

## SI1563EDH-T1-GE3-VB Datasheet

### N-and P- Channel 20 V (D-S) MOSFET

#### PRODUCT SUMMARY

|           | $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ )   | $I_D$ (A) |
|-----------|--------------|-----------------------------|-----------|
| N-Channel | 20           | 0.090 at $V_{GS} = 4.5$ V   | 3.28      |
|           |              | 0.110 at $V_{GS} = 2.5$ V   | 2.13      |
|           |              | 0.130 at $V_{GS} = 1.8$ V   | 1.50      |
| P-Channel | - 20         | 0.155 at $V_{GS} = - 4.5$ V | - 2.80    |
|           |              | 0.190 at $V_{GS} = - 2.5$ V | - 1.81    |
|           |              | 0.220 at $V_{GS} = - 1.8$ V | - 1.15    |

#### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Trench Power MOSFETs: 1.8 V Rated
- Thermally Enhanced SC-70 Package
- Fast Switching
- Compliant to RoHS Directive 2002/95/EC



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

#### APPLICATIONS

- Load Switch for Portable Devices



#### ABSOLUTE MAXIMUM RATINGS $T_A = 25^\circ\text{C}$ , unless otherwise noted

| Parameter                                                           | Symbol         | N-Channel   |              | P-Channel |              | Unit             |
|---------------------------------------------------------------------|----------------|-------------|--------------|-----------|--------------|------------------|
|                                                                     |                | 5 s         | Steady State | 5 s       | Steady State |                  |
| Drain-Source Voltage                                                | $V_{DS}$       | 20          |              | - 20      |              | V                |
| Gate-Source Voltage                                                 | $V_{GS}$       | $\pm 20$    |              | $\pm 20$  |              |                  |
| Continuous Drain Current ( $T_J = 150^\circ\text{C}$ ) <sup>a</sup> | $I_D$          | 3.28        | 3.03         | - 2.80    | - 2.58       | A                |
|                                                                     |                | 2.12        | 1.81         | - 1.72    | - 1.53       |                  |
| Pulsed Drain Current                                                | $I_{DM}$       | 9.5         |              | - 8.5     |              |                  |
| Continuous Source Current (Diode Conduction) <sup>a</sup>           | $I_S$          | 2.61        | 2.48         | - 1.61    | -1.48        |                  |
| Maximum Power Dissipation <sup>a</sup>                              | $P_D$          | 1.24        | 1.17         | 1.10      | 0.97         | W                |
|                                                                     |                | 0.88        | 0.75         | 0.66      | 0.5          |                  |
| Operating Junction and Storage Temperature Range                    | $T_J, T_{stg}$ | - 55 to 150 |              |           |              | $^\circ\text{C}$ |

#### THERMAL RESISTANCE RATINGS

| Parameter                                |              | Symbol     | Typical | Maximum | Unit               |
|------------------------------------------|--------------|------------|---------|---------|--------------------|
| Maximum Junction-to-Ambient <sup>a</sup> | $t \leq 5$ s | $R_{thJA}$ | 130     | 170     | $^\circ\text{C/W}$ |
|                                          | Steady State |            | 170     | 220     |                    |
| Maximum Junction-to-Foot (Drain)         | Steady State | $R_{thJF}$ | 80      | 100     |                    |

Notes:

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

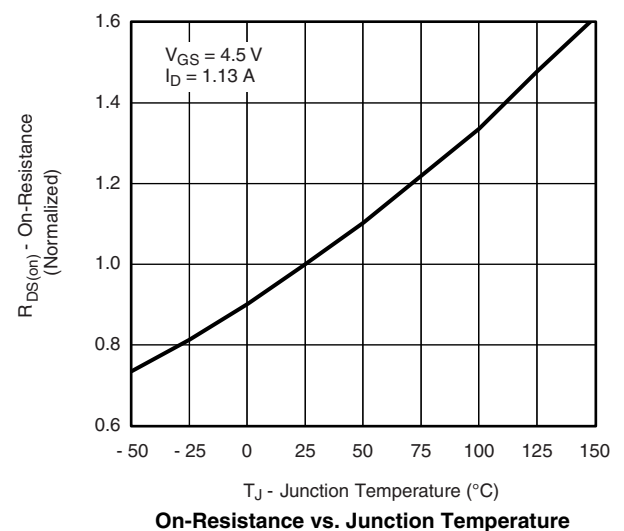
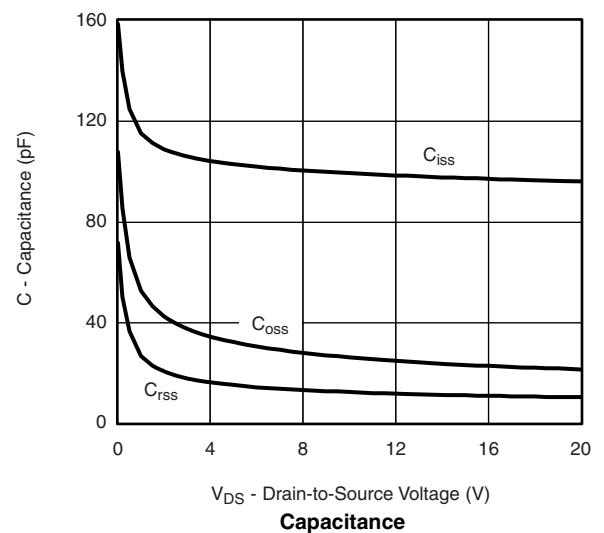
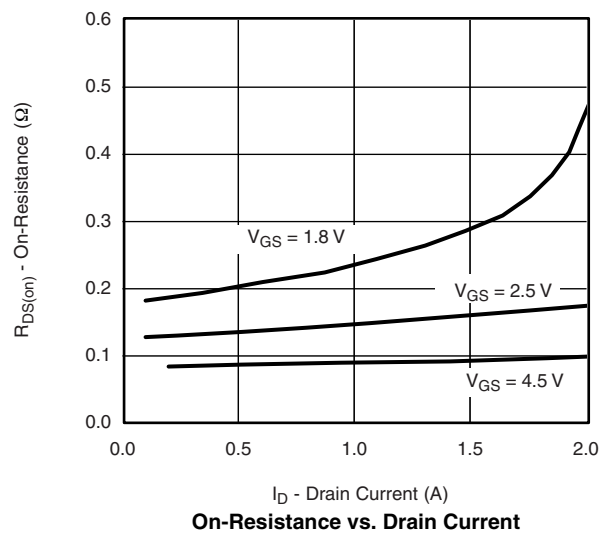
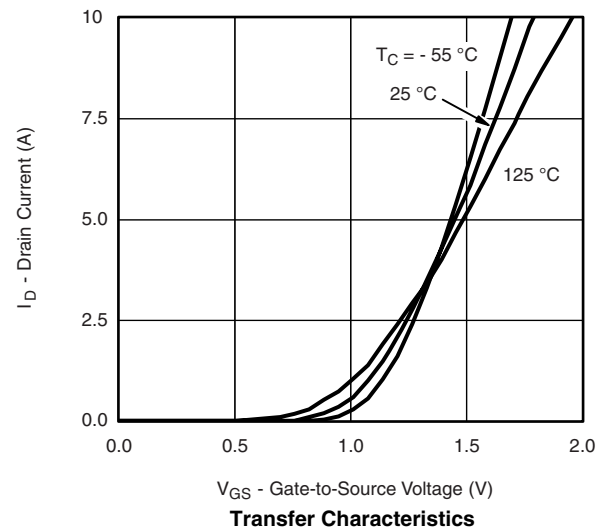
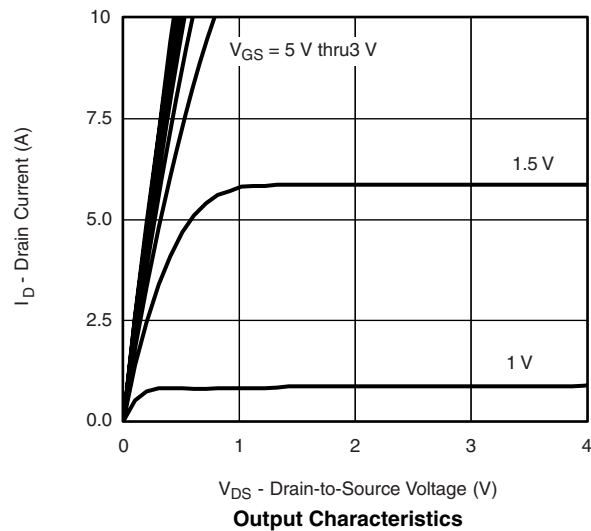
| SPECIFICATIONS T <sub>J</sub> = 25 °C, unless otherwise noted |                     |                                                                                                                                                                                                                                                                                        |                                           |        |             |                |      |    |
|---------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|--------|-------------|----------------|------|----|
| 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> = 100 μA                                                                                                                                                                                                                            | N-Ch                                      | 0.45   |             | 1              | V    |    |
|                                                               |                     | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = - 100 μA                                                                                                                                                                                                                          | P-Ch                                      | - 0.45 |             | 1              |      |    |
| Gate-Body Leakage                                             | I <sub>GSS</sub>    | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 8 V                                                                                                                                                                                                                                         | N-Ch<br>P-Ch                              |        |             | ± 100<br>± 100 | nA   |    |
| Zero Gate Voltage Drain Current                               | I <sub>DSS</sub>    | V <sub>DS</sub> = 16 V, V <sub>GS</sub> = 0 V                                                                                                                                                                                                                                          | N-Ch                                      |        |             | 1              | μA   |    |
|                                                               |                     | V <sub>DS</sub> = - 16 V, V <sub>GS</sub> = 0 V                                                                                                                                                                                                                                        | P-Ch                                      |        |             | - 1            |      |    |
|                                                               |                     | V <sub>DS</sub> = 16 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 85 °C                                                                                                                                                                                                                  | N-Ch                                      |        |             | 5              |      |    |
|                                                               |                     | V <sub>DS</sub> = - 16 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 85 °C                                                                                                                                                                                                                | P-Ch                                      |        |             | - 5            |      |    |
| On-State Drain Current <sup>a</sup>                           | I <sub>D(on)</sub>  | V <sub>DS</sub> ≥ 5 V, V <sub>GS</sub> = 4.5 V                                                                                                                                                                                                                                         | N-Ch                                      | 2      |             |                | A    |    |
|                                                               |                     | V <sub>DS</sub> ≤ - 5 V, V <sub>GS</sub> = - 4.5 V                                                                                                                                                                                                                                     | P-Ch                                      | - 2    |             |                |      |    |
| Drain-Source On-State Resistance <sup>a</sup>                 | R <sub>DS(on)</sub> | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 2.55 A                                                                                                                                                                                                                                       | N-Ch                                      |        | 0.090       |                | Ω    |    |
|                                                               |                     | V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 1.85 A                                                                                                                                                                                                                                   | P-Ch                                      |        | 0.155       |                |      |    |
|                                                               |                     | V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 1.55 A                                                                                                                                                                                                                                       | N-Ch                                      |        | 0.110       |                |      |    |
|                                                               |                     | V <sub>GS</sub> = - 2.5 V, I <sub>D</sub> = - 1.35 A                                                                                                                                                                                                                                   | P-Ch                                      |        | 0.190       |                |      |    |
|                                                               |                     | V <sub>GS</sub> = 1.8 V, I <sub>D</sub> = 0.50 A                                                                                                                                                                                                                                       | N-Ch                                      |        | 0.130       |                |      |    |
|                                                               |                     | V <sub>GS</sub> = - 1.8 V, I <sub>D</sub> = - 0.50 A                                                                                                                                                                                                                                   | P-Ch                                      |        | 0.220       |                |      |    |
| Forward Transconductance <sup>a</sup>                         | g <sub>fs</sub>     | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1.13 A                                                                                                                                                                                                                                        | N-Ch                                      |        | 2.6         |                | S    |    |
|                                                               |                     | V <sub>DS</sub> = - 10 V, I <sub>D</sub> = - 0.88 A                                                                                                                                                                                                                                    | P-Ch                                      |        | 1.5         |                |      |    |
| Diode Forward Voltage <sup>a</sup>                            | V <sub>SD</sub>     | I <sub>S</sub> = 0.48 A, V <sub>GS</sub> = 0 V                                                                                                                                                                                                                                         | N-Ch                                      |        | 0.8         | 1.2            | V    |    |
|                                                               |                     | I <sub>S</sub> = - 0.48 A, V <sub>GS</sub> = 0 V                                                                                                                                                                                                                                       | P-Ch                                      |        | - 0.8       | - 1.2          |      |    |
| Dynamic <sup>b</sup>                                          |                     |                                                                                                                                                                                                                                                                                        |                                           |        |             |                |      |    |
| Total Gate Charge                                             | Q <sub>g</sub>      | N-Channel<br>V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 2.55 A<br><br>P-Channel<br>V <sub>DS</sub> = - 10 V, V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 0.88 A                                                                                               | N-Ch<br>P-Ch                              |        | 1.25<br>1.2 | 2<br>1.8       | nC   |    |
| Gate-Source Charge                                            | Q <sub>gs</sub>     |                                                                                                                                                                                                                                                                                        | N-Ch<br>P-Ch                              |        | 0.21<br>0.3 |                |      |    |
| Gate-Drain Charge                                             | Q <sub>gd</sub>     |                                                                                                                                                                                                                                                                                        | N-Ch<br>P-Ch                              |        | 0.3<br>0.21 |                |      |    |
| Turn-On Delay Time                                            | t <sub>d(on)</sub>  | N-Channel<br>V <sub>DD</sub> = 10 V, R <sub>L</sub> = 20 Ω<br>I <sub>D</sub> ≅ 0.5 A, V <sub>GEN</sub> = 4.5 V, R <sub>g</sub> = 6 Ω<br><br>P-Channel<br>V <sub>DD</sub> = - 10 V, R <sub>L</sub> = 20 Ω<br>I <sub>D</sub> ≅ - 0.5 A, V <sub>GEN</sub> = - 4.5 V, R <sub>g</sub> = 6 Ω | N-Ch<br>P-Ch                              |        | 15<br>18    | 25<br>30       | ns   |    |
| Rise Time                                                     | t <sub>r</sub>      |                                                                                                                                                                                                                                                                                        | N-Ch<br>P-Ch                              |        | 22<br>25    | 35<br>40       |      |    |
| Turn-Off Delay Time                                           | t <sub>d(off)</sub> |                                                                                                                                                                                                                                                                                        | N-Ch<br>P-Ch                              |        | 25<br>15    | 40<br>25       |      |    |
| Fall Time                                                     | t <sub>f</sub>      |                                                                                                                                                                                                                                                                                        | N-Ch<br>P-Ch                              |        | 12<br>12    | 20<br>20       |      |    |
| Reverse Recovery Time                                         | t <sub>rr</sub>     |                                                                                                                                                                                                                                                                                        | I <sub>F</sub> = 0.48 A, dI/dt = 100 A/μs | N-Ch   |             | 30             |      | 60 |
|                                                               |                     |                                                                                                                                                                                                                                                                                        |                                           | P-Ch   |             | 30             |      | 60 |

Notes:

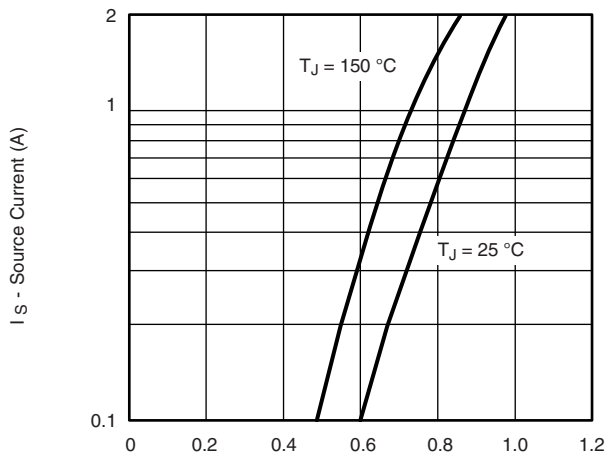
a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

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

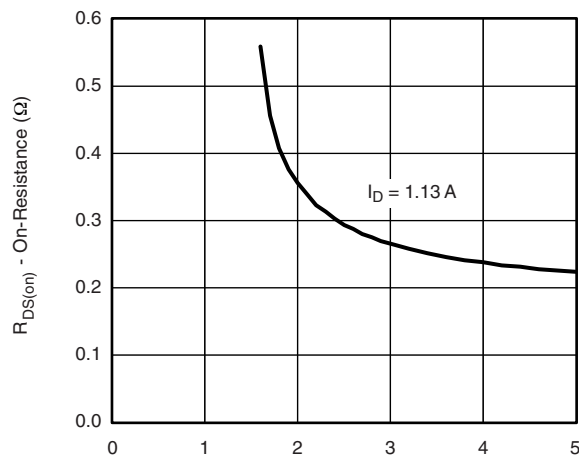
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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


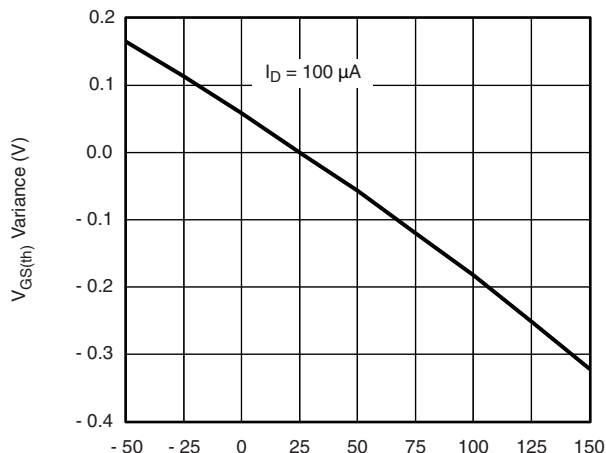
**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



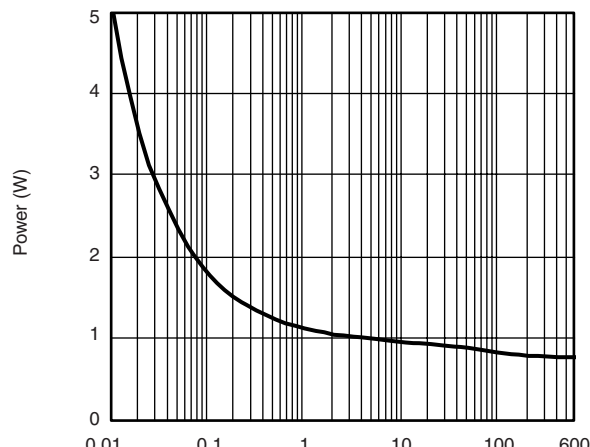
Source-Drain Diode Forward Voltage



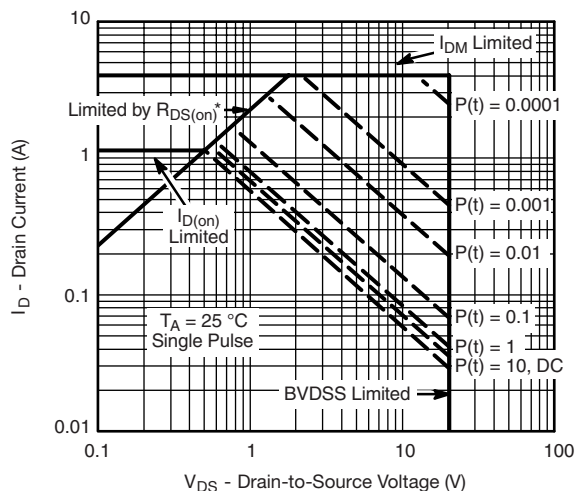
On-Resistance vs. Gate-to-Source Voltage



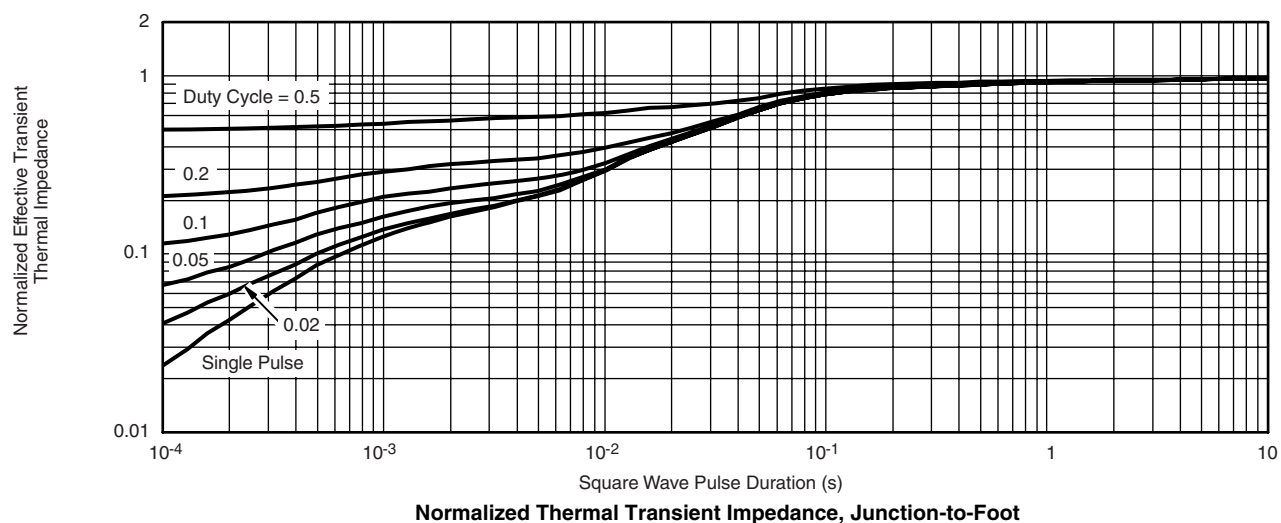
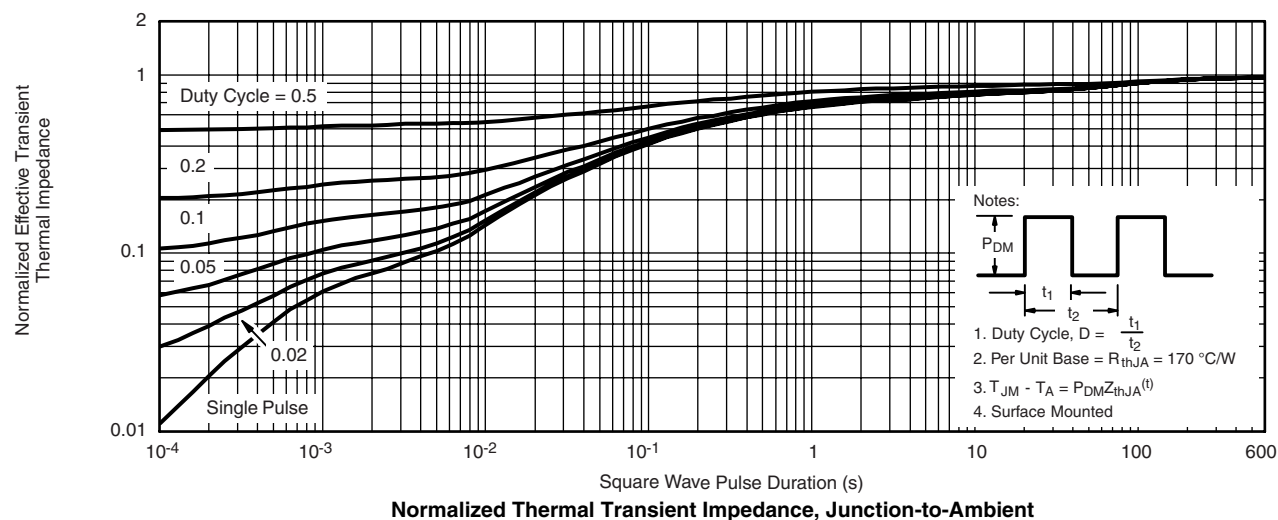
Threshold Voltage

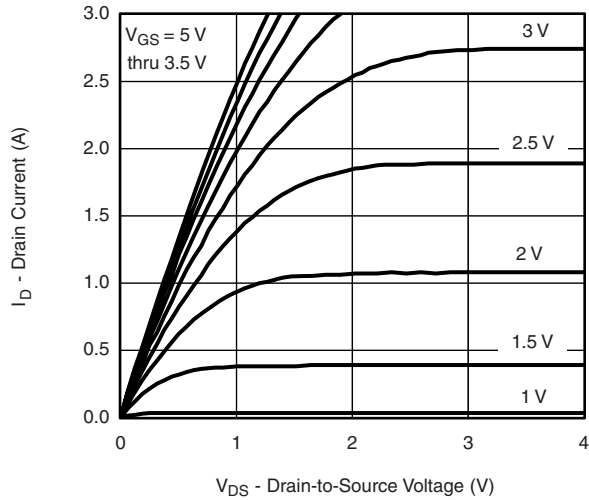
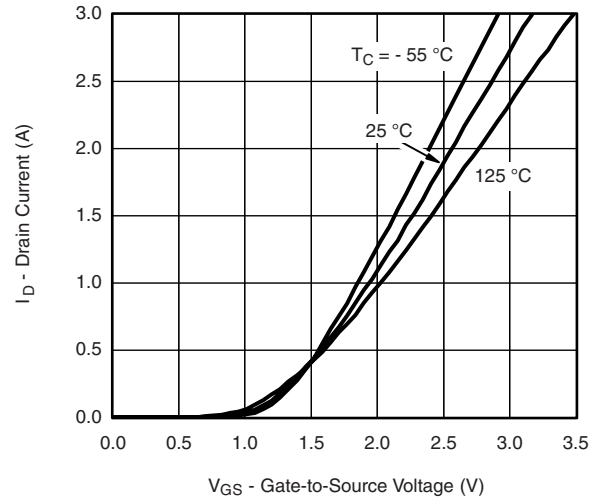


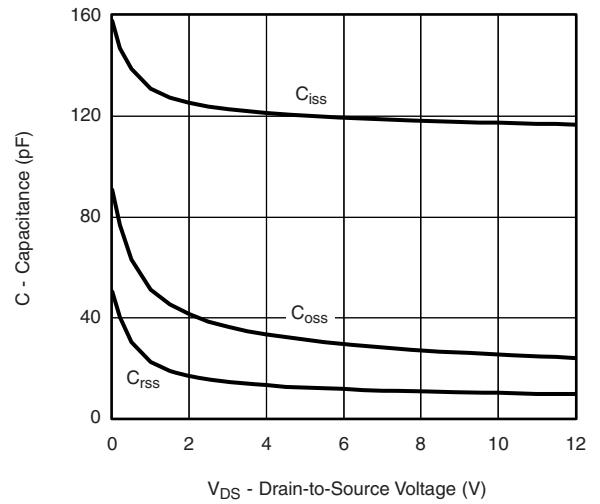
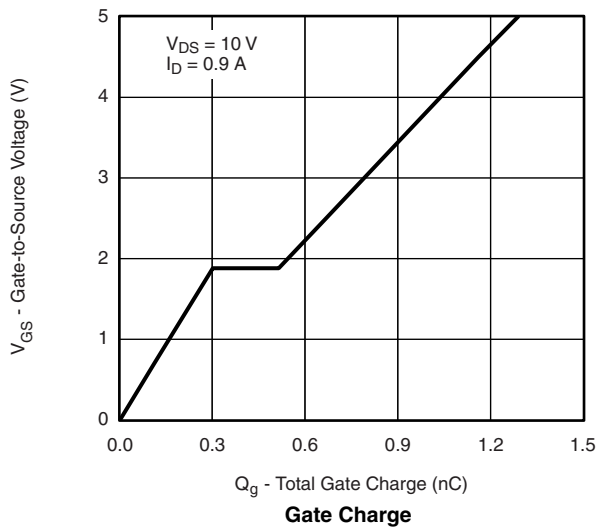
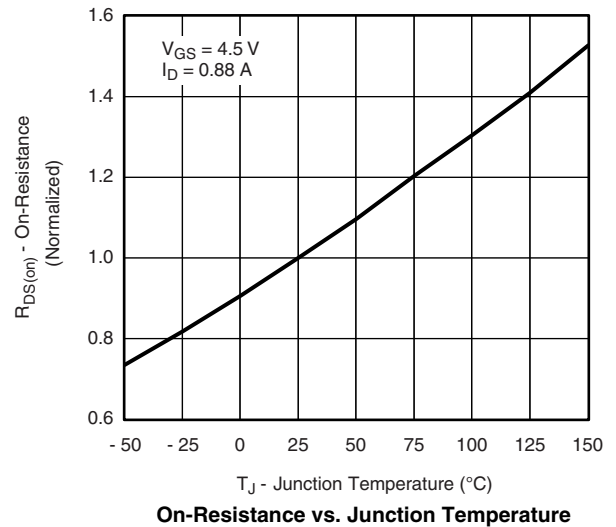
Single Pulse Power, Junction-to-Ambient



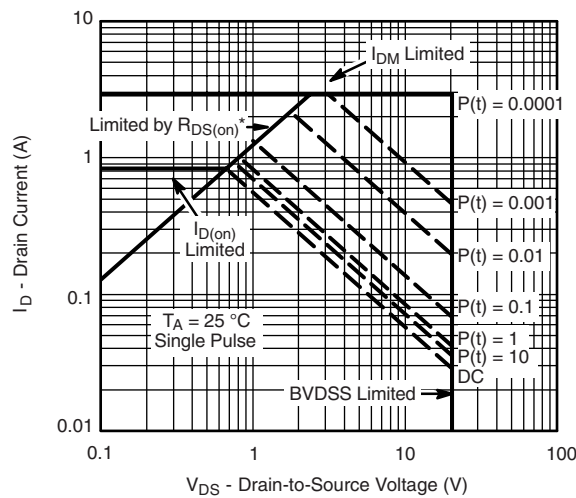
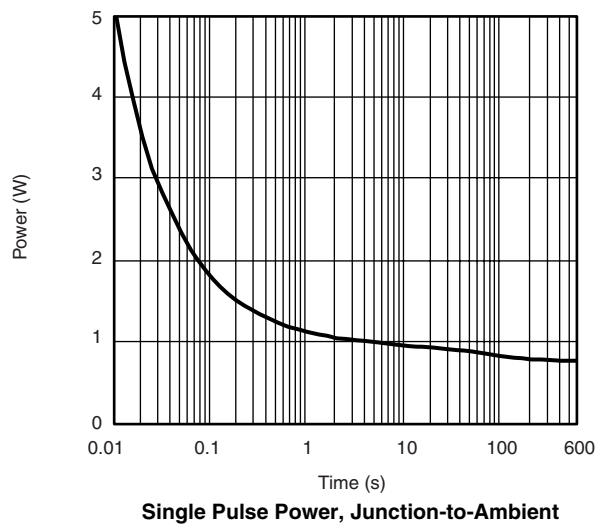
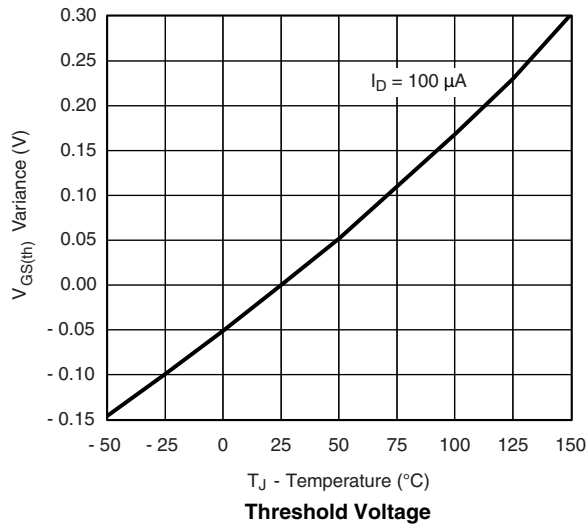
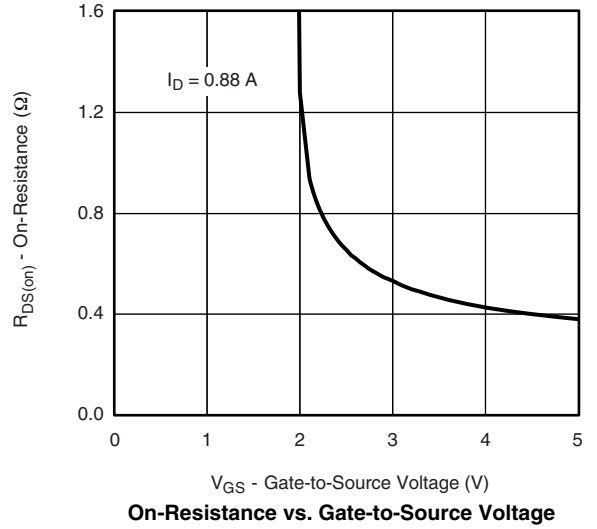
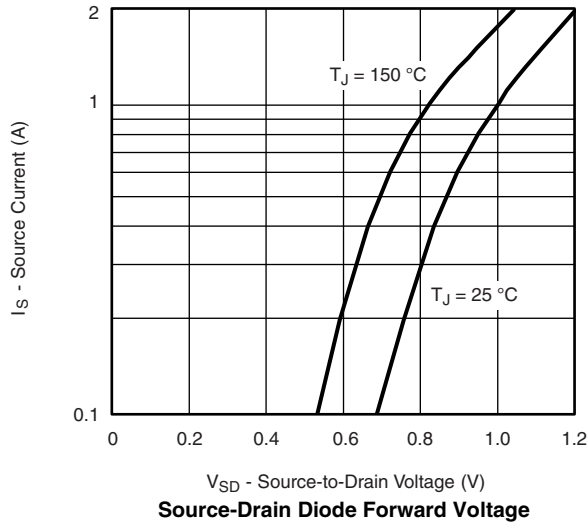
\*  $V_{GS}$  > minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified  
**Safe Operating Area, Junction-to-Ambient**

**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**

**Gate Charge**

**On-Resistance vs. Junction Temperature**

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



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

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



SC-70: 6-LEADS



| Dim            | MILLIMETERS |      |      | INCHES   |       |       |
|----------------|-------------|------|------|----------|-------|-------|
|                | Min         | Nom  | Max  | Min      | Nom   | Max   |
| A              | 0.90        | —    | 1.10 | 0.035    | —     | 0.043 |
| A <sub>1</sub> | —           | —    | 0.10 | —        | —     | 0.004 |
| A <sub>2</sub> | 0.80        | —    | 1.00 | 0.031    | —     | 0.039 |
| b              | 0.15        | —    | 0.30 | 0.006    | —     | 0.012 |
| c              | 0.10        | —    | 0.25 | 0.004    | —     | 0.010 |
| D              | 1.80        | 2.00 | 2.20 | 0.071    | 0.079 | 0.087 |
| E              | 1.80        | 2.10 | 2.40 | 0.071    | 0.083 | 0.094 |
| E <sub>1</sub> | 1.15        | 1.25 | 1.35 | 0.045    | 0.049 | 0.053 |
| e              | 0.65BSC     |      |      | 0.026BSC |       |       |
| e <sub>1</sub> | 1.20        | 1.30 | 1.40 | 0.047    | 0.051 | 0.055 |
| L              | 0.10        | 0.20 | 0.30 | 0.004    | 0.008 | 0.012 |
| α              | 7°Nom       |      |      | 7°Nom    |       |       |

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