

## Dual N-Channel 20-V (D-S) MOSFET with Schottky Diode

| PRODUCT SUMMARY |                     |                                   |                    |
|-----------------|---------------------|-----------------------------------|--------------------|
|                 | V <sub>DS</sub> (V) | R <sub>DS(on)</sub> (Ω)           | I <sub>D</sub> (A) |
| Channel-1       | 20                  | 0.012 at V <sub>GS</sub> = 10 V   | 9.6                |
|                 |                     | 0.0175 at V <sub>GS</sub> = 4.5 V | 7.8                |
| Channel-2       |                     | 0.010 at V <sub>GS</sub> = 10 V   | 13.5               |
|                 |                     | 0.0115 at V <sub>GS</sub> = 4.5 V | 12.8               |

| SCHOTTKY PRODUCT SUMMARY |                                       |           |
|--------------------------|---------------------------------------|-----------|
| $V_{DS}$ (V)             | $V_{SD}$ (V)<br>Diode Forward Voltage | $I_F$ (A) |
| 20                       | 0.53 V at 3 A                         | 2.0       |

### FEATURES

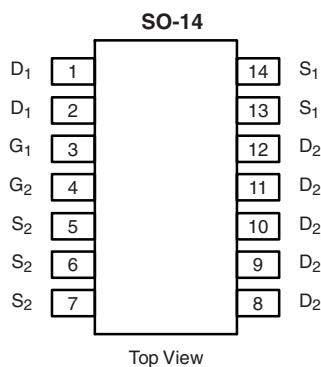
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- 100 %  $R_g$  Tested
- Compliant to RoHS Directive 2002/95/EC



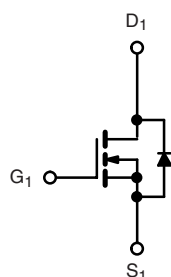
**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available

### APPLICATIONS

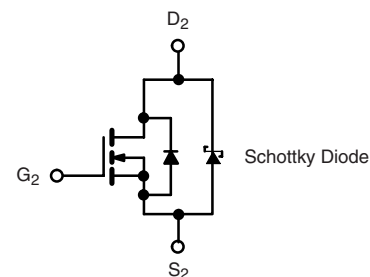
- DC/DC Converters
- Game Stations
- Notebook PC Logic



**Ordering Information:** Si4340DY-T1-E3 (Lead (Pb)-free)  
Si4340DY-T1-GE3 (Lead (Pb)-free and Halogen-free)



N-Channel 1  
MOSFET



N-Channel 2  
MOSFET

| ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted |                |             |              |           |              |      |  |
|----------------------------------------------------------------|----------------|-------------|--------------|-----------|--------------|------|--|
| Parameter                                                      | Symbol         | Channel-1   |              | Channel-2 |              | Unit |  |
|                                                                |                | 10 s        | Steady State | 10 s      | Steady State |      |  |
| Drain-Source Voltage                                           | $V_{DS}$       | 20          |              |           |              | V    |  |
| Gate-Source Voltage                                            | $V_{GS}$       | $\pm 20$    |              | $\pm 16$  |              |      |  |
| Continuous Drain Current ( $T_J = 150$ °C) <sup>a</sup>        | $I_D$          | 9.6         | 7.3          | 13.5      | 9.9          | A    |  |
|                                                                |                | 7.7         | 5.8          | 10.8      | 7.5          |      |  |
| Pulsed Drain Current                                           | $I_{DM}$       | 40          |              | 50        |              |      |  |
| Continuous Source Current (Diode Conduction) <sup>a</sup>      | $I_S$          | 1.8         | 1.04         | 2.73      | 1.30         |      |  |
| Maximum Power Dissipation <sup>a</sup>                         | $P_D$          | 2.0         | 1.14         | 3.0       | 1.43         | W    |  |
|                                                                |                | 1.28        | 0.73         | 1.9       | 0.91         |      |  |
| Operating Junction and Storage Temperature Range               | $T_J, T_{stg}$ | - 55 to 150 |              |           |              | °C   |  |

| THERMAL RESISTANCE RATINGS               |               |            |           |      |           |      |          |      |      |
|------------------------------------------|---------------|------------|-----------|------|-----------|------|----------|------|------|
| Parameter                                | $t \leq 10$ s | Symbol     | Channel-1 |      | Channel-2 |      | Schottky |      | Unit |
|                                          |               |            | Typ.      | Max. | Typ.      | Max. | Typ.     | Max. |      |
| Maximum Junction-to-Ambient <sup>a</sup> | Steady State  | $R_{thJA}$ | 53        | 62.5 | 35        | 42   | 40       | 48   | °C/W |
|                                          |               |            | 92        | 110  | 72        | 87   | 76       | 93   |      |
| Maximum Junction-to-Foot (Drain)         | Steady State  | $R_{thJF}$ | 35        | 42   | 18        | 23   | 21       | 25   |      |

Notes:

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

| MOSFET SPECIFICATIONS T <sub>J</sub> = 25 °C, unless otherwise noted |                     |                                                                                                                                                                                                          |                              |             |                                     |                                    |      |
|----------------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------|-------------------------------------|------------------------------------|------|
| Parameter                                                            | Symbol              | Test Conditions                                                                                                                                                                                          |                              | Min.        | Typ. <sup>a</sup>                   | 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                                                                                                                                              | Ch-1<br>Ch-2                 | 0.8<br>0.8  |                                     | 2.00<br>1.90                       | V    |
| Gate-Body Leakage                                                    | I <sub>GSS</sub>    | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V<br>V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 12 V                                                                                                       | Ch-1<br>Ch-2                 |             |                                     | 100<br>100                         | nA   |
| Zero Gate Voltage Drain Current                                      | I <sub>DSS</sub>    | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V<br>V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 85 °C                                                                                   | Ch-1<br>Ch-2<br>Ch-1<br>Ch-2 |             |                                     | 1<br>100<br>15<br>4000             | μA   |
| On-State Drain Current <sup>b</sup>                                  | I <sub>D(on)</sub>  | V <sub>DS</sub> = 5 V, V <sub>GS</sub> = 10 V                                                                                                                                                            | Ch-1<br>Ch-2                 | 20<br>30    |                                     |                                    | A    |
| Drain-Source On-State Resistance <sup>b</sup>                        | R <sub>DS(on)</sub> | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 9.6 A<br>V <sub>GS</sub> = 10 V, I <sub>D</sub> = 13.5 A<br>V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 7.8 A<br>V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 12.8 A | Ch-1<br>Ch-2<br>Ch-1<br>Ch-2 |             | 0.0095<br>0.007<br>0.0135<br>0.0085 | 0.012<br>0.010<br>0.0175<br>0.0115 | Ω    |
| Forward Transconductance <sup>b</sup>                                | g <sub>fs</sub>     | V <sub>DS</sub> = 15 V, I <sub>D</sub> = 9.6 A<br>V <sub>DS</sub> = 15 V, I <sub>D</sub> = 13.5 A                                                                                                        | Ch-1<br>Ch-2                 |             | 25<br>38                            |                                    | S    |
| Diode Forward Voltage <sup>b</sup>                                   | V <sub>SD</sub>     | I <sub>S</sub> = 1.8 A, V <sub>GS</sub> = 0 V<br>I <sub>S</sub> = 2.73 A, V <sub>GS</sub> = 0 V                                                                                                          | Ch-1<br>Ch-2                 |             | 0.74<br>0.485                       | 1.1<br>0.53                        | V    |
| Dynamic <sup>a</sup>                                                 |                     |                                                                                                                                                                                                          |                              |             |                                     |                                    |      |
| Total Gate Charge                                                    | Q <sub>g</sub>      | Channel-1<br>V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 9.6 A                                                                                                                     | Ch-1<br>Ch-2                 |             | 10<br>17                            | 15<br>25                           | nC   |
| Gate-Source Charge                                                   | Q <sub>gs</sub>     | Channel-2                                                                                                                                                                                                | Ch-1<br>Ch-2                 |             | 3.3<br>4.5                          |                                    |      |
| Gate-Drain Charge                                                    | Q <sub>gd</sub>     | V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = - 13.5 A                                                                                                                               | Ch-1<br>Ch-2                 |             | 3.1<br>4.5                          |                                    |      |
| Gate Resistance                                                      | R <sub>g</sub>      | f = 1 MHz                                                                                                                                                                                                | Ch-1<br>Ch-2                 | 0.45<br>0.7 | 0.9<br>1.4                          | 1.35<br>2.1                        |      |
| Turn-On Delay Time                                                   | t <sub>d(on)</sub>  | Channel-1<br>V <sub>DD</sub> = 10 V, R <sub>L</sub> = 10 Ω<br>I <sub>D</sub> ≅ 1 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 6 Ω                                                                        | Ch-1<br>Ch-2                 |             | 15<br>24                            | 25<br>35                           | ns   |
| Rise Time                                                            | t <sub>r</sub>      |                                                                                                                                                                                                          | Ch-1<br>Ch-2                 |             | 16<br>22                            | 25<br>35                           |      |
| Turn-Off Delay Time                                                  | t <sub>d(off)</sub> | Channel-2<br>V <sub>DD</sub> = 10 V, R <sub>L</sub> = 10 Ω                                                                                                                                               | Ch-1<br>Ch-2                 |             | 42<br>68                            | 65<br>100                          |      |
| Fall Time                                                            | t <sub>f</sub>      | I <sub>D</sub> ≅ 1 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 6 Ω                                                                                                                                      | Ch-1<br>Ch-2                 |             | 16<br>19                            | 25<br>30                           |      |
| Source-Drain Reverse Recovery Time                                   | t <sub>rr</sub>     | I <sub>F</sub> = 1.8 A, dI/dt = 100 A/μs<br>I <sub>F</sub> = 2.73 A, dI/dt = 100 μA/μs                                                                                                                   | Ch-1<br>Ch-2                 |             | 35<br>38                            | 60<br>65                           |      |

Notes:

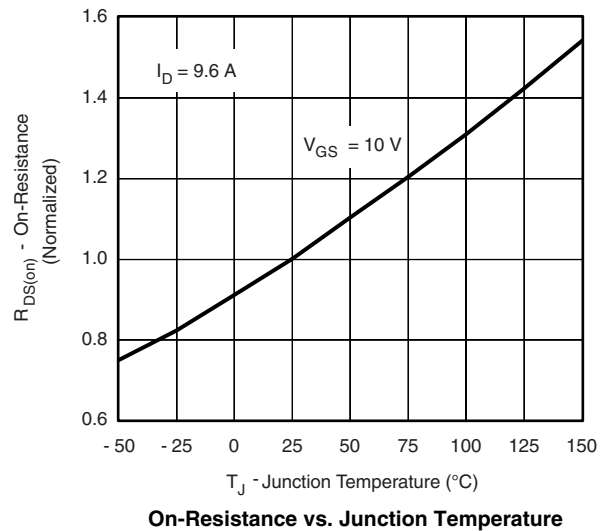
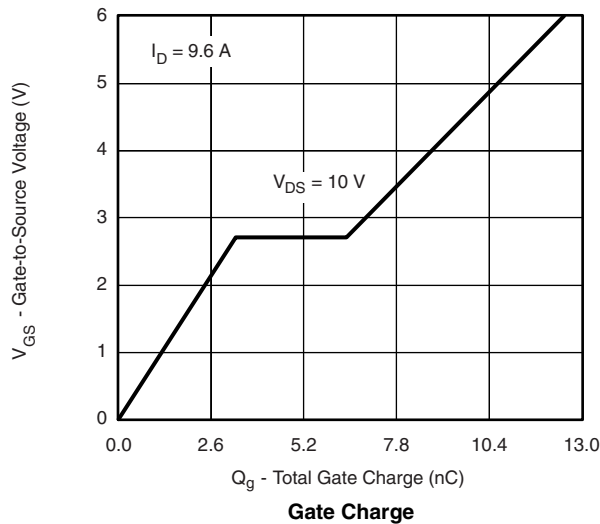
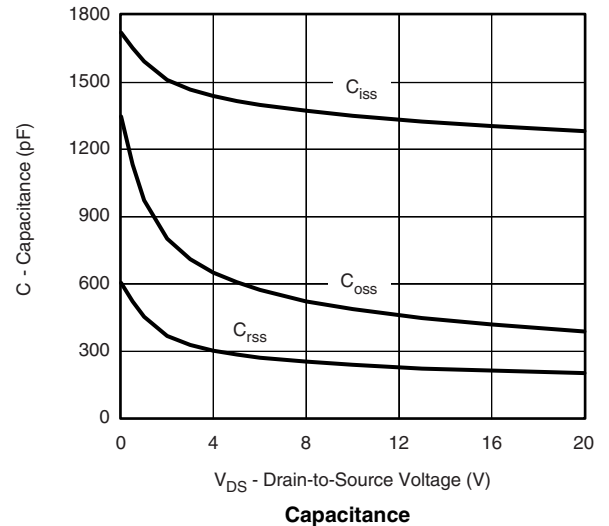
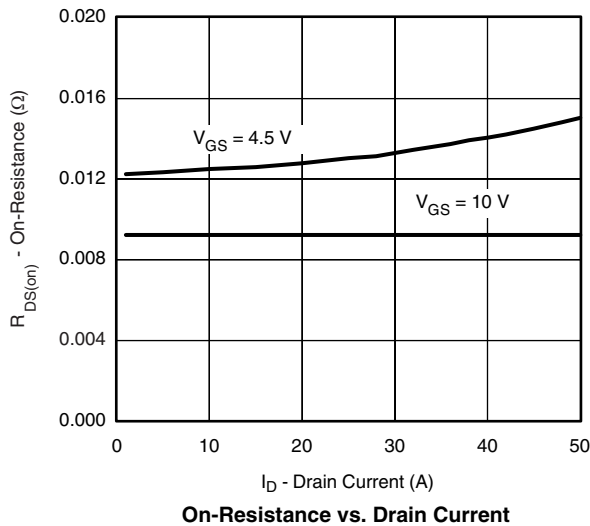
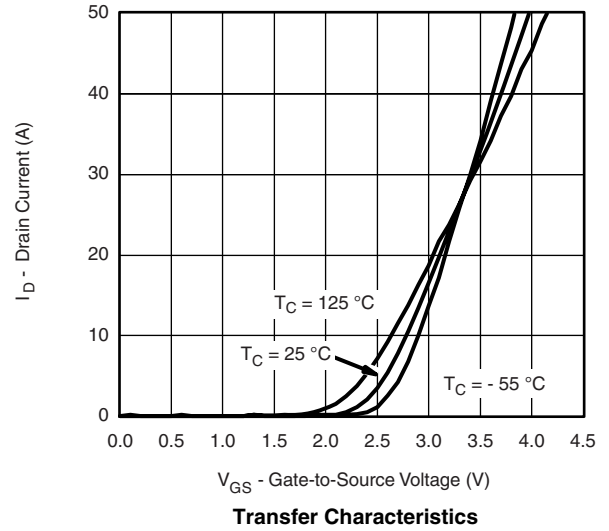
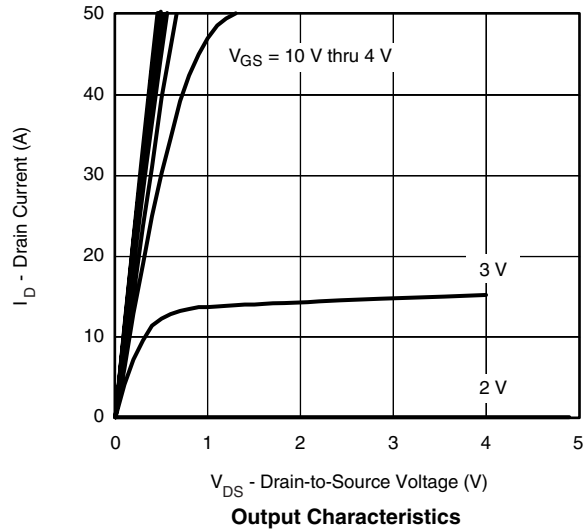
a. Guaranteed by design, not subject to production testing.

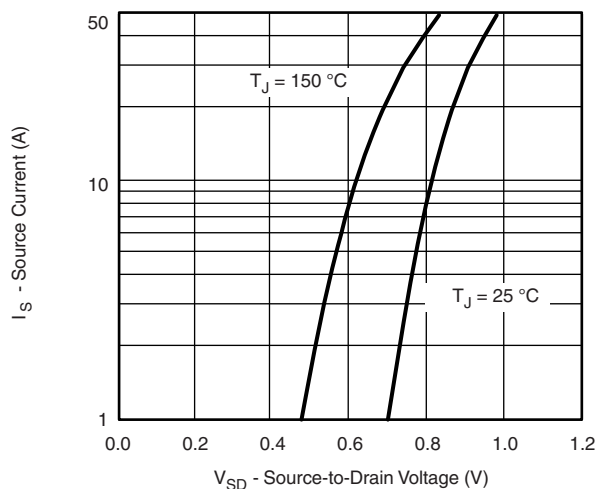
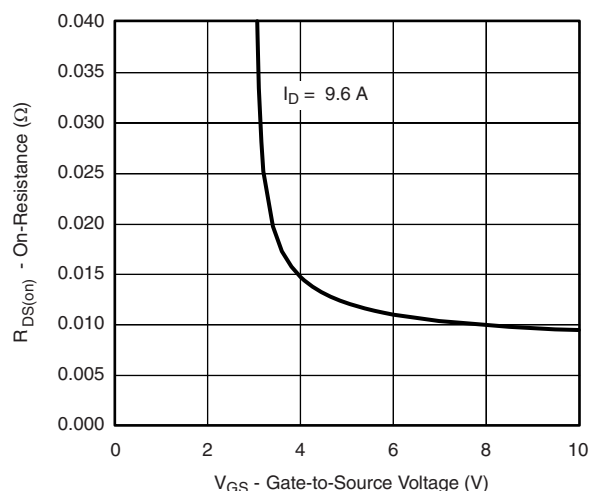
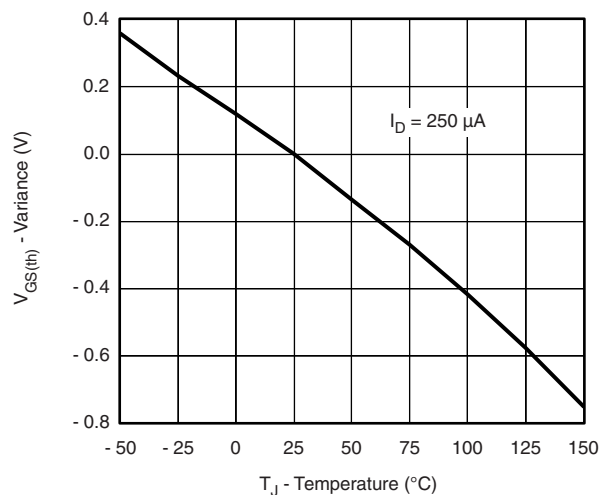
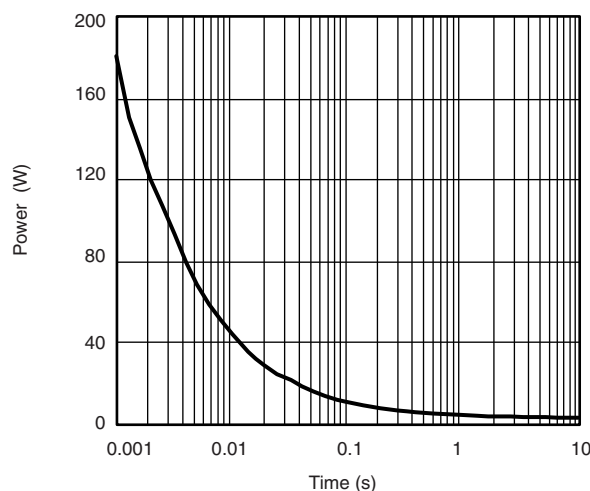
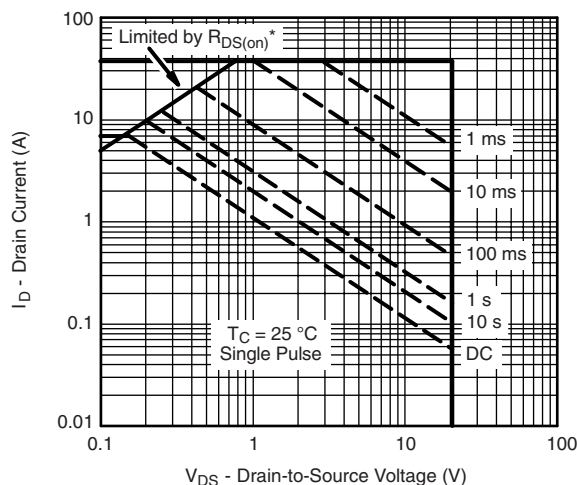
b. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

| SCHOTTKY SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted |          |                                                            |      |       |       |      |
|-------------------------------------------------------------------------------------|----------|------------------------------------------------------------|------|-------|-------|------|
| Parameter                                                                           | Symbol   | Test Conditions                                            | Min. | Typ.  | Max.  | Unit |
| Forward Voltage Drop                                                                | $V_F$    | $I_F = 3\text{ A}$                                         |      | 0.485 | 0.53  | V    |
|                                                                                     |          | $I_F = 3\text{ A}$ , $T_J = 125\text{ }^{\circ}\text{C}$   |      | 0.42  | 0.42  |      |
| Maximum Reverse Leakage Current                                                     | $I_{rm}$ | $V_R = 20\text{ V}$                                        |      | 0.008 | 0.100 | mA   |
|                                                                                     |          | $V_R = 20\text{ V}$ , $T_J = 75\text{ }^{\circ}\text{C}$   |      | 0.4   | 5     |      |
|                                                                                     |          | $V_R = -20\text{ V}$ , $T_J = 125\text{ }^{\circ}\text{C}$ |      | 6.5   | 20    |      |
| Junction Capacitance                                                                | $C_T$    | $V_R = 15\text{ V}$                                        |      | 102   |       | pF   |

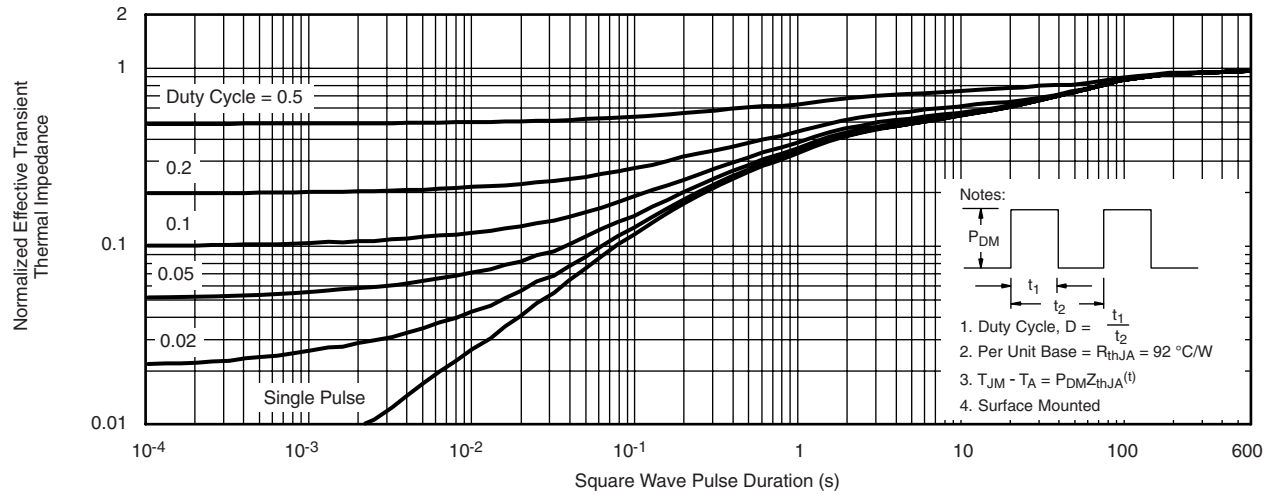
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

## CHANNEL-1 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

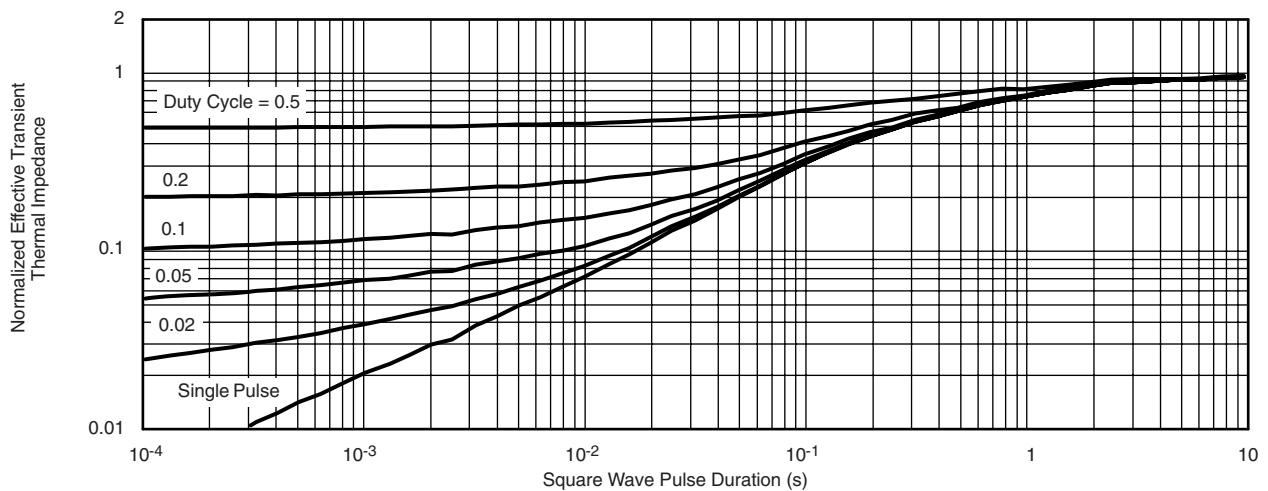


**CHANNEL-1 TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Source-Drain Diode Forward Voltage****On-Resistance vs. Gate-to-Source Voltage****Threshold Voltage****Single Pulse Power**\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified**Safe Operating Area, Junction-to-Case**

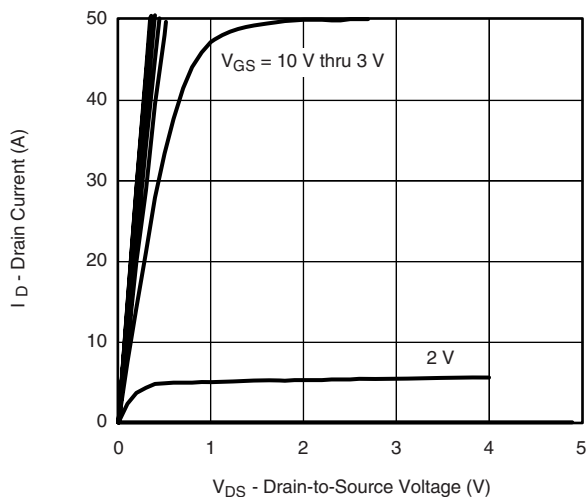
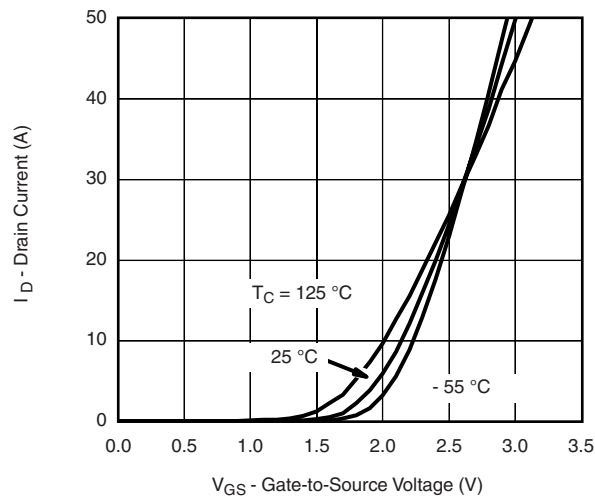
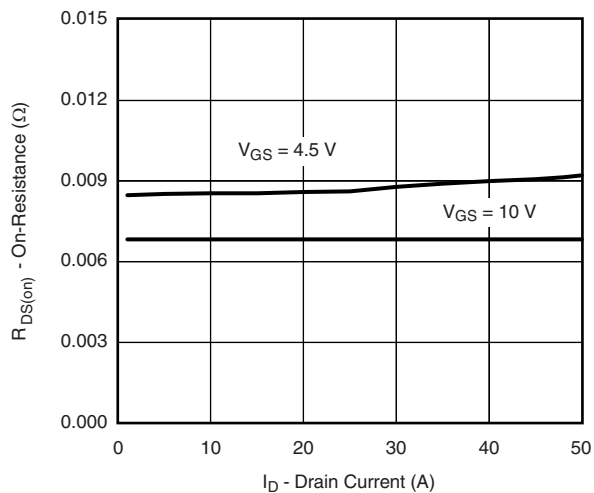
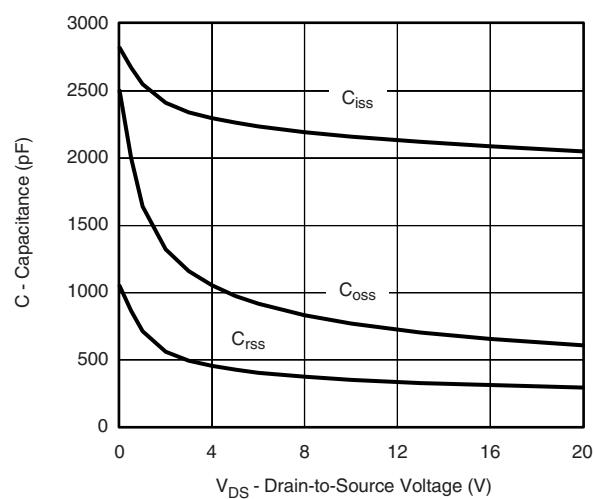
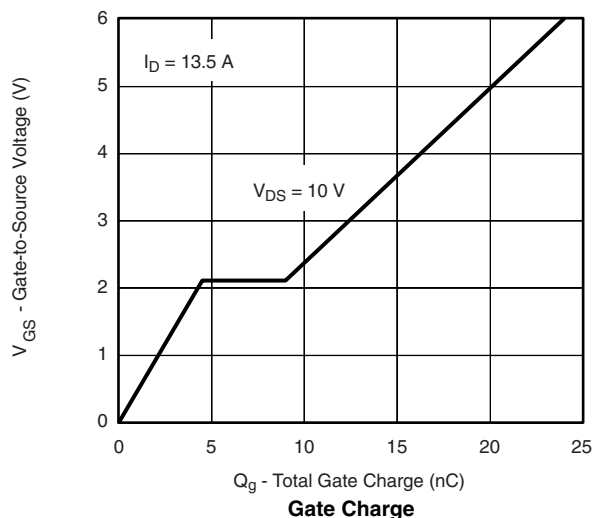
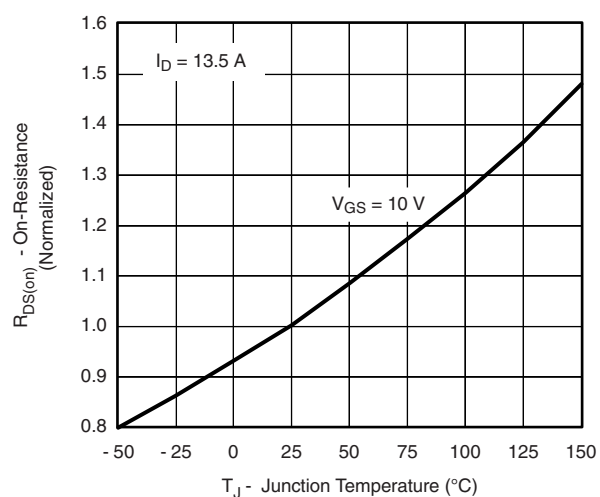
## CHANNEL-1 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



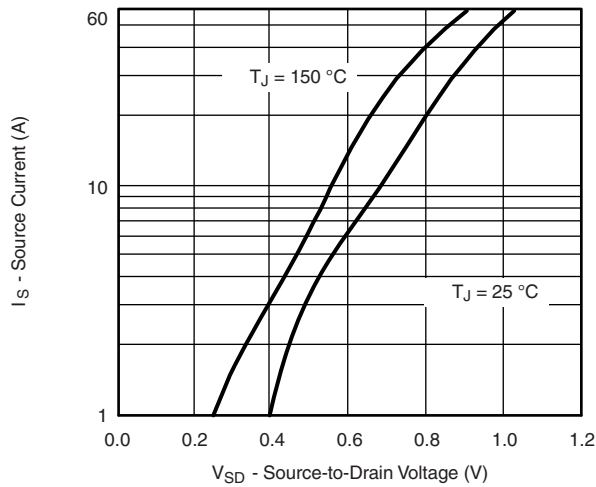
Normalized Thermal Transient Impedance, Junction-to-Ambient



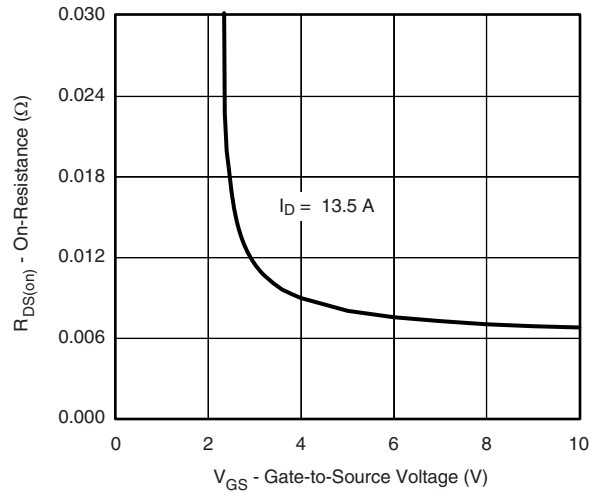
Normalized Thermal Transient Impedance, Junction-to-Foot

**CHANNEL-2 TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Output Characteristics****Transfer Characteristics****On-Resistance vs. Drain Current****Capacitance****Gate Charge****On-Resistance vs. Junction Temperature**

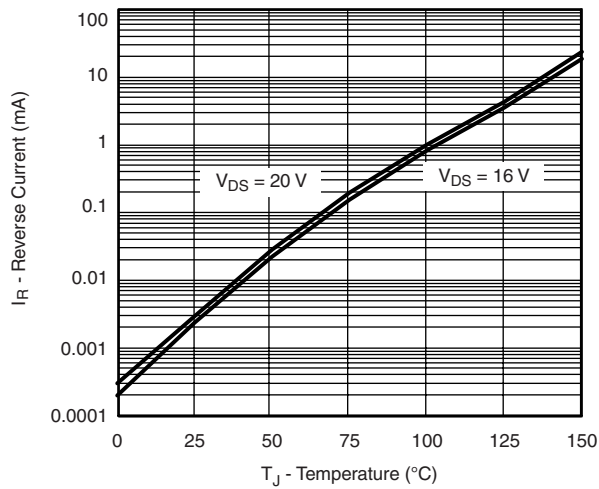
## CHANNEL-2 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



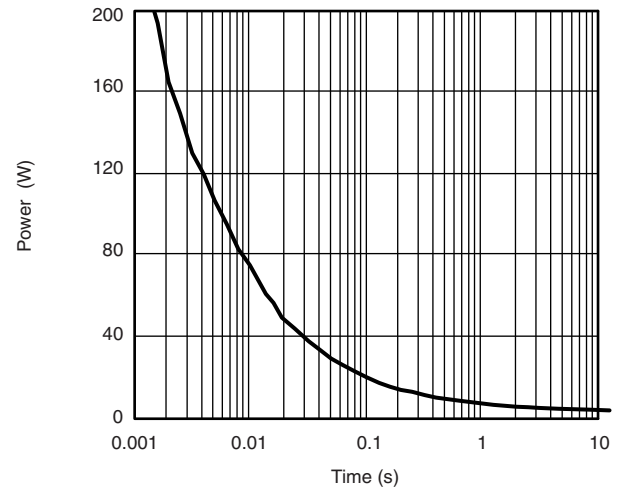
Source-Drain Diode Forward Voltage



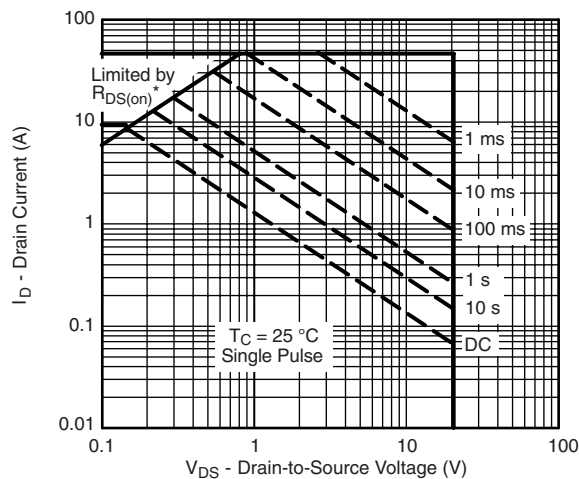
On-Resistance vs. Gate-to-Source Voltage



Reverse Current vs. Junction Temperature

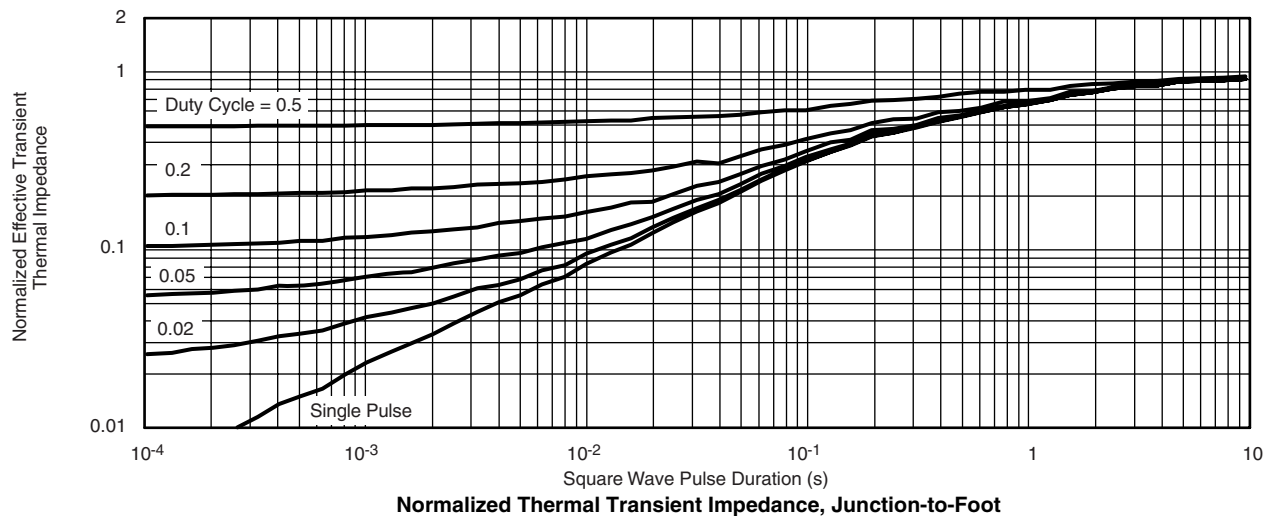
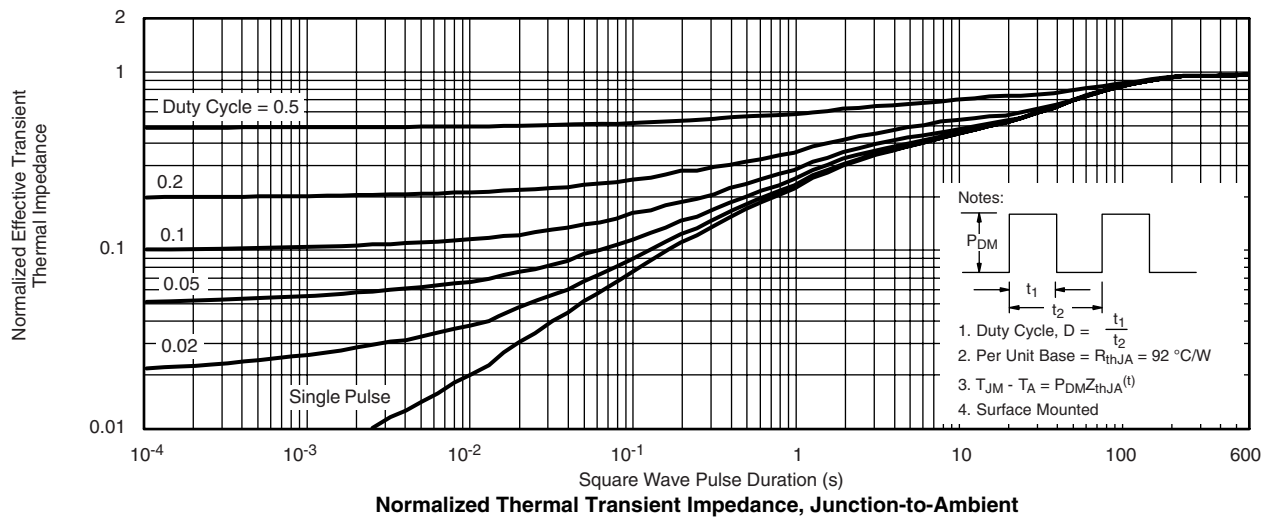
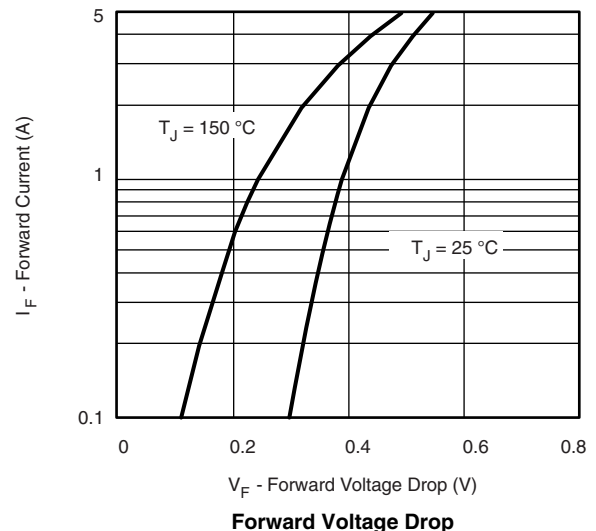
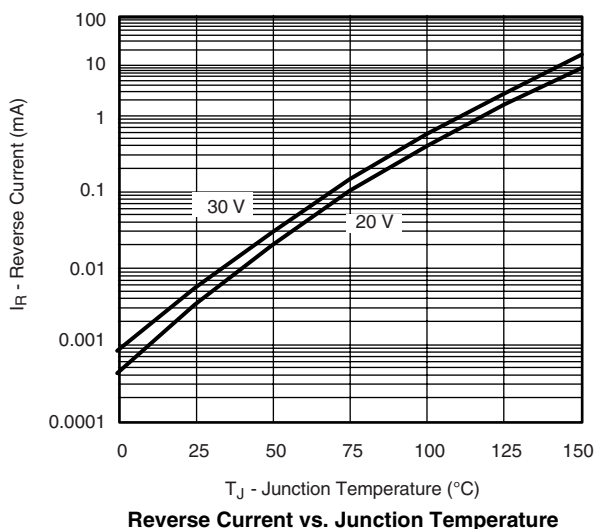


Single Pulse Power

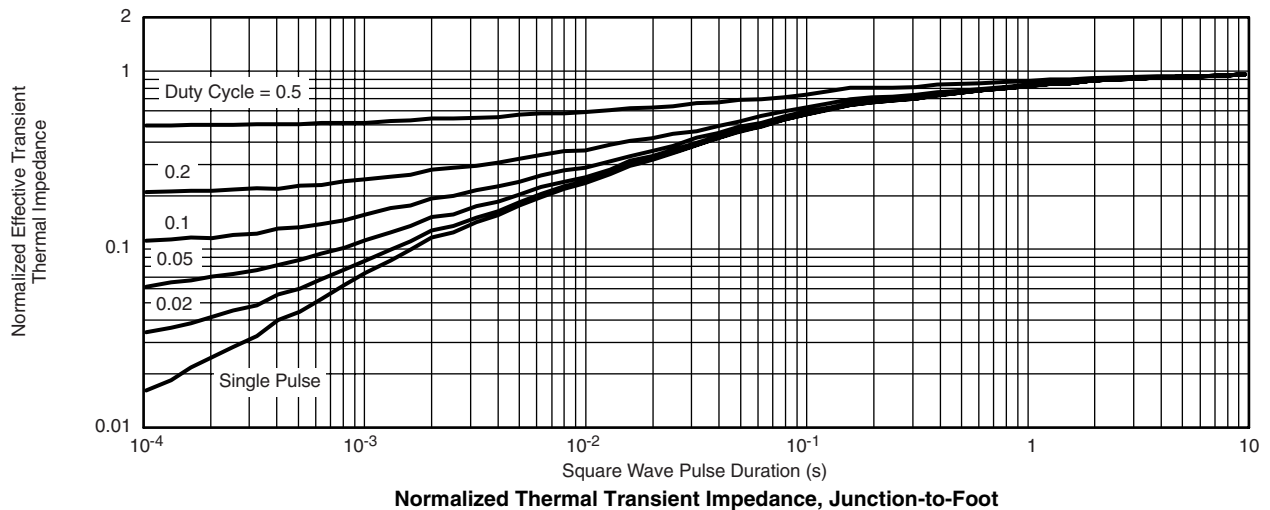
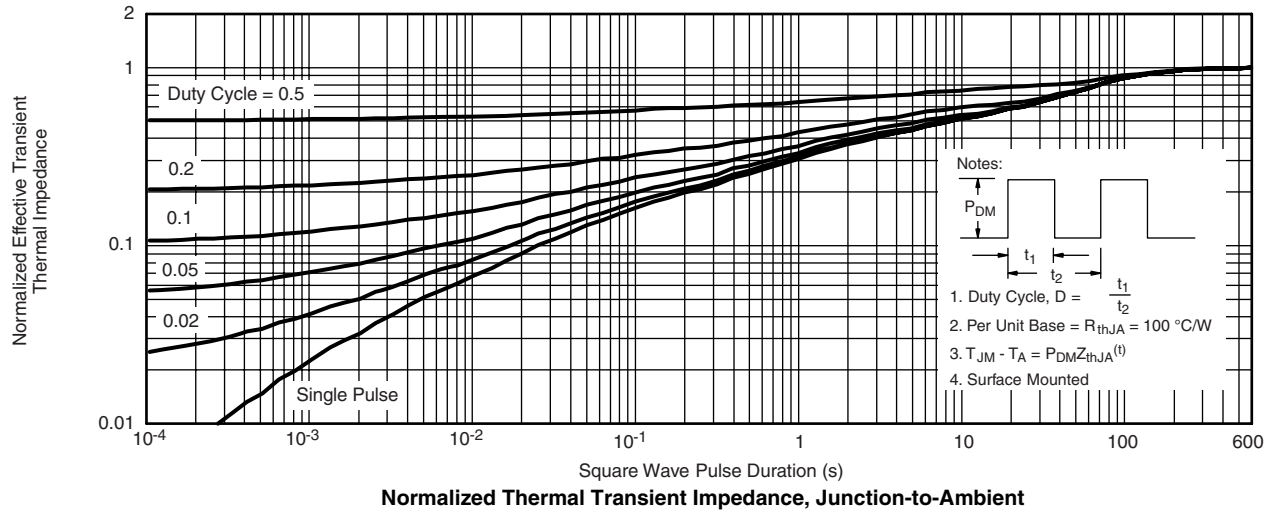
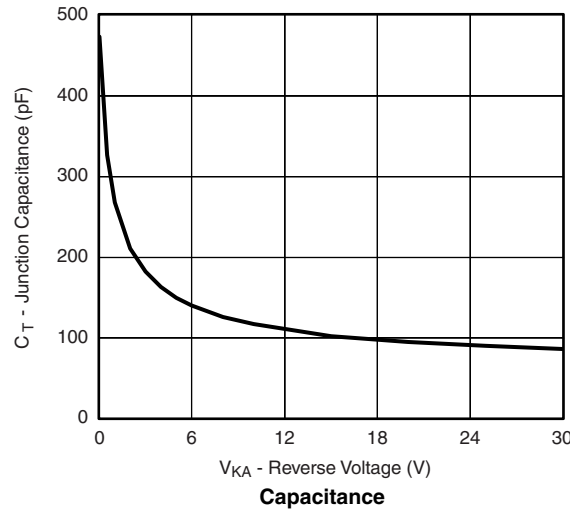


\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

Safe Operating Area, Junction-to-Case

**CHANNEL-2 TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**SCHOTTKY TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted

**SCHOTTKY TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



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