

## P5506NVG-VB Datasheet

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

| PRODUCT SUMMARY |                     |                                    |                                 |                       |
|-----------------|---------------------|------------------------------------|---------------------------------|-----------------------|
|                 | V <sub>DS</sub> (V) | R <sub>DS(on)</sub> (Ω)            | I <sub>D</sub> (A) <sup>a</sup> | Q <sub>g</sub> (Typ.) |
| N-Channel       | 60                  | 0.026 at V <sub>GS</sub> = 10 V    | 5.3                             | 6 nC                  |
|                 |                     | 0.029 at V <sub>GS</sub> = 4.5 V   | 4.7                             |                       |
| P-Channel       | - 60                | 0.055 at V <sub>GS</sub> = - 10 V  | - 4.9                           | 8 nC                  |
|                 |                     | 0.060 at V <sub>GS</sub> = - 4.5 V | - 4.5                           |                       |

#### FEATURES

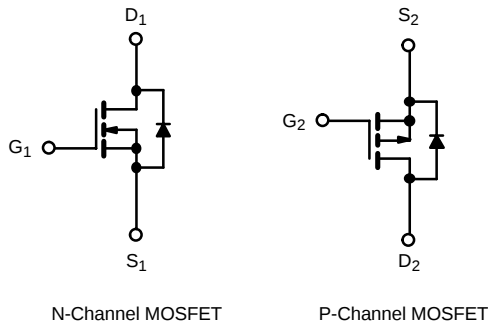
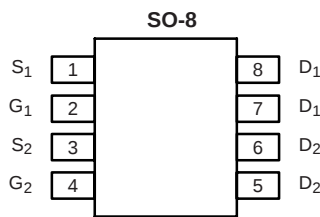
- Halogen-free According to IEC 61249-2-21 Available
- Trench Power MOSFET
- 100 % R<sub>g</sub> and UIS Tested

#### APPLICATIONS

- CCFL Inverter



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



| ABSOLUTE MAXIMUM RATINGS T <sub>A</sub> = 25 °C, unless otherwise noted |                        |                                   |                     |                       |      |
|-------------------------------------------------------------------------|------------------------|-----------------------------------|---------------------|-----------------------|------|
| Parameter                                                               |                        | Symbol                            | N-Channel           | P-Channel             | Unit |
| Drain-Source Voltage                                                    |                        | V <sub>DS</sub>                   | 60                  | - 60                  | V    |
| Gate-Source Voltage                                                     |                        | V <sub>GS</sub>                   | ± 20                |                       |      |
| Continuous Drain Current (T <sub>J</sub> = 150 °C)                      | T <sub>C</sub> = 25 °C | I <sub>D</sub>                    | 5.3                 | - 4.9                 | A    |
|                                                                         | T <sub>C</sub> = 70 °C |                                   | 4.3                 | - 4.2                 |      |
|                                                                         | T <sub>A</sub> = 25 °C |                                   | 4.3 <sup>b, c</sup> | - 4.0 <sup>b, c</sup> |      |
|                                                                         | T <sub>A</sub> = 70 °C |                                   | 3.4 <sup>b, c</sup> | - 3.4 <sup>b, c</sup> |      |
| Pulsed Drain Current (10 μs Pulse Width)                                |                        | I <sub>DM</sub>                   | 20                  | - 25                  |      |
| Source Drain Current Diode Current                                      | T <sub>C</sub> = 25 °C | I <sub>S</sub>                    | 2.6                 | - 2.8                 |      |
|                                                                         | T <sub>A</sub> = 25 °C |                                   | 1.7 <sup>b, c</sup> | - 1.7 <sup>b, c</sup> |      |
| Pulsed Source-Drain Current                                             |                        | I <sub>SM</sub>                   | 20                  | - 25                  |      |
| Single Pulse Avalanche Current                                          | L = 0.1 mH             | I <sub>AS</sub>                   | 11                  | 15                    |      |
| Single Pulse Avalanche Energy                                           |                        | E <sub>AS</sub>                   | 6.1                 | 11                    | mJ   |
| Maximum Power Dissipation                                               | T <sub>C</sub> = 25 °C | P <sub>D</sub>                    | 3.1                 | 3.4                   | W    |
|                                                                         | T <sub>C</sub> = 70 °C |                                   | 2                   | 2.2                   |      |
|                                                                         | T <sub>A</sub> = 25 °C |                                   | 2 <sup>b, c</sup>   | 2 <sup>b, c</sup>     |      |
|                                                                         | T <sub>A</sub> = 70 °C |                                   | 1.3 <sup>b, c</sup> | 1.3 <sup>b, c</sup>   |      |
| Operating Junction and Storage Temperature Range                        |                        | T <sub>J</sub> , T <sub>stg</sub> | - 55 to 150         |                       | °C   |

#### THERMAL RESISTANCE RATINGS

| Parameter                                   |              | Symbol            | N-Channel |      | P-Channel |      | Unit |
|---------------------------------------------|--------------|-------------------|-----------|------|-----------|------|------|
|                                             |              |                   | Typ.      | Max. | Typ.      | Max. |      |
| Maximum Junction-to-Ambient <sup>b, d</sup> | t ≤ 10 s     | R <sub>thJA</sub> | 55        | 62.5 | 53        | 62.5 | °C/W |
| Maximum Junction-to-Foot (Drain)            | Steady State | R <sub>thJF</sub> | 33        | 40   | 30        | 37   |      |

Notes:

a. Based on T<sub>C</sub> = 25 °C.

b. Surface Mounted on 1" x 1" FR4 board.

c. t = 10 s.

d. Maximum under Steady State conditions is 110 °C/W for N-Channel and P-Channel.

| SPECIFICATIONS T <sub>J</sub> = 25 °C, unless otherwise noted |                                                                                      |                                                                                            |      |      |                   |       |      |  |  |
|---------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|------|------|-------------------|-------|------|--|--|
| Parameter                                                     | Symbol                                                                               | Test Conditions                                                                            |      | Min. | Typ. <sup>a</sup> | Max.  | Unit |  |  |
| Static                                                        |                                                                                      |                                                                                            |      |      |                   |       |      |  |  |
| Drain-Source Breakdown Voltage                                | V <sub>DS</sub>                                                                      | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA                                             | N-Ch | 60   |                   |       | V    |  |  |
|                                                               |                                                                                      | V <sub>GS</sub> = 0 V, I <sub>D</sub> = - 250 μA                                           | P-Ch | - 60 |                   |       |      |  |  |
| V <sub>DS</sub> Temperature Coefficient                       | ΔV <sub>DS</sub> /T <sub>J</sub>                                                     | I <sub>D</sub> = 250 μA                                                                    | N-Ch |      | 55                |       | mV   |  |  |
|                                                               |                                                                                      | I <sub>D</sub> = - 250 μA                                                                  | P-Ch |      | - 50              |       |      |  |  |
| V <sub>GS(th)</sub> Temperature Coefficient                   | ΔV <sub>GS(th)</sub> /T <sub>J</sub>                                                 | I <sub>D</sub> = 250 μA                                                                    | N-Ch |      | - 6               |       |      |  |  |
|                                                               |                                                                                      | I <sub>D</sub> = - 250 μA                                                                  | P-Ch |      | 4                 |       |      |  |  |
| Gate Threshold Voltage                                        | V <sub>GS(th)</sub>                                                                  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                                | N-Ch | 1    |                   | 3     | V    |  |  |
|                                                               |                                                                                      | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = - 250 μA                              | P-Ch | - 1  |                   | - 3   |      |  |  |
| Gate-Body Leakage                                             | I <sub>GSS</sub>                                                                     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V                                            | N-Ch |      |                   | 100   | nA   |  |  |
|                                                               |                                                                                      |                                                                                            | P-Ch |      |                   | - 100 |      |  |  |
| Zero Gate Voltage Drain Current                               | I <sub>DSS</sub>                                                                     | V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V                                              | N-Ch |      |                   | 1     | μA   |  |  |
|                                                               |                                                                                      | V <sub>DS</sub> = - 60 V, V <sub>GS</sub> = 0 V                                            | P-Ch |      |                   | - 1   |      |  |  |
|                                                               |                                                                                      | V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C                      | N-Ch |      |                   | 10    |      |  |  |
|                                                               |                                                                                      | V <sub>DS</sub> = - 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C                    | P-Ch |      |                   | - 10  |      |  |  |
| On-State Drain Current <sup>b</sup>                           | I <sub>D(on)</sub>                                                                   | V <sub>DS</sub> ≥ 5 V, V <sub>GS</sub> = 10 V                                              | N-Ch | 20   |                   |       | A    |  |  |
|                                                               |                                                                                      | V <sub>DS</sub> ≤ - 5 V, V <sub>GS</sub> = - 10 V                                          | P-Ch | - 25 |                   |       |      |  |  |
| Drain-Source On-State Resistance <sup>b</sup>                 | R <sub>DS(on)</sub>                                                                  | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 4.3 A                                             | N-Ch |      | 0.026             |       | Ω    |  |  |
|                                                               |                                                                                      | V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 3.1 A                                         | P-Ch |      | 0.055             |       |      |  |  |
|                                                               |                                                                                      | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 3.9 A                                            | N-Ch |      | 0.029             |       |      |  |  |
|                                                               |                                                                                      | V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 0.2 A                                        | P-Ch |      | 0.060             |       |      |  |  |
| Forward Transconductance <sup>b</sup>                         | g <sub>fs</sub>                                                                      | V <sub>DS</sub> = 15 V, I <sub>D</sub> = 4.3 A                                             | N-Ch |      | 15                |       | S    |  |  |
|                                                               |                                                                                      | V <sub>DS</sub> = - 15 V, I <sub>D</sub> = - 3.1 A                                         | P-Ch |      | 8.5               |       |      |  |  |
| Dynamic <sup>a</sup>                                          |                                                                                      |                                                                                            |      |      |                   |       |      |  |  |
| Input Capacitance                                             | C <sub>iss</sub>                                                                     | N-Channel<br>V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V, f = 1 MHz                      | N-Ch |      | 665               |       | pF   |  |  |
|                                                               |                                                                                      |                                                                                            | P-Ch |      | 650               |       |      |  |  |
| Output Capacitance                                            | C <sub>oss</sub>                                                                     | P-Channel<br>V <sub>DS</sub> = - 15 V, V <sub>GS</sub> = 0 V, f = 1 MHz                    | N-Ch |      | 75                |       |      |  |  |
|                                                               |                                                                                      |                                                                                            | P-Ch |      | 95                |       |      |  |  |
| Reverse Transfer Capacitance                                  | C <sub>rss</sub>                                                                     |                                                                                            | N-Ch |      | 40                |       |      |  |  |
|                                                               |                                                                                      |                                                                                            | P-Ch |      | 60                |       |      |  |  |
| Total Gate Charge                                             | Q <sub>g</sub>                                                                       | V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 4.3 A                     | N-Ch |      | 13                | 20    | nC   |  |  |
|                                                               |                                                                                      | V <sub>DS</sub> = - 30 V, V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 3.1 A               | P-Ch |      | 14.5              | 22    |      |  |  |
|                                                               | N-Channel<br>V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 4.3 A | N-Ch                                                                                       |      | 6    | 9                 |       |      |  |  |
|                                                               |                                                                                      | P-Ch                                                                                       |      | 8    | 12                |       |      |  |  |
| Gate-Source Charge                                            | Q <sub>gs</sub>                                                                      | P-Channel<br>V <sub>DS</sub> = - 30 V, V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 3.1 A | N-Ch |      | 2.3               |       |      |  |  |
|                                                               | P-Ch                                                                                 |                                                                                            |      | 2.2  |                   |       |      |  |  |
| Gate-Drain Charge                                             | Q <sub>gd</sub>                                                                      |                                                                                            |      | N-Ch |                   | 2.6   |      |  |  |
|                                                               |                                                                                      |                                                                                            |      | P-Ch |                   | 3.7   |      |  |  |
| Gate Resistance                                               | R <sub>g</sub>                                                                       | f = 1 MHz                                                                                  | N-Ch |      | 2                 | 3     | Ω    |  |  |
|                                                               |                                                                                      |                                                                                            | P-Ch |      | 14                | 20    |      |  |  |

| SPECIFICATIONS T <sub>J</sub> = 25 °C, unless otherwise noted |                     |                                                                                                                                              |                                                                                 |      |                   |       |      |    |
|---------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|------|-------------------|-------|------|----|
| Parameter                                                     | Symbol              | Test Conditions                                                                                                                              |                                                                                 | Min. | Typ. <sup>a</sup> | Max.  | Unit |    |
| Dynamic <sup>a</sup>                                          |                     |                                                                                                                                              |                                                                                 |      |                   |       |      |    |
| Turn-On Delay Time                                            | t <sub>d(on)</sub>  | N-Channel<br>V <sub>DD</sub> = 30 V, R <sub>L</sub> = 8.8 Ω<br>I <sub>D</sub> ≅ 3.4 A, V <sub>GEN</sub> = 4.5 V, R <sub>g</sub> = 1 Ω        | N-Ch                                                                            |      | 15                | 25    | ns   |    |
|                                                               |                     |                                                                                                                                              | P-Ch                                                                            |      | 30                | 45    |      |    |
| Rise Time                                                     | t <sub>r</sub>      |                                                                                                                                              | N-Ch                                                                            |      | 65                | 100   |      |    |
|                                                               |                     |                                                                                                                                              | P-Ch                                                                            |      | 70                | 105   |      |    |
| Turn-Off Delay Time                                           | t <sub>d(off)</sub> | P-Channel<br>V <sub>DD</sub> = - 30 V, R <sub>L</sub> = 12.5 Ω<br>I <sub>D</sub> ≅ - 2.4 A, V <sub>GEN</sub> = - 4.5 V, R <sub>g</sub> = 1 Ω | N-Ch                                                                            |      | 15                | 25    |      |    |
|                                                               |                     |                                                                                                                                              | P-Ch                                                                            |      | 40                | 60    |      |    |
| Fall Time                                                     | t <sub>f</sub>      |                                                                                                                                              | N-Ch                                                                            |      | 10                | 15    |      |    |
|                                                               |                     |                                                                                                                                              | P-Ch                                                                            |      | 30                | 45    |      |    |
| Turn-On Delay Time                                            | t <sub>d(on)</sub>  | N-Channel<br>V <sub>DD</sub> = 30 V, R <sub>L</sub> = 8.8 Ω<br>I <sub>D</sub> ≅ 3.4 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω         | N-Ch                                                                            |      | 10                | 15    |      |    |
|                                                               |                     |                                                                                                                                              | P-Ch                                                                            |      | 10                | 15    |      |    |
| Rise Time                                                     | t <sub>r</sub>      |                                                                                                                                              | N-Ch                                                                            |      | 15                | 25    |      |    |
|                                                               |                     |                                                                                                                                              | P-Ch                                                                            |      | 13                | 20    |      |    |
| Turn-Off Delay Time                                           | t <sub>d(off)</sub> | P-Channel<br>V <sub>DD</sub> = - 30 V, R <sub>L</sub> = 12.5 Ω<br>I <sub>D</sub> ≅ - 2.4 A, V <sub>GEN</sub> = - 10 V, R <sub>g</sub> = 1 Ω  | N-Ch                                                                            |      | 20                | 30    |      |    |
|                                                               |                     |                                                                                                                                              | P-Ch                                                                            |      | 35                | 55    |      |    |
| Fall Time                                                     | t <sub>f</sub>      |                                                                                                                                              | N-Ch                                                                            |      | 10                | 15    |      |    |
|                                                               |                     |                                                                                                                                              | P-Ch                                                                            |      | 30                | 45    |      |    |
| Drain-Source Body Diode Characteristics                       |                     |                                                                                                                                              |                                                                                 |      |                   |       |      |    |
| Continuous Source-Drain Diode Current                         | I <sub>S</sub>      | T <sub>C</sub> = 25 °C                                                                                                                       | N-Ch                                                                            |      |                   | 2.6   | A    |    |
|                                                               |                     |                                                                                                                                              | P-Ch                                                                            |      |                   | - 2.8 |      |    |
| Pulse Diode Forward Current <sup>a</sup>                      | I <sub>SM</sub>     |                                                                                                                                              | N-Ch                                                                            |      |                   | 20    |      |    |
|                                                               |                     |                                                                                                                                              | P-Ch                                                                            |      |                   | - 25  |      |    |
| Body Diode Voltage                                            | V <sub>SD</sub>     | I <sub>S</sub> = 1.7 A                                                                                                                       | N-Ch                                                                            |      | 0.8               | 1.2   | V    |    |
|                                                               |                     | I <sub>S</sub> = - 2 A                                                                                                                       | P-Ch                                                                            |      | - 0.8             | - 1.2 |      |    |
| Body Diode Reverse Recovery Time                              | t <sub>rr</sub>     | N-Channel<br>I <sub>F</sub> = 1.7 A, dI/dt = 100 A/μs, T <sub>J</sub> = 25 °C                                                                | N-Ch                                                                            |      | 30                | 60    | ns   |    |
|                                                               |                     |                                                                                                                                              | P-Ch                                                                            |      | 30                | 50    |      |    |
| Body Diode Reverse Recovery Charge                            | Q <sub>rr</sub>     |                                                                                                                                              | P-Channel<br>I <sub>F</sub> = - 2 A, dI/dt = - 100 A/μs, T <sub>J</sub> = 25 °C | N-Ch |                   | 32    | 50   | nC |
|                                                               |                     |                                                                                                                                              |                                                                                 | P-Ch |                   | 35    | 60   |    |
| Reverse Recovery Fall Time                                    | t <sub>a</sub>      |                                                                                                                                              |                                                                                 | N-Ch |                   | 25    |      | ns |
|                                                               |                     |                                                                                                                                              |                                                                                 | P-Ch |                   | 16    |      |    |
| Reverse Recovery Rise Time                                    | t <sub>b</sub>      |                                                                                                                                              | N-Ch                                                                            |      | 5                 |       |      |    |
|                                                               |                     |                                                                                                                                              | P-Ch                                                                            |      | 14                |       |      |    |

Notes:

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

b. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

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.

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



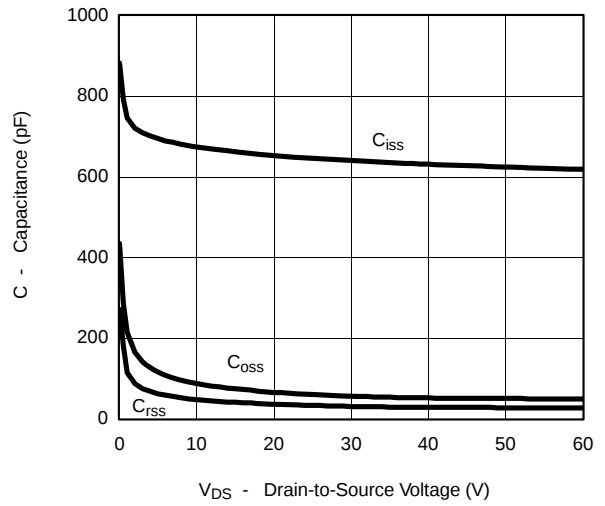
**Output Characteristics**



**Transfer Characteristics**



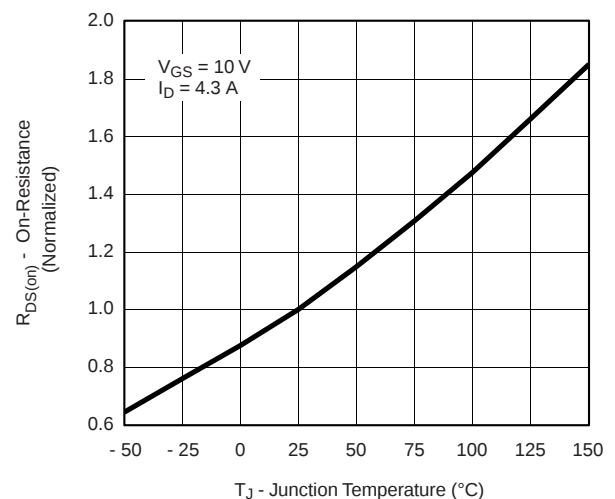
**On-Resistance vs. Drain Current and Gate Voltage**



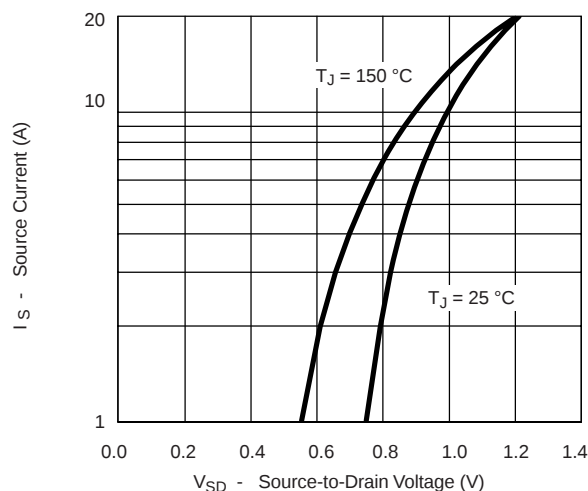
**Capacitance**



**Gate Charge**



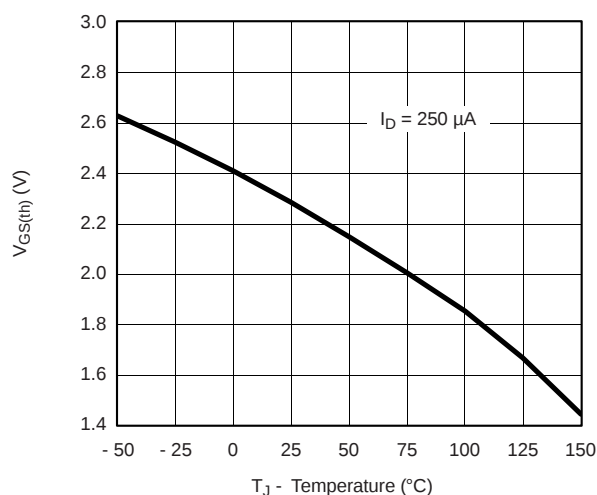
**On-Resistance vs. Junction Temperature**

**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

 $T_C$  - Case Temperature (°C)

**Current Derating\***

 $T_C$  - Case Temperature (°C)

**Power Derating**

**Single Pulse Avalanche Capability**

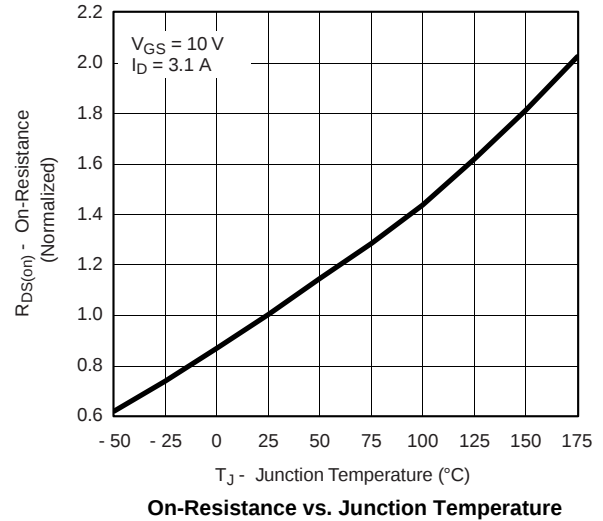
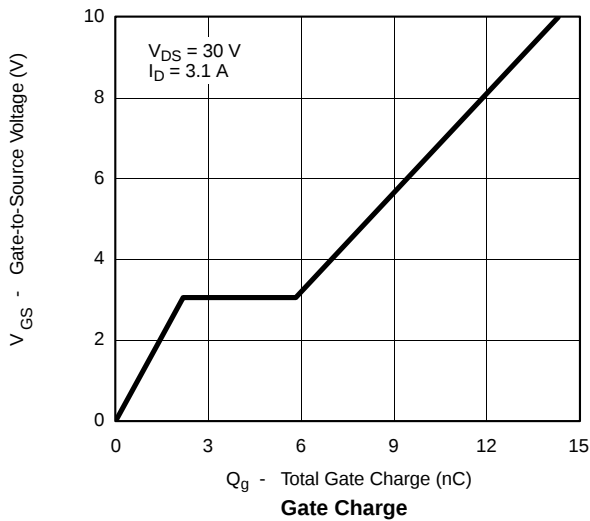
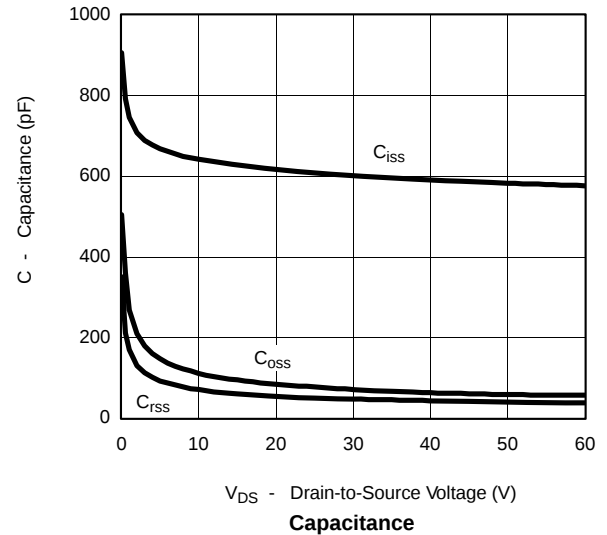
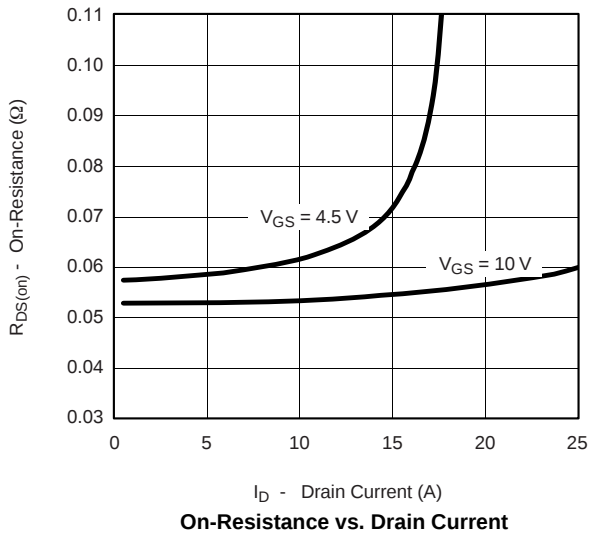
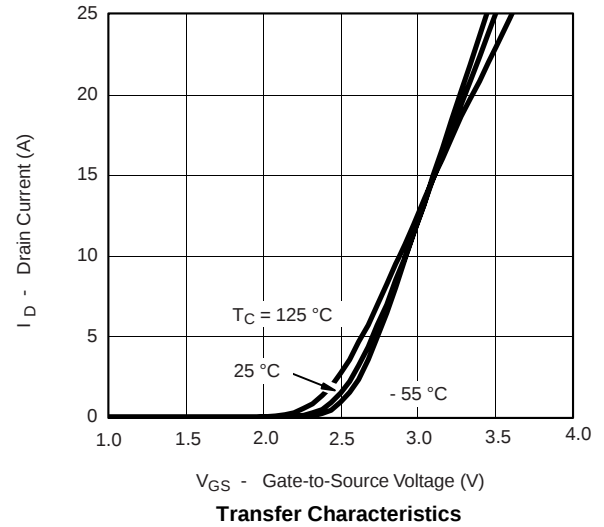
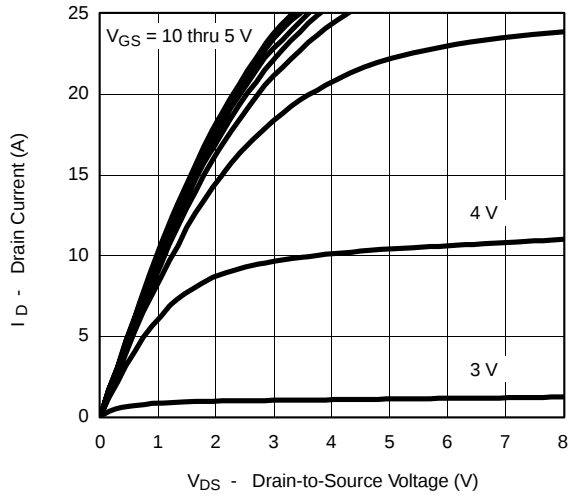
\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

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

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

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

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



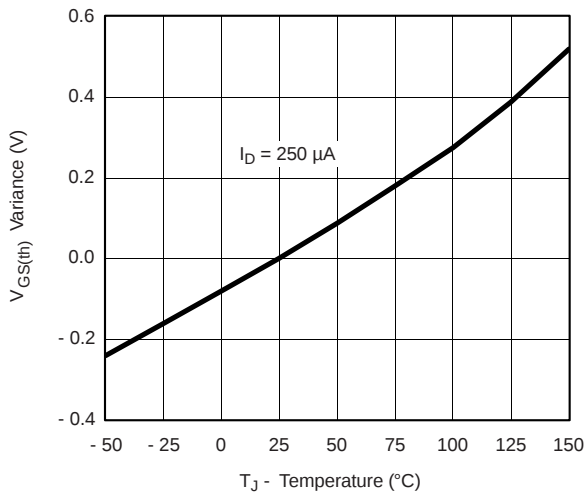
**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



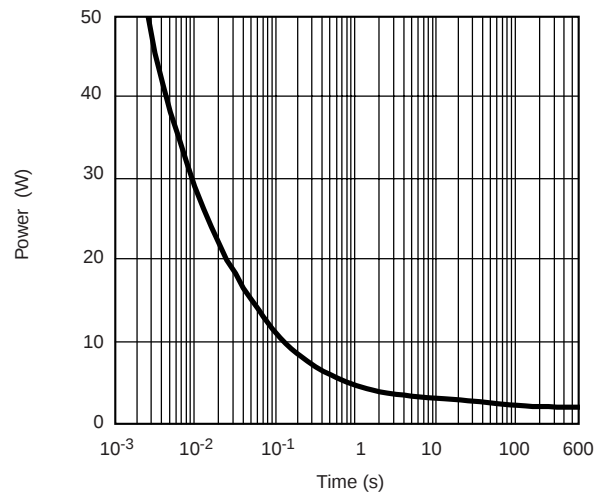
Source-Drain Diode Forward Voltage



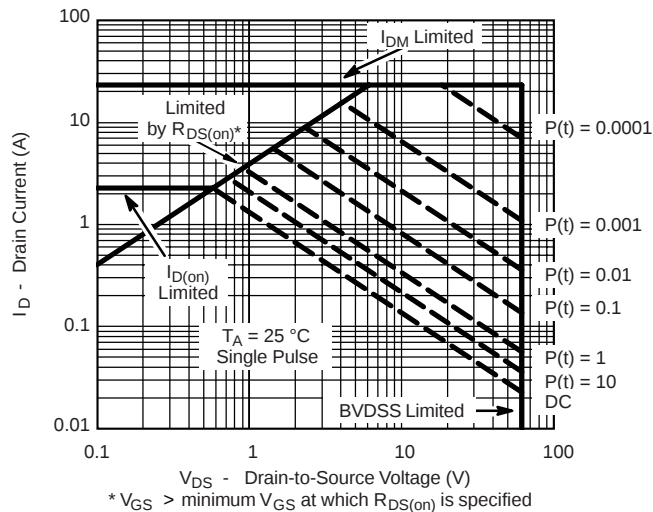
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power



Safe Operating Area, Junction-to-Case

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


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



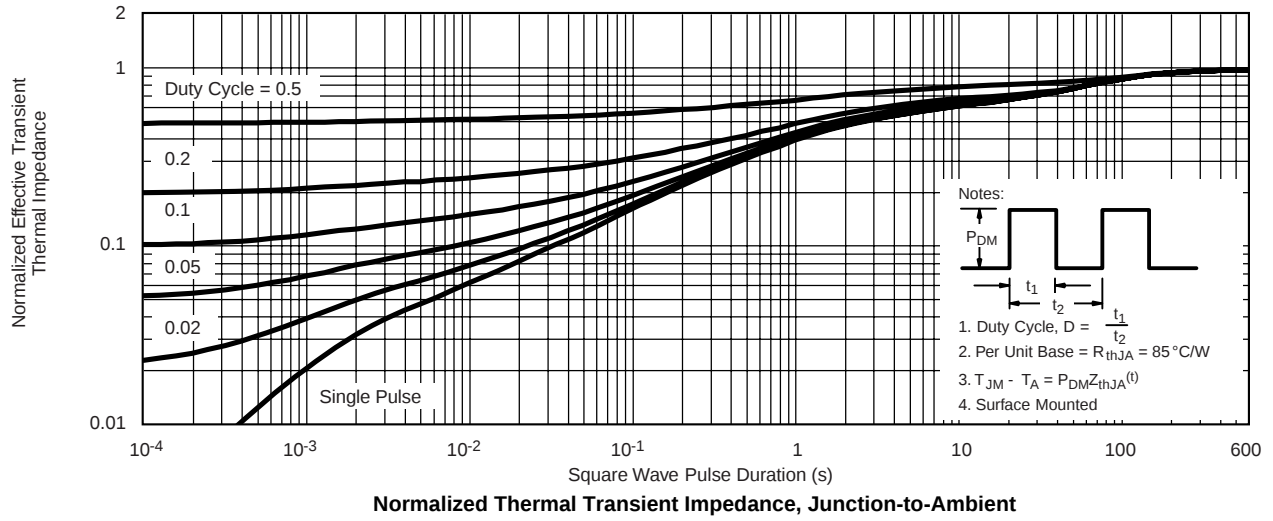
$T_C$  - Case Temperature (°C)  
**Power Derating, Junction-to-Foot**



**Single Pulse Avalanche Capability**

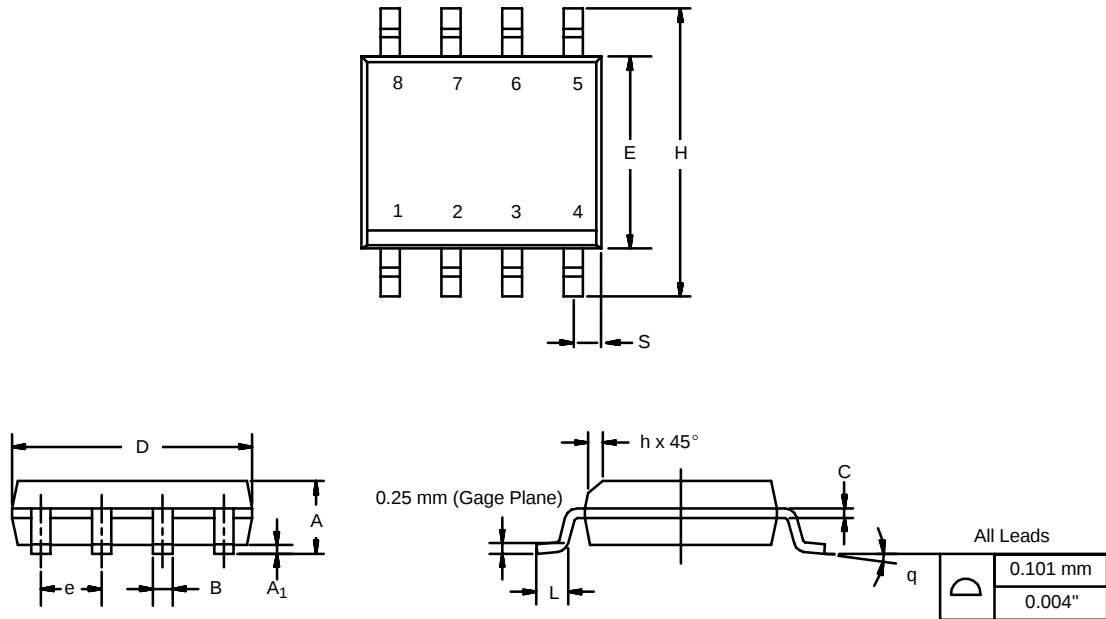
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**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



**SOIC (NARROW): 8-LEAD**

JEDEC Part Number: MS-012



| DIM                            | MILLIMETERS |      | INCHES    |       |
|--------------------------------|-------------|------|-----------|-------|
|                                | Min         | Max  | Min       | Max   |
| A                              | 1.35        | 1.75 | 0.053     | 0.069 |
| A <sub>1</sub>                 | 0.10        | 0.20 | 0.004     | 0.008 |
| B                              | 0.35        | 0.51 | 0.014     | 0.020 |
| C                              | 0.19        | 0.25 | 0.0075    | 0.010 |
| D                              | 4.80        | 5.00 | 0.189     | 0.196 |
| E                              | 3.80        | 4.00 | 0.150     | 0.157 |
| e                              | 1.27 BSC    |      | 0.050 BSC |       |
| H                              | 5.80        | 6.20 | 0.228     | 0.244 |
| h                              | 0.25        | 0.50 | 0.010     | 0.020 |
| L                              | 0.50        | 0.93 | 0.020     | 0.037 |
| q                              | 0°          | 8°   | 0°        | 8°    |
| S                              | 0.44        | 0.64 | 0.018     | 0.026 |
| ECN: C-06527-Rev. I, 11-Sep-06 |             |      |           |       |
| DWG: 5498                      |             |      |           |       |

RECOMMENDED MINIMUM PADS FOR SO-8



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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