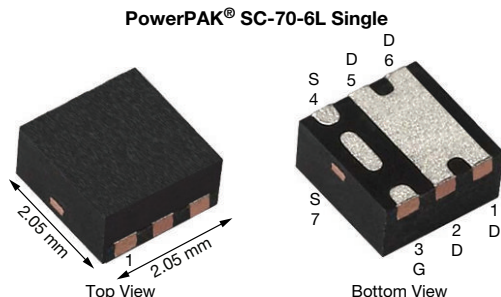


P-Channel 20 V (D-S) MOSFET



Marking code: BQ

PRODUCT SUMMARY	
V_{DS} (V)	-20
$R_{DS(on)}$ max. (Ω) at $V_{GS} = -4.5$ V	0.0165
$R_{DS(on)}$ max. (Ω) at $V_{GS} = -3.7$ V	0.0185
$R_{DS(on)}$ max. (Ω) at $V_{GS} = -2.5$ V	0.0300
Q_g typ. (nC)	23
I_D (A) ^a	-12
Configuration	Single

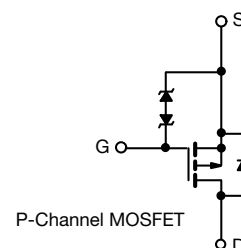
FEATURES

- TrenchFET[®] power MOSFET
- Thermally enhanced PowerPAK SC-70 package
 - Small footprint area
 - Low on-resistance
- 100 % R_g tested
- Built in ESD protection with Zener diode
- Typical ESD performance: 2000 V
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Smart phones, tablet PCs, mobile computing
 - Battery switch
 - Charger switch
 - Load switch



P-Channel MOSFET

ORDERING INFORMATION	
Package	PowerPAK SC-70
Lead (Pb)-free and halogen-free	SiA445EDJ-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)	$T_C = 25$ °C	-12 ^a	A	
	$T_C = 70$ °C	-12 ^a		
	$T_A = 25$ °C	-11.8 ^{b, c}		
	$T_A = 70$ °C	-9.5 ^{b, c}		
Pulsed drain current ($t = 300$ μ s)	I_{DM}	-50		
Continuous source-drain diode current	$T_C = 25$ °C	-12 ^a		
	$T_A = 25$ °C	-2.9 ^{b, c}		
Maximum power dissipation	$T_C = 25$ °C	19	W	
	$T_C = 70$ °C	12		
	$T_A = 25$ °C	3.5 ^{b, c}		
	$T_A = 70$ °C	2.2 ^{b, c}		
Operating junction and storage temperature range	T_J, T_{stg}	-55 to +150	°C	
Soldering recommendations (peak temperature) ^{d, e}		260		

THERMAL RESISTANCE RATINGS					
PARAMETER		SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum junction-to-ambient ^{b, f}	$t \leq 5$ s	R_{thJA}	28	36	°C/W
Maximum junction-to-case (drain)	Steady state	R_{thJC}	5.3	6.5	

Notes

- Package limited
- Surface mounted on 1" x 1" FR4 board
- $t = 5$ s
- See solder profile (www.vishay.com/doc?73257). The PowerPAK SC-70-6L 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
- Maximum under steady state conditions is 80 °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 = -250 μA	-	-13	-	mV/°C
V _{GS(th)} temperature coefficient	ΔV _{GS(th)} /T _J		-	2.6	-	
Gate-source threshold voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = -250 μA	-0.5	-	-1.2	V
Gate-source leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 12 V	-	-	± 60	μA
		V _{DS} = 0 V, V _{GS} = ± 4.5 V	-	-	± 1	
Zero gate voltage drain current	I _{DSS}	V _{DS} = -20 V, V _{GS} = 0 V	-	-	-1	
		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} = -4.5 V	-20	-	-	A
Drain-source on-state resistance ^a	R _{DS(on)}	V _{GS} = -4.5 V, I _D = -7 A	-	0.0135	0.0165	Ω
		V _{GS} = -3.7 V, I _D = -5 A	-	0.0150	0.0185	
		V _{GS} = -2.5 V, I _D = -5 A	-	0.0210	0.0300	
Forward transconductance ^a	g _{fs}	V _{DS} = -10 V, I _D = -7 A	-	29	-	S
Dynamic ^b						
Input capacitance	C _{iss}	V _{DS} = -10 V, V _{GS} = 0 V, f = 1 MHz	-	2130	-	pF
Output capacitance	C _{oss}		-	290	-	
Reverse transfer capacitance	C _{rss}		-	280	-	
Total gate charge	Q _g	V _{DS} = -10 V, V _{GS} = -10 V, I _D = -12 A	-	48	72	nC
		V _{DS} = -10 V, V _{GS} = -4.5 V, I _D = -12 A	-	23	35	
Gate-source charge	Q _{gs}		-	3.1	-	
Gate-drain charge	Q _{gd}		-	6.7	-	
Gate resistance	R _g	f = 1 MHz	1.2	6	12	Ω
Turn-on delay time	t _{d(on)}	V _{DD} = -10 V, R _L = 1 Ω I _D ≅ -9.5 A, V _{GEN} = -4.5 V, R _g = 1 Ω	-	25	50	ns
Rise time	t _r		-	25	50	
Turn-off delay time	t _{d(off)}		-	55	110	
Fall time	t _f		-	20	40	
Turn-on delay time	t _{d(on)}	V _{DD} = -10 V, R _L = 1 Ω I _D ≅ -9.5 A, V _{GEN} = -10 V, R _g = 1 Ω	-	7	15	
Rise time	t _r		-	10	20	
Turn-off delay time	t _{d(off)}		-	60	120	
Fall time	t _f		-	17	35	
Drain-Source Body Diode Characteristics						
Continuous source-drain diode current	I _S	T _C = 25 °C	-	-	-12	A
Pulse diode forward current	I _{SM}		-	-	-50	
Body diode voltage	V _{SD}	I _S = -9.5 A, V _{GS} = 0 V	-	-0.8	-1.2	V
Body diode reverse recovery time	t _{rr}	I _F = -9.5 A, di/dt = 100 A/μs, T _J = 25 °C	-	15	30	ns
Body diode reverse recovery charge	Q _{rr}		-	5	10	nC
Reverse recovery fall time	t _a		-	7	-	ns
Reverse recovery rise time	t _b		-	8	-	

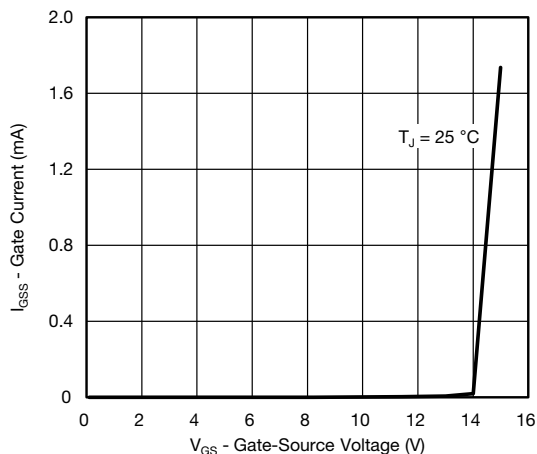
Notes

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

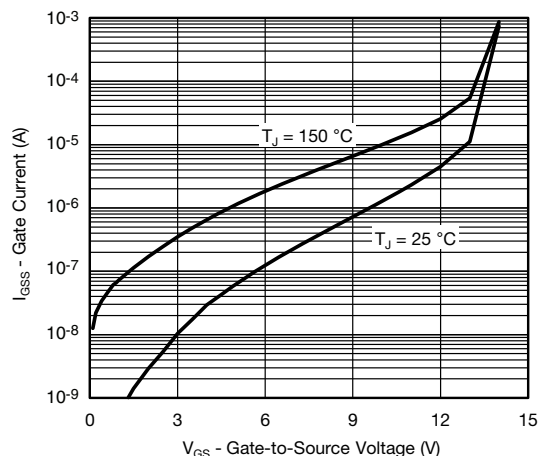
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



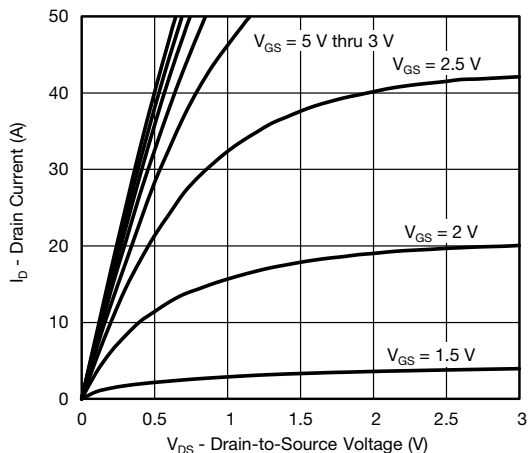
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



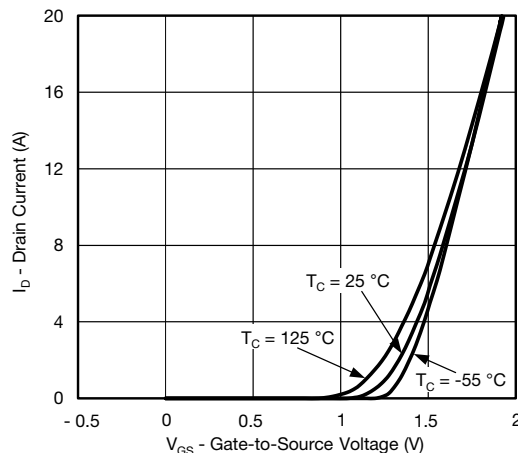
Gate Current vs. Gate-Source Voltage



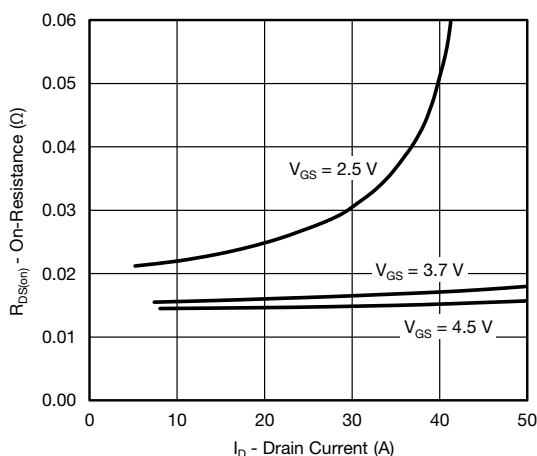
Gate Current vs. Gate-Source Voltage



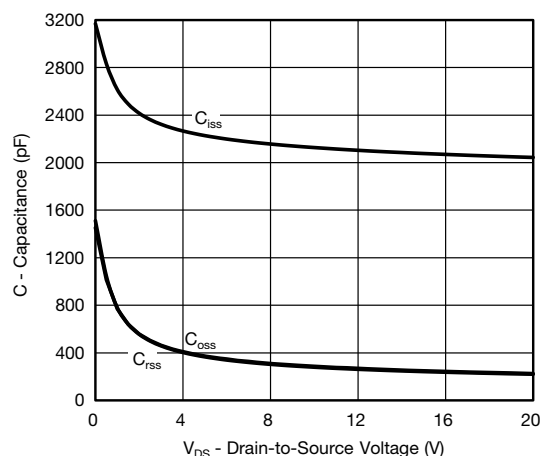
Output Characteristics



Transfer Characteristics



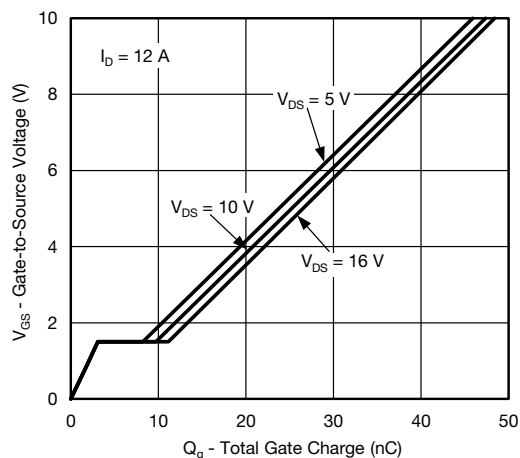
On-Resistance vs. Drain Current



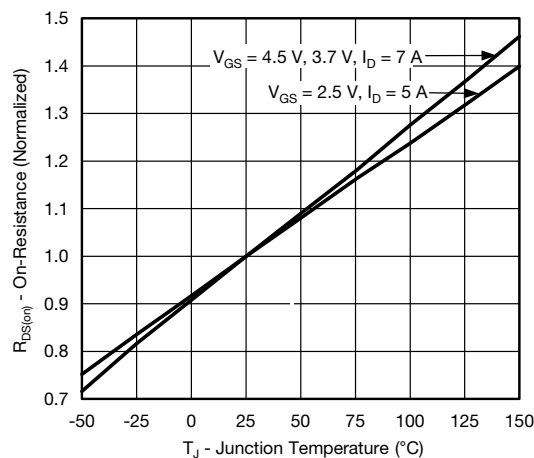
Capacitance



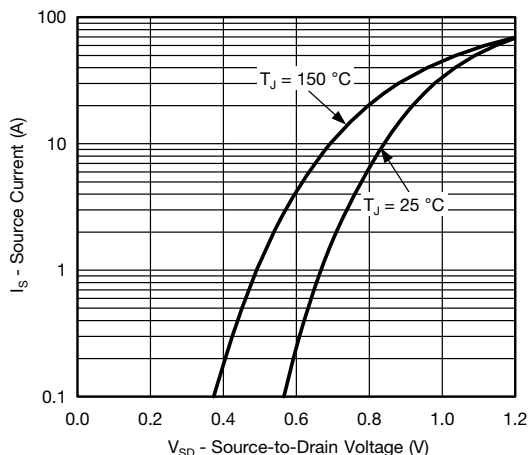
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



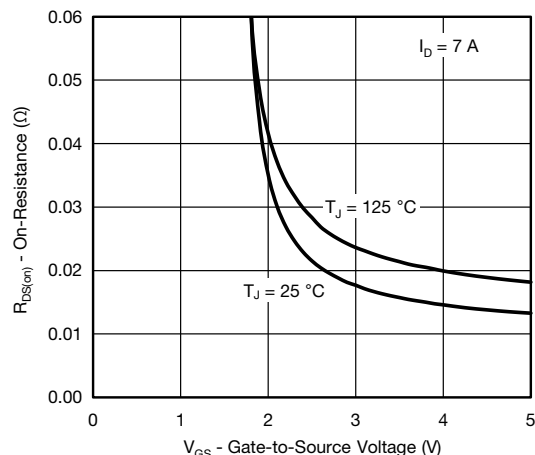
Gate Charge



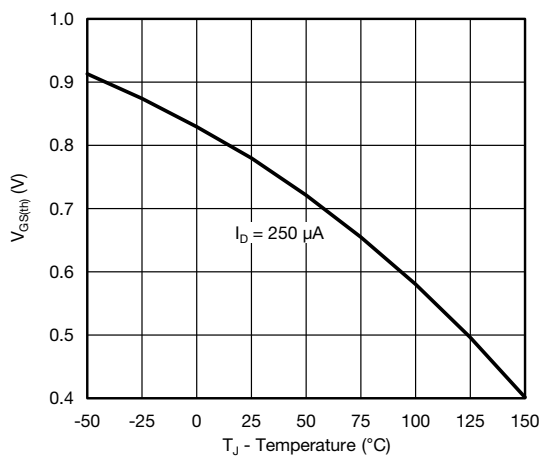
On-Resistance vs. Junction Temperature



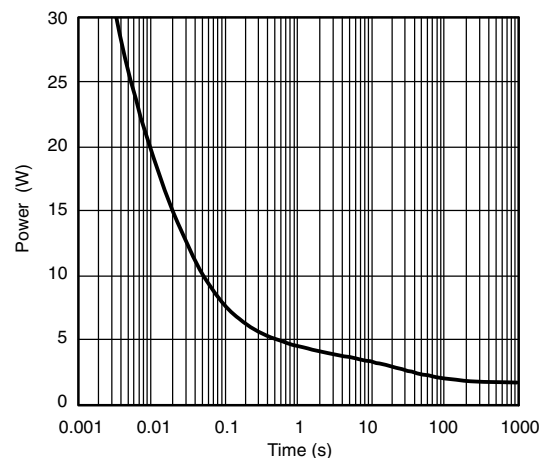
Source-Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage



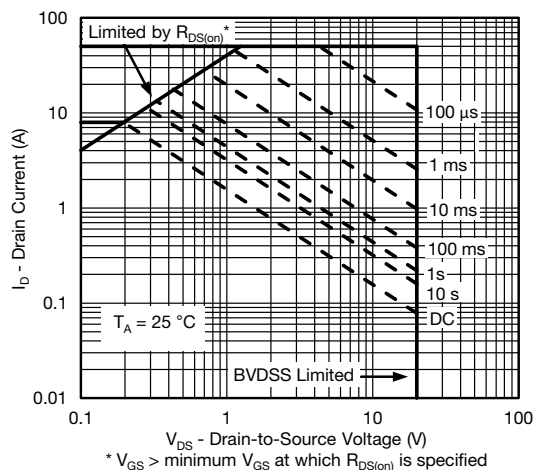
Threshold Voltage



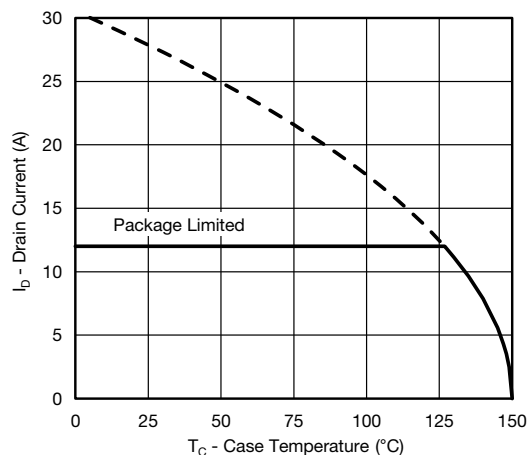
Single Pulse Power, Junction-to-Ambient



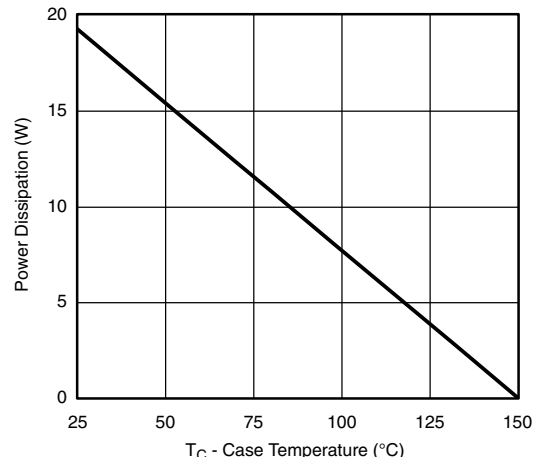
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Safe Operating Area, Junction-to-Ambient



Current Derating ^a



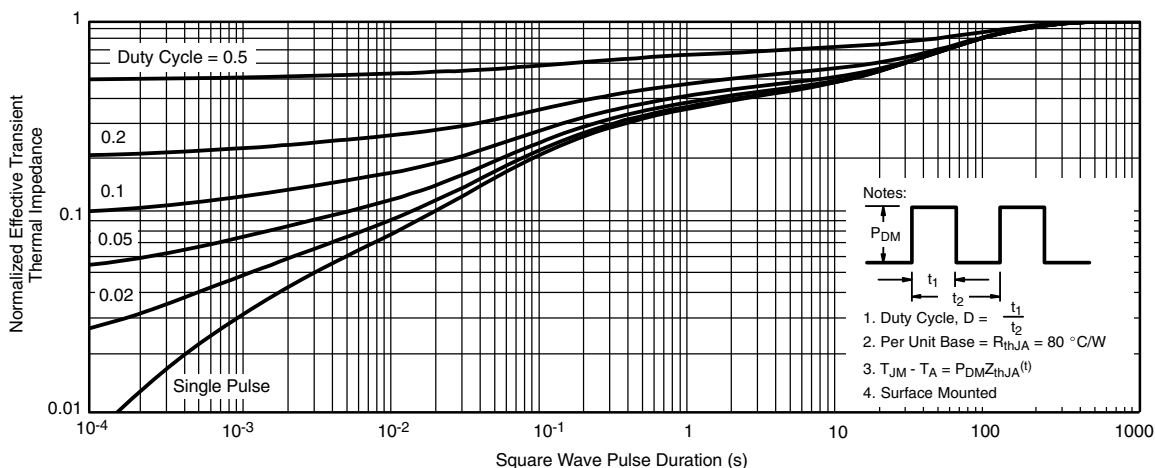
Power Derating

Note

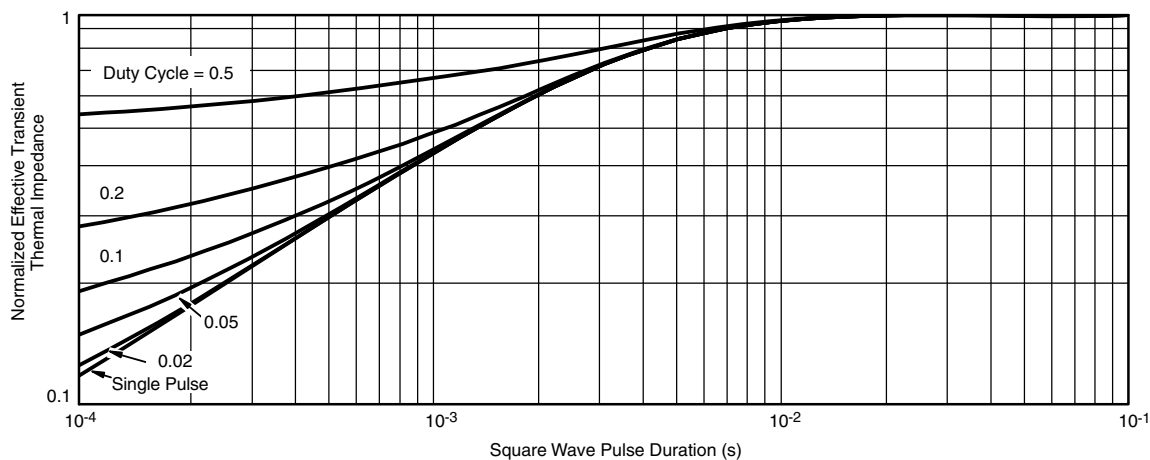
- a. The power dissipation P_D is based on $T_J \text{ max.} = 150\text{ }^{\circ}\text{C}$, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating 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

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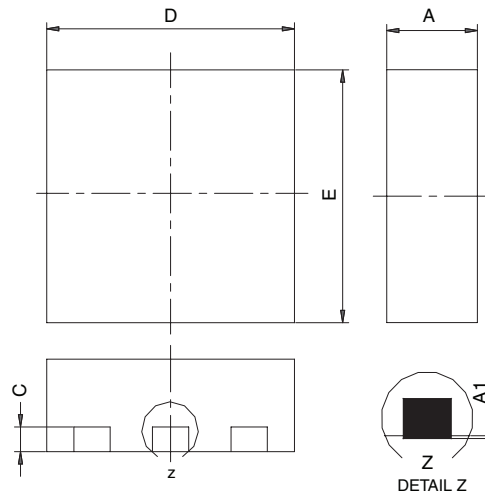
PowerPAK® SC70-6L



BACKSIDE VIEW OF SINGLE



BACKSIDE VIEW OF DUAL



Notes:

1. All dimensions are in millimeters
2. Package outline exclusive of mold flash and metal burr
3. Package outline inclusive of plating

DIM	SINGLE PAD						DUAL PAD					
	MILLIMETERS			INCHES			MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
A	0.675	0.75	0.80	0.027	0.030	0.032	0.675	0.75	0.80	0.027	0.030	0.032
A1	0	-	0.05	0	-	0.002	0	-	0.05	0	-	0.002
b	0.23	0.30	0.38	0.009	0.012	0.015	0.23	0.30	0.38	0.009	0.012	0.015
C	0.15	0.20	0.25	0.006	0.008	0.010	0.15	0.20	0.25	0.006	0.008	0.010
D	1.98	2.05	2.15	0.078	0.081	0.085	1.98	2.05	2.15	0.078	0.081	0.085
D1	0.85	0.95	1.05	0.033	0.037	0.041	0.513	0.613	0.713	0.020	0.024	0.028
D2	0.135	0.235	0.335	0.005	0.009	0.013						
E	1.98	2.05	2.15	0.078	0.081	0.085	1.98	2.05	2.15	0.078	0.081	0.085
E1	1.40	1.50	1.60	0.055	0.059	0.063	0.85	0.95	1.05	0.033	0.037	0.041
E2	0.345	0.395	0.445	0.014	0.016	0.018						
E3	0.425	0.475	0.525	0.017	0.019	0.021						
e	0.65 BSC			0.026 BSC			0.65 BSC			0.026 BSC		
K	0.275 TYP			0.011 TYP			0.275 TYP			0.011 TYP		
K1	0.400 TYP			0.016 TYP			0.320 TYP			0.013 TYP		
K2	0.240 TYP			0.009 TYP			0.252 TYP			0.010 TYP		
K3	0.225 TYP			0.009 TYP								
K4	0.355 TYP			0.014 TYP								
L	0.175	0.275	0.375	0.007	0.011	0.015	0.175	0.275	0.375	0.007	0.011	0.015
T							0.05	0.10	0.15	0.002	0.004	0.006
ECN: C-07431 – Rev. C, 06-Aug-07 DWG: 5934												

RECOMMENDED PAD LAYOUT FOR PowerPAK® SC70-6L Single



Dimensions in mm/(Inches)

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