

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

PRODUCT SUMMARY			
V_{DS} (V)	$r_{DS(on)}$ (Ω)	I_D (A) ^a	Q_g (Typ)
20	0.168 at $V_{GS} = 4.5$ V	1.3 ^a	1.6 nC
	0.200 at $V_{GS} = 2.5$ V	1.3 ^a	
	0.250 at $V_{GS} = 1.8$ V	1.3 ^a	

FEATURES

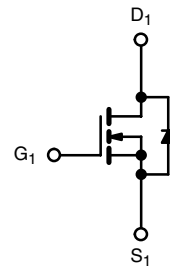
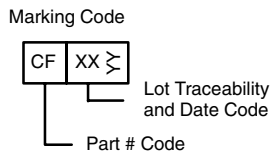
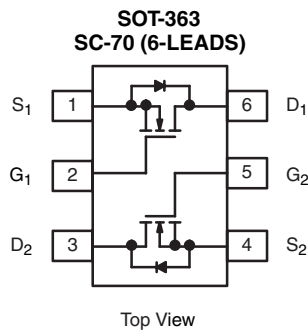
- TrenchFET[®] Power MOSFET

APPLICATIONS

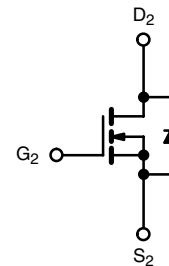
- Load Switch for Portable Applications



RoHS
COMPLIANT



N-Channel MOSFET



N-Channel MOSFET

Ordering Information: Si1988DH-T1-E3 (Lead (Pb)-free)

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}	± 8	
Continuous Drain Current ($T_J = 150$ °C)	I_D	$T_C = 25$ °C	1.3 ^a
		$T_C = 70$ °C	1.3 ^a
		$T_A = 25$ °C	1.3 ^{a, b, c}
		$T_A = 70$ °C	1.3 ^{a, b, c}
Pulsed Drain Current	I_{DM}	4	A
Continuous Source-Drain Diode Current	I_S	$T_C = 25$ °C	
		$T_A = 25$ °C	0.61 ^{b, c}
Maximum Power Dissipation	P_D	$T_C = 25$ °C	1.25
		$T_C = 70$ °C	0.8
		$T_A = 25$ °C	0.74 ^{b, c}
		$T_A = 70$ °C	0.47 ^{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}	R_{thJA}	130	170	°C/W
Maximum Junction-to-Foot (Drain)	R_{thJF}	80	100	

Notes:

- Package limited.
- Surface Mounted on 1" x 1" FR4 Board.
- t = 5 sec.
- Maximum under Steady State conditions is 220 °C/W.

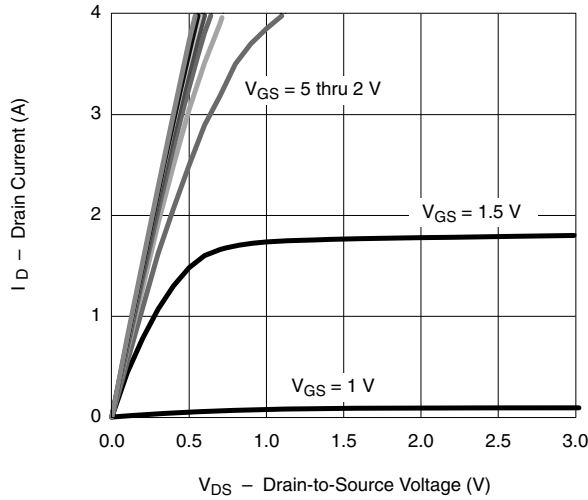
SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	20			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		19.7		mV/ $^\circ\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			-2.4		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	0.4		1	V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 8\text{ V}$			± 100	ns
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 20\text{ V}$, $V_{GS} = 0\text{ V}$			1	μA
		$V_{DS} = 20\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 55\text{ }^\circ\text{C}$			10	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \leq 5\text{ V}$, $V_{GS} = 4.5\text{ V}$	4			A
Drain-Source On-State Resistance ^a	$r_{DS(on)}$	$V_{GS} = 4.5\text{ V}$, $I_D = 1.4\text{ A}$		0.139	0.168	Ω
		$V_{GS} = 2.5\text{ V}$, $I_D = 1.3\text{ A}$		0.165	0.200	
		$V_{GS} = 1.8\text{ V}$, $I_D = 0.4\text{ A}$		0.205	0.250	
Forward Transconductance ^a	g_{fs}	$V_{DS} = 4\text{ V}$, $I_D = 1.4\text{ A}$		4		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = 10\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$		110		pF
Output Capacitance	C_{oss}			25		
Reverse Transfer Capacitance	C_{rss}			11		
Total Gate Charge	Q_g	$V_{DS} = 10\text{ V}$, $V_{GS} = 8\text{ V}$, $I_D = 1.6\text{ A}$		2.7	4.1	nC
		$V_{DS} = 10\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 1.6\text{ A}$		1.6	2.4	
Gate-Source Charge	Q_{gs}			0.3		
Gate-Drain Charge	Q_{gd}		0.25			
Gate Resistance	R_g	$f = 1\text{ MHz}$		4		Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}$, $R_L = 7.7\text{ }\Omega$ $I_D \cong 1.3\text{ A}$, $V_{GEN} = 4.5\text{ V}$, $R_g = 1\text{ }\Omega$		8	12	ns
Rise Time	t_r			20	30	
Turn-Off Delay Time	$t_{d(off)}$			15	25	
Fall Time	t_f			10	15	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}$, $R_L = 7.7\text{ }\Omega$ $I_D \cong 1.3\text{ A}$, $V_{GEN} = 8\text{ V}$, $R_g = 1\text{ }\Omega$		5	10	
Rise Time	t_r			11	20	
Turn-Off Delay Time	$t_{d(off)}$			10	15	
Fall Time	t_f			6	10	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^\circ\text{C}$			1	A
Pulse Diode Forward Current	I_{SM}				4	
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}	$I_F = 1.3\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $T_J = 25\text{ }^\circ\text{C}$		20	40	ns
Body Diode Reverse Recovery Charge	Q_{rr}			20	40	nC
Reverse Recovery Fall Time	t_a			16		ns
Reverse Recovery Rise Time	t_b			4		

Notes:

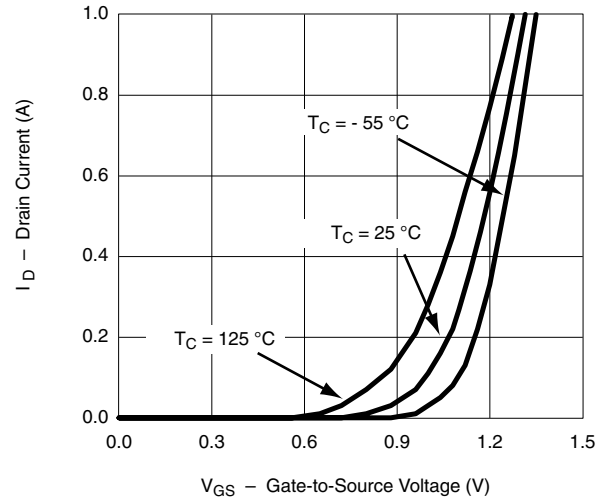
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
b. Guaranteed by design, not subject to production testing.

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.

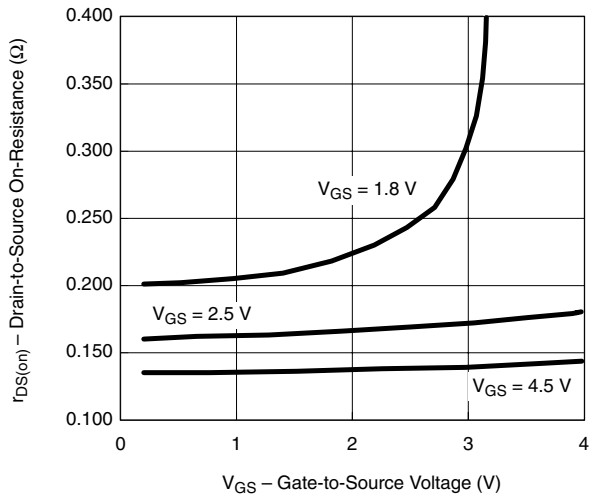
TYPICAL CHARACTERISTICS 25 °C, unless noted



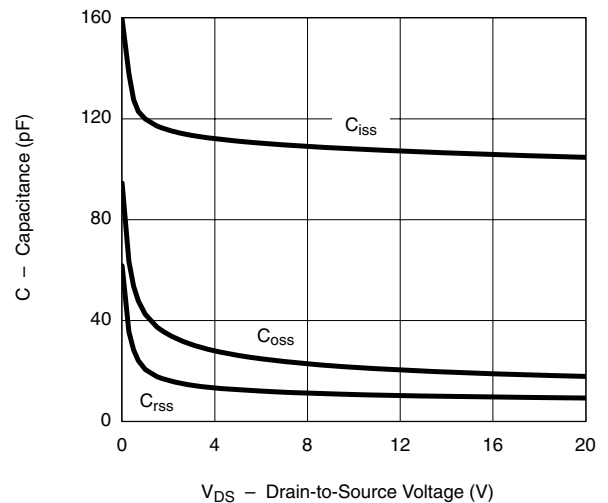
Output Characteristics



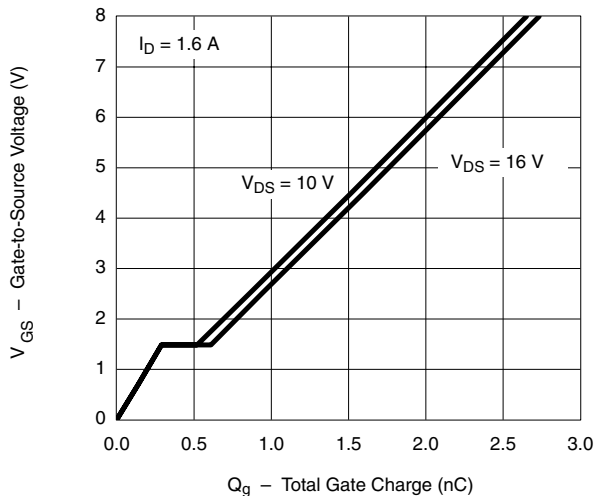
Transfer Characteristics



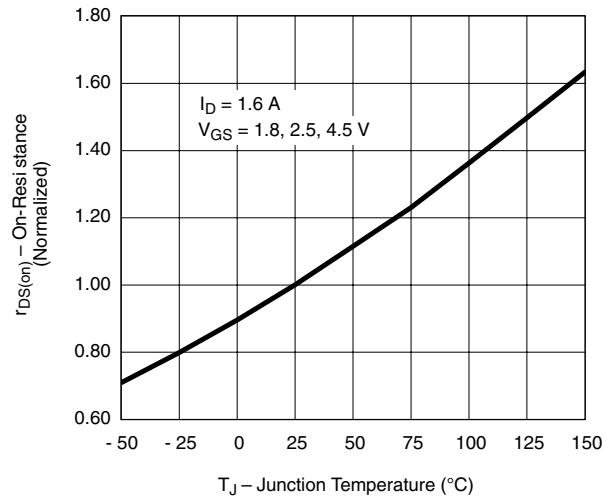
On-Resistance vs. Drain Current



Capacitance

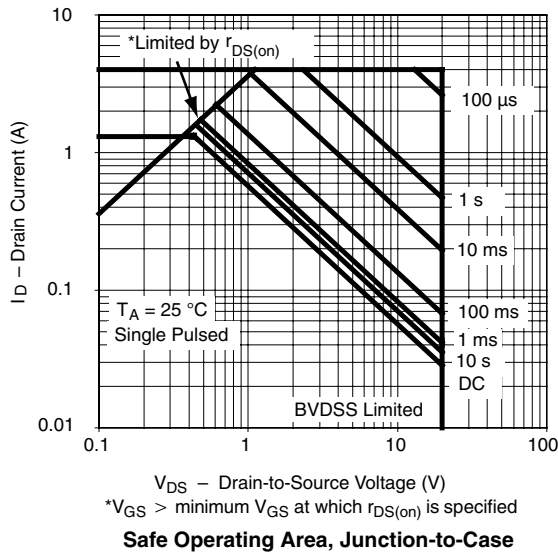
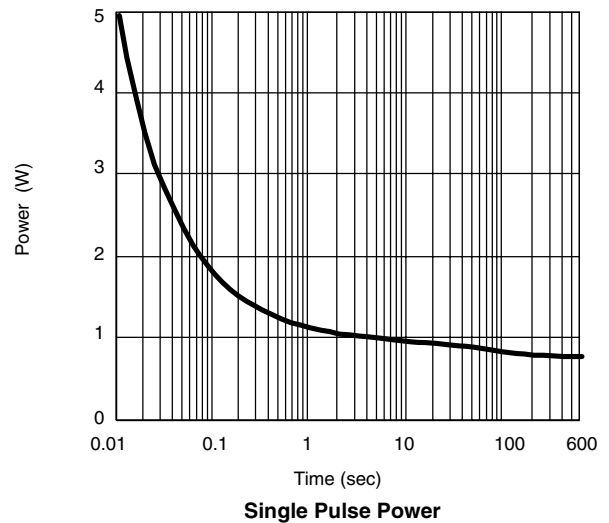
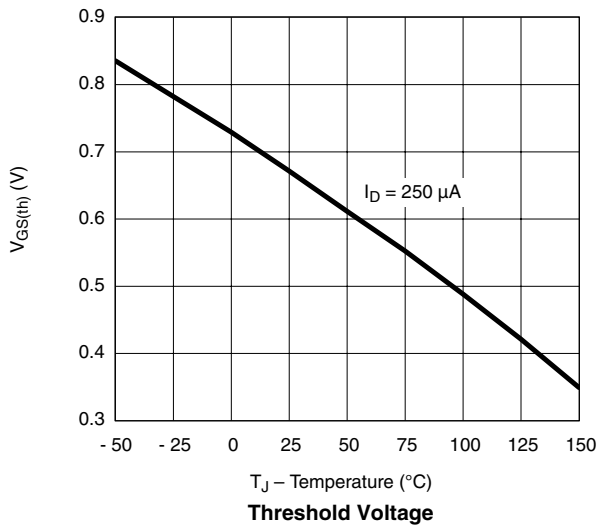
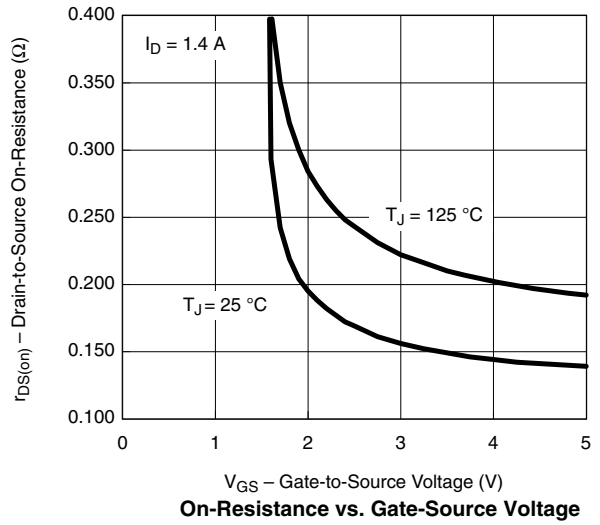
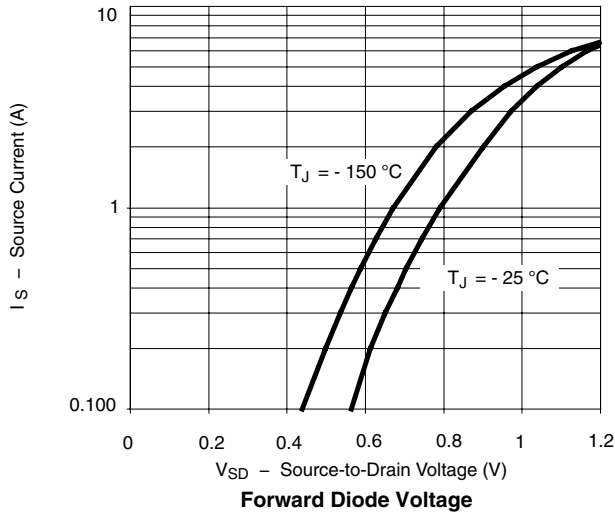


Gate Charge

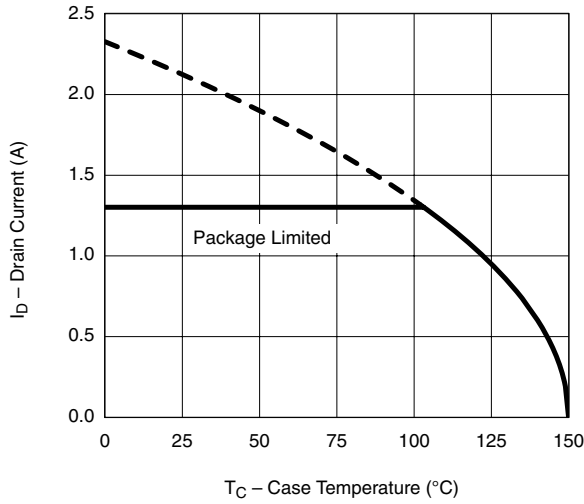


On-Resistance vs. Junction Temperature

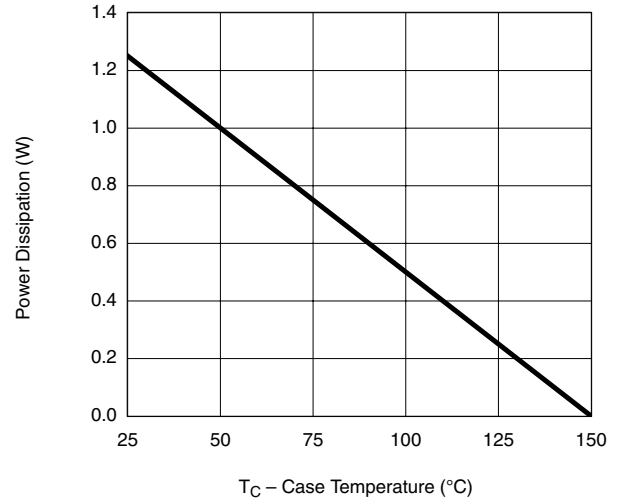
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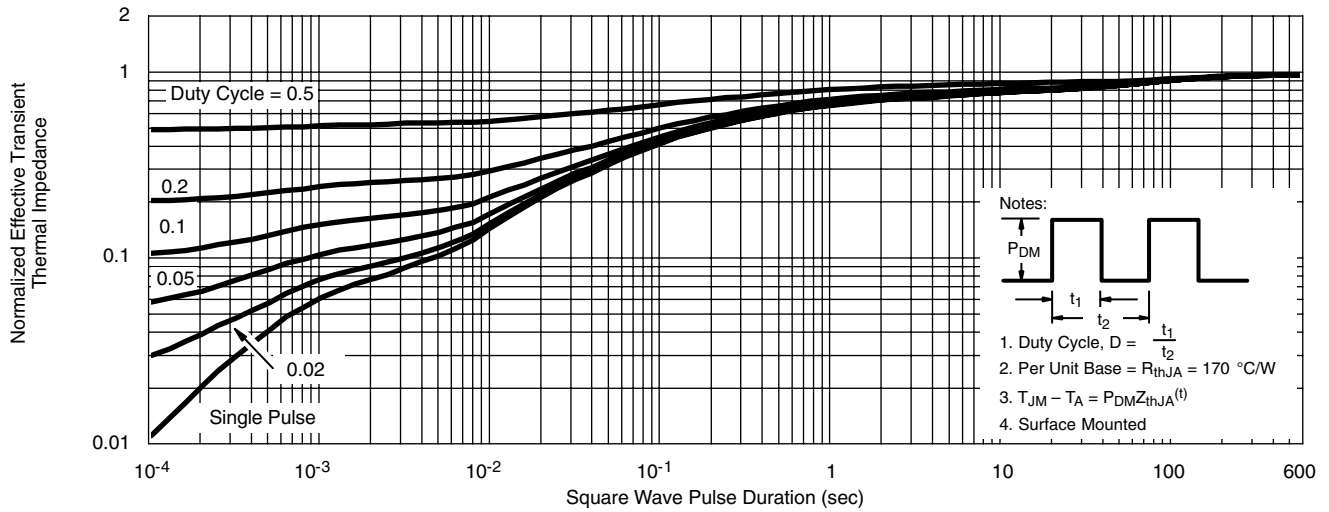


Current Derating*



Power Derating

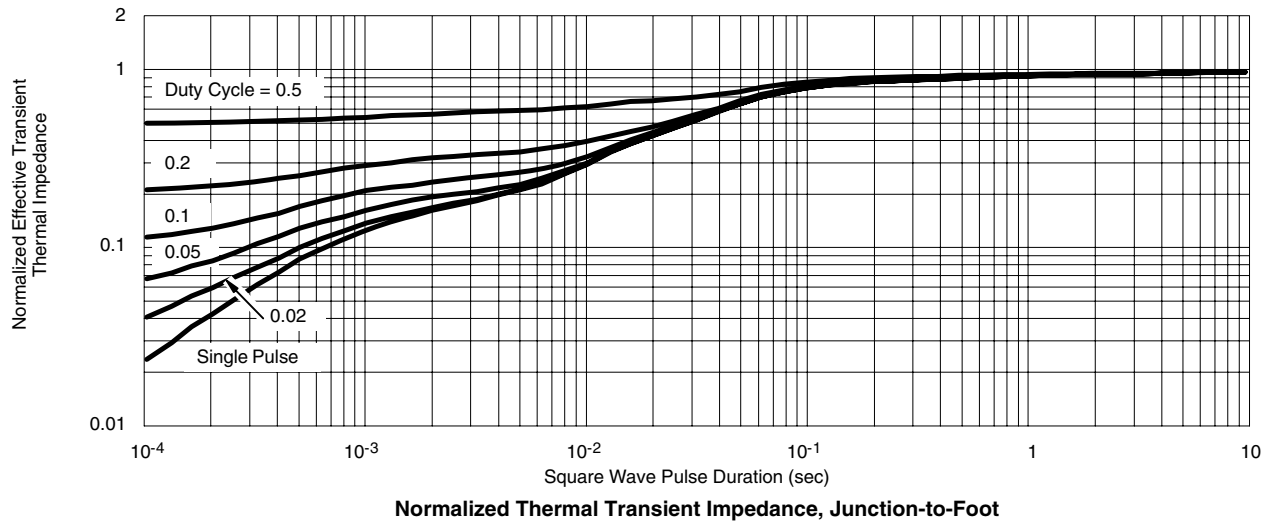
*The power dissipation P_D is based on $T_{J(max)} = 150\text{ °C}$, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package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



Normalized Thermal Transient Impedance, Junction-to-Ambient



TYPICAL CHARACTERISTICS 25 °C, unless noted



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