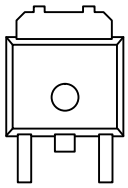
# N-Channel 60-V (D-S) MOSFET

| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) | $r_{DS(on)}$ (Ω) | $I_D$ (A) |
| 60 | 0.033@ $V_{GS}$ = 10 V | 35 |

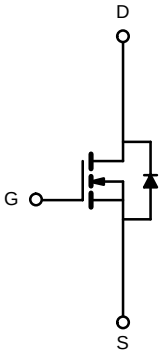
## FEATURES

- TrenchFET® Power MOSFET
- 175°C Maximum Junction Temperature
- 100% $R_g$ Tested

**TO-252**




Top View




N-Channel MOSFET

| 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 ($T_J$ = 175°C)[b] | $T_C$ = 25°C | $I_D$ | 35 | A |
| | $T_C$ = 125°C | | 20 | |
| Pulsed Drain Current | | $I_{DM}$ | 90 | |
| Continuous Source Current (Diode Conduction) | | $I_S$ | 30 | |
| Avalanche Current | | $I_{AR}$ | 10 | |
| Repetitive Avalanche Energy (Duty Cycle ≤ 1%) | L = 0.1 mH | $E_{AR}$ | 50 | mJ |
| Maximum Power Dissipation | $T_C$ = 25°C | $P_D$ | 106[b] | W |
| | $T_A$ = 25°C | | 2[a] | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | –55 to 175 | °C |

| THERMAL RESISTANCE RATINGS | | | | | |
|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Typical** | **Maximum** | **Unit** |
| Junction-to-Ambient[a] | t ≤ 10 sec | $R_{thJA}$ | 15 | 23 | °C/W |
| | Steady State | | 40 | 60 | |
| Junction-to-Case | | $R_{thJC}$ | 0.85 | 1.5 | |

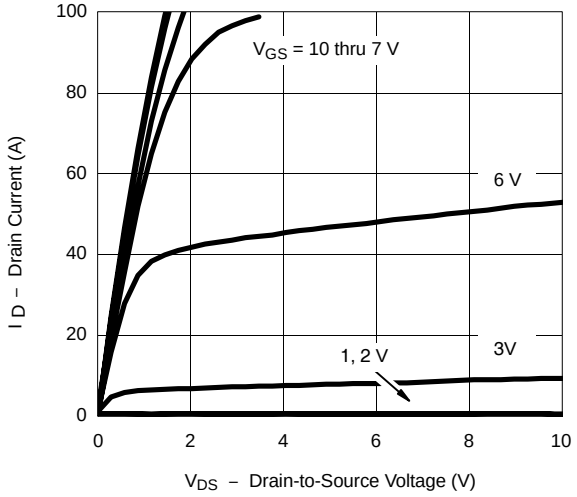
Notes
a. Surface Mounted on 1" x1" FR4 Board.
b. See SOA curve for voltage derating.

| SPECIFICATIONS ($T_J$ = 25°C UNLESS OTHERWISE NOTED) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Condition** | **Min** | **Typ[a]** | **Max** | **Unit** |
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 250 µA | 60 | | | V |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 1.0 | | 3.0 | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±20 V | | | ±100 | nA |
| 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 | | | 50 | |
| | | $V_{DS}$ = 60 V, $V_{GS}$ = 0 V, $T_J$ = 175°C | | | 250 | |
| On-State Drain Current[b] | $I_{D(on)}$ | $V_{DS}$ = 5 V, $V_{GS}$ = 10 V | 10 | | | A |
| Drain-Source On-State Resistance[b] | $r_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 5 A | | 0.033 | 0.040 | Ω |
| | | $V_{GS}$ = 10 V, $I_D$ = 5A, $T_J$ = 125°C | | 0.042 | 0.050 | |
| | | $V_{GS}$ = 10 V, $I_D$ = 5 A, $T_J$ = 175°C | | 0.046 | 0.053 | |
| Forward Transconductance[b] | $g_{fs}$ | $V_{DS}$ = 15 V, $I_D$ = 5 A | | 23 | | S |
| **Dynamic[a]** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 25 V, F = 1 MHz | | 1560 | | pF |
| Output Capacitance | $C_{oss}$ | | | 370 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 200 | | |
| Total Gate Charge[c] | $Q_g$ | $V_{DS}$ = 40 V, $V_{GS}$ = 10 V, $I_D$ = 10 A | | 42 | 60 | nC |
| Gate-Source Charge[c] | $Q_{gs}$ | | | 7 | | |
| Gate-Drain Charge[c] | $Q_{gd}$ | | | 13 | | |
| Gate Resistance | $R_g$ | | 0.5 | | 2.7 | Ω |
| Turn-On Delay Time[c] | $t_{d(on)}$ | $V_{DD}$ = 40 V, $R_L$ = 1.0 Ω<br>$I_D$ ≅ 10 A, $V_{GEN}$ = 10 V, $R_g$ = 2.5 Ω | | 12 | 20 | ns |
| Rise Time[c] | $t_r$ | | | 52 | 80 | |
| Turn-Off Delay Time[c] | $t_{d(off)}$ | | | 25 | 38 | |
| Fall Time[c] | $t_f$ | | | 10 | 15 | |
| **Source-Drain Diode Ratings and Characteristic ($T_C$ = 25°C)** | | | | | | |
| Pulsed Current | $I_{SM}$ | | | | 90 | A |
| Diode Forward Voltage[b] | $V_{SD}$ | $I_F$ = 10 A, $V_{GS}$ = 0 V | | 1.0 | 1.5 | V |
| Source-Drain Reverse Recovery Time | $t_{rr}$ | $I_F$ = 10 A, di/dt = 100 A/µs | | 45 | 70 | ns |

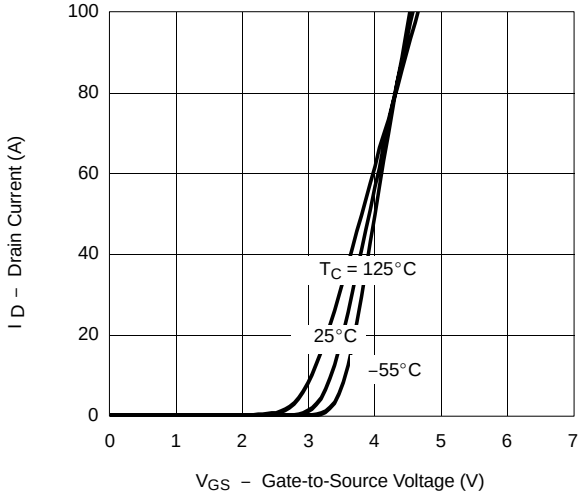
Notes
a. Guaranteed by design, not subject to production testing.
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2%.
c. Independent of operating temperature.

## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

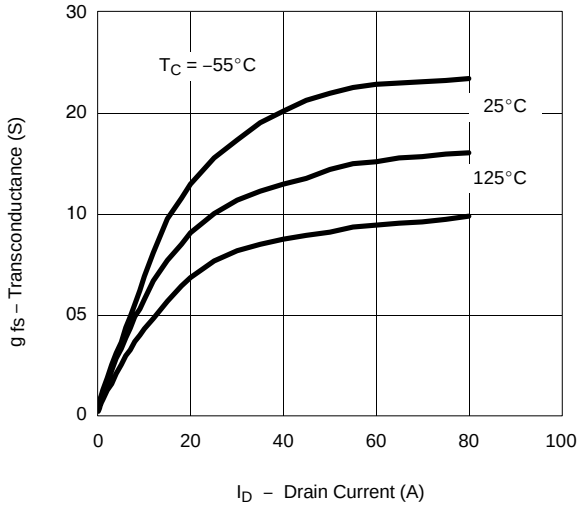
**Output Characteristics**



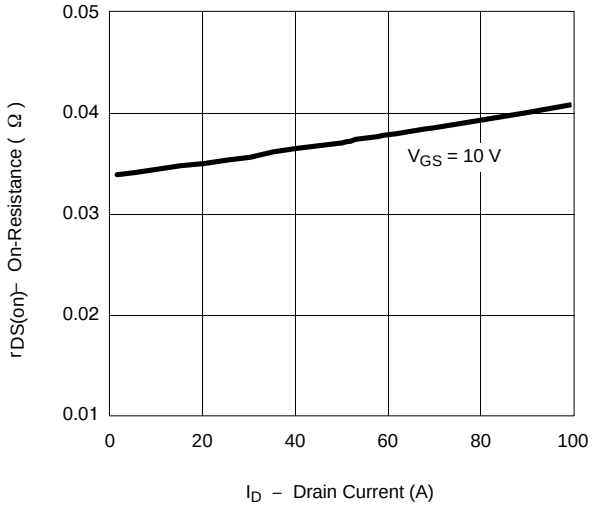

**Transfer Characteristics**



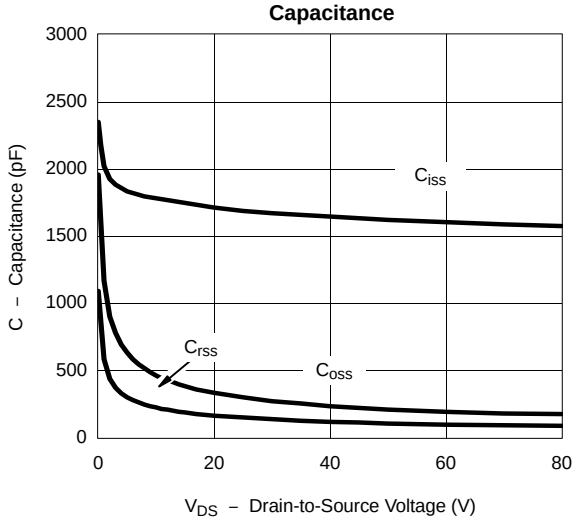

**Transconductance**



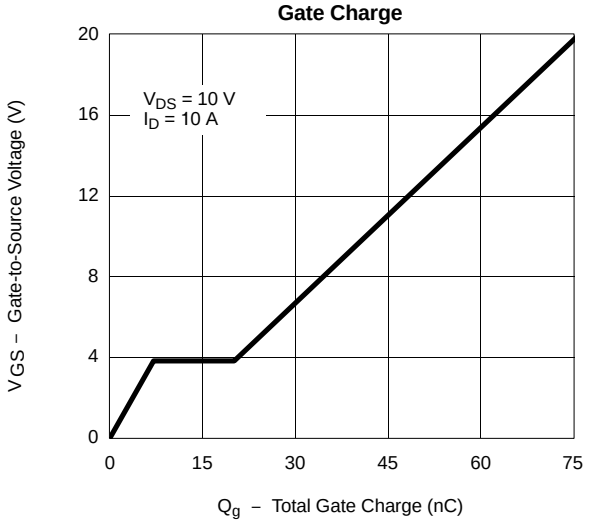

**On-Resistance vs. Drain Current**




**Capacitance**

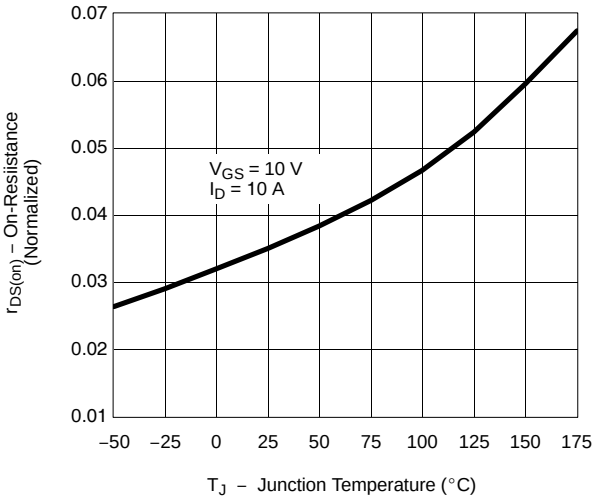



**Gate Charge**

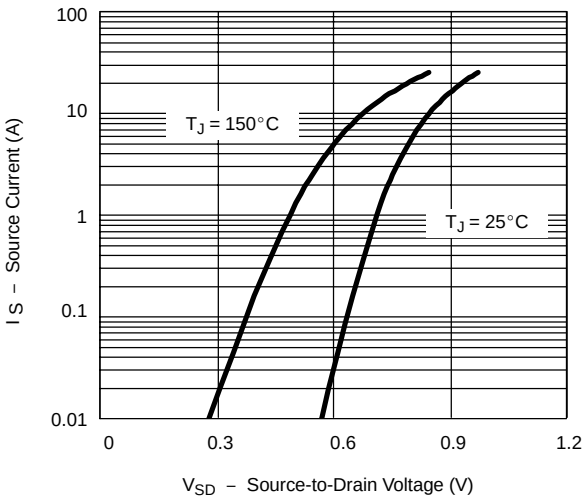


## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

**On-Resistance vs. Junction Temperature**

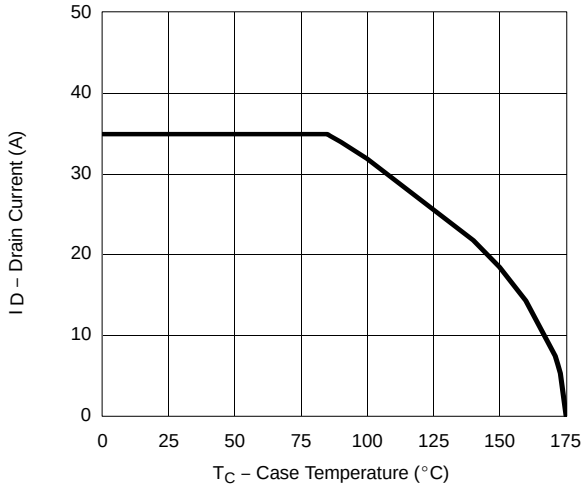



**Source-Drain Diode Forward Voltage**

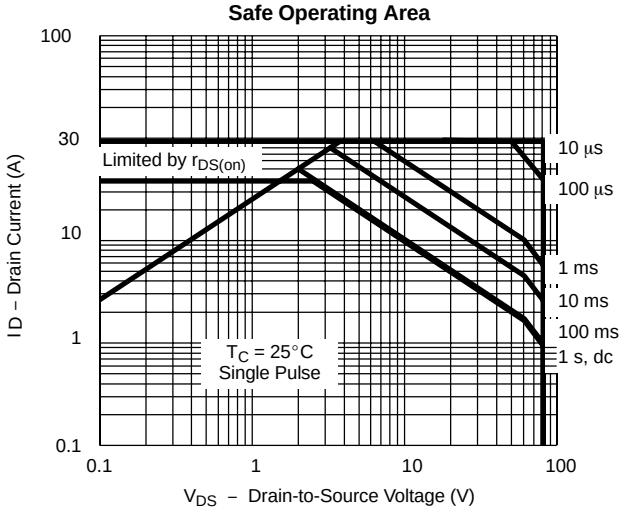



## THERMAL RATINGS

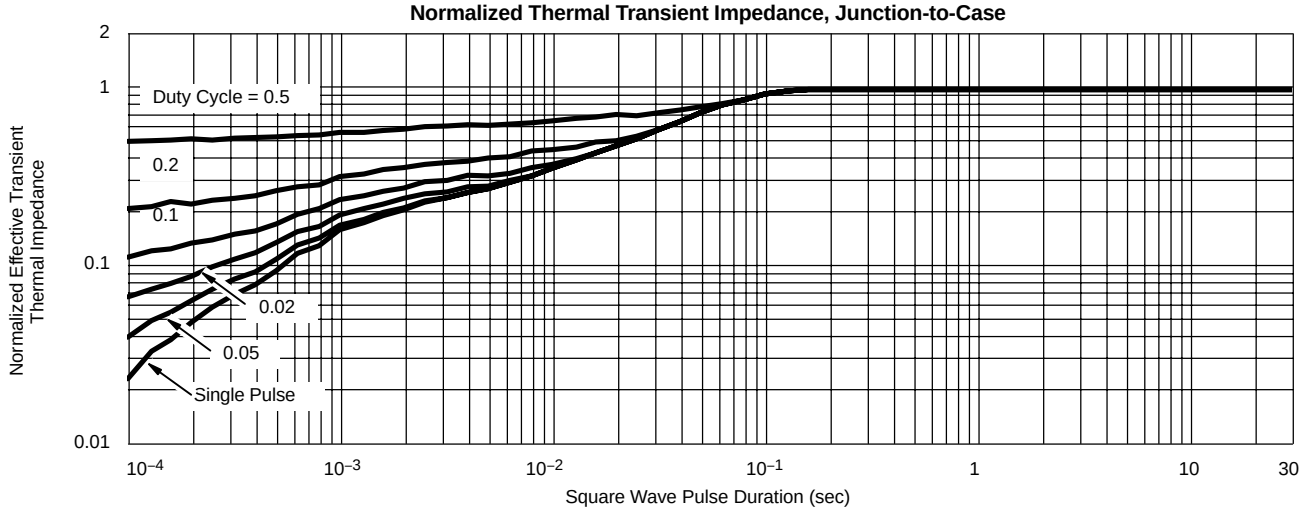
**Maximum Avalanche Drain Current vs. Case Temperature**



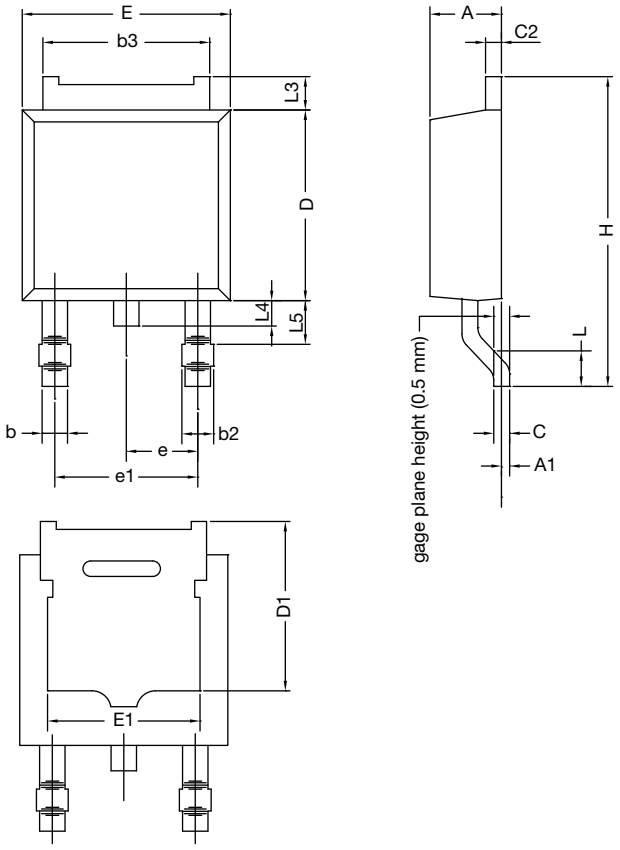

**Safe Operating Area**




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



# TO-252AA CASE OUTLINE

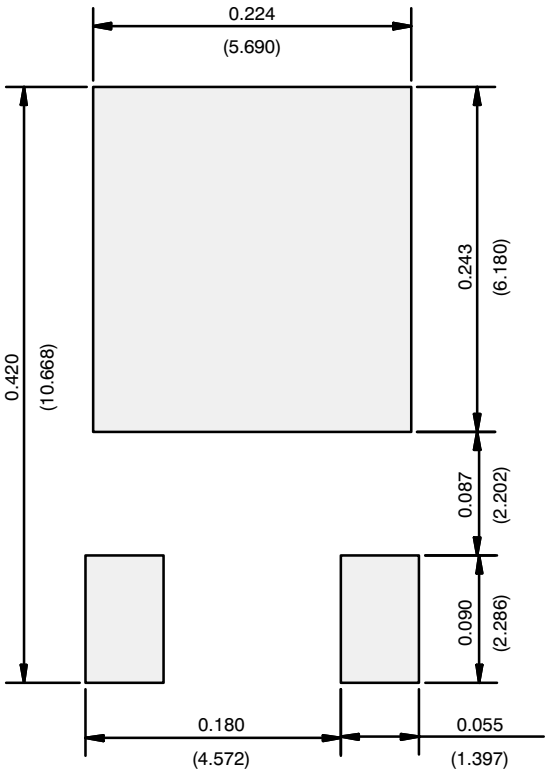



| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| **DIM.** | **MIN.** | **MAX.** | **MIN.** | **MAX.** |
| A | 2.18 | 2.38 | 0.086 | 0.094 |
| A1 | - | 0.127 | - | 0.005 |
| b | 0.64 | 0.88 | 0.025 | 0.035 |
| b2 | 0.76 | 1.14 | 0.030 | 0.045 |
| b3 | 4.95 | 5.46 | 0.195 | 0.215 |
| C | 0.46 | 0.61 | 0.018 | 0.024 |
| C2 | 0.46 | 0.89 | 0.018 | 0.035 |
| D | 5.97 | 6.22 | 0.235 | 0.245 |
| D1 | 5.21 | - | 0.205 | - |
| 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 | 1.14 | 1.52 | 0.045 | 0.060 |
| ECN: X12-0247-Rev. M, 24-Dec-12<br>DWG: 5347 | | | | |

**Note**

- Dimension L3 is for reference only.

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




Recommended Minimum Pads
Dimensions in Inches/(mm)

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