N-Channel 12 V and 20 V (D-S) MOSFETs

PRODUCT SUMMARY

	V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)	Q_g (Typ.)
Channel 1	12	0.029 at V_{GS} = 4.5 V	4.5[a]	5.6 nC
		0.034 at V_{GS} = 2.5 V	4.5[a]	
		0.044 at V_{GS} = 1.8 V	4.5[a]	
		0.065 at V_{GS} = 1.5 V	4.5[a]	
Channel 2	20	0.225 at V_{GS} = - 4.5 V	1.5[a]	1.1 nC
		0.270 at V_{GS} = - 2.5 V	1.5[a]	
		0.345 at V_{GS} = - 1.8 V	1.5[a]	
		0.960 at V_{GS} = - 1.5 V	0.5[a]	

FEATURES

- **Halogen-free According to IEC 61249-2-21 Definition**
- TrenchFET® Power MOSFETs
- New Thermally Enhanced PowerPAK® SC-70 Package
  - Small Footprint Area
  - Low On-Resistance
- Typical ESD Performance for Channel 2: 2800 V
- Compliant to RoHS Directive 2002/95/EC

Pb-free

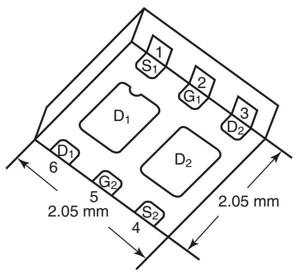
RoHS COMPLIANT

HALOGEN FREE

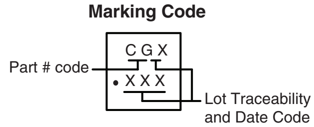
APPLICATIONS

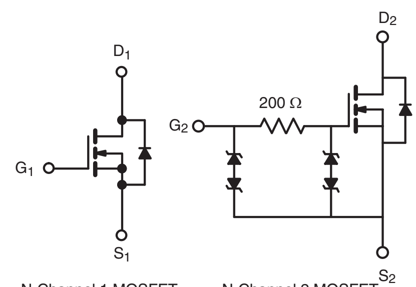
- N-Channel Level Shift Load Switch for Portable Devices
  - for 0 V to 8 V Power Lines

PowerPAK SC-70-6 Dual



Marking Code





N-Channel 1 MOSFET N-Channel 2 MOSFET

Ordering Information: SiA778DJ-T1-GE3 (Lead (Pb)-free and Halogen-free)

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

Parameter		Symbol	Channel 1	Channel 2	Unit
Drain-Source Voltage		V_{DS}	12	20	V
Gate-Source Voltage		V_{GS}	± 8	± 6	
Continuous Drain Current (T_J = 150 °C)	T_C = 25 °C	I_D	4.5[a]	1.5[a]	A
	T_C = 70 °C		4.5[a]	1.5[a]	
	T_A = 25 °C		4.5[a, b, c]	1.5[b, c]	
	T_A = 70 °C		4.5[a, b, c]	1.5[b, c]	
Pulsed Drain Current		I_{DM}	20	4	
Source Drain Current Diode Current	T_C = 25 °C	I_S	4.5[a]	1.5[a]	
	T_A = 25 °C		1.6[b, c]	1.5[b, c]	
Maximum Power Dissipation	T_C = 25 °C	P_D	6.5	5	W
	T_C = 70 °C		5	3.2	
	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	Channel 1 Typ.	Channel 1 Max.	Channel 2 Typ.	Channel 2 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	20	25	

Notes:
a. Package limited.
b. Surface mounted on 1" x 1" FR4 board.
c. t = 5 s.
d. See solder profile (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 for channel 1 and channel 2 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	Ch-1	12			V
		V_{GS} = 0 V, I_D = 250 µA	Ch-2	20			
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	I_D = 250 µA	Ch-1		12		mV/°C
		I_D = 250 µA	Ch-2		21		
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	I_D = 250 µA	Ch-1		- 2.5		
		I_D = 250 µA	Ch-2		- 2.3		
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, I_D = 250 µA	Ch-1	0.4		1	V
		$V_{DS} = V_{GS}$, I_D = 250 µA	Ch-2	0.4		1	
Gate-Body Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 8 V	Ch-1			± 100	nA
		V_{DS} = 0 V, V_{GS} = ± 6 V	Ch-2			1	mA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 12 V, V_{GS} = 0 V	Ch-1			1	µA
		V_{DS} = 20 V, V_{GS} = 0 V	Ch-2			1	
		V_{DS} = 12 V, V_{GS} = 0 V, T_J = 55 °C	Ch-1			10	
		V_{DS} = 20 V, V_{GS} = 0 V, T_J = 55 °C	Ch-2			10	
On-State Drain Current[b]	$I_{D(on)}$	$V_{DS} \geq$ 5 V, V_{GS} = 4.5 V	Ch-1	15			A
		$V_{DS} \geq$ 5 V, V_{GS} = 4.5 V	Ch-2	4			
Drain-Source On-State Resistance[b]	$R_{DS(on)}$	V_{GS} = 4.5 V, I_D = 5 A	Ch-1		0.024	0.029	Ω
		V_{GS} = 4.5 V, I_D = 1.6 A	Ch-2		0.183	0.225	
		V_{GS} = 2.5 V, I_D = 4.6 A	Ch-1		0.028	0.034	
		V_{GS} = 2.5 V, I_D = 1.5 A	Ch-2		0.220	0.270	
		V_{GS} = 1.8 V, I_D = 4.1 A	Ch-1		0.032	0.044	
		V_{GS} = 1.8 V, I_D = 1.3 A	Ch-2		0.275	0.345	
		V_{GS} = 1.5 V, I_D = 2 A	Ch-1		0.042	0.065	
		V_{GS} = 1.5 V, I_D = 0.3 A	Ch-2		0.320	0.960	
Forward Transconductance[b]	g_{fs}	V_{DS} = 6 V, I_D = 5 A	Ch-1		21		S
		V_{DS} = 10 V, I_D = 1.6 A	Ch-2		3.5		
Dynamic[a]							
Input Capacitance	C_{iss}	Channel 1 V_{DS} = 6 V, V_{GS} = 0 V, f = 1 MHz	Ch-1		500		pF
Output Capacitance	C_{oss}		Ch-1		160		
Reverse Transfer Capacitance	C_{rss}		Ch-1		100		
Total Gate Charge	Q_g	V_{DS} = 6 V, V_{GS} = 8 V, I_D = 6.5 A	Ch-1		9.7	15	nC
		V_{DS} = 10 V, V_{GS} = 5 V, I_D = 1.7 A	Ch-2		1.3	2.2	
		Channel 1 V_{DS} = 6 V, V_{GS} = 4.5 V, I_D = 6.5 A Channel 2 V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 1.7 A	Ch-1		5.6	8.5	
			Ch-2		1.1	1.7	
Gate-Source Charge	Q_{gs}		Ch-1		0.72		
			Ch-2		0.2		
Gate-Drain Charge	Q_{gd}		Ch-1		0.74		
			Ch-2		0.1		
Gate Resistance	R_g	f = 1 MHz	Ch-1	0.7	3.5	7	Ω
			Ch-2	40	200	400	

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

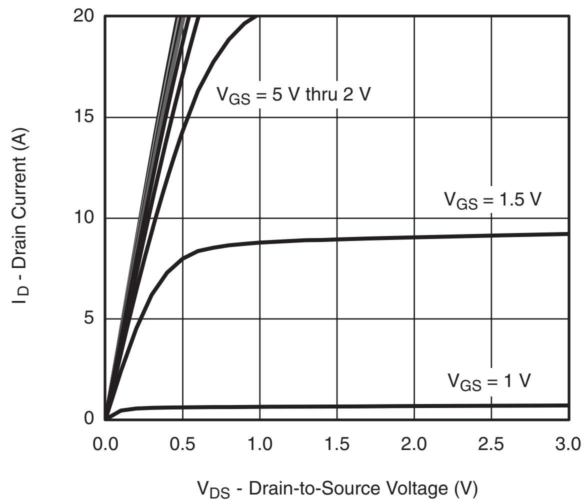
SPECIFICATIONS T_J = 25 °C, unless otherwise noted							
Parameter	**Symbol**	**Test Conditions**		**Min.**	**Typ.**	**Max.**	**Unit**
Dynamic[a]							
Turn-On Delay Time	$t_{d(on)}$	Channel 1 V_{DD} = 6 V, R_L = 1.2 Ω $I_D \cong$ 5.2 A, V_{GEN} = 4.5 V, R_g = 1 Ω Channel 2 V_{DD} = 10 V, R_L = 7.7 Ω $I_D \cong$ 1.3 A, V_{GEN} = 4.5 V, R_g = 1 Ω	Ch-1		10	15	ns
			Ch-2		20	30	
Rise Time	t_r		Ch-1		10	15	
			Ch-2		12	20	
Turn-Off Delay Time	$t_{d(off)}$		Ch-1		22	30	
			Ch-2		70	105	
Fall Time	t_f		Ch-1		10	15	
			Ch-2		20	30	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	T_C = 25 °C	Ch-1			4.5	A
			Ch-2			1.5	
Pulse Diode Forward Current[a]	I_{SM}		Ch-1			20	
			Ch-2			4	
Body Diode Voltage	V_{SD}	I_S = 5.2 A, V_{GS} = 0 V	Ch-1		0.85	1.2	V
		I_S = 1.3 A, V_{GS} = 0 V	Ch-2		0.9	1.2	
Body Diode Reverse Recovery Time	t_{rr}	Channel 1 I_F = 5.2 A, dI//dt = 100 A/µs, T_J = 25 °C Channel 2 I_F = 1.3 A, dI/dt = 100 A/µs, T_J = 25 °C	Ch-1		20	40	ns
			Ch-2		50	75	
Body Diode Reverse Recovery Charge	Q_{rr}		Ch-1		5	10	nC
			Ch-2		30	45	
Reverse Recovery Fall Time	t_a		Ch-1		8		ns
			Ch-2		115		
Reverse Recovery Rise Time	t_b		Ch-1		12		
			Ch-2		35		

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

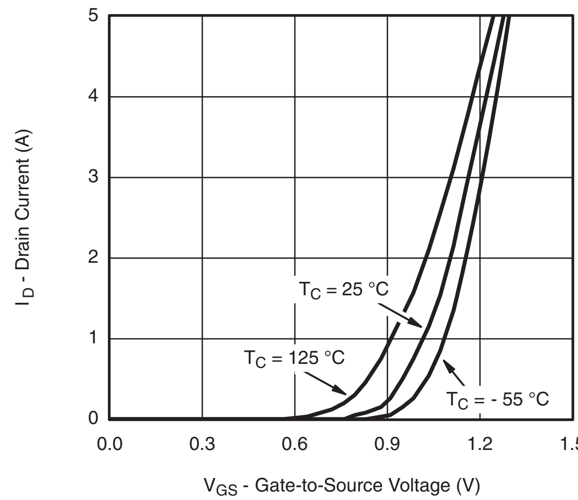
Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

VISHAY

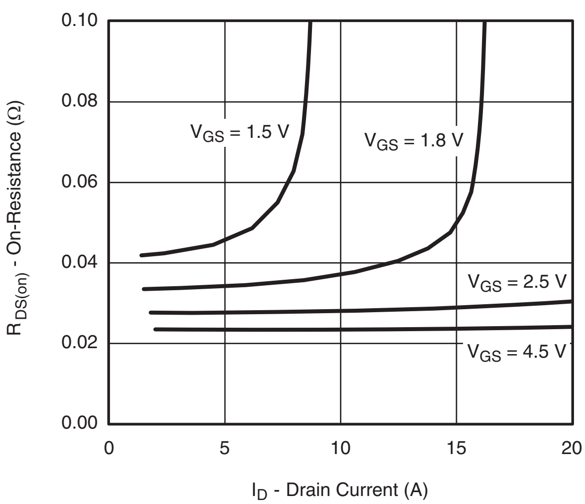
CHANNEL 1 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



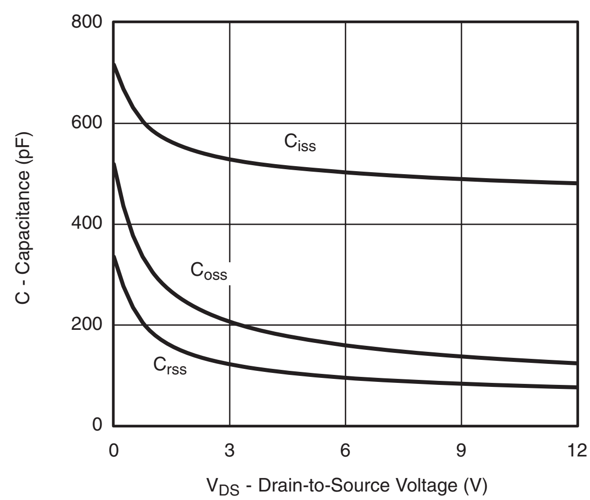
Output Characteristics



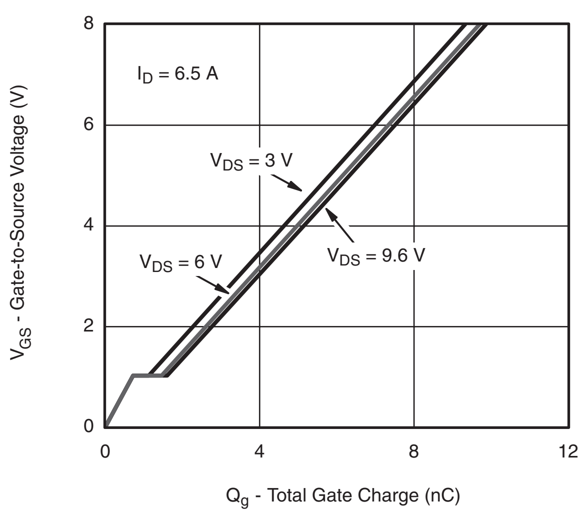
Transfer Characteristics



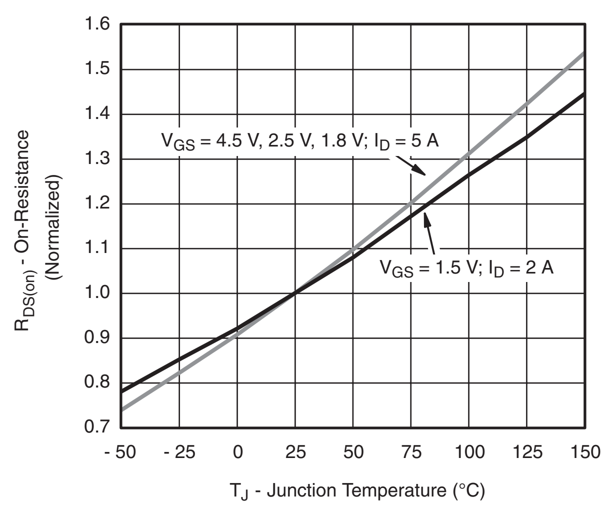
On-Resistance vs. Drain Current and Gate Voltage



Capacitance

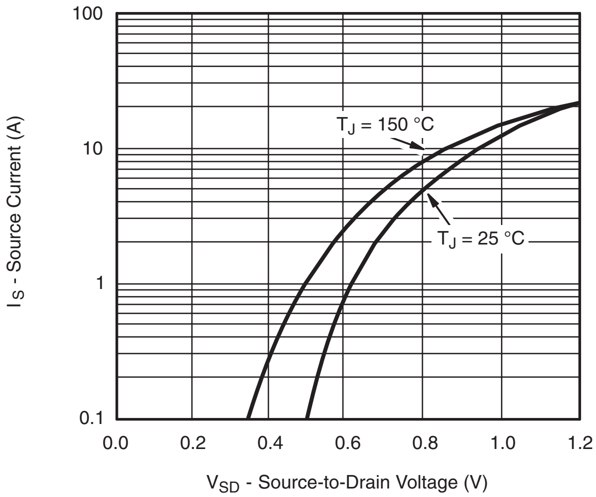


Gate Charge

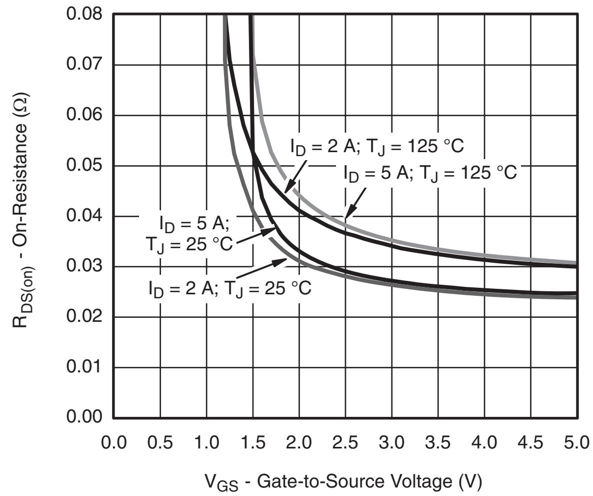


On-Resistance vs. Junction Temperature

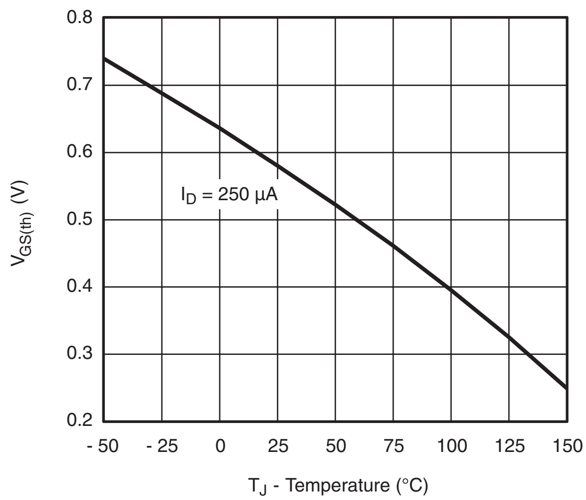
CHANNEL 1 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



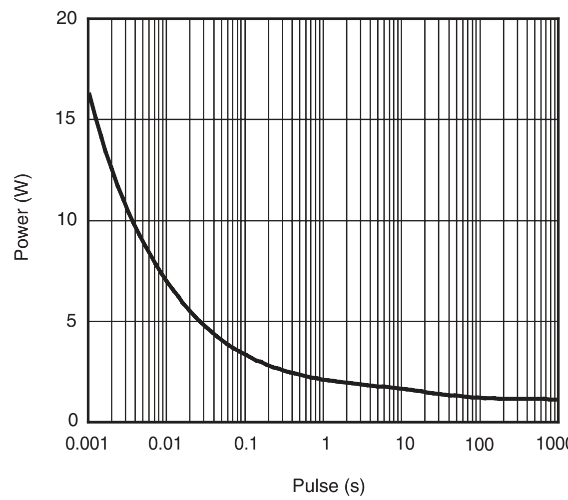
Source-Drain Diode Forward Voltage



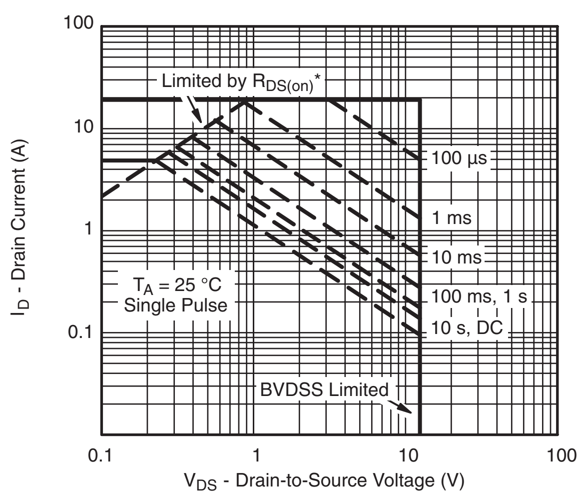
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



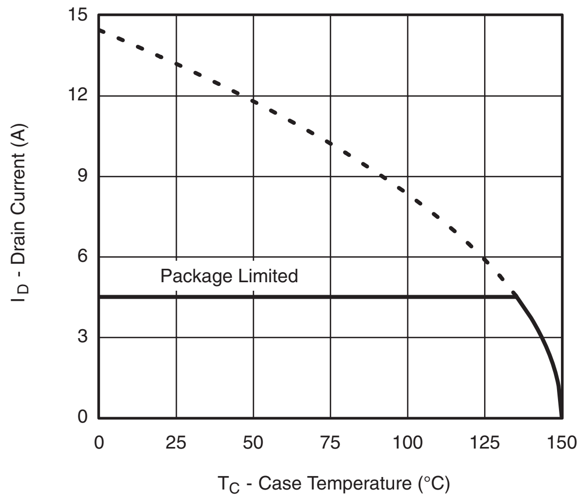
Single Pulse Power (Junction-to-Ambient)



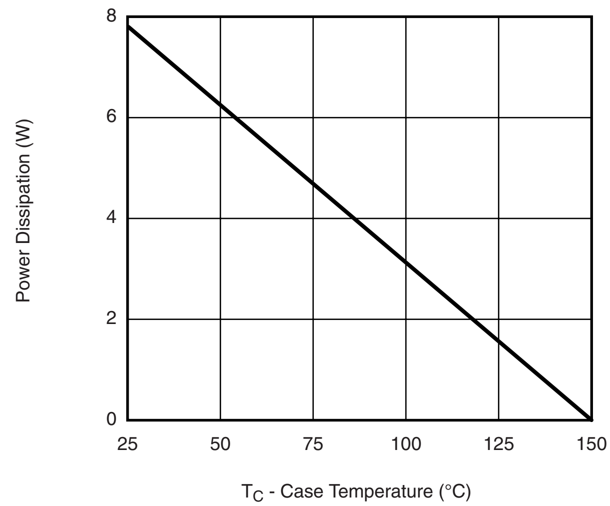
* V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

CHANNEL 1 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



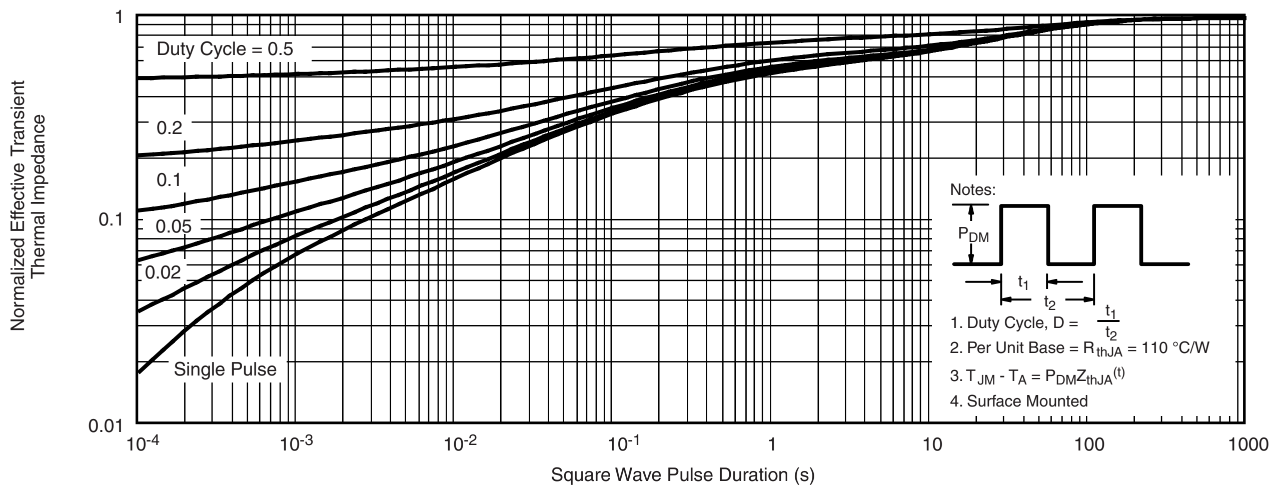
Current Derating*



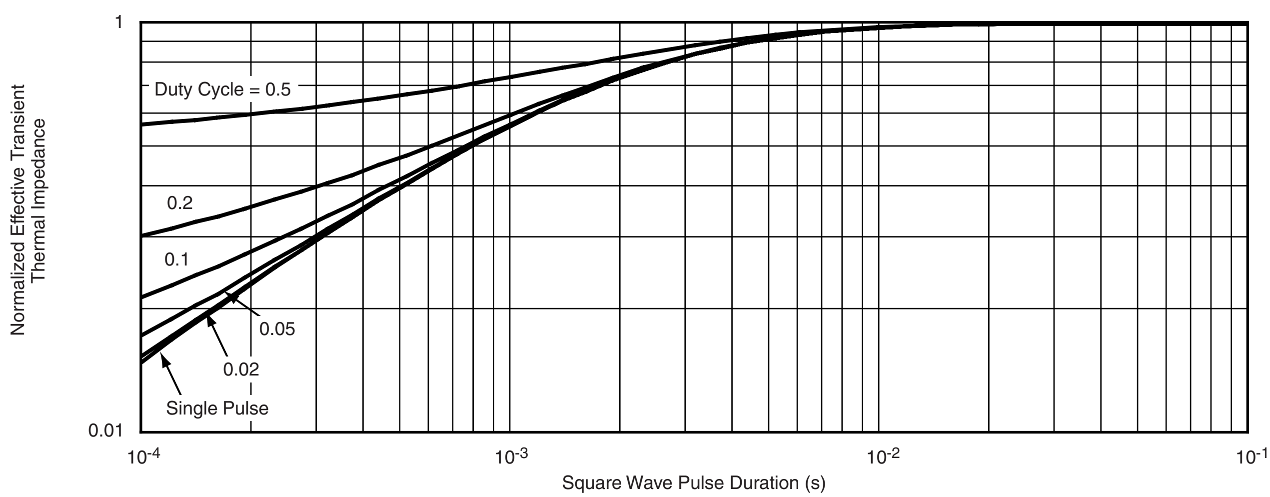
Power Derating

* 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.

CHANNEL 1 TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

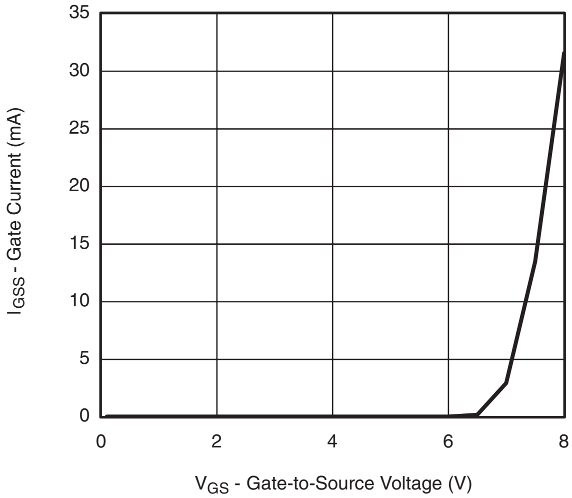


Normalized Thermal Transient Impedance, Junction-to-Ambient

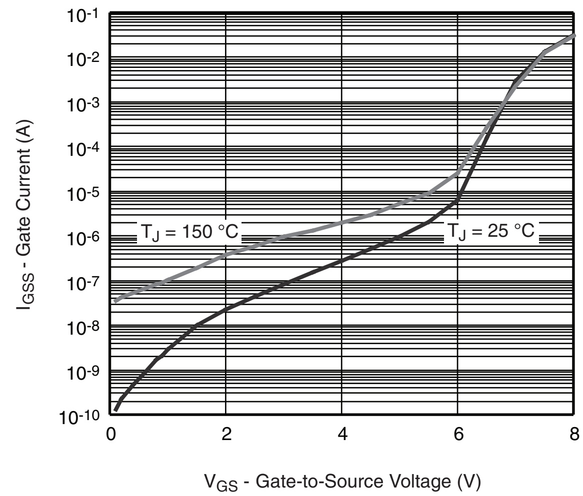


Normalized Thermal Transient Impedance, Junction-to-Case

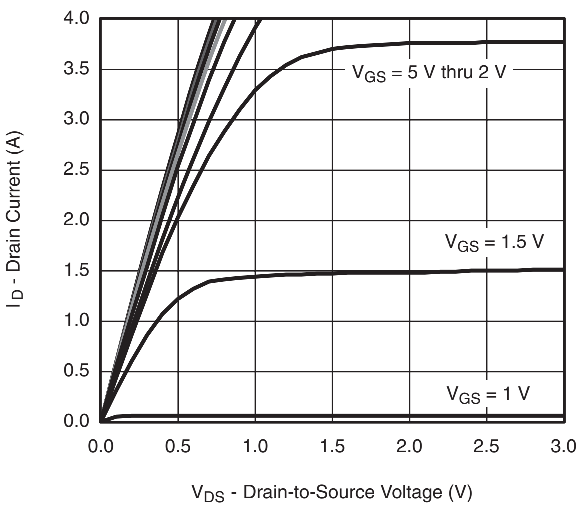
CHANNEL 2 TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



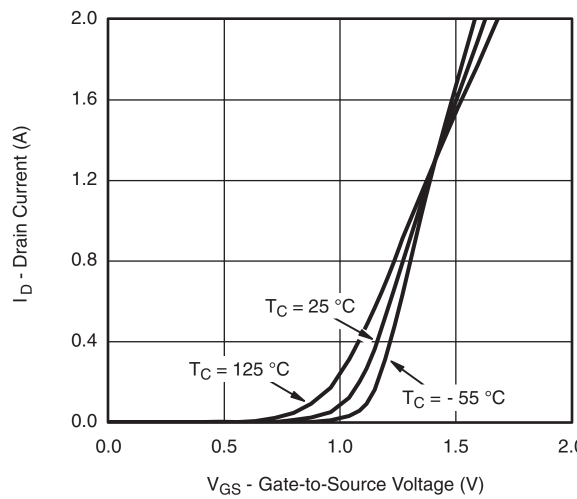
Gate Current vs. Gate-to-Source Voltage



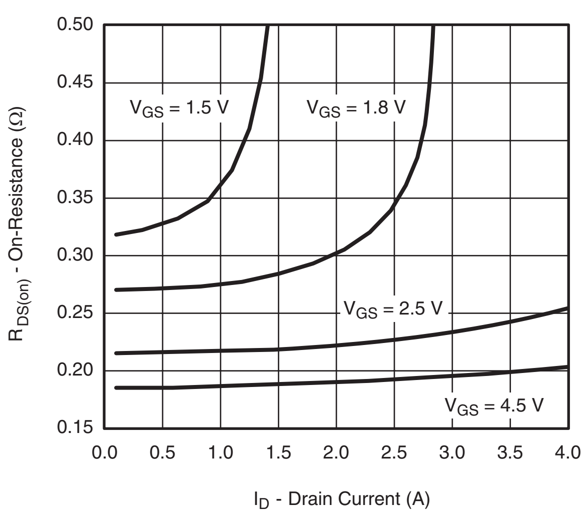
Gate Current vs. Gate-to-Source Voltage



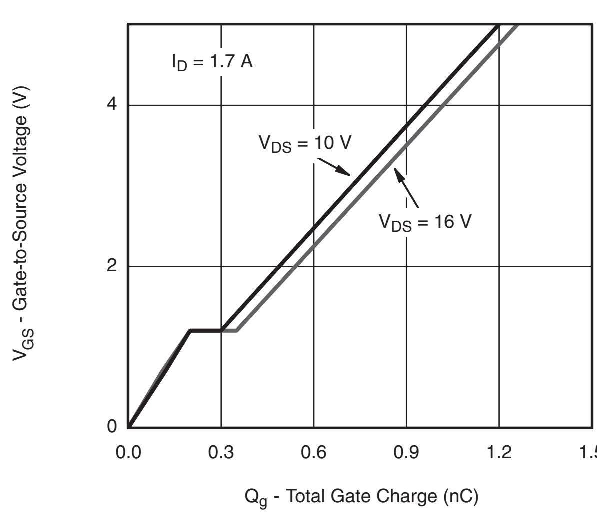
Output Characteristics



Transfer Characteristics

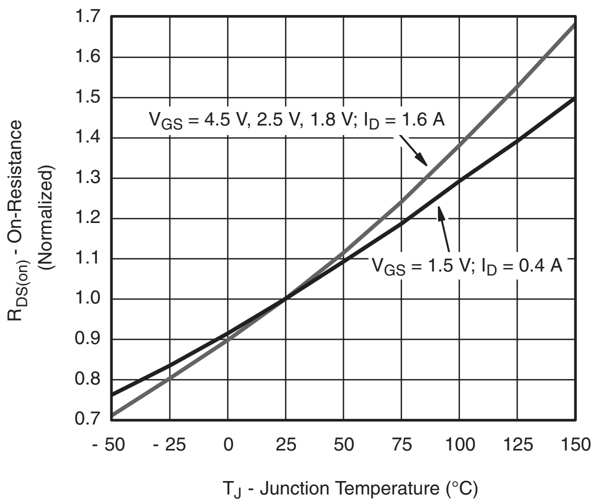


On-Resistance vs. Drain Current

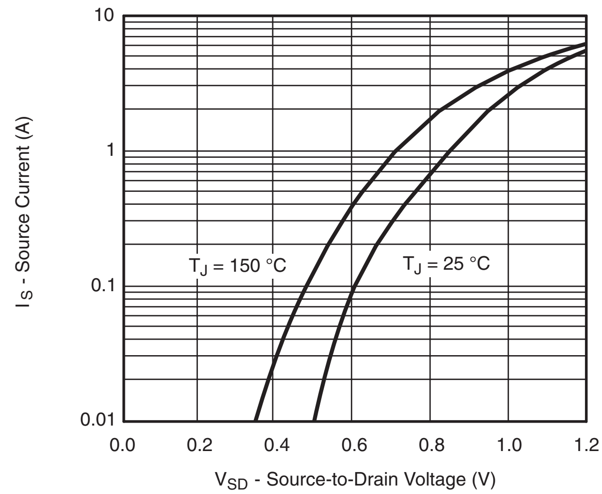


Gate Charge

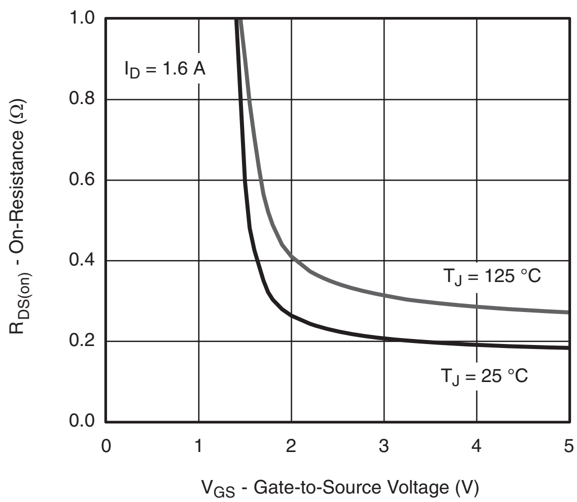
CHANNEL 2 TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



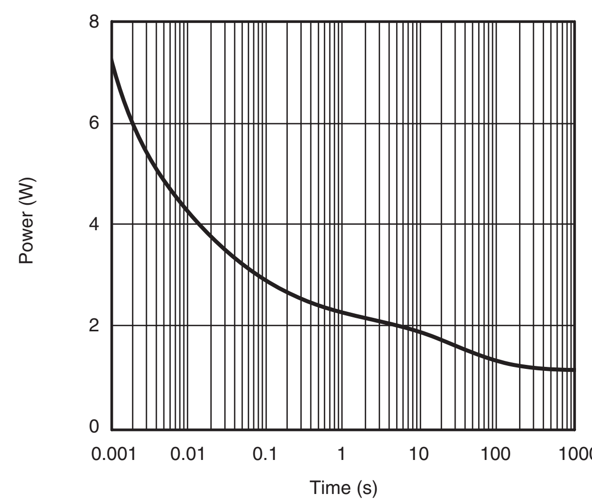
Normalized On-Resistance vs. Junction Temperature



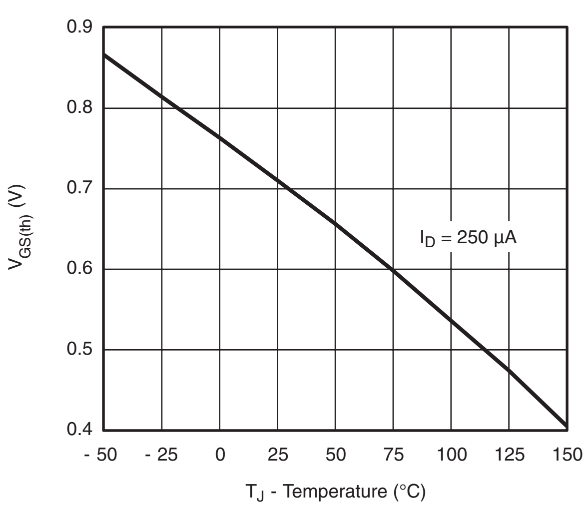
Source-Drain Diode Forward Voltage



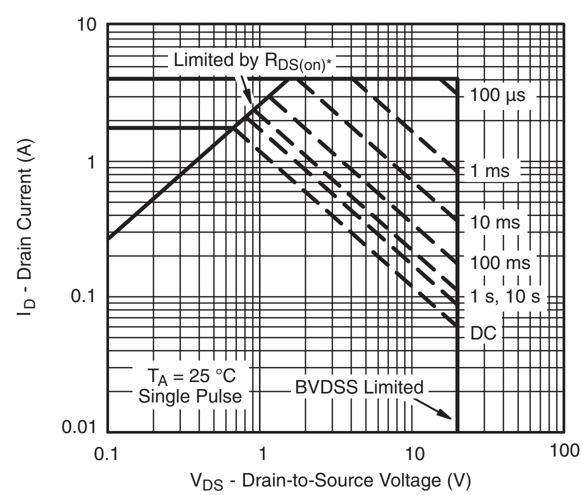
On-Resistance vs. Gate-to-Source Voltage



Single Pulse Power, Junction-to-Ambient



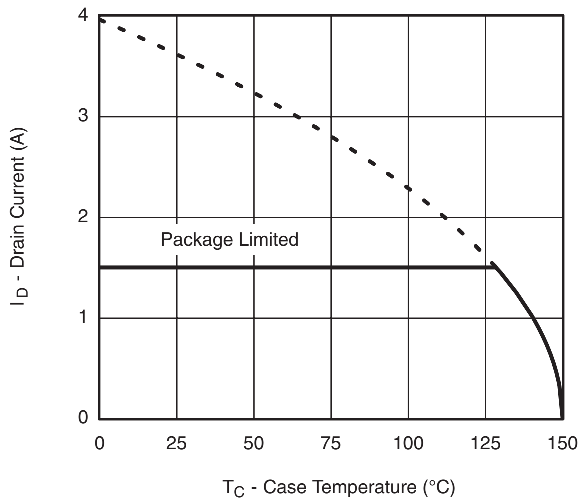
Threshold Voltage



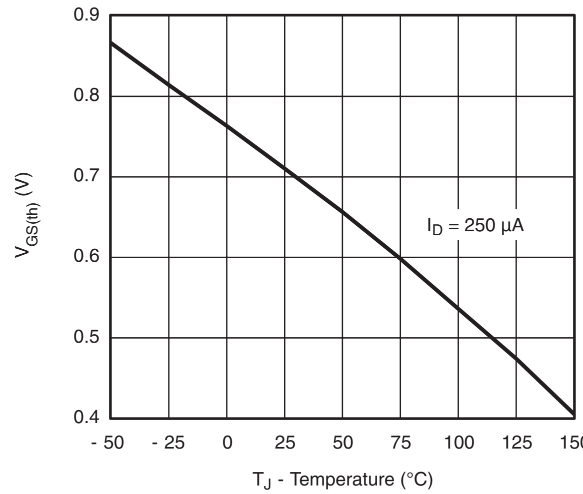
* V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

CHANNEL 2 TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



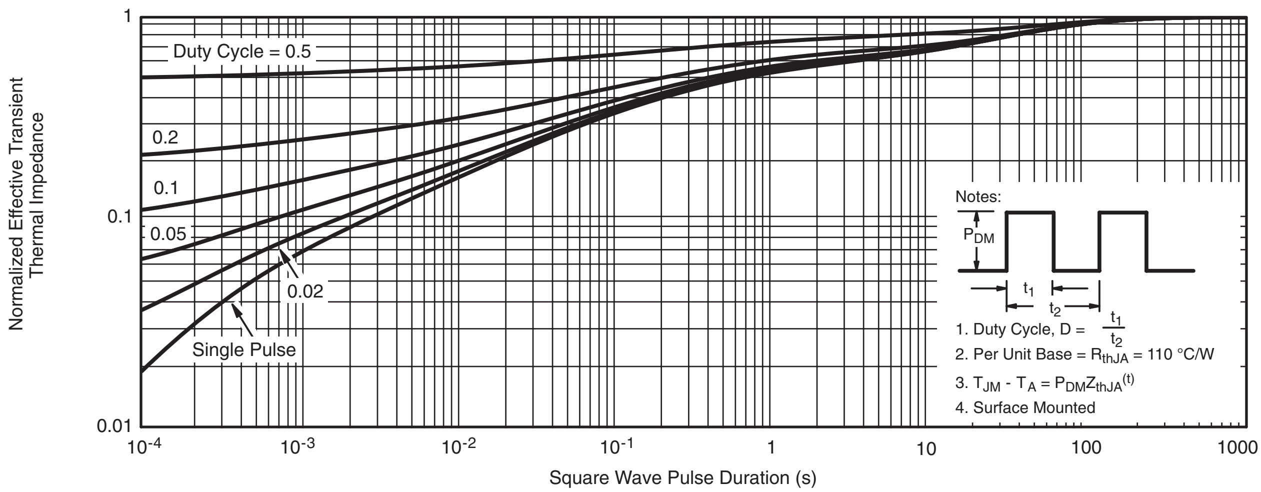
Current Derating*



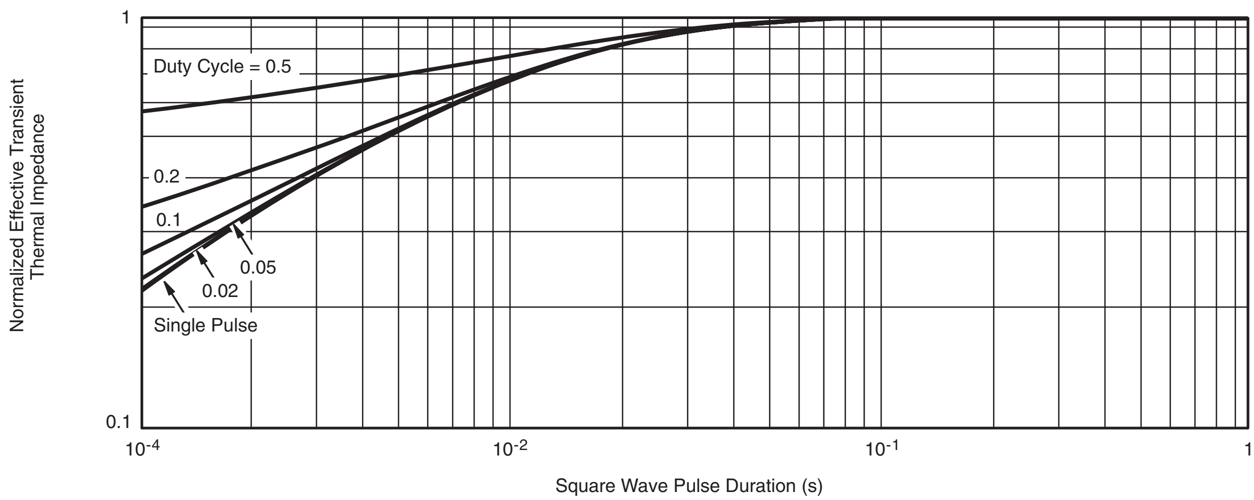
Power Derating

* 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.

CHANNEL 2 TYPICAL CHARACTERISTICS T_A = 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?65669.

Disclaimer

All product specifications and data are subject to change without notice.

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 herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

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.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.