

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

PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^a	Q_g
- 20	0.094 at $V_{GS} = - 4.5$ V	- 4.5	4.9 nC
	0.131 at $V_{GS} = - 2.5$ V	- 4.5	
	0.185 at $V_{GS} = - 1.8$ V	- 4.5	

SCHOTTKY PRODUCT SUMMARY		
V_{KA} (V)	V_f (V) Diode Forward Voltage	I_F (A) ^a
20	0.46 at 0.5 A	1

FEATURES

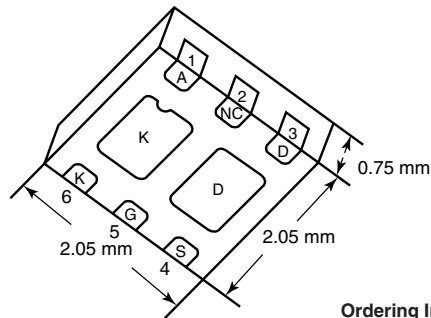
- Halogen-free
- LITTLE FOOT® Plus Schottky Power MOSFET
- New Thermally Enhanced PowerPAK® SC-70 Package
 - Small Footprint Area
 - Low On-Resistance
 - Thin 0.75 mm Profile



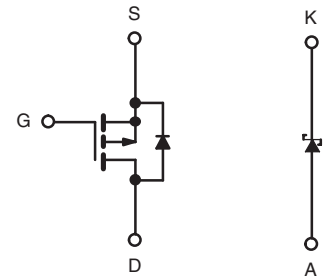
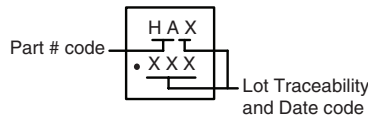
APPLICATIONS

- Cellular Charger Switch
- Buck Converter for Portable Devices
- Load Switch for Portable Devices

PowerPAK SC-70-6 Dual



Marking Code



Ordering Information: SiA813DJ-T1-GE3 (Lead (Pb)-free and Halogen-free)

P-Channel MOSFET

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}	± 8		
Continuous Drain Current ($T_J = 150$ °C) (MOSFET)	I_D	$T_C = 25$ °C	- 4.5 ^a	A
		$T_C = 70$ °C	- 4.5 ^a	
		$T_A = 25$ °C	- 3.6 ^{b, c}	
		$T_A = 70$ °C	- 2.9 ^{b, c}	
Pulsed Drain Current (MOSFET)	I_{DM}	- 8		
Continuous Source-Drain Diode Current (MOSFET Diode Conduction)	I_S	$T_C = 25$ °C	- 4.5 ^a	
		$T_A = 25$ °C	- 1.6 ^{b, c}	
Average Forward Current (Schottky)	I_F	1 ^b		
Pulsed Forward Current (Schottky)	I_{FM}	2		
Maximum Power Dissipation (MOSFET)	P_D	$T_C = 25$ °C	6.5	W
		$T_C = 70$ °C	5	
		$T_A = 25$ °C	1.9 ^{b, c}	
		$T_A = 70$ °C	1.2 ^{b, c}	
Maximum Power Dissipation (Schottky)	P_D	$T_C = 25$ °C	7.3	
		$T_C = 70$ °C	4.7	
		$T_A = 25$ °C	2.3 ^{b, c}	
		$T_A = 70$ °C	1.5 ^{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	Typical	Maximum	Unit
Maximum Junction-to-Ambient (MOSFET) ^{b, f}	$t \leq 5$ s	R_{thJA}	52	65	°C/W
Maximum Junction-to-Case (Drain) (MOSFET)	Steady State	R_{thJC}	12.5	16	
Maximum Junction-to-Ambient (Schottky) ^{b, g}	$t \leq 5$ s	R_{thJA}	40	55	
Maximum Junction-to-Case (Drain) (Schottky)	Steady State	R_{thJC}	13	17	

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 for MOSFET is 110 °C/W.

g. Maximum under Steady State conditions for Schottky is 85 °C.

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, $I_D = -250$ μ A	-20			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250$ μ A		-16.2		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			2.1		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = -250$ μ A	-0.4		-1	V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0$ V, $V_{GS} = \pm 8$ V			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -20$ V, $V_{GS} = 0$ V			-1	μ A
		$V_{DS} = -20$ V, $V_{GS} = 0$ V, $T_J = 55$ °C			-10	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \leq 5$ V, $V_{GS} = -4.5$ V	-8			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = -4.5$ V, $I_D = -2.8$ A		0.078	0.094	Ω
		$V_{GS} = -2.5$ V, $I_D = -2.3$ A		0.109	0.131	
		$V_{GS} = -1.8$ V, $I_D = -0.54$ A		0.153	0.185	
Forward Transconductance ^a	g_{fs}	$V_{DS} = -10$ V, $I_D = -2.8$ A		7		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = -10$ V, $V_{GS} = 0$ V, $f = 1$ MHz		355		pF
Output Capacitance	C_{oss}			75		
Reverse Transfer Capacitance	C_{rss}			50		
Total Gate Charge	Q_g	$V_{DS} = -10$ V, $V_{GS} = -8$ V, $I_D = -4.5$ A		8.5	13	nC
				4.9	7.4	
Gate-Source Charge	Q_{gs}	$V_{DS} = -10$ V, $V_{GS} = -4.5$ V, $I_D = -4.5$ A		0.75		nC
Gate-Drain Charge	Q_{gd}			1.2		
Gate Resistance	R_g	$f = 1$ MHz		8		Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10$ V, $R_L = 2.2$ Ω $I_D \equiv -4.5$ A, $V_{GEN} = -4.5$ V, $R_g = 1$ Ω		10	15	ns
Rise Time	t_r			35	55	
Turn-Off Delay Time	$t_{d(off)}$			40	60	
Fall Time	t_f			50	75	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10$ V, $R_L = 2.2$ Ω $I_D \equiv -4.5$ A, $V_{GEN} = -8$ V, $R_g = 1$ Ω		5	10	ns
Rise Time	t_r			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
Drain-Source Body Diode Characteristics						
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}	$I_S = - 4.5\text{ A}, V_{GS} = 0\text{ V}$		- 0.85	- 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}			13	26	nC
Reverse Recovery Fall Time	t_a			10		ns
Reverse Recovery Rise Time	t_b			15		

Notes:

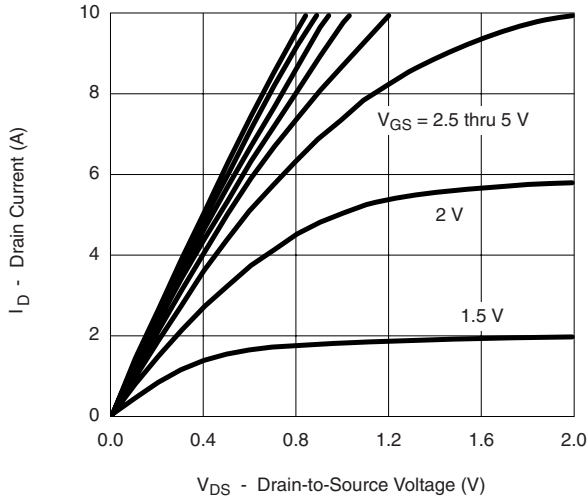
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
b. Guaranteed by design, not subject to production testing.

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	$I_F = 0.5\text{ A}$		0.381	0.46	V
		$I_F = 1\text{ A}$		0.468	0.560	
		$I_F = 1\text{ A}, T_J = 125\text{ }^\circ\text{C}$		0.44	0.53	
Maximum Reverse Leakage Current	I_{rm}	$V_r = 5\text{ V}$		0.0081	0.041	mA
		$V_r = 5\text{ V}, T_J = 85\text{ }^\circ\text{C}$		0.4	4	
		$V_r = 5\text{ V}, T_J = 125\text{ }^\circ\text{C}$		2.8	28	
		$V_r = 10\text{ V}$		0.0085	0.043	
		$V_r = 10\text{ V}, T_J = 85\text{ }^\circ\text{C}$		0.5	5	
		$V_r = 10\text{ V}, T_J = 125\text{ }^\circ\text{C}$		3	30	
		$V_r = 20\text{ V}$		0.0093	0.047	
		$V_r = 20\text{ V}, T_J = 85\text{ }^\circ\text{C}$		0.5	5	
		$V_r = 20\text{ V}, T_J = 125\text{ }^\circ\text{C}$		3.2	32	
Junction Capacitance	C_T	$V_r = 10\text{ V}$		30		pF

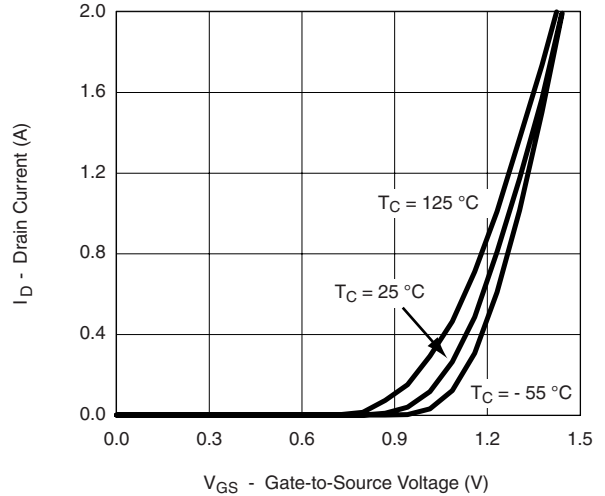
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



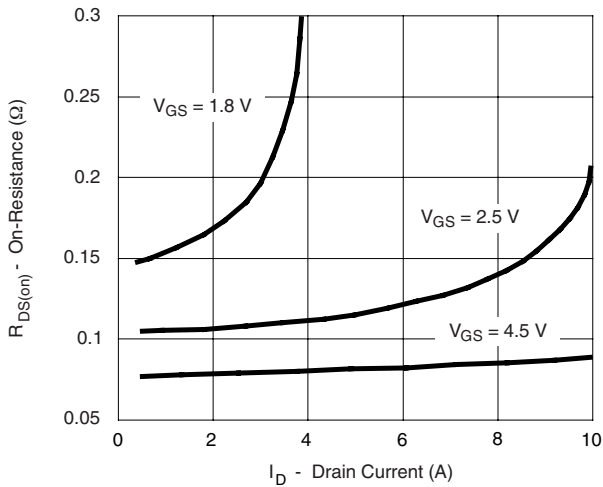
MOSFET TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted



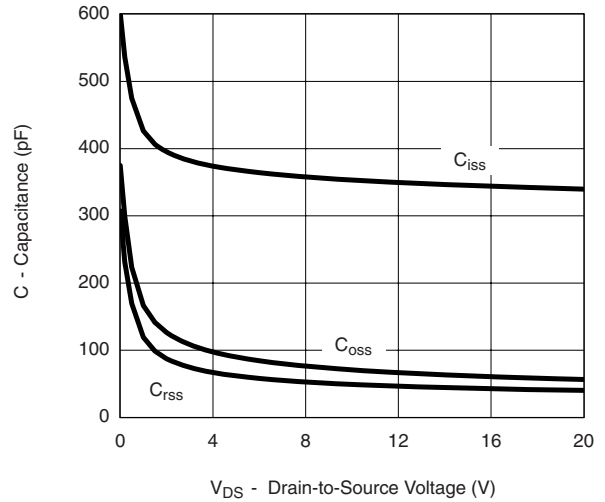
Output Characteristics



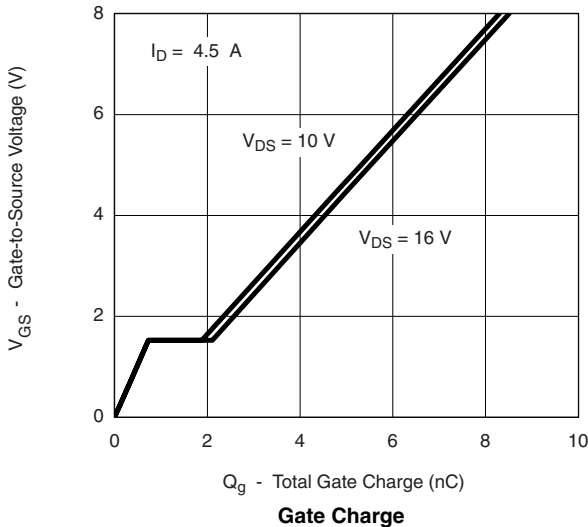
Transfer Characteristics



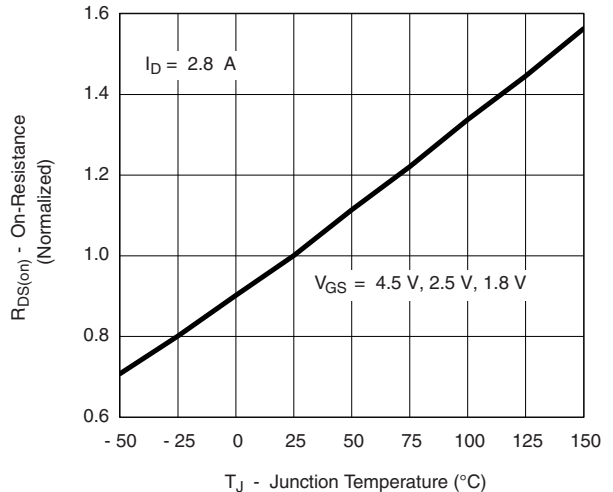
On-Resistance vs. Drain Current and Gate Voltage



Capacitance



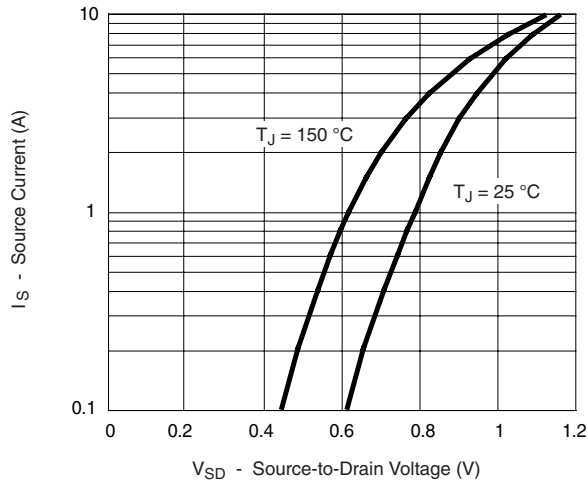
Gate Charge



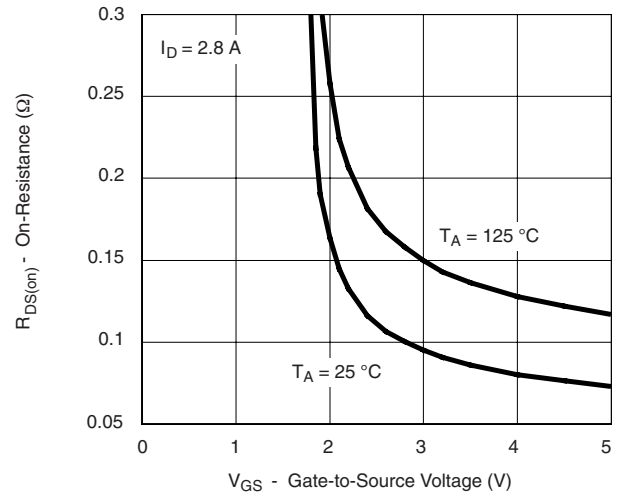
On-Resistance vs. Junction Temperature



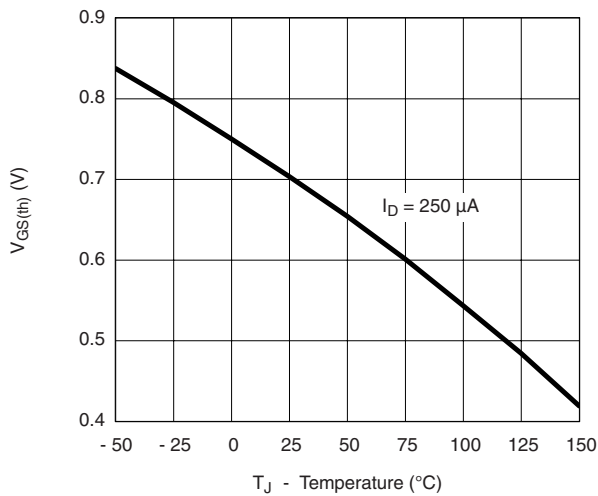
MOSFET TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted



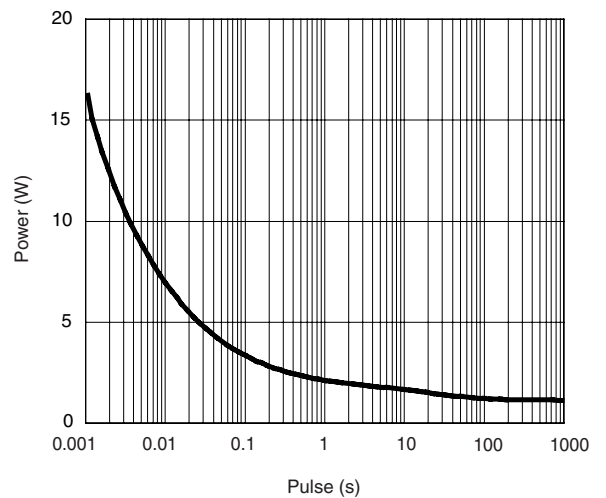
Source-Drain Diode Forward Voltage



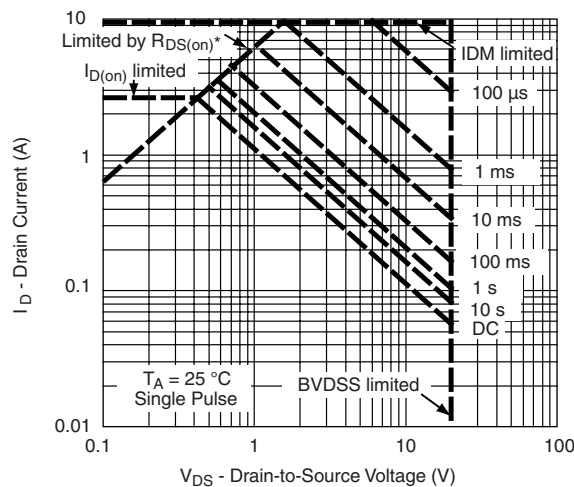
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

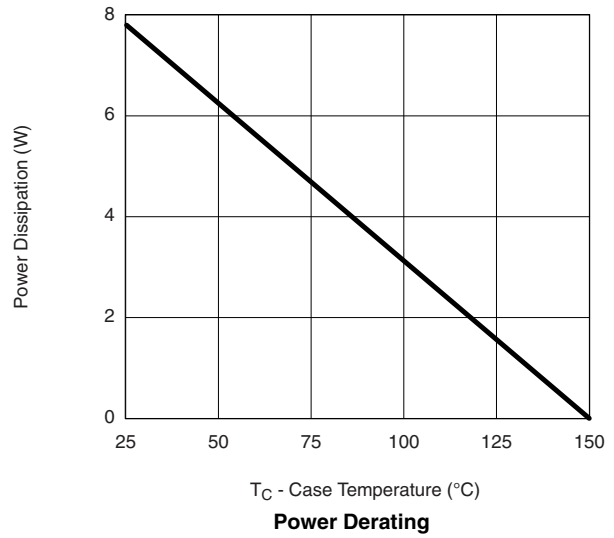
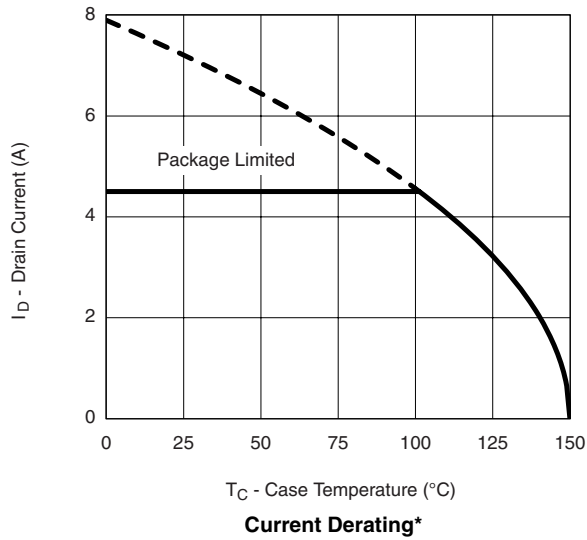


Single Pulse Power, Junction-to-Ambient



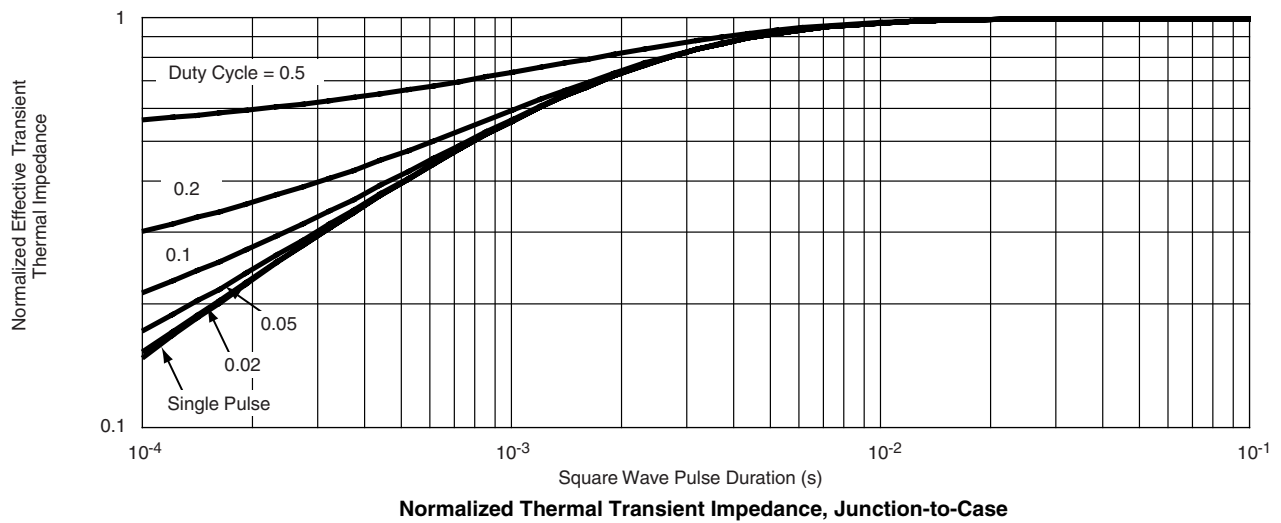
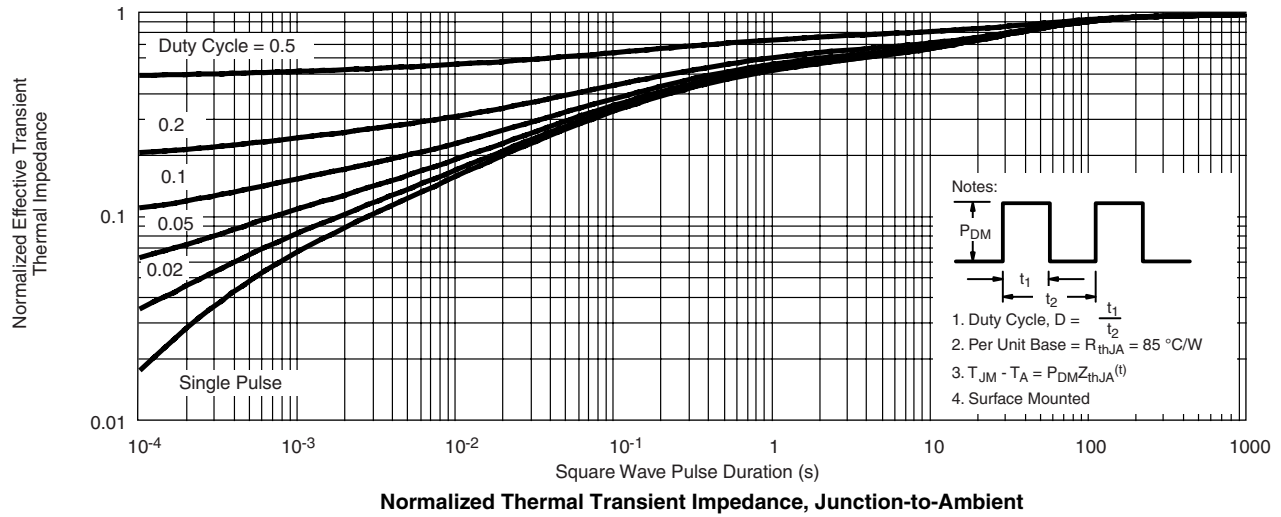
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Case

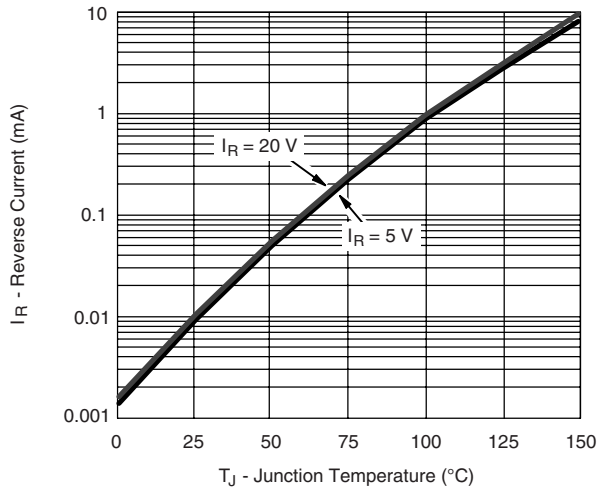
MOSFET TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted


* The power dissipation P_D is based on $T_{J(\max)} = 150\text{ }^\circ\text{C}$, 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.

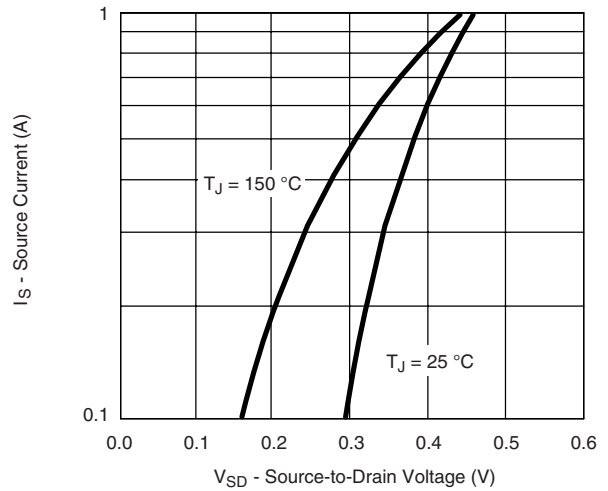
MOSFET TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted



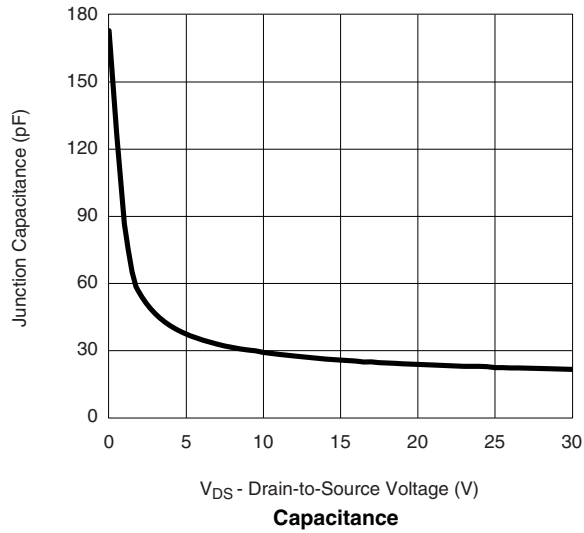
SCHOTTKY TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted



Reverse Current vs. Junction Temperature

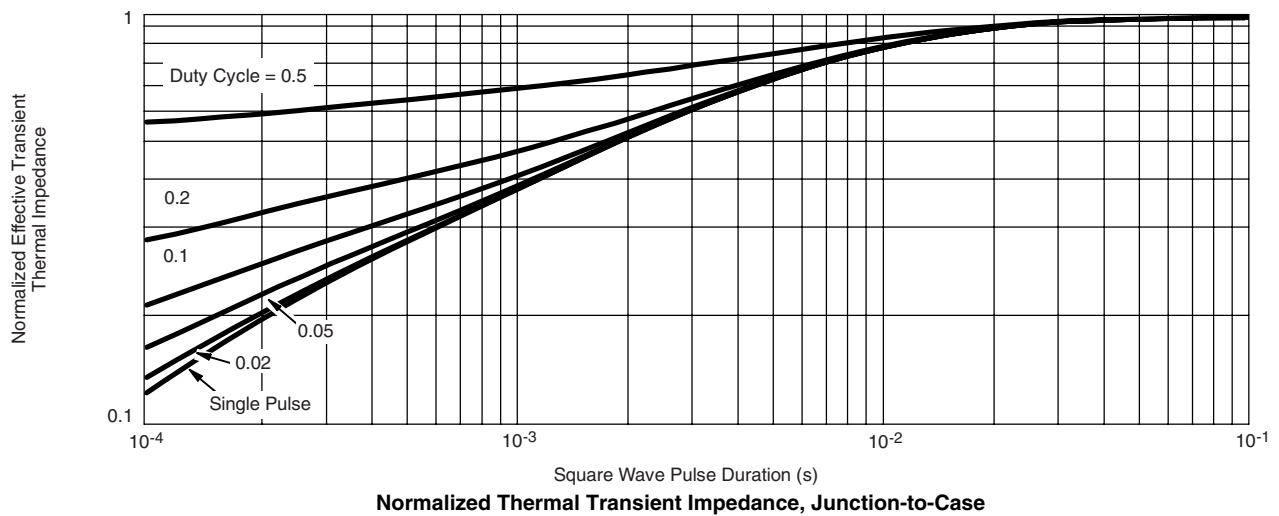
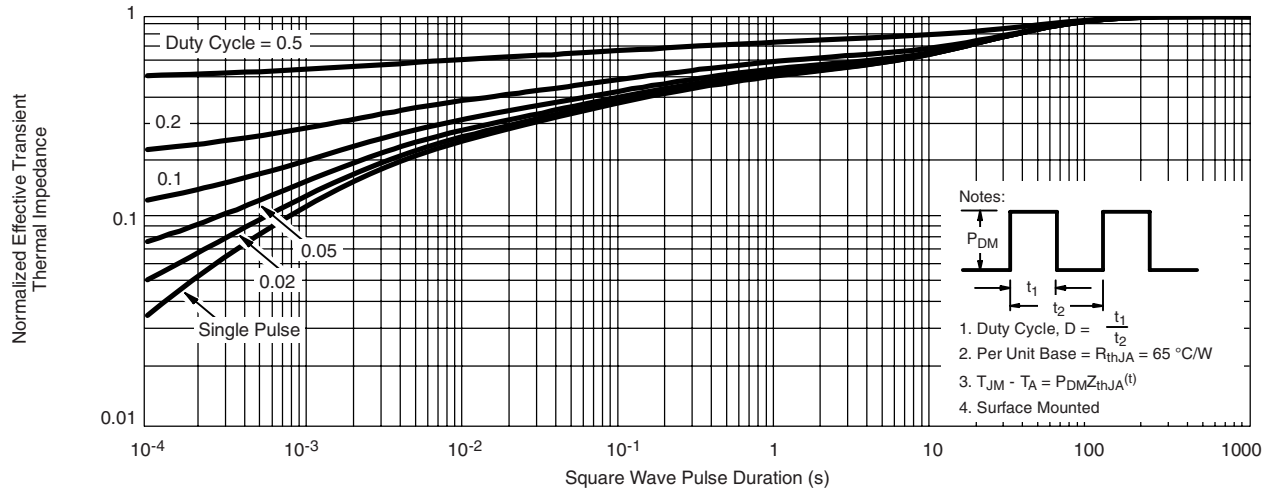


Forward Voltage Drop



Capacitance

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



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