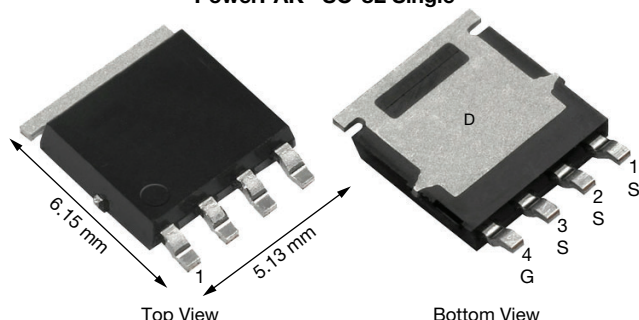


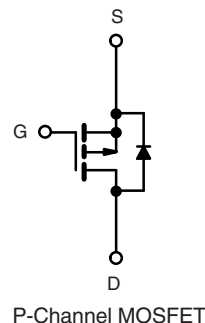
# Automotive P-Channel 40 V (D-S) 175 °C MOSFET

**PowerPAK® SO-8L Single**


## FEATURES

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

AUTOMOTIVE  
GRADE

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


P-Channel MOSFET

## PRODUCT SUMMARY

$V_{DS}$ (V)	-40
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = -10$ V	0.0140
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = -4.5$ V	0.0200
$I_D$ (A)	-30
Configuration	Single

## ORDERING INFORMATION

Package	PowerPAK SO-8L
Lead (Pb)-free and halogen-free	SQJ415EP (for detailed order number please see <a href="http://www.vishay.com/doc?79771">www.vishay.com/doc?79771</a> )

## ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted)

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		V <sub>DS</sub>	-40	V
Gate-source voltage		V <sub>GS</sub>	± 20	
Continuous drain current	T <sub>C</sub> = 25 °C <sup>a</sup>	I <sub>D</sub>	-30	A
	T <sub>C</sub> = 125 °C		-23	
Continuous source current (diode conduction) <sup>a</sup>		I <sub>S</sub>	-30	
Pulsed drain current <sup>b</sup>		I <sub>DM</sub>	-120	
Single pulse avalanche current	L = 0.1 mH	I <sub>AS</sub>	-25	
Single pulse avalanche energy		E <sub>AS</sub>	31.2	mJ
Maximum power dissipation <sup>b</sup>	T <sub>C</sub> = 25 °C	P <sub>D</sub>	45	W
	T <sub>C</sub> = 125 °C		15	
Operating junction and storage temperature range		T <sub>J</sub> , T <sub>stg</sub>	-55 to +175	°C
Soldering recommendations (peak temperature) <sup>d, e</sup>			260	

## THERMAL RESISTANCE RATINGS

PARAMETER	SYMBOL	LIMIT	UNIT
Junction-to-ambient	$R_{thJA}$	70	°C/W
Junction-to-case (drain)	$R_{thJC}$	3.3	

### 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)). For PowerPAK SO-8L, 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

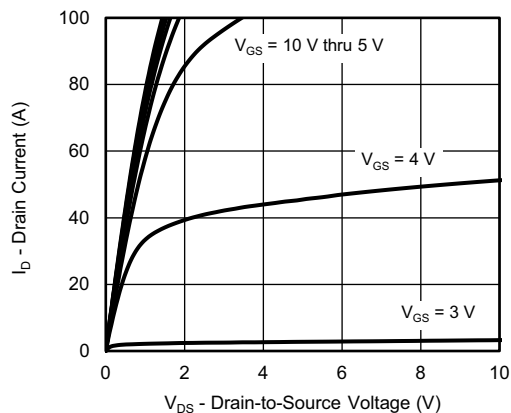
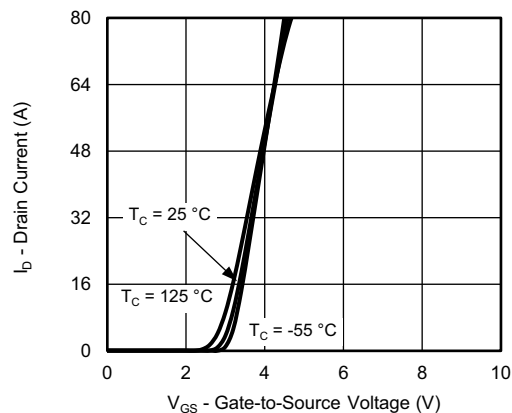
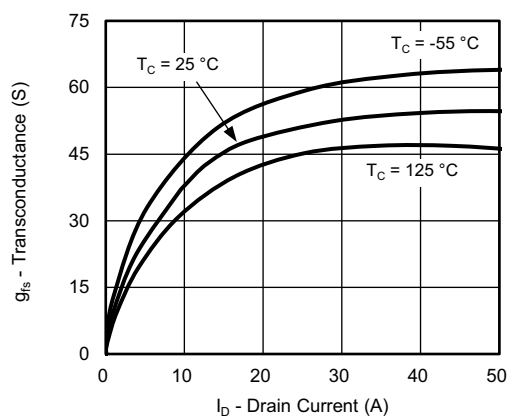
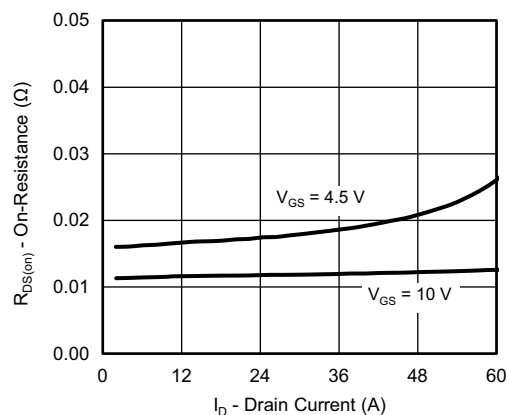
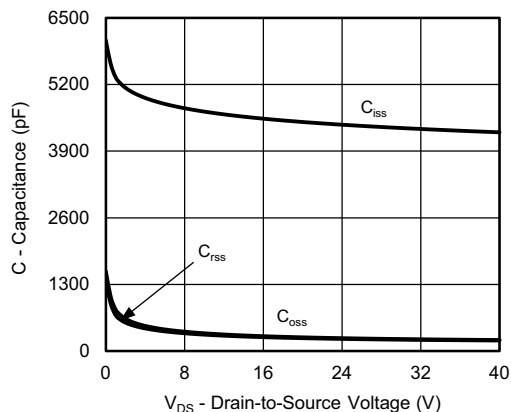
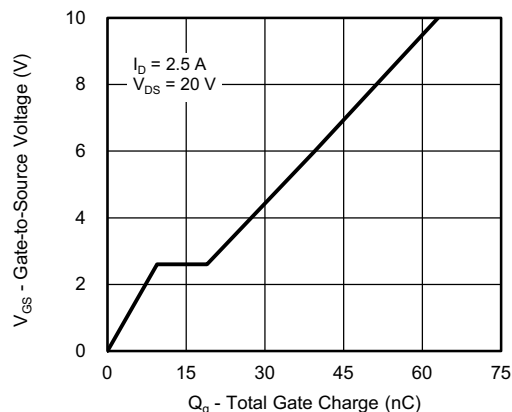


SPECIFICATIONS (T <sub>C</sub> = 25 °C, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-source breakdown voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0, I <sub>D</sub> = -250 μA		-40	-	-	V
Gate-source threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 μA		-1.5	-2.0	-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> = -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	-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> = -10 A	-	0.0115	0.0140	Ω
		V <sub>GS</sub> = -10 V	I <sub>D</sub> = -10 A, T <sub>J</sub> = 125 °C	-	-	0.0219	
		V <sub>GS</sub> = -10 V	I <sub>D</sub> = -10 A, T <sub>J</sub> = 175 °C	-	-	0.0261	
		V <sub>GS</sub> = -4.5 V	I <sub>D</sub> = -6 A	-	0.0163	0.0200	
Forward transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = -15 V, I <sub>D</sub> = -10 A		-	37	-	S
Dynamic <sup>b</sup>							
Input capacitance	C <sub>iss</sub>	V <sub>GS</sub> = 0 V	V <sub>DS</sub> = -25 V, f = 1 MHz	-	4405	6000	pF
Output capacitance	C <sub>oss</sub>			-	248	350	
Reverse transfer capacitance	C <sub>rss</sub>			-	234	320	
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> = -2.5 A	-	63	95	nC
Gate-source charge <sup>c</sup>	Q <sub>gs</sub>			-	9.5	-	
Gate-drain charge <sup>c</sup>	Q <sub>gd</sub>			-	9.5	-	
Gate resistance	R <sub>g</sub>	f = 1 MHz		2	4.6	7	Ω
Turn-on delay time <sup>c</sup>	t <sub>d(on)</sub>	V <sub>DD</sub> = -20 V, R <sub>L</sub> = 8 Ω I <sub>D</sub> ≡ -2.5 A, V <sub>GEN</sub> = -10 V, R <sub>g</sub> = 1 Ω		-	12	20	ns
Rise time <sup>c</sup>	t <sub>r</sub>			-	4	10	
Turn-off delay time <sup>c</sup>	t <sub>d(off)</sub>			-	67	110	
Fall time <sup>c</sup>	t <sub>f</sub>			-	17	30	
Source-Drain Diode Ratings and Characteristics <sup>b</sup>							
Pulsed current <sup>a</sup>	I <sub>SM</sub>			-	-	-120	A
Forward voltage	V <sub>SD</sub>	I <sub>F</sub> = -10 A, V <sub>GS</sub> = 0 V		-	-0.82	-1.2	V
Body diode reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = -2.5 A, di/dt = 100 A/μs		-	26	55	ns
Body diode reverse recovery charge	Q <sub>rr</sub>			-	21	50	nC
Reverse recovery fall time	t <sub>a</sub>			-	15	-	ns
Reverse recovery rise time	t <sub>b</sub>			-	11	-	
Body diode peak reverse recovery current	I <sub>RM(REC)</sub>			-	-1.6	-	A

**Notes**

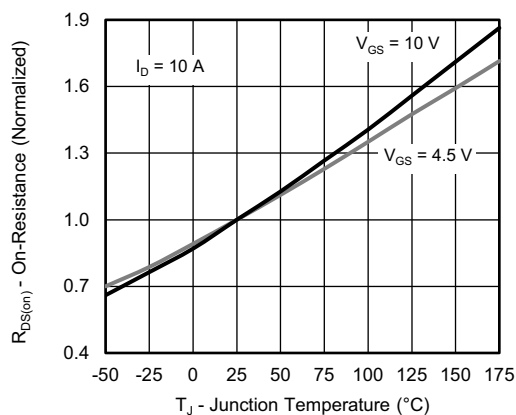
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$   
b. Guaranteed by design, not subject to production testing  
c. Independent of operating temperature

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.

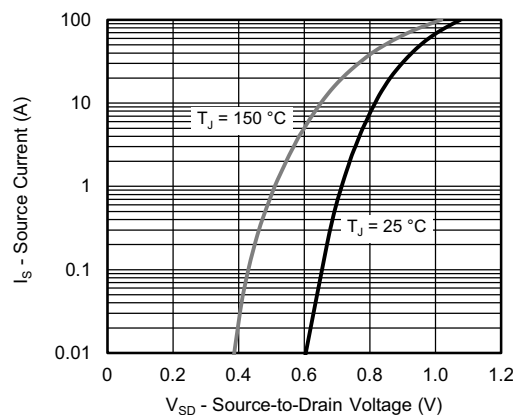
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)

**Output Characteristics**

**Transfer Characteristics**

**Transconductance**

**On-Resistance vs. Drain Current**

**Capacitance**

**Gate Charge**



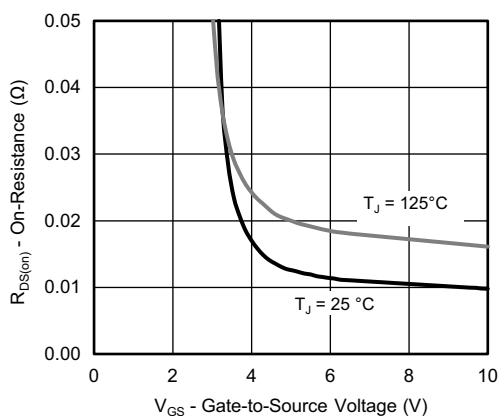
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)



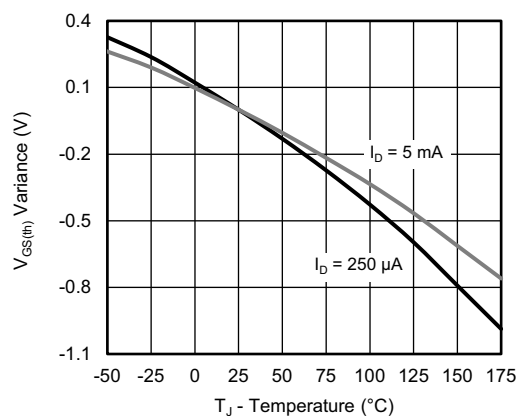
**On-Resistance vs. Junction Temperature**



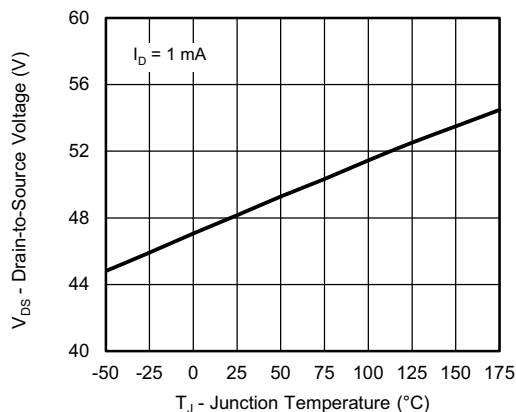
**Source Drain Diode Forward Voltage**



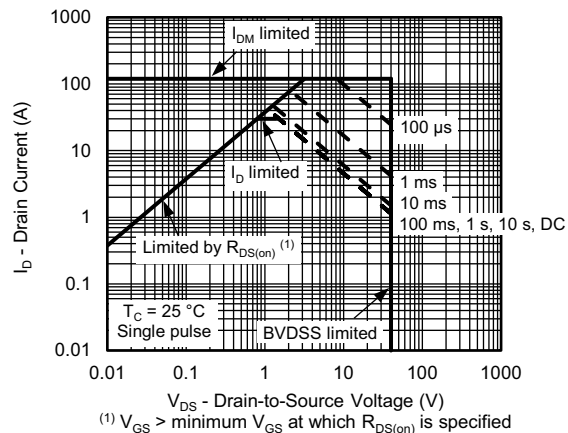
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**



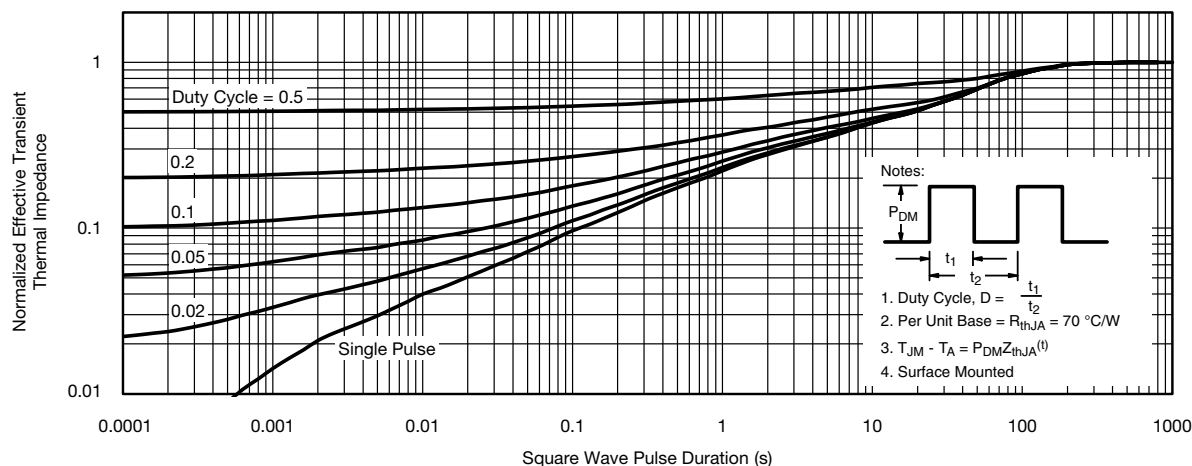
**Drain-Source Breakdown vs. Junction Temperature**



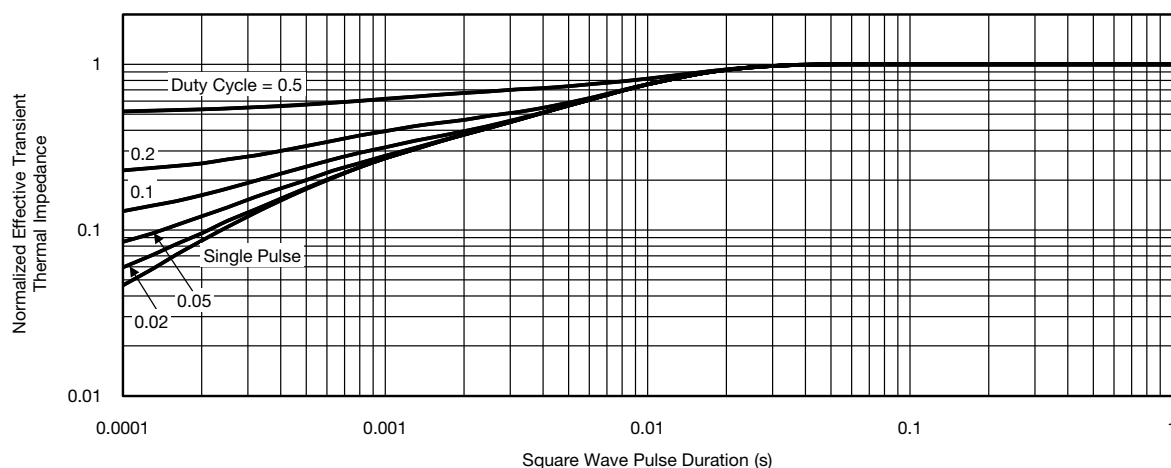
**Safe Operating Area**



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



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



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

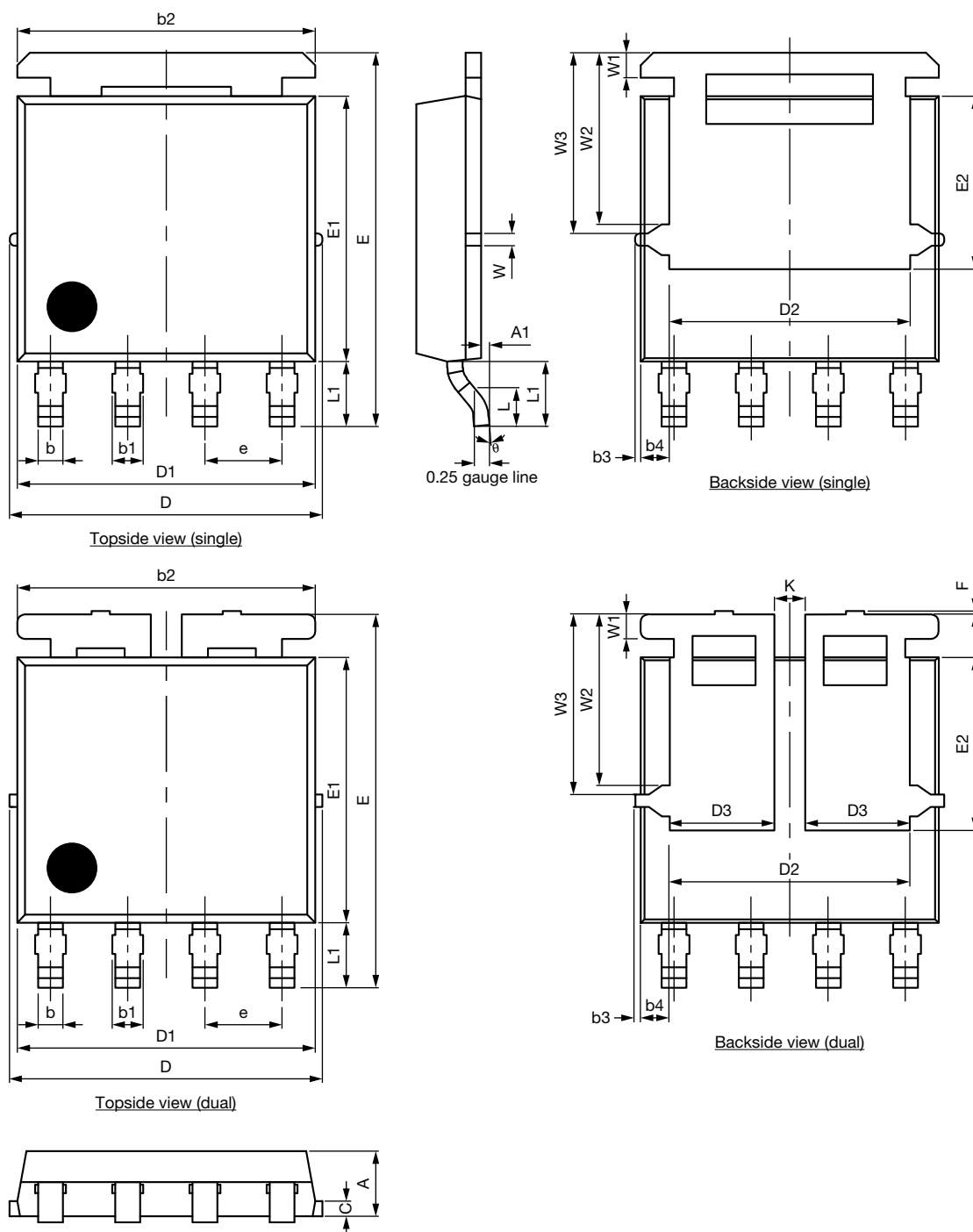
**Note**

- 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?75876](http://www.vishay.com/ppg?75876).



## PowerPAK® SO-8L Case Outline 2





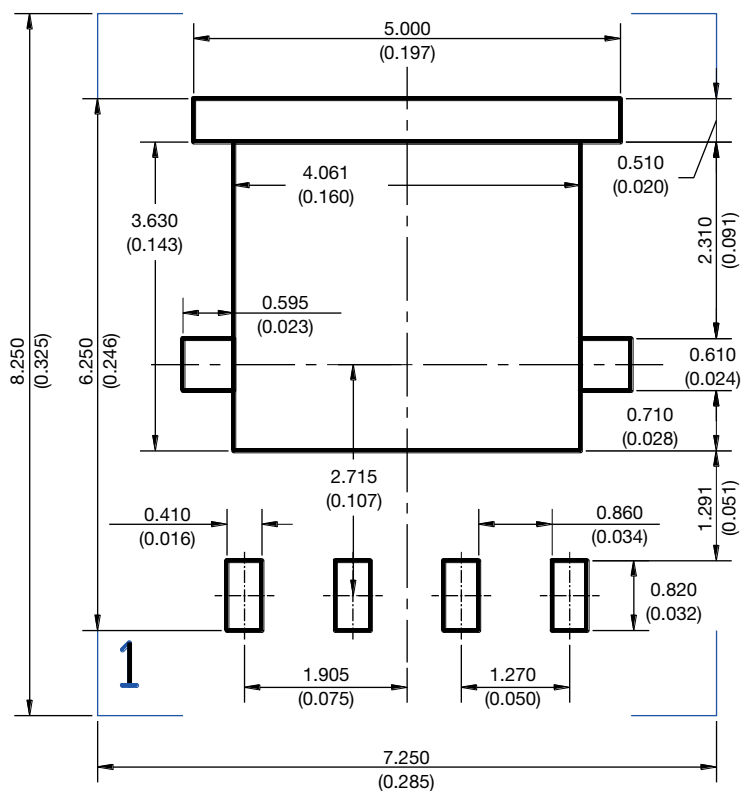
DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	1.00	1.07	1.14	0.039	0.042	0.045
A1	0.00	-	0.127	0.00	-	0.005
b	0.33	0.41	0.48	0.013	0.016	0.019
b1	0.44	0.51	0.58	0.017	0.020	0.023
b2	4.80	4.90	5.00	0.189	0.193	0.197
b3	0.094			0.004		
b4	0.47			0.019		
c	0.20	0.25	0.30	0.008	0.010	0.012
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		
θ	0°	-	10°	0°	-	10°
ECN: C21-1498-Rev. C, 01-Nov-2021						
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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## Ordering Code for SQ Series Automotive MOSFET

Standard ordering code for SQ series of automotive MOSFETs can be derived per the following table:

PACKAGE TYPE	DATASHEET PART NUMBER	ORDERING SUFFIX	ORDERING PART NUMBER
PowerPAK® SC-70	Datasheet part number (example: SQA401EJ)	-T1_GE3	Datasheet part number + "-T1_GE3" (example: SQA401EJ-T1_GE3)
PowerPAK® 1212	Datasheet part number (example: SQ7415AENW)	-T1_GE3	Datasheet part number + "-T1_GE3" (example: SQ7415AENW-T1_GE3)
PowerPAK® SO-8L	Datasheet part number (example: SQJ459EP)	-T1_GE3	Datasheet part number + "-T1_GE3" (example: SQJ459EP-T1_GE3)
PowerPAK® 8 x 8L	Datasheet part number (example: SQJQ402E)	-T1_GE3	Datasheet part number + "-T1_GE3" (example: SQJQ402E-T1_GE3)
SC-70	Datasheet part number (example: SQ1431EH)	-T1_GE3	Datasheet part number + "-T1_GE3" (example: SQ1431EH-T1_GE3)
SOT-23	Datasheet part number (example: SQ2389ES)	-T1_GE3	Datasheet part number + "-T1_GE3" (example: SQ2389ES-T1_GE3)
TSOP-6	Datasheet part number (example: SQ3427EV)	-T1_GE3	Datasheet part number + "-T1_GE3" (example: SQ3427EV-T1_GE3)
SO-8	Datasheet part number (example: SQ4005EY)	-T1_GE3	Datasheet part number + "-T1_GE3" (example: SQ4005EY-T1_GE3)
TO-252 / DPAK, Reverse lead DPAK	Datasheet part number (example: SQD10N30-330H)	_GE3	Datasheet part number + "_GE3" (example: SQD10N30-330H_GE3)
TO-263 / D <sup>2</sup> PAK, D <sup>2</sup> PAK-7L	Datasheet part number (example: SQM40022EM)	_GE3	Datasheet part number + "_GE3" (example: SQM40022EM_GE3)
TO-220, TO-262	Datasheet part number (example: SQV120N10-3M8)	_GE3	Datasheet part number + "_GE3" (example: SQV120N10-3M8_GE3)

**Note**

- For bare die parts and for non-standard orientations in tape (such as T2, T4) please contact your local sales or marketing for ordering code information