

Automotive N-Channel 60 V (D-S) 175 °C MOSFET

| PRODUCT SUMMARY | |
|---|--------|
| V _{DS} (V) | 60 |
| R _{DS(on)} (Ω) at V _{GS} = 10 V | 0.025 |
| I _D (A) | 5.6 |
| Configuration | Single |

FEATURES

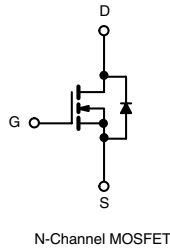
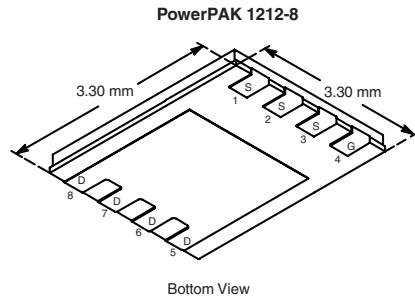
- TrenchFET® Power MOSFET
- Package with Low Thermal Resistance

AEC Q101 RELIABILITY

- Passed all AEC Q101 Reliability Testing



Available
RoHS*
COMPLIANT



| ORDERING INFORMATION | |
|---------------------------------|----------------|
| Package | PowerPAK1212-8 |
| Lead (Pb)-free and Halogen-free | SQ7414EN-T1-E3 |
| SnPb | SQ7414EN-T1 |

| ABSOLUTE MAXIMUM RATINGS T _C = 25 °C, unless otherwise noted | | | |
|---|-----------------------------------|------------------------|------|
| PARAMETER | SYMBOL | LIMIT | UNIT |
| Drain-Source Voltage | V _{DS} | 60 | V |
| Gate-Source Voltage | V _{GS} | ± 20 | |
| Continuous Drain Current ^a | I _D | T _C = 25 °C | A |
| | | T _C = 70 °C | |
| Continuous Source Current (Diode Conduction) ^a | I _S | 1.3 | A |
| Pulsed Drain Current ^b | I _{DM} | 30 | |
| Single Pulse Avalanche Energy | E _{AS} | 18 | |
| Single Pulse Avalanche Current | I _{AS} | 19 | A |
| Maximum Power Dissipation ^b | P _D | T _C = 25 °C | W |
| | | T _A = 25 °C | |
| Operating Junction and Storage Temperature Range | T _J , T _{stg} | - 55 to + 175 | °C |

| THERMAL RESISTANCE RATINGS | | | |
|----------------------------|-------------------|-------|------|
| PARAMETER | SYMBOL | LIMIT | UNIT |
| Junction-to-Ambient | R _{thJA} | 81 | °C/W |
| Junction-to-Case (Drain) | R _{thJC} | 2.4 | |

Notes

- Package limited.
- Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %.
- When mounted on 1" square PCB (FR-4 material).

* Pb containing terminations are not RoHS compliant, exemptions may apply

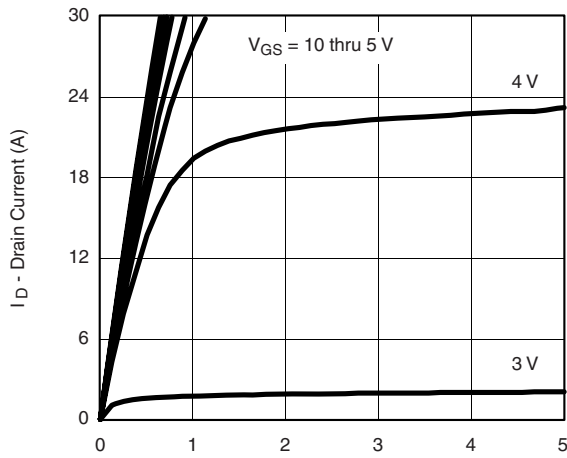
| SPECIFICATIONS $T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted | | | | | | |
|---|---------------|---|------|-------|-----------|---------------|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | V_{DS} | $V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$ | - | - | - | V |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$ | 1.5 | - | 3 | |
| Gate-Source Leakage | I_{GSS} | $V_{DS} = 0\text{ V}$, $V_{GS} = \pm 20\text{ V}$ | - | - | ± 100 | nA |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS} = 0\text{ V}$ $V_{DS} = 60\text{ V}$ | - | - | 1.0 | μA |
| | | $V_{GS} = 0\text{ V}$ $V_{DS} = 60\text{ V}$, $T_J = 55\text{ }^\circ\text{C}$ | - | - | 5 | |
| | | $V_{GS} = 0\text{ V}$ $V_{DS} = 60\text{ V}$, $T_J = 175\text{ }^\circ\text{C}$ | - | - | - | |
| On-State Drain Current ^a | $I_{D(on)}$ | $V_{GS} = 10\text{ V}$ $V_{DS} \geq 5\text{ V}$ | 30 | - | - | A |
| Drain-Source On-State Resistance ^a | $R_{DS(on)}$ | $V_{GS} = 10\text{ V}$ $I_D = 8.7\text{ A}$ | - | 0.021 | 0.025 | Ω |
| | | $V_{GS} = 10\text{ V}$ $I_D = 30\text{ A}$, $T_J = 125\text{ }^\circ\text{C}$ | - | - | - | |
| | | $V_{GS} = 10\text{ V}$ $I_D = 30\text{ A}$, $T_J = 175\text{ }^\circ\text{C}$ | - | - | - | |
| Forward Transconductance ^a | g_{fs} | $V_{DS} = 15\text{ V}$, $I_D = 8.7\text{ A}$ | - | 18 | - | S |
| Dynamic^b | | | | | | |
| Input Capacitance | C_{iss} | $V_{GS} = 0\text{ V}$ $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$ | - | - | - | μF |
| Output Capacitance | C_{oss} | | - | - | - | |
| Reverse Transfer Capacitance | C_{rss} | | - | - | - | |
| Total Gate Charge ^c | Q_g | $V_{GS} = 10\text{ V}$ $V_{DS} = 30\text{ V}$, $I_D = 8.7\text{ A}$ | - | 16 | 25 | nC |
| Gate-Source Charge ^c | Q_{gs} | | - | 2.7 | - | |
| Gate-Drain Charge ^c | Q_{gd} | | - | 4.4 | - | |
| Turn-On Delay Time ^c | $t_{d(on)}$ | $V_{DD} = 30\text{ V}$, $R_L = 30\text{ }\Omega$ $I_D \cong 1\text{ A}$, $V_{GEN} = 10\text{ V}$, $R_g = 6\text{ }\Omega$ | - | 15 | 25 | ns |
| Rise Time ^c | t_r | | - | 12 | 20 | |
| Turn-Off Delay Time ^c | $t_{d(off)}$ | | - | 30 | 50 | |
| Fall Time ^c | t_f | | - | 12 | 20 | |
| Source-Drain Diode Ratings and Characteristics $T_C = 25\text{ }^\circ\text{C}$^b | | | | | | |
| Pulsed Current ^a | I_{SM} | | - | - | - | A |
| Forward Voltage | V_{SD} | $I_F = 85\text{ A}$, $V_{GS} = 0\text{ V}$ | - | - | - | V |
| Reverse Recovery Time | t_{rr} | $I_F = 3.2\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ | - | 45 | 90 | ns |
| Peak Reverse Recovery Current | $I_{RM(REC)}$ | | - | - | - | A |
| Reverse Recovery Charge | Q_{rr} | | - | - | - | μC |

Notes

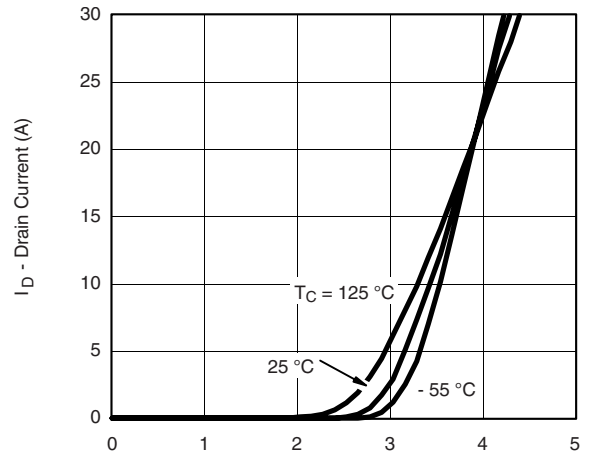
- Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
- Guaranteed by design, not subject to production testing.
- Independent of operating temperature.

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.

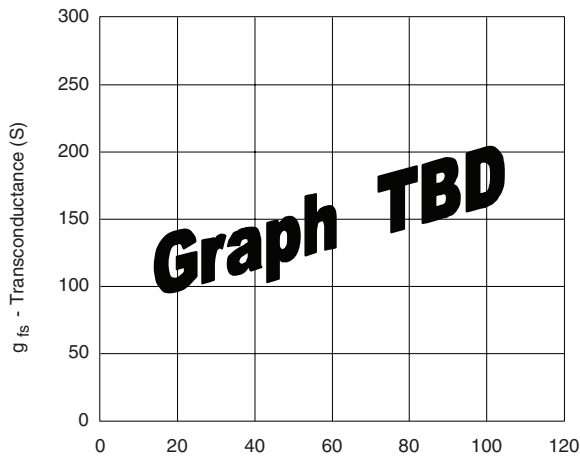
TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted



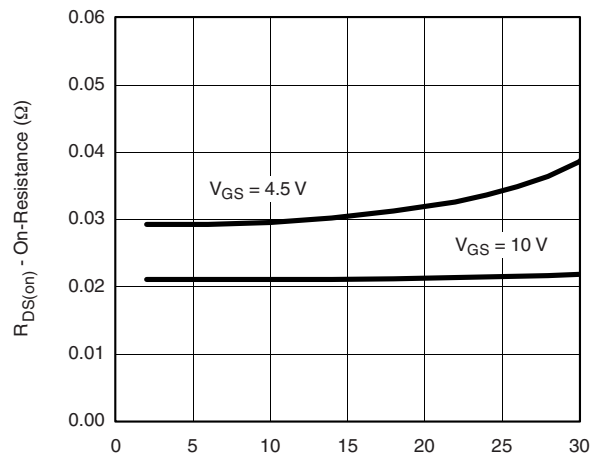
Output Characteristics



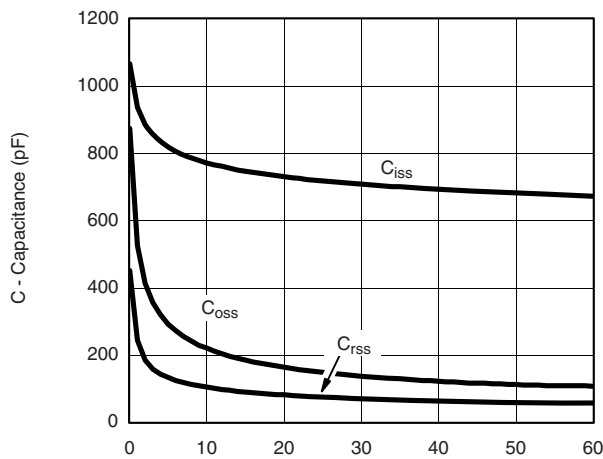
Transfer Characteristics



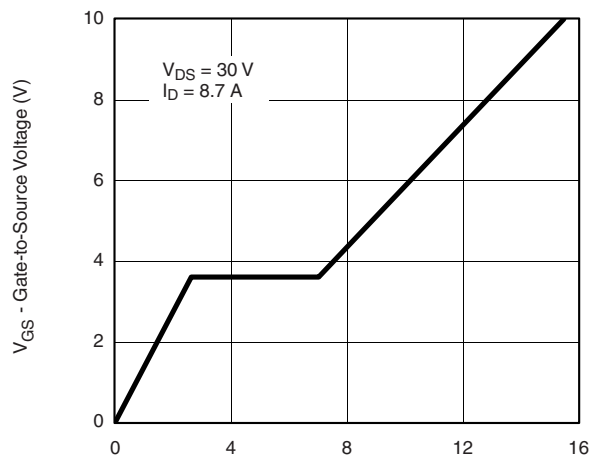
Transconductance



On-Resistance vs. Drain Current

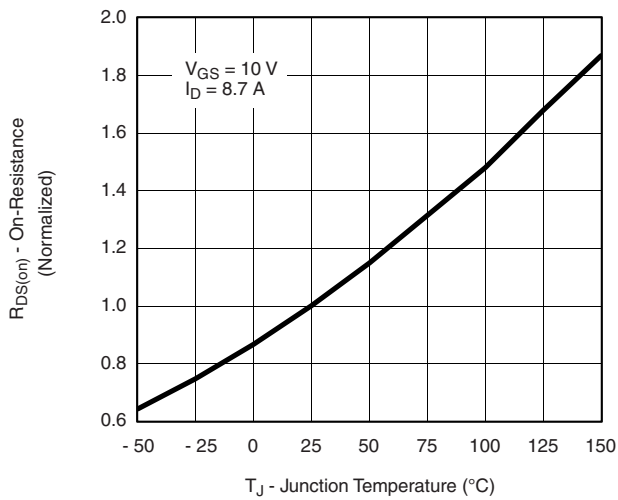


Capacitance

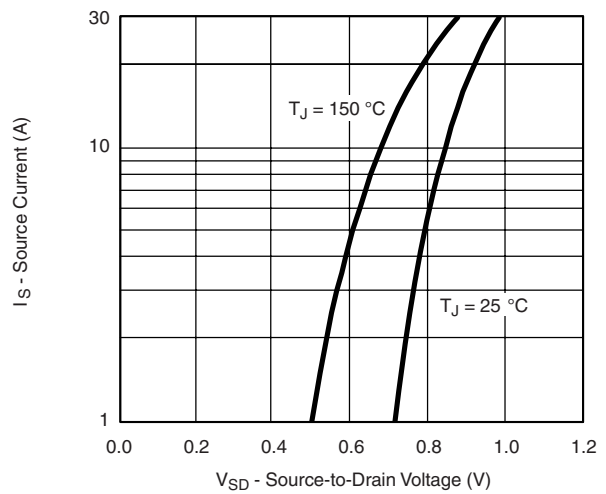


Gate Charge

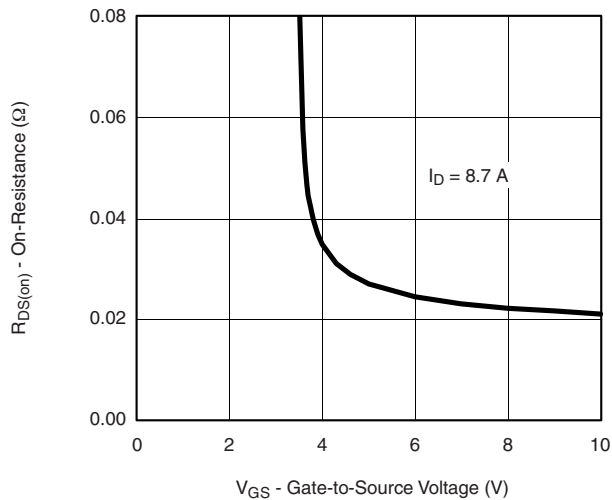
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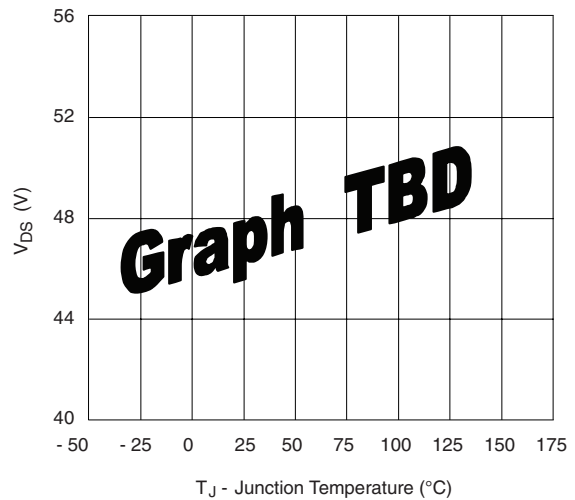
On-Resistance vs. Junction Temperature



Source Drain Diode Forward Voltage

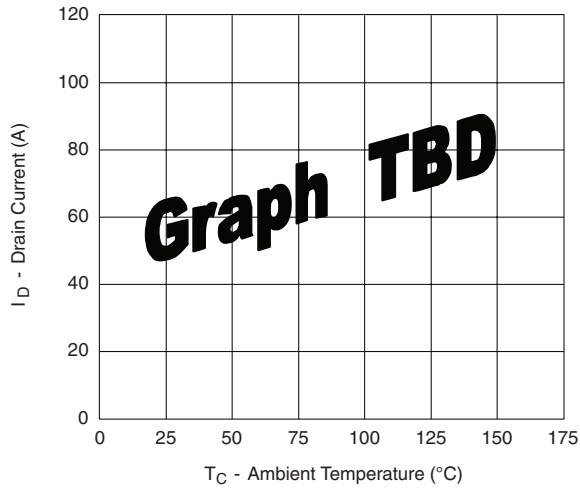


On-Resistance vs. Gate-to-Source Voltage

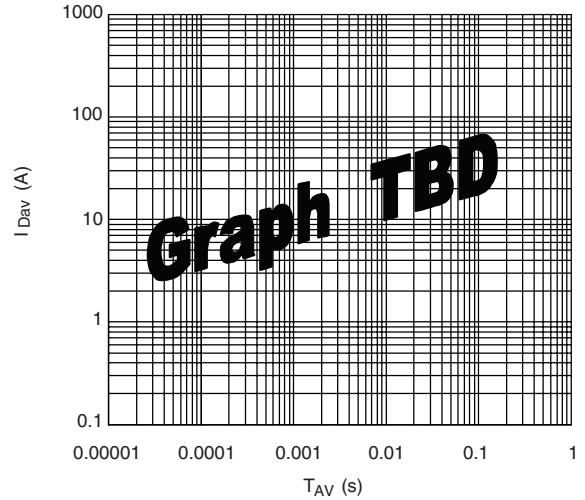


Drain Source Breakdown vs. Junction Temperature

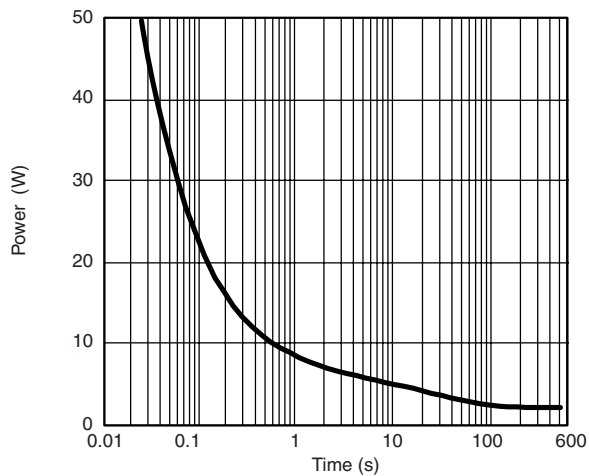
THERMAL RATINGS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted



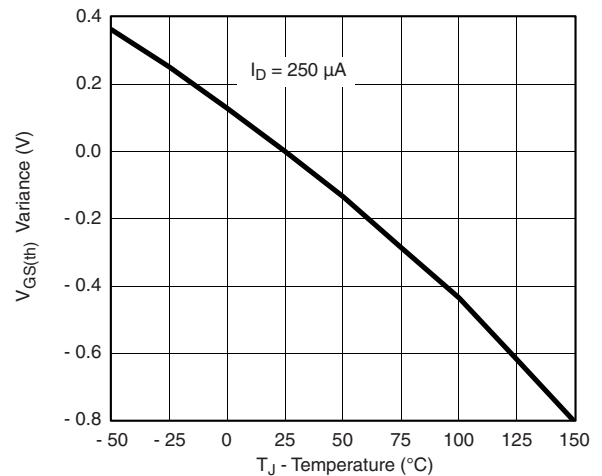
Maximum Drain Current vs. Ambient Temperature



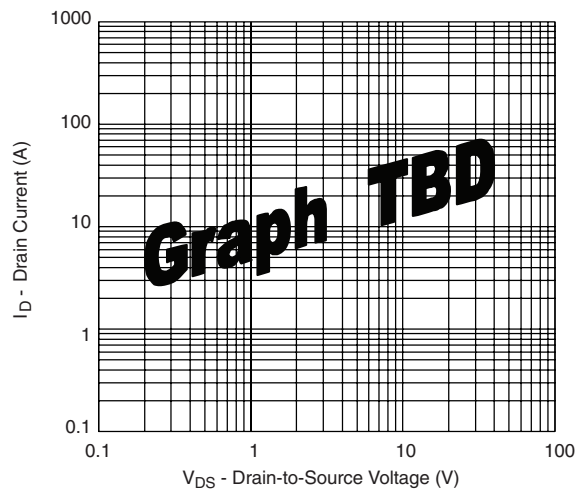
Avalanche Current vs. Time



Single Pulse Power, Junction-to-Ambient



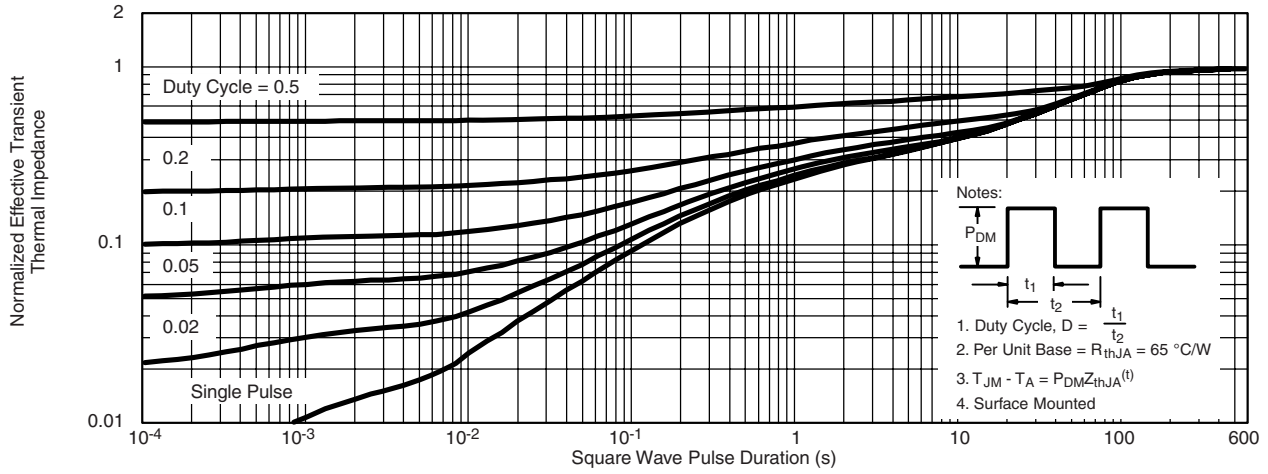
Threshold Voltage



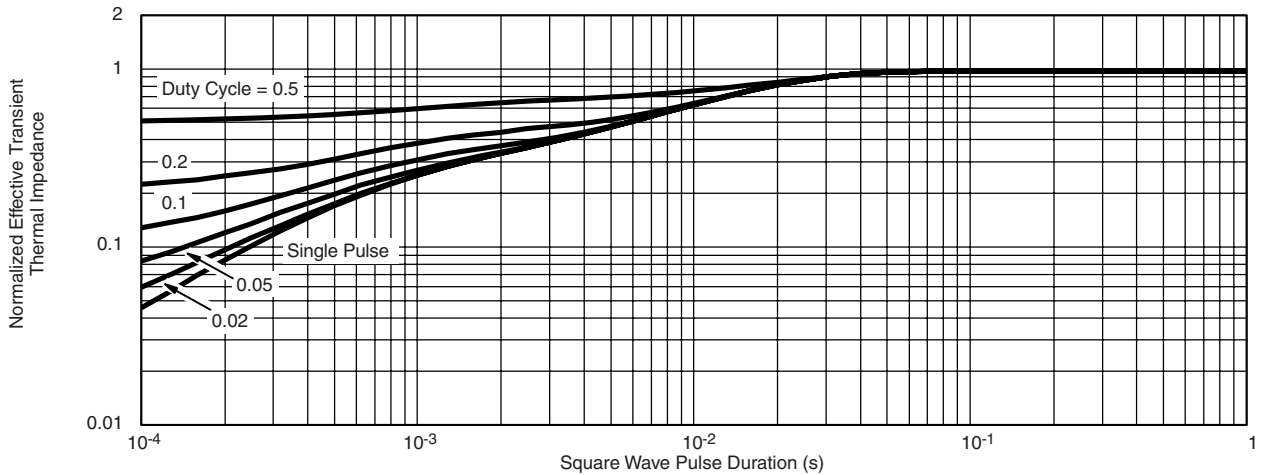
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area

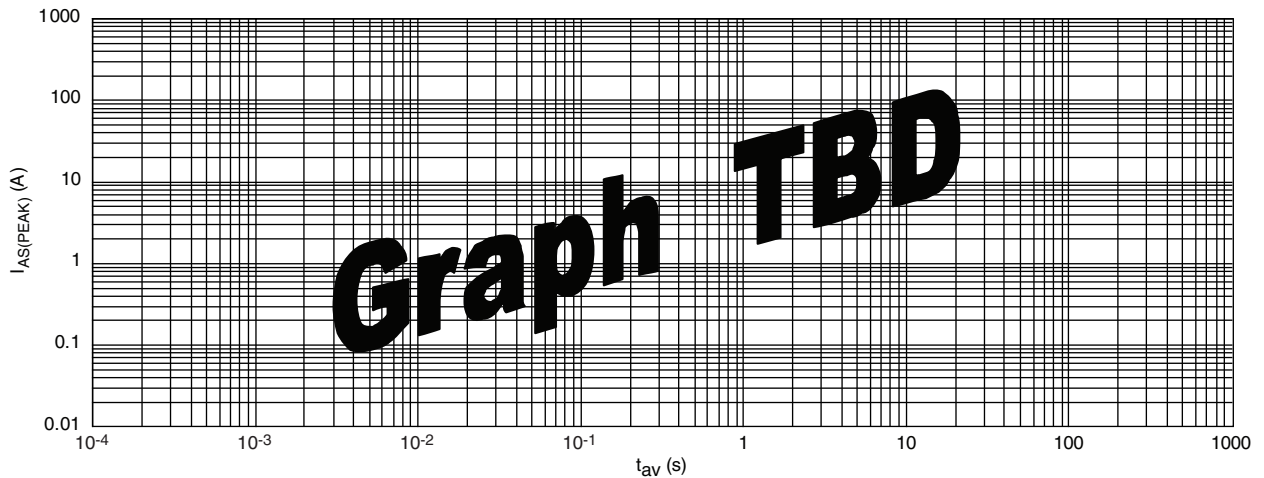
THERMAL RATINGS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted



Normalized Thermal Transient Impedance, Junction-to-Case

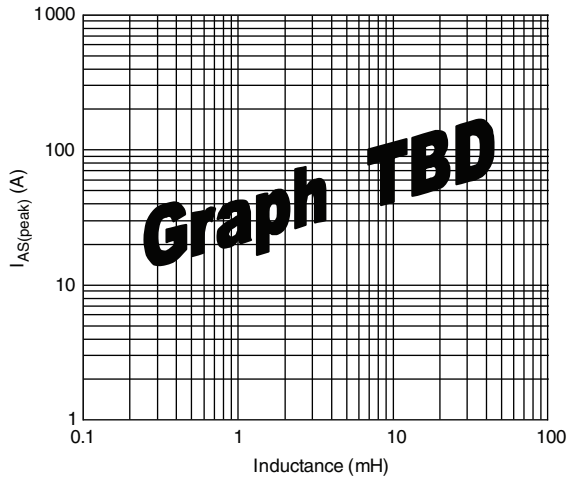


Normalized Thermal Transient Impedance, Junction-to-Ambient

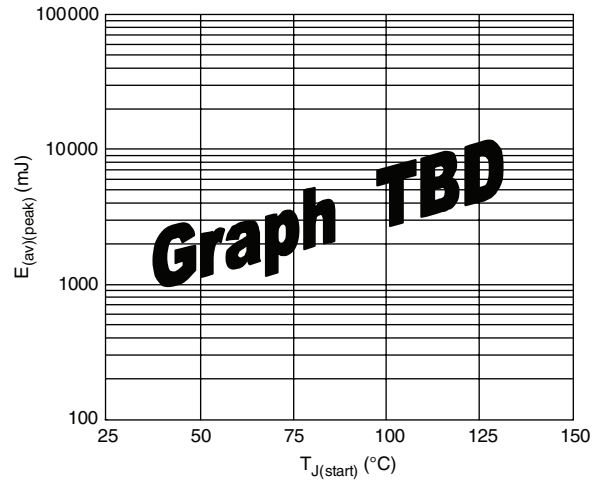


Single Pulse Avalanche Current (Peak) vs. Time in Avalanche

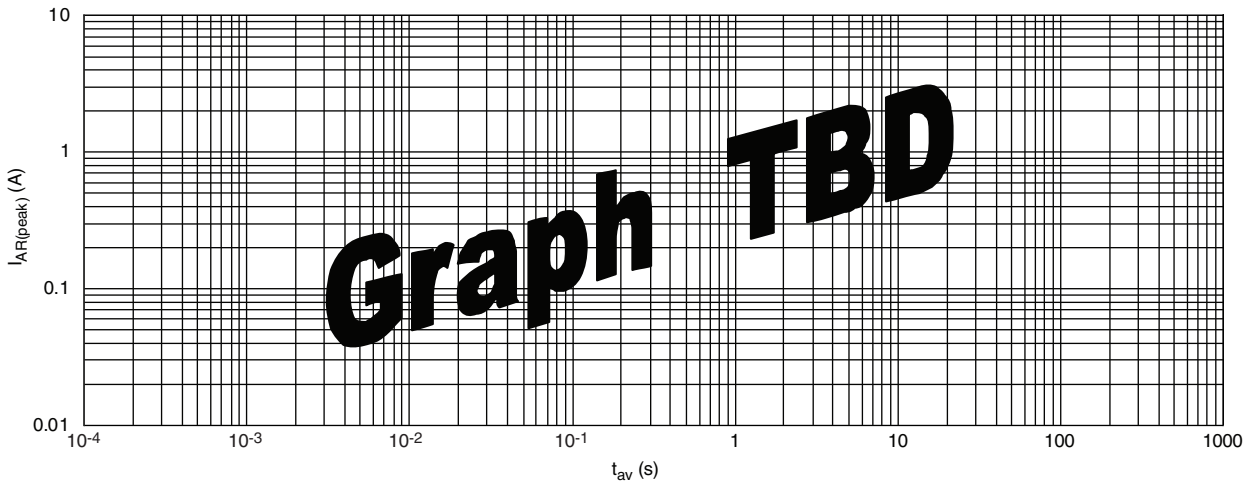
THERMAL RATINGS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted



Single Pulse Avalanche Current (Peak) vs. Inductance

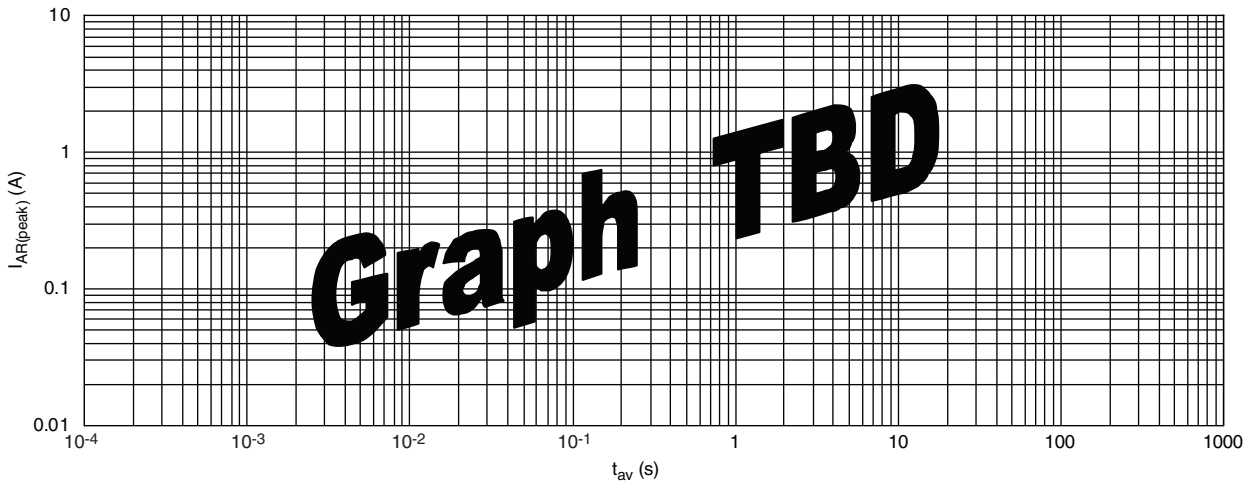


Single Pulse Avalanche Energy (Peak) vs. $T_{J(\text{start})}$



Repetitive Avalanche Current (Peak) vs. Time in Avalanche at $T_A = 25\text{ }^\circ\text{C}$

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



Repetitive Avalanche Current (Peak) vs. Time in Avalanche at $T_A = 150\text{ }^\circ\text{C}$

Note

The characteristics shown in the six graphs

- Normalized Transient Thermal Impedance Junction to Ambient ($25\text{ }^\circ\text{C}$)
- Single Pulse Avalanche Current (Peak) vs. Time in Avalanche
- Single Pulse Avalanche Current (Peak) vs. Inductance
- Single Pulse Avalanche Energy (Peak) vs. $T_{J(\text{start})}$
- Repetitive Avalanche Current (Peak) vs. Time in Avalanche at $T_A = 25\text{ }^\circ\text{C}$
- Repetitive Avalanche Current (Peak) vs. Time in Avalanche at $T_A = 150\text{ }^\circ\text{C}$

are given for general guidelines only to enable the user to get a "ball park" indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions.

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