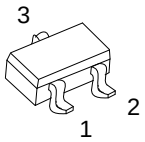
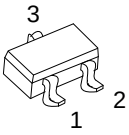
UT3406 *Power MOSFET*

# 3.6A, 30V N-CHANNEL ENHANCEMENT MODE FIELD EFFECT TRANSISTOR



SOT-23
(EIAJ SC-59)



SOT-23-3
(JEDEC TO-236)

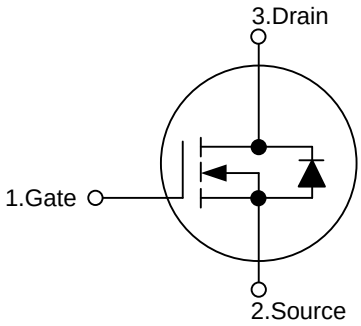
## ■ DESCRIPTION

The **UT3406** uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and can be operated at low gate voltages. This device is perfect fit for use as a load switch or in PWM applications.

## ■ FEATURES

* $R_{DS(ON)} \leq 65\ m\Omega$ @ $V_{GS}$=10V, $I_D$=3.6A
* $R_{DS(ON)} \leq 105\ m\Omega$ @ $V_{GS}$=4.5V, $I_D$=2.8A

## ■ SYMBOL



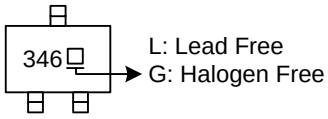

## ■ ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|---|---|---|---|---|---|---|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| UT3406L-AE2-R | UT3406G-AE2-R | SOT-23-3 | G | S | D | Tape Reel |
| UT3406L-AE3-R | UT3406G-AE3-R | SOT-23 | G | S | D | Tape Reel |

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

| | |
|---|---|
| UT3406G-AE2-R<br>(1)Packing Type<br>(2)Package Type<br>(3)Green Package | (1) R: Tape Reel<br>(2) AE2: SOT-23-3, AE3: SOT-23<br>(3) G: Halogen Free and Lead Free, L: Lead Free |

## ■ MARKING



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

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | 30 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±20 | V |
| Continuous Drain Current ($T_A$ = 25°C) | | $I_D$ | 3.6 | A |
| Pulsed Drain Current (Note 2) | | $I_{DM}$ | 15 | A |
| Avalanche Energy | Single Pulsed (Note 3) | $E_{AS}$ | 66 | mJ |
| Power Dissipation ($T_A$ = 25°C) | SOT-23-3 | $P_D$ | 0.5 | W |
| | SOT-23 | | 0.6 | 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, $I_{AS}$ = 11.5A, $V_{DD}$ = 100V, $R_G$ = 25 Ω, Starting $T_J$ = 25°C

## ■ THERMAL DATA

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---|---|---|---|---|
| Junction to Ambient | SOT-23-3 | $\theta_{JA}$ | 250 | °C/W |
| | SOT-23 | | 208 | °C/W |

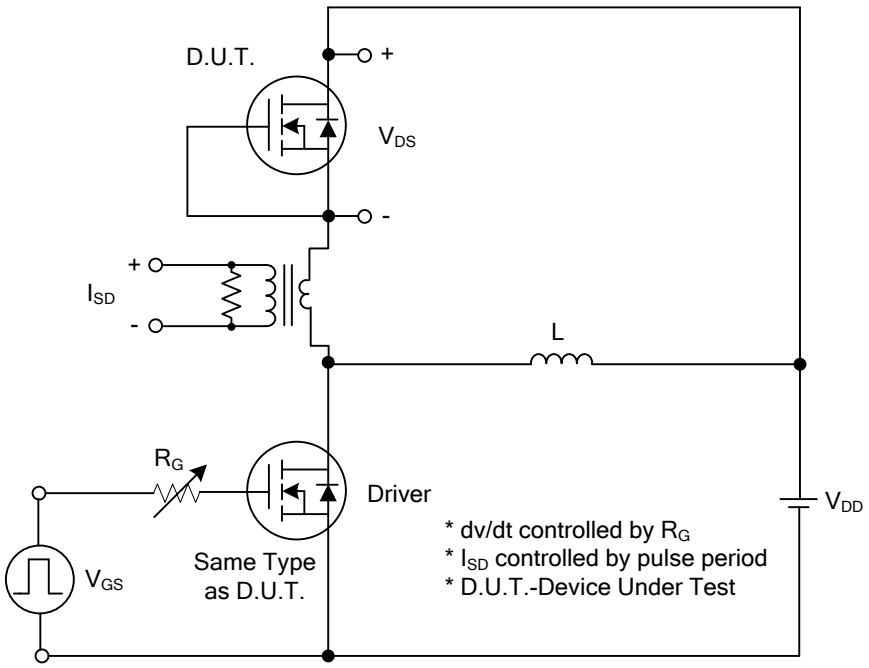
Note: Device mounted on FR-4 substrate $P_C$ board, 2oz copper, with 1inch square copper plate.

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

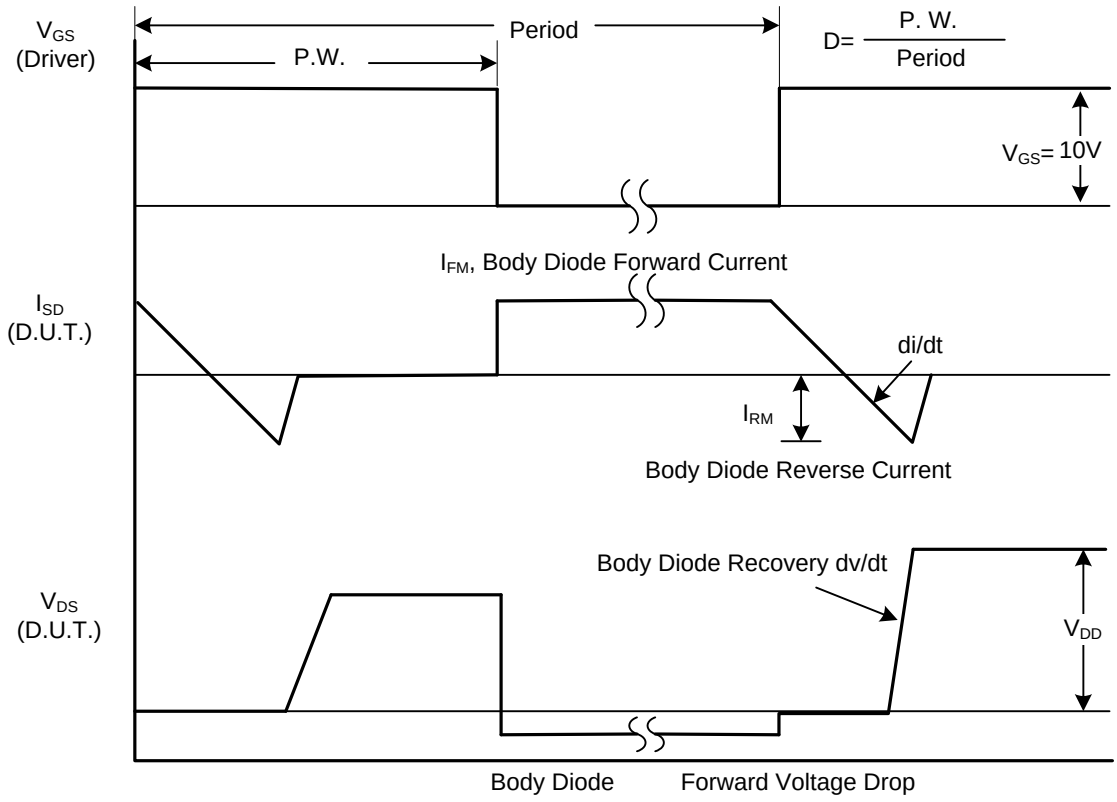
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0 V, $I_D$=250 μA | 30 | | | V |
| Drain-Source Leakage Current | $I_{DSS}$ | $V_{DS}$=24 V,$V_{GS}$=0 V | | | 1 | μA |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±20 V, $V_{DS}$=0 V | | | 100 | nA |
| **ON CHARACTERISTICS** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{DS}$= $V_{GS}$, $I_D$=250 μA | 1.0 | | 3.0 | V |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | $V_{GS}$=10 V, $I_D$=3.6 A | | 50 | 65 | mΩ |
| | | $V_{GS}$=4.5 V, $I_D$=2.8 A | | 75 | 105 | mΩ |
| **DYNAMIC PARAMETERS** | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{DS}$=15V, $V_{GS}$=0 V, f=1MHz | | 145 | | pF |
| Output Capacitance | $C_{OSS}$ | | | 43 | | pF |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | 35 | | pF |
| **SWITCHING PARAMETERS** | | | | | | |
| Total Gate Charge | $Q_G$ | $V_{DS}$=24V, $V_{GS}$=10V, $I_D$=3.6A | | 6 | | nC |
| Gate Source Charge | $Q_{GS}$ | | | 1.5 | | nC |
| Gate Drain Charge | $Q_{GD}$ | | | 0.7 | | nC |
| Turn-ON Delay Time | $t_{D(ON)}$ | $V_{DS}$=15V, $V_{GS}$=10V, $I_D$=3.6A $R_G$=3Ω | | 4 | | ns |
| Turn-ON Rise Time | $t_R$ | | | 14 | | ns |
| Turn-OFF Delay Time | $t_{D(OFF)}$ | | | 6 | | ns |
| Turn-OFF Fall-Time | $t_F$ | | | 18 | | ns |
| **SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | |
| Maximum Body-Diode Continuous Current | $I_S$ | | | | 3.6 | A |
| Maximum Body-Diode Pulsed Current | $I_{SM}$ | | | | 15 | A |
| Drain-Source Diode Forward Voltage | $V_{SD}$ | $I_S$=1.0A | | | 1.0 | V |

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

## ■ TEST CIRCUITS AND WAVEFORMS

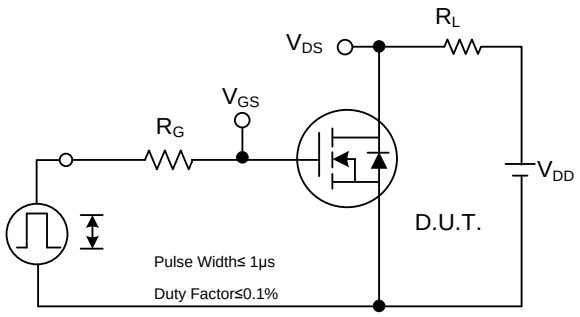



**Peak Diode Recovery dv/dt Test Circuit**

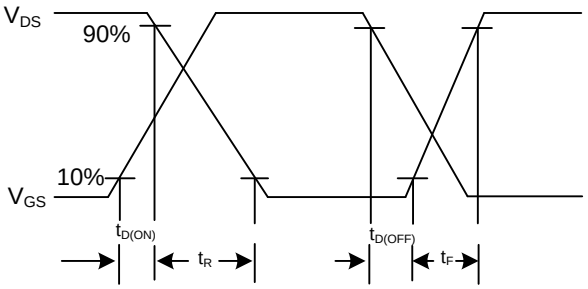



**Peak Diode Recovery dv/dt Waveforms**

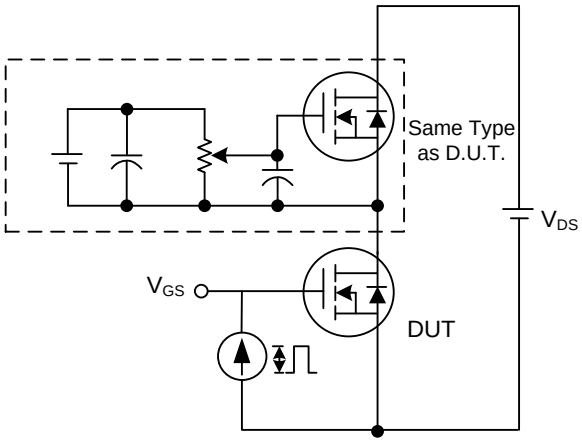
## ■ TEST CIRCUITS AND WAVEFORMS



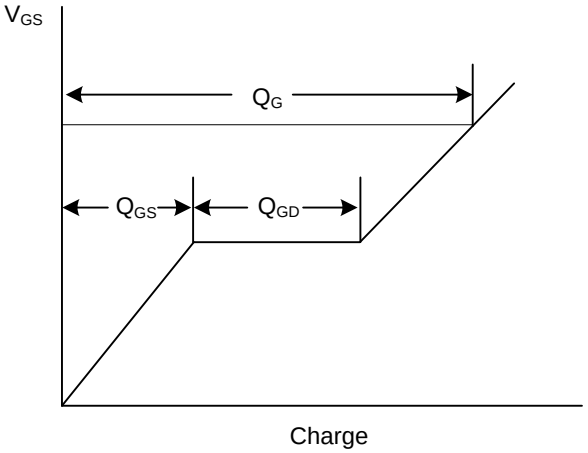

**Switching Test Circuit**



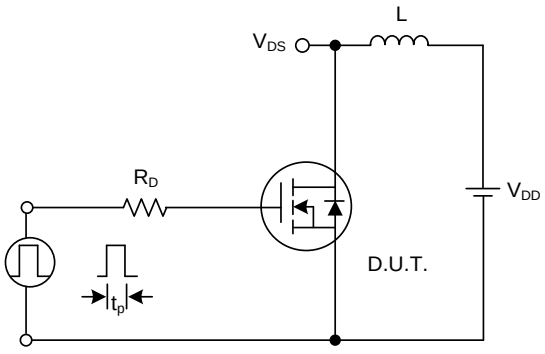

**Switching Waveforms**



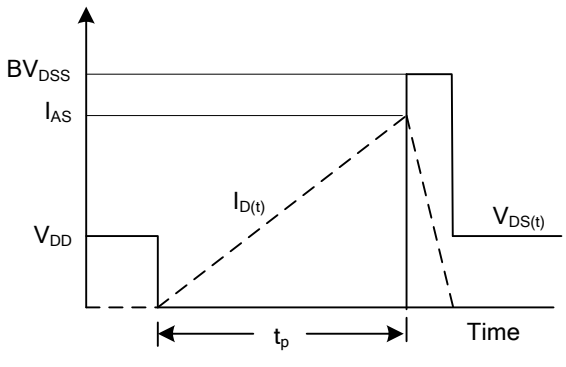

**Gate Charge Test Circuit**




**Gate Charge Waveform**



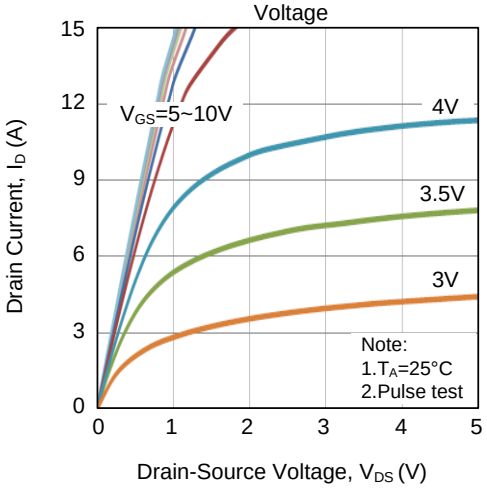

**Unclamped Inductive Switching Test Circuit**



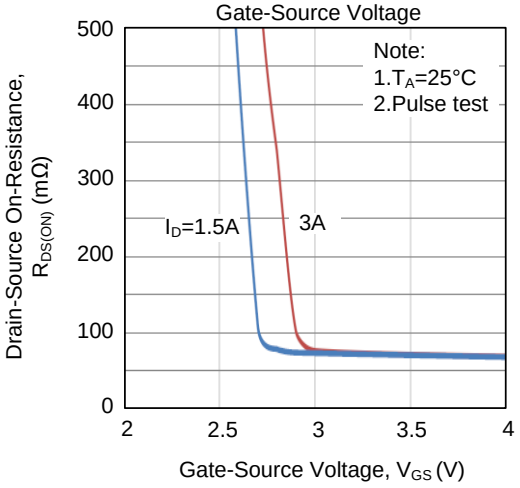

**Unclamped Inductive Switching Waveforms**

## ■ TYPICAL CHARACTERISTICS

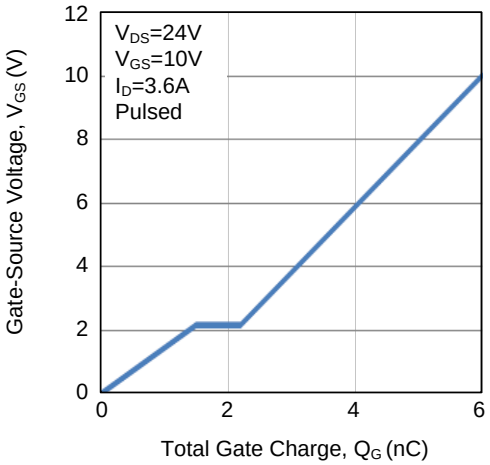
Drain Current vs. Drain-Source Voltage



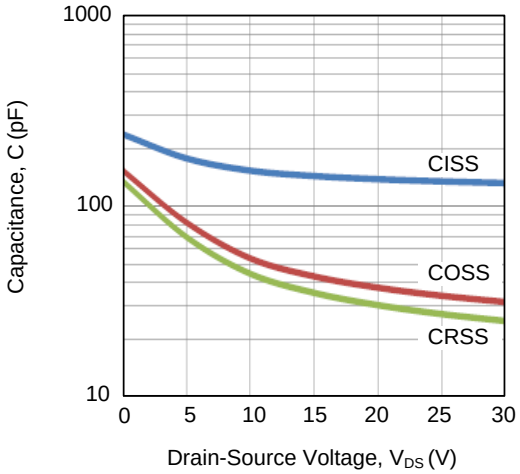

Drain-Source On-Resistance vs. Gate-Source Voltage



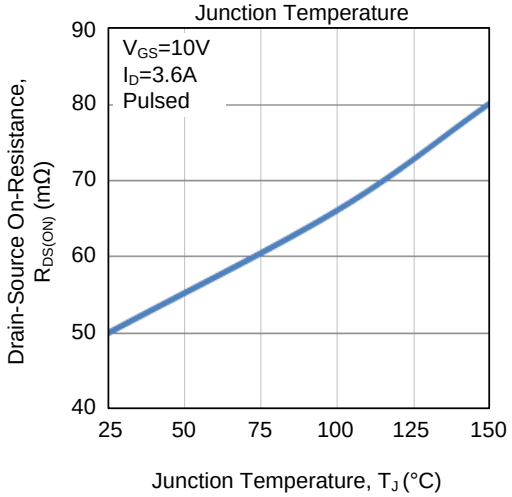

Gate Charge Characteristics



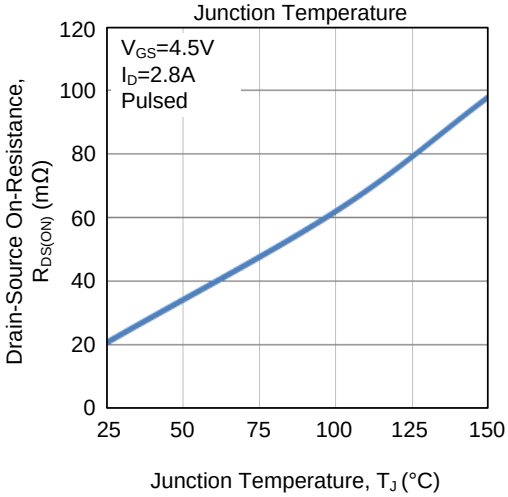

Capacitance Characteristics




Drain-Source On-Resistance vs. Junction Temperature

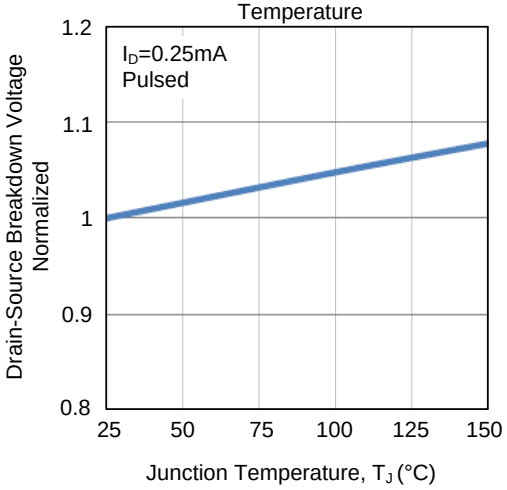



Drain-Source On-Resistance vs. Junction Temperature

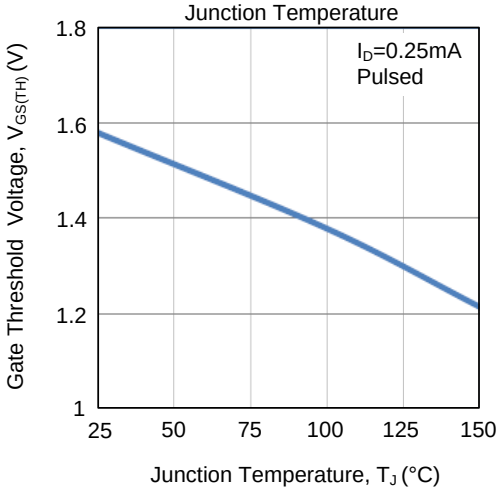


## ■ TYPICAL CHARACTERISTICS (Cont.)

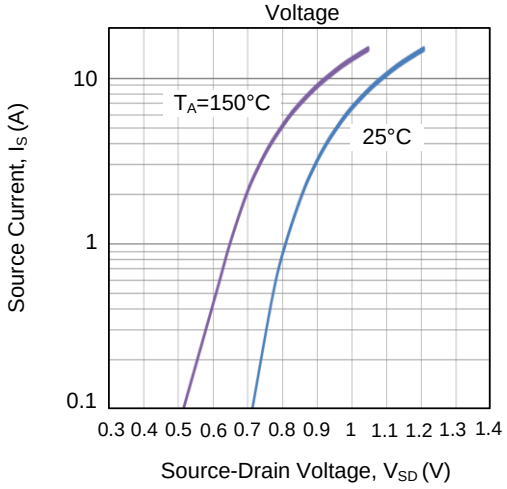
Breakdown Voltage vs. Junction Temperature



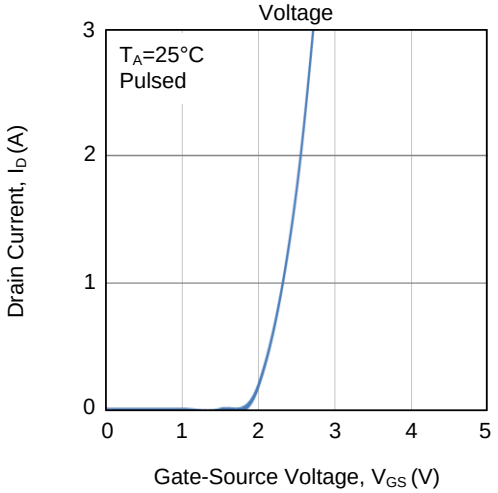

Gate Threshold Voltage vs. Junction Temperature



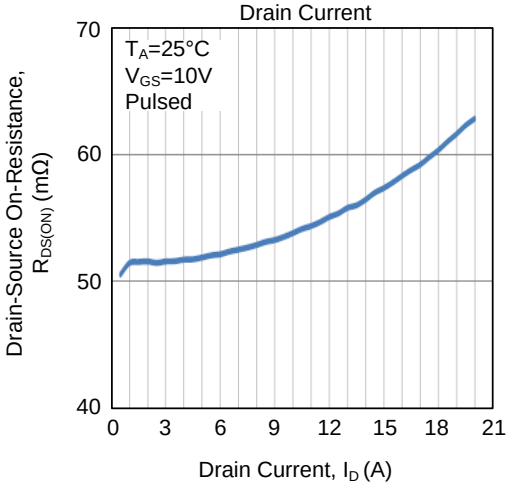

Source Current vs. Source-Drain Voltage



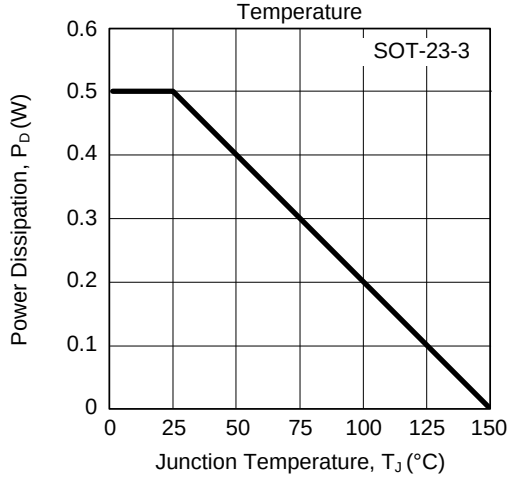

Drain Current vs. Gate-Source Voltage




Drain-Source On-Resistance vs. Drain Current




Power Dissipation vs. Junction Temperature



## ■ TYPICAL CHARACTERISTICS (Cont.)