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	0.060 at V_{GS} = 4.5 V	4.5[a]	3.5 nC
		0.092 at V_{GS} = 2.5 V	4.5[a]	
P-Channel	- 20	0.110 at V_{GS} = - 4.5 V	- 4.5[a]	3 nC
		0.185 at V_{GS} = - 2.5 V	- 4.5[a]	

FEATURES

- **Halogen-free**
- TrenchFET® Power MOSFETs
- New Thermally Enhanced PowerPAK® SC-70 Package
  - Small Footprint Area
  - Low On-Resistance

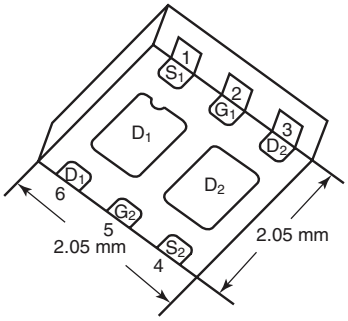
Pb-free

RoHS COMPLIANT

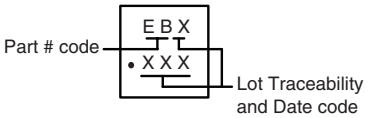
APPLICATIONS

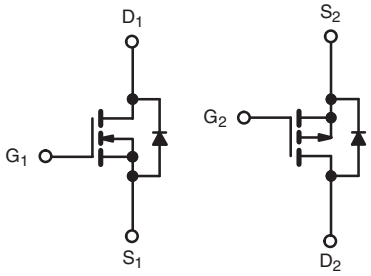
- Portable Devices

PowerPAK SC-70-6 Dual



Marking Code





N-Channel MOSFET P-Channel MOSFET

Ordering Information: SiA513DJ-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]	- 3.3[b, c]	
	T_A = 70 °C		3.2[b, c]	- 2.4[b, c]	
Pulsed Drain Current		I_{DM}	15	- 10	
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	6.5	6.5	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							
			N-Channel		**P-Channel**		
Parameter		**Symbol**	**Typ.**	**Max.**	**Typ.**	**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 (*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**
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		22		mV/°C
		I_D = - 250 µA	P-Ch		- 16		
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	I_D = 250 µA	N-Ch		- 3.5		
		I_D = - 250 µA	P-Ch		2.5		
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	N-Ch	0.6		1.5	V
		V_{DS} = V_{GS}, I_D = - 250 µA	P-Ch	- 0.6		- 1.5	
Gate-Body Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 12 V	N-Ch			± 100	nA
			P-Ch			± 100	
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 20 V, V_{GS} = 0 V	N-Ch			1	µA
		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	- 5			
Drain-Source On-State Resistance[b]	$R_{DS(on)}$	V_{GS} = 4.5 V, I_D = 3.4 A	N-Ch		0.050	0.060	Ω
		V_{GS} = - 4.5 V, I_D = - 2.5 A	P-Ch		0.091	0.110	
		V_{GS} = 2.5 V, I_D = 1.1 A	N-Ch		0.076	0.092	
		V_{GS} = - 2.5 V, I_D = - 0.54 A	P-Ch		0.152	0.185	
Forward Transconductance[b]	g_{fs}	V_{DS} = 10 V, I_D = 3.4 A	N-Ch		8		S
		V_{DS} = - 10 V, I_D = - 2.5 A	P-Ch		3.5		
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		360		pF
			P-Ch		250		
Output Capacitance	C_{oss}		N-Ch		70		
			P-Ch		70		
Reverse Transfer Capacitance	C_{rss}		N-Ch		40		
			P-Ch		45		
Total Gate Charge	Q_g	V_{DS} = 10 V, V_{GS} = 10 V, I_D = 4.5 A	N-Ch		7.5	12	nC
		V_{DS} = - 10 V, V_{GS} = - 10 V, I_D = - 3.3 A	P-Ch		6	9	
		N-Channel V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 4.5 A P-Channel V_{DS} = - 10 V, V_{GS} = - 4.5 V, I_D = - 3.3 A	N-Ch		3.5	5.3	
			P-Ch		3	4.5	
Gate-Source Charge	Q_{gs}		N-Ch		0.9		
			P-Ch		0.7		
Gate-Drain Charge	Q_{gd}		N-Ch		0.7		
			P-Ch		0.9		
Gate Resistance	R_g	f = 1 MHz	N-Ch		2.5		Ω
			P-Ch		8		

Notes:

a. Guaranteed by design, not subject to production testing.

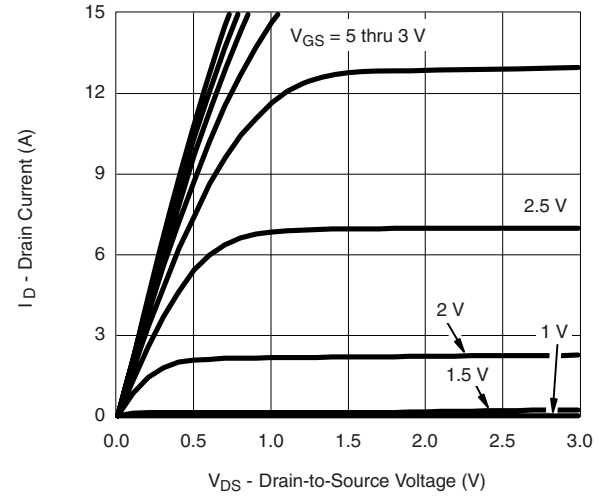
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.

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 = 2.8 Ω $I_D \cong$ 3.6 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		40	60	
			P-Ch		45	70	
Turn-Off Delay Time	$t_{d(off)}$	P-Channel V_{DD} = - 10 V, R_L = 3.9 Ω $I_D \cong$ - 2.6 A, V_{GEN} = - 4.5 V, R_g = 1 Ω	N-Ch		20	30	
			P-Ch		15	25	
Fall Time	t_f		N-Ch		30	45	
			P-Ch		10	15	
Turn-On Delay Time	$t_{d(on)}$	N-Channel V_{DD} = 10 V, R_L = 2.8 Ω $I_D \cong$ 3.6 A, V_{GEN} = 10 V, R_g = 1 Ω	N-Ch		5	10	
			P-Ch		4	8	
Rise Time	t_r		N-Ch		15	25	
			P-Ch		12	20	
Turn-Off Delay Time	$t_{d(off)}$	P-Channel V_{DD} = - 10 V, R_L = 3.9 Ω $I_D \cong$ - 2.6 A, V_{GEN} = - 10 V, R_g = 1 Ω	N-Ch		15	25	
			P-Ch		12	20	
Fall Time	t_f		N-Ch		10	15	
			P-Ch		5	10	
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			- 10	
Body Diode Voltage	V_{SD}	I_S = 3.6 A, V_{GS} = 0 V	N-Ch		0.8	1.2	V
		I_S = - 2.6 A, V_{GS} = 0 V	P-Ch		- 0.8	- 1.2	
Body Diode Reverse Recovery Time	t_{rr}	N-Channel I_F = 3.6 A, di/dt = 100 A/µs, T_J = 25 °C P-Channel I_F = - 2.6 A, di/dt = - 100 A/µs, T_J = 25 °C	N-Ch		15	30	ns
			P-Ch		20	40	
Body Diode Reverse Recovery Charge	Q_{rr}		N-Ch		10	20	nC
			P-Ch		10	20	
Reverse Recovery Fall Time	t_a		N-Ch		10		ns
			P-Ch		8		
Reverse Recovery Rise Time	t_b		N-Ch		5		
			P-Ch		12		

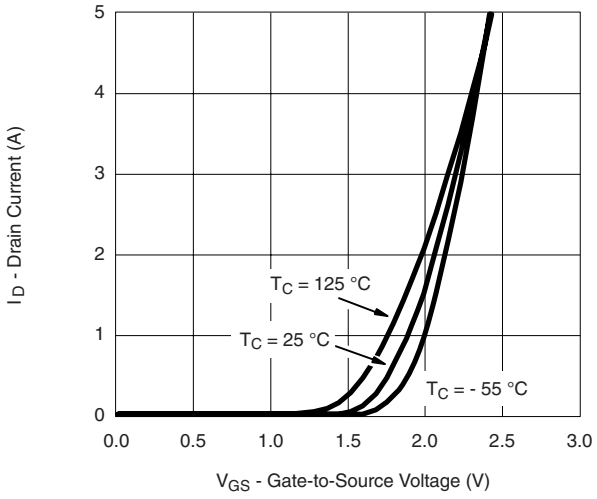
Notes:
a. Guaranteed by design, not subject to production testing.
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.

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.

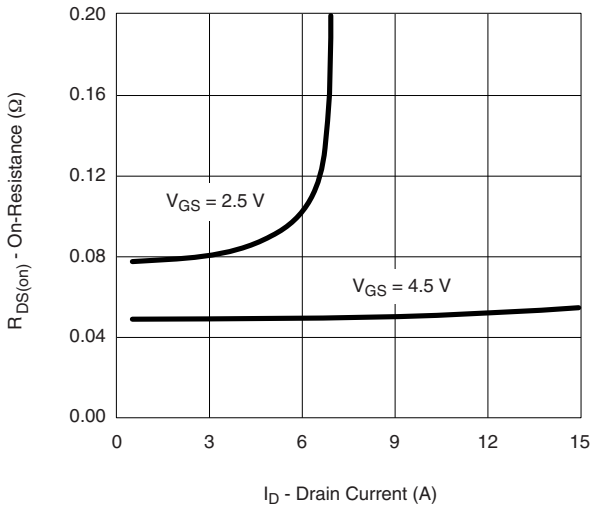
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



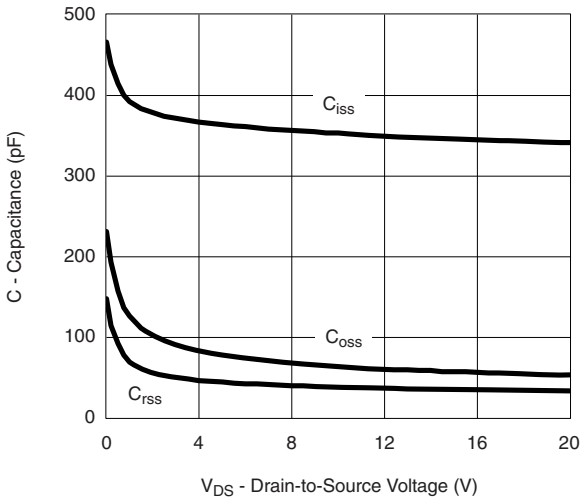
Output Characteristics



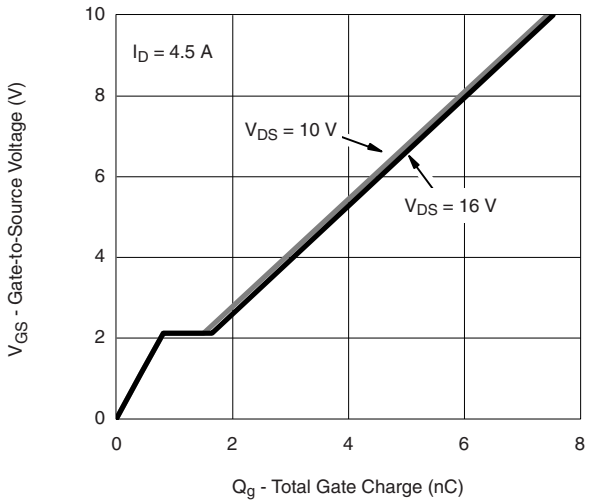
Transfer Characteristics



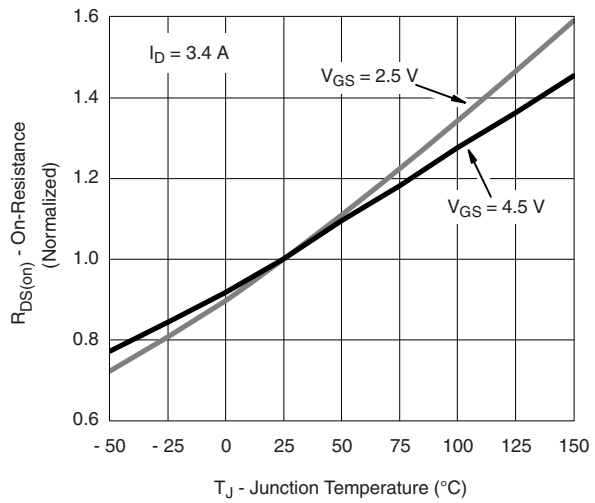
On-Resistance vs. Drain Current



Capacitance

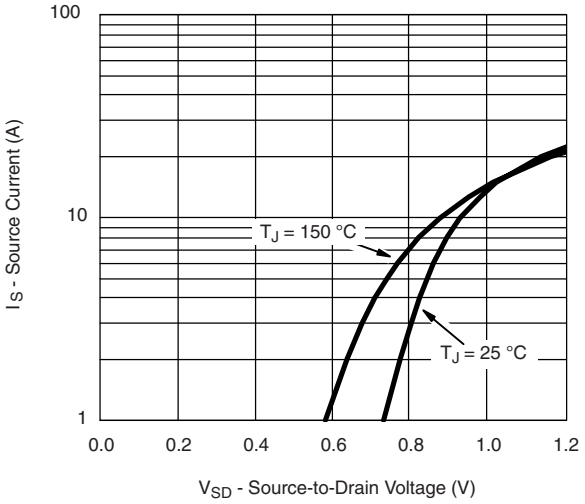


Gate Charge

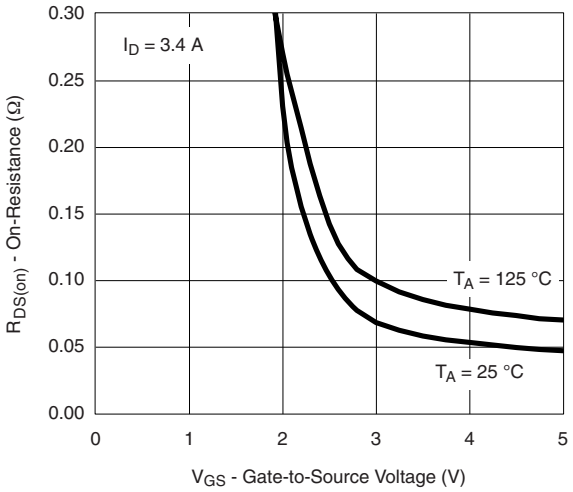


On-Resistance vs. Junction Temperature

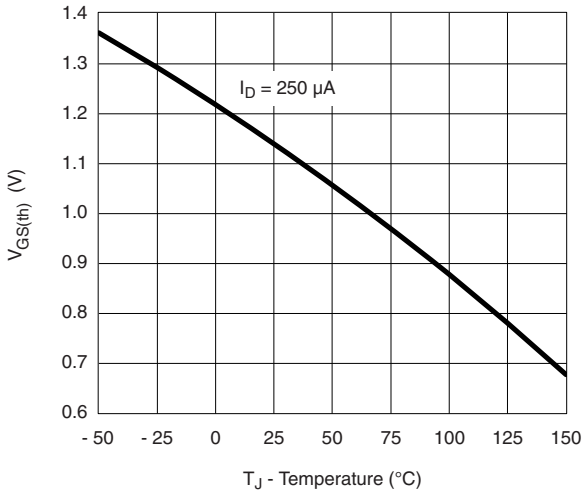
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



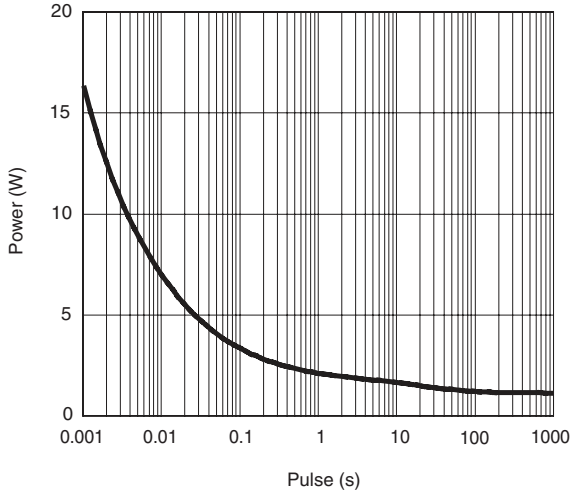
Source-Drain Diode Forward Voltage



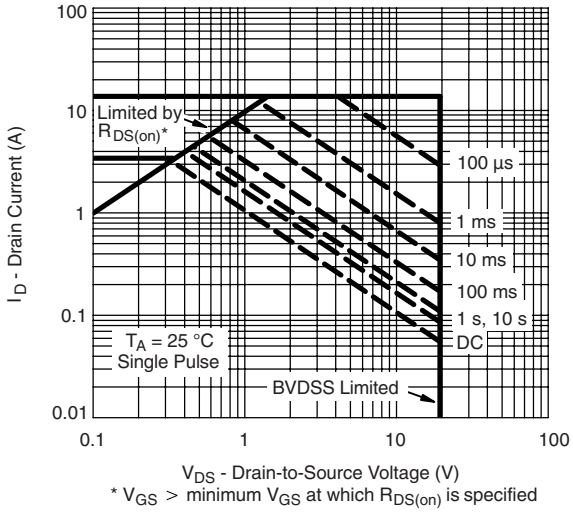
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

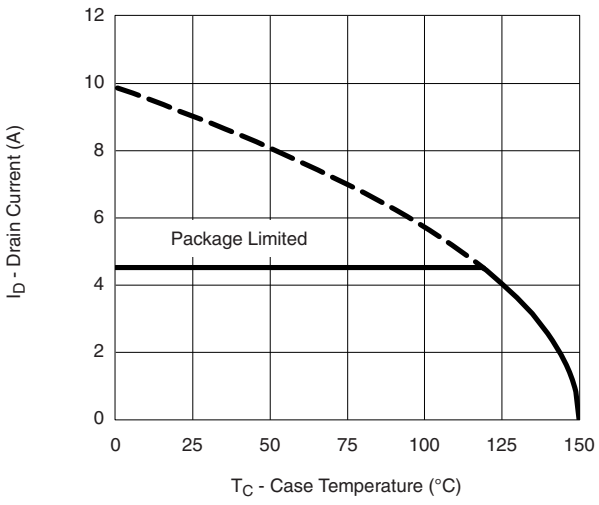


Single Pulse Power

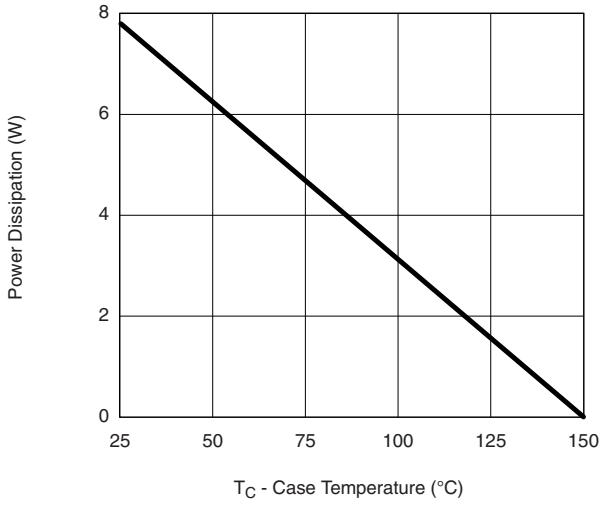


Safe Operating Area, Junction-to-Ambient

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



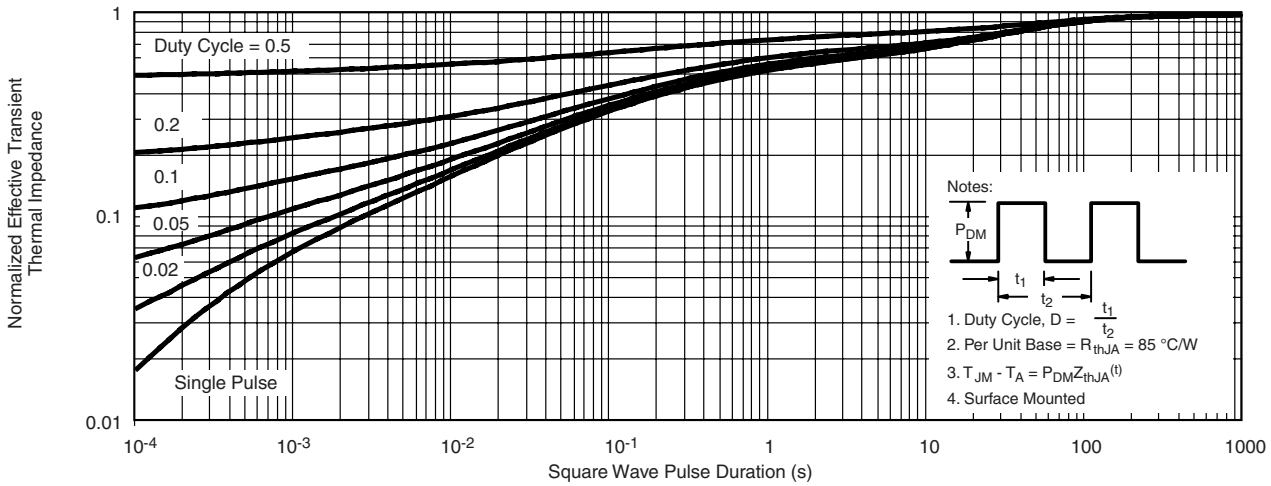
Current Derating*



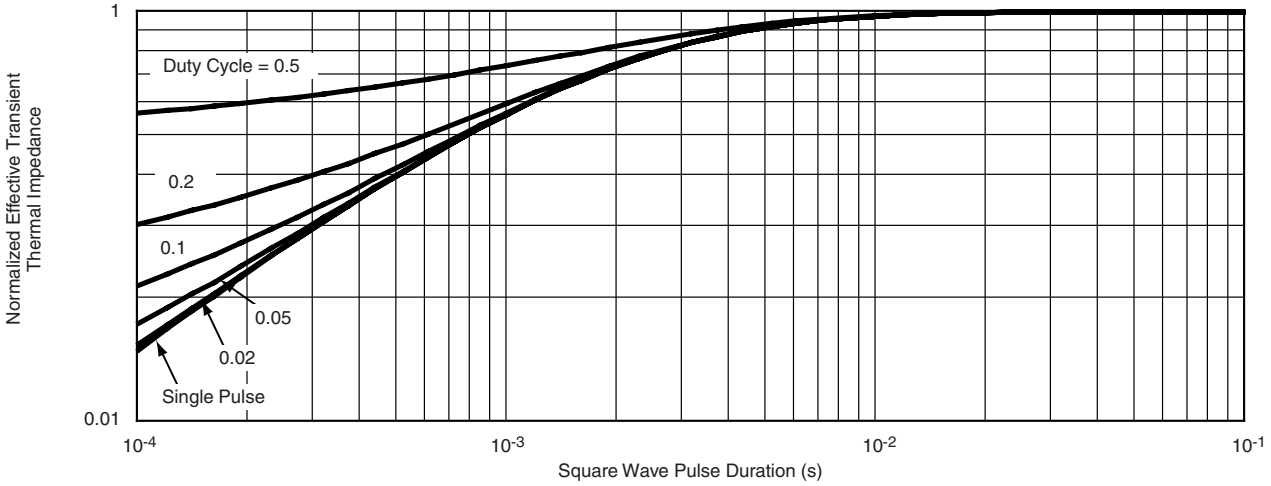
Power Derating

* 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

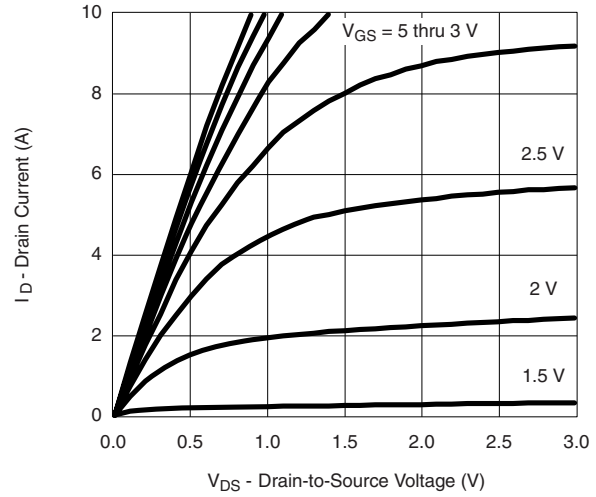


Normalized Thermal Transient Impedance, Junction-to-Ambient

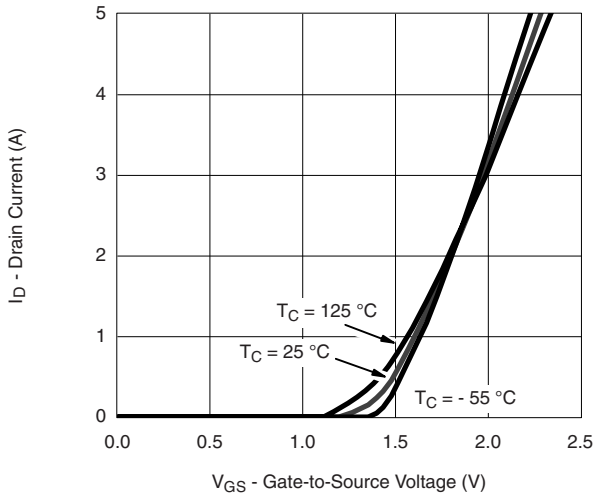


Normalized Thermal Transient Impedance, Junction-to-Case

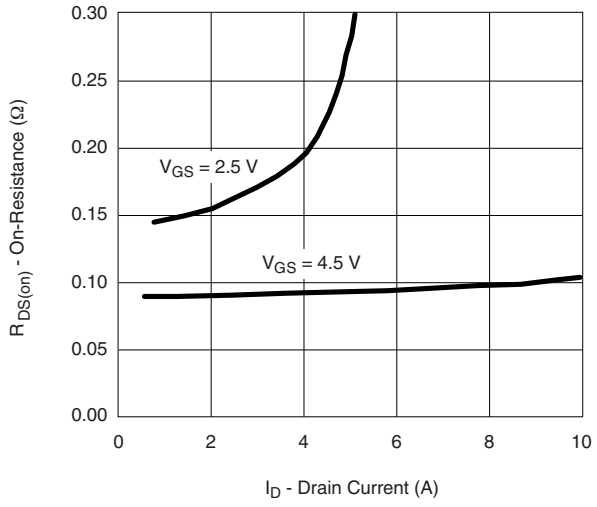
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



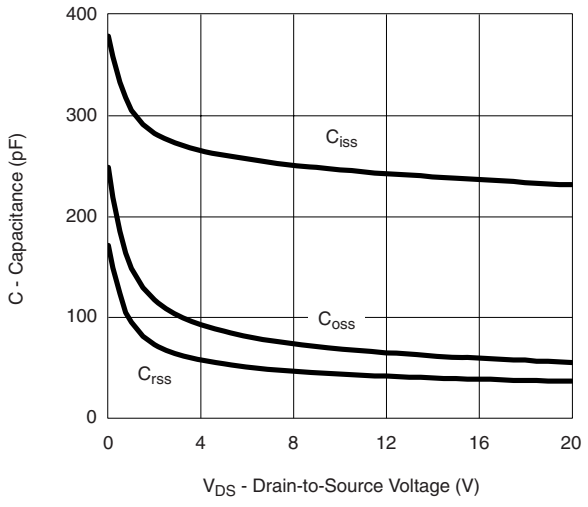
Output Characteristics



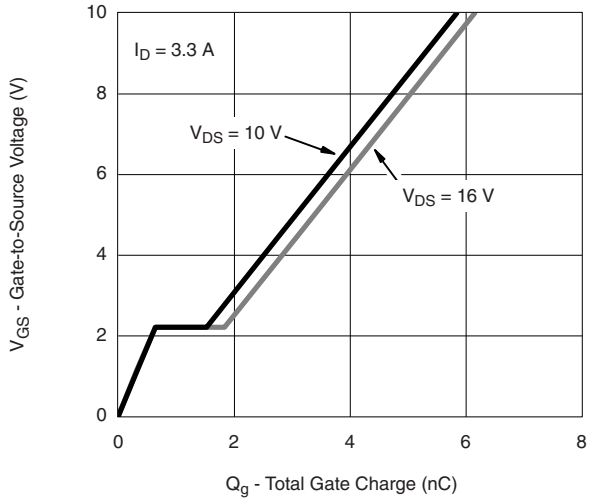
Transfer Characteristics



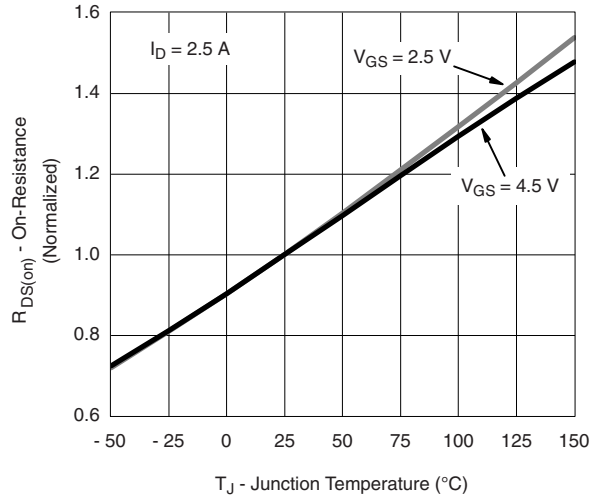
On-Resistance vs. Drain Current



Capacitance

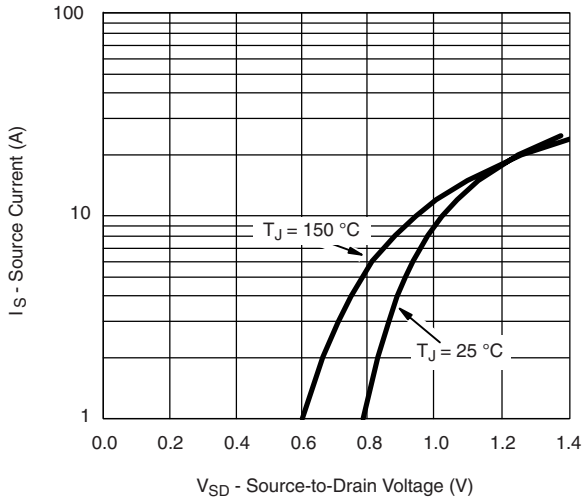


Gate Charge

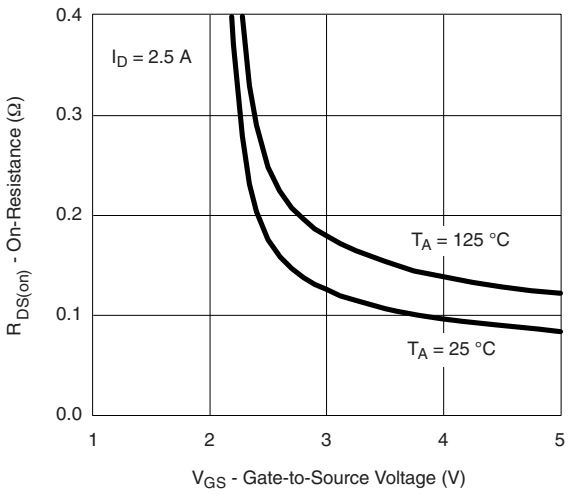


On-Resistance vs. Junction Temperature

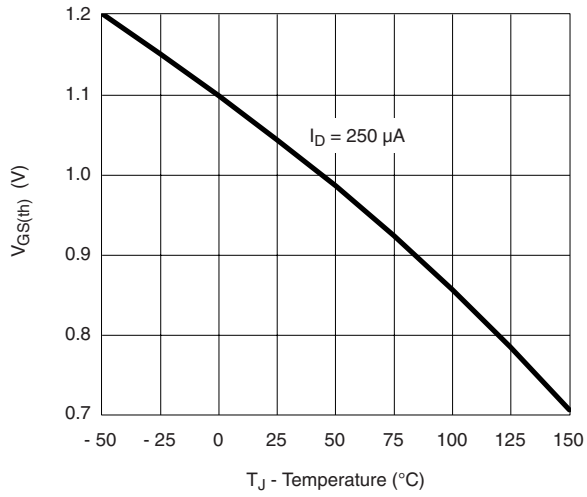
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



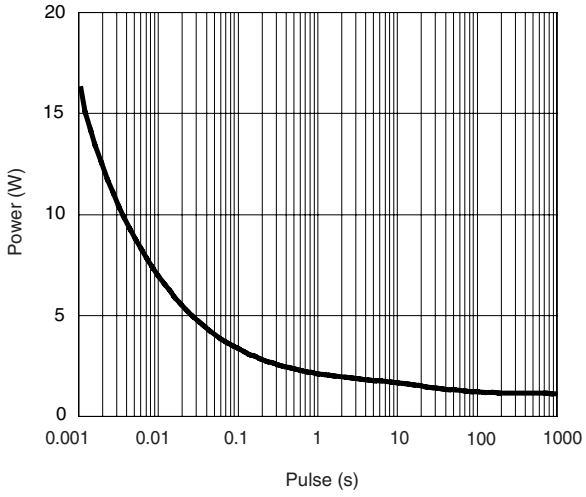
Source-Drain Diode Forward Voltage



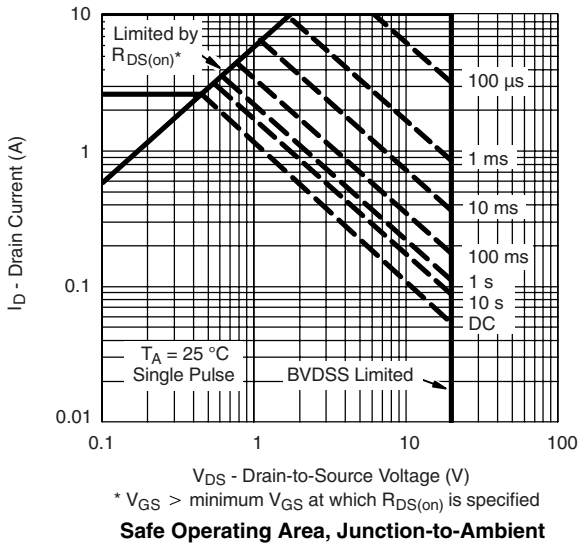
On-Resistance vs. Gate-to-Source



Threshold Voltage



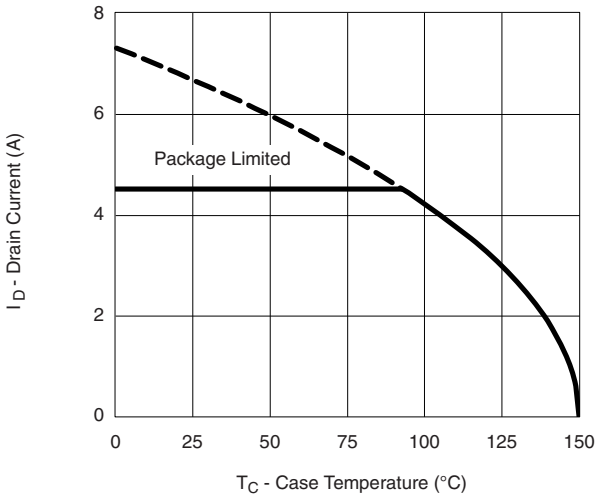
Single Pulse Power



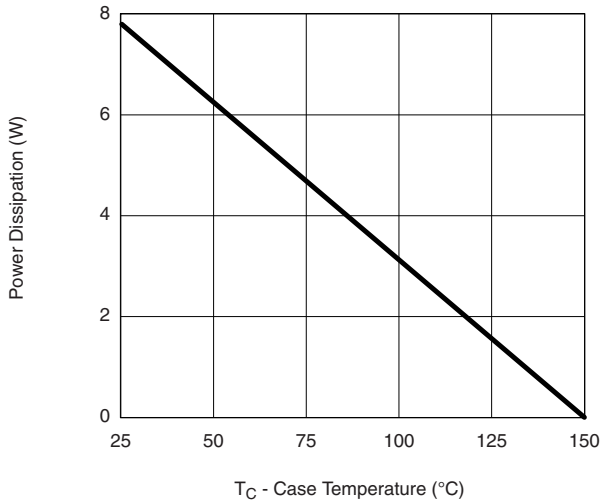
* V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

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



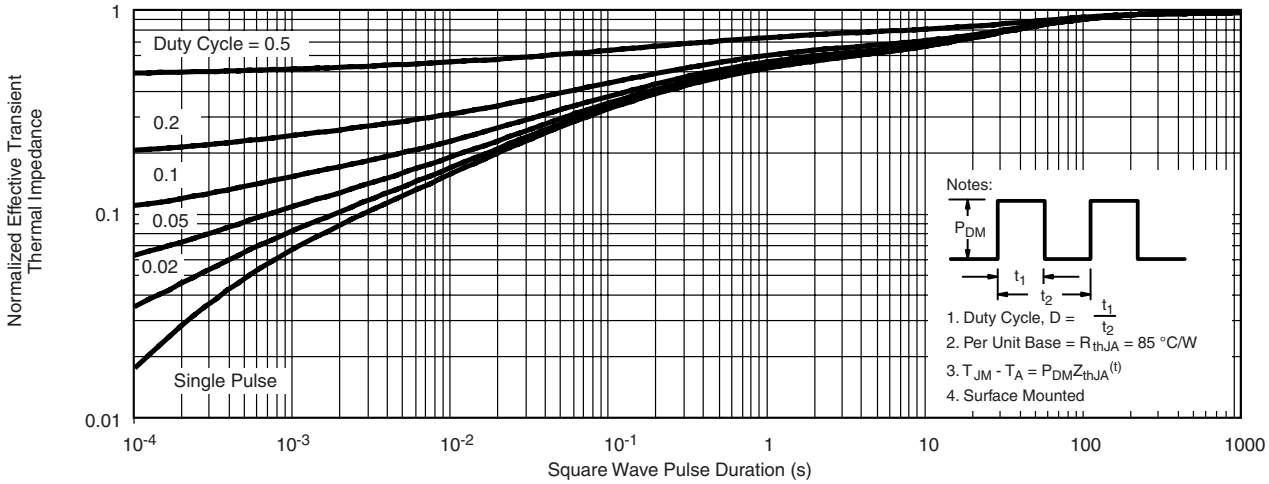
Current Derating*



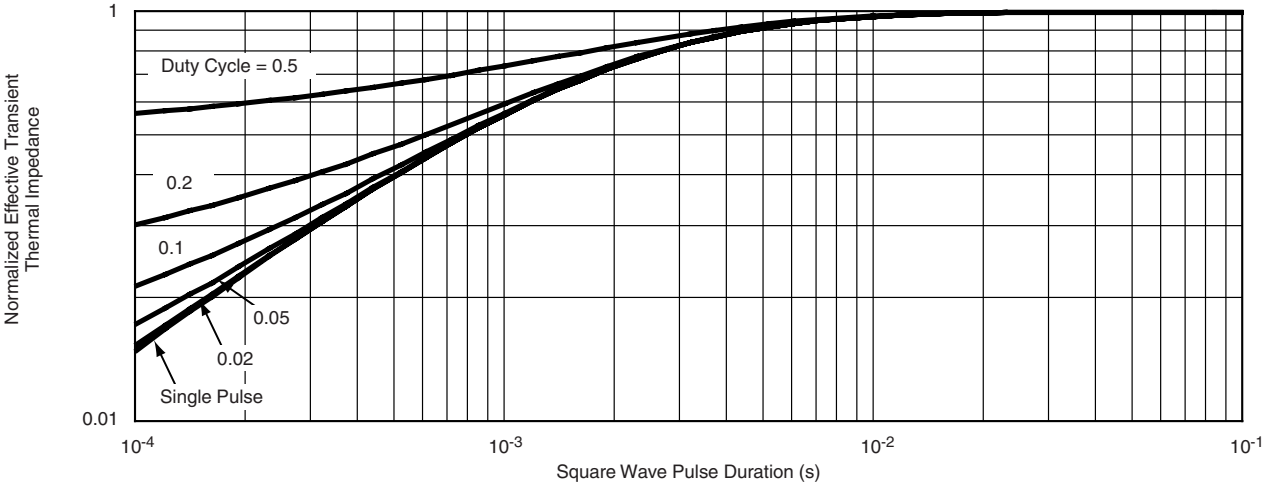
Power Derating

* 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.

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 http://www.vishay.com/ppg?70443.

Notice

Specifications of the products displayed herein are subject to change without notice. Vishay Intertechnology, Inc., or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Information contained herein is intended to provide a product description only. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Vishay's terms and conditions of sale for such products, Vishay assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of Vishay products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Vishay for any damages resulting from such improper use or sale.