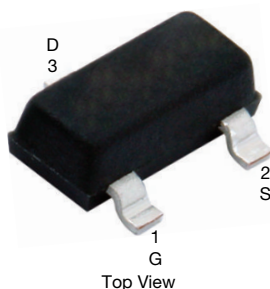


P-Channel 20 V (D-S) MOSFET

SOT-23 (TO-236)



Marking Code: H2

PRODUCT SUMMARY	
V_{DS} (V)	-20
$R_{DS(on)}$ max. (Ω) at $V_{GS} = -10$ V	0.028
$R_{DS(on)}$ max. (Ω) at $V_{GS} = -4.5$ V	0.037
$R_{DS(on)}$ max. (Ω) at $V_{GS} = -2.5$ V	0.0556
Q_g typ. (nC)	7.0
I_D (A) ^a	-6.5
Configuration	Single

FEATURES

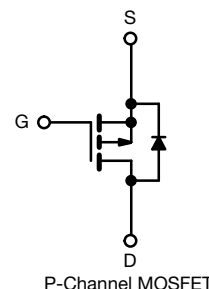
- TrenchFET[®] gen V p-channel MOSFET
- 100 % R_g and UIS tested
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Load switches
- DC/DC converters
- Power management
- LED backlighting



ORDERING INFORMATION	
Package	SOT-23 (TO-236)
Lead (Pb)-free and halogen-free	Si2399BDS-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}	± 12	
Continuous drain current ($T_J = 150$ °C) ^a	$T_F = 25$ °C	I_D	-6.5	A
	$T_F = 70$ °C		-5.2	
	$T_A = 25$ °C		-5.4 ^{b, c}	
	$T_A = 70$ °C		-4.2 ^{b, c}	
Pulsed drain current ($V_{GS} = 10$ V, $t = 100$ μ s)		I_{DM}	-30	
Continuous source-drain diode current	$T_F = 25$ °C	I_S	-1.6	A
	$T_A = 25$ °C		-1.1 ^{b, c}	
Maximum power dissipation ^a	$T_F = 25$ °C	P_D	1.8	W
	$T_F = 70$ °C		1.14	
	$T_A = 25$ °C		1.25 ^{b, c}	
	$T_A = 70$ °C		0.8 ^{b, c}	
Operating junction and storage temperature range		T_J, T_{stg}	-55 to +150	°C

THERMAL RESISTANCE RATINGS					
PARAMETER		SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum junction-to-ambient ^{b, d}	$t \leq 5$ s	R_{thJA}	80	100	°C/W
Maximum junction-to-foot (drain)	Steady state	R_{thJF}	55	70	

Notes

- $T_F = 25$ °C
- Surface mounted on 1" x 1" FR4 board
- $t = 5$ s
- Maximum under steady state conditions is 130 °C/W



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	ΔV _{DS} /T _J	I _D = -10 mA	-	-14.2	-	mV/°C
V _{GS(th)} temperature coefficient	ΔV _{GS(th)} /T _J	I _D = -250 μA	-	3.2	-	
Gate-source threshold voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = -250 μA	-0.6	-	-1.5	V
Gate-source leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 12 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	
Drain-source on-state resistance ^a	R _{DS(on)}	V _{GS} = -10 V, I _D = -5 A	-	0.022	0.028	Ω
		V _{GS} = -4.5 V, I _D = -3 A	-	0.027	0.037	
		V _{GS} = -2.5 V, I _D = -2 A	-	0.038	0.0556	
Forward transconductance	g _{fs}	V _{DS} = -10 V, I _D = -6 A	-	20	-	S
Dynamic ^b						
Input capacitance	C _{iss}	V _{DS} = -10 V, V _{GS} = 0 V, f = 1 MHz	-	730	-	pF
Output capacitance	C _{oss}		-	125	-	
Reverse transfer capacitance	C _{rss}		-	100	-	
Total gate charge	Q _g	V _{DS} = -10 V, V _{GS} = 10 V, I _D = -10 A	-	15	23	nC
		V _{DS} = -10 V, V _{GS} = 4.5 V, I _D = 10 A	-	7	11	
Q _{gs}	-		1.8	-		
Gate-source charge	Q _{gd}		-	1.8	-	
Gate-drain charge	Q _{gd}					
Gate resistance	R _g	f = 1 MHz	1.3	6.5	13	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	-	12	25	ns
Rise time	t _r		-	32	65	
Turn-off delay time	t _{d(off)}		-	22	45	
Fall time	t _f		-	10	20	
Turn-on delay time	t _{d(on)}	V _{DD} = -10 V, R _L = 1 Ω I _D ≅ -10 A, V _{GEN} = -10 V, R _g = 1 Ω	-	7	15	ns
Rise time	t _r		-	5	10	
Turn-off delay time	t _{d(off)}		-	19	40	
Fall time	t _f		-	7	15	
Drain-Source Body Diode Characteristics						
Continous source-drain diode current	I _S	T _C = 25 °C	-	-	-1.6	A
Pulse diode forward current ^a	I _{SM}		-	-	-30	
Body diode voltage	V _{SD}	I _S = -5 A, V _{GS} = 0 V	-	-0.83	-1.1	V
Body diode reverse recovery charge	Q _{rr}	I _F = -10 A, dI/dt = 100 A/μs, T _J = 25 °C	-	2.5	5	nC
Body diode reverse recovery time	t _{rr}		-	8	20	
Reverse recovery fall time	t _a		-	5	-	
Reverse recovery rise time	t _b		-	3	-	

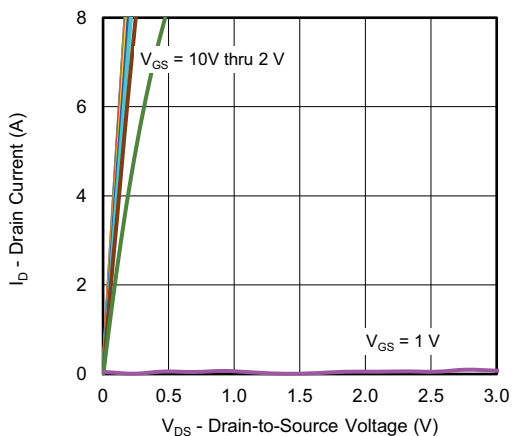
Notes

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

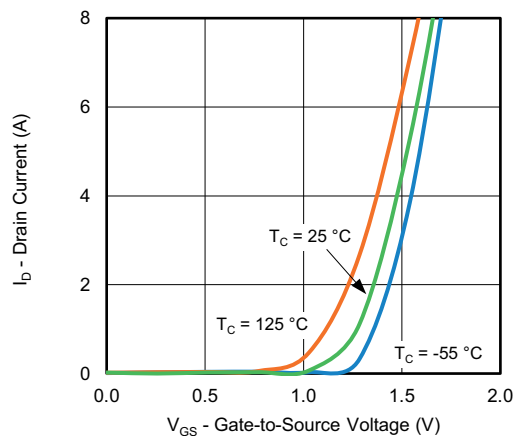
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



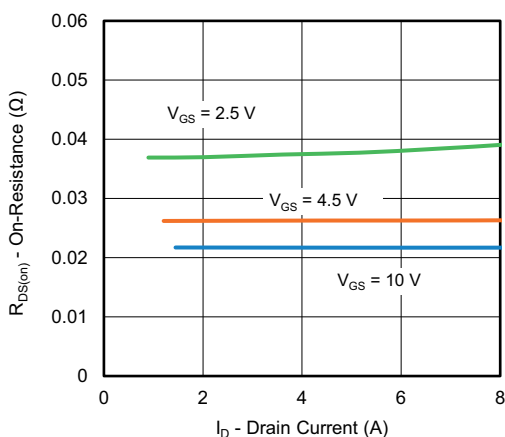
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)



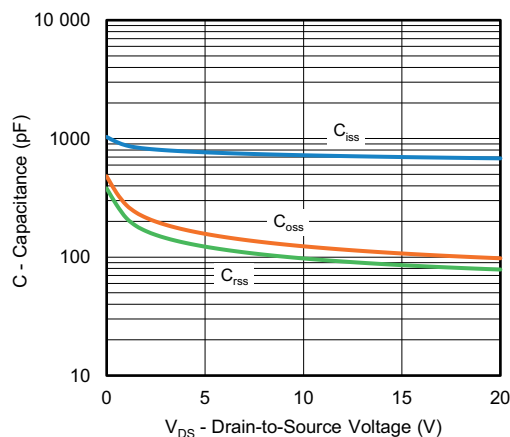
Output Characteristics



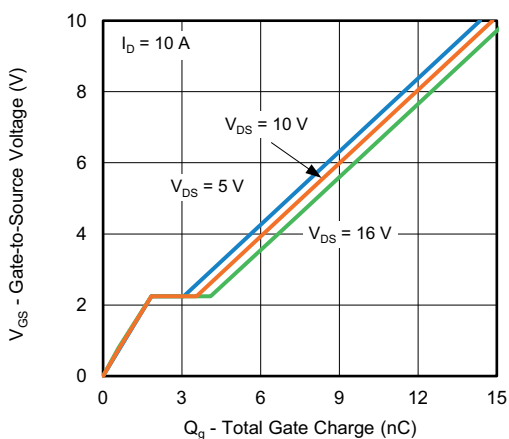
Transfer Characteristics Curves vs. Temperature



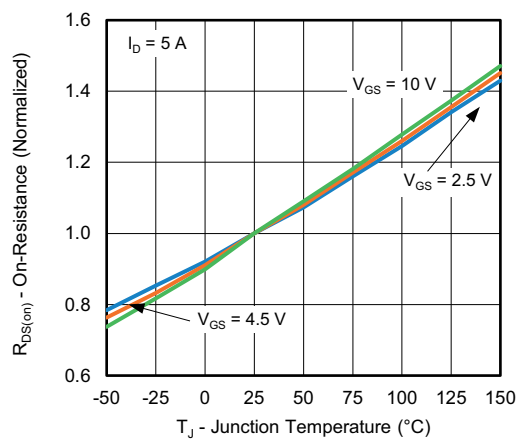
On-Resistance vs. Drain Current



Capacitance



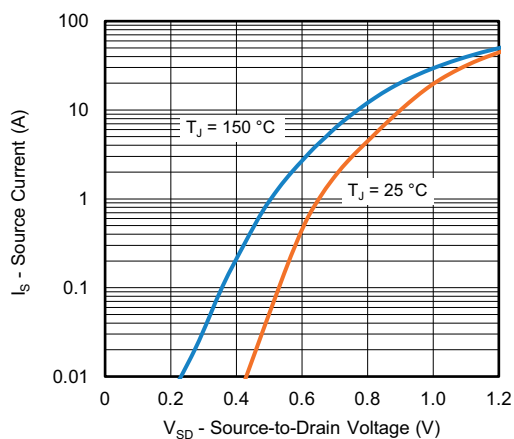
Gate Charge



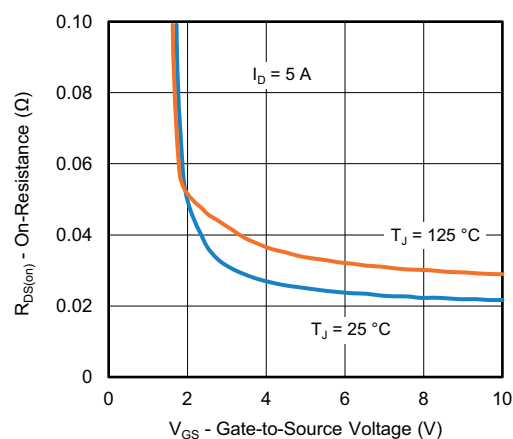
On-Resistance vs. Junction Temperature



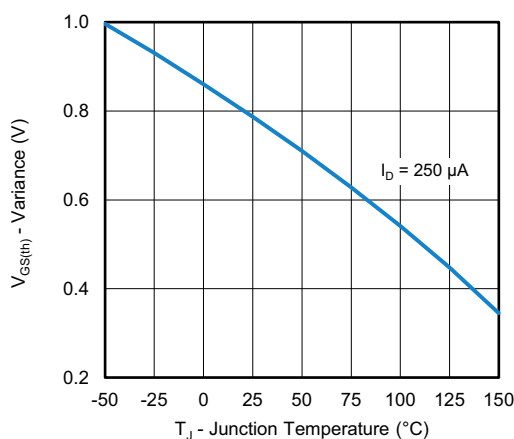
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)



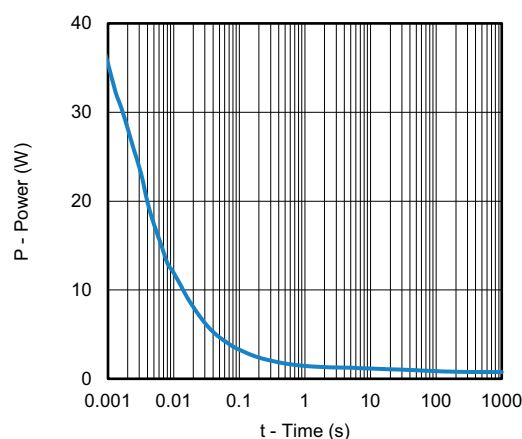
Source-Drain Diode Forward Voltage



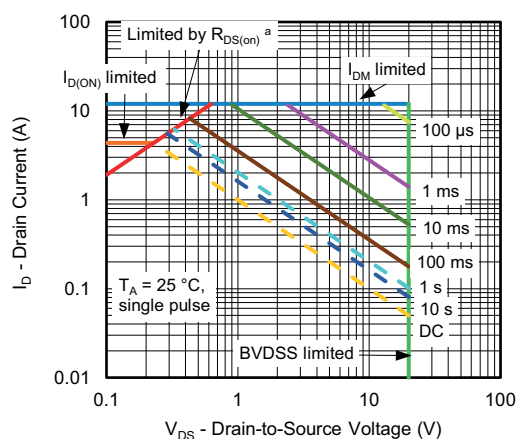
$R_{DS(on)}$ vs. V_{GS} vs. Temperature



Threshold Voltage



Single Pulse Power



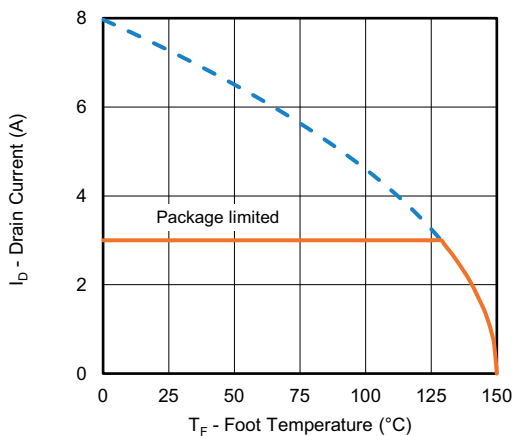
Safe Operating Area, Junction-to-Ambient

Note

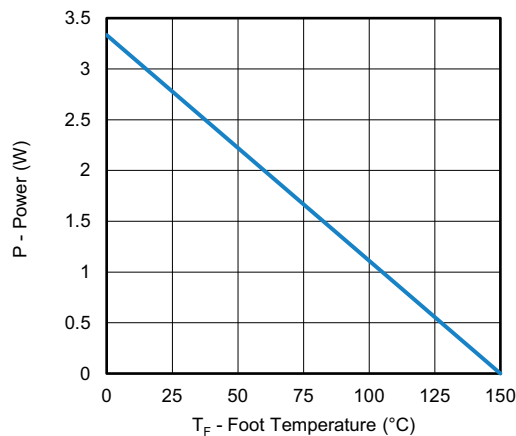
a. $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified



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



Current Derating ^a



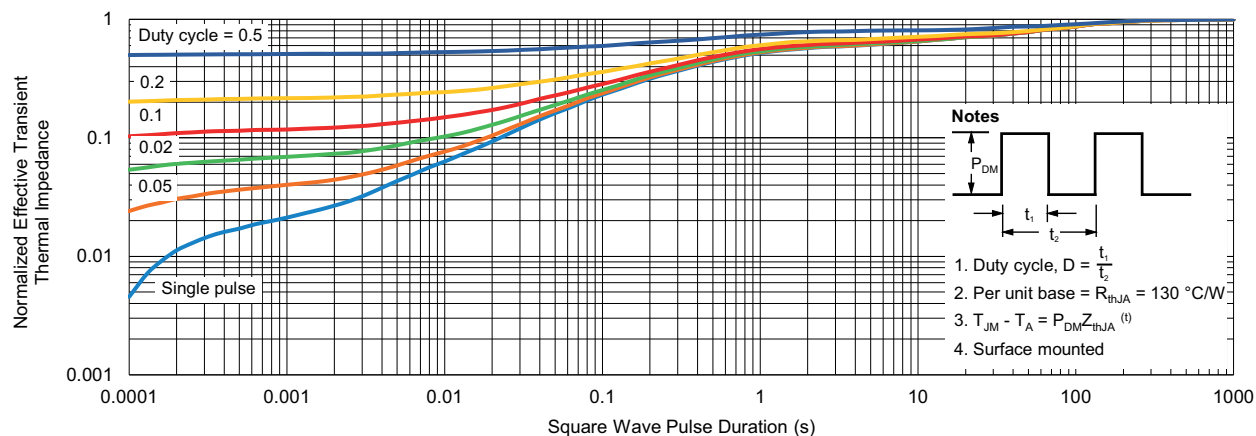
Power, Junction-to-Foot

Note

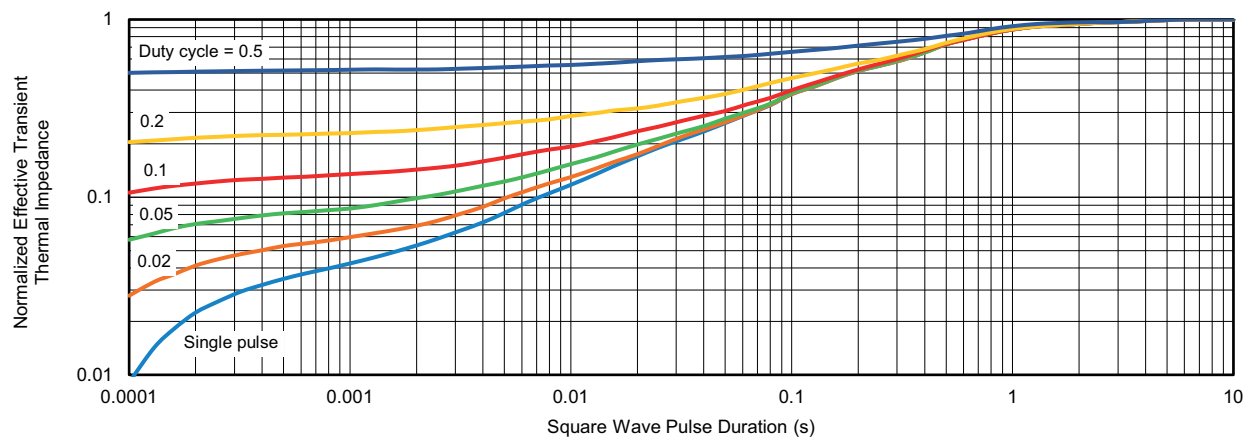
- a. The power dissipation P_D is based on T_J max. = 150°C , using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit



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



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

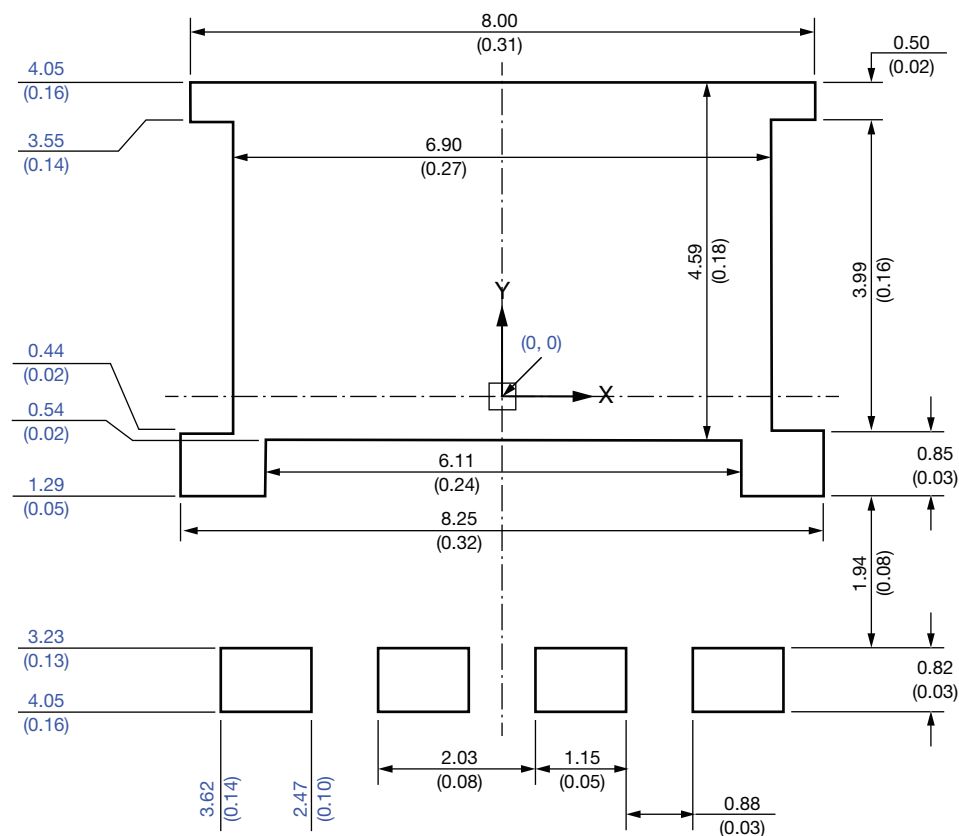
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SOT-23 (TO-236): 3-LEAD



Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	0.89	1.12	0.035	0.044
A ₁	0.01	0.10	0.0004	0.004
A ₂	0.88	1.02	0.0346	0.040
b	0.35	0.50	0.014	0.020
c	0.085	0.18	0.003	0.007
D	2.80	3.04	0.110	0.120
E	2.10	2.64	0.083	0.104
E ₁	1.20	1.40	0.047	0.055
e	0.95 BSC		0.0374 Ref	
e ₁	1.90 BSC		0.0748 Ref	
L	0.40	0.60	0.016	0.024
L ₁	0.64 Ref		0.025 Ref	
S	0.50 Ref		0.020 Ref	
q	3°	8°	3°	8°
ECN: S-03946-Rev. K, 09-Jul-01				
DWG: 5479				

Recommended Minimum PADs for PowerPAK® 8 x 8L Single



Dimensions in millimeters (inches)

Note

- Linear dimensions are in black, the same information is provided in ordinate dimensions which are in blue.



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