

P-Channel 60-V (D-S) MOSFET

PRODUCT SUMMARY			
V _{DS} (V)	R _{DS(on)} (Ω)	I _D (A) ^a	Q _g (Typ.)
- 60	0.115 at V _{GS} = - 10 V	- 8	14.5 nC
	0.146 at V _{GS} = - 4.5 V	- 8	

FEATURES

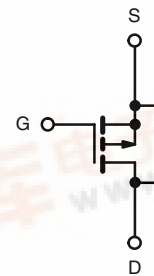
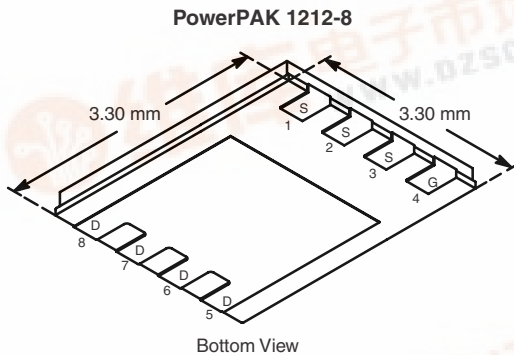
- Halogen-free According to IEC 61249-2-21 Available
- TrenchFET[®] Power MOSFET
- Low Thermal Resistance PowerPAK[®] Package with Small Size and Low 1.07 mm Profile



RoHS
 COMPLIANT
 HALOGEN
FREE
 Available

APPLICATIONS

- CCFL inverter
- Class D-amp



P-Channel MOSFET

Ordering Information: Si7309DN-T1-E3 (Lead (Pb)-free)
 Si7309DN-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS T _A = 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 (T _J = 150 °C)	I _D	T _C = 25 °C	- 8 ^a
		T _C = 70 °C	- 7.8
		T _A = 25 °C	- 3.9 ^{b, c}
		T _A = 70 °C	- 3.1 ^{b, c}
Pulsed Drain Current (10 μs Width)	I _{DM}	- 20	A
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C	
		T _A = 25 °C	- 2.7 ^{b, c}
Avalanche Current	I _{AS}	- 15	mJ
Single-Pulse Avalanche Energy	E _{AS}	11	
Maximum Power Dissipation	P _D	T _C = 25 °C	19.8
		T _C = 70 °C	12.7
		T _A = 25 °C	3.2 ^{b, c}
		T _A = 70 °C	2.1 ^{b, c}
Operating Junction and Storage Temperature Range	T _J , T _{stg}	- 55 to 150	°C

THERMAL RESISTANCE RATINGS				
Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient ^{a, d}	R _{thJA}	31	39	°C/W
Maximum Junction-to-Case (Drain)	R _{thJC}	5	6.3	

Notes:

- Package limited.
- Surface Mounted on 1" x 1" FR4 board.
- t = 10 s.
- See Solder Profile (www.vishay.com/ppg?73257). The PowerPAK 1212-8 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 81 °C/W.



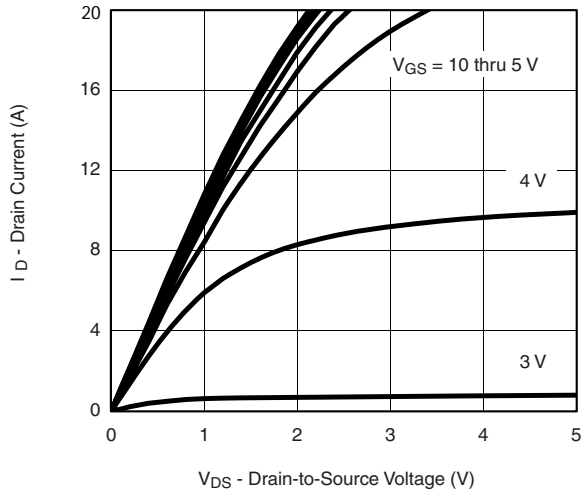
SPECIFICATIONS $T_J = 25^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	- 60			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\ \mu\text{A}$		- 50		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$		+ 3.8			
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	- 1		- 3	V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	ns
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}$			- 1	μA
		$V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}, T_J = 85^\circ\text{C}$			- 10	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \geq -5\text{ V}, V_{GS} = -10\text{ V}$	- 20			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -3.9\text{ A}$		0.092	0.115	Ω
		$V_{GS} = -4.5\text{ V}, I_D = -3.5\text{ A}$		0.120	0.146	
Forward Transconductance ^a	g_{fs}	$V_{DS} = -15\text{ V}, I_D = -3.9\text{ A}$		10		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = -30\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		600		pF
Output Capacitance	C_{oss}		70			
Reverse Transfer Capacitance	C_{rss}		50			
Total Gate Charge	Q_g	$V_{DS} = -30\text{ V}, V_{GS} = -10\text{ V}, I_D = -3.9\text{ A}$		14.5	22	nC
				7.5	12	
Gate-Source Charge	Q_{gs}	$V_{DS} = -30\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -3.9\text{ A}$		2.2		
Gate-Drain Charge	Q_{gd}			3.7		
Gate Resistance	R_g	$f = 1\text{ MHz}$		14		Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -30\text{ V}, R_L = 9.4\ \Omega$ $I_D \cong -3.2\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 1\ \Omega$		25	40	ns
Rise Time	t_r			80	120	
Turn-Off Delay Time	$t_{d(off)}$			33	50	
Fall Time	t_f			35	50	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -30\text{ V}, R_L = 9.4\ \Omega$ $I_D \cong -3.2\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\ \Omega$		10	15	
Rise Time	t_r			15	25	
Turn-Off Delay Time	$t_{d(off)}$			30	45	
Fall Time	t_f			33	50	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25^\circ\text{C}$			- 8	A
Pulse Diode Forward Current	I_{SM}				- 20	
Body Diode Voltage	V_{SD}	$I_S = -1.3\text{ A}, V_{GS} = 0\text{ V}$		- 0.8	- 1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = -1.3\text{ A}, dI/dt = -100\text{ A}/\mu\text{s}, T_J = 25^\circ\text{C}$		30	50	ns
Body Diode Reverse Recovery Charge	Q_{rr}			32	50	nC
Reverse Recovery Fall Time	t_a			17		ns
Reverse Recovery Rise Time	t_b			13		

Notes:

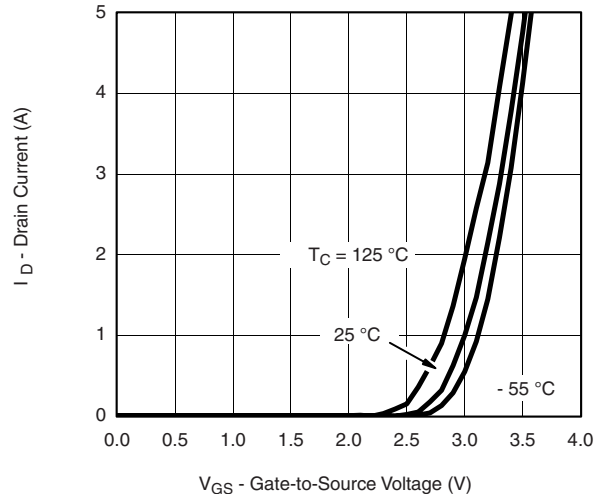
- a. Pulse test; pulse width $\leq 300\ \mu\text{s}$, duty cycle $\leq 2\%$.
b. Guaranteed by design, not subject to production testing.

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.

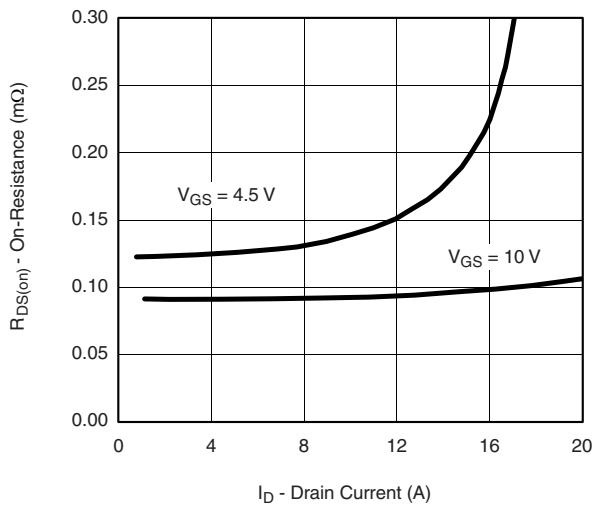
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



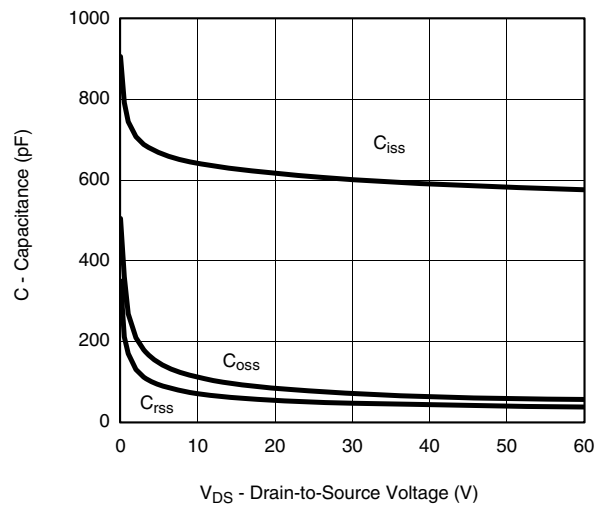
Output Characteristics



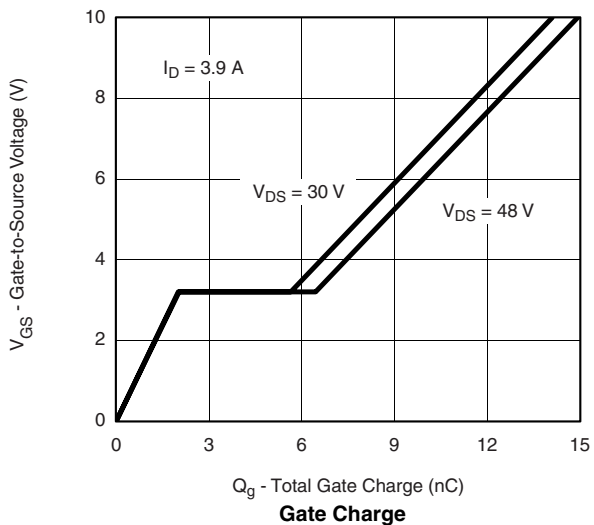
Transfer Characteristics



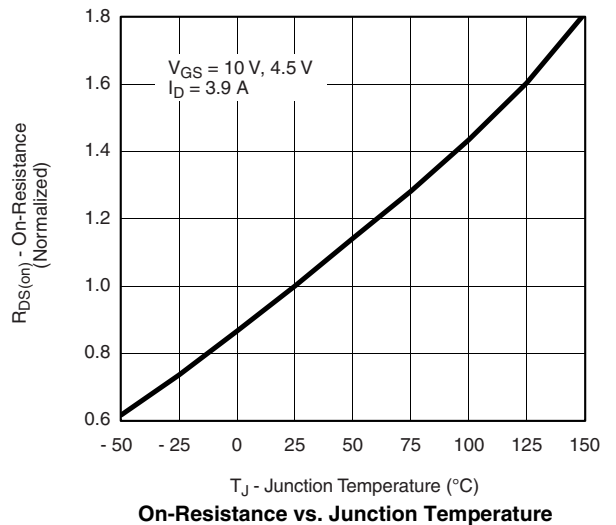
On-Resistance vs. Drain Current and Gate Voltage



Capacitance

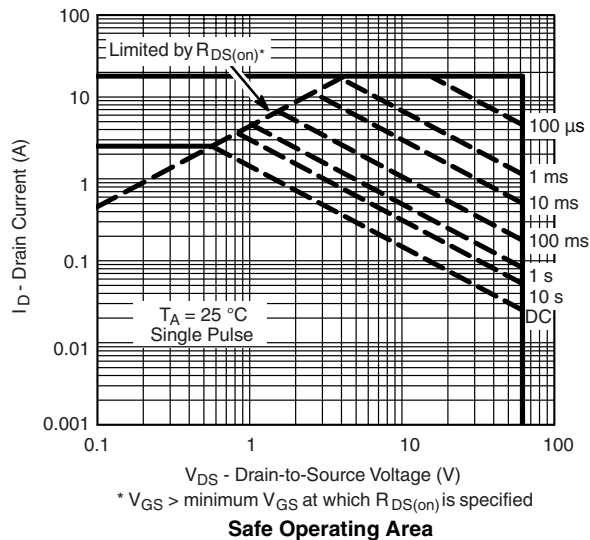
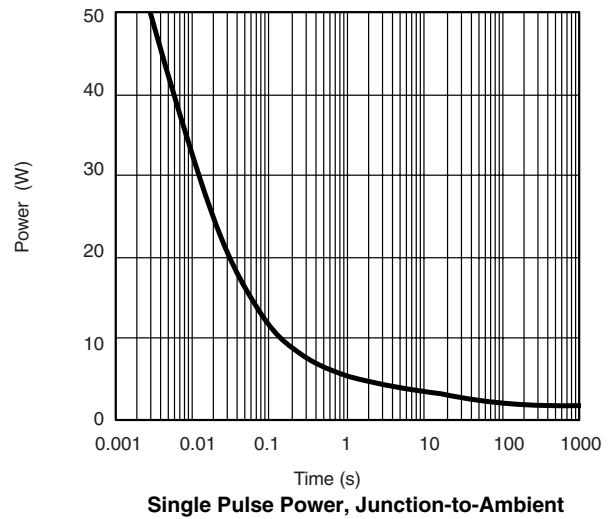
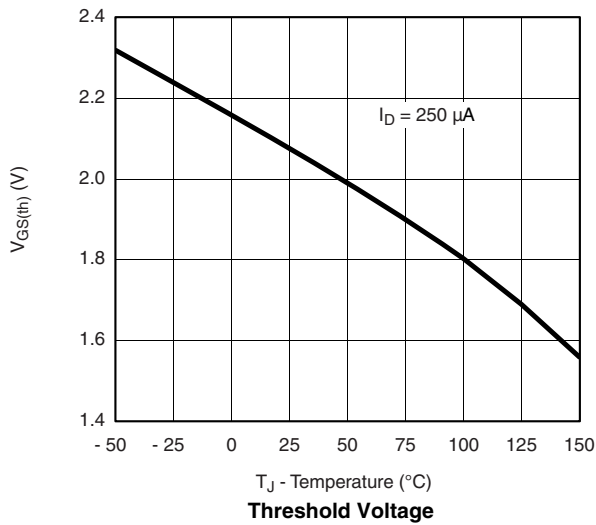
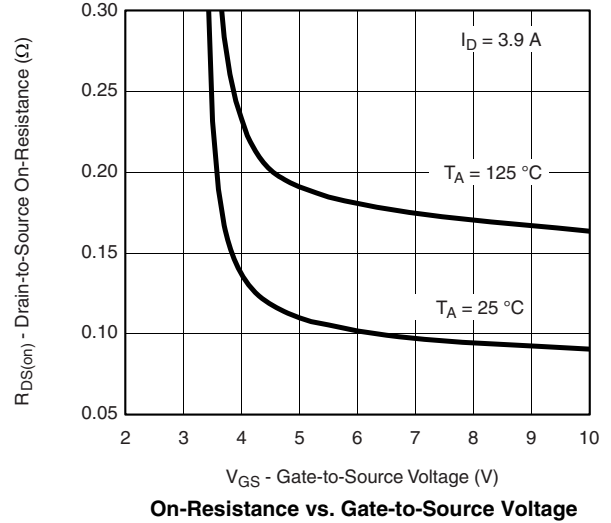
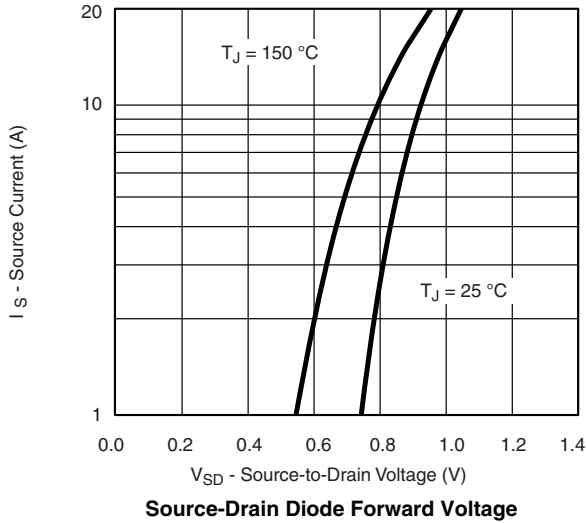


Gate Charge

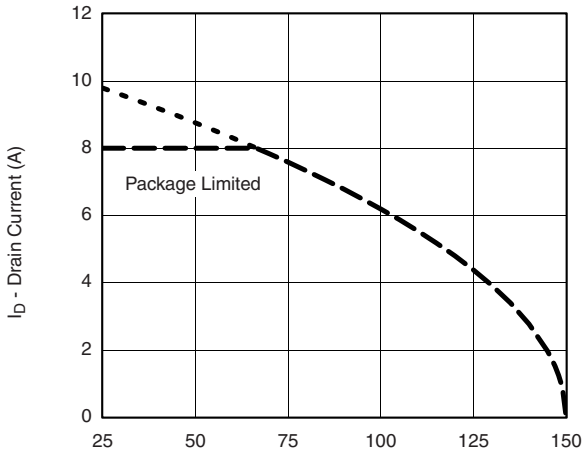


On-Resistance vs. Junction Temperature

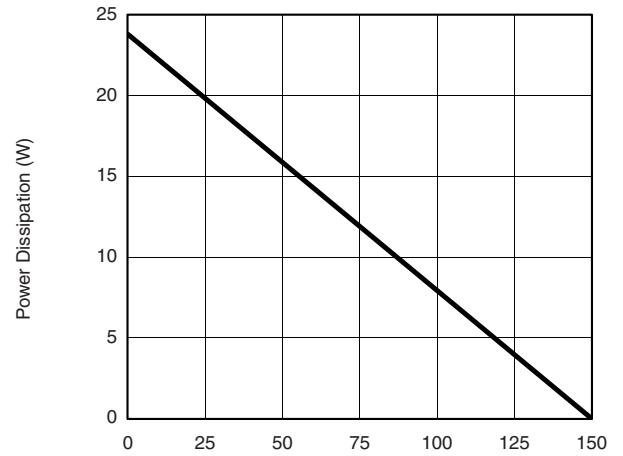
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



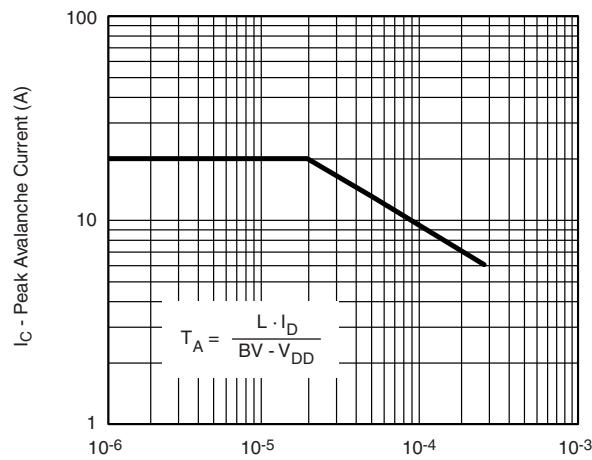
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



T_C - Case Temperature (°C)
Current Derating*



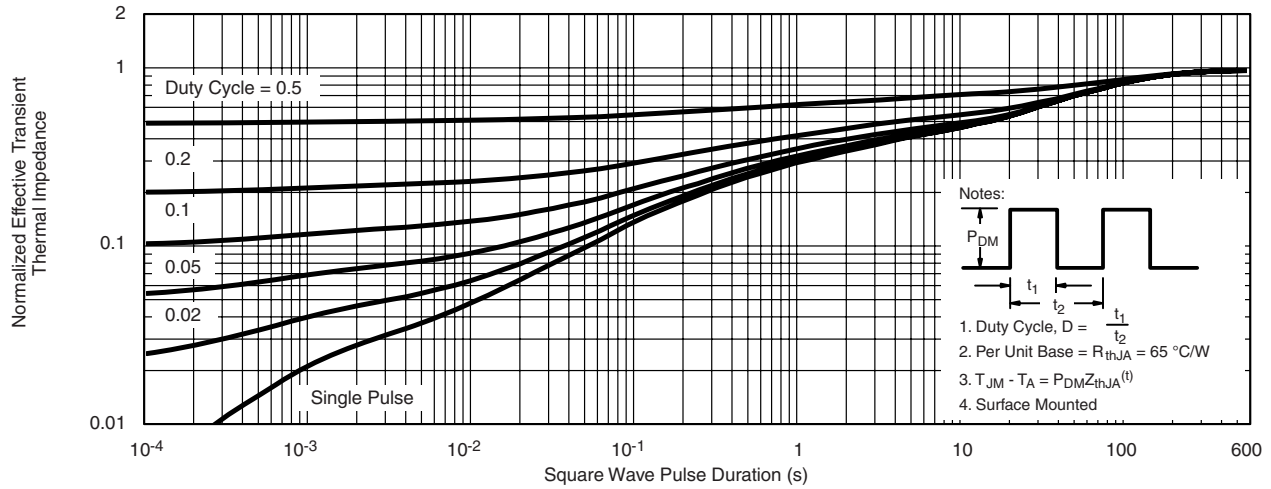
T_C - Case Temperature (°C)
Power Derating



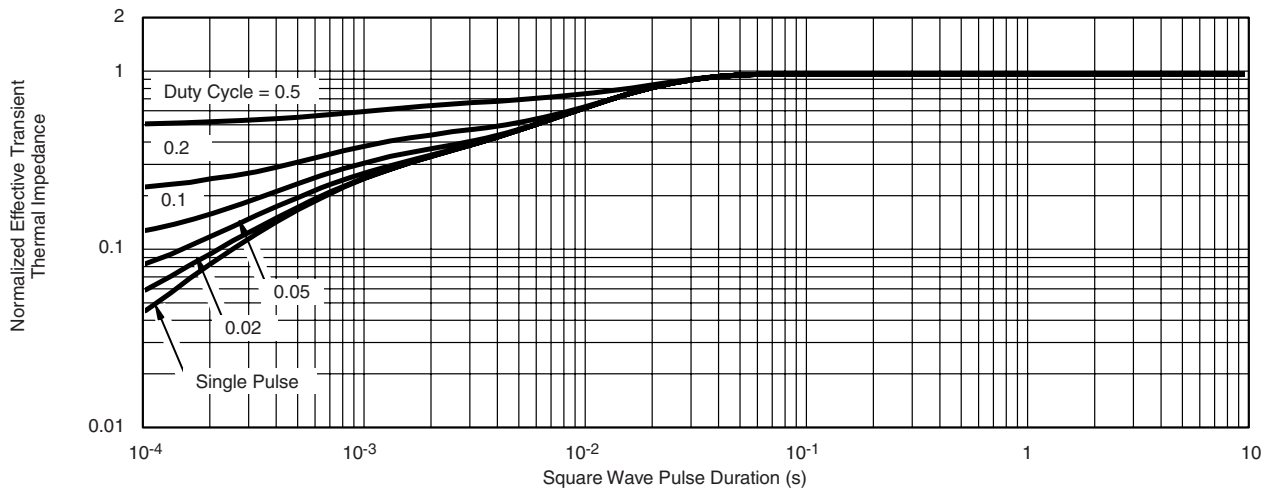
Single Pulse Avalanche Capability

* 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.

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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