N- and P-Channel 20-V (D-S) MOSFET

PRODUCT SUMMARY

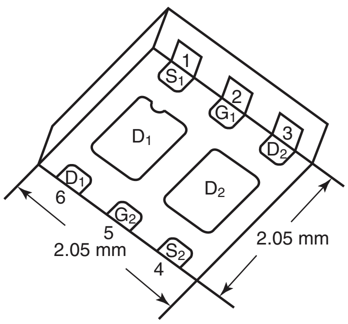
	V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)	Q_g (Typ.)
N-Channel	20	0.040 at V_{GS} = 4.5 V	4.5[a]	3.7 nC
		0.065 at V_{GS} = 2.5 V	4.5[a]	
P-Channel	- 20	0.090 at V_{GS} = - 4.5 V	- 4.5[a]	5.3 nC
		0.137 at V_{GS} = - 2.5 V	- 4.5[a]	

FEATURES

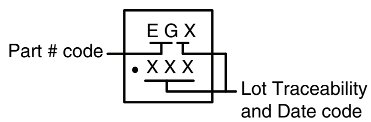
- TrenchFET® Power MOSFETs
- Typical ESD Protection: N-Channel 2000 V
  P-Channel 1000 V
- 100 % R_g Tested
- Material categorization:
  For definitions of compliance please see www.vishay.com/doc?99912

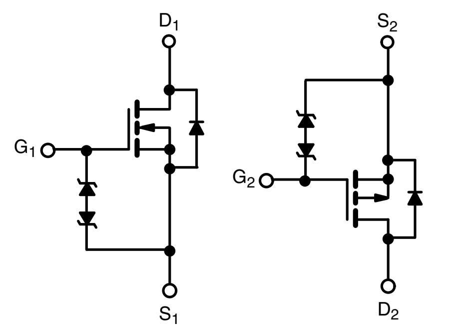
Pb-free
RoHS COMPLIANT
HALOGEN FREE

PowerPAK® SC-70-6 Dual



Marking Code





N-Channel MOSFET P-Channel MOSFET

Ordering Information: SiA533EDJ-T1-GE3 (Lead (Pb)-free and Halogen-free)

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

Parameter		Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage		V_{DS}	20	- 20	V
Gate-Source Voltage		V_{GS}	± 12		
Continuous Drain Current (T_J = 150 °C)	T_C = 25 °C	I_D	4.5[a]	- 4.5[a]	A
	T_C = 70 °C		4.5[a]	- 4.5[a]	
	T_A = 25 °C		4.5[a, b, c]	- 3.7[b, c]	
	T_A = 70 °C		4.4[b, c]	- 3[b, c]	
Pulsed Drain Current		I_{DM}	15	- 15	
Source Drain Current Diode Current	T_C = 25 °C	I_S	4.5[a]	- 4.5[a]	
	T_A = 25 °C		1.6[b, c]	- 1.6[b, c]	
Maximum Power Dissipation	T_C = 25 °C	P_D	7.8	7.8	W
	T_C = 70 °C		5	5	
	T_A = 25 °C		1.9[b, c]	1.9[b, c]	
	T_A = 70 °C		1.2[b, c]	1.2[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	N-Channel Typ.	N-Channel Max.	P-Channel Typ.	P-Channel Max.	Unit
Maximum Junction-to-Ambient[b, f]	t ≤ 5 s	R_{thJA}	52	65	52	65	°C/W
Maximum Junction-to-Case (Drain)	Steady State	R_{thJC}	12.5	16	12.5	16	

Notes:
a. Package limited.
b. Surface mounted on 1" x 1" FR4 board.
c. t = 5 s.
d. See solder profile (www.vishay.com/doc?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**
Static							
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA	N-Ch	20			V
		V_{GS} = 0 V, I_D = - 250 µA	P-Ch	- 20			
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	I_D = 250 µA	N-Ch		23		mV/°C
		I_D = - 250 µA	P-Ch		- 11		
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	I_D = 250 µA	N-Ch		- 3.3		
		I_D = - 250 µA	P-Ch		2.6		
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	N-Ch	0.6		1.4	V
		V_{DS} = V_{GS}, I_D = - 250 µA	P-Ch	- 0.5		- 1.3	
Gate-Body Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 4.5 V	N-Ch			± 0.5	µA
			P-Ch			± 0.5	
		V_{DS} = 0 V, V_{GS} = ± 12 V	N-Ch			± 90	
			P-Ch			± 8	
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 20 V, V_{GS} = 0 V	N-Ch			1	
		V_{DS} = - 20 V, V_{GS} = 0 V	P-Ch			- 1	
		V_{DS} = 20 V, V_{GS} = 0 V, T_J = 55 °C	N-Ch			10	
		V_{DS} = - 20 V, V_{GS} = 0 V, T_J = 55 °C	P-Ch			- 10	
On-State Drain Current[b]	$I_{D(on)}$	$V_{DS} \geq$ 5 V, V_{GS} = 4.5 V	N-Ch	10			A
		$V_{DS} \leq$ - 5 V, V_{GS} = - 4.5 V	P-Ch	- 10			
Drain-Source On-State Resistance[b]	$R_{DS(on)}$	V_{GS} = 4.5 V, I_D = 4.2 A	N-Ch		0.032	0.040	Ω
		V_{GS} = - 4.5 V, I_D = - 2.9 A	P-Ch		0.074	0.090	
		V_{GS} = 2.5 V, I_D = 3.3 A	N-Ch		0.053	0.065	
		V_{GS} = - 2.5 V, I_D = - 2.3 A	P-Ch		0.113	0.137	
Forward Transconductance[b]	g_{fs}	V_{DS} = 10 V, I_D = 4.2 A	N-Ch		12		S
		V_{DS} = - 10 V, I_D = - 2.9 A	P-Ch		7		
Dynamic[a]							
Input Capacitance	C_{iss}	N-Channel V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz P-Channel V_{DS} = - 10 V, V_{GS} = 0 V, f = 1 MHz	N-Ch		350		pF
			P-Ch		340		
Output Capacitance	C_{oss}		N-Ch		82		
			P-Ch		105		
Reverse Transfer Capacitance	C_{rss}		N-Ch		50		
			P-Ch		95		
Total Gate Charge	Q_g	V_{DS} = 10 V, V_{GS} = 10 V, I_D = 5.5 A	N-Ch		7.7	12	nC
		V_{DS} = - 10 V, V_{GS} = - 10 V, I_D = - 3.7 A	P-Ch		10.5	16	
		N-Channel V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 5.5 A P-Channel V_{DS} = - 10 V, V_{GS} = - 4.5 V, I_D = - 3.7 A	N-Ch		3.7	6	
			P-Ch		5.3	8	
Gate-Source Charge	Q_{gs}		N-Ch		0.85		
			P-Ch		0.75		
Gate-Drain Charge	Q_{gd}		N-Ch		0.95		
			P-Ch		2		
Gate Resistance	R_g	f = 1 MHz	N-Ch	0.7	3.5	7	Ω
			P-Ch	0.2	10	20	

Notes:
a. Guaranteed by design, not subject to production testing.
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.

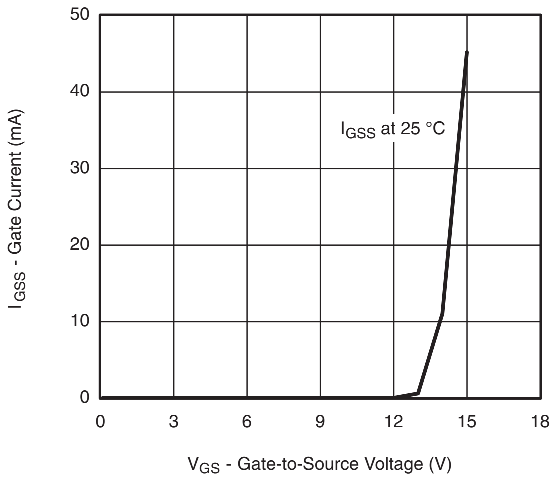
SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)

Parameter	Symbol	Test Conditions		Min.	Typ.	Max.	Unit
Dynamic[a]							
Turn-On Delay Time	$t_{d(on)}$	N-Channel V_{DD} = 10 V, R_L = 2.3 Ω $I_D \cong$ 4.4 A, V_{GEN} = 4.5 V, R_g = 1 Ω; P-Channel V_{DD} = - 10 V, R_L = 3.3 Ω $I_D \cong$ - 3 A, V_{GEN} = - 4.5 V, R_g = 1 Ω	N-Ch		10	15	ns
			P-Ch		20	30	
Rise Time	t_r		N-Ch		12	20	
			P-Ch		20	30	
Turn-Off Delay Time	$t_{d(off)}$		N-Ch		21	35	
			P-Ch		25	40	
Fall Time	t_f		N-Ch		16	25	
			P-Ch		10	15	
Turn-On Delay Time	$t_{d(on)}$	N-Channel V_{DD} = 10 V, R_L = 2.3 Ω $I_D \cong$ 4.4 A, V_{GEN} = 10 V, R_g = 1 Ω; P-Channel V_{DD} = - 10 V, R_L = 3.3 Ω $I_D \cong$ - 3 A, V_{GEN} = - 10 V, R_g = 1 Ω	N-Ch		5	10	
			P-Ch		5	10	
Rise Time	t_r		N-Ch		10	15	
			P-Ch		10	15	
Turn-Off Delay Time	$t_{d(off)}$		N-Ch		15	25	
			P-Ch		20	30	
Fall Time	t_f		N-Ch		10	15	
			P-Ch		10	15	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	T_C = 25 °C	N-Ch			4.5	A
			P-Ch			- 4.5	
Pulse Diode Forward Current[a]	I_{SM}		N-Ch			15	
			P-Ch			- 15	
Body Diode Voltage	V_{SD}	I_S = 4.4 A, V_{GS} = 0 V	N-Ch		0.8	1.2	V
		I_S = - 3 A, V_{GS} = 0 V	P-Ch		- 0.8	- 1.2	
Body Diode Reverse Recovery Time	t_{rr}	N-Channel I_F = 4.4 A, dI/dt = 100 A/µs, T_J = 25 °C; P-Channel I_F = - 3 A, dI/dt = - 100 A/µs, T_J = 25 °C	N-Ch		15	30	ns
			P-Ch		26	50	
Body Diode Reverse Recovery Charge	Q_{rr}		N-Ch		8	20	nC
			P-Ch		13	25	
Reverse Recovery Fall Time	t_a		N-Ch		8		ns
			P-Ch		14		
Reverse Recovery Rise Time	t_b		N-Ch		7		
			P-Ch		12		

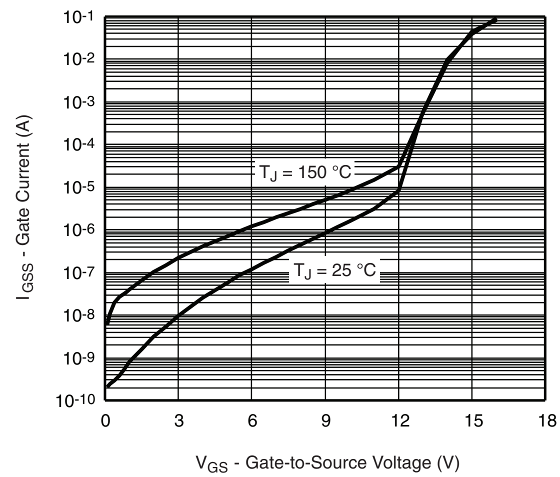
Notes:
a. Guaranteed by design, not subject to production testing.
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.

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.

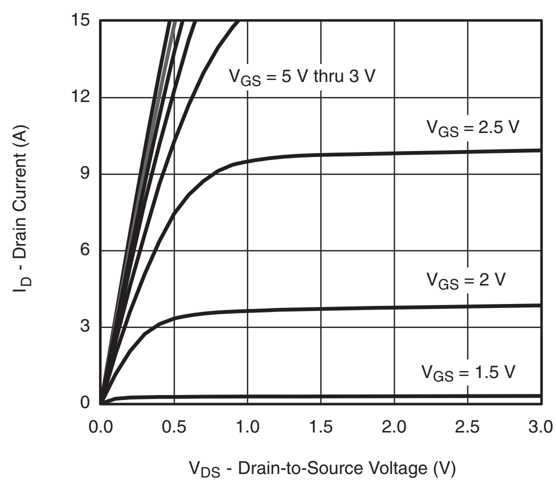
N-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



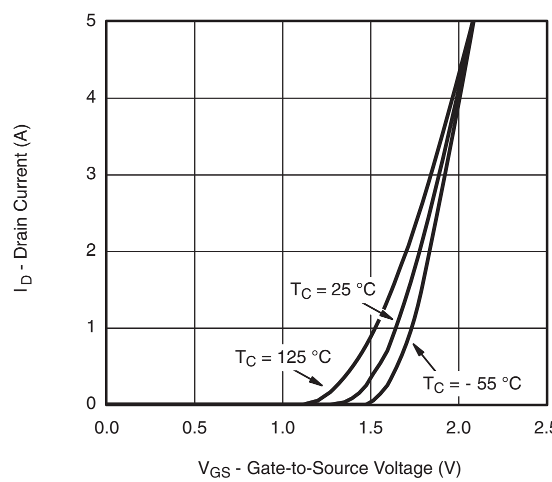
Gate Current vs. Gate-Source Voltage



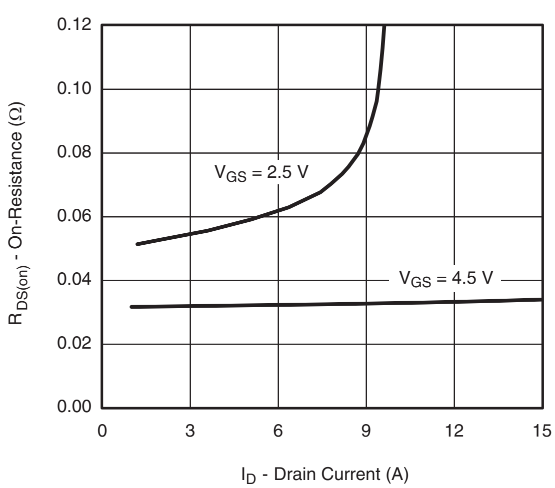
Gate Current vs. Gate-Source Voltage



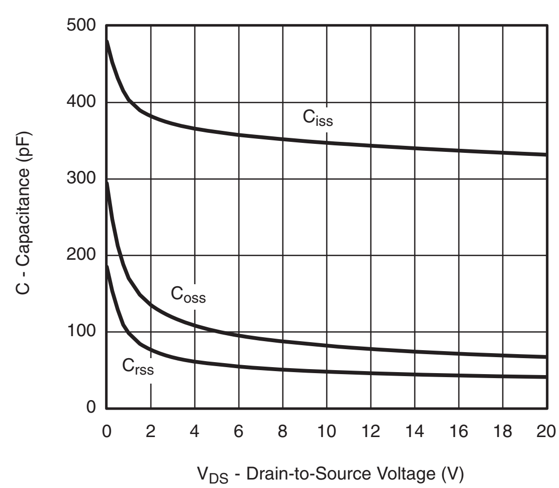
Output Characteristics



Transfer Characteristics

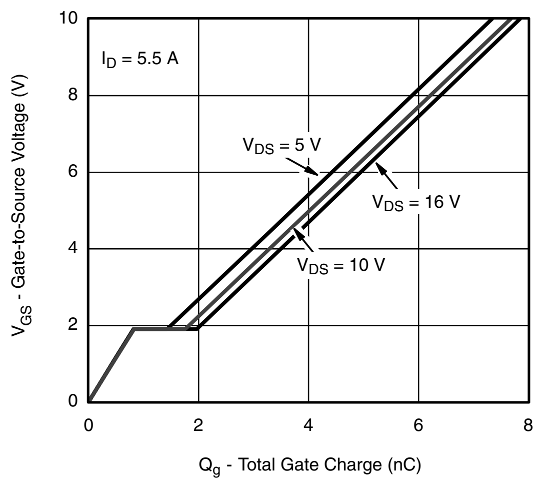


On-Resistance vs. Drain Current and Gate Voltage

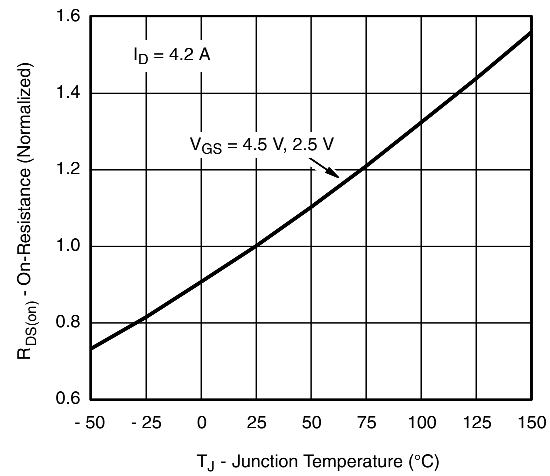


Capacitance

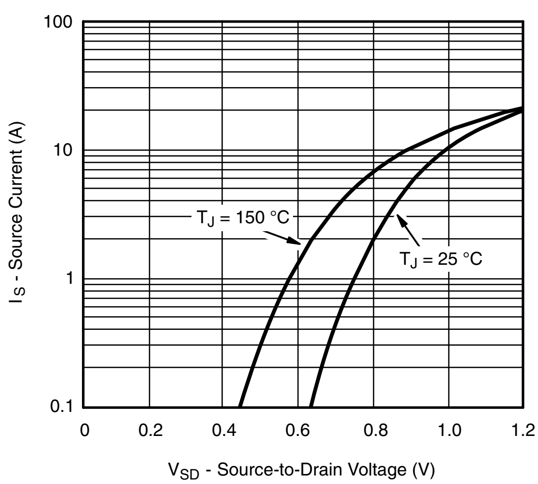
N-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



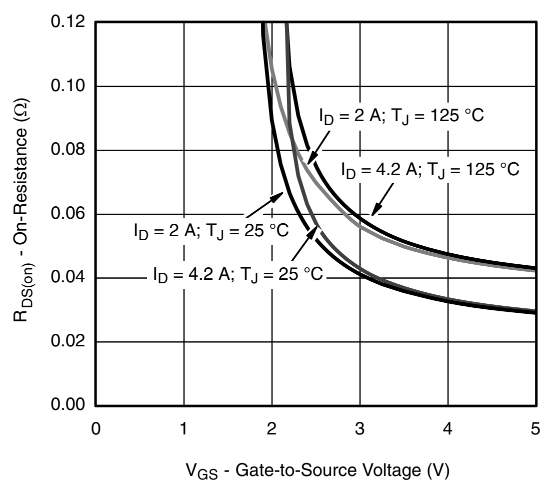
Gate Charge



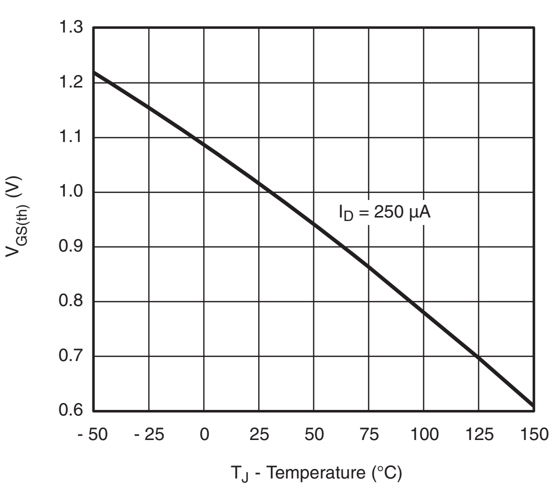
On-Resistance vs. Junction Temperature



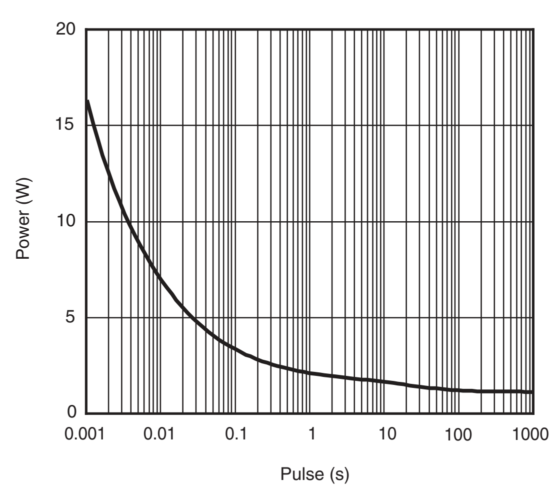
Source-Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage

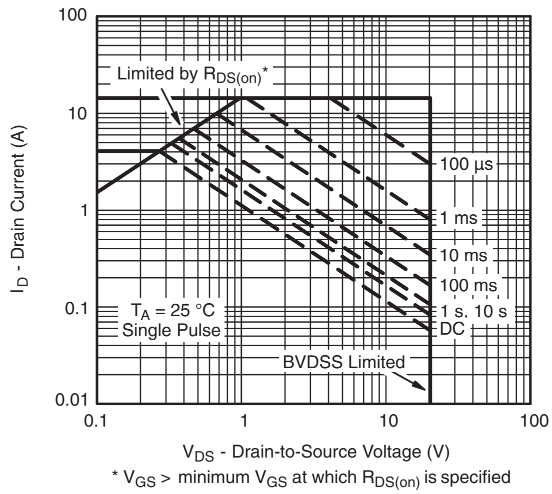


Threshold Voltage

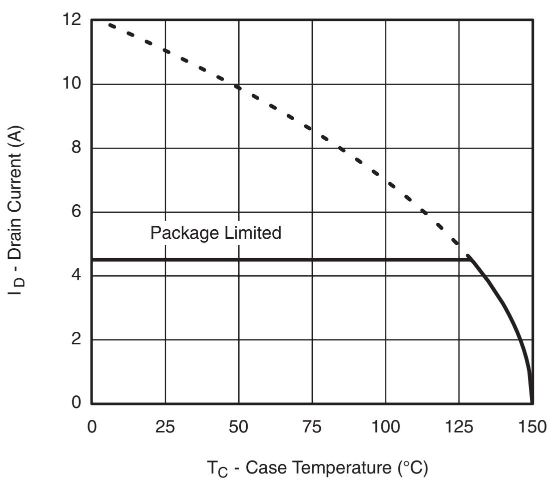


Single Pulse Power (Junction-to-Ambient)

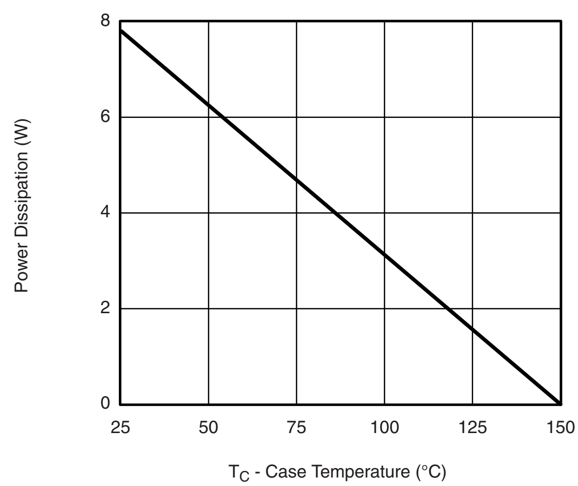
N-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Safe Operating Area, Junction-to-Ambient



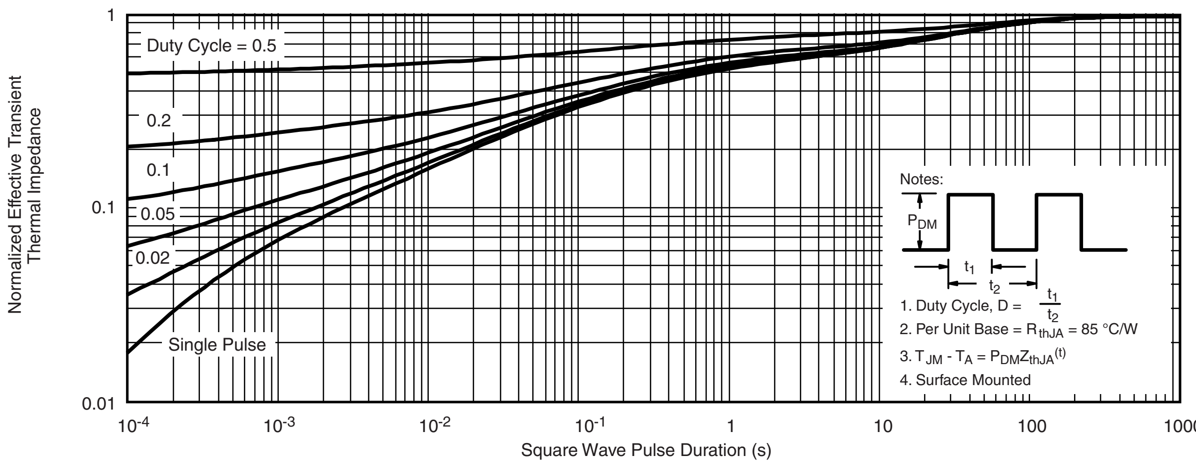
Current Derating*



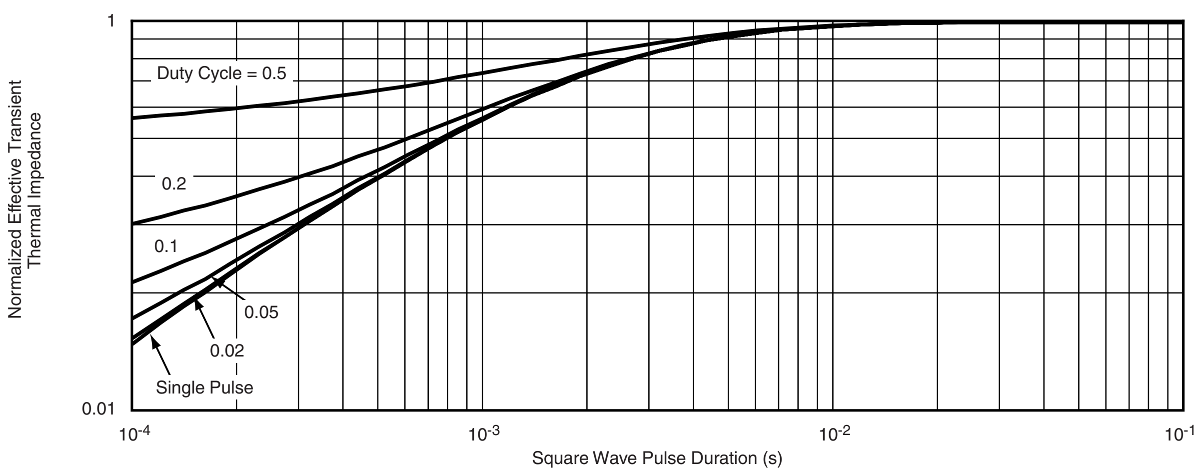
Power Derating

* 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.

N-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

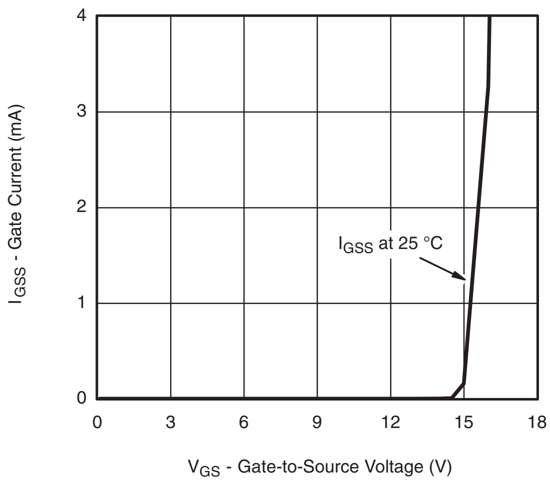


Normalized Thermal Transient Impedance, Junction-to-Ambient

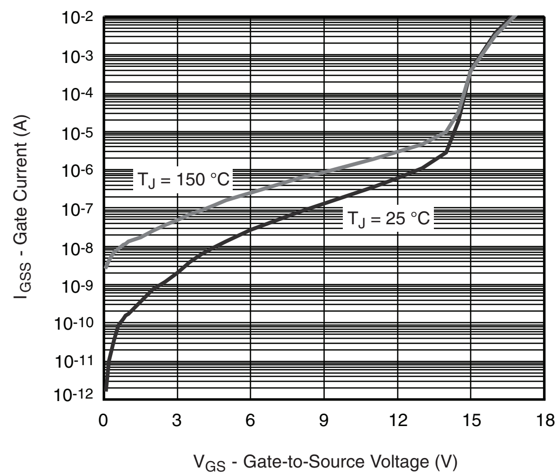


Normalized Thermal Transient Impedance, Junction-to-Case

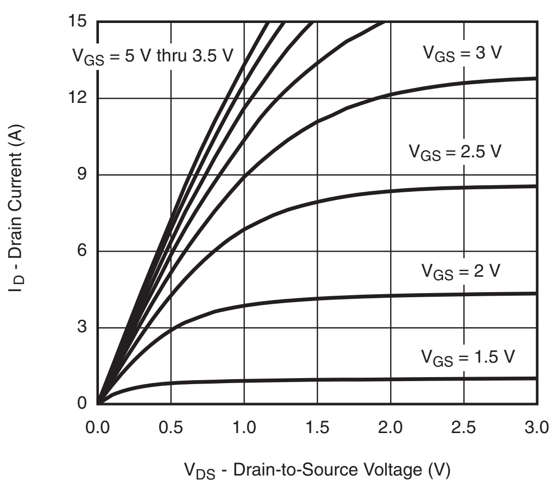
P-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



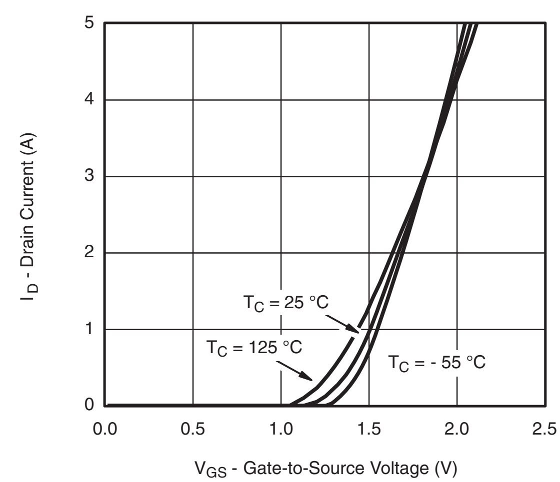
Gate Current vs. Gate-Source Voltage



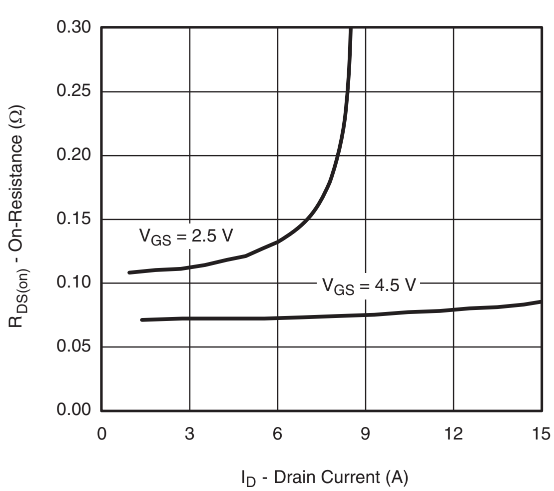
Gate Current vs. Gate-Source Voltage



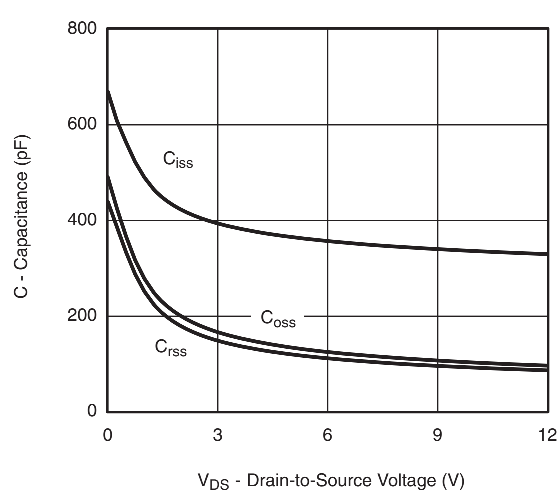
Output Characteristics



Transfer Characteristics

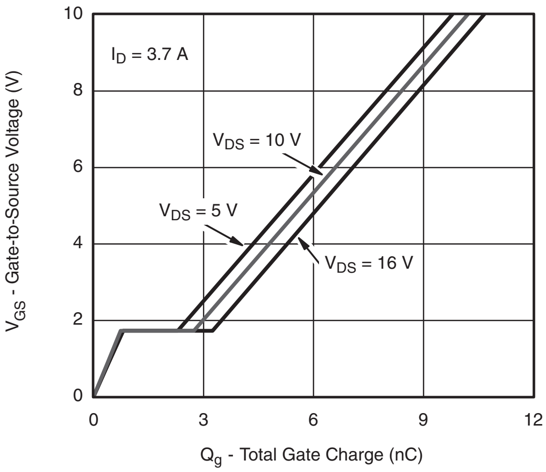


On-Resistance vs. Drain Current and Gate Voltage

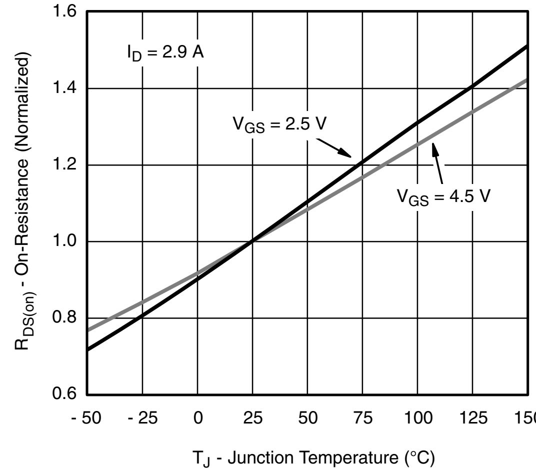


Capacitance

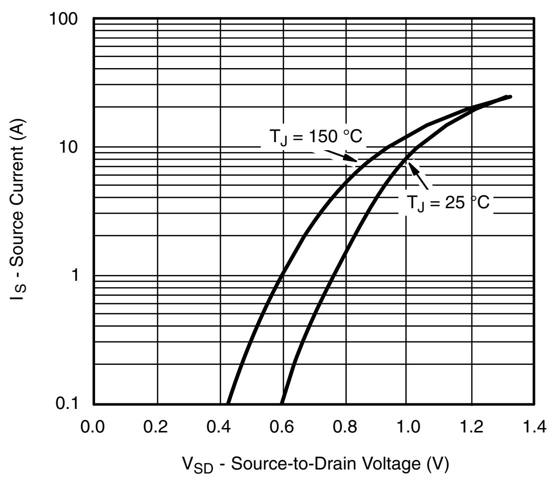
P-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



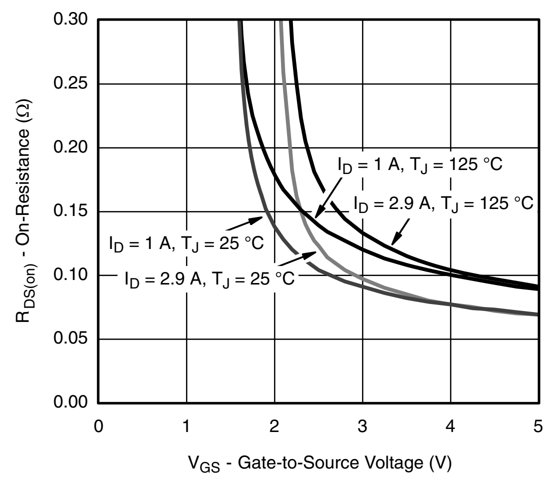
Gate Charge



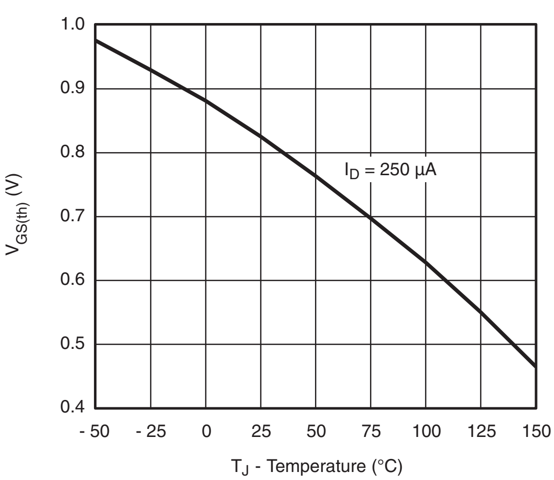
On-Resistance vs. Junction Temperature



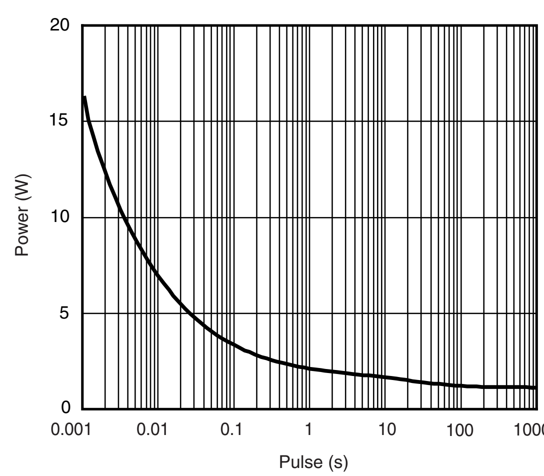
Source-Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage

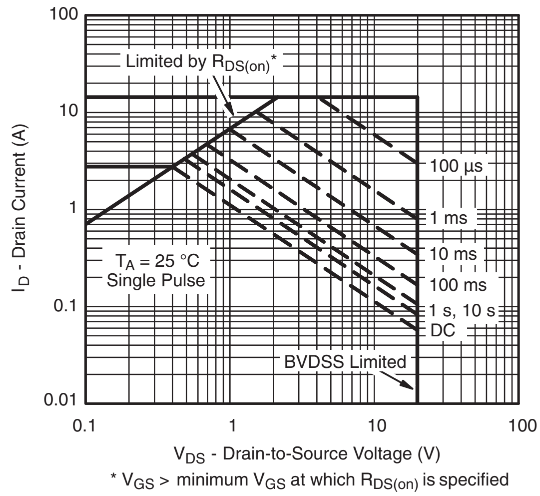


Threshold Voltage

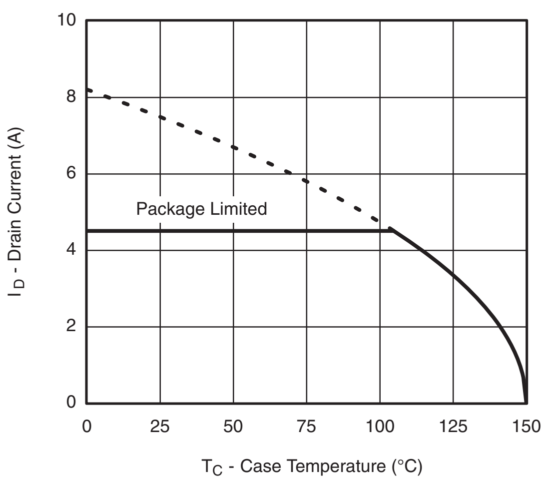


Single Pulse Power (Junction-to-Ambient)

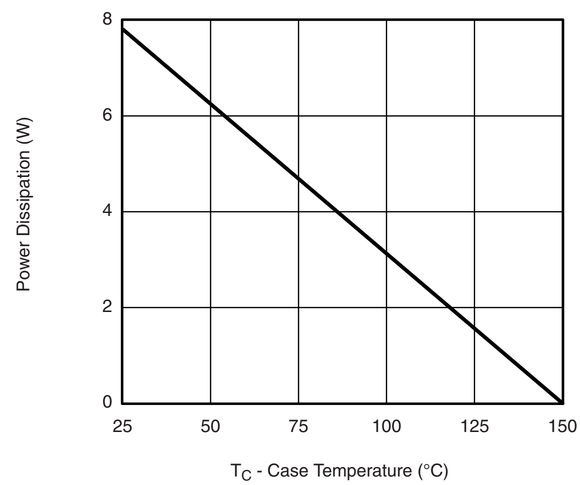
P-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Safe Operating Area, Junction-to-Ambient



Current Derating*



Power Derating

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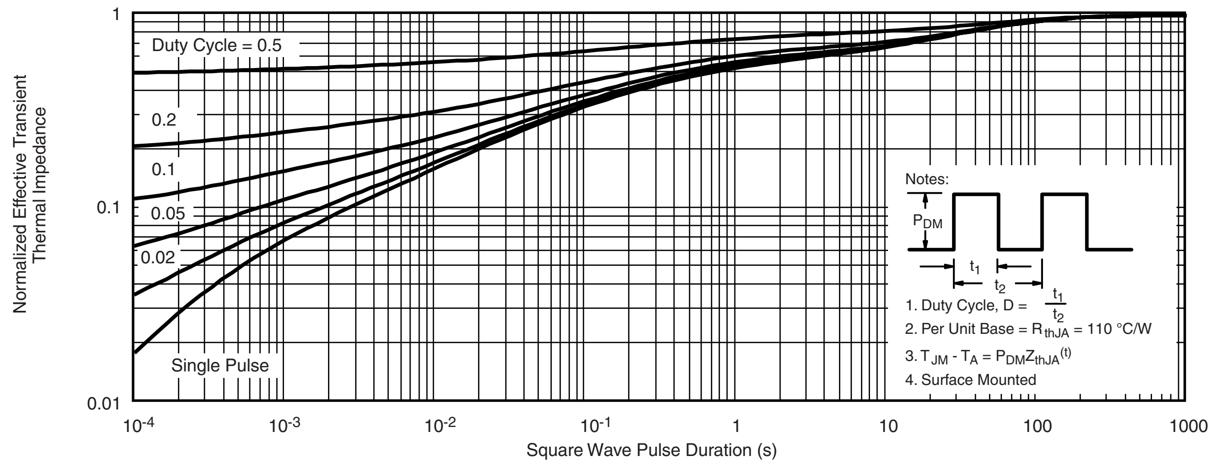
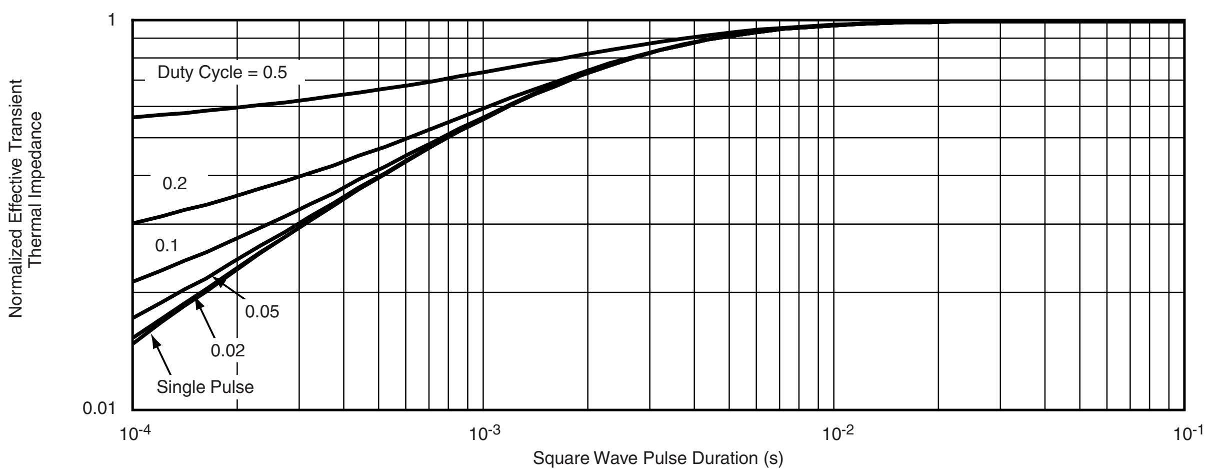
For technical questions, contact: pmostechsupport@vishay.com

P-CHANNEL TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



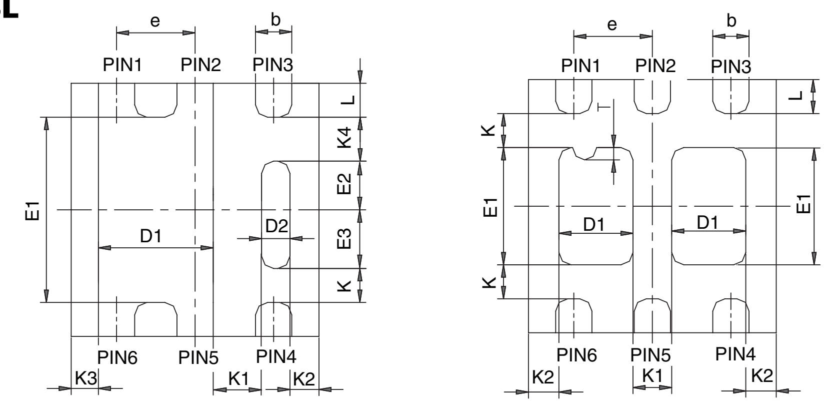
Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

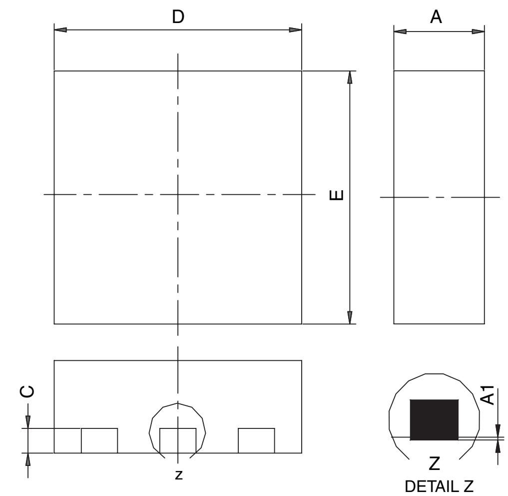
Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?65176.

PowerPAK® SC70-6L



BACKSIDE VIEW OF SINGLE

BACKSIDE VIEW OF DUAL

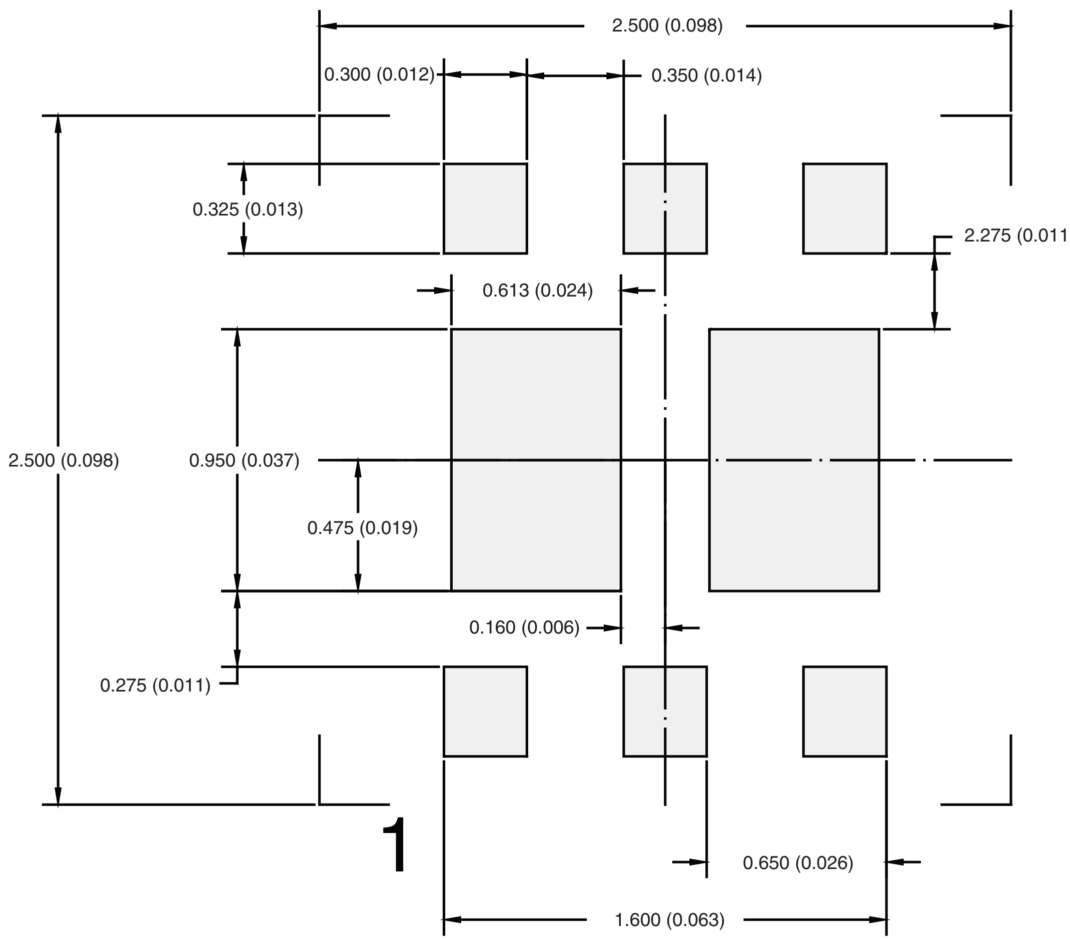


Notes:
1. All dimensions are in millimeters
2. Package outline exclusive of mold flash and metal burr
3. Package outline inclusive of plating

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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- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

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