

## AP4506GEH-VB Datasheet

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

| PRODUCT SUMMARY |              |                             |                        |              |
|-----------------|--------------|-----------------------------|------------------------|--------------|
|                 | $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ )   | $I_D$ (A) <sup>a</sup> | $Q_g$ (Typ.) |
| N-Channel       | 60           | 0.030 at $V_{GS} = 10$ V    | 35                     | 6 nC         |
|                 |              | 0.033 at $V_{GS} = 4.5$ V   | 30                     |              |
| P-Channel       | - 60         | 0.050 at $V_{GS} = - 10$ V  | - 19                   | 8 nC         |
|                 |              | 0.060 at $V_{GS} = - 4.5$ V | - 15                   |              |

#### FEATURES

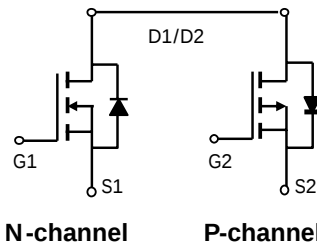
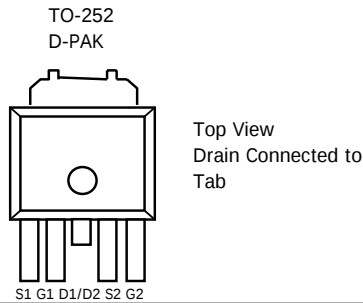
- Halogen-free According to IEC 61249-2-21 Available
- Trench Power MOSFET
- 100 %  $R_g$  and UIS Tested

#### APPLICATIONS

- CCFL Inverter



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



| ABSOLUTE MAXIMUM RATINGS (TA = 25°C UNLESS OTHERWISE NOTED) |                          |                |                |            |                  |
|-------------------------------------------------------------|--------------------------|----------------|----------------|------------|------------------|
| Parameter                                                   |                          | Symbol         | Nch Limit      | Pch Limit  | Units            |
| Drain-Source Voltage                                        |                          | $V_{DS}$       | 60             | -60        | V                |
| Gate-Source Voltage                                         |                          | $V_{GS}$       | $\pm 20$       | $\pm 20$   |                  |
| Continuous Drain Current <sup>a</sup>                       | $T_C = 25^\circ\text{C}$ | $I_D$          | 35             | -20        | A                |
| Pulsed Drain Current <sup>b</sup>                           |                          | $I_{DM}$       | 140            | -80        |                  |
| Continuous Source Current (Diode Conduction) <sup>a</sup>   | $T_C = 25^\circ\text{C}$ | $I_S$          | 35             | -20        | A                |
| Power Dissipation <sup>a</sup>                              | $T_C = 25^\circ\text{C}$ | $P_D$          | 50             | 50         | W                |
| Operating Junction and Storage Temperature Range            |                          | $T_J, T_{stg}$ | $T_J, T_{stg}$ | -55 to 175 | $^\circ\text{C}$ |

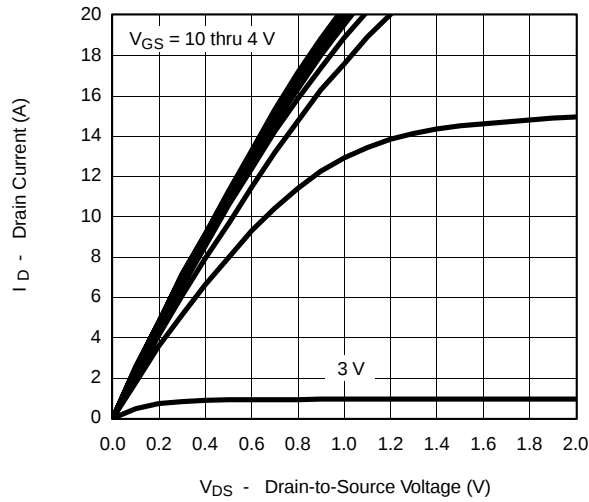
| THERMAL RESISTANCE RATINGS               |                 |         |                    |
|------------------------------------------|-----------------|---------|--------------------|
| Parameter                                | Symbol          | Maximum | Units              |
| Maximum Junction-to-Ambient <sup>c</sup> | $R_{\theta JA}$ | 50      | $^\circ\text{C/W}$ |
| Maximum Junction-to-Case                 | $R_{\theta JC}$ | 3       |                    |

#### Notes

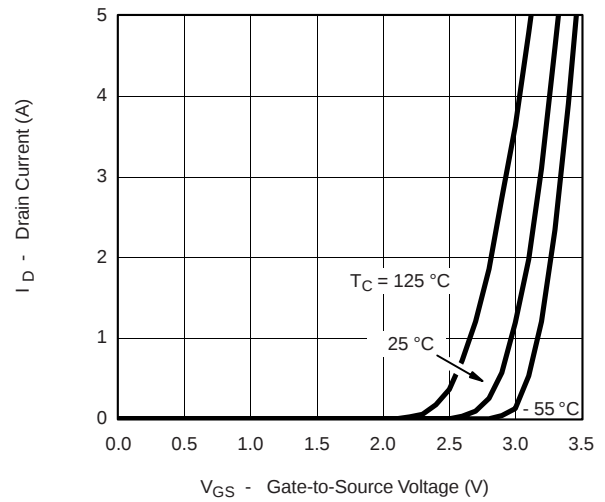
- Package Limited
- Pulse width limited by maximum junction temperature
- Surface Mounted on 1" x 1" FR4 Board.

| Parameter                               | Symbol       | Test Conditions                                                                                                                                     | Min | Typ   | Max       | Unit          |
|-----------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------|-----------|---------------|
| Static                                  |              |                                                                                                                                                     |     |       |           |               |
| Gate-Source Threshold Voltage           | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250 \text{ }\mu\text{A}$                                                                                                    | 1   |       | 3         | V             |
|                                         |              | $V_{DS} = V_{GS}, I_D = -250 \text{ }\mu\text{A}$                                                                                                   | -1  |       | -3        | V             |
| Gate-Body Leakage                       | $I_{GSS}$    | $V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$                                                                                                   |     |       | $\pm 100$ | nA            |
| Zero Gate Voltage Drain Current         | $I_{DSS}$    | $V_{DS} = 60 \text{ V}, V_{GS} = 0 \text{ V}$                                                                                                       |     |       | 1         | $\mu\text{A}$ |
|                                         |              | $V_{DS} = -48 \text{ V}, V_{GS} = 0 \text{ V}$                                                                                                      |     |       | -1        |               |
| On-State Drain Current <sup>a</sup>     | $I_{D(on)}$  | $V_{DS} = 5 \text{ V}, V_{GS} = 10 \text{ V}$                                                                                                       | 45  |       |           | A             |
|                                         |              | $V_{DS} = -5 \text{ V}, V_{GS} = -10 \text{ V}$                                                                                                     | -25 |       |           | A             |
| Drain-Source On-Resistance <sup>a</sup> | $r_{DS(on)}$ | $V_{GS} = 10 \text{ V}, I_D = 20 \text{ A}$                                                                                                         |     | 30    |           | m $\Omega$    |
|                                         |              | $V_{GS} = 4.5 \text{ V}, I_D = 16 \text{ A}$                                                                                                        |     | 33    |           |               |
|                                         |              | $V_{GS} = -10 \text{ V}, I_D = -10 \text{ A}$                                                                                                       |     | 50    |           | m $\Omega$    |
|                                         |              | $V_{GS} = -4.5 \text{ V}, I_D = -8 \text{ A}$                                                                                                       |     | 60    |           |               |
| Forward Transconductance <sup>a</sup>   | $g_{fs}$     | $V_{DS} = 15 \text{ V}, I_D = 20 \text{ A}$                                                                                                         |     | 15    |           | S             |
|                                         |              | $V_{DS} = -15 \text{ V}, I_D = -10 \text{ A}$                                                                                                       |     | 11    |           | S             |
| Diode Forward Voltage <sup>a</sup>      | $V_{SD}$     | $I_S = 17 \text{ A}, V_{GS} = 0 \text{ V}$                                                                                                          |     | 0.89  |           | V             |
|                                         |              | $I_S = -10 \text{ A}, V_{GS} = 0 \text{ V}$                                                                                                         |     | -0.98 |           | V             |
| Dynamic <sup>b</sup>                    |              |                                                                                                                                                     |     |       |           |               |
| Total Gate Charge                       | $Q_g$        | N - Channel<br>$V_{DS} = 30 \text{ V}, V_{GS} = 4.5 \text{ V},$<br>$I_D = 20 \text{ A}$                                                             |     | 9     |           | nC            |
| Gate-Source Charge                      | $Q_{gs}$     |                                                                                                                                                     |     | 3     |           |               |
| Gate-Drain Charge                       | $Q_{gd}$     |                                                                                                                                                     |     | 4     |           |               |
| Turn-On Delay Time                      | $t_{d(on)}$  | N - Channel<br>$V_{DS} = 30 \text{ V}, R_L = 1.5 \text{ }\Omega,$<br>$I_D = 20 \text{ A},$<br>$V_{GEN} = 10 \text{ V}, R_{GEN} = 6 \text{ }\Omega$  |     | 5     |           | ns            |
| Rise Time                               | $t_r$        |                                                                                                                                                     |     | 5     |           |               |
| Turn-Off Delay Time                     | $t_{d(off)}$ |                                                                                                                                                     |     | 27    |           |               |
| Fall Time                               | $t_f$        |                                                                                                                                                     |     | 8     |           |               |
| Input Capacitance                       | $C_{iss}$    | N - Channel<br>$V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ Mhz}$                                                                     |     | 1500  |           | pF            |
| Output Capacitance                      | $C_{oss}$    |                                                                                                                                                     |     | 84    |           |               |
| Reverse Transfer Capacitance            | $C_{rss}$    |                                                                                                                                                     |     | 79    |           |               |
| Total Gate Charge                       | $Q_g$        | P - Channel<br>$V_{DS} = -30 \text{ V}, V_{GS} = 4.5 \text{ V},$<br>$I_D = -10 \text{ A}$                                                           |     | 10    |           | nC            |
| Gate-Source Charge                      | $Q_{gs}$     |                                                                                                                                                     |     | 5     |           |               |
| Gate-Drain Charge                       | $Q_{gd}$     |                                                                                                                                                     |     | 4     |           |               |
| Turn-On Delay Time                      | $t_{d(on)}$  | P - Channel<br>$V_{DS} = -30 \text{ V}, R_L = 3 \text{ }\Omega,$<br>$I_D = -10 \text{ A},$<br>$V_{GEN} = -10 \text{ V}, R_{GEN} = 6 \text{ }\Omega$ |     | 5     |           | ns            |
| Rise Time                               | $t_r$        |                                                                                                                                                     |     | 4     |           |               |
| Turn-Off Delay Time                     | $t_{d(off)}$ |                                                                                                                                                     |     | 30    |           |               |
| Fall Time                               | $t_f$        |                                                                                                                                                     |     | 11    |           |               |
| Input Capacitance                       | $C_{iss}$    | P - Channel<br>$V_{DS} = -15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ Mhz}$                                                                    |     | 1180  |           | pF            |
| Output Capacitance                      | $C_{oss}$    |                                                                                                                                                     |     | 84    |           |               |
| Reverse Transfer Capacitance            | $C_{rss}$    |                                                                                                                                                     |     | 60    |           |               |

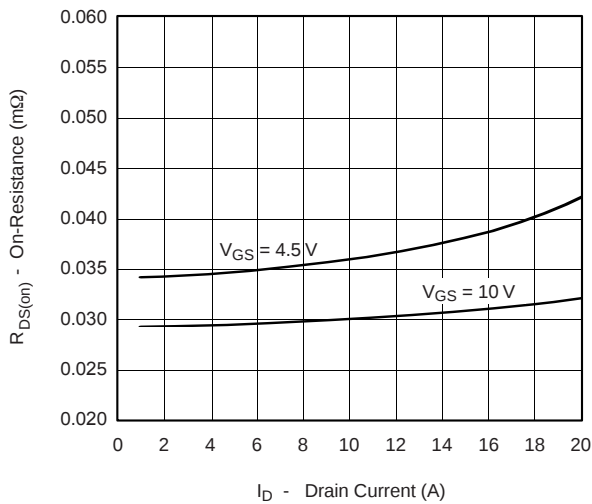
**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



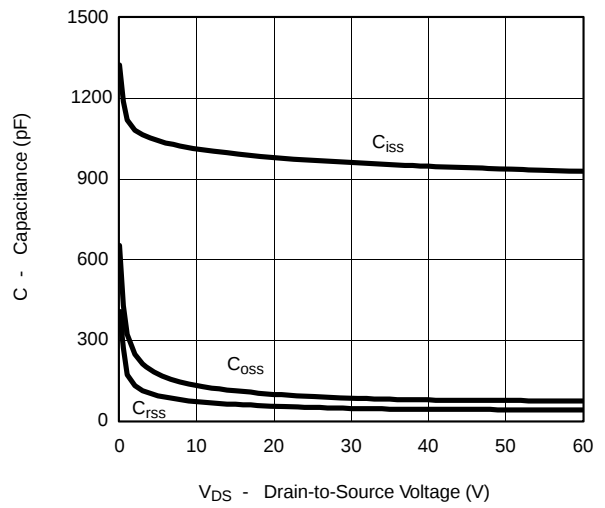
**Output Characteristics**



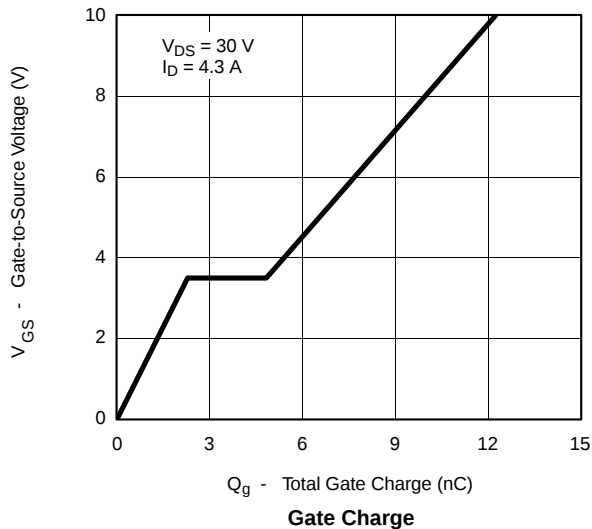
**Transfer Characteristics**



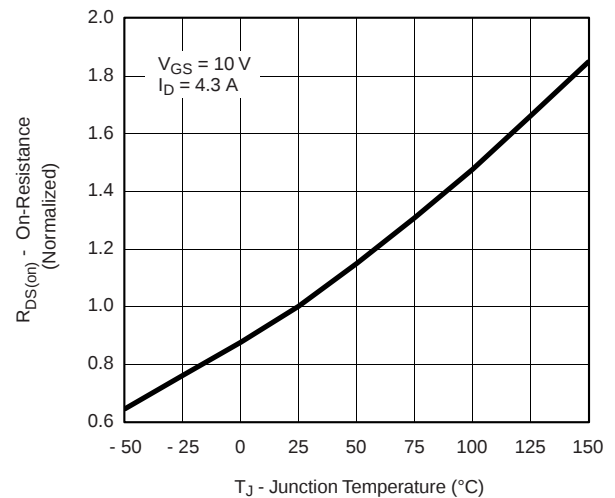
**On-Resistance vs. Drain Current and Gate Voltage**



**Capacitance**

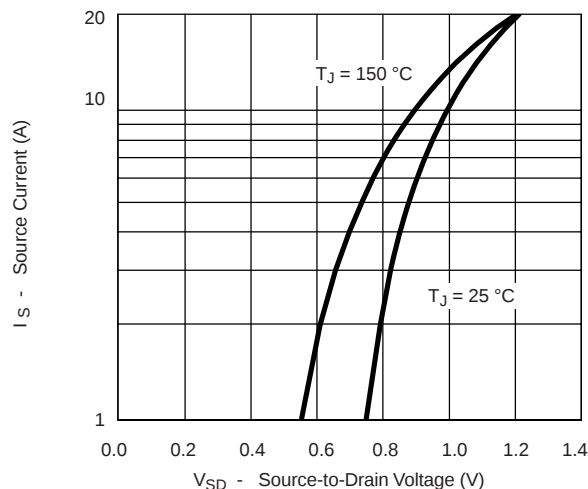


**Gate Charge**

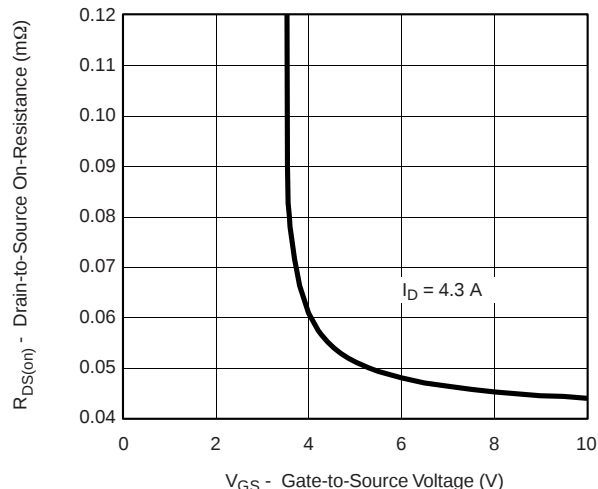


**On-Resistance vs. Junction Temperature**

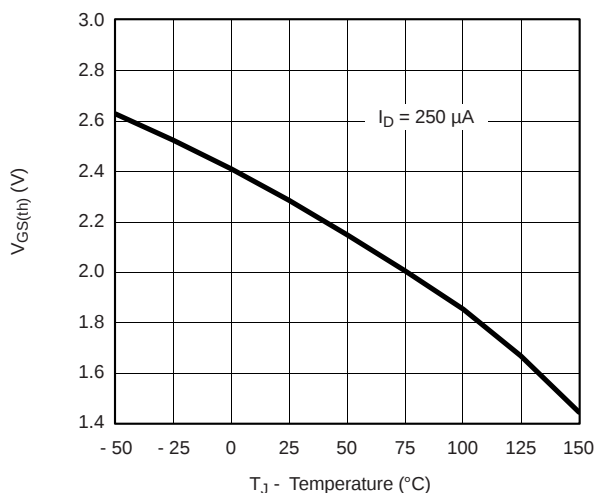
**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



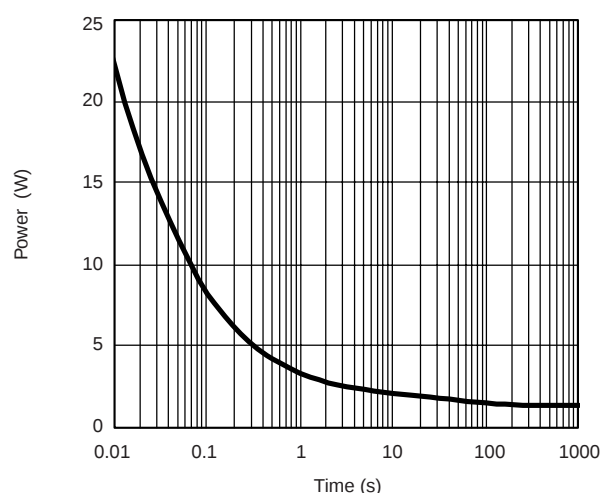
Source-Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

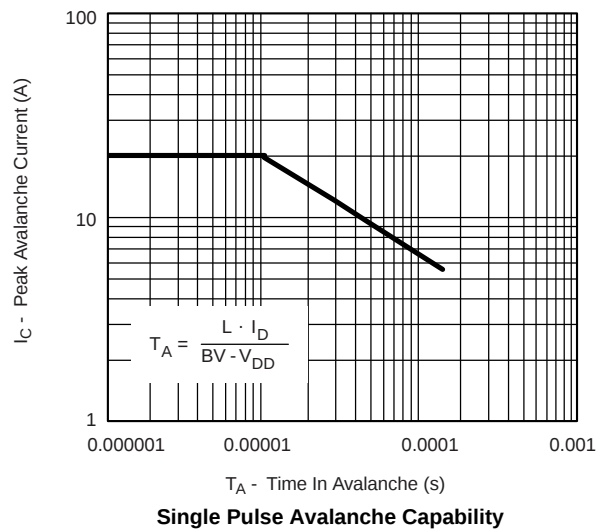
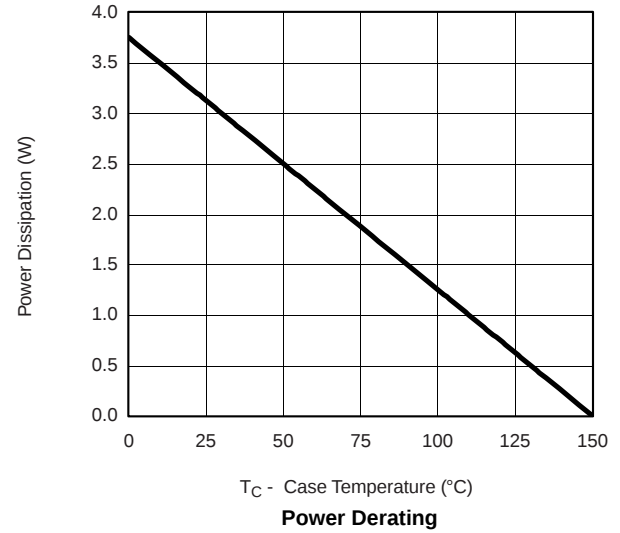
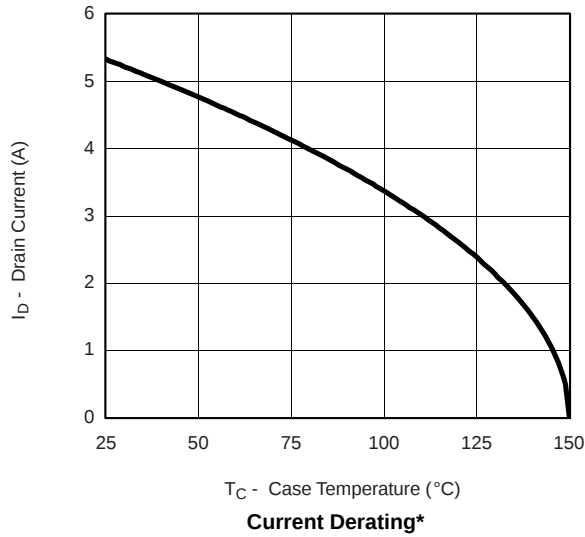


Single Pulse Power, Junction-to-Ambient



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

Safe Operating Area

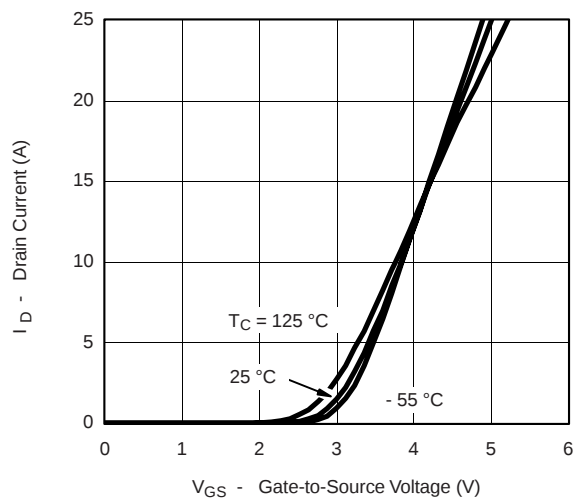
**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted


\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °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.

**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted


**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

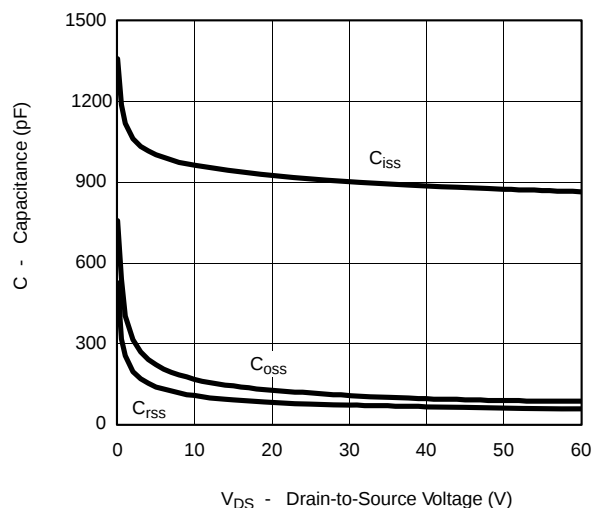

Output Characteristics



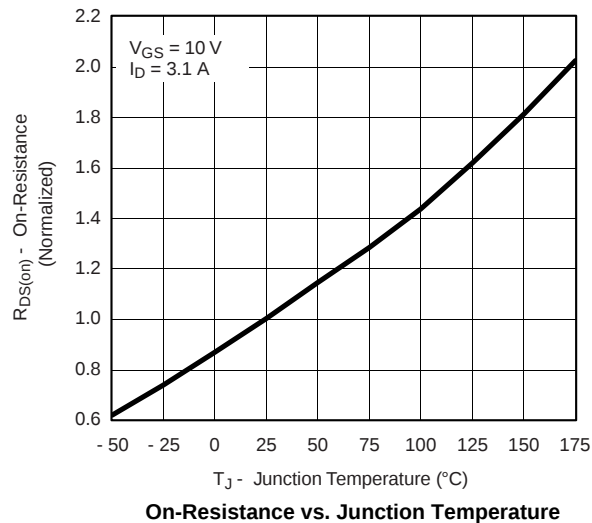
Transfer Characteristics



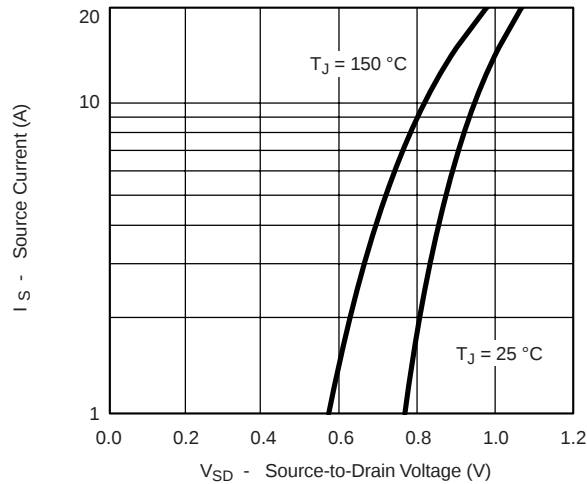
On-Resistance vs. Drain Current



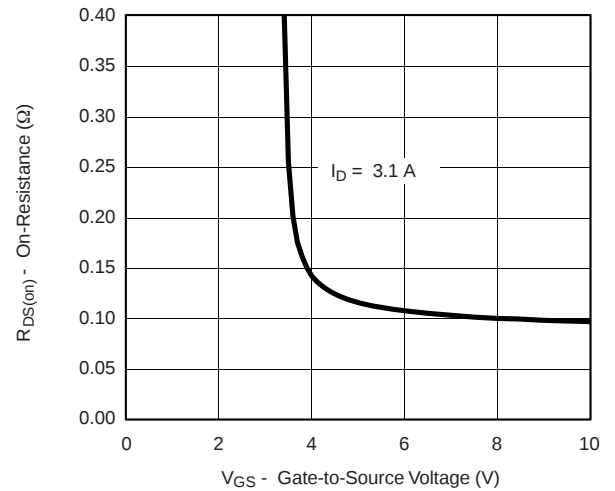
Capacitance



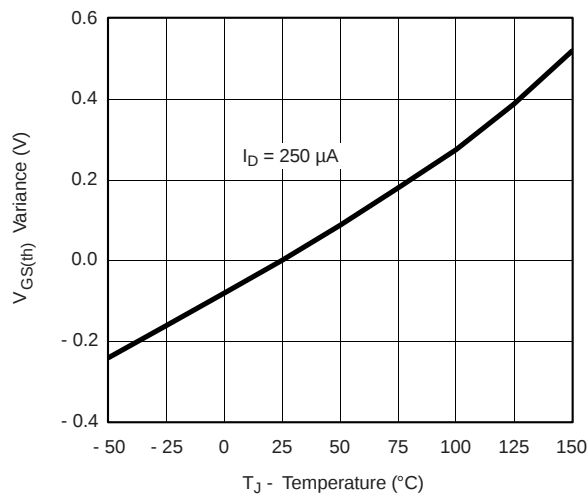
**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



Source-Drain Diode Forward Voltage



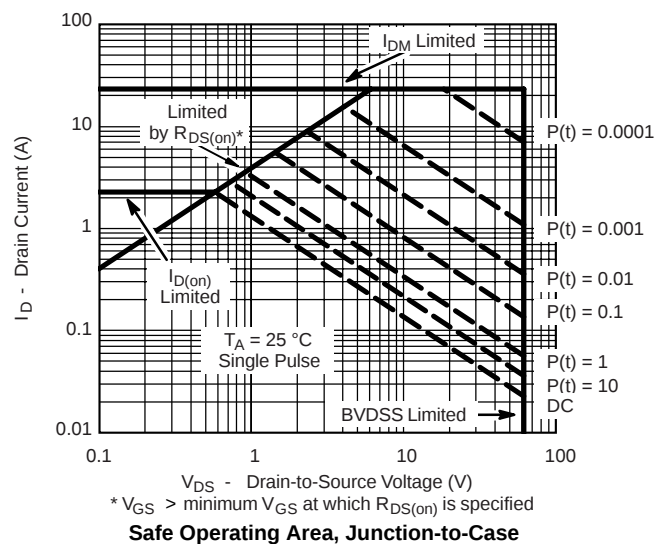
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

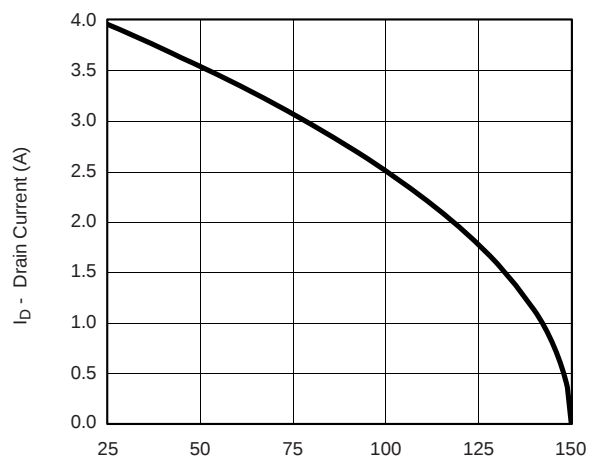


Single Pulse Power

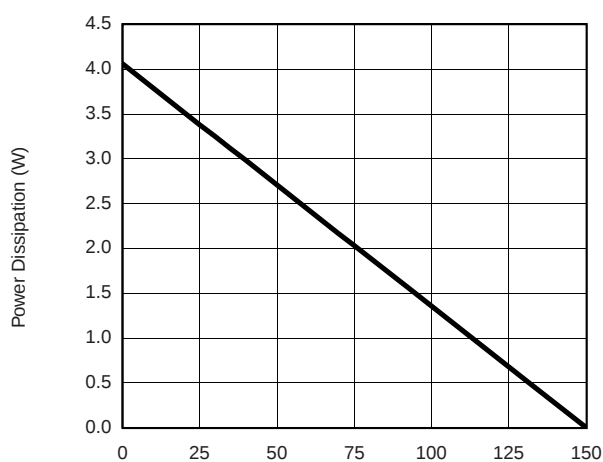


\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

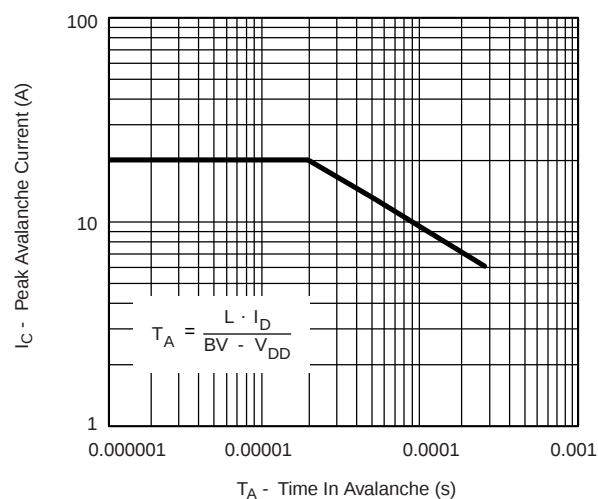
Safe Operating Area, Junction-to-Case

**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted


$T_C$  - Case Temperature (°C)  
**Current Derating\***



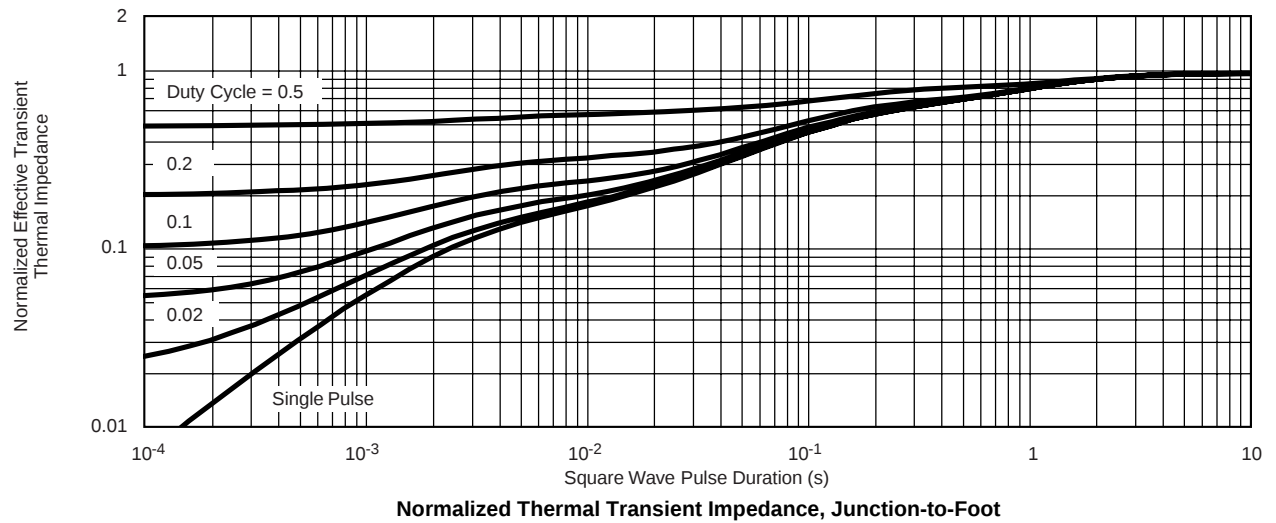
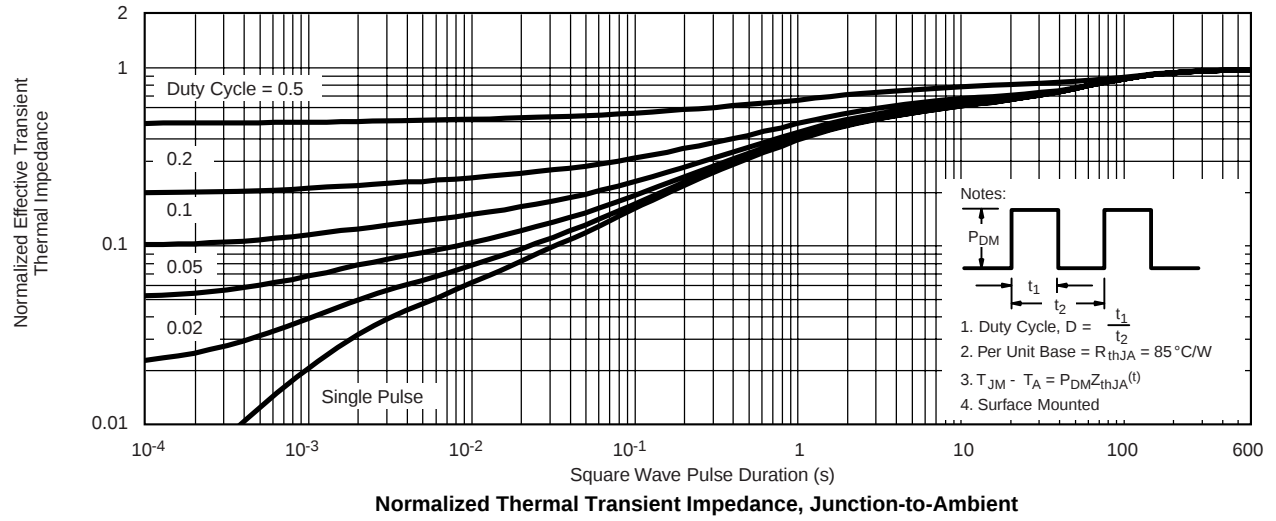
$T_C$  - Case Temperature (°C)  
**Power Derating, Junction-to-Foot**



**Single Pulse Avalanche Capability**

\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °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.

**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



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