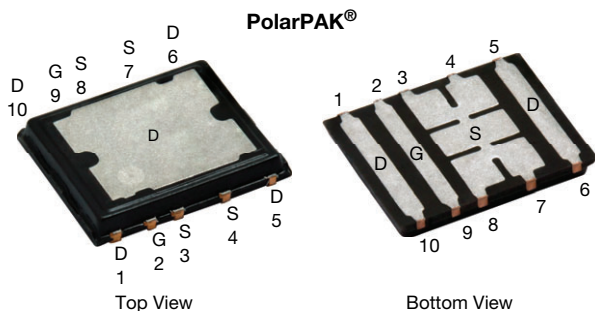


N-Channel 20 V (D-S) MOSFET



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

PRODUCT SUMMARY

V_{DS} (V)	20
$R_{DS(on)}$ max. (Ω) at $V_{GS} = 10$ V	0.0034
$R_{DS(on)}$ max. (Ω) at $V_{GS} = 4.5$ V	0.0055
Q_g typ. (nC)	24
I_D (A) ^a (package limit)	50
I_D (A) ^a (silicon limit)	138
Configuration	Single

FEATURES

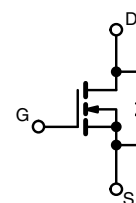
- TrenchFET[®] power MOSFET
- Ultra low thermal resistance using top-exposed PolarPAK[®] package for double-sided cooling
- Leadframe-based encapsulated package
 - Die not exposed
 - Same layout regardless of die size
- Low Q_{gd}/Q_{gs} ratio helps prevent shoot-through
- 100 % R_g and UIS tested
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
Available

APPLICATIONS

- VRM
- DC/DC conversion
- Synchronous rectification



N-Channel MOSFET

ORDERING INFORMATION

Package	PolarPAK
Lead (Pb)-free	SiE822DF-T1-E3
Lead (Pb)-free and halogen-free	SiE822DF-T1-GE3

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)	I_D	50 ^a (package limit)	A
		138 (silicon limit)	
		50 ^a	
		31 ^{b, c}	
Pulsed drain current	I_{DM}	80	
Continuous source-drain diode current	I_S	50 ^a	A
		4.3 ^{b, c}	
Single pulse avalanche current	I_{AS}	30	
Avalanche energy	E_{AS}	45	mJ
Maximum power dissipation	P_D	104	W
		66	
		5.2 ^{b, 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

- Package limited is 50 A
- Surface mounted on 1" x 1" FR4 board
- $t = 10$ s
- 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
- 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 ^{a, b}	$t \leq 10 \text{ s}$	R_{thJA}	20	24	°C/W
Maximum junction-to-case (drain top) ^a	Steady state	$R_{thJC} \text{ (drain)}$	1	1.2	
Maximum junction-to-case (source) ^{a, c}		$R_{thJC} \text{ (source)}$	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 ($T_J = 25^\circ\text{C}$, 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	ΔV _{DS} /T _J	I _D = 250 μA	-	24.1	-	mV/°C
V _{GS(th)} temperature coefficient	ΔV _{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
		V _{DS} = 10 V, V _{GS} = 4.5 V, I _D = 20 A	-	24	36	
Gate-source charge	Q _{gs}		-	13	-	
Gate-drain charge	Q _{gd}		-	5	-	
Gate resistance	R _g	f = 1 MHz	-	1	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	-	

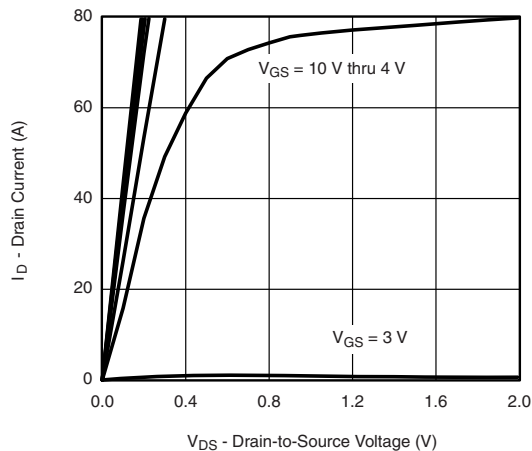
Notes

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

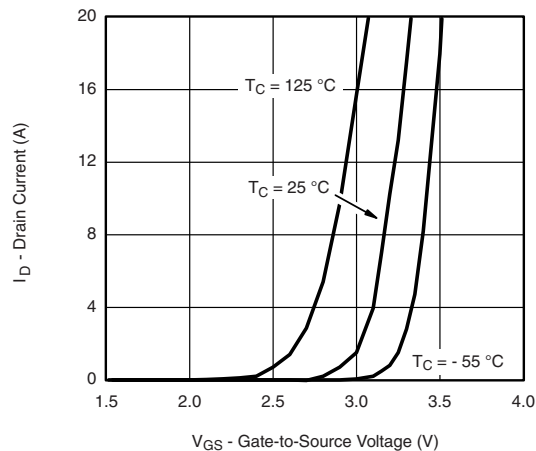
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



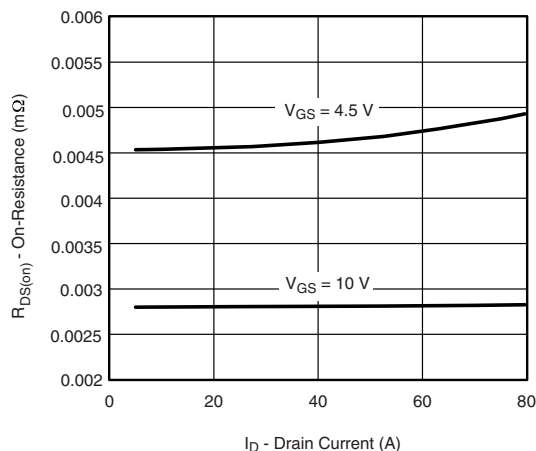
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



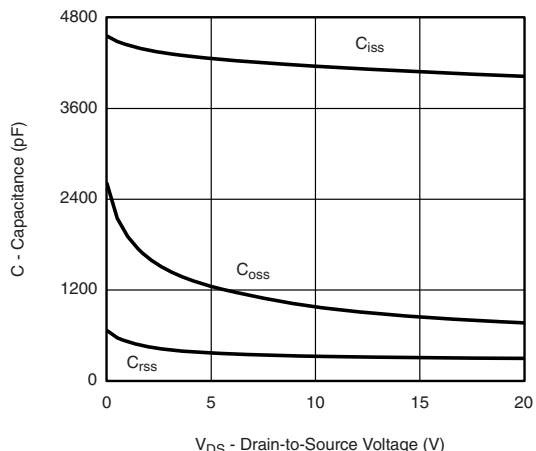
Output Characteristics



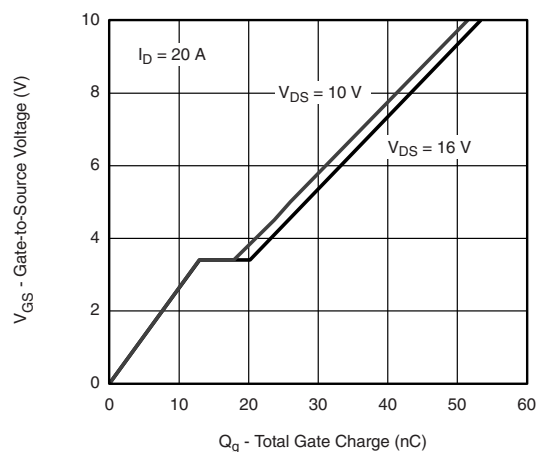
Transfer Characteristics



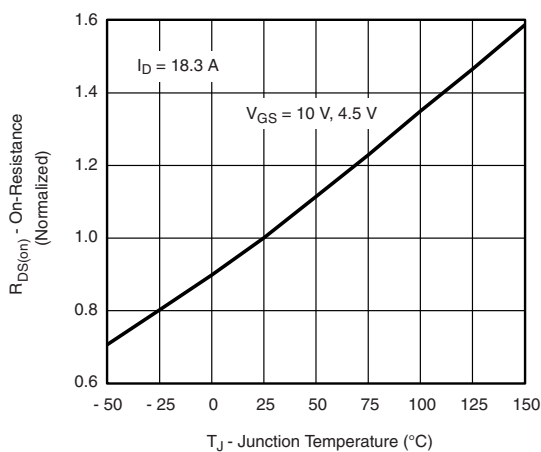
On-Resistance vs. Drain Current



Capacitance



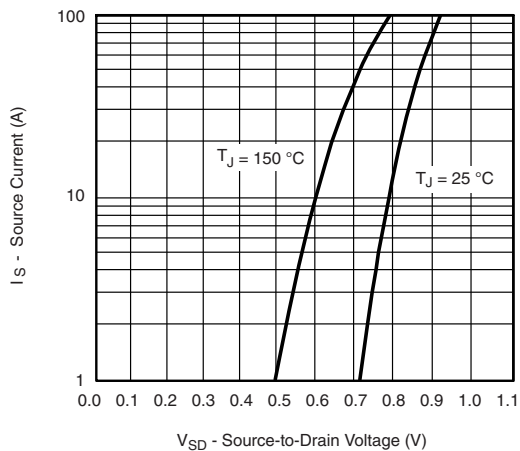
Gate Charge



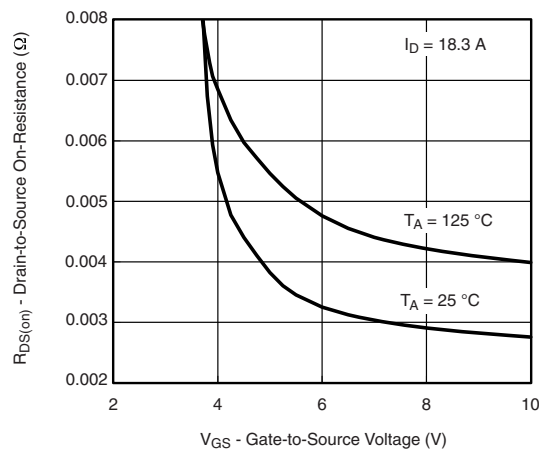
On-Resistance vs. Junction Temperature



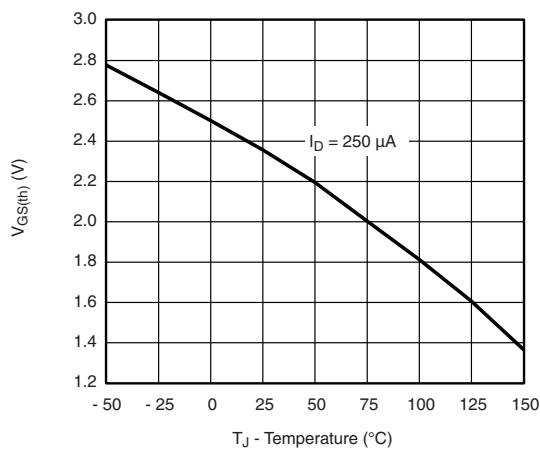
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



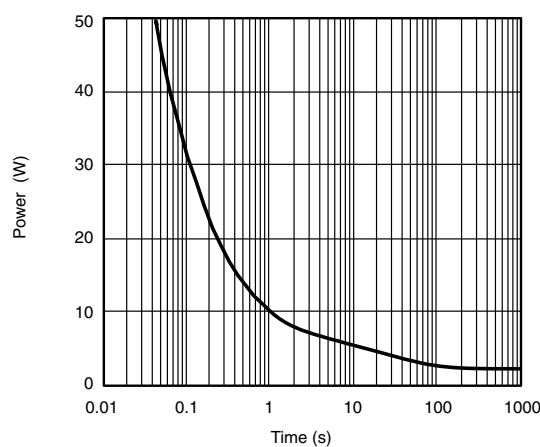
Source-Drain Diode Forward Voltage



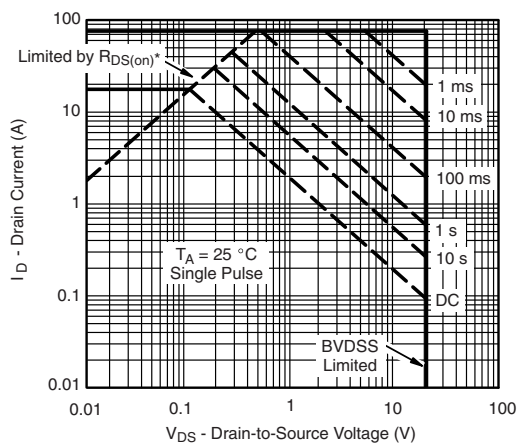
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



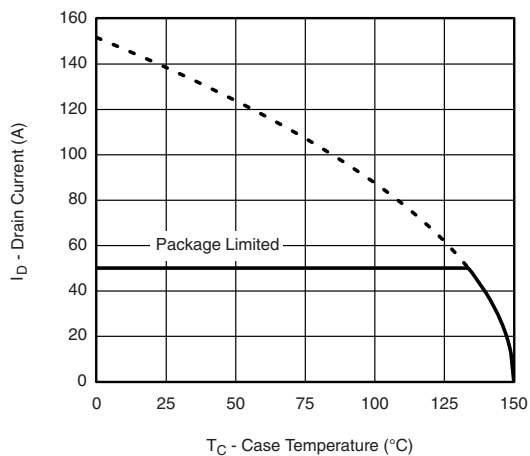
Single Pulse Power, Junction-to-Ambient



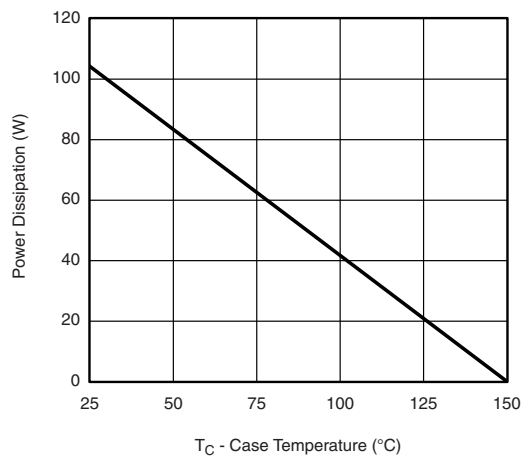
Safe Operating Area, Junction-to-Ambient



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating ^a



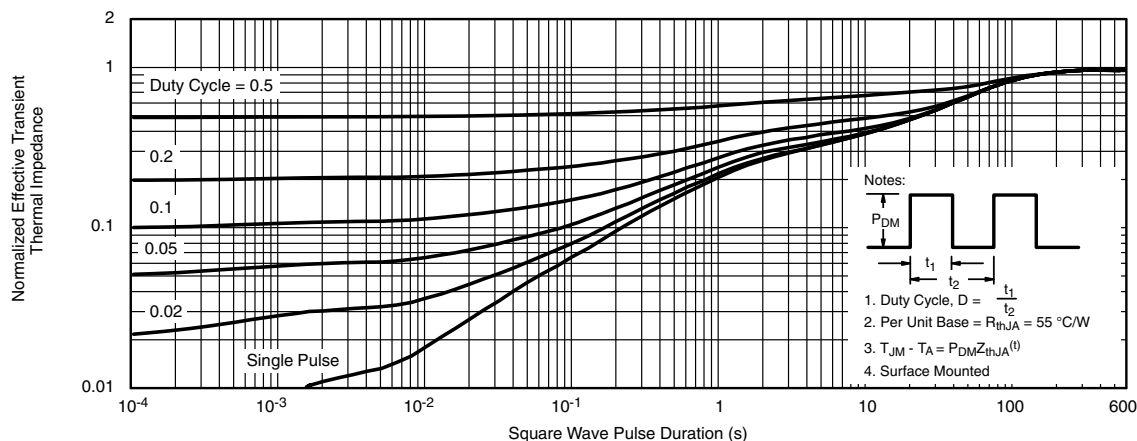
Power Derating, Junction-to-Case

Note

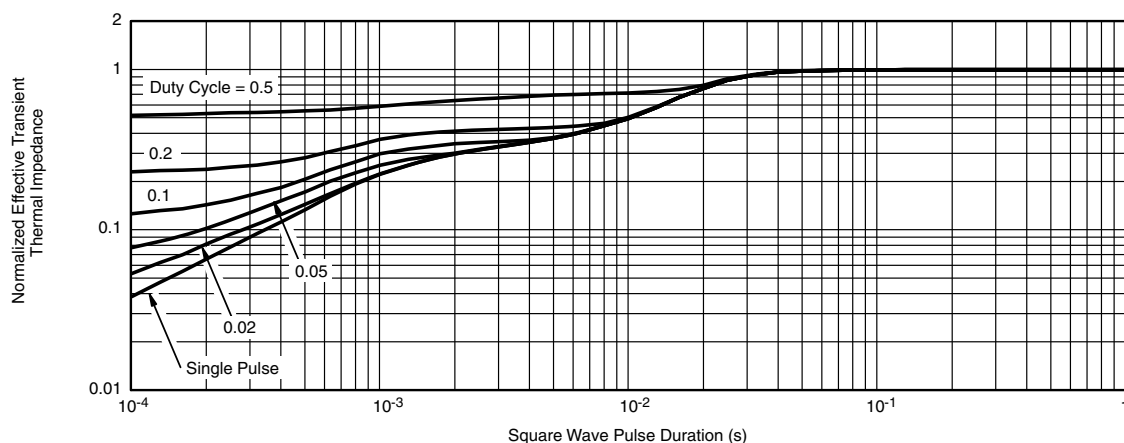
- a. The power dissipation P_D is based on T_J max. = 150 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit



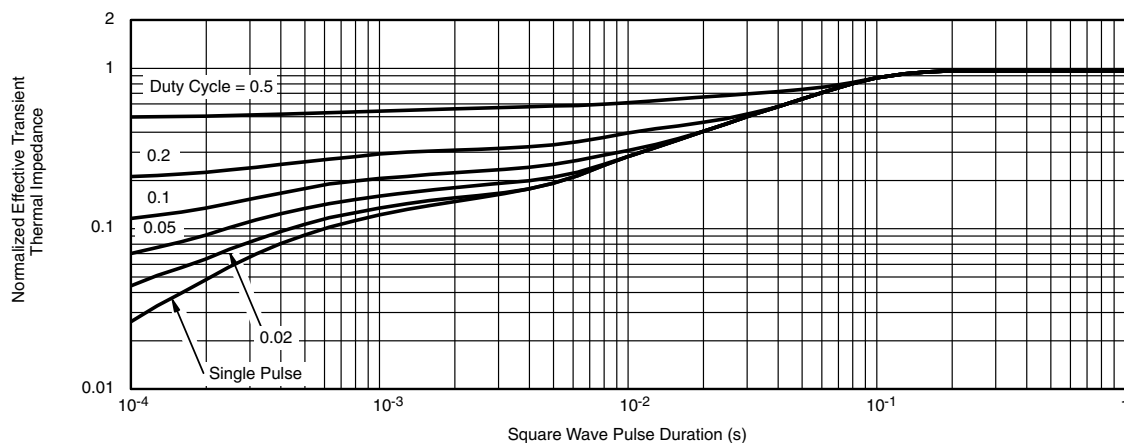
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



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

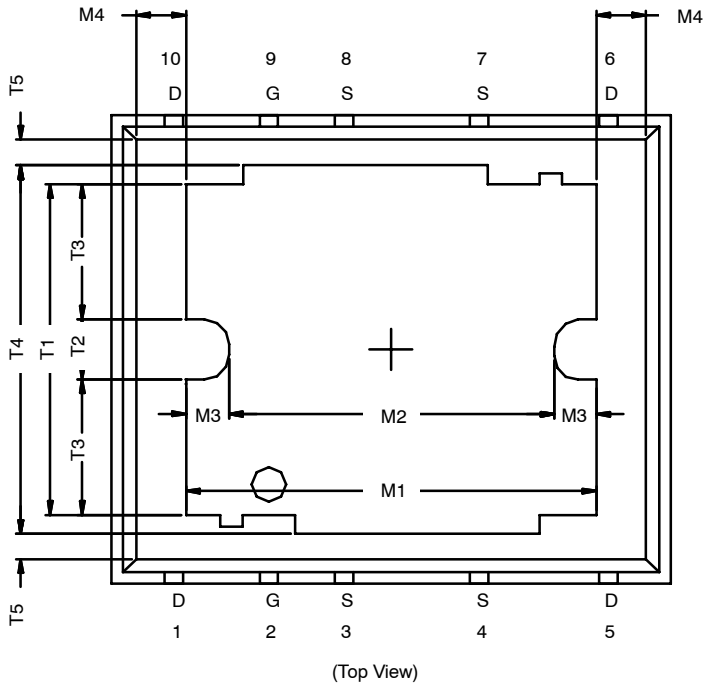


Normalized Thermal Transient Impedance, Junction-to-Source

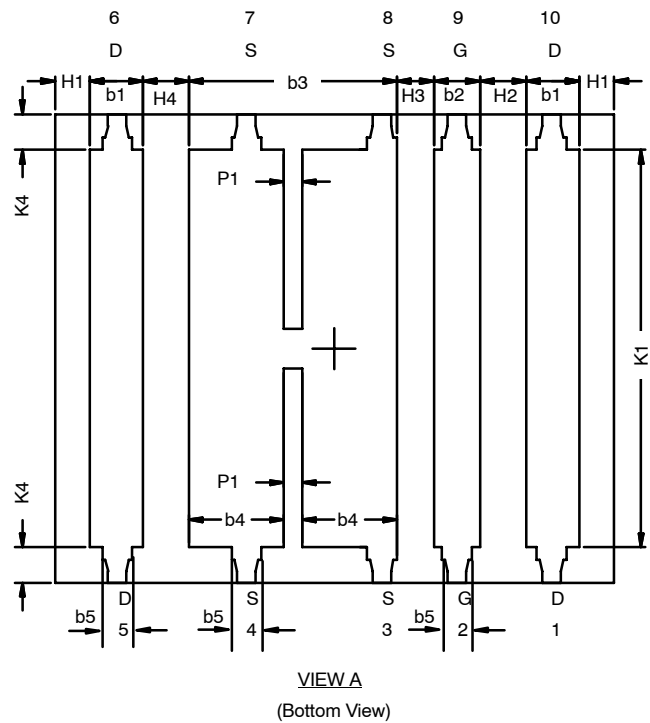
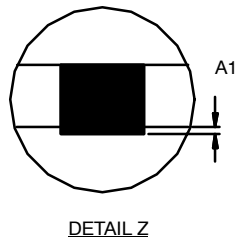
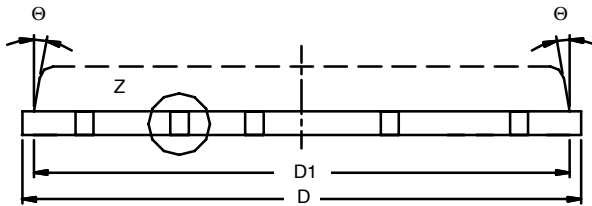
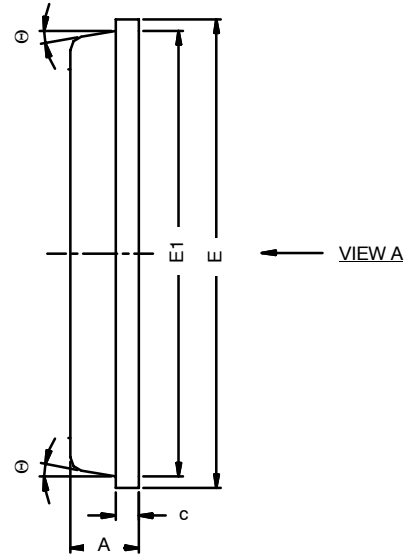
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PolarPAK™ (Option S)



Product datasheet/information page contain links to applicable package drawing.

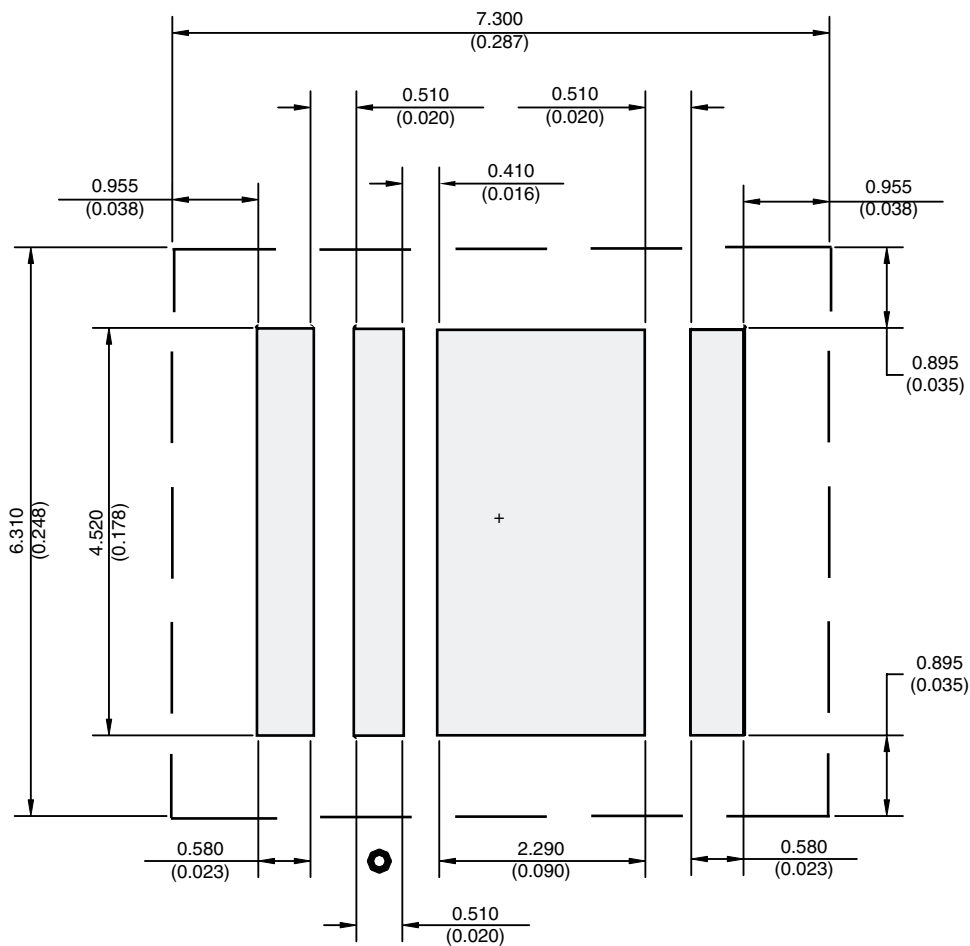




Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
A	0.75	0.80	0.85	0.030	0.031	0.033
A1	0.00	–	0.05	0.000	–	0.002
b1	0.48	0.58	0.68	0.019	0.023	0.027
b2	0.41	0.51	0.61	0.016	0.020	0.024
b3	2.19	2.29	2.39	0.086	0.090	0.094
b4	0.89	1.04	1.19	0.035	0.041	0.047
b5	0.23	0.33	0.43	0.009	0.013	0.017
c	0.20	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)



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