

Automotive P-Channel 40 V (D-S) 175 °C MOSFET

PRODUCT SUMMARY	
V_{DS} (V)	- 40
$R_{DS(on)}$ (Ω) at $V_{GS} = 10$ V	0.014
I_D (A)	- 8.7
Configuration	Single

FEATURES

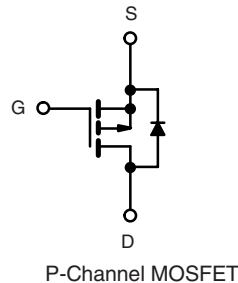
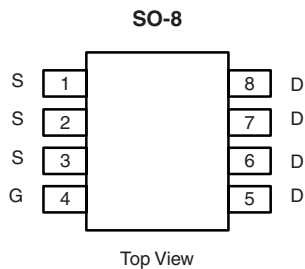
- Halogen-free According to IEC 61249-2-21
- TrenchFET® Power MOSFET
- Package with Low Thermal Resistance



RoHS
COMPLIANT
HALOGEN
FREE

AEC Q101 RELIABILITY

- Passed all AEC Q101 Reliability Testing
- Characterization Ongoing



ORDERING INFORMATION	
Package	SO-8
Lead (Pb)-free and Halogen-free	SQ4401EY-T1-GE3

ABSOLUTE MAXIMUM RATINGS $T_C = 25$ °C, unless otherwise noted				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V_{DS}	- 40	V
Gate-Source Voltage		V_{GS}	± 20	
Continuous Drain Current ^a	$T_C = 25$ °C	I_D	- 8.7	A
	$T_C = 70$ °C		- 7.4	
Continuous Source Current (Diode Conduction) ^a		I_S	- 1.36	
Pulsed Drain Current ^b		I_{DM}	- 50	
Single Pulse Avalanche Energy	L = 0.1 mH	E_{AS}	45	mJ
Single Pulse Avalanche Current			I_{AS}	30
Maximum Power Dissipation ^b	$T_C = 25$ °C	P_D	1.8	W
	$T_A = 70$ °C		1.2	
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}	84	°C/W
Junction-to-Case (Drain)		R_{thJC}	21	

Notes

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

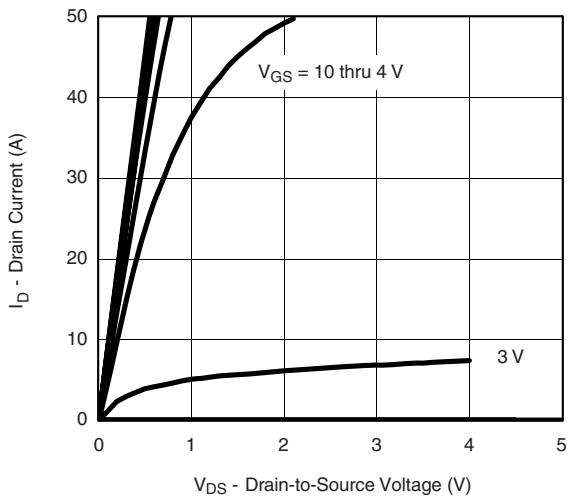
SPECIFICATIONS $T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT	
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}$, $I_D = -250\text{ }\mu\text{A}$	-	-	-	V	
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = -250\text{ }\mu\text{A}$	-1.0	-	-3.0		
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}	$V_{GS} = 0\text{ V}$	$V_{DS} = -40\text{ V}$	-	-	-1.0	μA
		$V_{GS} = 0\text{ V}$	$V_{DS} = -40\text{ V}$, $T_J = 125\text{ }^\circ\text{C}$	-	-	-	
		$V_{GS} = 0\text{ V}$	$V_{DS} = -40\text{ V}$, $T_J = 70\text{ }^\circ\text{C}$	-	-	-10	
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	$R_{DS(on)}$	$V_{GS} = -10\text{ V}$	$I_D = -10.5\text{ A}$	-	0.011	0.014	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}	$V_{DS} = -15\text{ V}$, $I_D = -10.5\text{ A}$		-	26	S	
Dynamic^b							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}$	$V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	-	-	-	pF
Output Capacitance	C_{oss}			-	-	-	
Reverse Transfer Capacitance	C_{rss}			-	-	-	
Total Gate Charge ^c	Q_g	$V_{GS} = -5\text{ V}$	$V_{DS} = -15\text{ V}$, $I_D = -10.5\text{ A}$	-	40	-	nC
Gate-Source Charge ^c	Q_{gs}			-	10	-	
Gate-Drain Charge ^c	Q_{gd}			-	14	-	
Turn-On Delay Time ^c	$t_{d(on)}$	$V_{DD} = -15\text{ V}$, $R_L = 15\text{ }\Omega$ $I_D \cong -1\text{ A}$, $V_{GEN} = -10\text{ V}$, $R_g = 6\text{ }\Omega$		-	16	-	ns
Rise Time ^c	t_r			-	15	-	
Turn-Off Delay Time ^c	$t_{d(off)}$			-	97	-	
Fall Time ^c	t_f			-	47	-	
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}	$I_F = -2.1\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$		-	35	-	ns
Peak Reverse Recovery Current	$I_{RM(REC)}$			-	-	-	A
Reverse Recovery Charge	Q_{rr}			-	-	-	μC

Notes

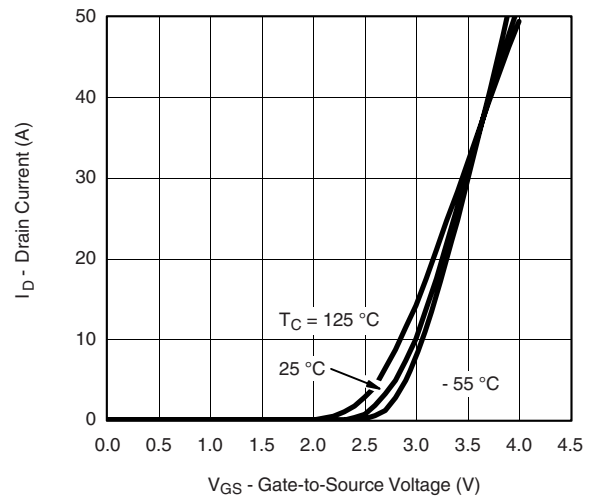
- Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
- Guaranteed by design, not subject to production testing.
- Independent of operating temperature.

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.

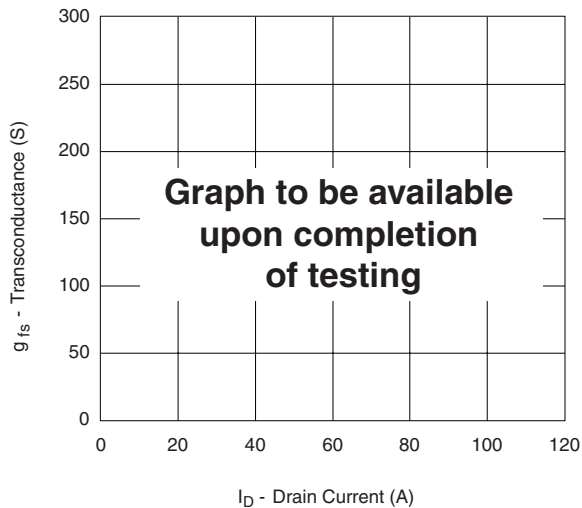
TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted



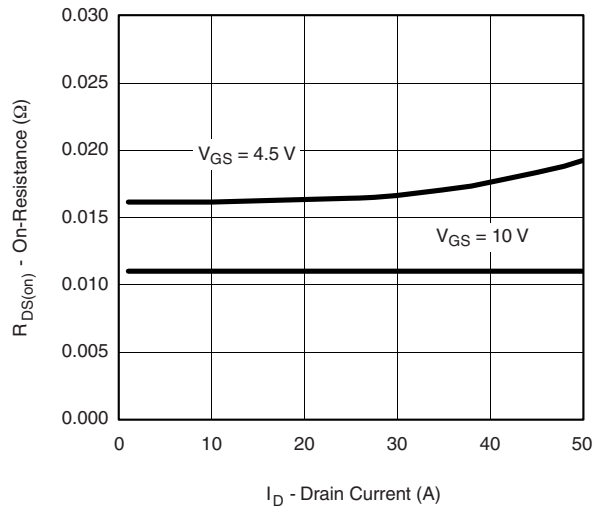
Output Characteristics



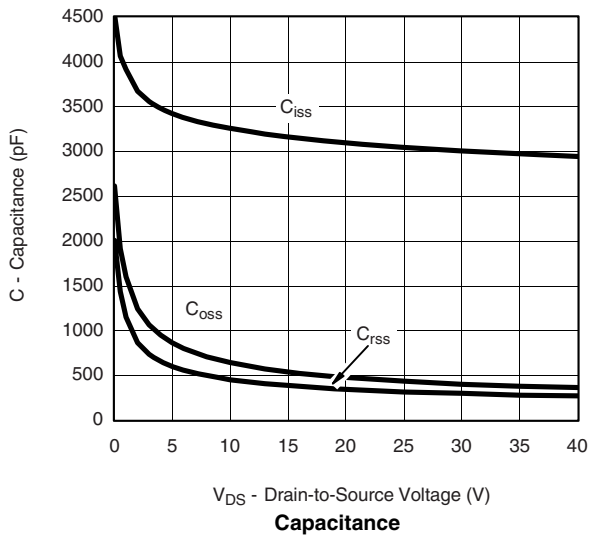
Transfer Characteristics



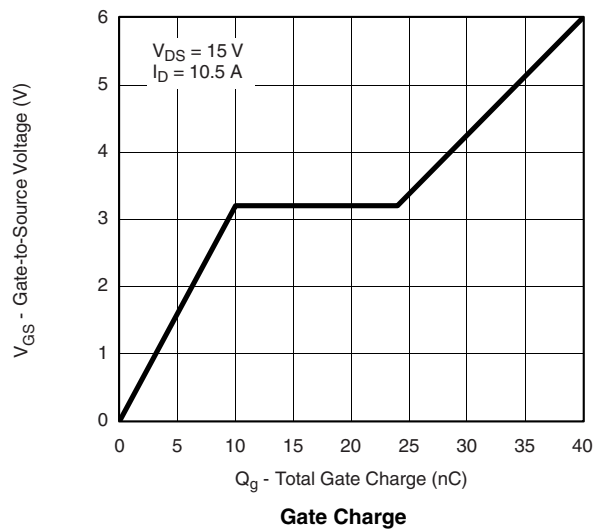
Transconductance



On-Resistance vs. Drain Current

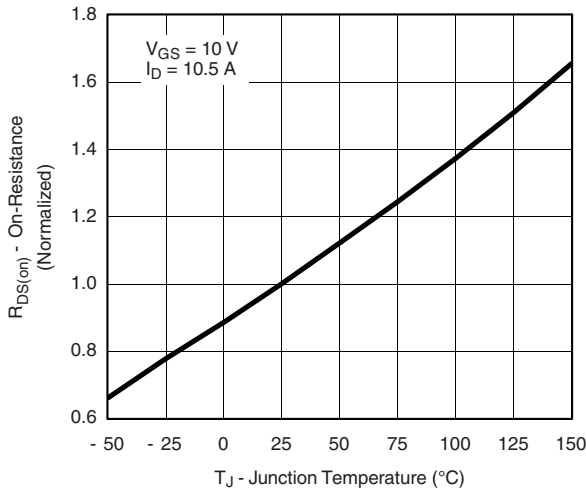


Capacitance

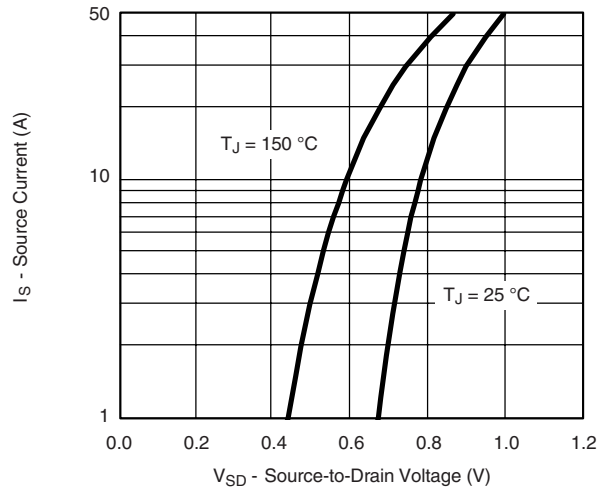


Gate Charge

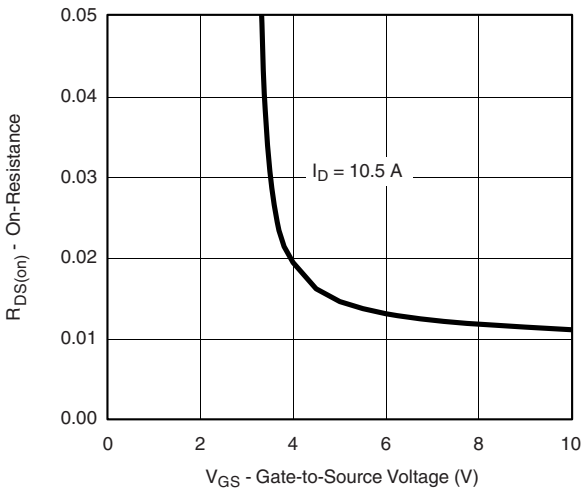
TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted



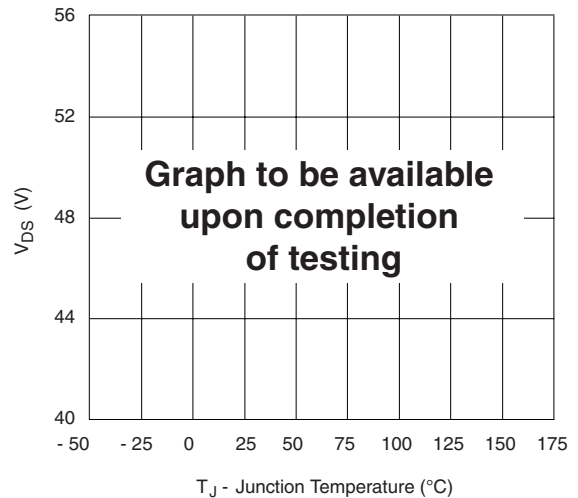
On-Resistance vs. Junction Temperature



Source Drain Diode Forward Voltage

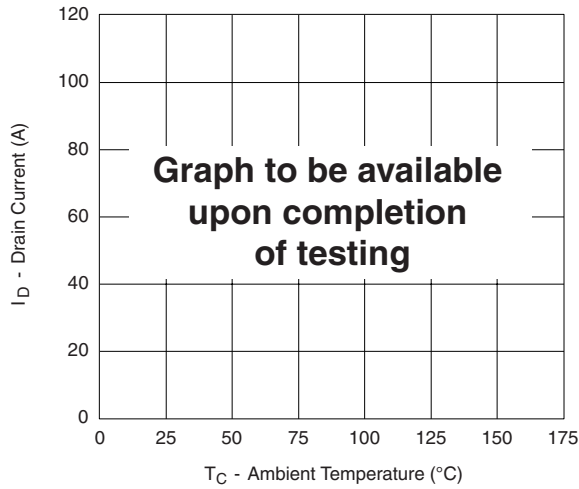


On-Resistance vs. Gate-to-Source Voltage

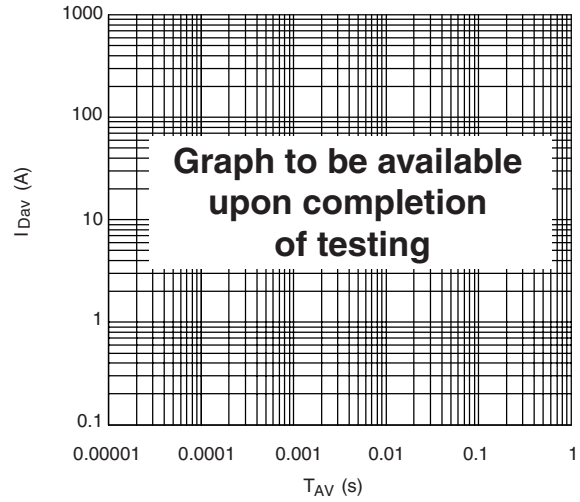


Drain Source Breakdown vs. Junction Temperature

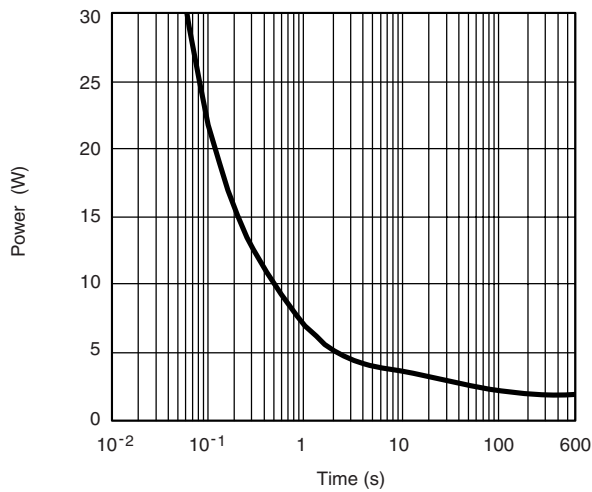
THERMAL RATINGS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted



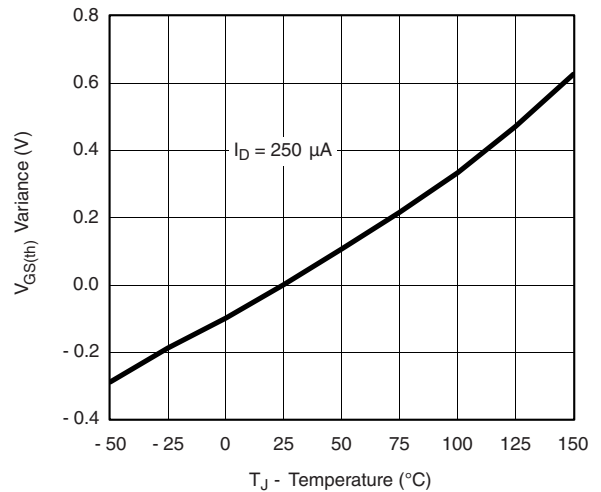
Maximum Drain Current vs. Ambient Temperature



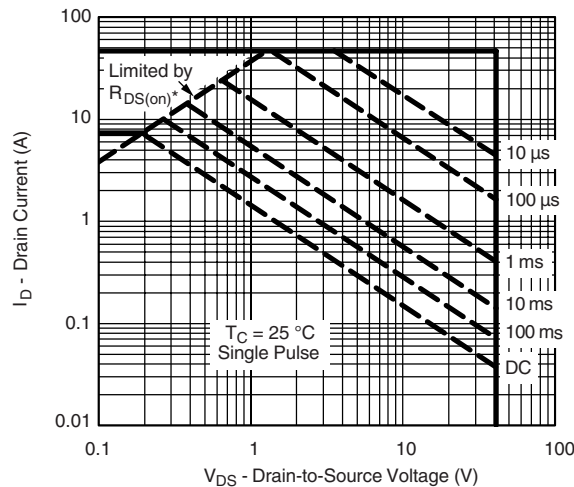
Avalanche Current vs. Time



Single Pulse Power, Junction-to-Ambient



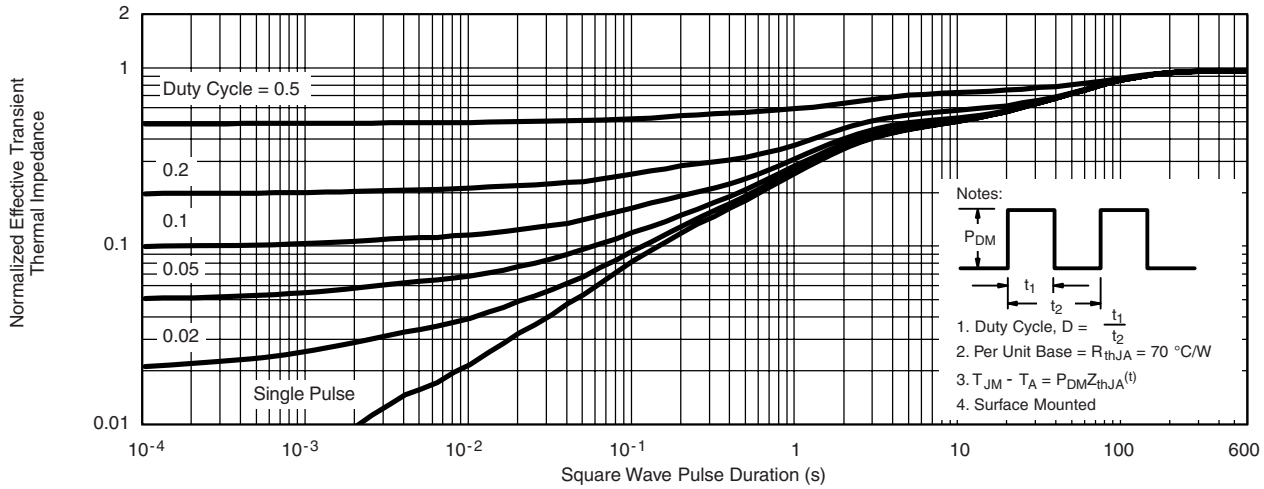
Threshold Voltage



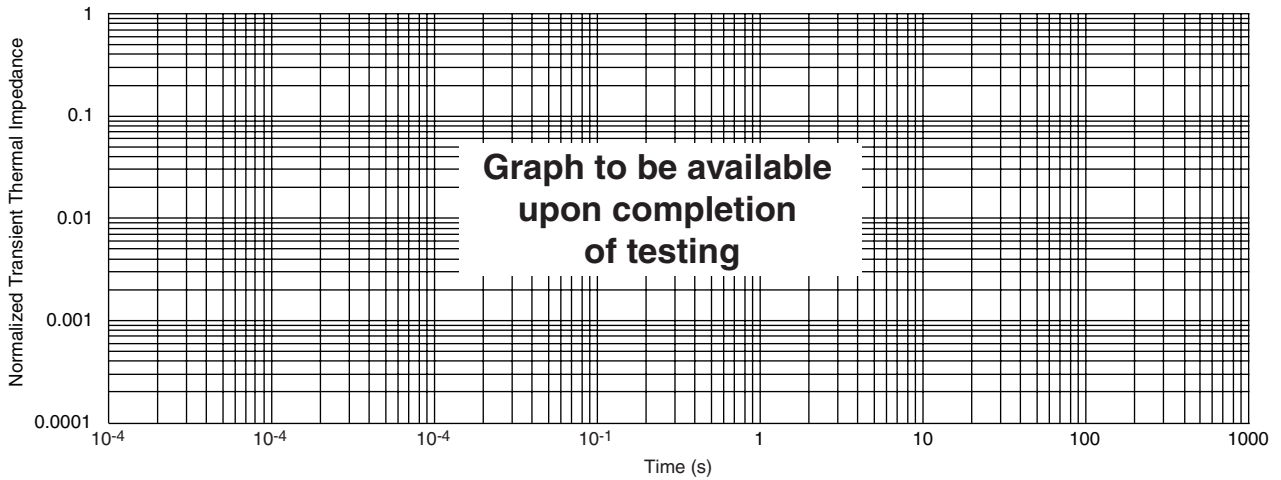
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area

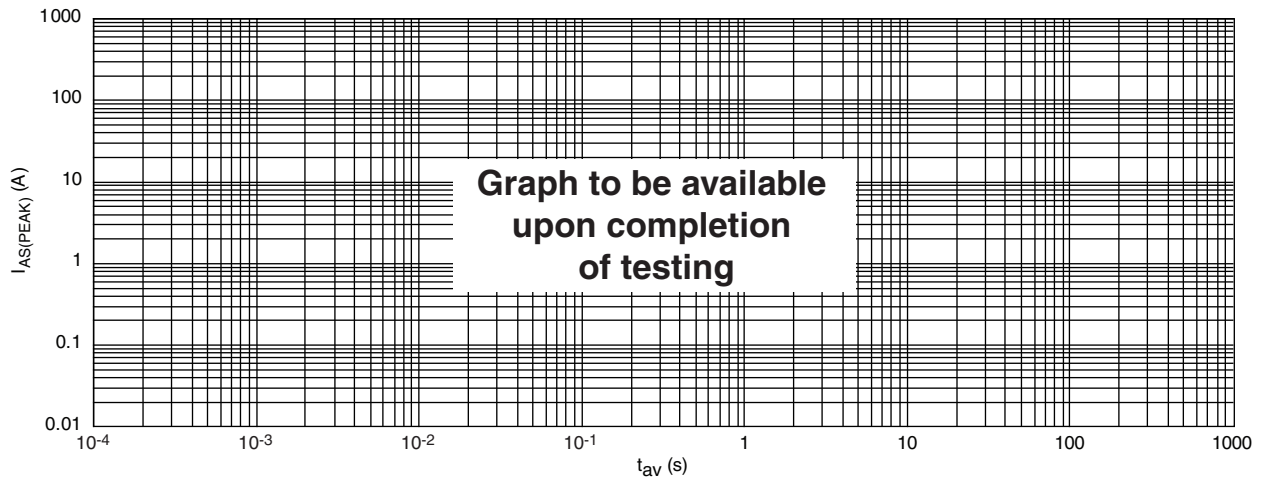
THERMAL RATINGS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted



Normalized Thermal Transient Impedance, Junction-to-Case

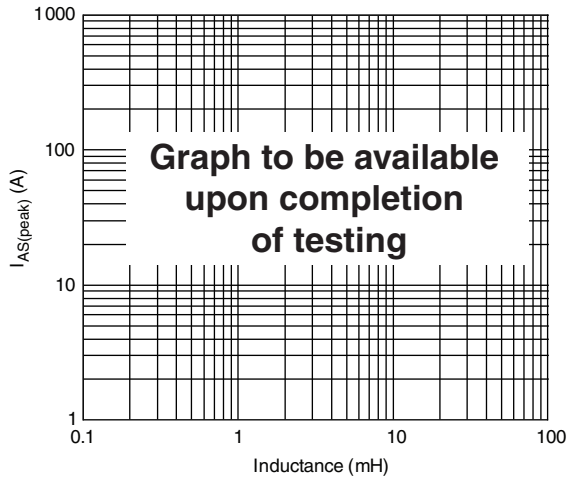


Normalized Thermal Transient Impedance, Junction-to-Ambient

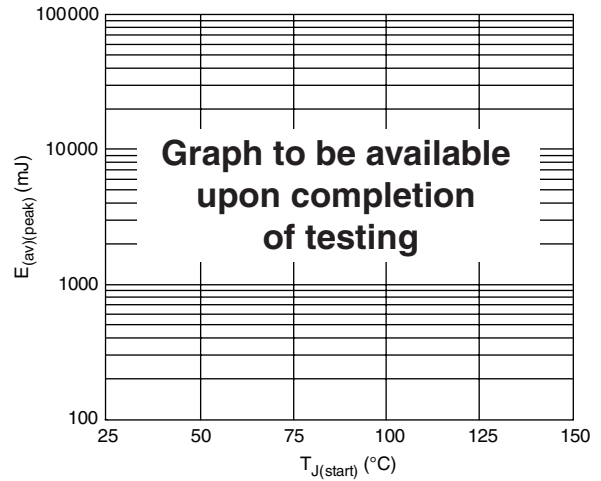


Single Pulse Avalanche Current (Peak) vs. Time in Avalanche

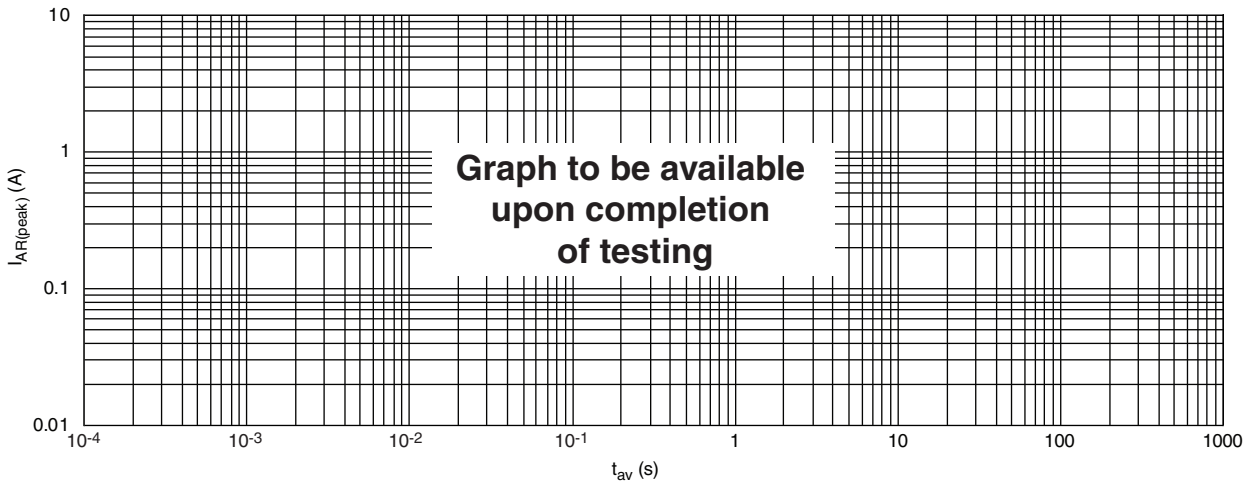
THERMAL RATINGS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted



Single Pulse Avalanche Current (Peak) vs. Inductance

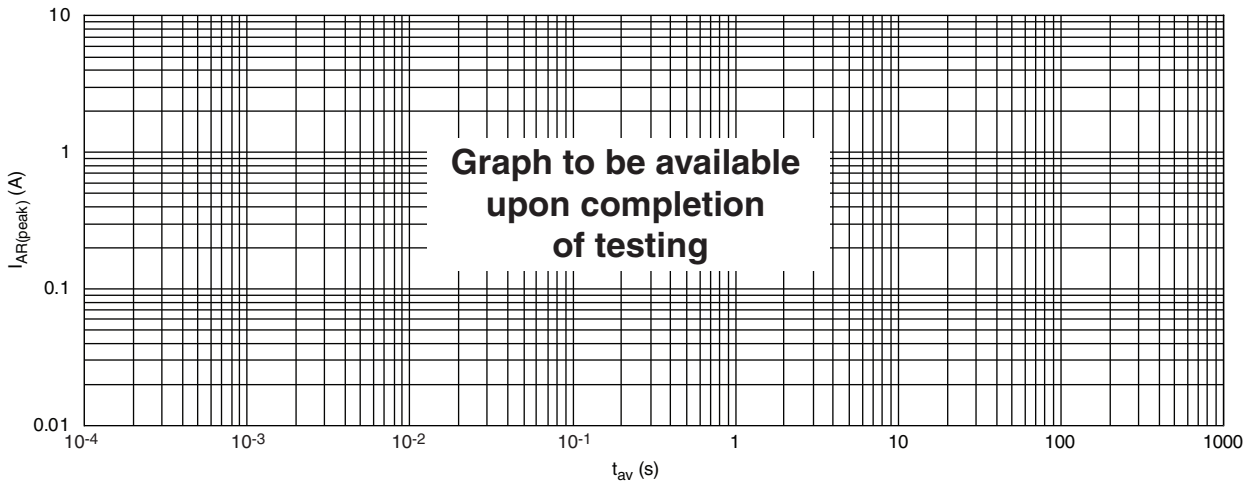


Single Pulse Avalanche Energy (Peak) vs. $T_{J(\text{start})}$



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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