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P-Channel NexFET™ Power MOSFET

FEATURES

- **Ultralow Q_g and Q_{gd}**
- **Low Thermal Resistance**
- **Avalanche Rated**
- **Pb Free Terminal Plating**
- **RoHS Compliant**
- **Halogen Free**
- **SON 2-mm × 2-mm Plastic Package**

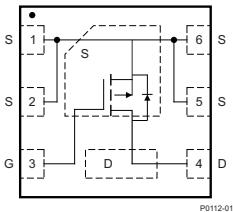
APPLICATIONS

- **Battery Management**
- **Load Management**
- **Battery Protection**

DESCRIPTION

The device has been designed to deliver the lowest on resistance and gate charge in the smallest outline possible with excellent thermal characteristics in an ultra low profile. Low on resistance coupled with the extremely small footprint and low profile make the device ideal for battery operated space constrained applications.

Top View



PRODUCT SUMMARY

| | | | |
|--------------|-------------------------------|------------------|-------|
| V_{DS} | Drain to Source Voltage | -20 | V |
| Q_g | Gate Charge Total (-4.5V) | 2.6 | nC |
| Q_{gd} | Gate Charge Gate to Drain | 0.5 | nC |
| $R_{DS(on)}$ | Drain to Source On Resistance | $V_{GS} = -1.8V$ | 71 mΩ |
| | | $V_{GS} = -2.5V$ | 56 mΩ |
| | | $V_{GS} = -4.5V$ | 39 mΩ |
| $V_{GS(th)}$ | Threshold Voltage | -0.65 | V |

ORDERING INFORMATION

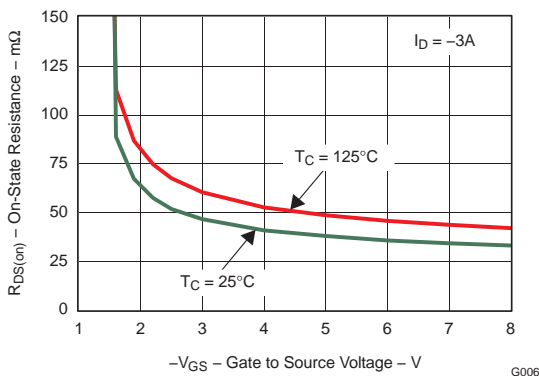
| Device | Package | Media | Qty | Ship |
|------------|---------------------------------|--------------|------|---------------|
| CSD25302Q2 | SON 2-mm × 2-mm Plastic Package | 13-Inch Reel | 3000 | Tape and Reel |

ABSOLUTE MAXIMUM RATINGS

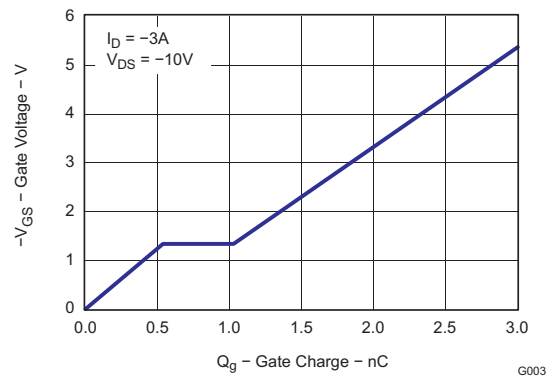
| $T_A = 25^\circ C$ unless otherwise stated | | VALUE | UNIT |
|--|---|------------|------|
| V_{DS} | Drain to Source Voltage | -20 | V |
| V_{GS} | Gate to Source Voltage | ±8 | V |
| I_D | Continuous Drain Current, $T_C = 25^\circ C$ | -5 | A |
| | Continuous Drain Current ⁽¹⁾ | -5 | A |
| I_{DM} | Pulsed Drain Current, $T_A = 25^\circ C$ ⁽²⁾ | -20 | A |
| P_D | Power Dissipation | 2.4 | W |
| T_J, T_{STG} | Operating Junction and Storage Temperature Range | -55 to 150 | °C |

- (1) Package Limited
- (2) Pulse duration 10 μs, duty cycle ≤2%

$R_{DS(on)}$ VS V_{GS}



GATE CHARGE



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These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

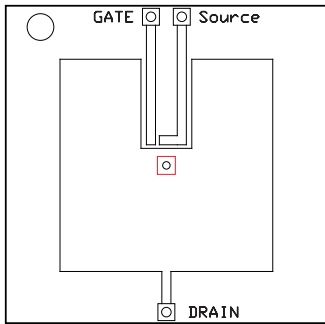
ELECTRICAL CHARACTERISTICS
 $T_A = 25^\circ\text{C}$, unless otherwise specified

| PARAMETER | | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--------------------------------|----------------------------------|--|------|-------|------|------------|
| Static Characteristics | | | | | | |
| BV_{DSS} | Drain to Source Voltage | $V_{GS} = 0V, I_{DS} = -250\mu A$ | -20 | | | V |
| I_{DSS} | Drain to Source Leakage | $V_{GS} = 0V, V_{DS} = -16V$ | | | -1 | μA |
| I_{GSS} | Gate to Source Leakage | $V_{DS} = 0V, V_{GS} = \pm 8V$ | | | -100 | nA |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{DS} = V_{GS}, I_{DS} = -250\mu A$ | -0.5 | -0.65 | -0.9 | V |
| $R_{DS(on)}$ | Drain to Source On Resistance | $V_{GS} = -1.8V, I_{DS} = -3.0A$ | | 71 | 92 | m Ω |
| | | $V_{GS} = -2.5V, I_{DS} = -3.0A$ | | 56 | 70 | m Ω |
| | | $V_{GS} = -4.5V, I_{DS} = -3.0A$ | | 39 | 49 | m Ω |
| g_{fs} | Transconductance | $V_{DS} = -10V, I_{DS} = -3.0A$ | | 12.3 | | S |
| Dynamic Characteristics | | | | | | |
| C_{ISS} | Input Capacitance | $V_{GS} = 0V, V_{DS} = -10V, f = 1MHz$ | | 270 | 350 | pF |
| C_{OSS} | Output Capacitance | | | 120 | 150 | pF |
| C_{RSS} | Reverse Transfer Capacitance | | | 40 | 55 | pF |
| Q_g | Gate Charge Total (-4.5V) | $V_{DS} = -10V, I_{DS} = -3.0A$ | | 2.6 | 3.4 | nC |
| Q_{gd} | Gate Charge – Gate to Drain | | | 0.5 | | nC |
| Q_{gs} | Gate Charge Gate to Source | | | 0.54 | | nC |
| $Q_{g(th)}$ | Gate Charge at V_{th} | | | 0.2 | | nC |
| Q_{OSS} | Output Charge | $V_{DS} = -13V, V_{GS} = 0V$ | | 2.3 | | nC |
| $t_{d(on)}$ | Turn On Delay Time | $V_{DS} = -10V, V_{GS} = -4.5V, I_{DS} = -3.0A, R_G = 2\Omega$ | | 3.2 | | ns |
| t_r | Rise Time | | | 13.2 | | ns |
| $t_{d(off)}$ | Turn Off Delay Time | | | 8.6 | | ns |
| t_f | Fall Time | | | 1.3 | | ns |
| Diode Characteristics | | | | | | |
| V_{SD} | Diode Forward Voltage | $I_{DS} = -3.0A, V_{GS} = 0V$ | -0.8 | -1.0 | | V |
| Q_{rr} | Reverse Recovery Charge | $V_{dd} = -13V, I_F = -3.0A, di/dt = 300A/\mu s$ | | 2.5 | | nC |
| t_{rr} | Reverse Recovery Time | | | 8.8 | | ns |

THERMAL CHARACTERISTICS
 $T_A = 25^\circ\text{C}$, unless otherwise specified

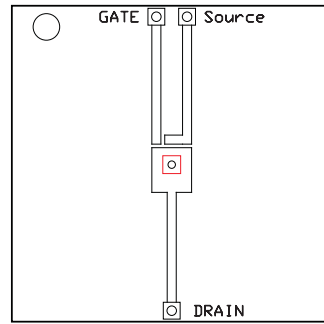
| PARAMETER | | MIN | TYP | MAX | UNIT |
|-----------------|--|-----|-----|-----|--------------------|
| $R_{\theta JC}$ | Thermal Resistance Junction to Case ⁽¹⁾ | | | 8.6 | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance Junction to Ambient ⁽¹⁾⁽²⁾ | | | 66 | $^\circ\text{C/W}$ |

- (1) $R_{\theta JC}$ is determined with the device mounted on a 1-inch² (6.45-cm²), 2-oz. (0.071-mm thick) Cu pad on a 1.5-inch × 1.5-inch (3.81-cm × 3.81-cm), 0.06-inch (1.52-mm) thick FR4 PCB. $R_{\theta JC}$ is specified by design, whereas $R_{\theta JA}$ is determined by the user's board design.
- (2) Device mounted on FR4 material with 1-inch² (6.45-cm²), 2-oz. (0.071-mm thick) Cu.



Max $R_{\theta JA} = 66^{\circ}\text{C/W}$
when mounted on
1 inch² (6.45 cm²) of
2-oz. (0.071-mm thick)
Cu.

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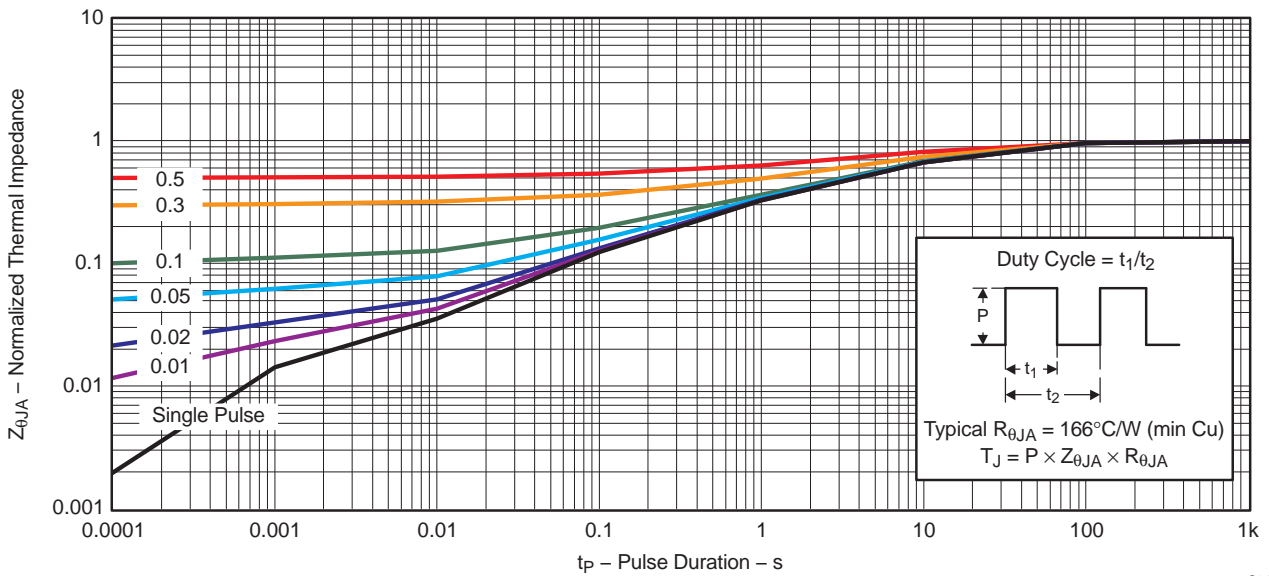


Max $R_{\theta JA} = 207^{\circ}\text{C/W}$
when mounted on
minimum pad area of
2-oz. (0.071-mm thick)
Cu.

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TYPICAL MOSFET CHARACTERISTICS

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G012

Figure 1. Transient Thermal Impedance

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TYPICAL MOSFET CHARACTERISTICS (continued)

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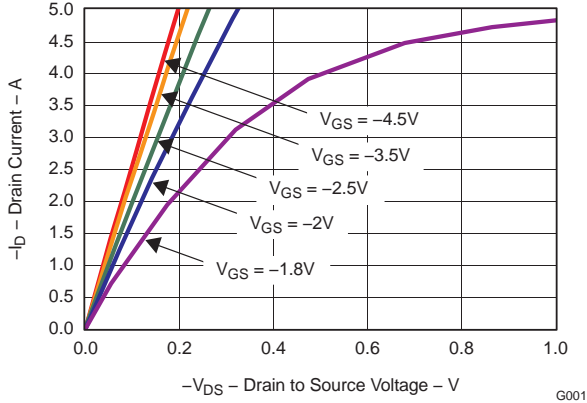


Figure 2. Saturation Characteristics

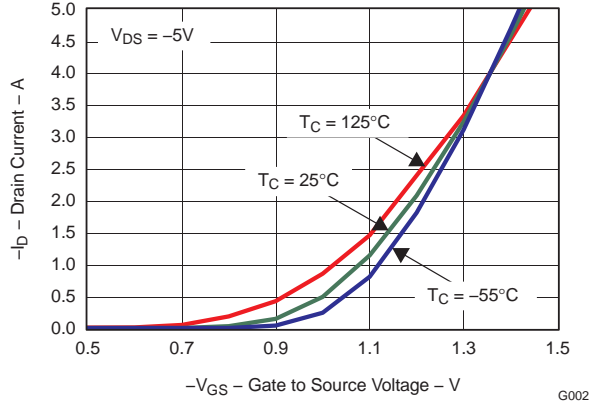


Figure 3. Transfer Characteristics

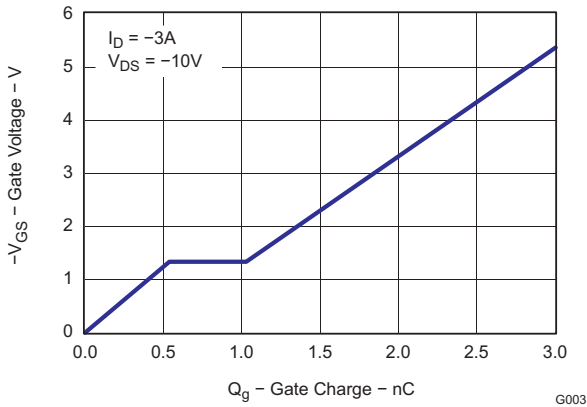


Figure 4. Gate Charge

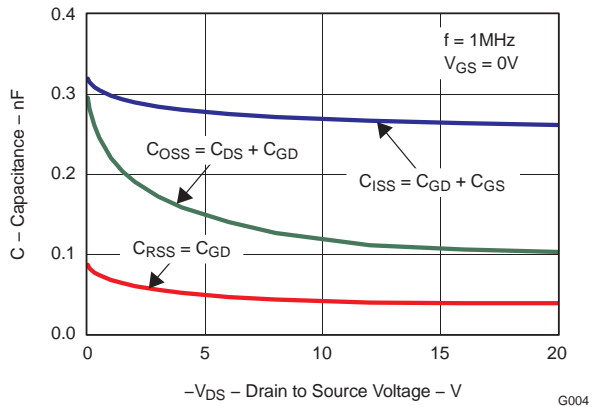


Figure 5. Capacitance

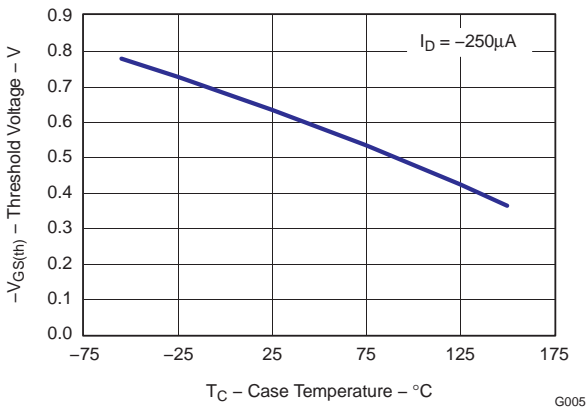


Figure 6. Threshold Voltage vs. Temperature

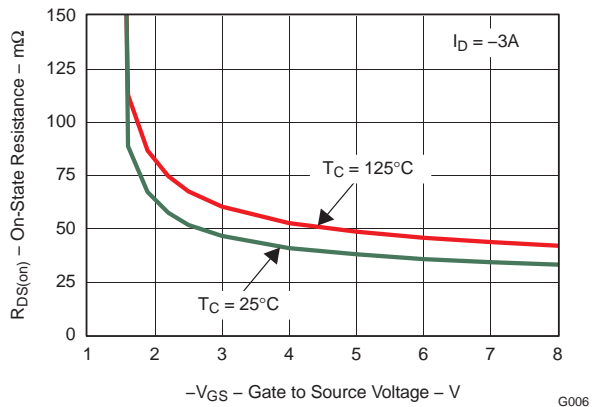


Figure 7. On-State Resistance vs. Gate to Source Voltage

TYPICAL MOSFET CHARACTERISTICS (continued)

$T_A = 25^\circ\text{C}$, unless otherwise specified

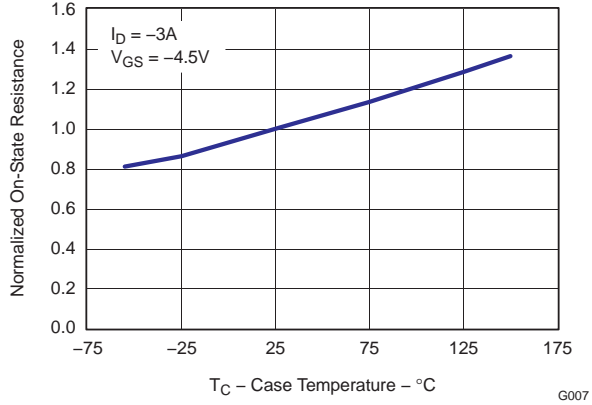


Figure 8. Normalized On-State Resistance vs. Temperature

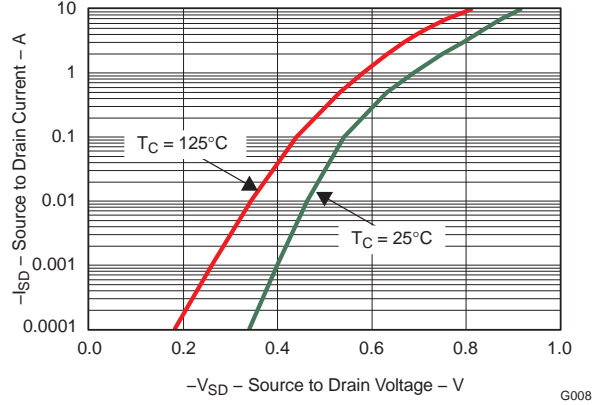


Figure 9. Typical Diode Forward Voltage

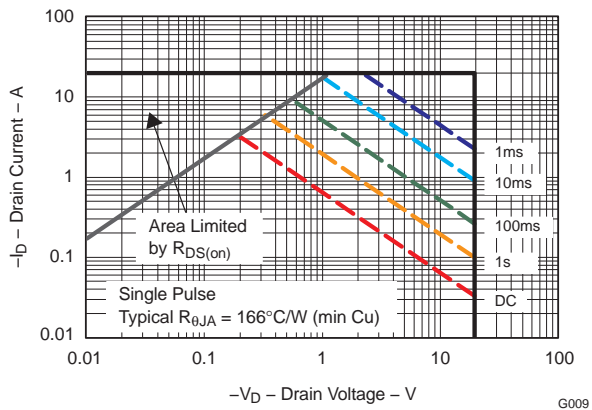


Figure 10. Maximum Safe Operating Area

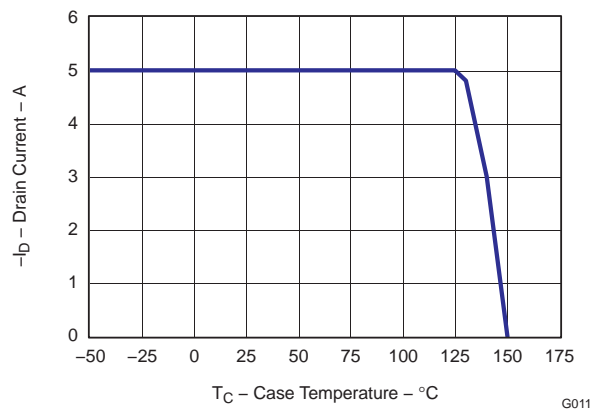


Figure 11. Maximum Drain Current vs. Temperature

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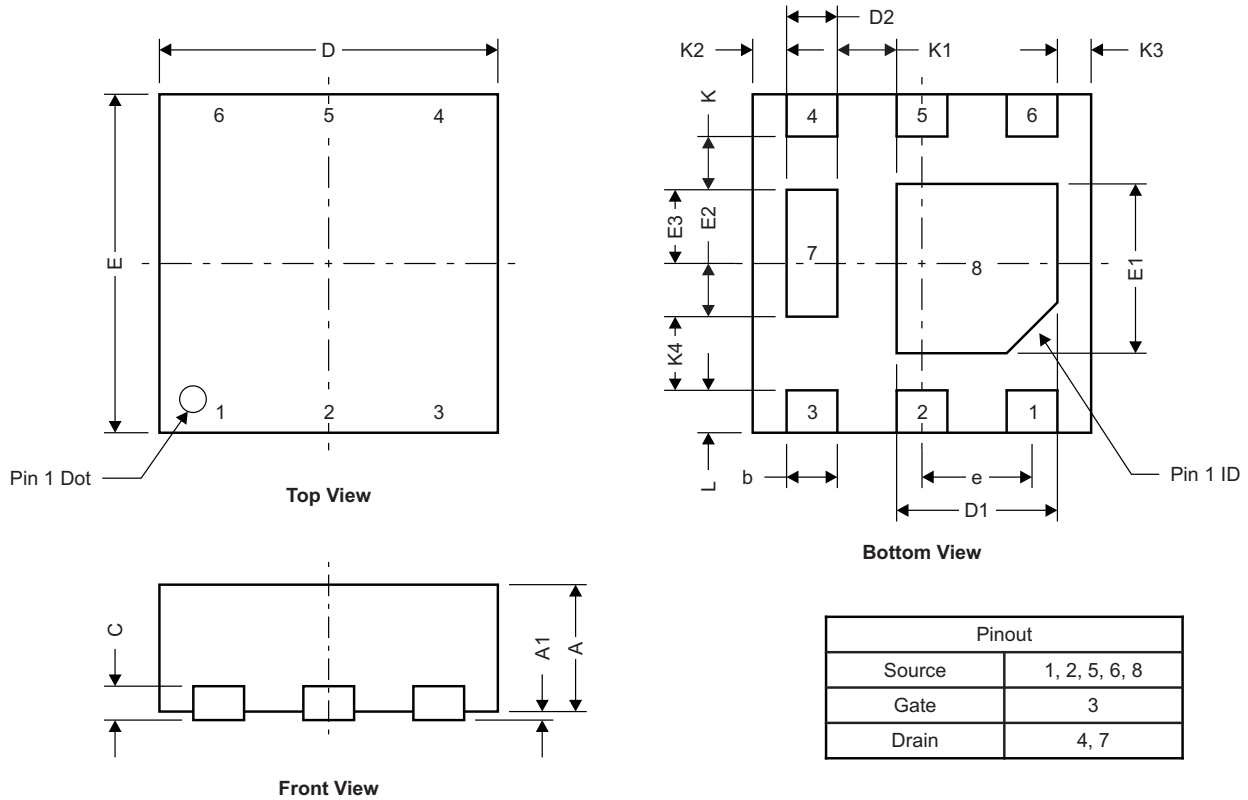


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MECHANICAL DATA

Q2 Package Dimensions



| Pinout | |
|--------|---------------|
| Source | 1, 2, 5, 6, 8 |
| Gate | 3 |
| Drain | 4, 7 |

M0175-01

| DIM | MILLIMETERS | | | INCHES | | |
|-----|-------------|-------|-------|------------|-------|--------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.700 | 0.750 | 0.800 | 0.028 | 0.030 | 0.032 |
| A1 | 0.000 | | 0.050 | 0.000 | | 0.002 |
| b | 0.250 | 0.300 | 0.350 | 0.010 | 0.012 | 0.014 |
| C | 0.203 TYP | | | 0.008 TYP | | |
| D | 2.000 TYP | | | 0.080 TYP | | |
| D1 | 0.900 | 0.950 | 1.000 | 0.036 | 0.038 | 0.040 |
| D2 | 0.300 TYP | | | 0.012 TYP | | |
| E | 2.000 TYP | | | 0.080 TYP | | |
| E1 | 0.900 | 1.000 | 1.100 | 0.036 | 0.040 | 0.044 |
| E2 | 0.280 TYP | | | 0.0112 TYP | | |
| E3 | 0.470 TYP | | | 0.0188 TYP | | |
| e | 0.650 BSC | | | 0.026 TYP | | |
| K | 0.280 TYP | | | 0.0112 TYP | | |
| K1 | 0.350 TYP | | | 0.014 TYP | | |
| K2 | 0.200 TYP | | | 0.008 TYP | | |
| K3 | 0.200 TYP | | | 0.008 TYP | | |
| K4 | 0.470 TYP | | | 0.0188 TYP | | |
| L | 0.200 | 0.25 | 0.300 | 0.008 | 0.010 | 0.0121 |

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REVISION HISTORY

Changes from Original (November 2009) to Revision A **Page**

- Deleted the Package Marking Information section [8](#)

Changes from Revision A (October 2010) to Revision B **Page**

- Added ESDS statement [2](#)

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