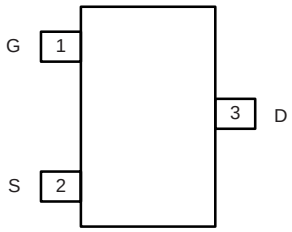
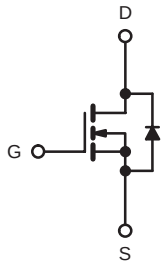
# MTN7002ZHN3-VB Datasheet
# N-Channel 60-V (D-S) MOSFET

| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) | $R_{DS(on)}$ (Ω) | $I_D$ (mA) |
| 60 | 2.8 at $V_{GS}$ = 10 V | 250 |

SOT-23




Top View




N-Channel MOSFET

## FEATURES

- **Halogen-free According to IEC 61249-2-21 Definition**
- Low Threshold: 2 V (typ.)
- Low Input Capacitance: 25 pF
- Fast Switching Speed: 25 ns
- Low Input and Output Leakage
- Trench Power MOSFET
- Compliant to RoHS Directive 2002/95/EC

Pb-free Available
RoHS* COMPLIANT
HALOGEN FREE Available

## BENEFITS

- Low Offset Voltage
- Low-Voltage Operation
- Easily Driven Without Buffer
- High-Speed Circuits
- Low Error Voltage

## APPLICATIONS

- Direct Logic-Level Interface: TTL/CMOS
- Drivers: Relays, Solenoids, Lamps, Hammers, Display, Memories, Transistors, etc.
- Battery Operated Systems
- Solid-State Relays

**ABSOLUTE MAXIMUM RATINGS** $T_A$ = 25 °C, unless otherwise noted

| Parameter | | Symbol | Limit | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 60 | V |
| Gate-Source Voltage | | $V_{GS}$ | ± 20 | |
| Continuous Drain Current ($T_J$ = 150 °C)[b] | $T_A$ = 25 °C | $I_D$ | 250 | mA |
| | $T_A$ = 100 °C | | 150 | |
| Pulsed Drain Current[a] | | $I_{DM}$ | 800 | |
| Power Dissipation[b] | $T_A$ = 25 °C | $P_D$ | 0.30 | W |
| | $T_A$ = 100 °C | | 0.13 | |
| Maximum Junction-to-Ambient[b] | | $R_{thJA}$ | 350 | °C/W |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | - 55 to 150 | °C |

Notes:
a. Pulse width limited by maximum junction temperature.
b. Surface Mounted on FR4 board.

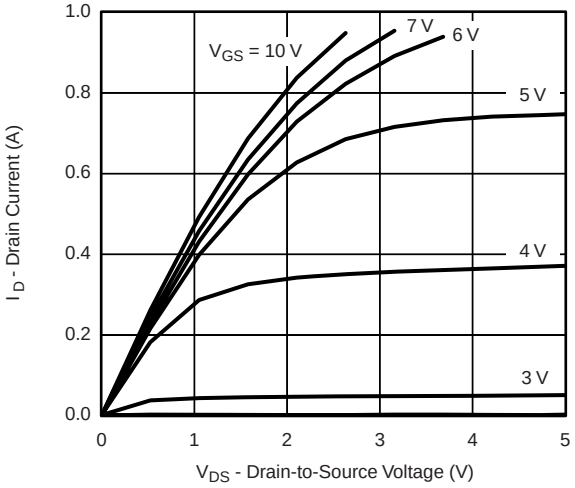
* Pb containing terminations are not RoHS compliant, exemptions may apply.

| **SPECIFICATIONS** $T_A$ = 25 °C, unless otherwise noted | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions** | **Limits** | | | **Unit** |
| | | | **Min.** | **Typ.[a]** | **Max.** | |
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{DS}$ | $V_{GS}$ = 0 V, $I_D$ = 10 µA | 60 | | | V |
| Gate-Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 1 | | 2.5 | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 20 V | | | ± 10 | µA |
| | | $V_{DS}$ = 0 V, $V_{GS}$ = ± 15 V | | | 1 | |
| | | $V_{DS}$ = 0 V, $V_{GS}$ = ± 10 V | | | ± 150 | nA |
| | | $V_{DS}$ = 0 V, $V_{GS}$ = ± 10 V, $T_J$ = 85 °C | | | ± 1000 | |
| | | $V_{DS}$ = 0 V, $V_{GS}$ = ± 5 V | | | ± 100 | |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 60 V, $V_{GS}$ = 0 V | | | 1 | µA |
| | | $V_{DS}$ = 60 V, $V_{GS}$ = 0 V , $T_J$ = 125 °C | | | 500 | |
| On-State Drain Current[a] | $I_{D(on)}$ | $V_{GS}$ = 10 V, $V_{DS}$ = 7.5 V | 500 | | | mA |
| | | $V_{GS}$ = 4.5 V, $V_{DS}$ = 10 V | 300 | | | |
| Drain-Source On-Resistance[a] | $R_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 200 mA | | 2.8 | | Ω |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 150 mA | | 3.1 | | |
| Forward Transconductance[a] | $g_{fs}$ | $V_{DS}$ = 10 V, $I_D$ = 100 mA | 100 | | | mS |
| Diode Forward Voltage | $V_{SD}$ | $I_S$ = 100 mA, $V_{GS}$ = 0 V | | | 1.3 | V |
| **Dynamic[a]** | | | | | | |
| Total Gate Charge | $Q_g$ | $V_{DS}$ = 10 V, $V_{GS}$ = 4.5 V<br>$I_D \cong$ 150 mA | | 0.4 | 0.6 | nC |
| Input Capacitance | $C_{iss}$ | $V_{DS}$ = 25 V, $V_{GS}$ = 0 V<br>f = 1 MHz | | 25 | | pF |
| Output Capacitance | $C_{oss}$ | | | 5 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 2.0 | | |
| **Switching[a, b, c]** | | | | | | |
| Turn-On Time | $t_{d(on)}$ | $V_{DD}$ = 30 V, $R_L$ = 150 Ω<br>$I_D \cong$ 200 mA, $V_{GEN}$ = 10 V, $R_G$ = 10 Ω | | | 20 | ns |
| Turn-Off Time | $t_{d(off)}$ | | | | 30 | |

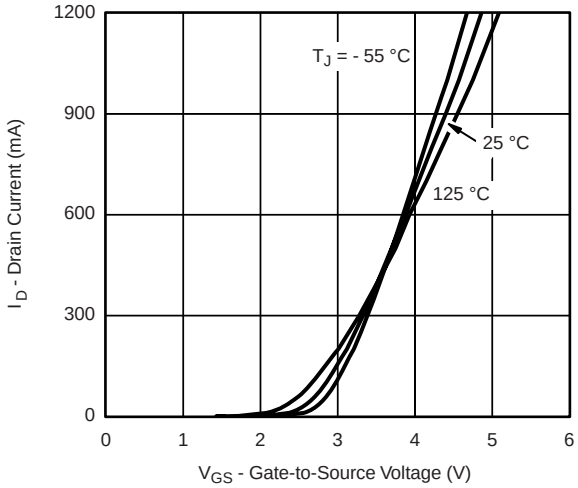
Notes:
a. For DESIGN AID ONLY, not subject to production testing.
b. Pulse test: PW ≤ 300 µs duty cycle ≤ 2 %.
c. Switching time is essentially independent of operating temperature.

*Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*

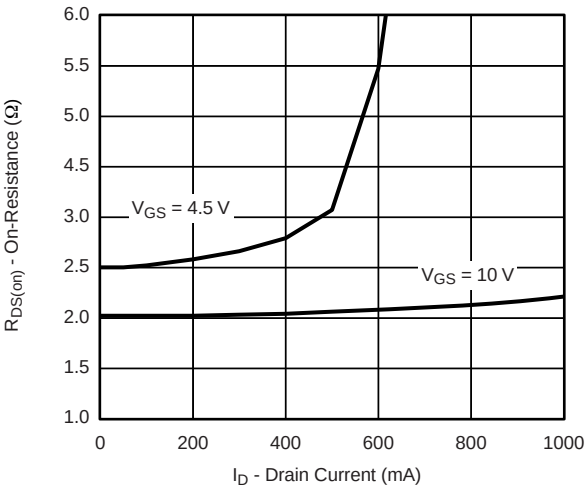
## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



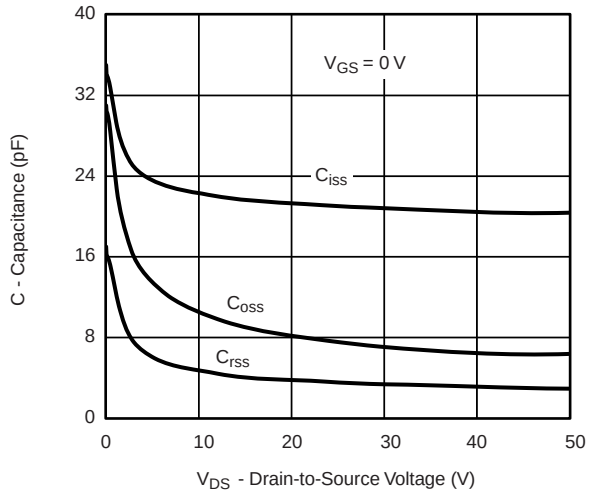

**Output Characteristics**



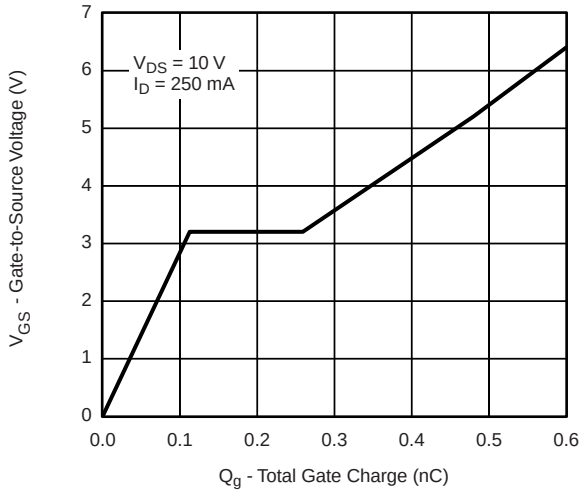

**Transfer Characteristics**



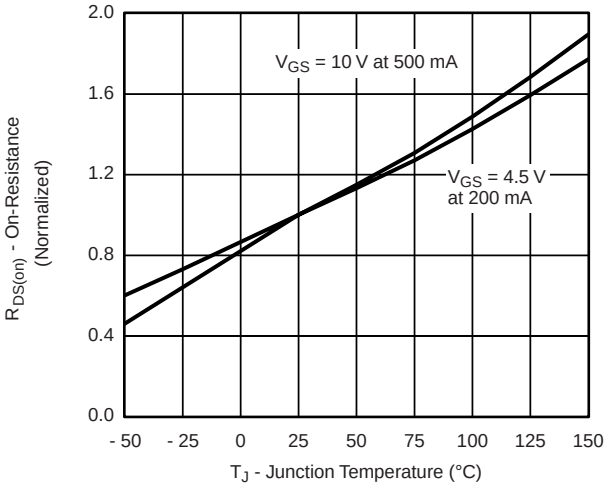

**On-Resistance vs. Drain Current**




**Capacitance**

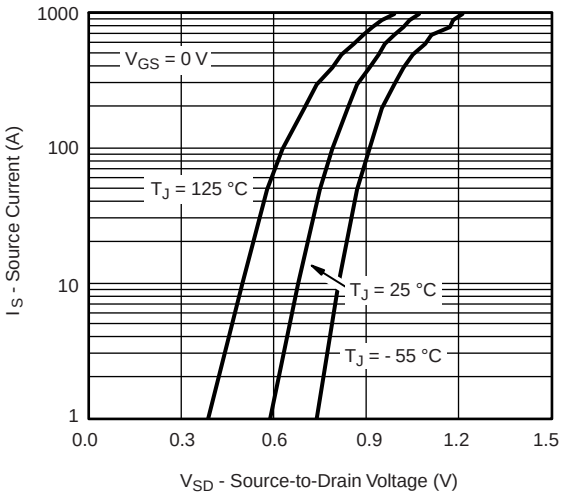



**Gate Charge**

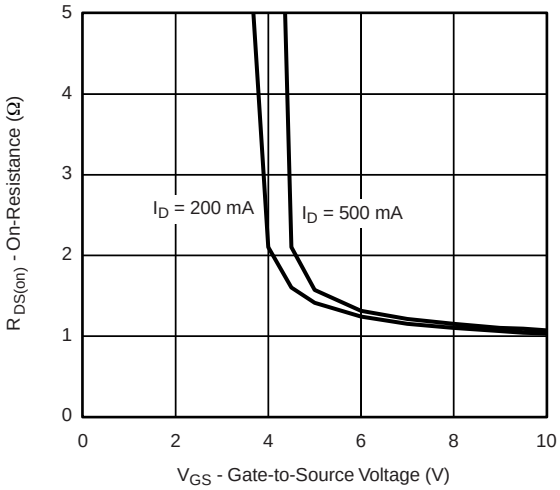



**On-Resistance vs. Junction Temperature**

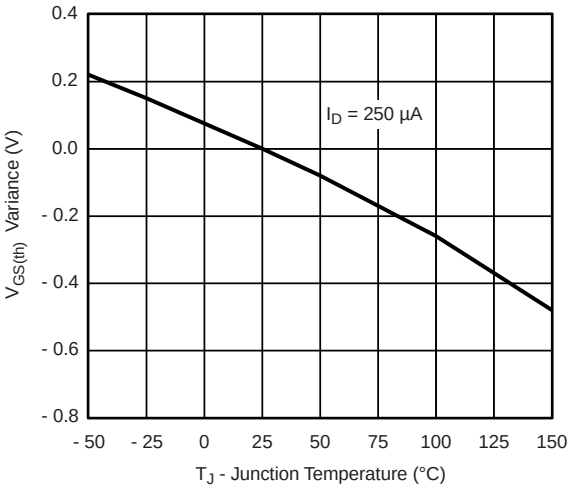
## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



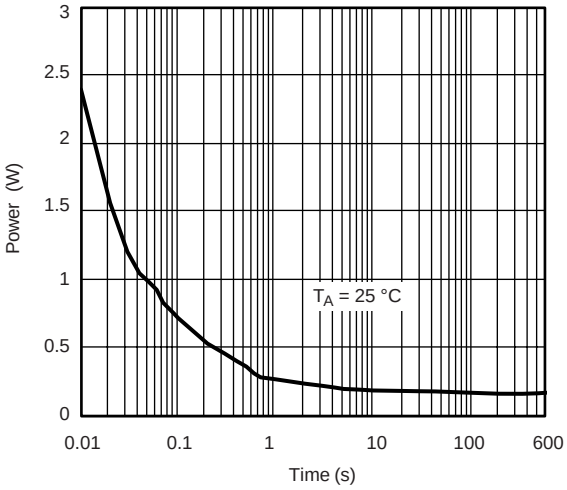

**Source-Drain Diode Forward Voltage**



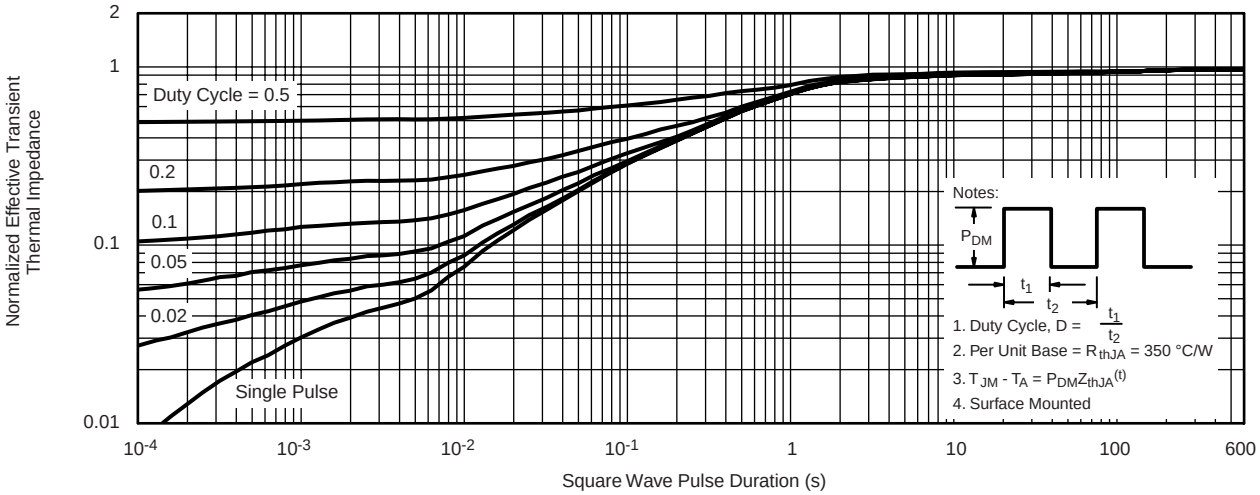

**On-Resistance vs. Gate-Source Voltage**




**Threshold Voltage Variance Over Temperature**

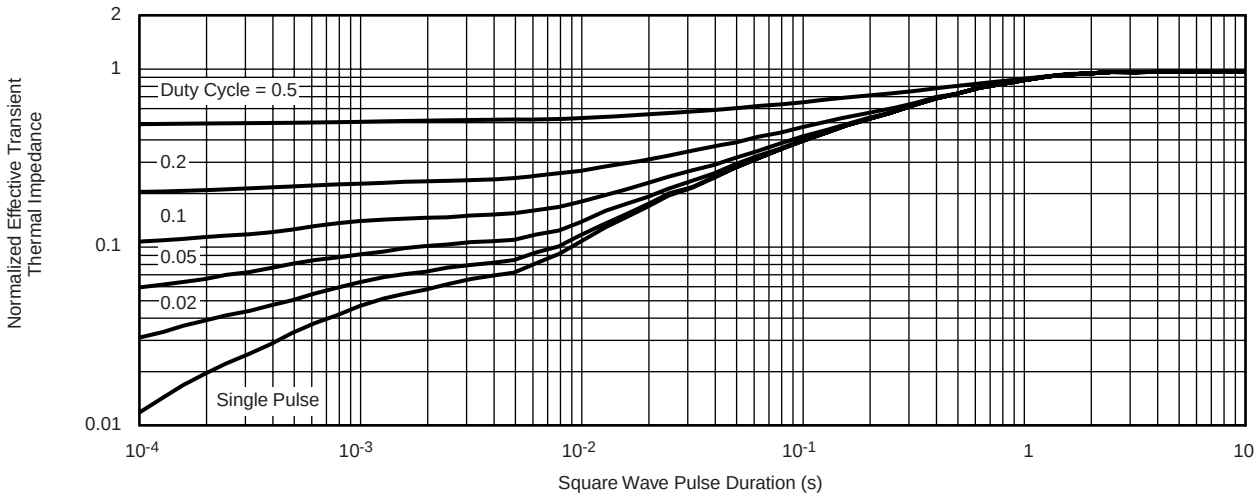



**Single Pulse Power, Junction-to-Ambient**




**Normalized Thermal Transient Impedance, Junction-to-Ambient**

**THERMAL RATINGS** ($T_A$ = 25 °C, unless otherwise noted)



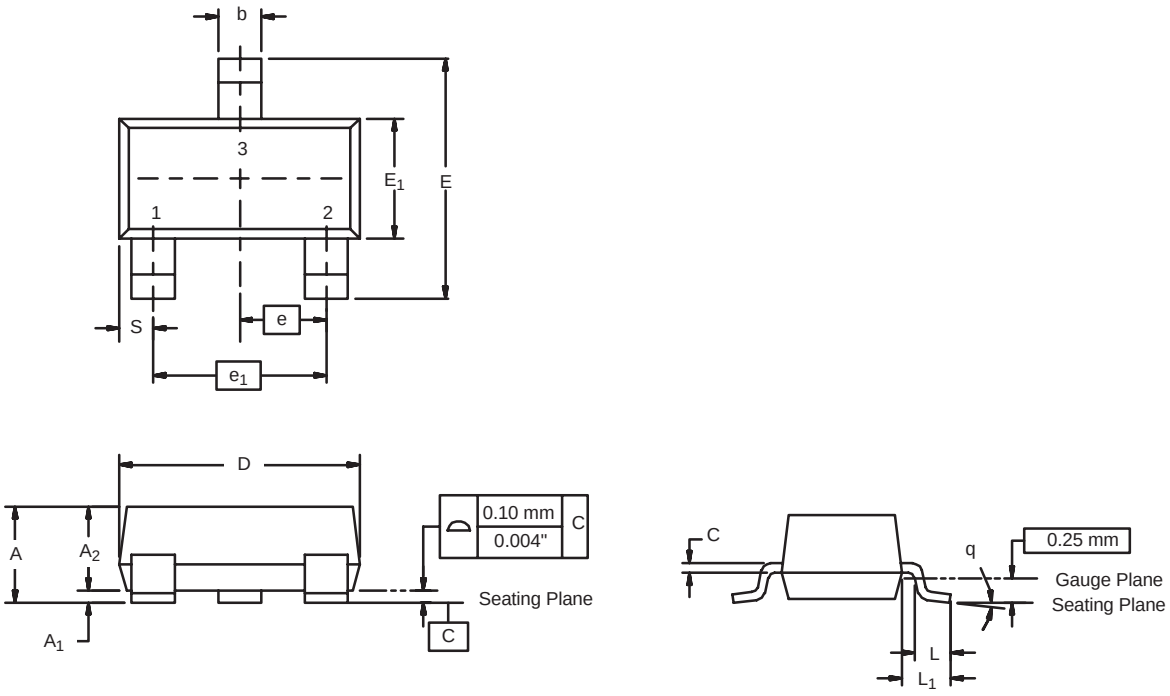

**Normalized Thermal Transient Impedance, Junction-to-Foot**

**Note**

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction-to-Ambient (25 °C)
  - Normalized Transient Thermal Impedance Junction-to-Foot (25 ℃)

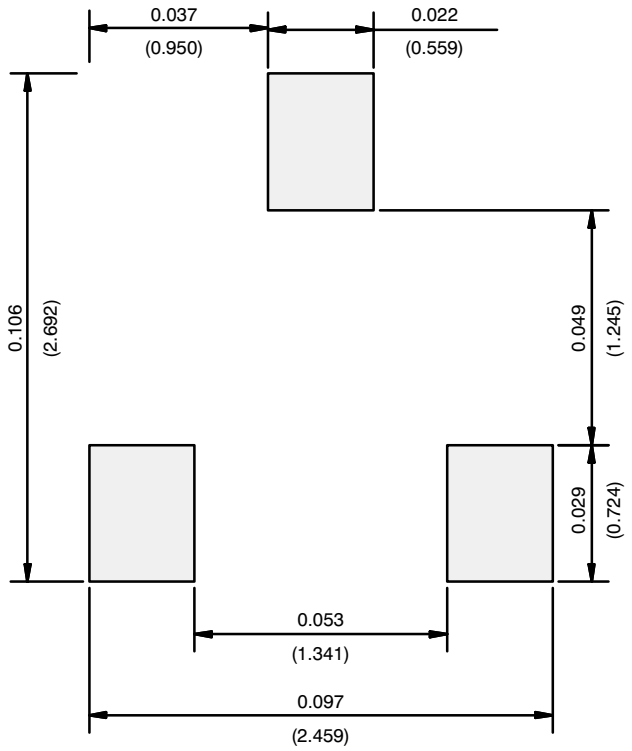
  are given for general guidelines only to enable the user to get a “ball park” indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions.

## SOT-23 (TO-236): 3-LEAD




| Dim | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.89 | 1.12 | 0.035 | 0.044 |
| $A_1$ | 0.01 | 0.10 | 0.0004 | 0.004 |
| $A_2$ | 0.88 | 1.02 | 0.0346 | 0.040 |
| b | 0.35 | 0.50 | 0.014 | 0.020 |
| c | 0.085 | 0.18 | 0.003 | 0.007 |
| D | 2.80 | 3.04 | 0.110 | 0.120 |
| E | 2.10 | 2.64 | 0.083 | 0.104 |
| $E_1$ | 1.20 | 1.40 | 0.047 | 0.055 |
| e | 0.95 BSC | | 0.0374 Ref | |
| $e_1$ | 1.90 BSC | | 0.0748 Ref | |
| L | 0.40 | 0.60 | 0.016 | 0.024 |
| $L_1$ | 0.64 Ref | | 0.025 Ref | |
| S | 0.50 Ref | | 0.020 Ref | |
| q | 3° | 8° | 3° | 8° |
| ECN: S-03946-Rev. K, 09-Jul-01<br>DWG: 5479 | | | | |

## RECOMMENDED MINIMUM PADS FOR SOT-23




Recommended Minimum Pads
Dimensions in Inches/(mm)

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