# N- and P-Channel 40-V (D-S) MOSFET

| PRODUCT SUMMARY | | | | |
|---|---|---|---|---|
| | $V_{DS}$ (V) | $r_{DS(on)}$ (Ω) | $I_D$ (A) | $Q_g$ (Typ) |
| N-Channel | 40 | 0.040 @ $V_{GS}$ = 10 V | 5.2 | 8 |
| | | 0.045 @ $V_{GS}$ = 4.5 V | 4.9 | |
| P-Channel | –40 | 0.054 @ $V_{GS}$ = –10 V | –4.5 | 9 |
| | | 0.072 @ $V_{GS}$ = –4.5 V | –3.9 | |

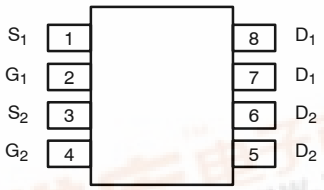
## FEATURES

- TrenchFET® Power MOSFET
- 100% $R_g$ Tested
- UIS Tested

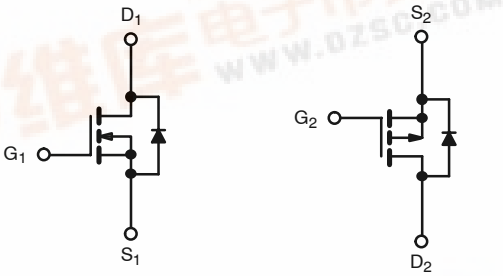
## APPLICATIONS

- CCFL Inverter

**SO-8**




Top View




N-Channel MOSFET P-Channel MOSFET

Ordering Information: Si4565DY—E3
Si4565DY-T1—E3 (with Tape and Reel)

| ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°C UNLESS OTHERWISE NOTED) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameter | | Symbol | N-Channel | | P-Channel | | Unit |
| | | | 10 secs | Steady State | 10 secs | Steady State | |
| Drain-Source Voltage | | $V_{DS}$ | 40 | | –40 | | V |
| Gate-Source Voltage | | $V_{GS}$ | ±12 | | ±16 | | |
| Continuous Drain Current ($T_J$ = 150°C)[a] | $T_A$ = 25°C | $I_D$ | 5.2 | 3.9 | –4.5 | –3.3 | A |
| | $T_A$ = 70°C | | 4.2 | 3.1 | –3.6 | –2.7 | |
| Pulsed Drain Current | | $I_{DM}$ | 30 | | | | |
| Continuous Source Current (Diode Conduction)[a] | | $I_S$ | 1.7 | 0.9 | –1.7 | –0.9 | |
| Avalanche Current | L = 0.1 mH | $I_{AS}$ | 13 | | 16 | | |
| Single Pulse Avalanche Energy | | $E_{AS}$ | 8.5 | | 13 | | mJ |
| Maximum Power Dissipatio[a] | $T_A$ = 25°C | $P_D$ | 2.0 | 1.1 | 2 | 1.1 | W |
| | $T_A$ = 70°C | | 1.3 | 0.7 | 1.3 | 0.7 | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | –55 to 150 | | | | °C |

| THERMAL RESISTANCE RATINGS | | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameter | | Symbol | N-Channel | | P-Channel | | Unit |
| | | | Typ | Max | Typ | Max | |
| Maximum Junction-to-Ambient[a] | t ≤ 10 sec | $R_{thJA}$ | 52 | 62.5 | 50 | 62.5 | °C/W |
| | Steady State | | 90 | 110 | 85 | 110 | |
| Maximum Junction-to-Foot (Drain) | Steady State | $R_{thJF}$ | 32 | 40 | 30 | 40 | |

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

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

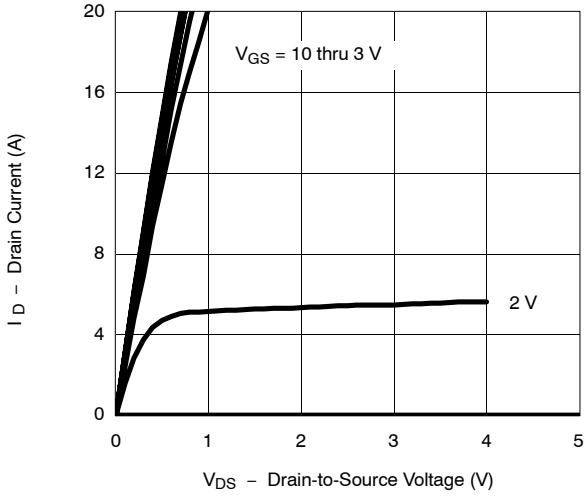
| Parameter | Symbol | Test Condition | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static** | | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | N-Ch | 0.6 | | 1.6 | V |
| | | $V_{DS}$ = $V_{GS}$, $I_D$ = −250 µA | P-Ch | −0.8 | | −2.2 | |
| $V_{DS}$ Temperature Coefficient | $\Delta V_{DS/Tj}$ | $I_D$ = 250 µA | N-Ch | | 40 | | mV/°C |
| | | | P-Ch | | −40 | | |
| $V_{GS(th)}$ Temperature Coefficient | $\Delta V_{GS(th)/Tj}$ | | N-Ch | | −3.8 | | |
| | | | P-Ch | | 3.4 | | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±12 V | N-Ch | | | ±100 | nA |
| | | $V_{DS}$ = 0 V, $V_{GS}$ = ±16 V | P-Ch | | | ±100 | |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 40 V, $V_{GS}$ = 0 V | N-Ch | | | 1 | µA |
| | | $V_{DS}$ = −40 V, $V_{GS}$ = 0 V | P-Ch | | | −1 | |
| | | $V_{DS}$ = 40 V, $V_{GS}$ = 0 V, $T_J$ = 55°C | N-Ch | | | 10 | |
| | | $V_{DS}$ = −40 V, $V_{GS}$ = 0 V, $T_J$ = 55°C | P-Ch | | | −10 | |
| On-State Drain Current[a] | $I_{D(on)}$ | $V_{DS}$ ≥ 5 V, $V_{GS}$ = 10 V | N-Ch | 20 | | | A |
| | | $V_{DS}$ ≤ −5 V, $V_{GS}$ = −10 V | P-Ch | −20 | | | |
| Drain-Source On-State Resistance[a] | $r_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 5.2 A | N-Ch | | 0.033 | 0.040 | Ω |
| | | $V_{GS}$ = −10 V, $I_D$ = −4.5 A | P-Ch | | 0.045 | 0.054 | |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 4.9 A | N-Ch | | 0.037 | 0.045 | |
| | | $V_{GS}$ = −4.5 V, $I_D$ = −3.9 A | P-Ch | | 0.059 | 0.072 | |
| Forward Transconductance[a] | $g_{fs}$ | $V_{DS}$ = 15 V, $I_D$ = 5.2 A | N-Ch | | 18 | | S |
| | | $V_{DS}$ = −15 V, $I_D$ = −4.5 A | P-Ch | | 13 | | |
| Diode Forward Voltage[a] | $V_{SD}$ | $I_S$ = 1.7 A, $V_{GS}$ = 0 V | N-Ch | | 0.75 | 1.2 | V |
| | | $I_S$ = −1.7 A, $V_{GS}$ = 0 V | P-Ch | | −0.79 | −1.2 | |
| **Dynamic[b]** | | | | | | | |
| Input Capacitance | $C_{iss}$ | N-Channel $V_{DS}$ = 20 V, $V_{GS}$ = 0 V, f = 1 MHz | N-Ch | | 700 | | pF |
| | | | P-Ch | | 805 | | |
| Output Capacitance | $C_{oss}$ | P-Channel $V_{DS}$ = −20 V, $V_{GS}$ = 0 V, f = 1 MHz | N-Ch | | 76 | | |
| | | | P-Ch | | 120 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | N-Ch | | 45 | | |
| | | | P-Ch | | 85 | | |
| Total Gate Charge | $Q_g$ | N-Channel $V_{DS}$ = 20 V, $V_{GS}$ = 4.5 V, $I_D$ = 5.2 A | N-Ch | | 8 | 12 | nC |
| | | | P-Ch | | 9 | 14 | |
| Gate-Source Charge | $Q_{gs}$ | P-Channel $V_{DS}$ = −20 V, $V_{GS}$ = −4.5 V, $I_D$ = −4.5 A | N-Ch | | 1.5 | | |
| | | | P-Ch | | 2 | | |
| Gate-Drain Charge | $Q_{gd}$ | | N-Ch | | 2.4 | | |
| | | | P-Ch | | 3.6 | | |
| Gate Resistance | $R_g$ | | N-Ch | 0.9 | 1.9 | 2.9 | Ω |
| | | | P-Ch | 5 | 11.5 | 18 | |
| Turn-On Delay Time | $t_{d(on)}$ | N-Channel $V_{DD}$ = 15 V, $R_L$ = 15 Ω $I_D$ ≅ 1 A, $V_{GEN}$ = 10 V, $R_g$ = 6 Ω | N-Ch | | 7 | 11 | ns |
| | | | P-Ch | | 8 | 13 | |
| Rise Time | $t_r$ | | N-Ch | | 11 | 17 | |
| | | | P-Ch | | 12 | 18 | |
| Turn-Off Delay Time | $t_{d(off)}$ | P-Channel $V_{DD}$ = −15 V, $R_L$ = 15 Ω $I_D$ ≅ −1 A, $V_{GEN}$ = −10 V, $R_g$ = 6 Ω | N-Ch | | 27 | 40 | |
| | | | P-Ch | | 74 | 110 | |
| Fall Time | $t_f$ | | N-Ch | | 8 | 13 | |
| | | | P-Ch | | 38 | 60 | |
| Source-Drain Reverse Recovery Time | $t_{rr}$ | $I_F$ = 1.7 A, di/dt = 100 A/µs | N-Ch | | 25 | 40 | ns |
| | | $I_F$ = −1.7 A, di/dt = 100 A/µs | P-Ch | | 27 | 45 | |
| Body Diode Reverse Recovery Charge | $Q_{rr}$ | $I_F$ = 1.7 A, di/dt = 100 A/µs | N-Ch | | 17 | 26 | nC |
| | | $I_F$ = −1.7 A, di/dt = 100 A/µs | P-Ch | | 17 | 26 | |

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

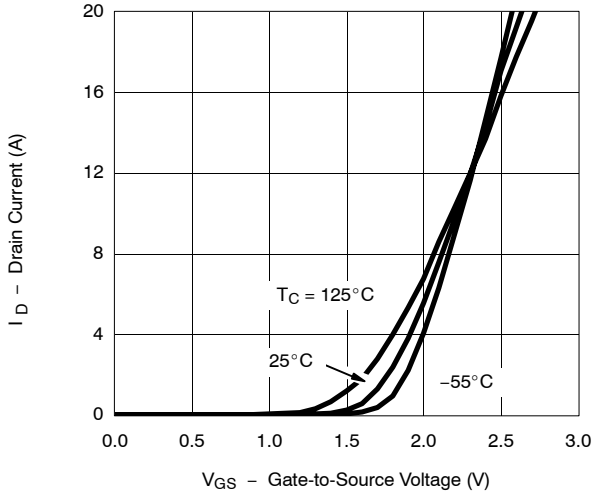
*Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED) N-CHANNEL

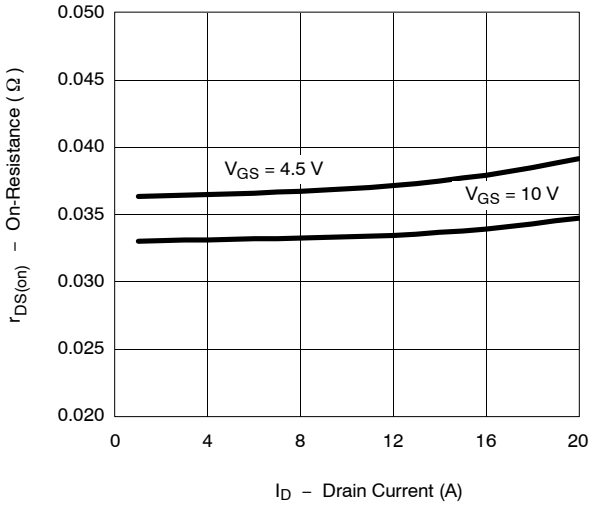
**Output Characteristics**



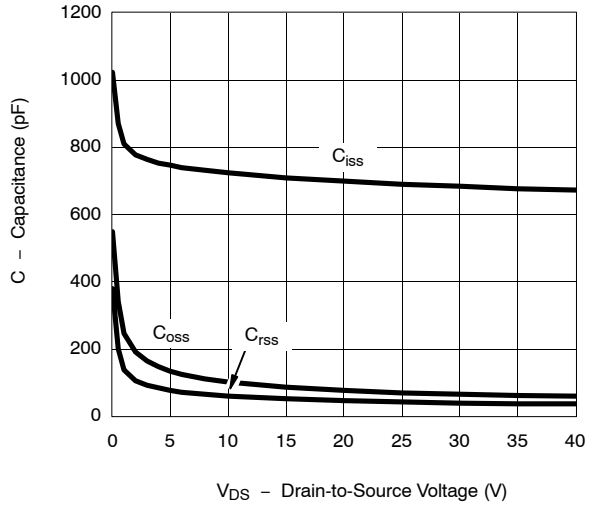

**Transfer Characteristics**



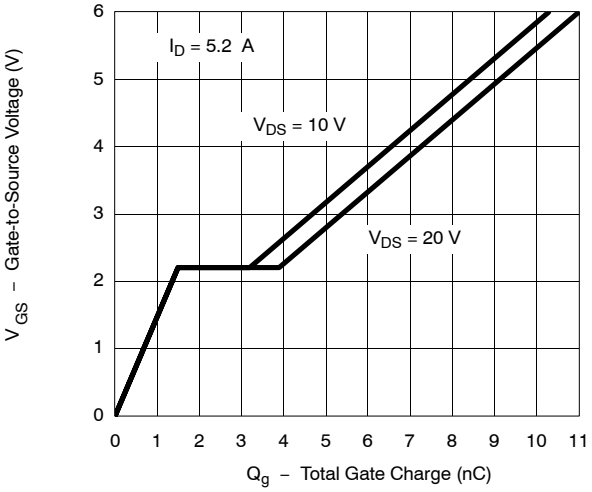

**On-Resistance vs. Drain Current**



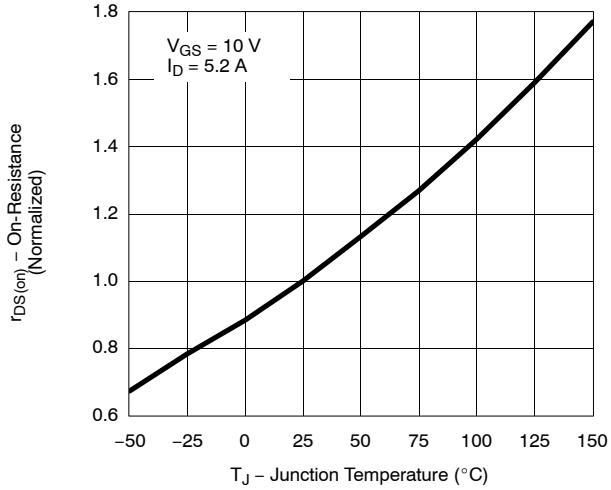

**Capacitance**




**Gate Charge**

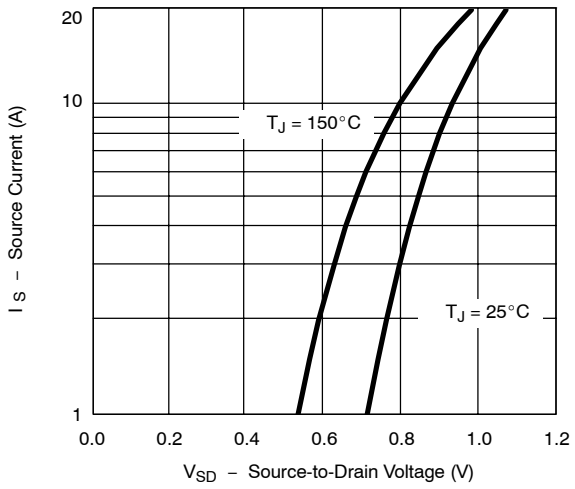



**On-Resistance vs. Junction Temperature**

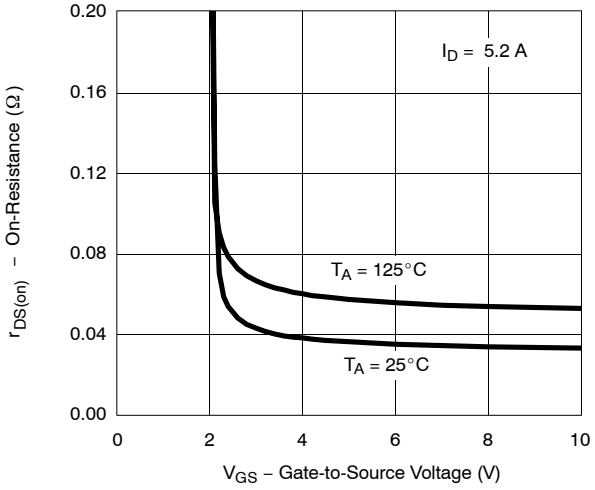


## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED) N-CHANNEL

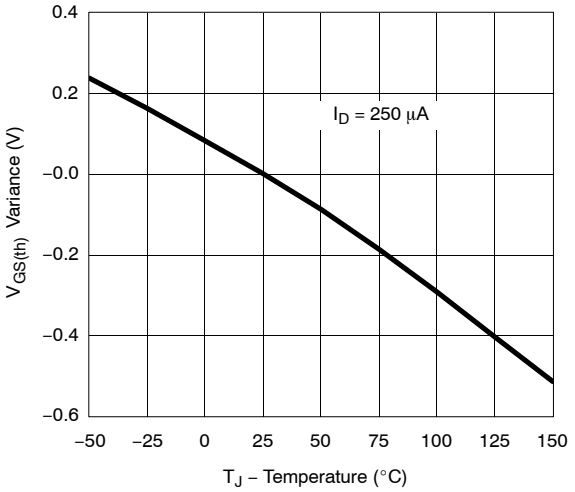
**Source-Drain Diode Forward Voltage**



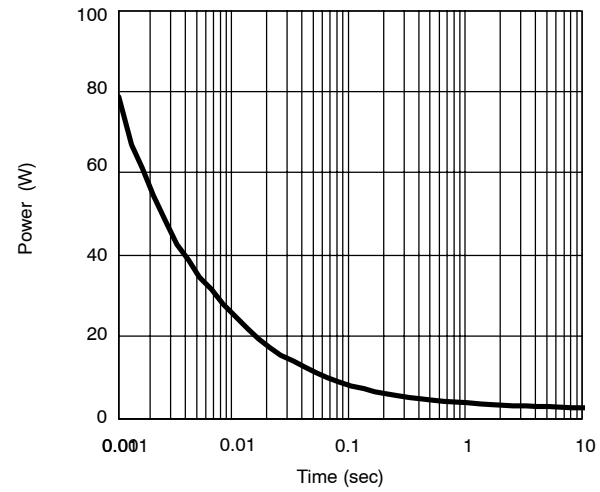

**On-Resistance vs. Gate-to-Source Voltage**



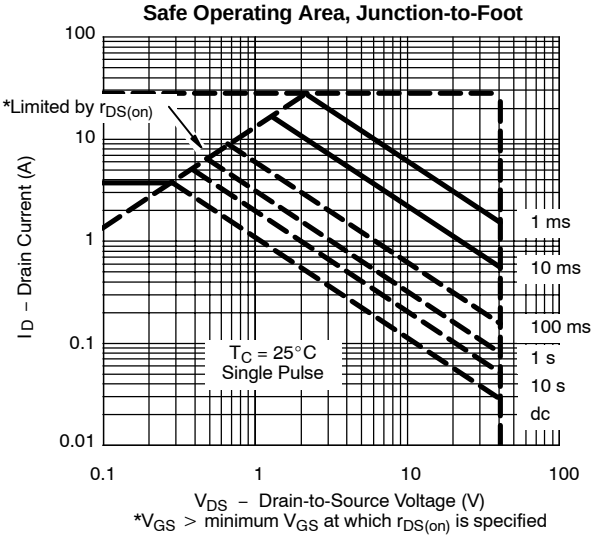

**Threshold Voltage**




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

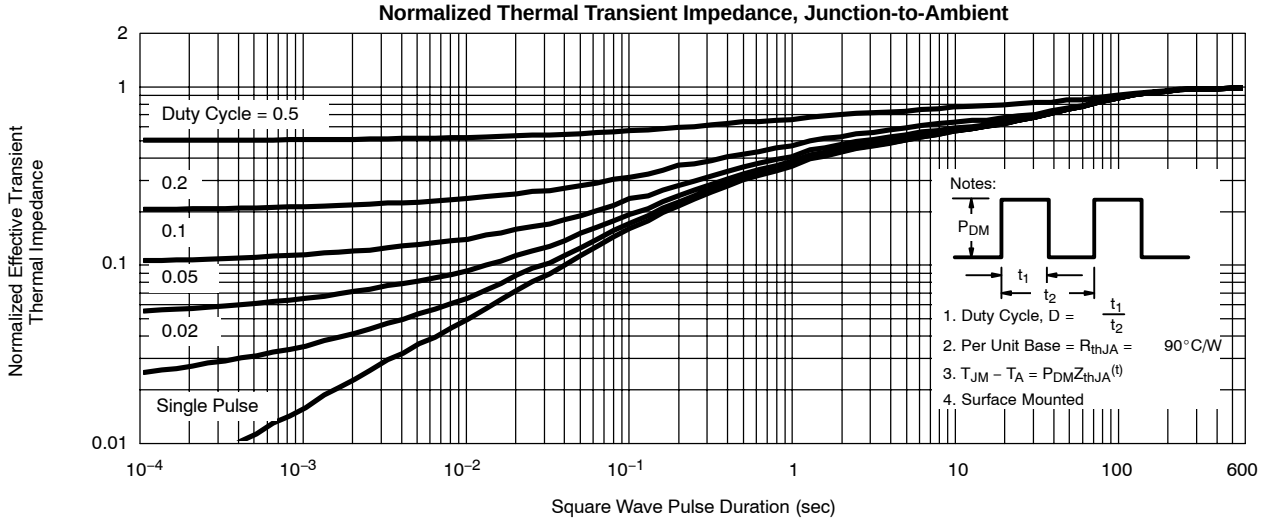



**Safe Operating Area, Junction-to-Foot**

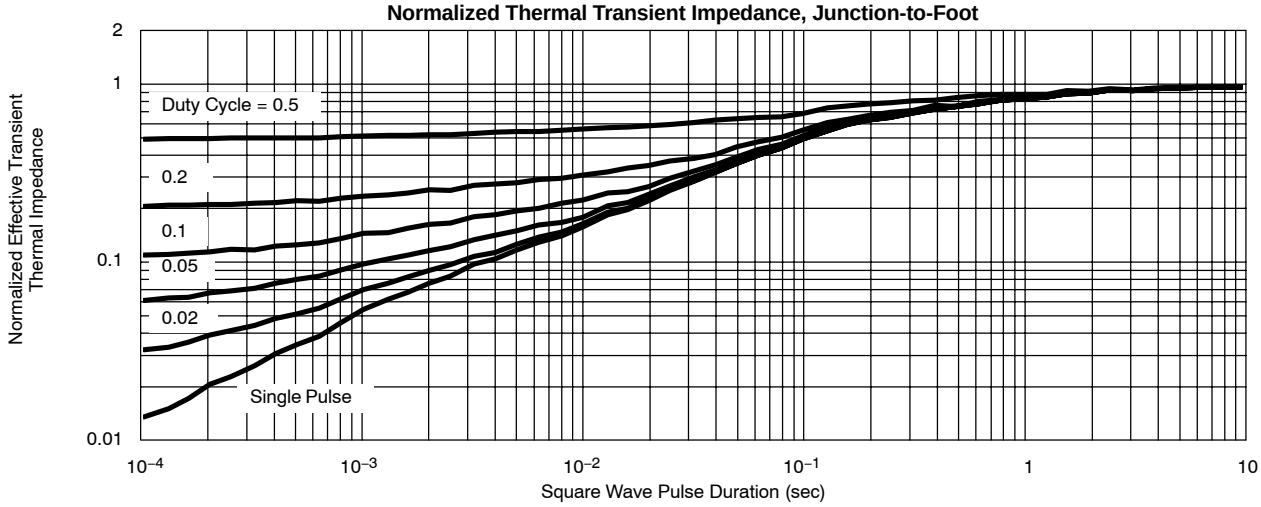


## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED) N-CHANNEL

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

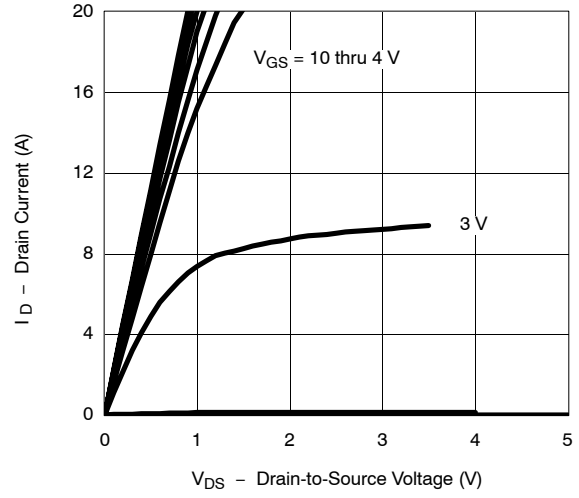



**Normalized Thermal Transient Impedance, Junction-to-Foot**

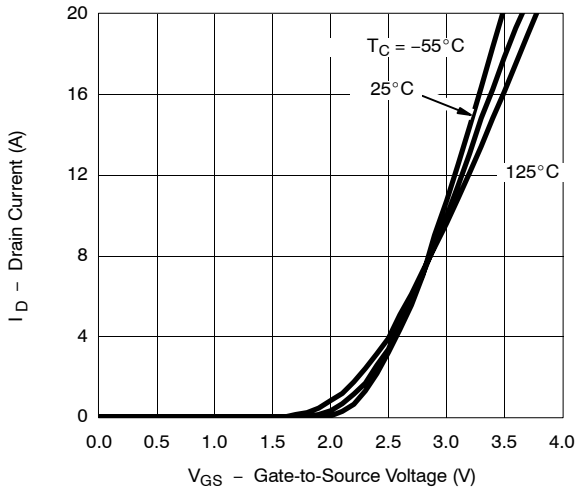



## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED) P-CHANNEL

**Output Characteristics**

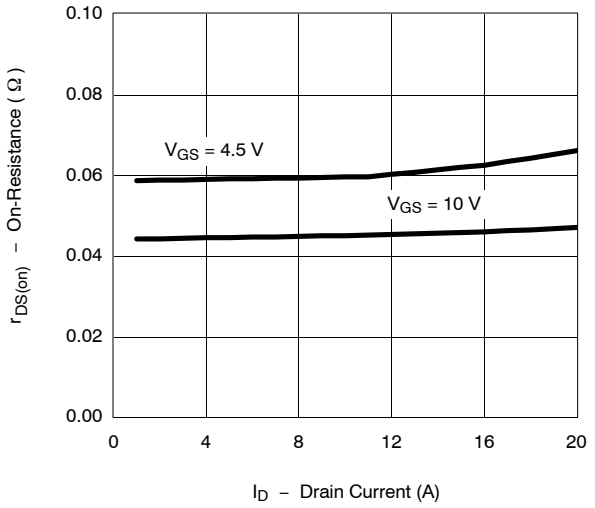



**Transfer Characteristics**

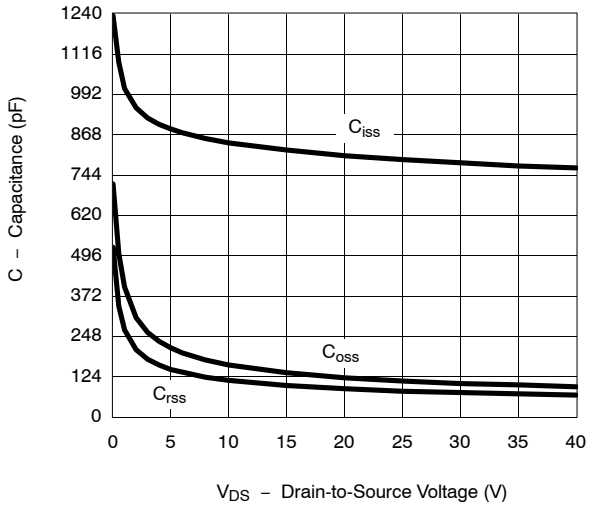


## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED) P-CHANNEL

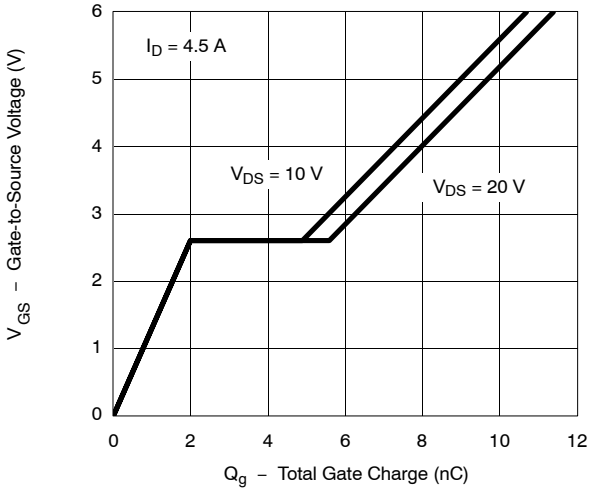
**On-Resistance vs. Drain Current**



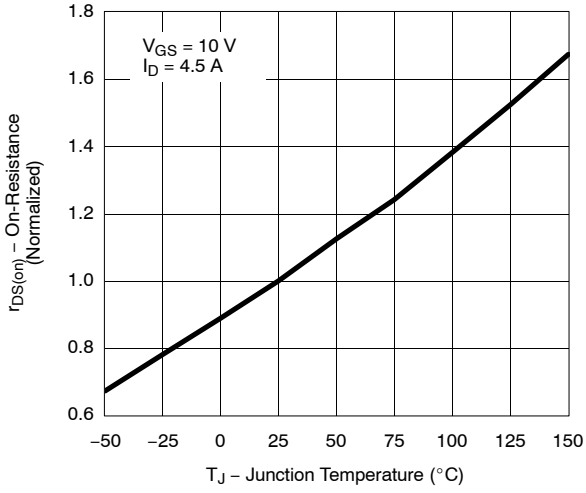

**Capacitance**



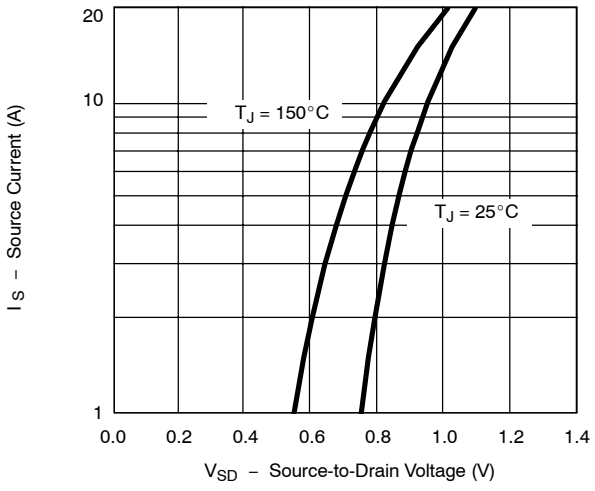

**Gate Charge**



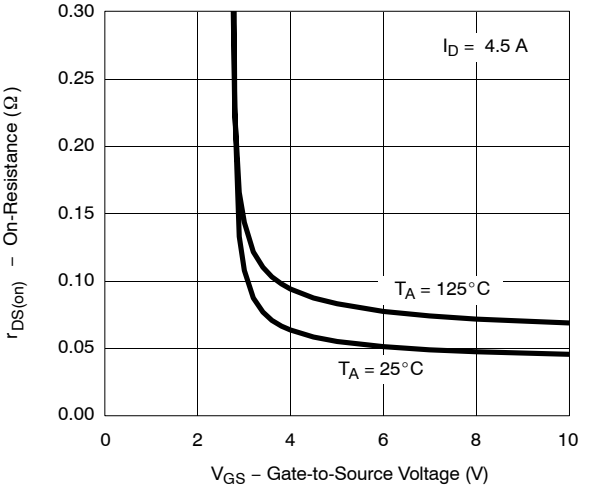

**On-Resistance vs. Junction Temperature**




**Source-Drain Diode Forward Voltage**

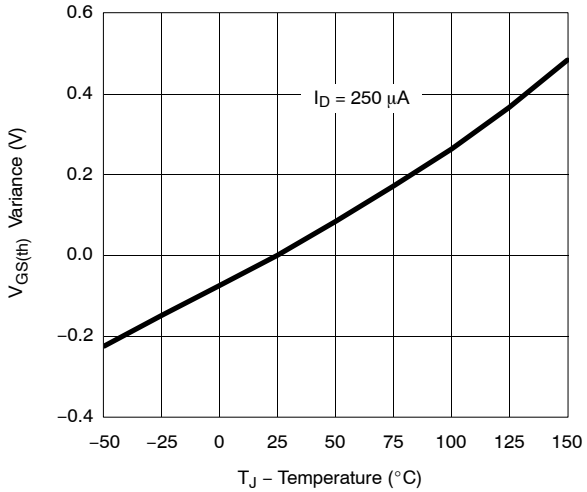



**On-Resistance vs. Gate-to-Source Voltage**

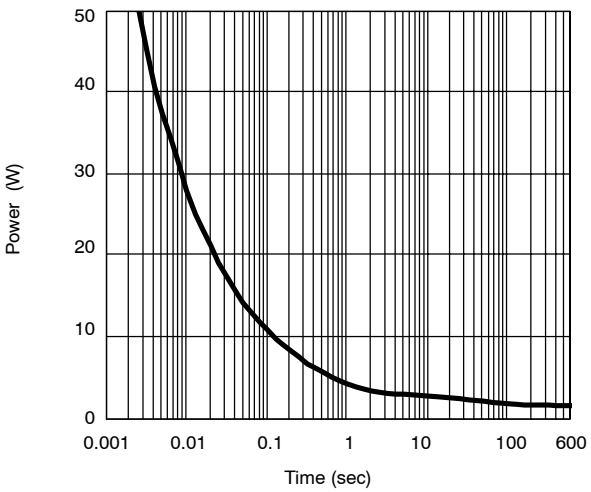


## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED) P-CHANNEL

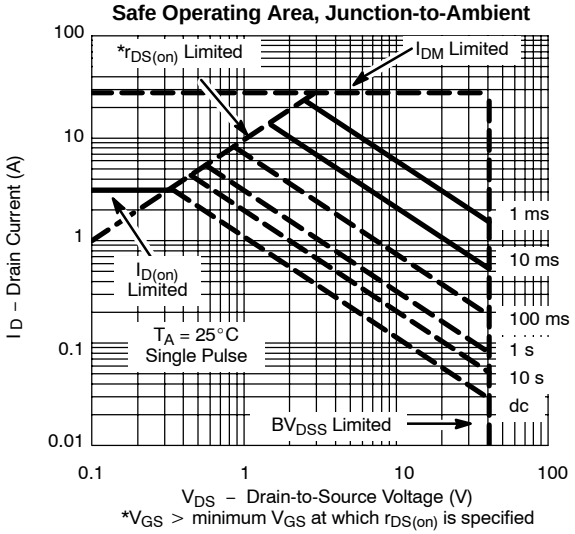
**Threshold Voltage**



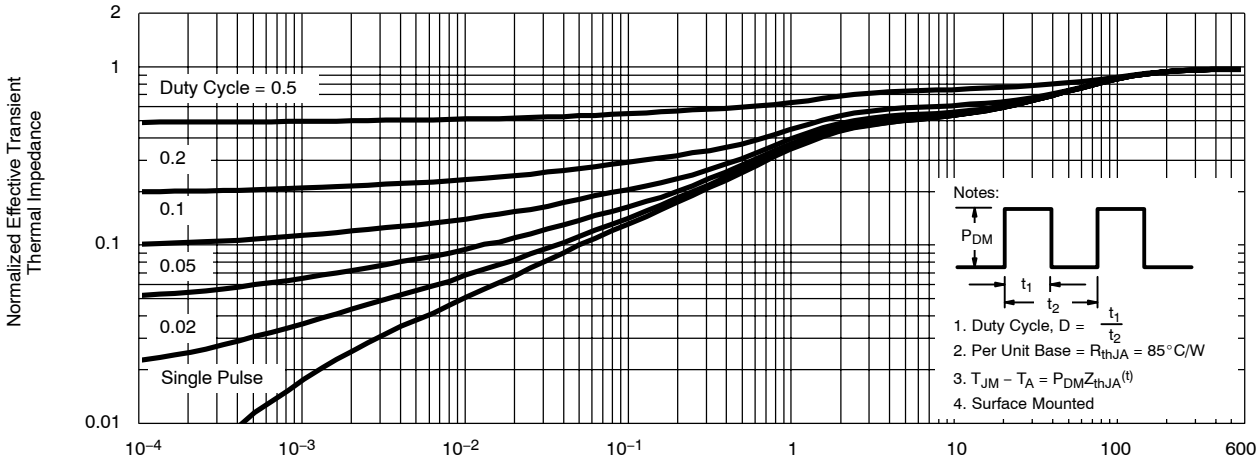

**Single Pulse Power**




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




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



## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED) P-CHANNEL