



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

PRODUCT SUMMARY			
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$
- 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) <sup>a</sup>
20	0.46 at 0.5 A	1

### FEATURES

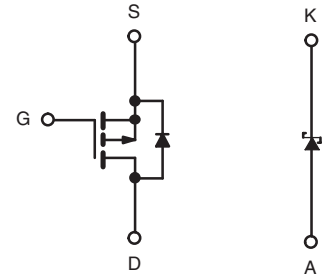
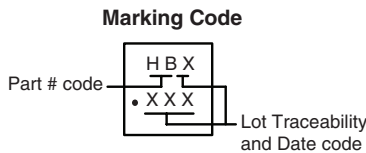
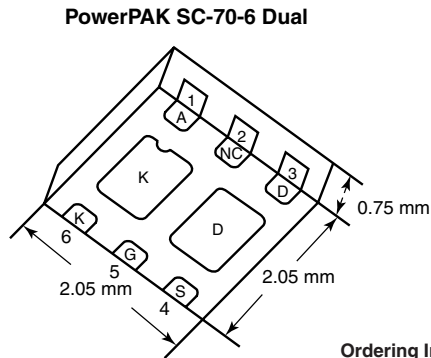
- Halogen-free According to IEC 61249-2-21 Definition
- LITTLE FOOT<sup>®</sup> Plus Schottky Power MOSFET
- New Thermally Enhanced PowerPAK<sup>®</sup> SC-70 Package
  - Small Footprint Area
  - Low On-Resistance
  - Thin 0.75 mm Profile
- Compliant to RoHS Directive 2002/95/EC



RoHS  
COMPLIANT  
HALOGEN  
FREE

### APPLICATIONS

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



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)	$V_{GS}$	$\pm 8$		
Continuous Drain Current ( $T_J = 150$ °C) (MOSFET)	$I_D$	$T_C = 25$ °C	- 4.5 <sup>a</sup>	A
		$T_C = 70$ °C	- 4.5 <sup>a</sup>	
		$T_A = 25$ °C	- 3.6 <sup>b, c</sup>	
		$T_A = 70$ °C	- 2.9 <sup>b, c</sup>	
Pulsed Drain Current (MOSFET)	$I_{DM}$	- 8		
Continuous Source-Drain Diode Current (MOSFET Diode Conduction)	$I_S$	$T_C = 25$ °C	- 4.5 <sup>a</sup>	
		$T_A = 25$ °C	- 1.6 <sup>b, c</sup>	
Average Forward Current (Schottky)	$I_F$	1 <sup>b</sup>		
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 <sup>b, c</sup>	
		$T_A = 70$ °C	1.2 <sup>b, c</sup>	
Maximum Power Dissipation (Schottky)	$P_D$	$T_C = 25$ °C	7.3	
		$T_C = 70$ °C	4.7	
		$T_A = 25$ °C	2.3 <sup>b, c</sup>	
		$T_A = 70$ °C	1.5 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150	°C	
Soldering Recommendations (Peak Temperature) <sup>d, e</sup>		260		

THERMAL RESISTANCE RATINGS					
Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient (MOSFET) <sup>b, f</sup>	$t \leq 5$ 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) <sup>b, g</sup>	$t \leq 5$ s	$R_{thJA}$	40	55	
Maximum Junction-to-Case (Drain) (Schottky)	Steady State	$R_{thJC}$	13	17	

## Notes:

- Package limited.
- Surface mounted on 1" x 1" FR4 board.
- $t = 5$  s.
- See solder profile ([www.vishay.com/ppg?73257](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.
- Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.
- Maximum under steady state conditions for MOSFET is 110 °C/W.
- 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
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0$ V, $I_D = -250$ $\mu$ A	-20			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250$ $\mu$ A		-16.2		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$		2.1			
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = -250$ $\mu$ A	-0.4		-1	V
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0$ V, $V_{GS} = \pm 8$ V			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -20$ V, $V_{GS} = 0$ V			-1	$\mu$ A
		$V_{DS} = -20$ V, $V_{GS} = 0$ V, $T_J = 55$ °C			-10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \leq 5$ V, $V_{GS} = -4.5$ V	-8			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -4.5$ V, $I_D = -2.8$ A		0.078	0.094	$\Omega$
		$V_{GS} = -2.5$ 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 <sup>a</sup>	$g_{fs}$	$V_{DS} = -10$ V, $I_D = -2.8$ A		7		S
<b>Dynamic<sup>b</sup></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		
Gate-Drain Charge	$Q_{gd}$		1.2			
Gate Resistance	$R_g$	$f = 1$ MHz		8		$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10$ V, $R_L = 2.2$ $\Omega$ $I_D \cong -4.5$ A, $V_{GEN} = -4.5$ V, $R_g = 1$ $\Omega$		10	15	ns
Rise Time	$t_r$		35	55		
Turn-Off DelayTime	$t_{d(off)}$		40	60		
Fall Time	$t_f$		50	75		
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10$ V, $R_L = 2.2$ $\Omega$ $I_D \cong -4.5$ A, $V_{GEN} = -8$ V, $R_g = 1$ $\Omega$		5	10	
Rise Time	$t_r$		10	15		
Turn-Off DelayTime	$t_{d(off)}$		20	30		
Fall Time	$t_f$		10	15		



<b>SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Drain-Source Body Diode Characteristics</b>						
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.

<b>SCHOTTKY SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , 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

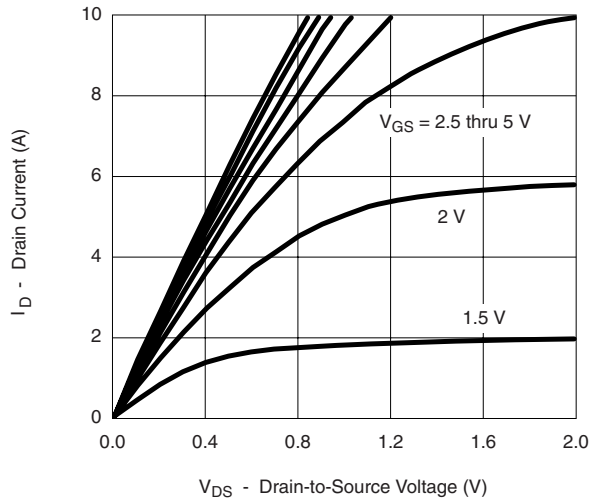
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

# SiA813DJ

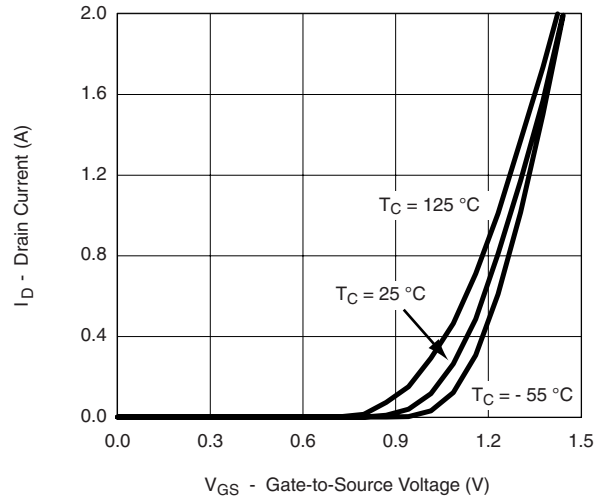
Vishay Siliconix



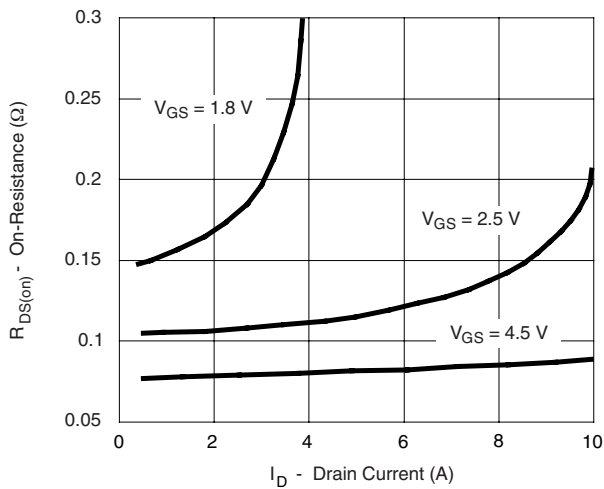
## MOSFET TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



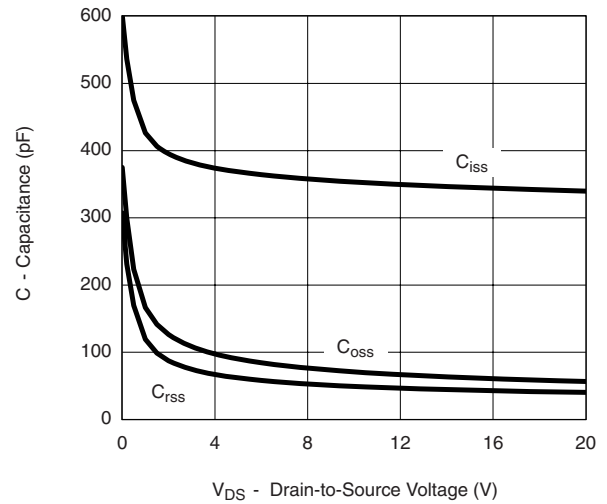
Output Characteristics



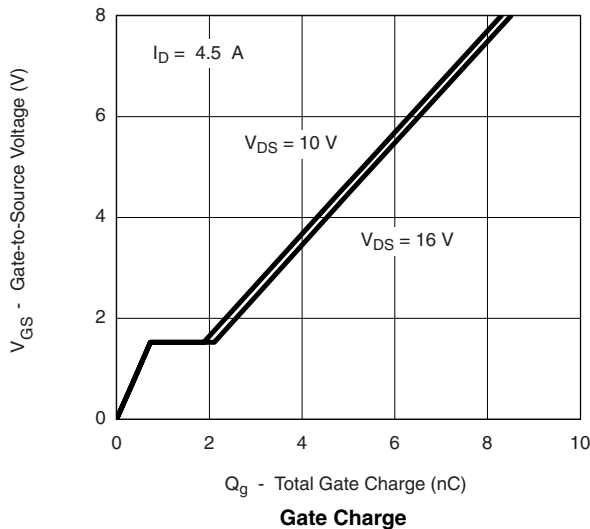
Transfer Characteristics



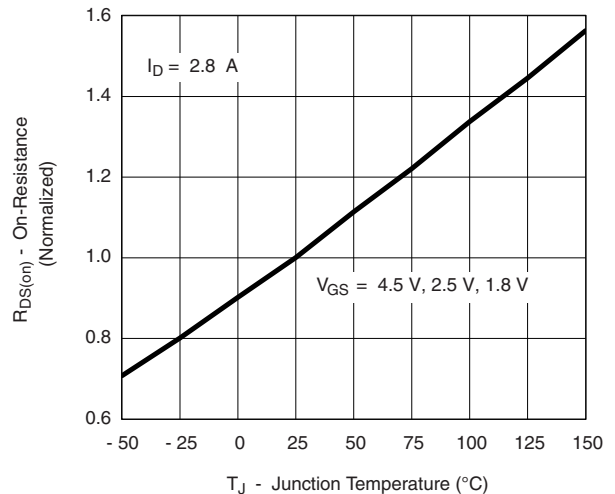
On-Resistance vs. Drain Current and Gate Voltage



Capacitance



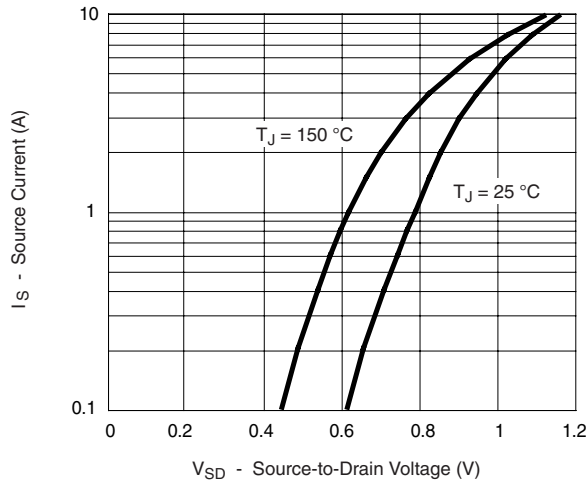
Gate Charge



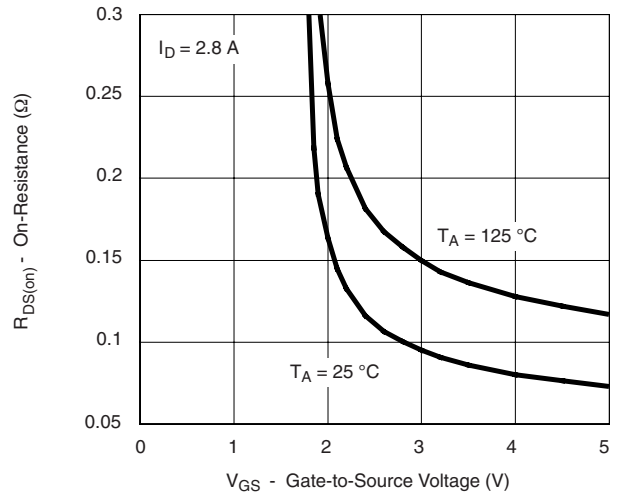
On-Resistance vs. Junction Temperature



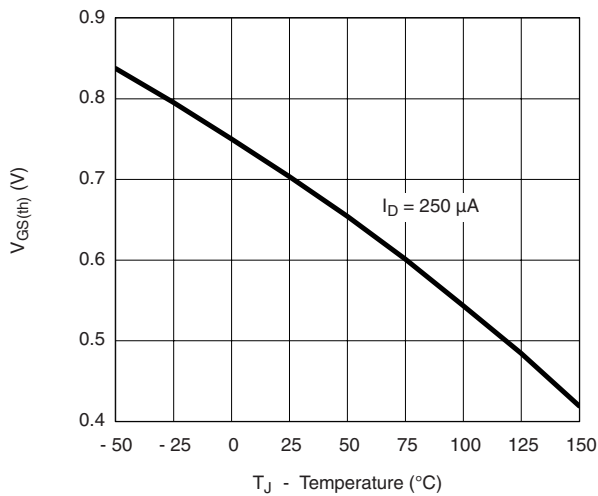
**MOSFET TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



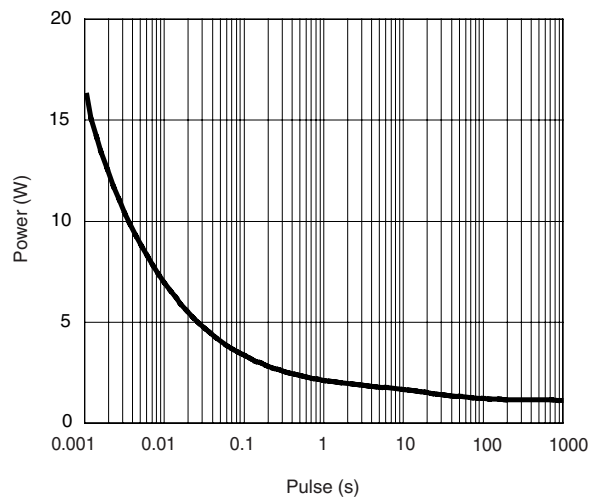
**Source-Drain Diode Forward Voltage**



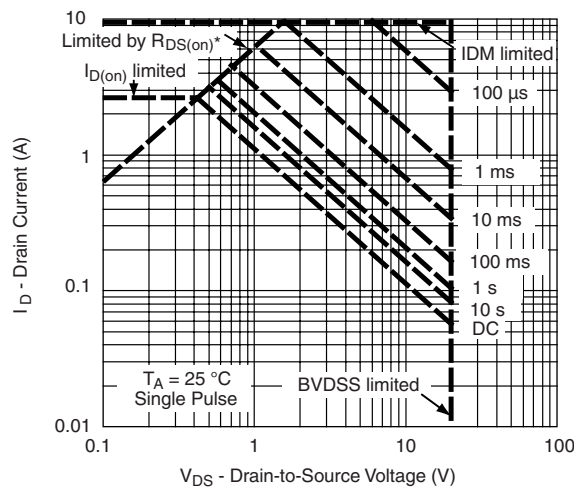
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**



**Single Pulse Power, Junction-to-Ambient**



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

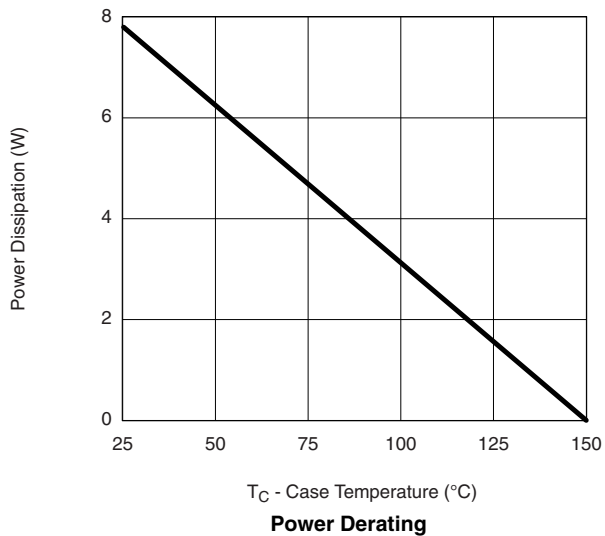
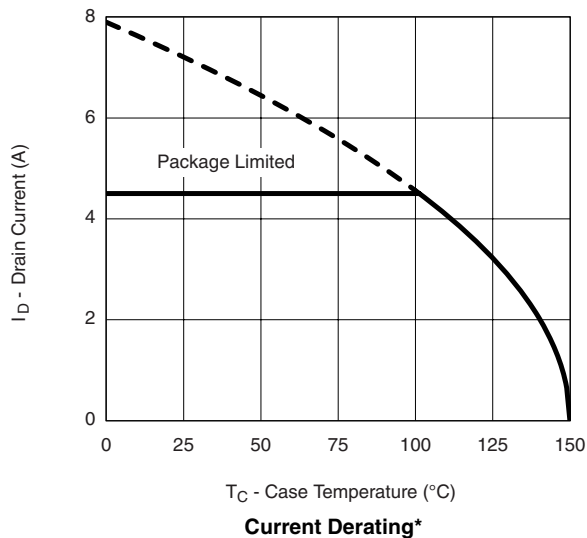
**Safe Operating Area, Junction-to-Case**

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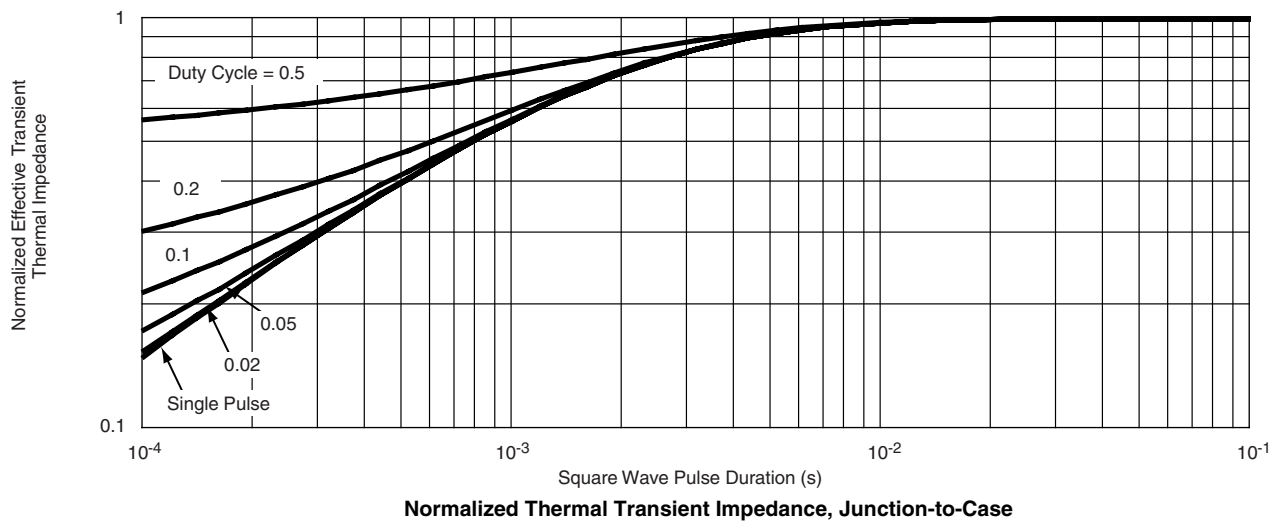
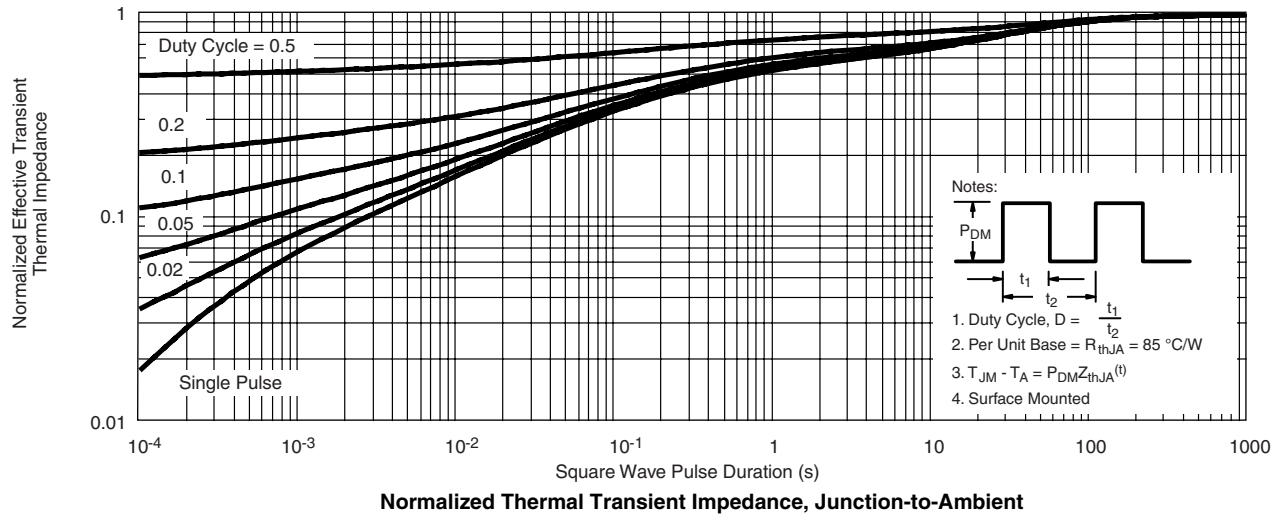
## MOSFET TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



\* 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

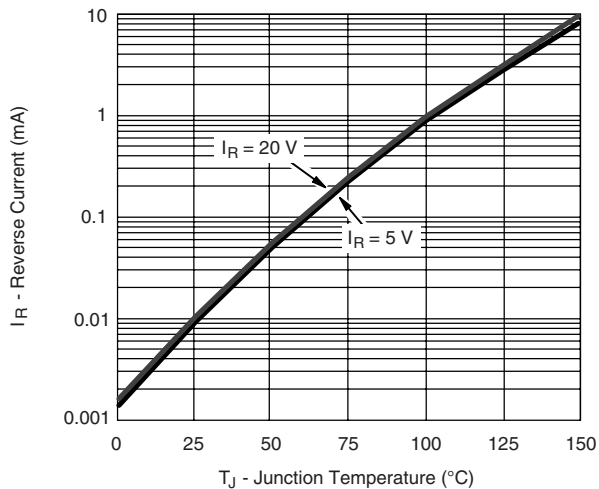


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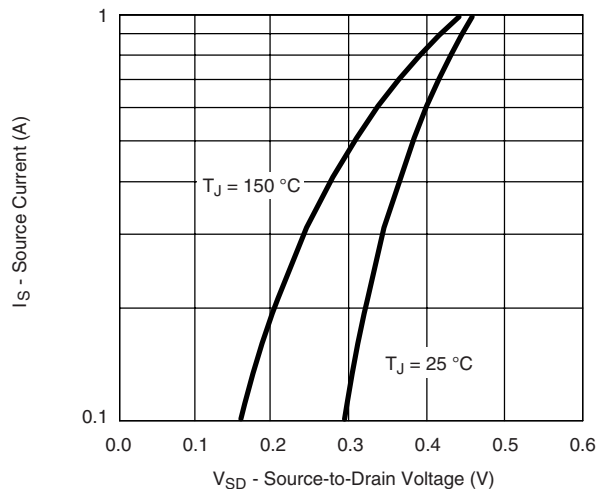
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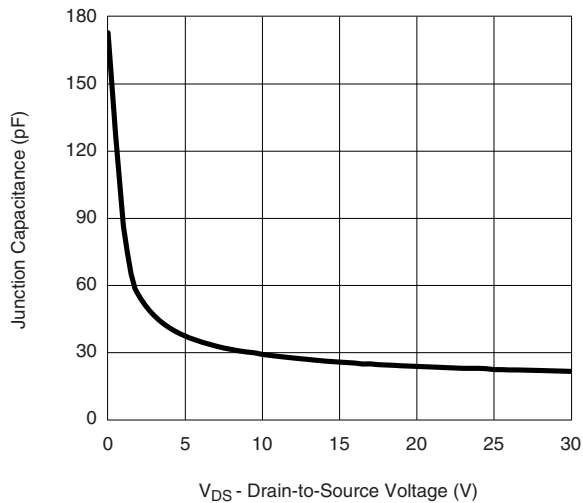
## SCHOTTKY TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



Reverse Current vs. Junction Temperature



Forward Voltage Drop

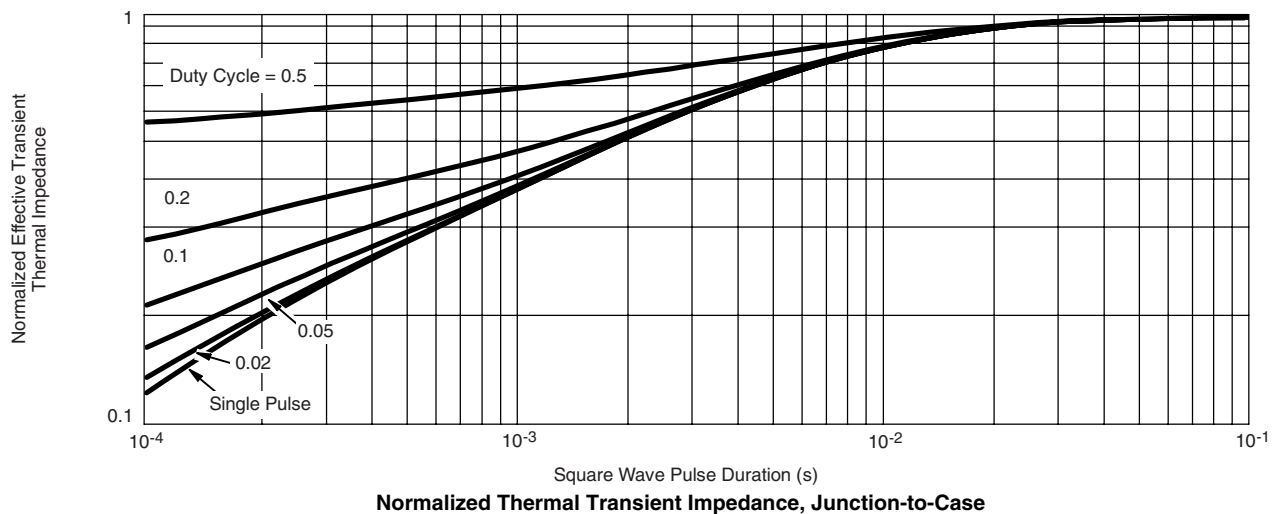
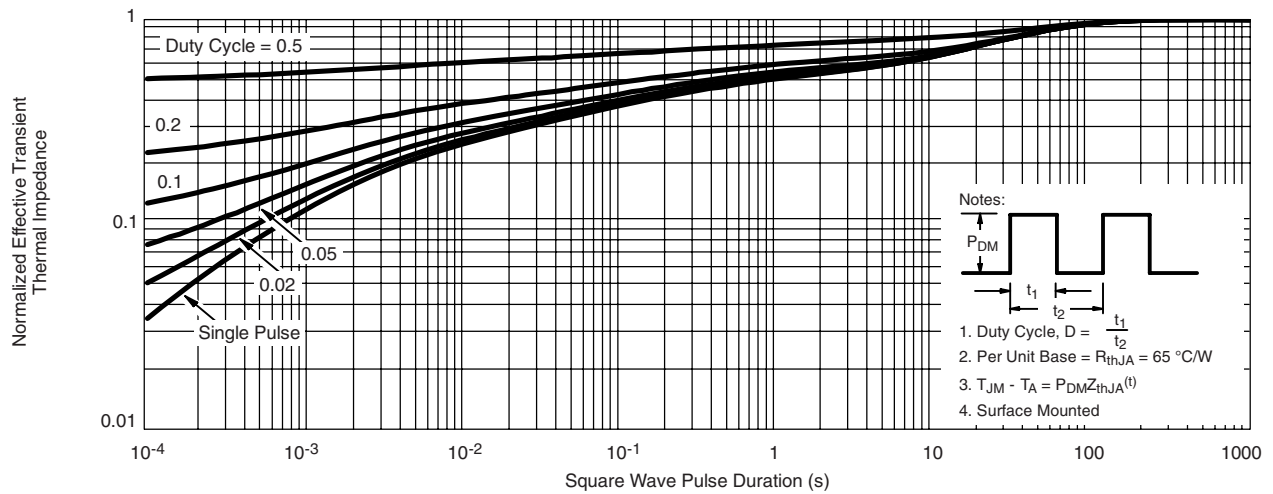


Capacitance





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



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