

## Complementary 30-V (D-S) MOSFET

### PRODUCT SUMMARY

|           | V <sub>DS</sub> (V) | R <sub>DS(on)</sub> (Ω)           | I <sub>D</sub> (A) |
|-----------|---------------------|-----------------------------------|--------------------|
| P-Channel | - 30                | 0.051 at V <sub>GS</sub> = - 10 V | - 6.4              |
|           |                     | 0.075 at V <sub>GS</sub> = - 6 V  | - 5.3              |
| N-Channel | 30                  | 0.035 at V <sub>GS</sub> = 10 V   | 7.7                |
|           |                     | 0.050 at V <sub>GS</sub> = 4.5 V  | 6.5                |

### FEATURES

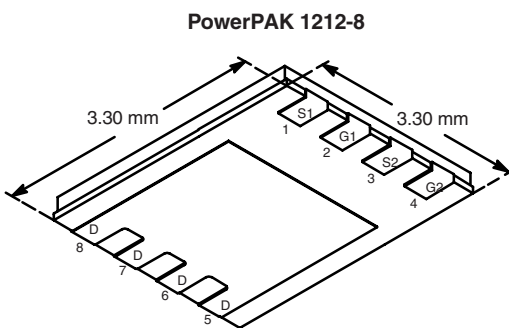
- Halogen-free Option Available
- TrenchFET® Power MOSFET
- New Low Thermal Resistance
- PowerPAK® Package with Low 1.07 mm Profile



**RoHS**  
COMPLIANT

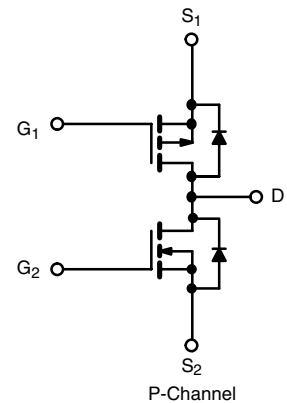
### APPLICATIONS

- Backlight Inverter
- DC/DC Converter
- 4 Cell Battery



Bottom View

Ordering Information: Si7501DN-T1-E3 (Lead (Pb)-free)  
Si7501DN-T1-GE3 (Lead (Pb)-free and Halogen-free)



### ABSOLUTE MAXIMUM RATINGS T<sub>A</sub> = 25 °C, unless otherwise noted

| Parameter                                                       |                        | Symbol                            | P-Channel   |              | N-Channel |              | Unit |
|-----------------------------------------------------------------|------------------------|-----------------------------------|-------------|--------------|-----------|--------------|------|
|                                                                 |                        |                                   | 10 s        | Steady State | 10 s      | Steady State |      |
| Drain-Source Voltage                                            |                        | V <sub>DS</sub>                   | - 30        |              | 30        |              | V    |
| Gate-Source Voltage                                             |                        | V <sub>GS</sub>                   | ± 25        |              | ± 20      |              |      |
| Continuous Drain Current (T <sub>J</sub> = 150 °C) <sup>a</sup> | T <sub>A</sub> = 25 °C | I <sub>D</sub>                    | - 6.4       | - 4.5        | 7.7       | 5.4          | A    |
|                                                                 | T <sub>A</sub> = 70 °C |                                   | - 5.1       | - 3.6        | 4.7       | 4.3          |      |
| Pulsed Drain Current                                            |                        | I <sub>DM</sub>                   | - 25        |              | 25        |              |      |
| Continuous Source Current (Diode Conduction) <sup>a</sup>       |                        | I <sub>S</sub>                    | - 2.6       | - 1.3        | 2.6       | 1.3          |      |
| Maximum Power Dissipation <sup>a</sup>                          | T <sub>A</sub> = 25 °C | P <sub>D</sub>                    | 3.1         | 1.6          | 3.1       | 1.6          | W    |
|                                                                 | T <sub>A</sub> = 70 °C |                                   | 3           | 1.0          | 2         | 1.0          |      |
| Operating Junction and Storage Temperature Range                |                        | T <sub>J</sub> , T <sub>stg</sub> | - 55 to 150 |              |           |              | °C   |
| Soldering Recommendations (Peak Temperature) <sup>b, c</sup>    |                        |                                   | 260         |              |           |              |      |

### THERMAL RESISTANCE RATINGS

| Parameter                                |              | Symbol            | Typical | Maximum | Unit |
|------------------------------------------|--------------|-------------------|---------|---------|------|
| Maximum Junction-to-Ambient <sup>a</sup> | t ≤ 10 s     | R <sub>thJA</sub> | 32      | 40      | °C/W |
|                                          | Steady State |                   | 65      | 81      |      |
| Maximum Junction-to-Foot (Case)          | Steady State | R <sub>thJC</sub> | 5       | 6.3     |      |

Notes:

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

b. See Solder Profile (<http://www.vishay.com/ppg773257>). The PowerPAK 1212-8 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.

c. Rework Conditions: manual soldering with a soldering iron is not recommended for leadless components.

| SPECIFICATIONS T <sub>J</sub> = 25 °C, unless otherwise noted |                     |                                                                                                                                        |      |       |        |       |      |
|---------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------|------|-------|--------|-------|------|
| Parameter                                                     | Symbol              | Test Conditions                                                                                                                        |      | Min.  | Typ.   | Max.  | Unit |
| Static                                                        |                     |                                                                                                                                        |      |       |        |       |      |
| Gate Threshold Voltage                                        | V <sub>GS(th)</sub> | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = - 250 μA                                                                          | P-Ch | - 1.0 |        | - 3   | V    |
|                                                               |                     | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                                                                            | N-Ch | 1.0   |        | 3     |      |
| Gate-Body Leakage                                             | I <sub>GSS</sub>    | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 25 V                                                                                        | P-Ch |       |        | ± 200 | nA   |
|                                                               |                     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V                                                                                        | N-Ch |       |        | ± 100 |      |
| Zero Gate Voltage Drain Current                               | I <sub>DSS</sub>    | V <sub>DS</sub> = - 30 V, V <sub>GS</sub> = 0 V                                                                                        | P-Ch |       |        | - 1   | μA   |
|                                                               |                     | V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V                                                                                          | N-Ch |       |        | 1     |      |
|                                                               |                     | V <sub>DS</sub> = - 30 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C                                                                | P-Ch |       |        | - 5   |      |
|                                                               |                     | V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C                                                                  | N-Ch |       |        | 5     |      |
| On-State Drain Current <sup>a</sup>                           | I <sub>D(on)</sub>  | V <sub>DS</sub> ≥ - 5 V, V <sub>GS</sub> = - 10 V                                                                                      | P-Ch | - 25  |        |       | A    |
|                                                               |                     | V <sub>DS</sub> ≤ 5 V, V <sub>GS</sub> = 10 V                                                                                          | N-Ch | 25    |        |       |      |
| Drain-Source On-State Resistance <sup>a</sup>                 | R <sub>DS(on)</sub> | V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 6.4 A                                                                                     | P-Ch |       | 0.041  | 0.051 | Ω    |
|                                                               |                     | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 7.7 A                                                                                         | N-Ch |       | 0.028  | 0.035 |      |
|                                                               |                     | V <sub>GS</sub> = - 6 V, I <sub>D</sub> = - 5.3 A                                                                                      | P-Ch |       | 0.055  | 0.075 |      |
|                                                               |                     | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 6.5 A                                                                                        | N-Ch |       | 0.040  | 0.050 |      |
| Forward Transconductance <sup>a</sup>                         | g <sub>fs</sub>     | V <sub>DS</sub> = - 15 V, I <sub>D</sub> = - 6.4 A                                                                                     | P-Ch |       | 13     |       | S    |
|                                                               |                     | V <sub>DS</sub> = 15 V, I <sub>D</sub> = 7.7 A                                                                                         | N-Ch |       | 15     |       |      |
| Diode Forward Voltage <sup>a</sup>                            | V <sub>SD</sub>     | I <sub>S</sub> = - 1.7 A, V <sub>GS</sub> = 0 V                                                                                        | P-Ch |       | - 0.80 | - 1.2 | V    |
|                                                               |                     | I <sub>S</sub> = 1.7 A, V <sub>GS</sub> = 0 V                                                                                          | N-Ch |       | 0.80   | 1.2   |      |
| Dynamic <sup>b</sup>                                          |                     |                                                                                                                                        |      |       |        |       |      |
| Total Gate Charge                                             | Q <sub>g</sub>      | P-Channel<br>V <sub>DS</sub> = - 15 V, V <sub>GS</sub> = - 10 V, I <sub>D</sub> = - 6.4 A                                              | P-Ch |       | 12.5   | 19    | nC   |
| Gate-Source Charge                                            | Q <sub>gs</sub>     |                                                                                                                                        | N-Ch |       | 9      | 14    |      |
| Gate-Drain Charge                                             | Q <sub>gd</sub>     | N-Channel<br>V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 7.7 A                                                    | P-Ch |       | 2.5    |       |      |
|                                                               |                     |                                                                                                                                        | N-Ch |       | 2      |       |      |
| Gate Resistance                                               | R <sub>g</sub>      |                                                                                                                                        | P-Ch |       | 9      |       | Ω    |
|                                                               |                     |                                                                                                                                        | N-Ch |       | 3      |       |      |
| Turn-On Delay Time                                            | t <sub>d(on)</sub>  | P-Channel<br>V <sub>DD</sub> = - 15 V, R <sub>L</sub> = 5 Ω<br>I <sub>D</sub> ≅ - 3 A, V <sub>GEN</sub> = - 10 V, R <sub>G</sub> = 1 Ω | P-Ch |       | 10     | 15    | ns   |
| Rise Time                                                     | t <sub>r</sub>      |                                                                                                                                        | N-Ch |       | 10     | 15    |      |
|                                                               |                     | P-Ch                                                                                                                                   |      | 20    | 30     |       |      |
|                                                               |                     | N-Ch                                                                                                                                   |      | 15    | 25     |       |      |
| Turn-Off Delay Time                                           | t <sub>d(off)</sub> | N-Channel<br>V <sub>DD</sub> = 15 V, R <sub>L</sub> = 5 Ω<br>I <sub>D</sub> ≅ 3 A, V <sub>GEN</sub> = 10 V, R <sub>G</sub> = 1 Ω       | P-Ch |       | 25     | 40    |      |
|                                                               |                     |                                                                                                                                        | N-Ch |       | 20     | 30    |      |
| Fall Time                                                     | t <sub>f</sub>      |                                                                                                                                        | P-Ch |       | 30     | 45    |      |
|                                                               |                     |                                                                                                                                        | N-Ch |       | 10     | 15    |      |
| Source-Drain Reverse Recovery Time                            | t <sub>rr</sub>     | I <sub>F</sub> = - 1.7 A, dI/dt = 100 A/μs                                                                                             | P-Ch |       | 25     | 50    |      |
|                                                               |                     | I <sub>F</sub> = 1.7 A, dI/dt = 100 A/μs                                                                                               | N-Ch |       | 20     | 40    |      |

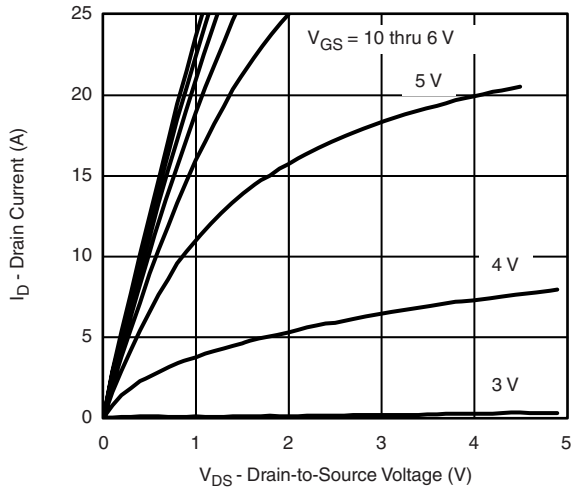
## Notes:

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

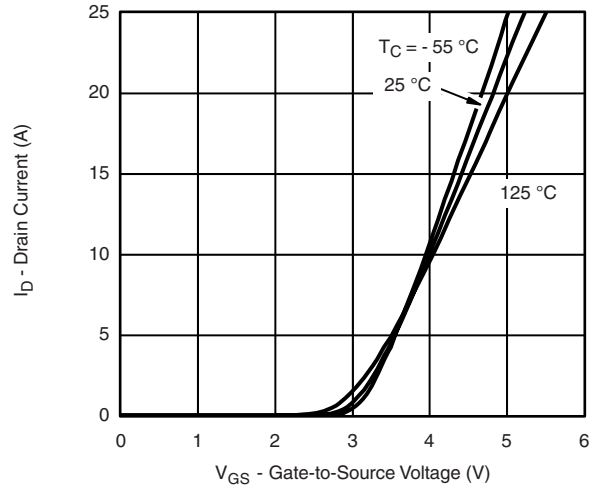
b. Guaranteed by design, not subject to production testing.

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.

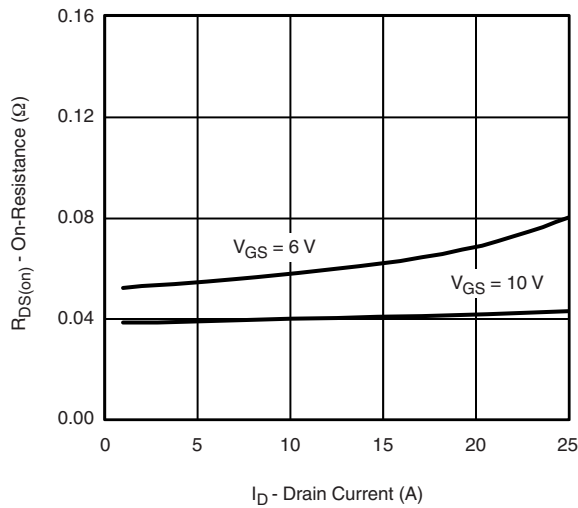
## P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



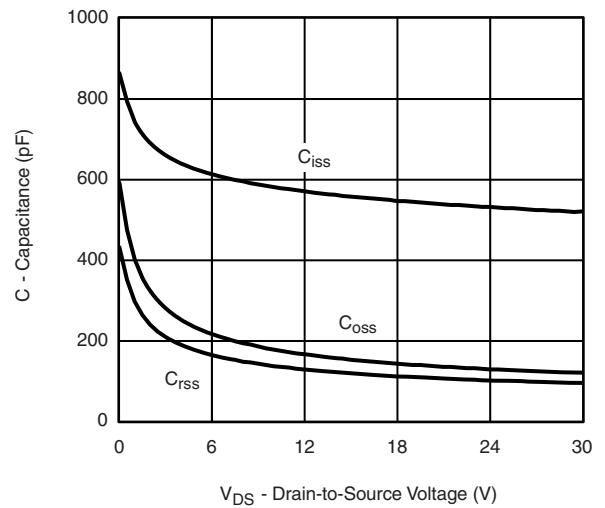
Output Characteristics



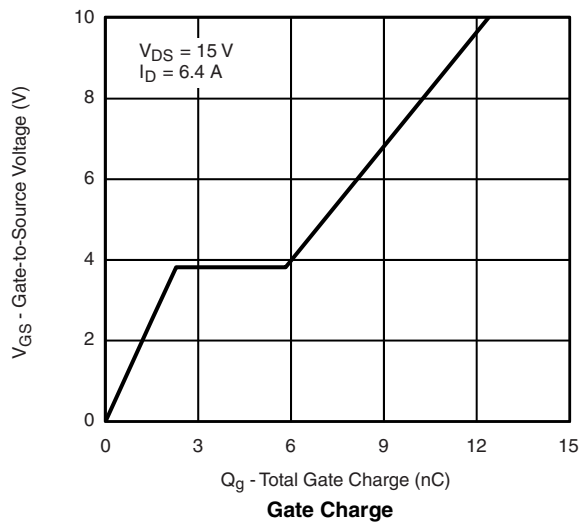
Transfer Characteristics



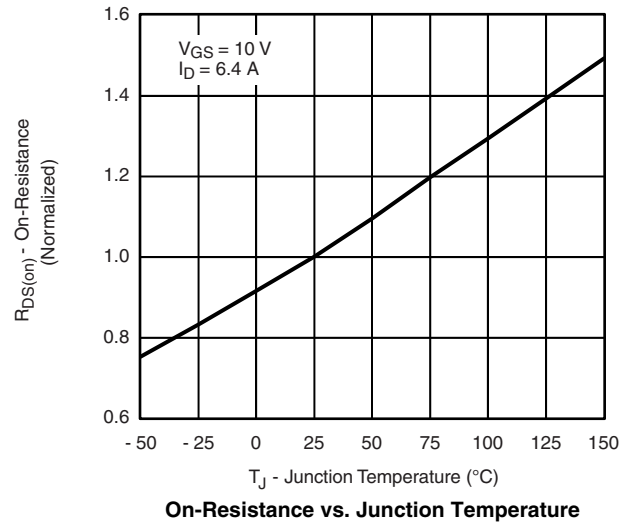
On-Resistance vs. Drain Current



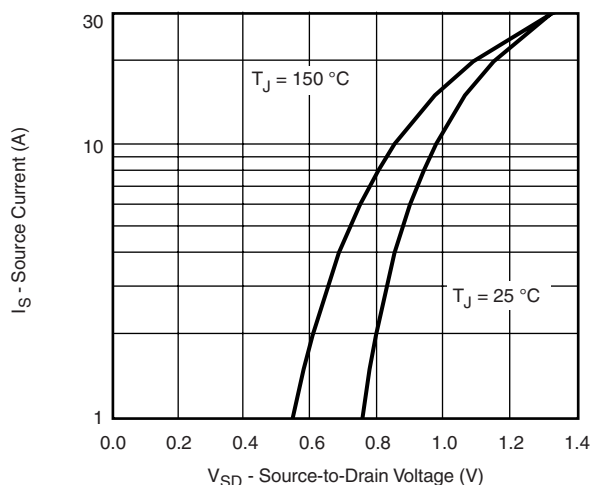
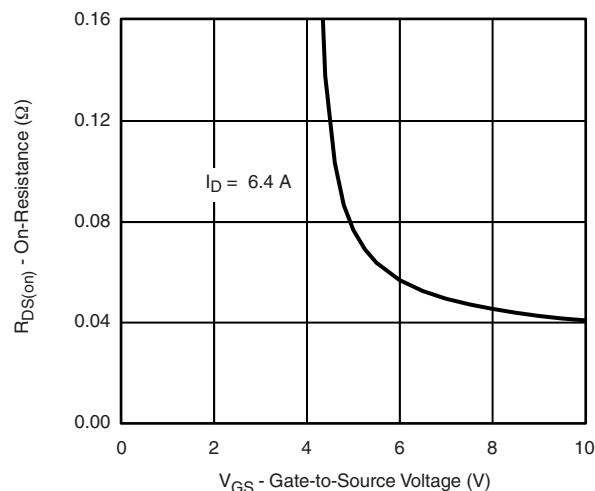
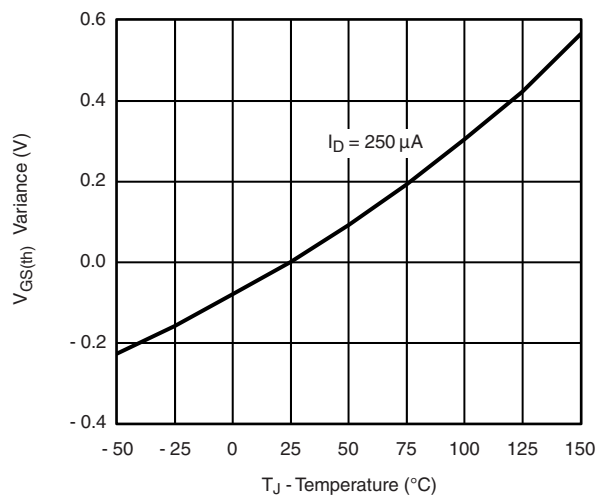
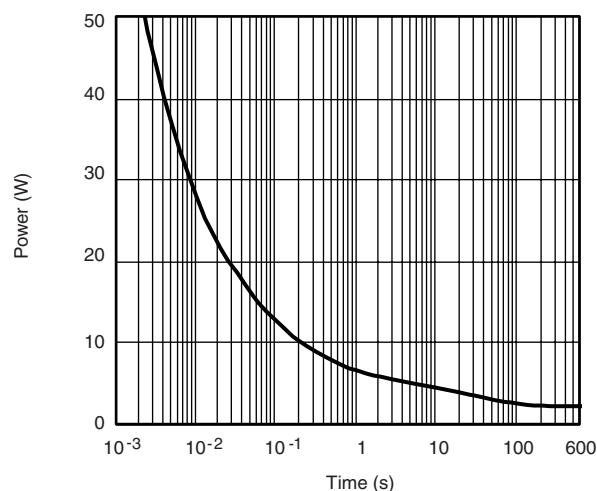
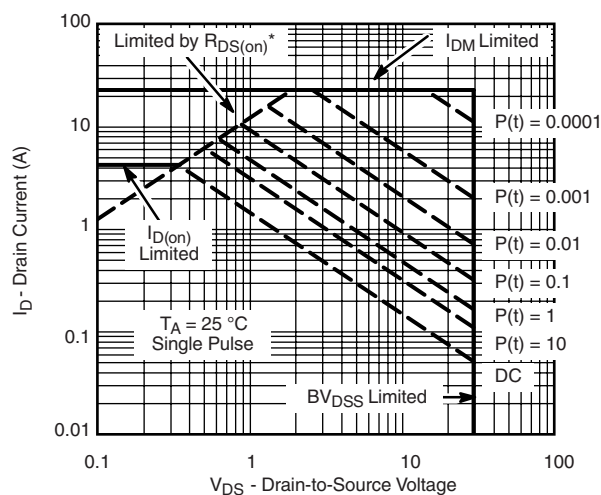
Capacitance



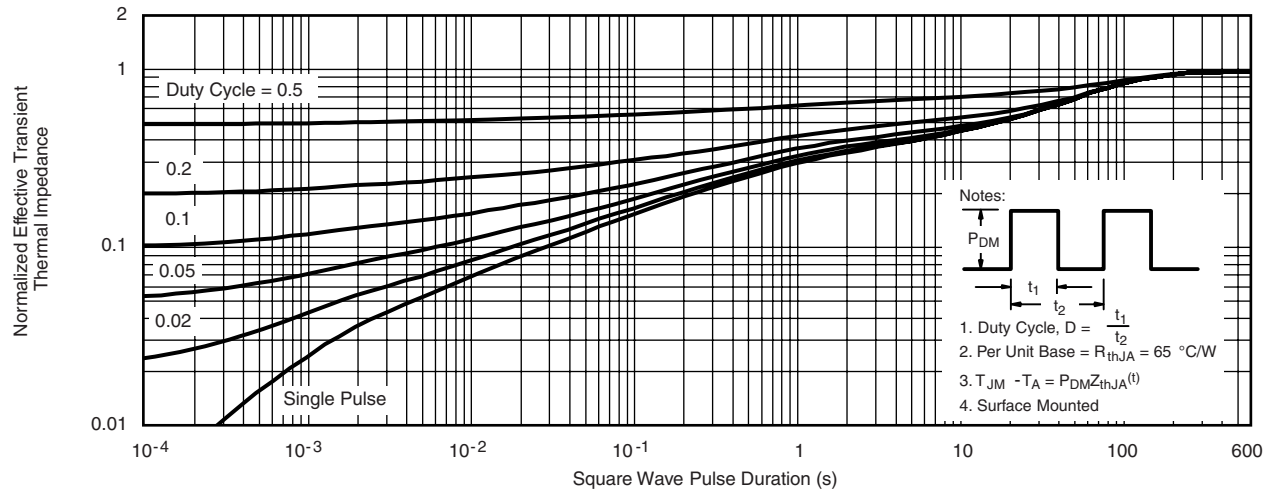
Gate Charge



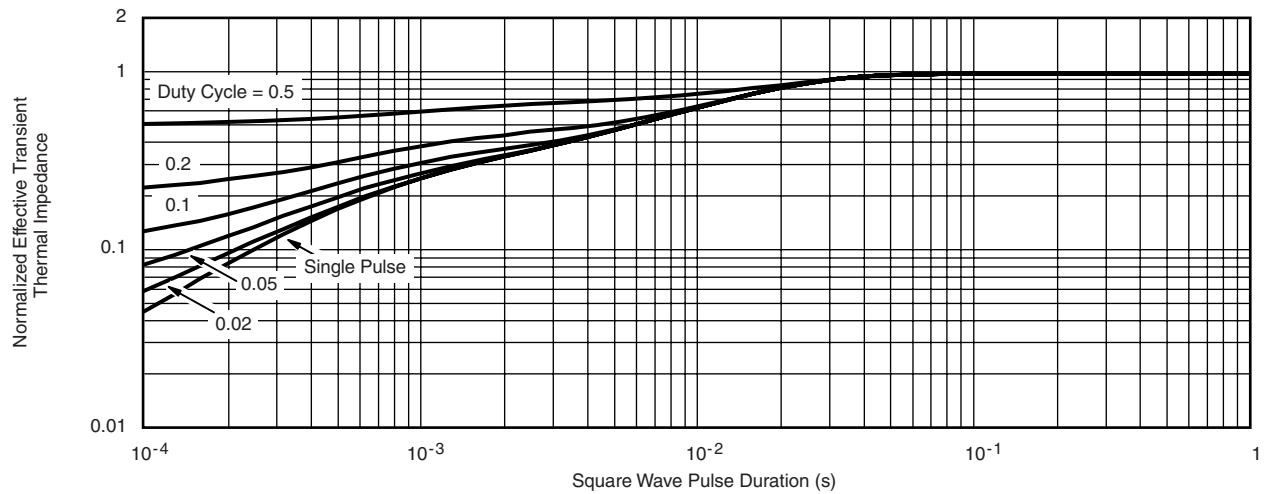
On-Resistance vs. Junction Temperature

**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**

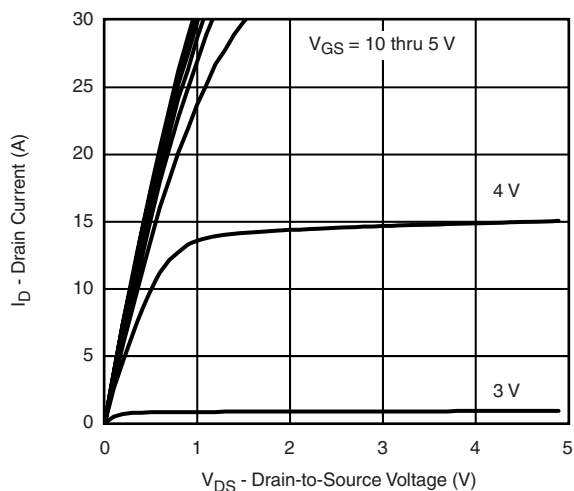
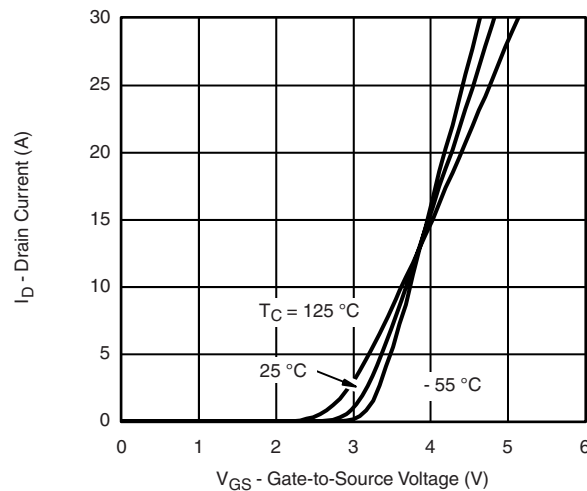
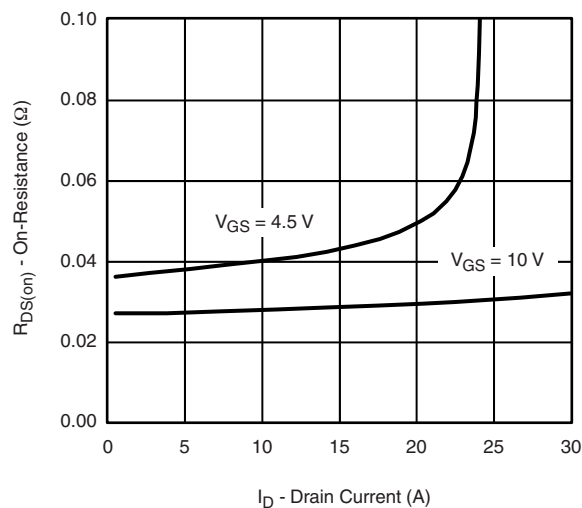
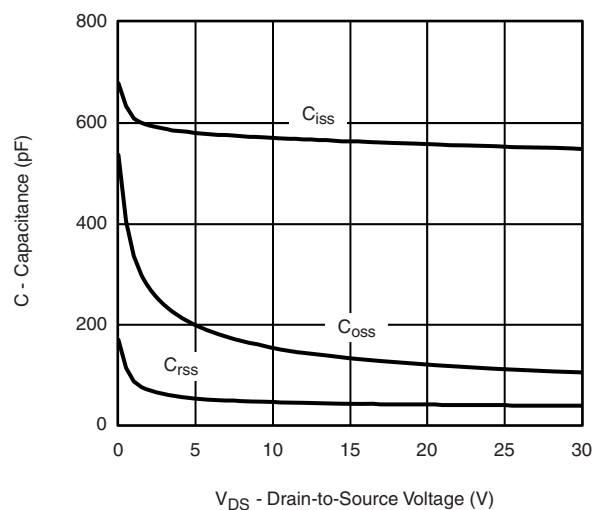
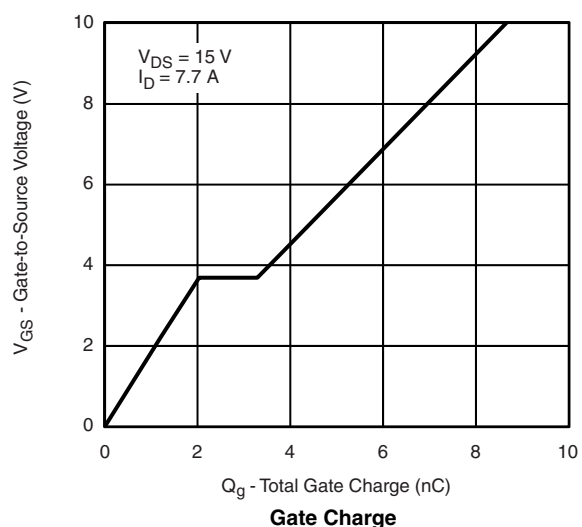
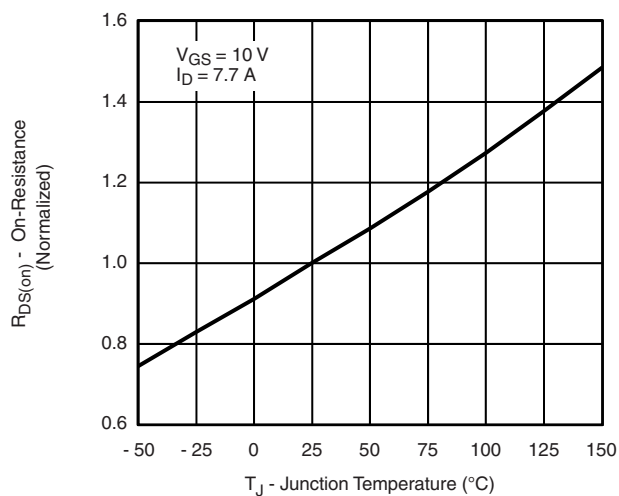
**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



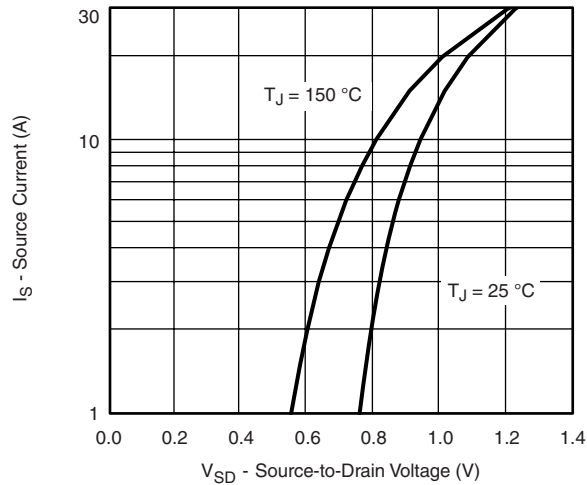
**Normalized Thermal Transient Impedance, Junction-to-Ambient**



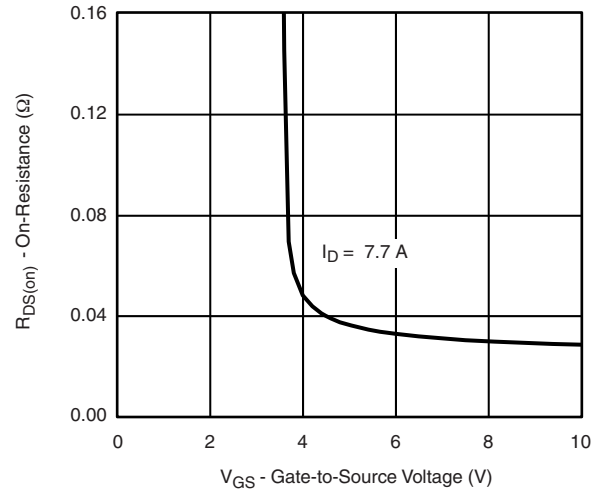
**Normalized Thermal Transient Impedance, Junction-to-Case**

**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Output Characteristics****Transfer Characteristics****On-Resistance vs. Drain Current****Capacitance****Gate Charge****On-Resistance vs. Junction Temperature**

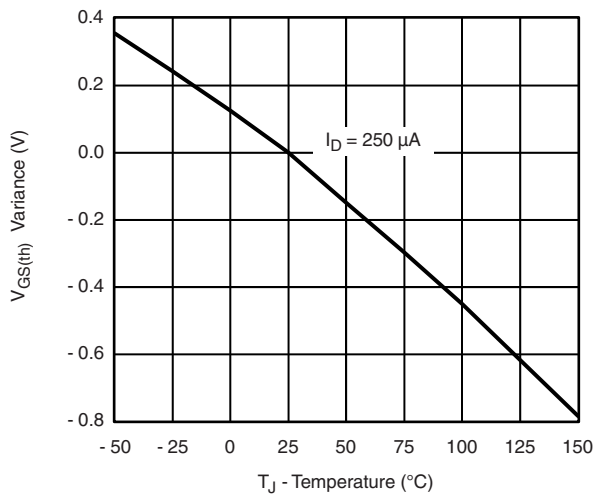
**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



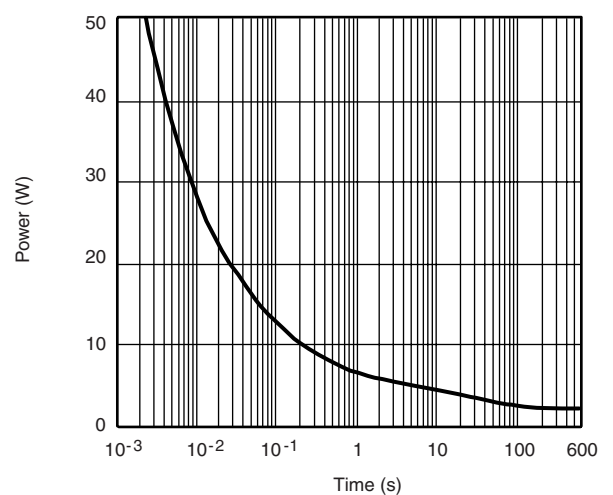
**Source-Drain Diode Forward Voltage**



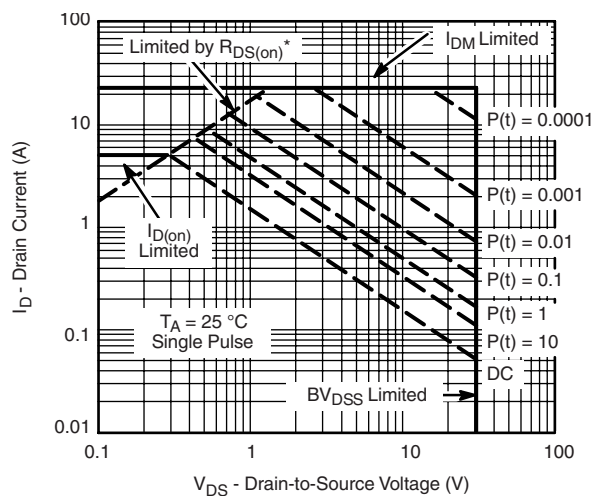
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**

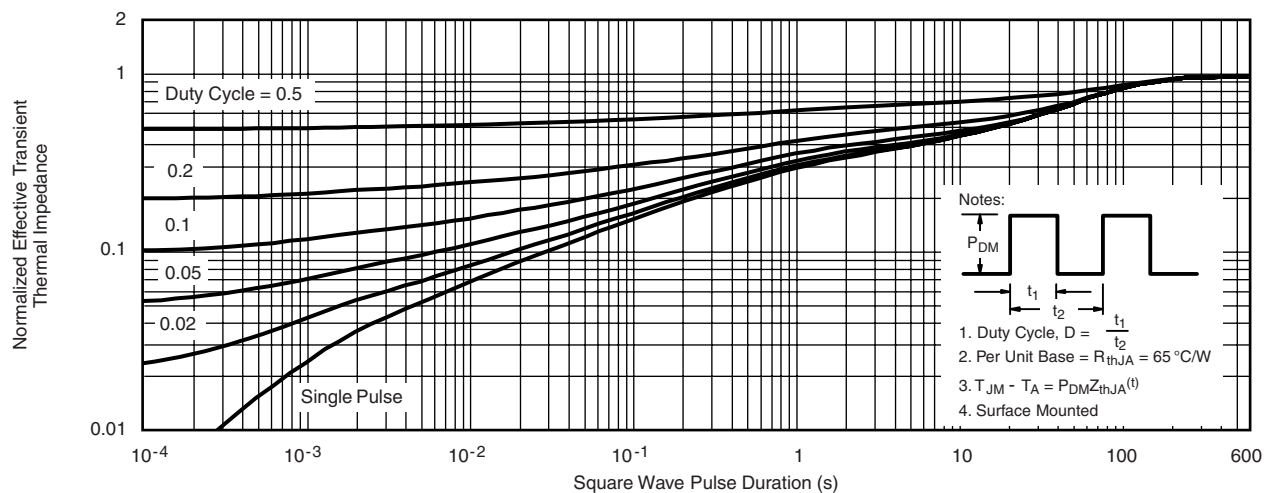
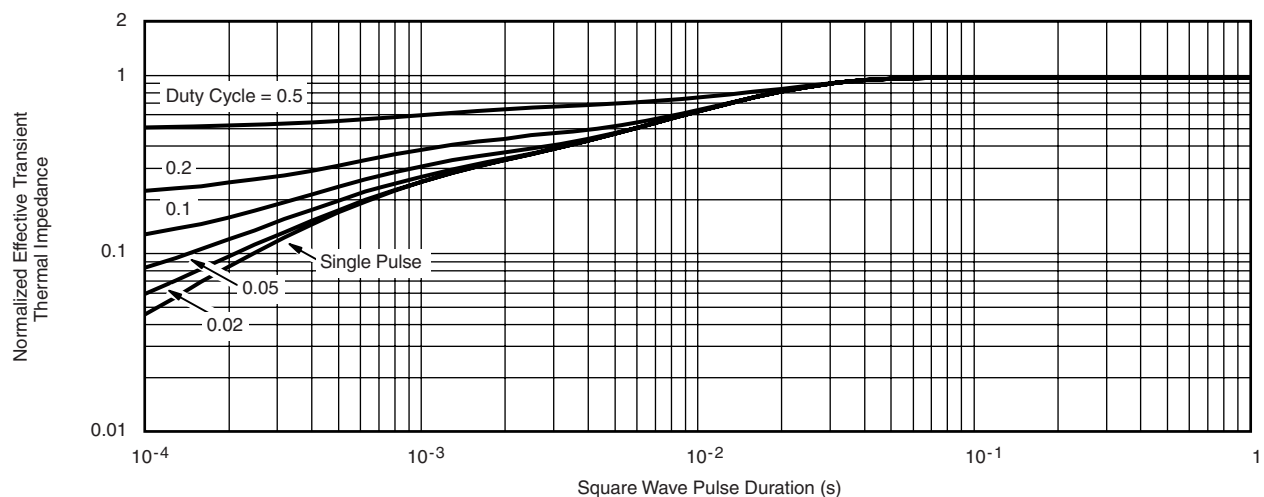


**Single Pulse Power**



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

**Safe Operating Area**

**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Normalized Thermal Transient Impedance, Junction-to-Ambient****Normalized Thermal Transient Impedance, Junction-to-Case**

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