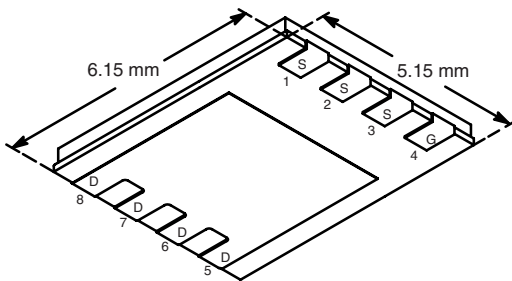




## N-Channel 40-V (D-S) MOSFET

<b>PRODUCT SUMMARY</b>			
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ.)
40	0.0035 at $V_{GS} = 10$ V	50	45 nC
	0.0047 at $V_{GS} = 4.5$ V	50	

PowerPAK<sup>®</sup> SO-8



Bottom View

Ordering Information: Si7156DP-T1-E3 (Lead (Pb)-free)  
Si7156DP-T1-GE3 (Lead (Pb)-free and Halogen-free)

### FEATURES

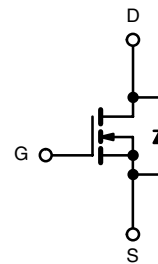
- Halogen-free According to IEC 61249-2-21 Available
- TrenchFET<sup>®</sup> Power MOSFET
- 100 %  $R_g$  Tested
- 100 % Avalanche Tested



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available

### APPLICATIONS

- Synchronous Rectification
- Secondary Side DC/DC



N-Channel MOSFET

<b>ABSOLUTE MAXIMUM RATINGS</b> $T_A = 25$ °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	50 <sup>a</sup>	A
		$T_C = 70$ °C	50 <sup>a</sup>	
		$T_A = 25$ °C	29 <sup>b, c</sup>	
		$T_A = 70$ °C	23 <sup>b, c</sup>	
Pulsed Drain Current	$I_{DM}$	70		
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25$ °C	50 <sup>a</sup>	
		$T_A = 25$ °C	4.9 <sup>b, c</sup>	
Single Pulse Avalanche Current	$I_{AS}$	40		
Single Pulse Avalanche Energy	$E_{AS}$	80	mJ	
Maximum Power Dissipation	$P_D$	$T_C = 25$ °C	83	W
		$T_C = 70$ °C	53	
		$T_A = 25$ °C	5.4 <sup>b, c</sup>	
		$T_A = 70$ °C	3.4 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150	°C	
Soldering Recommendations (Peak Temperature) <sup>d, e</sup>		260		

<b>THERMAL RESISTANCE RATINGS</b>					
Parameter	Symbol	Typical	Maximum	Unit	
Maximum Junction-to-Ambient <sup>b, f</sup>	$R_{thJA}$	18	23	°C/W	
Maximum Junction-to-Case (Drain)	$R_{thJC}$	1.0	1.5		

Notes:

- Package Limited.
- Surface Mounted on 1" x 1" FR4 board.
- $t = 10$  s.
- See Solder Profile ([www.vishay.com/ppg?73257](http://www.vishay.com/ppg?73257)). The PowerPAK SO-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 65 °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	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	40			V	
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$		45		mV/ $^\circ\text{C}$	
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			- 6.5			
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.0		3.0	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	$\mu\text{A}$	
		$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			10		
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	30			A	
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 20\text{ A}$		0.0028	0.0035	$\Omega$	
		$V_{GS} = 4.5\text{ V}, I_D = 15\text{ A}$		0.0038	0.0047		
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}, I_D = 20\text{ A}$		85		S	
<b>Dynamic<sup>b</sup></b>							
Input Capacitance	$C_{iss}$	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		6900		pF	
Output Capacitance	$C_{oss}$			605			
Reverse Transfer Capacitance	$C_{rss}$			310			
Total Gate Charge	$Q_g$	$V_{DS} = 20\text{ V}, V_{GS} = 10\text{ V}, I_D = 20\text{ A}$		103	155	nC	
				45	70		
Gate-Source Charge	$Q_{gs}$	$V_{DS} = 20\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 20\text{ A}$		19			
Gate-Drain Charge	$Q_{gd}$			12.3			
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		0.6	1.2	$\Omega$	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 20\text{ V}, R_L = 2\text{ }\Omega$ $I_D \cong 10\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		22	40	ns	
Rise Time	$t_r$			10	20		
Turn-Off Delay Time	$t_{d(off)}$			45	80		
Fall Time	$t_f$			9	18		
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 20\text{ V}, R_L = 2\text{ }\Omega$ $I_D \cong 10\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 1\text{ }\Omega$		55	90		
Rise Time	$t_r$			32	60		
Turn-Off Delay Time	$t_{d(off)}$			56	100		
Fall Time	$t_f$			25	50		
<b>Drain-Source Body Diode Characteristics</b>							
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$			40	A	
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$				70		
Body Diode Voltage	$V_{SD}$	$I_S = 5\text{ A}$		0.75	1.1	V	
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = 10\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		40	70	ns	
Body Diode Reverse Recovery Charge	$Q_{rr}$				52	100	nC
Reverse Recovery Fall Time	$t_a$				23		ns
Reverse Recovery Rise Time	$t_b$				17		

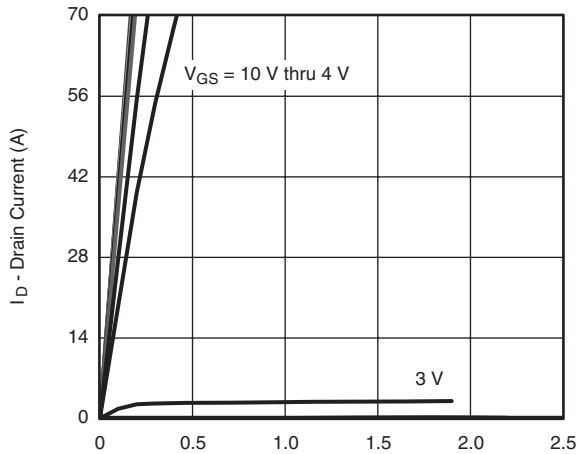
Notes:

a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

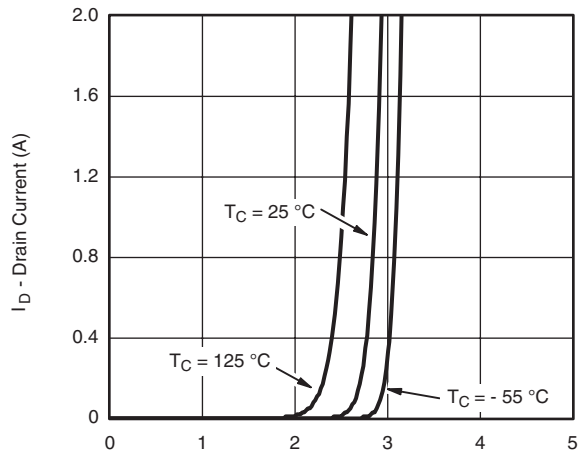
b. Guaranteed by design, not subject to production testing.

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.

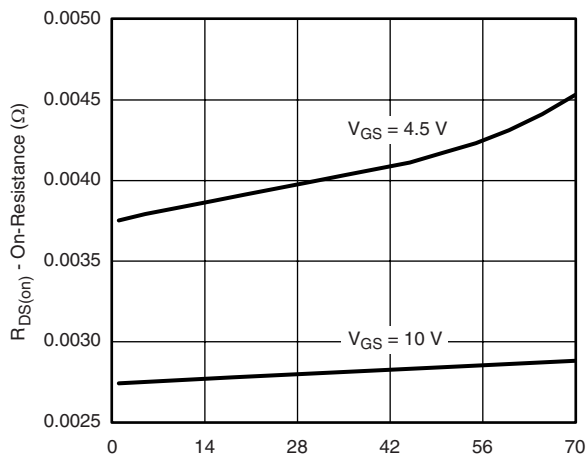
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



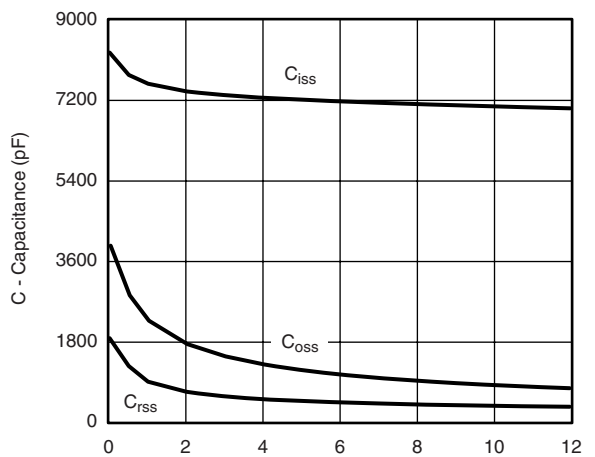
**Output Characteristics**



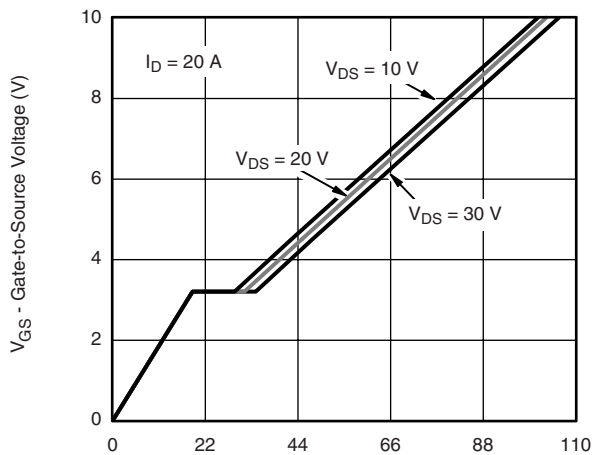
**Transfer Characteristics**



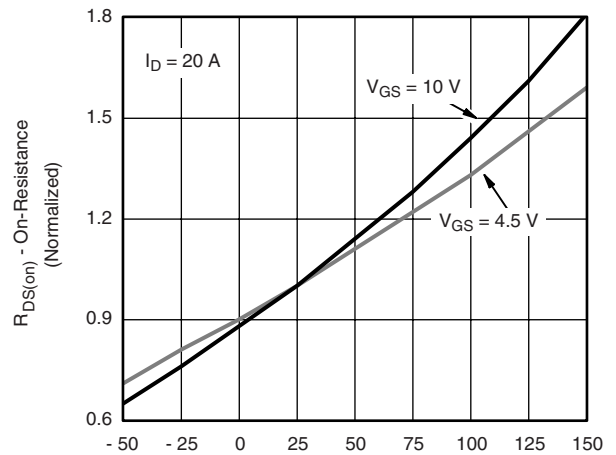
**On-Resistance vs. Drain Current and Gate Voltage**



**Capacitance**

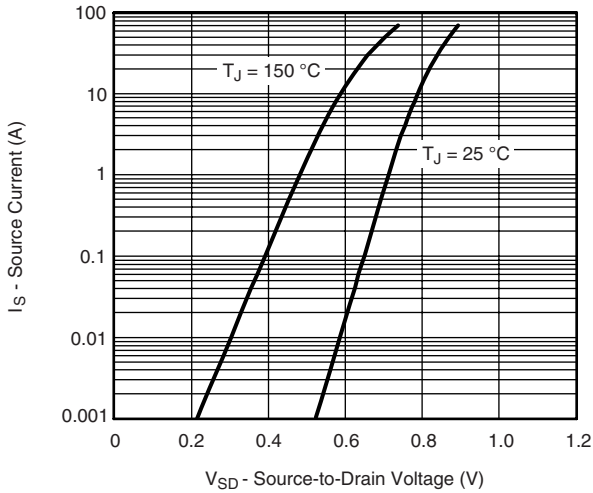


**Gate Charge**

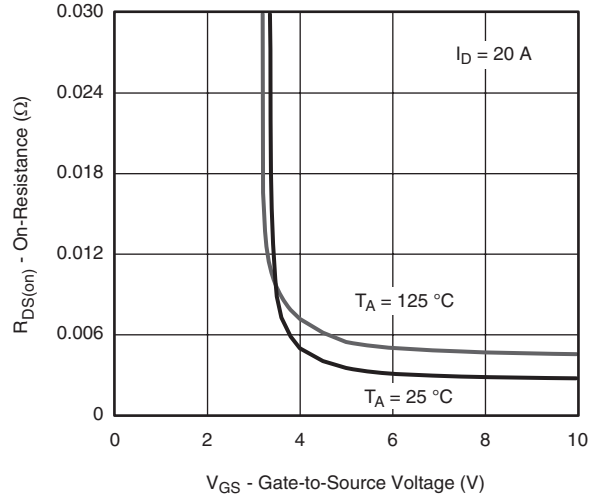


**On-Resistance vs. Junction Temperature**

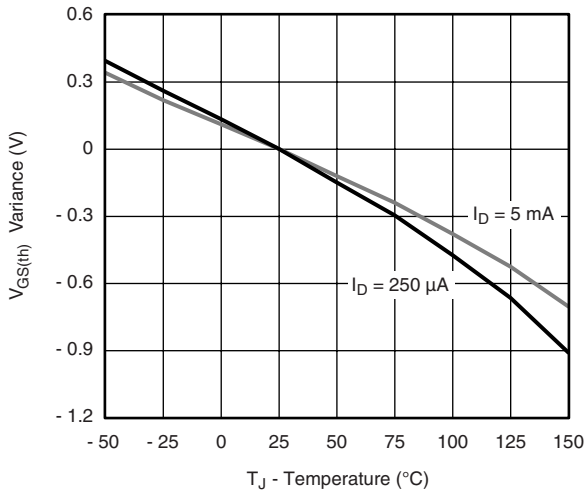
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



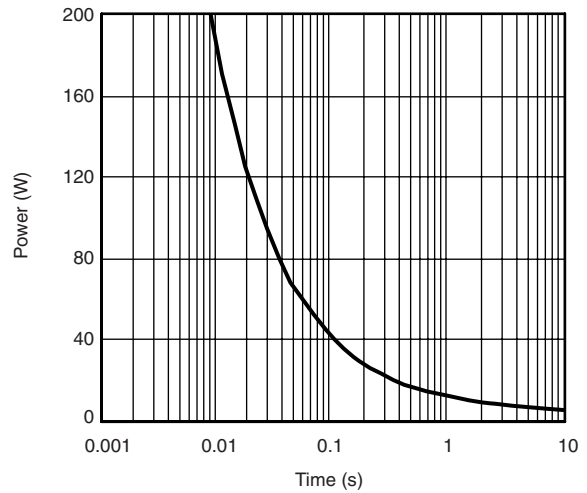
**Source-Drain Diode Forward Voltage**



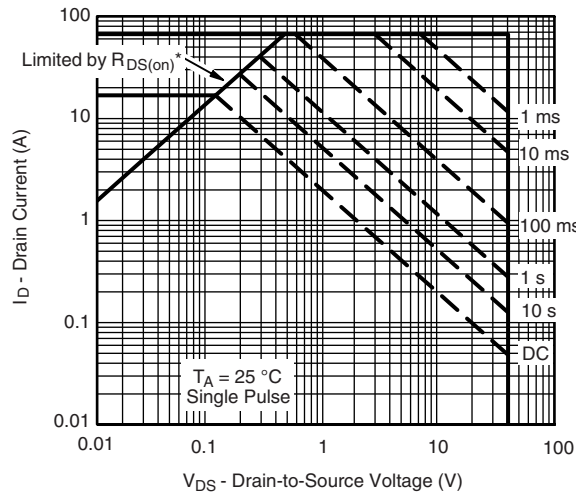
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**



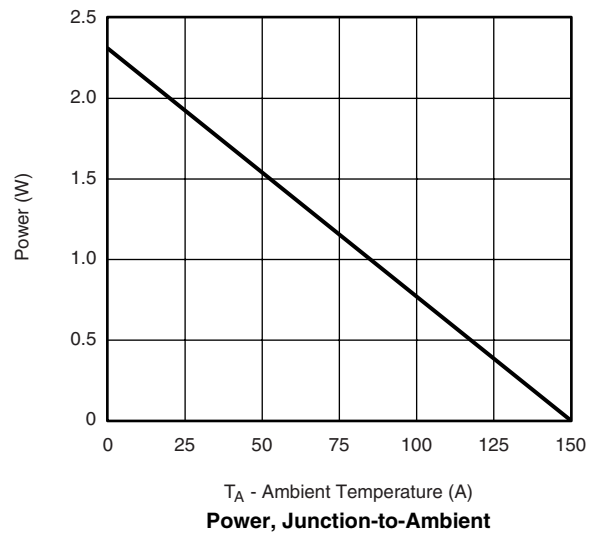
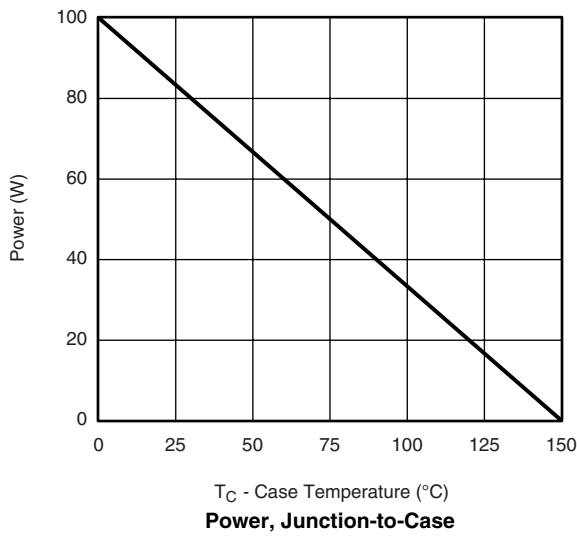
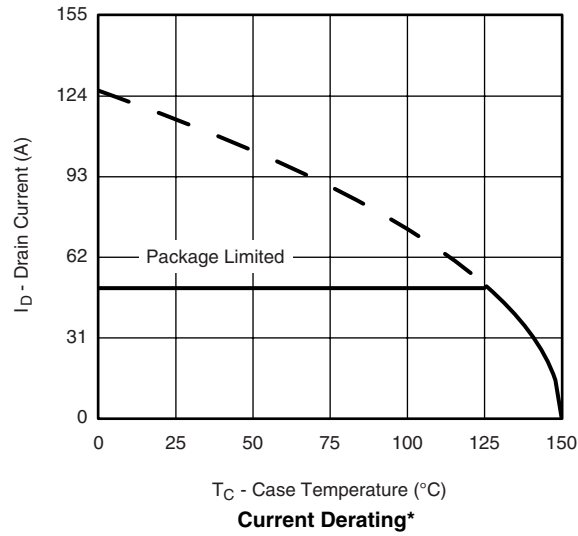
**Single Pulse Power, Junction-to-Ambient**



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

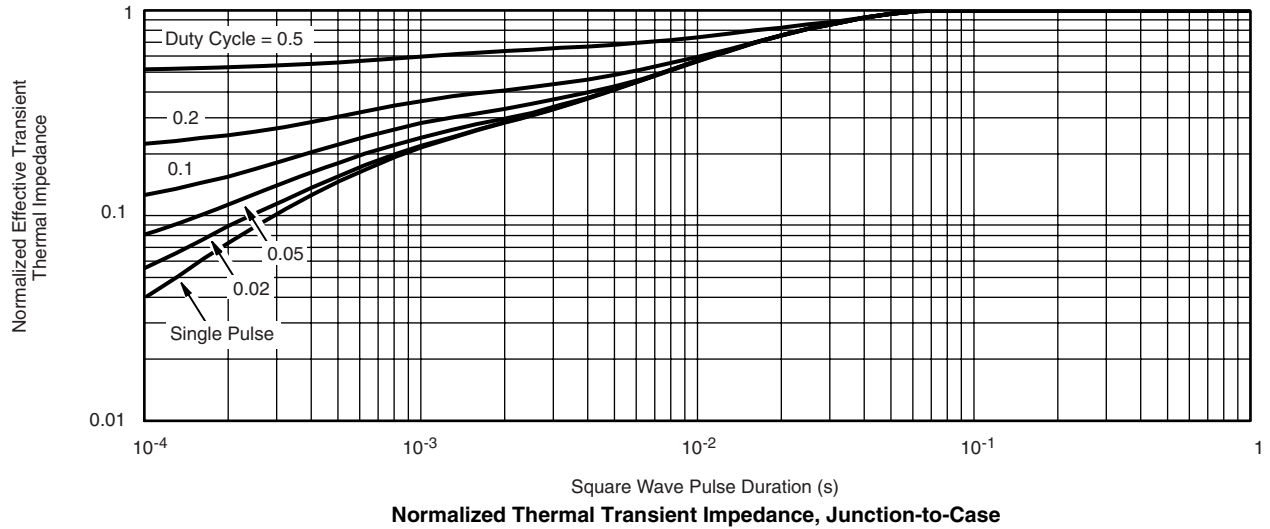
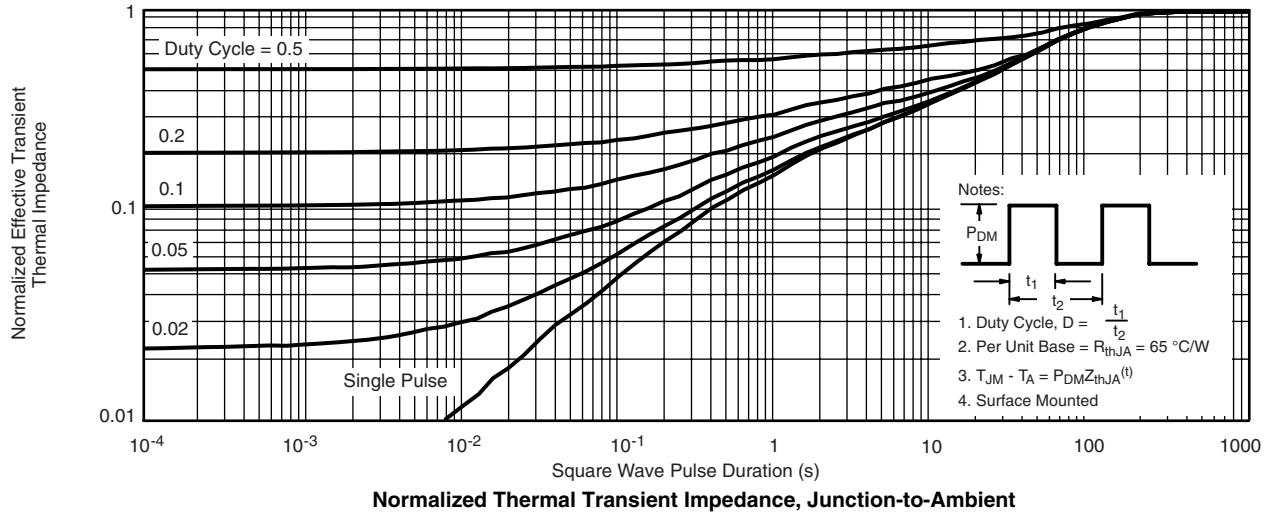
**Safe Operating Area, Junction-to-Ambient**

**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



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