

N-Channel 20-V (D-S) MOSFET

| PRODUCT SUMMARY | | | |
|---------------------|----------------------------------|---------------------------------|-----------------------|
| V _{DS} (V) | R _{DS(on)} (Ω) | I _D (A) ^a | Q _g (Typ.) |
| 20 | 0.046 at V _{GS} = 4.5 V | 6 | 3.5 nC |
| | 0.063 at V _{GS} = 2.5 V | 6 | |

FEATURES

- Halogen-free According to IEC 61249-2-21
- TrenchFET[®] Power MOSFET
- New Thermally Enhanced PowerPAK[®] SC-70 Package
 - Small Footprint Area
 - Low On-Resistance
- Typical ESD Protection 1200 V

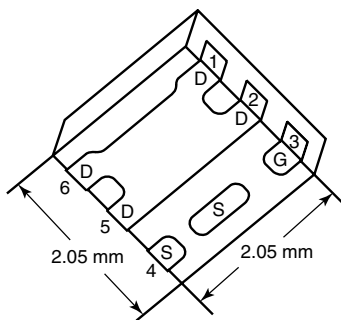


RoHS
COMPLIANT
HALOGEN
FREE

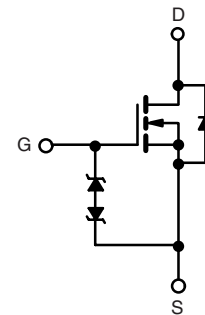
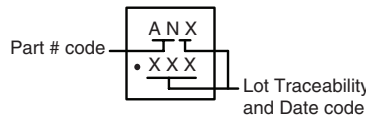
APPLICATIONS

- Load Switch for Portable Applications
- High Frequency DC/DC Converter

PowerPAK SC-70-6L-Single



Marking Code



Ordering Information: SiA438EDJ-T1-GE3 (Lead (Pb)-free and Halogen-free)

N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS T _A = 25 °C, unless otherwise noted | | | |
|---|-----------------------------------|------------------------|----------------------|
| Parameter | Symbol | Limit | Unit |
| Drain-Source Voltage | V _{DS} | 20 | V |
| Gate-Source Voltage | V _{GS} | ± 12 | |
| Continuous Drain Current (T _J = 150 °C) | I _D | T _C = 25 °C | 6 ^a |
| | | T _C = 70 °C | 6 ^a |
| | | T _A = 25 °C | 5.7 ^{b, c} |
| | | T _A = 70 °C | 4.5 ^{b, c} |
| Pulsed Drain Current | I _{DM} | 15 | A |
| Continuous Source-Drain Diode Current | I _S | T _C = 25 °C | |
| | | T _A = 25 °C | 1.75 ^{b, c} |
| Maximum Power Dissipation | P _D | T _C = 25 °C | 11.4 |
| | | T _C = 70 °C | 7.3 |
| | | T _A = 25 °C | 2.4 ^{b, c} |
| | | T _A = 70 °C | 1.5 ^{b, c} |
| Operating Junction and Storage Temperature Range | T _J , T _{stg} | - 55 to 150 | °C |
| Soldering Recommendations (Peak Temperature) ^{d, e} | | 260 | |

| THERMAL RESISTANCE RATINGS | | | | | |
|---|--------------|-------------------|---------|---------|------|
| Parameter | | Symbol | Typical | Maximum | Unit |
| Maximum Junction-to-Ambient ^{b, f} | t ≤ 5 s | R _{thJA} | 41 | 52 | °C/W |
| Maximum Junction-to-Case (Drain) | Steady State | R _{thJC} | 9 | 11 | |

Notes:

- Package limited
- Surface Mounted on 1" x 1" FR4 board.
- t = 5 s.
- See Solder Profile (www.vishay.com/ppg?7325Z). The PowerPAK SC-70 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.
- Rework Conditions: manual soldering with a soldering iron is not recommended for leadless components.
- Maximum under Steady State conditions is 90 °C/W.

| SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted | | | | | | |
|--|-------------------------|--|------|-------|----------|----------------------|
| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$ | 20 | | | V |
| V_{DS} Temperature Coefficient | $\Delta V_{DS}/T_J$ | $I_D = 250\text{ }\mu\text{A}$ | | 23 | | mV/ $^\circ\text{C}$ |
| $V_{GS(th)}$ Temperature Coefficient | $\Delta V_{GS(th)}/T_J$ | | | - 3.3 | | |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$ | 0.6 | | 1.4 | V |
| Gate-Source Leakage | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$ | | | ± 70 | μA |
| | | $V_{DS} = 0\text{ V}, V_{GS} = \pm 4.5\text{ V}$ | | | ± 1 | |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$ | | | - 1 | |
| | | $V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$ | | | - 10 | |
| On-State Drain Current ^a | $I_{D(on)}$ | $V_{DS} \geq 5\text{ V}, V_{GS} = 4.5\text{ V}$ | 10 | | | A |
| Drain-Source On-State Resistance ^a | $R_{DS(on)}$ | $V_{GS} = 4.5\text{ V}, I_D = 3.9\text{ A}$ | | 0.037 | 0.046 | Ω |
| | | $V_{GS} = 2.5\text{ V}, I_D = 3.3\text{ A}$ | | 0.051 | 0.063 | |
| Forward Transconductance ^a | g_{fs} | $V_{DS} = 10\text{ V}, I_D = 3.9\text{ A}$ | | 14 | | S |
| Dynamic^b | | | | | | |
| Input Capacitance | C_{iss} | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$ | | 350 | | pF |
| Output Capacitance | C_{oss} | | | 63 | | |
| Reverse Transfer Capacitance | C_{rss} | | | 37 | | |
| Total Gate Charge | Q_g | $V_{DS} = 10\text{ V}, V_{GS} = 10\text{ V}, I_D = 5.1\text{ A}$ | | 7.5 | 12 | nC |
| | | $V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 5.1\text{ A}$ | | 3.5 | 5.5 | |
| Gate-Source Charge | Q_{gs} | | | 0.95 | | |
| Gate-Drain Charge | Q_{gd} | | 0.75 | | | |
| Gate Resistance | R_g | $f = 1\text{ MHz}$ | | 3.5 | | Ω |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = 10\text{ V}, R_L = 2.4\text{ }\Omega$ $I_D \cong 4.1\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$ | | 10 | 15 | ns |
| Rise Time | t_r | | | 12 | 20 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 18 | 30 | |
| Fall Time | t_f | | | 12 | 20 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD} = 10\text{ V}, R_L = 2.4\text{ }\Omega$ $I_D \cong 4.1\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$ | | 5 | 10 | |
| Rise Time | t_r | | | 12 | 20 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 15 | 25 | |
| Fall Time | t_f | | | 10 | 15 | |
| Drain-Source Body Diode Characteristics | | | | | | |
| Continuous Source-Drain Diode Current | I_S | $T_C = 25\text{ }^\circ\text{C}$ | | | 6 | A |
| Pulse Diode Forward Current | I_{SM} | | | | 15 | |
| Body Diode Voltage | V_{SD} | $I_S = 4.1\text{ A}, V_{GS} = 0\text{ V}$ | | 0.8 | 1.2 | V |
| Body Diode Reverse Recovery Time | t_{rr} | $I_F = 4.1\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$ | | 15 | 30 | ns |
| Body Diode Reverse Recovery Charge | Q_{rr} | | | 8 | 20 | nC |
| Reverse Recovery Fall Time | t_a | | | 8 | | ns |
| Reverse Recovery Rise Time | t_b | | | 7 | | |

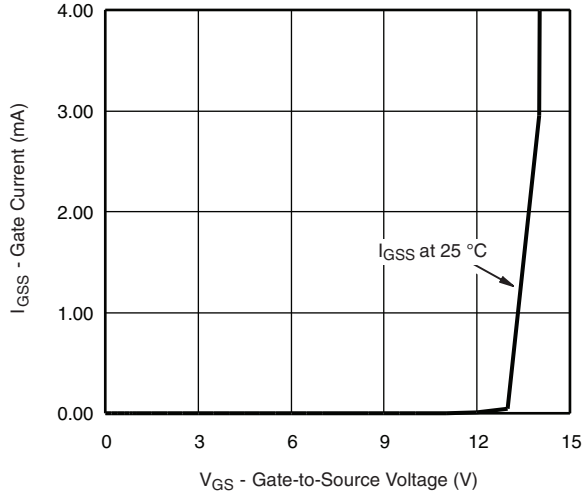
Notes:

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

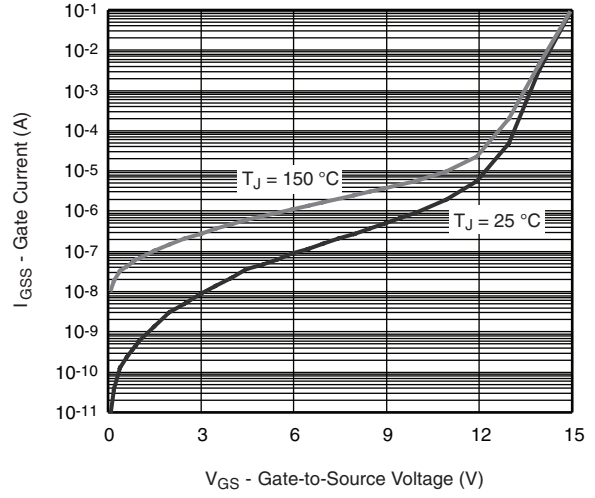
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



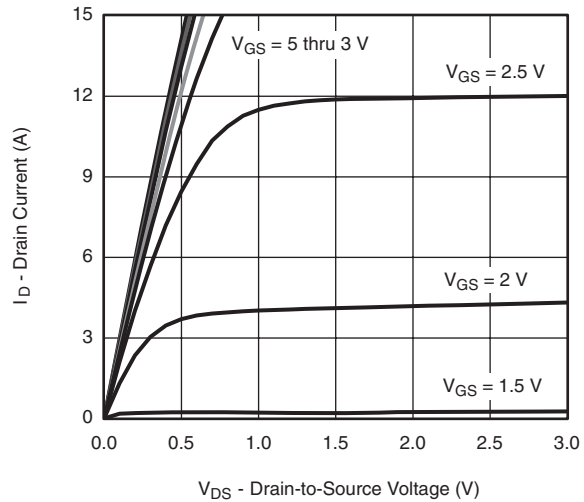
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



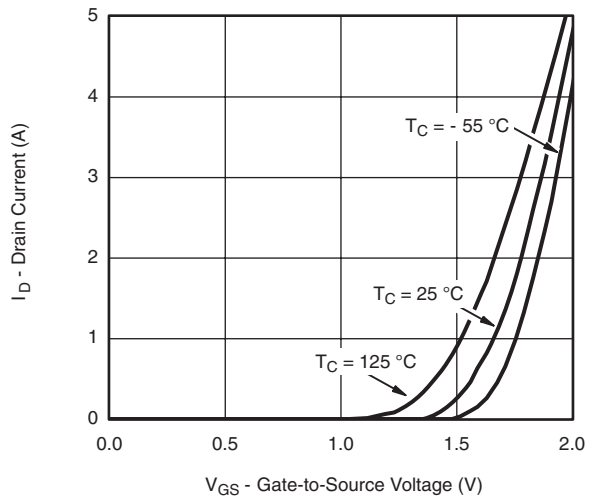
Gate Current vs. Gate-Source Voltage



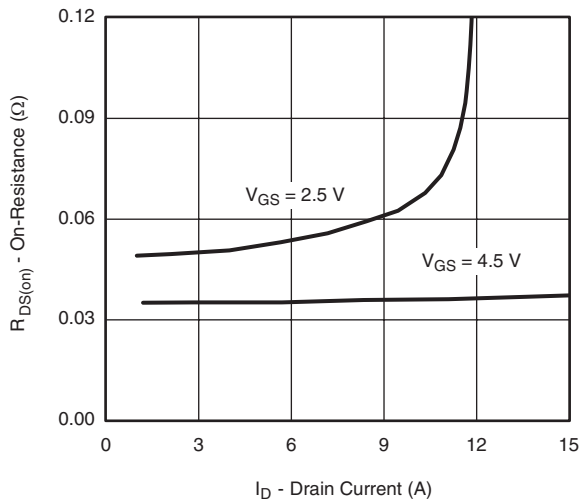
Gate Current vs. Gate-Source Voltage



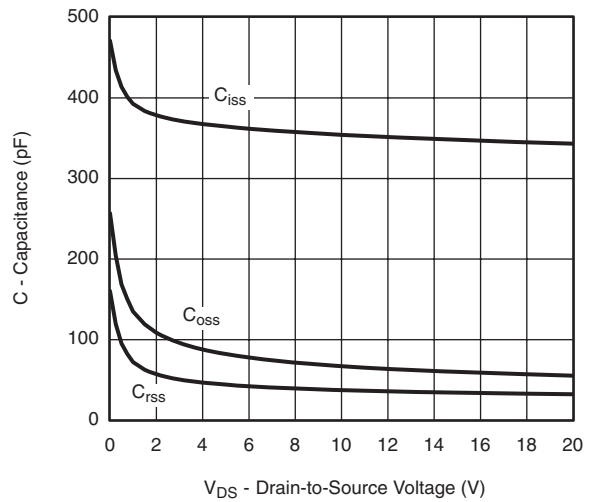
Output Characteristics



Transfer Characteristics



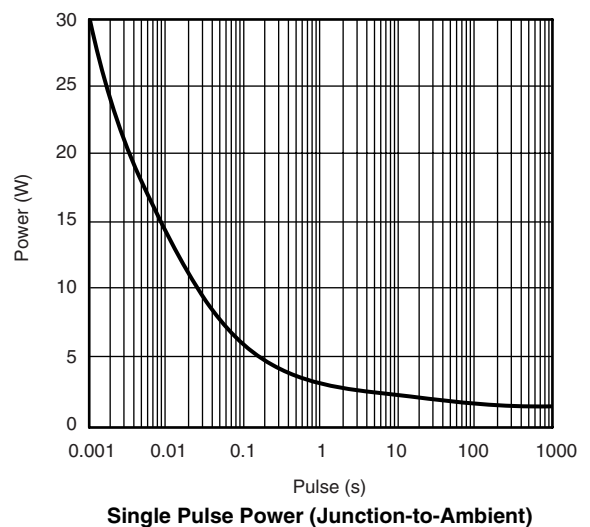
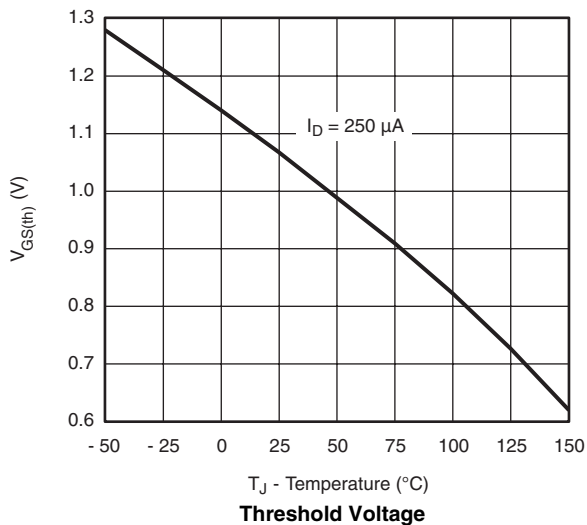
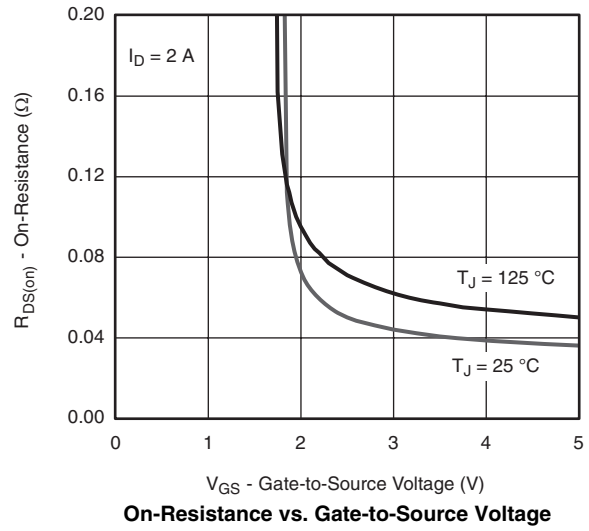
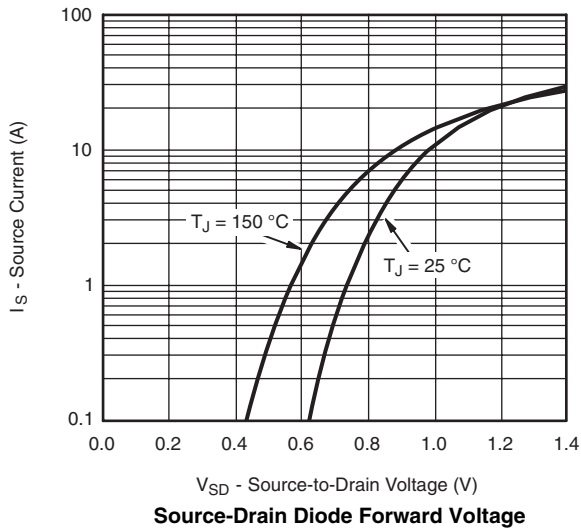
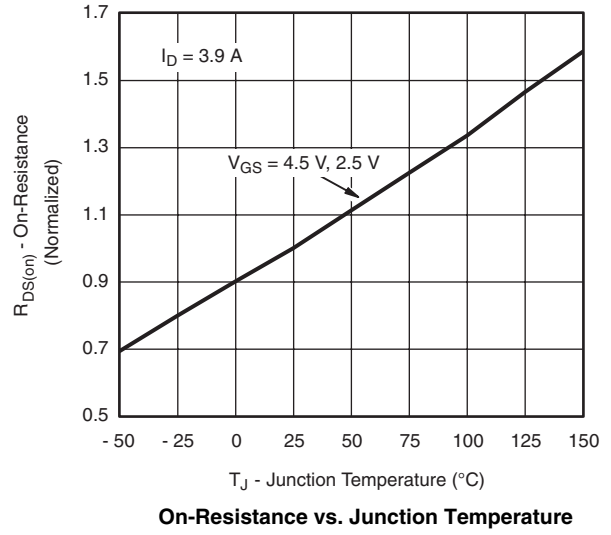
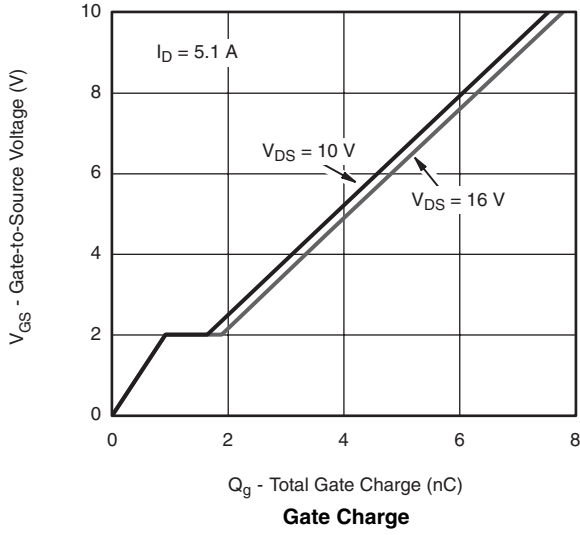
On-Resistance vs. Drain Current and Gate Voltage



Capacitance

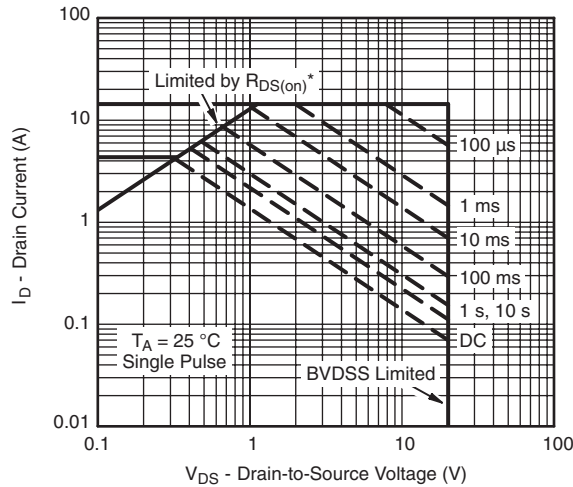


TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



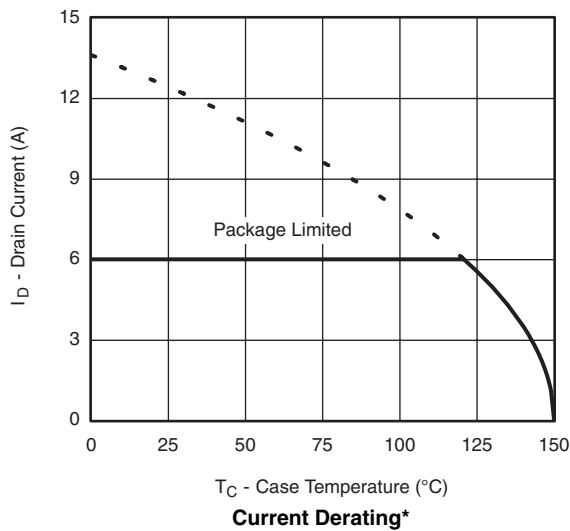


TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

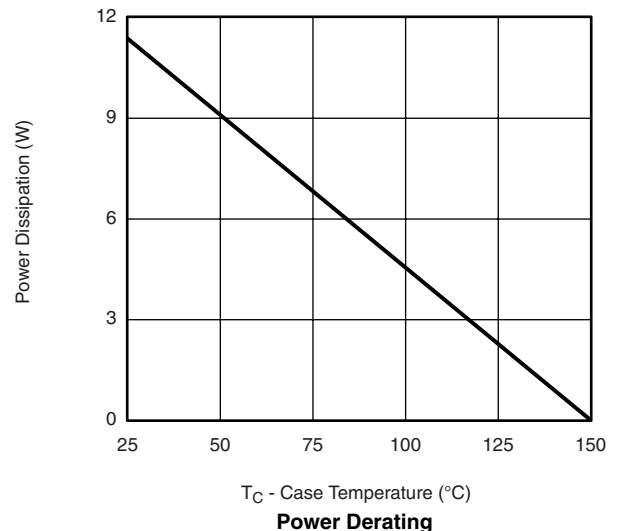


* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient



Current Derating*

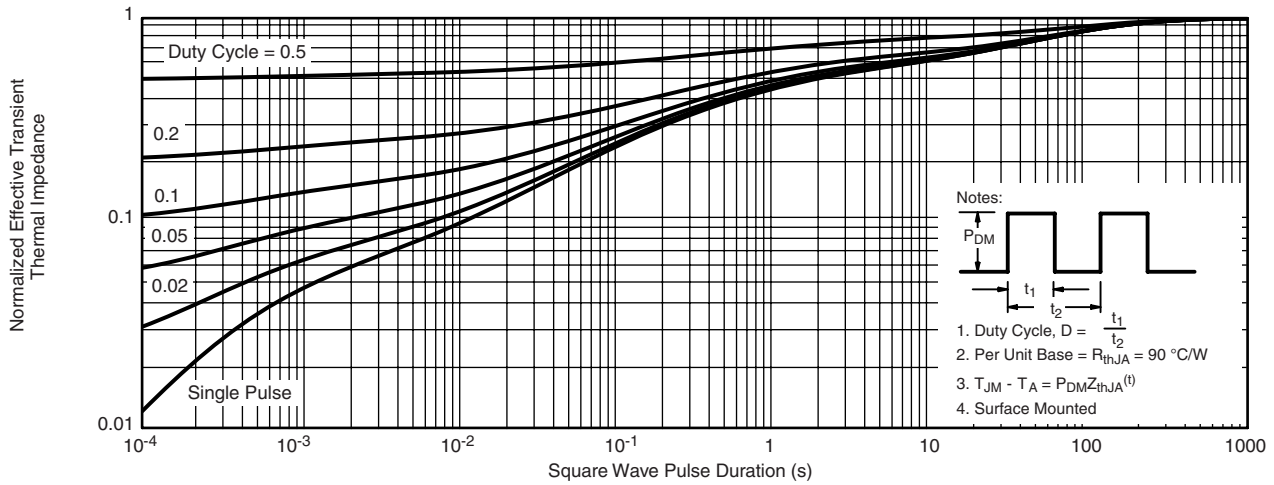


Power Derating

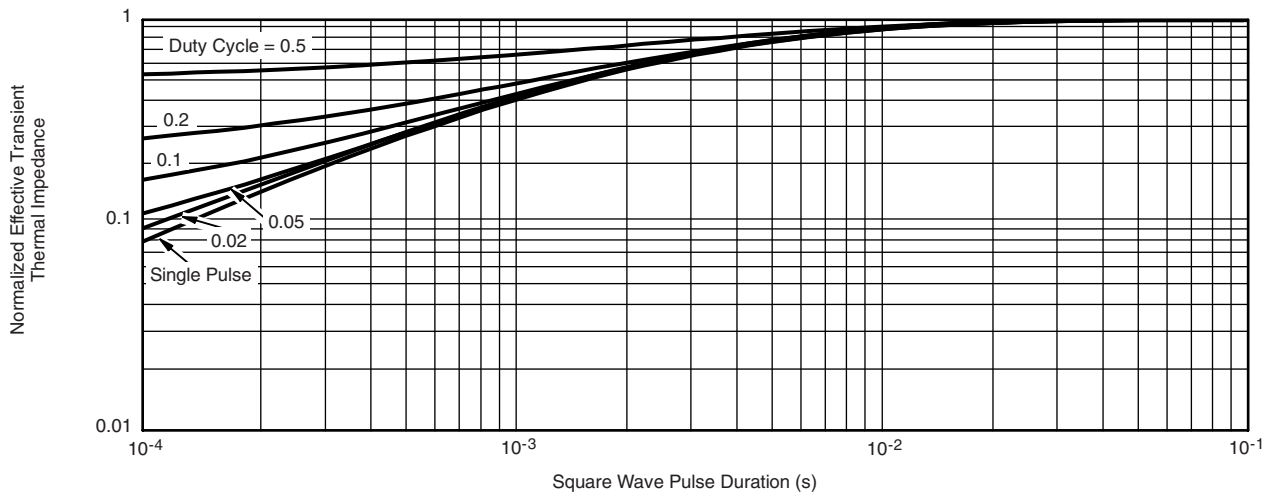
* The power dissipation P_D is based on $T_{J(max)} = 150\text{ }^\circ\text{C}$, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below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



TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

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