

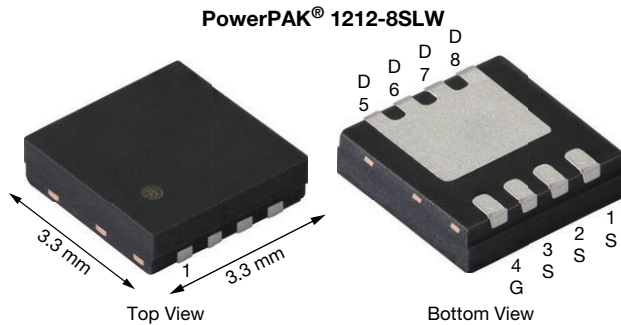
# Automotive N-Channel 60 V (D-S) 175 °C MOSFET



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

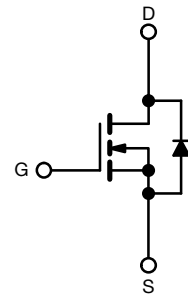
## FEATURES

- TrenchFET® Gen IV power MOSFET
- AEC-Q101 qualified
- 100 % R<sub>g</sub> and UIS tested
- Wettable flank terminals
- Low thermal resistance with 0.75 mm profile
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



Marking code: Q045

PRODUCT SUMMARY	
V <sub>DS</sub> (V)	60
R <sub>DS(on)</sub> (Ω) at V <sub>GS</sub> = 4.5 V	0.0059
R <sub>DS(on)</sub> (Ω) at V <sub>GS</sub> = 10 V	0.0038
I <sub>D</sub> (A)	141
Configuration	Single
Package	PowerPAK 1212-8SLW



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T <sub>C</sub> = 25 °C, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		V <sub>DS</sub>	60	V
Gate-source voltage		V <sub>GS</sub>	± 20	
Continuous drain current	T <sub>C</sub> = 25 °C	I <sub>D</sub>	141	A
	T <sub>C</sub> = 125 °C		81	
Continuous source current (diode conduction)		I <sub>S</sub>	179	
Pulsed drain current <sup>a</sup>		I <sub>DM</sub>	192	
Single pulse avalanche current	L = 0.1 mH	I <sub>AS</sub>	30	
Single pulse avalanche energy		E <sub>AS</sub>	45	mJ
Maximum power dissipation <sup>a</sup>	T <sub>C</sub> = 25 °C	P <sub>D</sub>	197	W
	T <sub>C</sub> = 125 °C		66	
Operating junction and storage temperature range		T <sub>J</sub> , T <sub>stg</sub>	-55 to +175	°C
Soldering recommendations (peak temperature) <sup>c</sup>			260	

THERMAL RESISTANCE RATINGS				
PARAMETER		SYMBOL	LIMIT	UNIT
Junction-to-ambient	PCB mount <sup>b</sup>	R <sub>thJA</sub>	81	°C/W
Junction-to-case (drain)		R <sub>thJC</sub>	0.76	

### Notes

- Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %
- When mounted on 1" square PCB (FR4 material)
- See solder profile ([www.vishay.com/doc?73257](http://www.vishay.com/doc?73257)). A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection



SPECIFICATIONS ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT	
<b>Static</b>							
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0, I_D = 250\text{ }\mu\text{A}$	60	-	-	V	
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.5	2.0	2.5		
Gate-source leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$	-	-	$\pm 100$	nA	
Zero gate voltage drain current	$I_{DSS}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 60\text{ V}$	-	-	1	$\mu\text{A}$
		$V_{GS} = 0\text{ V}$	$V_{DS} = 60\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	-	50	
		$V_{GS} = 0\text{ V}$	$V_{DS} = 60\text{ V}, T_J = 175\text{ }^\circ\text{C}$	-	-	150	
On-state drain current <sup>a</sup>	$I_{D(on)}$	$V_{GS} = 10\text{ V}$	$V_{DS} \geq 5\text{ V}$	20	-	-	A
Drain-source on-state resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}$	$I_D = 10\text{ A}$	-	0.0038	0.0059	$\Omega$
		$V_{GS} = 10\text{ V}$		-	0.0025	0.0038	
		$V_{GS} = 10\text{ V}$	$I_D = 10\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	-	0.0095	
		$V_{GS} = 10\text{ V}$	$I_D = 10\text{ A}, T_J = 175\text{ }^\circ\text{C}$	-	-	0.0113	
Forward transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = 15\text{ V}, I_D = 20\text{ A}$		-	90	-	S
<b>Dynamic <sup>b</sup></b>							
Input capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}$	$V_{DS} = 25\text{ V}, f = 1\text{ MHz}$	-	2761	3866	$\text{pF}$
Output capacitance	$C_{OSS}$			-	851	1192	
Reverse transfer capacitance	$C_{RSS}$			-	67	94	
Total gate charge <sup>c</sup>	$Q_g$	$V_{GS} = 10\text{ V}$	$V_{DS} = 30\text{ V}, I_D = 4\text{ A}$	-	47	71	$\text{nC}$
Gate-source charge <sup>c</sup>	$Q_{gs}$			-	10	-	
Gate-drain charge <sup>c</sup>	$Q_{gd}$			-	8	-	
Gate resistance	$R_g$	$f = 1\text{ MHz}$		0.4	0.9	1.4	$\Omega$
Turn-on delay time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = 30\text{ V}, R_L = 12\text{ }\Omega,$ $I_D \cong 2.5\text{ A}, V_{GEN} = 10\text{ V}, R_g = 1\text{ }\Omega$		-	12	18	$\text{ns}$
Rise time <sup>c</sup>	$t_r$			-	4	8	
Turn-off delay time <sup>c</sup>	$t_{d(off)}$			-	32	48	
Fall time <sup>c</sup>	$t_f$			-	14	21	
<b>Source-Drain Diode Ratings and Characteristic <sup>b</sup></b>							
Pulsed current <sup>a</sup>	$I_{SM}$			-	-	192	A
Forward voltage	$V_{SD}$	$I_F = 10\text{ A}, V_{GS} = 0\text{ V}$		-	0.82	1.1	V
Body diode reverse recovery time	$t_{rr}$	$V_{DD} = 48\text{ V}, I_{FM} = 3\text{ A}, di/dt = 100\text{ A}/\mu\text{s},$ $R = 10\text{ }\Omega, L = 0.3\text{ mH}, \text{pulse width} = 2\text{ }\mu\text{s}$		-	38	76	ns
Body diode reverse recovery charge	$Q_{rr}$			-	35	70	$\text{nC}$
Reverse recovery fall time	$t_a$			-	19	-	
Reverse recovery rise time	$t_b$			-	20	-	
Body diode peak reverse recovery current	$I_{RM(REC)}$					-	-1.6

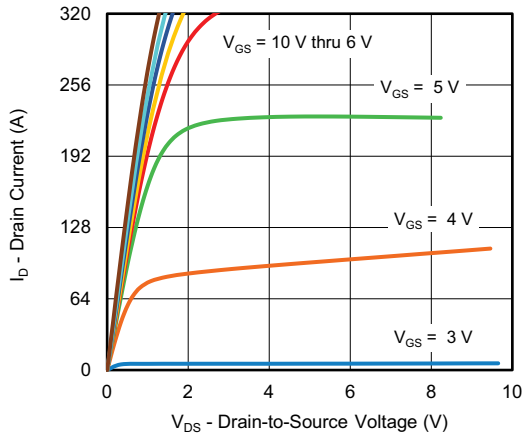
**Notes**

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

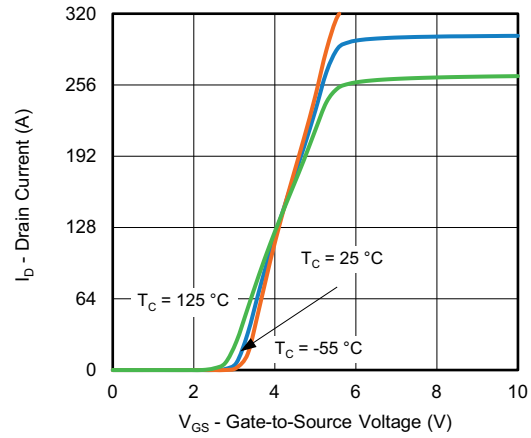
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



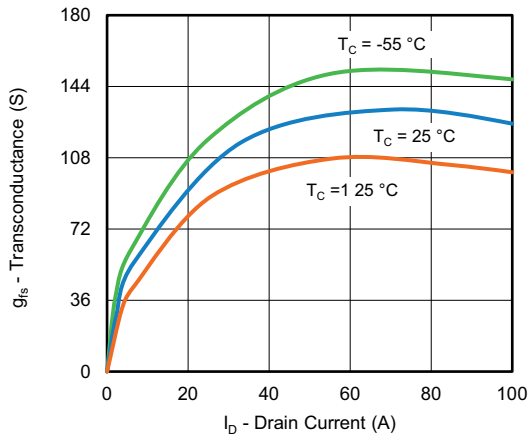
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C, unless otherwise noted)



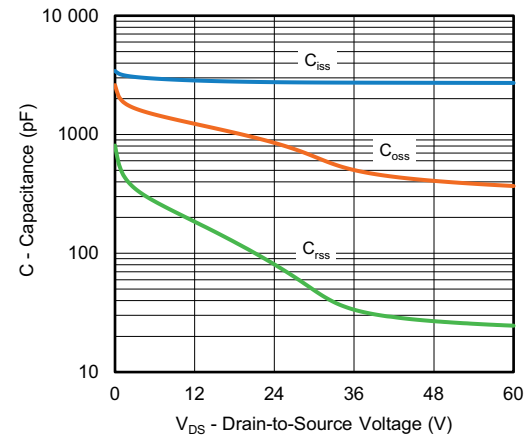
Output Characteristics



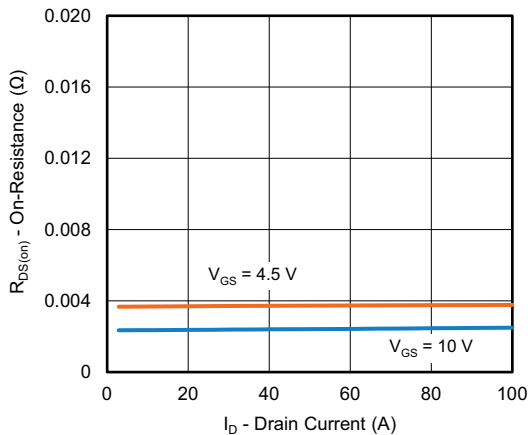
Transfer Characteristics



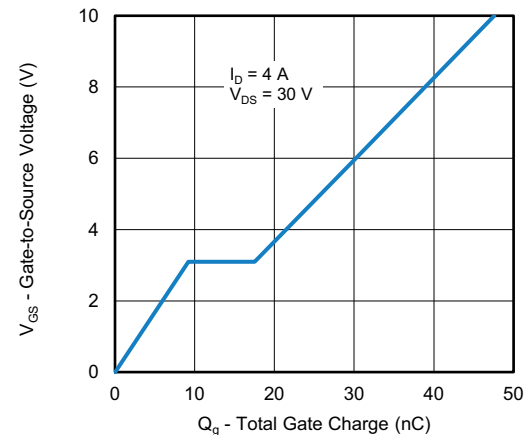
Transconductance



Capacitance



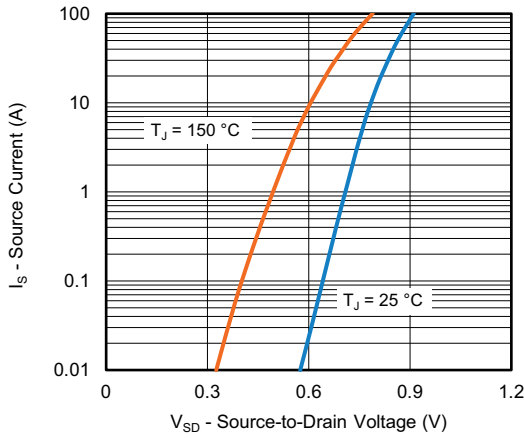
On-Resistance vs. Drain Current



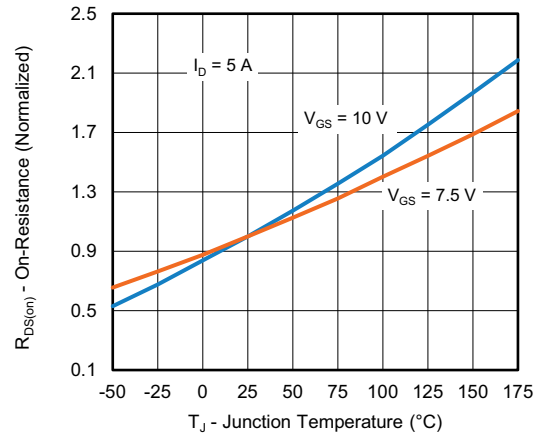
Gate Charge



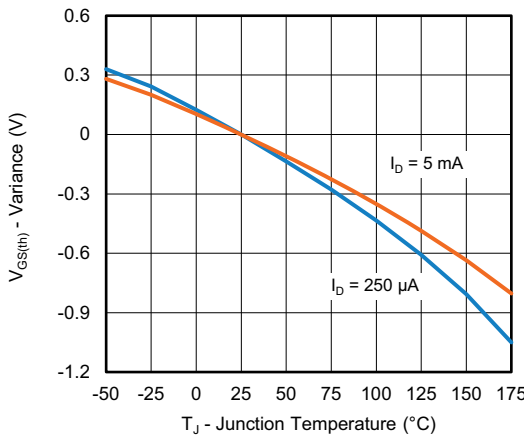
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C, unless otherwise noted)



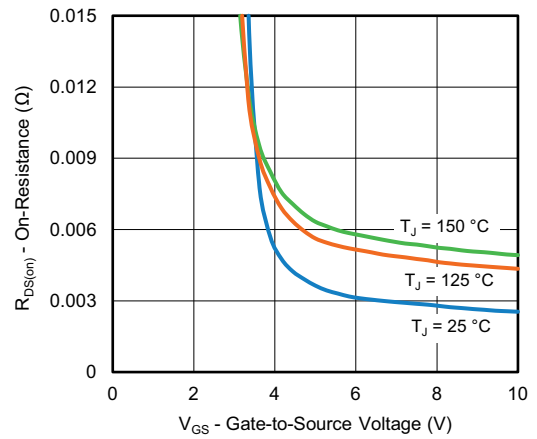
Source Drain Diode Forward Voltage



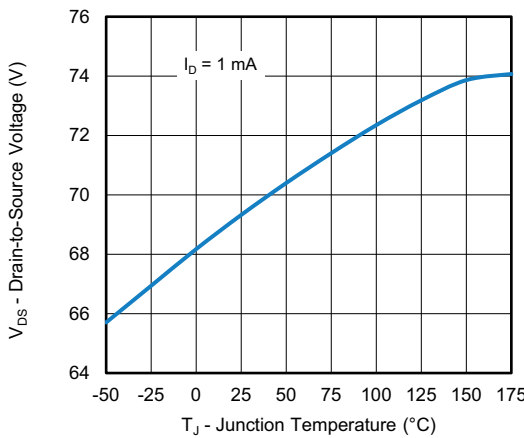
On-Resistance vs. Junction Temperature



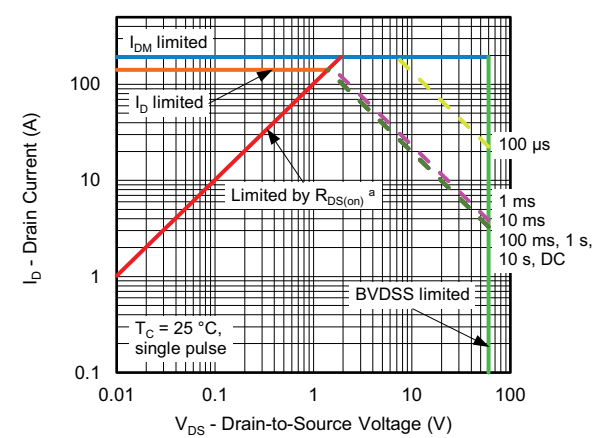
Threshold Voltage



On-Resistance vs. Gate-to-Source Voltage



Drain Source Breakdown vs. Junction Temperature



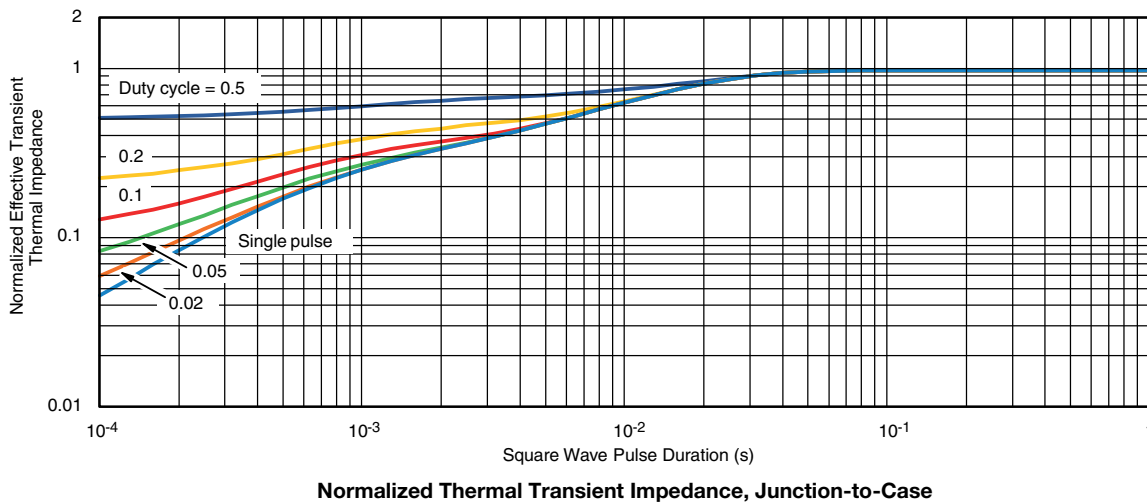
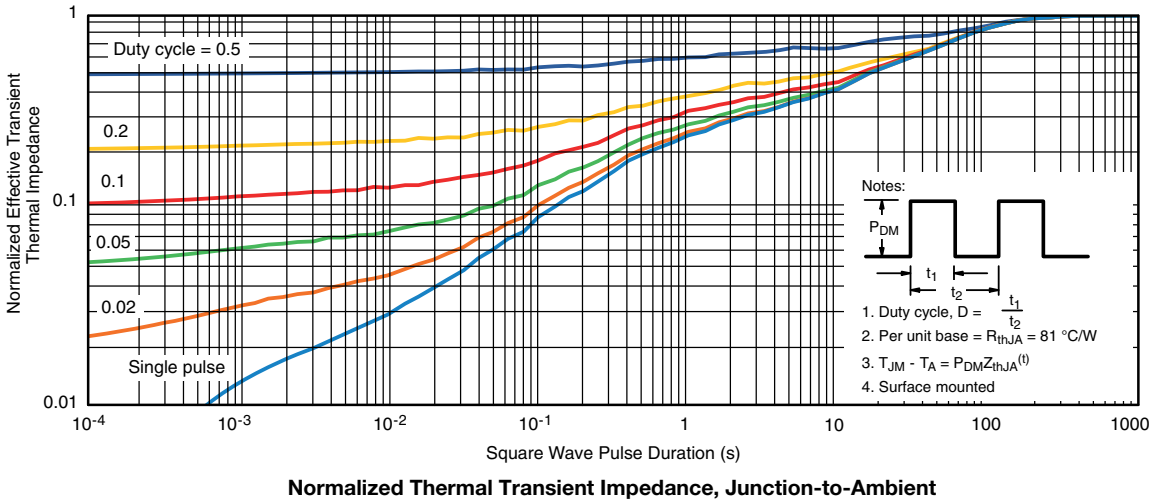
Safe Operating Area

Note

a. V<sub>GS</sub> > minimum V<sub>GS</sub> at which R<sub>DS(on)</sub> is specified



**THERMAL RATINGS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)

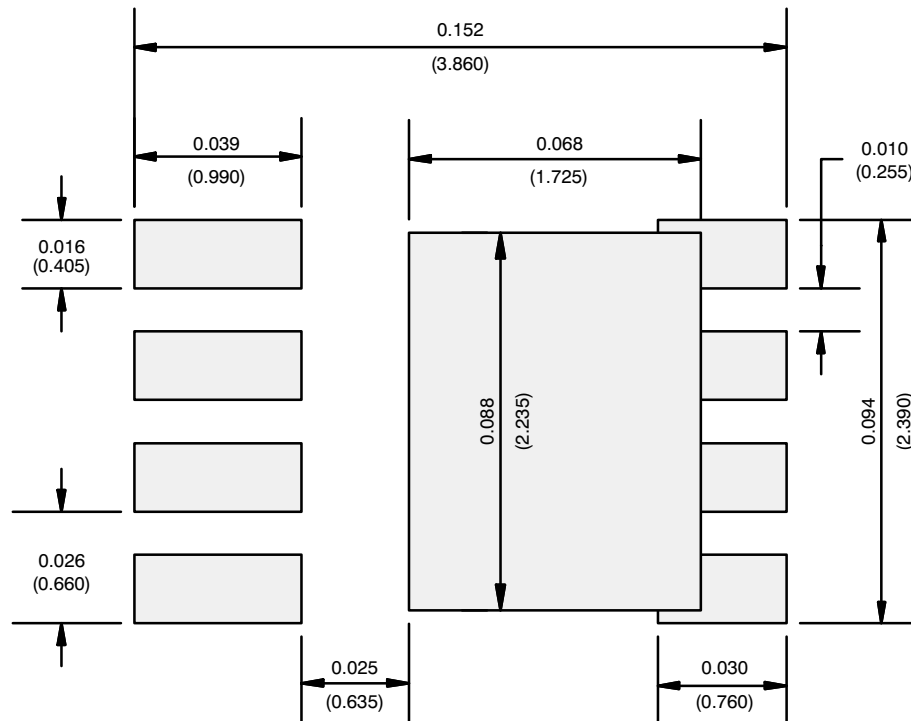


**Note**

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction-to-Ambient ( $25\text{ }^\circ\text{C}$ )
  - Normalized Transient Thermal Impedance Junction-to-Case ( $25\text{ }^\circ\text{C}$ )
 are given for general guidelines only to enable the user to get a “ball park” indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions

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



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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