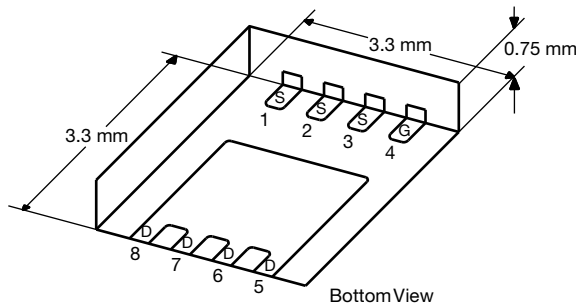


## P-Channel 20 V (D-S) MOSFET

PRODUCT SUMMARY			
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω) Max.	I <sub>D</sub> (A)	Q <sub>g</sub> (Typ.)
- 20	0.0045 at V <sub>GS</sub> = - 4.5 V	- 50 <sup>e</sup>	93 nC
	0.0063 at V <sub>GS</sub> = - 2.5 V	- 50 <sup>e</sup>	
	0.0115 at V <sub>GS</sub> = - 1.8 V	- 50 <sup>e</sup>	

PowerPAK 1212-8S



**Ordering Information:**  
SiSS23DN-T1-GE3 (Lead (Pb)-free and Halogen-free)

### FEATURES

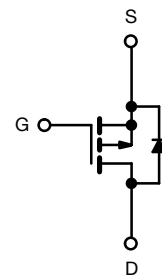
- TrenchFET<sup>®</sup> Power MOSFET
- Low Thermal Resistance PowerPAK<sup>®</sup> Package with Small Size and Low 0.75 mm Profile
- 100 % R<sub>g</sub> and UIS Tested
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



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

### APPLICATIONS

- Smart Phones, Tablet PCs, Mobile Computing
  - Battery Switch
  - Load Switch
  - Power Management
  - Battery Management



P-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>	± 8	
Continuous Drain Current (T <sub>J</sub> = 150 °C)	T <sub>C</sub> = 25 °C	I <sub>D</sub>	- 50 <sup>e</sup>	A
	T <sub>C</sub> = 70 °C		- 50 <sup>e</sup>	
	T <sub>A</sub> = 25 °C		- 27 <sup>a, b</sup>	
	T <sub>A</sub> = 70 °C		- 21 <sup>a, b</sup>	
Pulsed Drain Current (t = 100 μs)		I <sub>DM</sub>	- 200	
Continuous Source-Drain Diode Current	T <sub>C</sub> = 25 °C	I <sub>S</sub>	- 47.5	
	T <sub>A</sub> = 25 °C		- 4 <sup>a, b</sup>	
Avalanche Current	L = 0.1 mH	I <sub>AS</sub>	- 23	
Single-Pulse Avalanche Energy		E <sub>AS</sub>	26	mJ
Maximum Power Dissipation	T <sub>C</sub> = 25 °C	P <sub>D</sub>	57	W
	T <sub>C</sub> = 70 °C		36	
	T <sub>A</sub> = 25 °C		4.8 <sup>a, b</sup>	
	T <sub>A</sub> = 70 °C		3 <sup>a, b</sup>	
Operating Junction and Storage Temperature Range		T <sub>J</sub> , T <sub>stg</sub>	- 50 to 150	°C
Soldering Recommendations (Peak Temperature) <sup>c, d</sup>			260	

Notes:

- Surface mounted on 1" x 1" FR4 board.
- t = 10 s.
- See solder profile ([www.vishay.com/doc?73257](http://www.vishay.com/doc?73257)). The PowerPAK 1212-8S 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.
- Package limited.

**THERMAL RESISTANCE RATINGS**

Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>a, b</sup>	$t \leq 10$ s	$R_{thJA}$	21	26	°C/W
Maximum Junction-to-Case (Drain)	Steady State	$R_{thJC}$	1.7	2.2	

Notes:

a. Surface mounted on 1" x 1" FR4 board.

b. Maximum under steady state conditions is 63 °C/W.

**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	$V_{DS}$	$V_{GS} = 0$ V, $I_D = -250$ $\mu$ A	-20			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250$ $\mu$ A		-12		mV/ °C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$		3.4			
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = -250$ $\mu$ A	-0.4		-0.9	V
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0$ V, $V_{GS} = \pm 8$ V			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -20$ V, $V_{GS} = 0$ V			-1	$\mu$ A
		$V_{DS} = -20$ V, $V_{GS} = 0$ V, $T_J = 55$ °C			-10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \leq -5$ V, $V_{GS} = -4.5$ V	-20			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -4.5$ V, $I_D = -20$ A		0.0035	0.0045	$\Omega$
		$V_{GS} = -2.5$ V, $I_D = -10$ A		0.0051	0.0063	
		$V_{GS} = -1.8$ V, $I_D = -10$ A		0.0081	0.0115	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -10$ V, $I_D = -20$ A		44		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = -15$ V, $V_{GS} = 0$ V, $f = 1$ MHz		8840		pF
Output Capacitance	$C_{oss}$		835			
Reverse Transfer Capacitance	$C_{rss}$		900			
Total Gate Charge	$Q_g$	$V_{DS} = -15$ V, $V_{GS} = -10$ V, $I_D = -20$ A		195	300	nC
				93	140	
Gate-Source Charge	$Q_{gs}$	$V_{DS} = -15$ V, $V_{GS} = -4.5$ V, $I_D = -20$ A		12		nC
Gate-Drain Charge	$Q_{gd}$		21			
Gate Resistance	$R_g$		$f = 1$ MHz	0.5	2.6	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10$ V, $R_L = 1$ $\Omega$ $I_D \cong -10$ A, $V_{GEN} = -4.5$ V, $R_g = 1$ $\Omega$		45	90	ns
Rise Time	$t_r$		50	100		
Turn-Off Delay Time	$t_{d(off)}$		140	280		
Fall Time	$t_f$		50	100		
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10$ V, $R_L = 1$ $\Omega$ $I_D \cong -10$ A, $V_{GEN} = -10$ V, $R_g = 1$ $\Omega$		15	30	ns
Rise Time	$t_r$		5	10		
Turn-Off Delay Time	$t_{d(off)}$		150	300		
Fall Time	$t_f$		40	80		
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25$ °C			-50 <sup>c</sup>	A
Pulse Diode Forward Current <sup>d</sup>	$I_{SM}$				-200	
Body Diode Voltage	$V_{SD}$	$I_F = -10$ A		-0.8	-1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = -10$ A, $di/dt = 100$ A/ $\mu$ s, $T_J = 25$ °C		30	60	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$		15	30	nC	
Reverse Recovery Fall Time	$t_a$		16		ns	
Reverse Recovery Rise Time	$t_b$		14			

Notes:

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

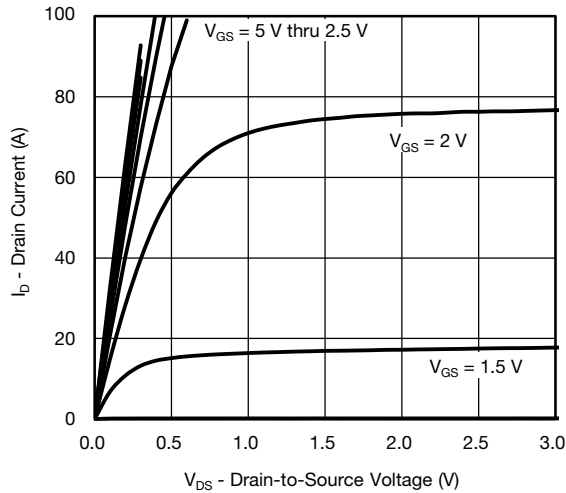
b. Guaranteed by design, not subject to production testing.

c. Package limited.

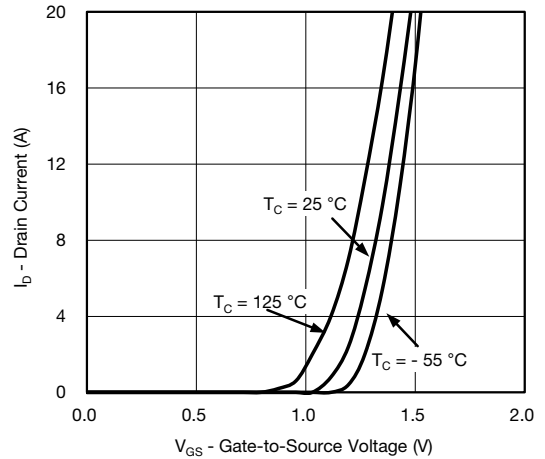
d.  $t = 100$   $\mu$ s.

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.

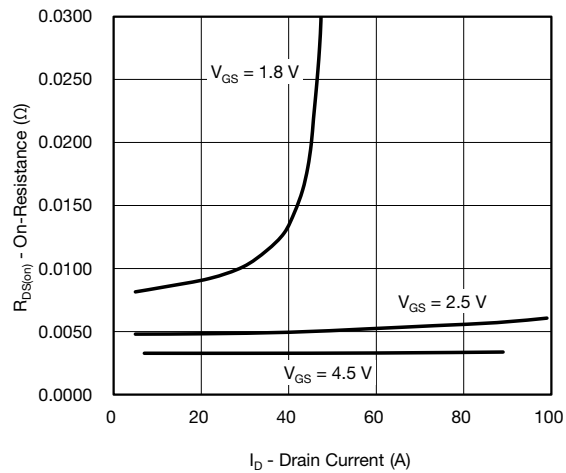
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



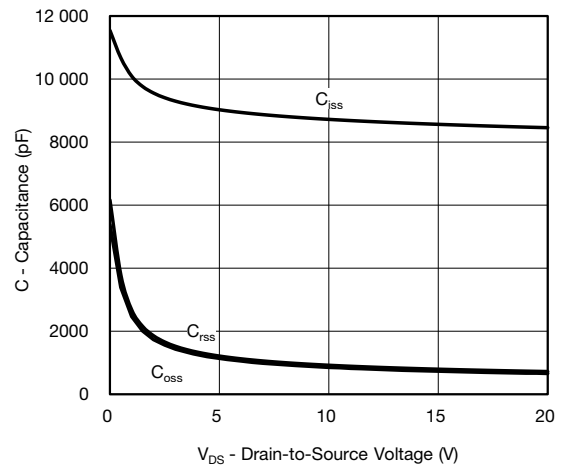
**Output Characteristics**



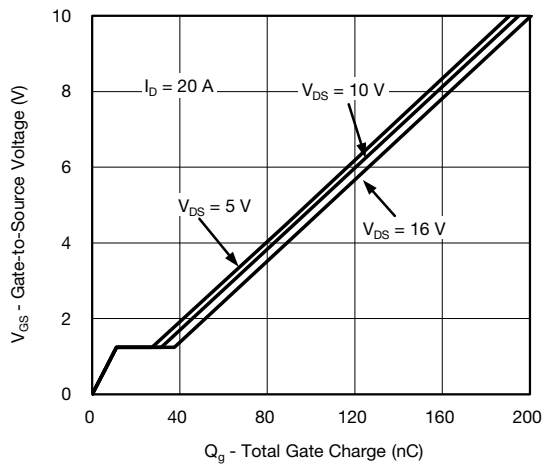
**Transfer Characteristics**



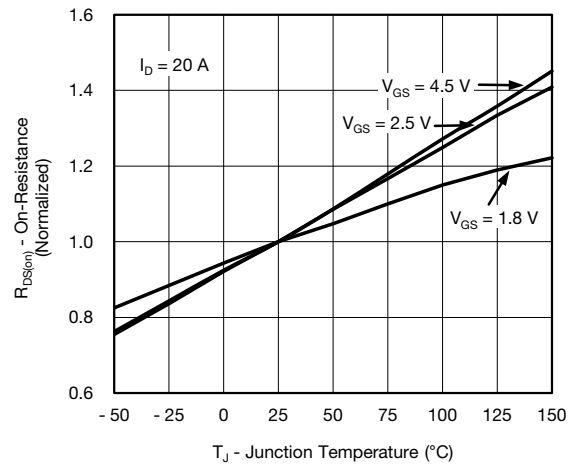
**On-Resistance vs. Drain Current and Gate Voltage**



**Capacitance**

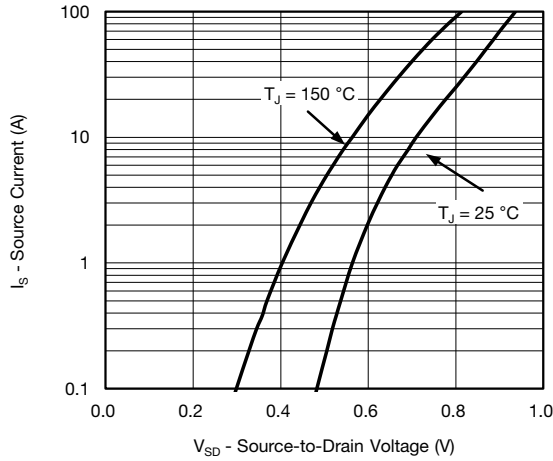


**Gate Charge**

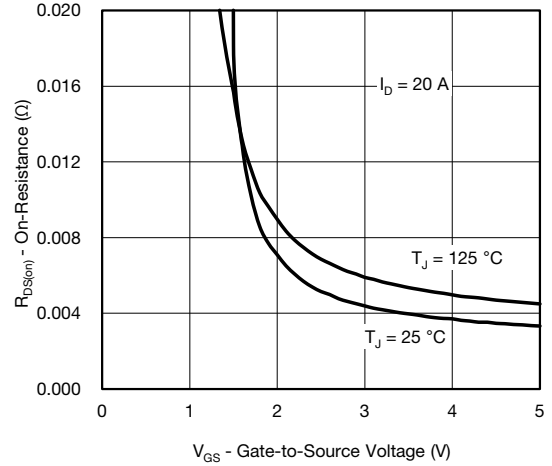


**On-Resistance vs. Junction Temperature**

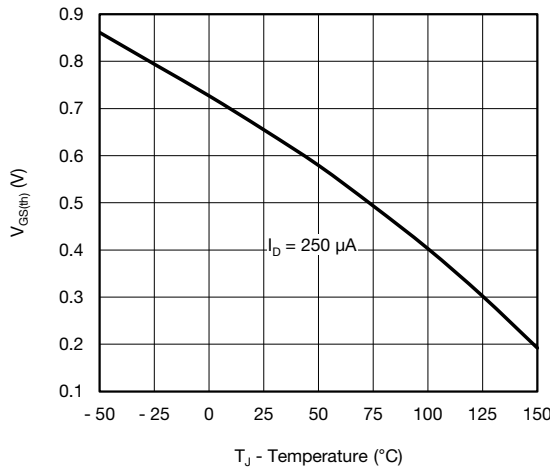
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



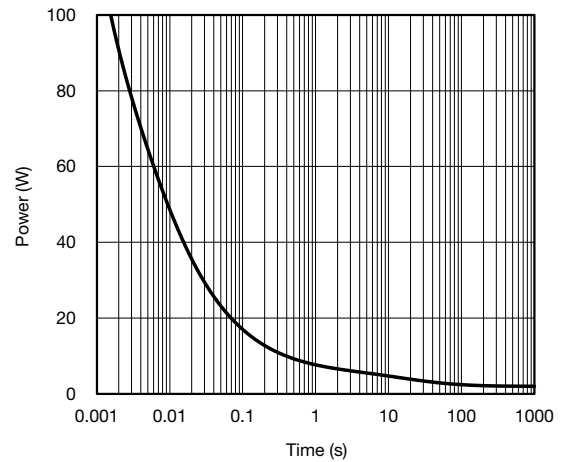
**Source-Drain Diode Forward Voltage**



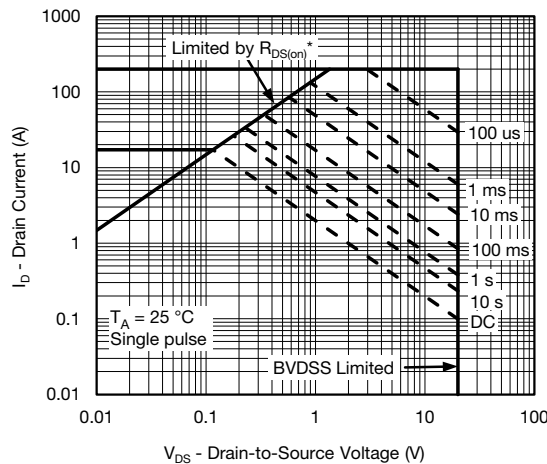
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**

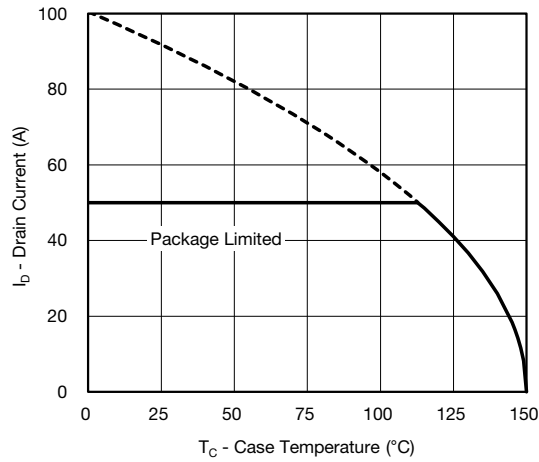


**Single Pulse Power, Junction-to-Ambient**

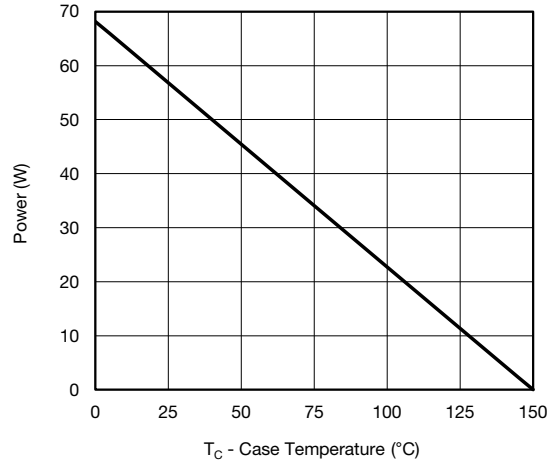


**Safe Operating Area, Junction-to-Ambient**

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

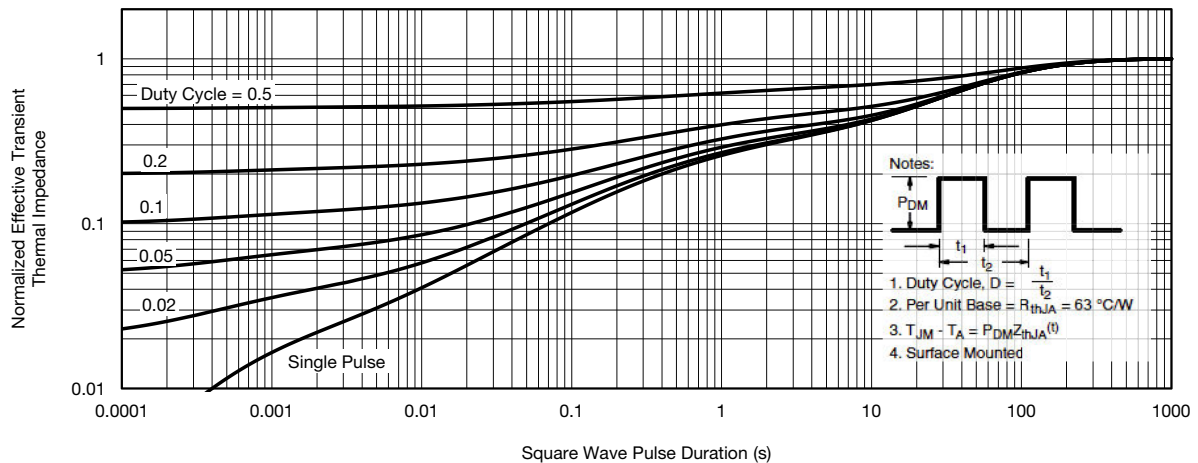


**Current Derating\***



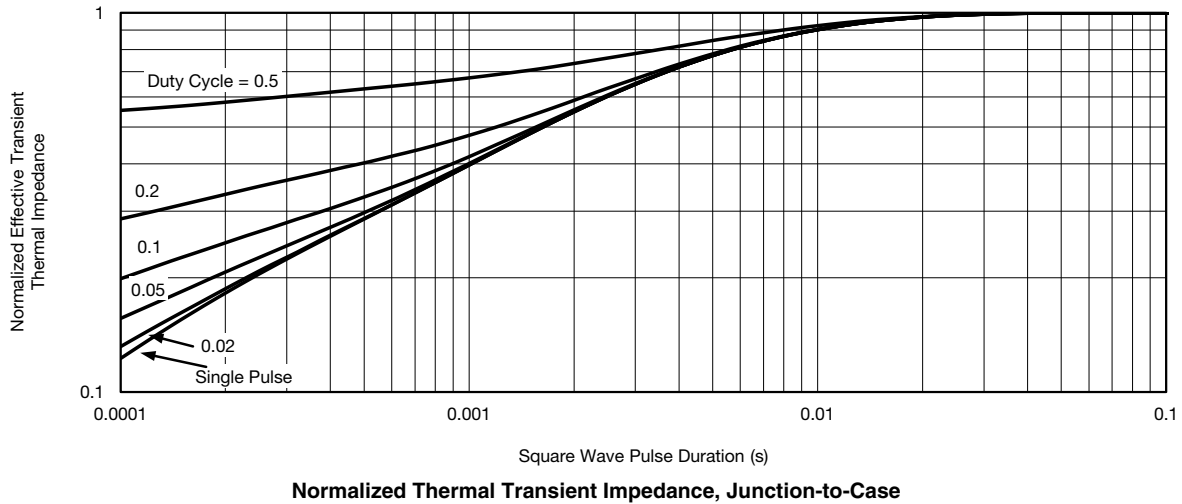
**Power, Junction-to-Case**

\* 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.



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

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



Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see [www.vishay.com/ppg?62852](http://www.vishay.com/ppg?62852).



### Case Outline for PowerPAK® 1212-8S



DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.67	0.75	0.83	0.027	0.030	0.033
A1	0	-	0.05	0	-	0.002
A3	0.20 REF			0.008 REF		
b	0.30 BSC			0.012 BSC		
D	3.30 BSC			0.130 BSC		
D1	2.15	2.25	2.35	0.084	0.088	0.092
E	3.30 BSC			0.130 BSC		
E1	1.60	1.70	1.80	0.063	0.067	0.071
e	0.65 BSC			0.026 BSC		
K	0.76 TYP			0.030 TYP		
K1	0.41 TYP			0.016 TYP		
L	0.43 BSC			0.017 BSC		
z	0.525 TYP			0.021 TYP		

ECN: C12-0200-Rev. A, 12-Mar-12  
DWG: 6008

**Note**

- Millimeters will govern.

## RECOMMENDED MINIMUM PADS FOR PowerPAK® 1212-8 Single



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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