

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

### PRODUCT SUMMARY

| $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ )   | $I_D$ (A) |
|--------------|-----------------------------|-----------|
| - 60         | 0.020 at $V_{GS} = - 10$ V  | - 50      |
|              | 0.025 at $V_{GS} = - 4.5$ V | - 45      |

### FEATURES

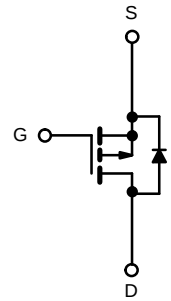
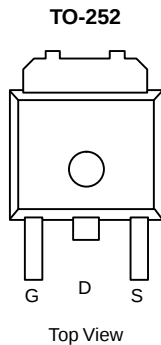
- TrenchFET<sup>®</sup> Power MOSFET
- Material categorization:



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### APPLICATIONS

- Load Switch



P-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                              | $V_{GS}$       | $\pm 20$                             |      |
| Continuous Drain Current ( $T_J = 175$ °C)       | $I_D$          | $T_C = 25$ °C<br>- 50                | A    |
|                                                  |                | $T_C = 125$ °C<br>- 40               |      |
| Pulsed Drain Current                             | $I_{DM}$       | - 160                                |      |
| Avalanche Current                                | $I_{AS}$       | - 50                                 |      |
| Single Pulse Avalanche Energy <sup>a</sup>       | $E_{AS}$       | 125                                  | mJ   |
| Power Dissipation                                | $P_D$          | $T_C = 25$ °C<br>113 <sup>c</sup>    | W    |
|                                                  |                | $T_A = 25$ °C<br>2.5 <sup>b, c</sup> |      |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$ | - 55 to 150                          | °C   |

### THERMAL RESISTANCE RATINGS

| Parameter                        | Symbol     | Typical             | Maximum | Unit |
|----------------------------------|------------|---------------------|---------|------|
| Junction-to-Ambient <sup>b</sup> | $R_{thJA}$ | $t \leq 10$ s<br>15 | 18      | °C/W |
|                                  |            | Steady State<br>40  | 50      |      |
| Junction-to-Case                 | $R_{thJC}$ | 0.82                | 1.1     |      |

Notes:

- Duty cycle  $\leq 1$  %.
- When mounted on 1" square PCB (FR-4 material).
- See SOA curve for voltage derating.
- Package limited.

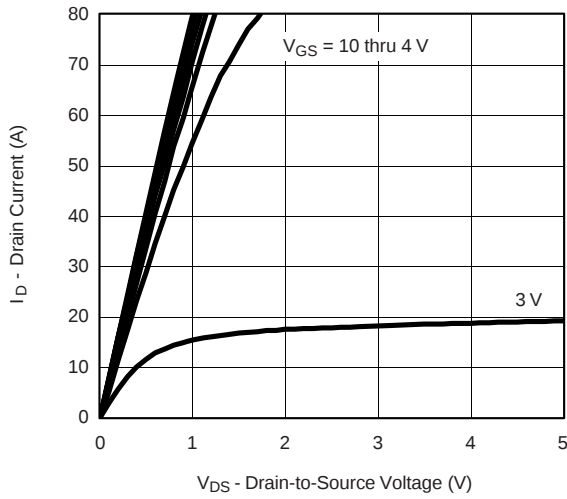
| SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)                    |                     |                                                                                                                              |       |       |       |      |
|------------------------------------------------------------------------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------|-------|-------|-------|------|
| Parameter                                                                          | Symbol              | Test Conditions                                                                                                              | Min.  | Typ.  | Max.  | Unit |
| Static                                                                             |                     |                                                                                                                              |       |       |       |      |
| Drain-Source Breakdown Voltage                                                     | V <sub>DS</sub>     | V <sub>GS</sub> = 0 V, I <sub>D</sub> = - 250 μA                                                                             | - 60  |       |       | V    |
| Gate Threshold Voltage                                                             | V <sub>GS(th)</sub> | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = - 250 μA                                                                | - 1.5 |       | - 3   |      |
| Gate-Body Leakage                                                                  | I <sub>GSS</sub>    | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V                                                                              |       |       | ± 100 | nA   |
| Zero Gate Voltage Drain Current                                                    | I <sub>DSS</sub>    | V <sub>DS</sub> = - 60 V, V <sub>GS</sub> = 0 V                                                                              |       |       | - 1   | μA   |
|                                                                                    |                     | V <sub>DS</sub> = - 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C                                                     |       |       | - 50  |      |
|                                                                                    |                     | V <sub>DS</sub> = - 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 150 °C                                                     |       |       | - 100 |      |
| On-State Drain Current <sup>a</sup>                                                | I <sub>D(on)</sub>  | V <sub>DS</sub> = - 5 V, V <sub>GS</sub> = - 10 V                                                                            | - 50  |       |       | A    |
| Drain-Source On-State Resistance <sup>a</sup>                                      | R <sub>DS(on)</sub> | V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 17 A                                                                            |       | 0.020 |       | Ω    |
|                                                                                    |                     | V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 40 A, T <sub>J</sub> = 125 °C                                                   |       | 0.030 |       |      |
|                                                                                    |                     | V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 40 A, T <sub>J</sub> = 150 °C                                                   |       | 0.035 |       |      |
|                                                                                    |                     | V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 14 A                                                                           |       | 0.025 |       |      |
| Forward Transconductance <sup>a</sup>                                              | g <sub>fs</sub>     | V <sub>DS</sub> = - 15 V, I <sub>D</sub> = - 17 A                                                                            |       | 61    |       | S    |
| Dynamic <sup>b</sup>                                                               |                     |                                                                                                                              |       |       |       |      |
| Input Capacitance                                                                  | C <sub>iss</sub>    | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = - 25 V, f = 1 MHz                                                                   |       | 2950  |       | pF   |
| Output Capacitance                                                                 | C <sub>oss</sub>    |                                                                                                                              |       | 380   |       |      |
| Reverse Transfer Capacitance                                                       | C <sub>rss</sub>    |                                                                                                                              |       | 305   |       |      |
| Total Gate Charge <sup>c</sup>                                                     | Q <sub>g</sub>      | V <sub>DS</sub> = - 30 V, V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 40 A                                                  |       | 110   | 165   | nC   |
| Gate-Source Charge <sup>c</sup>                                                    | Q <sub>gs</sub>     |                                                                                                                              |       | 19    |       |      |
| Gate-Drain Charge <sup>c</sup>                                                     | Q <sub>gd</sub>     |                                                                                                                              |       | 28    |       |      |
| Turn-On Delay Time <sup>c</sup>                                                    | t <sub>d(on)</sub>  | V <sub>DD</sub> = - 30 V, R <sub>L</sub> = 0.6 Ω<br>I <sub>D</sub> ≡ - 40 A, V <sub>GEN</sub> = - 10 V, R <sub>G</sub> = 6 Ω |       | 15    | 23    | ns   |
| Rise Time <sup>c</sup>                                                             | t <sub>r</sub>      |                                                                                                                              |       | 70    | 105   |      |
| Turn-Off Delay Time <sup>c</sup>                                                   | t <sub>d(off)</sub> |                                                                                                                              |       | 175   | 260   |      |
| Fall Time <sup>c</sup>                                                             | t <sub>f</sub>      |                                                                                                                              |       | 175   | 260   |      |
| Source-Drain Diode Ratings and Characteristics T <sub>C</sub> = 25 °C <sup>b</sup> |                     |                                                                                                                              |       |       |       |      |
| Continuous Current                                                                 | I <sub>S</sub>      |                                                                                                                              |       |       | - 40  | A    |
| Pulsed Current                                                                     | I <sub>SM</sub>     |                                                                                                                              |       |       | - 80  |      |
| Forward Voltage <sup>a</sup>                                                       | V <sub>SD</sub>     | I <sub>F</sub> = - 40 A, V <sub>GS</sub> = 0 V                                                                               |       | - 1   | - 1.6 | V    |
| Reverse Recovery Time                                                              | t <sub>rr</sub>     | I <sub>F</sub> = - 40 A, dI/dt = 100 A/μs                                                                                    |       | 45    | 70    | ns   |

Notes:

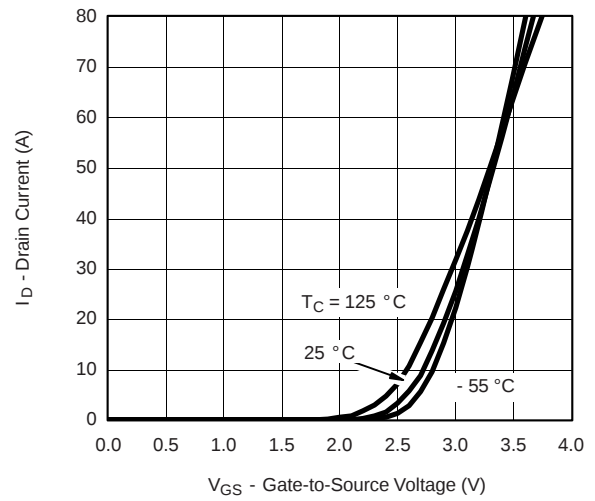
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
 b. Guaranteed by design, not subject to production testing.  
 c. Independent of operating temperature.

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)



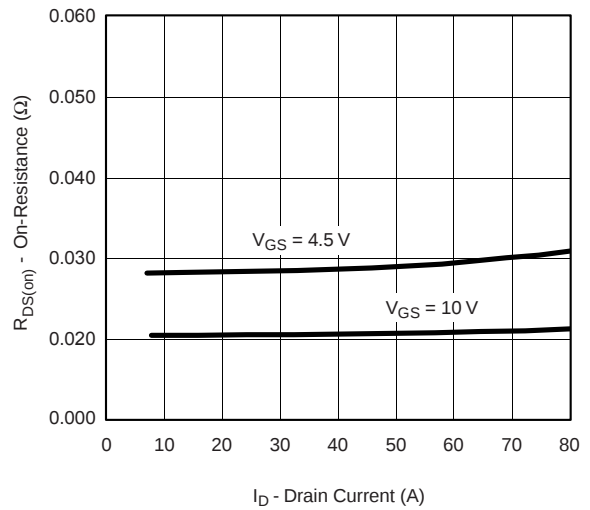
**Output Characteristics**



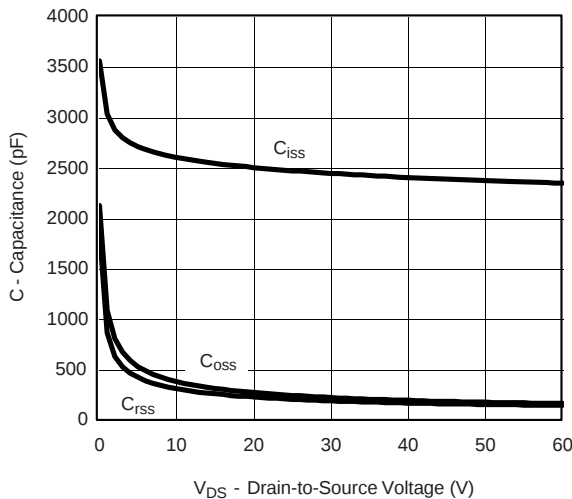
**Transfer Characteristics**



**Transconductance**



**On-Resistance vs. Drain Current**

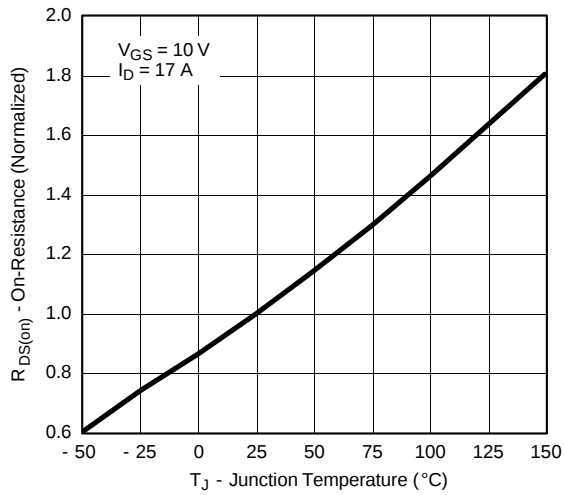


**Capacitance**

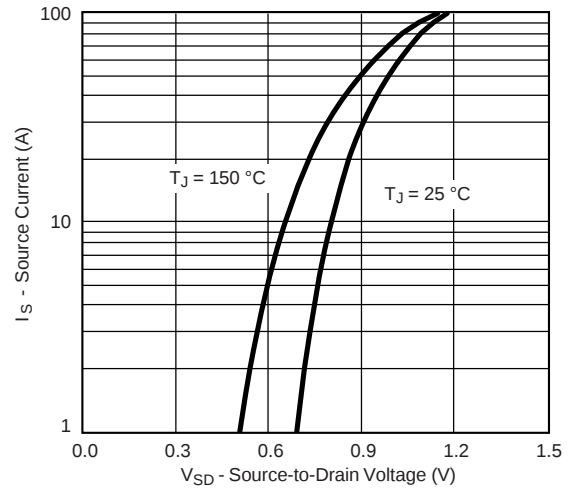


**Gate Charge**

## TYPICAL CHARACTERISTICS

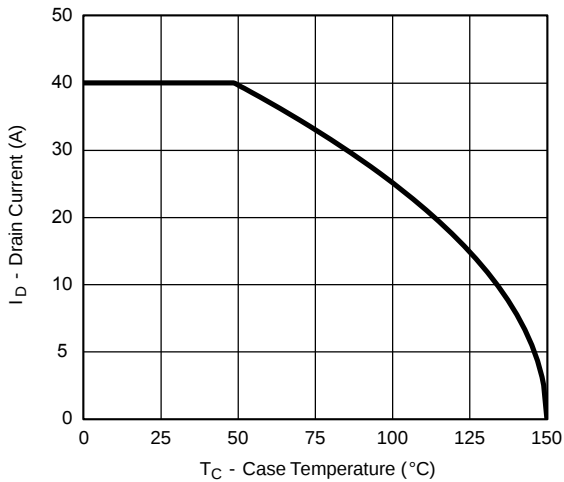


On-Resistance vs. Junction Temperature

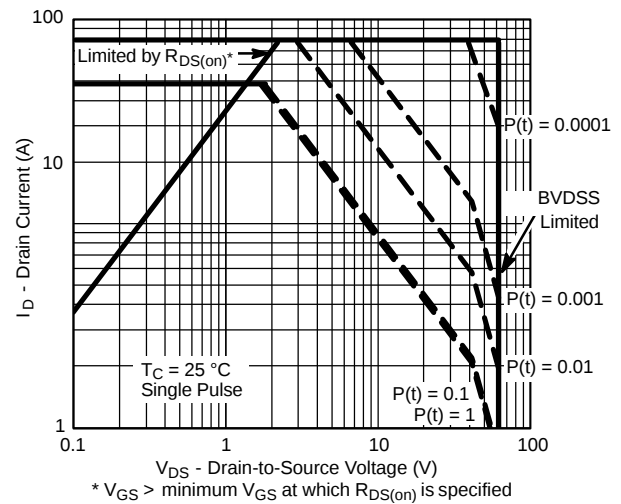


Source-Drain Diode Forward Voltage

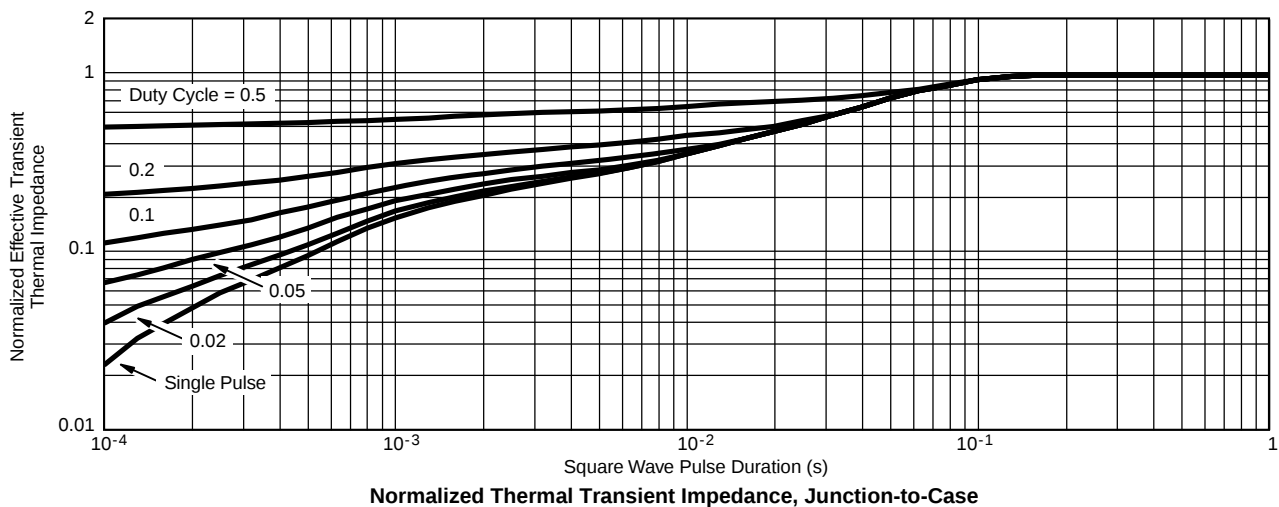
## THERMAL RATINGS (25 $^{\circ}C$ , unless otherwise noted)



Drain Current vs. Case Temperature

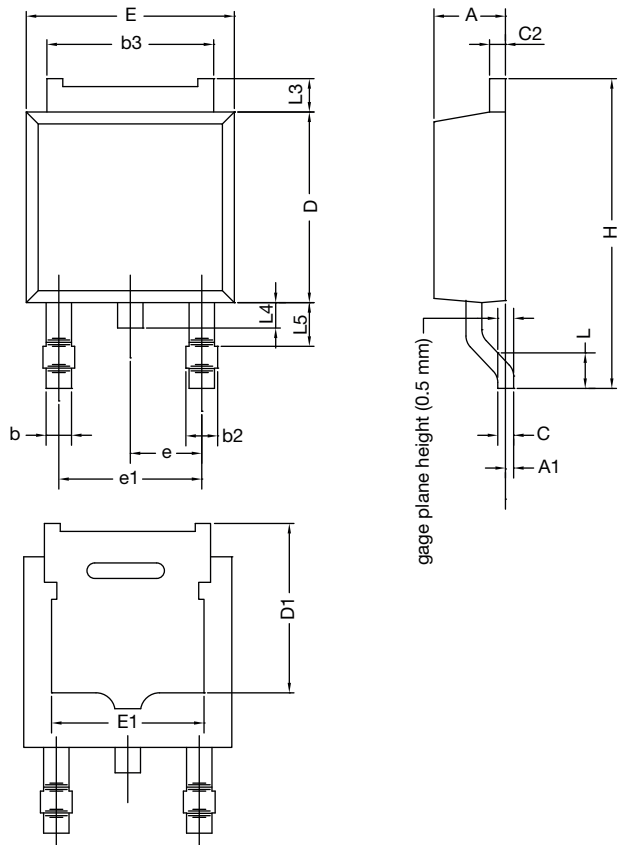


Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

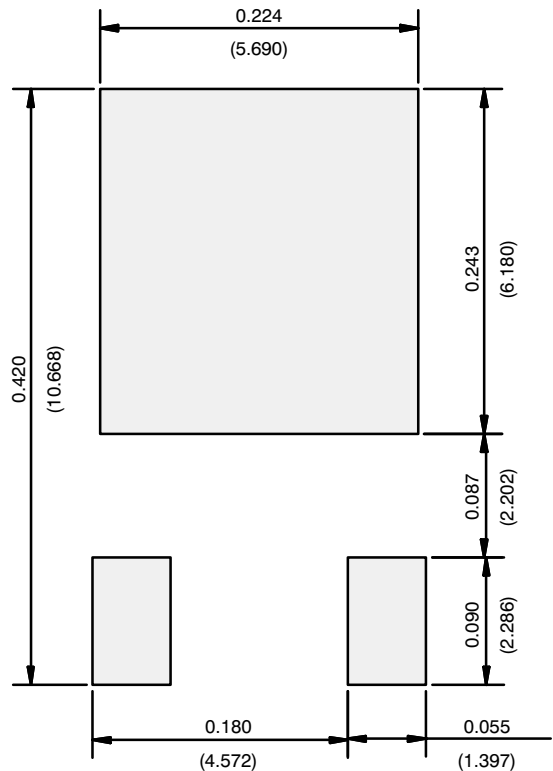
TO-252AA CASE OUTLINE



| DIM.                            | MILLIMETERS |       | INCHES    |       |
|---------------------------------|-------------|-------|-----------|-------|
|                                 | 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 |             |       |           |       |
| 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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