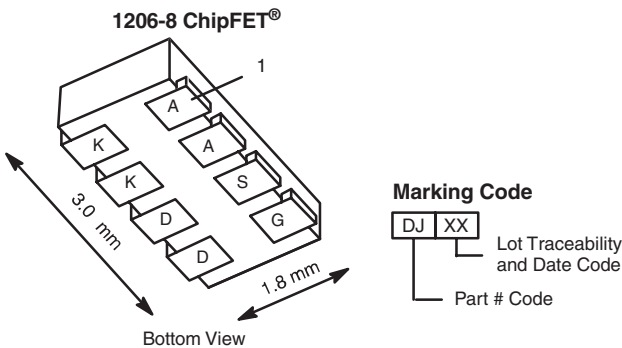


## P-Channel 20 V (D-S) MOSFET with Schottky Diode

PRODUCT SUMMARY			
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ.)
- 20	0.084 at $V_{GS} = -10$ V	- 4 <sup>f</sup>	4 nC
	0.108 at $V_{GS} = -4.5$ V	- 4 <sup>f</sup>	
	0.175 at $V_{GS} = -2.5$ V	- 3.5	

SCHOTTKY PRODUCT SUMMARY		
$V_{KA}$ (V)	$V_f$ (V) Diode Forward Voltage	$I_F$ (A) <sup>a</sup>
20	0.5 at 1 A	2



Ordering Information: Si5913DC-T1-E3 (Lead (Pb)-free)  
Si5913DC-T1-GE3 (Lead (Pb)-free and Halogen-free)

### FEATURES

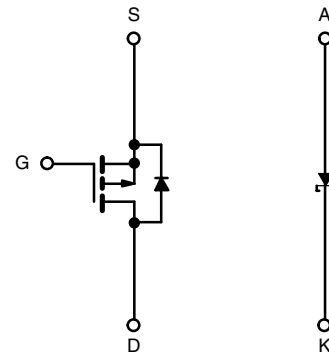
- Halogen-free According to IEC 61249-2-21 Definition
- LITTLE FOOT<sup>®</sup> Plus Schottky Power MOSFET
- Compliant to RoHS Directive 2002/95/EC



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available

### APPLICATIONS

- HDD
- DC/DC Converter
- Asynchronous Rectification



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)	$V_{GS}$	$\pm 12$	
Continuous Drain Current ( $T_J = 150$ °C) (MOSFET)	$I_D$	$T_C = 25$ °C	- 4 <sup>f</sup>
		$T_C = 70$ °C	- 4 <sup>f</sup>
		$T_A = 25$ °C	- 3.7 <sup>b, c</sup>
		$T_A = 70$ °C	- 2.9 <sup>b, c</sup>
Pulsed Drain Current (MOSFET)	$I_{DM}$	- 15	A
Continuous Source-Drain Diode Current (MOSFET Diode Conduction)	$I_S$	$T_C = 25$ °C	
		$T_A = 25$ °C	- 1.4 <sup>b, c</sup>
Average Forward Current (Schottky)	$I_F$	2 <sup>b</sup>	A
Pulsed Forward Current (Schottky)	$I_{FM}$	5	
Maximum Power Dissipation (MOSFET)	$P_D$	$T_C = 25$ °C	3.1
		$T_C = 70$ °C	2.0
		$T_A = 25$ °C	1.7 <sup>b, c</sup>
		$T_A = 70$ °C	1.1 <sup>b, c</sup>
Maximum Power Dissipation (Schottky)	$P_D$	$T_C = 25$ °C	3.1
		$T_C = 70$ °C	2.0
		$T_A = 25$ °C	1.3 <sup>b, c</sup>
		$T_A = 70$ °C	0.8 <sup>b, c</sup>
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150	°C
Soldering Recommendation (Peak Temperature) <sup>g, h</sup>		260	

**THERMAL RESISTANCE RATINGS**

Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient (MOSFET) <sup>b, d</sup>	$t \leq 5$ s	$R_{thJA}$	62	74	°C/W
Maximum Junction-to-Foot (Drain) (MOSFET)	Steady State	$R_{thJF}$	32	40	
Maximum Junction-to-Ambient (Schottky) <sup>b, e</sup>	$t \leq 5$ s	$R_{thJA}$	77	95	
Maximum Junction-to-Foot (Drain) (Schottky)	Steady State	$R_{thJF}$	33	40	

## Notes:

a. Based on  $T_C = 25$  °C.

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

c.  $t = 5$  s

d. Maximum under steady state conditions is 115 °C/W.

e. Maximum under steady state conditions is 130 °C/W.

f. Package limited.

g. See Solder Profile ([www.vishay.com/doc?73257](http://www.vishay.com/doc?73257)). The ChipFET 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 soldering interconnection.

h. Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.

**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		-20		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$		3			
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = -250$ $\mu$ A	-0.6		-1.5	V
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0$ V, $V_{GS} = \pm 12$ 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, $V_{GS} = -10$ V	-15			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -10$ V, $I_D = -3.7$ A		0.070	0.084	$\Omega$
		$V_{GS} = -4.5$ V, $I_D = -3.2$ A		0.090	0.108	
		$V_{GS} = -2.5$ V, $I_D = -2.5$ A		0.140	0.175	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -10$ V, $I_D = -3.7$ A		6		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = -10$ V, $V_{GS} = 0$ V, $f = 1$ MHz		330		pF
Output Capacitance	$C_{oss}$		80			
Reverse Transfer Capacitance	$C_{rss}$		57			
Total Gate Charge	$Q_g$	$V_{DS} = -10$ V, $V_{GS} = -10$ V, $I_D = -3.7$ A		8	12	nC
		$V_{DS} = -10$ V, $V_{GS} = -4.5$ V, $I_D = -3.7$ A		4	6	
$Q_{gs}$			0.8			
$Q_{gd}$			1.4			
Gate Resistance	$R_g$	$f = 1$ MHz	1.2	6	12	$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10$ V, $R_L = 3.4$ $\Omega$ $I_D \cong -2.9$ A, $V_{GEN} = -10$ V, $R_g = 1$ $\Omega$		3	6	ns
Rise Time	$t_r$			10	20	
Turn-Off Delay Time	$t_{d(off)}$			16	24	
Fall Time	$t_f$			8	15	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -10$ V, $R_L = 3.4$ $\Omega$ $I_D \cong -2.9$ A, $V_{GEN} = -4.5$ V, $R_g = 1$ $\Omega$		18	27	
Rise Time	$t_r$			40	60	
Turn-Off Delay Time	$t_{d(off)}$			18	27	
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	$I_S$	$T_C = 25\text{ }^\circ\text{C}$			- 1.2	A
Pulse Diode Forward Current	$I_{SM}$				- 15	
Body Diode Voltage	$V_{SD}$	$I_S = - 2.9\text{ A}, V_{GS} = 0\text{ V}$		- 0.75	- 1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = - 2.9\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^\circ\text{C}$		23	35	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			14	21	nC
Reverse Recovery Fall Time	$t_a$			11		ns
Reverse Recovery Rise Time	$t_b$			12		

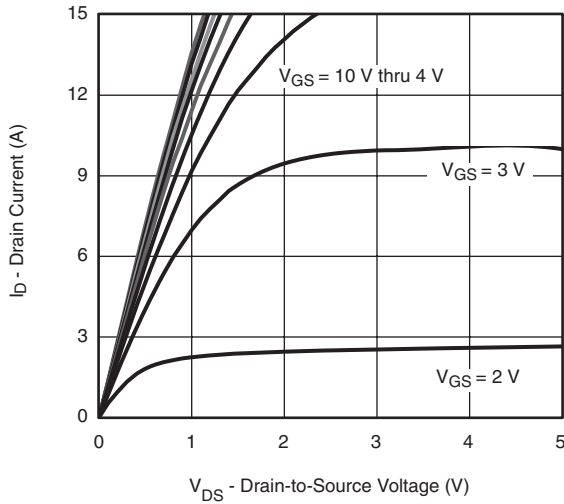
Notes:

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

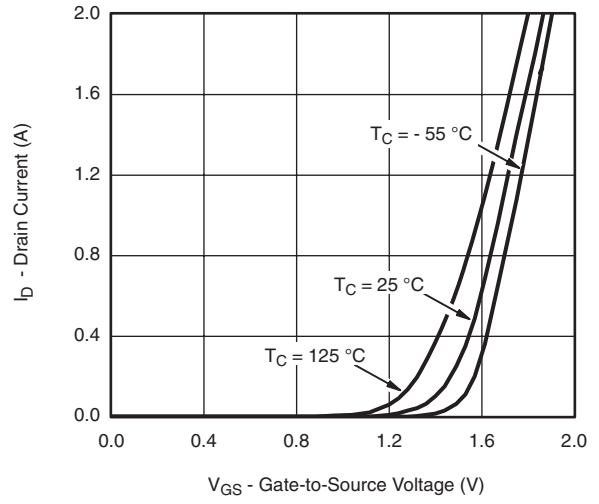
<b>SCHOTTKY SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Forward Voltage Drop	$V_F$	$I_F = 1\text{ A}$		0.42	0.50	V
		$I_F = 1\text{ A}, T_J = 125\text{ }^\circ\text{C}$		0.36	0.43	
Maximum Reverse Leakage Current	$I_{rm}$	$V_r = 5\text{ V}$		0.015	0.08	mA
		$V_r = 5\text{ V}, T_J = 85\text{ }^\circ\text{C}$		0.50	5.00	
		$V_r = 20\text{ V}$		0.02	0.10	
		$V_r = 20\text{ V}, T_J = 85\text{ }^\circ\text{C}$		0.7	7.00	
		$V_r = 20\text{ V}, T_J = 125\text{ }^\circ\text{C}$		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.*

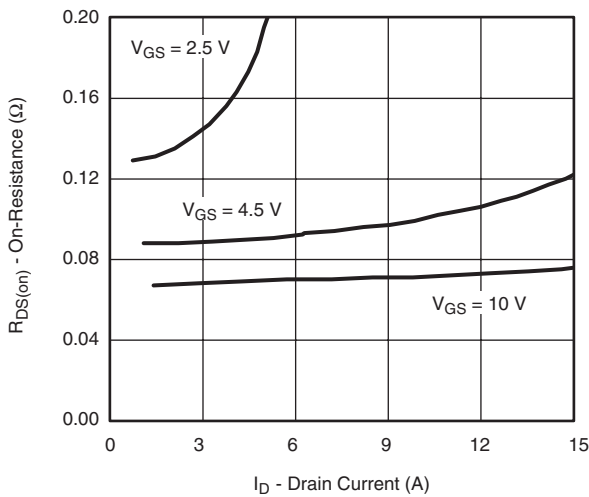
**MOSFET TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



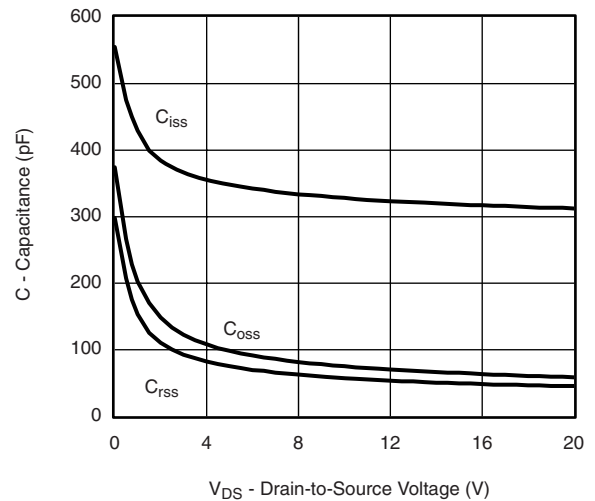
**Output Characteristics**



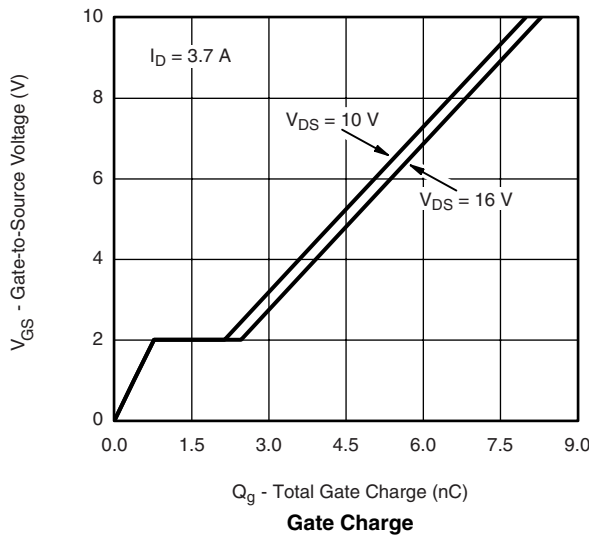
**Transfer Characteristics**



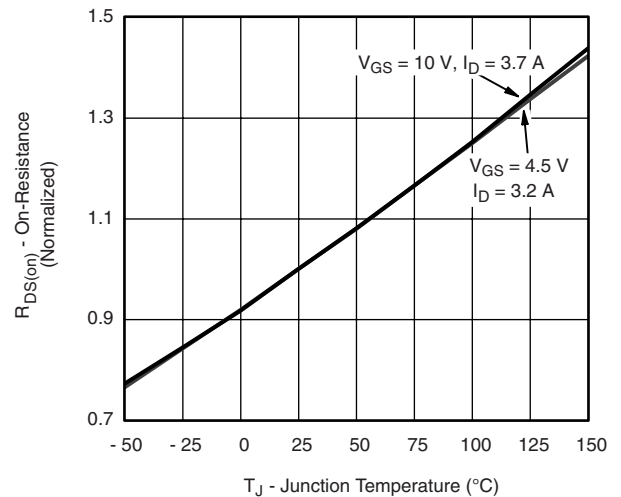
**On-Resistance vs. Drain Current and Gate Voltage**



**Capacitance**

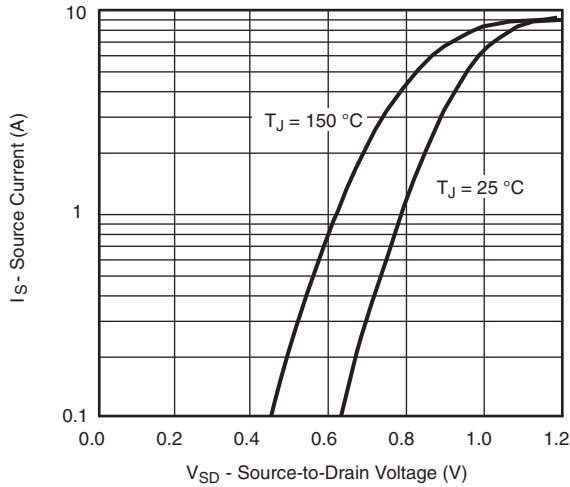


**Gate Charge**

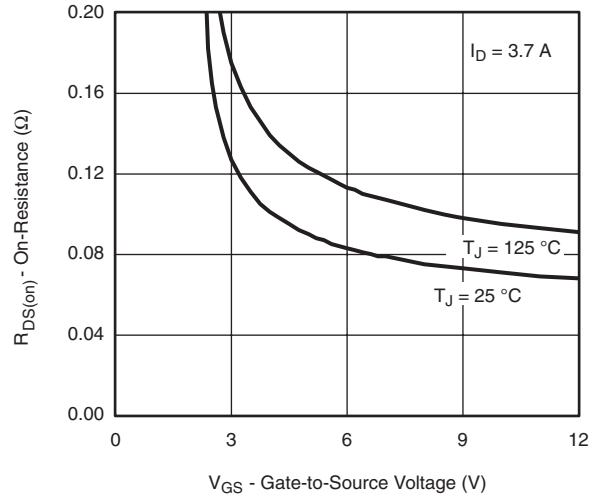


**On-Resistance vs. Junction Temperature**

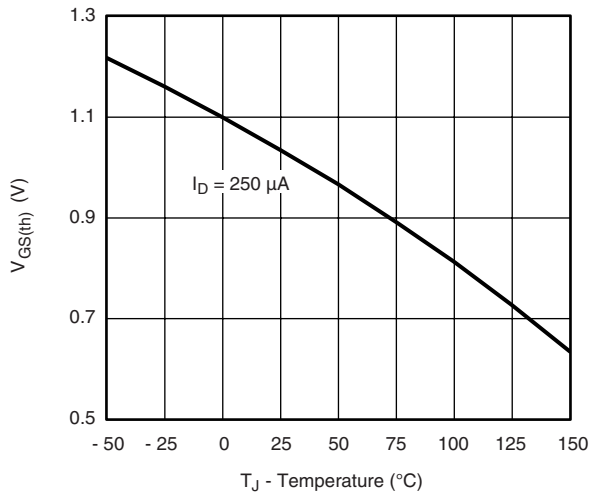
**MOSFET TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



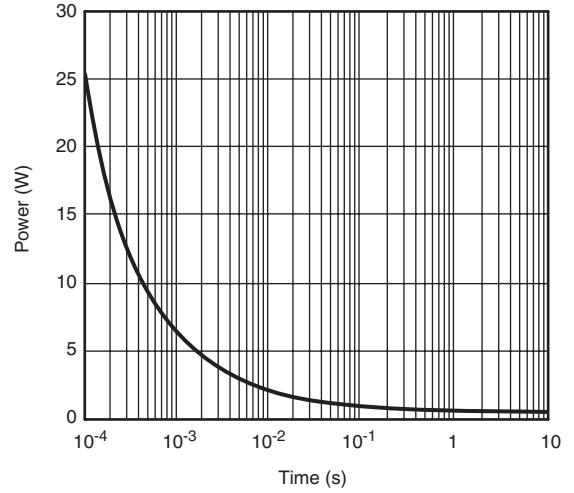
**Source-Drain Diode Forward Voltage**



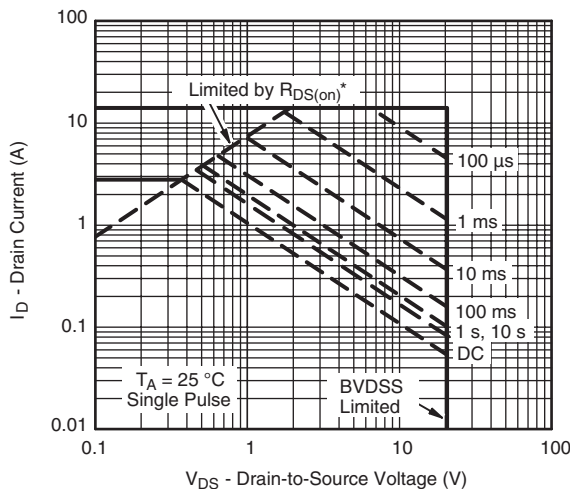
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**

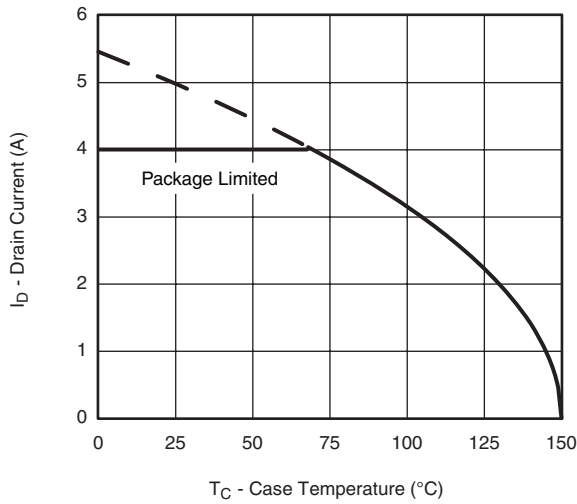


**Single Pulse Power, Junction-to-Ambient**

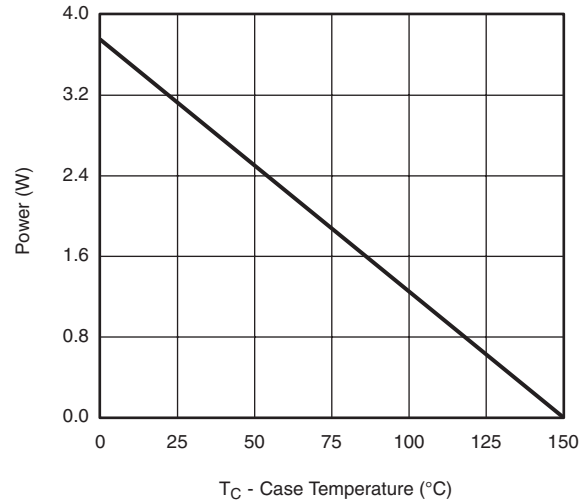


**Safe Operating Area, Junction-to-Case**

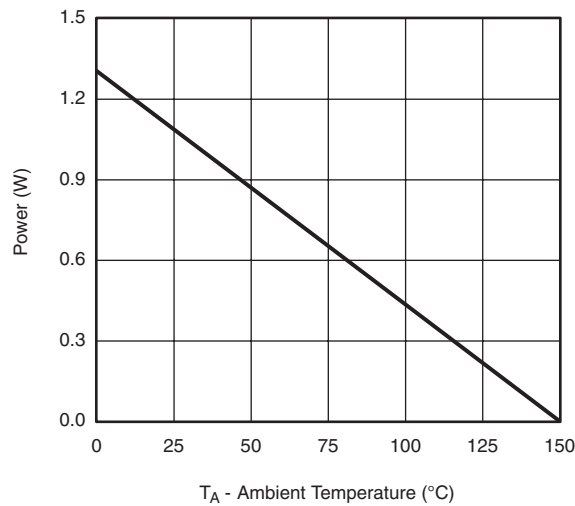
**MOSFET TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



**Current Derating\***



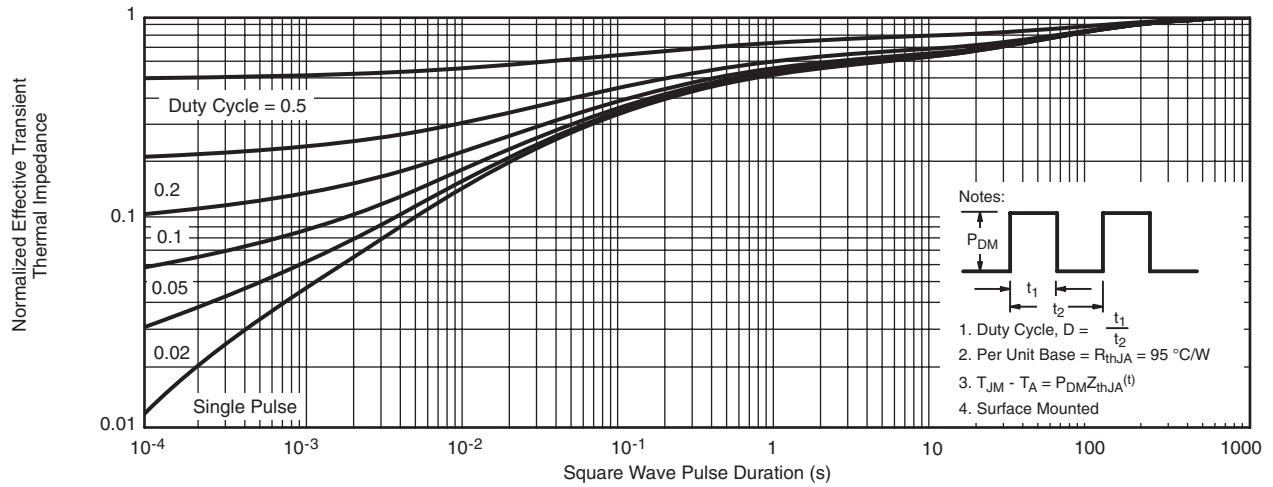
**Power Derating, Junction-to-Foot**



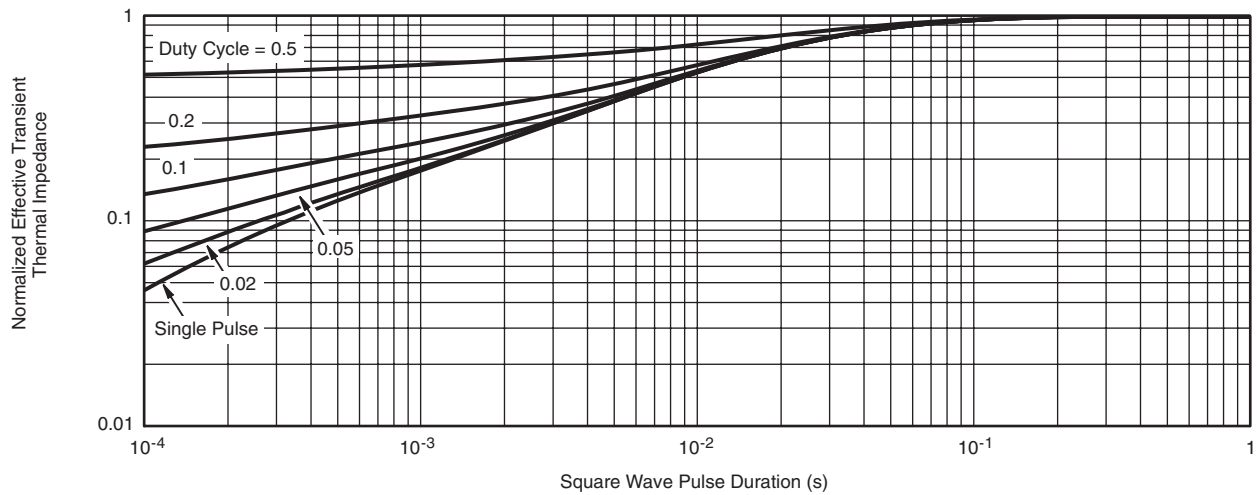
**Power Derating, Junction-to-Ambient**

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

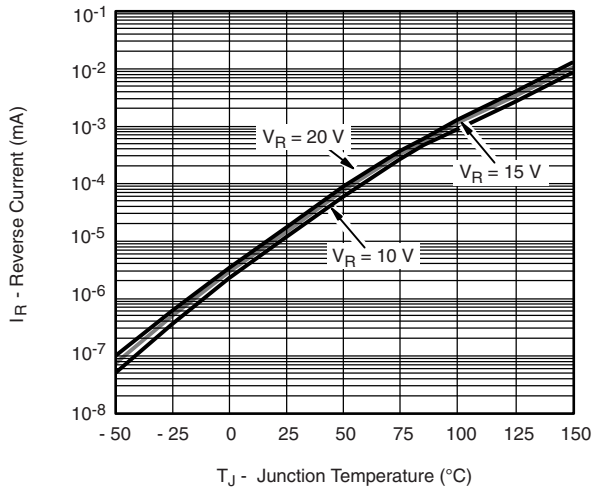


**Normalized Thermal Transient Impedance, Junction-to-Ambient**

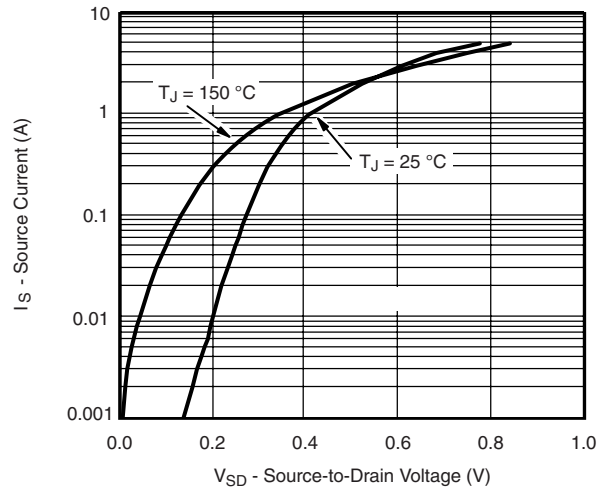


**Normalized Thermal Transient Impedance, Junction-to-Foot**

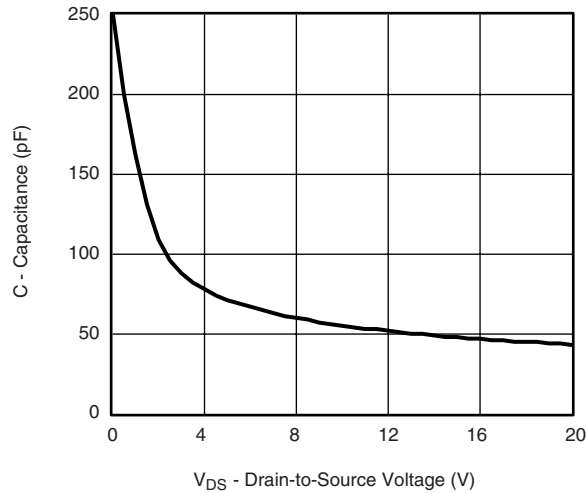
**SCHOTTKY TYPICAL CHARACTERISTICS**  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted



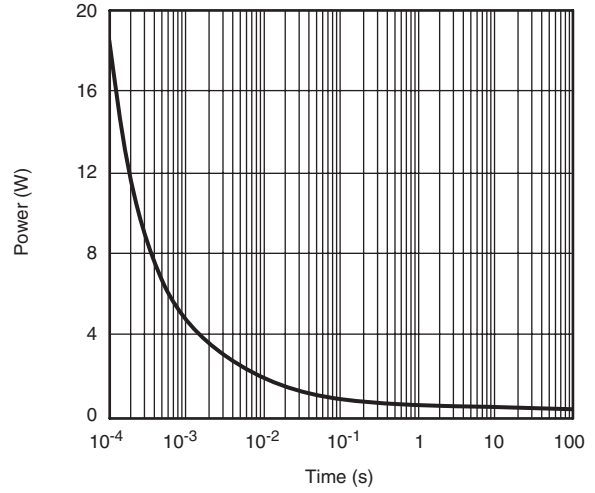
**Reverse Current vs. Junction Temperature**



**Forward Diode Voltage**



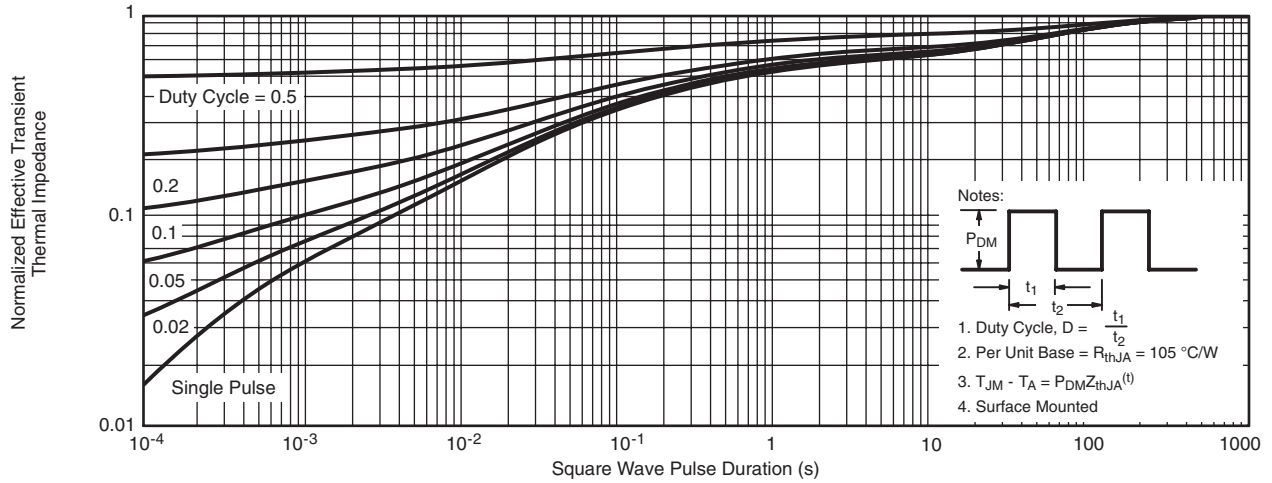
**Capacitance**



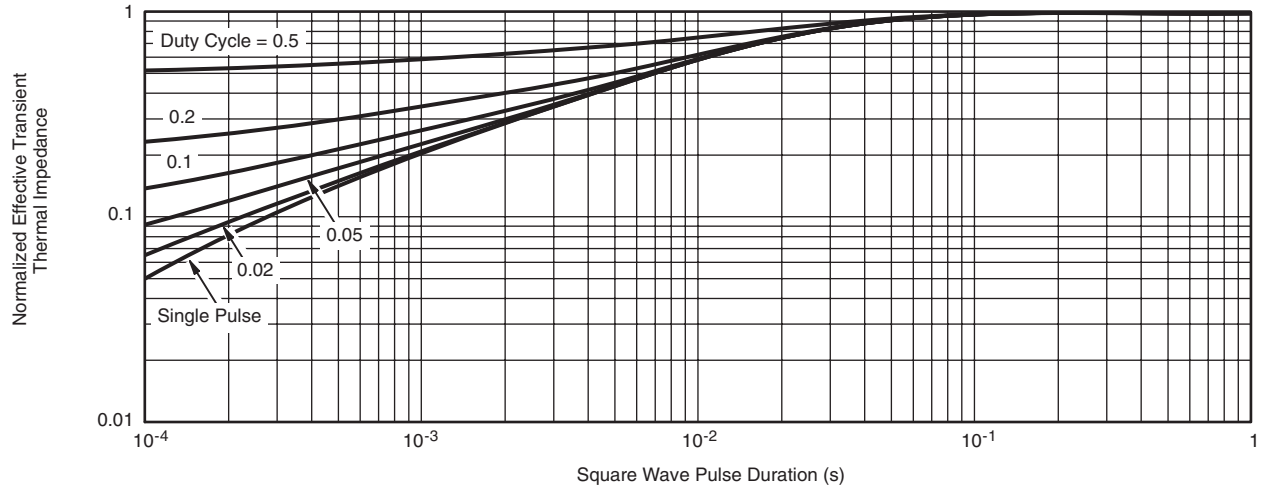
**Single Pulse Power, Junction-to-Ambient**



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



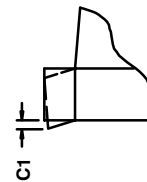
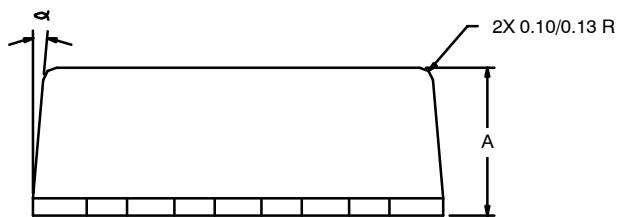
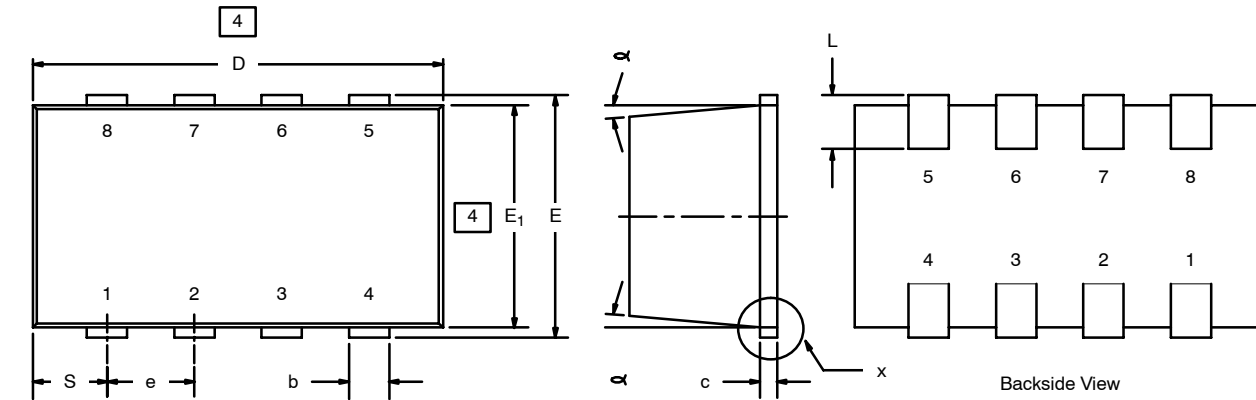
**Normalized Thermal Transient Impedance, Junction-to-Ambient**



**Normalized Thermal Transient Impedance, Junction-to-Foot**

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see [www.vishay.com/ppg?68920](http://www.vishay.com/ppg?68920).

### 1206-8 ChipFET®



**NOTES:**

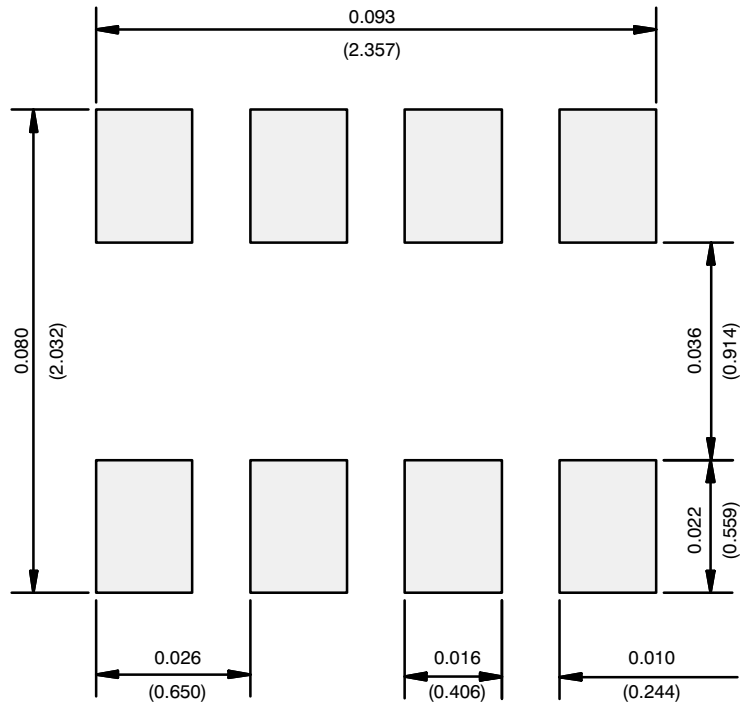
1. All dimensions are in millimeters.
2. Mold gate burrs shall not exceed 0.13 mm per side.
3. Leadframe to molded body offset is horizontal and vertical shall not exceed 0.08 mm.

**4.** Dimensions exclusive of mold gate burrs.

5. No mold flash allowed on the top and bottom lead surface.

Dim	MILLIMETERS			INCHES		
	Min	Nom	Max	Min	Nom	Max
<b>A</b>	1.00	—	1.10	0.039	—	0.043
<b>b</b>	0.25	0.30	0.35	0.010	0.012	0.014
<b>c</b>	0.1	0.15	0.20	0.004	0.006	0.008
<b>c1</b>	0	—	0.038	0	—	0.0015
<b>D</b>	2.95	3.05	3.10	0.116	0.120	0.122
<b>E</b>	1.825	1.90	1.975	0.072	0.075	0.078
<b>E<sub>1</sub></b>	1.55	1.65	1.70	0.061	0.065	0.067
<b>e</b>	0.65 BSC			0.0256 BSC		
<b>L</b>	0.28	—	0.42	0.011	—	0.017
<b>S</b>	0.55 BSC			0.022 BSC		
<b>α</b>	5°Nom			5°Nom		
ECN: C-03528—Rev. F, 19-Jan-04 DWG: 5547						

## RECOMMENDED MINIMUM PADS FOR 1206-8 ChipFET®



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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