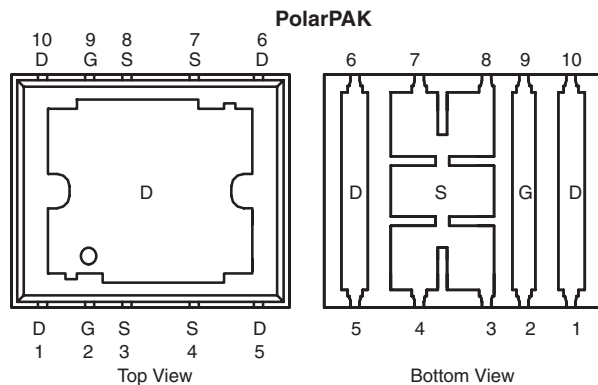




## N-Channel 30-V (D-S) MOSFET

PRODUCT SUMMARY				
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω) <sup>e</sup>	I <sub>D</sub> (A)		Q <sub>g</sub> (Typ.)
		Silicon Limit	Package Limit	
30	0.0021 at V <sub>GS</sub> = 10 V	178	60 <sup>a</sup>	34 nC
	0.0028 at V <sub>GS</sub> = 4.5 V	154	60 <sup>a</sup>	

Package Drawing  
[www.vishay.com/doc?68796](http://www.vishay.com/doc?68796)



Top surface is connected to pins 1, 5, 6, and 10  
**Ordering Information:** SiE860DF-T1-E3 (Lead (Pb)-free)  
 SiE860DF-T1-GE3 (Lead (Pb)-free and Halogen-free)

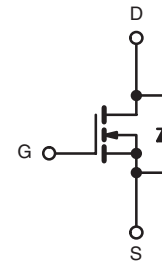
### FEATURES

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



### APPLICATIONS

- VRM, POL
- DC/DC Conversion
- Synchronous Rectification
- Server



N-Channel MOSFET  
 For Related Documents  
[www.vishay.com/ppg?68786](http://www.vishay.com/ppg?68786)

ABSOLUTE MAXIMUM RATINGS T <sub>A</sub> = 25 °C, unless otherwise noted				
Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	V <sub>DS</sub>	30		V
Gate-Source Voltage	V <sub>GS</sub>	± 20		
Continuous Drain Current (T <sub>J</sub> = 150 °C)	I <sub>D</sub>	T <sub>C</sub> = 25 °C	178 (Silicon Limit)	A
			60 <sup>a</sup> (Package Limit)	
		T <sub>C</sub> = 70 °C	60 <sup>a</sup>	
		T <sub>A</sub> = 25 °C	38 <sup>b, c</sup>	
	T <sub>A</sub> = 70 °C	31 <sup>b, c</sup>		
Pulsed Drain Current	I <sub>DM</sub>	80		
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	60 <sup>a</sup>	
		T <sub>A</sub> = 25 °C	4.3 <sup>b, c</sup>	
Single Pulse Avalanche Current	I <sub>AS</sub>	50		
Avalanche Energy	E <sub>AS</sub>	125		mJ
Maximum Power Dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	104	W
		T <sub>C</sub> = 70 °C	66	
		T <sub>A</sub> = 25 °C	5.2 <sup>b, c</sup>	
		T <sub>A</sub> = 70 °C	3.3 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150		°C
Soldering Recommendations (Peak Temperature) <sup>d, e</sup>		260		

Notes:

- Package limited at 60 A.
- Surface Mounted on 1" x 1" FR4 board.
- t = 10 s.
- 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.
- 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)	0.9	1.1	
Maximum Junction-to-Case (Source) <sup>a, c</sup>		$R_{thJC}$ (Source)	2.7	3.3	

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
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0$ V, $I_D = 250$ $\mu$ A	30			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = 250$ $\mu$ A		30		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$		- 6.1			
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = 250$ $\mu$ A	1.0		2.5	V
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0$ V, $V_{GS} = \pm 20$ V			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 30$ V, $V_{GS} = 0$ V			1	$\mu$ A
		$V_{DS} = 30$ V, $V_{GS} = 0$ V, $T_J = 55$ °C			10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5$ V, $V_{GS} = 10$ V	25			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10$ V, $I_D = 21.7$ A		0.0017	0.0021	$\Omega$
		$V_{GS} = 4.5$ V, $I_D = 19$ A		0.0023	0.0028	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 15$ V, $I_D = 21.7$ A		110		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 15$ V, $V_{GS} = 0$ V, $f = 1$ MHz		4500		pF
Output Capacitance	$C_{oss}$		850			
Reverse Transfer Capacitance	$C_{rss}$		300			
Total Gate Charge	$Q_g$	$V_{DS} = 15$ V, $V_{GS} = 10$ V, $I_D = 20$ A		70	105	nC
		$V_{DS} = 15$ V, $V_{GS} = 4.5$ V, $I_D = 20$ A		34	51	
Gate-Source Charge	$Q_{gs}$		14			
Gate-Drain Charge	$Q_{gd}$		9			
Gate Resistance	$R_g$	$f = 1$ MHz		0.9	1.8	$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 15$ V, $R_L = 1.5$ $\Omega$ $I_D \cong 10$ A, $V_{GEN} = 4.5$ V, $R_g = 1$ $\Omega$		35	55	ns
Rise Time	$t_r$		20	30		
Turn-Off Delay Time	$t_{d(off)}$		50	75		
Fall Time	$t_f$		30	45		
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 15$ V, $R_L = 1.5$ $\Omega$ $I_D \cong 10$ A, $V_{GEN} = 10$ V, $R_g = 1$ $\Omega$		16	25	
Rise Time	$t_r$		10	15		
Turn-Off Delay Time	$t_{d(off)}$		40	30		
Fall Time	$t_f$		10	15		
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25$ °C			60	A
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$				80	
Body Diode Voltage	$V_{SD}$	$I_S = 10$ A		0.8	1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = 10$ A, $di/dt = 100$ A/ $\mu$ s, $T_J = 25$ °C		35	55	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			30	45	nC
Reverse Recovery Fall Time	$t_a$			21		ns
Reverse Recovery Rise Time	$t_b$			14		

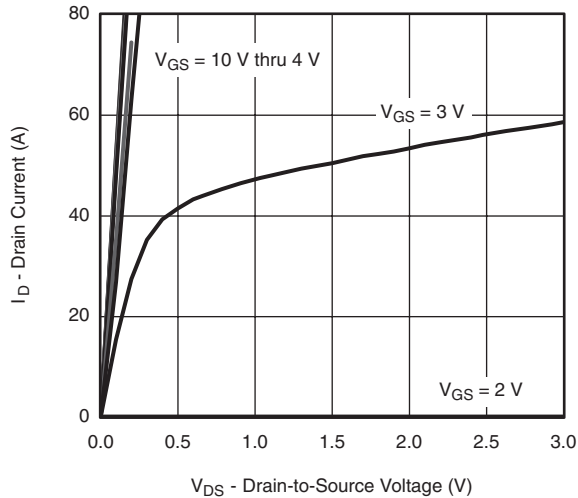
Notes:

- a. Pulse test; pulse width  $\leq 300$   $\mu$ s, duty cycle  $\leq 2$  %  
b. Guaranteed by design, not subject to production testing.

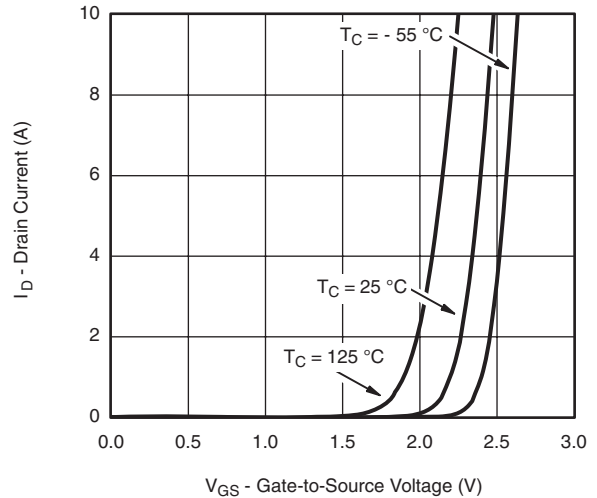
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



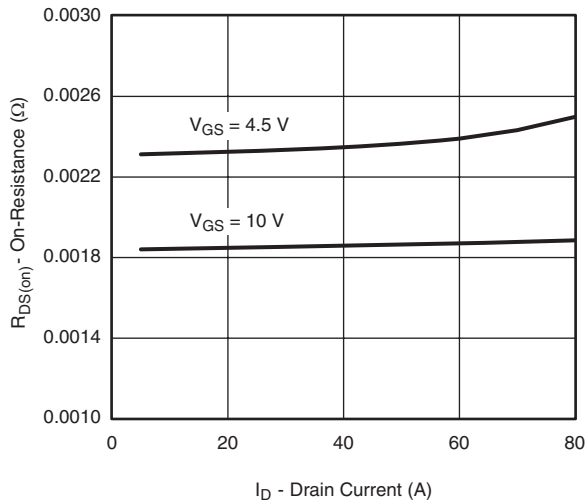
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



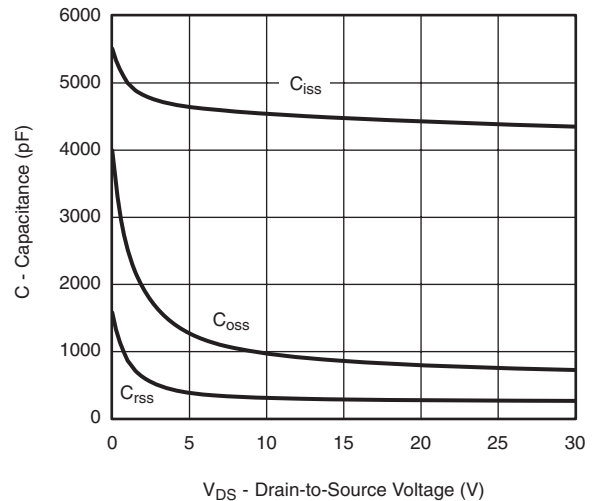
**Output Characteristics**



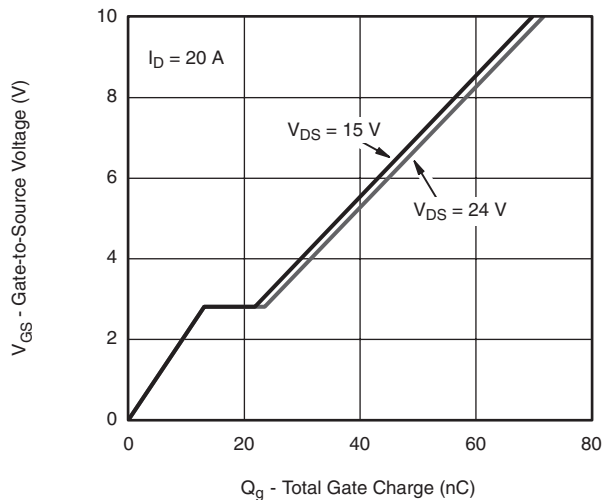
**Transfer Characteristics**



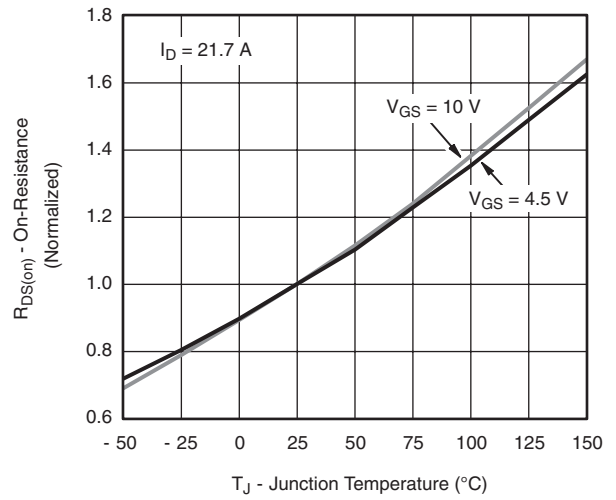
**On-Resistance vs. Drain Current**



**Capacitance**



**Gate Charge**



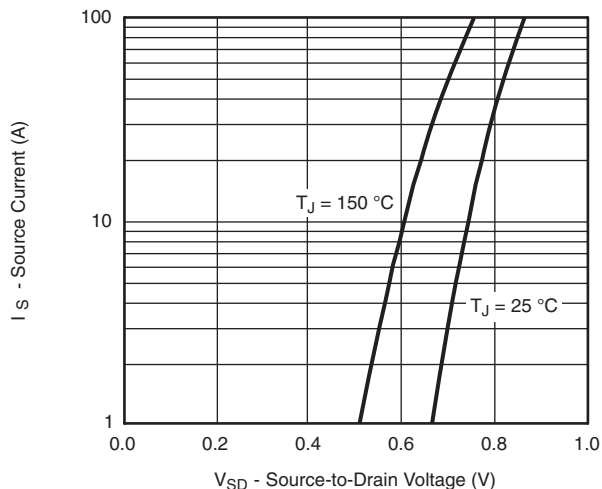
**On-Resistance vs. Junction Temperature**

# SiE860DF

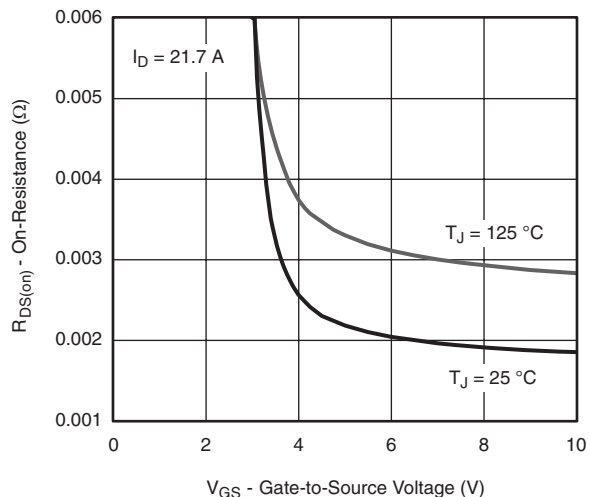
Vishay Siliconix



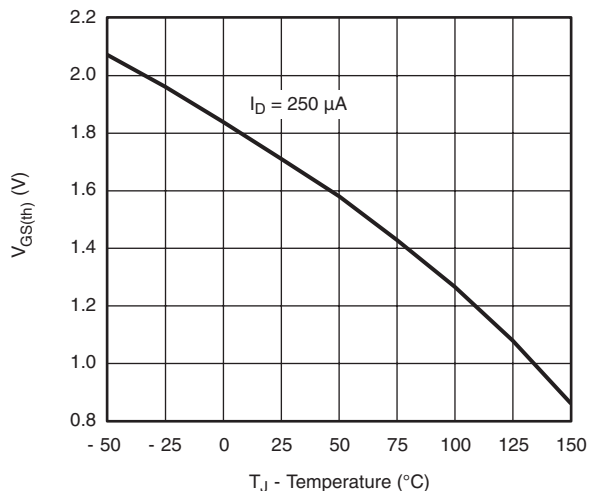
## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



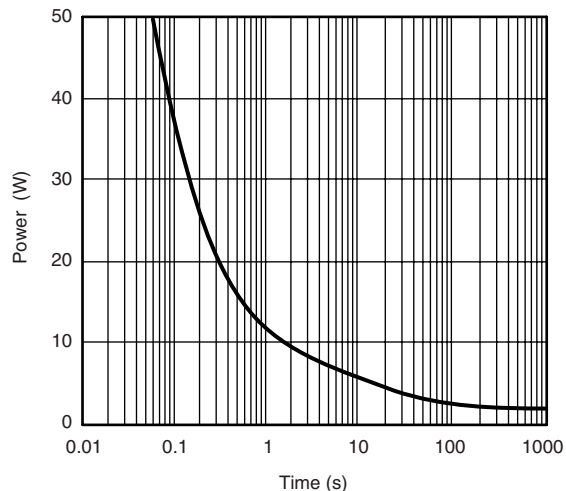
Source-Drain Diode Forward Voltage



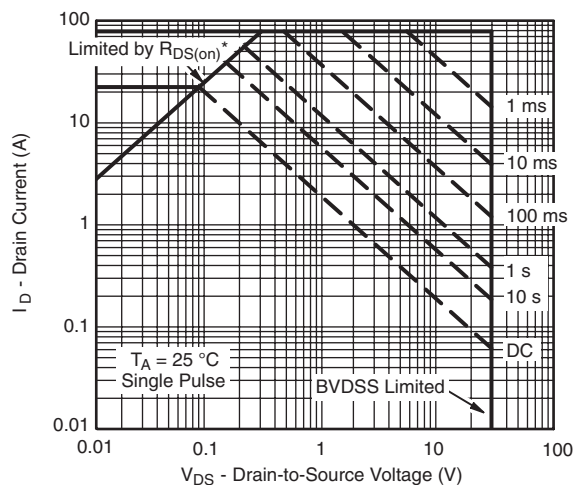
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



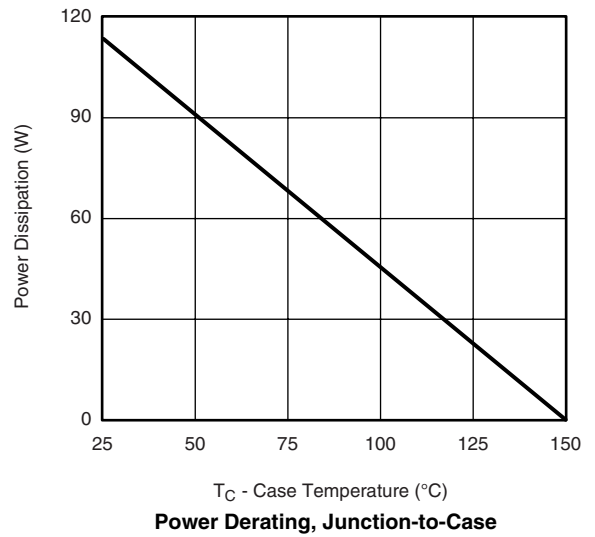
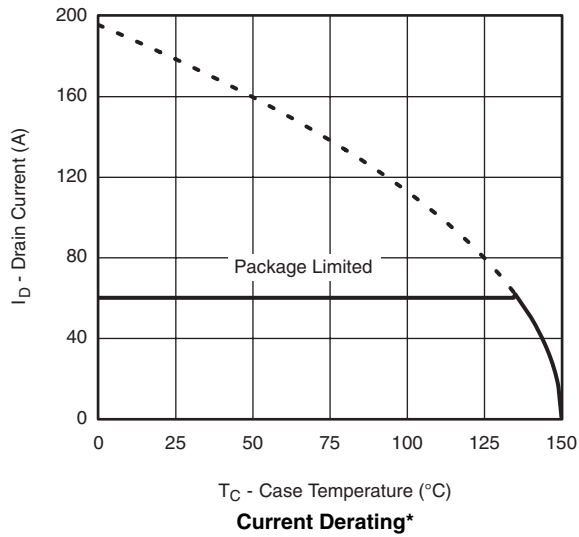
Single Pulse Power, Junction-to-Ambient



Safe Operating Area, Junction-to-Ambient



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



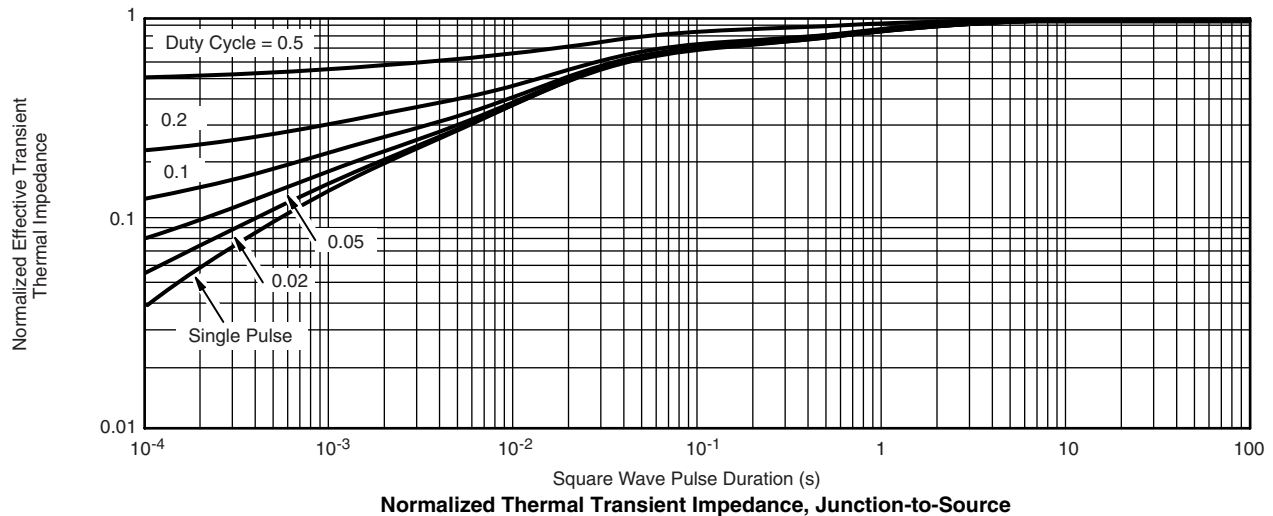
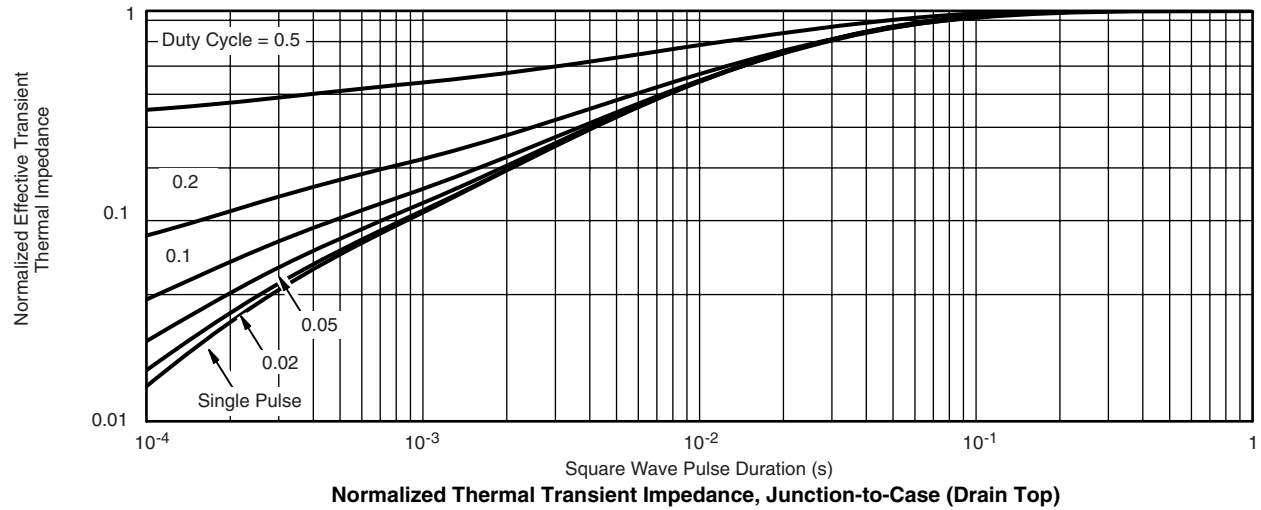
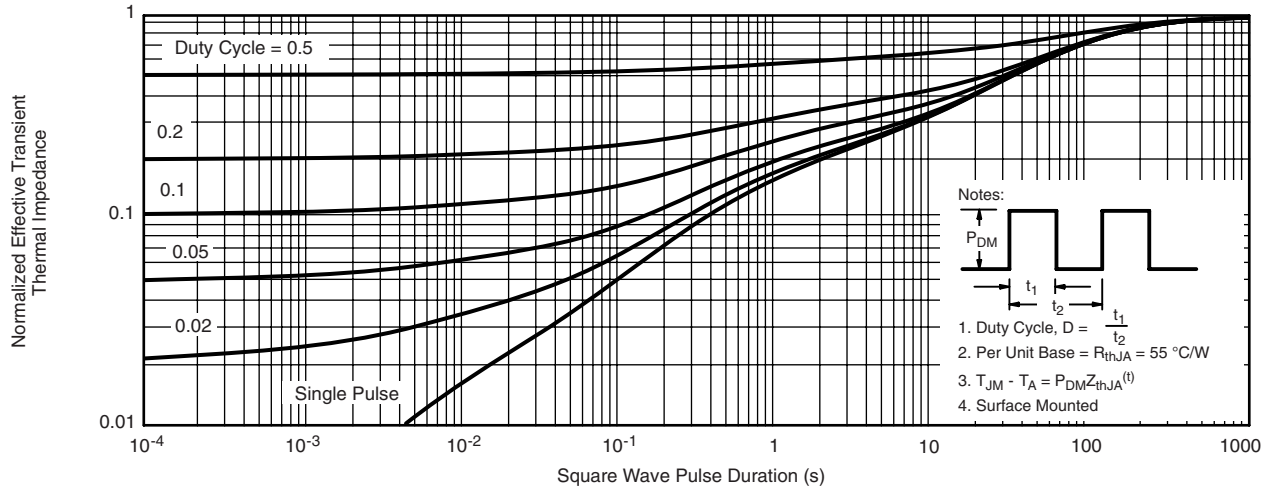
\* The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

# SiE860DF

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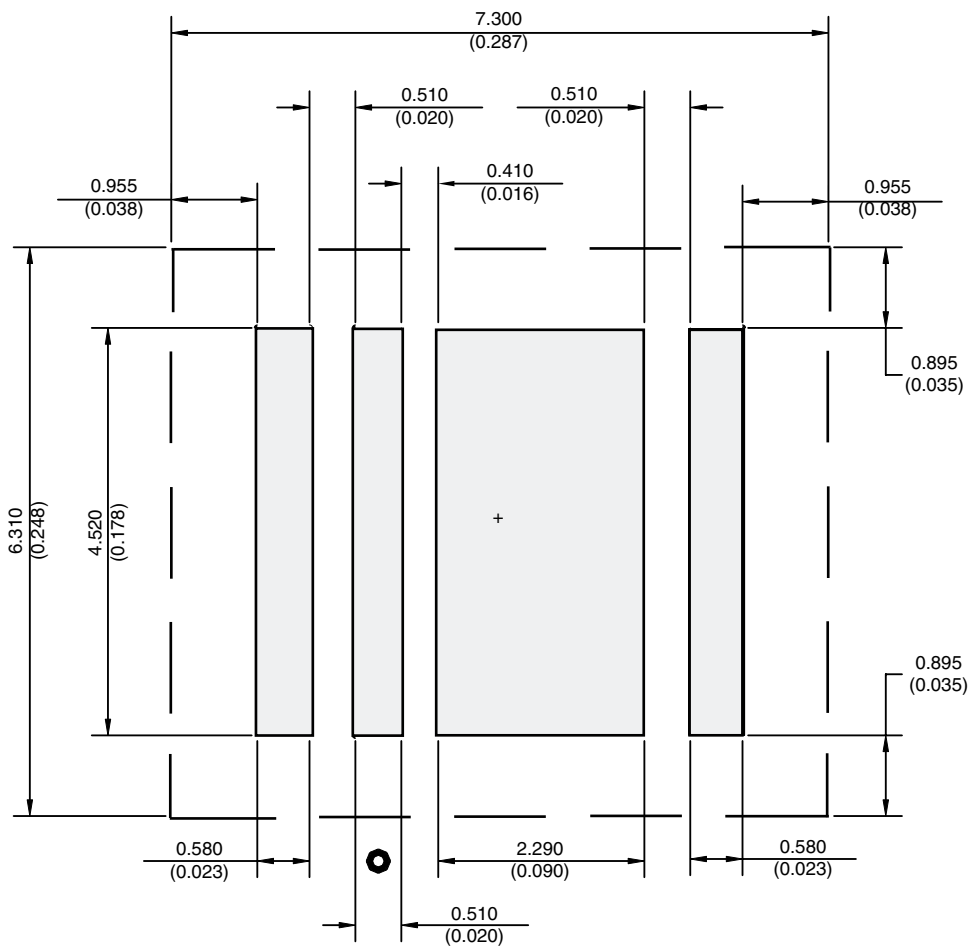


## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



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?68786](http://www.vishay.com/ppg?68786).

## 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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