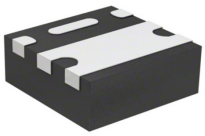
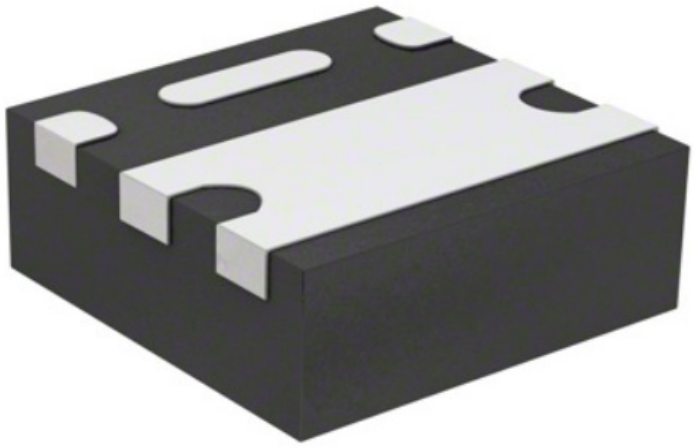
SIA416DJ Siliconix Discrete Semiconductor



VISHAY SIA416DJ Siliconix Discrete Semiconductor Owner's Manual

Contents

VISHAY SIA416DJ Siliconix Discrete Semiconductor



Specifications:

- Manufacturer: Vishay Siliconix
- Product Name: SiA416DJ
- Channel Type: N-Channel
- Maximum Drain-Source Voltage (VDS): 100V
- Maximum On-State Resistance (RDS(on)): 0.083 ohms at VGS = 10V, 0.130 ohms at VGS = 4.5V
- Continuous Drain Current (ID): 11.3A
- Total Gate Charge (Qg): 3.5nC
- Package Type: PowerPAK SC-70-6L-Single
- Lead-free and Halogen-free

Product Usage Instructions

Features and Parameters:

- Maximum Drain-Source Voltage (VDS): 100V
- Continuous Drain Current (ID): 11.3A
- Total Gate Charge (Qg): 3.5nC
- Maximum Power Dissipation: 12W
- Operating Temperature Range: -55°C to 150°C
- Soldering Peak Temperature: 260°C

Static Parameters:

- Drain-Source Breakdown Voltage: 100V
- Gate-Source Threshold Voltage: 3V
- Zero Gate Voltage Drain Current: 10nA
- On-State Drain Current: 9A
- Drain-Source On-State Resistance: 0.083 ohms at VGS = 10V, 0.130 ohms at VGS = 4.5V

Dynamic Parameters:

- Total Gate Charge: 3.5nC

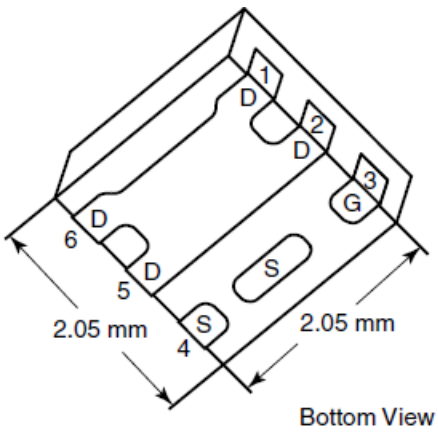
- Input Capacitance: 295pF
- Output Capacitance: 92pF
- Reverse Transfer Capacitance: 16pF
- Turn-On Delay Time: 25ns
- Rise Time: 50ns
- Turn-Off Delay Time: 100ns
- Fall Time: 200ns

Frequently Asked Questions (FAQ):

1. **Q: What is the maximum operating temperature range for the SiA416DJ MOSFET?**
   A: The MOSFET can operate within a temperature range of -55°C to 150°C.
2. **Q: Does the SiA416DJ MOSFET come with lead and halogen-free options?**
   A: Yes, the ordering information includes lead (Pb)-free and Halogen-free options.
3. **Q: What is the maximum drain-source voltage supported by the SiA416DJ MOSFET?**
   A: The MOSFET supports a maximum drain-source voltage of 100V.
4. **Q: What is the total gate charge for the SiA416DJ MOSFET?**
   A: The total gate charge is specified to be 3.5nC.

PRODUCT SUMMARY			
VDS (V)	**RDS(on) (W) Max.**	**ID (A)[a]**	**Qg (Typ.)**
100	0.083 at VGS = 10 V	11.3	3.5 nC
	0.130 at VGS = 4.5 V	9	

PowerPAK SC-70-6L-Single



Ordering Information:
SiA416DJ-T1-GE3 (Lead (Pb)-free and Halogen-free)

FEATURES

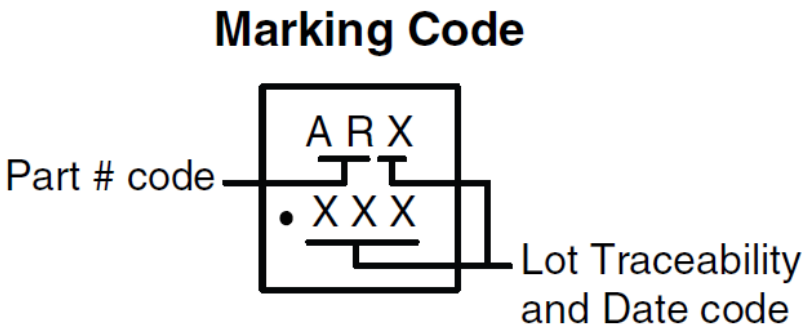
- TrenchFET® Power MOSFET
- 100 % Rg and UIS Tested

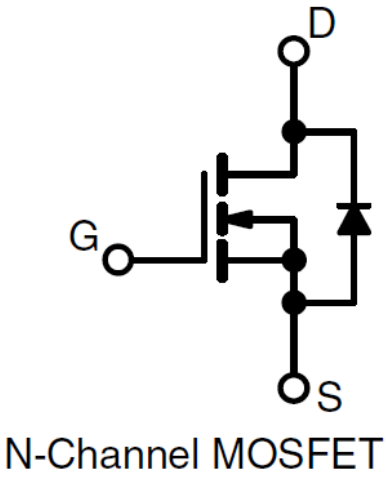
- **Material categorization:**

  For definitions of compliance please see www.vishay.com/doc?99912

APPLICATIONS

- DC/DC Converters
- Full-Bridge Converters
- For Power Bricks and POL Power





ABSOLUTE MAXIMUM RATINGS (TA = 25 °C, unless otherwise noted)				
Parameter		**Symbol**	**Limit**	**Unit**
Drain-Source Voltage		VDS	100	V
Gate-Source Voltage		VGS	± 20	
Continuous Drain Current (TJ = 150 °C)	TC = 25 °C	ID	11.3	A
	TC = 70 °C		9	
	TA = 25 °C		4.8b, c	
	TA = 70 °C		3.9b, c	
Pulsed Drain Current (t = 300 µs)		IDM	15	
Continuous Source-Drain Diode Current	TC = 25 °C	IS	12	
	TA = 25 °C		2.9b, c	
Single Pulse Avalanche Current	L = 0.1 mH	IAS	3	
Single Pulse Avalanche Energy		EAS	0.45	mJ
Maximum Power Dissipation	TC = 25 °C	PD	19	W
	TC = 70 °C		12	
	TA = 25 °C		3.5b, c	
	TA = 70 °C		2.2b, c	
Operating Junction and Storage Temperature Range		TJ, Tstg	– 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 £ 5 s	RthJA	28	36	°C/W
Maximum Junction-to-Case (Drain)	Steady State	RthJC	5.3	6.5	

Notes:

- Based on TC = 25 °C.
- Surface mounted on 1″ x 1″ FR4 board.
- t = 5 s.
- 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.
- Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.
- Maximum under steady state conditions is 80 °C/W.

SPECIFICATIONS (TJ = 25 °C, unless otherwise noted						
Parameter	**Symbol**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Static						
Drain-Source Breakdown Voltage	VDS	VGS = 0 V, ID = 250 µA	100			V
VDS Temperature Coefficient	DVDS/TJ	ID = 250 µA		54		mV/°C
VGS(th) Temperature Coefficient	DVGS(th)/TJ			– 4.4		
Gate-Source Threshold Voltage	VGS(th)	VDS = VGS, ID = 250 µA	1.6		3	V
Gate-Source Leakage	IGSS	VDS = 0 V, VGS = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	IDSS	VDS = 100 V, VGS = 0 V			1	µA
		VDS = 100 V, VGS = 0 V, TJ = 55 °C			10	
On-State Drain Current[a]	ID(on)	VDS ³ 5 V, VGS = 10 V	10			A
Drain-Source On-State Resistance[a]	RDS(on)	VGS = 10 V, ID = 3.2 A		0.068	0.083	W
		VGS = 4.5 V, ID = 2.6 A		0.092	0.130	
Forward Transconductance[a]	gfs	VDS = 10 V, ID = 3.2 A		8		S
Dynamic[b]						
Input Capacitance	Ciss	VDS = 50 V, VGS = 0 V, f = 1 MHz		295		pF
Output Capacitance	Coss			92		
Reverse Transfer Capacitance	Crss			16		
Total Gate Charge	Qg	VDS = 50 V, VGS = 10 V, ID = 4.8 A		6.5	10	nC
		VDS = 50 V, VGS = 4.5 V, ID = 4.8 A		3.5	5.3	
Gate-Source Charge	Qgs			1.2		
Gate-Drain Charge	Qgd			1.9		
Output Charge	Qoss	VDS = 50 V, VGS = 0 V		7.6		
Gate Resistance	Rg	f = 1 MHz	0.4	1.8	3.6	W
Turn-On Delay Time	td(on)	VDD = 50 V, RL = 12.8 W ID @ 3.9 A, VGEN = 10 V, Rg = 1 W		5	10	ns
Rise Time	tr			13	25	
Turn-Off Delay Time	td(off)			10	20	
Fall Time	tf			10	20	
Turn-On Delay Time	td(on)	VDD = 50 V, RL = 12.8 W ID @ 3.9 A, VGEN = 4.5 V, Rg		25	50	
Rise Time	tr			100	200	

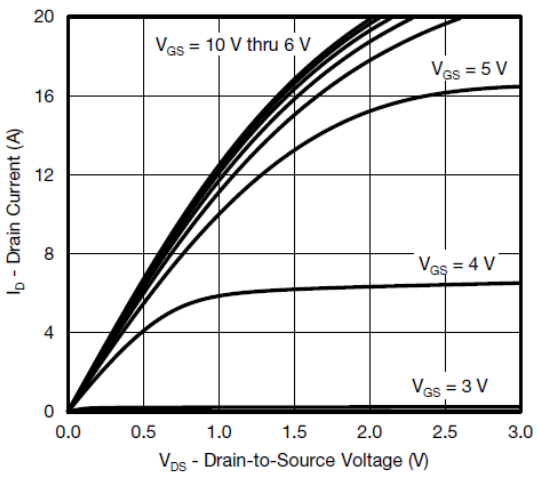
Turn-Off Delay Time	td(off)	= 1 W		15	30	
Fall Time	tf			25	50	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	IS	TC = 25 °C			12	A
Pulse Diode Forward Current[a]	ISM				15	
Body Diode Voltage	VSD	IS = 3.9 A		0.85	1.2	V
Body Diode Reverse Recovery Time	trr	IF = 3.9 A, dI/dt = 100 A/µs, TJ = 25 °C		30	60	ns
Body Diode Reverse Recovery Charge	Qrr			30	60	nC
Reverse Recovery Fall Time	ta			20		ns
Reverse Recovery Rise Time	tb			10		

Notes:

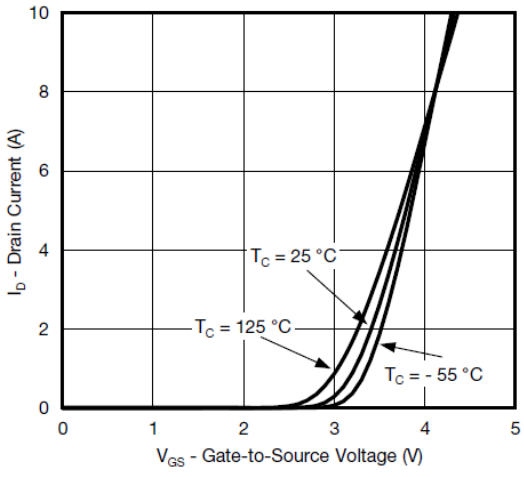
- Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
- Guaranteed by design, not subject to production testing.

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.

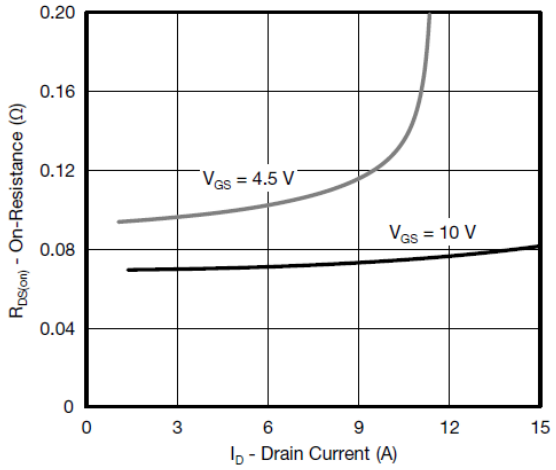
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



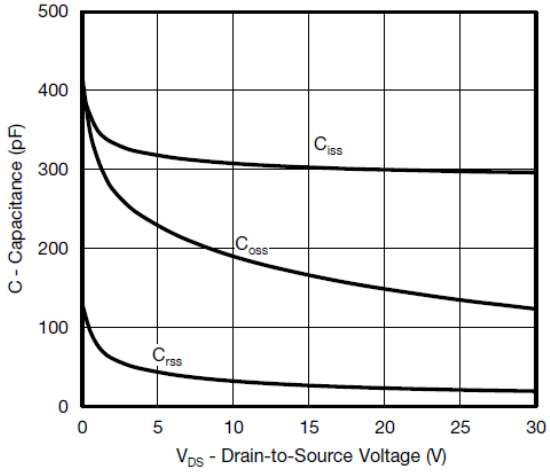
Output Characteristics



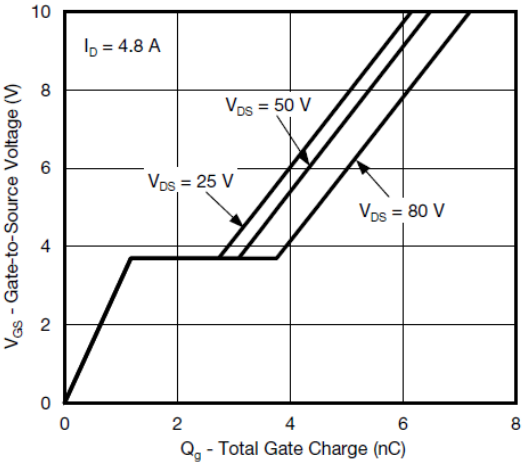
Transfer Characteristics



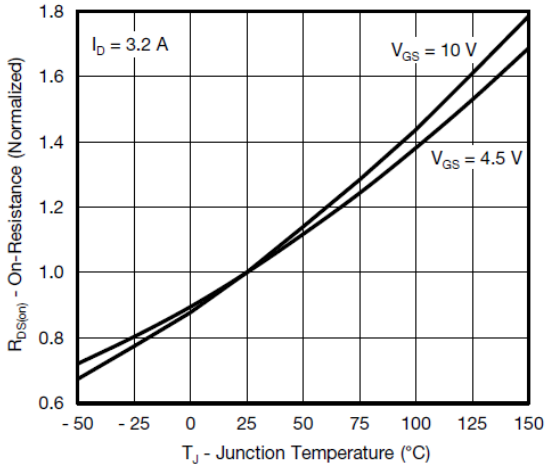
On-Resistance vs. Drain Current and Gate Voltage



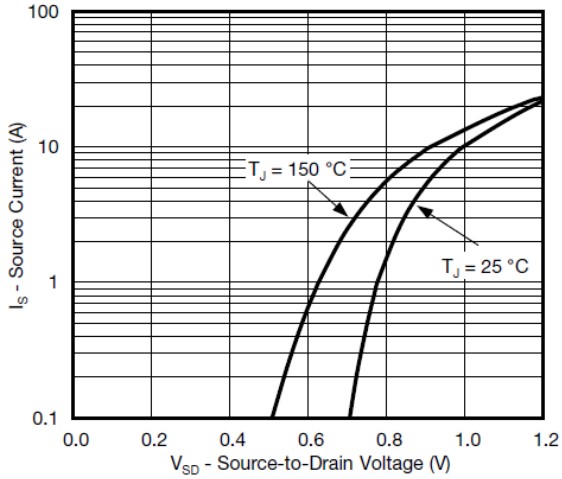
Capacitance



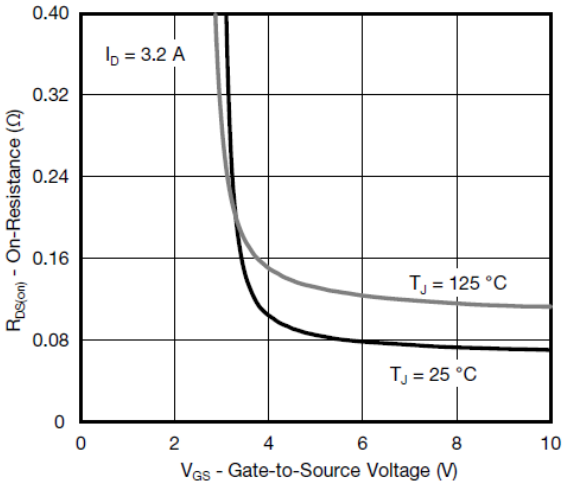
Gate Charge



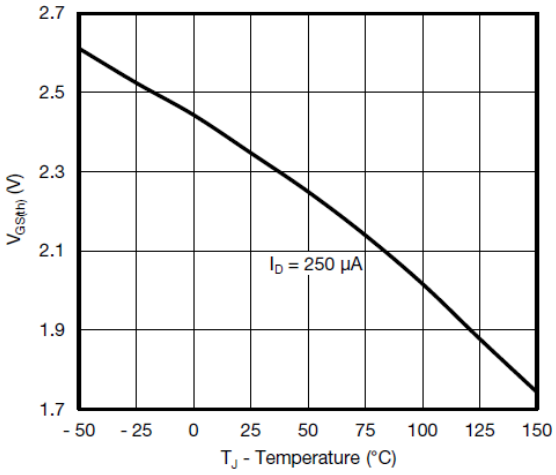
On-Resistance vs. Junction Temperature



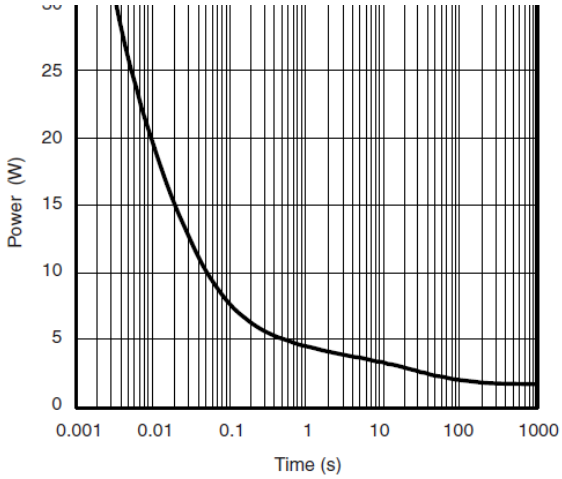
Source-Drain Diode Forward Voltage



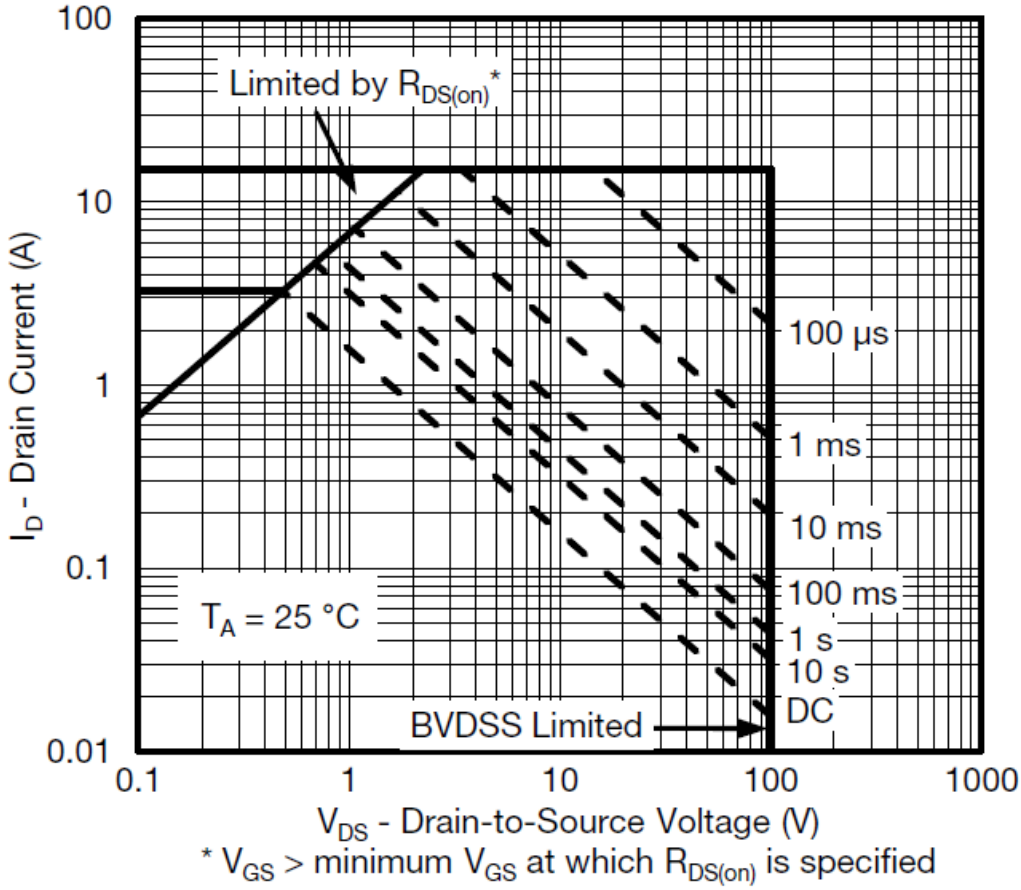
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

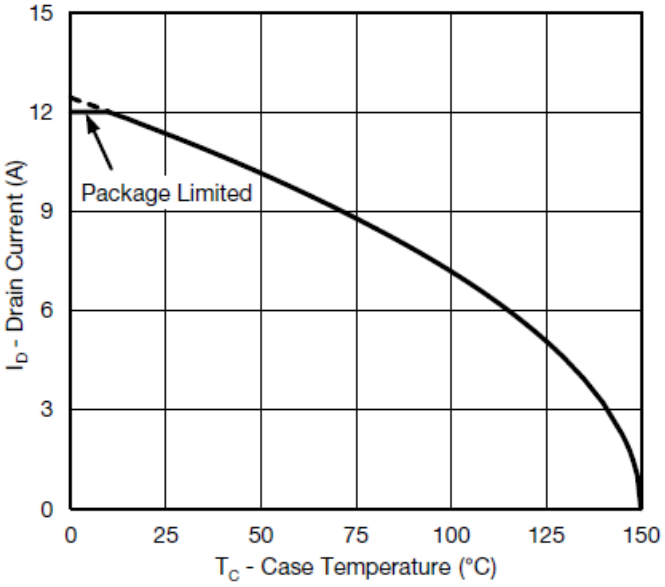


Single Pulse Power, Junction-to-Ambient

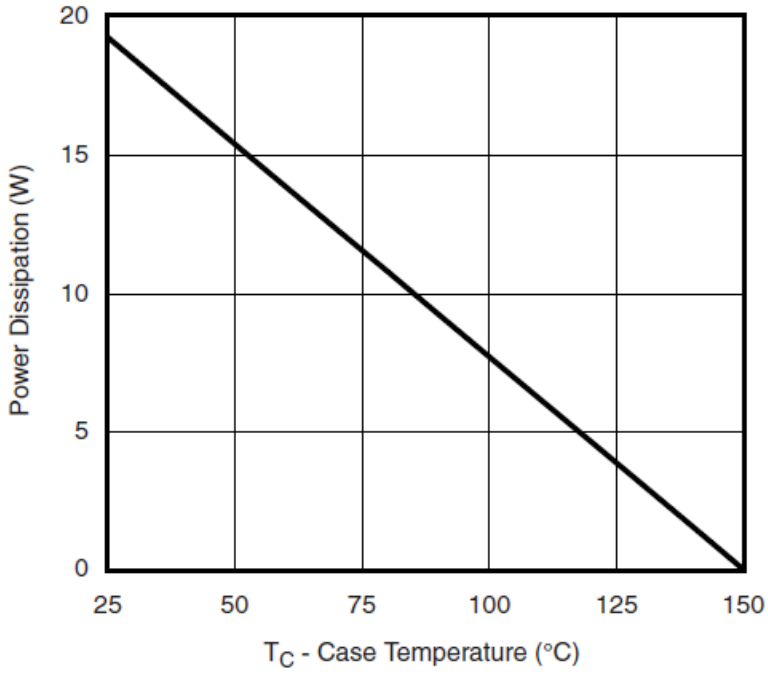


Safe Operating Area, Junction-to-Ambient

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



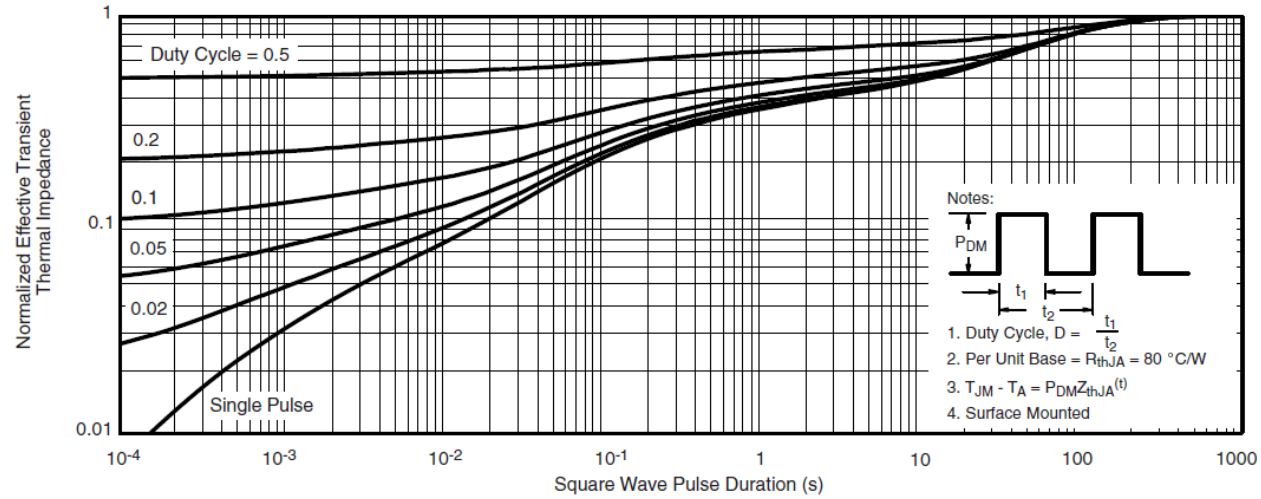
Current Derating*



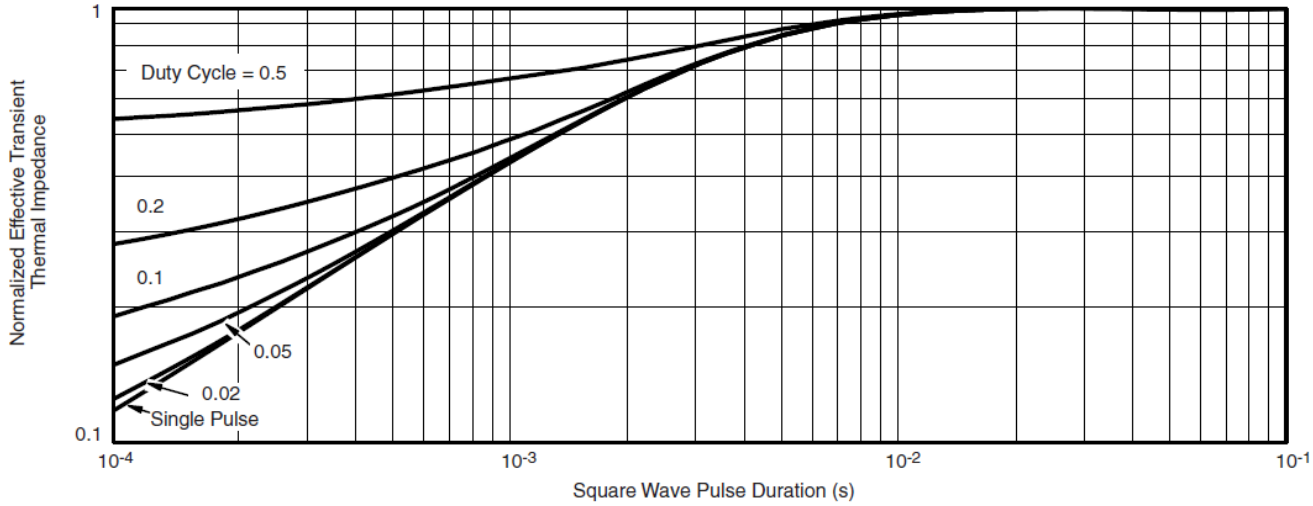
Power, Junction-to-Case

* The power dissipation PD is based on TJ(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 (25 °C, unless otherwise noted)



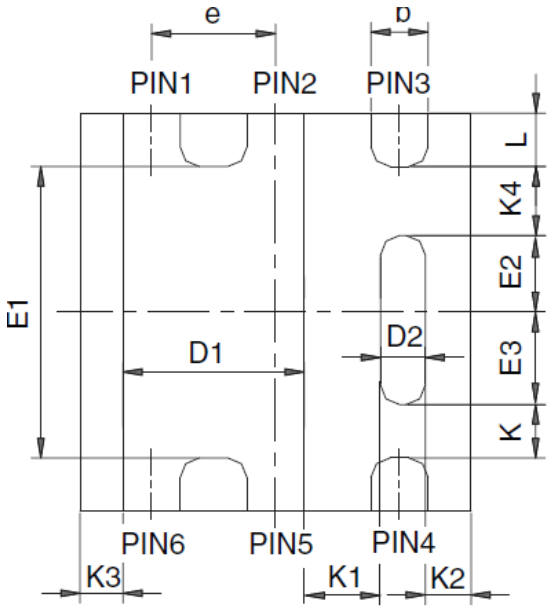
Normalized Thermal Transient Impedance, Junction-to-Ambient



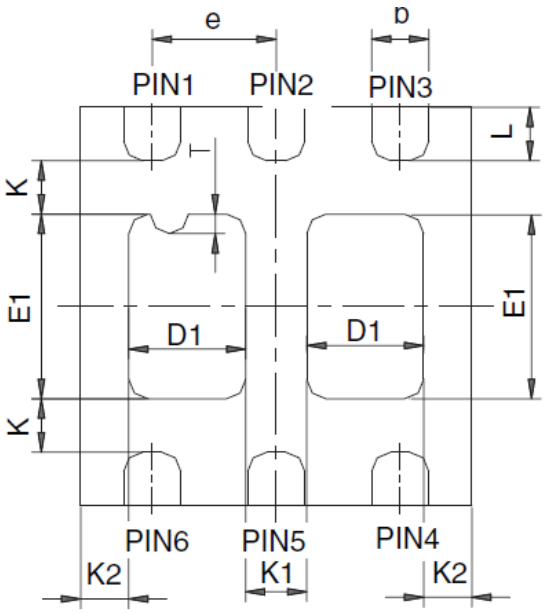
Normalized Thermal Transient Impedance, Junction-to-Case

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?63649.

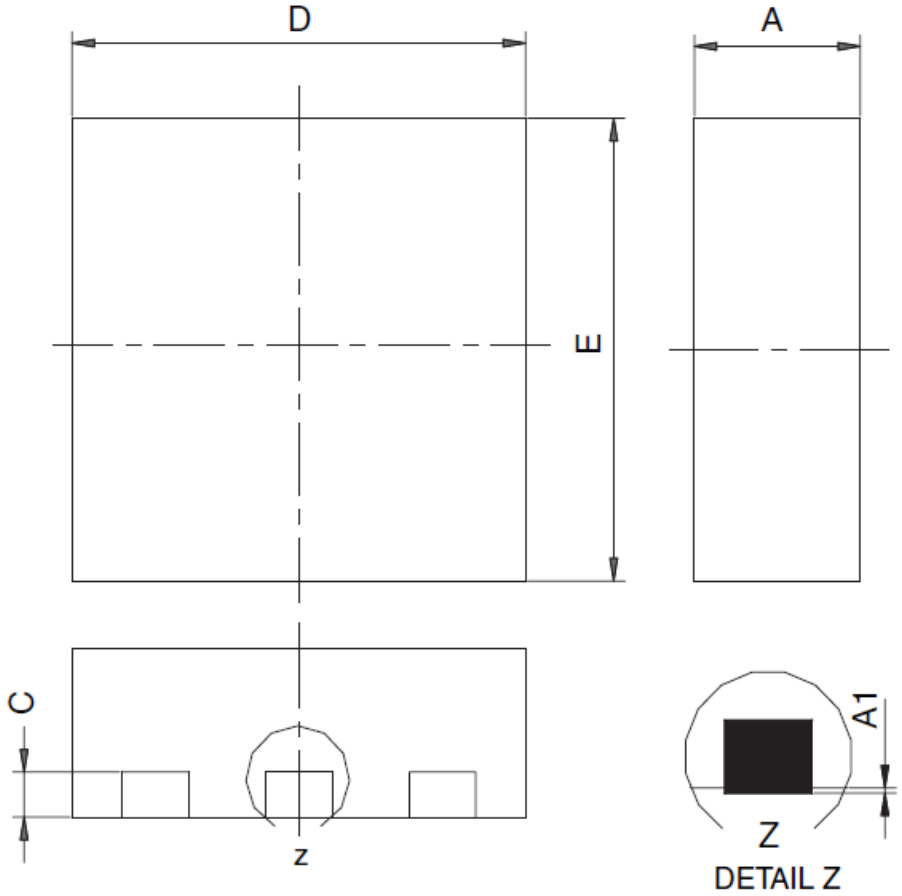
PowerPAK® SC70-6L



BACKSIDE VIEW OF SINGLE



BACKSIDE VIEW OF DUAL



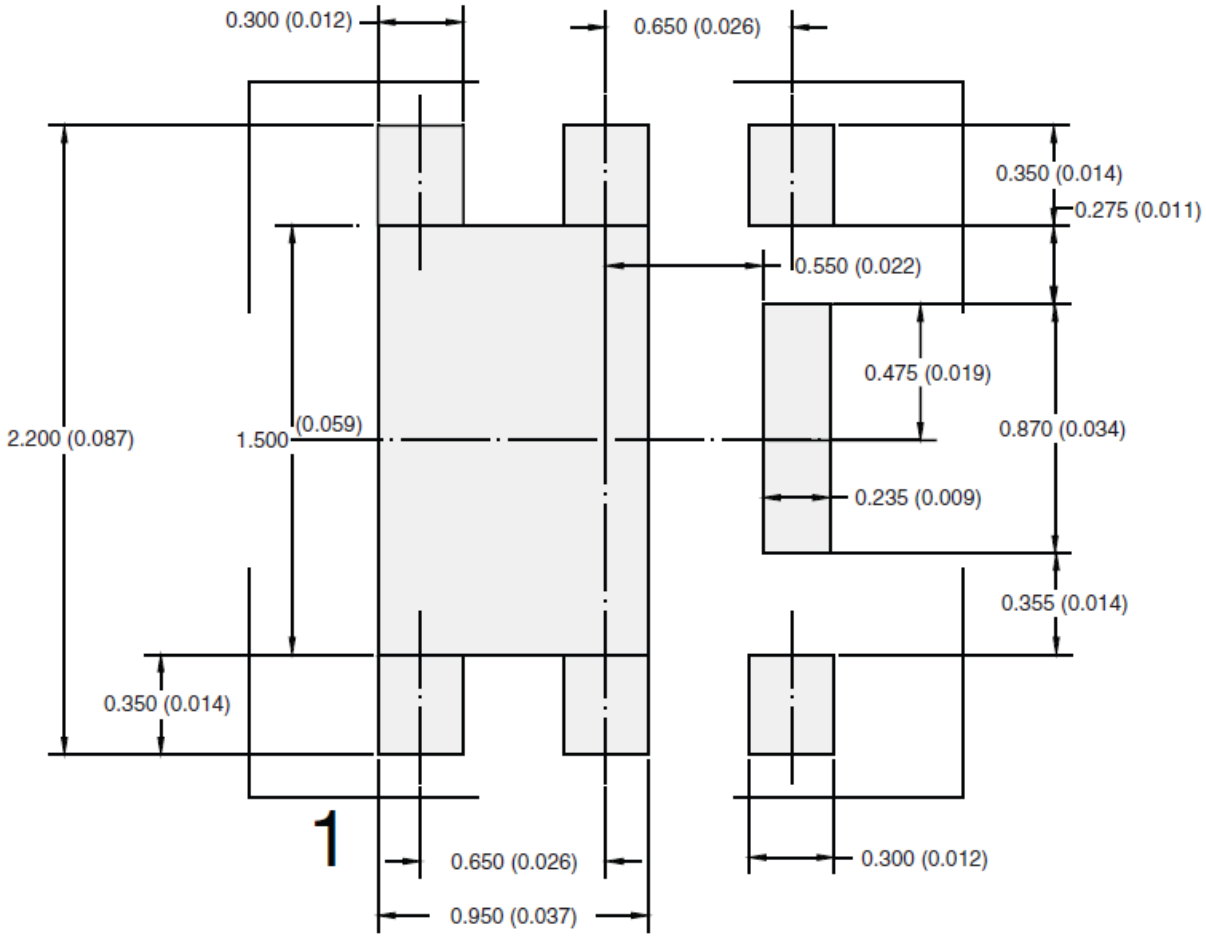
DETAIL Z

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)

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.
Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.
Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims

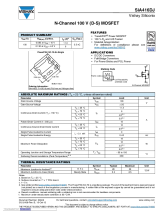
1. any and all liability arising out of the application or use of any product,
2. any and all liability, including without limitation special, consequential or incidental damages, and
3. any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay’s knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer’s responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer’s technical experts. Product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein.
Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an

endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.
Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.
No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.
1

For technical questions, contact:
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT **www.vishay.com/doc?91000**

Documents / Resources

	**VISHAY SIA416DJ Siliconix Discrete Semiconductor** [pdf] Owner's Manual SIA416DJ Siliconix Discrete Semiconductor, SIA416DJ, Siliconix Discrete Semiconductor, Discrete Semiconductor, Semiconductor

References

- **Vishay Intertechnology: Passives & Discrete Semiconductors**
- **User Manual**