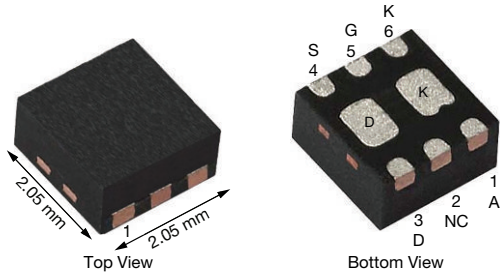


## P-Channel 20 V (D-S) MOSFET with Schottky Diode

PowerPAK® SC-70-6L Dual with Schottky Diode



Marking code: HD

PRODUCT SUMMARY	
<b>MOSFET</b>	
$V_{DS}$ (V)	-20
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -4.5$ V	0.116
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -2.5$ V	0.155
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = -1.8$ V	0.205
$Q_g$ typ. (nC)	4.9
$I_D$ (A) <sup>a</sup>	-4.5
<b>SCHOTTKY</b>	
$V_{KA}$ (V)	20
$V_F$ (V) at 1 A	0.45
$I_F$ (A) <sup>a</sup>	2
Configuration	Dual plus integrated Schottky

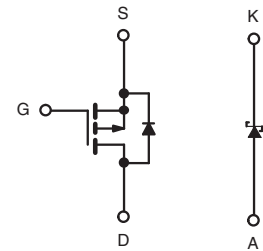
### FEATURES

- LITTLE FOOT® plus Schottky power MOSFET
- New thermally enhanced PowerPAK® SC-70 package
  - Small footprint area
  - Low on-resistance
  - Thin 0.75 mm profile
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


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

### APPLICATIONS

- Cellular charger switch
- Asynchronous DC/DC for portable devices
- Load switch for portable devices



P-Channel MOSFET

### ORDERING INFORMATION

Package	PowerPAK SC-70
Lead (Pb)-free and halogen-free	SiA811ADJ-T1-GE3

### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-source voltage (MOSFET)	$V_{DS}$	-20	V	
Reverse voltage (Schottky)	$V_{KA}$	20		
Gate-source voltage (MOSFET)	$V_{GS}$	$\pm 8$		
Continuous drain current ( $T_J = 150$ °C) (MOSFET)	$I_D$	$T_C = 25$ °C	-4.5 <sup>a</sup>	
		$T_C = 70$ °C	-4.5 <sup>a</sup>	
		$T_A = 25$ °C	-3.2 <sup>b, c</sup>	
		$T_A = 70$ °C	-2.6 <sup>b, c</sup>	
Pulsed drain current (MOSFET)	$I_{DM}$	-8	A	
Continuous source-drain diode current (MOSFET diode conduction)	$I_S$	$T_C = 25$ °C		-4.5 <sup>a</sup>
		$T_A = 25$ °C		-1.5 <sup>b, c</sup>
Average forward current (Schottky)	$I_F$	2 <sup>b</sup>	W	
Pulsed forward current (Schottky)	$I_{FM}$	5		
Maximum power dissipation (MOSFET)	$P_D$	$T_C = 25$ °C		6.5
		$T_C = 70$ °C	4.2	
		$T_A = 25$ °C	1.8 <sup>b, c</sup>	
		$T_A = 70$ °C	1.1 <sup>b, c</sup>	
Maximum power dissipation (Schottky)	$P_D$	$T_C = 25$ °C	6.8	
		$T_C = 70$ °C	4.3	
		$T_A = 25$ °C	1.6 <sup>b, c</sup>	
		$T_A = 70$ °C	1 <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 (MOSFET) <sup>b, f</sup>	$t \leq 5$ s	$R_{thJA}$	55	70	°C/W	
Maximum junction-to-case (drain) (MOSFET)	Steady state	$R_{thJC}$	15	19		
Maximum junction-to-ambient (Schottky) <sup>b, f</sup>	$t \leq 5$ s	$R_{thJA}$	62	76		
Maximum junction-to-case (drain) (Schottky)	Steady state	$R_{thJC}$	15	18.5		

**Notes**

- a. Package limited
- b. Surface mounted on 1" x 1" FR4 board
- c.  $t = 10$  s
- d. See solder profile ([www.vishay.com/ppg?73257](http://www.vishay.com/ppg?73257)). The PowerPAK SC-70 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
- f. Maximum under steady state conditions is 110 °C/W

SPECIFICATIONS ( $T_J = 25$ °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-source breakdown voltage	$V_{DS}$	$V_{GS} = 0$ V, $I_D = -250$ $\mu$ A	-20	-	-	V
$V_{DS}$ temperature coefficient	$\Delta V_{DS}/T_J$	$I_D = -250$ $\mu$ A	-	-19	-	mV/°C
$V_{GS(th)}$ temperature coefficient	$\Delta V_{GS(th)}/T_J$		-	2.4	-	
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = -250$ $\mu$ A	-0.4	-	-1	V
Gate-source leakage	$I_{GSS}$	$V_{DS} = 0$ V, $V_{GS} = \pm 8$ V	-	-	$\pm 100$	nA
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = -20$ V, $V_{GS} = 0$ V	-	-	-1	$\mu$ A
		$V_{DS} = -20$ V, $V_{GS} = 0$ V, $T_J = 55$ °C	-	-	-10	
On-state drain current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \leq 5$ V, $V_{GS} = -4.5$ V	-8	-	-	A
Drain-source on-state resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -4.5$ V, $I_D = -2.8$ A	-	0.096	0.116	$\Omega$
		$V_{GS} = -2.5$ V, $I_D = -2.3$ A	-	0.126	0.155	
		$V_{GS} = -1.8$ V, $I_D = -0.54$ A	-	0.165	0.205	
Forward transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -10$ V, $I_D = -2.8$ A	-	7	-	S
<b>Dynamic <sup>b</sup></b>						
Input capacitance	$C_{iss}$	$V_{DS} = -10$ V, $V_{GS} = 0$ V, $f = 1$ MHz	-	345	-	pF
Output capacitance	$C_{oss}$		-	65	-	
Reverse transfer capacitance	$C_{rss}$		-	50	-	
Total gate charge	$Q_g$	$V_{DS} = -10$ V, $V_{GS} = -8$ V, $I_D = -3.5$ A	-	8.4	13	nC
		$V_{DS} = -10$ V, $V_{GS} = -4.5$ V, $I_D = -3.5$ A	-	4.9	7.4	
Gate-source charge	$Q_{gs}$		-	0.75	-	
Gate-drain charge	$Q_{gd}$		-	1.2	-	
Gate resistance	$R_g$	$f = 1$ MHz	-	6	-	$\Omega$
Turn-on delay time	$t_{d(on)}$	$V_{DD} = -10$ V, $R_L = 2.85$ $\Omega$ $I_D \cong -3.5$ A, $V_{GEN} = -4.5$ V, $R_g = 1$ $\Omega$	-	15	25	ns
Rise time	$t_r$		-	45	70	
Turn-off delay time	$t_{d(off)}$		-	20	30	
Fall time	$t_f$		-	10	15	
Turn-on delay time	$t_{d(on)}$		-	5	10	
Rise time	$t_r$	$V_{DD} = -10$ V, $R_L = 2.85$ $\Omega$ $I_D \cong -3.5$ A, $V_{GEN} = -8$ V, $R_g = 1$ $\Omega$	-	10	15	
Turn-off delay time	$t_{d(off)}$	-	20	30		
Fall time	$t_f$	-	10	15		



SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Drain-Source Body Diode Characteristics</b>						
Continuous source-drain diode current	$I_S$	$T_C = 25\text{ }^\circ\text{C}$	-	-	-4.5	A
Pulse diode forward current	$I_{SM}$		-	-	-8	
Body diode voltage	$V_{SD}$	$I_S = -1\text{ A}, V_{GS} = 0\text{ V}$	-	-0.8	-1.2	V
Body diode reverse recovery time	$t_{rr}$	$I_F = -4.5\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$	-	30	60	ns
Body diode reverse recovery charge	$Q_{rr}$		-	20	40	nC
Reverse recovery fall time	$t_a$		-	15	-	ns
Reverse recovery rise time	$t_b$		-	15	-	

**Notes**

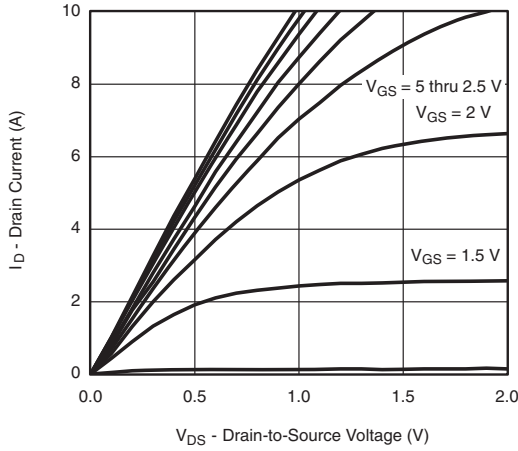
- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$   
b. Guaranteed by design, not subject to production testing

SCHOTTKY SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Forward voltage drop	$V_F$	$I_F = 1\text{ A}$	-	0.41	0.45	V
		$I_F = 1\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	0.36	0.41	
Maximum reverse leakage current	$I_{rm}$	$V_r = 5\text{ V}$	-	0.015	0.080	mA
		$V_r = 5\text{ V}, T_J = 85\text{ }^\circ\text{C}$	-	0.5	5	
		$V_r = 20\text{ V}$	-	0.02	0.10	
		$V_r = 20\text{ V}, T_J = 85\text{ }^\circ\text{C}$	-	0.7	7	
Junction capacitance	$C_T$	$V_r = 20\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	5	50	pF
		$V_r = 10\text{ V}$	-	60	-	

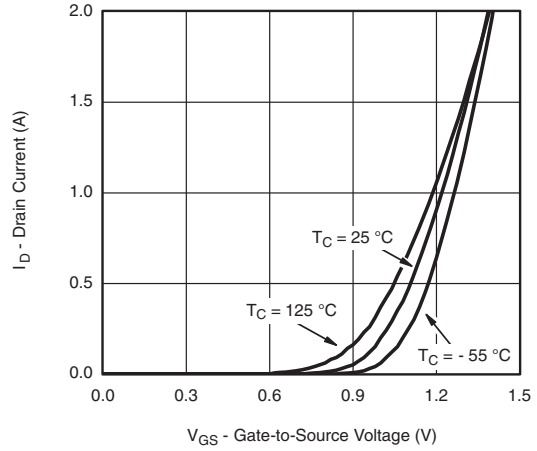
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



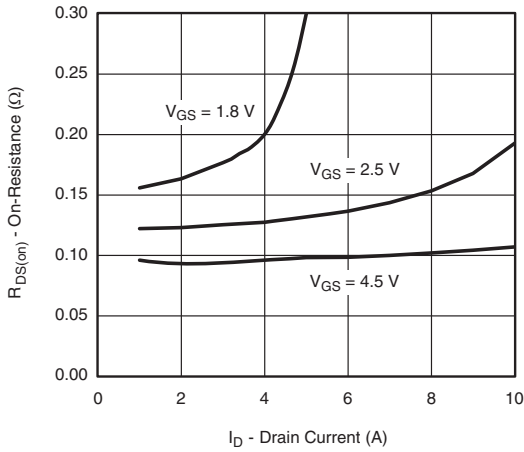
**MOSFET TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



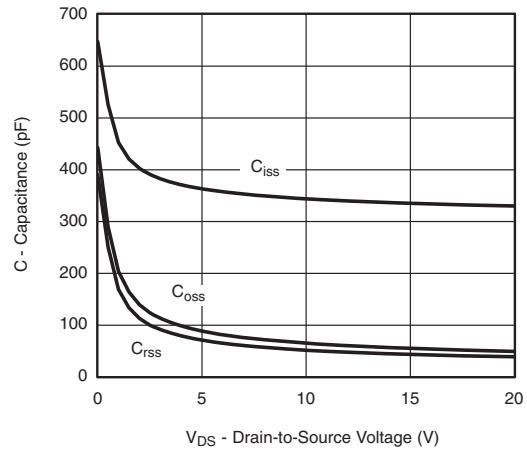
**Output Characteristics**



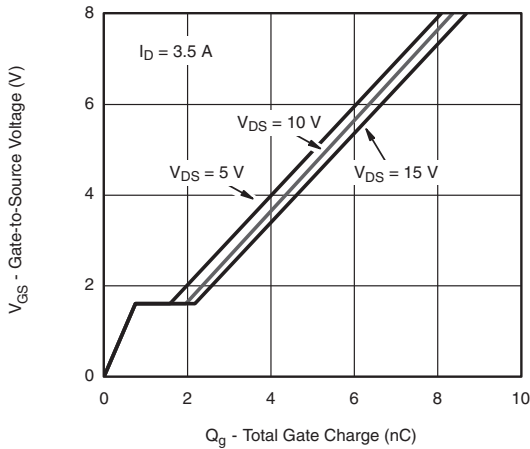
**Transfer Characteristics**



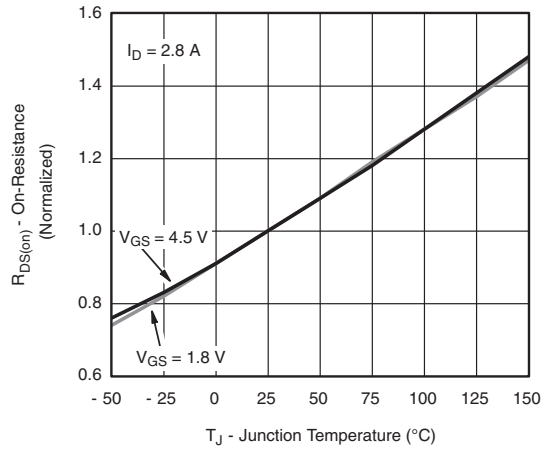
**On-Resistance vs. Drain Current and Gate Voltage**



**Capacitance**



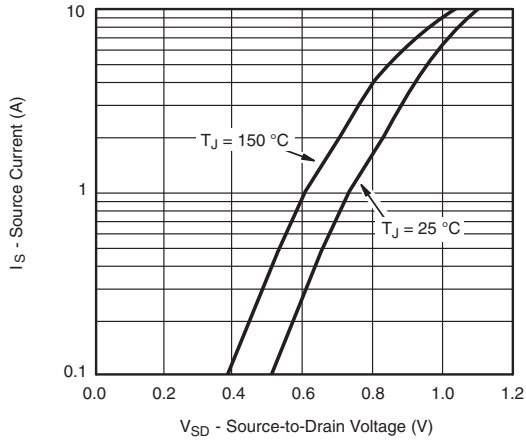
**Gate Charge**



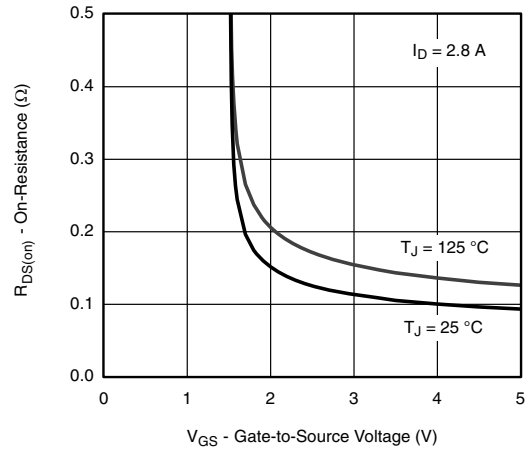
**On-Resistance vs. Junction Temperature**



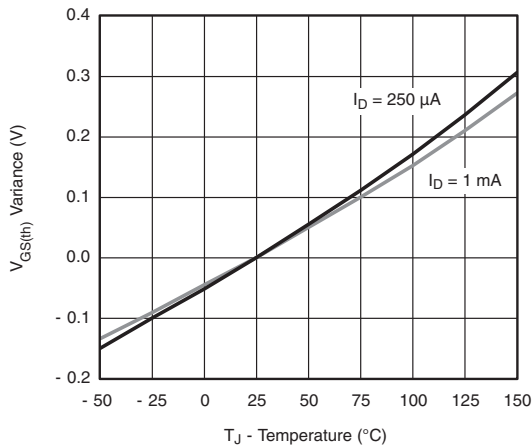
**MOSFET TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



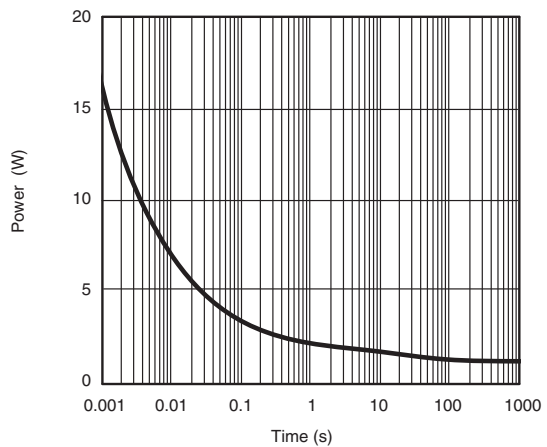
**Source-Drain Diode Forward Voltage**



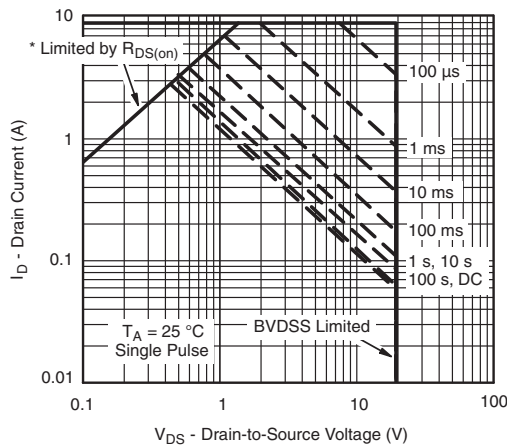
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**



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

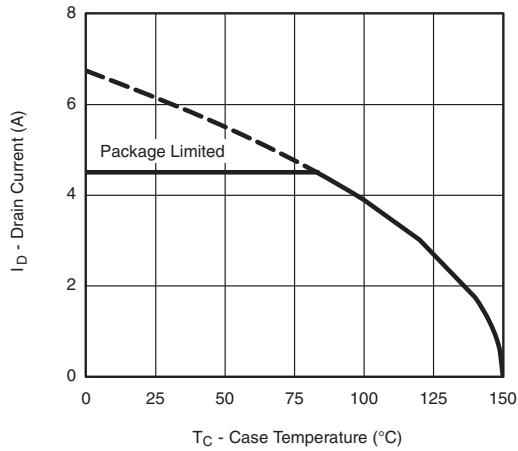


\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

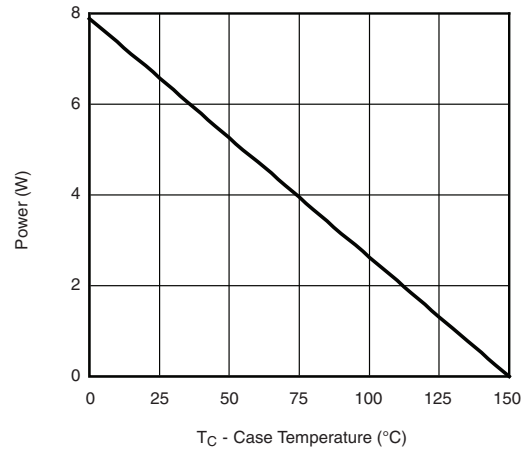
**Safe Operating Area, Junction-to-Case**



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



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



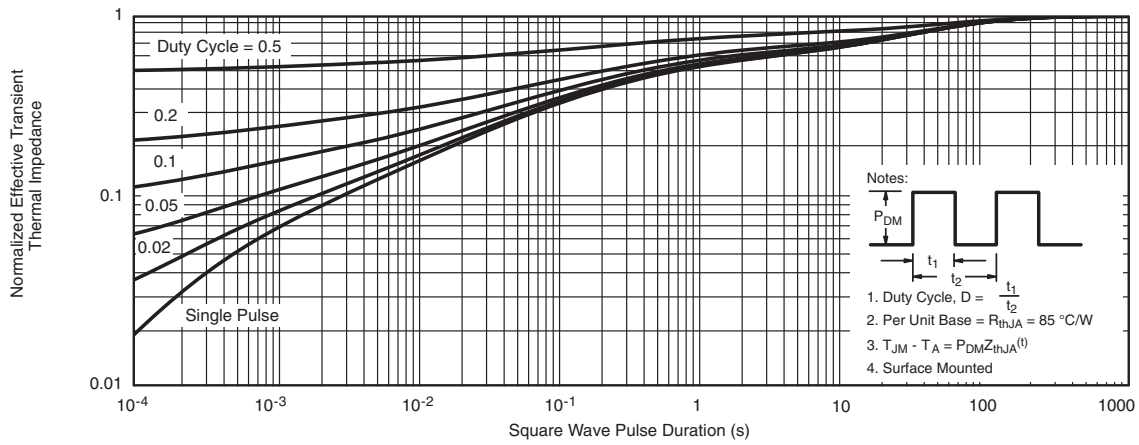
**Power Derating**

**Note**

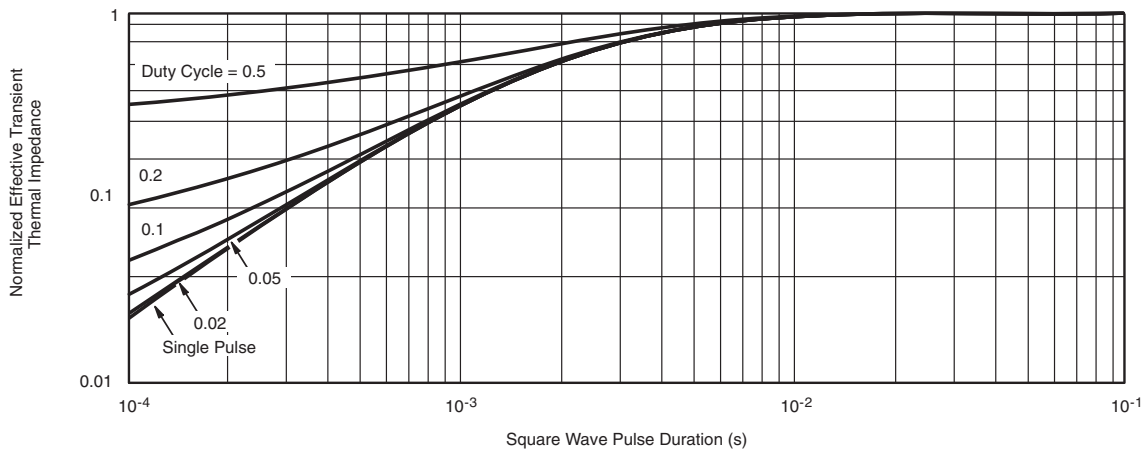
- a. The power dissipation  $P_D$  is based on  $T_J \text{ max.} = 150\text{ }^\circ\text{C}$ , using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this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



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



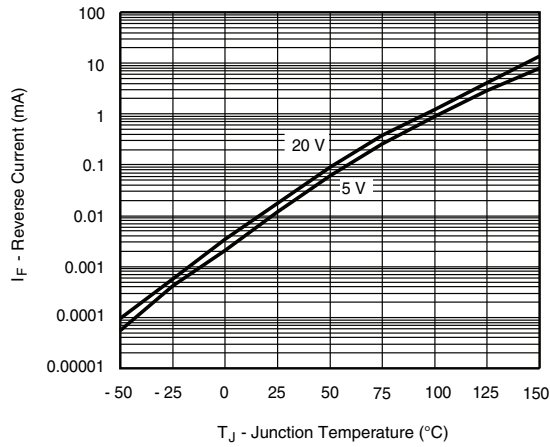
**Normalized Thermal Transient Impedance, Junction-to-Ambient**



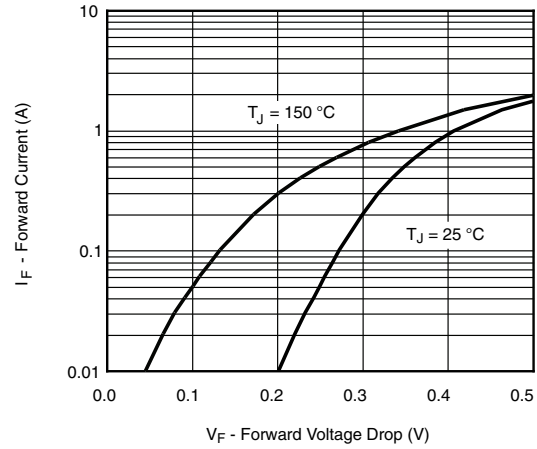
**Normalized Thermal Transient Impedance, Junction-to-Case**



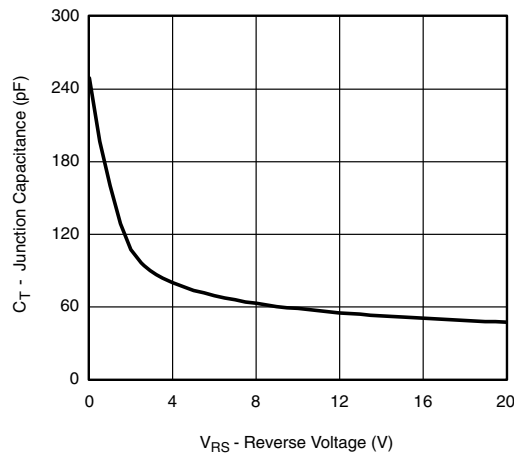
**SCHOTTKY TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



**Reverse Current vs. Junction Temperature**



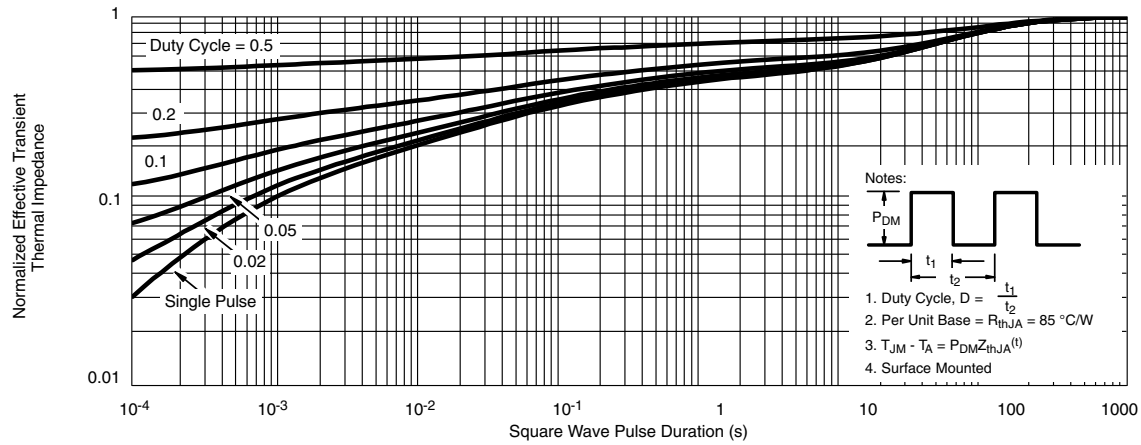
**Forward Voltage Drop**



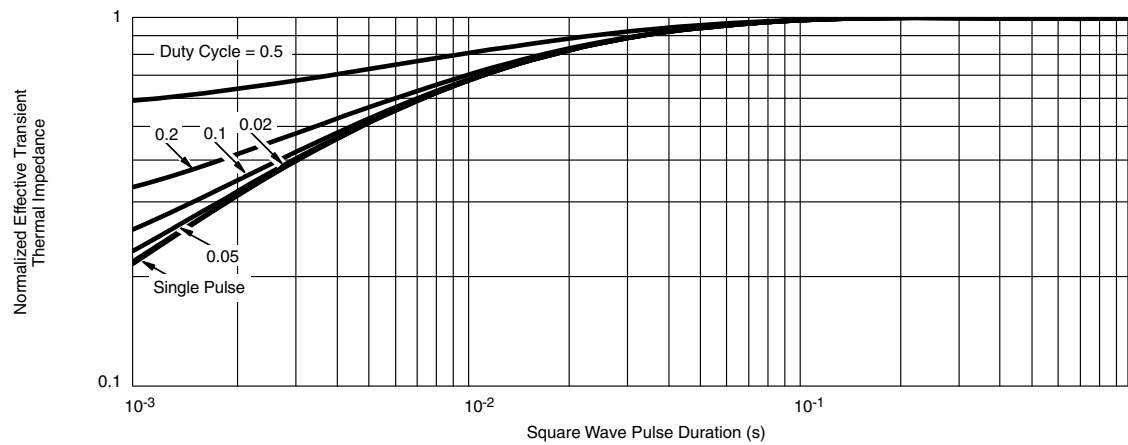
**Capacitance**



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



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

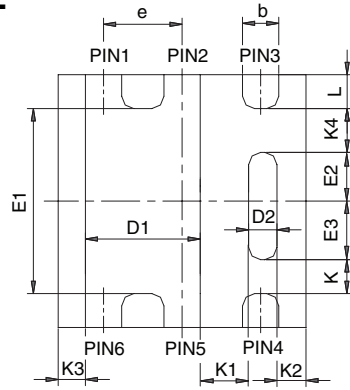


**Normalized Thermal Transient Impedance, Junction-to-Case**

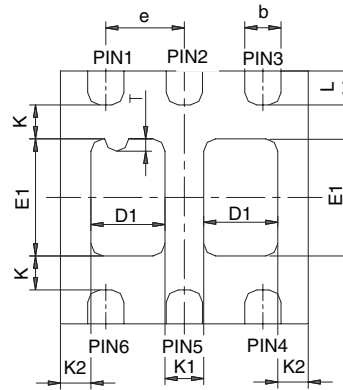
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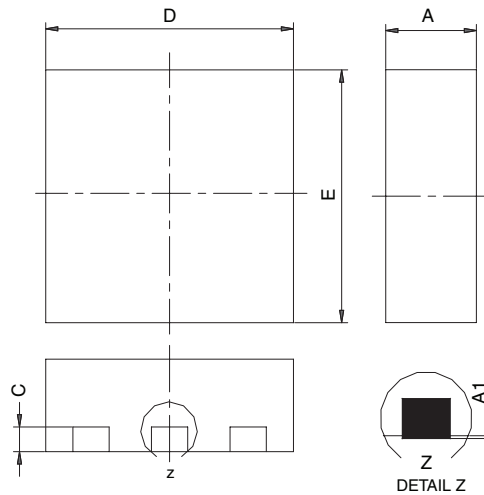
PowerPAK® SC70-6L



BACKSIDE VIEW OF SINGLE



BACKSIDE VIEW OF DUAL



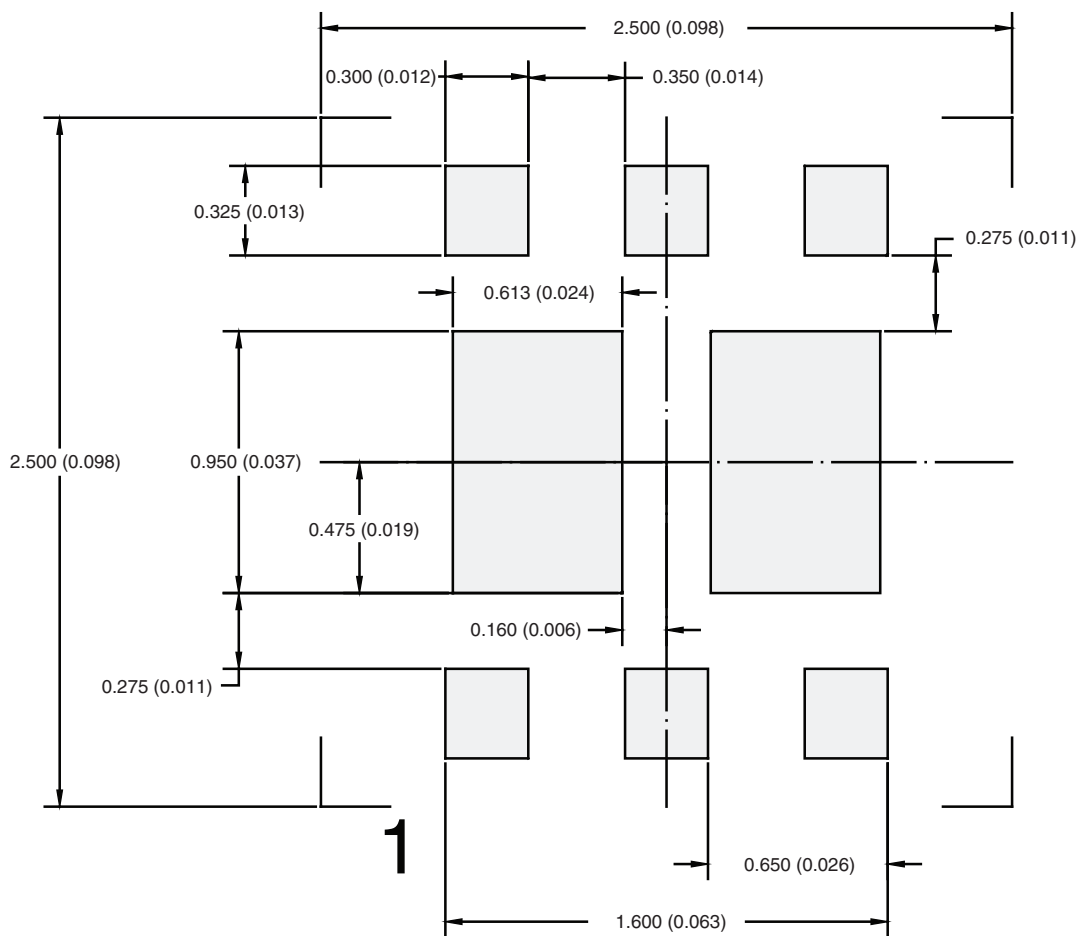
Notes:

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 Dual



Dimensions in mm (inches)

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APPLICATION NOTE



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