

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

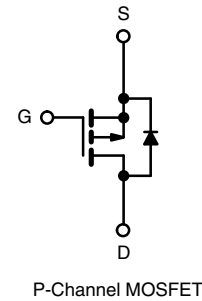
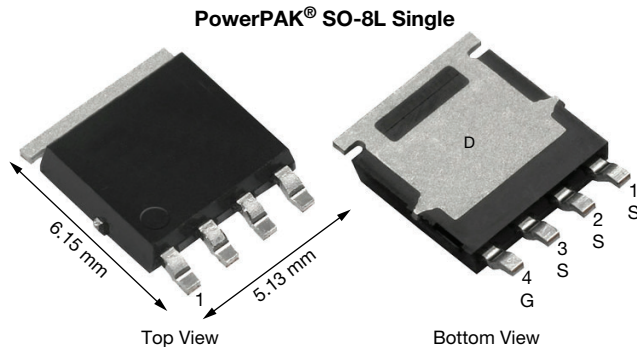
 AUTOMOTIVE  
GRADE

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

PRODUCT SUMMARY	
$V_{DS}$ (V)	-60
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = -10$ V	0.018
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = -4.5$ V	0.024
$I_D$ (A)	-52
Configuration	Single
Package	PowerPAK SO-8L

### FEATURES

- TrenchFET® power MOSFET
- 100 %  $R_g$  and UIS tested
- AEC-Q101 qualified <sup>c</sup>
- Material categorization:  
for definitions of compliance please see  
[www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		$V_{DS}$	-60	V
Gate-Source Voltage		$V_{GS}$	$\pm 20$	
Continuous Drain Current	$T_C = 25$ °C	$I_D$	-52	A
	$T_C = 125$ °C		-30	
Continuous Source Current (Diode Conduction)		$I_S$	-75	
Pulsed Drain Current <sup>a</sup>		$I_{DM}$	-200	
Single Pulse Avalanche Current	L = 0.1 mH	$I_{AS}$	-40	
Single Pulse Avalanche Energy				
Maximum Power Dissipation <sup>a</sup>	$T_C = 25$ °C	$P_D$	83	W
	$T_C = 125$ °C		27	
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	-55 to +175	°C
Soldering Recommendations (Peak Temperature) <sup>d, e</sup>			260	

THERMAL RESISTANCE RATINGS				
PARAMETER		SYMBOL	LIMIT	UNIT
Junction-to-Ambient	PCB Mount <sup>b</sup>	$R_{thJA}$	65	°C/W
Junction-to-Case (Drain)		$R_{thJC}$	1.8	

### Notes

- Pulse test; pulse width  $\leq 300$   $\mu$ s, duty cycle  $\leq 2$  %.
- When mounted on 1" square PCB (FR4 material).
- Parametric verification ongoing.
- See solder profile ([www.vishay.com/doc?73257](http://www.vishay.com/doc?73257)). The PowerPAK SO-8L 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.



SPECIFICATIONS (T <sub>C</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, I <sub>D</sub> = -250 μA		-60	-	-	V
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 μA		-1.5	-2.0	-2.5	
Gate-Source Leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V		-	-	± 100	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V	V <sub>DS</sub> = -60 V	-	-	-1	μA
		V <sub>GS</sub> = 0 V	V <sub>DS</sub> = -60 V, T <sub>J</sub> = 125 °C	-	-	-50	
		V <sub>GS</sub> = 0 V	V <sub>DS</sub> = -60 V, T <sub>J</sub> = 175 °C	-	-	-150	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>GS</sub> = -10 V	V <sub>DS</sub> ≤ -5 V	-30	-	-	A
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = -10 V	I <sub>D</sub> = -3.5 A	-	0.0155	0.0180	Ω
		V <sub>GS</sub> = -4.5 V	I <sub>D</sub> = -3.1 A	-	0.0206	0.0240	
		V <sub>GS</sub> = -10 V	I <sub>D</sub> = -3.5 A, T <sub>J</sub> = 125 °C	-	0.0255	-	
		V <sub>GS</sub> = -10 V	I <sub>D</sub> = -3.5 A, T <sub>J</sub> = 175 °C	-	0.0310	-	
Forward Transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = -30 V, I <sub>D</sub> = -15 A		-	40	-	S
<b>Dynamic <sup>b</sup></b>							
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V	V <sub>DS</sub> = -30 V, f = 1 MHz	-	3448	4586	pF
Output Capacitance	C <sub>oss</sub>			-	374	497	
Reverse Transfer Capacitance	C <sub>rss</sub>			-	234	312	
Total Gate Charge <sup>c</sup>	Q <sub>g</sub>	V <sub>GS</sub> = -10 V	V <sub>DS</sub> = -40 V, I <sub>D</sub> = -15 A	-	73	108	nC
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>			-	10	-	
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>			-	20	-	
Gate Resistance	R <sub>g</sub>	f = 1 MHz		0.5	1.1	2	Ω
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = -30 V, R <sub>L</sub> = 30 Ω I <sub>D</sub> ≅ -1 A, V <sub>GEN</sub> = -10 V, R <sub>g</sub> = 6 Ω		-	12	17	ns
Rise Time <sup>c</sup>	t <sub>r</sub>			-	19	26	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>			-	88	117	
Fall Time <sup>c</sup>	t <sub>f</sub>			-	45	60	
<b>Source-Drain Diode Ratings and Characteristics <sup>b</sup></b>							
Pulsed Current <sup>a</sup>	I <sub>SM</sub>			-	-	-200	A
Forward Voltage	V <sub>SD</sub>	I <sub>F</sub> = -2.5 A, V <sub>GS</sub> = 0		-	-0.8	-1.2	V

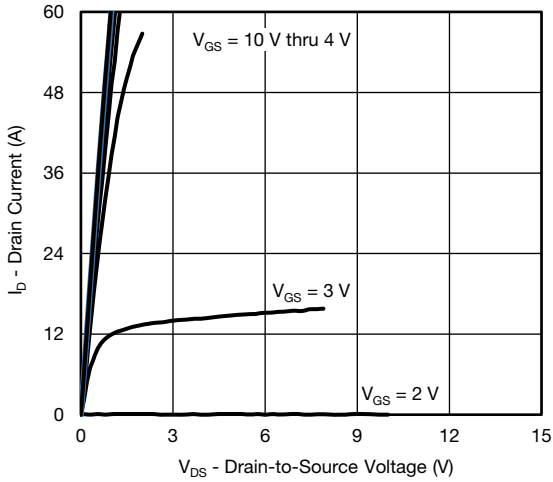
**Notes**

- a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %.
- b. Guaranteed by design, not subject to production testing.
- c. Independent of operating temperature.

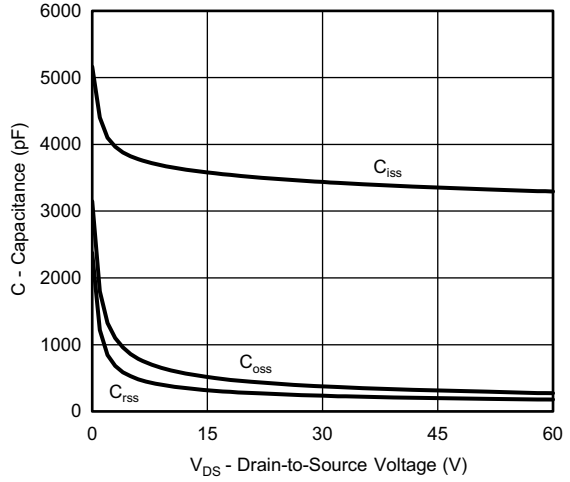
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



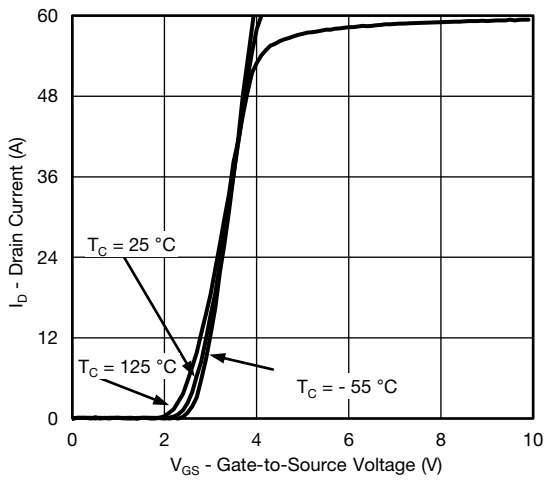
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C, unless otherwise noted)



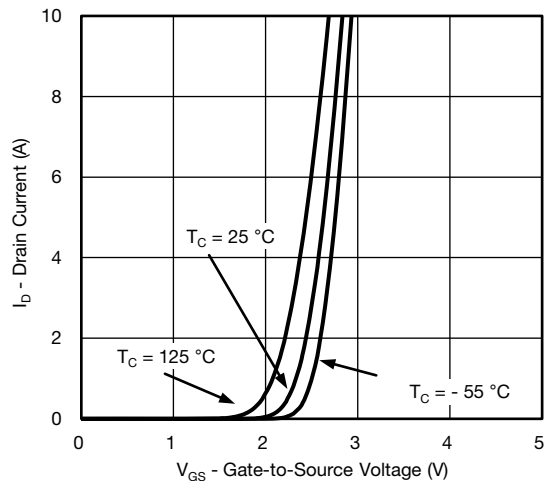
Output Characteristics



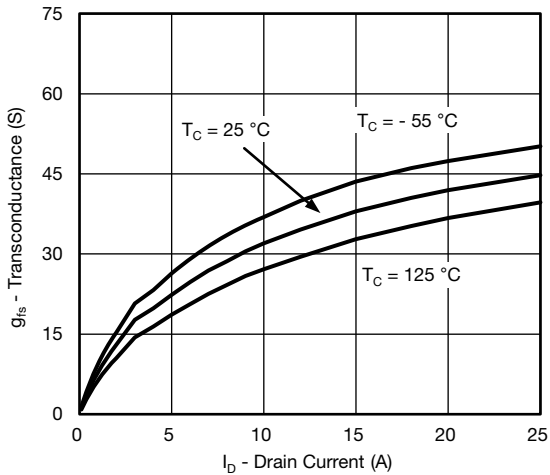
Capacitance



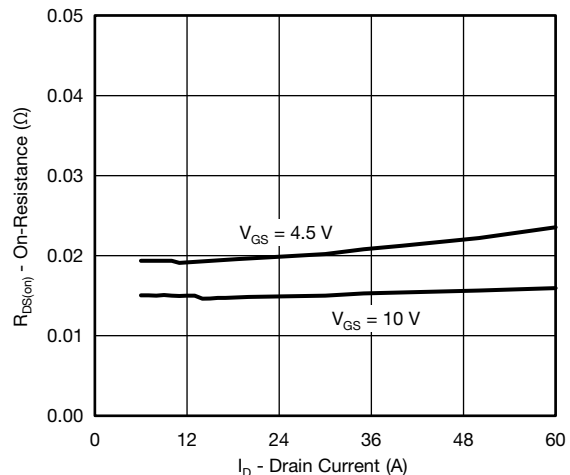
Transfer Characteristics



Transfer Characteristics



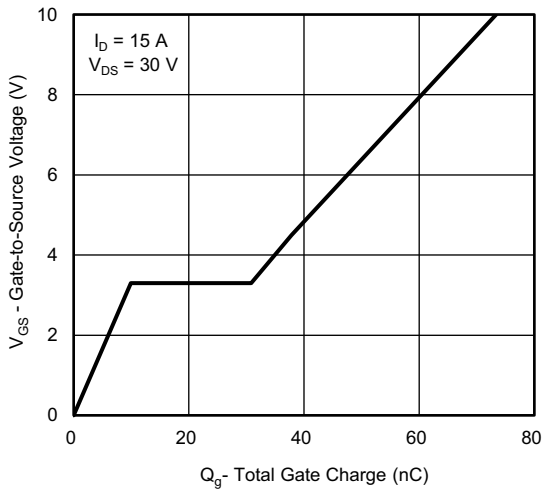
Transconductance



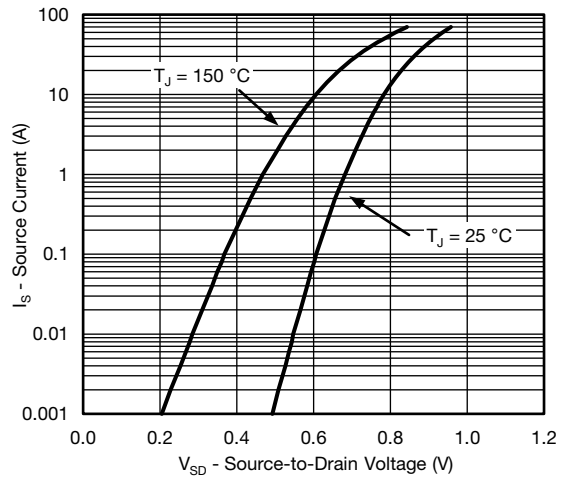
On-Resistance vs. Drain Current



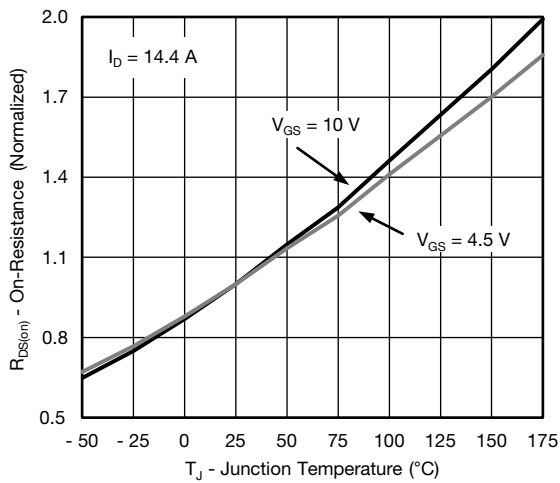
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C, unless otherwise noted)



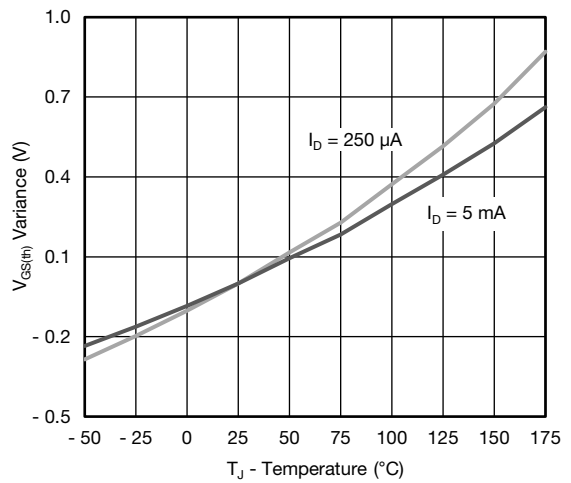
Gate Charge



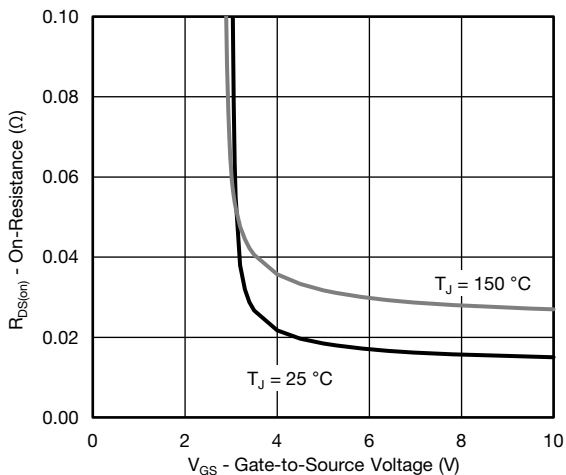
Source Drain Diode Forward Voltage



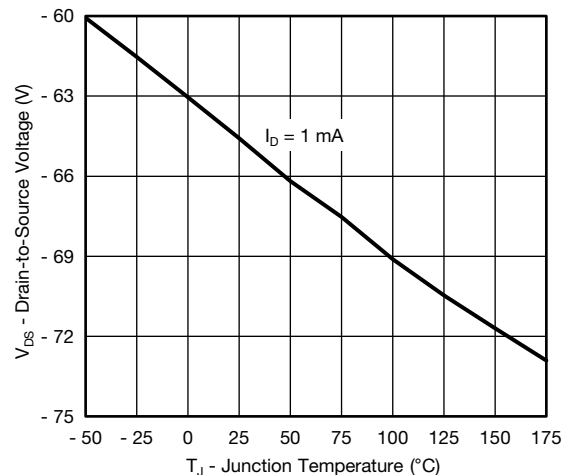
On-Resistance vs. Junction Temperature



Threshold Voltage



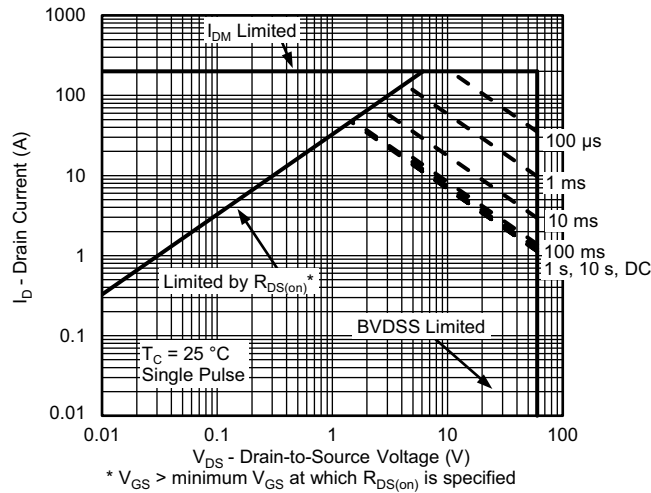
On-Resistance vs. Gate-to-Source Voltage



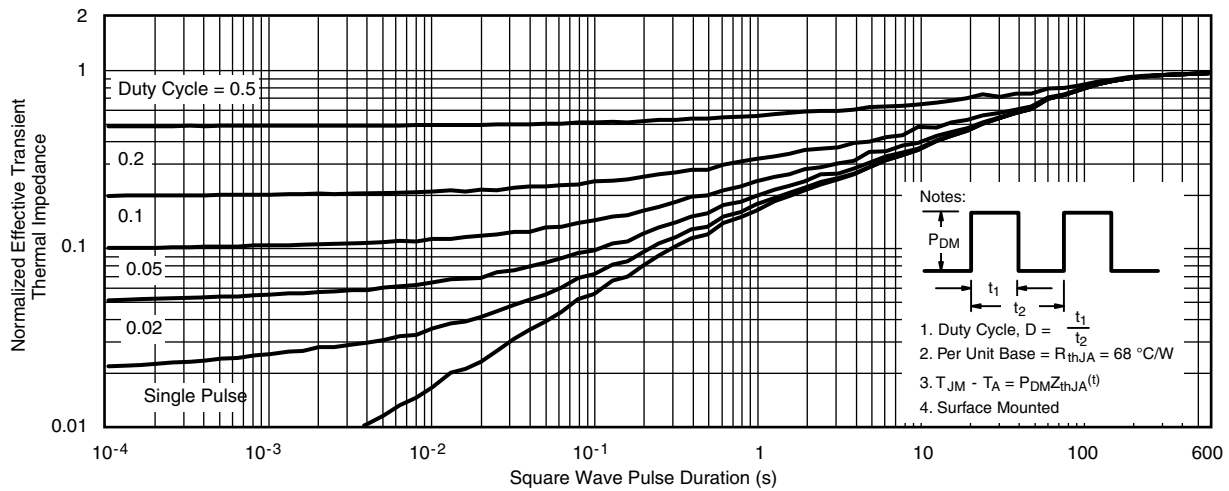
Drain Source Breakdown vs. Junction Temperature



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



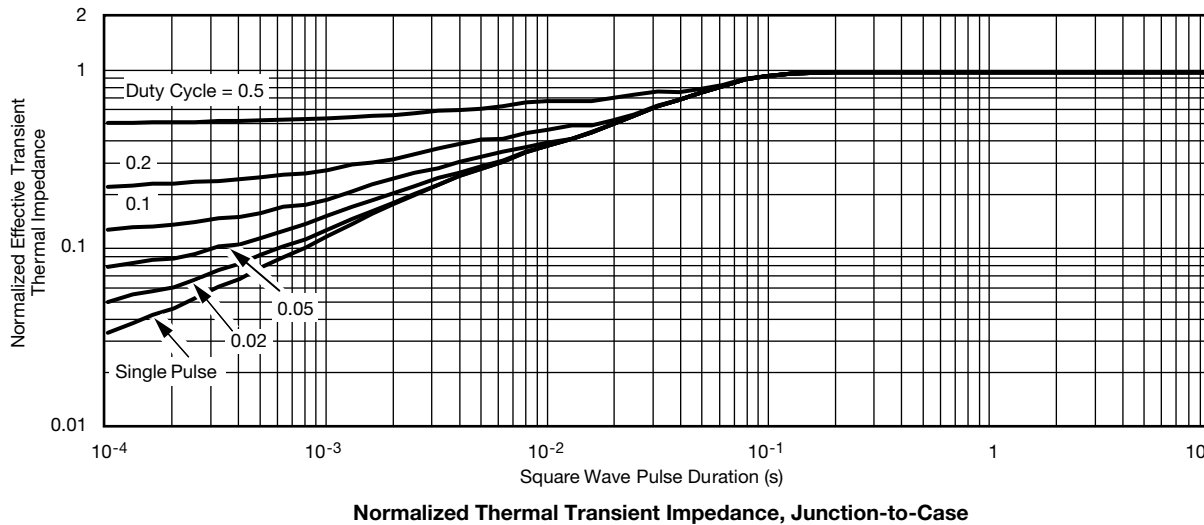
**Safe Operating Area**



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



**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.

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?66963](http://www.vishay.com/ppg?66963).



### PowerPAK® SO-8L Case Outline 2





DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	1.00	1.07	1.14	0.039	0.042	0.045
A1	0.00	-	0.127	0.00	-	0.005
b	0.33	0.41	0.48	0.013	0.016	0.019
b1	0.44	0.51	0.58	0.017	0.020	0.023
b2	4.80	4.90	5.00	0.189	0.193	0.197
b3	0.094			0.004		
b4	0.47			0.019		
c	0.20	0.25	0.30	0.008	0.010	0.012
D	5.00	5.13	5.25	0.197	0.202	0.207
D1	4.80	4.90	5.00	0.189	0.193	0.197
D2	3.86	3.96	4.06	0.152	0.156	0.160
D3	1.63	1.73	1.83	0.064	0.068	0.072
e	1.27 BSC			0.050 BSC		
E	6.05	6.15	6.25	0.238	0.242	0.246
E1	4.27	4.37	4.47	0.168	0.172	0.176
E2	2.75	2.85	2.95	0.108	0.112	0.116
F	-	-	0.15	-	-	0.006
L	0.62	0.72	0.82	0.024	0.028	0.032
L1	0.92	1.07	1.22	0.036	0.042	0.048
K	0.51			0.020		
W	0.23			0.009		
W1	0.41			0.016		
W2	2.82			0.111		
W3	2.96			0.117		
q	0°	-	10°	0°	-	10°
ECN: S19-0643-Rev. B, 05-Aug-2019 DWG: 6044						

Note

- Millimeters will govern





**RECOMMENDED MINIMUM PAD FOR PowerPAK® SO-8L SINGLE**



Recommended Minimum Pads  
Dimensions in mm (inches)



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