N-Channel 20-V (D-S) MOSFET

PRODUCT SUMMARY

| V_{DS} (V) | $R_{DS(on)}$ (Ω) | I_D (A)[a] | | Q_g (Typ.) |
		Silicon Limit	Package Limit	
20	0.0034 at V_{GS} = 10 V	138	50	24 nC
	0.0055 at V_{GS} = 4.5 V	108	50	

Package Drawing
www.vishay.com/doc?73398

PolarPAK

Top View
Bottom View

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

Ordering Information: SiE822DF-T1-E3 (Lead (Pb)-free)
SiE822DF-T1-GE3 (Lead (Pb)-free and Halogen-free)
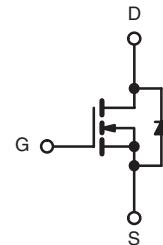
FEATURES

- **Halogen-free According to IEC 61249-2-21 Definition**
- TrenchFET® 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

APPLICATIONS

- VRM
- DC-DC Conversion
- Synchronous Rectification

N-Channel MOSFET

For Related Documents
www.vishay.com/ppg?74451

ABSOLUTE MAXIMUM RATINGS T_A = 25 °C, unless otherwise noted

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V_{DS}	20	V
Gate-Source Voltage		V_{GS}	± 20	
Continuous Drain Current (T_J = 150 °C)	T_C = 25 °C	I_D	138 (Silicon Limit)	A
			50[a] (Package Limit)	
	T_C = 70 °C		50[a]	
	T_A = 25 °C		31[b, c]	
	T_A = 70 °C		24.8[b, c]	
Pulsed Drain Current		I_{DM}	80	
Continuous Source-Drain Diode Current	T_C = 25 °C	I_S	50[a]	
	T_A = 25 °C		4.3[b, c]	
Single Pulse Avalanche Current	L = 0.1 mH	I_{AS}	30	
Avalanche Energy		E_{AS}	45	mJ
Maximum Power Dissipation	T_C = 25 °C	P_D	104	W
	T_C = 70 °C		66	
	T_A = 25 °C		5.2[b, c]	
	T_A = 70 °C		3.3[b, c]	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150	°C
Soldering Recommendations (Peak Temperature)[d, e]			260	

Notes:
a. Package limited is 50 A.
b. Surface Mounted on 1" x 1" FR4 board.
c. t = 10 s.
d. See Solder Profile (www.vishay.com/doc?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.

SiE822DF

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THERMAL RESISTANCE RATINGS

Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient[a, b]	t ≤ 10 s	R_{thJA}	20	24	°C/W
Maximum Junction-to-Case (Drain Top)[a]	Steady State	R_{thJC} (Drain)	1	1.2	
Maximum Junction-to-Case (Source)[a, c]		R_{thJC} (Source)	2.8	3.4	

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).
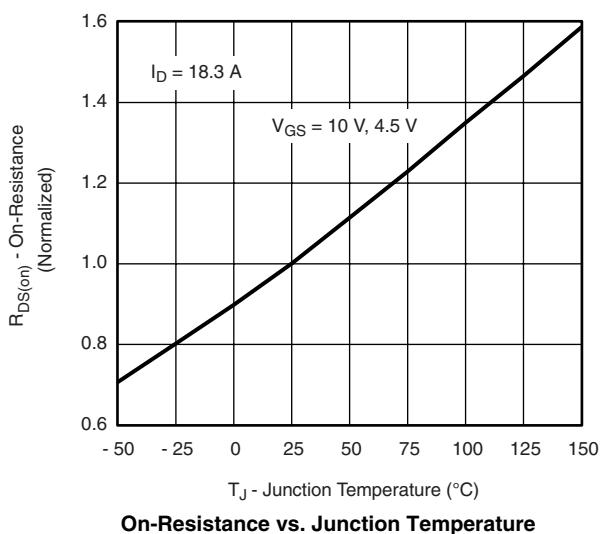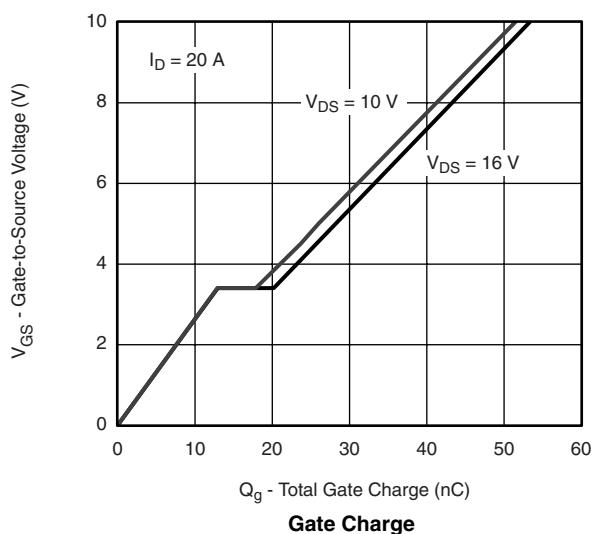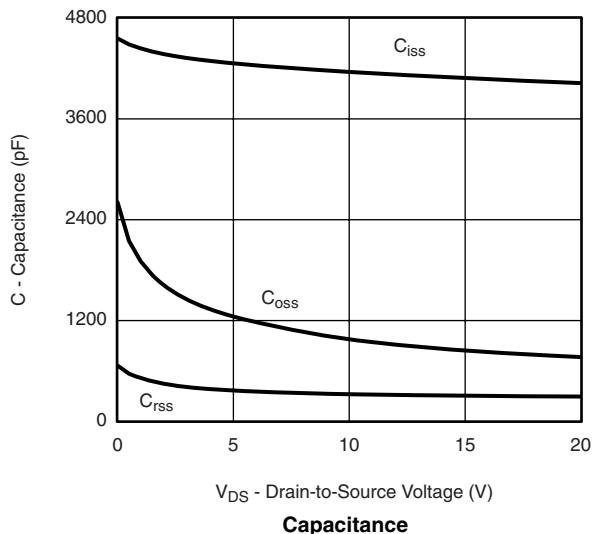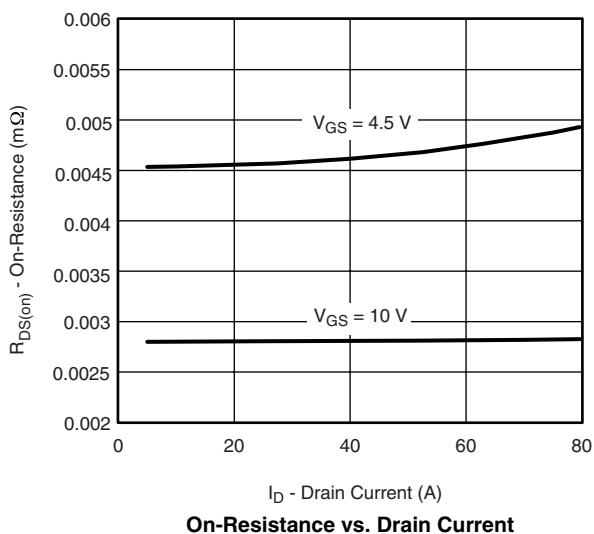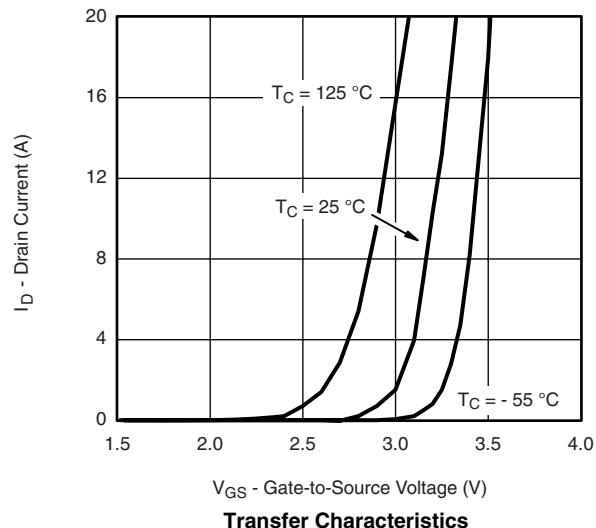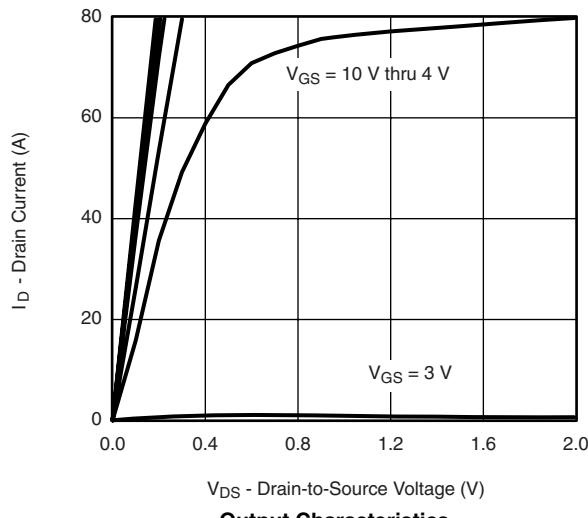
### SPECIFICATIONS T_J = 25 °C, unless otherwise noted
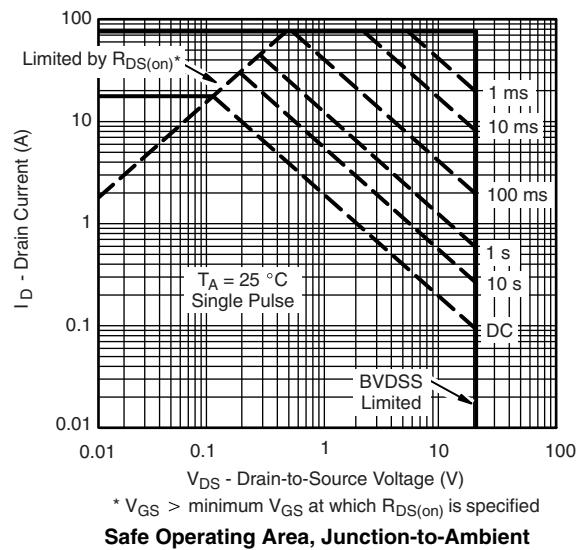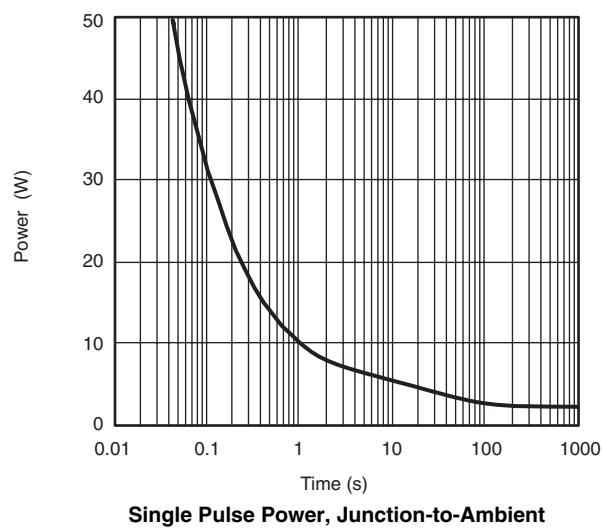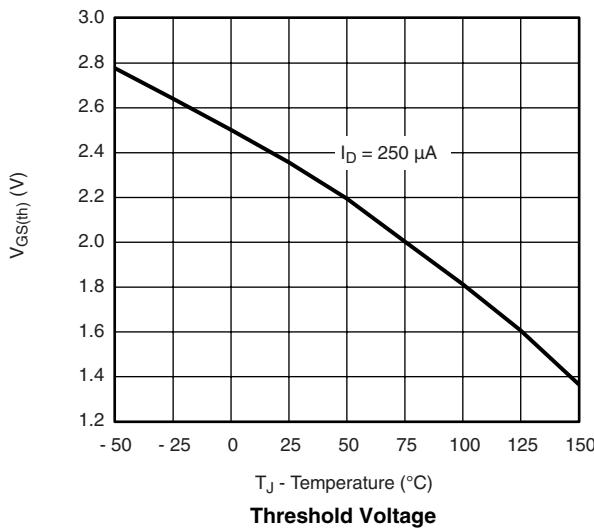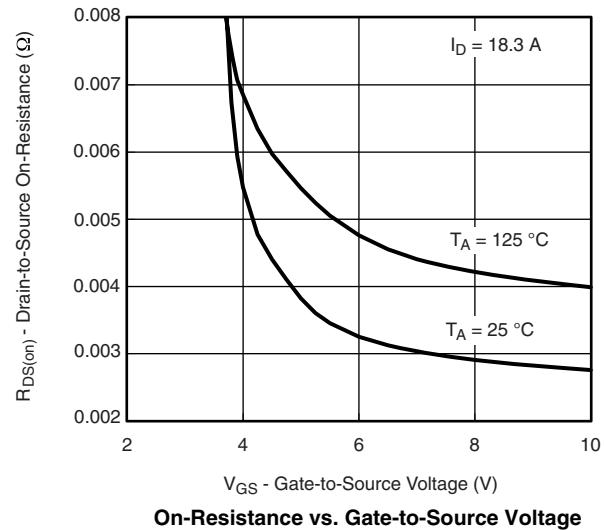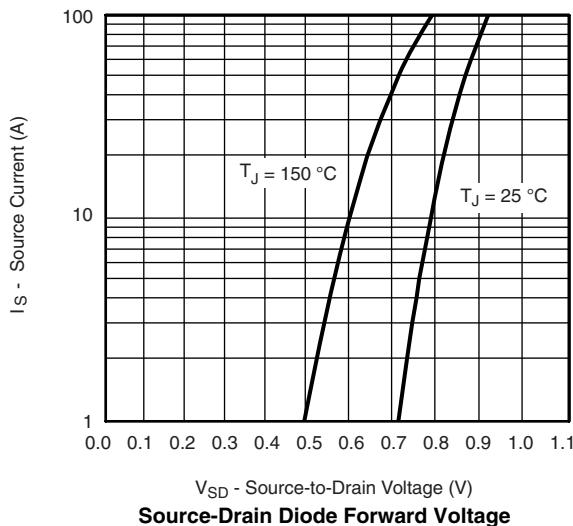
| Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 μA	20			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	I_D = 250 μA		24.1		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			- 7.1		
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS} , I_D = 250 μA	1.5	2.3	3.0	V
Gate-Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 20 V, V_{GS} = 0 V			1	μA
		V_{DS} = 20 V, V_{GS} = 0 V, T_J = 55 °C			10	
On-State Drain Current[a]	$I_{D(on)}$	V_{DS} ≥ 5 V, V_{GS} = 10 V	25			A
Drain-Source On-State Resistance[a]	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 18.3 A		0.0028	0.0034	Ω
		V_{GS} = 4.5 V, I_D = 14.5 A		0.0045	0.0055	
Forward Transconductance[a]	g_{fs}	V_{DS} = 15 V, I_D = 18.3 A		90		S
Dynamic[b]						
Input Capacitance	C_{iss}	V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz		4200		pF
Output Capacitance	C_{oss}			1000		
Reverse Transfer Capacitance	C_{rss}			320		
Total Gate Charge	Q_g	V_{DS} = 10 V, V_{GS} = 10 V, I_D = 20 A		52	78	nC
				24	36	
Gate-Source Charge	Q_{gs}	V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 20 A		13		
Gate-Drain Charge	Q_{gd}			5		
Gate Resistance	R_g	f = 1 MHz		1.0	1.5	Ω
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 10 V, R_L = 1 Ω I_D ≅ 10 A, V_{GEN} = 4.5 V, R_g = 1 Ω		50	75	ns
Rise Time	t_r			220	330	
Turn-Off Delay Time	$t_{d(off)}$			35	55	
Fall Time	t_f			20	30	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 20 V, R_L = 1 Ω I_D ≅ 10 A, V_{GEN} = 10 V, R_g = 1 Ω		15	25	
Rise Time	t_r			25	40	
Turn-Off Delay Time	$t_{d(off)}$			35	55	
Fall Time	t_f			10	15	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	T_C = 25 °C			50	A
Pulse Diode Forward Current[a]	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/μs, T_J = 25 °C		40	60	ns
Body Diode Reverse Recovery Charge	Q_{rr}			36	60	nC
Reverse Recovery Fall Time	t_a			19		ns
Reverse Recovery Rise Time	t_b			21		
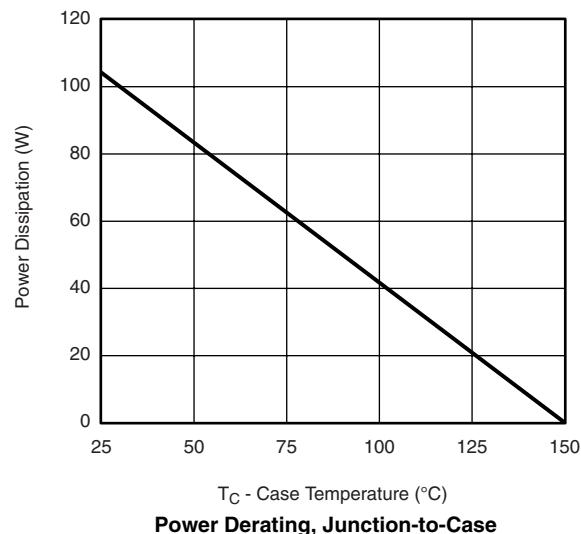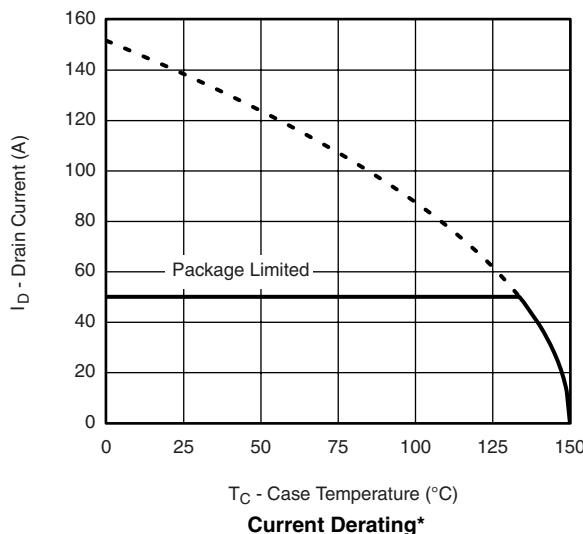
Notes:
a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %
b. Guaranteed by design, not subject to production testing.
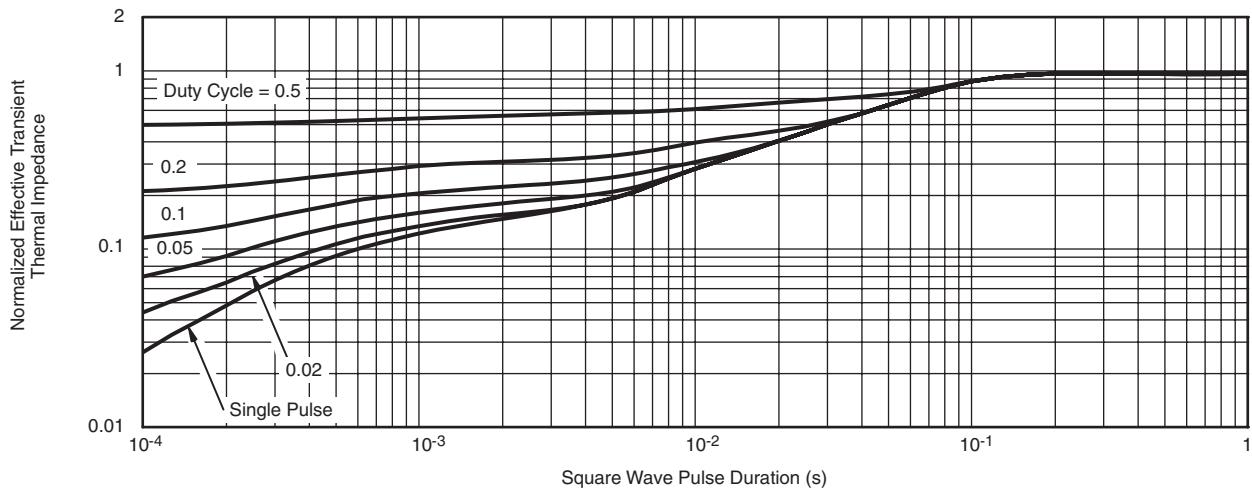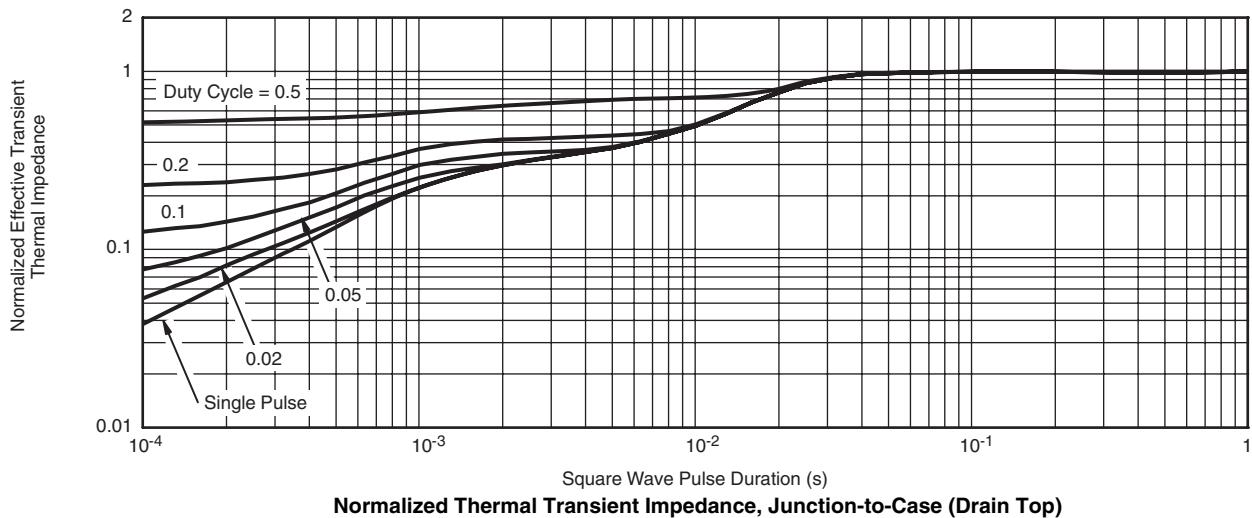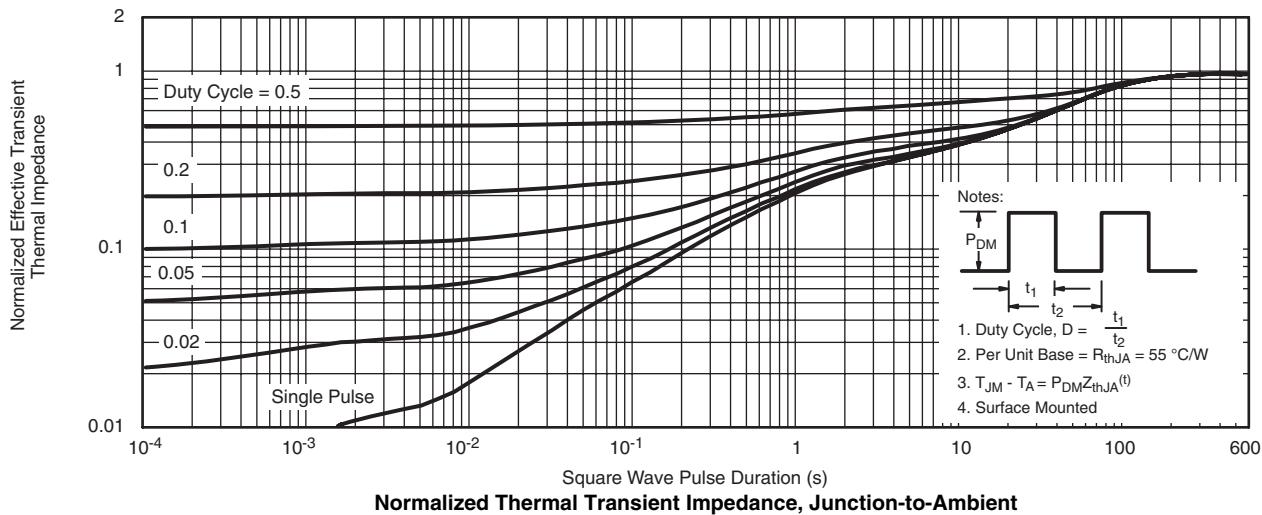
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

SiE822DF

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**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

x-axis: V_{SD} - Source-to-Drain Voltage (V)
y-axis: I_S - Source Current (A)
curves: $T_J = 150$ °C, $T_J = 25$ °C

On-Resistance vs. Gate-to-Source Voltage

x-axis: V_{GS} - Gate-to-Source Voltage (V)
y-axis: $R_{DS(on)}$ - Drain-to-Source On-Resistance (Ω)
$I_D = 18.3$ A
curves: $T_A = 125$ °C, $T_A = 25$ °C

Threshold Voltage

x-axis: T_J - Temperature (°C)
y-axis: $V_{GS(th)}$ (V)
$I_D = 250$ µA

Single Pulse Power, Junction-to-Ambient

x-axis: Time (s)
y-axis: Power (W)

Safe Operating Area, Junction-to-Ambient

x-axis: V_{DS} - Drain-to-Source Voltage (V)
y-axis: I_D - Drain Current (A)
Limited by $R_{DS(on)}$*
$T_A = 25$ °C Single Pulse
1 ms, 10 ms, 100 ms, 1 s, 10 s, DC
BVDSS Limited
* V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

Current Derating*

Power Derating, Junction-to-Case

* 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.

## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

Notes:

1. Duty Cycle, $D = \dfrac{t_1}{t_2}$
2. Per Unit Base = R_{thJA} = 55 °C/W
3. $T_{JM} - T_A = P_{DM}Z_{thJA}^{(t)}$
4. Surface Mounted

Normalized Thermal Transient Impedance, Junction-to-Ambient

Normalized Thermal Transient Impedance, Junction-to-Case (Drain Top)

**Normalized Thermal Transient Impedance, Junction-to-Source**
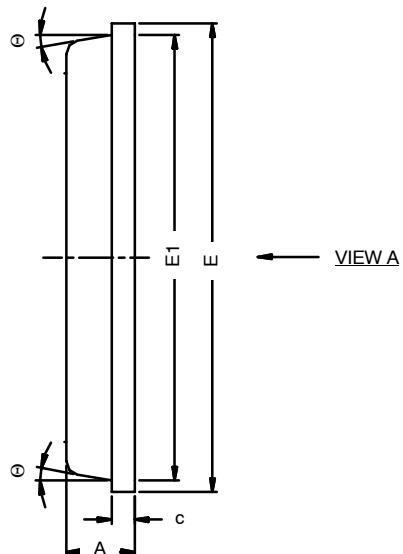
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PolarPAK™   (Option S)
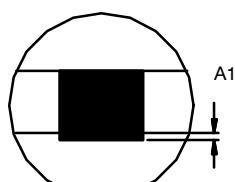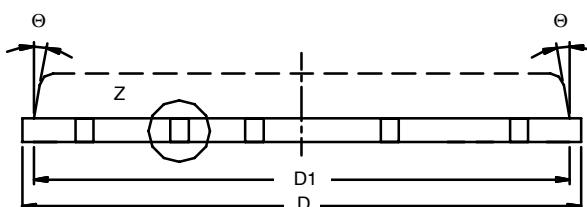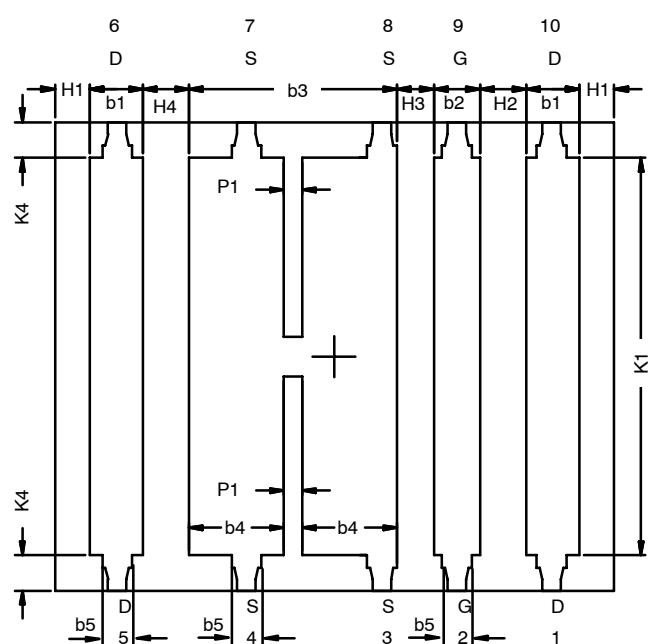
Product datasheet/information page contain links to applicable package drawing.

(Top View)

VIEW A

DETAIL Z

VIEW A
(Bottom View)
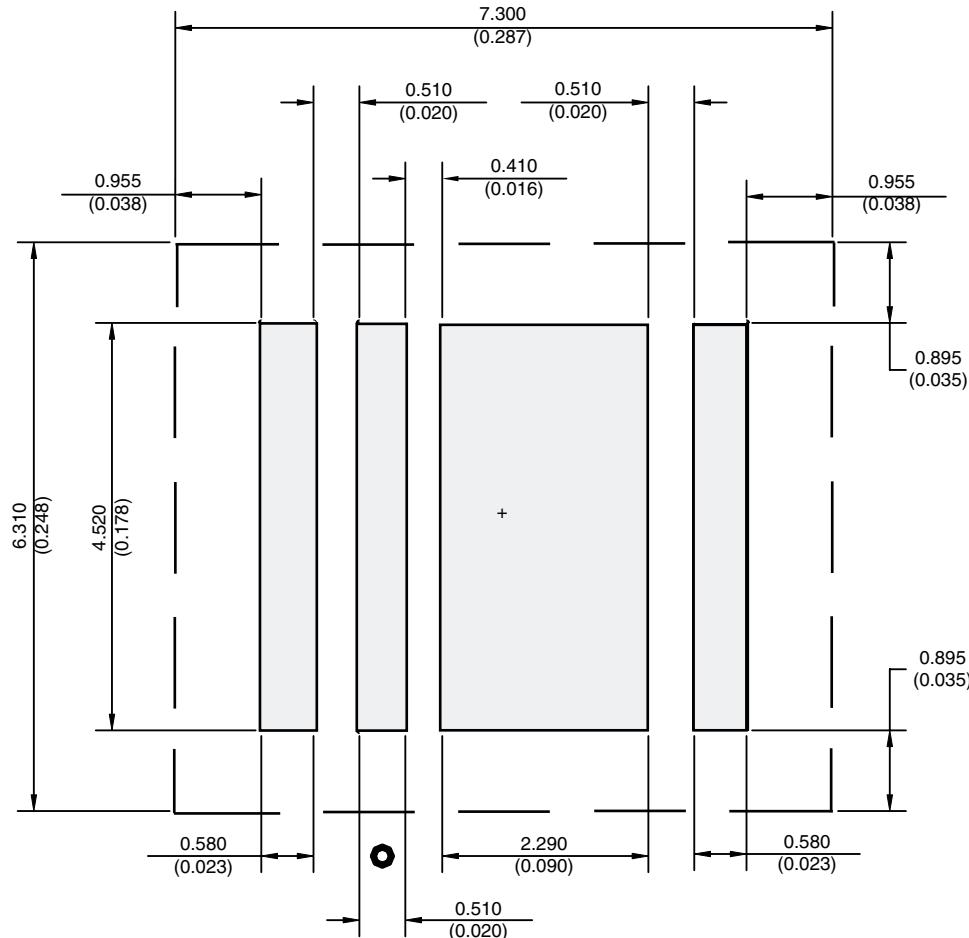
Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.75	0.80	0.85	0.030	0.031	0.033
A1	0.00	–	0.05	0.000	–	0.002
b1	0.48	0.58	0.68	0.019	0.023	0.027
b2	0.41	0.51	0.61	0.016	0.020	0.024
b3	2.19	2.29	2.39	0.086	0.090	0.094
b4	0.89	1.04	1.19	0.035	0.041	0.047
b5	0.23	0.33	0.43	0.009	0.013	0.017
c	0.20	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	0.020	–	0.022
H3	0.31	0.41	0.51	0.012	0.016	0.020
H4	0.45	–	0.56	0.020	–	0.022
K1	4.22	4.37	4.52	0.166	0.172	0.178
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	0.150
T2	0.56	0.76	0.95	0.22	0.030	0.037
T3	1.20	–	–	0.051	–	–
T4	3.90	–	–	0.154	–	–
T5	0	0.18	0.36	0.000	0.007	0.014
Θ	0°	10°	12°	0°	10°	12°

ECN: S–51049—Rev. B, 13-Jun-05
DWG: 5947

Note: 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)

APPLICATION NOTE

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