# MOSFET - Single N-Channel
## 100 V, 9.0 mΩ, 60 A

# NTBS9D0N10MC

### Features
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low $Q_G$ and Capacitance to Minimize Driver Losses
- Lowers Switching Noise/EMI
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

### Typical Applications
- Power Tools, Battery Operated Vacuums
- UAV/Drones, Material Handling
- BMS/Storage, Home Automation

**MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise noted)

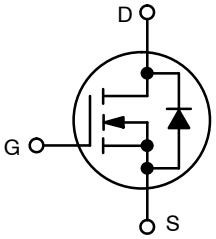
| Parameter | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain−to−Source Voltage | | | $V_{DSS}$ | 100 | V |
| Gate−to−Source Voltage | | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current $R_{\theta JC}$ (Note 2) | Steady State | $T_C$ = 25°C | $I_D$ | 60 | A |
| Power Dissipation $R_{\theta JC}$ (Note 2) | Steady State | $T_C$ = 25°C | $P_D$ | 68 | W |
| Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2) | Steady State | $T_A$ = 25°C | $I_D$ | 14 | A |
| Power Dissipation $R_{\theta JA}$ (Notes 1, 2) | Steady State | $T_A$ = 25°C | $P_D$ | 3.8 | W |
| Pulsed Drain Current | $T_C$ = 25°C, $t_p$ = 100 μs | | $I_{DM}$ | 239 | A |
| Operating Junction and Storage Temperature Range | | | $T_J$, $T_{stg}$ | −55 to +175 | °C |
| Source Current (Body Diode) | | | $I_S$ | 57 | A |
| Single Pulse Drain−to−Source Avalanche Energy ($I_L$ = 11 $A_{pk}$, L = 3 mH) | | | $E_{AS}$ | 181.5 | mJ |
| Lead Temperature for Soldering Purposes (1/8″ from case for 10 s) | | | $T_L$ | 260 | °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.
1. Surface−mounted on FR4 board using a 1 $in^2$, 2 oz. Cu pad.
2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

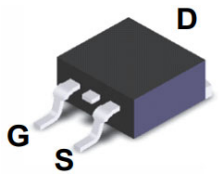
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| $V_{(BR)DSS}$ | $R_{DS(ON)}$ MAX | $I_D$ MAX |
|---|---|---|
| 100 V | 9.0 mΩ @ 10 V | 60 A |




**N−CHANNEL MOSFET**




**$D^2PAK3$**
**TO−263**
**CASE 418AJ**

**MARKING DIAGRAM**




A = Assembly Location
Y = Year
WW = Work Week
ZZ = Lot Traceability
NTBS9D0N10MC = Specific Device Code

**ORDERING INFORMATION**

| Device | Package | Shipping† |
|---|---|---|
| NTBS9D0N10MC | $D^2PAK$ (Pb−Free) | 800 / 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.

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## THERMAL RESISTANCE MAXIMUM RATINGS

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Junction−to−Case − Steady State (Note 2) | $R_{\theta JC}$ | 2.2 | °C/W |
| Junction−to−Ambient − Steady State (Notes 1, 2) | $R_{\theta JA}$ | 40 | |

## ELECTRICAL CHARACTERISTICS ($T_J$ = 25°C unless otherwise specified)

| Parameter | Symbol | Test Condition | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain−to−Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 250 μA | | 100 | | | V |
| Drain−to−Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | $I_D$ = 250 μA, referenced to 25°C | | | 56 | | mV/°C |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 80 V | $T_J$ = 25°C | | | 1 | μA |
| | | | $T_J$ = 150°C | | | 100 | μA |
| Gate−to−Source Leakage Current | $I_{GSS}$ | $V_{GS}$ = ±20 V, $V_{DS}$ = 0 V | | | | ±100 | nA |
| **ON CHARACTERISTICS** (Note 3) | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS}$ = $V_{DS}$, $I_D$ = 131 μA | | 2.0 | 3.0 | 4.0 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | $I_D$ = 131 μA, referenced to 25°C | | | −9.6 | | mV/°C |
| Drain−to−Source On Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 23 A | | | 7.8 | 9.0 | mΩ |
| | | $V_{GS}$ = 6 V, $I_D$ = 12 A | | | 12 | 22.2 | |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 10 V, $I_D$ = 23 A | | | 59 | | S |
| Gate−Resistance | $R_G$ | $T_A$ = 25°C | | | 0.6 | | Ω |
| **CHARGES & CAPACITANCES** | | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$ = 0 V, f = 1 MHz, $V_{DS}$ = 50 V | | | 1695 | | pF |
| Output Capacitance | $C_{OSS}$ | | | | 935 | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | | 13 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 50 V, $I_D$ = 23 A | | | 23 | | nC |
| Threshold Gate Charge | $Q_{G(TH)}$ | | | | 5 | | |
| Gate−to−Source Charge | $Q_{GS}$ | | | | 8 | | |
| Gate−to−Drain Charge | $Q_{GD}$ | | | | 5 | | |
| Output Charge | $Q_{OSS}$ | $V_{DS}$ = 50 V, $V_{GS}$ = 0 V | | | 59 | | |
| **SWITCHING CHARACTERISTICS, $V_{GS}$ = 10 V** (Note 3) | | | | | | | |
| Turn−On Delay Time | $t_{d(ON)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 50 V, $I_D$ = 23 A, $R_G$ = 6 Ω | | | 15 | | ns |
| Rise Time | $t_r$ | | | | 6 | | |
| Turn−Off Delay Time | $t_{d(OFF)}$ | | | | 21 | | |
| Fall Time | $t_f$ | | | | 7 | | |
| **DRAIN−SOURCE DIODE CHARACTERISTICS** | | | | | | | |
| Forward Diode Voltage | $V_{SD}$ | $V_{GS}$ = 0 V, $I_S$ = 23 A, $T_J$ = 25°C | | | 0.87 | 1.2 | V |
| | | $V_{GS}$ = 0 V, $I_S$ = 23 A, $T_J$ = 150°C | | | 0.72 | | |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, $dI_S/dt$ = 300 A/μs, $I_S$ = 12 A | | | 29 | | ns |
| Reverse Recovery Charge | $Q_{RR}$ | | | | 61 | | nC |
| Reverse Recovery Time | $t_{RR}$ | $V_{GS}$ = 0 V, $dI_S/dt$ = 1000 A/μs, $I_S$ = 12 A | | | 23 | | ns |
| Reverse Recovery Charge | $Q_{RR}$ | | | | 147 | | nC |

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.

3. Switching characteristics are independent of operating junction temperature

## TYPICAL CHARACTERISTICS

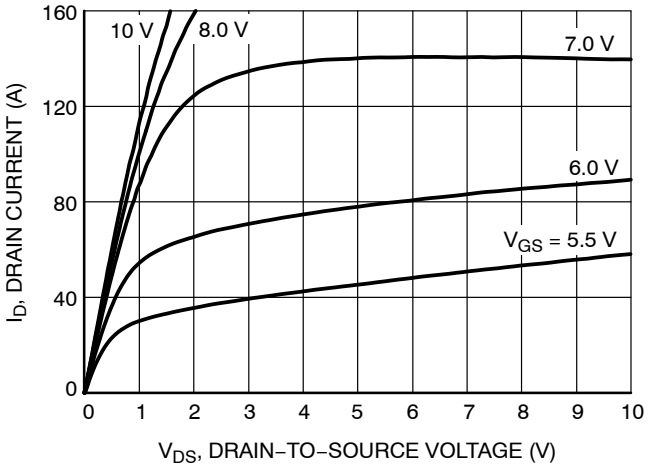



**Figure 1. On−Region Characteristics**

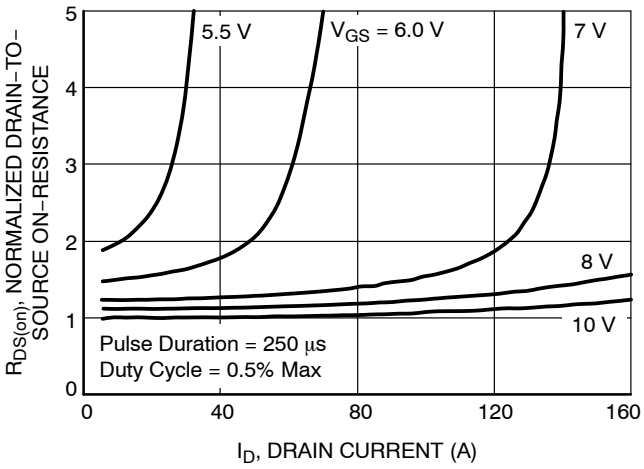



**Figure 2. Normalized On−Resistance vs. Drain Current and Gate Voltage**

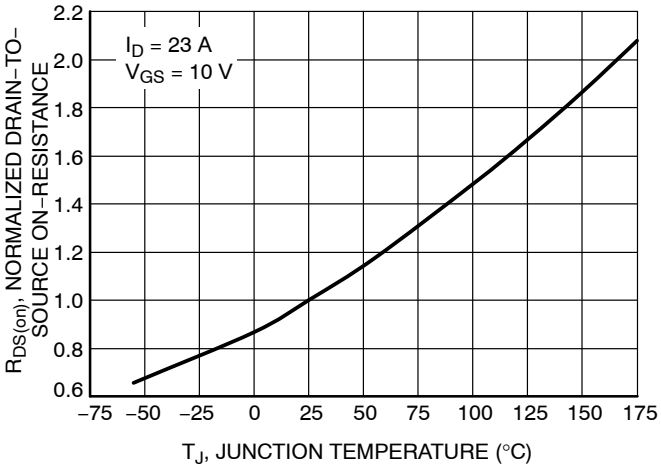



**Figure 3. Normalized On−Resistance vs. Junction Temperature**

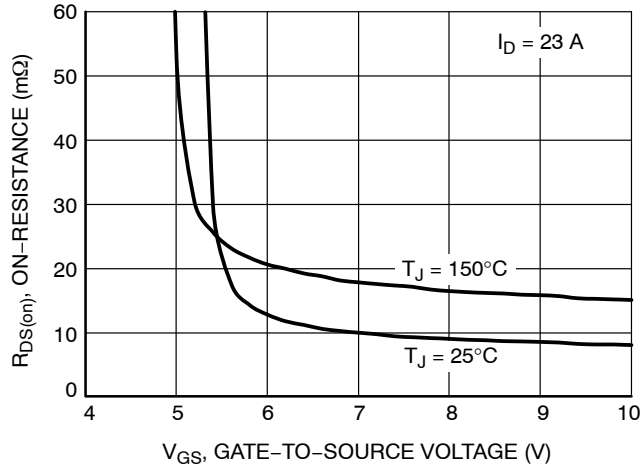



**Figure 4. On−Resistance vs. Gate−to−Source Voltage**

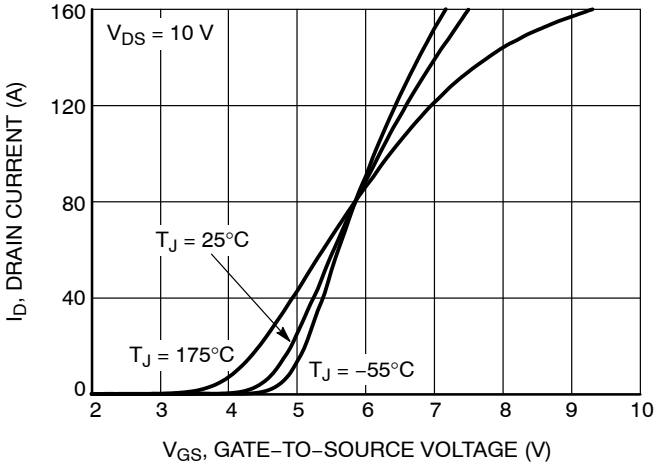



**Figure 5. Transfer Characteristics**

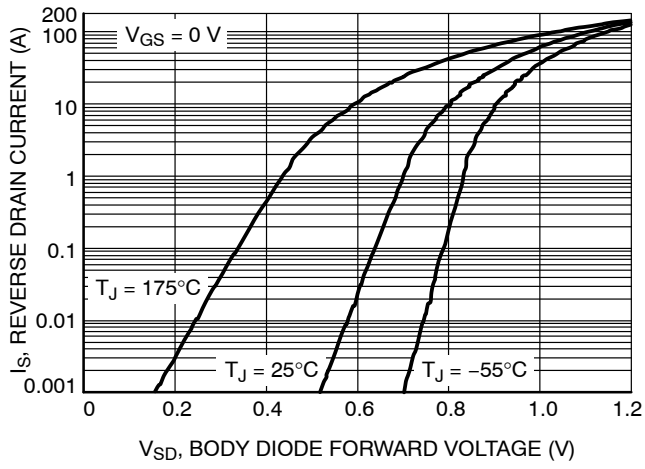



**Figure 6. Source−to−Drain Diode Forward Voltage vs. Source Current**

## TYPICAL CHARACTERISTICS

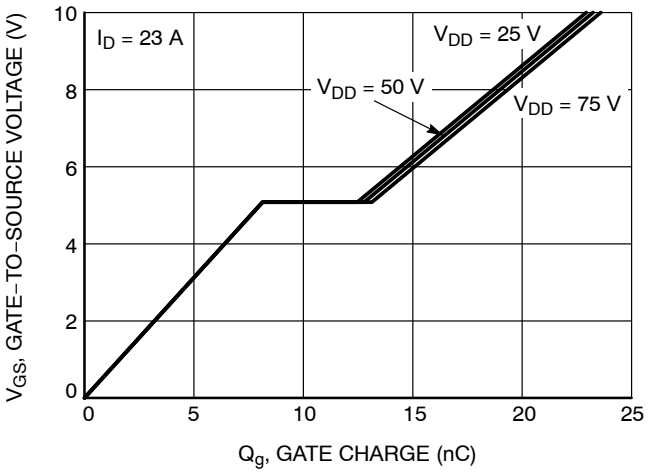



**Figure 7. Gate Charge Characteristics**

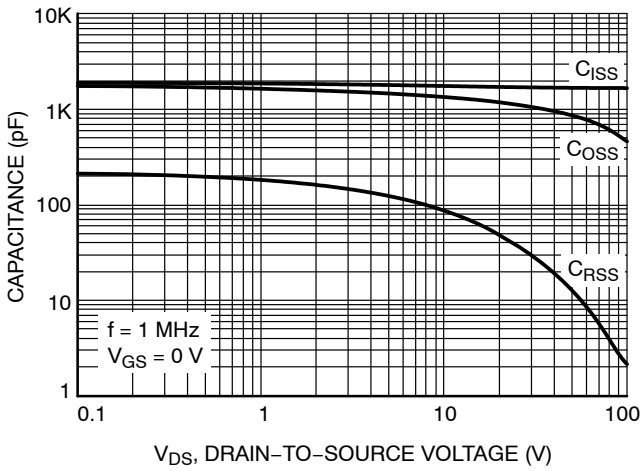



**Figure 8. Capacitance vs. Drain−to−Source Voltage**

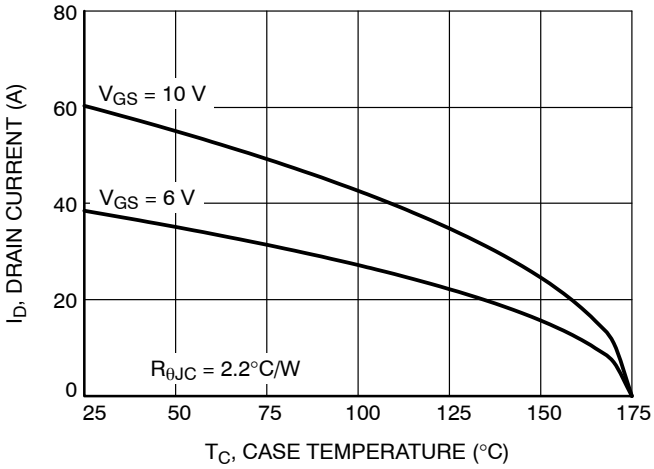



**Figure 9. Drain Current vs. Case Temperature**

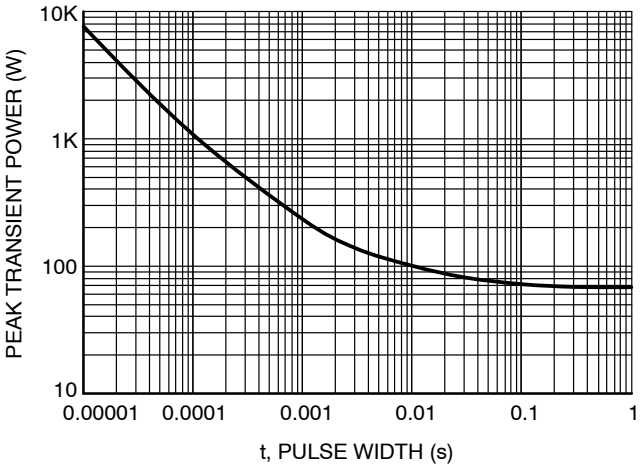



**Figure 10. Peak Power**

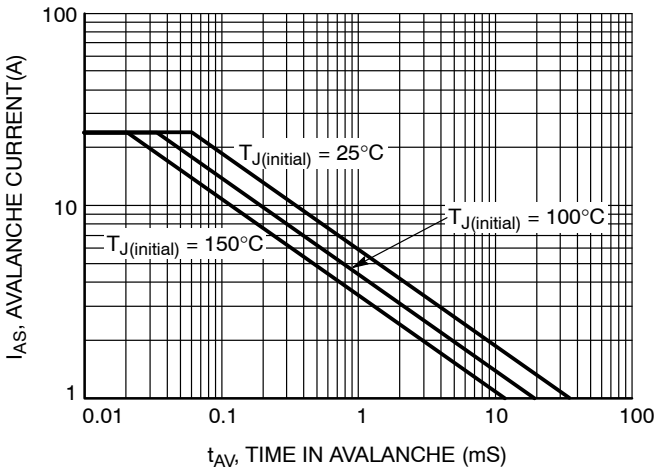



**Figure 11. Unclamped Inductive Switching Capability**

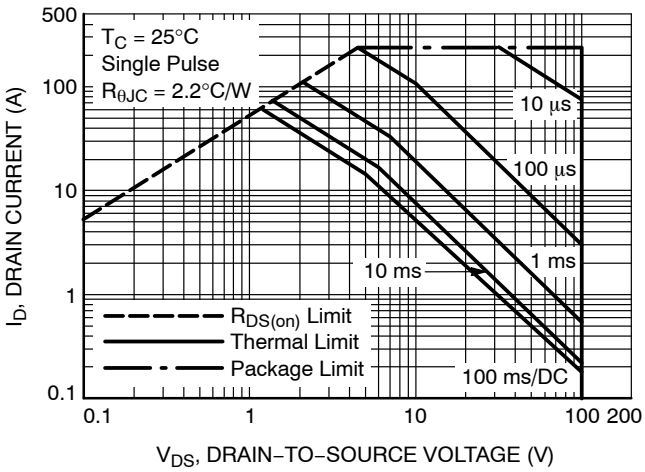



**Figure 12. Forward Bias Safe Operating Area**

## TYPICAL CHARACTERISTICS

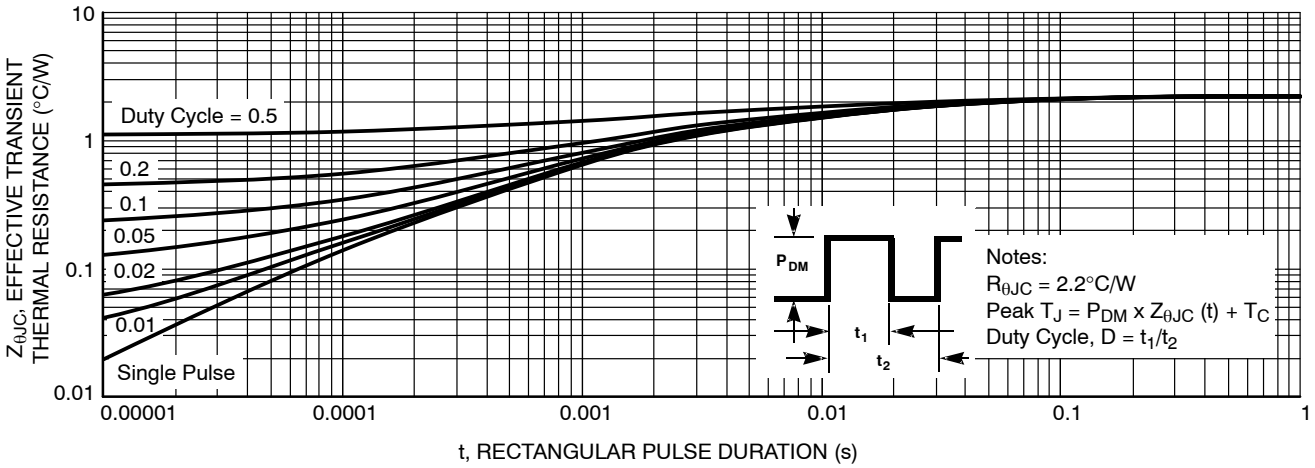
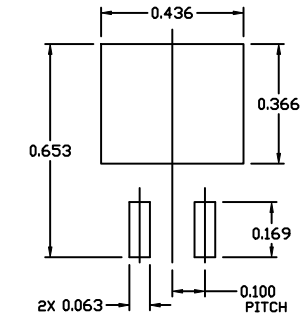



**Figure 13. Transient Thermal Impedance**

# NTBS9D0N10MC

## PACKAGE DIMENSIONS

### D²PAK−3 (TO−263, 3−LEAD)
CASE 418AJ
ISSUE E



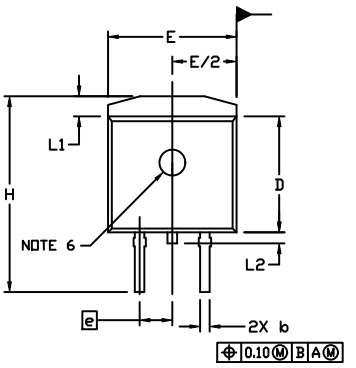

RECOMMENDED
MOUNTING FOOTPRINT

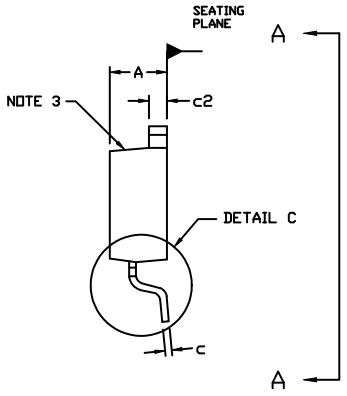
For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

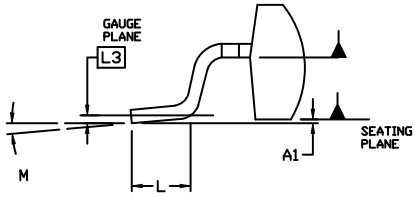
NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: INCHES
3. CHAMFER OPTIONAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.005 PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY AT DATUM H.
5. THERMAL PAD CONTOUR IS OPTIONAL WITHIN DIMENSIONS E, L1, D1, AND E1.
6. OPTIONAL MOLD FEATURE.
7. ①, ② … OPTIONAL CONSTRUCTION FEATURE CALL OUTS.

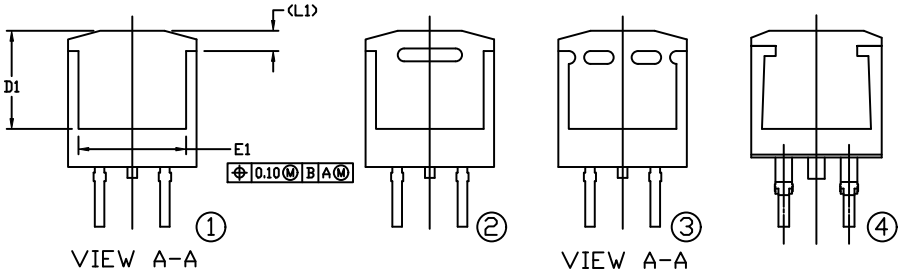
| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN. | MAX. | MIN. | MAX. |
| A | 0.160 | 0.190 | 4.06 | 4.83 |
| A1 | 0.000 | 0.010 | 0.00 | 0.25 |
| b | 0.020 | 0.039 | 0.51 | 0.99 |
| c | 0.012 | 0.029 | 0.30 | 0.74 |
| c2 | 0.045 | 0.065 | 1.14 | 1.65 |
| D | 0.330 | 0.380 | 8.38 | 9.65 |
| D1 | 0.260 | --- | 6.60 | --- |
| E | 0.380 | 0.420 | 9.65 | 10.67 |
| E1 | 0.245 | --- | 6.22 | --- |
| e | 0.100 BSC | | 2.54 BSC | |
| H | 0.575 | 0.625 | 14.60 | 15.88 |
| L | 0.070 | 0.110 | 1.78 | 2.79 |
| L1 | --- | 0.066 | --- | 1.68 |
| L2 | --- | 0.070 | --- | 1.78 |
| L3 | 0.010 BSC | | 0.25 BSC | |
| M | −8° | 8° | −8° | 8° |




DETAIL C
TIP LEADFORM
ROTATED 90° CW




VIEW A−A

VIEW A−A
OPTIONAL CONSTRUCTIONS

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