

Dual N-Channel 30-V (D-S) MOSFET

| PRODUCT SUMMARY | | | | |
|-----------------|---------------------|-----------------------------------|---------------------------------|-----------------------|
| | V _{DS} (V) | R _{DS(on)} (Ω) | I _D (A) ^a | Q _g (Typ.) |
| Channel 1 | 30 | 0.0145 at V _{GS} = 10 V | 10.8 | 8.3 |
| | | 0.0195 at V _{GS} = 4.5 V | 9.3 | |
| Channel 2 | 30 | 0.0265 at V _{GS} = 10 V | 7.2 | 4 |
| | | 0.036 at V _{GS} = 4.5 V | 6.2 | |

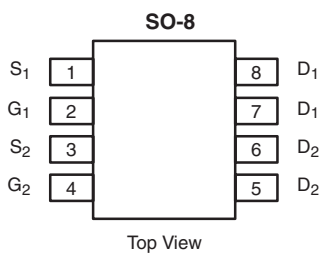
FEATURES

- Halogen-free According to IEC 61249-2-21 Available
- TrenchFET[®] Power MOSFET
- 100 % R_g Tested

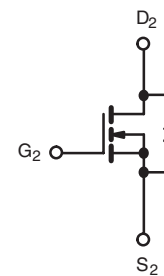
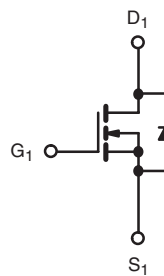


APPLICATIONS

- Logic DC/DC for Notebook PC



Ordering Information: Si4972DY-T1-E3 (Lead (Pb)-free)
Si4972DY-T1-GE3 (Lead (Pb)-free and Halogen-free)



| ABSOLUTE MAXIMUM RATINGS T _A = 25 °C, unless otherwise noted | | | | |
|---|-----------------------------------|---------------------|---------------------|------|
| Parameter | Symbol | Channel 1 | Channel 2 | Unit |
| Drain-Source Voltage | V _{DS} | 30 | | V |
| Gate-Source Voltage | V _{GS} | ± 20 | | |
| Continuous Drain Current (T _J = 150 °C) | T _C = 25 °C | 10.8 | 7.2 | A |
| | T _C = 70 °C | 8.7 | 5.7 | |
| | T _A = 25 °C | 8.7 ^{b,c} | 6.4 ^{b,c} | |
| | T _A = 70 °C | 6.9 ^{b,c} | 5.1 ^{b,c} | |
| Pulsed Drain Current (10 μs Pulse Width) | I _{DM} | 20 | 20 | A |
| Source-Drain Current Diode Current | T _C = 25 °C | 2.5 | 2.1 | |
| | T _A = 25 °C | 1.6 ^{b,c} | 1.6 ^{b,c} | |
| Pulsed Source-Drain Current | I _{SM} | 20 | 20 | mJ |
| Single Pulse Avalanche Current | L = 0.1 mH I _{AS} | 15 | 6 | |
| Avalanche Energy | E _{AS} | 11 | 1.8 | W |
| Maximum Power Dissipation | T _C = 25 °C | 3.1 | 2.5 | |
| | T _C = 70 °C | 2.1 | 1.6 | |
| | T _A = 25 °C | 2.0 ^{b,c} | 2.0 ^{b,c} | |
| | T _A = 70 °C | 1.25 ^{b,c} | 1.25 ^{b,c} | |
| Operating Junction and Storage Temperature Range | T _J , T _{stg} | - 55 to 150 | | °C |

| THERMAL RESISTANCE RATINGS | | | | | | |
|---|-------------------------------|-----------|---------|-----------|---------|------|
| Parameter | Symbol | Channel 1 | | Channel 2 | | Unit |
| | | Typical | Maximum | Typical | Maximum | |
| Maximum Junction-to-Ambient ^{b, d} | t ≤ 10 s R _{thJA} | 52 | 62.5 | 55 | 62.5 | °C/W |
| Maximum Junction-to-Foot (Drain) | Steady R _{thJF} | 32 | 40 | 40 | 50 | |

- Notes:
a. Based on T_C = 25 °C.
b. Surface mounted on 1" x 1" FR4 board.
c. t = 10 s.
d. Maximum under steady state conditions is 110 °C/W (Ch 1) and 120 °C/W (Ch 2).

| SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted | | | | | | | |
|---|-------------------------|--|------|-------------------|-------|----------------------|----------|
| Parameter | Symbol | Test Conditions | Min. | Typ. ^a | Max. | Unit | |
| Static | | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | Ch 1 | 30 | | V | |
| | | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | Ch 2 | 30 | | | |
| V_{DS} Temperature Coefficient | $\Delta V_{DS}/T_J$ | $I_D = 250\text{ }\mu\text{A}$ | Ch 1 | | 35 | mV/ $^\circ\text{C}$ | |
| | | $I_D = 250\text{ }\mu\text{A}$ | Ch 2 | | 35 | | |
| $V_{GS(th)}$ Temperature Coefficient | $\Delta V_{GS(th)}/T_J$ | $I_D = 250\text{ }\mu\text{A}$ | Ch 1 | | - 6.5 | | |
| | | $I_D = 250\text{ }\mu\text{A}$ | Ch 2 | | - 6.5 | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | Ch 1 | 1.5 | 3.0 | V | |
| | | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | Ch 2 | 1.5 | 3.0 | | |
| Gate-Body Leakage | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$ | Ch 1 | | 100 | nA | |
| | | | Ch 2 | | 100 | | |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$ | Ch 1 | | 1 | μA | |
| | | $V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$ | Ch 2 | | 1 | | |
| | | $V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$ | Ch 1 | | 10 | | |
| | | $V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$ | Ch 2 | | 10 | | |
| On-State Drain Current ^b | $I_{D(on)}$ | $V_{DS} = 5\text{ V}, V_{GS} = 10\text{ V}$ | Ch 1 | 10 | | A | |
| | | $V_{DS} = 5\text{ V}, V_{GS} = 10\text{ V}$ | Ch 2 | 10 | | | |
| Drain-Source On-State Resistance ^b | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}, I_D = 6\text{ A}$ | Ch 1 | | 0.012 | 0.0145 | Ω |
| | | $V_{GS} = 10\text{ V}, I_D = 4.5\text{ A}$ | Ch 2 | | 0.022 | 0.0265 | |
| | | $V_{GS} = 4.5\text{ V}, I_D = 5.6\text{ A}$ | Ch 1 | | 0.016 | 0.0195 | |
| | | $V_{GS} = 4.5\text{ V}, I_D = 4\text{ A}$ | Ch 2 | | 0.030 | 0.036 | |
| Forward Transconductance ^b | g_{fs} | $V_{DS} = 15\text{ V}, I_D = 6\text{ A}$ | Ch 1 | | 27 | S | |
| | | $V_{DS} = 15\text{ V}, I_D = 4.5\text{ A}$ | Ch 2 | | 20 | | |
| Dynamic^a | | | | | | | |
| Input Capacitance | C_{iss} | Channel 1 $V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | Ch 1 | | 1080 | pF | |
| | | | Ch 2 | | 515 | | |
| Output Capacitance | C_{oss} | Channel 2 $V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | Ch 1 | | 170 | | |
| | | | Ch 2 | | 91 | | |
| Reverse Transfer Capacitance | C_{rss} | | Ch 1 | | 72 | | |
| | | | Ch 2 | | 38 | | |
| Total Gate Charge | Q_g | $V_{DS} = 15\text{ V}, V_{GS} = 10\text{ V}, I_D = 5\text{ A}$ | Ch 1 | | 18.5 | 28 | nC |
| | | $V_{DS} = 15\text{ V}, V_{GS} = 10\text{ V}, I_D = 5\text{ A}$ | Ch 2 | | 9.6 | 15 | |
| | | Channel 1 $V_{DS} = 15\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 5\text{ A}$ | Ch 1 | | 8.3 | 13 | |
| | | | Ch 2 | | 4 | 6 | |
| Gate-Source Charge | Q_{gs} | Channel 2 $V_{DS} = 15\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 5\text{ A}$ | Ch 1 | | 3.9 | | |
| | | | Ch 2 | | 1.9 | | |
| Gate-Drain Charge | Q_{gd} | | Ch 1 | | 2.7 | | |
| | | | Ch 2 | | 1.3 | | |
| Gate Resistance | R_g | $f = 1\text{ MHz}$ | Ch 1 | | 2.5 | 3.8 | Ω |
| | | | Ch 2 | | 2.9 | 4.4 | |



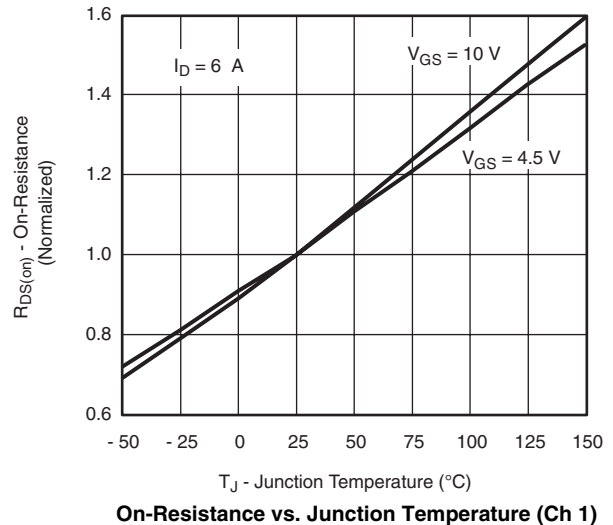
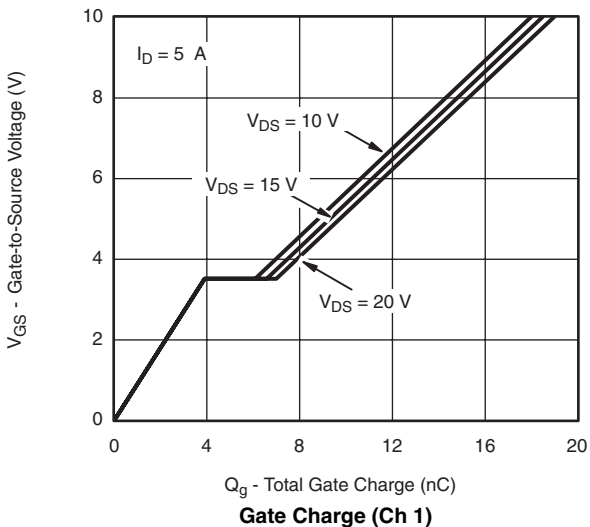
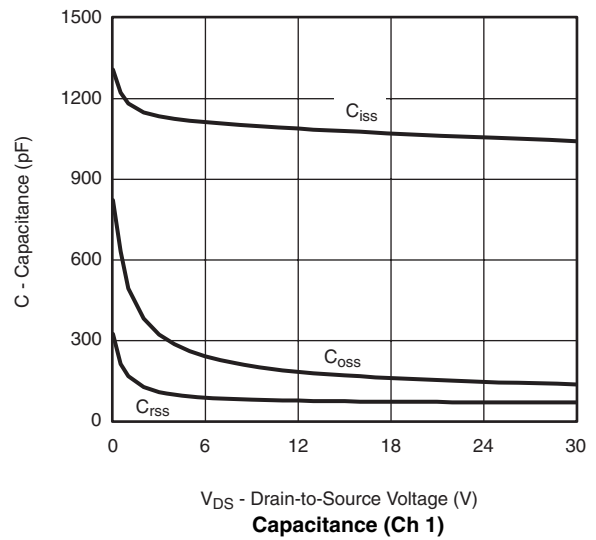
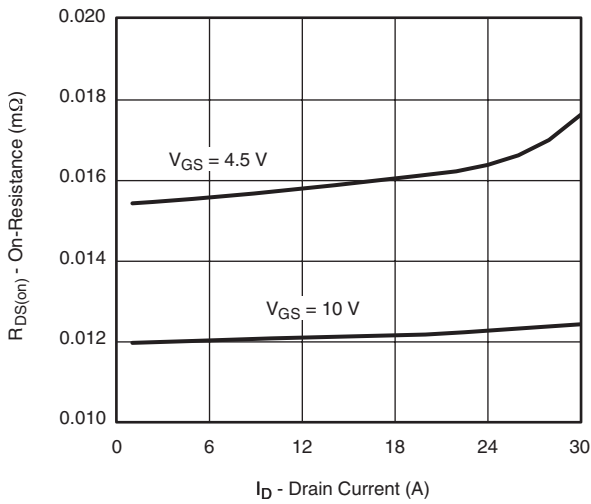
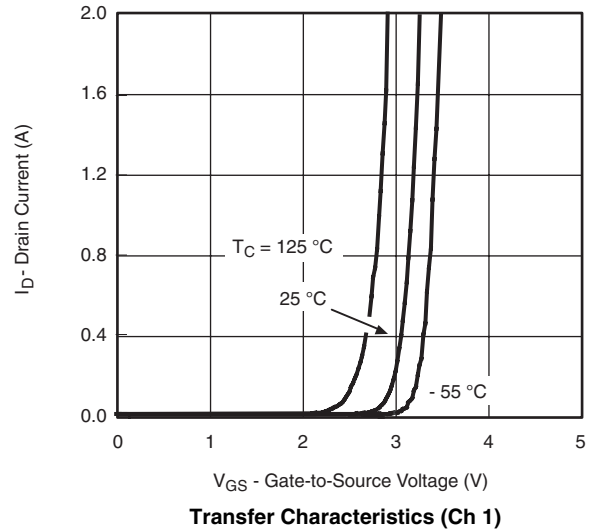
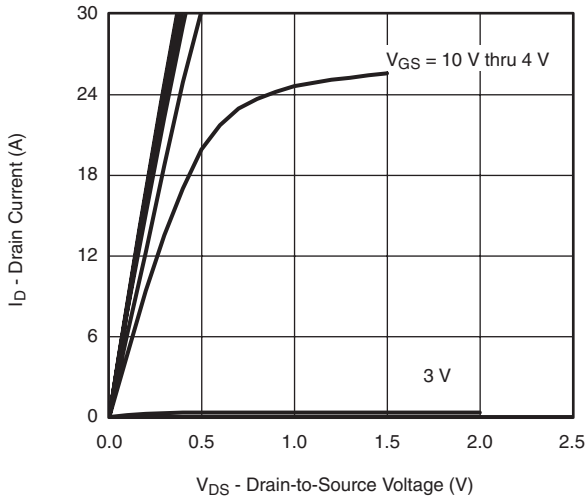
| SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted | | | | | | | |
|---|--------------|--|------|-------------------|------|------|----|
| Parameter | Symbol | Test Conditions | Min. | Typ. ^a | Max. | Unit | |
| Dynamic^a | | | | | | | |
| Turn-On Delay Time | $t_{d(on)}$ | Channel 1 $V_{DD} = 15\text{ V}, R_L = 3\ \Omega$ $I_D \cong 5\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\ \Omega$ | Ch 1 | | 12 | 18 | ns |
| | | | Ch 2 | | 10 | 15 | |
| Rise Time | t_r | | Ch 1 | | 55 | 83 | |
| | | | Ch 2 | | 60 | 90 | |
| Turn-Off Delay Time | $t_{d(off)}$ | Channel 2 $V_{DD} = 15\text{ V}, R_L = 3\ \Omega$ $I_D \cong 5\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\ \Omega$ | Ch 1 | | 30 | 45 | |
| | | | Ch 2 | | 22 | 33 | |
| Fall Time | t_f | | Ch 1 | | 7 | 11 | |
| | | | Ch 2 | | 6 | 9 | |
| Turn-On Delay Time | $t_{d(on)}$ | Channel 1 $V_{DD} = 15\text{ V}, R_L = 3\ \Omega$ $I_D \cong 5\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\ \Omega$ | Ch 1 | | 120 | 180 | |
| | | | Ch 2 | | 108 | 162 | |
| Rise Time | t_r | | Ch 1 | | 150 | 225 | |
| | | | Ch 2 | | 130 | 195 | |
| Turn-Off Delay Time | $t_{d(off)}$ | Channel 2 $V_{DD} = 15\text{ V}, R_L = 3\ \Omega$ $I_D \cong 5\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 16\ \Omega$ | Ch 1 | | 29 | 44 | |
| | | | Ch 2 | | 19 | 29 | |
| Fall Time | t_f | | Ch 1 | | 13 | 20 | |
| | | | Ch 2 | | 26 | 39 | |
| Drain-Source Body Diode Characteristics | | | | | | | |
| Continuous Source-Drain Diode Current | I_S | $T_C = 25\text{ }^\circ\text{C}$ | Ch 1 | | | 2.5 | A |
| | | | Ch 2 | | | 2.1 | |
| Pulse Diode Forward Current ^a | I_{SM} | | Ch 1 | | | 20 | |
| | | | Ch 2 | | | 20 | |
| Body Diode Voltage | V_{SD} | $I_S = 1.6\text{ A}$ | Ch 1 | | 0.77 | 1.2 | V |
| | | | Ch 2 | | 0.79 | 1.2 | |
| Body Diode Reverse Recovery Time | t_{rr} | Channel 1 $I_F = 2\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$ | Ch 1 | | 21 | 42 | ns |
| | | | Ch 2 | | 18 | 36 | |
| Body Diode Reverse Recovery Charge | Q_{rr} | | Ch 1 | | 15 | 30 | nC |
| | | | Ch 2 | | 11 | 22 | |
| Reverse Recovery Fall Time | t_a | Channel 2 $I_F = 2\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$ | Ch 1 | | 13 | | ns |
| | | | Ch 2 | | 11 | | |
| Reverse Recovery Rise Time | t_b | | Ch 1 | | 8 | | |
| | | | Ch 2 | | 7 | | |

Notes:

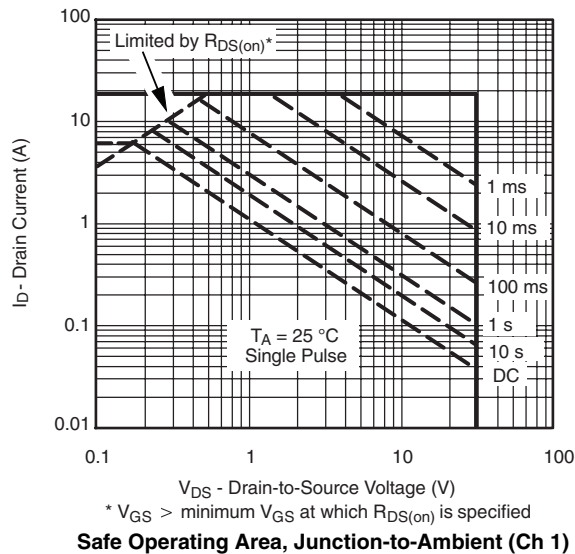
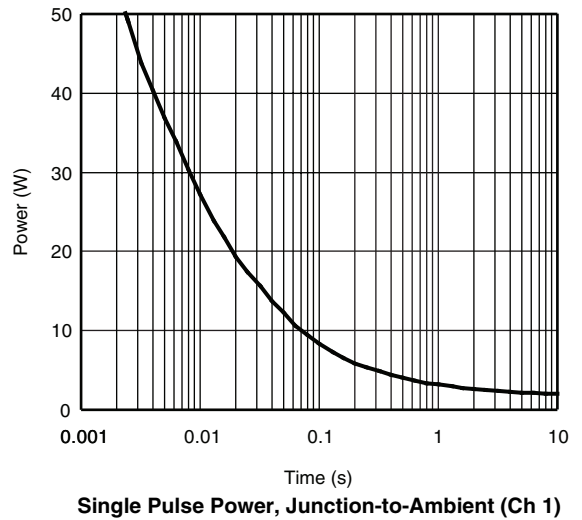
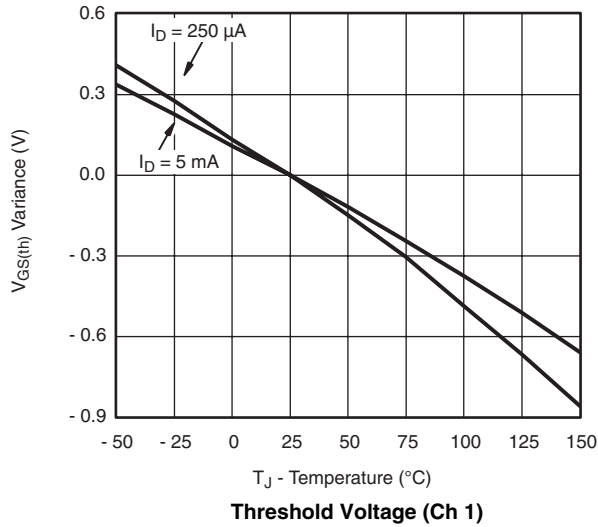
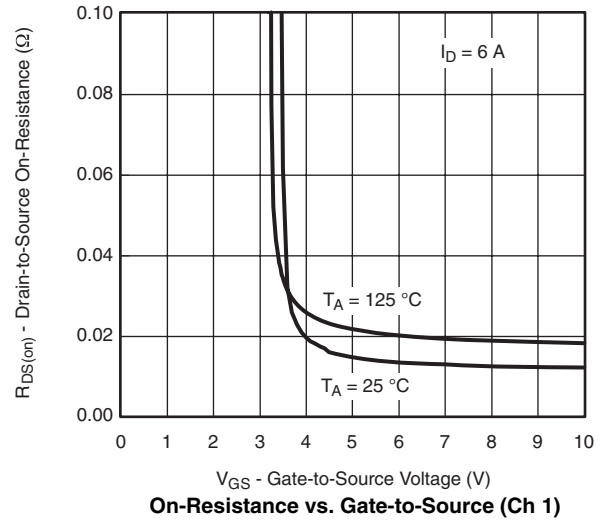
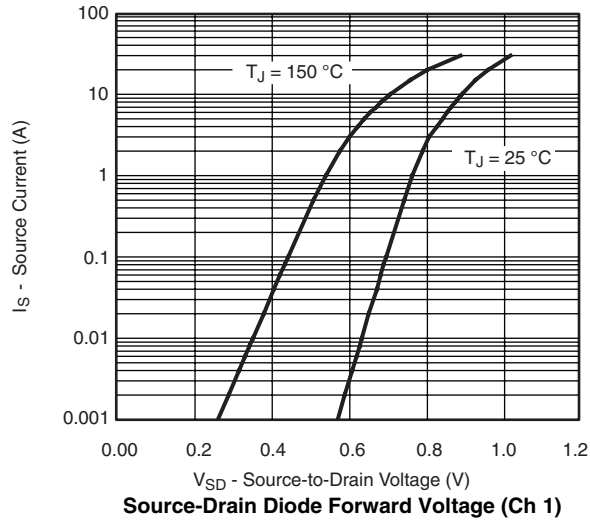
- a. Guaranteed by design, not subject to production testing.
- b. Pulse test; pulse width $\leq 300\ \mu\text{s}$, duty cycle $\leq 2\%$.

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.

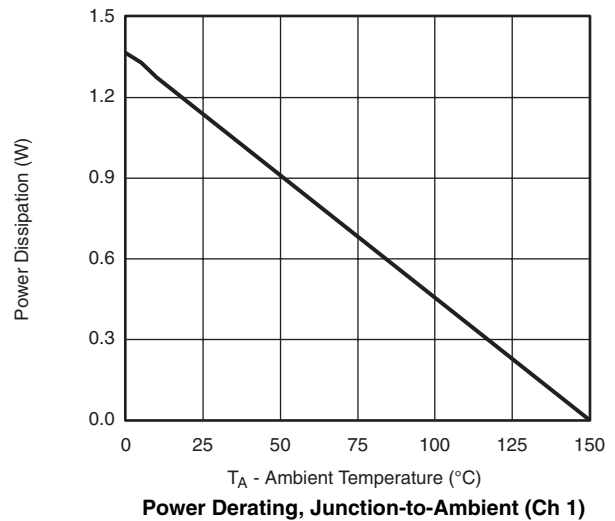
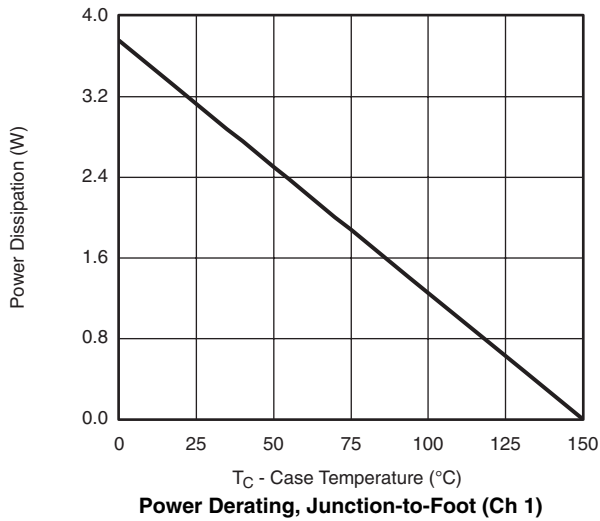
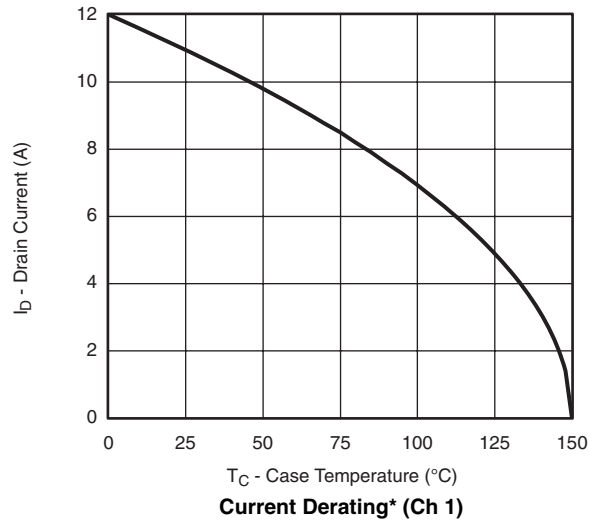
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



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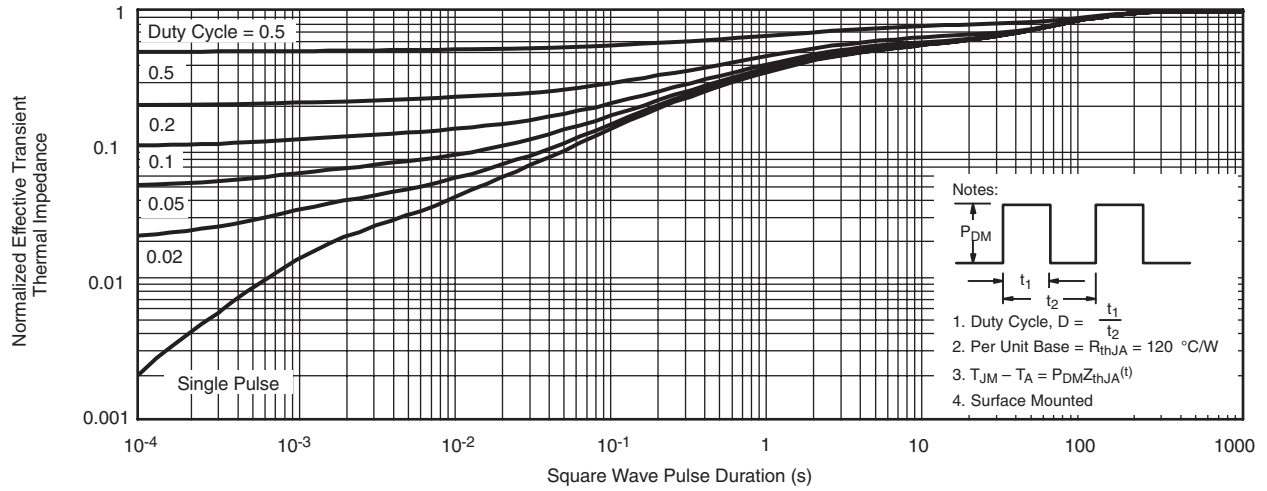


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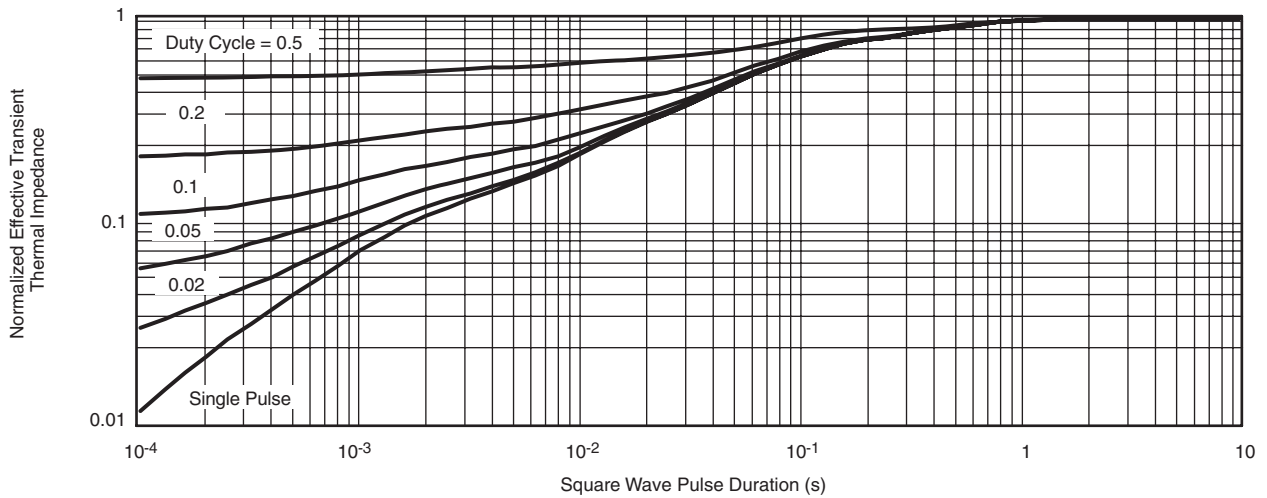


* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

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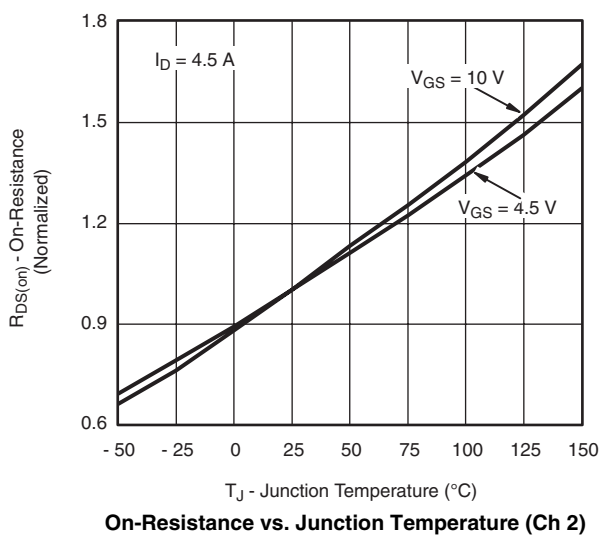
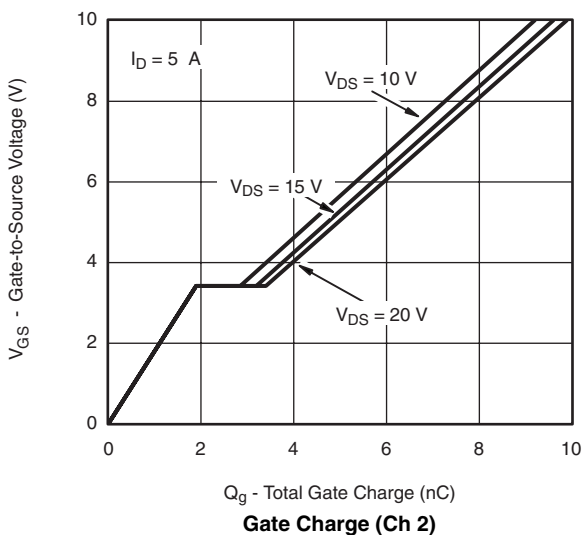
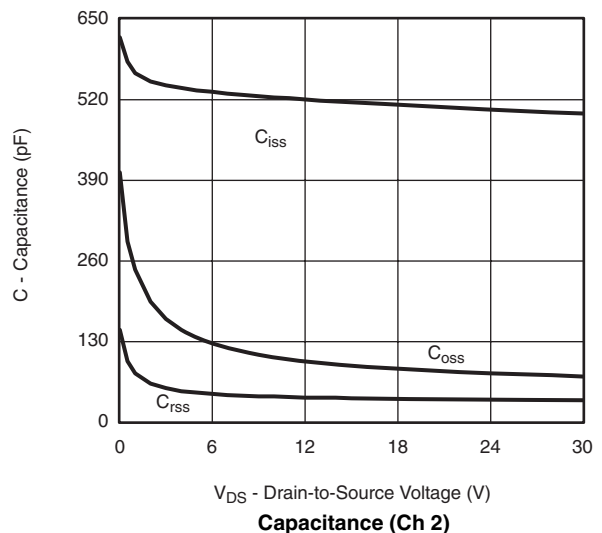
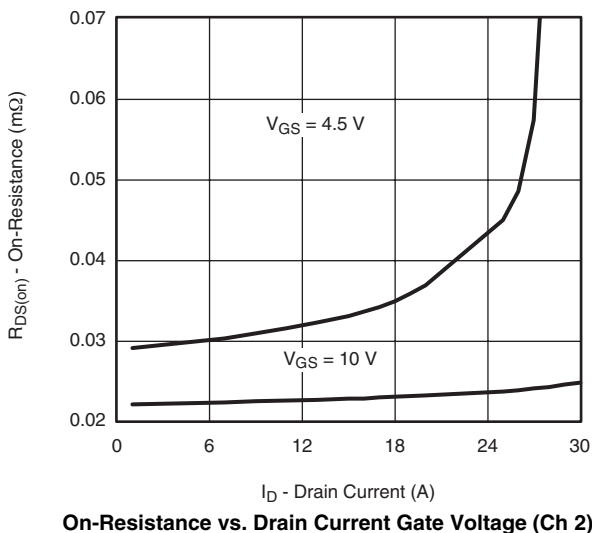
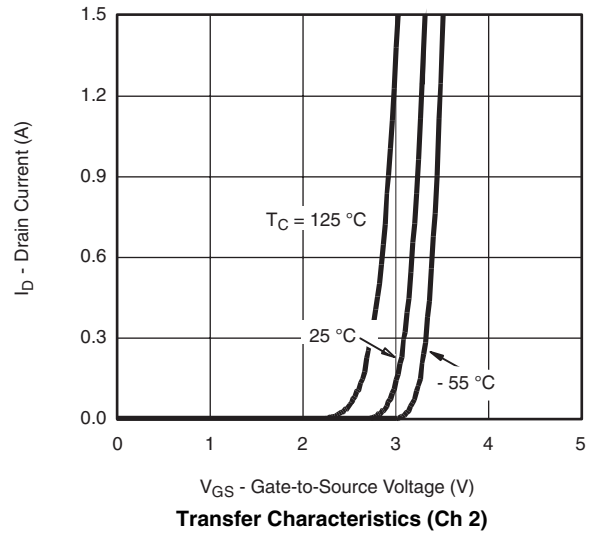
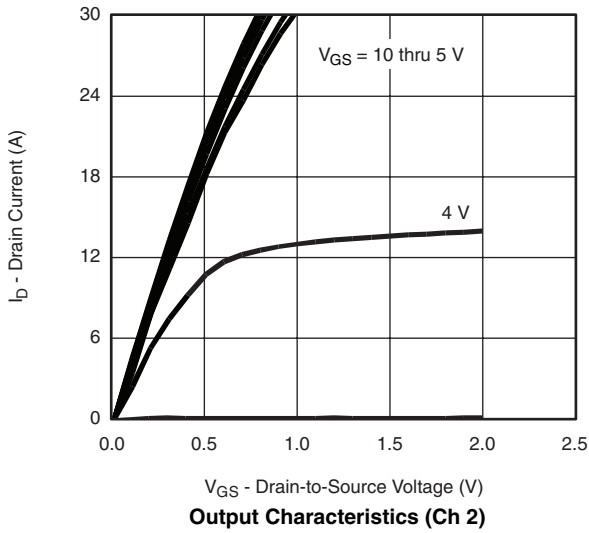


Normalized Thermal Transient Impedance, Junction-to-Ambient (Ch 1)

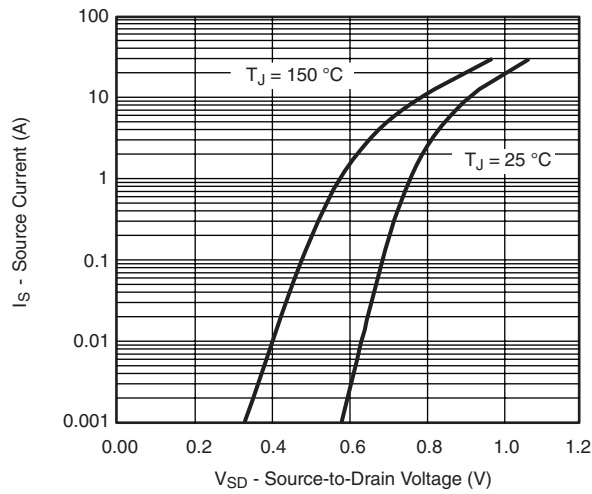


Normalized Thermal Transient Impedance, Junction-to-Case (Ch 1)

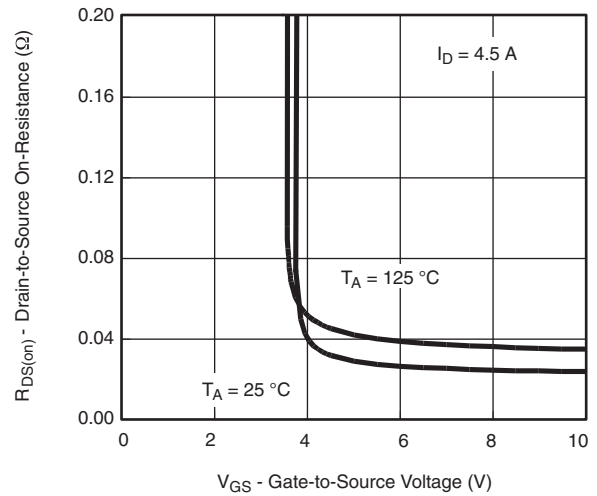
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



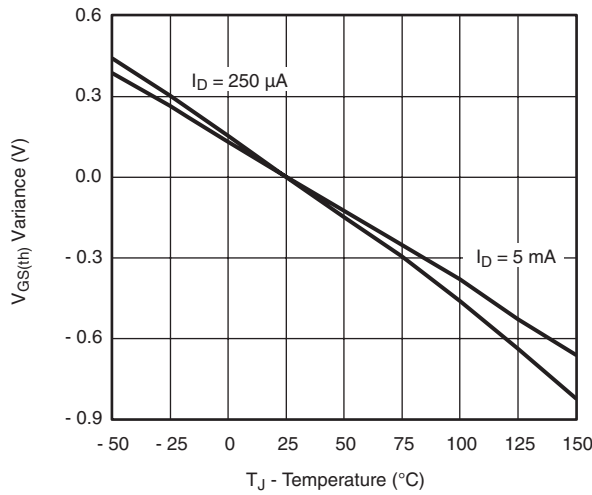
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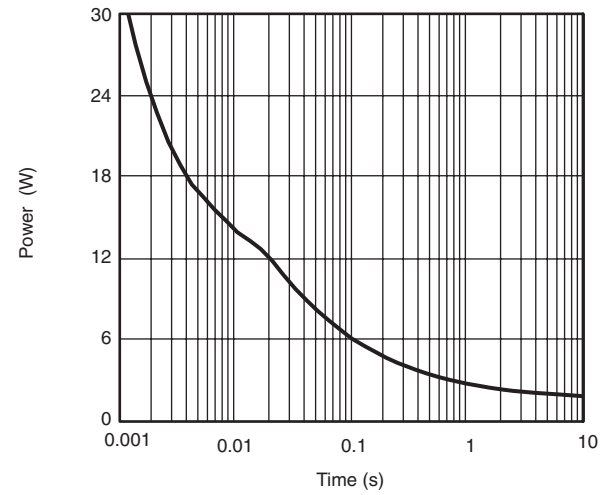
Source-Drain Diode Forward Voltage (Ch 2)



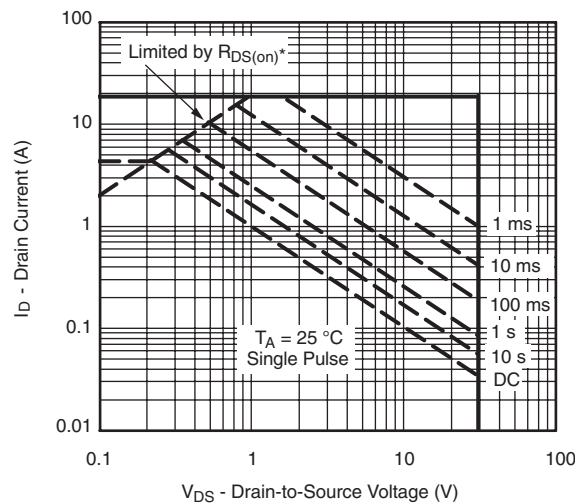
On-Resistance vs. Gate-to-Source Temperature (Ch 2)



Threshold Voltage (Ch 2)



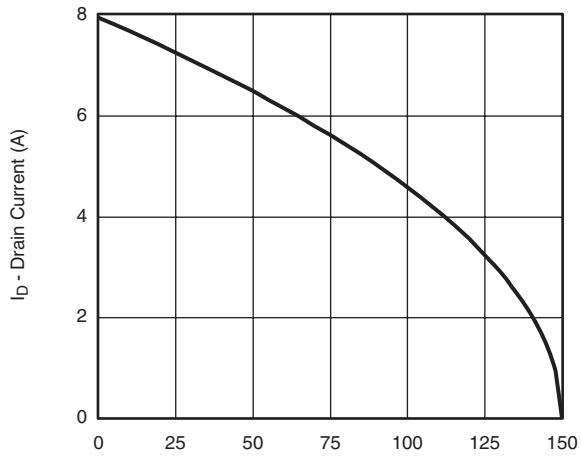
Single Pulse Power, Junction-to-Ambient (Ch 2)



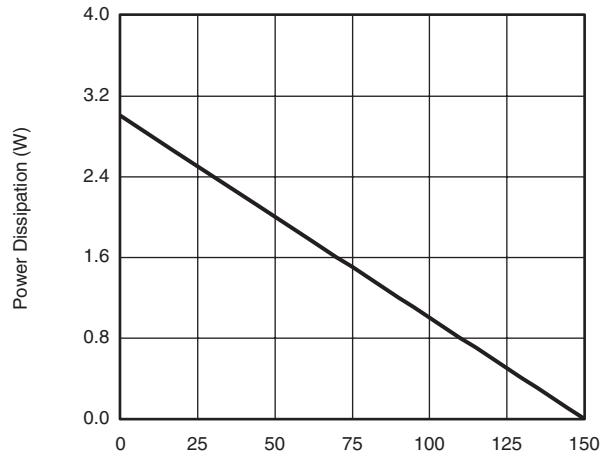
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient (Ch 2)

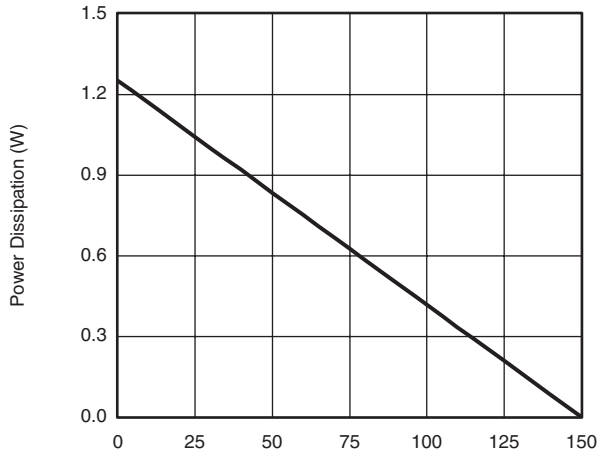
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



T_C - Case Temperature (°C)
Current Derating* (Ch 2)



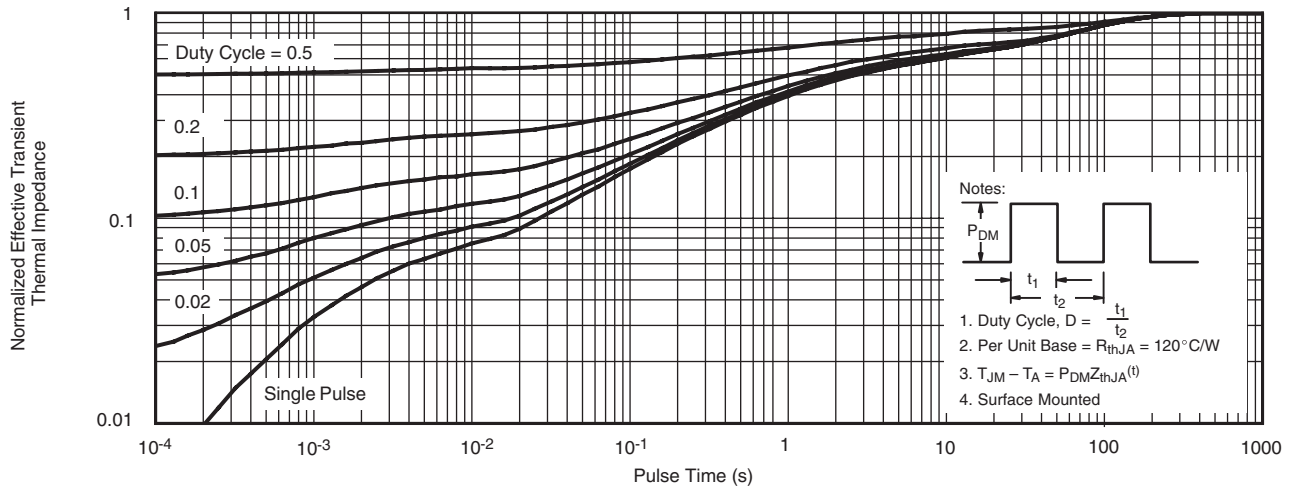
T_C - Case Temperature (°C)
Power Derating, Junction-to-Foot (Ch 2)



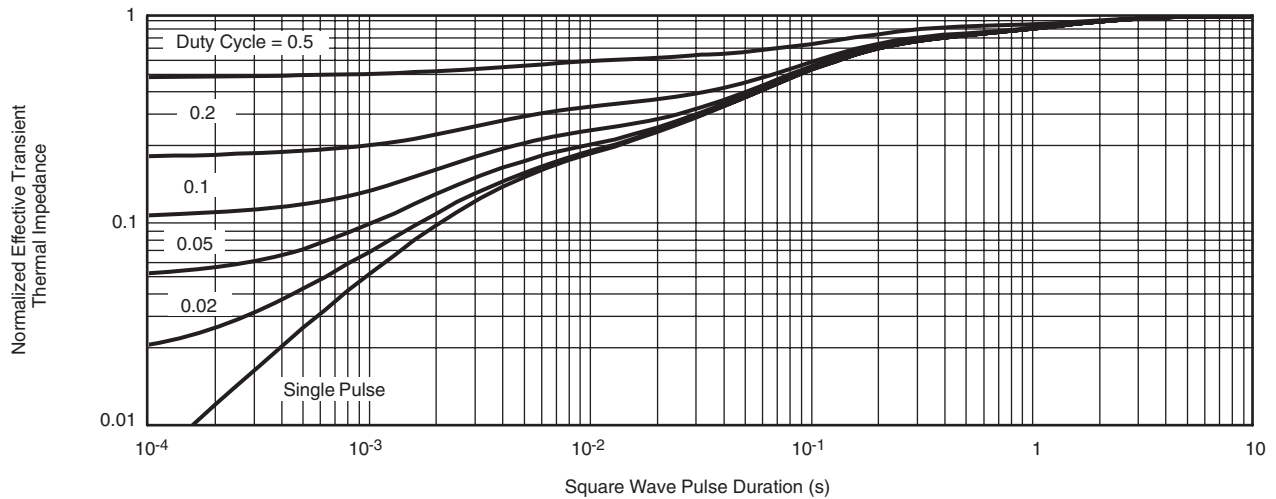
T_A - Ambient Temperature (°C)
Power Derating, Junction-to-Ambient (Ch 2)

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TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



Normalized Thermal Transient Impedance, Junction-to-Ambient (Ch 2)



Normalized Thermal Transient Impedance, Junction-to-Case (Ch 2)

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