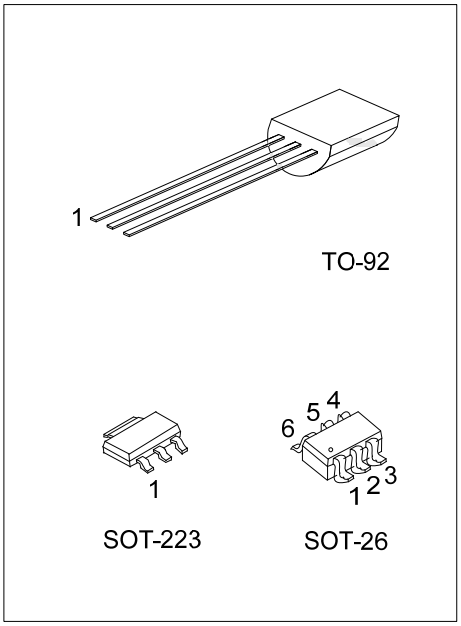
# UT2N20

**POWER MOSFET**

## 2.0A, 200V N-CHANNEL POWER MOSFET



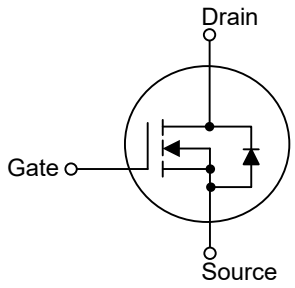

## ■ DESCRIPTION

The UTC **UT2N20** is a high voltage power MOSFET combines advanced trench MOSFET designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and high rugged avalanche characteristics. This power MOSFET is usually used in high speed switching applications of switching power supplies and adaptors.

## ■ FEATURES

* $R_{DS(ON)} \leq 625\ m\Omega$ @ $V_{GS}$=10V, $I_D$=1.0A
* Fast switching capability
* Avalanche energy tested
* Improved dv/dt capability, high ruggedness

## ■ SYMBOL



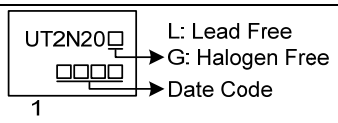
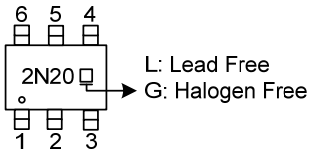
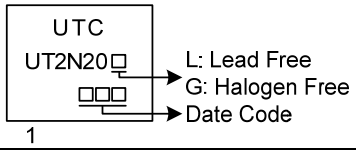

## ■ ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | | | | Packing |
|---|---|---|---|---|---|---|---|---|---|
| Lead Free | Halogen Free | | 1 | 2 | 3 | 4 | 5 | 6 | |
| UT2N20L-AA3-R | UT2N20G-AA3-R | SOT-223 | G | D | S | - | - | - | Tape Reel |
| UT2N20L-AG6-R | UT2N20G-AG6-R | SOT-26 | D | D | G | S | D | D | Tape Reel |
| UT2N20L-T92-B | UT2N20G-T92-B | TO-92 | G | D | S | - | - | - | Tape Box |
| UT2N20L-T92-K | UT2N20G-T92-K | TO-92 | G | D | S | - | - | - | Bulk |
| UT2N20L-T92-C-B | UT2N20G-T92-C-B | TO-92 | S | G | D | - | - | - | Tape Box |
| UT2N20L-T92-C-K | UT2N20G-T92-C-K | TO-92 | S | G | D | - | - | - | Bulk |

Note: Pin Assignment: D: Drain G: Gate S: Source

| | |
|---|---|
| UT2N20G-T92-C-B<br>(1)Packing Type<br>(2)Pin Assignment<br>(3)Package Type<br>(4)Green Package | (1) B: Tape Box, K: Bulk, R: Tape Reel<br>(2) refer to Pin Assignment (for TO-92)<br>(3) AA3: SOT-223, AG6: SOT-26, T92: TO-92<br>(4) G: Halogen Free and Lead Free, L: Lead Free |

## ■ MARKING

| PACKAGE | MARKING |
|---|---|
| SOT-223 |   |
| SOT-26 |   |
| TO-92 |   |

## ■ ABSOLUTE MAXIMUM RATING ($T_A$=25°C, unless otherwise specified)

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | 200 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±20 | V |
| Drain Current | Continuous | $I_D$ | 2 | A |
| | Pulsed | $I_{DM}$ | 4 | A |
| Peak Diode Recovery dv/dt (Note 3) | | dv/dt | 3.7 | V/ns |
| Power Dissipation | SOT-223 | $P_D$ | 2.2 | W |
| | SOT-26 | | 1.5 | W |
| | TO-92 | | 2 | W |
| Junction Temperature | | $T_J$ | +150 | °C |
| Storage Temperature Range | | $T_{STG}$ | -55 ~ +150 | °C |

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Repetitive Rating: Pulse width limited by maximum junction temperature.
3. $I_{SD}$ ≤ 2.0A, di/dt ≤ 200A/μs, $V_{DD}$≤ $BV_{DSS}$, Starting $T_J$= 25°C

## ■ THERMAL DATA

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Junction to Ambient | SOT-223 | $\theta_{JA}$ | 140 | °C/W |
| | SOT-26 | | 240 | °C/W |
| | TO-92 | | 160 | °C/W |
| Junction to Case | SOT-223 | $\theta_{Jc}$ | 56.8 | °C/W |
| | SOT-26 | | 83 | °C/W |
| | TO-92 | | 62.5 | °C/W |

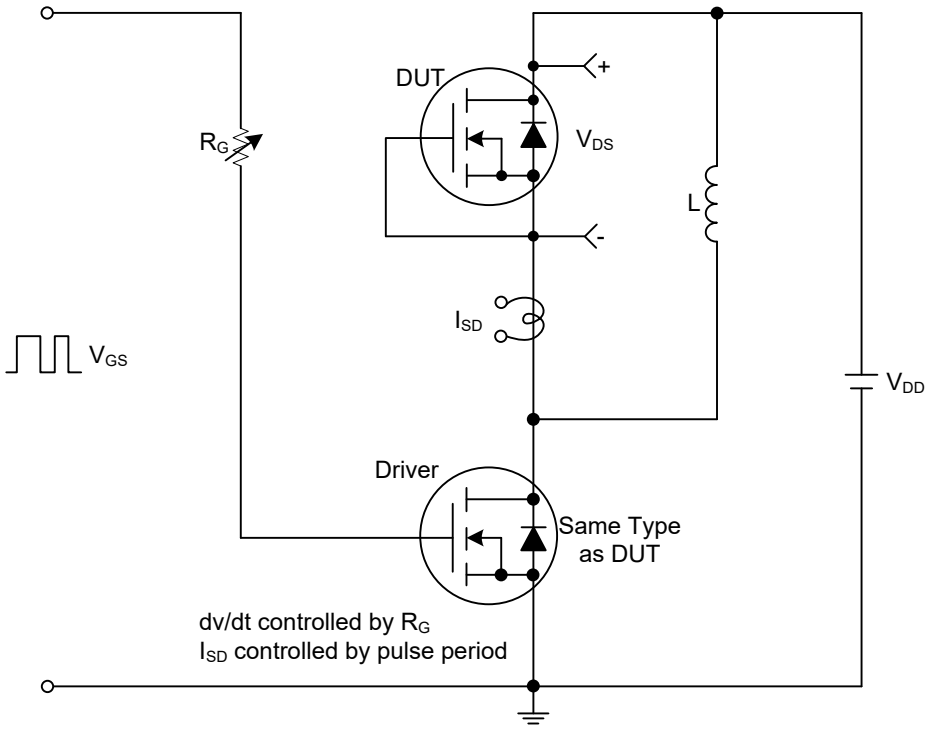
Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

## ■ ELECTRICAL CHARACTERISTICS ($T_J$=25°C, unless otherwise specified)

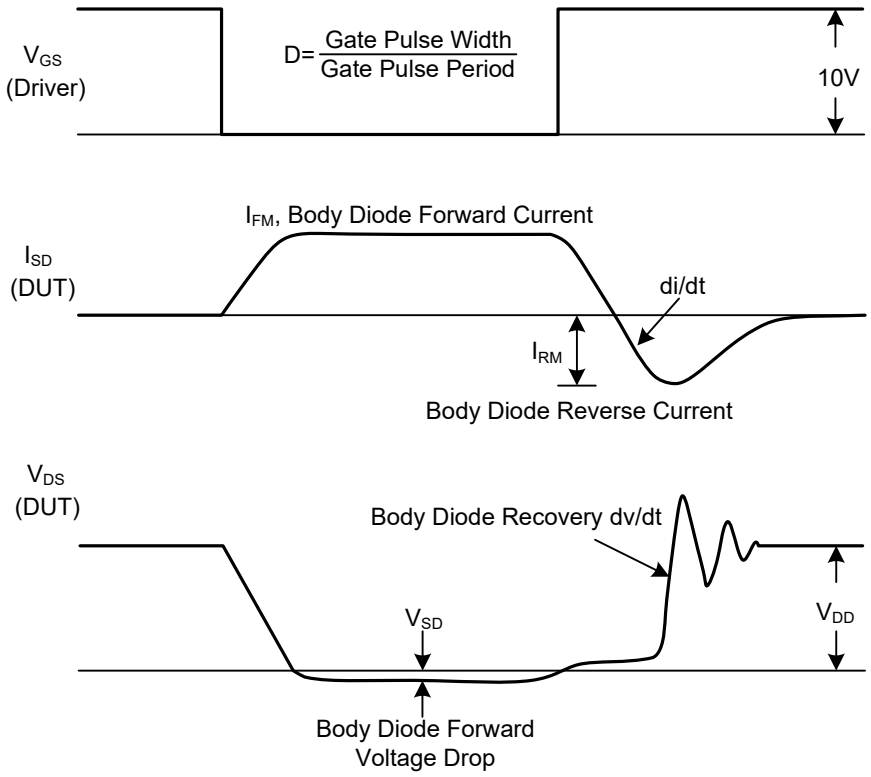
| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain-Source Breakdown Voltage | | $BV_{DSS}$ | $I_D$=250μA, $V_{GS}$=0V | 200 | | | V |
| Drain-Source Leakage Current | | $I_{DSS}$ | $V_{DS}$=200V, $V_{GS}$=0V | | | 10 | μA |
| Gate-Source Leakage Current | Forward | $I_{GSS}$ | $V_{GS}$=+20V, $V_{DS}$=0V | | | +100 | nA |
| | Reverse | | $V_{GS}$=-20V, $V_{DS}$=0V | | | -100 | nA |
| **ON CHARACTERISTICS** | | | | | | | |
| Gate Threshold Voltage | | $V_{GS(TH)}$ | $V_{DS}$=$V_{GS}$, $I_D$=250μA | 2.0 | | 3.5 | V |
| Static Drain-Source On-State Resistance | | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=1.0A | | | 625 | mΩ |
| **DYNAMIC CHARACTERISTICS** | | | | | | | |
| Input Capacitance | | $C_{ISS}$ | $V_{DS}$=25V, $V_{GS}$=0V, f=1MHz | | 404.8 | | pF |
| Output Capacitance | | $C_{OSS}$ | | | 32.1 | | pF |
| Reverse Transfer Capacitance | | $C_{RSS}$ | | | 17.2 | | pF |
| **SWITCHING PARAMETERS** | | | | | | | |
| Total Gate Charge (Note 1) | | $Q_G$ | $V_{DS}$=160V, $V_{GS}$=10V, $I_D$=2.0A (Note 1, 2) | | 16.1 | | nC |
| Gate to Source Charge | | $Q_{GS}$ | | | 4.3 | | nC |
| Gate to Drain Charge | | $Q_{GD}$ | | | 3.5 | | nC |
| Turn-on Delay Time (Note 1) | | $t_{D(ON)}$ | $V_{DD}$=100V, $V_{GS}$=10V, $I_D$ =2.0A, $R_G$ =25Ω (Note 1, 2) | | 17.6 | | ns |
| Rise Time | | $t_R$ | | | 15.2 | | ns |
| Turn-off Delay Time | | $t_{D(OFF)}$ | | | 41.6 | | ns |
| Fall-Time | | $t_F$ | | | 22 | | ns |
| **SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | | |
| Maximum Body-Diode Continuous Current | | $I_S$ | | | | 2 | A |
| Maximum Body-Diode Pulsed Current | | $I_{SM}$ | | | | 4 | A |
| Drain-Source Diode Forward Voltage (Note 1) | | $V_{SD}$ | $I_S$=2.0A, $V_{GS}$=0V | | | 1.4 | V |
| Reverse Recovery Time | | $t_{rr}$ | $I_S$=2.0A, $V_{GS}$=0V, $d_{IF}/d_t$=100A/μs | | 72 | | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | | | 0.1 | | μC |

Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.
2. Essentially independent of operating temperature.

## ■ TEST CIRCUITS AND WAVEFORMS



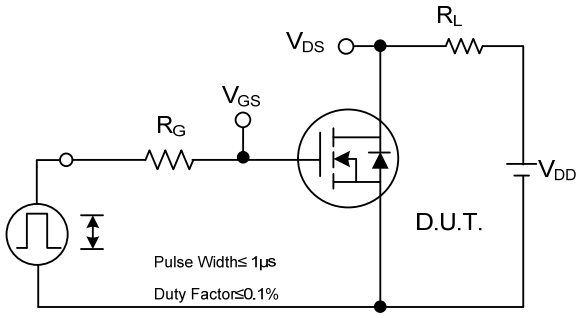

**Peak Diode Recovery dv/dt Test Circuit**



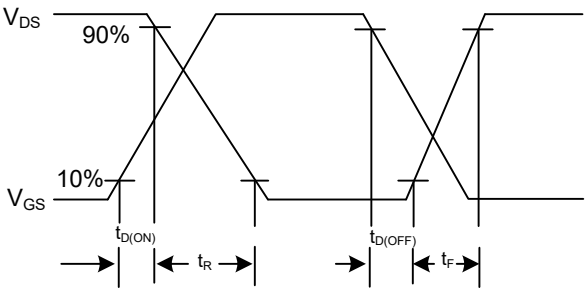

Peak Diode Recovery dv/dt Test Circuit and Waveforms

**Peak Diode Recovery dv/dt Waveforms**

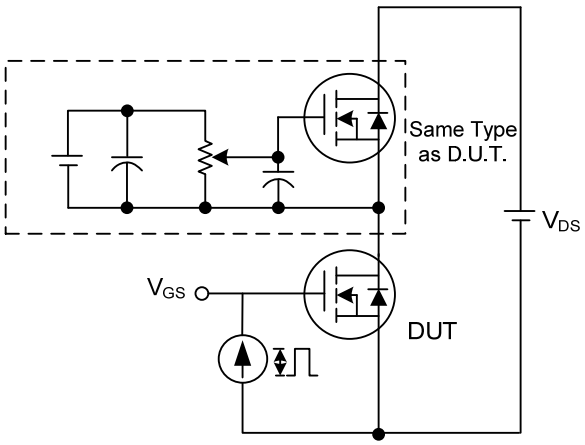
## ■ TEST CIRCUITS AND WAVEFORMS



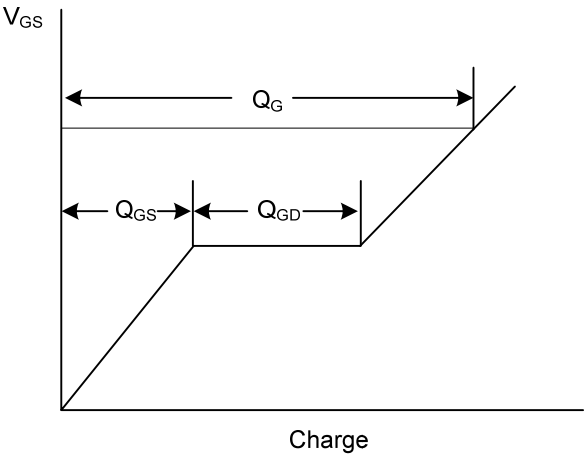

**Switching Test Circuit**



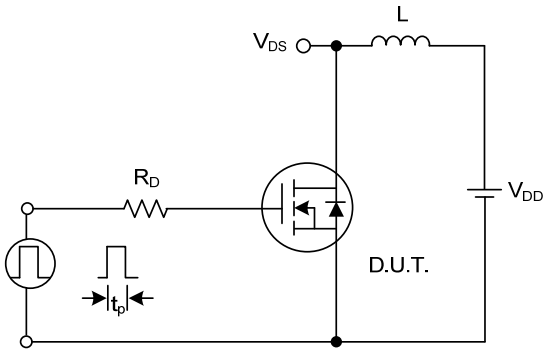

**Switching Waveforms**



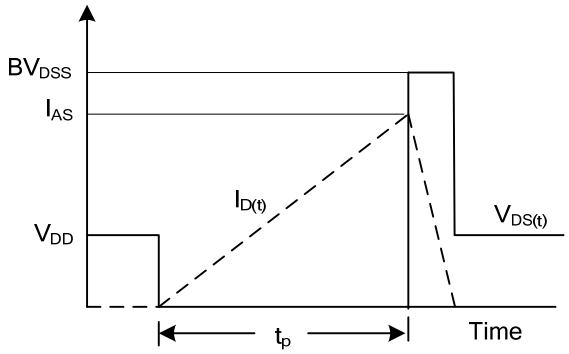

**Gate Charge Test Circuit**




**Gate Charge Waveform**

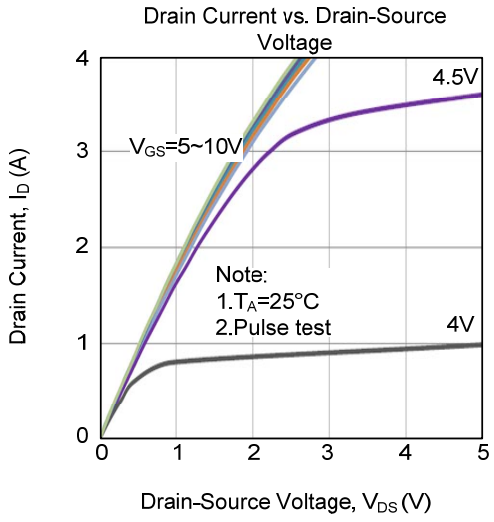


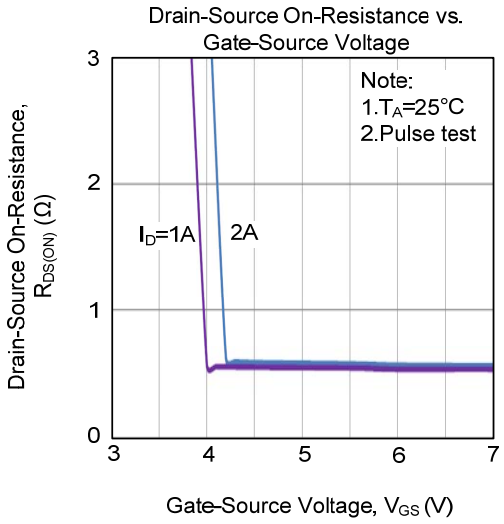

**Unclamped Inductive Switching Test Circuit**

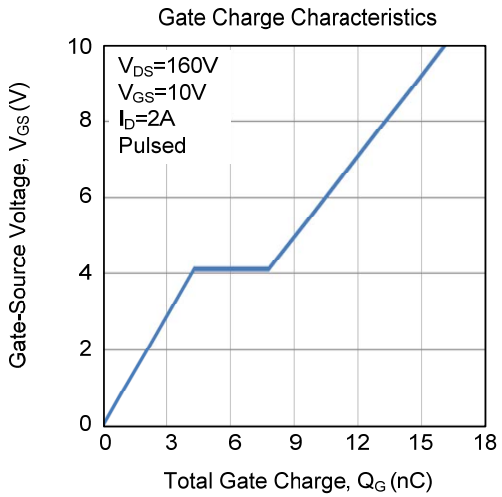


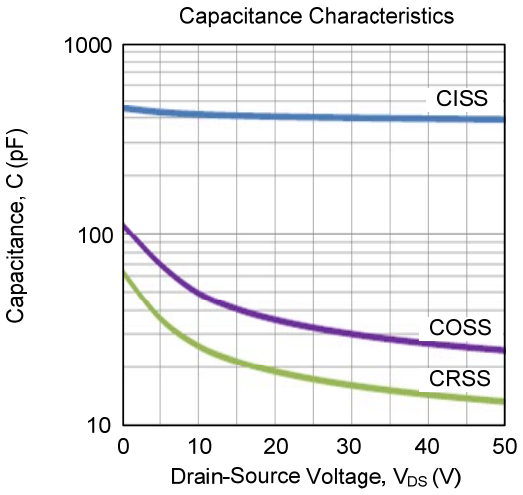

**Unclamped Inductive Switching Waveforms**

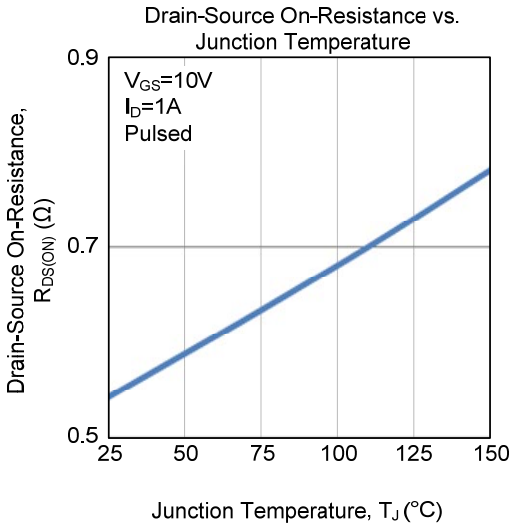
## ■ TYPICAL CHARACTERISTICS

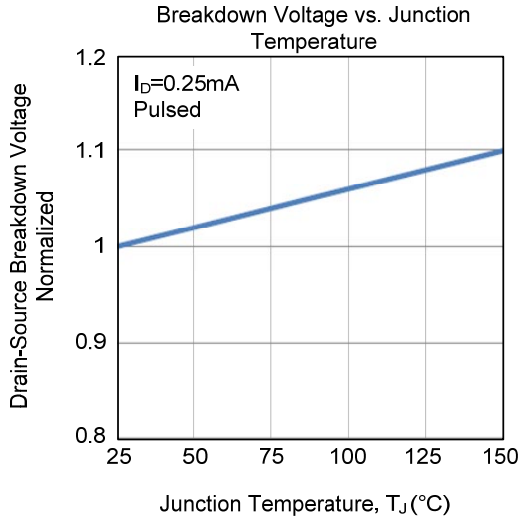


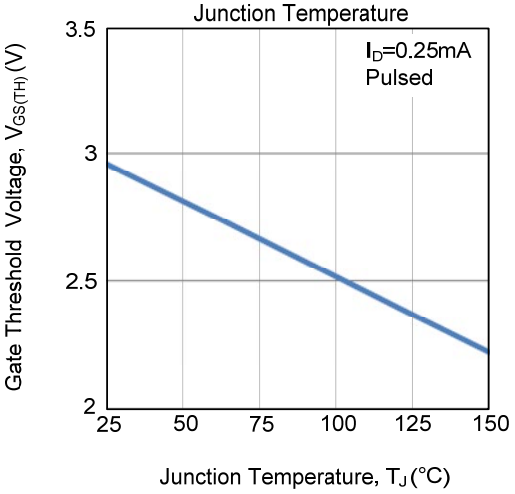



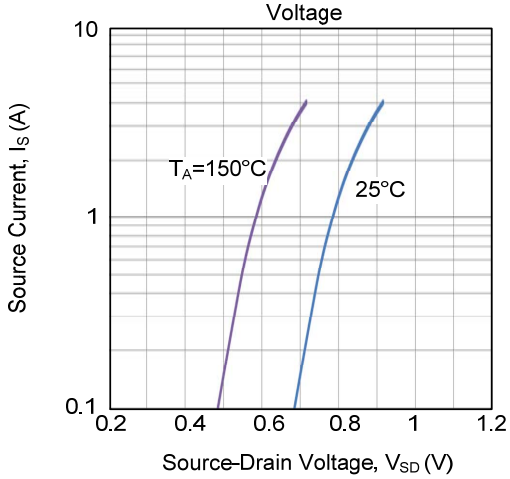



## ■ TYPICAL CHARACTERISTICS (Cont.)

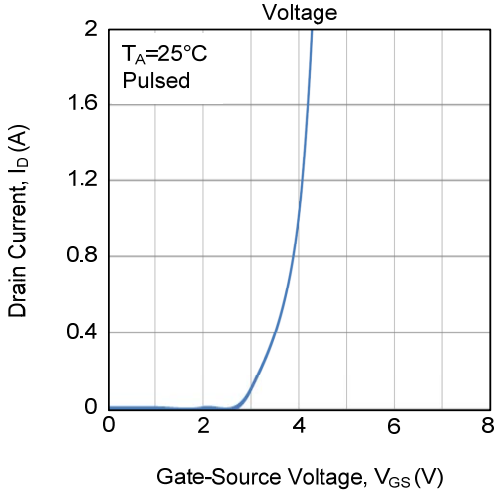
Gate Threshold Voltage vs. Junction Temperature



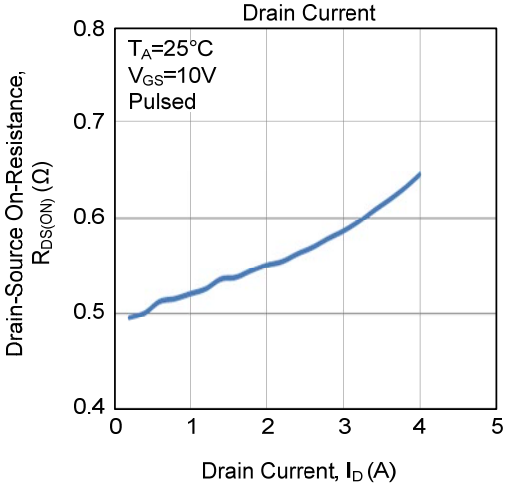

Source Current vs. Source-Drain Voltage



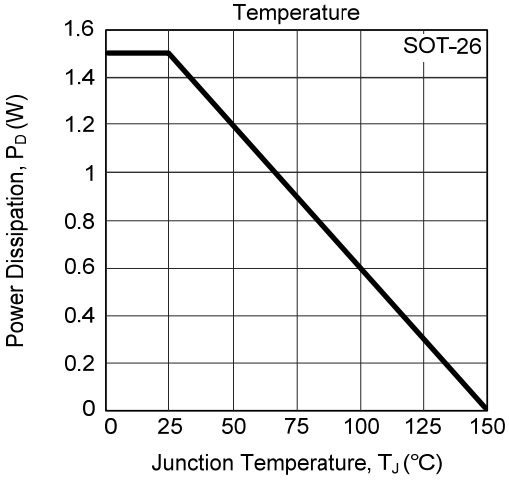

Drain Current vs. Gate-Source Voltage



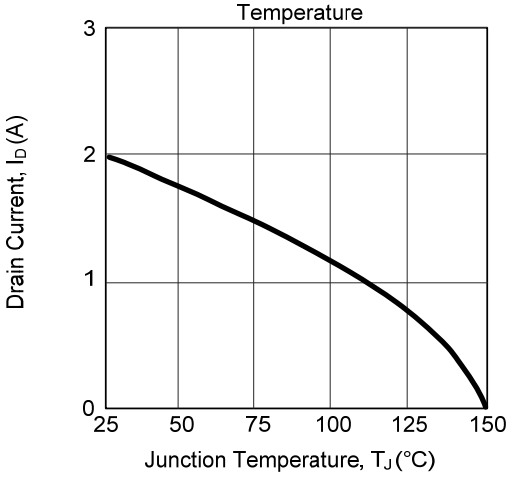

Drain-Source On-Resistance vs. Drain Current




Power Dissipation vs. Junction Temperature




Drain Current vs. Junction Temperature



■ TYPICAL CHARACTERISTICS (Cont.)