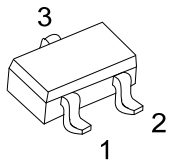
# -3.7A, -30V P-CHANNEL ENHANCEMENT MODE POWER MOSFET



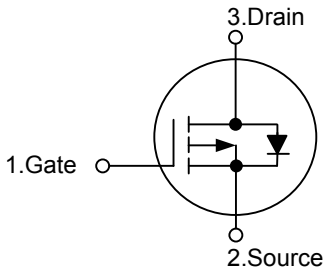

SOT-23
(EIAJ SC-59)

## ■ DESCRIPTION

The **UT2309A** is a P-channel power MOSFET, designed with high density cell with fast switching speed, ultra low on-resistance and excellent thermal and electrical capabilities.

Used in commercial and industrial surface mount applications and suited for low voltage applications such as DC/DC converters.

## ■ SYMBOL



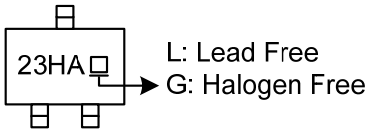

## ■ ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|---|---|---|---|---|---|---|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| UT2309AL-AE2-R | UT2309AG-AE2-R | SOT-23-3 | G | S | D | Tape Reel |
| UT2309AL-AE3-R | UT2309AG-AE3-R | SOT-23 | G | S | D | Tape Reel |

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

| | |
|---|---|
| UT2309AG-AE3-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 ($T_C$=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 | Continuous | $I_D$ | -3.7 | A |
| Pulsed Drain Current | Pulsed (Note 2) | $I_{DM}$ | -12 | A |
| Avalanche Current (Note 2) | | $I_{AR}$ | -12 | A |
| Avalanche Energy | Single Pulsed (Note 3) | $E_{AS}$ | 7.2 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | | dv/dt | 1.1 | V/ns |
| Total Power Dissipation | | $P_D$ | 1.38 | 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 $T_J$.
3. L=0.1mH, $I_{AS}$=-12A, $V_{DD}$=-30V, $R_G$=25 Ω, Starting $T_J$ = 25°C
4. $I_{SD}$≤3.0A, di/dt≤200A/μs, $V_{DD}$ ≤ $BV_{DSS}$, Starting $T_J$ = 25°C

## ■ THERMAL CHARACTERISTICS

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Junction to Ambient | $\theta_{JA}$ | 90 | °C/W |

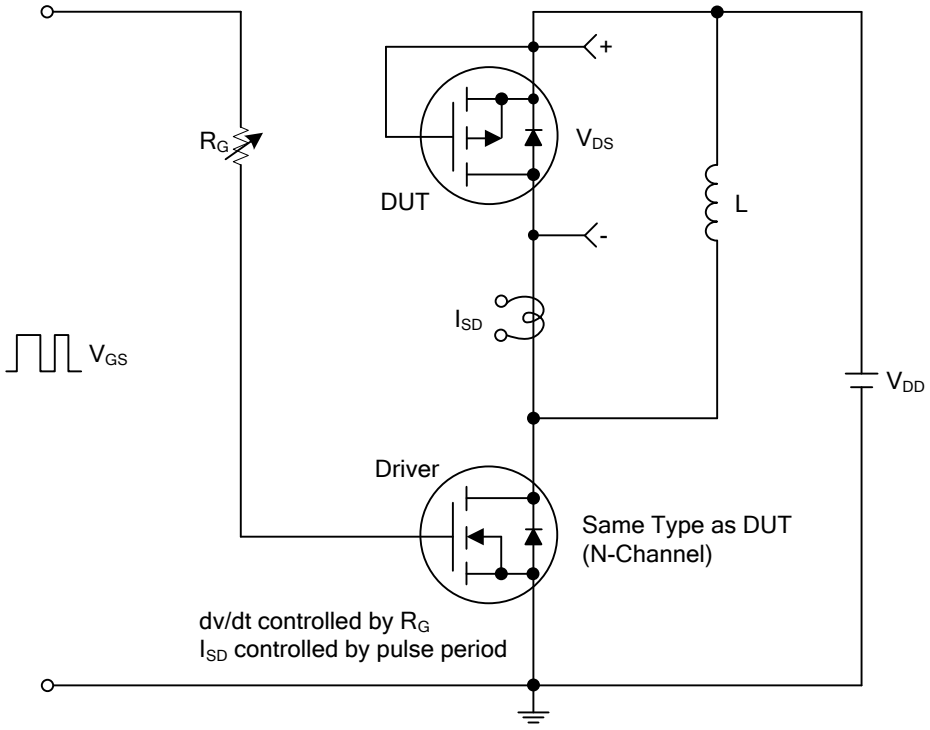
Note: Surface mounted on 1 in $^2$ copper pad of FR4 board.

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

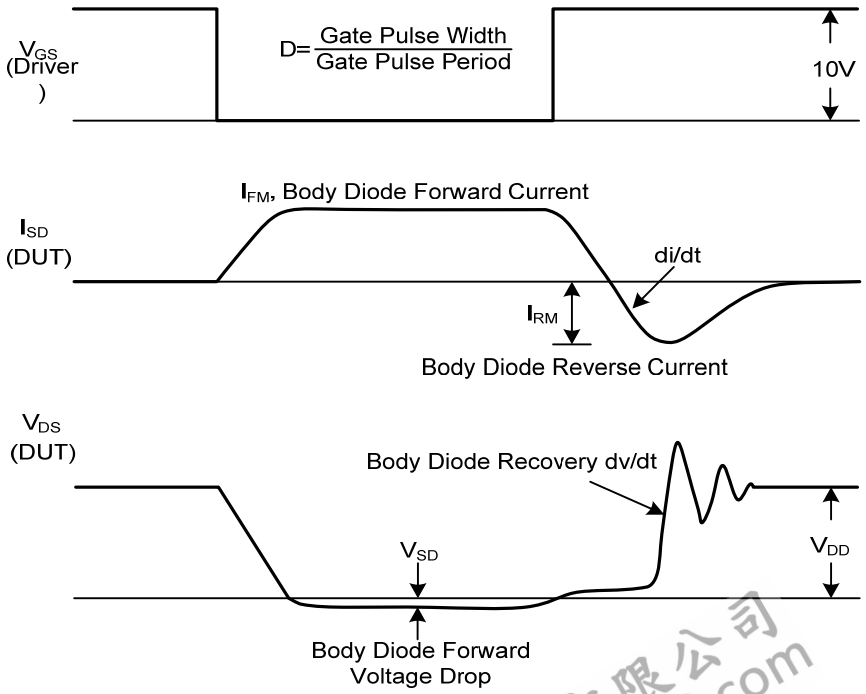
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$ =0 V, $I_D$ =-250 μA | -30 | | | V |
| Drain-Source Leakage Current | $I_{DSS}$ | $V_{DS}$=-30V, $V_{GS}$=0V | | | -0.5 | uA |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V, $V_{DS}$=0V | | | ±100 | nA |
| **ON CHARACTERISTICS** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{DS}$=$V_{GS}$, $I_D$=-250uA | -1 | | -3 | V |
| Static Drain-Source On-Resistance (Note 1) | $R_{DS(ON)}$ | $V_{GS}$=-10V, $I_D$=-3A | | | 75 | mΩ |
| | | $V_{GS}$=-4.5V, $I_D$=-2.6A | | | 120 | mΩ |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{GS}$=0V, $V_{DS}$=-25V, f=1.0MHz | | 705 | | pF |
| Output Capacitance | $C_{OSS}$ | | | 85 | | pF |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | 75 | | pF |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| Total Gate Charge (Note 1) | $Q_G$ | $V_{DS}$=-30V, $V_{GS}$=-10V, $I_D$=-0.5A | | 56.5 | | nC |
| Gate-Source Charge | $Q_{GS}$ | | | 2.8 | | nC |
| Gate-Drain Charge | $Q_{GD}$ | | | 5.8 | | nC |
| Turn-ON Delay Time (Note 1) | $t_{D(ON)}$ | $V_{DS}$=-30V, $I_D$=-0.5A, $R_G$=25Ω, $V_{GS}$=-10V | | 34 | | ns |
| Turn-ON Rise Time | $t_R$ | | | 64 | | ns |
| Turn-OFF Delay Time | $t_{D(OFF)}$ | | | 206 | | ns |
| Turn-OFF Fall Time | $t_F$ | | | 168 | | ns |
| **SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | |
| Continuous Drain-Source Current | $I_S$ | | | | -3.7 | A |
| Maximum Body-Diode Pulsed Current | $I_{SM}$ | | | | -12 | A |
| Forward On Voltage (Note 1) | $V_{SD}$ | $I_S$=-1A, $V_{GS}$=0V | | | -1.2 | V |
| Reverse Recovery Time (Note 1) | $t_{rr}$ | $I_S$=-3A, $V_{GS}$=0V, dI/dt=-100A/μs | | 540 | | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | | 1810 | | nC |

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

## ■ TEST CIRCUITS AND WAVEFORMS

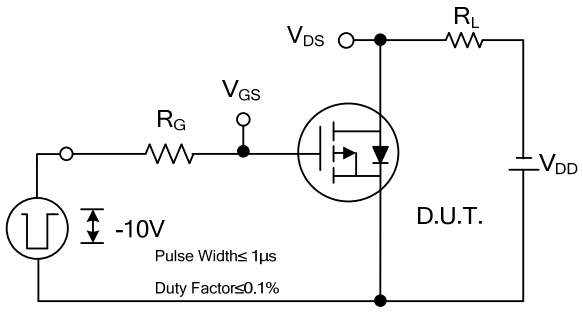



**Peak Diode Recovery dv/dt Test Circuit**

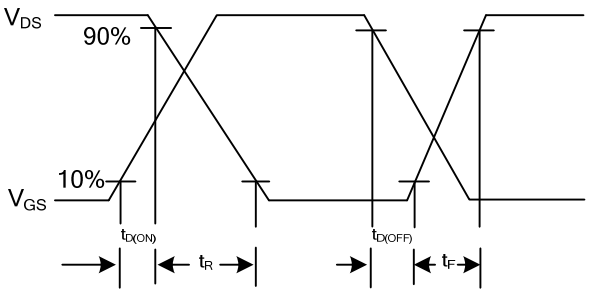



**Peak Diode Recovery dv/dt Waveforms**

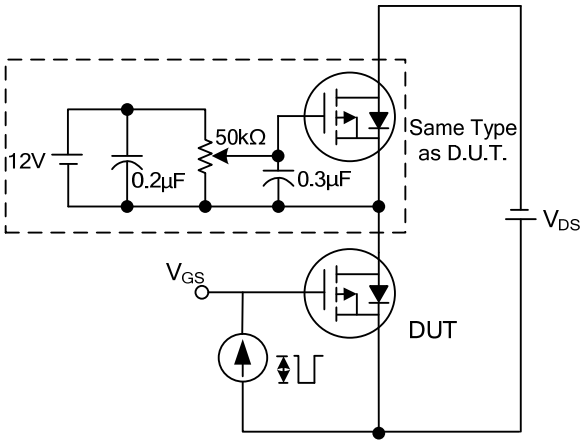
## ■ TEST CIRCUITS AND WAVEFORMS



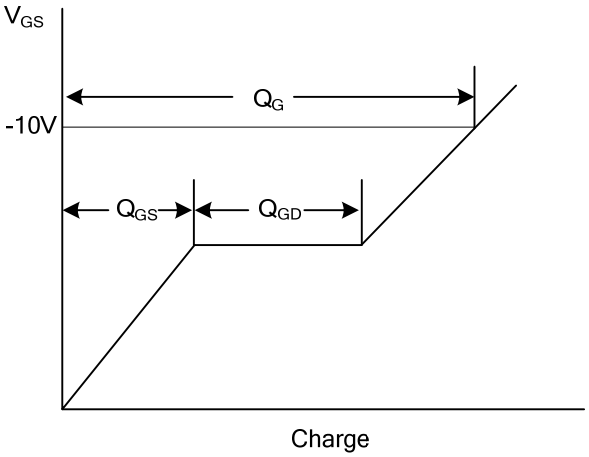

**Switching Test Circuit**



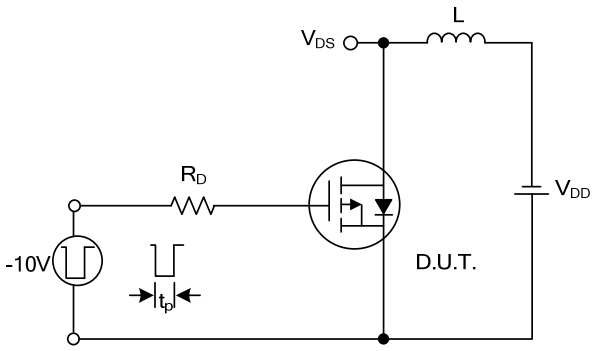

**Switching Waveforms**



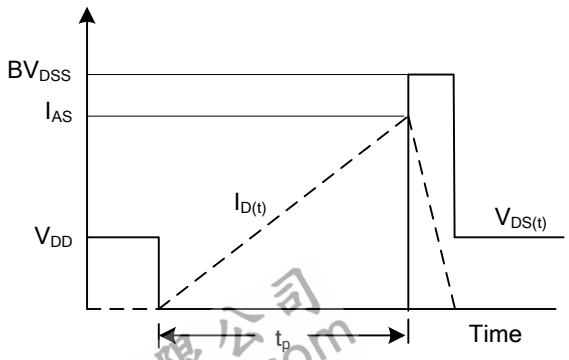

**Gate Charge Test Circuit**




**Gate Charge Waveform**




**Unclamped Inductive Switching Test Circuit**




**Unclamped Inductive Switching Waveforms**