# SUD50N04-37P

Vishay Siliconix

## N-Channel 40-V (D-S) MOSFET

| PRODUCT SUMMARY | | | |
|---|---|---|---|
| $V_{DS}$ (V) | $r_{DS(on)}$ (Ω) | $I_D$ (A)[a] | $Q_g$ (Typ.) |
| 40 | 0.037 at $V_{GS}$ = 10 V | 8 | 5.3 nC |
| | 0.046 at $V_{GS}$ = 4.5 V | 8 | |

### FEATURES

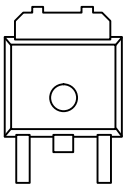
- TrenchFET® Power MOSFET
- 100 % UIS Tested

RoHS COMPLIANT

### APPLICATIONS

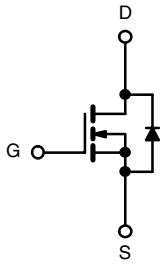
- Backlight Inverter for LCD Display
- Full Bridge DC/DC Converter

**TO-252**




Top View

**Ordering Information:**
SUD50N04-37P-E3 (Lead (Pb)-free)




N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS $T_A$ = 25 °C, unless otherwise noted | | | | |
|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Limit** | **Unit** |
| Drain-Source Voltage | | $V_{DS}$ | 40 | V |
| Gate-Source Voltage | | $V_{GS}$ | ± 20 | |
| Continuous Drain Current ($T_J$ = 150 °C) | $T_C$ = 25 °C | $I_D$ | 8[a] | A |
| | $T_C$ = 70 °C | | 8[a] | |
| | $T_A$ = 25 °C | | 5.4[b] | |
| | $T_A$ = 70 °C | | 4.4[b] | |
| Pulsed Drain Current | | $I_{DM}$ | 30 | |
| Continuous Source-Drain Diode Current | $T_C$ = 25 °C | $I_S$ | 8[a] | |
| | $T_A$ = 25 °C | | 1.6[b] | |
| Single Pulse Avalanche Current | L = 0.1 mH | $I_{AS}$ | 7 | |
| Avalanche Energy | | $E_{AS}$ | 2.45 | mJ |
| Maximum Power Dissipation | $T_C$ = 25 °C | $P_D$ | 10.8 | W |
| | $T_C$ = 70 °C | | 6.9 | |
| | $T_A$ = 25 °C | | 2.0[b] | |
| | $T_A$ = 70 °C | | 1.3[b] | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | - 55 to 150 | °C |

| THERMAL RESISTANCE RATINGS | | | | | |
|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Typical** | **Maximum** | **Unit** |
| Maximum Junction-to-Ambient[b] | Steady State | $R_{thJA}$ | 49 | 60 | °C/W |
| Maximum Junction-to-Case | Steady State | $R_{thJC}$ | 9.4 | 11.5 | |

Notes:
a. Package limited.
b. Surface mounted on 1" x 1" FR4 board.

| **SPECIFICATIONS** $T_J$ = 25 °C, unless otherwise noted | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions** | **Min.** | **Typ.** | **Max.** | **Unit** |
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{DS}$ | $V_{GS}$ = 0 V, $I_D$ = 1 mA | 40 | | | V |
| $V_{DS}$ Temperature Coefficient | $\Delta V_{DS}/T_J$ | $I_D$ = 250 µA | | 44 | | mV/°C |
| $V_{GS(th)}$ Temperature Coefficient | $\Delta V_{GS(th)}/T_J$ | | | - 5.5 | | |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 1.4 | | 2.5 | V |
| Gate-Source Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 20 V | | | ± 100 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 40 V, $V_{GS}$ = 0 V | | | 1 | µA |
| | | $V_{DS}$ = 40 V, $V_{GS}$ = 0 V, $T_J$ = 70 °C | | | 20 | |
| On-State Drain Current[a] | $I_{D(on)}$ | $V_{DS} \geq$ 5 V, $V_{GS}$ = 10 V | 10 | | | A |
| Drain-Source On-State Resistance[a] | $r_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 5 A | | 0.0305 | 0.037 | Ω |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 4 A | | 0.037 | 0.046 | |
| Forward Transconductance[a] | $g_{fs}$ | $V_{DS}$ = 15 V, $I_D$ = 5 A | | 22 | | S |
| **Dynamic[b]** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$ = 20 V, $V_{GS}$ = 0 V, f = 1 MHz | | 640 | | pF |
| Output Capacitance | $C_{oss}$ | | | 73 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 41 | | |
| Total Gate Charge | $Q_g$ | $V_{DS}$ = 20 V, $V_{GS}$ = 10 V, $I_D$ = 5 A | | 11.7 | 20 | nC |
| | | $V_{DS}$ = 20 V, $V_{GS}$ = 4.5 V, $I_D$ = 5 A | | 5.3 | 9 | |
| Gate-Source Charge | $Q_{gs}$ | | | 1.9 | | |
| Gate-Drain Charge | $Q_{gd}$ | | | 1.7 | | |
| Gate Resistance | $R_g$ | f = 1 MHz | | 2.2 | | Ω |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = 20 V, $R_L$ = 4 Ω<br>$I_D \cong$ 5 A, $V_{GEN}$ = 4.5 V, $R_g$ = 1 Ω | | 18 | 30 | ns |
| Rise Time | $t_r$ | | | 14 | 25 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 14 | 25 | |
| Fall Time | $t_f$ | | | 10 | 20 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = 20 V, $R_L$ = 4 Ω<br>$I_D \cong$ 5 A, $V_{GEN}$ = 10 V, $R_g$ = 1 Ω | | 9 | 18 | |
| Rise Time | $t_r$ | | | 11 | 20 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 14 | 25 | |
| Fall Time | $t_f$ | | | 8 | 18 | |
| **Drain-Source Body Diode Characteristics** | | | | | | |
| Continuous Source-Drain Diode Current | $I_S$ | $T_C$ = 25 °C | | | 8 | A |
| Pulse Diode Forward Current[a] | $I_{SM}$ | | | | 30 | |
| Body Diode Voltage | $V_{SD}$ | $I_S$ = 2 A | | 0.805 | 1.2 | V |
| Body Diode Reverse Recovery Time | $t_{rr}$ | $I_F$ = 2 A, di/dt = 100 A/µs, $T_J$ = 25 °C | | 19 | 30 | ns |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | | | 14 | 25 | nC |
| Reverse Recovery Fall Time | $t_a$ | | | 13 | | ns |
| Reverse Recovery Rise Time | $t_b$ | | | 6 | | |

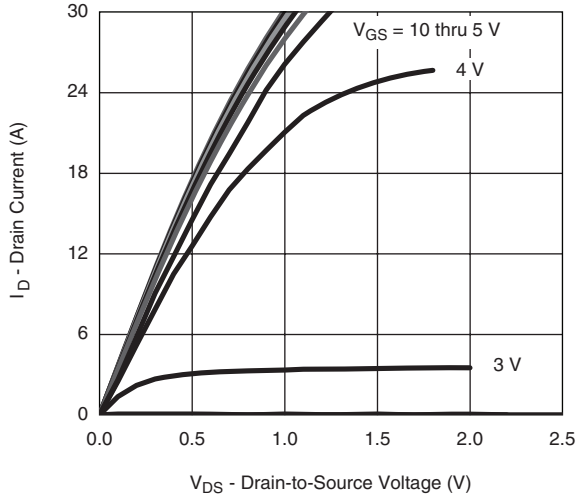
Notes:

a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.

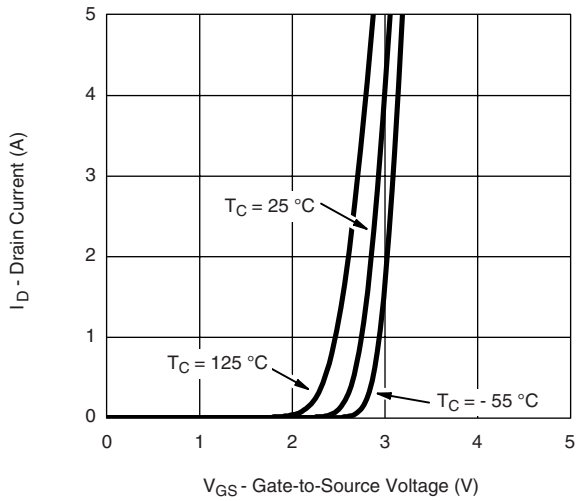
b. Guaranteed by design, not subject to production testing.

*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.*

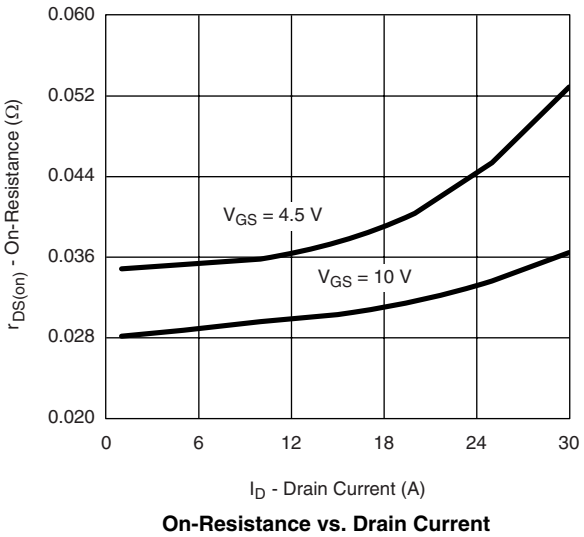
## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



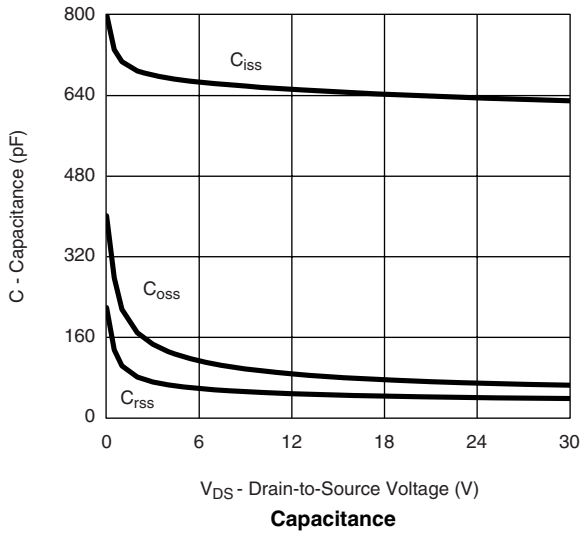

**Output Characteristics**



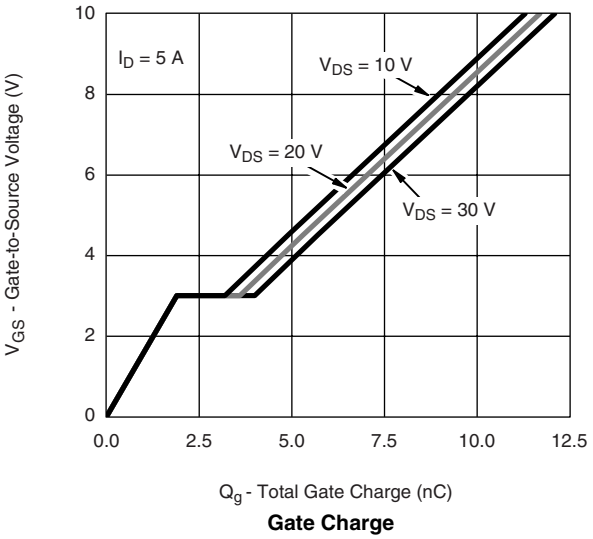

**Transfer Characteristics**



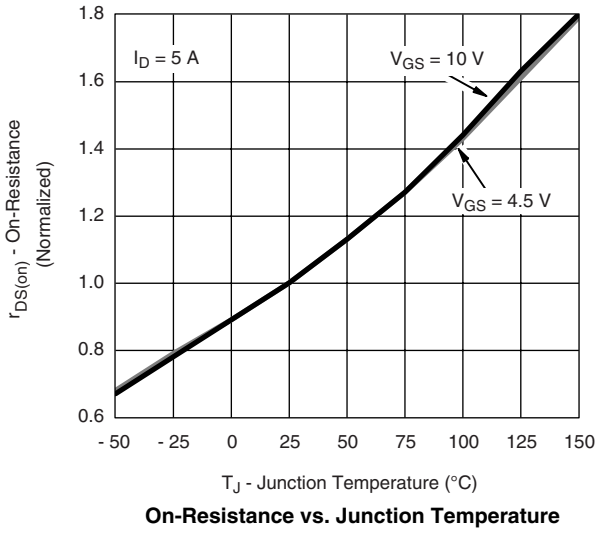

**On-Resistance vs. Drain Current**




**Capacitance**

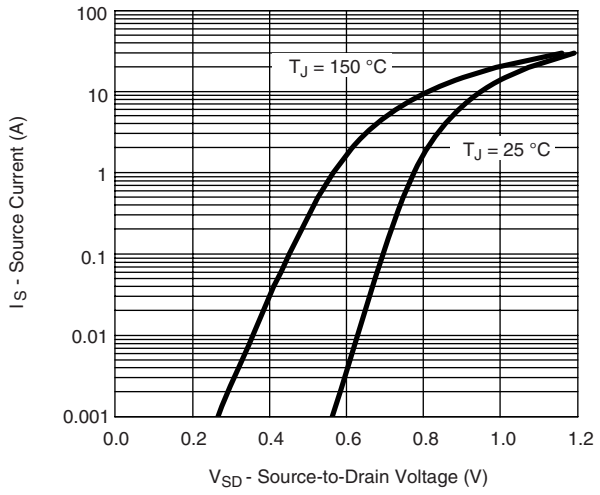



**Gate Charge**

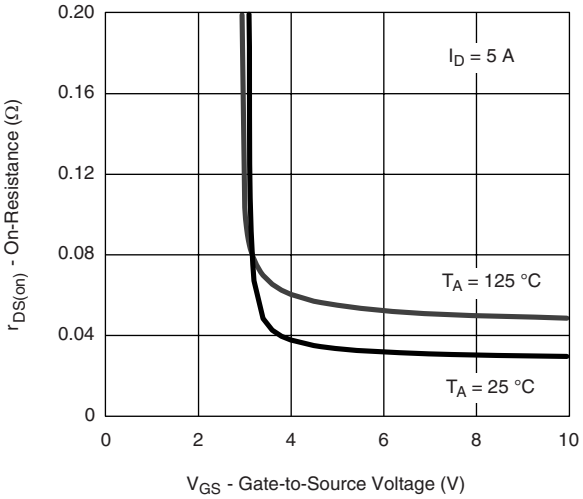



**On-Resistance vs. Junction Temperature**

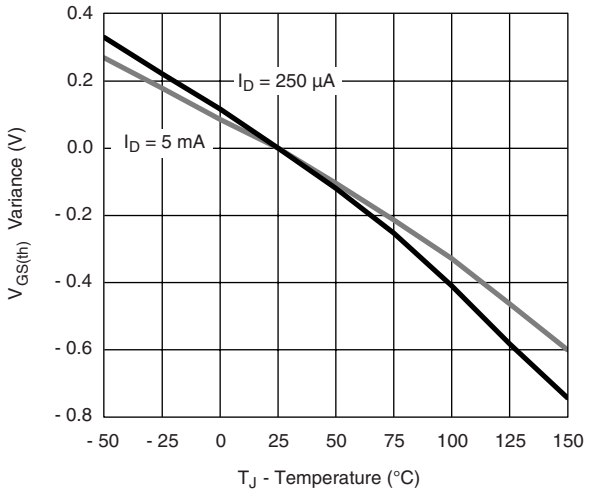
## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



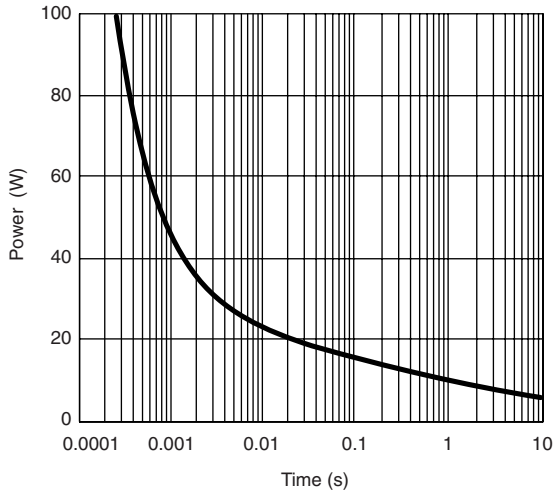

**Source-Drain Diode Forward Voltage**



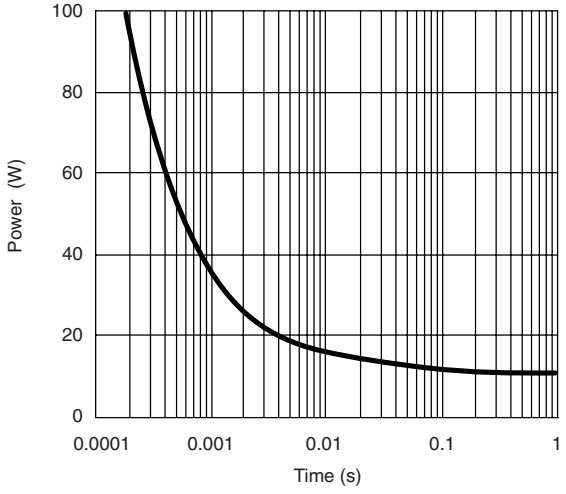

**On-Resistance vs. Gate-to-Source Voltage**



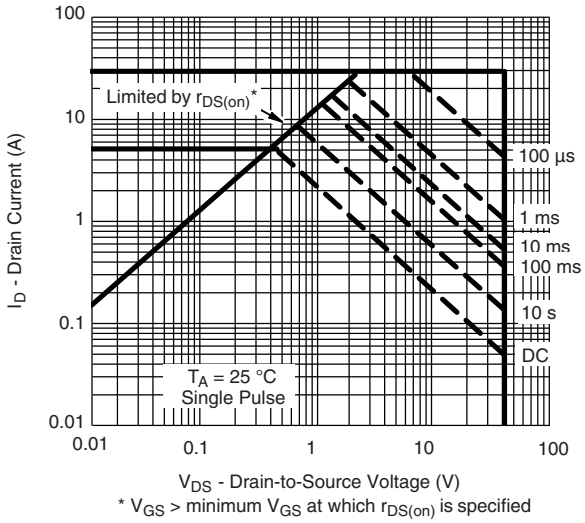

**Threshold Voltage**




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



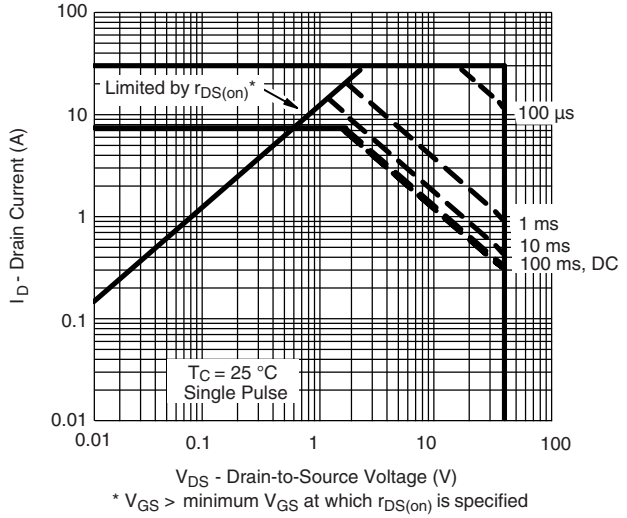

**Single Pulse Power, Junction-to-Case**




* $V_{GS}$ > minimum $V_{GS}$ at which $r_{DS(on)}$ is specified

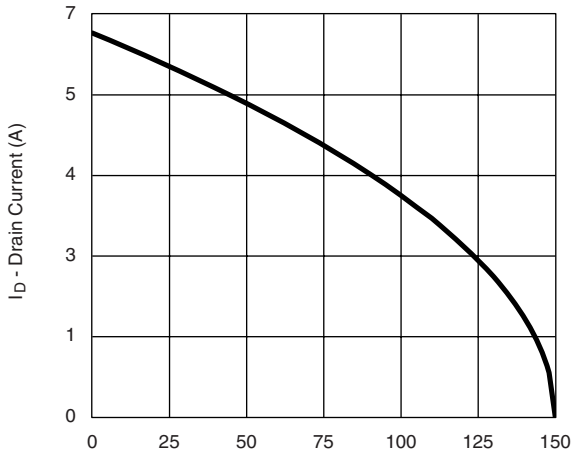
**Safe Operating Area, Junction-to-Ambient**

## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

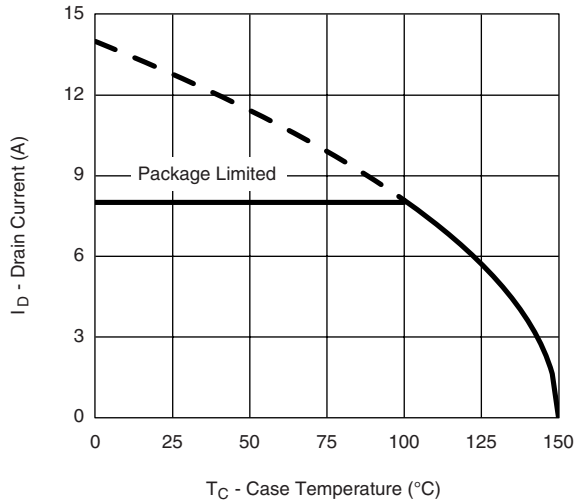



* $V_{GS}$ > minimum $V_{GS}$ at which $r_{DS(on)}$ is specified

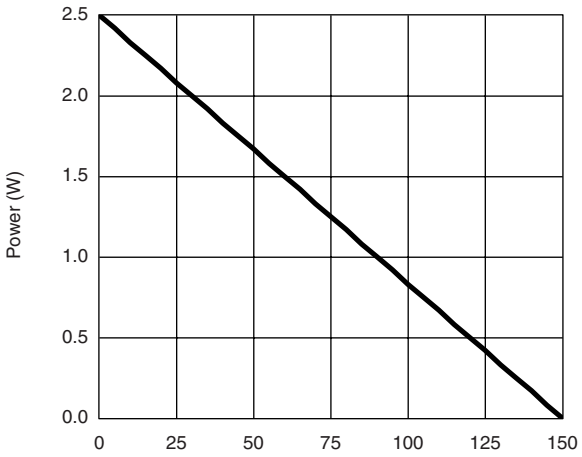
**Safe Operating Area, Junction-to-Case**



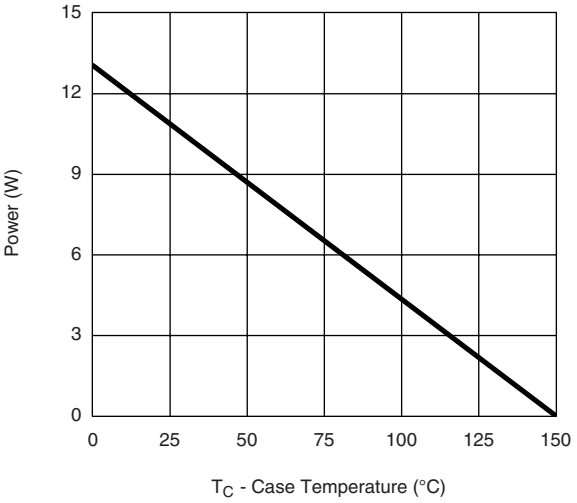

**Current Derating*, Junction-to-Ambient**




**Current Derating*, Junction-to-Case**



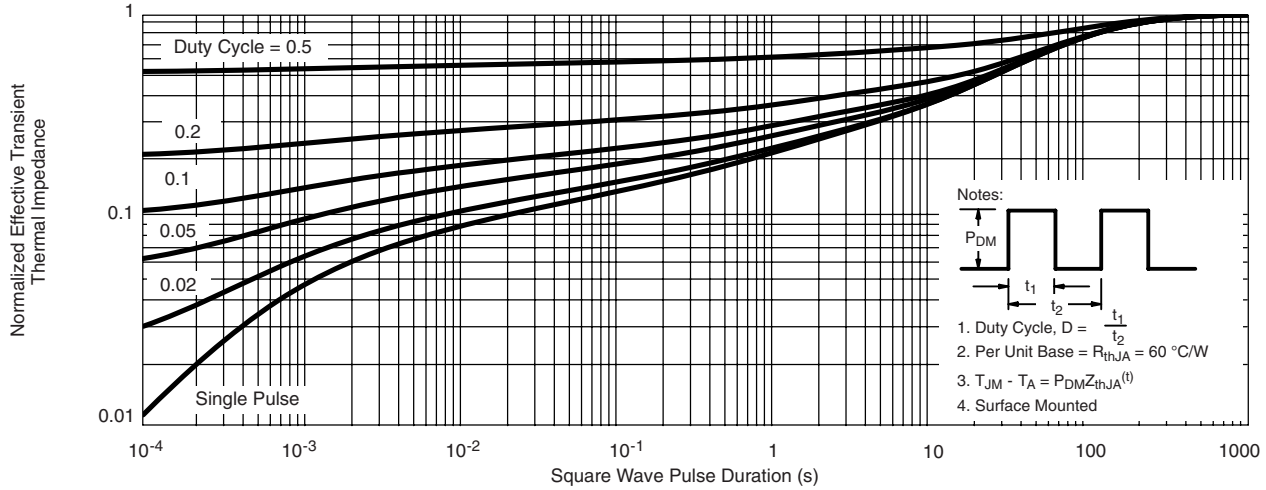

**Power Derating*, Junction-to-Ambient**



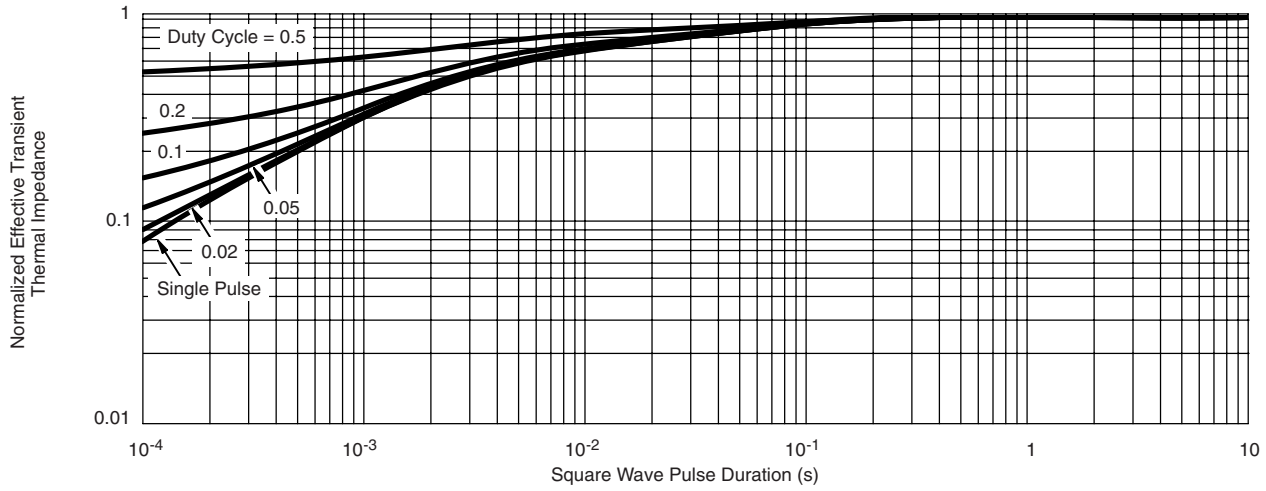

**Power Derating*, Junction-to-Case**

* The power dissipation $P_D$ is based on $T_{J(max)}$ = 175 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



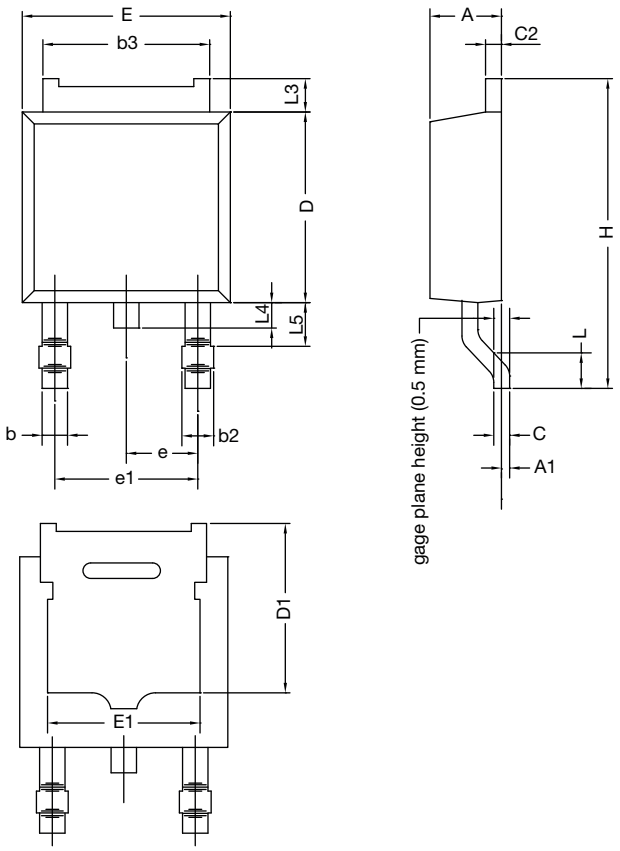

**Normalized Thermal Transient Impedance, Junction-to-Ambient**




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

*Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see http://www.vishay.com/ppg?69732.*

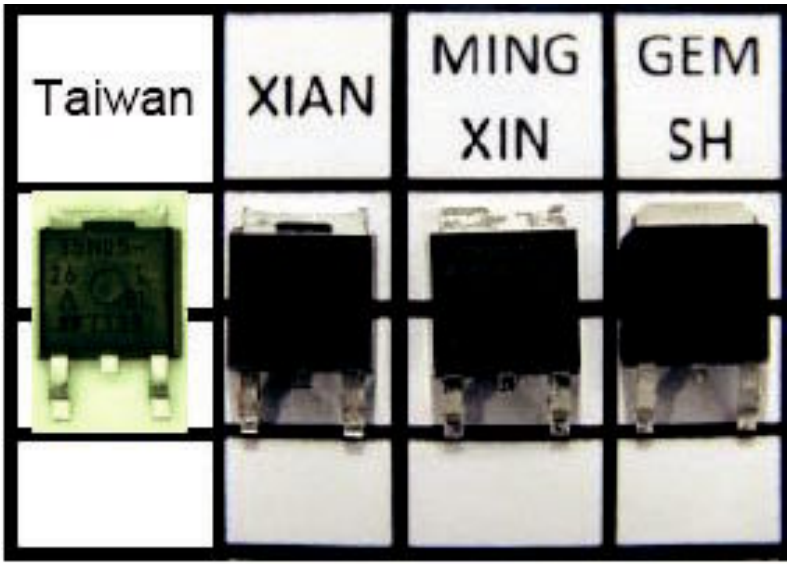
# TO-252AA Case Outline



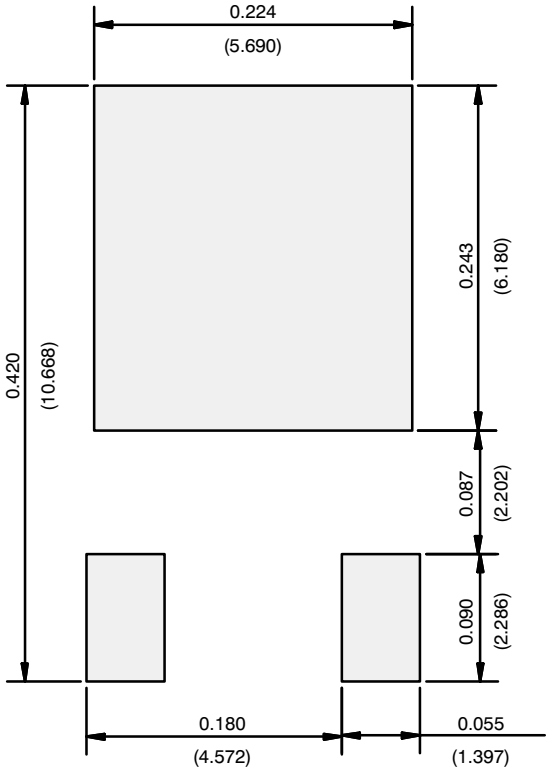

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM. | MIN. | MAX. | MIN. | MAX. |
| A | 2.18 | 2.38 | 0.086 | 0.094 |
| A1 | - | 0.127 | - | 0.005 |
| b | 0.64 | 0.88 | 0.025 | 0.035 |
| b2 | 0.76 | 1.14 | 0.030 | 0.045 |
| b3 | 4.95 | 5.46 | 0.195 | 0.215 |
| C | 0.46 | 0.61 | 0.018 | 0.024 |
| C2 | 0.46 | 0.89 | 0.018 | 0.035 |
| D | 5.97 | 6.22 | 0.235 | 0.245 |
| D1 | 4.10 | - | 0.161 | - |
| E | 6.35 | 6.73 | 0.250 | 0.265 |
| E1 | 4.32 | - | 0.170 | - |
| H | 9.40 | 10.41 | 0.370 | 0.410 |
| e | 2.28 BSC | | 0.090 BSC | |
| e1 | 4.56 BSC | | 0.180 BSC | |
| L | 1.40 | 1.78 | 0.055 | 0.070 |
| L3 | 0.89 | 1.27 | 0.035 | 0.050 |
| L4 | - | 1.02 | - | 0.040 |
| L5 | 1.01 | 1.52 | 0.040 | 0.060 |
| ECN: T13-0359-Rev. O, 03-Jun-13<br>DWG: 5347 | | | | |

**Notes**

- Dimension L3 is for reference only.
- Xi'an, Mingxin, and GEM SH actual photo.



## RECOMMENDED MINIMUM PADS FOR DPAK (TO-252)




Recommended Minimum Pads
Dimensions in Inches/(mm)

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