

MOSFET – Power, Single N-Channel 40 V, 1.07 mΩ, 531 A

NVMJST0D9N04C

Features

- Small Footprint (5x7 mm) for Compact Design
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Q_G and Capacitance to Minimize Driver Losses
- TCPAK57 Top Cool Package (TCPAK10)
- AEC-Q101 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

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

| Parameter | | Symbol | Value | Unit |
|---|---|-----------------------------------|----------------|------|
| Drain-to-Source Voltage | | V _{DSS} | 40 | V |
| Gate-to-Source Voltage | | V _{GS} | ±20 | V |
| Continuous Drain Current R _{θJC} (Notes 1, 3) | Steady State | T _C = 25°C | I _D | A |
| | | T _C = 100°C | 376 | |
| Power Dissipation R _{θJC} (Note 1) | | T _C = 25°C | P _D | W |
| | | T _C = 100°C | 278 | |
| Pulsed Drain Current | T _A = 25°C, t _p = 10 µs | I _{DM} | 900 | A |
| Operating Junction and Storage Temperature Range | | T _J , T _{stg} | -55 to +175 | °C |
| Source Current (Body Diode) | | I _S | 463 | A |
| Single Pulse Drain-to-Source Avalanche Energy (I _{L(pk)} = 34 A) | | E _{AS} | 578 | mJ |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | | T _L | 260 | °C |

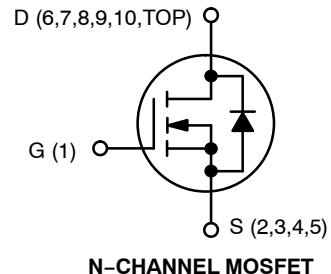
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL RESISTANCE MAXIMUM RATINGS

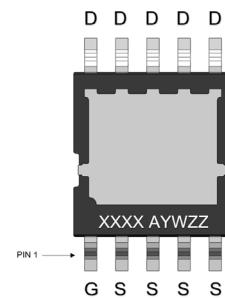
| Parameter | Symbol | Value | Unit |
|---|------------------|-------|------|
| Junction-to-Case – Steady State | R _{θJC} | 0.27 | °C/W |
| Junction-to-Ambient – Steady State (Note 2) | R _{θJA} | 28.5 | |
| Junction-to-Drain Lead | Ψ _{JL} | 4.7 | |
| Junction-to-Source Lead | Ψ _{JL} | 5.1 | |
| Junction-to-Heatsink Top (Note 2) | Ψ _{JH} | 1.3 | |

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. 2s2p JEDEC51-7 standard PCB mounted to a 25x25x3 (mm) aluminum heatsink with a 12 w/mK TIM interface.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

| V _{(BR)DSS} | R _{DS(ON) MAX} | I _{D MAX} |
|----------------------|-------------------------|--------------------|
| 40 V | 1.07 mΩ @ 10 V | 531 A |



MARKING DIAGRAM



XXXX = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
ZZ = Assembly Lot Code

ORDERING INFORMATION

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

NVMJST0D9N04C

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

| Parameter | Symbol | Test Condition | | Min | Typ | Max | Unit |
|---|---------------------------------|---|---------------------------|-----|-----|-----|----------------------------|
| OFF CHARACTERISTICS | | | | | | | |
| Drain-to-Source Breakdown Voltage | $V_{(\text{BR})\text{DSS}}$ | $V_{\text{GS}} = 0 \text{ V}$, $I_D = 250 \mu\text{A}$ | | 40 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(\text{BR})\text{DSS}}/T_J$ | | | | 16 | | $\text{mV}/^\circ\text{C}$ |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{\text{GS}} = 0 \text{ V}$, $V_{\text{DS}} = 40 \text{ V}$ | $T_J = 25^\circ\text{C}$ | | 10 | | μA |
| | | | $T_J = 125^\circ\text{C}$ | | | 100 | |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{\text{DS}} = 0 \text{ V}$, $V_{\text{GS}} = 20 \text{ V}$ | | | | 100 | nA |

ON CHARACTERISTICS (Note 4)

| | | | | | | | |
|-----------------------------------|--------------------------------|---|----------------------|-----|------|------|----------------------------|
| Gate Threshold Voltage | $V_{\text{GS}(\text{TH})}$ | $V_{\text{GS}} = V_{\text{DS}}$, $I_D = 190 \mu\text{A}$ | | 2.5 | | 3.5 | V |
| Threshold Temperature Coefficient | $V_{\text{GS}(\text{TH})}/T_J$ | | | | -7 | | $\text{mV}/^\circ\text{C}$ |
| Drain-to-Source On Resistance | $R_{\text{DS}(\text{on})}$ | $V_{\text{GS}} = 10 \text{ V}$ | $I_D = 50 \text{ A}$ | | 0.92 | 1.07 | $\text{m}\Omega$ |
| Forward Transconductance | g_{FS} | $V_{\text{DS}} = 15 \text{ V}$, $I_D = 50 \text{ A}$ | | | 190 | | S |

CHARGES, CAPACITANCES & GATE RESISTANCE

| | | | | | | |
|------------------------------|----------------------------|--|--|------|--|----|
| Input Capacitance | C_{iss} | $V_{\text{GS}} = 0 \text{ V}$, $f = 1 \text{ MHz}$, $V_{\text{DS}} = 25 \text{ V}$ | | 6100 | | pF |
| Output Capacitance | C_{oss} | | | 3400 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 70 | | |
| Total Gate Charge | $Q_{\text{G}(\text{TOT})}$ | $V_{\text{GS}} = 10 \text{ V}$, $V_{\text{DS}} = 32 \text{ V}$; $I_D = 50 \text{ A}$ | | 86 | | nC |
| Threshold Gate Charge | $Q_{\text{G}(\text{TH})}$ | | | 18 | | |
| Gate-to-Source Charge | Q_{GS} | | | 28 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 14 | | |
| Plateau Voltage | V_{GP} | | | 4.9 | | V |

SWITCHING CHARACTERISTICS (Note 5)

| | | | | | | |
|---------------------|----------------------------|--|--|-----|--|----|
| Turn-On Delay Time | $t_{\text{d}(\text{ON})}$ | $V_{\text{GS}} = 10 \text{ V}$, $V_{\text{DS}} = 32 \text{ V}$, $I_D = 50 \text{ A}$, $R_G = 2.5 \Omega$ | | 54 | | ns |
| Rise Time | t_r | | | 162 | | |
| Turn-Off Delay Time | $t_{\text{d}(\text{OFF})}$ | | | 227 | | |
| Fall Time | t_f | | | 173 | | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|-------------------------|-----------------|---|---------------------------|--|------|-----|----|
| Forward Diode Voltage | V_{SD} | $V_{\text{GS}} = 0 \text{ V}$, $I_S = 50 \text{ A}$ | $T_J = 25^\circ\text{C}$ | | 0.8 | 1.2 | V |
| | | | $T_J = 125^\circ\text{C}$ | | 0.65 | | |
| Reverse Recovery Time | t_{RR} | $V_{\text{GS}} = 0 \text{ V}$, $dI_S/dt = 100 \text{ A}/\mu\text{s}$, $I_S = 50 \text{ A}$ | | | 91 | | ns |
| Charge Time | t_a | | | | 42 | | |
| Discharge Time | t_b | | | | 49 | | |
| Reverse Recovery Charge | Q_{RR} | | | | 159 | | 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.

4. Pulse Test: pulse width $\leq 300 \mu\text{s}$, duty cycle $\leq 2\%$.
5. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

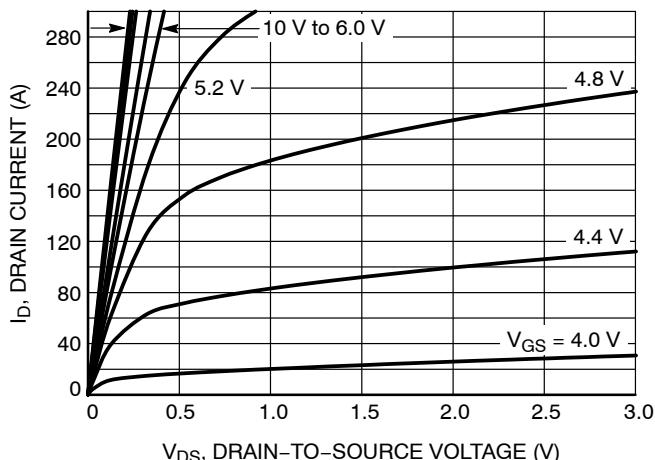


Figure 1. On-Region Characteristics

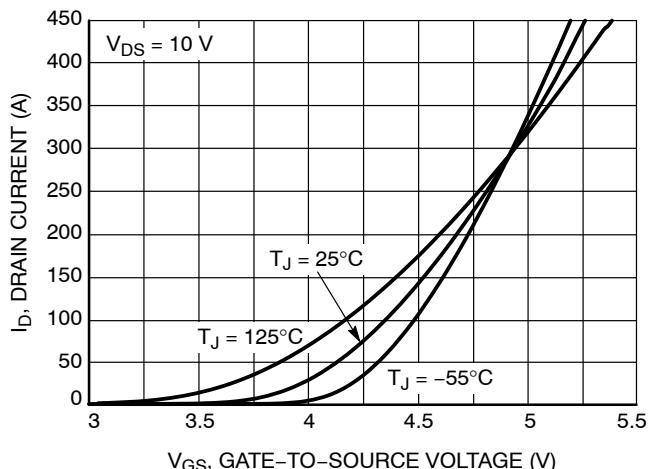


Figure 2. Transfer Characteristics

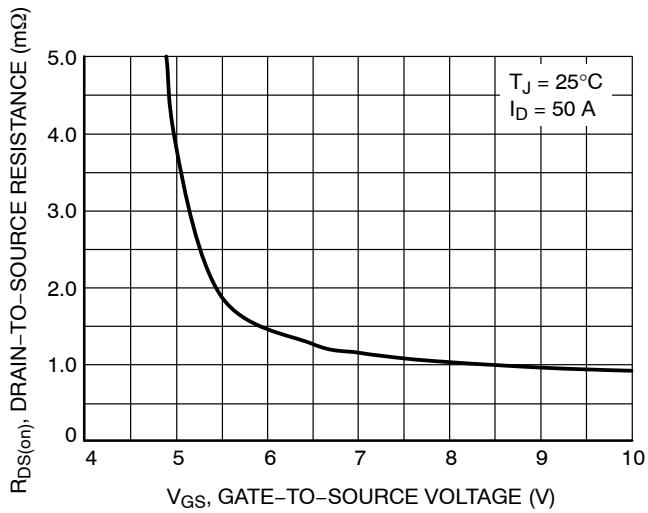


Figure 3. On-Resistance vs. Gate-to-Source Voltage

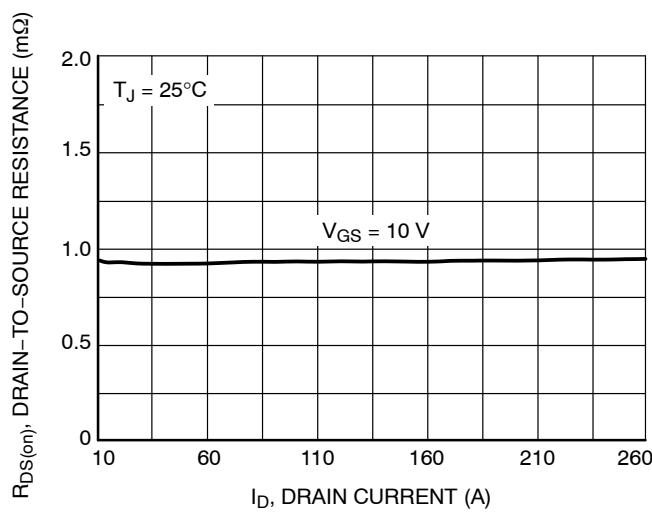


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

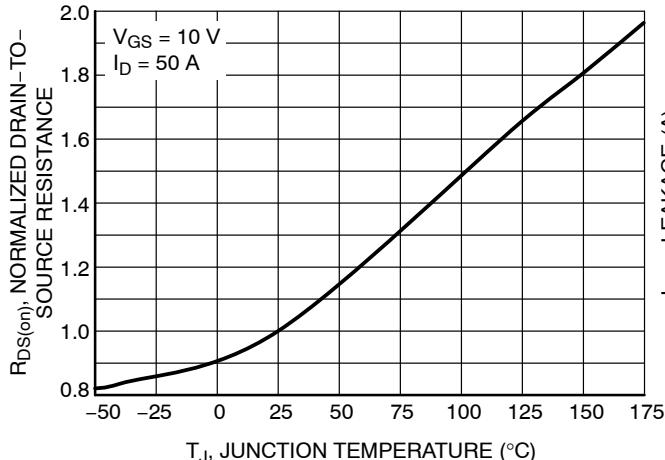


Figure 5. On-Resistance Variation with Temperature

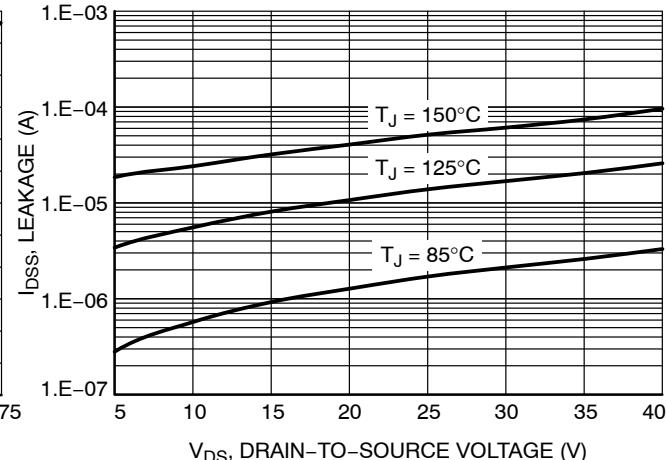
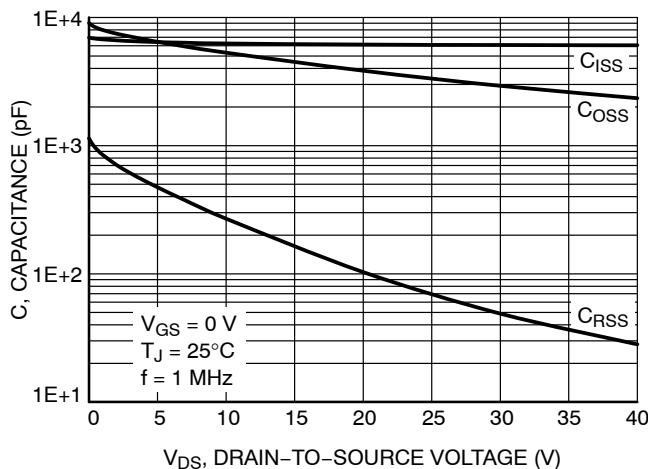
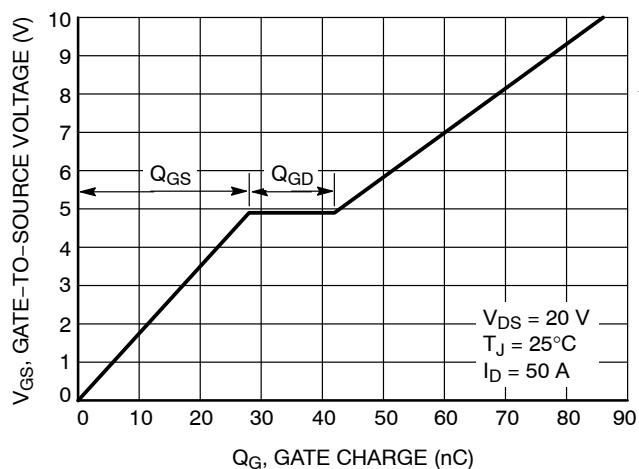
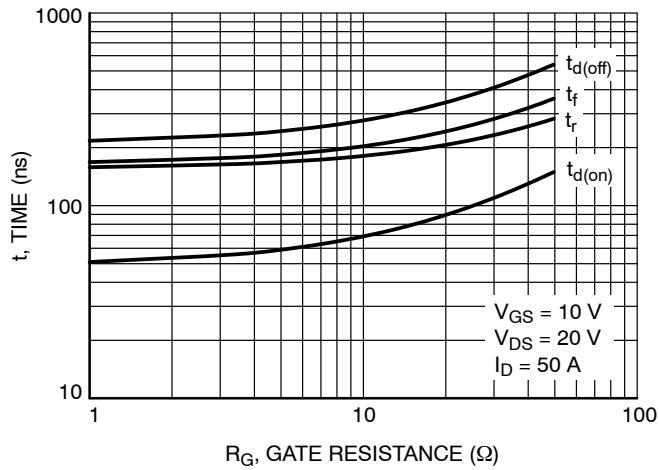
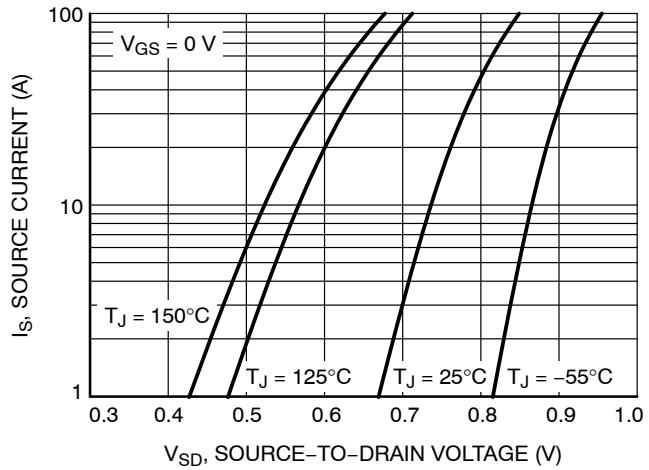
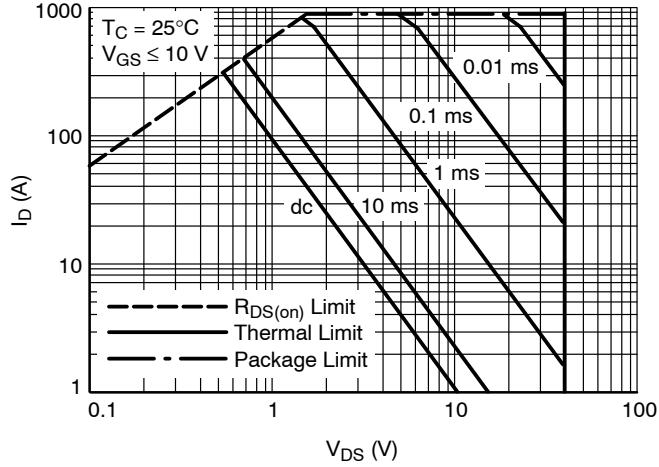
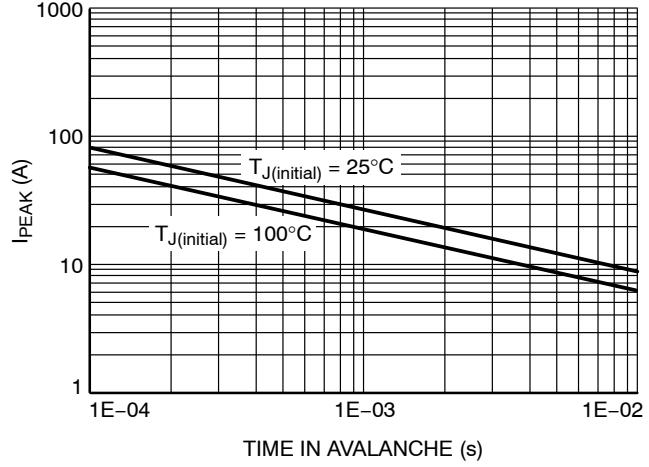


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

Figure 7. Capacitance Variation

Figure 8. Gate-to-Source Voltage vs. Charge

Figure 9. Resistive Switching Time Variation vs. Gate Resistance

Figure 10. Diode Forward Voltage vs. Current

Figure 11. Safe Operating Area

Figure 12. I_{PEAK} vs. Time in Avalanche

TYPICAL CHARACTERISTICS

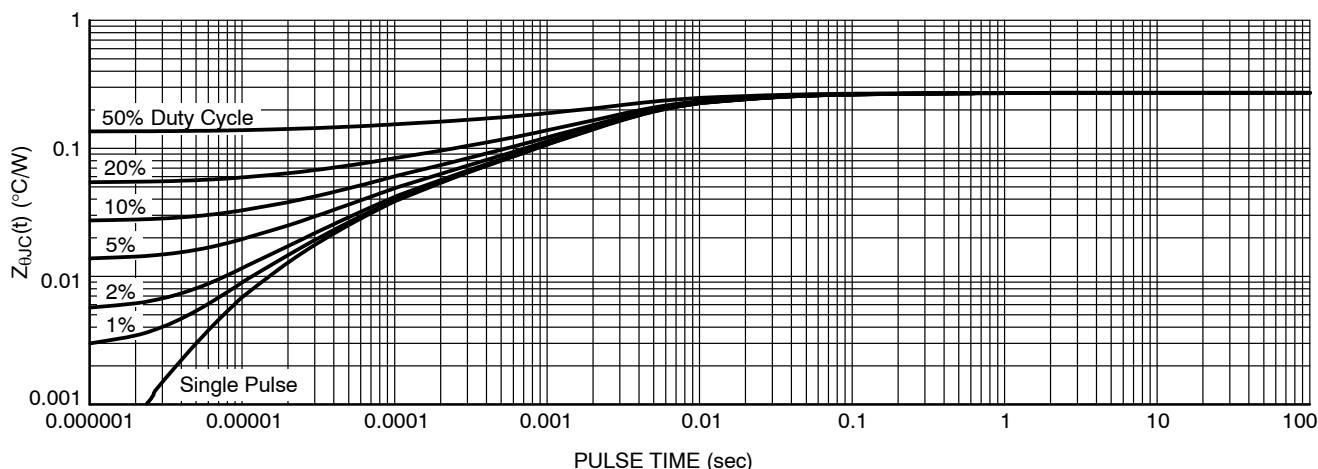


Figure 13. Thermal Characteristics

DEVICE ORDERING INFORMATION

| Device | Marking | Package | Shipping [†] |
|------------------|---------|----------------------|-----------------------|
| NVMJST0D9N04CTXG | 0D94C | TCPAK10 (Pb-Free) | 3000 / Tape & Reel |

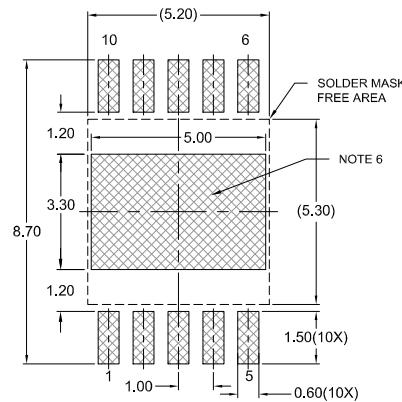
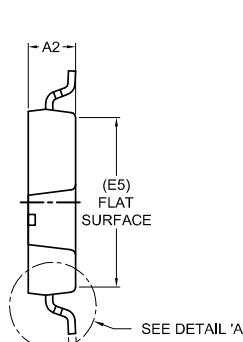
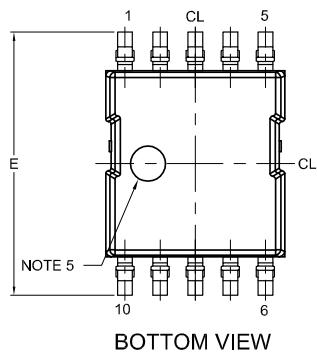
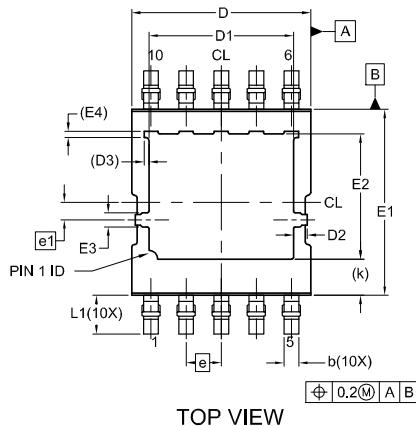
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

PACKAGE DIMENSIONS

TCPAK10 5.1x7.5, 1.0P

CASE 760AG

ISSUE D

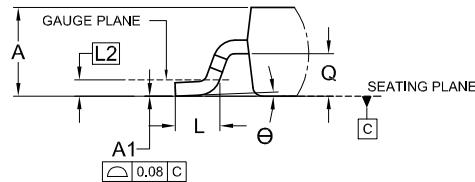


*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SODERRM/D.

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. UNIT DIMENSION: MILLIMETERS
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.150mm PER SIDE.
4. DIMENSIONS D AND E1 ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
5. OPTIONAL MOLD FEATURE.
6. LAND PAD UNDER THE PACKAGE BODY IS FOR MECHANICAL SUPPORT ONLY. SOLDER CONNECTION IS NOT REQUIRED.
7. DIMENSION A1 IS THE LEAD STAND-OFF FROM THE BOTTOM SURFACE OF THE PACKAGE BODY.

| MILLIMETERS | | | |
|-------------|----------|------|------|
| DIM | MIN | NOM | MAX |
| A | 1.30 | 1.35 | 1.45 |
| A1 | -0.05 | 0.00 | 0.05 |
| A2 | 1.30 | 1.35 | 1.40 |
| b | 0.36 | 0.41 | 0.46 |
| c | 0.16 | 0.21 | 0.26 |
| D | 5.00 | 5.10 | 5.20 |
| D1 | 4.02 | 4.12 | 4.22 |
| D2 | 0.30 | 0.40 | 0.50 |
| D3 | 0.14 REF | | |
| E | 7.40 | 7.50 | 7.60 |
| E1 | 5.20 | 5.30 | 5.40 |
| E2 | 3.47 | 3.57 | 3.67 |
| E3 | 0.30 | 0.40 | 0.50 |
| E4 | 0.17 REF | | |
| E5 | 4.82 REF | | |
| e | 1.00 BSC | | |
| e1 | 0.50 BSC | | |
| K | 1.03 REF | | |
| L | 0.49 | 0.69 | 0.89 |
| L1 | 0.90 | 1.10 | 1.30 |
| L2 | 0.25 BSC | | |
| Q | 0.60 | 0.65 | 0.70 |
| Θ | 0° | 2.5° | 5° |



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