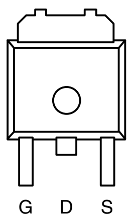
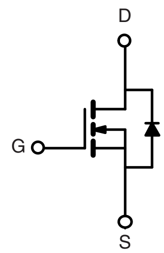
Automotive
N-Channel 60 V (D-S) 175 °C MOSFET

PRODUCT SUMMARY	
V_{DS} (V)	60
$R_{DS(on)}$ (Ω) at V_{GS} = 10 V	0.31
I_D (A)	23
Configuration	Single

TO-252



Top View



N-Channel MOSFET

FEATURES

- **Halogen-free**
- TrenchFET® Power MOSFET
- Package with Low Thermal Resistance

Pb
Pb-free
RoHS
COMPLIANT

AEC-Q101 RELIABILITY

- Passed all AEC-Q101 Reliability Testing
- Characterization Ongoing

ORDERING INFORMATION	
Package	TO-252
Lead (Pb)-free and Halogen-free	SQD23N06-31L-GE3

ABSOLUTE MAXIMUM RATINGS T_C = 25 °C, unless otherwise noted

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V_{DS}	-	V
Gate-Source Voltage		V_{GS}	± 20	
Continuous Drain Current[a]	T_C = 25 °C	I_D	23	A
	T_C = 100 °C		16.5	
Continuous Source Current (Diode Conduction)[a]		I_S	23	
Pulsed Drain Current[b]		I_{DM}	50	
Single Pulse Avalanche Energy	L = 0.1 mH	E_{AS}	20	mJ
Single Pulse Avalanche Current		I_{AS}	20	A
Maximum Power Dissipation[b]	T_C = 25 °C	P_D	100	W
	T_A = 25 °C		3	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to + 175	°C

THERMAL RESISTANCE RATINGS

PARAMETER		SYMBOL	LIMIT	UNIT
Junction-to-Ambient	PCB Mount[c]	R_{thJA}	22	°C/W
Junction-to-Case (Drain)		R_{thJC}	4	

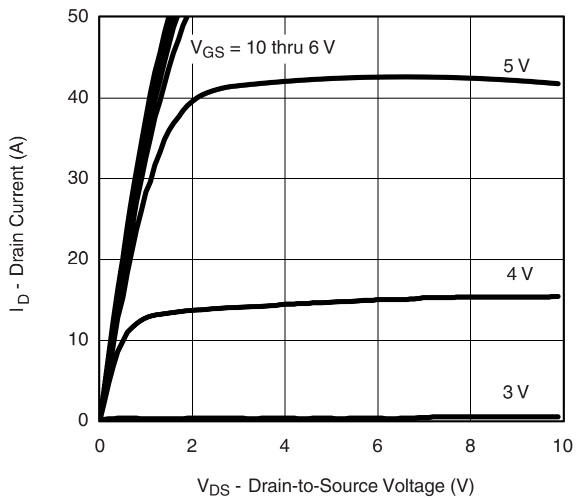
Notes
a. Package limited.
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
c. When mounted on 1" square PCB (FR-4 material).

SPECIFICATIONS T_C = 25 °C, unless otherwise noted							
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static							
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA		60	-	-	V
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA		1.0	2.0	3.0	
Gate-Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 20 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V	V_{DS} = 60 V	-	-	1.0	µA
		V_{GS} = 0 V	V_{DS} = 60 V, T_J = 125 °C	-	-	50	
		V_{GS} = 0 V	V_{DS} = 60 V, T_J = 175 °C	-	-	250	
On-State Drain Current[a]	$I_{D(on)}$	V_{GS} = 10 V	$V_{DS} \geq 5$ V	50	-	-	A
Drain-Source On-State Resistance[a]	$R_{DS(on)}$	V_{GS} = 10 V	I_D = 15 A	-	0.025	0.031	Ω
		V_{GS} = 10 V	I_D = 15 A, T_J = 125 °C	-	-	0.055	
		V_{GS} = 10 V	I_D = 15 A, T_J = 175 °C	-	-	0.069	
Forward Transconductance[a]	g_{fs}	V_{DS} = 15 V, I_D = 15 A		20	-	-	S
Dynamic[b]							
Input Capacitance	C_{iss}	V_{GS} = 0 V	V_{DS} = 25 V, f = 1 MHz	-	670	-	pF
Output Capacitance	C_{oss}			-	140	-	
Reverse Transfer Capacitance	C_{rss}			-	60	-	
Total Gate Charge[c]	Q_g	V_{GS} = 10 V	V_{DS} = 30 V, I_D = 23 A	-	11	-	nC
Gate-Source Charge[c]	Q_{gs}			-	3	-	
Gate-Drain Charge[c]	Q_{gd}			-	3	-	
Turn-On Delay Time [c]	$t_{d(on)}$	V_{DD} = 30 V, R_L = 1.3 Ω $I_D \cong$ 23 A, V_{GEN} = 10 V, R_g = 2.5 Ω		-	8	-	ns
Rise Time[c]	t_r			-	15	-	
Turn-Off Delay Time[c]	$t_{d(off)}$			-	30	-	
Fall Time[c]	t_f			-	25	-	
Source-Drain Diode Ratings and Characteristics T_C = 25 °C[b]							
Pulsed Current[a]	I_{SM}			-	-	50	A
Forward Voltage	V_{SD}	I_F = 15 A, V_{GS} = 0 V		-	1	1.5	V
Reverse Recovery Time	t_{rr}	I_F = 15 A, dI/dt = 100 A/µs		-	30	60	ns
Peak Reverse Recovery Current	$I_{RM(REC)}$			-	-	-	A
Reverse Recovery Charge	Q_{rr}			-	-	-	µC

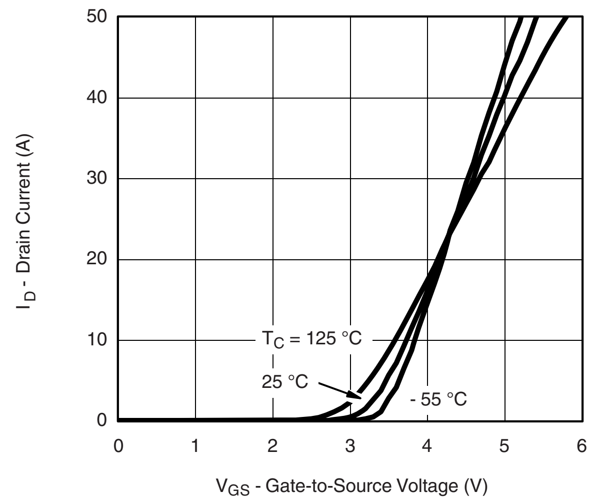
Notes
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.
c. Independent of operating temperature.

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.

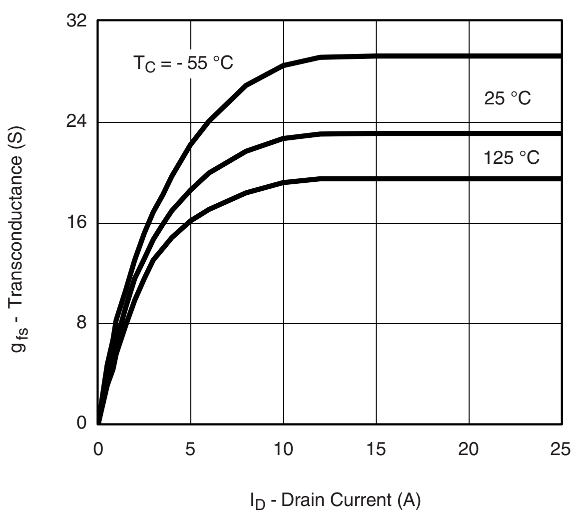
TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



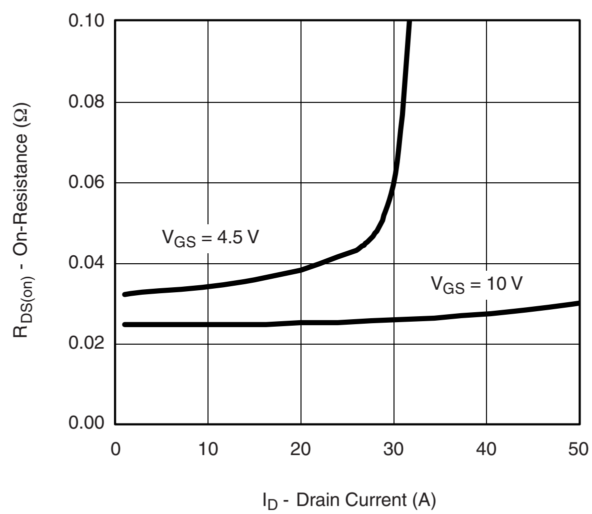
Output Characteristics



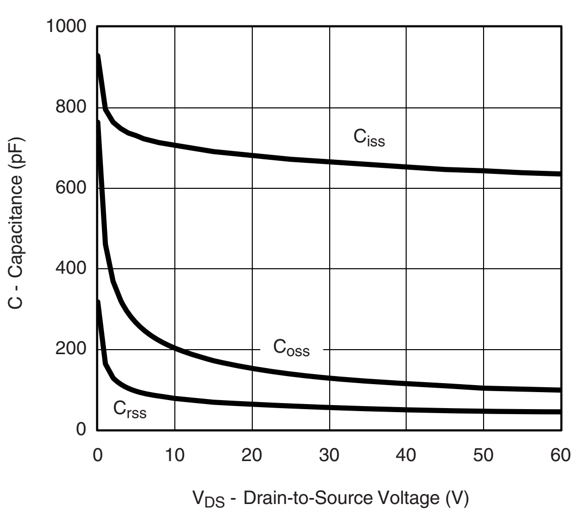
Transfer Characteristics



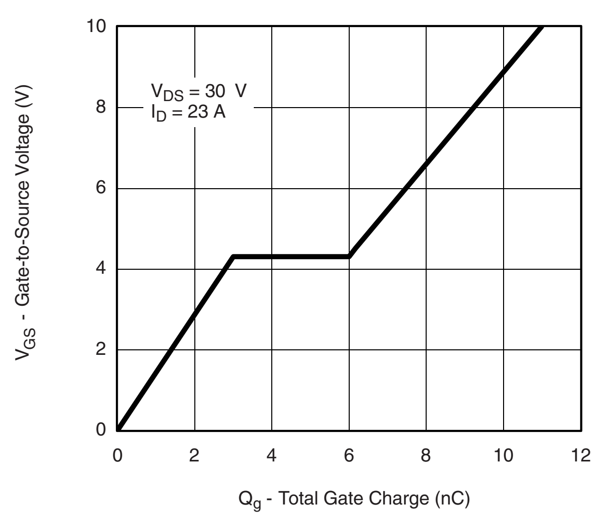
Transconductance



On-Resistance vs. Drain Current

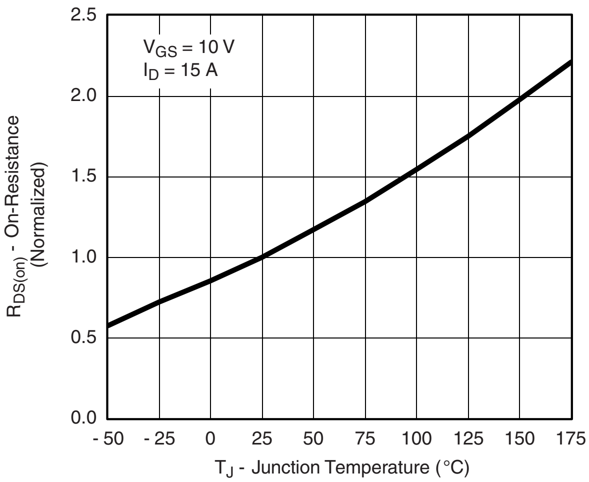


Capacitance

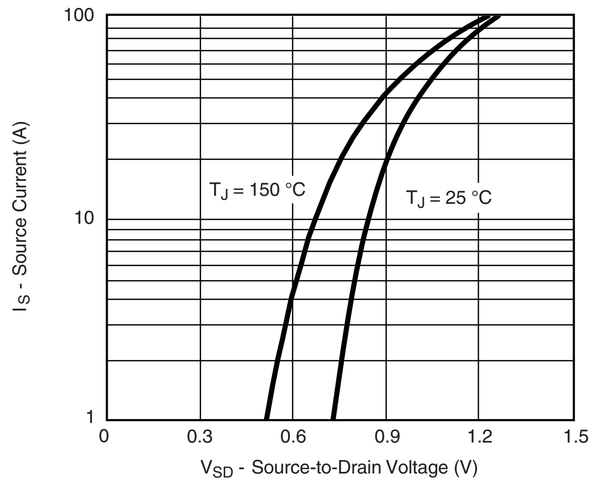


Gate Charge

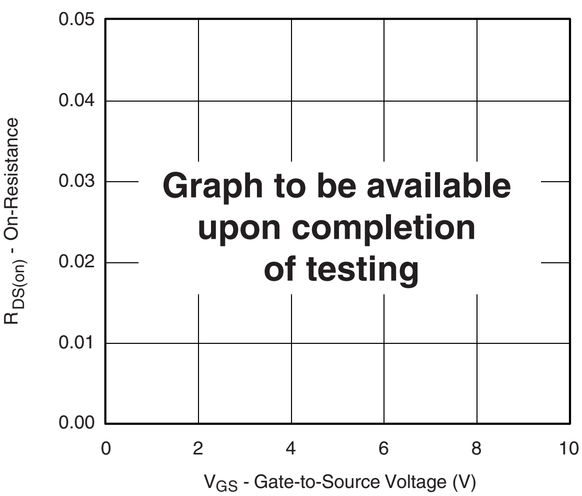
TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



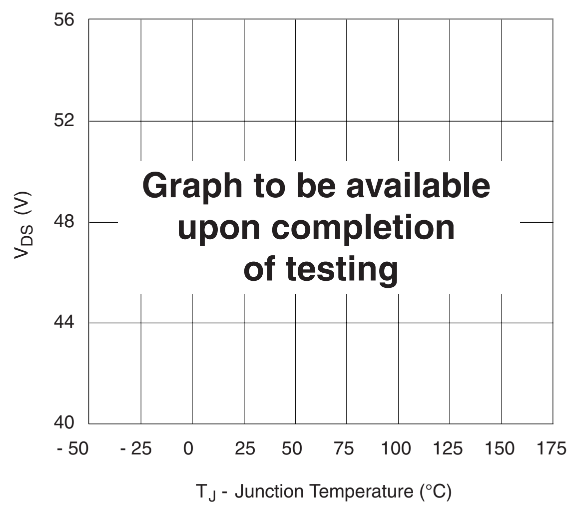
On-Resistance vs. Junction Temperature



Source Drain Diode Forward Voltage

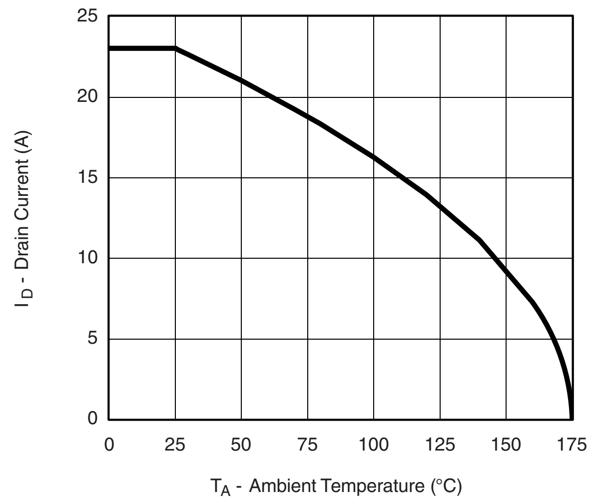


On-Resistance vs. Gate-to-Source Voltage

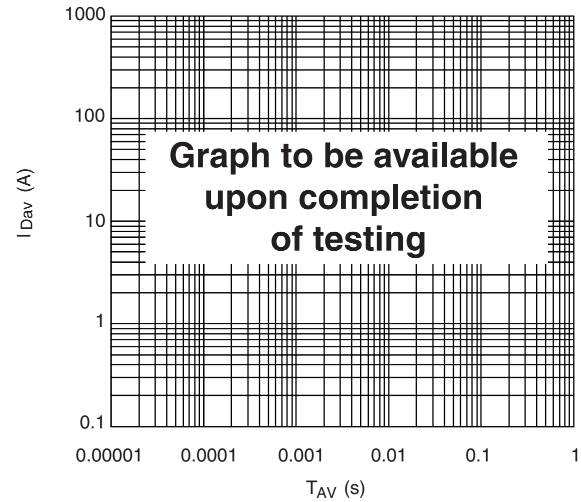


Drain Source Breakdown vs. Junction Temperature

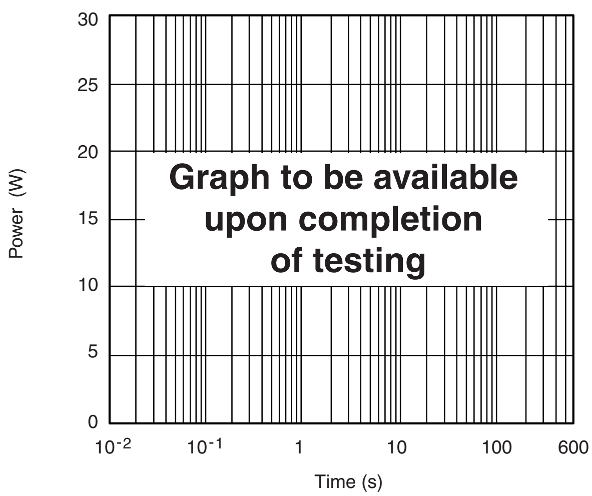
THERMAL RATINGS T_A = 25 °C, unless otherwise noted



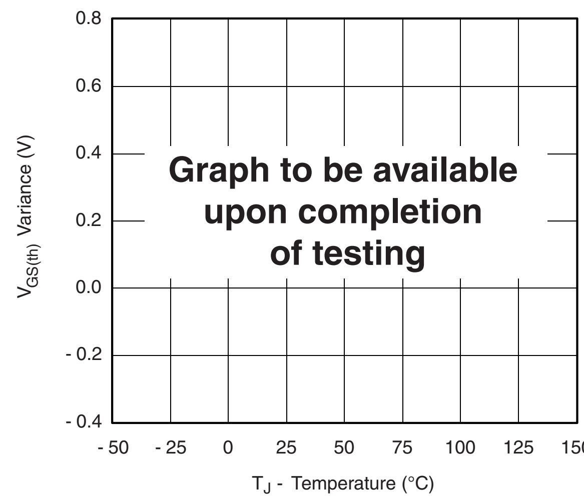
Maximum Drain Current vs. Ambient Temperature



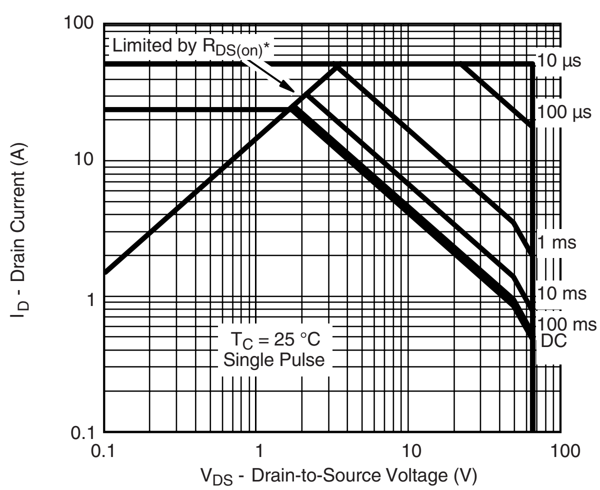
Avalanche Current vs. Time



Single Pulse Power, Junction-to-Ambient



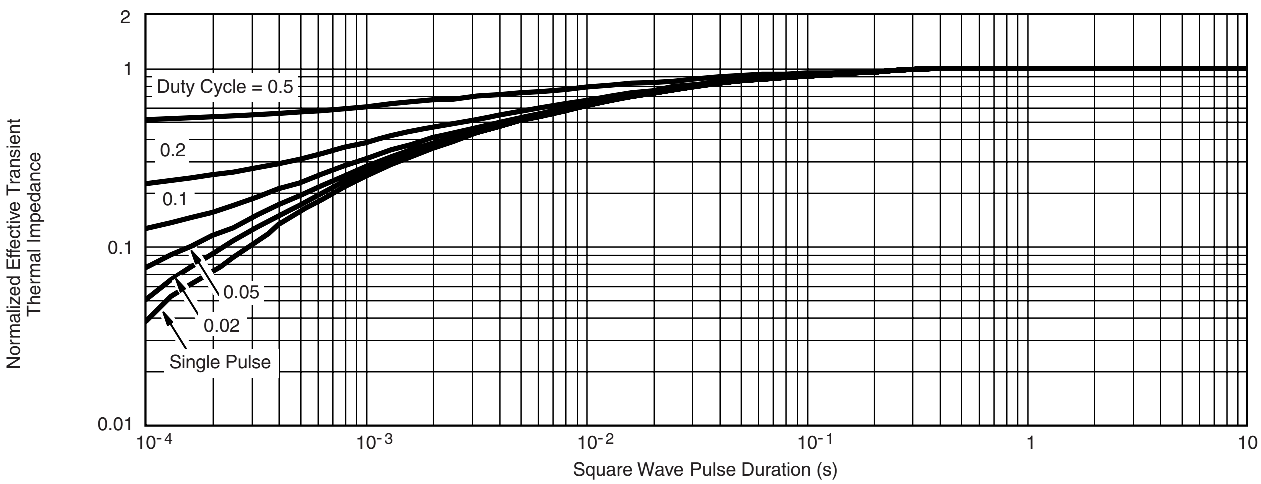
Threshold Voltage



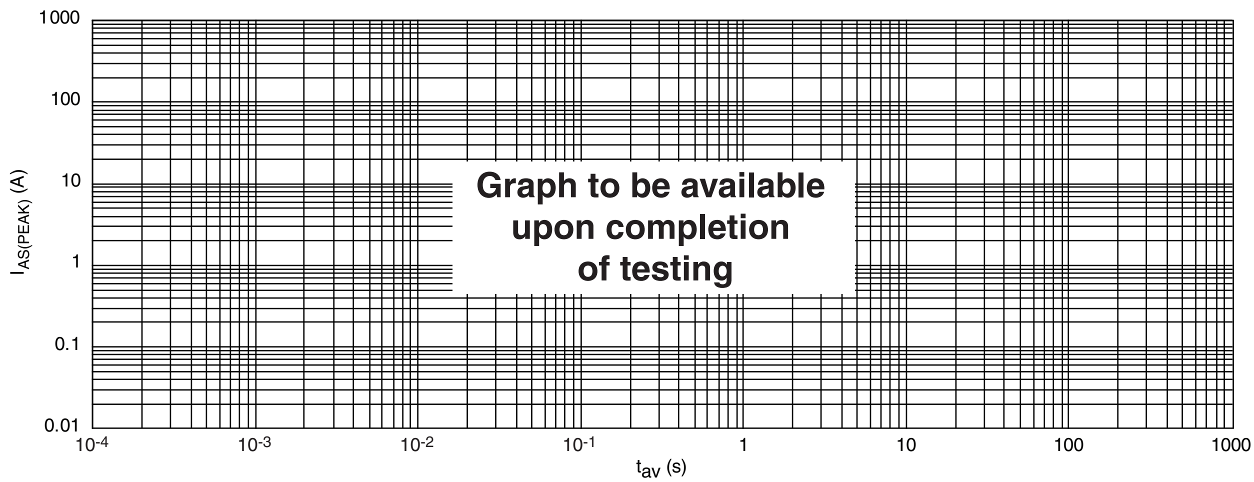
* V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area

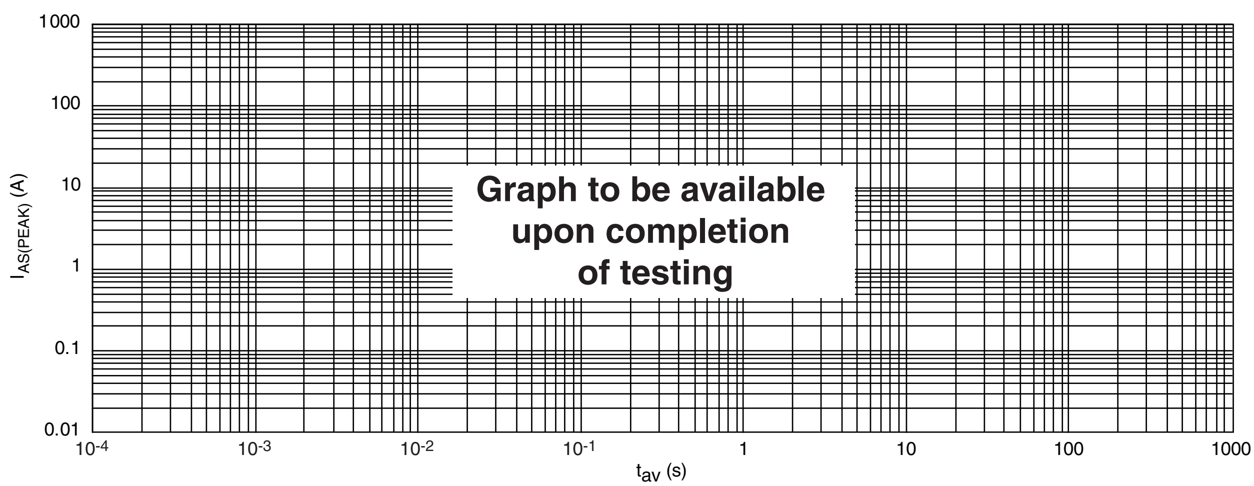
THERMAL RATINGS T_A = 25 °C, unless otherwise noted



Normalized Thermal Transient Impedance, Junction-to-Case



Normalized Thermal Transient Impedance, Junction-to-Ambient



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

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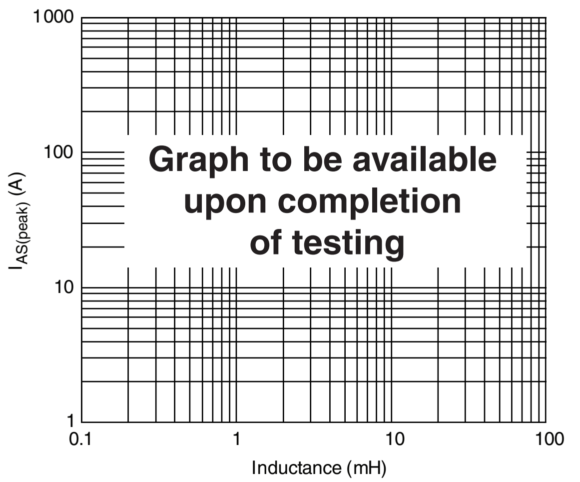
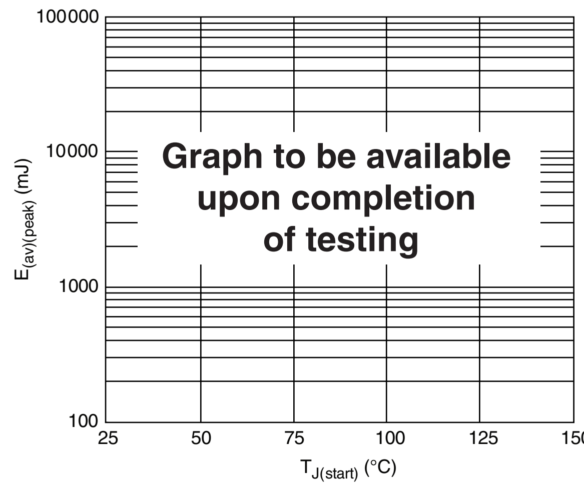
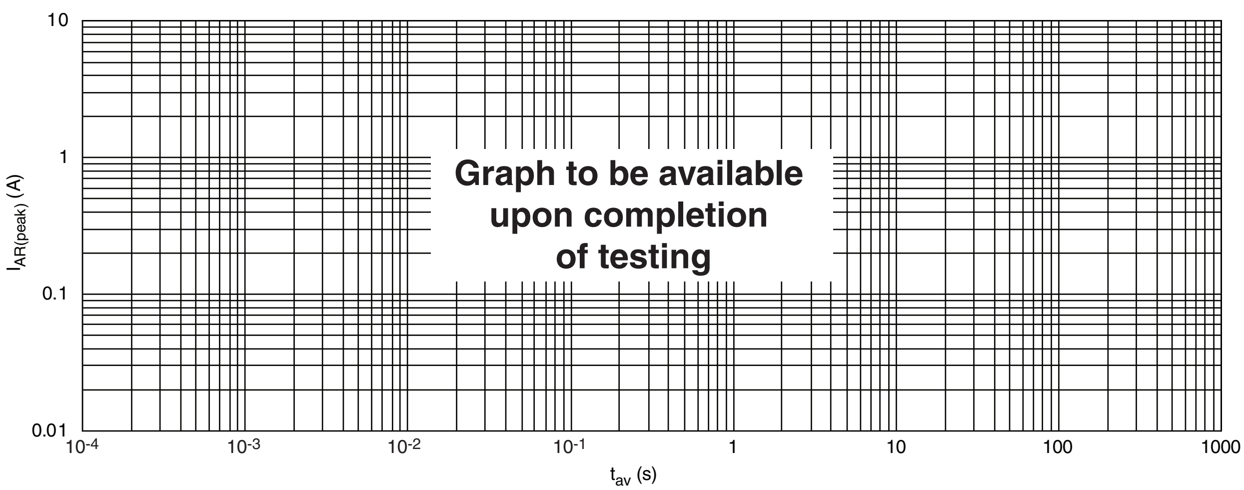
THERMAL RATINGS T_A = 25 °C, unless otherwise noted



Single Pulse Avalanche Current (Peak) vs. Inductance

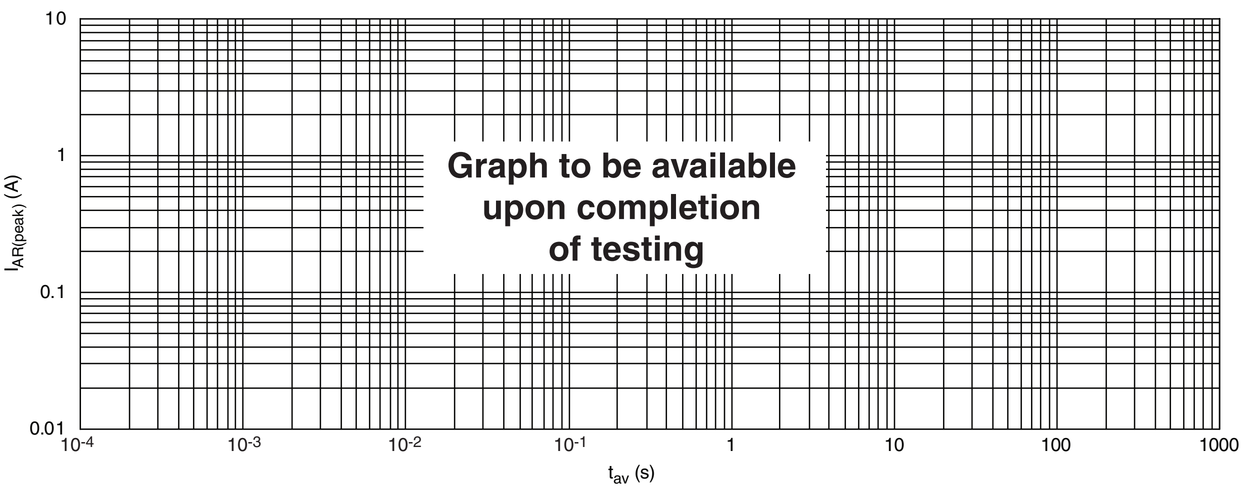


Single Pulse Avalanche Energy (Peak) vs. $T_{J(start)}$



Repetitive Avalanche Current (Peak) vs. Time in Avalanche at T_A = 25 °C

THERMAL RATINGS T_A = 25 °C, unless otherwise noted



Repetitive Avalanche Current (Peak) vs. Time in Avalanche at T_A = 150 °C

Note

The characteristics shown in the six graphs
- Normalized Transient Thermal Impedance Junction to Ambient (25 °C)
- Single Pulse Avalanche Current (Peak) vs. Time in Avalanche
- Single Pulse Avalanche Current (Peak) vs. Inductance
- Single Pulse Avalanche Energy (Peak) vs. $T_{J\ (start)}$
- Repetitive Avalanche Current (Peak) vs. Time in Avalanche at T_A = 25 °C
- Repetitive Avalanche Current (Peak) vs. Time in Avalanche at T_A = 150 °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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