

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

PRODUCT SUMMARY

V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)	Q_g (Typ.)
- 20	0.054 at $V_{GS} = -10$ V	6.2	4.5 nC
	0.094 at $V_{GS} = -4.5$ V	4.7	

SCHOTTKY PRODUCT SUMMARY

V_{KA} (V)	V_f (V) Diode Forward Voltage	I_F (A) ^a
20	0.45 at 1 A	2

FEATURES

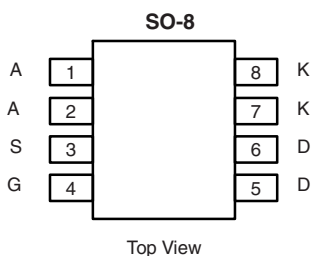
- Halogen-free According to IEC 61249-2-21 Definition
- LITTLE FOOT® Plus Schottky
- Compliant to RoHS Directive 2002/95/EC



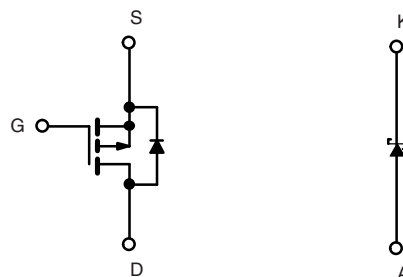
RoHS
COMPLIANT
HALOGEN
FREE
Available

APPLICATIONS

- Portable Devices
 - Ideal for Boost Circuits
 - Ideal for Buck Circuits



Ordering Information: Si4621DY-T1-E3 (Lead (Pb)-free)
Si4621DY-T1-GE3 (Lead (Pb)-free and Halogen-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}	$\pm$ 20	
Continuous Drain Current ($T_J = 150\text{ }^{\circ}\text{C}$) (MOSFET)	$T_C = 25\text{ }^{\circ}\text{C}$	I_D	- 6.2	A
	$T_C = 70\text{ }^{\circ}\text{C}$		- 5 ^a	
	$T_A = 25\text{ }^{\circ}\text{C}$		- 5 ^{b, c}	
	$T_A = 70\text{ }^{\circ}\text{C}$		- 4 ^{b, c}	
Pulsed Drain Current (MOSFET)		I_{DM}	- 25	
Continuous Source-Drain Diode Current (MOSFET Diode Conduction)	$T_C = 25\text{ }^{\circ}\text{C}$	I_S	- 2.6	
	$T_A = 25\text{ }^{\circ}\text{C}$		1.7 ^{b, c}	
Average Forward Current (Schottky)		I_F	2 ^b	
Pulsed Forward Current (Schottky)		I_{FM}	5	
Maximum Power Dissipation (MOSFET)	$T_C = 25\text{ }^{\circ}\text{C}$	P_D	3.1	W
	$T_C = 70\text{ }^{\circ}\text{C}$		2	
	$T_A = 25\text{ }^{\circ}\text{C}$		2 ^{b, c}	
	$T_A = 70\text{ }^{\circ}\text{C}$		1.3 ^{b, c}	
Maximum Power Dissipation (Schottky)	$T_C = 25\text{ }^{\circ}\text{C}$		2.7	
	$T_C = 70\text{ }^{\circ}\text{C}$		1.7	
	$T_A = 25\text{ }^{\circ}\text{C}$		1.6 ^{b, c}	
	$T_A = 70\text{ }^{\circ}\text{C}$		1 ^{b, c}	
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) ^{b, f}	R_{thJA}	55	62.5	°C/W
Maximum Junction-to-Foot (Drain) (MOSFET)	R_{thJF}	33	40	
Maximum Junction-to-Ambient (Schottky) ^{b, g}	R_{thJA}	63	78	
Maximum Junction-to-Foot (Drain) (Schottky)	R_{thJF}	39	47	

Notes:

b. Surface Mounted on 1" x 1" FR4 board.

c. $t = 10$ s.

f. Maximum under Steady State conditions is 110 °C/W.

g. Maximum under Steady State conditions is 115 °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, $I_D = -250$ μ A	- 20			V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250$ μ A		- 16		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			3.6		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = -250$ μ A	- 1		- 3	V
Gate-Source Leakage	I_{GSS}	$V_{DS} = 0$ V, $V_{GS} = \pm 20$ 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, $V_{GS} = -10$ V	- 25			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = -10$ V, $I_D = -5$ A		0.042	0.054	Ω
		$V_{GS} = -4.5$ V, $I_D = -1.1$ A		0.073	0.094	
Forward Transconductance ^a	g_{fs}	$V_{DS} = -10$ V, $I_D = -5$ A		10		S
Dynamic^b						
Input Capacitance	C_{iss}	$V_{DS} = -10$ V, $V_{GS} = 0$ V, $f = 1$ MHz		450		pF
Output Capacitance	C_{oss}			160		
Reverse Transfer Capacitance	C_{rss}			105		
Total Gate Charge	Q_g	$V_{DS} = -10$ V, $V_{GS} = -10$ V, $I_D = -6.2$ A		8.7	13	nC
		$V_{DS} = -10$ V, $V_{GS} = -4.5$ V, $I_D = -6.2$ A		4.5	6.8	
				1.7		
Gate-Source Charge	Q_{gs}	$f = 1$ MHz		1.8		Ω
Gate-Drain Charge	Q_{gd}			9		
Gate Resistance	R_g					
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		15	25	ns
Rise Time	t_r			60	90	
Turn-Off DelayTime	$t_{d(off)}$			22	35	
Fall Time	t_f			15	25	
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		5	10	
Rise Time	t_r			60	90	
Turn-Off DelayTime	$t_{d(off)}$			20	30	
Fall Time	t_f			7	15	



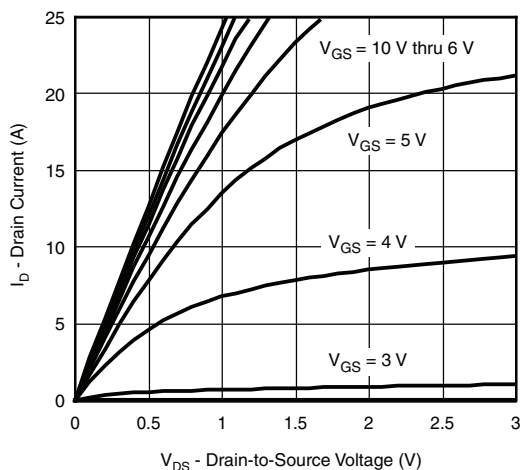
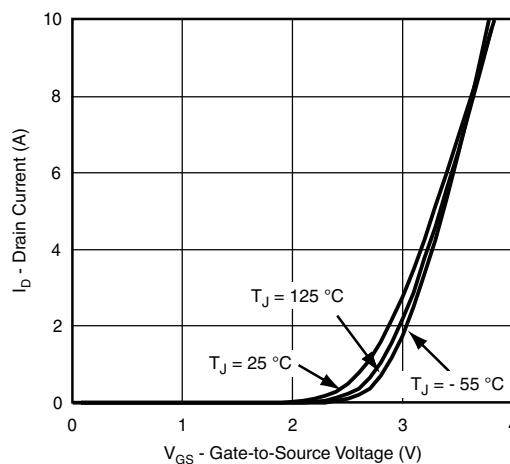
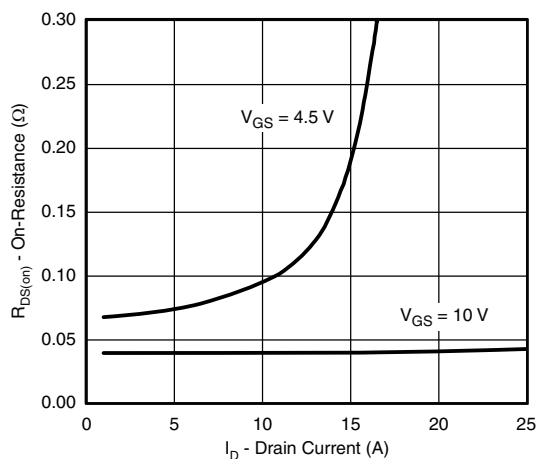
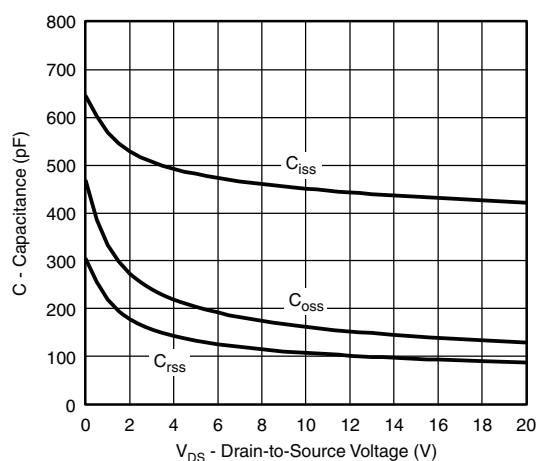
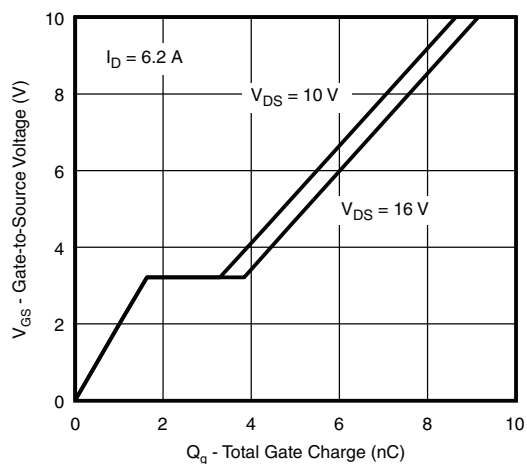
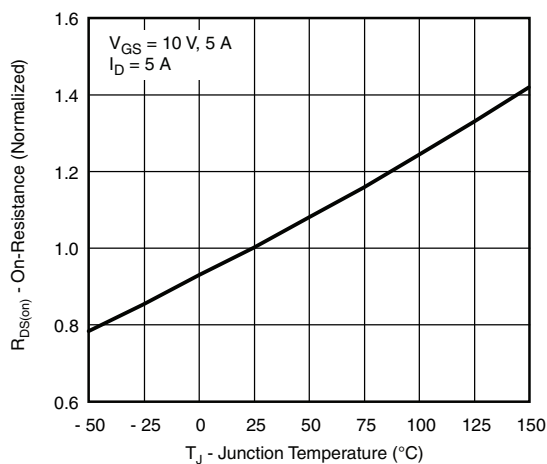
SPECIFICATIONS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I_S	$T_C = 25\text{ }^{\circ}\text{C}$			- 6.2	A
Pulse Diode Forward Current	I_{SM}				- 25	
Body Diode Voltage	V_{SD}	$I_S = -1.7\text{ A}$, $V_{GS} = 0\text{ V}$		- 0.8	- 1.2	V
Body Diode Reverse Recovery Time	t_{rr}	$I_F = -1.7\text{ A}$, $dI/dt = 100\text{ A}/\mu\text{s}$, $T_J = 25\text{ }^{\circ}\text{C}$		21	40	ns
Body Diode Reverse Recovery Charge	Q_{rr}			10	20	nC
Reverse Recovery Fall Time	t_a			7		ns
Reverse Recovery Rise Time	t_b			16		

Notes:

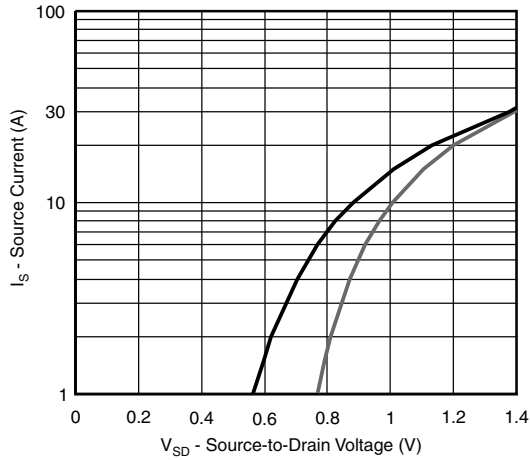
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
b. Guaranteed by design, not subject to production testing.

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	$I_F = 1\text{ A}$		0.41	0.45	V
		$I_F = 1\text{ A}$, $T_J = 125\text{ }^{\circ}\text{C}$		0.36	0.41	
Maximum Reverse Leakage Current	I_{rm}	$V_r = 20\text{ V}$		0.02	0.20	mA
		$V_r = 20\text{ V}$, $T_J = 85\text{ }^{\circ}\text{C}$		0.7	7	
		$V_r = 20\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$		5	50	
Junction Capacitance	C_T	$V_r = 10\text{ V}$		60		pF

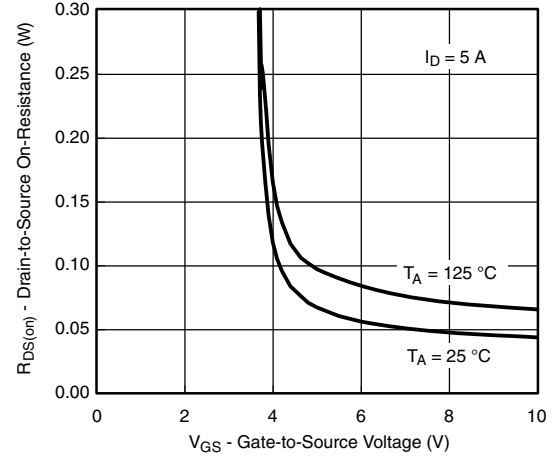
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

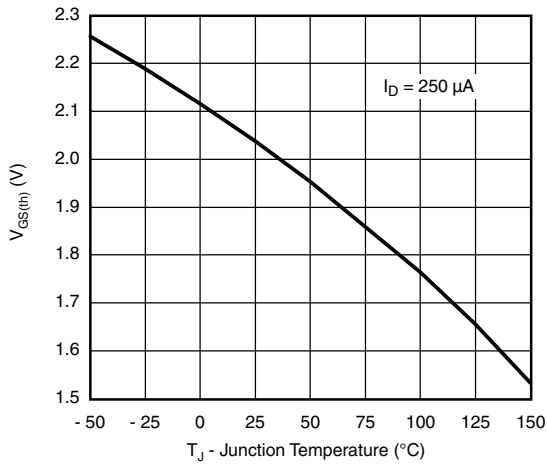
MOSFET TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise noted)



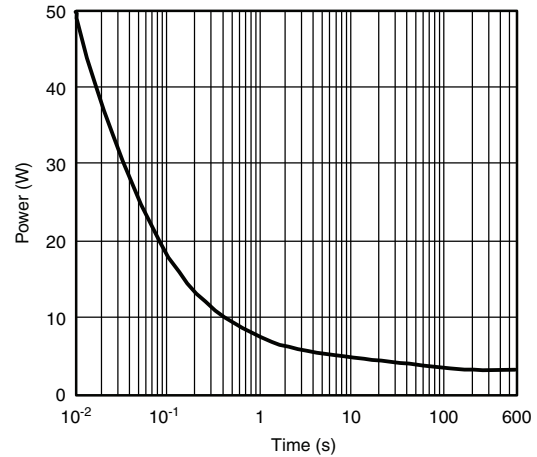
Source-Drain Diode Forward Voltage



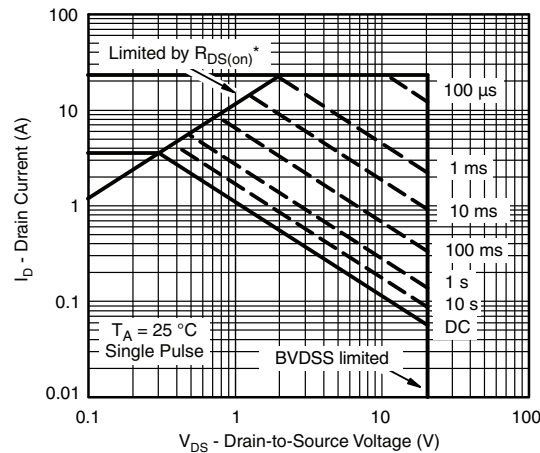
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

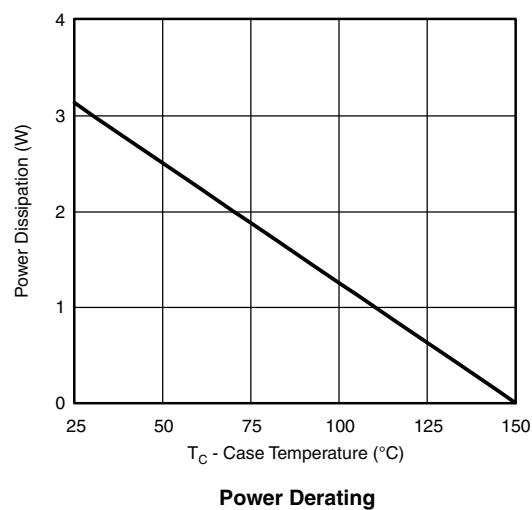
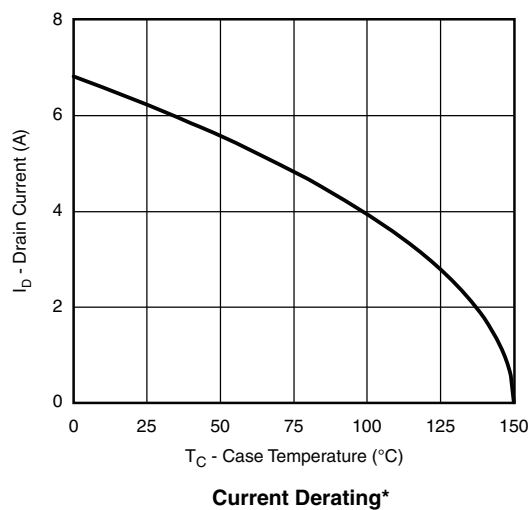


Single Pulse Power, Junction-to-Ambient



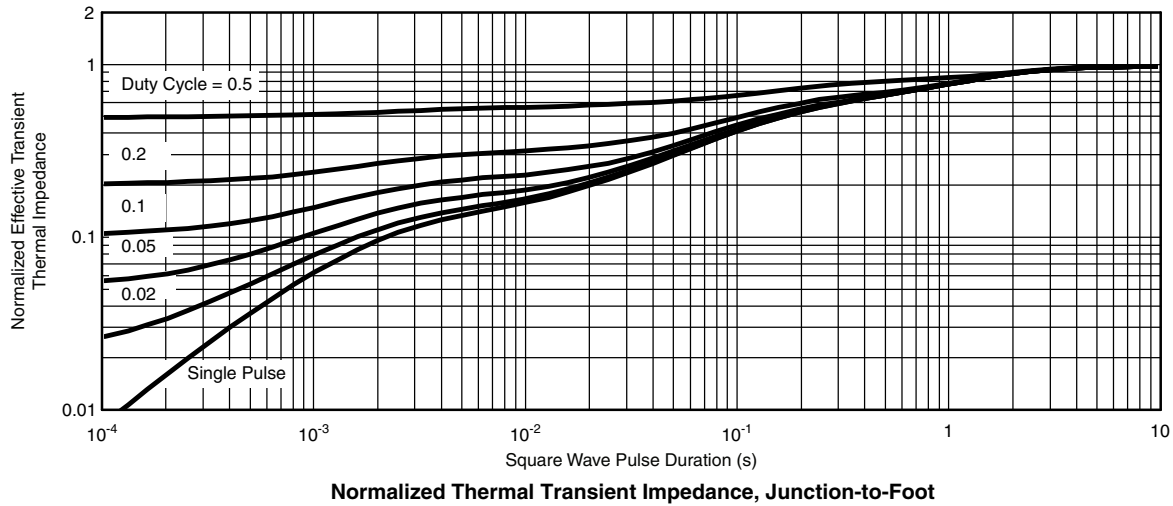
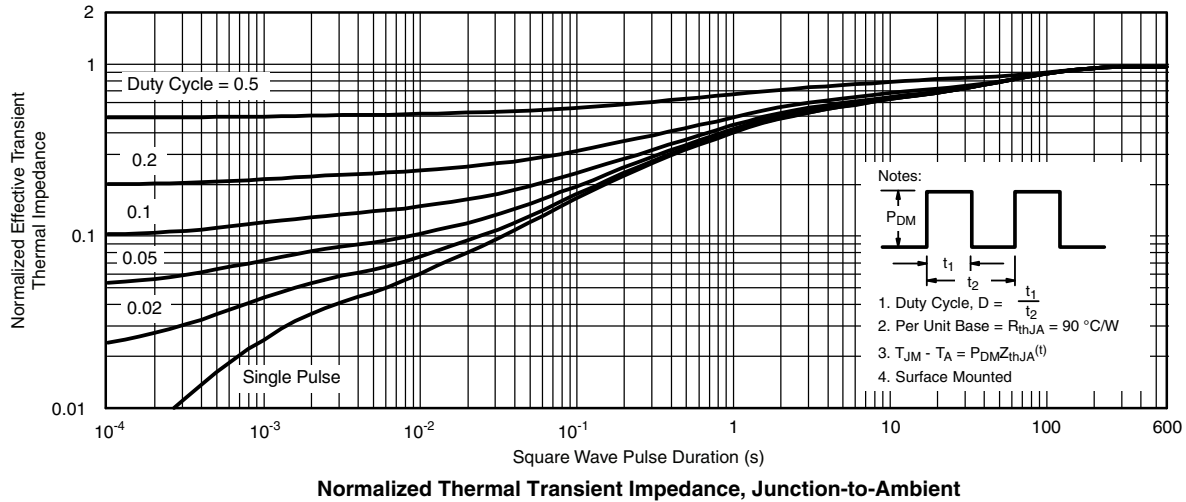
* $V_{DS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

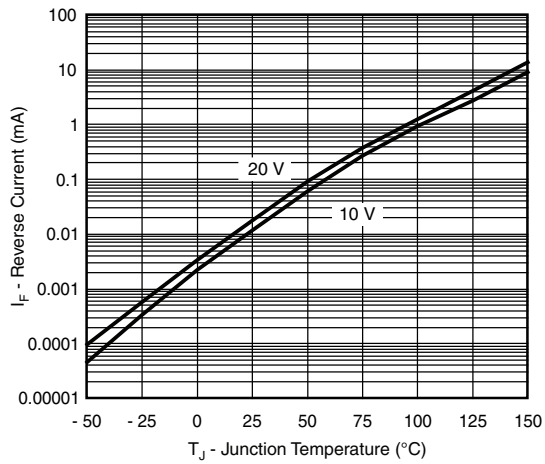
Safe Operating Area, Junction-to-Case

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

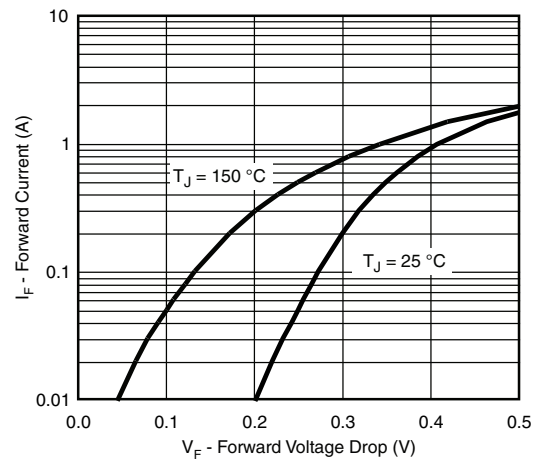
* The power dissipation P_D is based on $T_{J(max)} = 150\text{ }^{\circ}\text{C}$, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

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

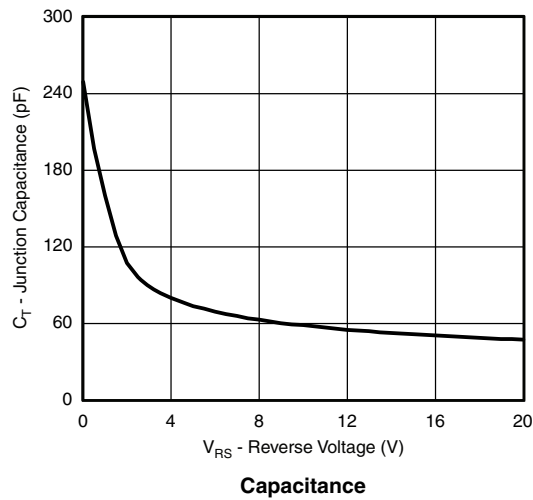


SCHOTTKY TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)


Reverse Current vs. Junction Temperature

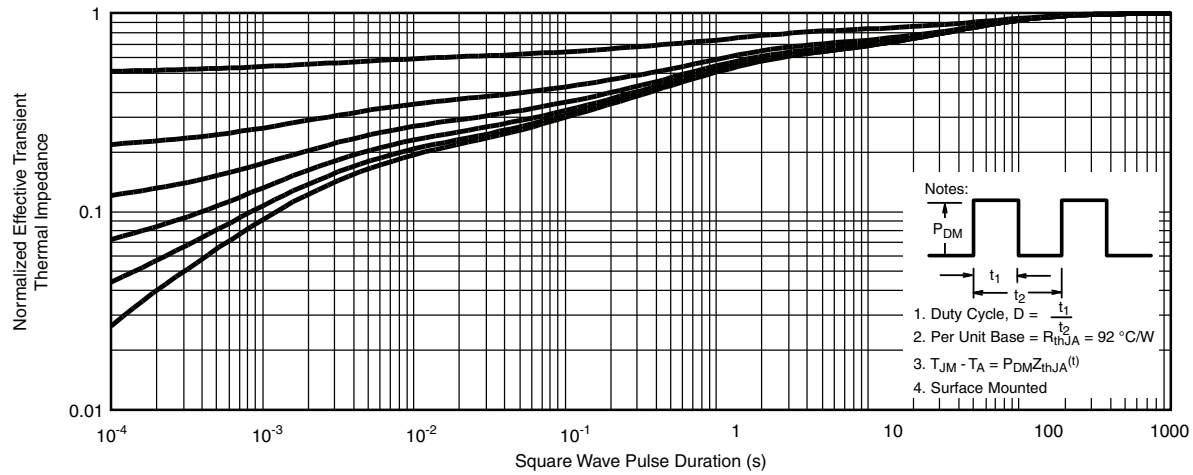


Forward Voltage Drop

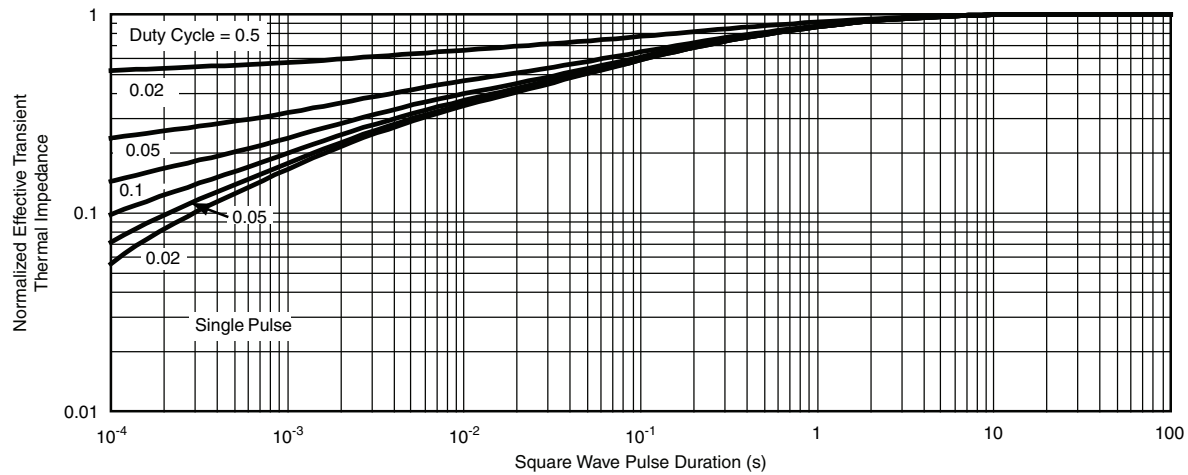


Capacitance

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



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

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