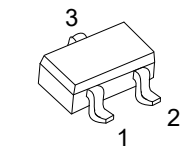
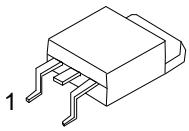
# UT1D5P06

**Power MOSFET**

## -1.5A, -60V P-CHANNEL POWER MOSFET




SOT-23
(EIAJ SC-59)




TO-252

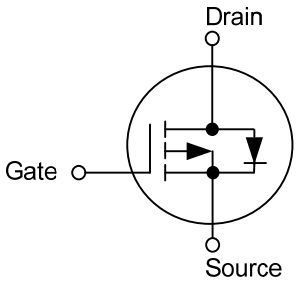
## ■ DESCRIPTION

The UTC **UT1D5P06** is a P-channel enhancement power MOSFET using UTC's advanced technology to provide the customers with perfect $R_{DS(ON)}$ and low gate charge.

## ■ FEATURES

* $R_{DS(ON)} \leq 0.23\ \Omega$ @ $V_{GS}$= -10V, $I_D$= -0.9A
  $R_{DS(ON)} \leq 0.27\ \Omega$ @ $V_{GS}$= -4.5V, $I_D$= -0.8A
* High switching speed

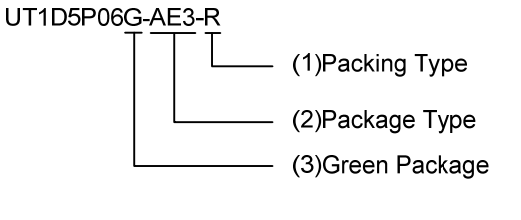
## ■ SYMBOL




## ■ ORDERING INFORMATION

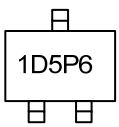
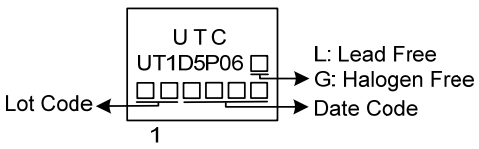
| Ordering Number | | Package | Pin Assignment | | | Packing |
|---|---|---|---|---|---|---|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| UT1D5P06L-AE3-R | UT1D5P06G-AE3-R | SOT-23 | G | S | D | Tape Reel |
| UT1D5P06L-TN3-R | UT1D5P06G-TN3-R | TO-252 | G | D | S | Tape Reel |

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




(1) R: Tape Reel
(2) AE3: SOT-23, TN3: TO-252
(3) G: Halogen Free and Lead Free, L: Lead Free

## ■ MARKING

| SOT-23 | TO-252 |
|---|---|
|  |  |

## ■ ABSOLUTE MAXIMUM RATINGS ($T_C$=25°C, unless otherwise specified)

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | -60 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±20 | V |
| Continuous Drain Current | Continuous | $I_D$ | -1.5 | A |
| Pulsed Drain Current | Pulsed (Note 2) | $I_{DM}$ | -3.0 | A |
| Single Pulsed Avalanche Energy | Single Pulsed (Note 3) | $E_{AS}$ | 6.5 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | | dv/dt | 2.7 | V/ns |
| Power Dissipation ($T_A$=25°C) | SOT-23 | $P_D$ | 0.35 | W |
| | TO-252 | | 2.2 | W |
| Junction Temperature | | $T_J$ | +150 | °C |
| Storage Temperature | | $T_{STG}$ | -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. L=0.1mH, $I_{AS}$=-11A, $V_{DD}$=-50V, $R_G$=25Ω, Starting $T_J$=25°C
4. $I_{SD}$≤-1.5A, di/dt ≤ 200μA/ s, $V_{DD}$≤$BV_{DSS}$, Starting $T_J$=25°C

## ■ THERMAL DATA

| PARAMETER | | SYMBOL | RATING | UNIT |
|---|---|---|---|---|
| Junction to Ambient | SOT-23 | $\theta_{JA}$ | 357 | °C/W |
| | TO-252 | | 56.82 | °C/W |

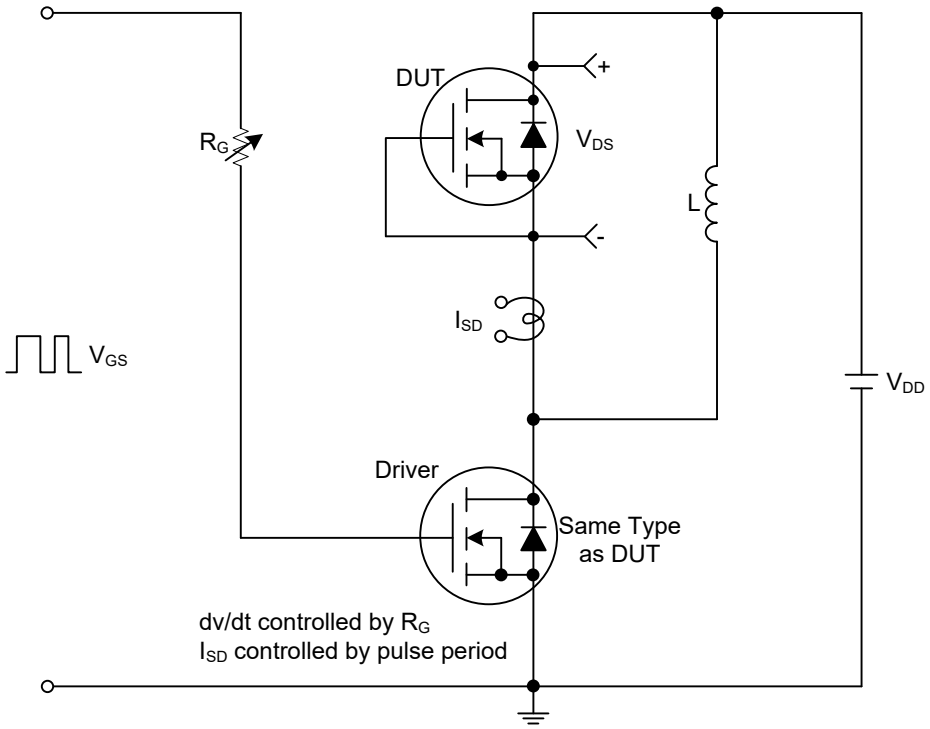
Note: Device mounted on FR-4 substrate $P_C$ board, 2oz copper, with 1inch square copper plate.

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

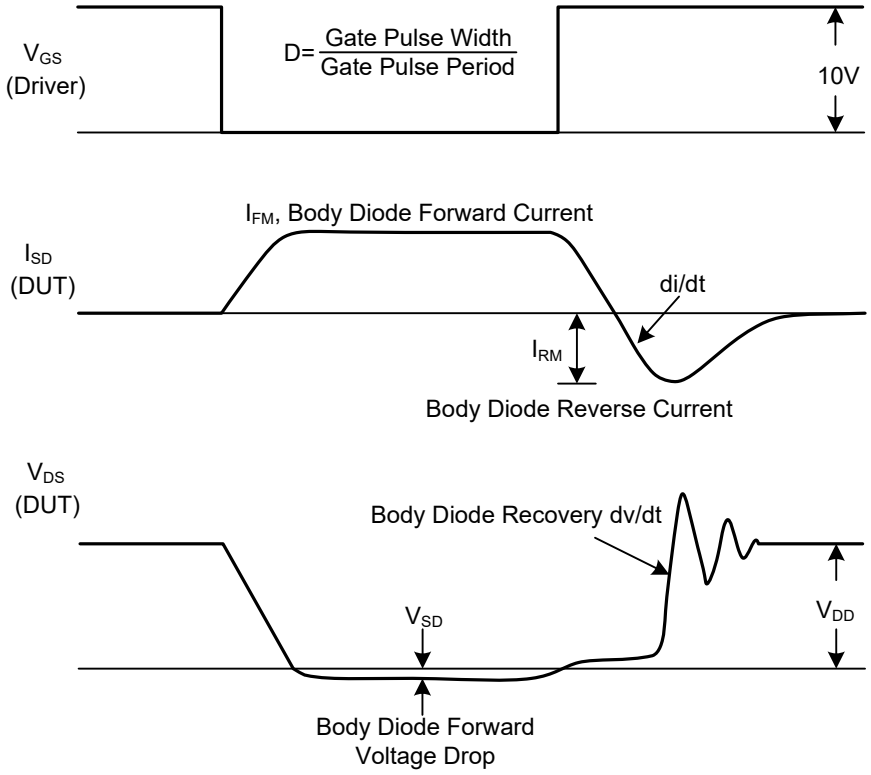
| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | |
| Drain-Source Breakdown Voltage | | $BV_{DSS}$ | $V_{GS}$=0 V, $I_D$=-250μA | -60 | | | V |
| Drain-Source Leakage Current | | $I_{DSS}$ | $V_{DS}$=-60V, $V_{GS}$=0V | | | -1 | μA |
| Gate-Source Leakage Current | Forward | $I_{GSS}$ | $V_{DS}$=0V, $V_{GS}$=+20V | | | 100 | nA |
| | Reverse | | $V_{DS}$=0V, $V_{GS}$=-20V | | | -100 | nA |
| **ON CHARACTERISTICS** | | | | | | | |
| Gate Threshold Voltage | | $V_{GS(TH)}$ | $V_{DS}$=$V_{GS}$, $I_D$=-250μA | -1.0 | | -3.0 | V |
| Static Drain-Source On-Resistance | | $R_{DS(ON)}$ | $V_{GS}$=-10V, $I_D$=-0.9A | | | 0.23 | Ω |
| | | | $V_{GS}$=-4.5V, $I_D$=-0.8A | | | 0.27 | Ω |
| **DYNAMIC PARAMETERS** | | | | | | | |
| Input Capacitance | | $C_{ISS}$ | $V_{DS}$=-25V, $V_{GS}$=0V, f=1.0MHz | | 350 | | pF |
| Output Capacitance | | $C_{OSS}$ | | | 32 | | pF |
| Reverse Transfer Capacitance | | $C_{RSS}$ | | | 22 | | pF |
| **SWITCHING PARAMETERS** | | | | | | | |
| Total Gate Charge (Note 1) | | $Q_G$ | $V_{DS}$=-48V, $V_{GS}$=-10V, $I_D$=-1.5A (Note 1, 2) | | 13 | | nC |
| Gate Source Charge | | $Q_{GS}$ | | | 3 | | nC |
| Gate Drain Charge | | $Q_{GD}$ | | | 1.5 | | nC |
| Turn-ON Delay Time (Note 1) | | $t_{D(ON)}$ | $V_{DD}$=-30V, $V_{GS}$=-10V, $I_D$=-1.5A, $R_G$=3Ω (Note 1, 2) | | 4 | | ns |
| Turn-ON Rise Time | | $t_R$ | | | 17 | | ns |
| Turn-OFF Delay Time | | $t_{D(OFF)}$ | | | 19 | | ns |
| Turn-OFF Fall-Time | | $t_F$ | | | 17 | | ns |
| **SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | | |
| Maximum Body-Diode Continuous Current | | $I_S$ | | | | 1.5 | A |
| Maximum Pulsed Drain-Source Diode Forward Current | | $I_{SM}$ | | | | 3 | A |
| Diode Forward Voltage (Note 1) | | $V_{SD}$ | $I_S$=-1.5A, $V_{GS}$=0V | | | 1.4 | V |
| Body Diode Reverse Recovery Time(Note 1) | | $t_{rr}$ | $I_S$=-1.5A, $V_{GS}$=0V, $dI_F/dt$=100A/μs | | 16 | | ns |
| Body Diode Reverse Recovery Charge | | $Q_{rr}$ | | | 12 | | nC |

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

## ■ TEST CIRCUITS AND WAVEFORMS



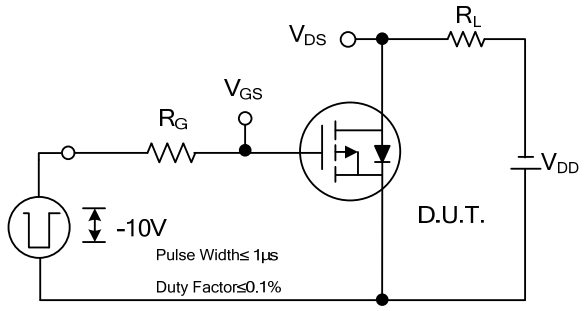

**Peak Diode Recovery dv/dt Test Circuit**



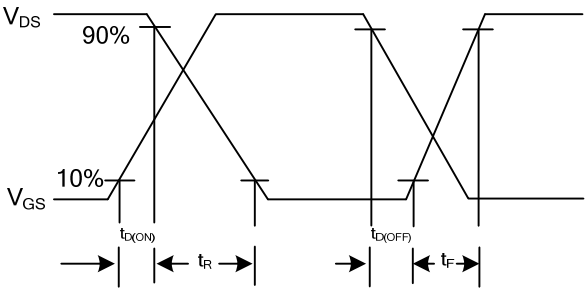

Peak Diode Recovery dv/dt Test Circuit and Waveforms

**Peak Diode Recovery dv/dt Waveforms**

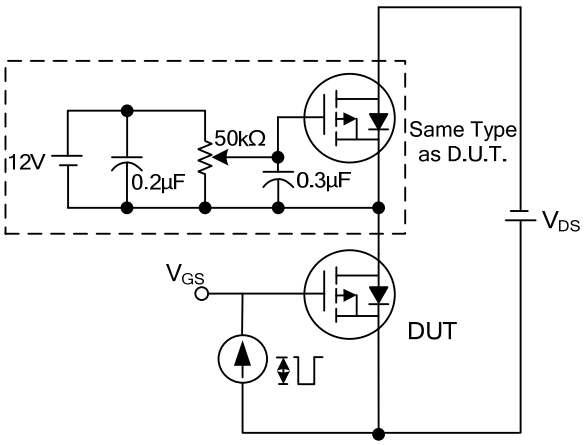
## ■ TEST CIRCUITS AND WAVEFORMS



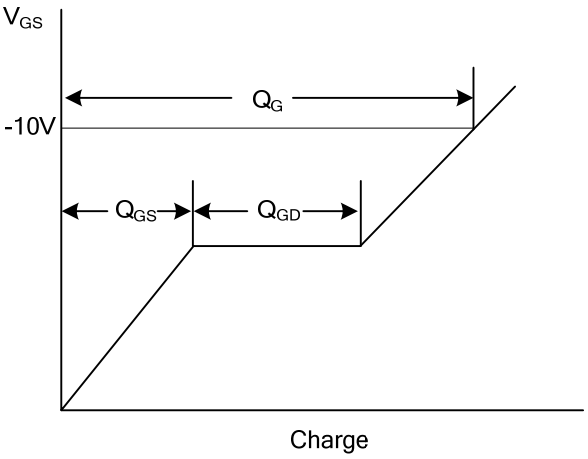

**Switching Test Circuit**



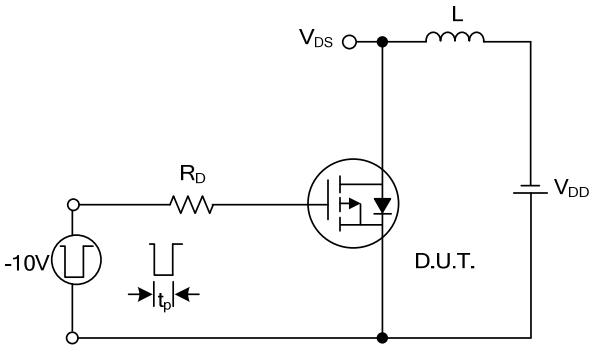

**Switching Waveforms**



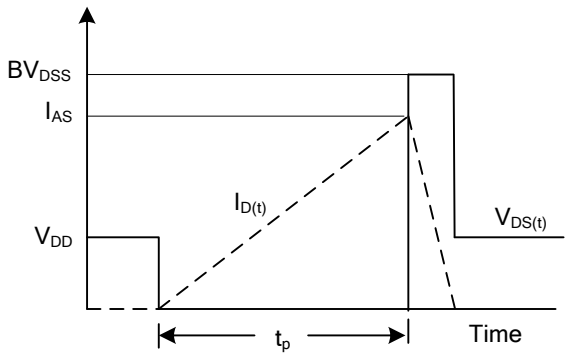

**Gate Charge Test Circuit**




**Gate Charge Waveform**

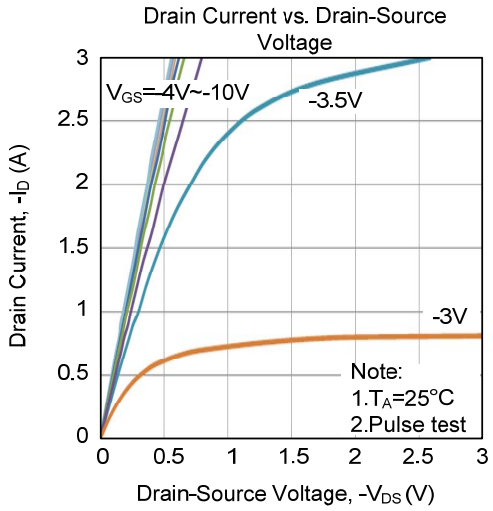


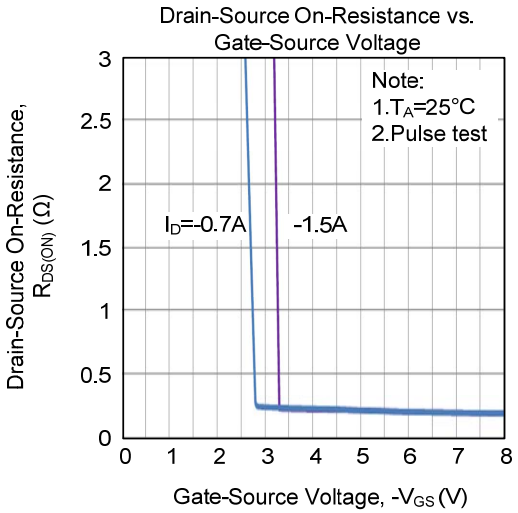

**Unclamped Inductive Switching Test Circuit**

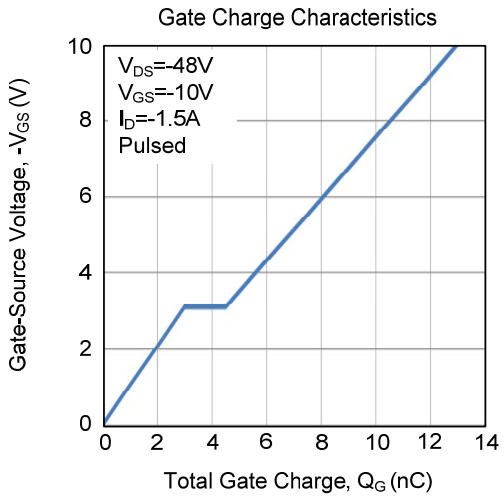


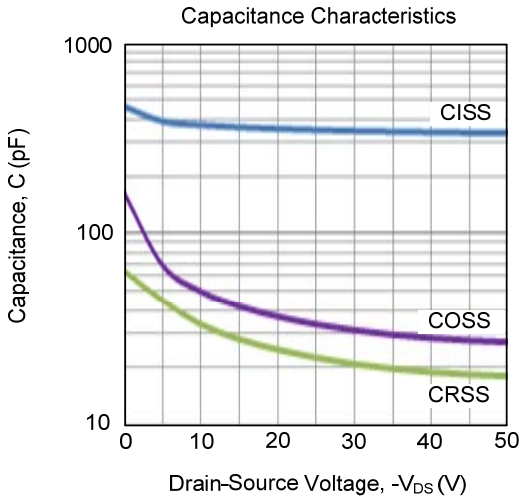

**Unclamped Inductive Switching Waveforms**

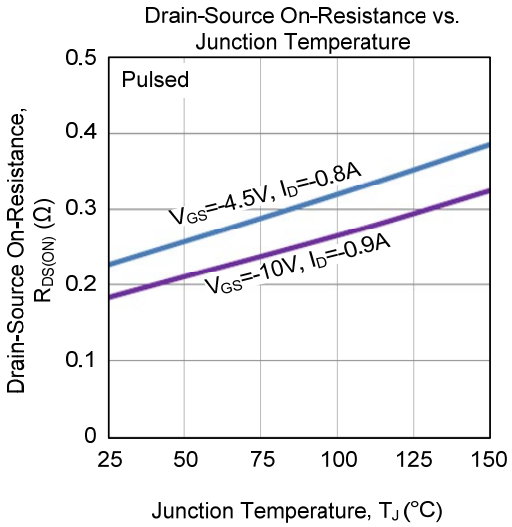
## ■ TYPICAL CHARACTERISTICS

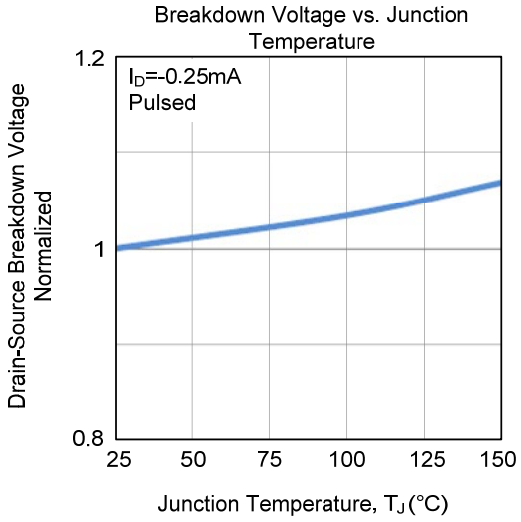


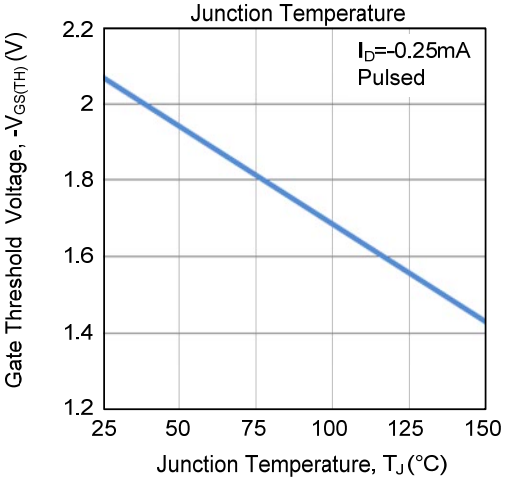



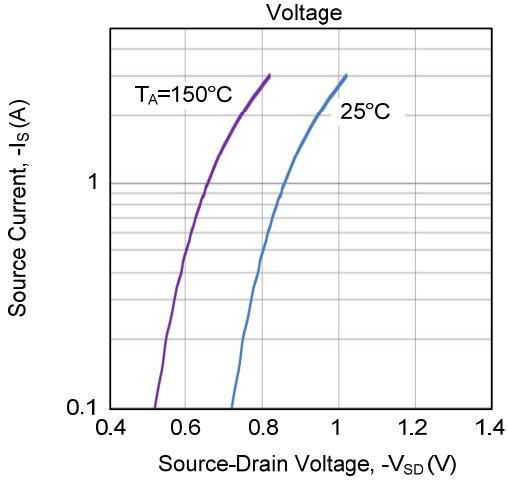



## ■ TYPICAL CHARACTERISTICS (Cont.)

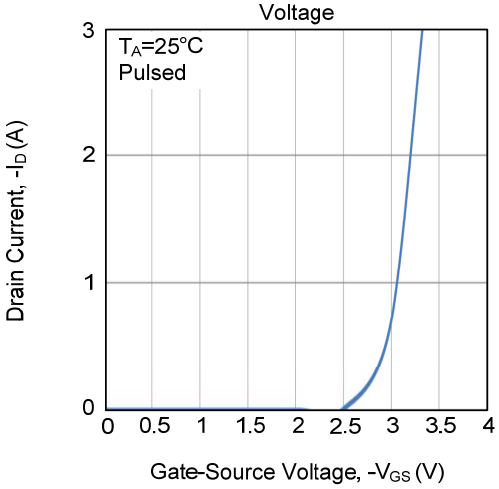
Gate Threshold Voltage vs. Junction Temperature



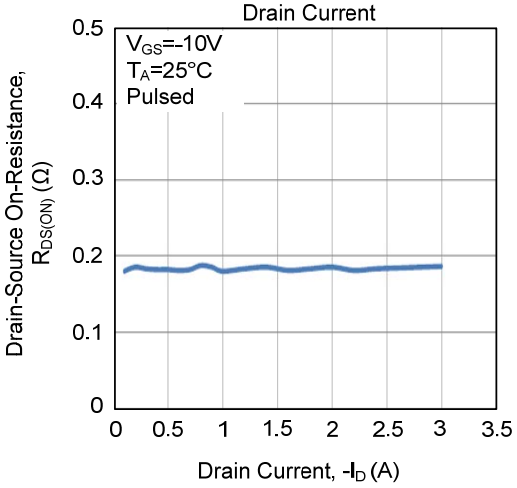

Source Current vs. Source-Drain Voltage



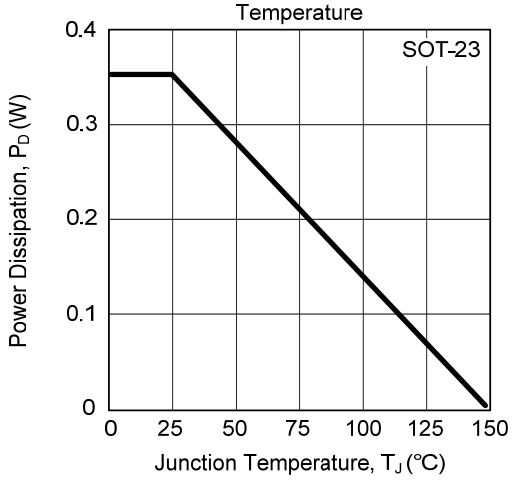

Drain Current vs. Gate-Source Voltage



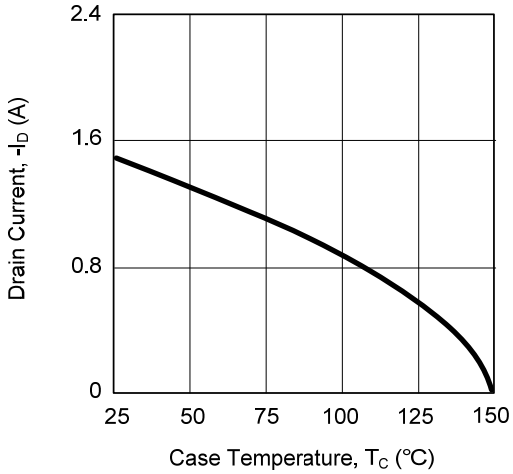

Drain-Source On-Resistance vs. Drain Current



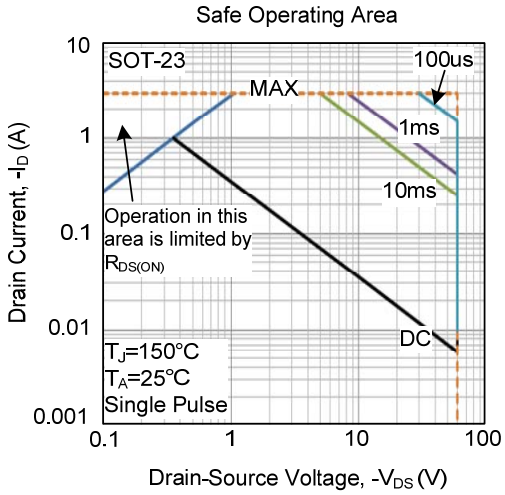

Power Dissipation vs. Junction Temperature




Drain Current vs. Case Temperature



## ■ TYPICAL CHARACTERISTICS (Cont.)




Note: 250°C/W when mounted on a 0.02 in2 pad of 2 oz. copper.