

## N-Channel 30-V (D-S) MOSFET with Schottky Diode

PRODUCT SUMMARY			
$V_{DS}$ (V)	$r_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ)
30	0.0115 at $V_{GS} = 10$ V	16	13.3 nC
	0.016 at $V_{GS} = 4.5$ V	12.7	

SCHOTTKY AND BODY DIODE PRODUCT SUMMARY		
$V_{DS}$ (V)	$V_{SD}$ (V) Diode Forward Voltage	$I_S$ (A)
30	0.4 at 2 A	5 <sup>a</sup>

### FEATURES

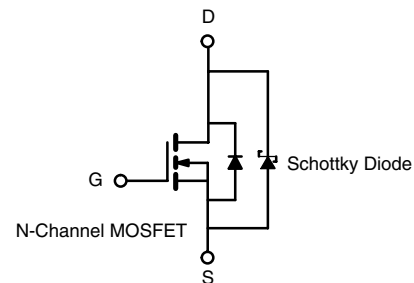
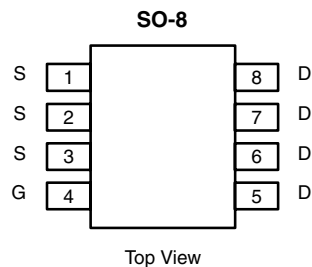
- TrenchFET<sup>®</sup> Power MOSFET
- 100 %  $R_g$  and UIS Tested

### APPLICATIONS

- Notebook Logic DC/DC  
- Low Side



**RoHS**  
COMPLIANT



Ordering Information : Si4396DY-T1-E3 (Lead (Pb)-free)

ABSOLUTE MAXIMUM RATINGS $T_A = 25$ °C, unless otherwise noted				
Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	$V_{DS}$	30	V	
Gate-Source Voltage	$V_{GS}$	$\pm 20$		
Continuous Drain Current ( $T_J = 150$ °C)	$I_D$	$T_C = 25$ °C	16	
		$T_C = 70$ °C	12.7	
		$T_A = 25$ °C	12.3 <sup>b, c</sup>	
		$T_A = 70$ °C	9.7 <sup>b, c</sup>	
Pulsed Drain Current	$I_{DM}$	40	A	
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25$ °C		5
		$T_A = 25$ °C		2.8 <sup>b, c</sup>
Single Pulse Avalanche Current	$I_{AS}$	20		mJ
Single Pulse Avalanche Energy	$E_{AS}$	20		
Maximum Power Dissipation	$P_D$	$T_C = 25$ °C	5.4	
		$T_C = 70$ °C	3.4	
		$T_A = 25$ °C	3.1 <sup>b, c</sup>	
		$T_A = 70$ °C	2.0 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150	°C	

THERMAL RESISTANCE RATINGS					
Parameter		Symbol	Typ	Max	Unit
Maximum Junction-to-Ambient <sup>b, d</sup>	$t \leq 10$ sec	$R_{thJA}$	34	40	°C/W
Maximum Junction-to-Foot (Drain)	Steady State	$R_{thJF}$	17	23	

Notes:

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

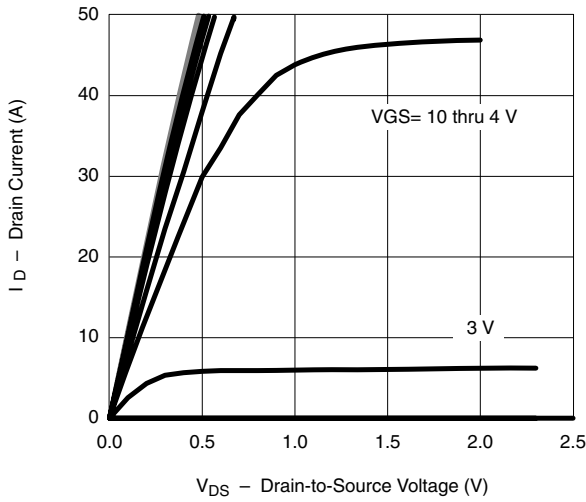
<b>SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	30			V
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.2		2.6	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	$I_{DSS}$	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$		0.18	1	mA
		$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}, T_J = 100\text{ }^\circ\text{C}$		22	100	
On -State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	20			A
Drain-Source On-State Resistance <sup>a</sup>	$r_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 10\text{ A}$		0.0095	0.0115	$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 8\text{ A}$		0.0132	0.0160	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}, I_D = 10\text{ A}$		40		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 15\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		1675		pF
Output Capacitance	$C_{oss}$			410		
Reverse Transfer Capacitance	$C_{rss}$			150		
Total Gate Charge	$Q_g$	$V_{DS} = 15\text{ V}, V_{GS} = 10\text{ V}, I_D = 10\text{ A}$		29.6	45	nC
				13.3	20	
Gate-Source Charge	$Q_{gs}$	$V_{DS} = 15\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 10\text{ A}$		4.5		
Gate-Drain Charge	$Q_{gd}$			4.3		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		1.55	2.4	$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 15\text{ V}, R_L = 3\text{ }\Omega$ $I_D \cong 5\text{ A}, V_{GEN} = 4.5\text{ V}, R_G = 1\text{ }\Omega$		22	33	ns
Rise Time	$t_r$			71	110	
Turn-Off Delay Time	$t_{d(off)}$			22	33	
Fall Time	$t_f$			7	14	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 15\text{ V}, R_L = 3\text{ }\Omega$ $I_D \cong 5\text{ A}, V_{GEN} = 10\text{ V}, R_G = 1\text{ }\Omega$		11	18	
Rise Time	$t_r$			29	45	
Turn-Off Delay Time	$t_{d(off)}$			24	36	
Fall Time	$t_f$			8	15	
<b>Drain-Source Body Diode and Schottky Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$			5	A
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$				40	
Body Diode Voltage	$V_{SD}$	$I_S = 2\text{ A}$		0.35	0.4	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = 4\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		29	45	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			18	27	nC
Reverse Recovery Fall Time	$t_a$			14		ns
Reverse Recovery Rise Time	$t_b$			15		

## Notes:

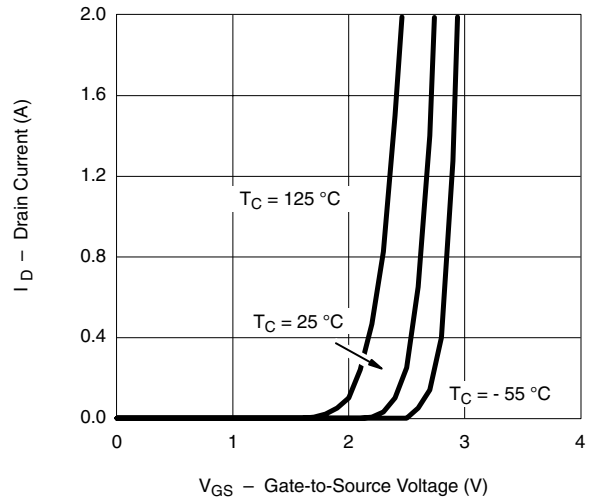
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$   
b. Guaranteed by design, not subject to production testing.

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.

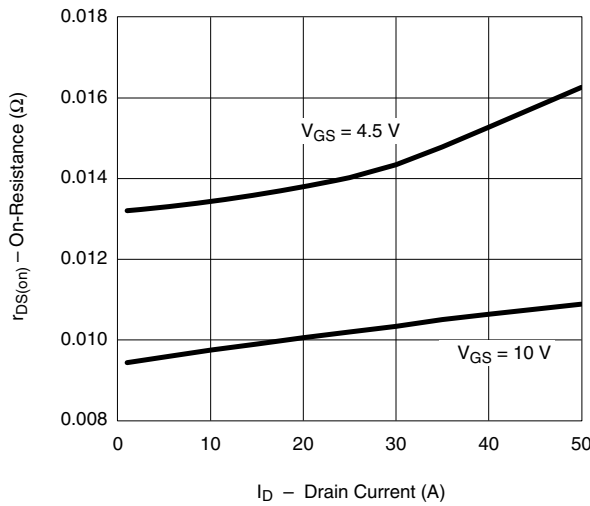
## TYPICAL CHARACTERISTICS 25 °C, unless noted



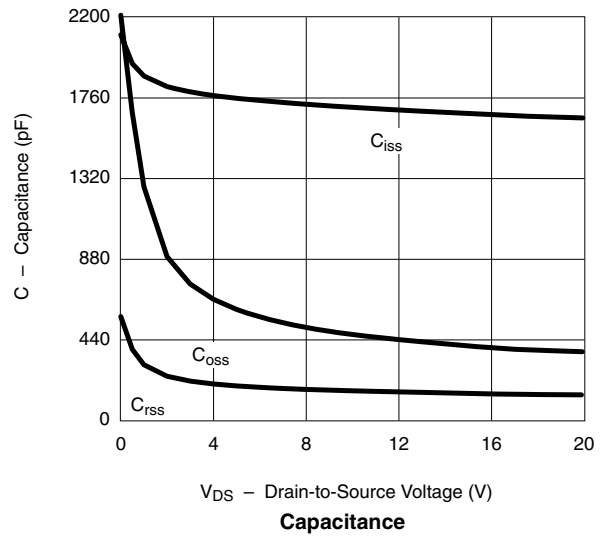
Output Characteristics



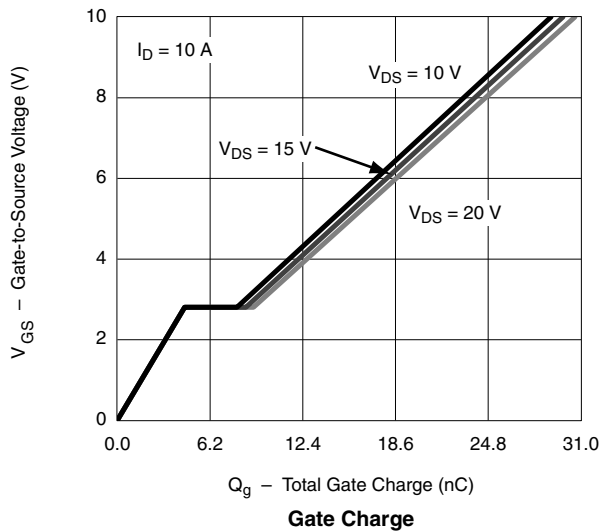
Transfer Characteristics



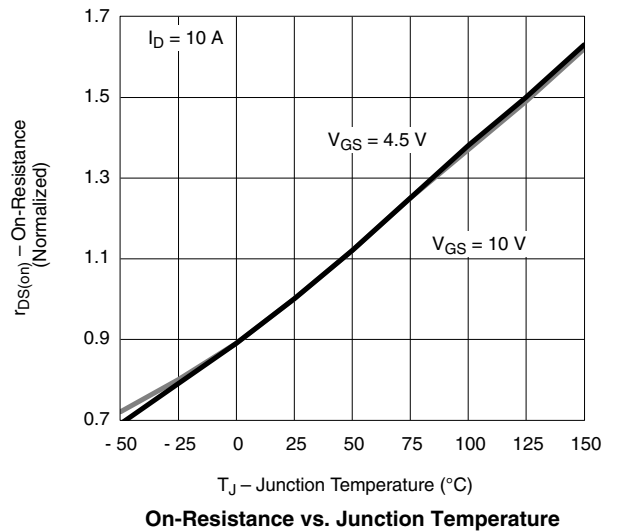
On-Resistance vs. Drain Current



Capacitance

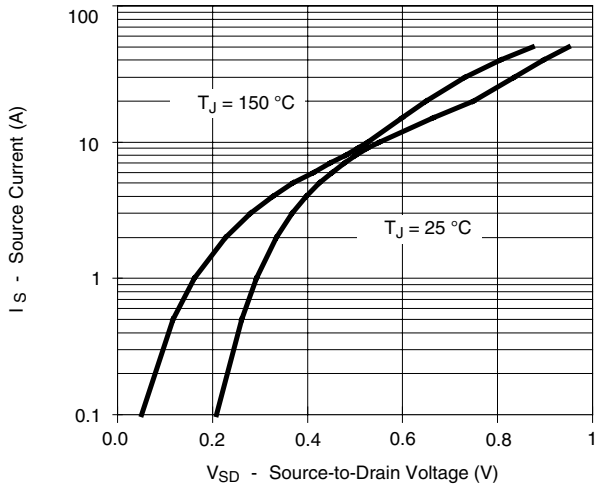


Gate Charge

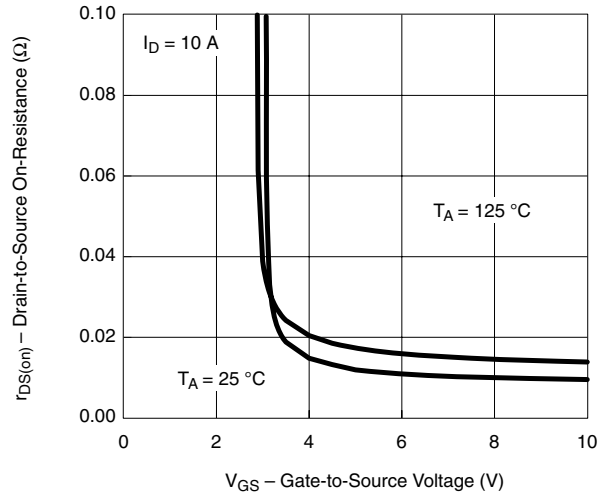


On-Resistance vs. Junction Temperature

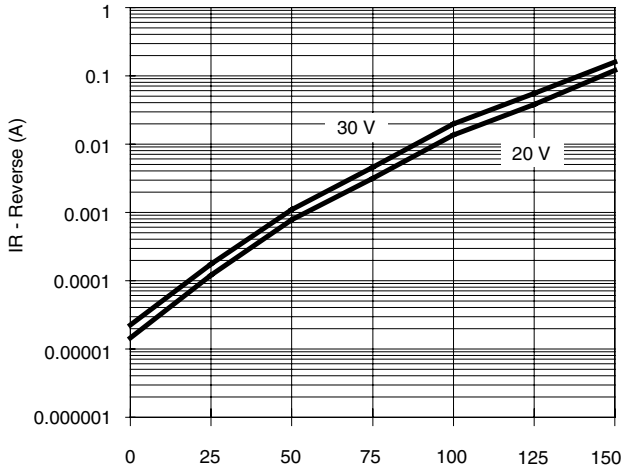
**TYPICAL CHARACTERISTICS** 25 °C, unless noted



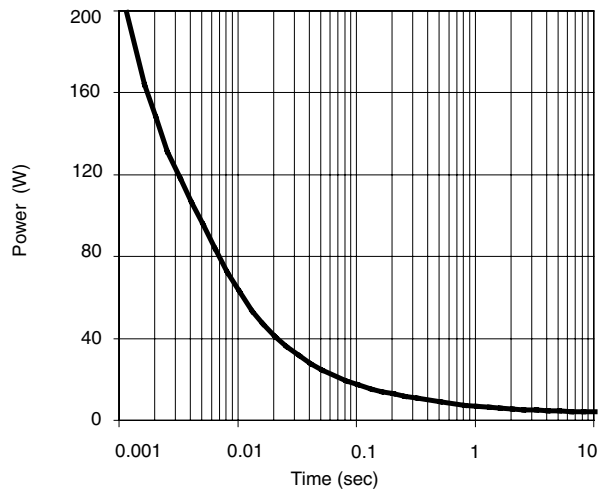
**Source-Drain Diode Forward Voltage**



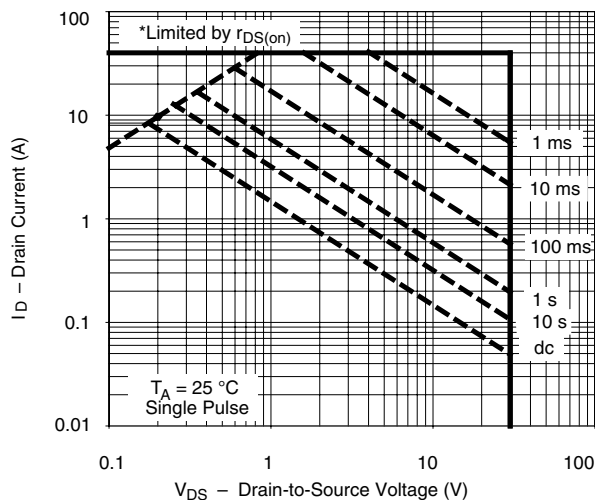
**On-Resistance vs. Gate-to-Source Voltage**



**Reverse Current (Schottky)**

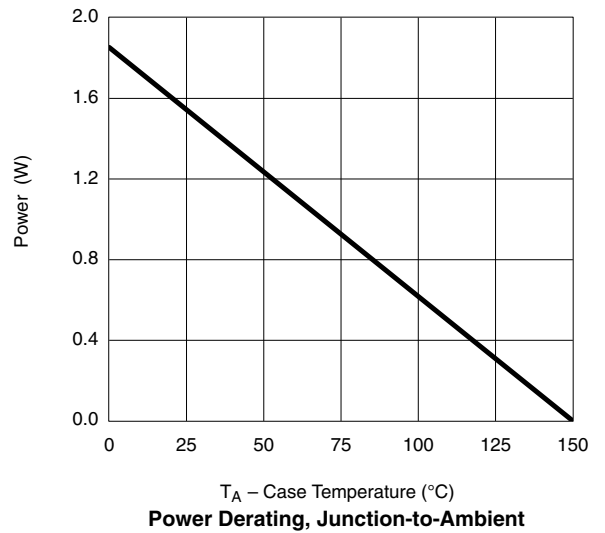
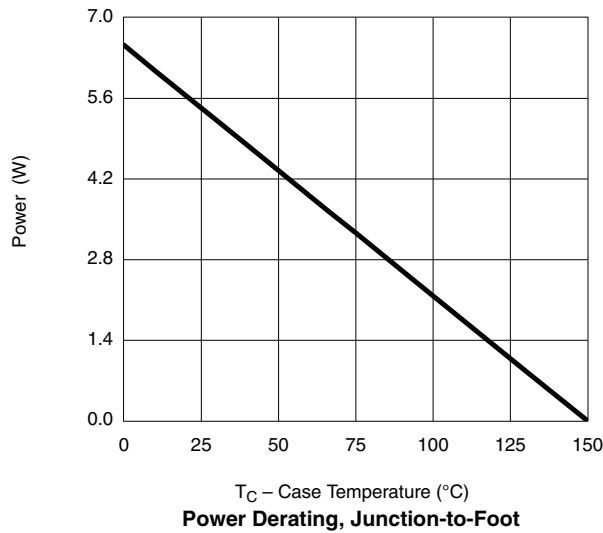
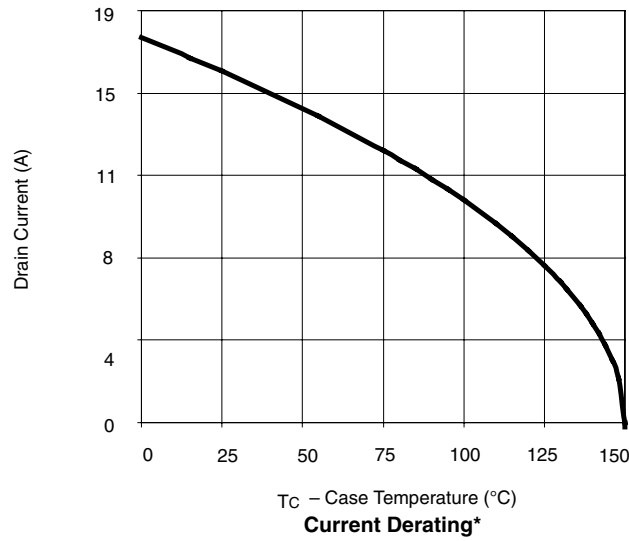


**Junction-to-Ambient**



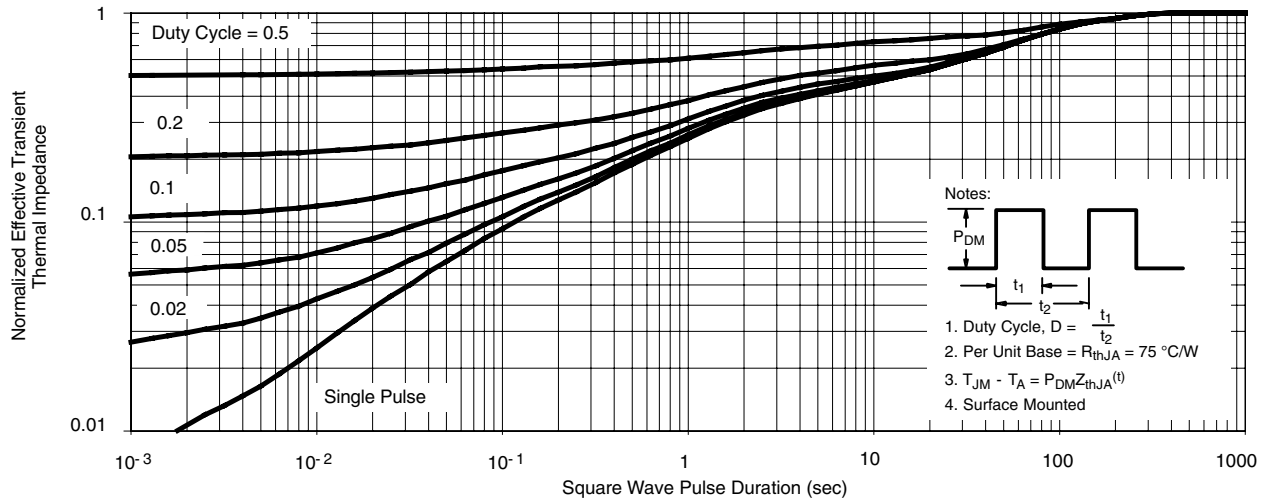
**Safe Operating Area**

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

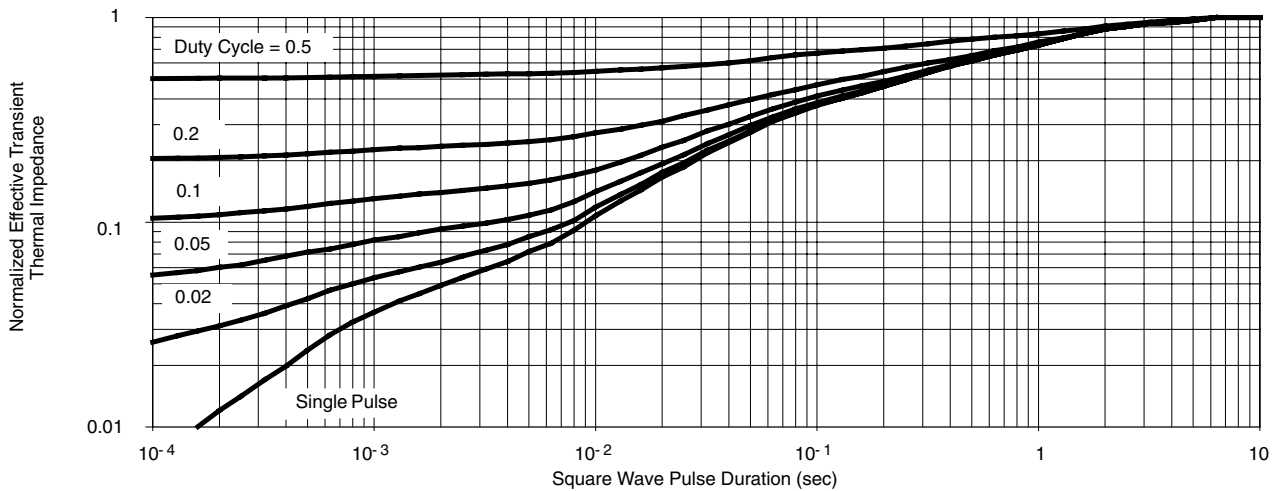


\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150\text{ °C}$ , using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the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

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



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



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

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