

# Complementary MOSFET Half-Bridge (N- and P-Channel)

## PRODUCT SUMMARY

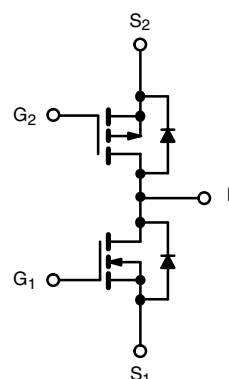
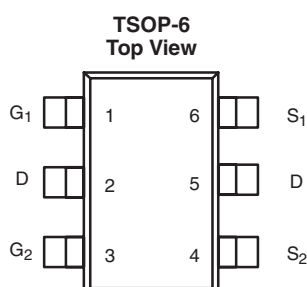
|           | $V_{DS}$ (V) | $R_{DS(on)}$ ( $\Omega$ )   | $I_D$ (A) |
|-----------|--------------|-----------------------------|-----------|
| N-Channel | 20           | 0.300 at $V_{GS} = 4.5$ V   | 1.4       |
|           |              | 0.410 at $V_{GS} = 3.0$ V   | 1.2       |
| P-Channel | - 20         | 0.640 at $V_{GS} = - 4.5$ V | - 0.96    |
|           |              | 0.980 at $V_{GS} = - 3.0$ V | - 0.78    |

## FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- 100 %  $R_g$  Tested
- Compliant to RoHS Directive 2002/95/EC



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



Ordering Information: Si3850ADV-T1-E3 (Lead (Pb)-free)  
Si3850ADV-T1-GE3 (Lead (Pb)-free and Halogen-free)

## ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted

| Parameter                                                   |                        | Symbol                            | N-Channel   | P-Channel | Unit |
|-------------------------------------------------------------|------------------------|-----------------------------------|-------------|-----------|------|
| Drain-Source Voltage                                        |                        | V <sub>DS</sub>                   | 20          | - 20      | V    |
| Gate-Source Voltage                                         |                        | V <sub>GS</sub>                   | ± 12        |           |      |
| Continuous Drain Current (T <sub>J</sub> = 150 °C)          | T <sub>A</sub> = 25 °C | I <sub>D</sub>                    | 1.4         | - 0.96    | A    |
|                                                             | T <sub>A</sub> = 70 °C |                                   | 1.1         | - 0.77    |      |
| Pulsed Drain Current                                        |                        | I <sub>DM</sub>                   | 3.5         | - 2.0     |      |
| Continuous Source Current (Diode Conduction) <sup>a</sup>   |                        | I <sub>S</sub>                    | 0.9         | - 0.9     |      |
| Maximum Power Dissipation<br>(Surface Mounted on FR4 Board) | T <sub>A</sub> = 25 °C | P <sub>D</sub>                    | 1.08        |           | W    |
|                                                             | T <sub>A</sub> = 70 °C |                                   | 0.70        |           |      |
| Operating Junction and Storage Temperature Range            |                        | T <sub>J</sub> , T <sub>stg</sub> | - 55 to 150 |           | °C   |

## THERMAL RESISTANCE RATINGS

| Parameter                                                                   | Symbol     | N- or P-Channel | Unit |
|-----------------------------------------------------------------------------|------------|-----------------|------|
| Maximum Junction-to-Ambient (Surface Mounted on FR4 Board, $\pm \leq 10$ s) | $R_{thJA}$ | 115             | °C/W |

Note:

Maximum under Steady State condition is 150 °C/W.

| 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                                                                          | N-Ch                | 0.6                                                                                                                                        |       | 1.5   | V    |      |
|                                                               |                     | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = - 250 μA                                                                        | P-Ch                | - 0.6                                                                                                                                      |       | - 1.5 |      |      |
| Gate-Body Leakage                                             | I <sub>GSS</sub>    | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 12 V                                                                                      |                     |                                                                                                                                            |       | ± 100 | nA   |      |
| Zero Gate Voltage Drain Current                               | I <sub>DSS</sub>    | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V                                                                                        | N-Ch                |                                                                                                                                            |       | 1     | μA   |      |
|                                                               |                     | V <sub>DS</sub> = - 20 V, V <sub>GS</sub> = 0 V                                                                                      | P-Ch                |                                                                                                                                            |       | - 1   |      |      |
|                                                               |                     | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 70 °C                                                                | N-Ch                |                                                                                                                                            |       | 10    |      |      |
|                                                               |                     | V <sub>DS</sub> = - 20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 70 °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> = 4.5 V                                                                                       | N-Ch                | 3.0                                                                                                                                        |       |       | A    |      |
|                                                               |                     | V <sub>DS</sub> = - 5 V, V <sub>GS</sub> = - 4.5 V                                                                                   | P-Ch                | - 1.5                                                                                                                                      |       |       |      |      |
| Drain-Source On-State Resistance <sup>b</sup>                 | R <sub>DS(on)</sub> | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 0.5 A                                                                                      | N-Ch                |                                                                                                                                            | 0.240 | 0.300 | Ω    |      |
|                                                               |                     | V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 0.5 A                                                                                  | P-Ch                |                                                                                                                                            | 0.510 | 0.640 |      |      |
|                                                               |                     | V <sub>GS</sub> = 3.0 V, I <sub>D</sub> = 0.5 A                                                                                      | N-Ch                |                                                                                                                                            | 0.325 | 0.410 |      |      |
|                                                               |                     | V <sub>GS</sub> = - 3.0 V, I <sub>D</sub> = - 0.5 A                                                                                  | P-Ch                |                                                                                                                                            | 0.780 | 0.980 |      |      |
| Forward Transconductance <sup>b</sup>                         | g <sub>fs</sub>     | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 A                                                                                         | N-Ch                |                                                                                                                                            | 1.8   |       | S    |      |
|                                                               |                     | V <sub>DS</sub> = - 10 V, I <sub>D</sub> = - 1 A                                                                                     | P-Ch                |                                                                                                                                            | 1.1   |       |      |      |
| Diode Forward Voltage <sup>b</sup>                            | V <sub>SD</sub>     | I <sub>S</sub> = 0.9 A, V <sub>GS</sub> = 0 V                                                                                        | N-Ch                |                                                                                                                                            | 0.87  | 1.2   | V    |      |
|                                                               |                     | I <sub>S</sub> = - 0.8 A, V <sub>GS</sub> = 0 V                                                                                      | P-Ch                |                                                                                                                                            | - 1.0 | - 1.3 |      |      |
| 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> = 1 A                                                   | N-Ch                |                                                                                                                                            | 0.95  | 1.4   | nC   |      |
| Gate-Source Charge                                            | Q <sub>gs</sub>     |                                                                                                                                      | P-Ch                |                                                                                                                                            | 1.10  | 1.7   |      |      |
|                                                               |                     | Gate-Drain Charge                                                                                                                    | Q <sub>gd</sub>     | P-Channel<br>V <sub>DS</sub> = - 10 V, V <sub>GS</sub> = - 4.5 V, I <sub>D</sub> = - 1 A                                                   | N-Ch  |       |      | 0.22 |
| P-Ch                                                          |                     |                                                                                                                                      |                     |                                                                                                                                            | 0.28  |       |      |      |
| Gate Resistance                                               | R <sub>g</sub>      |                                                                                                                                      | N-Ch                |                                                                                                                                            | 3.5   | 5.3   | Ω    |      |
|                                                               |                     |                                                                                                                                      | P-Ch                |                                                                                                                                            | 10.5  | 16    |      |      |
| Turn-On Delay Time                                            | t <sub>d(on)</sub>  | N-Channel<br>V <sub>DD</sub> = 10 V, R <sub>L</sub> = 10 Ω<br>I <sub>D</sub> ≅ 0.9 A, V <sub>GEN</sub> = 4.5 V, R <sub>g</sub> = 1 Ω | N-Ch                |                                                                                                                                            | 8     | 14    | ns   |      |
| Rise Time                                                     | t <sub>r</sub>      |                                                                                                                                      | P-Ch                |                                                                                                                                            | 13    | 20    |      |      |
|                                                               |                     | Turn-Off Delay Time                                                                                                                  | t <sub>d(off)</sub> | P-Channel<br>V <sub>DD</sub> = - 10 V, R <sub>L</sub> = 10 Ω<br>I <sub>D</sub> ≅ - 0.9 A, V <sub>GEN</sub> = - 4.5 V, R <sub>g</sub> = 1 Ω | N-Ch  |       |      | 16   |
| P-Ch                                                          |                     |                                                                                                                                      |                     |                                                                                                                                            | 34    | 50    |      |      |
| Fall Time                                                     | t <sub>f</sub>      |                                                                                                                                      | N-Ch                |                                                                                                                                            | 20    | 30    |      |      |
|                                                               |                     |                                                                                                                                      | P-Ch                |                                                                                                                                            | 18    | 30    |      |      |
| Body Diode Reverse Recovery Tme                               | t <sub>rr</sub>     | I <sub>F</sub> = 0.9 A, dI/dt = 100 A/μs                                                                                             | N-Ch                |                                                                                                                                            | 9     | 15    |      | nC   |
|                                                               |                     | I <sub>F</sub> = - 0.9 A, dI/dt = 100 A/μs                                                                                           | P-Ch                |                                                                                                                                            | 18    | 30    |      |      |
| Body Diode Reverse Recovery Charge                            | Q <sub>rr</sub>     | I <sub>F</sub> = 0.9 A, dI/dt = 100 A/μs                                                                                             | N-Ch                |                                                                                                                                            | 20    | 30    |      |      |
|                                                               |                     | I <sub>F</sub> = - 0.9 A, dI/dt = 100 A/μs                                                                                           | P-Ch                |                                                                                                                                            | 25    | 40    |      |      |

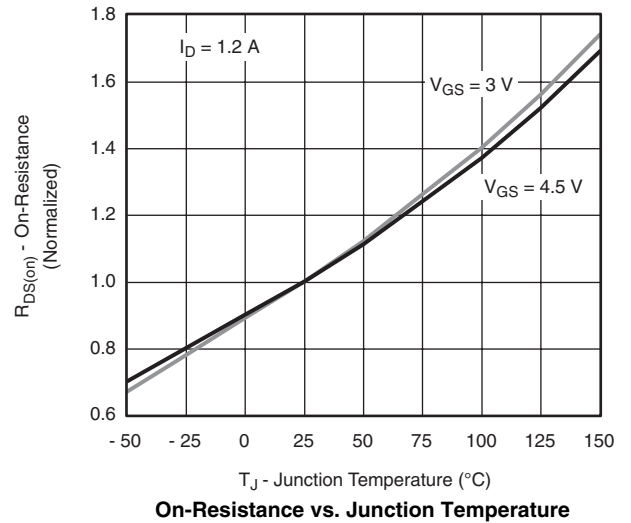
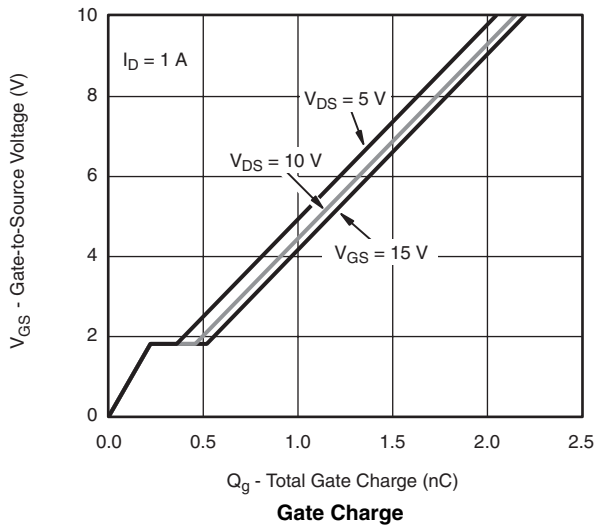
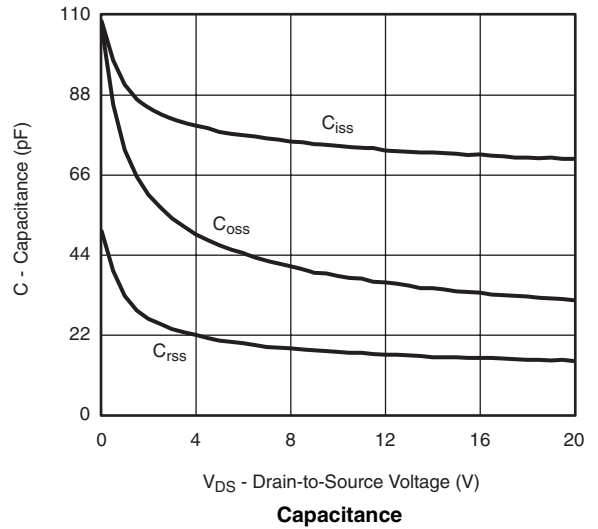
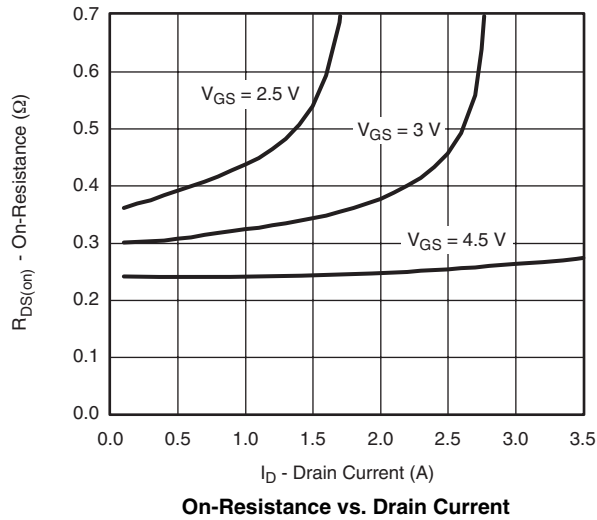
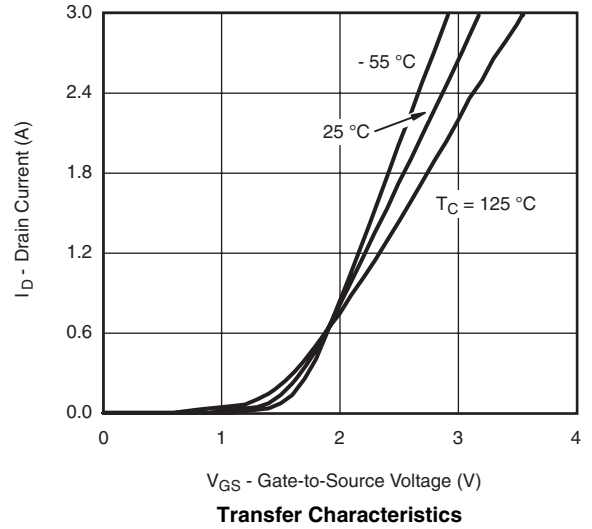
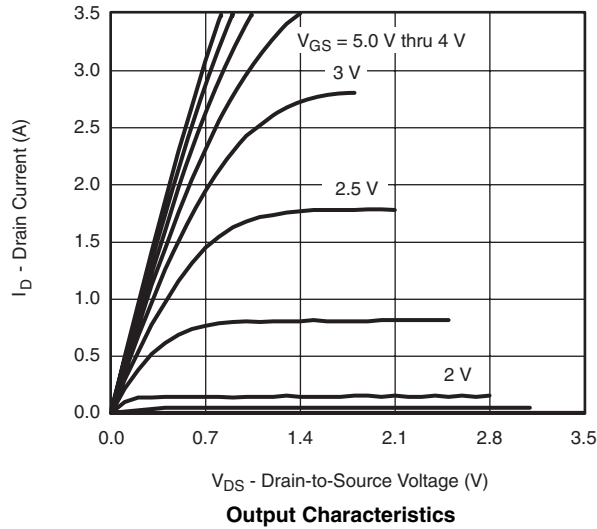
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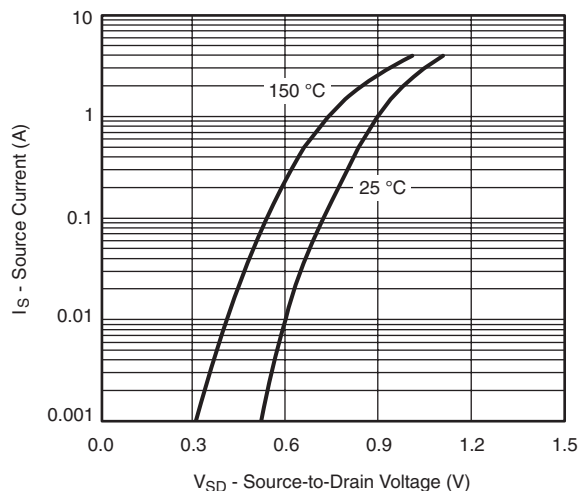
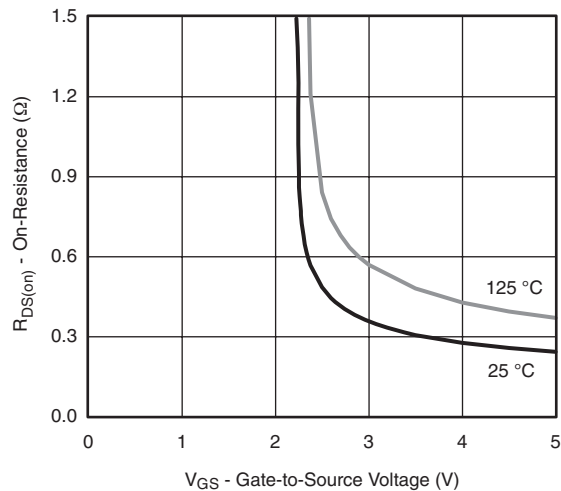
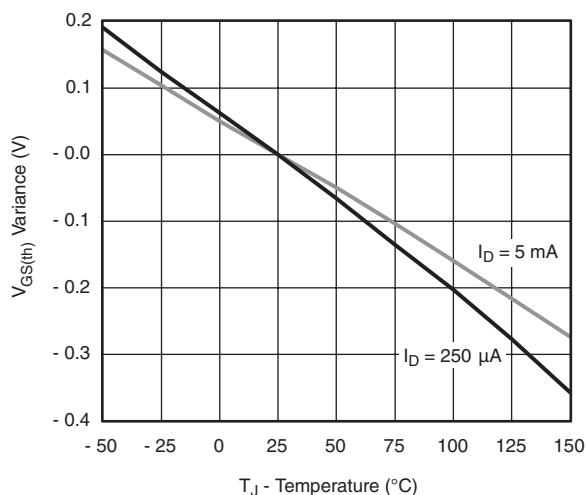
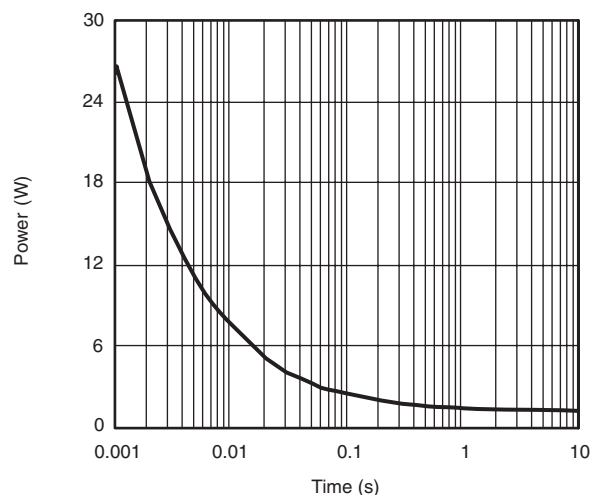
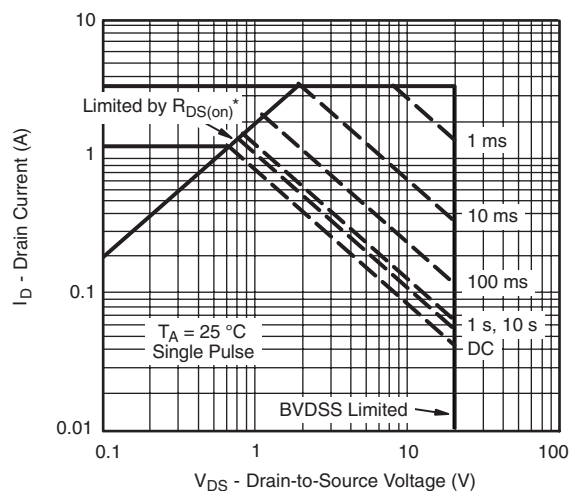
a. Guaranteed by design, not subject to production testing.

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

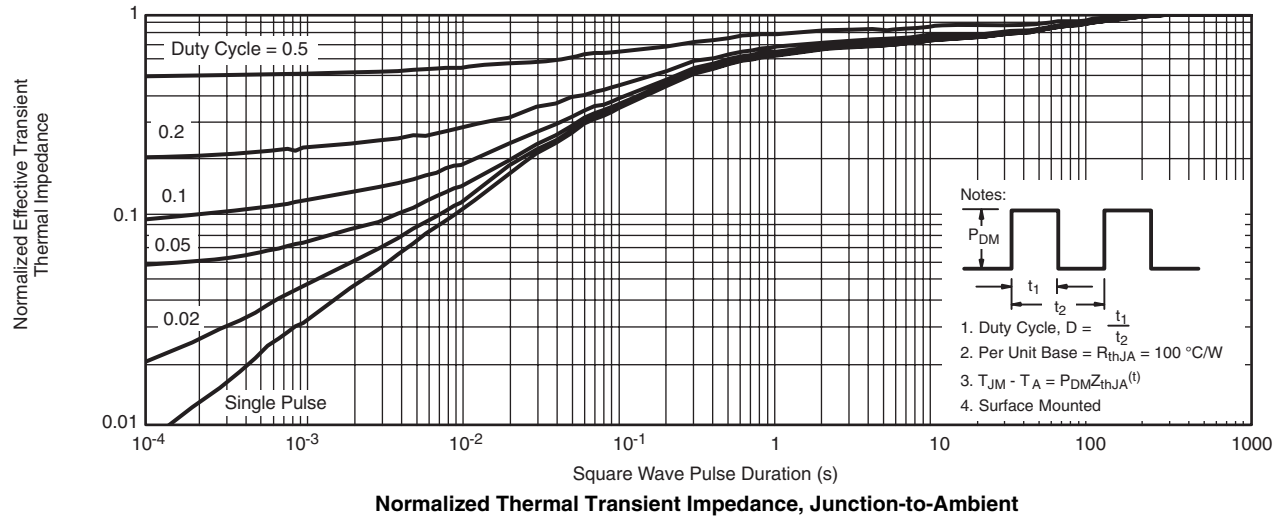
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

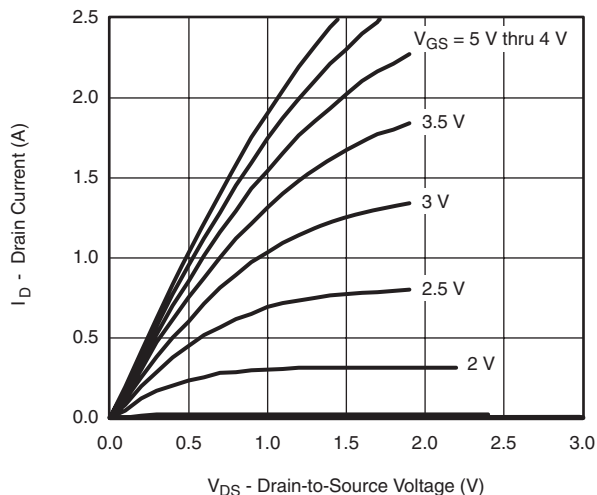
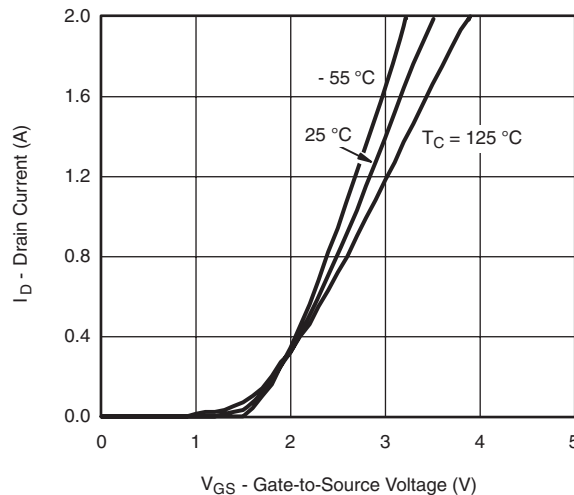
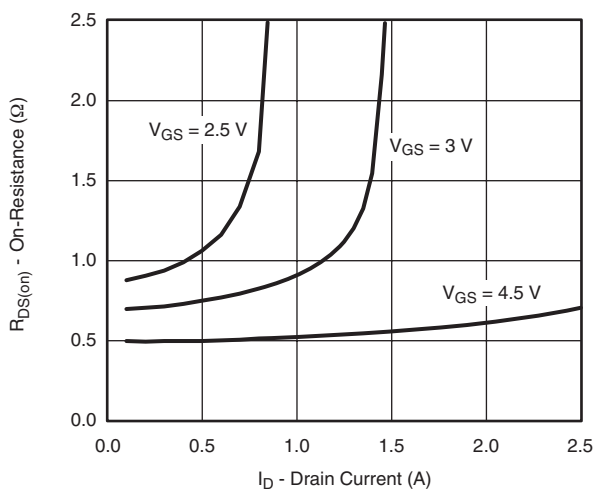
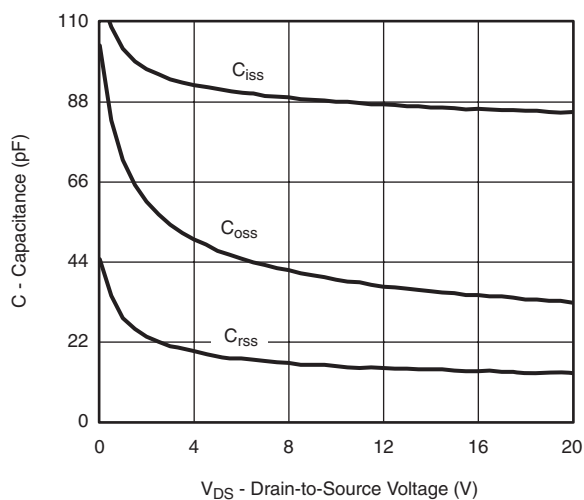
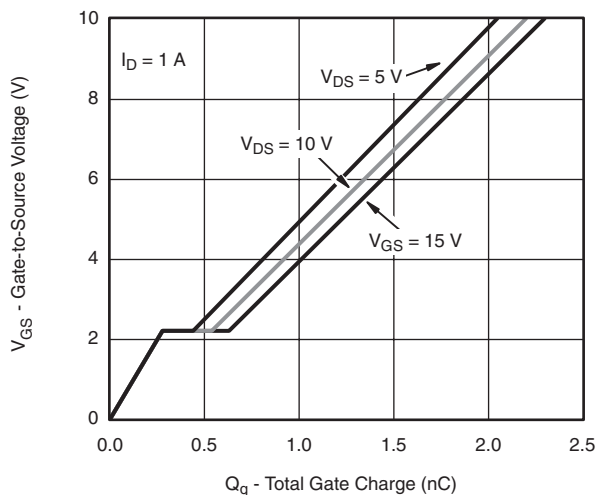
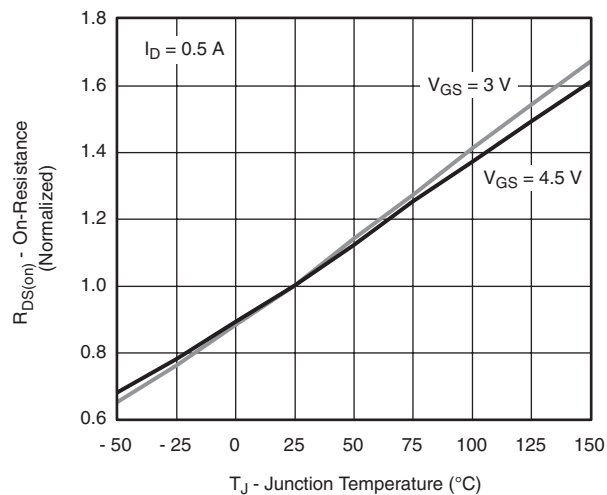
## N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



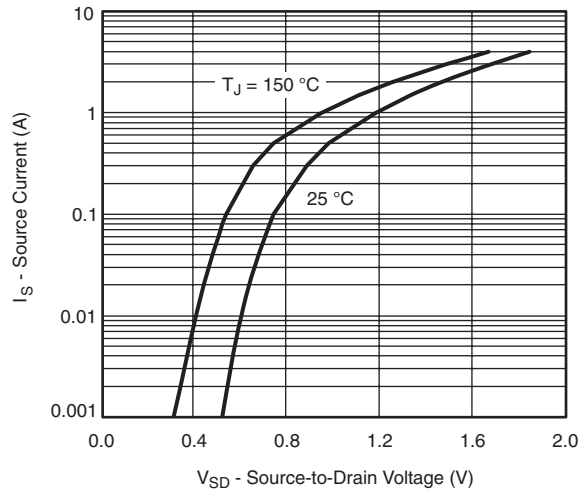
**N-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Source-Drain Diode Forward Voltage****On-Resistance vs. Gate-to-Source Voltage****Threshold Voltage****Single Pulse Power**\*  $V_{GS}$  > minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified**Safe Operating Area**

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

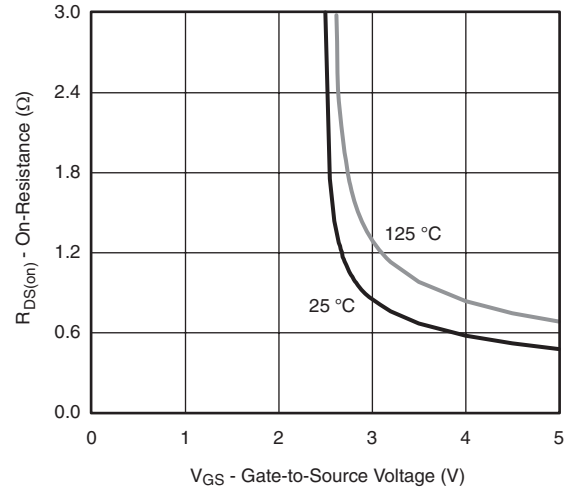


**P-CHANNEL TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Output Characteristics****Transfer Characteristics****On-Resistance vs. Drain Current****Capacitance****Gate Charge****On-Resistance vs. Junction Temperature**

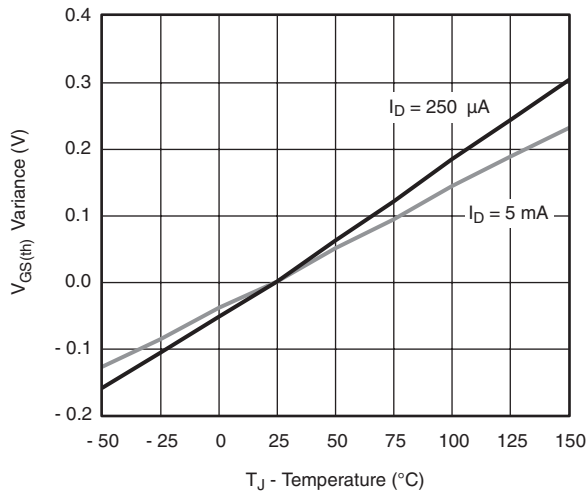
## P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



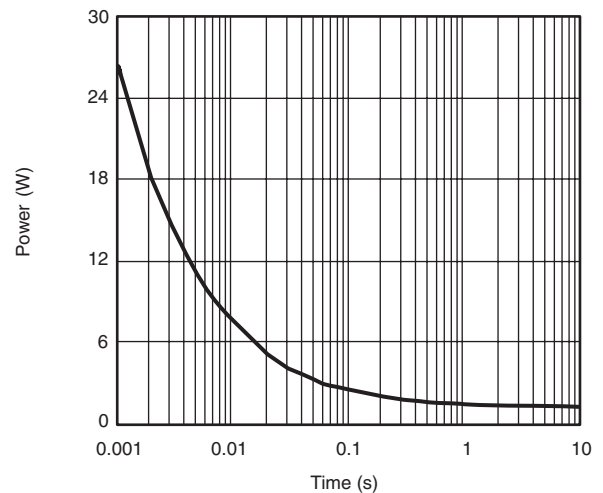
Source-Drain Diode Forward Voltage



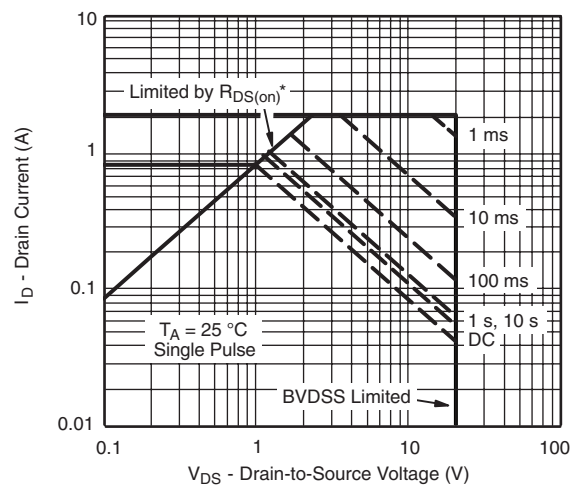
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

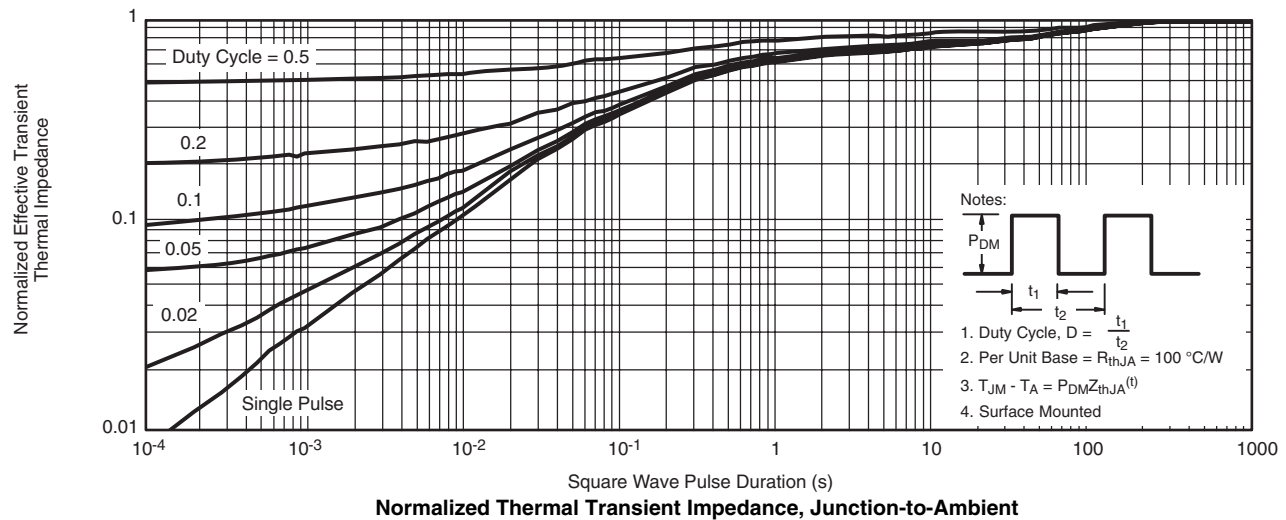


Single Pulse Power vs. Junction-to-Ambient



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

Safe Operating Area

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

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