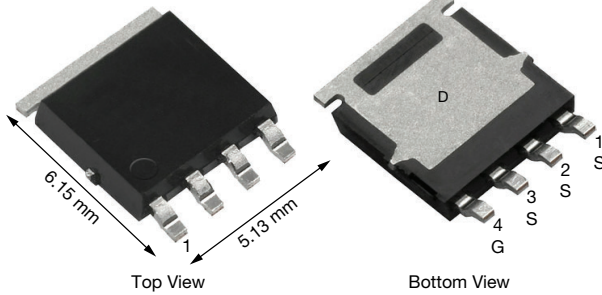


## N-Channel 40 V (D-S) MOSFET

PowerPAK® SO-8L Single



### FEATURES

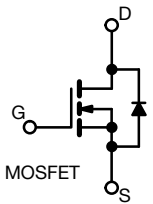
- TrenchFET® Gen IV power MOSFET
- Very low  $Q_g$  and  $Q_{oss}$  reduce power loss and improve efficiency
- Flexible leads provide resilience to mechanical stress
- 100 %  $R_g$  and UIS tested
- $Q_{gd}/Q_{gs}$  ratio < 1 optimizes switching characteristics
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



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

### APPLICATIONS

- Synchronous rectification
- High power density DC/DC
- DC/AC inverters



N-Channel MOSFET

PRODUCT SUMMARY	
$V_{DS}$ (V)	40
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 10$ V	0.00135
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 4.5$ V	0.00175
$Q_g$ typ. (nC)	49
$I_D$ (A) <sup>a</sup>	169
Configuration	Single

ORDERING INFORMATION	
Package	PowerPAK SO-8L
Lead (Pb)-free and halogen-free	SiJ438ADP-T1-GE3

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	$V_{DS}$	40	V
Gate-source voltage	$V_{GS}$	+20, -16	
Continuous drain current ( $T_J = 150$ °C)	$I_D$	$T_C = 25$ °C	169
		$T_C = 70$ °C	135
		$T_A = 25$ °C	45.3 <sup>b, c</sup>
		$T_A = 70$ °C	36.2 <sup>b, c</sup>
Pulsed drain current ( $t = 100$ $\mu$ s)	$I_{DM}$	300	A
Continuous source-drain diode current	$I_S$	$T_C = 25$ °C	
		$T_A = 25$ °C	4.5 <sup>b, c</sup>
Single pulse avalanche current	$I_{AS}$	50	mJ
Single pulse avalanche energy	$E_{AS}$	125	
Maximum power dissipation	$P_D$	$T_C = 25$ °C	69.4
		$T_C = 70$ °C	44.4
		$T_A = 25$ °C	5 <sup>b, c</sup>
		$T_A = 70$ °C	3.2 <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	

THERMAL RESISTANCE RATINGS					
PARAMETER	SYMBOL	TYPICAL	MAXIMUM	UNIT	
Maximum junction-to-ambient <sup>b, f</sup>	$R_{thJA}$	20	25	°C/W	
Maximum junction-to-case (drain)	$R_{thJC}$	1.3	1.8		

### Notes

- $T_C = 25$  °C
- 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 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
- Maximum under steady state conditions is 65 °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 <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	40	-	-	V
V <sub>DS</sub> temperature coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA	-	25	-	mV/°C
V <sub>GS(th)</sub> temperature coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>		-	-6.4	-	
Gate-source threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1.1	-	2.4	V
Gate-source leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = +20, -16 V	-	-	± 100	nA
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V	-	-	1	μA
		V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C	-	-	10	
On-state drain current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≥ 5 V, V <sub>GS</sub> = 10 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> = 20 A	-	0.00110	0.00135	Ω
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 10 A	-	0.00143	0.00175	
Forward transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 20 A	-	130	-	S
<b>Dynamic <sup>b</sup></b>						
Input capacitance	C <sub>ISS</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, f = 1 MHz	-	7800	-	pF
Output capacitance	C <sub>OSS</sub>		-	1400	-	
Reverse transfer capacitance	C <sub>RSS</sub>		-	90	-	
C <sub>RSS</sub> /C <sub>ISS</sub> ratio			-	0.012	0.024	
Total gate charge	Q <sub>g</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A	-	108	162	nC
		V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 10 A	-	49	74	
Gate-source charge	Q <sub>gs</sub>		-	25.3	-	
Gate-drain charge	Q <sub>gd</sub>		-	8.3	-	
Output charge	Q <sub>OSS</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V	-	65	-	
Gate resistance	R <sub>g</sub>	f = 1 MHz	0.4	1.2	2.0	Ω
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 20 V, R <sub>L</sub> = 2 Ω I <sub>D</sub> ≅ 10 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω	-	17	34	ns
Rise time	t <sub>r</sub>		-	8	16	
Turn-off delay time	t <sub>d(off)</sub>		-	51	102	
Fall time	t <sub>f</sub>		-	8	16	
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 20 V, R <sub>L</sub> = 2 Ω I <sub>D</sub> ≅ 10 A, V <sub>GEN</sub> = 4.5 V, R <sub>g</sub> = 1 Ω	-	48	96	
Rise time	t <sub>r</sub>		-	80	160	
Turn-off delay time	t <sub>d(off)</sub>		-	50	100	
Fall time	t <sub>f</sub>		-	20	40	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous source-drain diode current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	-	-	51.6	A
Pulse diode forward current (t <sub>p</sub> = 100 μs)	I <sub>SM</sub>		-	-	300	
Body diode voltage	V <sub>SD</sub>	I <sub>S</sub> = 5 A	-	0.7	1.1	V
Body diode reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 10 A, di/dt = 100 A/μs, T <sub>J</sub> = 25 °C	-	59	104	ns
Body diode reverse recovery charge	Q <sub>rr</sub>		-	60	120	nC
Reverse recovery fall time	t <sub>a</sub>		-	28	-	ns
Reverse recovery rise time	t <sub>b</sub>		-	24	-	

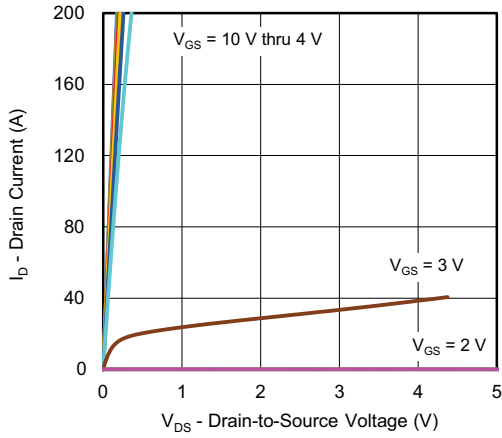
**Notes**

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

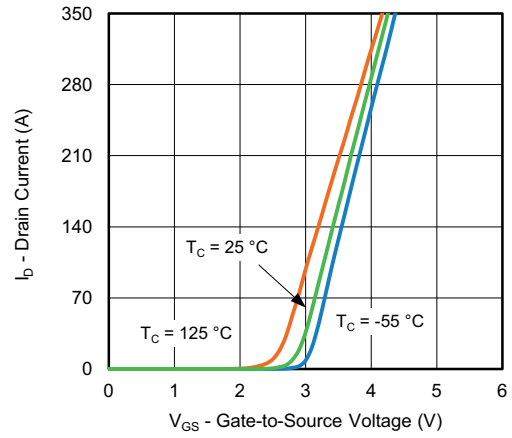
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



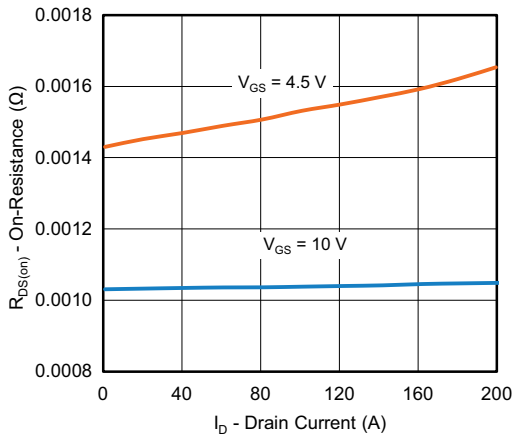
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



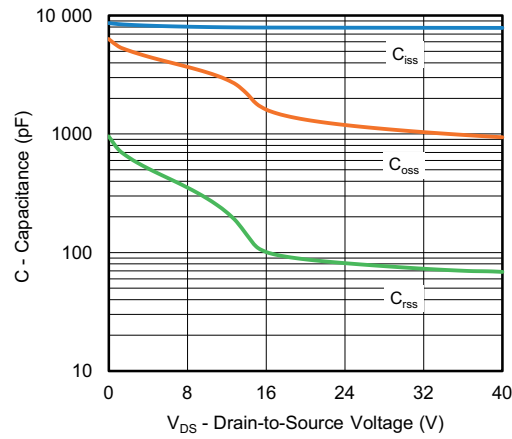
**Output Characteristics**



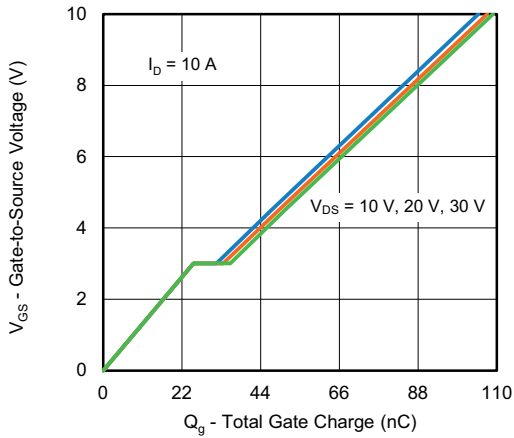
**Transfer Characteristics**



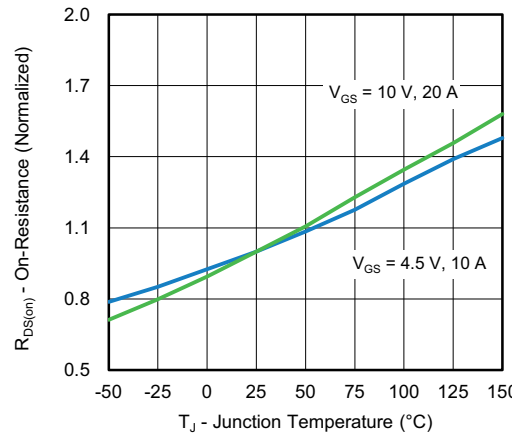
**On-Resistance vs. Drain Current**



**Capacitance**



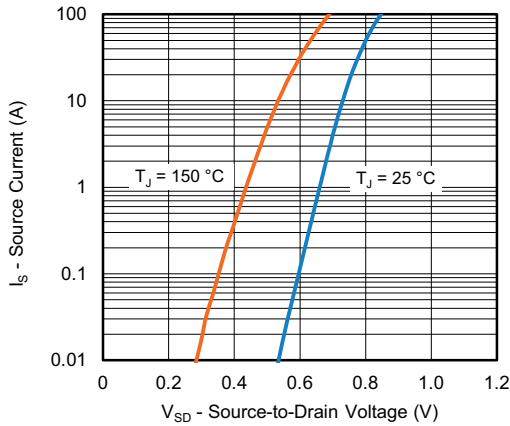
**Gate Charge**



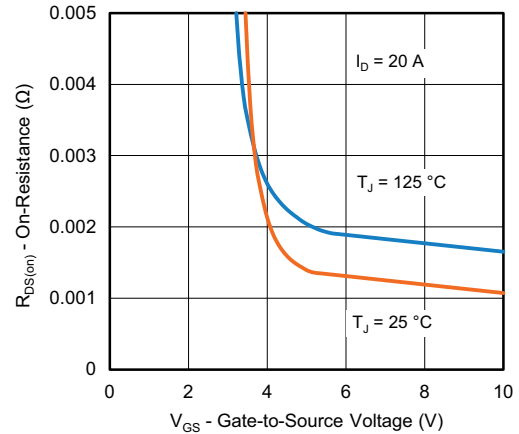
**On-Resistance vs. Junction Temperature**



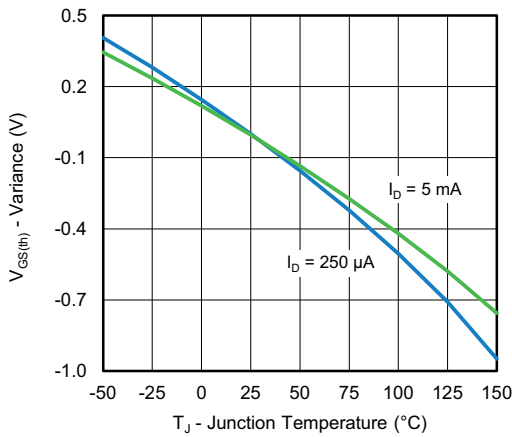
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



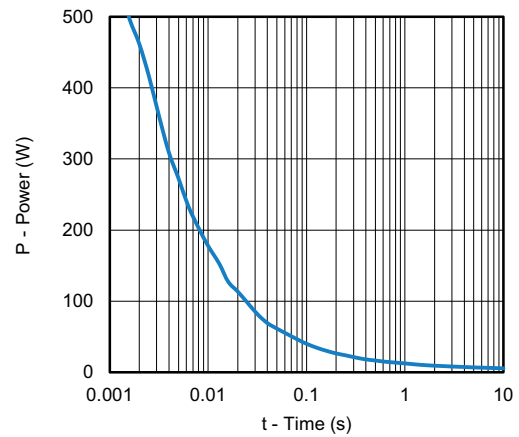
**Source-Drain Diode Forward Voltage**



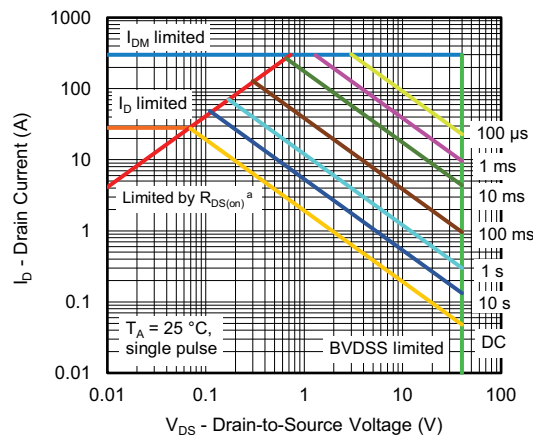
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**



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



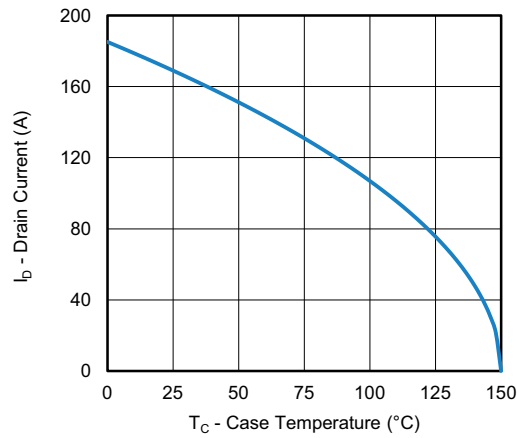
**Safe Operating Area**

**Note**

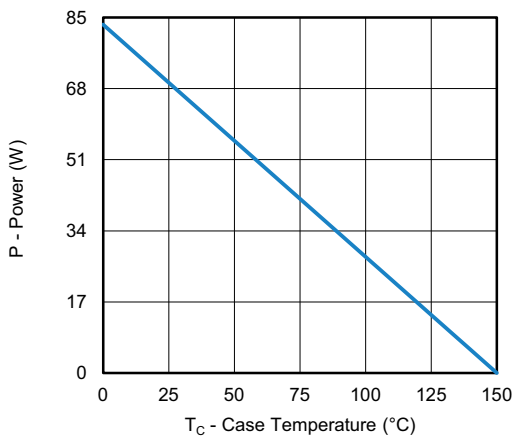
a.  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified



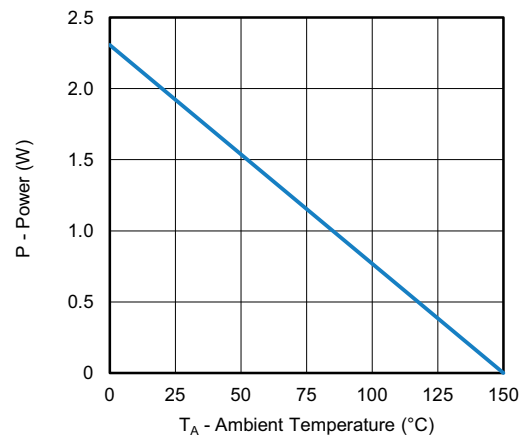
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



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



**Power, Junction-to-Case**



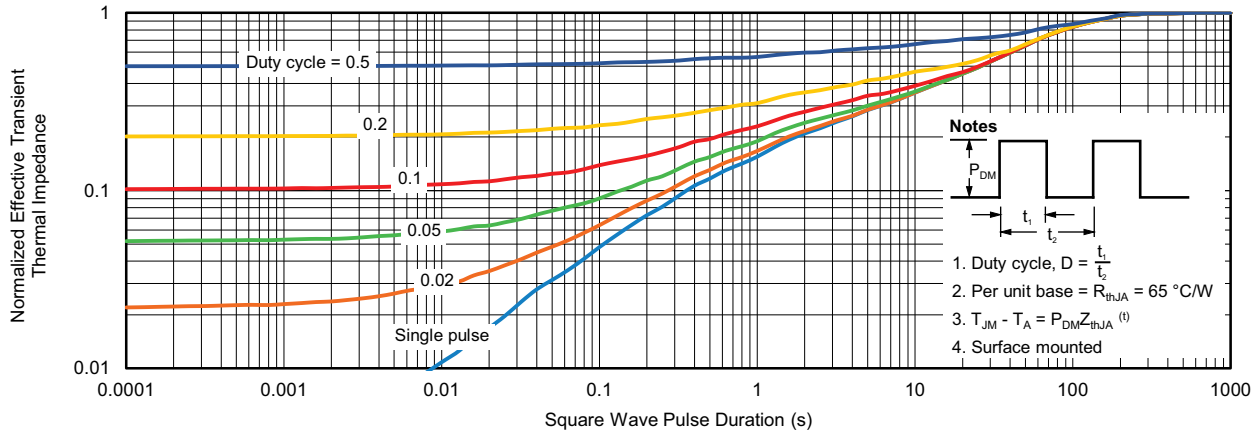
**Power, Junction-to-Ambient**

**Note**

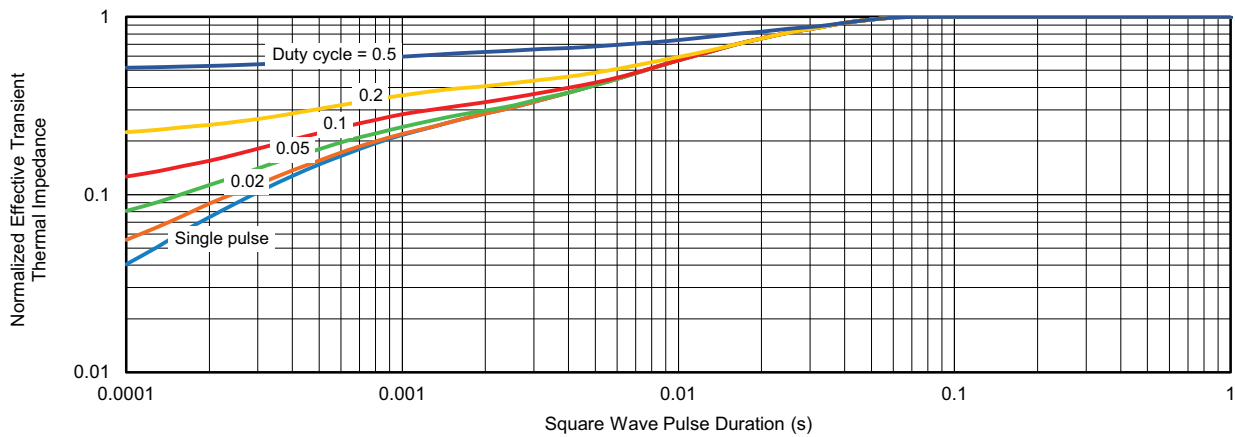
- a. The power dissipation P<sub>D</sub> is based on T<sub>J</sub> max. = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit



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



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



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

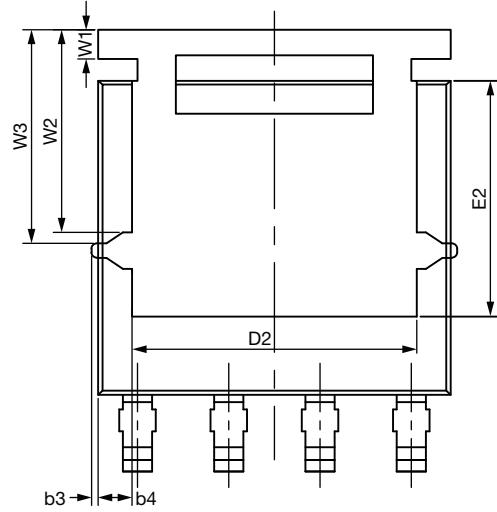
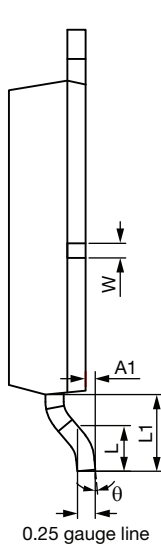
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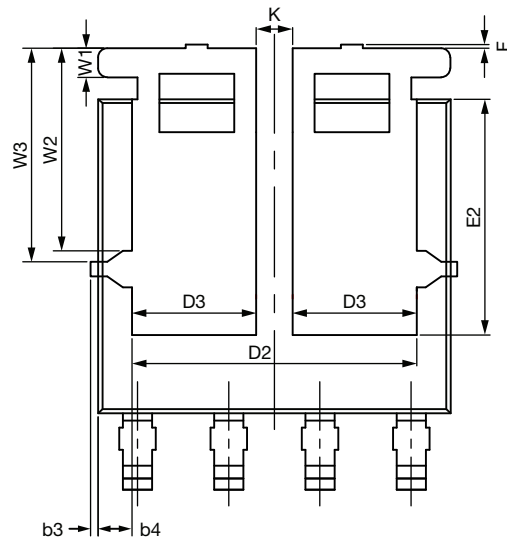
# PowerPAK® SO-8L Case Outline 1



Topside view



Backside view (single)



Backside view (dual)



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	3.18	3.28	3.38	0.125	0.129	0.133
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		
θ	0°	-	10°	0°	-	10°

ECN: S19-0643-Rev. E, 05-Aug-2019  
DWG: 5976

**Note**

- Millimeters will govern







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