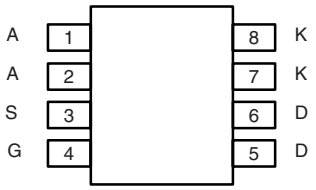
P-Channel 20-V (D-S) MOSFET with Schottky Diode

PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)[a]	Q_g (Typ.)
- 20	0.210 at V_{GS} = - 4.5 V	- 2.7	2.9
	0.345 at V_{GS} = - 2.5 V	- 2.1	

SCHOTTKY PRODUCT SUMMARY		
V_{KA} (V)	V_F (V) Diode Forward Voltage	I_F (A)
20	0.50 V at 1.0 A	2.4

SO-8



Top View

Ordering Information: Si4845DY-T1-E3 (Lead (Pb)-free)
Si4845DY-T1-GE3 (Lead (Pb)-free and Halogen-free)

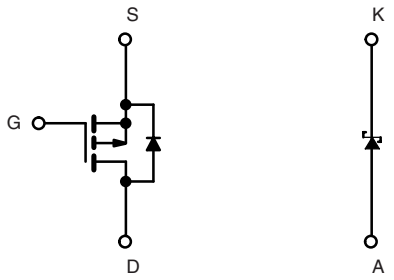
FEATURES

- **Halogen-free According to IEC 61249-2-21 Definition**
- LITTLE FOOT® *Plus* Integrated Schottky
- Compliant to RoHS Directive 2002/95/EC

Pb-free
RoHS COMPLIANT
HALOGEN FREE Available

APPLICATIONS

- Asynchronous dc-to-dc Buck



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}	± 12	
Continuous Drain Current (T_J = 150 °C) (MOSFET)	T_C = 25 °C	I_D	- 2.7	A
	T_C = 70 °C		- 2.1	
	T_A = 25 °C		- 2.1[b, c]	
	T_A = 70 °C		- 1.7[b, c]	
Pulsed Drain Current (MOSFET)		I_{DM}	- 7	
Continuous Source-Drain Diode Current (MOSFET Diode Conduction)	T_C = 25 °C	I_S	- 2.4	
	T_A = 25 °C		- 1.9[b, c]	
Average Forward Current (Schottky)		I_F	1[b]	
Pulsed Foward Current (Schottky)		I_{FM}	- 7	
Maximum Power Dissipation (Schottky)	T_C = 25 °C	P_D	2.75	W
	T_C = 70 °C		1.75	
	T_A = 25 °C		1.75[b, c]	
	T_A = 70 °C		1.1[b, c]	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150	°C

THERMAL RESISTANCE RATINGS				
Parameter	**Symbol**	**Typ.**	**Max.**	**Unit**
Maximum Junction-to-Ambient (MOSFET and Schottky)	R_{thJA}	60	71.5	°C/W
Maximum Junction-to-Foot (Drain) (MOSFET and Schottky)	R_{thJF}	35	45	

Notes:
a. Based on T_C = 25 °C.
b. Surface mounted on 1" x 1" FR4 board.
c. t = 10 s.
d. Maximum under steady state conditions is 120 °C/W.

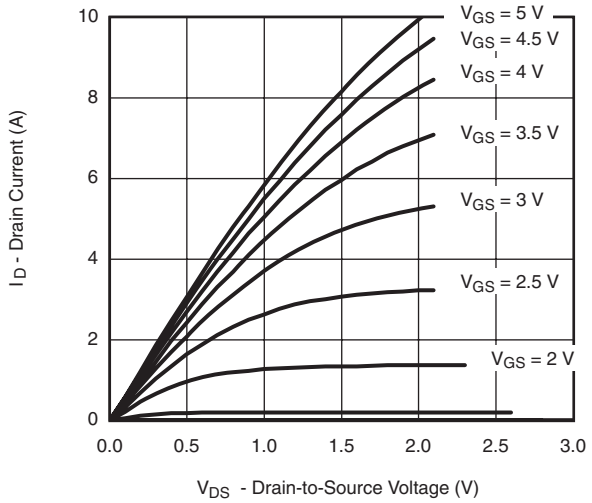
MOSFET SPECIFICATIONS T_J = 25 °C, unless otherwise noted						
Parameter	**Symbol**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Static						
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = - 250 µA	- 20			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	I_D = - 250 µA		- 25		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			2.6		
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = - 250 µA	- 0.5		- 1.5	V
Gate-Source Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 12 V			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = - 20 V, V_{GS} = 0 V			- 1	µA
		V_{DS} = - 20 V, V_{GS} = 0 V, T_J = 75 °C			- 10	
On-State Drain Current[a]	$I_{D(on)}$	$V_{DS} \geq$ - 5 V, V_{GS} = - 4.5 V	- 5			A
Drain-Source On-State Resistance[a]	$R_{DS(on)}$	V_{GS} = - 4.5 V, I_D = - 2 A		0.175	0.210	Ω
		V_{GS} = - 2.5 V, I_D = - 1.0 A		0.285	0.345	
Forward Transconductance[a]	g_{fs}	V_{DS} = - 15 V, I_D = - 2 A		3.5		S
Dynamic[b]						
Input Capacitance	C_{iss}	V_{DS} = - 10 V, V_{GS} = 0 V, f = 1 MHz		312		pF
Output Capacitance	C_{oss}			63		
Reverse Transfer Capacitance	C_{rss}			33		
Total Gate Charge	Q_g	V_{DS} = - 10 V, V_{GS} = - 4.5 V, I_D = - 4 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 MHz		5.5		Ω
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = - 10 V, R_L = 2.5 Ω $I_D \cong$ - 4 A, V_{GEN} = - 4.5 V, R_g = 1 Ω		8	13	ns
Rise Time	t_r			40	60	
Turn-Off DelayTime	$t_{d(off)}$			17	26	
Fall Time	t_f			11	18	
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = - 10 V, R_L = 2.5 Ω $I_D \cong$ - 4 A, V_{GEN} = - 10 V, R_g = 1 Ω		3	6	
Rise Time	t_r			10	16	
Turn-Off DelayTime	$t_{d(off)}$			12	20	
Fall Time	t_f			8	15	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	T_C = 25 °C			- 2.7	A
Pulse Diode Forward Current	I_{SM}				- 7	
Body Diode Voltage	V_{SD}	I_S = - 1.9 A, V_{GS} = 0 V		- 0.85	- 1.2	V
Body Diode Reverse Recovery Time	t_{rr}	I_F = - 2 A, dI/dt = 100 A/µs, T_J = 25 °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 ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.

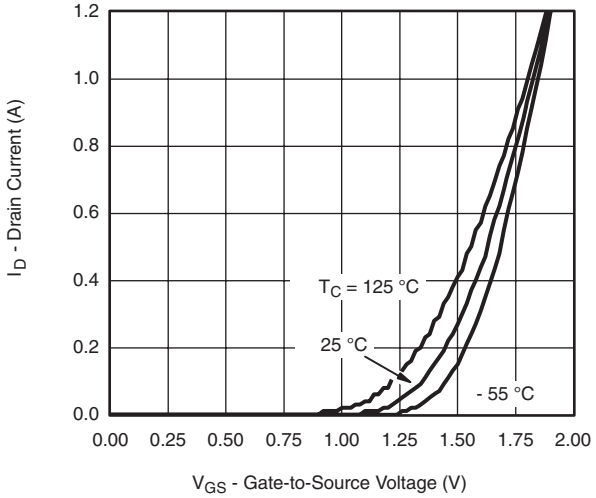
SCHOTTKY SPECIFICATIONS T_J = 25 °C, unless otherwise noted						
Parameter	**Symbol**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Forward Voltage Drop	V_F	I_F = 1 A		0.45	0.50	V
		I_F = 1 A, T_J = 125 °C		0.36	0.42	
Maximum Reverse Leakage Current	I_{rm}	V_R = 30 V		0.04	0.1	mA
		V_R = 30 V, T_J = 75 °C		0.1	2	
		V_R = 30 V, T_J = 125 °C		2	10	
Junction Capacitance	C_T	V_R = 10 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.

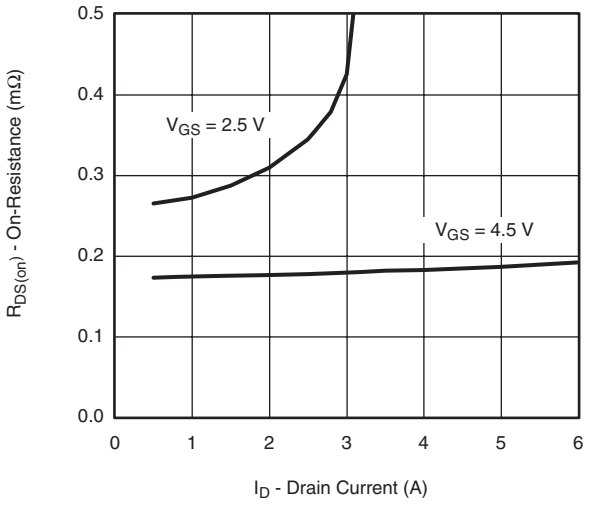
MOSFET TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



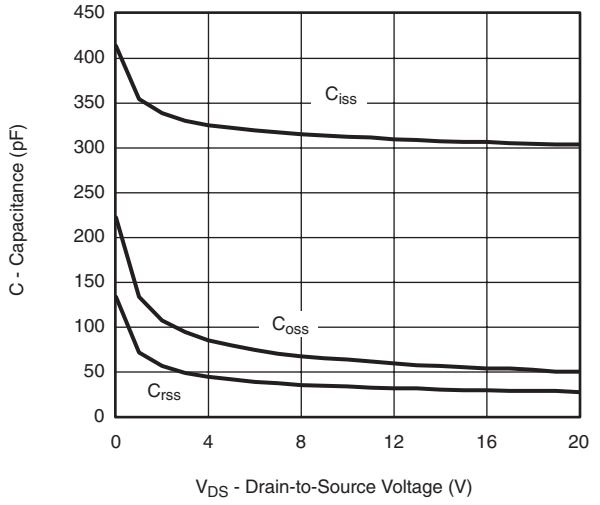
Output Characteristics



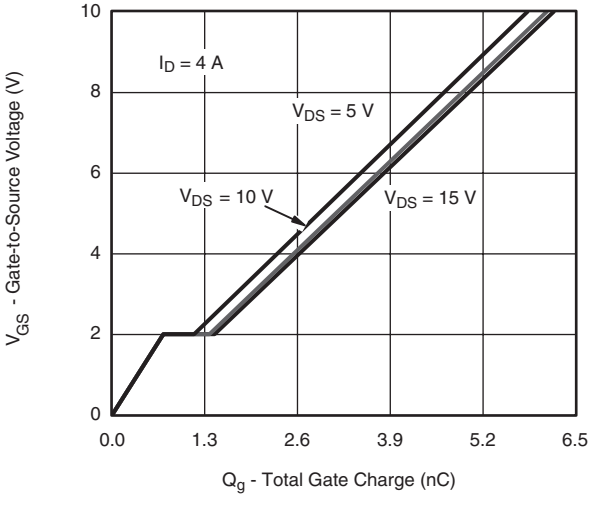
Transfer Characteristics



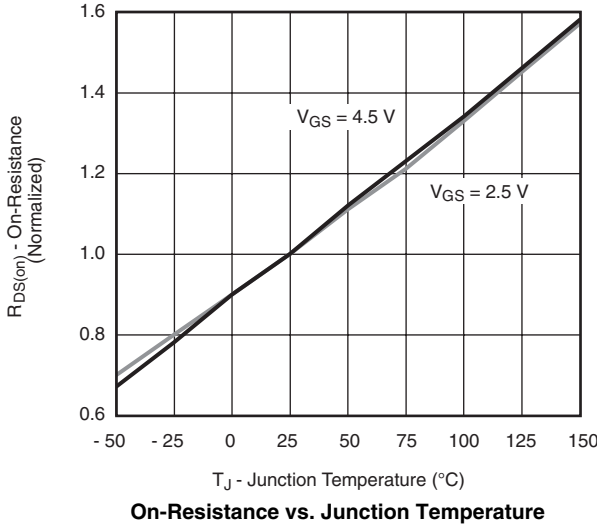
On-Resistance vs. Drain Current and Gate Voltage



Capacitance

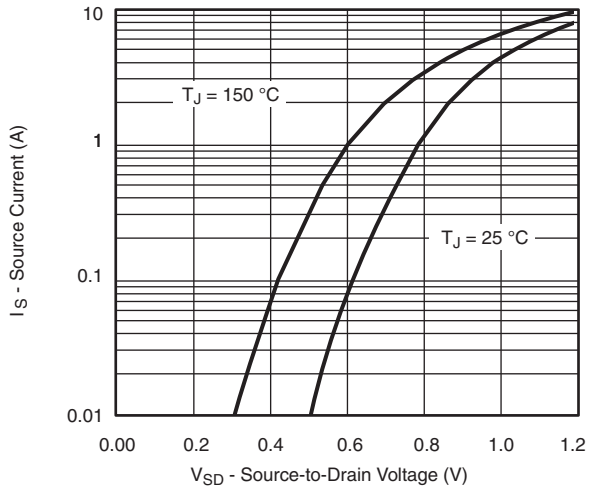


Gate Charge

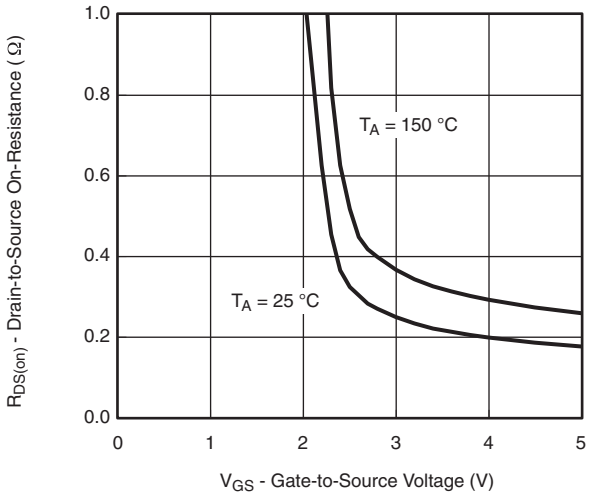


On-Resistance vs. Junction Temperature

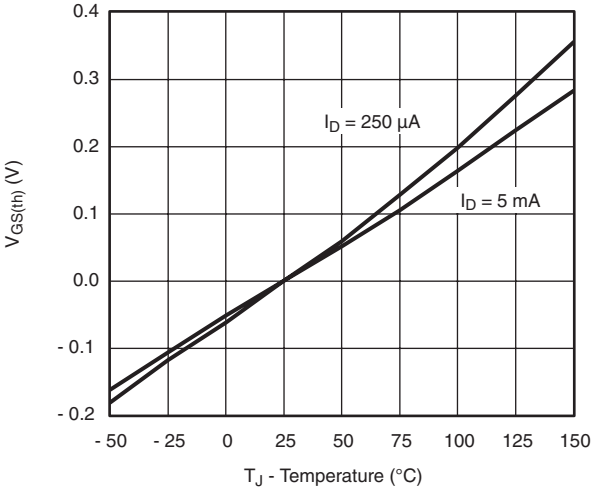
MOSFET TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



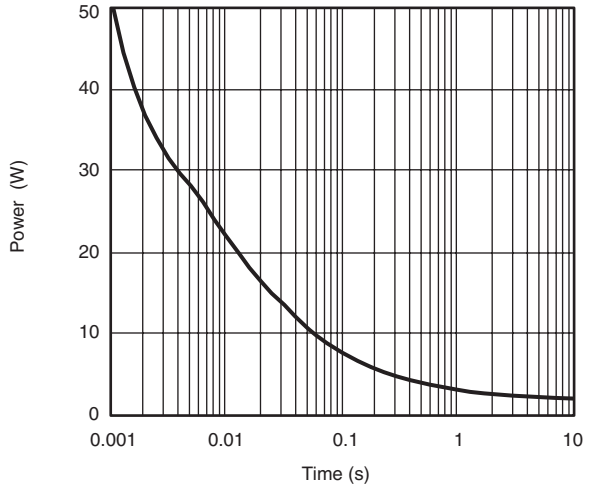
Source-Drain Diode Forward Voltage



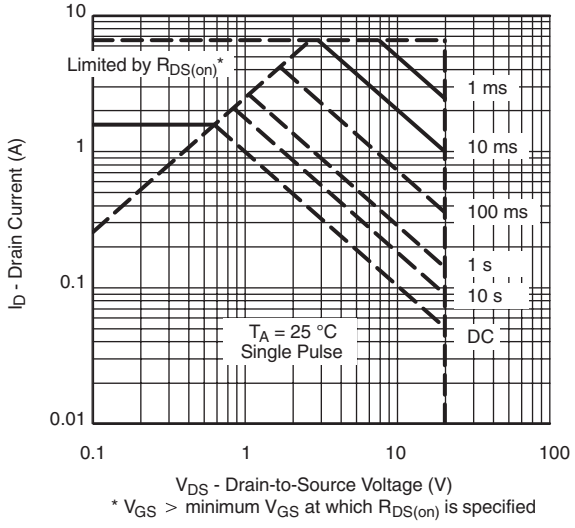
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

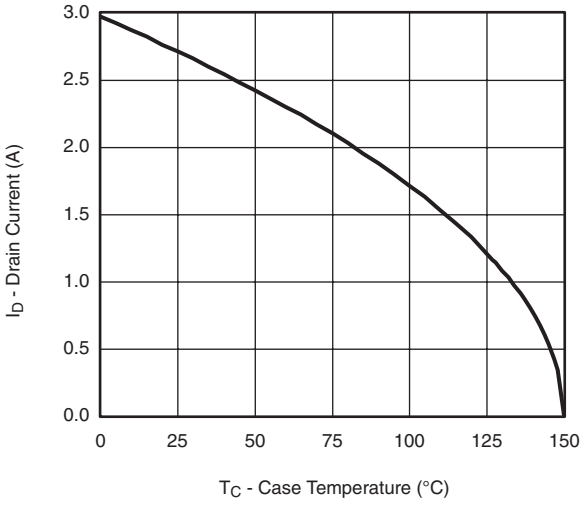


Single Pulse Power, Junction-to-Ambient

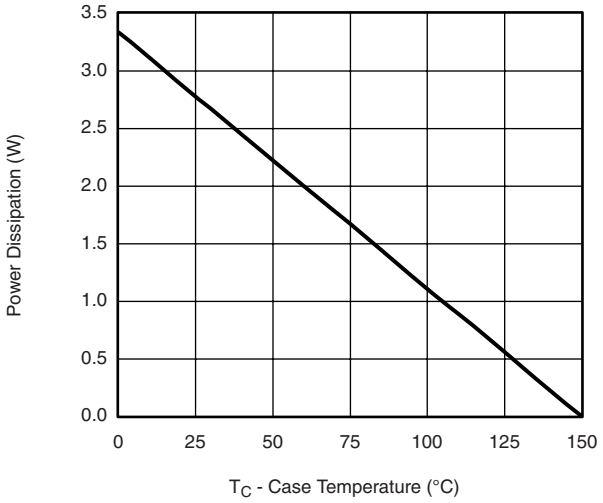


Safe Operating Area, Junction-to-Ambient

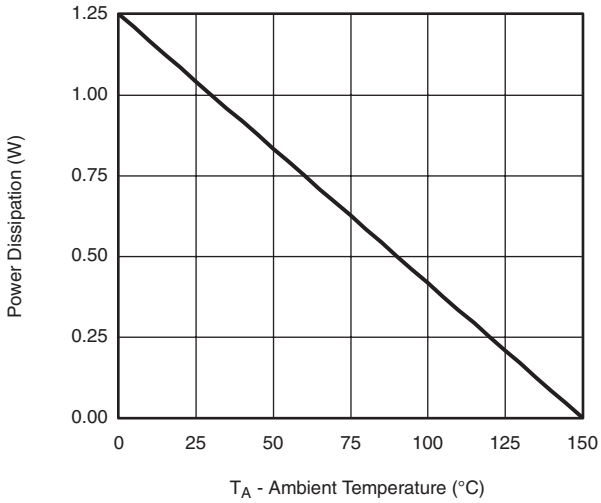
MOSFET TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



Current Derating*



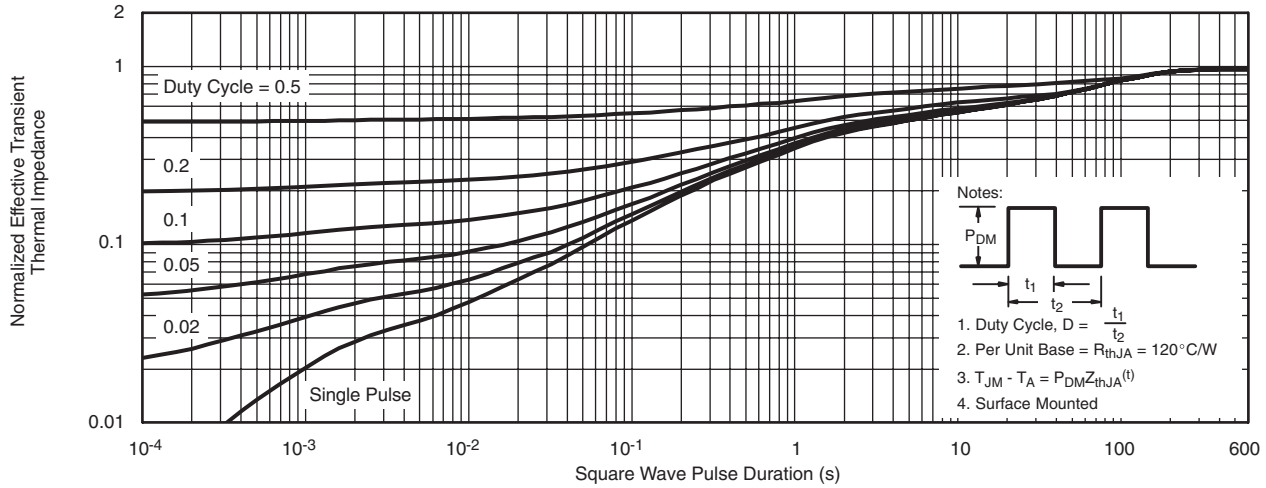
Power Derating, Junction-to-Foot



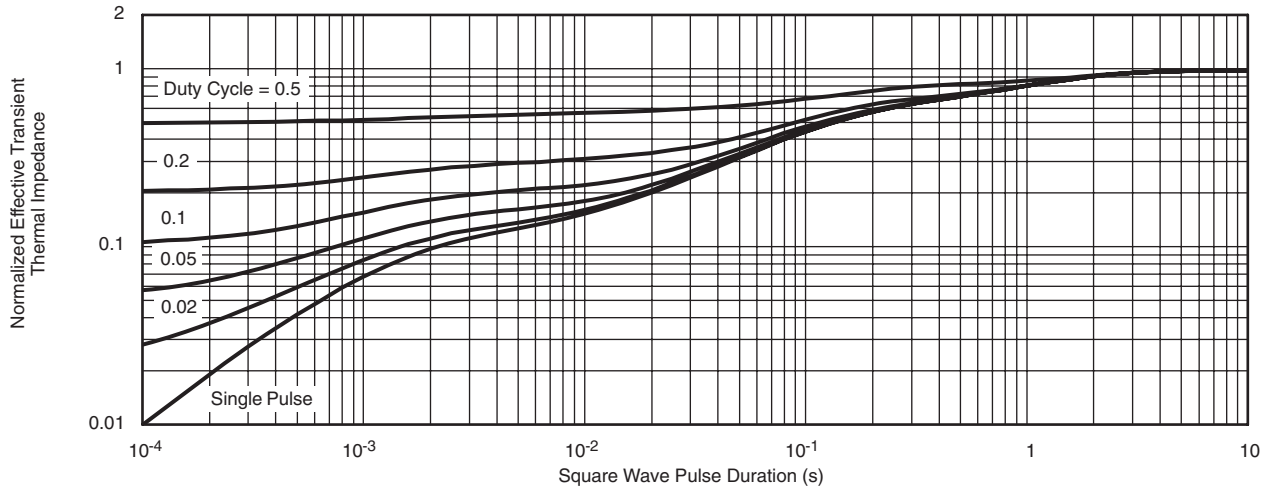
Power Derating, Junction-to-Ambient

* 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.

MOSFET TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted

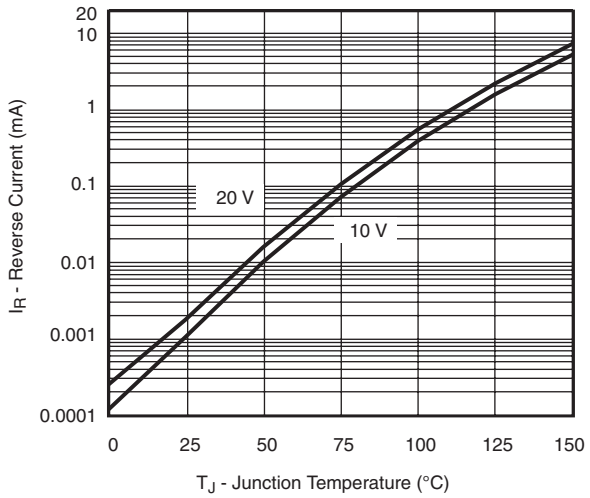


Normalized Thermal Transient Impedance, Junction-to-Ambient

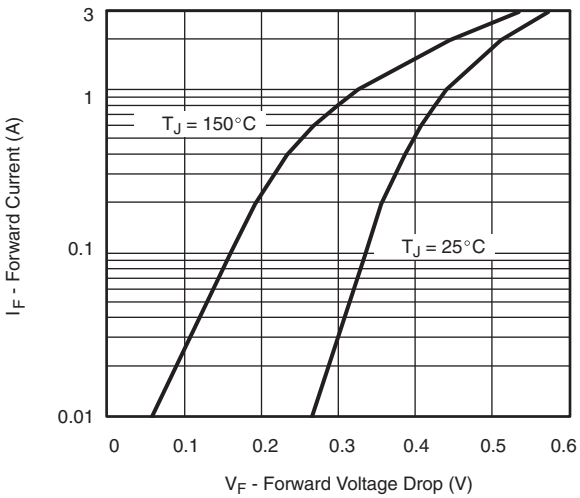


Normalized Thermal Transient Impedance, Junction-to-Foot

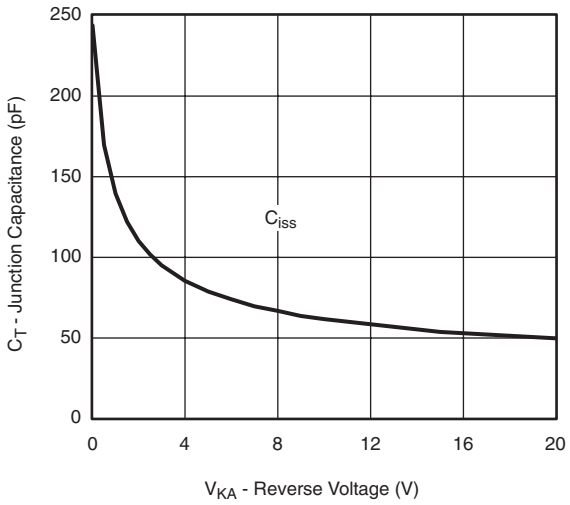
SCHOTTKY TYPICAL CHARACTERISTICS T_A = 25 °C, unless otherwise noted



Reverse Current vs. Junction Temperature



Forward Voltage Drop



Capacitance

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