

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

MOSFET PRODUCT SUMMARY			
$V_{DS}$ (V)	$r_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ)
-20	0.210 @ $V_{GS} = -4.5$ V	-2.7	2.9
	0.345 @ $V_{GS} = -2.5$ V	-2.1	

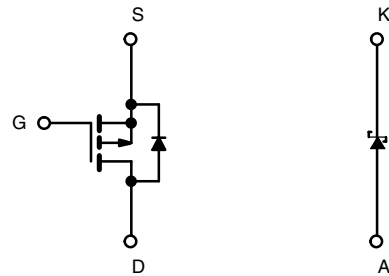
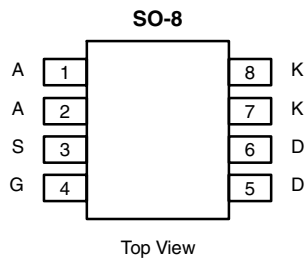
SCHOTTKY PRODUCT SUMMARY		
$V_{KA}$ (V)	$V_f$ (V) Diode Forward Voltage	$I_F$ (A) <sup>a</sup>
20	0.50 V @ 1 A	2.4

### FEATURES

- LITTLE FOOT® Plus Power MOSFET

### APPLICATIONS

- Asynchronous DC/DC Buck



Ordering Information: Si4845DY-T1—E3 (Lead (Pb)—Free)

P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ 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)		$V_{GS}$	$\pm 12$	
Continuous Drain Current ( $T_J = 150^\circ\text{C}$ ) (MOSFET)	$T_C = 25^\circ\text{C}$	$I_D$	-2.7	A
	$T_C = 70^\circ\text{C}$		-2.1	
	$T_A = 25^\circ\text{C}$		-2.1 <sup>b, c</sup>	
	$T_A = 70^\circ\text{C}$		-1.7 <sup>b, c</sup>	
Pulsed Drain Current (MOSFET)		$I_{DM}$	-7	A
Continuous Source Current (MOSFET Diode Conduction)	$T_C = 25^\circ\text{C}$	$I_S$	-2.4	
	$T_A = 25^\circ\text{C}$		-1.9 <sup>b, c</sup>	
Average Forward Current (Schottky)		$I_F$	-1 <sup>b</sup>	A
Pulsed Forward Current (Schottky)		$I_{FM}$	-7	
Maximum Power Dissipation (Schottky)	$T_C = 25^\circ\text{C}$	$P_D$	2.75	W
	$T_C = 70^\circ\text{C}$		1.75	
	$T_A = 25^\circ\text{C}$		1.75 <sup>b, c</sup>	
	$T_A = 70^\circ\text{C}$		1.1 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	-55 to 150	$^\circ\text{C}$

THERMAL RESISTANCE RATINGS				
Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient (MOSFET and Schottky)	$R_{thJA}$	60	71.5	$^\circ\text{C/W}$
Maximum Junction-to-Foot (Drain) (MOSFET and Schottky)	$R_{thJF}$	35	45	

Notes

- Based on  $T_C = 25^\circ\text{C}$ .
- Surface Mounted on FR4 Board.
- $t \leq 10$  sec.
- Maximum under Steady State conditions is  $120^\circ\text{C/W}$ .

MOSFET SPECIFICATIONS ( $T_J = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED)						
Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$	-20			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\ \mu\text{A}$		-25		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			2.6		
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$	-0.5		-1.5	V
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
		$V_{DS} = -20\text{ V}, V_{GS} = 0\text{ V}, T_J = 75^\circ\text{C}$			-10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq -5\text{ V}, V_{GS} = -4.5\text{ V}$	-5			A
Drain-Source On-State Resistance <sup>a</sup>	$r_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -2\text{ A}$		0.175	0.210	$\Omega$
		$V_{GS} = -2.5\text{ V}, I_D = -1\text{ A}$		0.285	0.345	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -15\text{ V}, I_D = -2\text{ A}$		3.5		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		312		pF
Output Capacitance	$C_{oss}$			63		
Reverse Transfer Capacitance	$C_{rss}$			33		
Total Gate Charge	$Q_g$	$V_{DS} = -10\text{ V}, V_{GS} = -4.5\text{ V}, I_D = -4\text{ A}$		2.9	4.5	nC
Gate-Source Charge	$Q_{gs}$			0.72		
Gate-Drain Charge	$Q_{gd}$			0.65		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		5.5		$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, R_L = 2.5\ \Omega$ $I_D \cong -4\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 1\ \Omega$		8	13	ns
Rise Time	$t_r$			40	60	
Turn-Off Delay Time	$t_{d(off)}$			17	26	
Fall Time	$t_f$			11	18	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10\text{ V}, R_L = 2.5\ \Omega$ $I_D \cong -4\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\ \Omega$		3	6	
Rise Time	$t_r$			10	16	
Turn-Off Delay Time	$t_{d(off)}$			12	20	
Fall Time	$t_f$			8	15	
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25^\circ\text{C}$			-2.7	A
Pulse Diode Forward Current <sup>a</sup>	$I_{SM}$				-7	
Body Diode Voltage	$V_{SD}$	$I_S = -1.9\text{ A}, V_{GS} = 0\text{ V}$		-0.85	-1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = -2\text{ A}, di/dt = 100\text{ A}/\mu\text{s}, T_J = 25^\circ\text{C}$		24	40	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			14	20	nC
Reverse Recovery Fall Time	$t_a$			14		ns
Reverse Recovery Rise Time	$t_b$			10		

## Notes

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



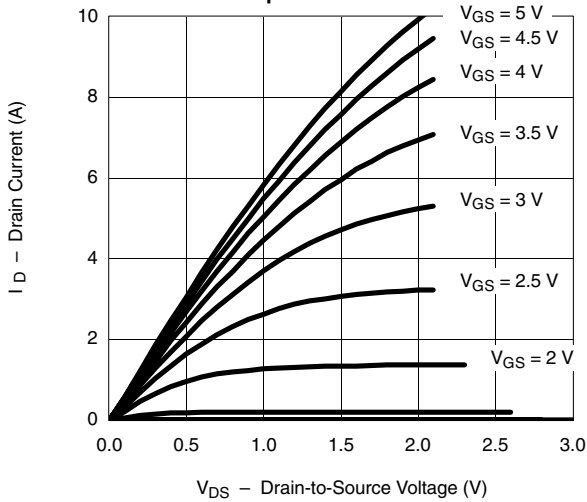
<b>SCHOTTKY SPECIFICATIONS (<math>T_J = 25^\circ\text{C}</math> UNLESS OTHERWISE NOTED)</b>						
<b>Parameter</b>	<b>Symbol</b>	<b>Test Condition</b>	<b>Min</b>	<b>Typ</b>	<b>Max</b>	<b>Unit</b>
Forward Voltage Drop	$V_F$	$I_F = 1\text{ A}$		0.45	0.50	V
		$I_F = 1\text{ A}, T_J = 125^\circ\text{C}$		0.36	0.42	
Maximum Reverse Leakage Current	$I_{rm}$	$V_r = 30\text{ V}$		0.04	0.1	mA
		$V_r = 30\text{ V}, T_J = 75^\circ\text{C}$		0.1	2	
		$V_r = 30\text{ V}, T_J = 125^\circ\text{C}$		2	10	
Junction Capacitance	$C_T$	$V_r = 10\text{ V}$		62		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.

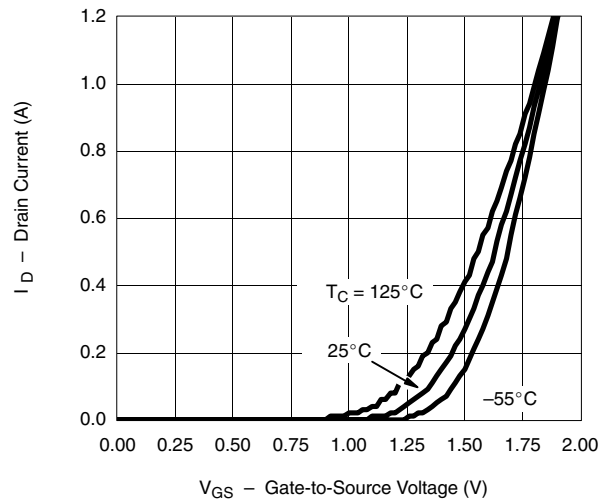


**TYPICAL CHARACTERISTICS (25 °C UNLESS NOTED) MOSFET**

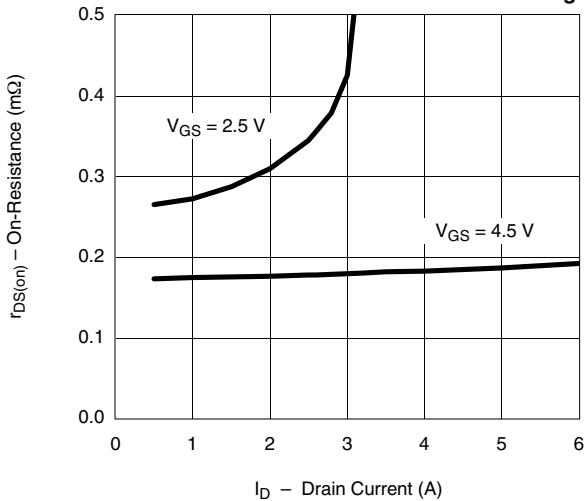
**Output Characteristics**



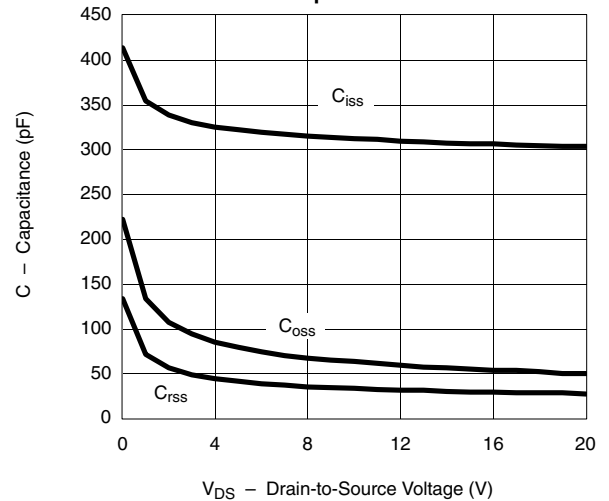
**Transfer Characteristics**



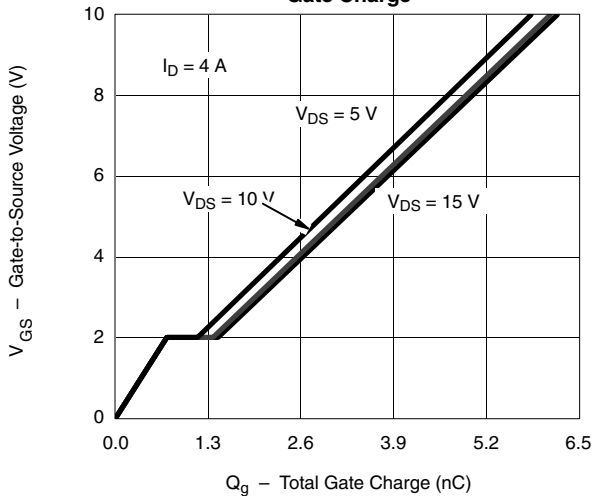
**On-Resistance vs. Drain Current and Gate Voltage**



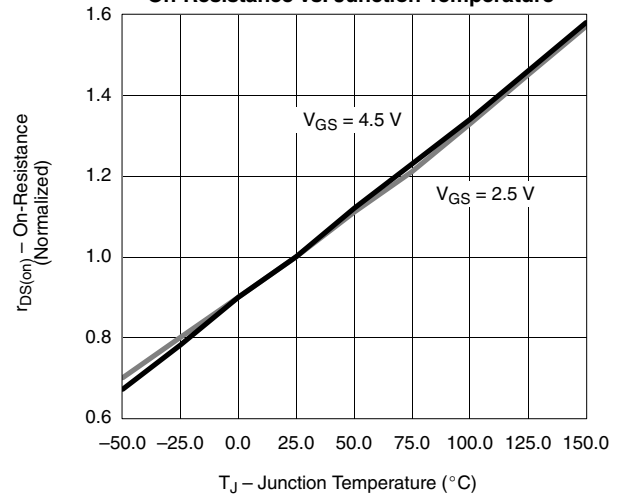
**Capacitance**



**Gate Charge**



**On-Resistance vs. Junction Temperature**

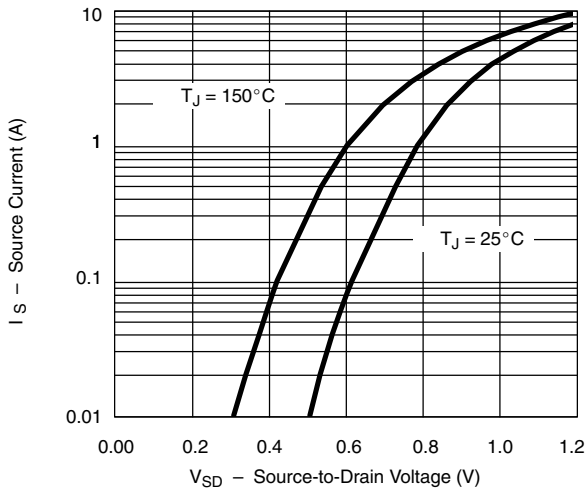




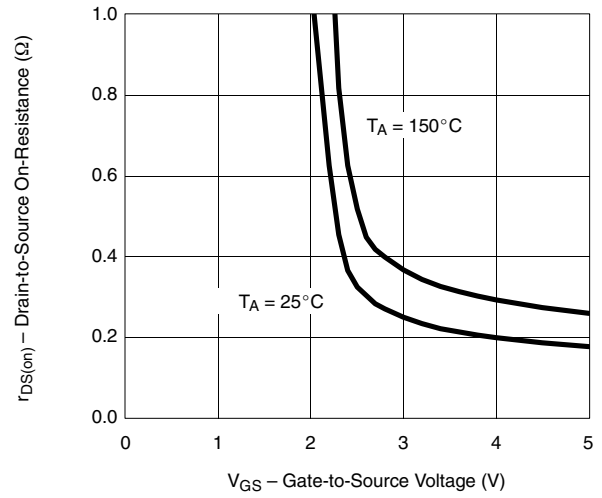
**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)**

**MOSFET**

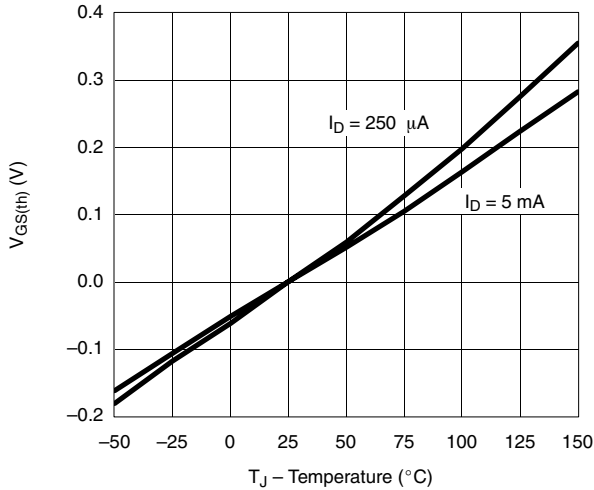
Source-Drain Diode Forward Voltage



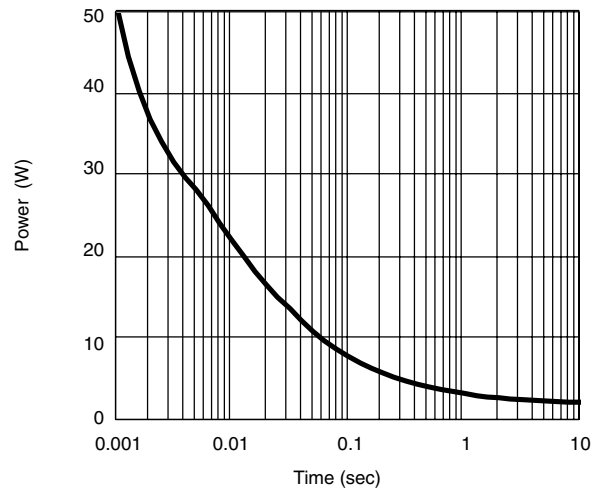
On-Resistance vs. Gate-to-Source Voltage



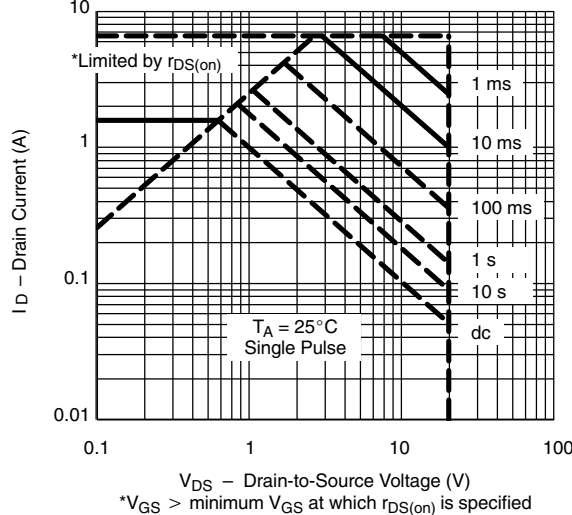
Threshold Voltage



Single Pulse Power, Junction-to-Ambient

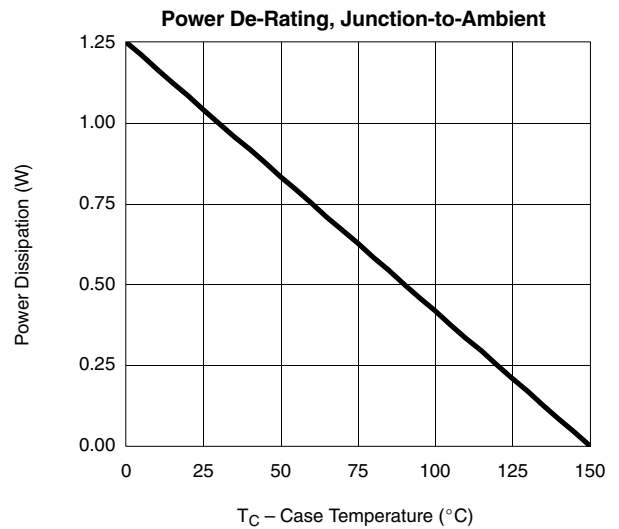
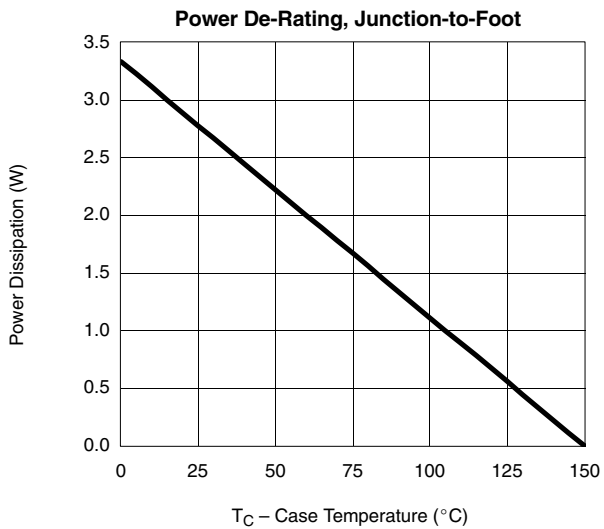
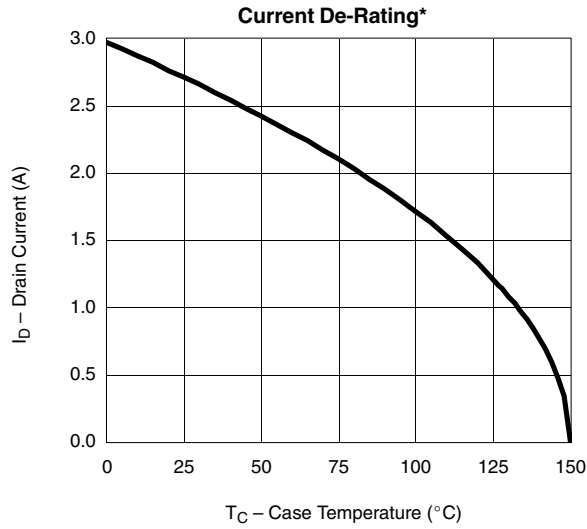


Safe Operating Area, Junction-to-Ambient



**TYPICAL CHARACTERISTICS (25 °C UNLESS NOTED)**

**MOSFET**

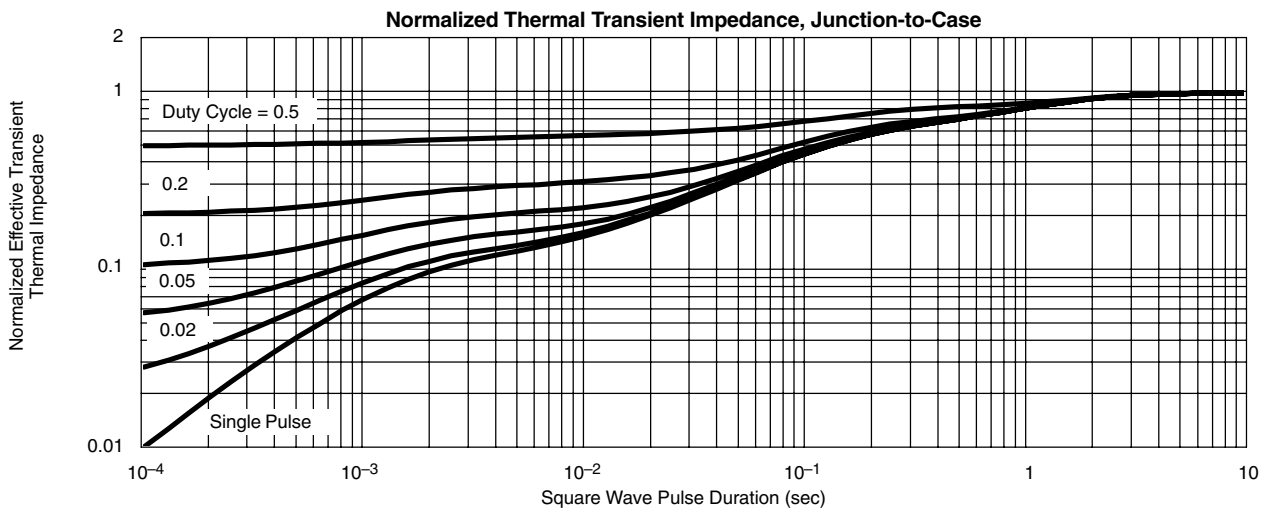
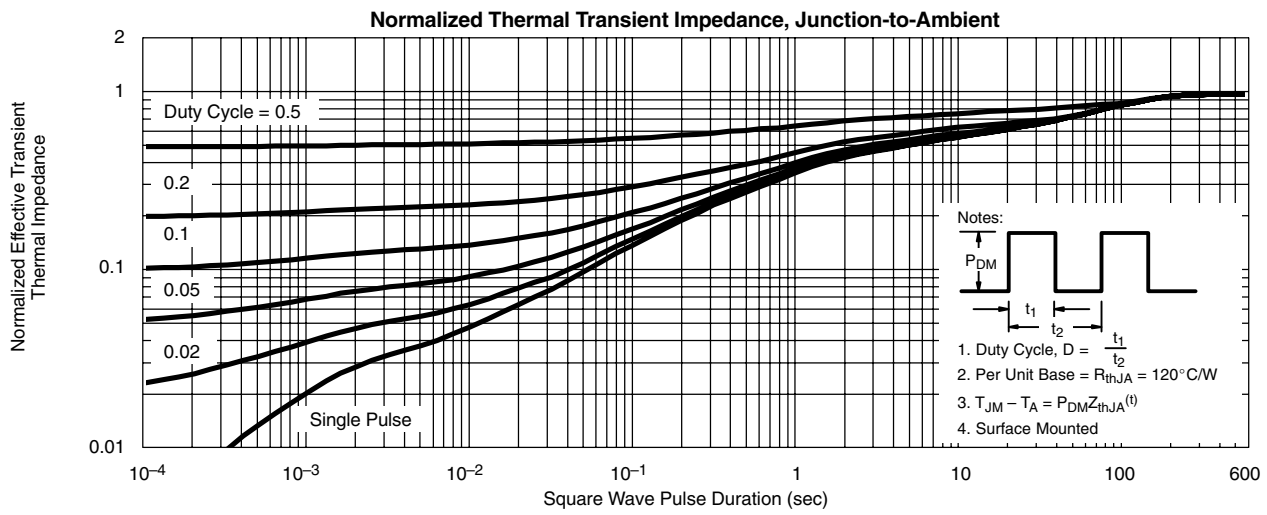


\*The power dissipation  $P_b$  is based on  $T_{J(max)} = 175^\circ\text{C}$ , using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.



TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

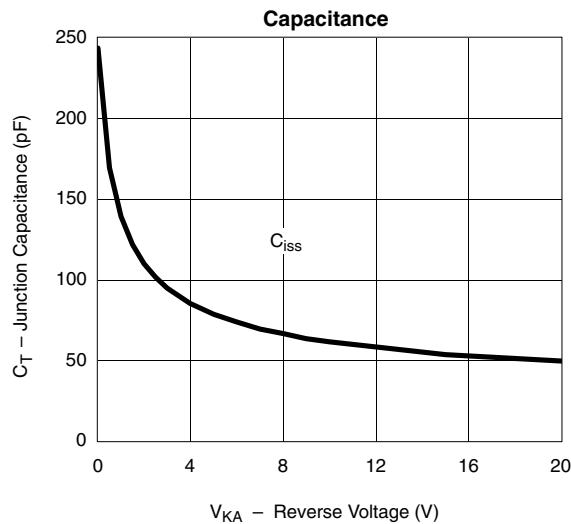
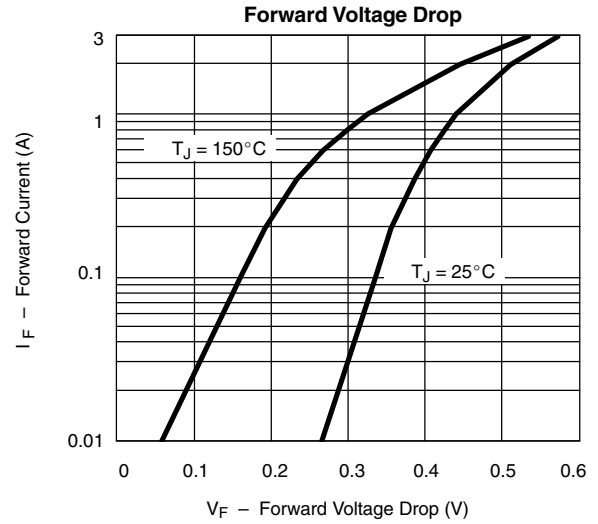
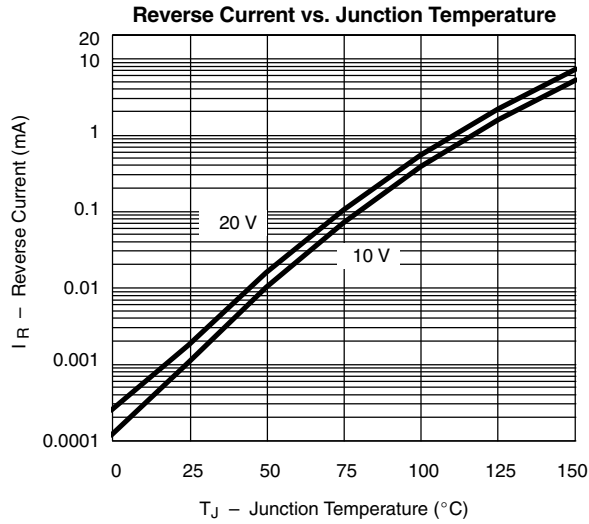
MOSFET





**TYPICAL CHARACTERISTICS (25 °C UNLESS NOTED)**

**SCHOTTKY**



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