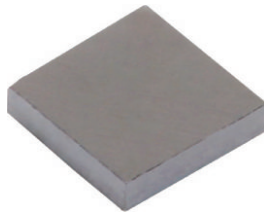
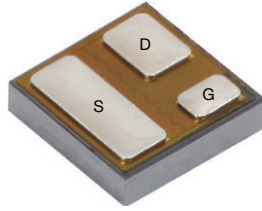


## 7 V (D-S), N-Channel Switch in WCSP3

WCSP3 0.96 x 0.96



Top View



Bottom View

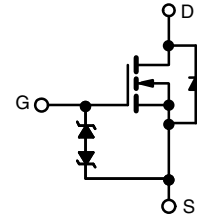
### FEATURES

- Ultra compact 0.96 mm x 0.96 mm outline
- Ultra thin; 0.27 mm
- Low gate drive voltage
- ESD protection: 7 kV HBM, 1 kV CDM
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


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

### APPLICATIONS

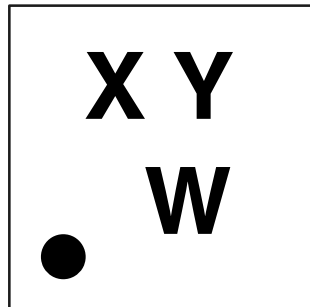
- Low side load switching with minimized voltage drop
- Smart phones, tablet, portable media players



PRODUCT SUMMARY			
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (mΩ) MAX.	I <sub>D</sub> (A)	Q <sub>g</sub> (TYP.)
7	20 at V <sub>GS</sub> = 3 V	5	2.5 nC
	21.6 at V <sub>GS</sub> = 2.65 V	5	
	22 at V <sub>GS</sub> = 2.1 V	5	
	29 at V <sub>GS</sub> = 1.8 V	1	

ORDERING INFORMATION	
Package	WCSP3 0.96 x 0.96
Lead (Pb)-free and halogen-free	SiP32481DB-T2-GE1

### PART MARKING INFORMATION



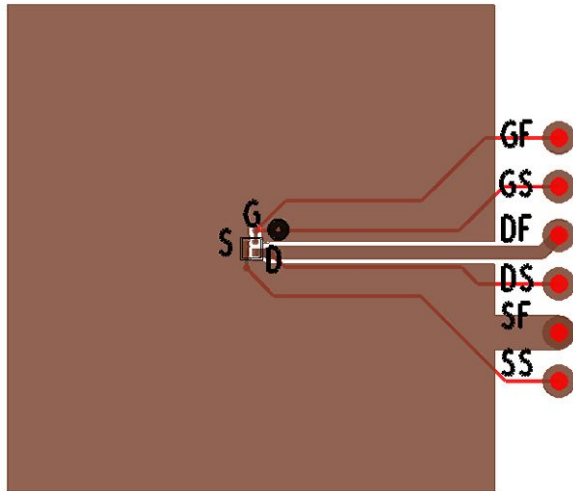
- = designates location of the gate pin
- XY = part number code (AA for SiP32481)
- W = week code

ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted)				
PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-source voltage	V <sub>DS</sub>	7	V	
Gate-source voltage °	V <sub>GS</sub>	± 7		
Continuous drain current, V <sub>GS</sub> = 2.65 V	I <sub>D</sub>	T <sub>A</sub> = 25 °C	6.5 <sup>a</sup>	A
		T <sub>A</sub> = 70 °C	5.2 <sup>a</sup>	
		T <sub>A</sub> = 25 °C	3.9 <sup>b</sup>	
		T <sub>A</sub> = 70 °C	3.1 <sup>b</sup>	
Pulsed drain current (t = 300 μs), V <sub>GS</sub> = 2.65 V	I <sub>DM</sub>	20		
Maximum power dissipation, V <sub>GS</sub> = 2.65 V	P <sub>D</sub>	T <sub>A</sub> = 25 °C	1.3 <sup>a</sup>	W
		T <sub>A</sub> = 70 °C	0.86 <sup>a</sup>	
		T <sub>A</sub> = 25 °C	0.47 <sup>b</sup>	
		T <sub>A</sub> = 70 °C	0.3 <sup>b</sup>	
Operating junction temperature range	T <sub>J</sub>	-40 to +150	°C	
Storage temperature range	T <sub>stg</sub>	-55 to +150		
Soldering recommendation (peak temperature)		260		
ESD / HBM	ESD / HBM	7000	V	
ESD / CDM	ESD / CDM	1000		

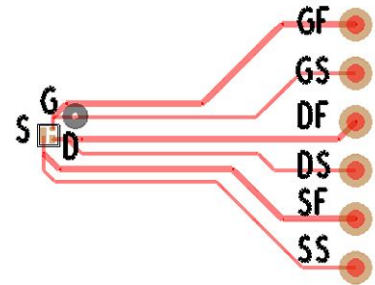
THERMAL RESISTANCE RATINGS					
PARAMETER	SYMBOL	CONDITION	LIMIT		UNIT
			TYP.	MAX.	
Junction to ambient	$R_{thJA}$	Steady state, test board a	75	93	°C/W
		t = 10 s, test board a	45	56	
		Steady state, test board b	210	262	
		t = 10 s, test board b	154	192	

**Notes**

- Surface mounted on 1.5" x 1.5" FR4 board with single sided 1" x 1" 2 oz. copper
- Surface mounted on 1.5" x 1.5" FR4 board with minimum 2 oz. copper pad

**BOARD LAYOUTS**


Test board a, 75 °C/W (typical)



Test board b, 210 °C/W (typical)



SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-source breakdown voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	8	-	-	V
Gate-source threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	0.45	-	0.8	V
Gate-source leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 5.5 V	-0.2	-	0.2	μA
On-state drain current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> = 5.5 V, V <sub>GS</sub> = 4.5 V	10	-	-	A
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = 5.5 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 25 °C	-	0.02	1	μA
		V <sub>DS</sub> = 5.5 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 85 °C	-	-	1.8	
		V <sub>DS</sub> = 5.5 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C	-	-	18	
		V <sub>DS</sub> = 5.5 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 150 °C	-	35	72	
Drain-source on-state resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 3 V, I <sub>D</sub> = 5 A, T <sub>J</sub> = 25 °C	-	13	20	mΩ
		V <sub>GS</sub> = 3 V, I <sub>D</sub> = 5 A, T <sub>J</sub> = 150 °C	-	19.6	31	
		V <sub>GS</sub> = 2.65 V, I <sub>D</sub> = 5 A, T <sub>J</sub> = 25 °C	-	13.8	21.6	
		V <sub>GS</sub> = 2.65 V, I <sub>D</sub> = 5 A, T <sub>J</sub> = 150 °C	-	21	31.3	
		V <sub>GS</sub> = 2.1 V, I <sub>D</sub> = 5 A, T <sub>J</sub> = 25 °C	-	15.2	22	
		V <sub>GS</sub> = 2.1 V, I <sub>D</sub> = 5 A, T <sub>J</sub> = 150 °C	-	23.9	38	
		V <sub>GS</sub> = 1.8 V, I <sub>D</sub> = 5 A, T <sub>J</sub> = 25 °C	-	17.5	29	
Forward transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 4 V, I <sub>D</sub> = 1 A	-	9	-	S
		V <sub>DS</sub> = 5.5 V, I <sub>D</sub> = 4 A	-	20	-	
<b>Dynamic <sup>b</sup></b>						
Input capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 4 V, V <sub>GS</sub> = 0 V, f = 1 MHz	-	450	680	pF
Output capacitance	C <sub>oss</sub>	V <sub>DS</sub> = 4 V, V <sub>GS</sub> = 0 V, f = 1 MHz	-	293	-	
Reverse transfer capacitance	C <sub>rss</sub>		-	91	-	
Total gate charge	Q <sub>g</sub>	V <sub>DS</sub> = 4 V, I <sub>D</sub> = 4 A, V <sub>GS</sub> = 3 V	-	2.7	-	nC
Gate-source charge	Q <sub>gs</sub>		-	0.63	-	
Gate-drain charge	Q <sub>gd</sub>		-	0.76	-	
Gate resistance	R <sub>g</sub>	V <sub>GS</sub> = 0.1 V, f = 1 MHz	-	0.73	-	Ω
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DS</sub> = 4 V, R <sub>L</sub> = 2 Ω, V <sub>GEN</sub> = 2.5 V, R <sub>g</sub> = 1 Ω	-	-	20	ns
Rise time	t <sub>r</sub>		-	-	30	
Turn-off delay time	t <sub>d(off)</sub>		-	-	80	
Fall time	t <sub>f</sub>		-	-	20	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous source-drain diode current	I <sub>S</sub>	T <sub>A</sub> = 25 °C	-	-	1.5	A
Pulse diode forward current <sup>b</sup>	I <sub>SM</sub>	t = 300 μs, at 25 °C	-	-	10	
Body diode voltage	V <sub>SD</sub>	I <sub>S</sub> = 1.5 A, V <sub>GD</sub> = 0 V	-	0.65	1.2	V
Body diode reverse recovery time <sup>b</sup>	t <sub>rr</sub>	I <sub>F</sub> = 2 A, di/dt = 100 A/μs, T <sub>J</sub> = 25 °C	-	102	200	ns
Body diode reverse recovery charge <sup>b</sup>	Q <sub>rr</sub>		-	0.03	0.1	nC
Reverse recovery fall time <sup>b</sup>	t <sub>a</sub>		-	17	-	ns
Reverse recovery rise time <sup>b</sup>	t <sub>b</sub>		-	85	-	

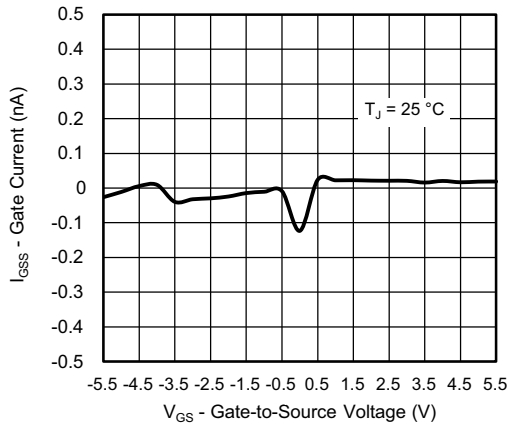
**Notes**

- a. Pulse test: pulse width ≤ 300 μs, duty cycle ≤ 2 %  
b. Guaranteed by design, not subject to production testing

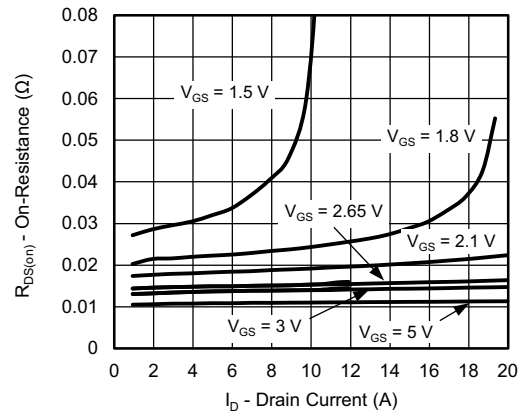
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



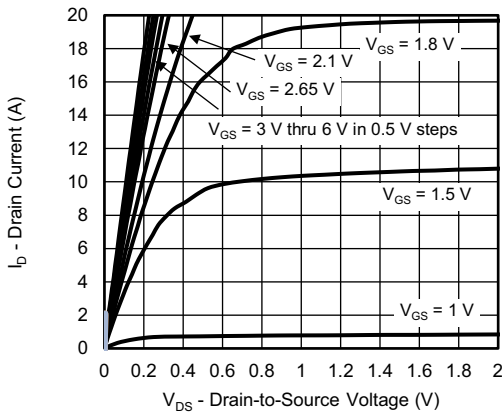
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



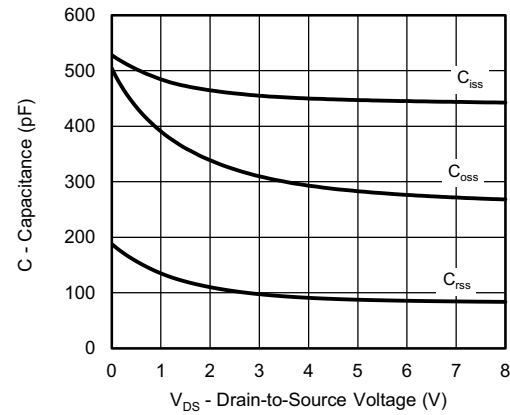
Gate Current vs. Gate-to-Source Voltage



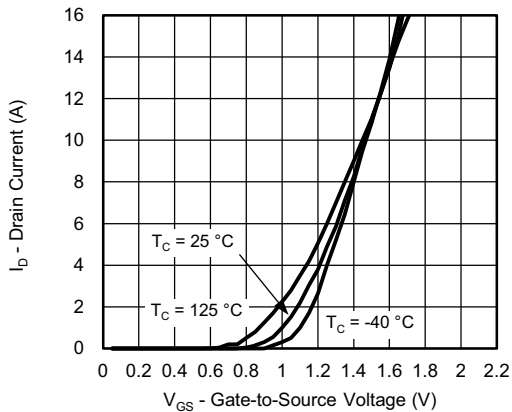
On-Resistance vs. Drain Current and Gate Voltage



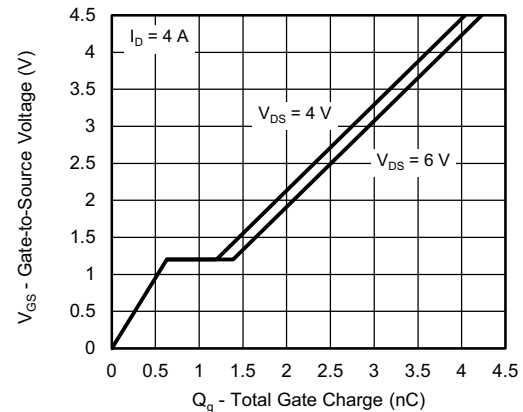
Output Characteristics



Capacitance



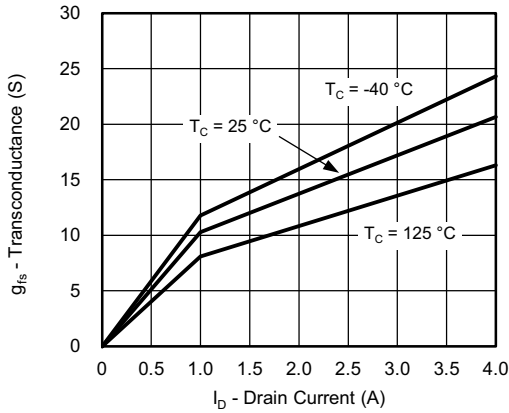
Transfer Characteristics



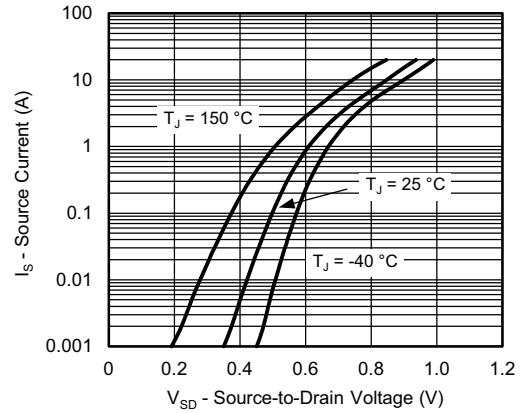
Gatecharge



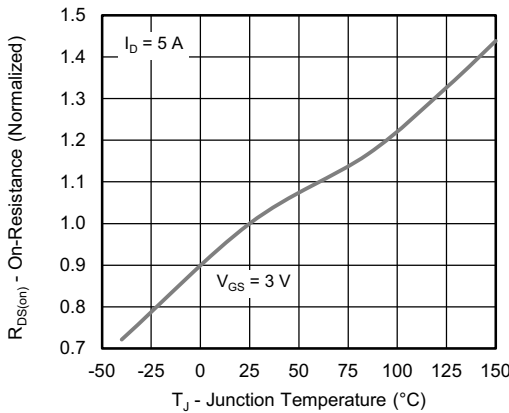
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



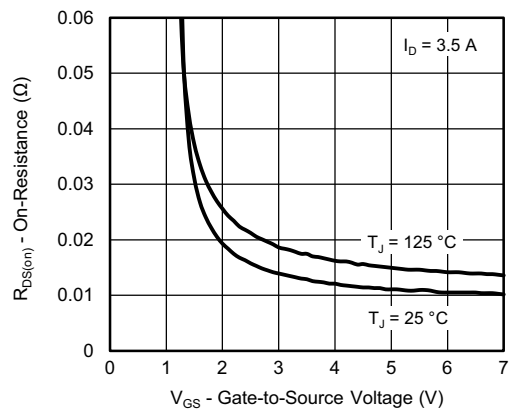
Transconductance



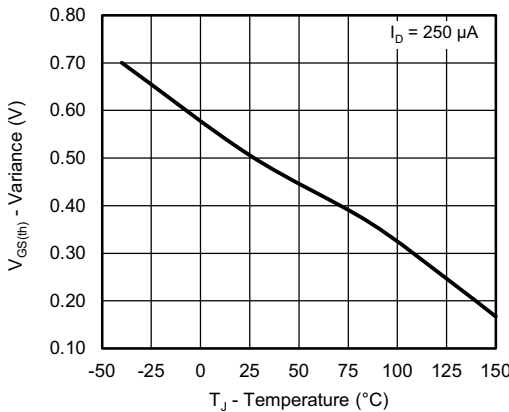
Forward Diode Voltage



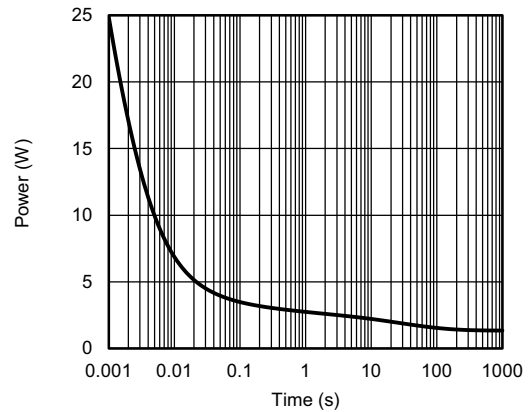
R<sub>DS(on)</sub> - On-Resistance (Normalized) vs. Junction Temperature



On-Resistance vs. Gate-to-Source Voltage

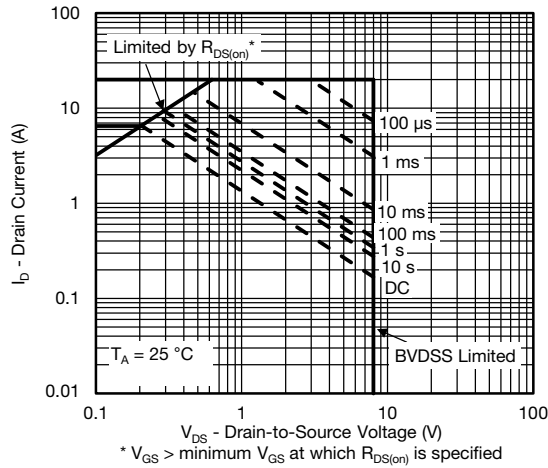


Threshold Voltage vs. Junction Temperature

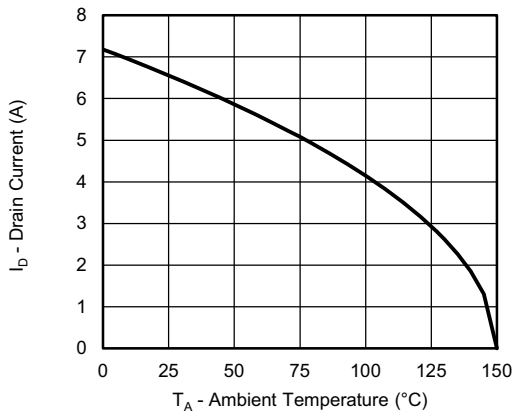


Single Pulse Power, Junction-to-Ambient

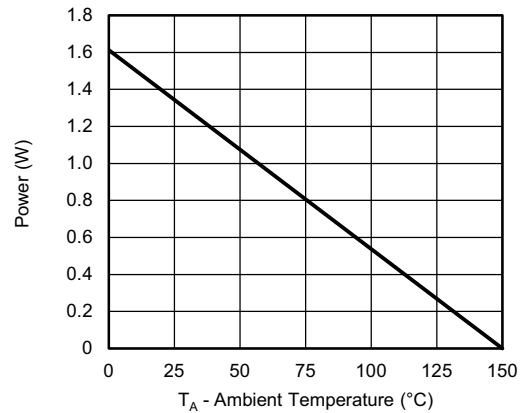
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



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



**Current Derating <sup>a</sup>**

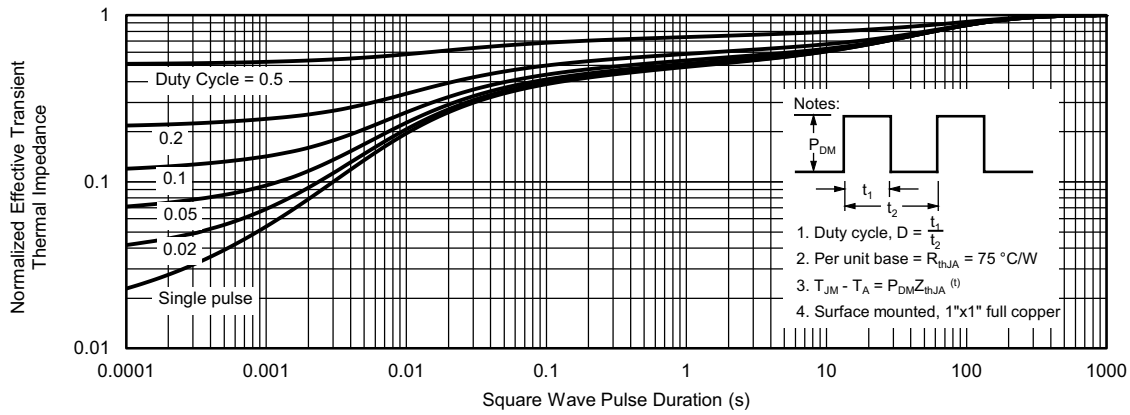


**Power Derating <sup>a</sup>**

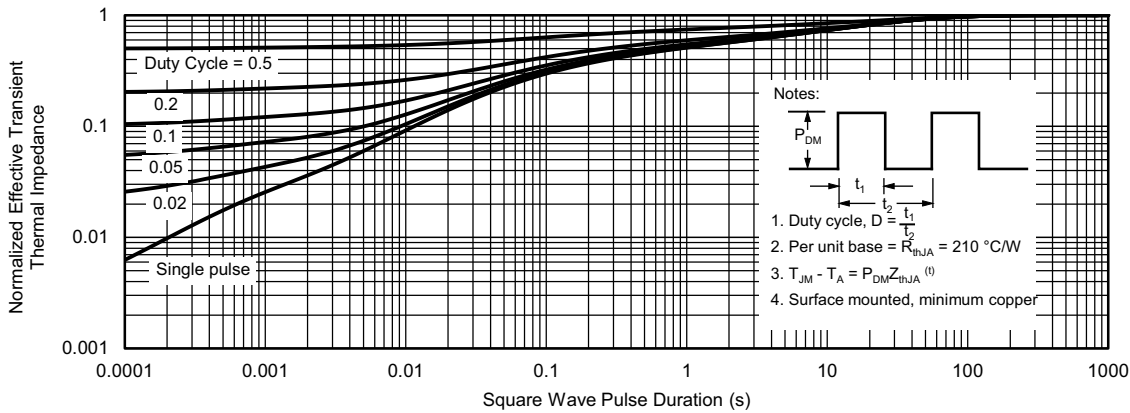
**Note**

- a. The power dissipation  $P_D$  is based on  $T_A \text{ max.} = 150 \text{ }^\circ\text{C}$ , using junction-to-ambient 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 (Test Board a)**



**Normalized Thermal Transient Impedance, Junction-to-Ambient (Test Board b)**

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