



## N-Channel 40-V (D-S) MOSFET

PRODUCT SUMMARY			
$V_{DS}$ (V)	$r_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>d</sup>	$Q_g$ (Typ.)
40	0.009 at $V_{GS} = 10$ V	19	15 nC
	0.012 at $V_{GS} = 4.5$ V	16	

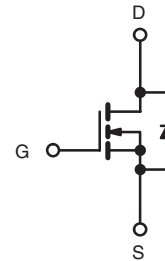
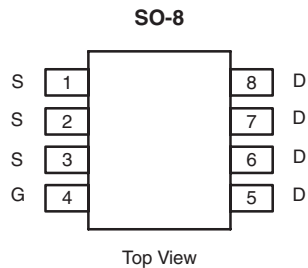
## FEATURES

- TrenchFET<sup>®</sup> Power MOSFET
- 100 %  $R_g$  Tested
- 100 % UIS Tested



## APPLICATIONS

- Synchronous Rectification
- POL, IBC  
- Secondary Side



Ordering Information: Si4840BDY-T1-E3 (Lead (Pb)-free)

N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted				
Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	$V_{DS}$	40	V	
Gate-Source Voltage	$V_{GS}$	$\pm 20$		
Continuous Drain Current ( $T_J = 150$ °C)	$I_D$	$T_C = 25$ °C	19	A
		$T_C = 70$ °C	15	
		$T_A = 25$ °C	12.4 <sup>a, b</sup>	
		$T_A = 70$ °C	9.9 <sup>a, b</sup>	
Pulsed Drain Current	$I_{DM}$	50		
Avalanche Current	$L = 0.1$ mH	$I_{AS}$	15	mJ
Avalanche Energy		$E_{AS}$	11	
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25$ °C	5	A
		$T_A = 25$ °C	2.1 <sup>a, b</sup>	
Maximum Power Dissipation	$P_D$	$T_C = 25$ °C	6	W
		$T_C = 70$ °C	3.8	
		$T_A = 25$ °C	2.5 <sup>a, b</sup>	
		$T_A = 70$ °C	1.6 <sup>a, b</sup>	
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 <sup>a, c</sup>	$R_{thJA}$	37	50	°C/W
Maximum Junction-to-Foot (Drain)	$R_{thJF}$	17	21	

Notes:

- Surface Mounted on 1" x 1" FR4 board.
- $t = 10$  s.
- Maximum under Steady State conditions is 85 °C/W.
- Based on  $T_C = 25$  °C.



SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	40			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		40		mV/ $^\circ\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			-6		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1		3	V
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			5	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	50			A
Drain-Source On-State Resistance <sup>a</sup>	$r_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 12.4\text{ A}$		0.0074	0.009	$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 10.8\text{ A}$		0.0095	0.012	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}, I_D = 12.4\text{ A}$		56		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		2000		pF
Output Capacitance	$C_{oss}$			260		
Reverse Transfer Capacitance	$C_{rss}$			150		
Total Gate Charge	$Q_g$	$V_{DS} = 10\text{ V}, V_{GS} = 10\text{ V}, I_D = 12.4\text{ A}$		33	50	nC
		$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 12.4\text{ A}$		15	23	
Gate-Source Charge	$Q_{gs}$	$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 12.4\text{ A}$		6.7		
Gate-Drain Charge	$Q_{gd}$			5.1		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		1.4	2.1	$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 20\text{ V}, R_L = 2\text{ }\Omega$ $I_D \cong 10\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$		30	45	ns
Rise Time	$t_r$			150	225	
Turn-Off Delay Time	$t_{d(off)}$			30	45	
Fall Time	$t_f$			40	60	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 20\text{ V}, R_L = 2\text{ }\Omega$ $I_D \cong 10\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		10	15	
Rise Time	$t_r$			15	25	
Turn-Off Delay Time	$t_{d(off)}$			30	45	
Fall Time	$t_f$			10	15	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$			30	A
Pulse Diode Forward Current	$I_{SM}$				50	
Body Diode Voltage	$V_{SD}$	$I_S = 10\text{ A}, V_{GS} = 0\text{ V}$		0.8	1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = 10\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		30	60	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			26	52	nC
Reverse Recovery Fall Time	$t_a$			17.5		ns
Reverse Recovery Rise Time	$t_b$			12.5		

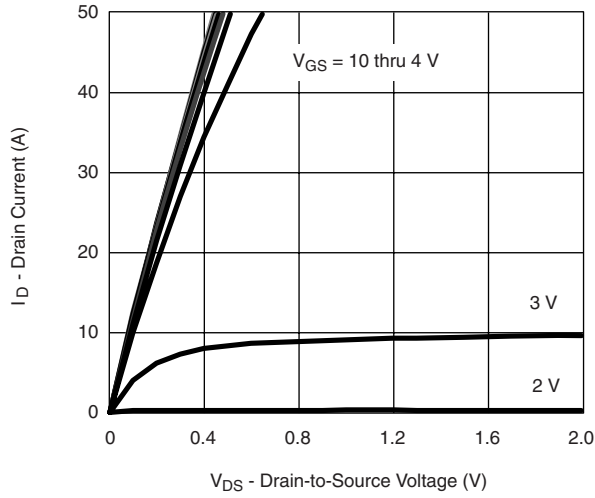
## Notes:

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

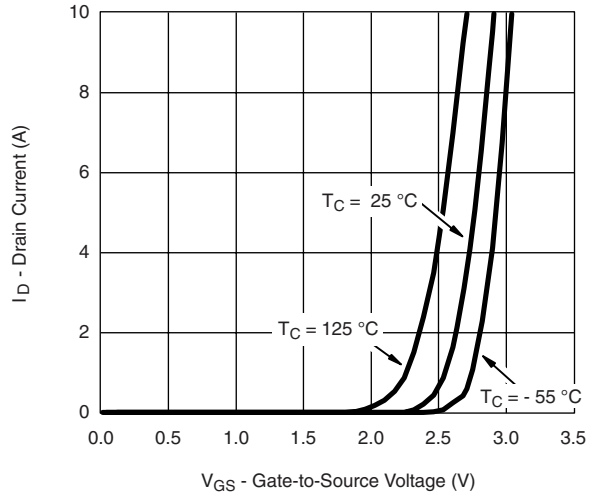
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



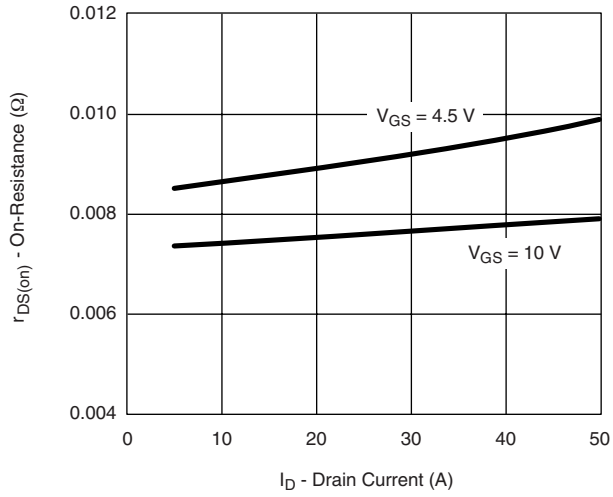
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



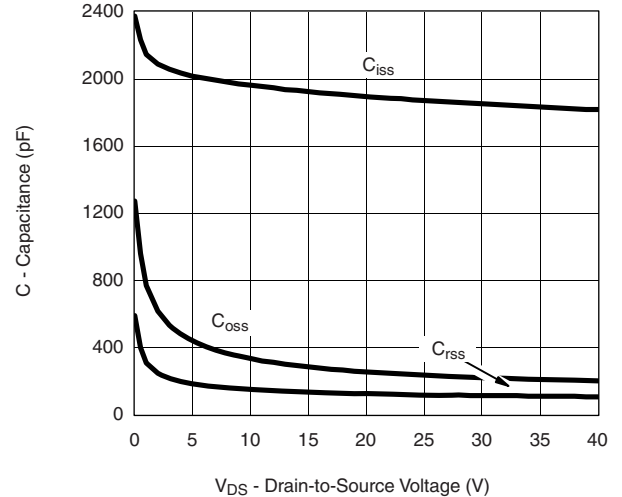
**Output Characteristics**



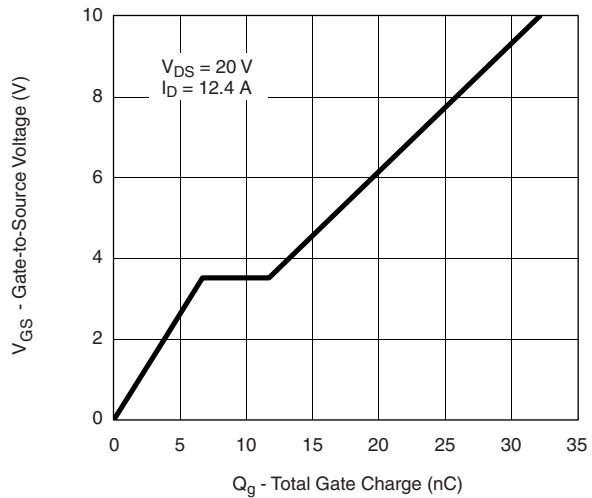
**Transfer Characteristics**



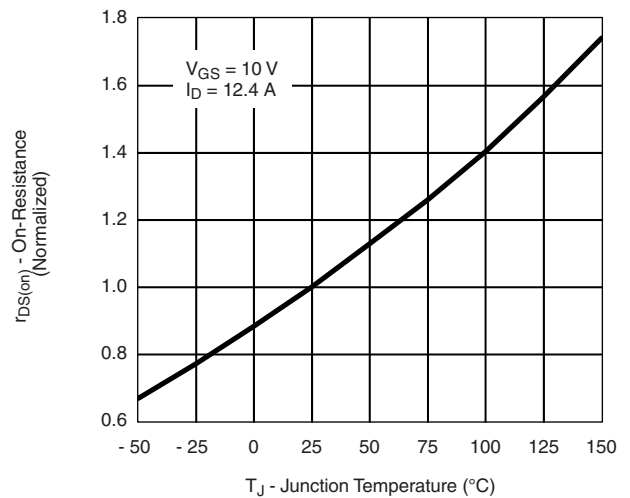
**On-Resistance vs. Drain Current and Gate Voltage**



**Capacitance**



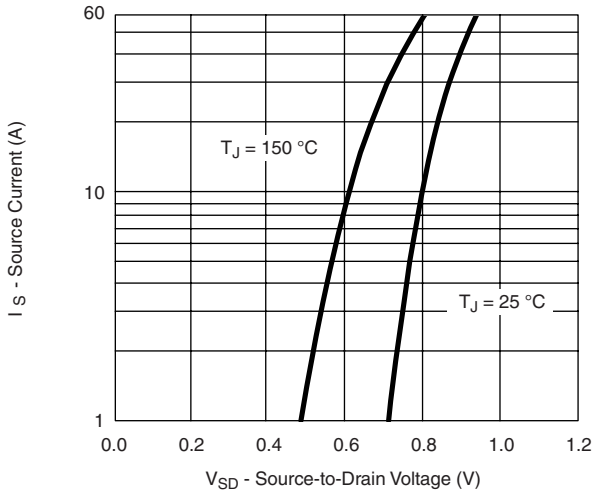
**Gate Charge**



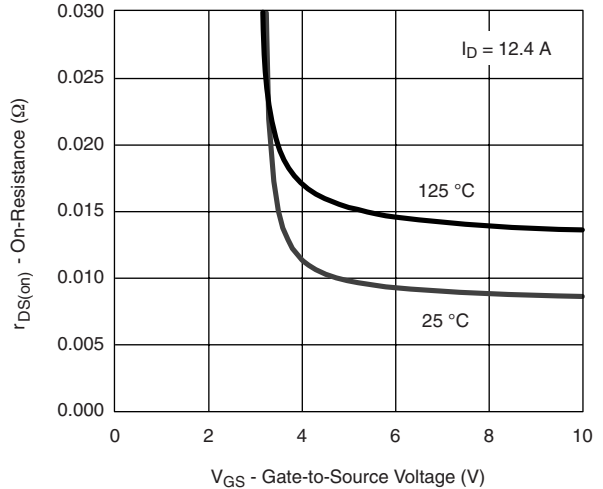
**On-Resistance vs. Junction Temperature**



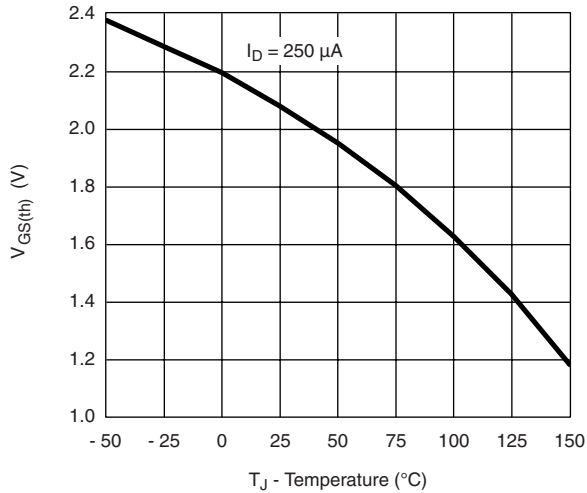
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



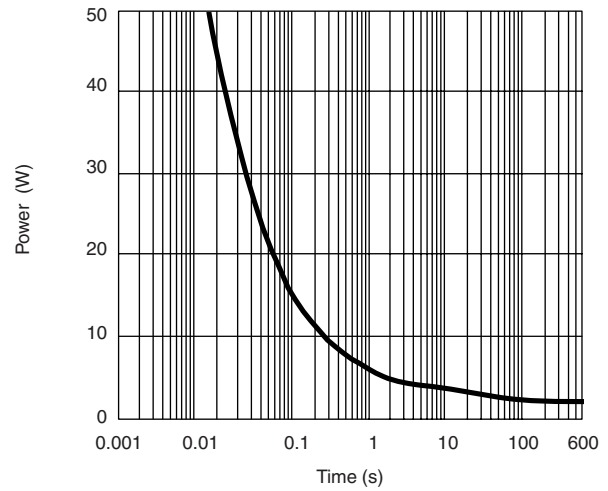
Source-Drain Diode Forward Voltage



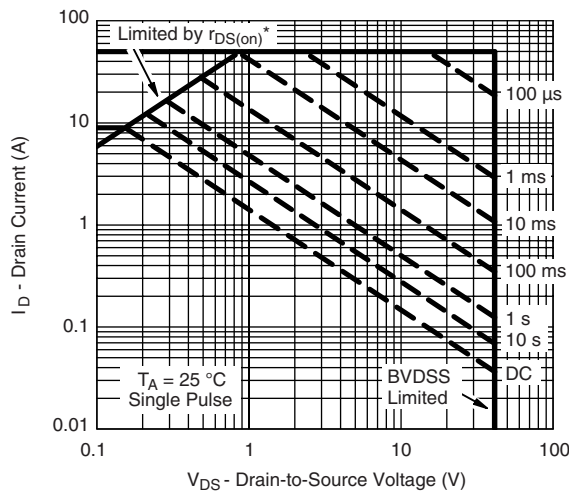
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power (Junction-to-Ambient)

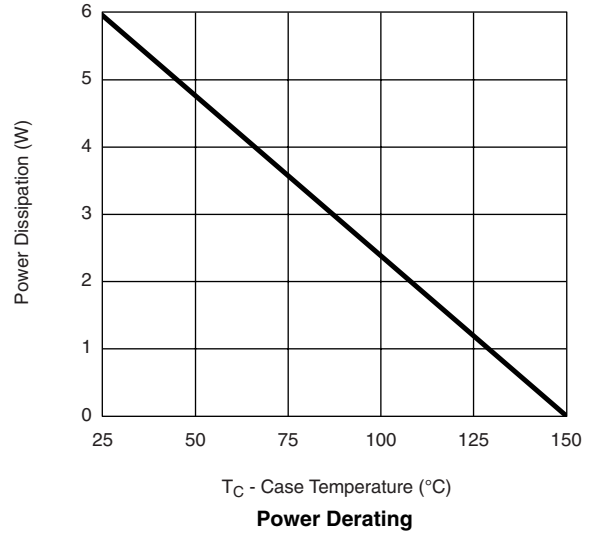
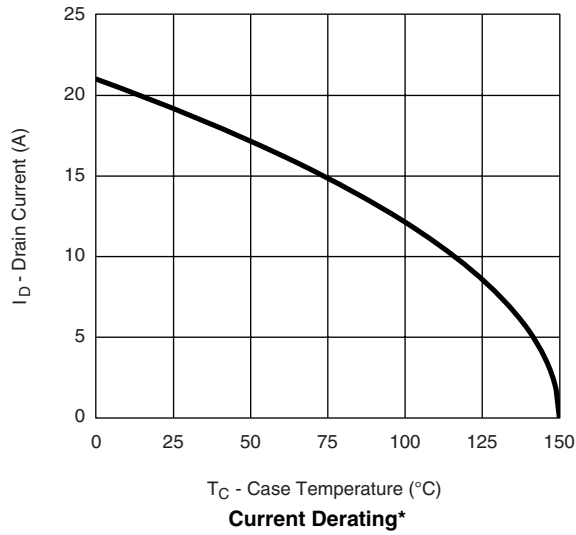


\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $r_{DS(on)}$  is specified

Safe Operating Area, Junction-to-Ambient



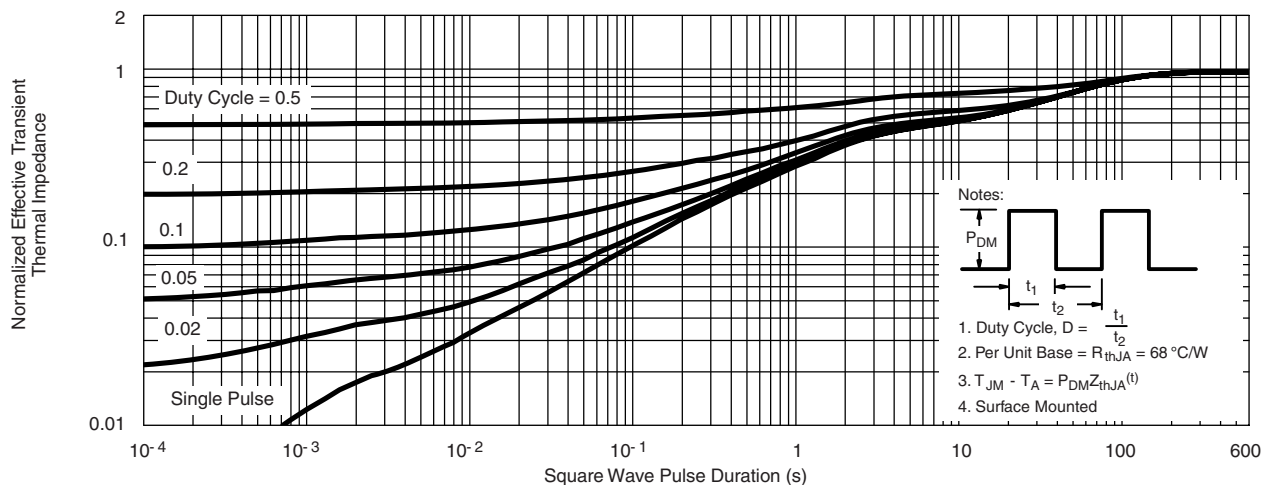
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



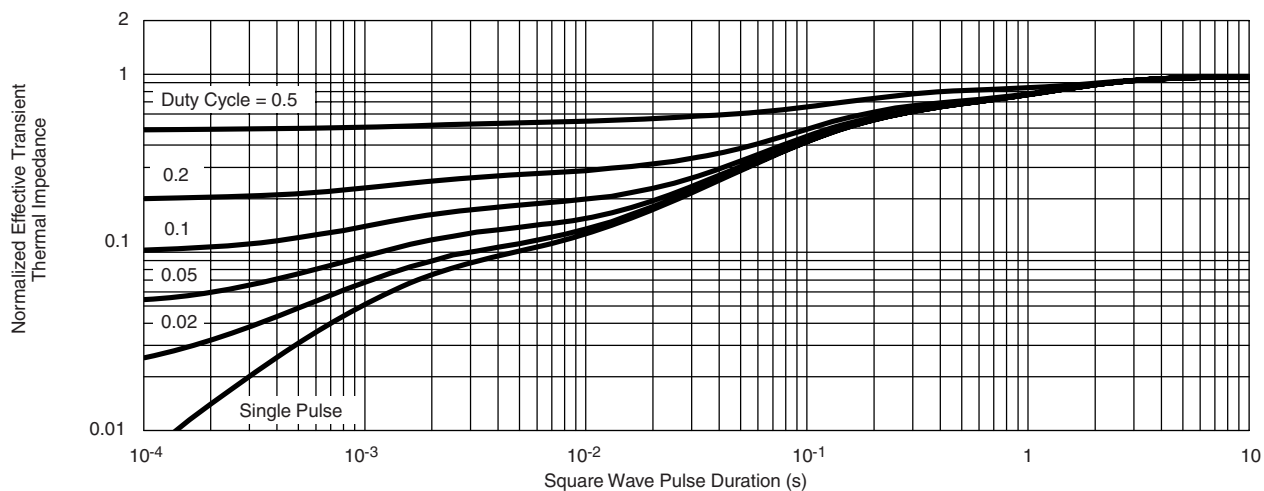
\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package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



**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



**Normalized Thermal Transient Impedance, Junction-to-Ambient**



**Normalized Thermal Transient Impedance, Junction-to-Foot**

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