# P-Channel 20-V (D-S) MOSFET

**TrenchFET®**
**MOSFETs**
**1.5-V Rated**

**ESD Protected**
**2000 V**

| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) | $r_{DS(on)}$ (Ω) | $I_D$ (mA) |
| -20 | 8 @ $V_{GS}$ = -4.5 V | -150 |
| | 12 @ $V_{GS}$ = -2.5 V | -125 |
| | 15 @ $V_{GS}$ = -1.8 V | -100 |
| | 20 @ $V_{GS}$ = -1.5 V | -30 |

## FEATURES

- High-Side Switching
- Low On-Resistance: 8 Ω
- Low Threshold: 0.9 V (typ)
- Fast Switching Speed: 45 ns
- 1.8-V Operation
- Gate-Source ESD Protection

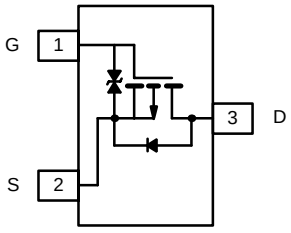
## BENEFITS

- Ease in Driving Switches
- Low Offset (Error) Voltage
- Low-Voltage Operation
- High-Speed Circuits
- Low Battery Voltage Operation

## APPLICATIONS

- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories
- Battery Operated Systems
- Power Supply Converter Circuits
- Load/Power Switching Cell Phones, Pagers

**SC-75A or SC-89**




Top View

**SC-75A (SOT- 416): Si1031R**
**SC-89 (SOT- 490): Si1031X**

**Marking Code: H**

| ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°C UNLESS OTHERWISE NOTED) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameter | | Symbol | Si1031R | | Si1031X | | Unit |
| | | | 5 secs | Steady State | 5 secs | Steady State | |
| Drain-Source Voltage | | $V_{DS}$ | -20 | | | | V |
| Gate-Source Voltage | | $V_{GS}$ | ±6 | | | | |
| Continuous Drain Current ($T_J$ = 150°C)[a] | $T_A$ = 25°C | $I_D$ | -150 | -140 | -165 | -155 | mA |
| | $T_A$ = 85°C | | -110 | -100 | -150 | -125 | |
| Pulsed Drain Current[a] | | $I_{DM}$ | -500 | | -600 | | |
| Continuous Source Current (diode conduction)[a] | | $I_S$ | -250 | -200 | -340 | -240 | |
| Maximum Power Dissipation[a] | $T_A$ = 25°C | $P_D$ | 280 | 250 | 340 | 300 | mW |
| | $T_A$ = 85°C | | 145 | 130 | 170 | 150 | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | -55 to 150 | | | | °C |
| Gate-Source ESD Rating (HBM, Method 3015) | | ESD | 2000 | | | | V |

Notes
a. Surface Mounted on FR4 Board.

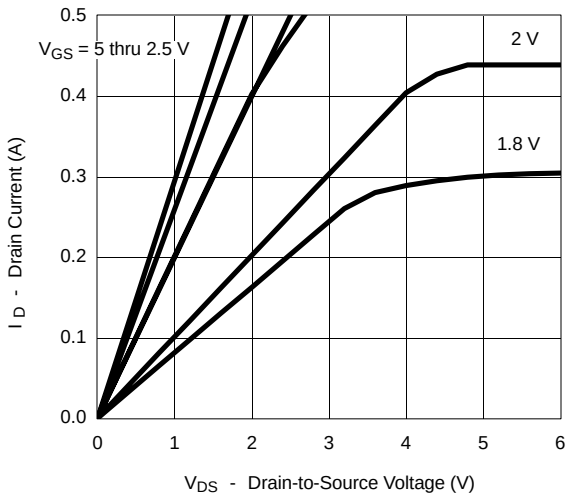
## SPECIFICATIONS ($T_A$ = 25°C UNLESS OTHERWISE NOTED)

| Parameter | Symbol | Test Condition | Min | Typ[a] | Max | Unit |
|---|---|---|---|---|---|---|
| **Static** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = -250 µA | -0.40 | | -1.20 | V |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±2.8 V | | ±0.5 | ±1 | µA |
| | | $V_{DS}$ = 0 V, $V_{GS}$ = ±4.5 V | | ±1 | ±2 | |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = -16 V, $V_{GS}$ = 0 V | | -1 | -500 | nA |
| | | $V_{DS}$ = -16 V, $V_{GS}$ = 0 V, $T_J$ = 85°C | | | -10 | µA |
| On-State Drain Current[a] | $I_{D(on)}$ | $V_{DS}$ = -5 V, $V_{GS}$ = -4.5 V | -200 | | | mA |
| Drain-Source On-State Resistance[a] | $r_{DS(on)}$ | $V_{GS}$ = -4.5 V, $I_D$ = -150 mA | | | 8 | Ω |
| | | $V_{GS}$ = -2.5 V, $I_D$ = -125 m A | | | 12 | |
| | | $V_{GS}$ = -1.8 V, $I_D$ = -100 m A | | | 15 | |
| | | $V_{GS}$ = -1.5 V, $I_D$ = -30 m A | | | 20 | |
| Forward Transconductance[a] | $g_{fs}$ | $V_{DS}$ = -10 V, $I_D$ = -150 mA | | 0.4 | | S |
| Diode Forward Voltage[a] | $V_{SD}$ | $I_S$ = -150 mA, $V_{GS}$ = 0 V | | | -1.2 | V |
| **Dynamic[b]** | | | | | | |
| Total Gate Charge | $Q_g$ | $V_{DS}$ = -10 V, $V_{GS}$ = -4.5 V, $I_D$ = -150 mA | | 1500 | | pC |
| Gate-Source Charge | $Q_{gs}$ | | | 150 | | |
| Gate-Drain Charge | $Q_{gd}$ | | | 450 | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = -10 V, $R_L$ = 65 Ω<br>$I_D$ ≅ -150 mA, $V_{GEN}$ = -4.5 V, $R_G$ = 10 Ω | | | 55 | ns |
| Rise Time | $t_r$ | | | | 30 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | | 60 | |
| Fall Time | $t_f$ | | | | 30 | |

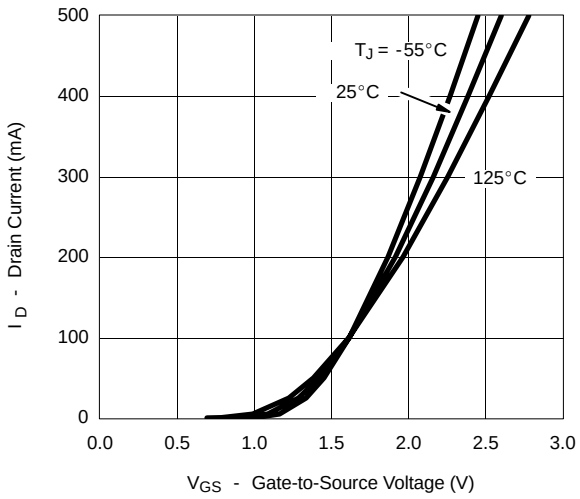
Notes
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2%.
b. Guaranteed by design, not subject to production testing.

## TYPICAL CHARACTERISTICS ($T_A$ = 25°C UNLESS NOTED)

**Output Characteristics**

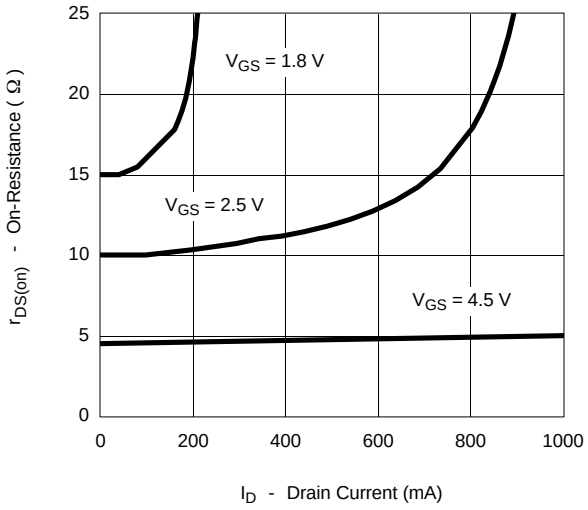



**Transfer Characteristics**

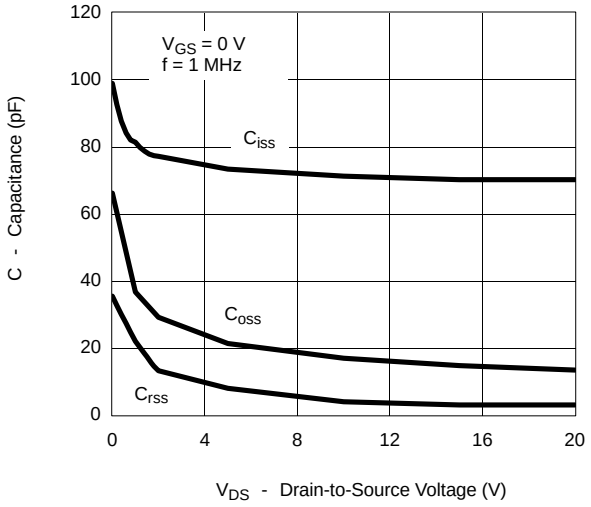


## TYPICAL CHARACTERISTICS ($T_A$ = 25°C UNLESS NOTED)

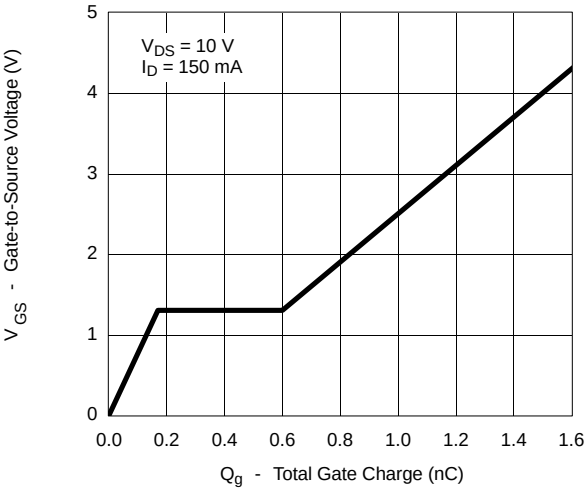
**On-Resistance vs. Drain Current**



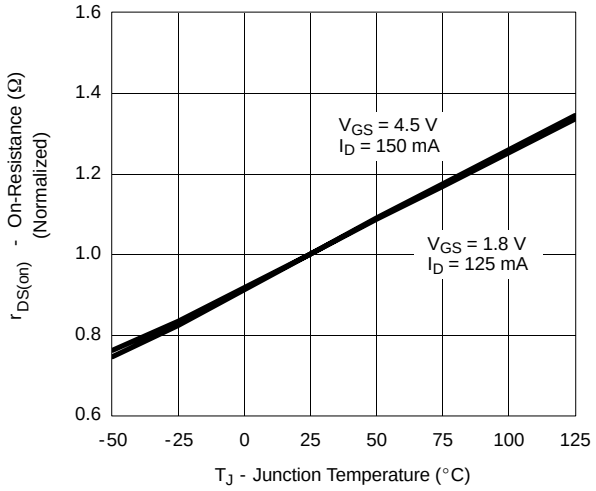

**Capacitance**



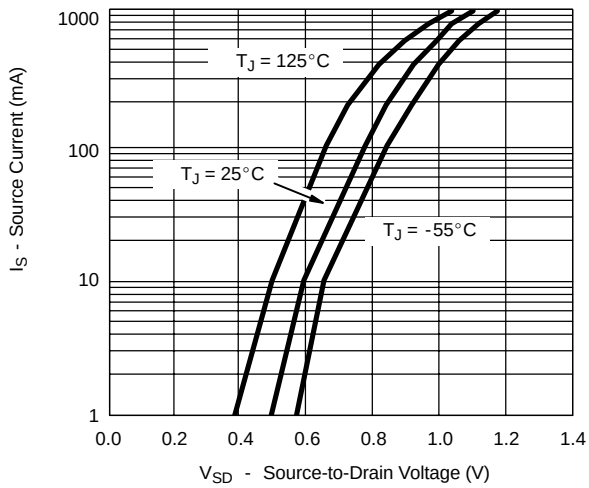

**Gate Charge**



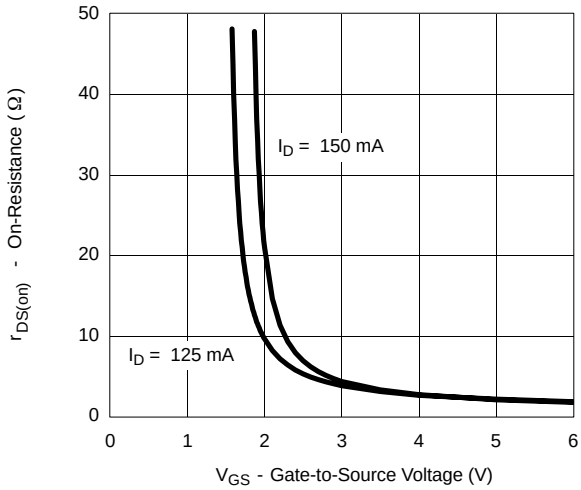

**On-Resistance vs. Junction Temperature**




**Source-Drain Diode Forward Voltage**

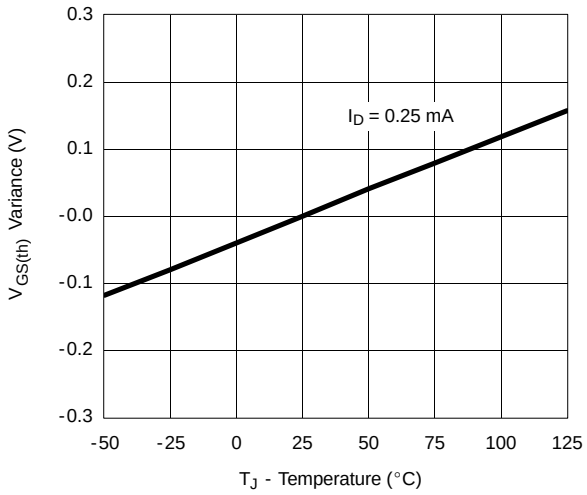



**On-Resistance vs. Gate-to-Source Voltage**

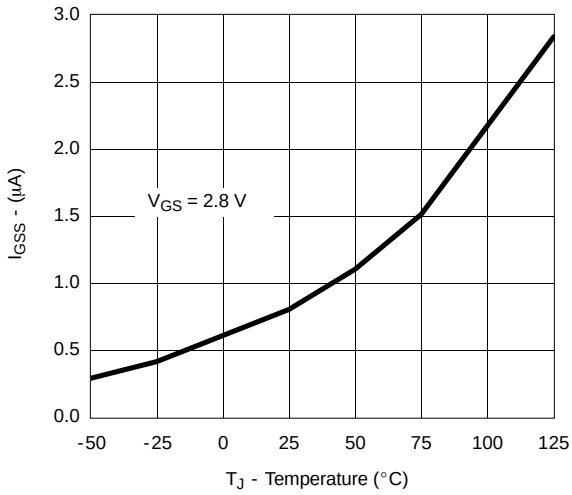


## TYPICAL CHARACTERISTICS ($T_A$ = 25°C UNLESS NOTED)

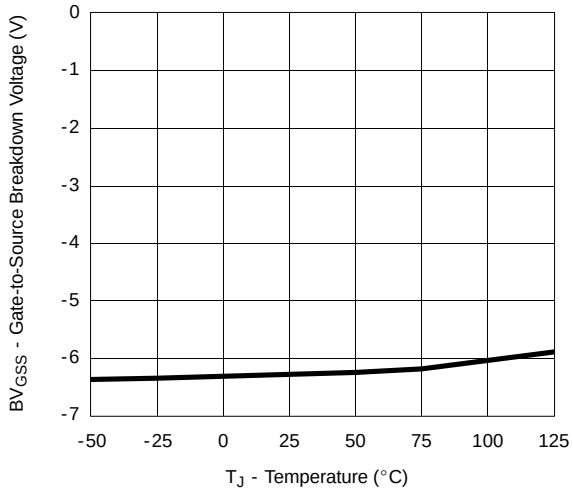
**Threshold Voltage Variance vs. Temperature**




**$I_{GSS}$ vs. Temperature**




**$BV_{GSS}$ vs. Temperature**




**Normalized Thermal Transient Impedance, Junction-to-Ambient (SC-75A, Si1031R Only)**