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

| MOSFET PRODUCT SUMMARY | | | |
|---|---|---|---|
| $V_{DS}$ (V) | $R_{DS(on)}$ (Ω) | $I_D$ (A)[a] | $Q_g$ (Typ.) |
| - 20 | 0.144 at $V_{GS}$ = - 4.5 V | - 3.7 | 4.1 nC |
| | 0.180 at $V_{GS}$ = - 2.5 V | - 3.3 | |
| | 0.222 at $V_{GS}$ = - 1.8 V | - 3.0 | |

| SCHOTTKY PRODUCT SUMMARY | | |
|---|---|---|
| $V_{KA}$ (V) | $V_f$ (V) Diode Forward Voltage | $I_F$ (A)[a] |
| 20 | 0.375 at 1 A | 1 |

## FEATURES

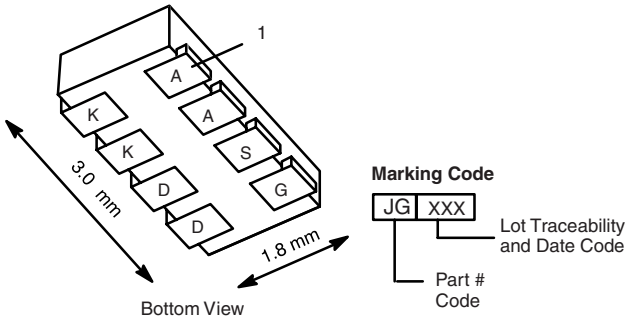
- **Halogen-free According to IEC 61249-2-21 Definition**
- LITTLE FOOT® *Plus* Power MOSFET
- Ultra Low $V_F$ Schottky
- Compliant to RoHS Directive 2002/95/EC

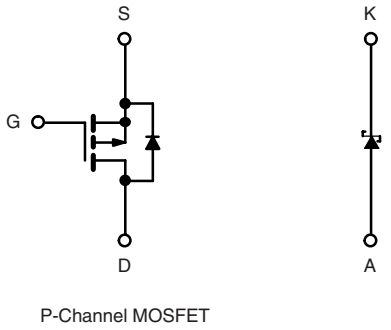
Pb-free
RoHS COMPLIANT
HALOGEN FREE Available

## APPLICATIONS

- Charging Switch for Portable Devices
  - With Integrated Low $V_F$ Trench Schottky Diode

**1206-8 ChipFET®**




P-Channel MOSFET

**Ordering Information:** Si5855CDC-T1-E3 (Lead (Pb)-free)
Si5855CDC-T1-GE3 (Lead (Pb)-free and Halogen-free)

| 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) | | $V_{GS}$ | ± 8 | |
| Continuous Drain Current ($T_J$ = 150 °C) (MOSFET) | $T_C$ = 25 °C | $I_D$ | - 3.7[a] | A |
| | $T_C$ = 70 °C | | - 3.0 | |
| | $T_A$ = 25 °C | | - 2.5[b, c] | |
| | $T_A$ = 70 °C | | - 2.0[b, c] | |
| Pulsed Drain Current (MOSFET) | | $I_{DM}$ | - 10 | |
| Continuous Source Current (MOSFET Diode Conduction) | $T_C$ = 25 °C | $I_S$ | - 2.3[a] | |
| | $T_A$ = 25 °C | | - 1.1[b, c] | |
| Average Forward Current (Schottky) | | $I_F$ | 1 | |
| Pulsed Forward Current (Schottky) | | $I_{FM}$ | 7 | |
| Maximum Power Dissipation (MOSFET) | $T_C$ = 25 °C | $P_D$ | 2.8 | W |
| | $T_C$ = 70 °C | | 1.8 | |
| | $T_A$ = 25 °C | | 1.3[b, c] | |
| | $T_A$ = 70 °C | | 0.8[b, c] | |
| Maximum Power Dissipation (Schottky) | $T_C$ = 25 °C | | 3.1 | W |
| | $T_C$ = 70 °C | | 2.0 | |
| | $T_A$ = 25 °C | | 1.9 | |
| | $T_A$ = 70 °C | | 1.2 | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | - 55 to 150 | °C |
| Soldering Recommendation (Peak Temperature)[d, e] | | | 260 | |

## THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Typical | Maximum | Unit |
|---|---|---|---|---|
| Maximum Junction-to-Ambient (MOSFET)[b, c, f] | $R_{thJA}$ | 82 | 99 | °C/W |
| Maximum Junction-to-Foot (Drain) (MOSFET) | $R_{thJF}$ | 35 | 45 | |
| Maximum Junction-to-Ambient (Schottky)[b, c, g] | $R_{thJA}$ | 54 | 65 | |
| Maximum Junction-to-Foot (Drain) (Schottky) | $R_{thJF}$ | 30 | 40 | |

Notes:
a. Based on $T_C$ = 25 °C.
b. Surface mounted on FR4 board.
c. t ≤ 5 s.
d. See Solder Profile (www.vishay.com/doc?73257). The PowerPAK 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 solder interconnection.
e. Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.
f. Maximum under steady state conditions for MOSFETs is 130 °C/W.
g. Maximum under steady state conditions for Schottky 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 µA | - 20 | | | V |
| $V_{DS}$ Temperature Coefficient | $\Delta V_{DS/TJ}$ | $I_D$ = - 250 µA | | - 19 | | mV/°C |
| $V_{GS(th)}$ Temperature Coefficient | $\Delta V_{GS(th)/TJ}$ | | | 2 | | |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = - 250 µA | - 0.45 | | - 1 | V |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 8 V | | | ± 100 | ns |
| 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, $T_J$ = 55 °C | | | - 10 | |
| On-State Drain Current[a] | $I_{D(on)}$ | $V_{DS}$ ≤ - 5 V, $V_{GS}$ = - 4.5 V | - 10 | | | A |
| Drain-Source On-State Resistance[a] | $R_{DS(on)}$ | $V_{GS}$ = - 4.5 V, $I_D$ = - 2.5 A | | 0.120 | 0.144 | Ω |
| | | $V_{GS}$ = - 2.5 V, $I_D$ = - 2.2 A | | 0.150 | 0.180 | |
| | | $V_{GS}$ = - 1.8 V, $I_D$ = - 2.0 A | | 0.185 | 0.222 | |
| Forward Transconductance[a] | $g_{fs}$ | $V_{DS}$ = - 10 V, $I_D$ = - 2.5 A | | 18 | | S |
| **Dynamic[b]** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$ = - 10 V, $V_{GS}$ = 0 V, f = 1 MHz | | 276 | | pF |
| Output Capacitance | $C_{oss}$ | | | 60 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 43 | | |
| Total Gate Charge | $Q_g$ | $V_{DS}$ = - 10 V, $V_{GS}$ = - 5 V, $I_D$ = - 2.5 A | | 4.5 | 6.8 | nC |
| | | $V_{DS}$ = - 10 V, $V_{GS}$ = - 4.5 V, $I_D$ = - 2.5 A | | 4.1 | 6.2 | |
| Gate-Source Charge | $Q_{gs}$ | | | 0.6 | | |
| Gate-Drain Charge | $Q_{gd}$ | | | 1.0 | | |
| Gate Resistance | $R_g$ | f = 1 MHz | 1.1 | 5.5 | 11 | Ω |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = - 10 V, $R_L$ = 5 Ω<br>$I_D$ ≅ - 2 A, $V_{GEN}$ = - 4.5 V, $R_g$ = 1 Ω | | 11 | 17 | ns |
| Rise Time | $t_r$ | | | 34 | 51 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 22 | 33 | |
| Fall Time | $t_f$ | | | 8 | 16 | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = - 10 V, $R_L$ = 5 Ω<br>$I_D$ ≅ - 2 A, $V_{GEN}$ = - 5 V, $R_g$ = 1 Ω | | 5 | 10 | |
| Rise Time | $t_r$ | | | 14 | 21 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 17 | 26 | |
| Fall Time | $t_f$ | | | 8 | 16 | |

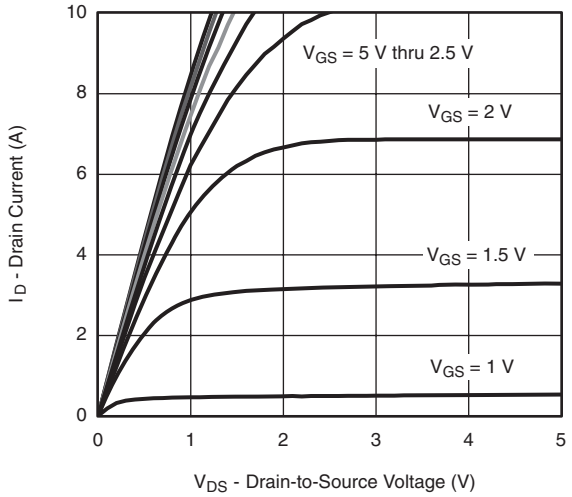
| **SPECIFICATIONS** $T_J$ = 25 °C, unless otherwise noted | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions** | **Min.** | **Typ.** | **Max.** | **Unit** |
| **Drain-Source Body Diode Characteristics** | | | | | | |
| Continuous Source-Drain Diode Current | $I_S$ | $T_C$ = 25 °C | | | - 2.3 | A |
| Pulse Diode Forward Current | $I_{SM}$ | | | | - 10 | |
| Body Diode Voltage | $V_{SD}$ | $I_S$ = - 2 A, $V_{GS}$ = 0 V | | - 0.8 | - 1.2 | V |
| Body Diode Reverse Recovery Time | $t_{rr}$ | $I_F$ = - 2 A dI/dt = 100 A/µs $T_J$ = 25 °C | | 23 | 35 | ns |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | | | 13 | 20 | nC |
| Reverse Recovery Fall Time | $t_a$ | | | 10 | | ns |
| Reverse Recovery Rise Time | $t_b$ | | | 13 | | |

Notes:
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.

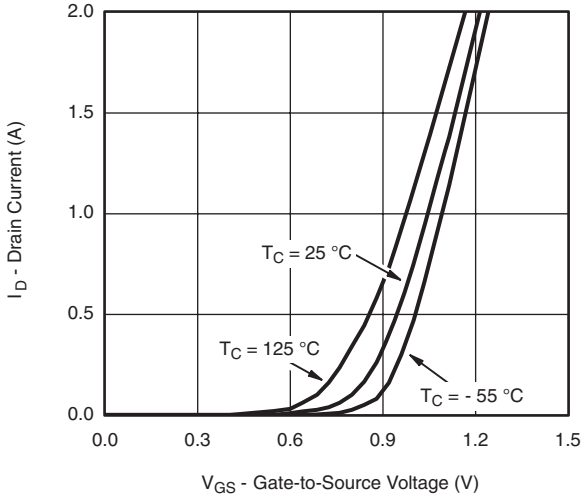
| **SCHOTTKY SPECIFICATIONS** $T_J$ = 25 °C, unless otherwise noted | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions** | **Min.** | **Typ.** | **Max.** | **Unit** |
| Forward Voltage Drop | $V_F$ | $I_F$ = 1 A | | 0.34 | 0.375 | V |
| | | $I_F$ = 1 A, $T_J$ = 125 °C | | 0.255 | 0.290 | |
| Maximum Reverse Leakage Current | $I_{rm}$ | $V_r$ = 20 V | | 0.05 | 0.500 | mA |
| | | $V_r$ = 20 V, $T_J$ = 85 °C | | 2 | 20 | |
| | | $V_r$ = 20 V, $T_J$ = 125 °C | | 10 | 100 | |
| Junction Capacitance | $C_T$ | $V_r$ = 10 V | | 90 | | 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 otherwise noted

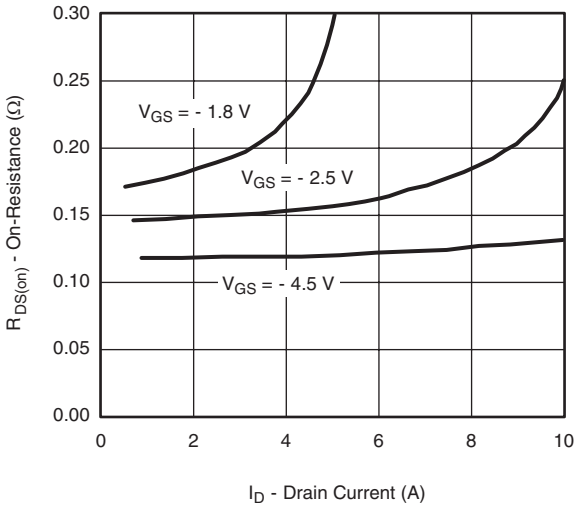



**Output Characteristics**

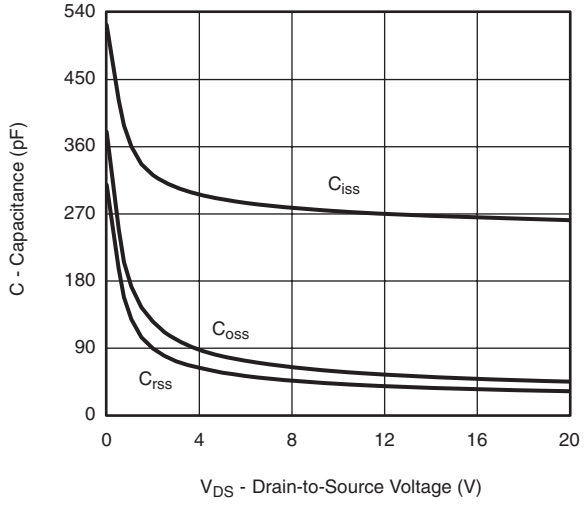



**Transfer Characteristics**

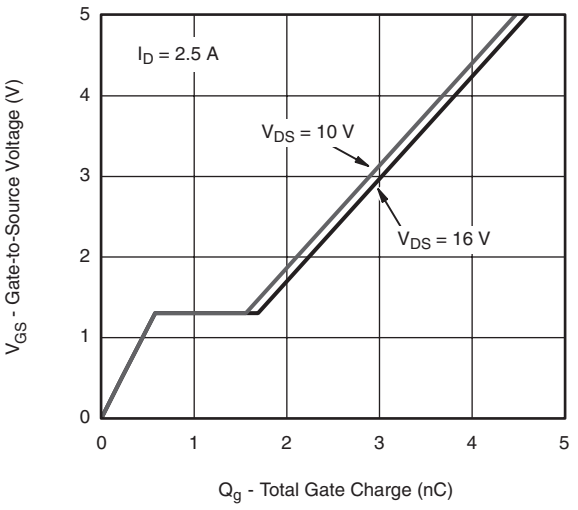
## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



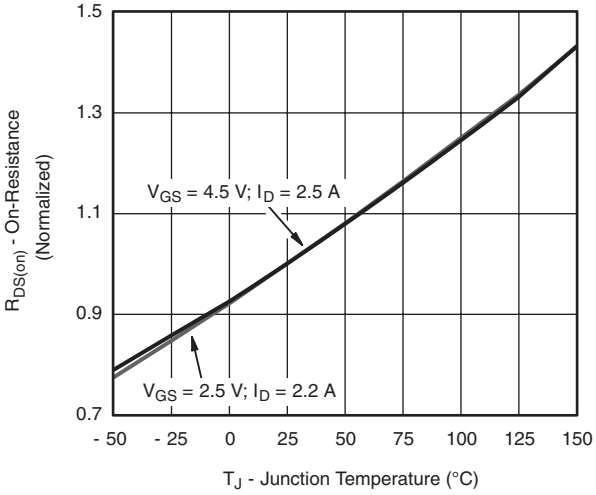

**On Resistance vs. Drain Current**



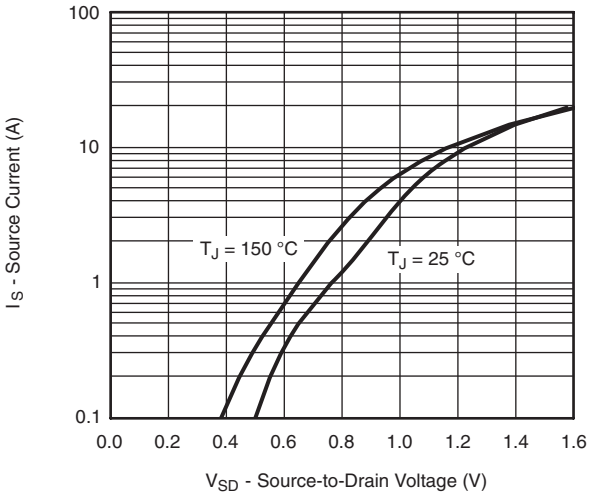

**Capacitance**



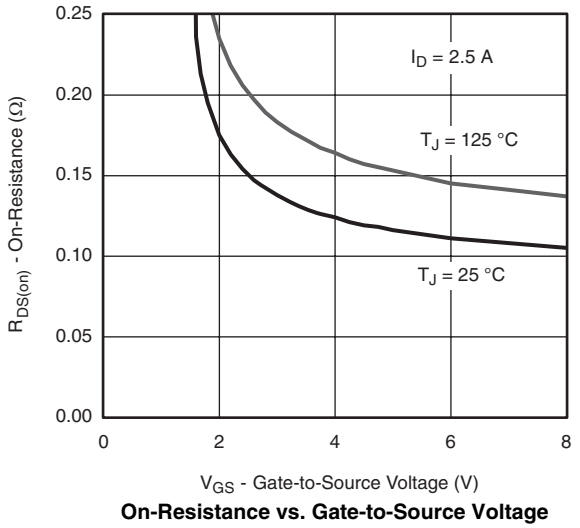

**Gate Charge**




**On-Resistance vs. Junction Temperature**

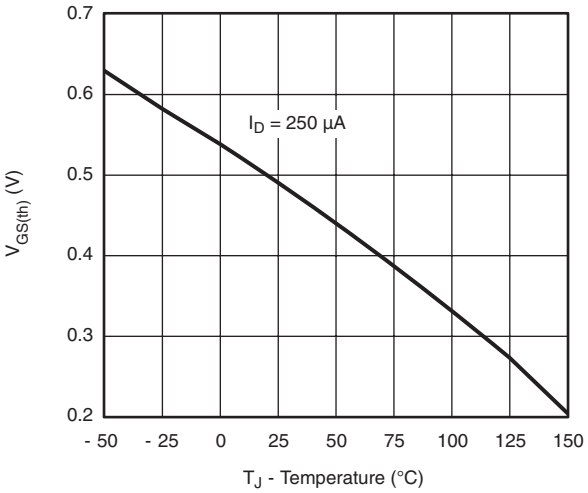



**Forward Diode Voltage vs. Temp.**

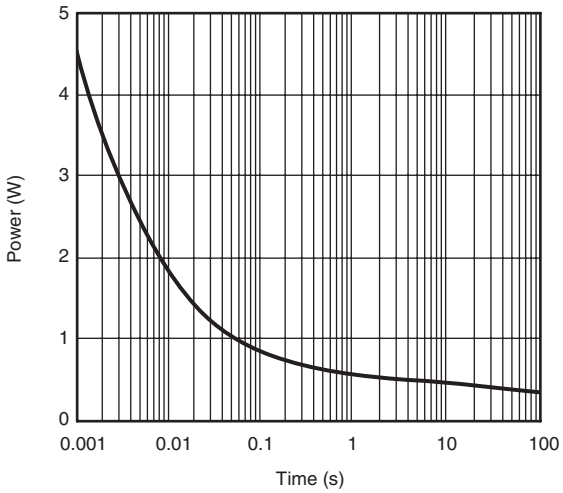



**On-Resistance vs. Gate-to-Source Voltage**

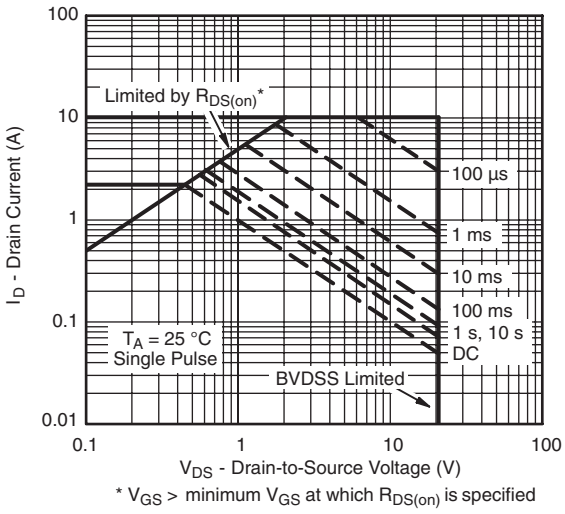
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted




**Threshold Voltage**



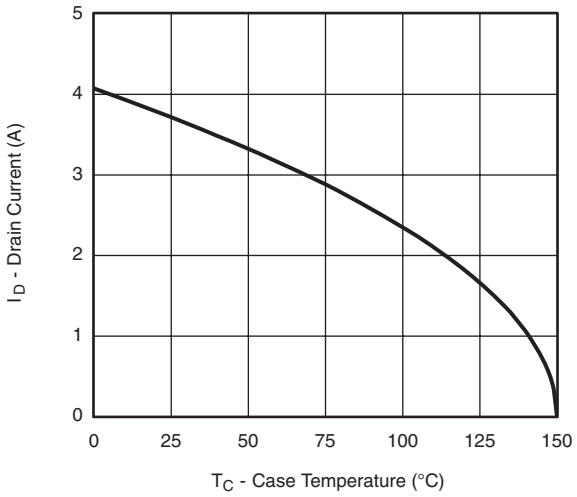

**Single Pulse Power**



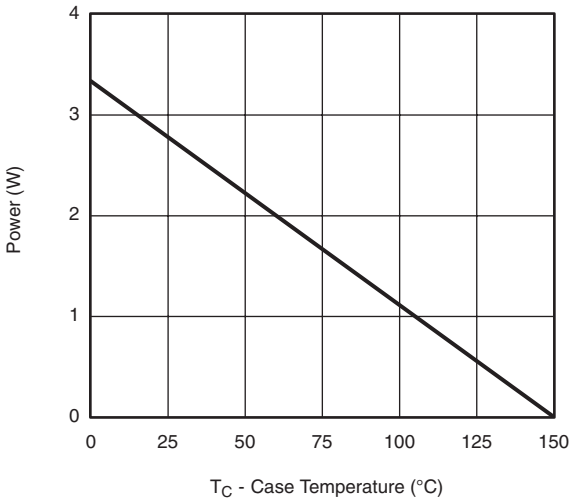

* $V_{GS}$ > minimum $V_{GS}$ at which $R_{DS(on)}$ is specified

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

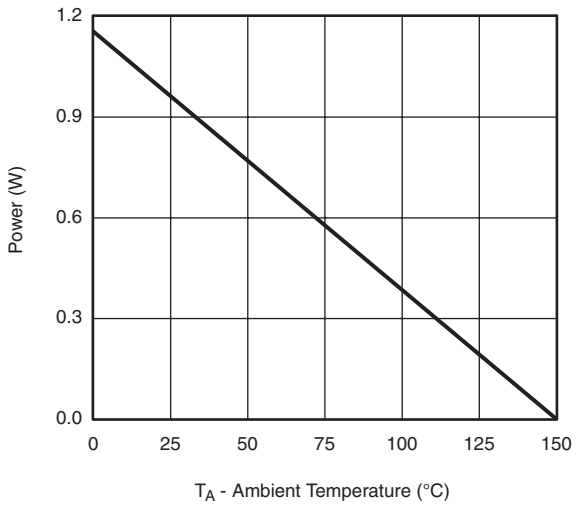
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted




**Current Derating***



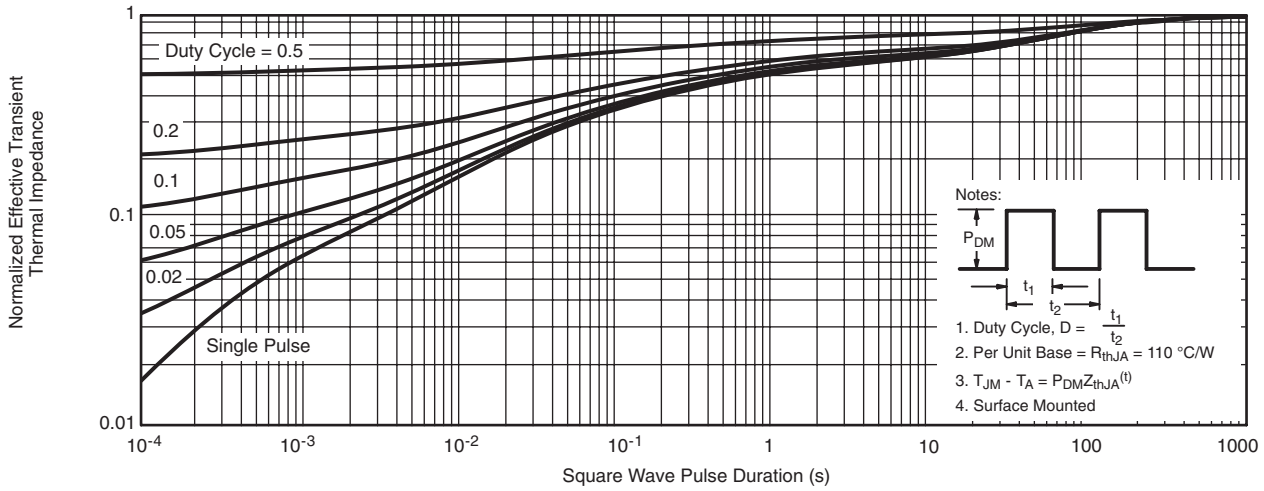

**Power, Junction-to-Foot**



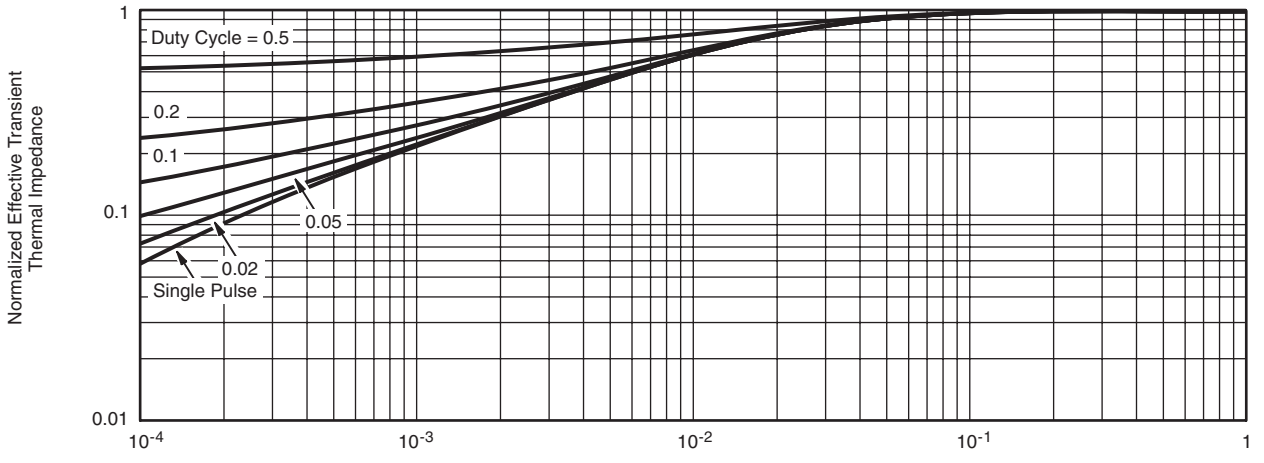

**Power, Junction-to-Ambient**

* 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.

## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

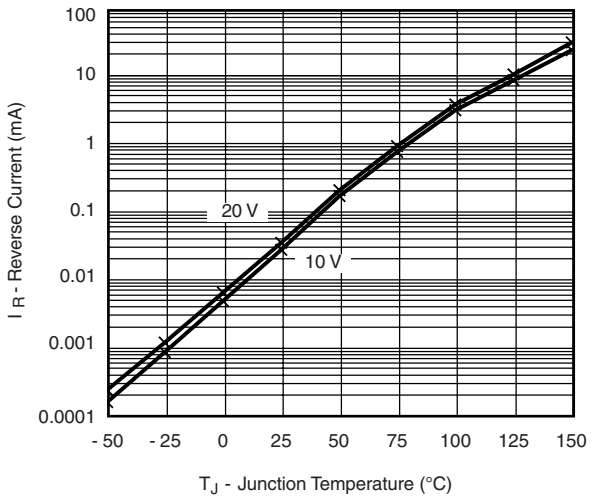



**Normalized Thermal Transient Impedance, Junction-to-Ambient**

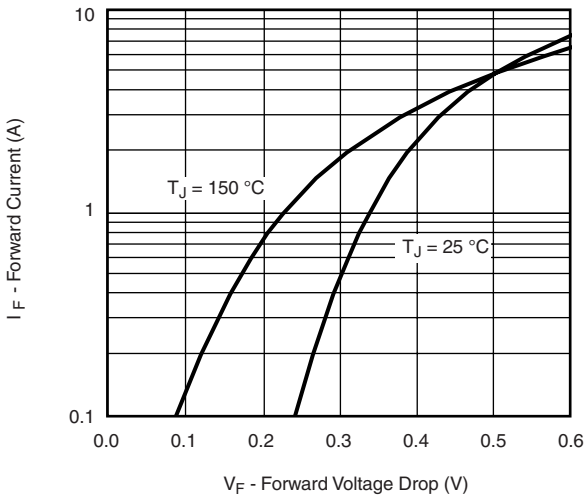



**Normalized Thermal Transient Impedance, Junction-to-Foot**

## SCHOTTKY TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

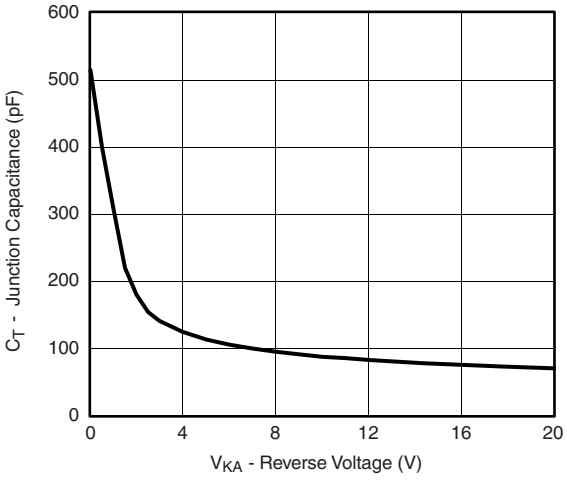



**Reverse Current vs. Junction Temperature**

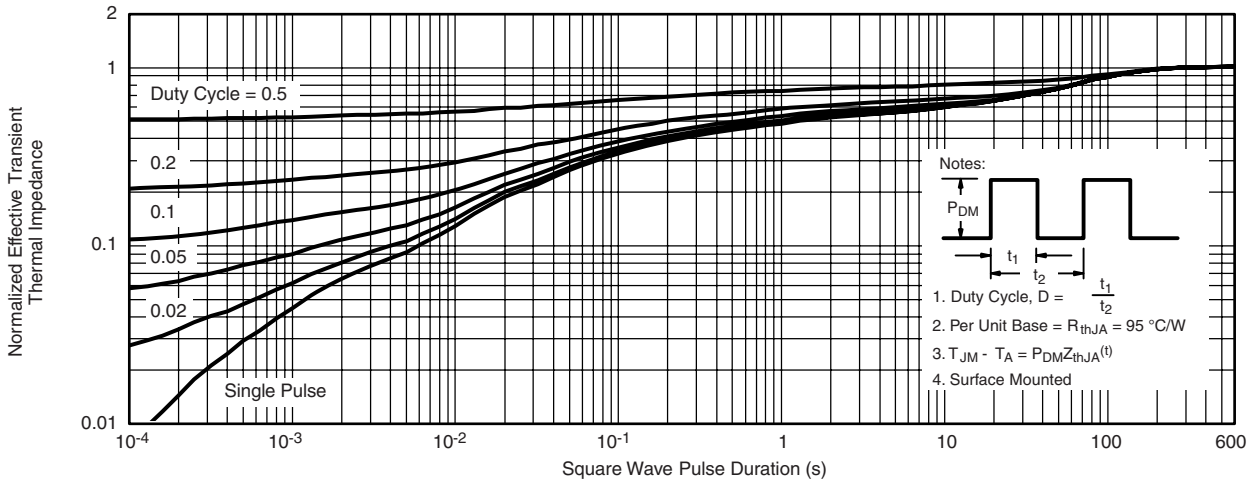



**Forward Voltage Drop**

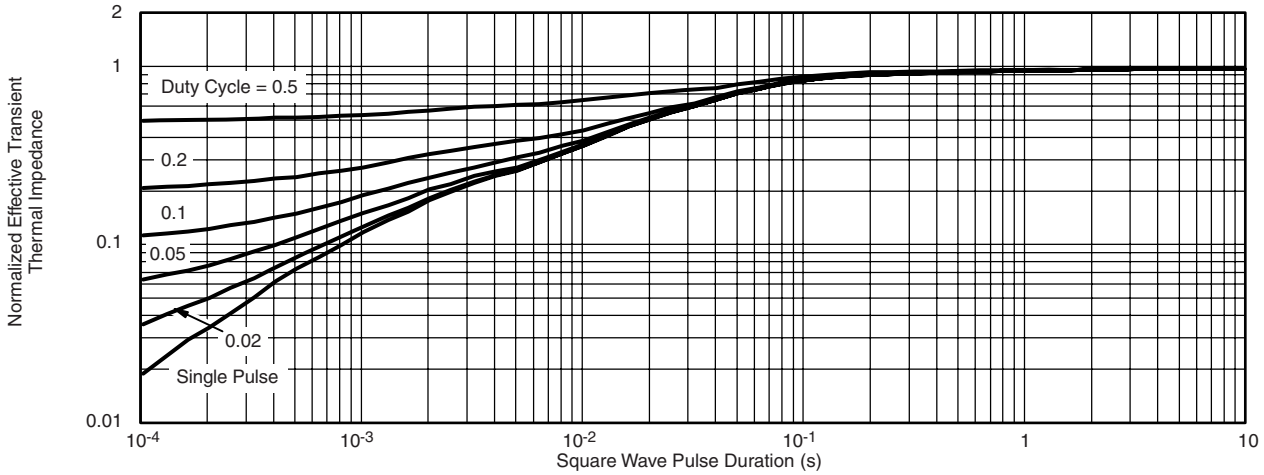
## SCHOTTKY TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted




**Capacitance**



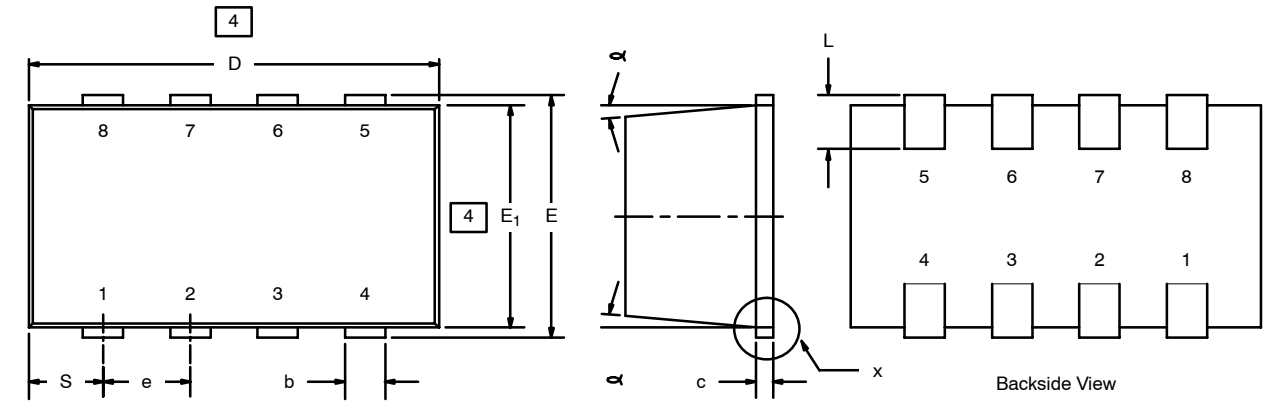

**Normalized Thermal Transient Impedance, Junction-to-Ambient**

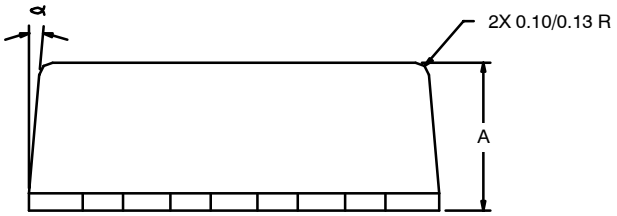


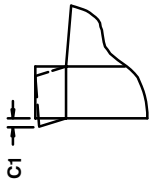

**Normalized Thermal Transient Impedance, Junction-to-Foot**

*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?68910](www.vishay.com/ppg?68910).*

## 1206-8 ChipFET®



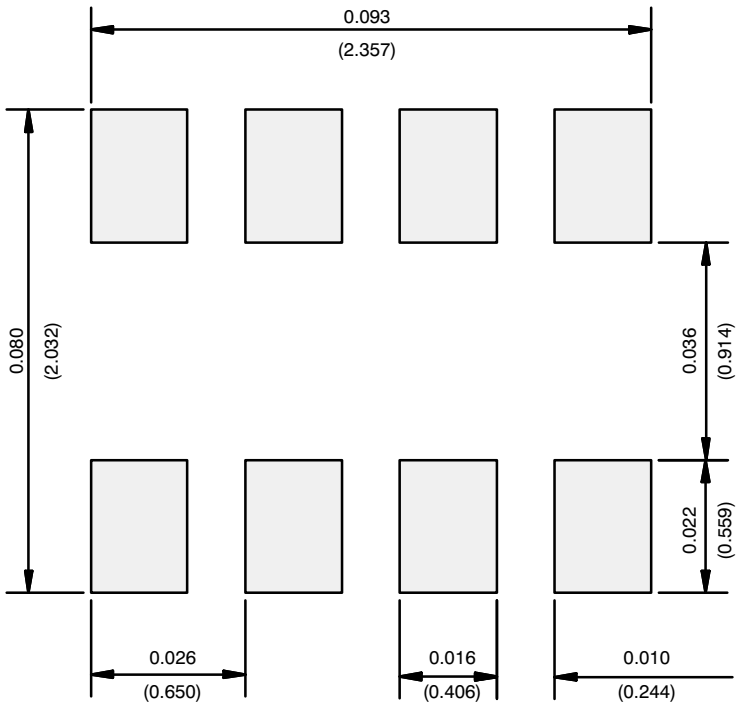

DETAIL X

NOTES:

1. All dimensions are in millimeaters.
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.

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| **Dim** | **Min** | **Nom** | **Max** | **Min** | **Nom** | **Max** |
| **A** | 1.00 | – | 1.10 | 0.039 | – | 0.043 |
| **b** | 0.25 | 0.30 | 0.35 | 0.010 | 0.012 | 0.014 |
| **c** | 0.1 | 0.15 | 0.20 | 0.004 | 0.006 | 0.008 |
| **c1** | 0 | – | 0.038 | 0 | – | 0.0015 |
| **D** | 2.95 | 3.05 | 3.10 | 0.116 | 0.120 | 0.122 |
| **E** | 1.825 | 1.90 | 1.975 | 0.072 | 0.075 | 0.078 |
| **$E_1$** | 1.55 | 1.65 | 1.70 | 0.061 | 0.065 | 0.067 |
| **e** | 0.65 BSC | | | 0.0256 BSC | | |
| **L** | 0.28 | – | 0.42 | 0.011 | – | 0.017 |
| **S** | 0.55 BSC | | | 0.022 BSC | | |
| **α** | 5°Nom | | | 5°Nom | | |
| ECN: C-03528—Rev. F, 19-Jan-04<br>DWG: 5547 | | | | | | |

## RECOMMENDED MINIMUM PADS FOR 1206-8 ChipFET®




Recommended Minimum Pads
Dimensions in Inches/(mm)

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ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

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# Material Category Policy

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**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

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