

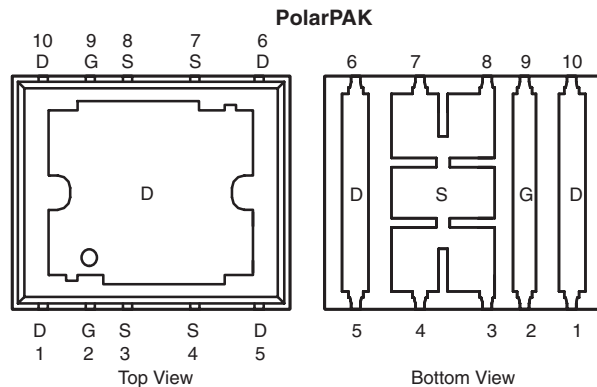


## N-Channel 25-V (D-S) MOSFET

### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ.)
25	0.0052 at $V_{GS} = 10$ V	45	11.2 nC
	0.0068 at $V_{GS} = 4.5$ V	45	

Package Drawing

[www.vishay.com/doc?68797](http://www.vishay.com/doc?68797)


Top surface is connected to pins 1, 5, 6, and 10

Ordering Information: SiE878DF-T1-GE3 (Lead (Pb)-free) and Halogen-free

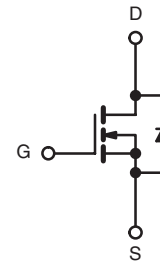
### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Gen III Power MOSFET
- Ultra Low Thermal Resistance Using Top-Exposed PolarPAK® Package for Double-Sided Cooling
- Leadframe-Based New Encapsulated Package
  - Die Not Exposed
  - Same Layout Regardless of Die Size
- Low  $Q_{gd}/Q_{gs}$  Ratio Helps Prevent Shoot-Through
- 100 %  $R_g$  and UIS Tested
- Compliant to RoHS directive 2002/95/EC


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

### APPLICATIONS

- VRM, POL
- DC/DC Conversion
- Server
- High-Side Switch



N-Channel MOSFET

For Related Documents

[www.vishay.com/ppg?65456](http://www.vishay.com/ppg?65456)

### ABSOLUTE MAXIMUM RATINGS $T_A = 25^\circ\text{C}$ , unless otherwise noted

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	25	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current ( $T_J = 150^\circ\text{C}$ )	$I_D$	$T_C = 25^\circ\text{C}$	45 <sup>a</sup>
		$T_C = 70^\circ\text{C}$	42.5
		$T_A = 25^\circ\text{C}$	24 <sup>b, c</sup>
		$T_A = 70^\circ\text{C}$	19 <sup>b, c</sup>
Pulsed Drain Current	$I_{DM}$	100	
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25^\circ\text{C}$	20.8
		$T_A = 25^\circ\text{C}$	4.3 <sup>b, c</sup>
Single Pulse Avalanche Current	$I_{AS}$	25	
Avalanche Energy	$E_{AS}$	31	mJ
Maximum Power Dissipation	$P_D$	$T_C = 25^\circ\text{C}$	25
		$T_C = 70^\circ\text{C}$	16
		$T_A = 25^\circ\text{C}$	5.2 <sup>b, c</sup>
		$T_A = 70^\circ\text{C}$	3.3 <sup>b, c</sup>
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$
Soldering Recommendations (Peak Temperature) <sup>d, e</sup>		260	

Notes:

a.  $T_C = 25^\circ\text{C}$ . Package limited.

b. Surface Mounted on 1" x 1" FR4 board.

c.  $t = 10$  s.d. See Solder Profile ([www.vishay.com/ppg?73257](http://www.vishay.com/ppg?73257)). The PolarPAK 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.

e. Rework Conditions: manual soldering with a soldering iron is not recommended for leadless components.

## THERMAL RESISTANCE RATINGS

Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>a, b</sup>	$t \leq 10$ s	$R_{thJA}$	20	24	°C/W
Maximum Junction-to-Case (Drain Top)	Steady State	$R_{thJC}$ (Drain)	4	5	
Maximum Junction-to-Case (Source) <sup>a, c</sup>		$R_{thJC}$ (Source)	5.5	7	

Notes:

a. Surface Mounted on 1" x 1" FR4 board.

b. Maximum under Steady State conditions is 68 °C/W.

c. Measured at source pin (on the side of the package).

SPECIFICATIONS  $T_J = 25$  °C, unless otherwise noted

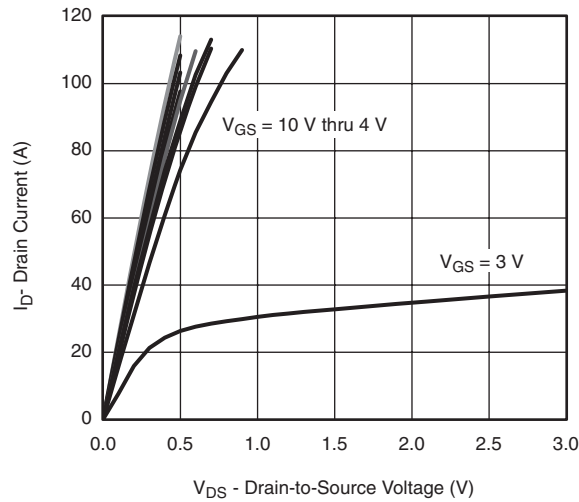
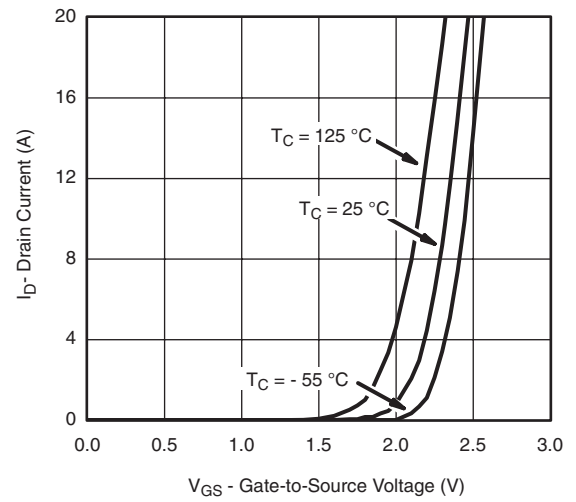
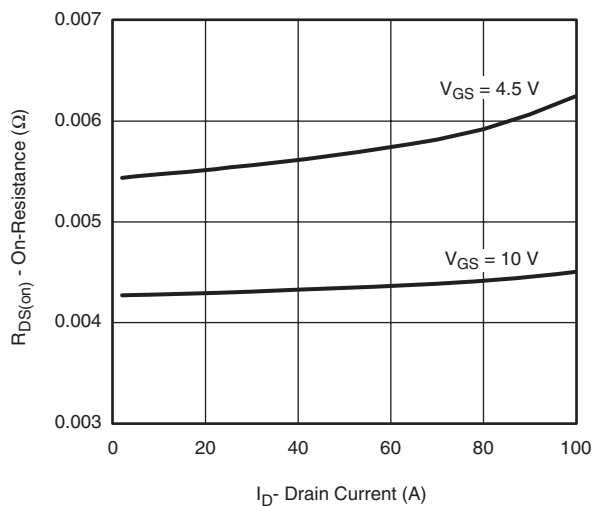
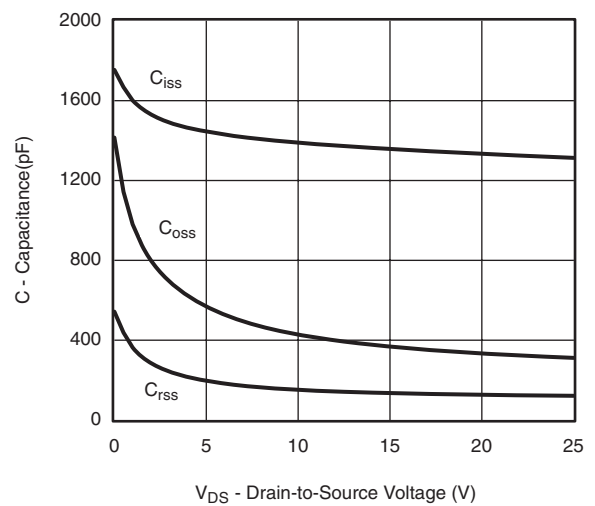
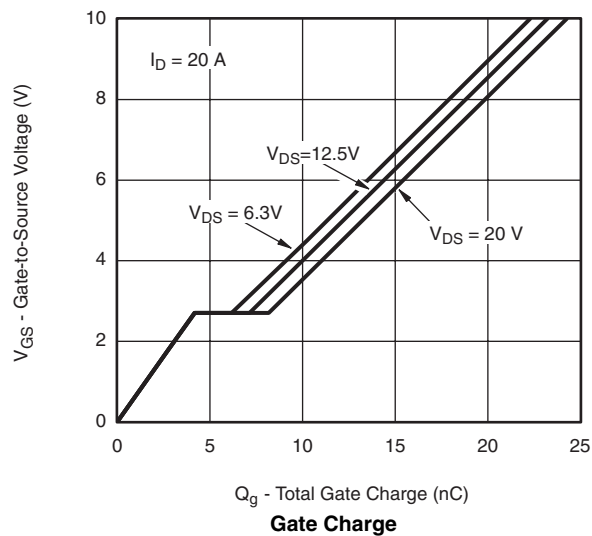
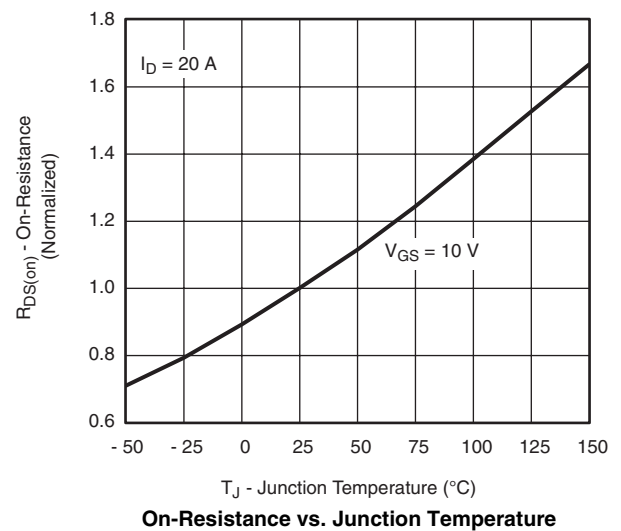
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	25			V
V <sub>DS</sub> Temperature Coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA		25		mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>			- 5		
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1		2.2	V
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>DS</sub> = 25 V, V <sub>GS</sub> = 0 V			1	μA
		V <sub>DS</sub> = 25 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	25			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		0.0042	0.0052	Ω
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 20 A		0.0055	0.0068	
Forward Transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 20 A		74		S
Dynamic <sup>b</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 12.5 V, V <sub>GS</sub> = 0 V, f = 1 MHz		1400		pF
Output Capacitance	C <sub>oss</sub>			400		
Reverse Transfer Capacitance	C <sub>rss</sub>			145		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = 12.5 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A		24	36	nC
		V <sub>DS</sub> = 12.5 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 20 A		11.2	17	
Gate-Source Charge	Q <sub>gs</sub>			4.2		
Gate-Drain Charge	Q <sub>gd</sub>			3		
Gate Resistance	R <sub>g</sub>	f = 1 MHz	0.2	1.2	2.4	Ω
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 12.5 V, R <sub>L</sub> = 1.25 Ω I <sub>D</sub> ≅ 10 A, V <sub>GEN</sub> = 4.5 V, R <sub>g</sub> = 1 Ω		15	25	ns
Rise Time	t <sub>r</sub>			15	25	
Turn-Off Delay Time	t <sub>d(off)</sub>			22	35	
Fall Time	t <sub>f</sub>			12	20	
Turn-On Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 12.5 V, R <sub>L</sub> = 1.25 Ω I <sub>D</sub> ≅ 10 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω		10	15	
Rise Time	t <sub>r</sub>			10	15	
Turn-Off Delay Time	t <sub>d(off)</sub>			20	30	
Fall Time	t <sub>f</sub>			10	15	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			20.8	A
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>				60	
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = 10 A		0.8	1.2	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		30	45	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			24	36	nC
Reverse Recovery Fall Time	t <sub>a</sub>			14		ns
Reverse Recovery Rise Time	t <sub>b</sub>			16		

Notes:

a. Pulse test; pulse width  $\leq 300$   $\mu$ s, duty cycle  $\leq 2$  %

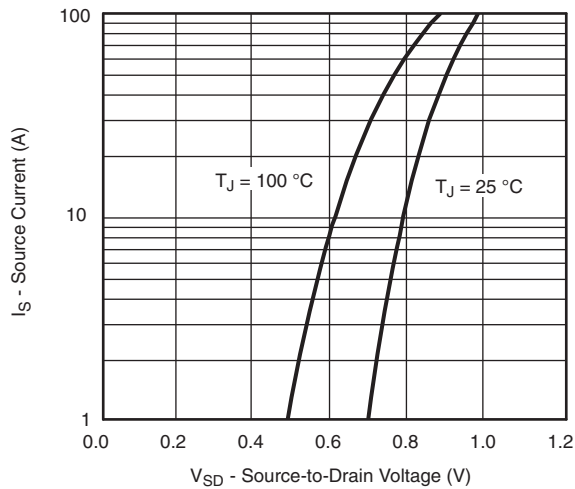
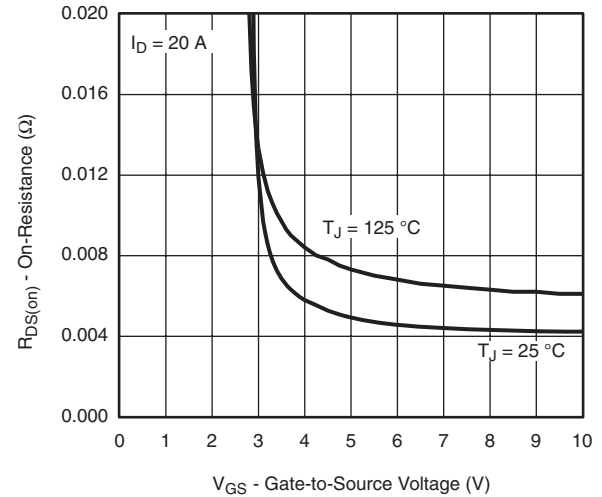
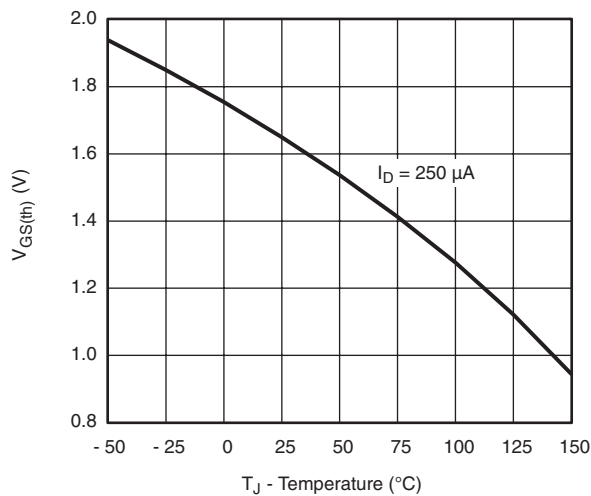
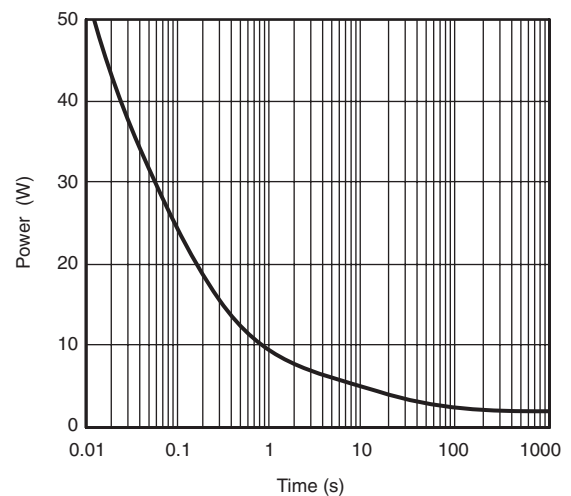
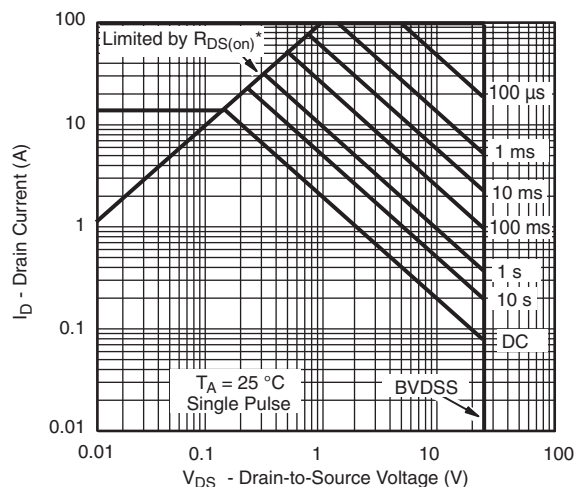
b. Guaranteed by design, not subject to production testing.

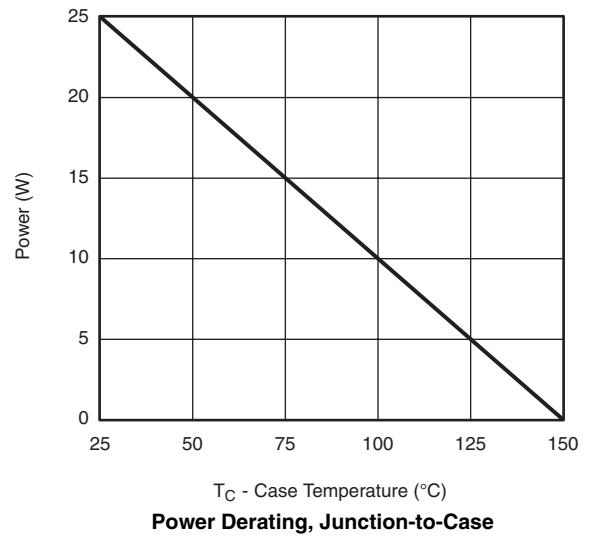
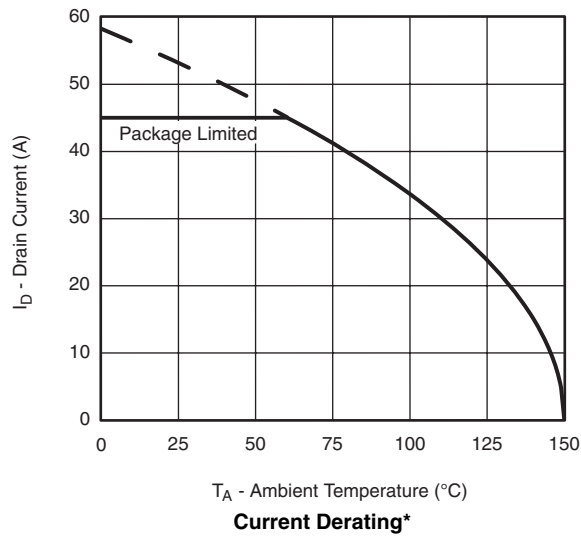
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

**SiE878DF**

Vishay Siliconix

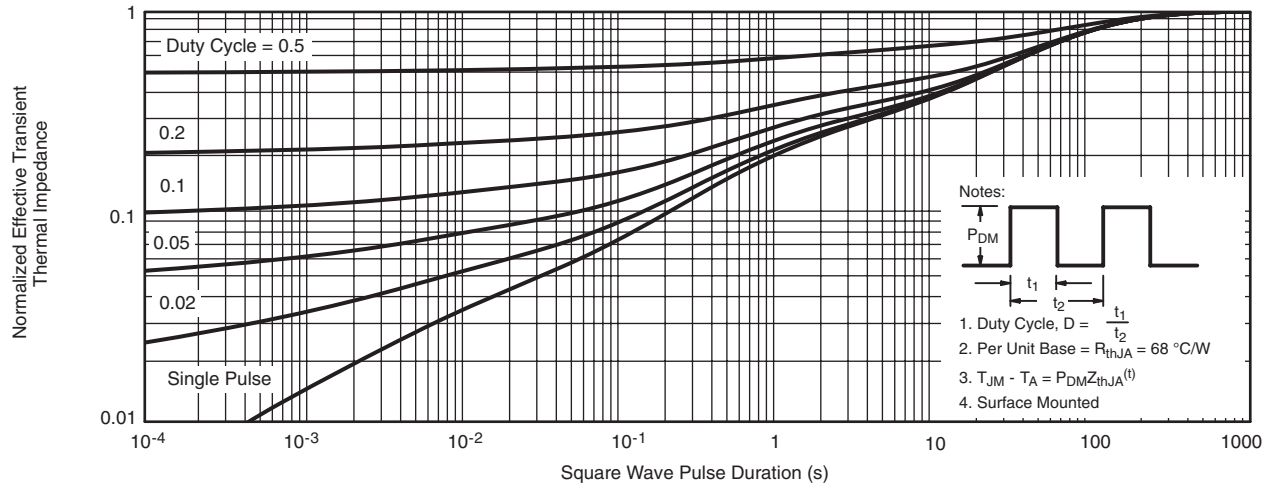
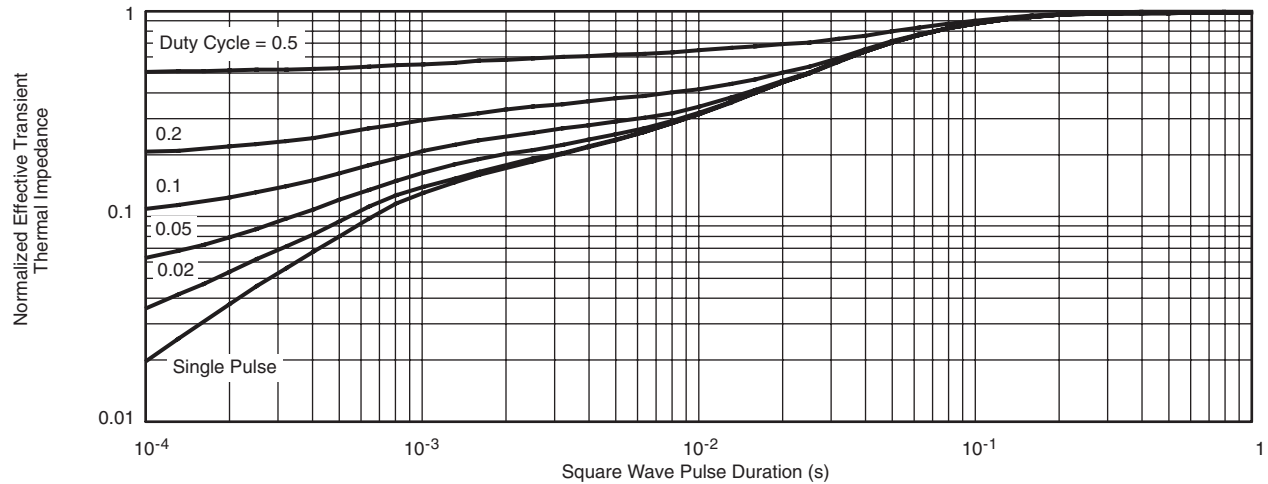
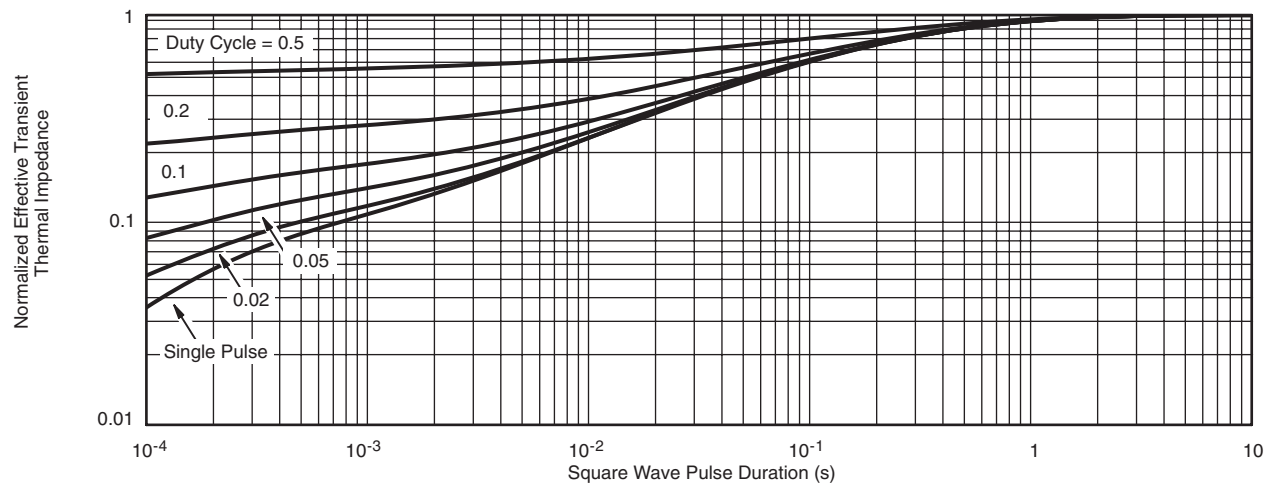
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Source-Drain Diode Forward Voltage****On-Resistance vs. Gate-to-Source Voltage****Threshold Voltage****Single Pulse Power, Junction-to-Ambient**\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified**Safe Operating Area, Junction-to-Ambient**


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


\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °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.

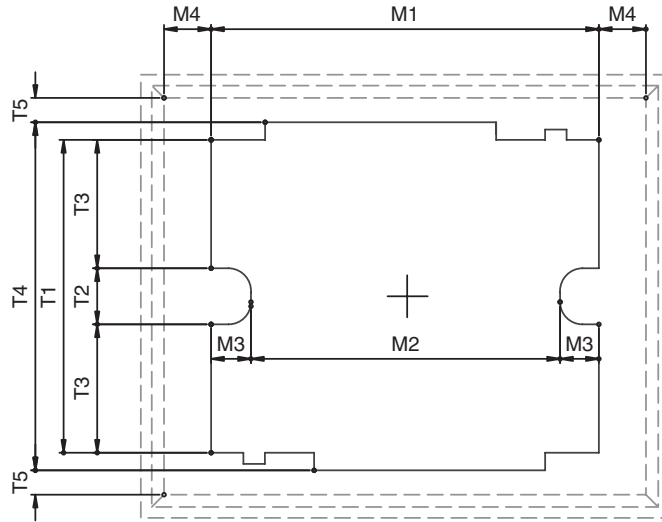
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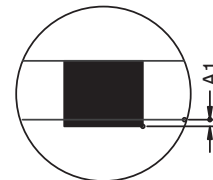
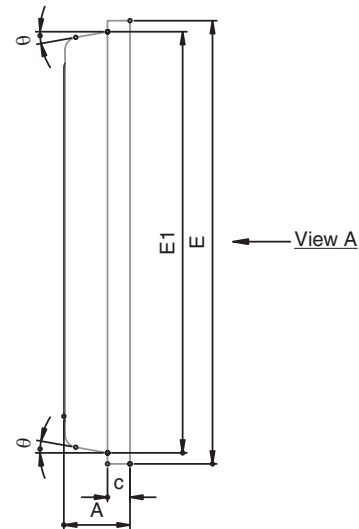
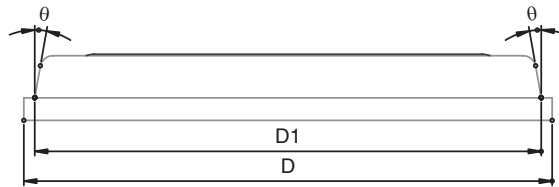
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted**Normalized Thermal Transient Impedance, Junction-to-Ambient****Normalized Thermal Transient Impedance, Junction-to-Case (Drain Top)****Normalized Thermal Transient Impedance, Junction-to-Source**

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?65456](http://www.vishay.com/ppg?65456).

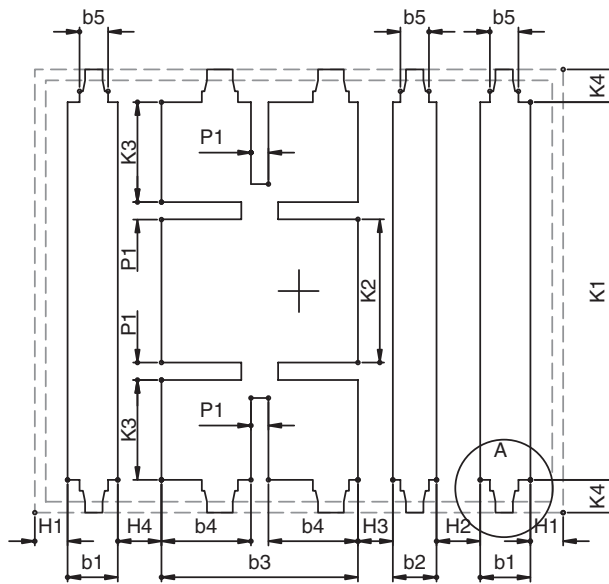
## POLARPAK™ OPTION U



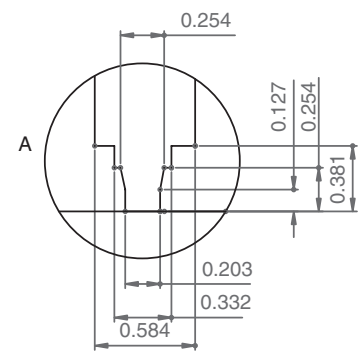
(Top View)



DETAIL Z



View A  
(Bottom View)



# Package Information

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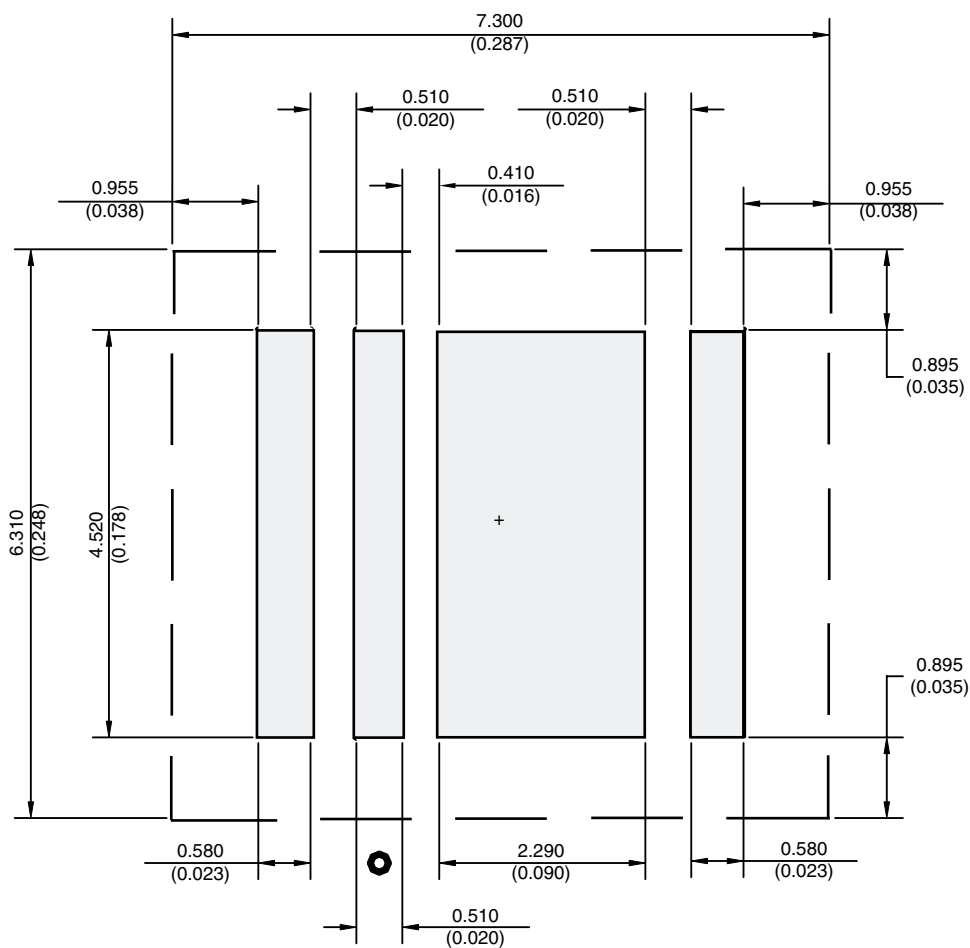
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	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.75	0.80	0.85	0.030	0.031	0.033
A1	0.00	-	0.05	0.000	-	0.002
b1	0.48	0.58	0.68	0.019	0.023	0.027
b2	0.41	0.51	0.61	0.016	0.020	0.024
b3	2.19	2.29	2.39	0.086	0.090	0.094
b4	0.89	1.04	1.19	0.035	0.041	0.047
b5	0.23	0.33	0.43	0.009	0.013	0.017
c	0.20	0.25	0.30	0.008	0.010	0.012
D	6.00	6.15	6.30	0.236	0.242	0.248
D1	5.74	5.89	6.04	0.226	0.232	0.238
E	5.01	5.16	5.31	0.197	0.203	0.209
E1	4.75	4.90	5.05	0.187	0.193	0.199
H1	0.23	-	-	0.009	-	-
H2	0.45	-	0.56	0.018	-	0.022
H3	0.31	0.41	0.51	0.012	0.016	0.020
H4	0.45	-	0.56	0.018	-	0.022
K1	4.22	4.37	4.52	0.166	0.172	0.178
K2	1.62	1.67	1.72	0.064	0.066	0.068
K3	1.16	-	-	0.046	-	-
K4	0.24	-	-	0.009	-	-
M1	4.30	4.50	4.70	0.169	0.177	0.185
M2	3.43	3.58	3.73	0.135	0.141	0.147
M3	0.22	-	-	0.009	-	-
M4	0.05	-	-	0.002	-	-
P1	0.15	0.20	0.25	0.006	0.008	0.010
T1	3.48	3.64	4.10	0.137	0.143	0.161
T2	0.56	0.76	0.95	0.022	0.030	0.037
T3	1.20	-	-	0.047	-	-
T4	3.90	-	-	0.153	-	-
T5	0	0.18	0.36	0.000	0.007	0.014
θ	0°	10°	12°	0°	10°	12°
ECN: T-08441-Rev. A, 11-Aug-08 DWG: 5966						

## Notes

Millimeters govern over inches.



### RECOMMENDED MINIMUM PADS FOR PolarPAK® Option L and S



Recommended Minimum for PolarPAK Option L and S  
Dimensions in mm/(Inches)  
No External Traces within Broken Lines  
Dot indicates Gate Pin (Part Marking)



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**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

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# Mouser Electronics

Authorized Distributor

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