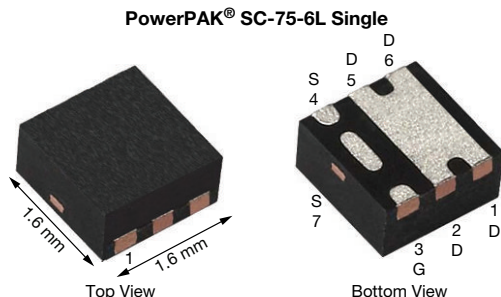


# N-Channel 20 V (D-S) MOSFET



Marking code: AF

PRODUCT SUMMARY	
$V_{DS}$ (V)	20
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 4.5$ V	0.030
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 2.5$ V	0.041
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 1.8$ V	0.057
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 1.5$ V	0.082
$Q_g$ typ. (nC)	6
$I_D$ (A) <sup>a</sup>	9
Configuration	Single

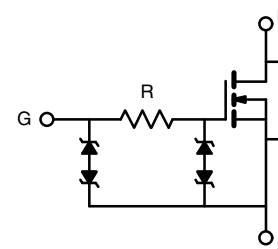
## FEATURES

- TrenchFET® power MOSFET
- Thermally enhanced PowerPAK® SC-75 package
  - Small footprint area
  - Low on-resistance
  - Thin 0.75 mm profile
- Typical ESD protection 4000 V
- 100 %  $R_g$  tested
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

## APPLICATIONS

- Portable devices
  - Load switch
  - Battery switch



ORDERING INFORMATION	
Package	PowerPAK SC-75
Lead (Pb)-free and halogen-free	SiB422EDK-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		$V_{GS}$	$\pm 8$	
Continuous drain current ( $T_J = 150$ °C)	$T_C = 25$ °C	$I_D$	9 <sup>a</sup>	A
	$T_C = 70$ °C		9 <sup>a</sup>	
	$T_A = 25$ °C		7.1 <sup>b, c</sup>	
	$T_A = 70$ °C		5.7 <sup>b, c</sup>	
Pulsed drain current		$I_{DM}$	25	A
Continuous source-drain diode current	$T_C = 25$ °C	$I_S$	9 <sup>a</sup>	
	$T_A = 25$ °C		2.1 <sup>b, c</sup>	
Maximum power dissipation	$T_C = 25$ °C	$P_D$	13	W
	$T_C = 70$ °C		8.4	
	$T_A = 25$ °C		2.5 <sup>b, c</sup>	
	$T_A = 70$ °C		1.6 <sup>b, c</sup>	
Operating junction and storage temperature range		$T_J, T_{stg}$	-55 to +150	°C
Soldering recommendations (peak temperature) <sup>d, e</sup>			260	

THERMAL RESISTANCE RATINGS					
PARAMETER		SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum junction-to-ambient <sup>b, f</sup>	$t \leq 5$ s	$R_{thJA}$	41	51	°C/W
Maximum junction-to-case (drain)	Steady state	$R_{thJC}$	7.5	9.5	

### Notes

- Package limited,  $T_C = 25$  °C
- Surface mounted on 1" x 1" FR4 board
- $t = 5$  s
- See solder profile ([www.vishay.com/doc?73257](http://www.vishay.com/doc?73257)). The PowerPAK SC-75 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 105 °C/W



SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-source breakdown voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	20	-	-	V
V <sub>DS</sub> temperature coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA	-	18	-	mV/°C
V <sub>GS(th)</sub> temperature coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>		-	-2.5	-	
Gate-source threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	0.4	-	1.0	V
Gate-source leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 4.5 V	-	-	± 1.5	μA
		V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 8 V	-	-	± 25	
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V	-	-	1	
		V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C	-	-	10	
On-state drain current <sup>a</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≥ 5 V, V <sub>GS</sub> = 4.5 V	15	-	-	A
Drain-source on-state resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 5 A	-	0.025	0.030	Ω
		V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 4.3 A	-	0.034	0.041	
		V <sub>GS</sub> = 1.8 V, I <sub>D</sub> = 1.5 A	-	0.046	0.057	
		V <sub>GS</sub> = 1.5 V, I <sub>D</sub> = 1 A	-	0.055	0.082	
Forward transconductance <sup>a</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 5 A	-	28	-	S
Dynamic <sup>b</sup>						
Total gate charge	Q <sub>g</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 8 V, I <sub>D</sub> = 7.1 A	-	11.5	18	nC
		V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 7.1 A	-	6	9	
Gate-source charge	Q <sub>gs</sub>		-	0.8	-	
Gate-drain charge	Q <sub>gd</sub>		-	1.6	-	
Gate resistance	R <sub>g</sub>	f = 1 MHz	460	2300	4600	Ω
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 10 V, R <sub>L</sub> = 1.8 Ω I <sub>D</sub> ≅ 5.7 A, V <sub>GEN</sub> = 4.5 V, R <sub>g</sub> = 1 Ω	-	0.3	0.45	μs
Rise time	t <sub>r</sub>		-	0.6	0.9	
Turn-off delay time	t <sub>d(off)</sub>		-	3.8	6	
Fall time	t <sub>f</sub>		-	1.7	2.6	
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 10 V, R <sub>L</sub> = 1.8 Ω I <sub>D</sub> ≅ 5.7 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω	-	0.15	0.25	
Rise time	t <sub>r</sub>		-	0.3	0.45	
Turn-off delay time	t <sub>d(off)</sub>		-	5.6	9	
Fall time	t <sub>f</sub>		-	1.6	2.5	
Drain-Source Body Diode Characteristics						
Continuous source-drain diode current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	-	-	9	A
Pulse diode forward current	I <sub>SM</sub>		-	-	25	
Body diode voltage	V <sub>SD</sub>	I <sub>S</sub> = 5.7 A, V <sub>GS</sub> = 0 V	-	0.85	1.2	V
Body diode reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 5.7 A, di/dt = 100 A/μs, T <sub>J</sub> = 25 °C	-	15	30	ns
Body diode reverse recovery charge	Q <sub>rr</sub>		-	7.5	15	nC
Reverse recovery fall time	t <sub>a</sub>		-	8	-	ns
Reverse recovery rise time	t <sub>b</sub>		-	15	-	

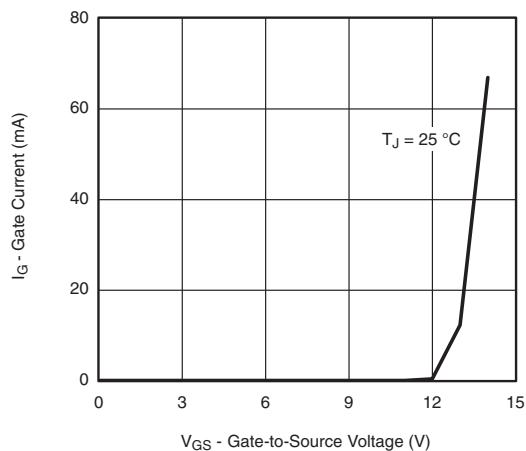
**Notes**

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

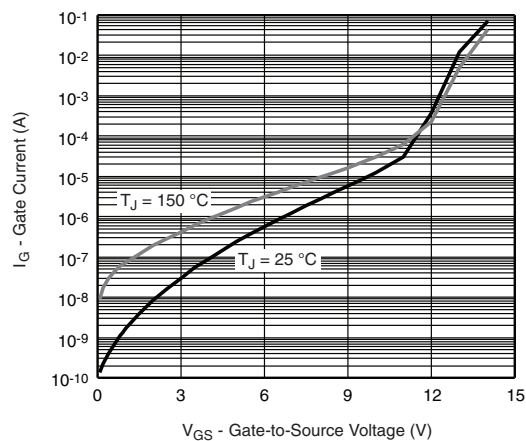
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



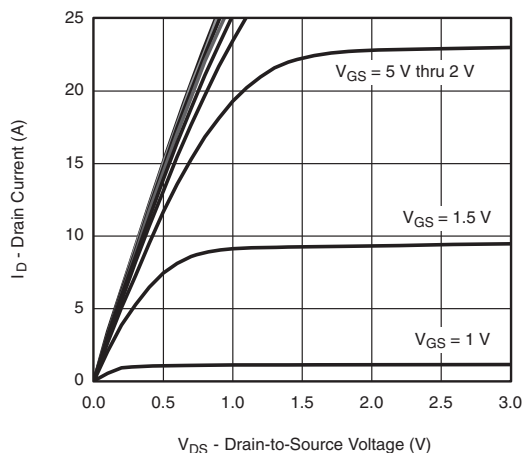
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted)



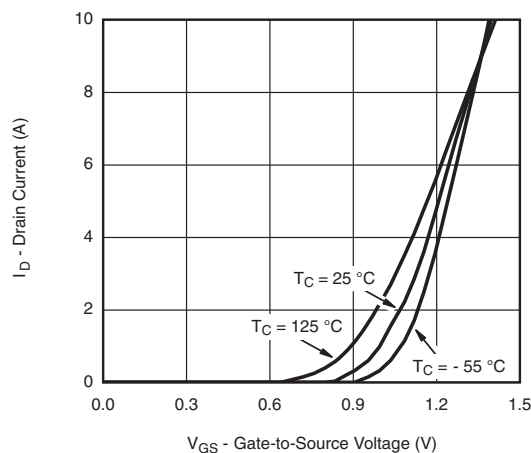
**Gate Current vs. Gate-to-Source Voltage**



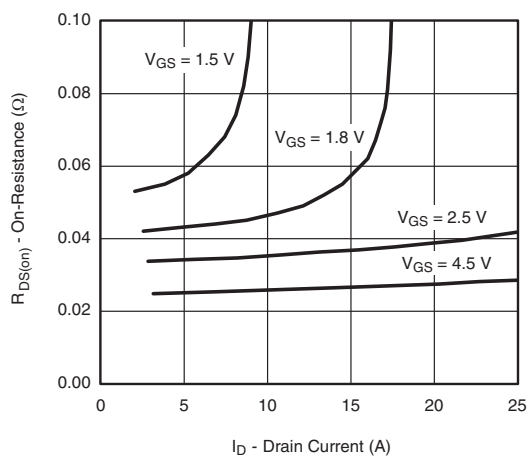
**Gate Current vs. Gate-to-Source Voltage**



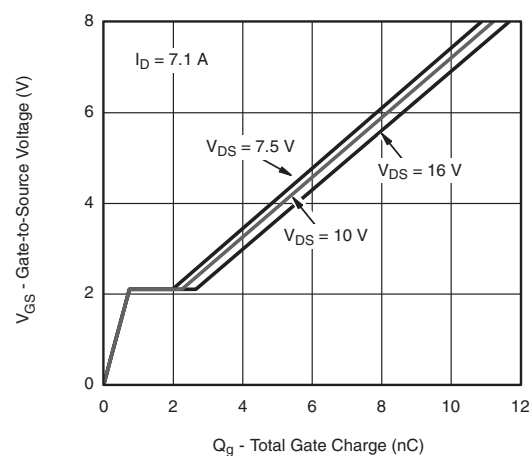
**Output Characteristics**



**Transfer Characteristics**



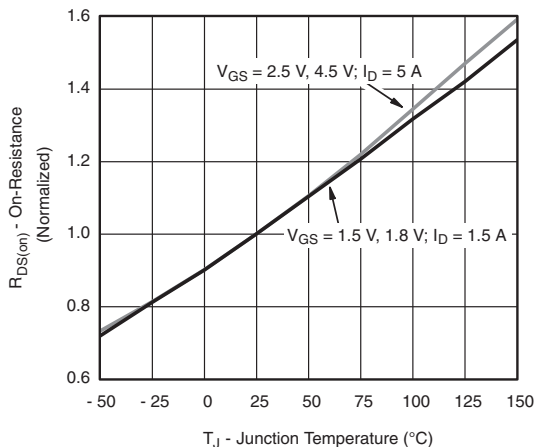
**On-Resistance vs. Drain Current**



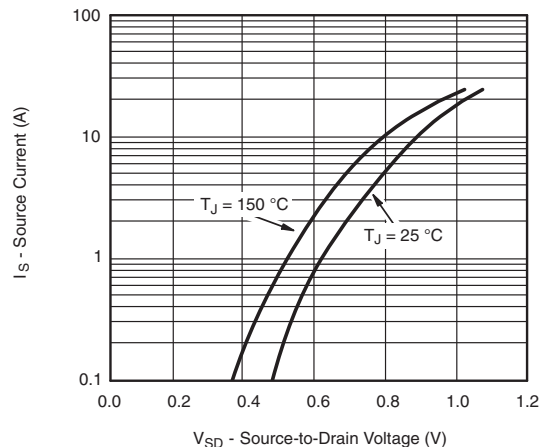
**Gate Charge**



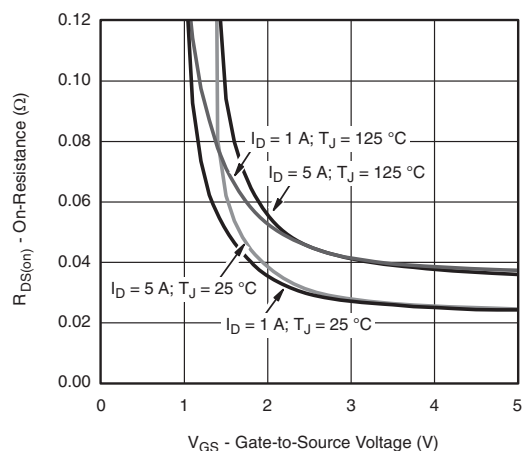
**TYPICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$ , unless otherwise noted)



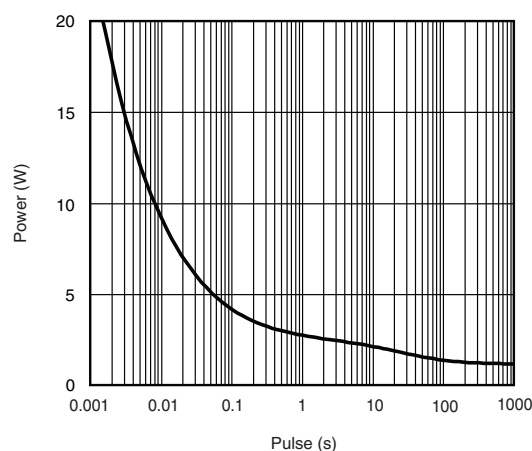
**Normalized On-Resistance vs. Junction Temperature**



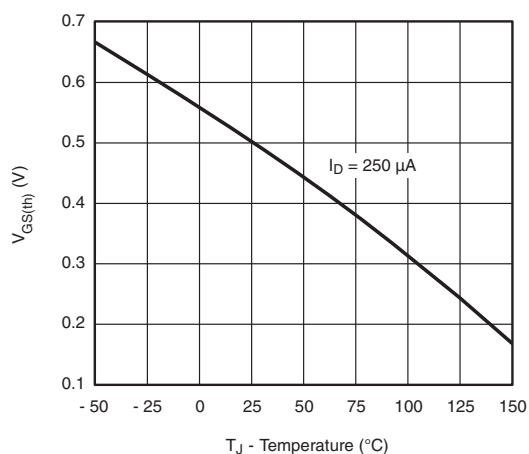
**Source-Drain Diode Forward Voltage**



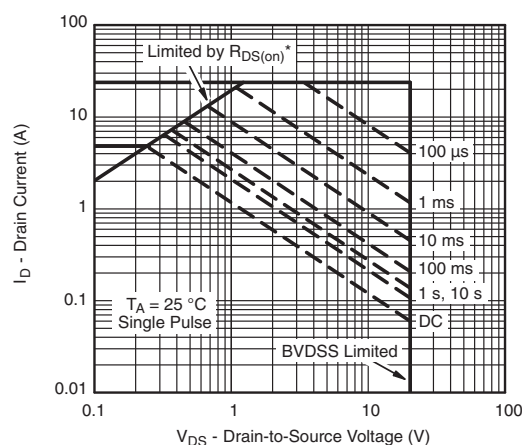
**On-Resistance vs. Gate-to-Source Voltage**



**Single Pulse Power, Junction-to-Ambient**



**Threshold Voltage**

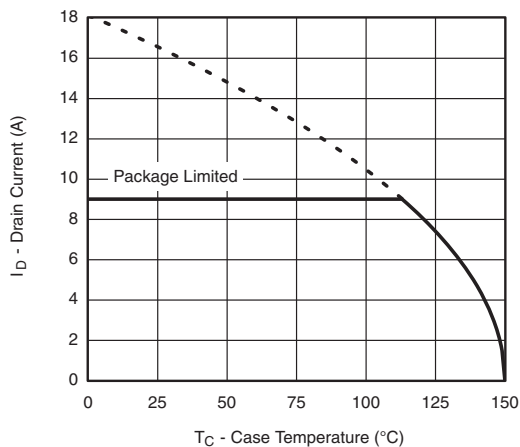


\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

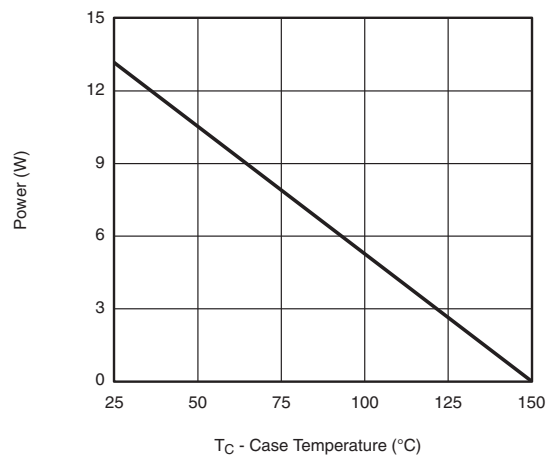
**Safe Operating Area, Junction-to-Ambient**



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



**Current Derating <sup>a</sup>**



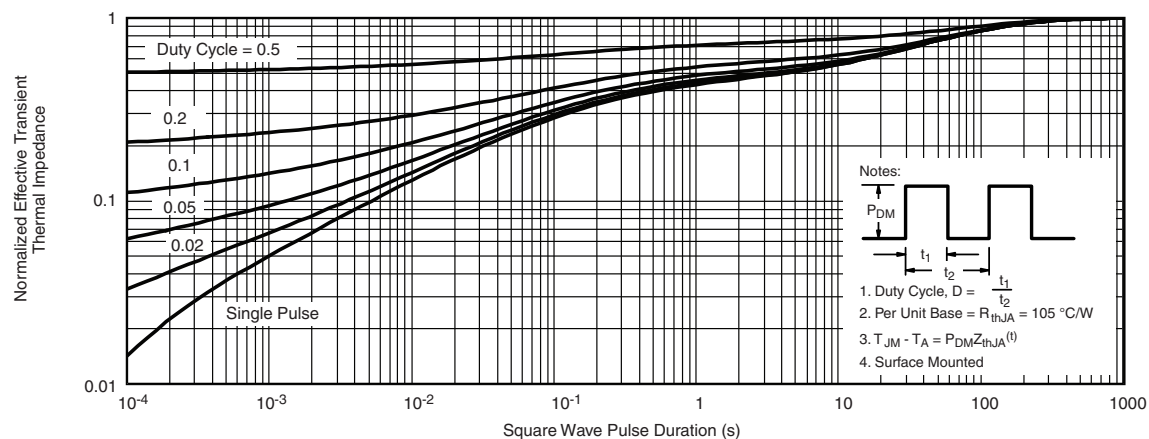
**Power Derating**

**Note**

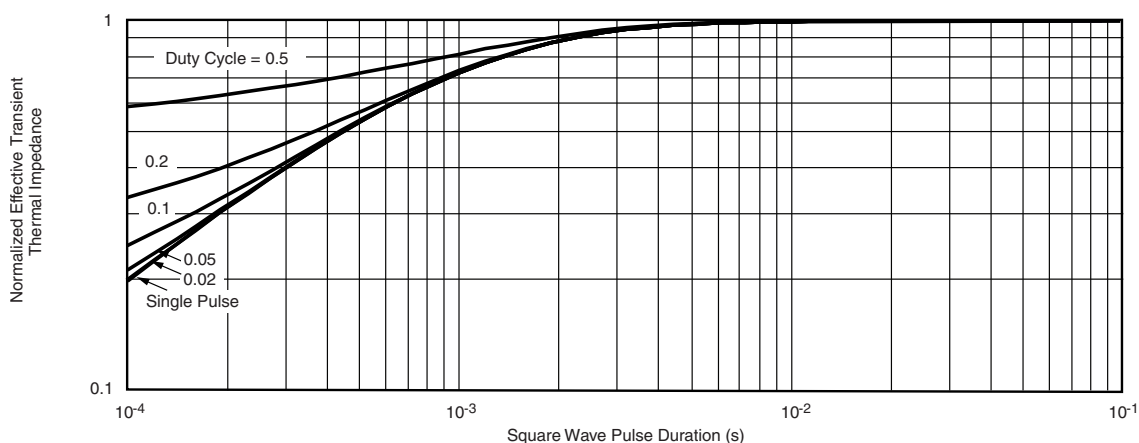
- a. The power dissipation  $P_D$  is based on  $T_J \text{ max.} = 150\text{ }^{\circ}\text{C}$ , using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this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



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



**Normalized Thermal Transient Impedance, Junction-to-Ambient**

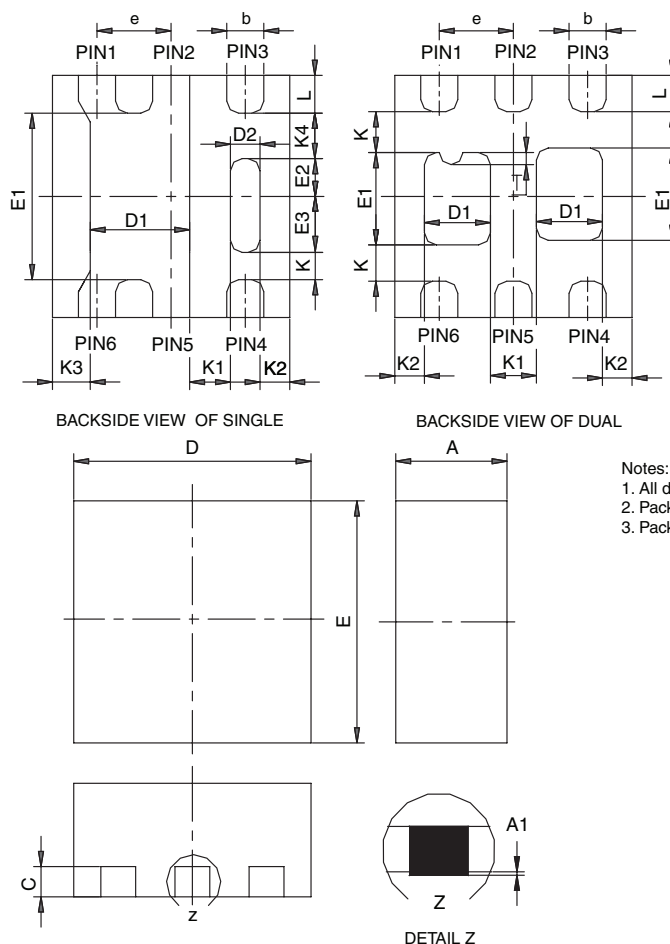


**Normalized Thermal Transient Impedance, Junction-to-Case**

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?65297](http://www.vishay.com/ppg?65297).



### PowerPAK® SC75-6L



- 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	0.18	0.25	0.33	0.007	0.010	0.013	0.18	0.25	0.33	0.007	0.010	0.013
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	1.53	1.60	1.70	0.060	0.063	0.067	1.53	1.60	1.70	0.060	0.063	0.067
D1	0.57	0.67	0.77	0.022	0.026	0.030	0.34	0.44	0.54	0.013	0.017	0.021
D2	0.10	0.20	0.30	0.004	0.008	0.012						
E	1.53	1.60	1.70	0.060	0.063	0.067	1.53	1.60	1.70	0.060	0.063	0.067
E1	1.00	1.10	1.20	0.039	0.043	0.047	0.51	0.61	0.71	0.020	0.024	0.028
E2	0.20	0.25	0.30	0.008	0.010	0.012						
E3	0.32	0.37	0.42	0.013	0.015	0.017						
e	0.50 BSC			0.020 BSC			0.50 BSC			0.020 BSC		
K	0.180 TYP			0.007 TYP			0.245 TYP			0.010 TYP		
K1	0.275 TYP			0.011 TYP			0.320 TYP			0.013 TYP		
K2	0.200 TYP			0.008 TYP			0.200 BSC			0.008 TYP		
K3	0.255 TYP			0.010 TYP								
K4	0.300 TYP			0.012 TYP								
L	0.15	0.25	0.35	0.006	0.010	0.014	0.15	0.25	0.35	0.006	0.010	0.014
T							0.03	0.08	0.13	0.001	0.003	0.005

ECN: C-07431 – Rev. C, 06-Aug-07  
DWG: 5935

Technical drawing of a mechanical part, showing dimensions in inches (in) and millimeters (mm) in parentheses. The drawing includes a central rectangular feature with a circular hole, and several smaller rectangular features (possibly holes or slots) on the top and bottom surfaces. The overall dimensions are 2.000 (0.079) in width and 2.000 (0.079) in height. The central hole has a diameter of 0.250 (0.01) in. The top and bottom surfaces have a thickness of 0.300 (0.012) in. The central rectangular feature has a width of 0.400 (0.016) in and a height of 0.370 (0.015) in. The overall width of the part is 2.000 (0.079) in, and the overall height is 2.000 (0.079) in. The drawing also shows a 1.700 (0.067) in dimension on the left side, a 1.100 (0.043) in dimension on the left side, and a 0.670 (0.026) in dimension on the bottom left. A large number '1' is present in the bottom left corner.

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