

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

PRODUCT SUMMARY			
V <sub>DS</sub> (V)	r <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A) <sup>a</sup>	Q <sub>g</sub> (Typ)
20	0.037 at V <sub>GS</sub> = 4.5 V	6	5.6 nC
	0.065 at V <sub>GS</sub> = 2.5V	6	

### FEATURES

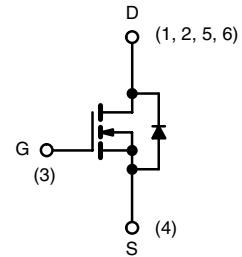
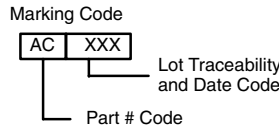
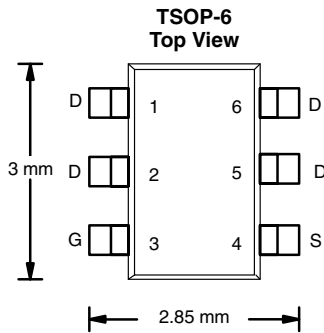
- TrenchFET<sup>®</sup> Power MOSFET
- New Thermally Enhanced PowerPAK<sup>®</sup> ChipFET<sup>®</sup> Package
  - Small Footprint Area
  - Low On-Resistance
  - Thin 0.8-mm Profile



**RoHS**  
COMPLIANT

### APPLICATIONS

- Load Switch for Portable Applications
- Small High Frequency DC-DC converter



Ordering Information: Si3446ADV-T1-E3 (Lead (Pb)-free)

N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS T <sub>A</sub> = 25 °C, unless otherwise noted				
Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V <sub>DS</sub>	20	V
Gate-Source Voltage		V <sub>GS</sub>	± 12	
Continuous Drain Current (T <sub>J</sub> = 150 °C)	T <sub>C</sub> = 25 °C	I <sub>D</sub>	6 <sup>a</sup>	A
	T <sub>C</sub> = 70 °C		5.9	
	T <sub>A</sub> = 25 °C		5.8 <sup>b,c</sup>	
	T <sub>A</sub> = 70 °C		4.7 <sup>b,c</sup>	
Pulsed Drain Current		I <sub>DM</sub>	20	
Continuous Source-Drain Diode Current	T <sub>C</sub> = 25 °C	I <sub>S</sub>	2.7	
	T <sub>A</sub> = 25 °C		1.7 <sup>b,c</sup>	
Maximum Power Dissipation	T <sub>C</sub> = 25 °C	P <sub>D</sub>	3.2	W
	T <sub>C</sub> = 70 °C		2.1	
	T <sub>A</sub> = 25 °C		2 <sup>b,c</sup>	
	T <sub>A</sub> = 70 °C		1.25 <sup>b,c</sup>	
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C

THERMAL RESISTANCE RATINGS					
Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>b, d</sup>	t ≤ 5 sec	R <sub>thJA</sub>	51	62.5	°C/W
Maximum Junction-to-Foot	Steady State	R <sub>thJF</sub>	32	39	

- Notes:
- Package Limited.
  - Surface mounted on 1" x 1" FR4 board.
  - t = 5 sec.
  - Maximum under steady state conditions is 110 °C/W.

<b>SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	20			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		21.5		mV/ $^\circ\text{C}$
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			- 4		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	0.8		1.8	V
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 4.5\text{ V}$	20			A
Drain-Source On-State Resistance <sup>a</sup>	$r_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 5.8\text{ A}$		0.031	0.037	$\Omega$
		$V_{GS} = 2.5\text{ V}, I_D = 1.5\text{ A}$		0.053	0.065	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 10\text{ V}, I_D = 5.8\text{ A}$		15		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		640		pF
Output Capacitance	$C_{oss}$			110		
Reverse Transfer Capacitance	$C_{rss}$			60		
Total Gate Charge	$Q_g$	$V_{DS} = 10\text{ V}, V_{GS} = 10\text{ V}, I_D = 5.8\text{ A}$		13	20	nC
		$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 5.8\text{ A}$		5.6	9	
Gate-Source Charge	$Q_{gs}$			1.45		
Gate-Drain Charge	$Q_{gd}$		1.4			
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		2.8		$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}, R_L = 2.1\text{ }\Omega$ $I_D \cong 4.7\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$		50	75	ns
Rise Time	$t_r$			120	180	
Turn-Off Delay Time	$t_{d(off)}$			30	45	
Fall Time	$t_f$			40	60	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}, R_L = 2.1\text{ }\Omega$ $I_D \cong 4.7\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		7	15	
Rise Time	$t_r$			86	130	
Turn-Off Delay Time	$t_{d(off)}$			25	40	
Fall Time	$t_f$			10	15	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$			6	A
Pulse Diode Forward Current	$I_{SM}$				20	
Body Diode Voltage	$V_{SD}$	$I_S = 4.7\text{ A}, V_{GS} = 0\text{ V}$		0.8	1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = 4.7\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		21	40	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			12	25	nC
Reverse Recovery Fall Time	$t_a$			13		ns
Reverse Recovery Rise Time	$t_b$			8		

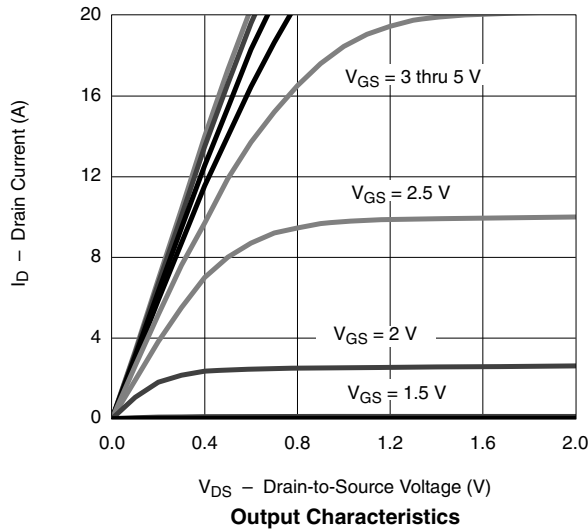
## Notes:

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

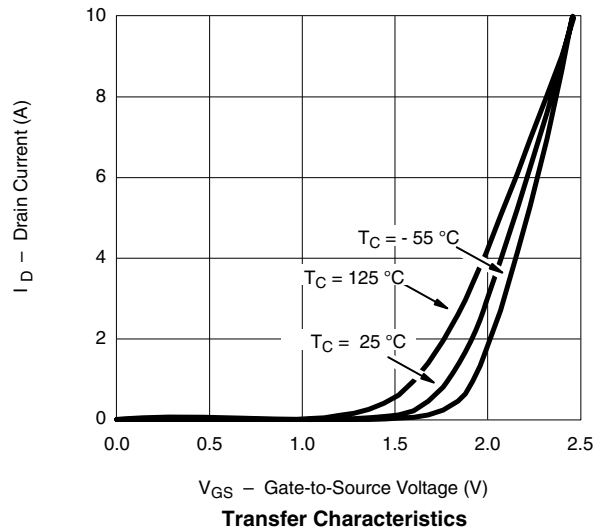
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



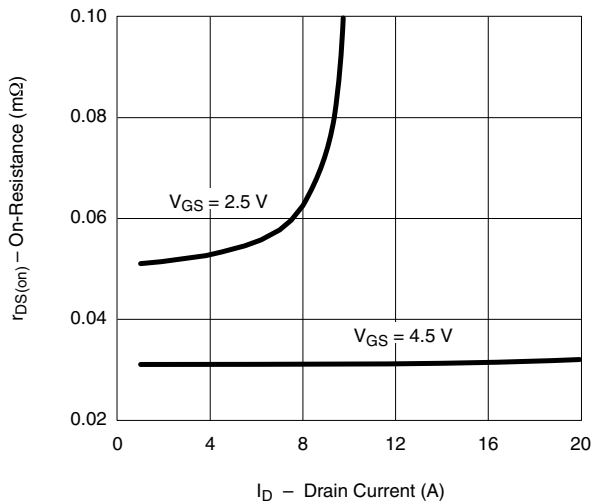
**TYPICAL CHARACTERISTICS** 25 °C unless noted



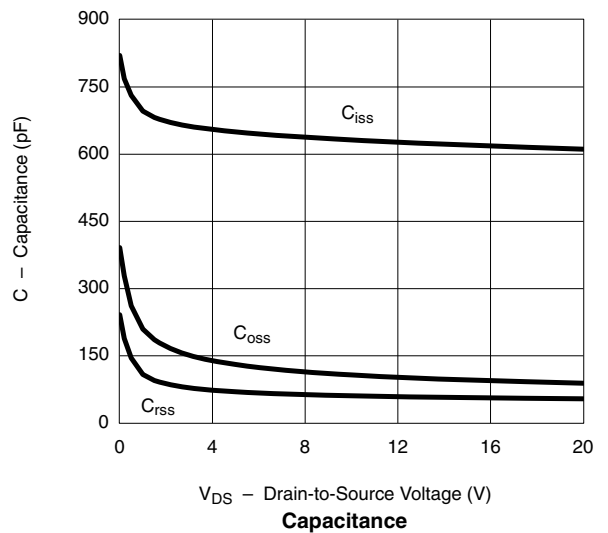
**Output Characteristics**



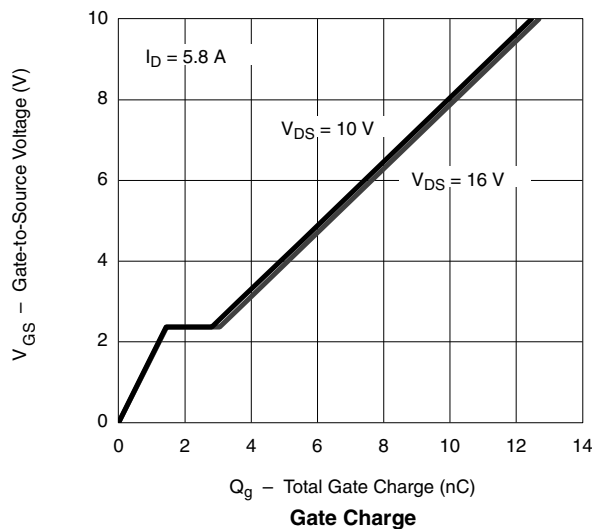
**Transfer Characteristics**



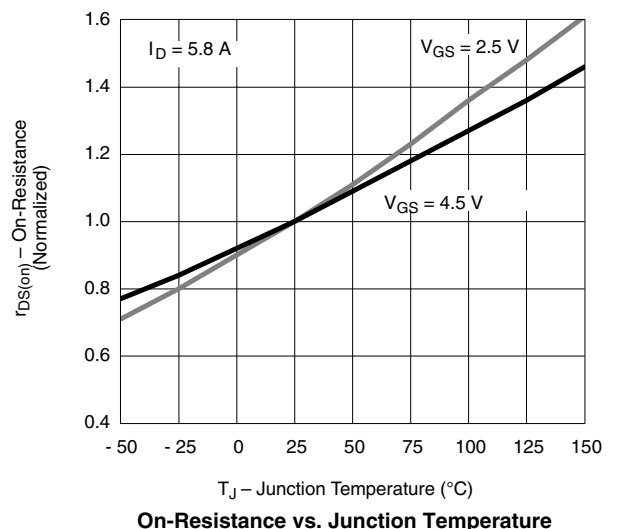
**On-Resistance vs. Drain Current and Gate Voltage**



**Capacitance**

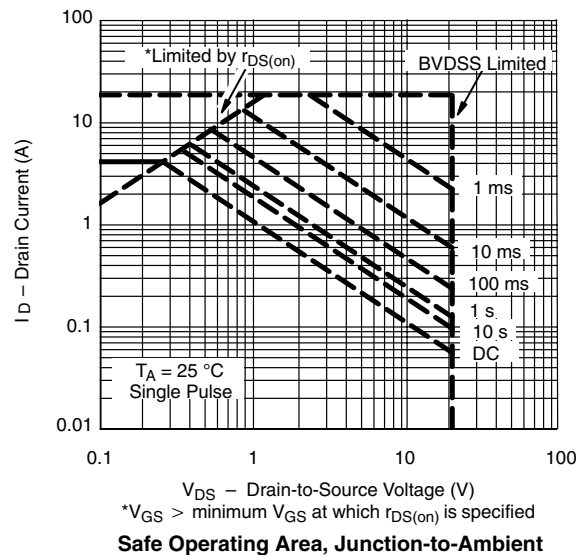
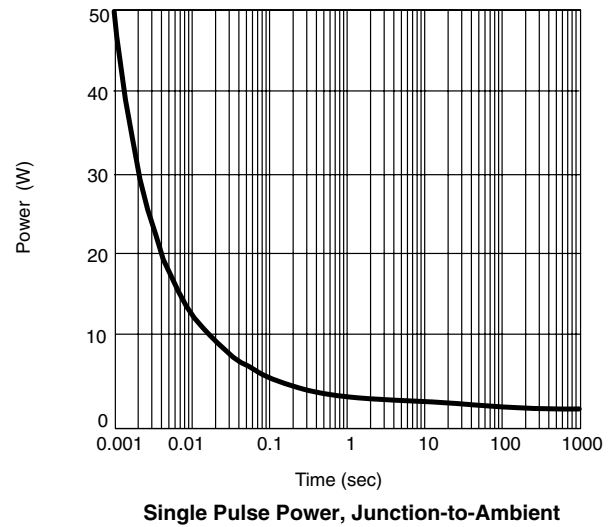
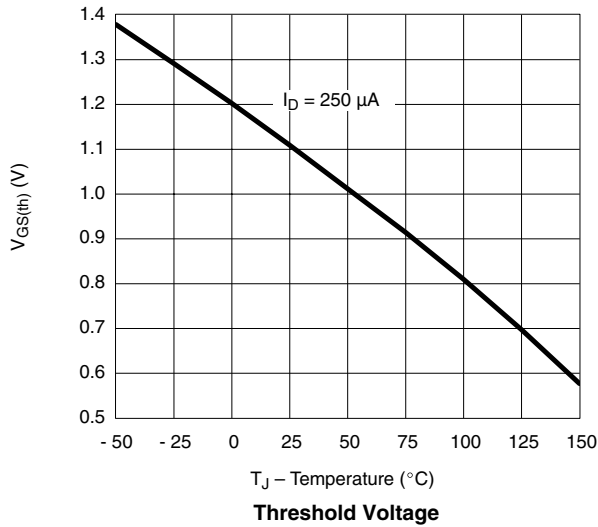
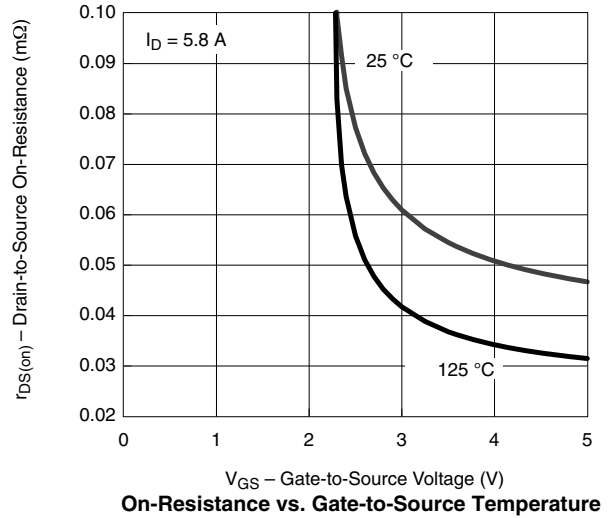
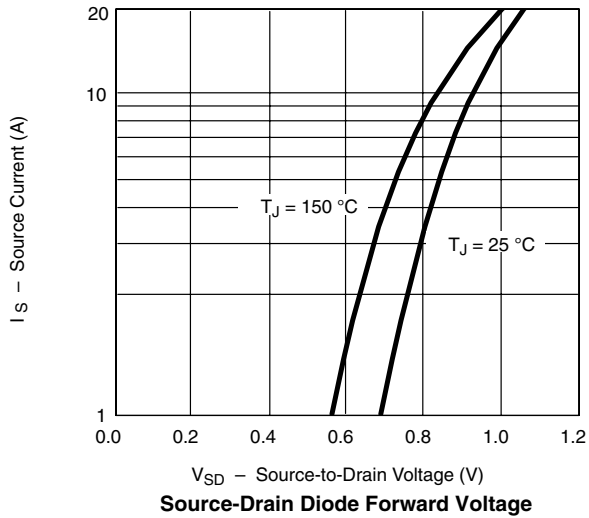


**Gate Charge**

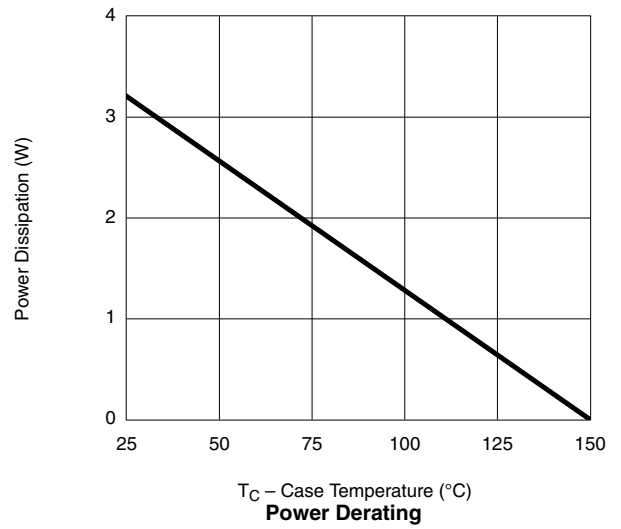
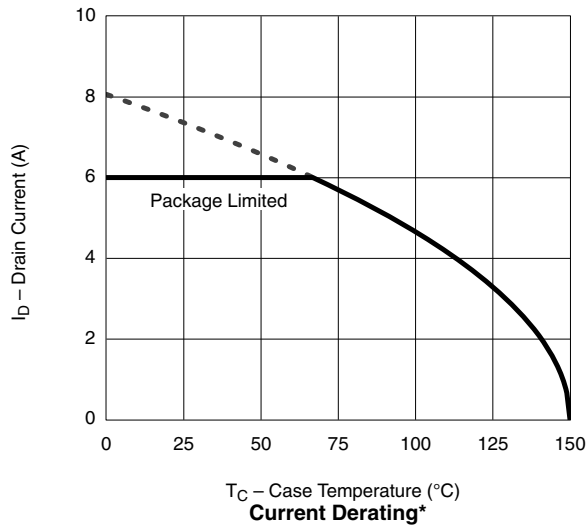


**On-Resistance vs. Junction Temperature**

**TYPICAL CHARACTERISTICS** 25 °C unless noted

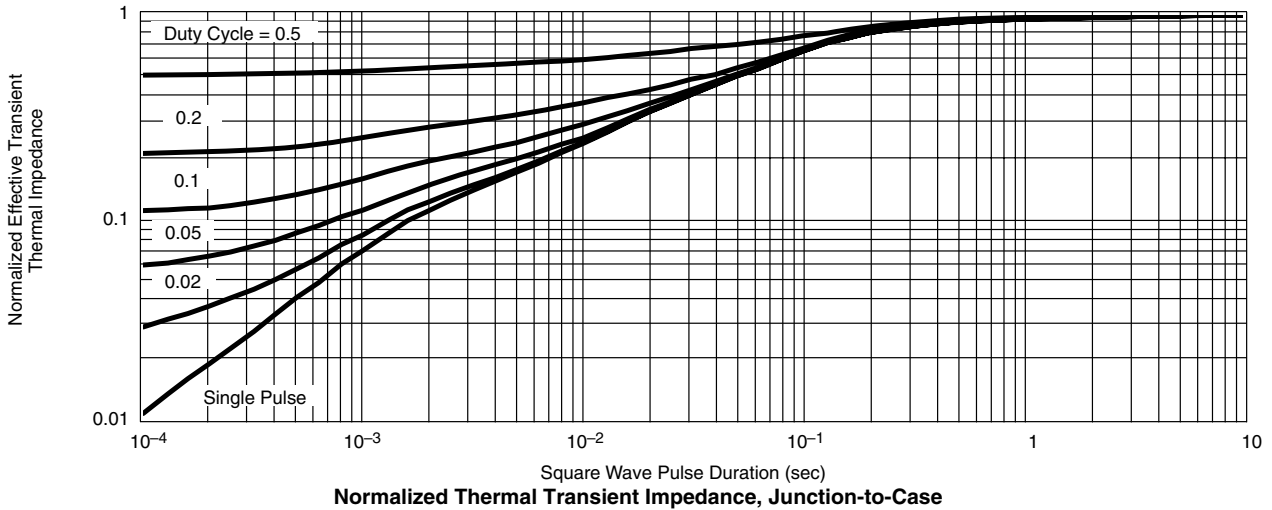
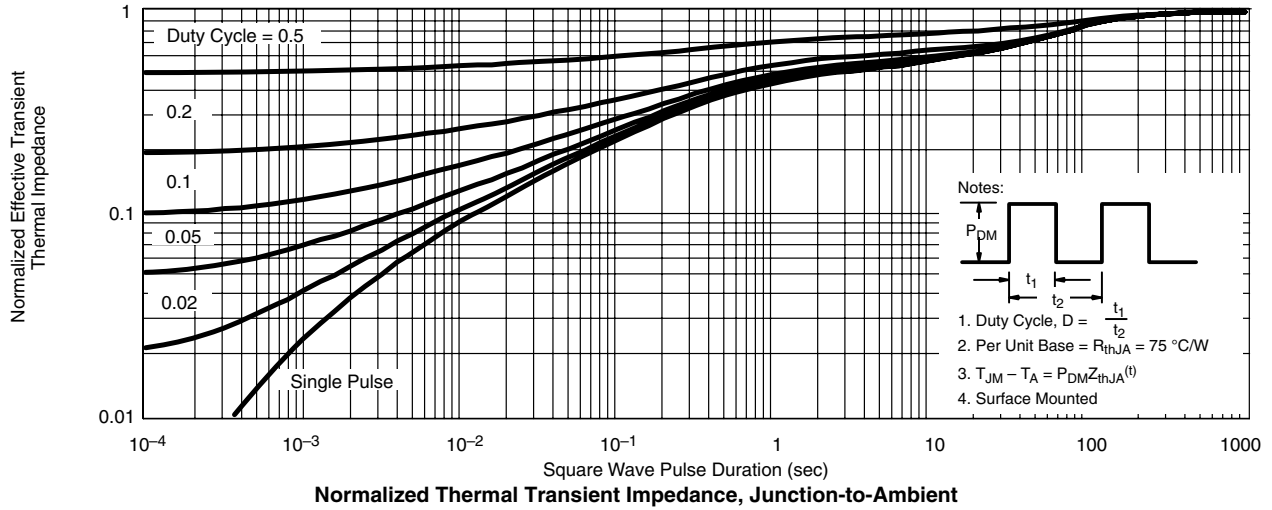


**TYPICAL CHARACTERISTICS** 25 °C unless noted



\*The power dissipation PD 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



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