

## Automotive N-Channel 40 V (D-S) 175 °C MOSFET

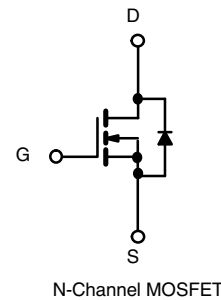
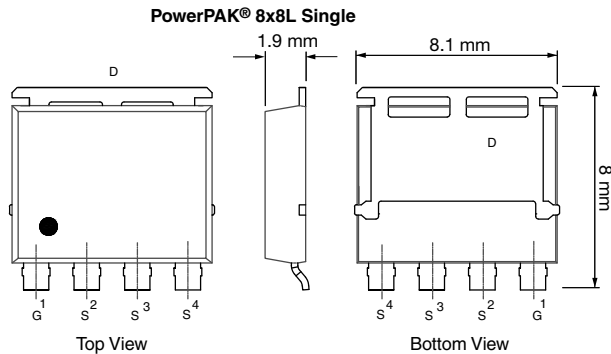
 AUTOMOTIVE  
GRADE

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

PRODUCT SUMMARY	
$V_{DS}$ (V)	40
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 10$ V	0.0017
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 4.5$ V	0.0020
$I_D$ (A)	200
Configuration	Single

### FEATURES

- TrenchFET® power MOSFET
- AEC-Q101 qualified
- 100 %  $R_g$  and UIS tested
- Thin 1.9 mm height
- Material categorization:  
for definitions of compliance please see  
[www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



ORDERING INFORMATION	
Package	PowerPAK 8x8L
Lead (Pb)-free and Halogen-free	SQJQ402E-T1-GE3

ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current	$I_D$	$T_C = 25$ °C <sup>a</sup>	200
		$T_C = 125$ °C	127
Continuous Source Current (Diode Conduction)	$I_S$	200	A
Pulsed Drain Current <sup>b</sup>	$I_{DM}$	300	
Single Pulse Avalanche Current	$I_{AS}$	L = 0.1 mH	85
Single Pulse Avalanche Energy			$E_{AS}$
Maximum Power Dissipation	$P_D$	$T_C = 25$ °C	150
		$T_C = 125$ °C	50
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	$R_{thJA}$	50	°C/W
Junction-to-Case (Drain)			

### Notes

- Package limited.
- Pulse test; pulse width  $\leq 300$   $\mu$ s, duty cycle  $\leq 2$  %.
- When mounted on 1" square Pcb (Fr4 material).
- See solder profile ([www.vishay.com/doc?73257](http://www.vishay.com/doc?73257)). The PowerPAK 8x8L 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		40	-	-	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	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> = 40 V	-	-	1	μA
		V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 40 V, T <sub>J</sub> = 125 °C	-	-	50	
		V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 40 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	100	-	-	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	-	0.0013	0.0017	Ω
		V <sub>GS</sub> = 4.5 V	I <sub>D</sub> = 10 A	-	0.0015	0.0020	
		V <sub>GS</sub> = 10 V	I <sub>D</sub> = 20 A, T <sub>J</sub> = 125 °C	-	-	0.0026	
		V <sub>GS</sub> = 10 V	I <sub>D</sub> = 20 A, T <sub>J</sub> = 175 °C	-	-	0.0031	
Forward Transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 20 A		-	140	-	S
<b>Dynamic <sup>b</sup></b>							
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V	V <sub>DS</sub> = 20 V, f = 1 MHz	-	10 760	13 500	pF
Output Capacitance	C <sub>oss</sub>			-	1370	1800	
Reverse Transfer Capacitance	C <sub>rss</sub>			-	650	850	
Total Gate Charge <sup>c</sup>	Q <sub>g</sub>	V <sub>GS</sub> = 10 V	V <sub>DS</sub> = 20 V, I <sub>D</sub> = 40 A	-	169	260	nC
Gate-Source Charge <sup>c</sup>	Q <sub>gs</sub>			-	32	-	
Gate-Drain Charge <sup>c</sup>	Q <sub>gd</sub>			-	29	-	
Gate Resistance	R <sub>g</sub>	f = 1 MHz		0.6	1.3	2.5	Ω
Turn-On Delay Time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = 20 V, R <sub>L</sub> = 0.5 Ω I <sub>D</sub> ≅ 40 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω		-	19	30	ns
Rise Time <sup>c</sup>	t <sub>r</sub>			-	15	25	
Turn-Off Delay Time <sup>c</sup>	t <sub>d(off)</sub>			-	69	110	
Fall Time <sup>c</sup>	t <sub>f</sub>			-	11	20	
<b>Source-Drain Diode Ratings and Characteristics <sup>b</sup></b>							
Pulsed Current <sup>a</sup>	I <sub>SM</sub>			-	-	300	A
Forward Voltage	V <sub>SD</sub>	I <sub>F</sub> = 50 A, V <sub>GS</sub> = 0		-	0.82	1.2	V

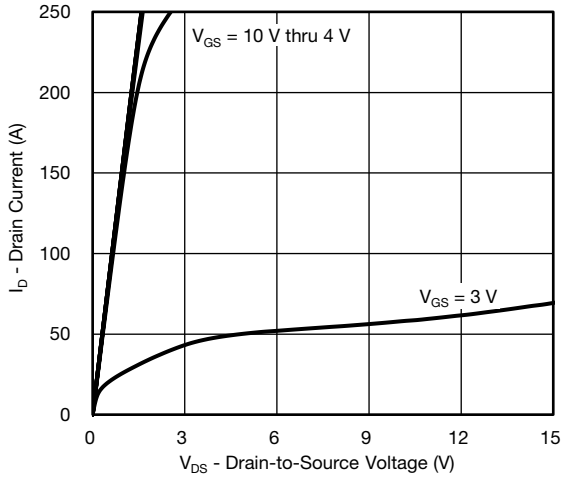
**Notes**

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

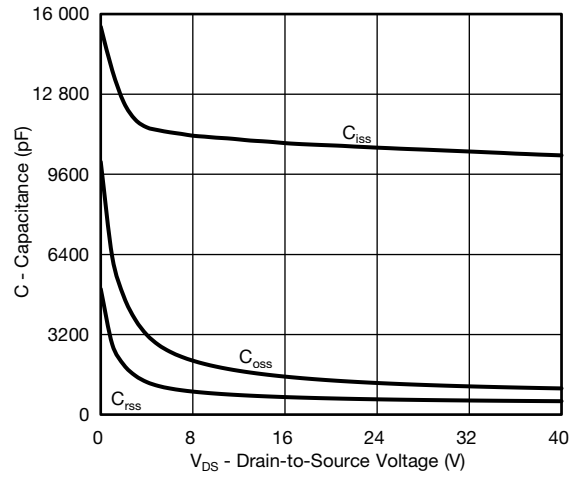
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



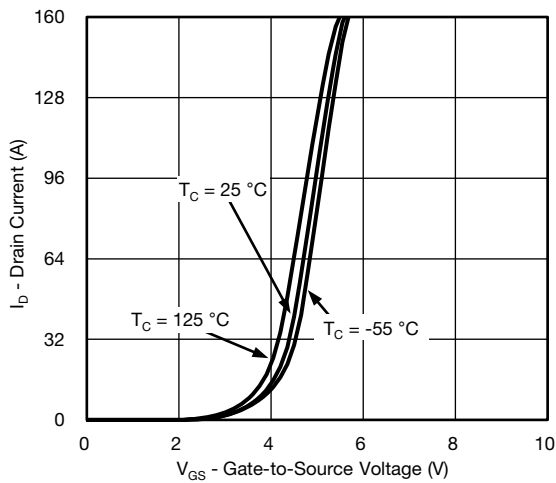
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



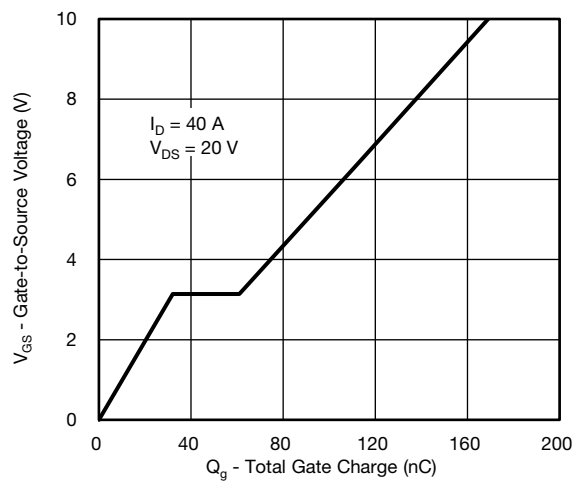
**Output Characteristics**



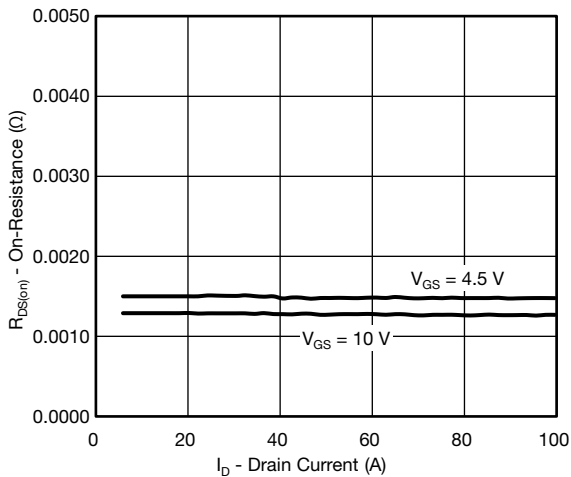
**Capacitance**



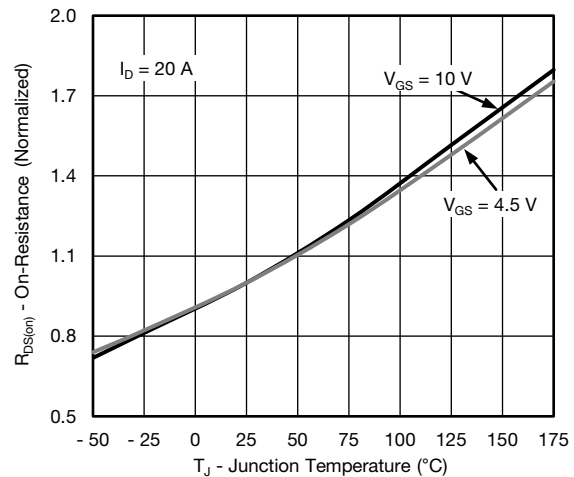
**Transfer Characteristics**



**Gate Charge**



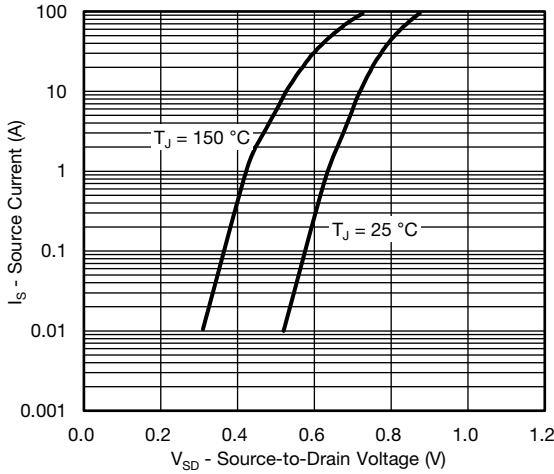
**On-Resistance vs. Drain Current**



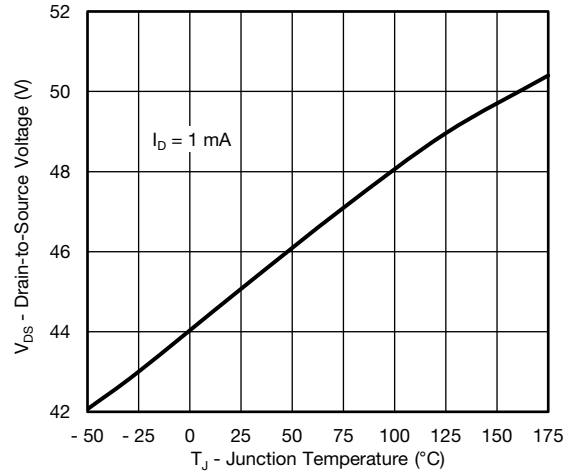
**On-Resistance vs. Junction Temperature**



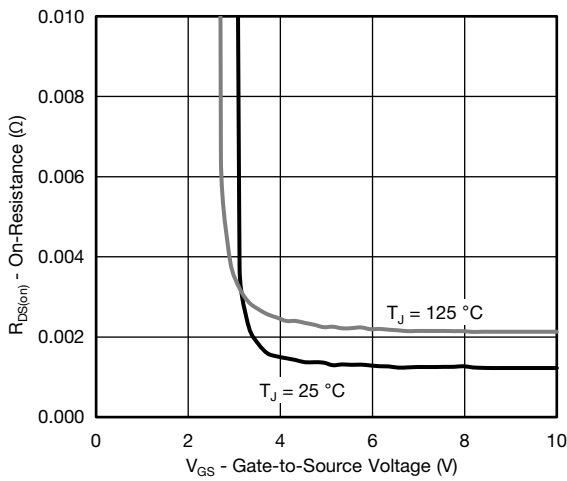
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



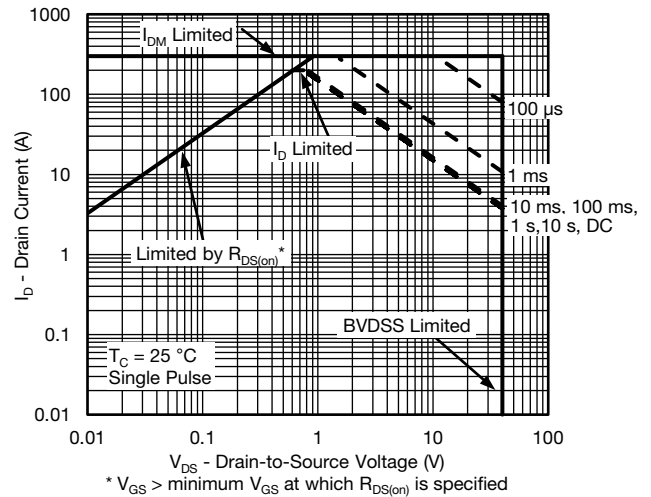
**Source Drain Diode Forward Voltage**



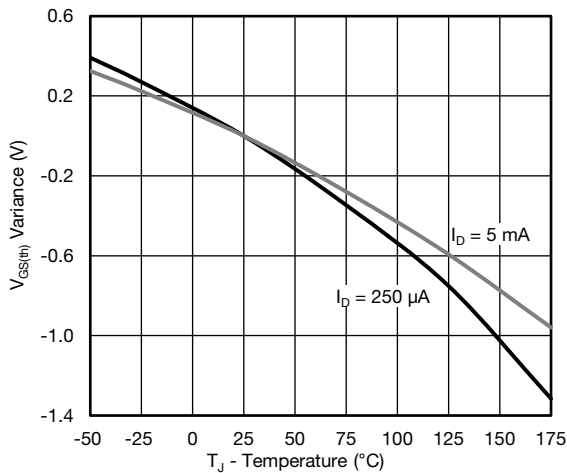
**Drain Source Breakdown vs. Junction Temperature**



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



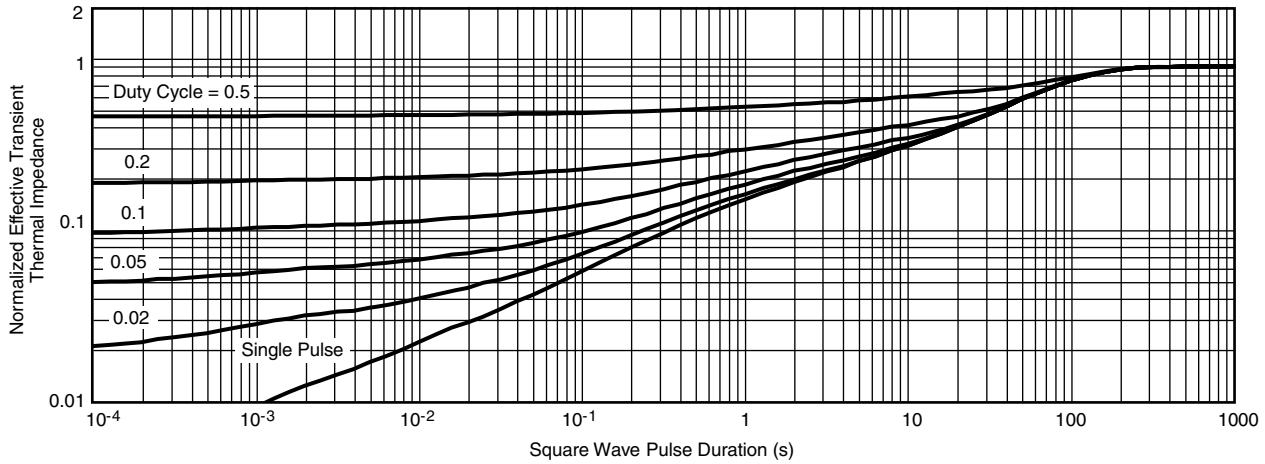
**Safe Operating Area**



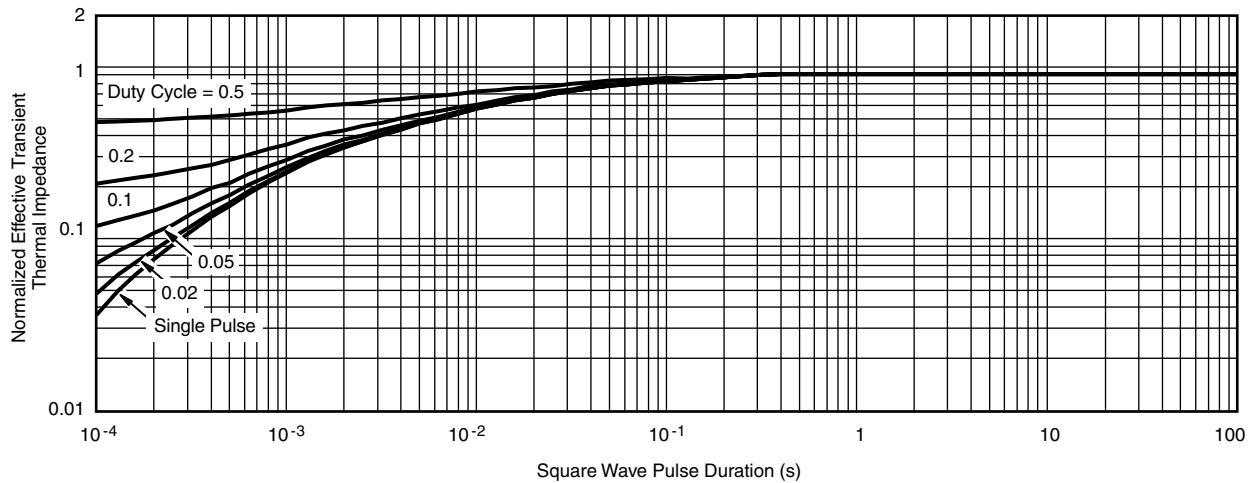
**Threshold Voltage**



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

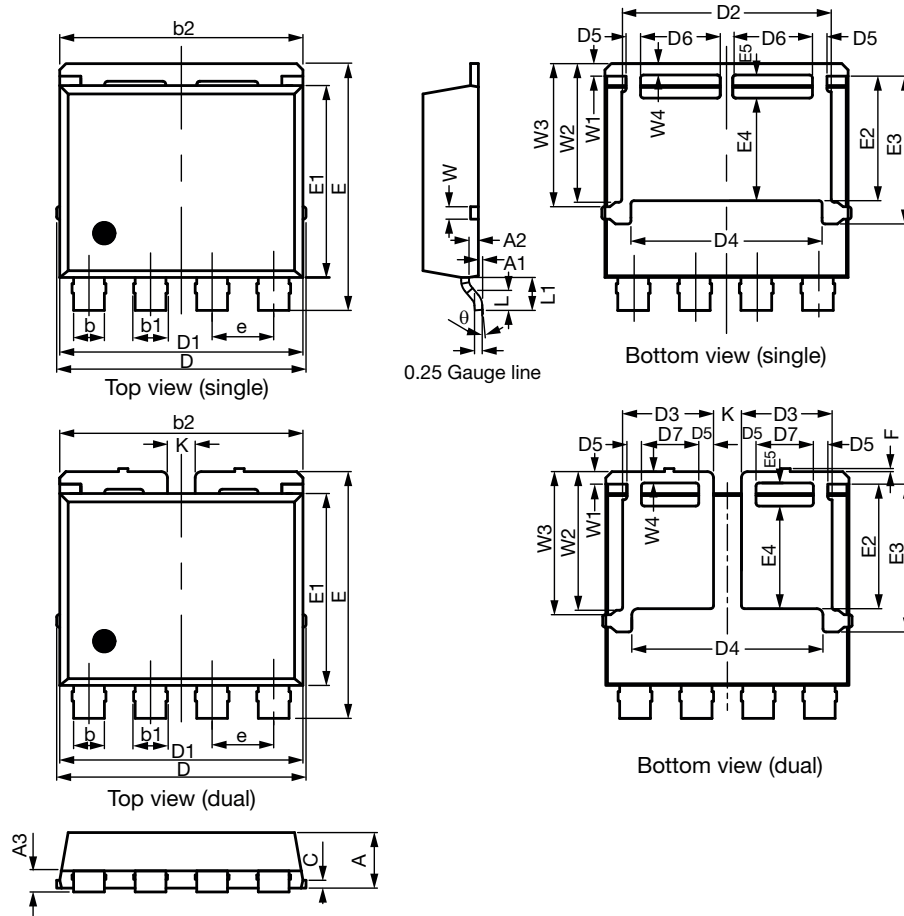


**Normalized Thermal Transient Impedance, Junction-to-Ambient**



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

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**PowerPAK<sup>®</sup> 8 x 8L Case Outline**


DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	1.70	1.80	1.90	0.067	0.071	0.075
A1	0.00	0.08	0.13	0.000	0.003	0.005
A2	0.25	0.30	0.35	0.010	0.012	0.014
A3	0.55	0.62	0.70	0.022	0.024	0.028
b	0.92	1.00	1.08	0.036	0.039	0.043
b1	1.02	1.10	1.18	0.040	0.043	0.046
b2	7.80	7.90	8.00	0.307	0.311	0.315
c	0.20	0.25	0.30	0.008	0.010	0.012
D	8.00	8.10	8.25	0.315	0.319	0.325
D1	7.80	7.90	8.00	0.307	0.311	0.315
D2	6.70	6.80	6.90	0.264	0.268	0.272
D3	2.85	2.95	3.05	0.112	0.116	0.120
D4	6.11	6.21	6.31	0.241	0.244	0.248
D5	0.37	0.47	0.57	0.015	0.019	0.022
D6	2.49	2.59	2.69	0.098	0.102	0.106
D7	1.76	1.86	1.96	0.069	0.073	0.077

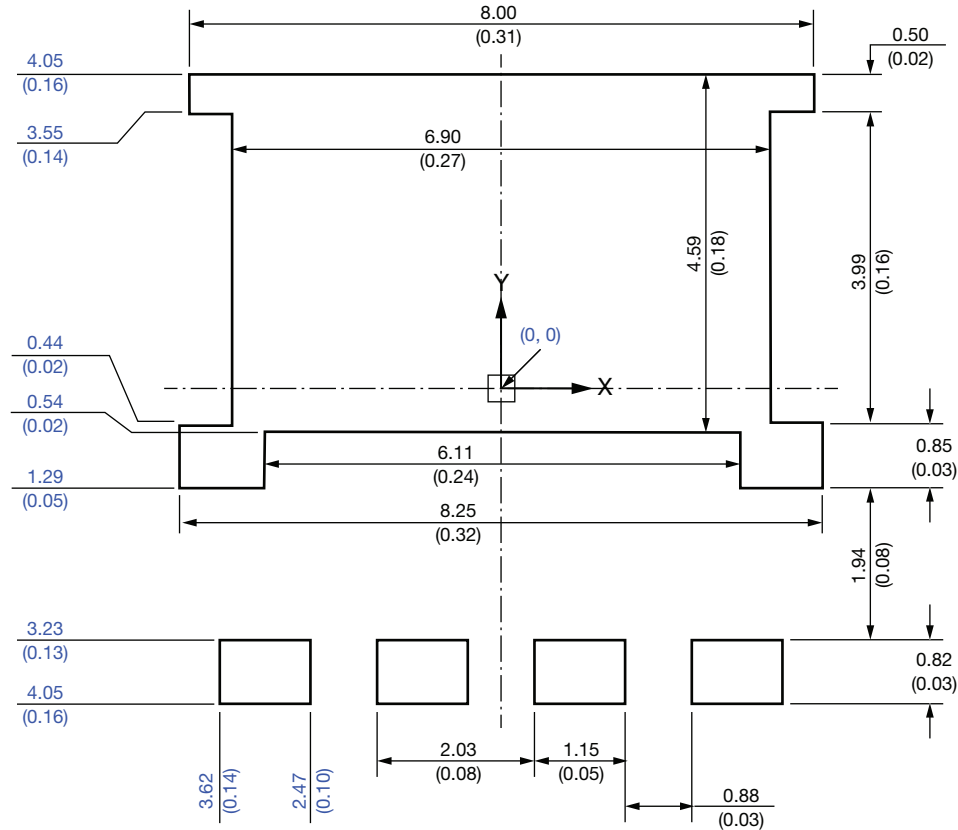


DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
e	1.95	2.00	2.05	0.077	0.079	0.081
E	7.90	8.00	8.10	0.311	0.315	0.319
E1	6.12	6.22	6.32	0.241	0.245	0.249
E2	3.94	4.04	4.14	0.140	0.159	0.163
E3	4.69	4.79	4.89	0.185	0.189	0.193
E4	3.23	3.33	3.43	0.127	0.131	0.135
E5	0.65	0.75	0.85	0.026	0.030	0.033
F	0.00	0.10	0.15	0.000	0.004	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	0.80	0.90	1.00	0.031	0.035	0.039
W	0.30	0.40	0.50	0.012	0.016	0.020
W1	0.30	0.40	0.50	0.012	0.016	0.020
W2	4.39	4.49	4.59	0.173	0.177	0.181
W3	4.54	4.64	4.74	0.179	0.183	0.187
W4	0.32	0.37	0.42	0.013	0.015	0.017
θ	6°	10°	14°	6°	10°	14°

C17-1388-Rev. B, 16-Oct-17  
DWG: 6026



# Recommended Minimum PADS for PowerPAK<sup>®</sup> 8 x 8L Single



Dimensions in millimeters (inches)

**Note**

- Linear dimensions are in black, the same information is provided in ordinate dimensions which are in blue.





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