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

| MOSFET PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) | $r_{DS(on)}$ (Ω) | $I_D$ (A) |
| –20 | 0.048 @ $V_{GS}$ = –4.5 V | –6.3 |
| | 0.068 @ $V_{GS}$ = –2.5 V | –5.3 |
| | 0.090 @ $V_{GS}$ = –1.8 V | –4.6 |

| SCHOTTKY PRODUCT SUMMARY | | |
|---|---|---|
| $V_{KA}$ (V) | $V_f$ (V) Diode Forward Voltage | $I_F$ (A) |
| 20 | 0.48 V @ 0.5 A | 1.0 |

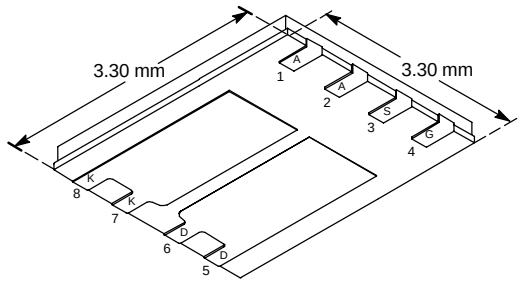
## FEATURES

- TrenchFET® Power MOSFETS: 1.8-V Rated
- ESD Protected: 4500 V
- Ultra-Low Thermal Resistance, PowerPAK™ Package with Low 1.07-mm Profile

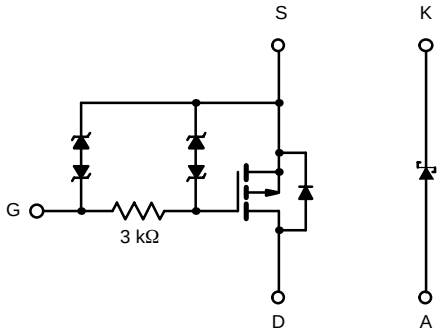
## APPLICATIONS

- Charger Switching

**PowerPAK™ 1212-8**




Bottom View




P-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°C UNLESS OTHERWISE NOTED) | | | | | |
|---|---|---|---|---|---|
| Parameter | | Symbol | 10 sec | Steady State | Unit |
| Drain-Source Voltage (MOSFET and Schottky) | | $V_{DS}$ | –20 | | V |
| Reverse Voltage (Schottky) | | $V_{KA}$ | 20 | | |
| Gate-Source Voltage (MOSFET) | | $V_{GS}$ | ±12 | ±12 | |
| Continuous Drain Current ($T_J$ = 150°C) (MOSFET)[a] | $T_A$ = 25°C | $I_D$ | –6.3 | –4.3 | A |
| | $T_A$ = 85°C | | –4.5 | –3.1 | |
| Pulsed Drain Current (MOSFET) | | $I_{DM}$ | –20 | | |
| Continuous Source Current (MOSFET Diode Conduction)[a] | | $I_S$ | –2.3 | –1.1 | |
| Average Foward Current (Schottky) | | $I_F$ | 1.0 | | |
| Pulsed Foward Current (Schottky) | | $I_{FM}$ | 7 | | |
| Maximum Power Dissipation (MOSFET)[a] | $T_A$ = 25°C | $P_D$ | 2.8 | 1.3 | W |
| | $T_A$ = 85°C | | 1.5 | 0.7 | |
| Maximum Power Dissipation (Schottky)[a] | $T_A$ = 25°C | | 2.0 | 1.1 | |
| | $T_A$ = 85°C | | 1.0 | 0.6 | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | –55 to 150 | | °C |

Notes
a. Surface Mounted on 1" x1" FR4 Board.

## THERMAL RESISTANCE RATINGS

| Parameter | | Device | Symbol | Typical | Maximum | Unit |
|---|---|---|---|---|---|---|
| Junction-to-Ambient[a] | t ≤ 10 sec | MOSFET | $R_{thJA}$ | 35 | 44 | °C/W |
| | | Schottky | | 51 | 64 | |
| | Steady State | MOSFET | | 75 | 94 | |
| | | Schottky | | 91 | 115 | |
| Junction-to-Case (Drain) | Steady State | MOSFET | $R_{thJC}$ | 4 | 5 | |
| | | Schottky | | 10 | 12 | |

Notes
a. Surface Mounted on 1" x 1" FR4 Board.

## MOSFET SPECIFICATIONS ($T_J$ = 25°C UNLESS OTHERWISE NOTED)

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Static** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = –800 µA | –0.45 | | | V |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±4.5 V | | | ±1.5 | µA |
| | | $V_{DS}$ = 0 V, $V_{GS}$ = ±12 V | | | ±100 | mA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = –16 V, $V_{GS}$ = 0 V | | | –1 | µA |
| | | $V_{DS}$ = –16 V, $V_{GS}$ = 0 V, $T_J$ = 85°C | | | –5 | |
| On-State Drain Current[a] | $I_{D(on)}$ | $V_{DS}$ ≤ –5 V, $V_{GS}$ = –4.5 V | –20 | | | A |
| Drain-Source On-State Resistance[a] | $r_{DS(on)}$ | $V_{GS}$ = –4.5 V, $I_D$ = –6.3 A | | 0.041 | 0.048 | Ω |
| | | $V_{GS}$ = –2.5 V, $I_D$ = –5.3 A | | 0.057 | 0.068 | |
| | | $V_{GS}$ = –1.8 V, $I_D$ = –1 A | | 0.072 | 0.090 | |
| Forward Transconductance[a] | $g_{fs}$ | $V_{DS}$ = –10 V, $I_D$ = –6.3 A | | 14 | | S |
| Diode Forward Voltage[a] | $V_{SD}$ | $I_S$ = –2.3 A, $V_{GS}$ = 0 V | | –0.8 | –1.2 | V |
| **Dynamic[b]** | | | | | | |
| Total Gate Charge | $Q_g$ | $V_{DS}$ = –10 V, $V_{GS}$ = –4.5 V, $I_D$ = –6.3 A | | 12 | 18 | nC |
| Gate-Source Charge | $Q_{gs}$ | | | 2.5 | | |
| Gate-Drain Charge | $Q_{gd}$ | | | 2.9 | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = –10 V, $R_L$ = 10 Ω<br>$I_D$ ≅ –1 A, $V_{GEN}$ = –4.5 V, $R_G$ = 6 Ω | | 2.5 | 4 | ns |
| Rise Time | $t_r$ | | | 4 | 6 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 15 | 23 | |
| Fall Time | $t_f$ | | | 12 | 18 | |

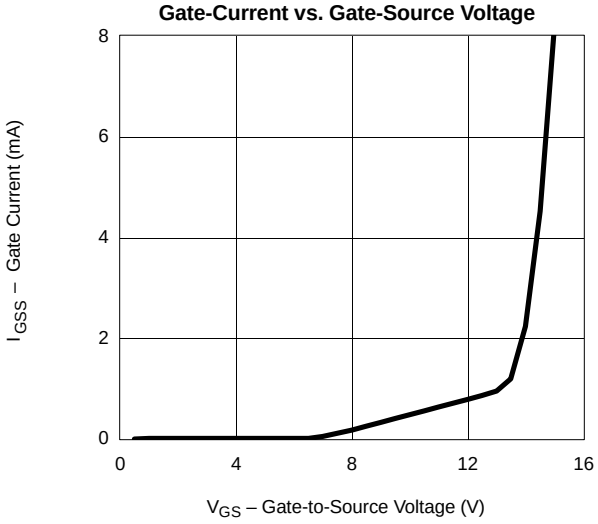
Notes
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2%.
b. Guaranteed by design, not subject to production testing.

## SCHOTTKY SPECIFICATIONS ($T_J$ = 25°C UNLESS OTHERWISE NOTED)

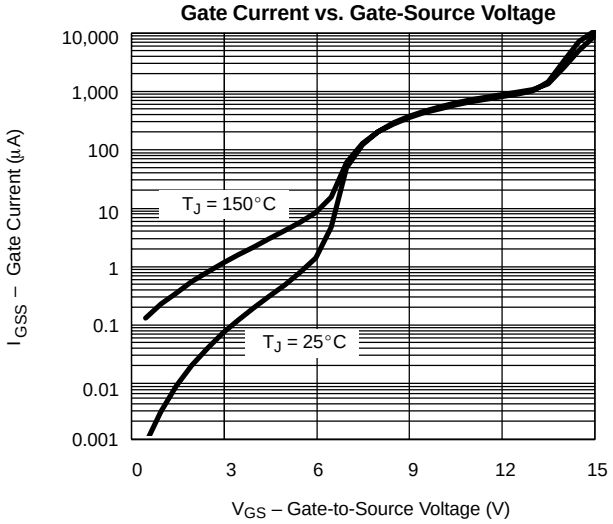
| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Forward Voltage Drop | $V_F$ | $I_F$ = 0.5 A | | 0.42 | 0.48 | V |
| | | $I_F$ = 0.5 A, $T_J$ = 125°C | | 0.33 | 0.4 | |
| Maximum Reverse Leakage Current | $I_{rm}$ | $V_r$ = 20 V | | 0.002 | 0.100 | mA |
| | | $V_r$ = 20 V, $T_J$ = 85°C | | 0.10 | 1 | |
| | | $V_r$ = 20 V, $T_J$ = 125°C | | 1.5 | 10 | |
| Junction Capacitance | $C_T$ | $V_r$ = 10 V | | 31 | | pF |

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

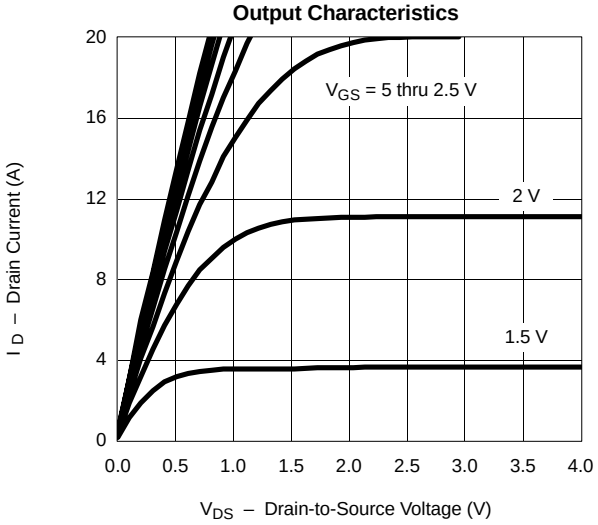
**Gate-Current vs. Gate-Source Voltage**



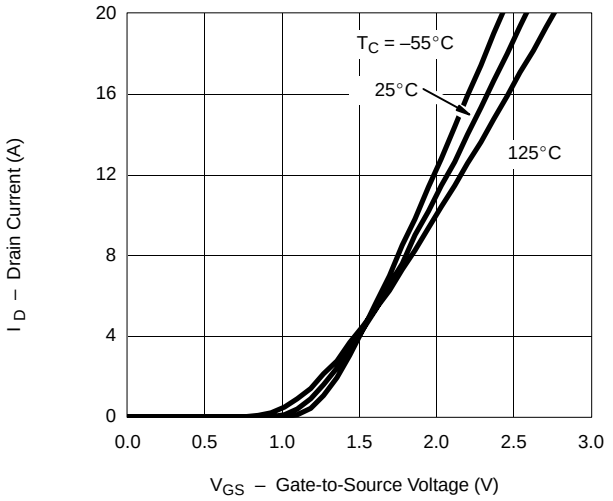

**Gate Current vs. Gate-Source Voltage**



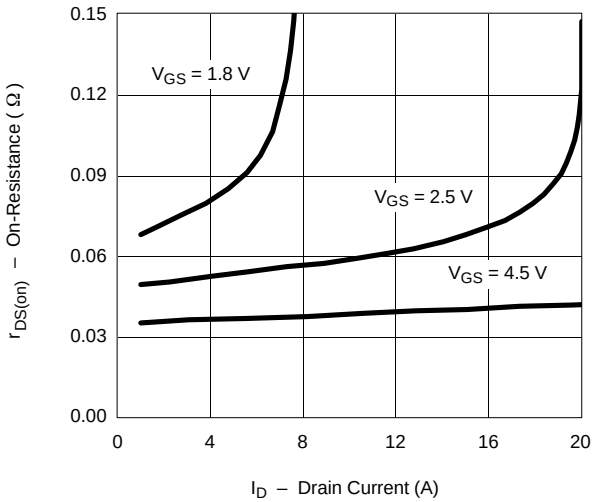

**Output Characteristics**



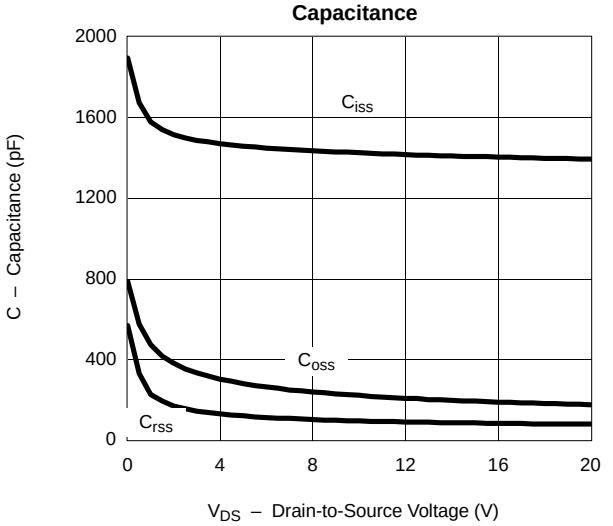

**Transfer Characteristics**




**On-Resistance vs. Drain Current**

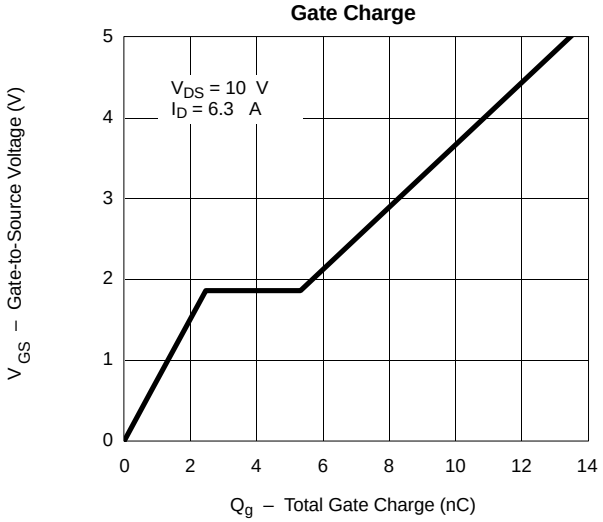



**Capacitance**

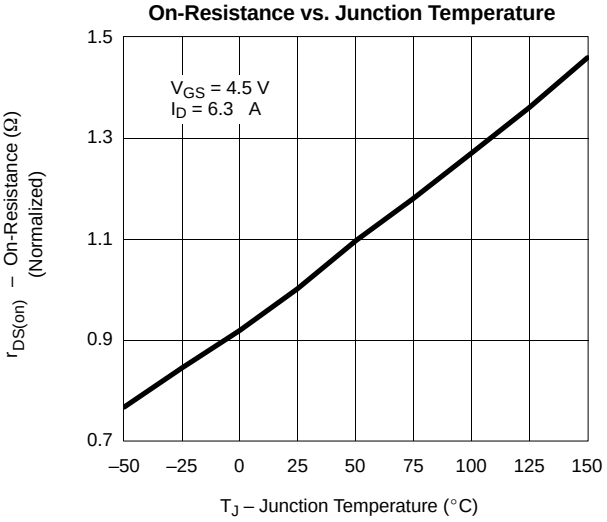


## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED) MOSFET

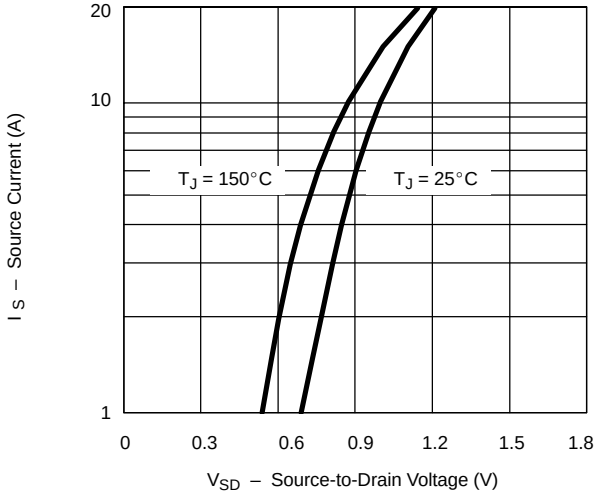
**Gate Charge**



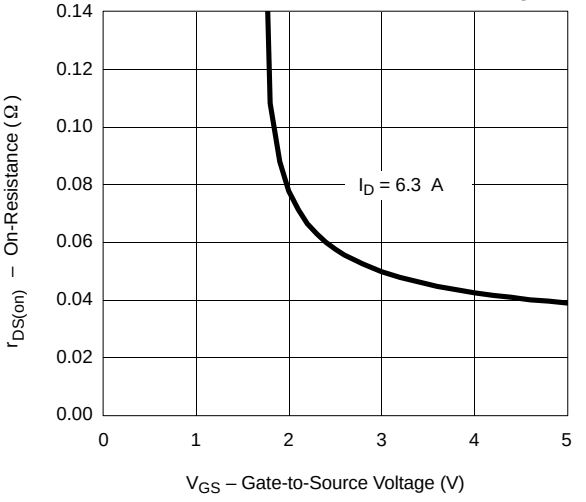

**On-Resistance vs. Junction Temperature**



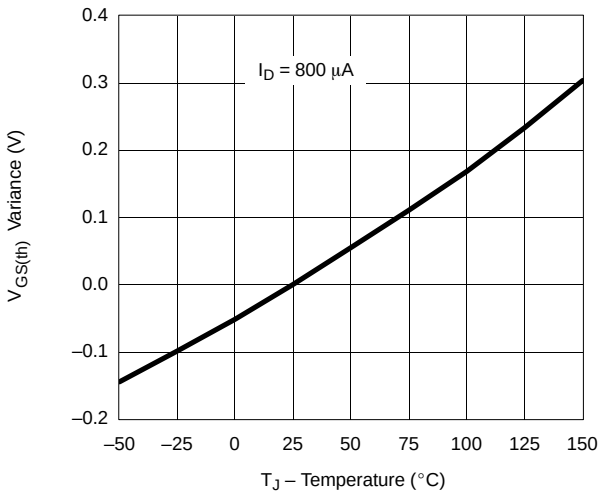

**Source-Drain Diode Forward Voltage**



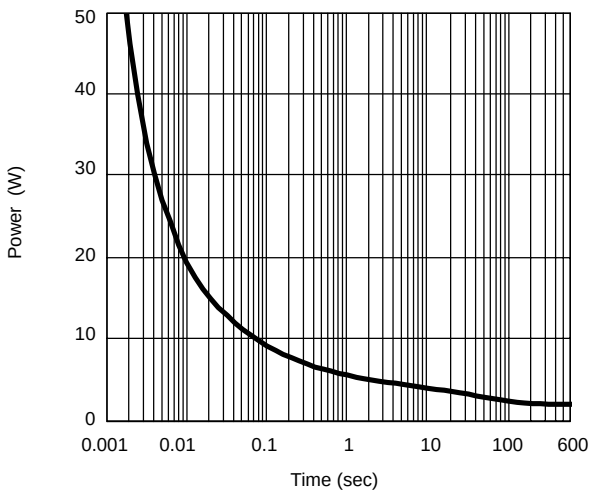

**On-Resistance vs. Gate-to-Source Voltage**




**Threshold Voltage**

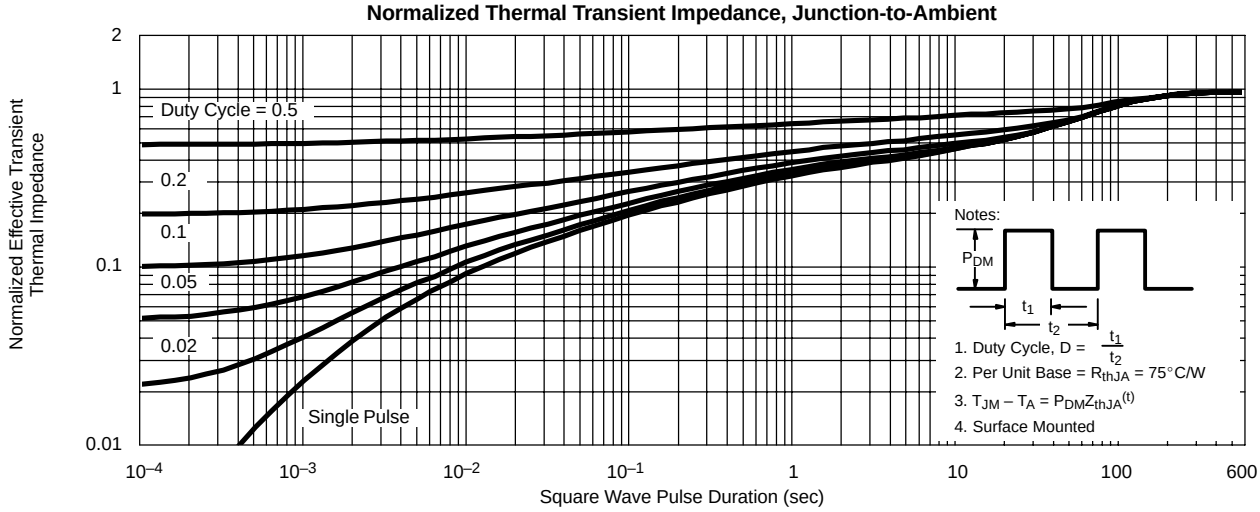



**Single Pulse Power, Junction-to-Ambient**

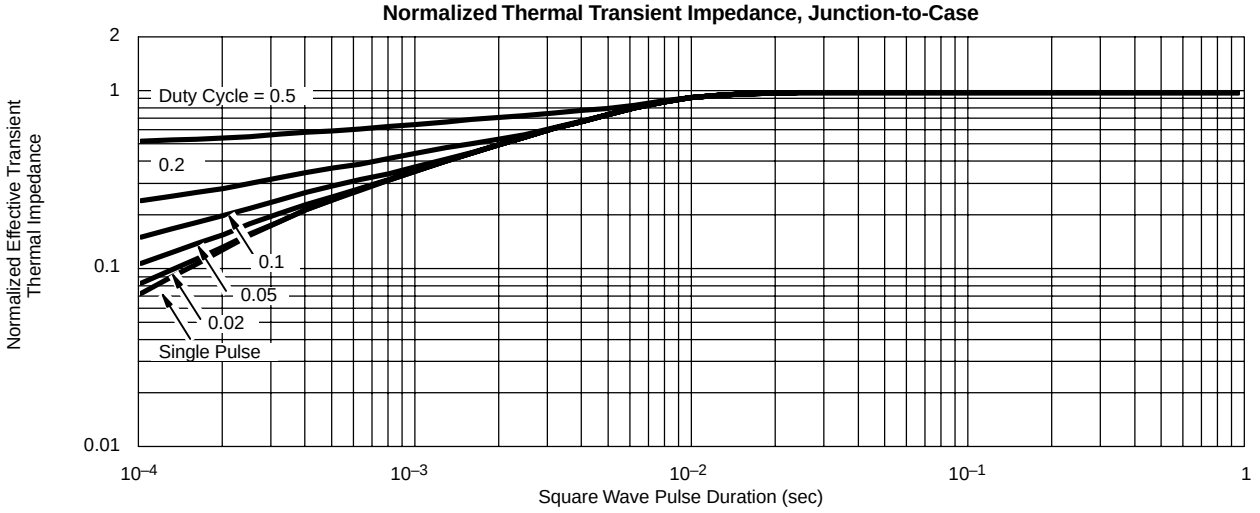


## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED) MOSFET

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

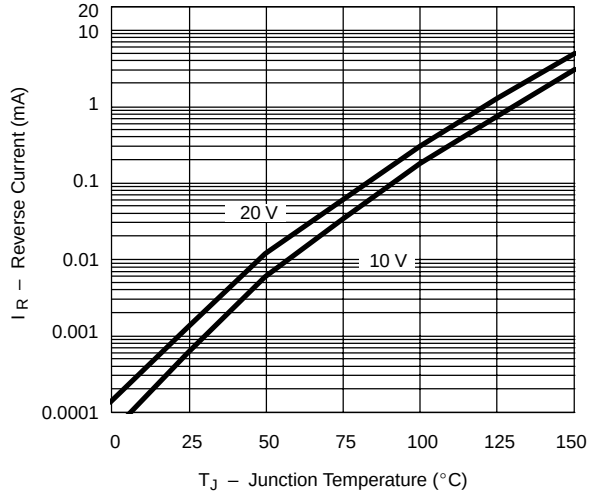



**Normalized Thermal Transient Impedance, Junction-to-Case**

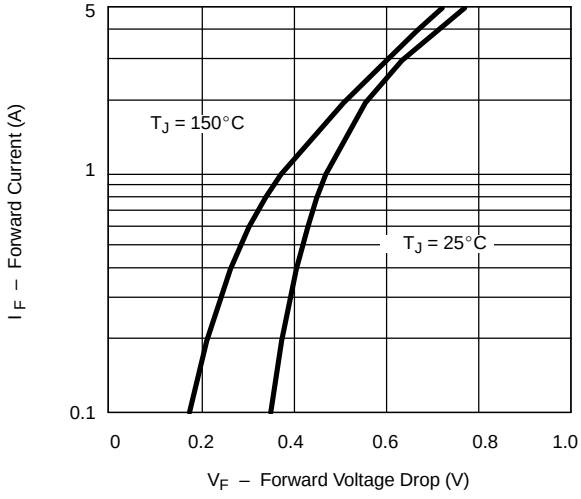



## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED) SCHOTTKY

**Reverse Current vs. Junction Temperature**

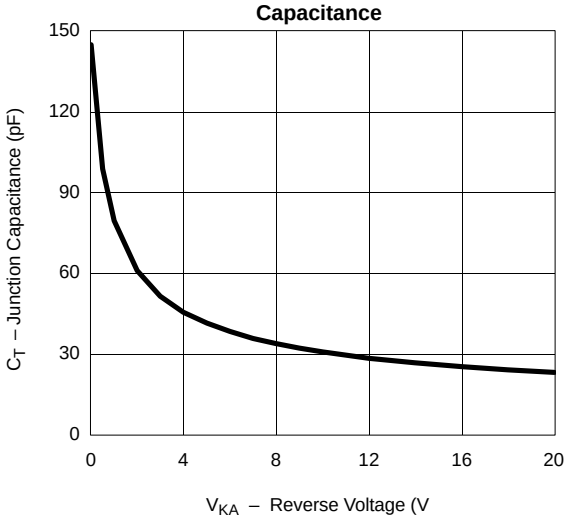



**Forward Voltage Drop**

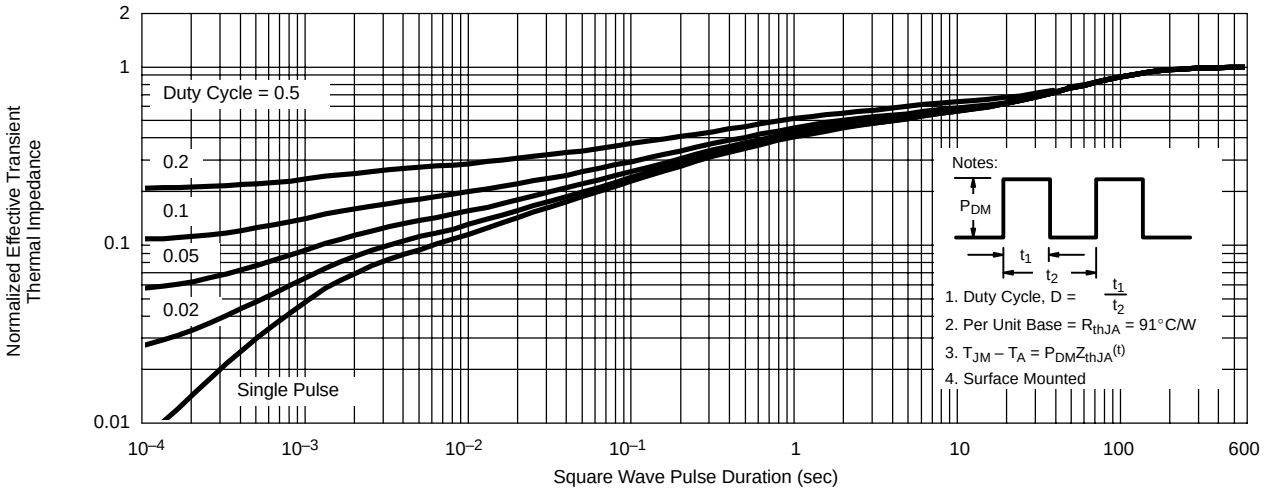


## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED) SCHOTTKY

**Capacitance**




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




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