    |
| I <sub>D(on)</sub>                     | On-State Drain Current                         | V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 5 V   | 10 | -               | -                 | A     |
| g <sub>FS</sub>                        | Forward Transconductance                       | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 2.6 A  | -  | 10              | -                 | S     |

### DYNAMIC CHARACTERISTICS

|                  |                              |  |     |     |     |    |
|------------------|------------------------------|--|-----|-----|-----|----|
| C <sub>iss</sub> | Input Capacitance            | V <sub>DS</sub> = 50 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz | -   | 660 | -   | pF |
| C <sub>oss</sub> | Output Capacitance           |  | -   | 55  | -   | pF |
| C <sub>rss</sub> | Reverse Transfer Capacitance |  | -   | 40  | -   | pF |
| R <sub>g</sub>   | Gate Resistance              |  | 0.1 | 1.4 | 3.0 | Ω  |

### SWITCHING CHARACTERISTICS (Note 2)

|                     |                     |   |   |     |     |    |
|---------------------|---------------------|---|---|-----|-----|----|
| t <sub>d(on)</sub>  | Turn-On Delay Time  | V <sub>DD</sub> = 50 V, I <sub>D</sub> = 1 A, V <sub>GS</sub> = 10 V,<br>R <sub>GEN</sub> = 6 Ω | - | 6   | 11  | ns |
| t <sub>r</sub>      | Turn-On Rise Time   |   | - | 3.5 | 7   | ns |
| t <sub>d(off)</sub> | Turn-Off Delay Time |   | - | 23  | 37  | ns |
| t <sub>f</sub>      | Turn-Off Fall Time  |   | - | 3.7 | 7.4 | ns |
| Q <sub>g</sub>      | Total Gate Charge   | V <sub>DS</sub> = 50 V, I <sub>D</sub> = 2.6 A, V <sub>GS</sub> = 10 V                          | - | 14  | 20  | nC |
| Q <sub>gs</sub>     | Gate-Source Charge  |   | - | 2.3 | -   | nC |
| Q <sub>gd</sub>     | Gate-Drain Charge   |   | - | 3.6 | -   | nC |

### DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

|                 |   |   |   |      |     |    |
|-----------------|---|---|---|------|-----|----|
| I <sub>S</sub>  | Maximum Continuous Drain-Source Diode Forward Current |   | -   | -    | 1.3 | A  |
| V <sub>SD</sub> | Drain-Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 1.3 A (Note 2)          | -   | 0.76 | 1.2 | V  |
| t <sub>rr</sub> | Diode Reverse Recovery Time                           | I <sub>F</sub> = 2.6 A, dI <sub>F</sub> /dt = 100 A/μs (Note 2) | -   | 31   | -   | ns |
| Q <sub>rr</sub> | Diode Reverse Recovery Charge                         |   | I <sub>F</sub> = 2.6 A, dI <sub>F</sub> /dt = 100 A/μs (Note 2) | -    | 56  | -  |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

- R<sub>θJA</sub> is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. R<sub>θJC</sub> is guaranteed by design while R<sub>θCA</sub> is determined by the user's board design.
  - 78 °C/W when mounted on a 1in<sup>2</sup> pad of 2oz copper on FR-4 board
  - 156 °C/W when mounted on a minimum pad
- Pulse Test: Pulse Width ≤ 300 μs, Duty cycle ≤ 2.0 %
- E<sub>AS</sub> of 37 mJ is based on starting T<sub>J</sub> = 25 °C; N-ch: L = 3 mH, I<sub>AS</sub> = 5 A, V<sub>DD</sub> = 100 V, V<sub>GS</sub> = 10 V. 100% test at L = 0.3 mH, I<sub>AS</sub> = 11 A.

TYPICAL CHARACTERISTICS

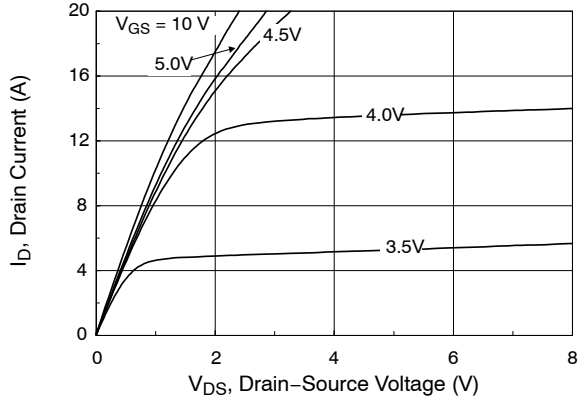


Figure 1. On-Region Characteristics

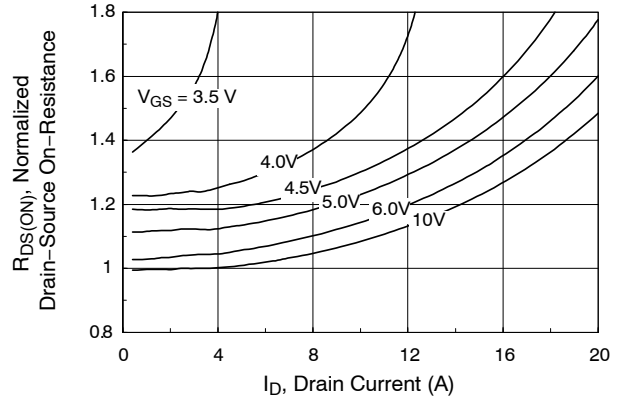


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

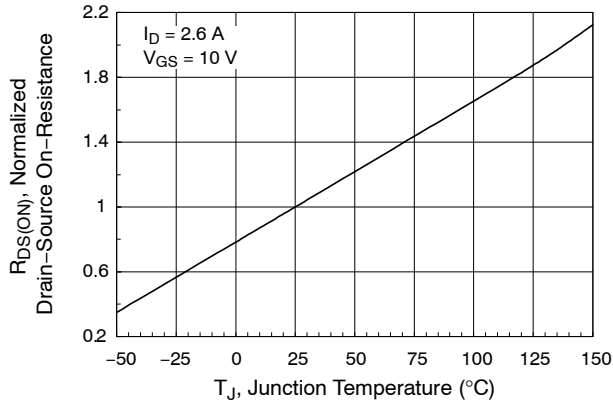


Figure 3. On-Resistance Variation with Temperature

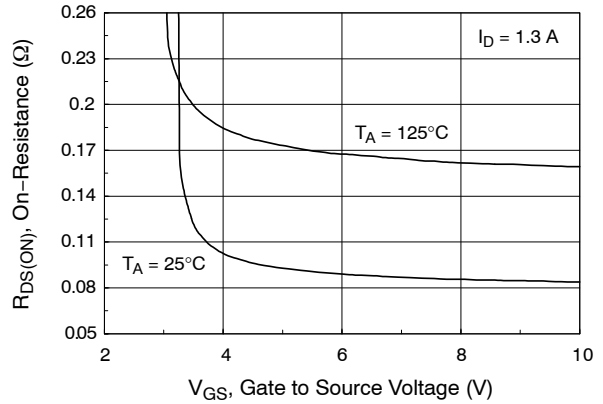


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

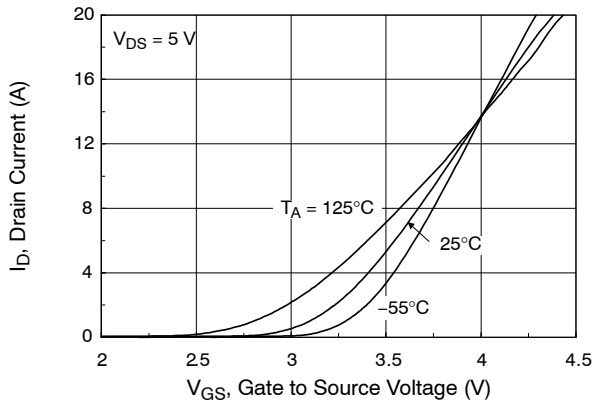


Figure 5. Transfer Characteristics

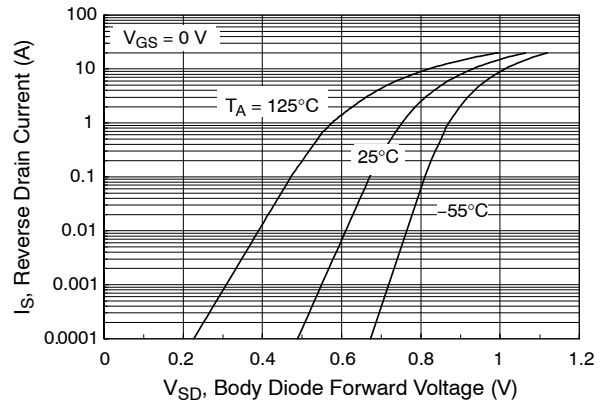


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

TYPICAL ELECTRICAL CHARACTERISTICS (continued)

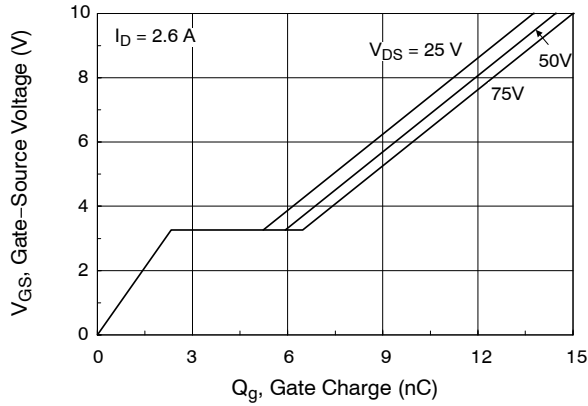


Figure 7. Gate Charge Characteristics

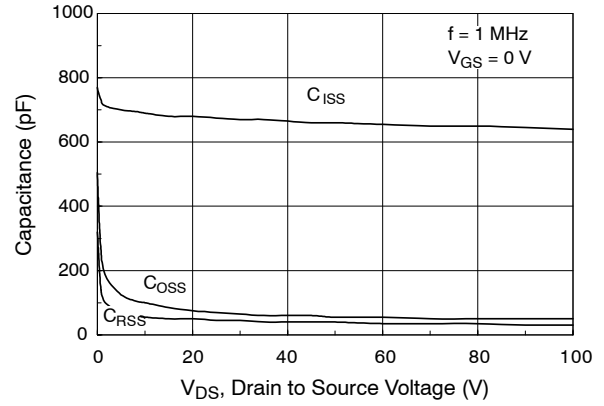


Figure 8. Capacitance Characteristics

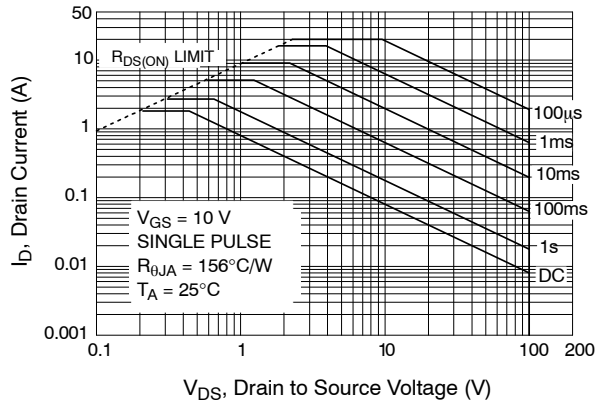


Figure 9. Maximum Safe Operating Area

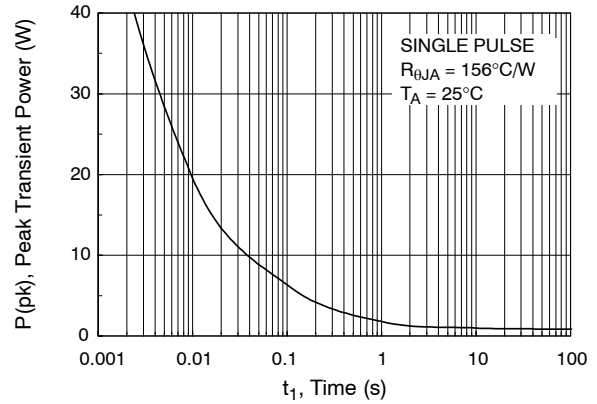


Figure 10. Single Pulse Maximum Power Dissipation

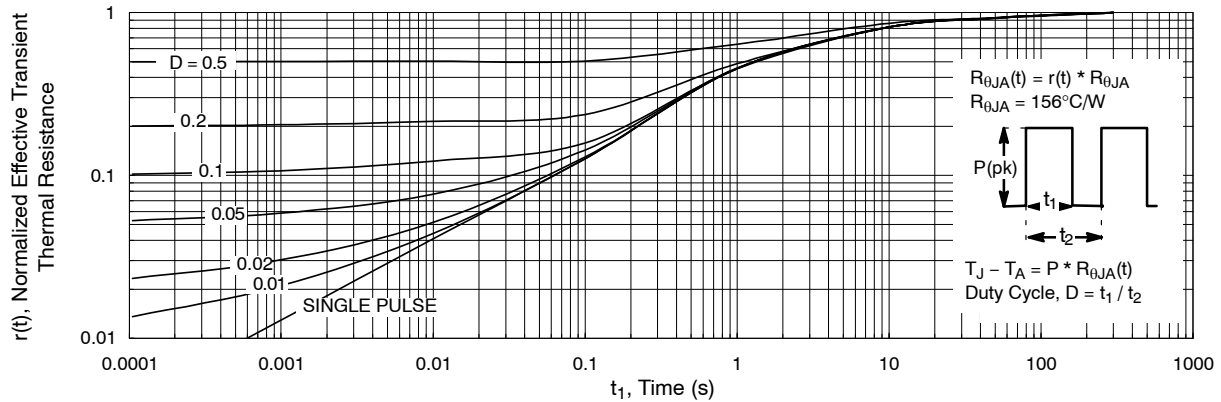


Figure 11. Transient Thermal Response Curve

(Note: Thermal characterization performed using the conditions described in Note 1b. Transient thermal response will change depending on the circuit board design.)

# FDC3612

## ORDERING INFORMATION

| Device  | Device Marking | Package Type        | Shipping <sup>†</sup> |
|---------|----------------|---------------------|-----------------------|
| FDC3612 | .362           | TSOT-23-6 (Pb-free) | 3000 / Tape & Reel    |

<sup>†</sup>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.

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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

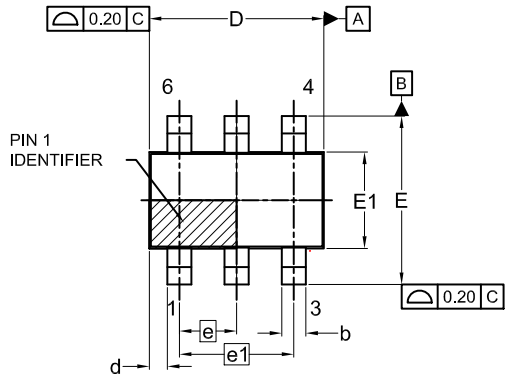
ON Semiconductor®



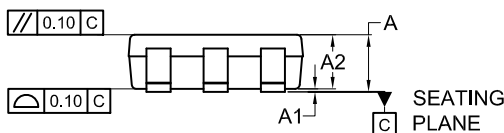
SCALE 2:1

### TSOT23 6-Lead CASE 419BL ISSUE A

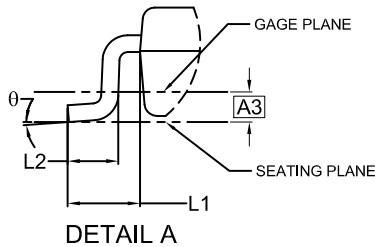
DATE 31 AUG 2020



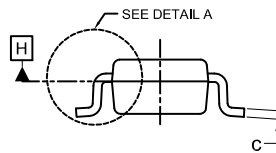
TOP VIEW



FRONT VIEW

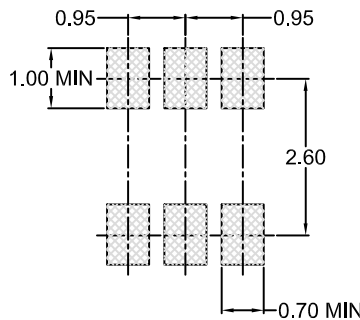


DETAIL A



SIDE VIEW

SYMM  
⌀



LAND PATTERN  
RECOMMENDATION

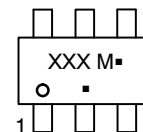
\*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
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 0.25MM PER END. DIMENSIONS D AND E1 ARE DETERMINED AT DATUM H.
4. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| A   | 0.90        | 1.00 | 1.10 |
| A1  | 0.00        | 0.05 | 0.10 |
| A2  | 0.70        | 0.85 | 1.00 |
| A3  | 0.25 BSC    |      |      |
| b   | 0.25        | 0.38 | 0.50 |
| c   | 0.10        | 0.18 | 0.26 |
| D   | 2.80        | 2.95 | 3.10 |
| d   | 0.30 REF    |      |      |
| E   | 2.50        | 2.75 | 3.00 |
| E1  | 1.30        | 1.50 | 1.70 |
| e   | 0.95 BSC    |      |      |
| e1  | 1.90 BSC    |      |      |
| L1  | 0.60 REF    |      |      |
| L2  | 0.20        | 0.40 | 0.60 |
| ⌀   | 0°          | --   | 10°  |

#### GENERIC MARKING DIAGRAM\*



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

(Note: Microdot may be in either 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.

|                         |                      |  |
|-------------------------|----------------------|--|
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| <b>DESCRIPTION:</b>     | <b>TSOT23 6-Lead</b> | <b>PAGE 1 OF 1</b>   |

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