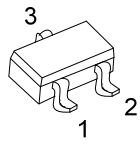
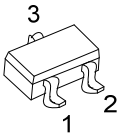
# -3.7A, -30V P-CHANNEL ENHANCEMENT MODE POWER MOSFET




SOT-23
(EIAJ SC-59)




SOT-23-3
(JEDEC TO-236)

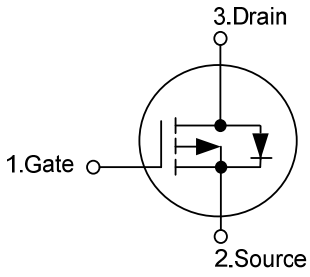
## ■ DESCRIPTION

The UTC **UT2309-H** is P-Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency fast switching applications.

## ■ FEATURES

* $R_{DS(ON)}$ < 75 mΩ @ $V_{GS}$ =-10V, $I_D$ =-3.0A
  $R_{DS(ON)}$ < 120 mΩ @ $V_{GS}$ =-4.5V, $I_D$ =-2.0A
* Extremely low on-resistance due to high density cell
* Perfect thermal performance and electrical capability with advanced technology of trench process

## ■ SYMBOL




## ■ ORDERING INFORMATION

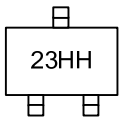
| Ordering Number | | Package | Pin Assignment | | | Packing |
|---|---|---|---|---|---|---|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| UT2309L-AE2-R | UT2309G-AE2-R | SOT-23-3 | G | S | D | Tape Reel |
| UT2309L-AE3-R | UT2309G-AE3-R | SOT-23 | G | S | D | Tape Reel |

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

UT2309G-AE2-R

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

■ MARKING



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

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Drain-Source Voltage | $V_{DSS}$ | -30 | V |
| Gate-Source Voltage | $V_{GSS}$ | ±20 | V |
| Continuous Drain Current | $I_D$ | -3.7 | A |
| Pulsed Drain Current | $I_{DM}$ | -14.8 | A |
| 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 maximum junction temperature.

## ■ THERMAL CHARACTERISTICS

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

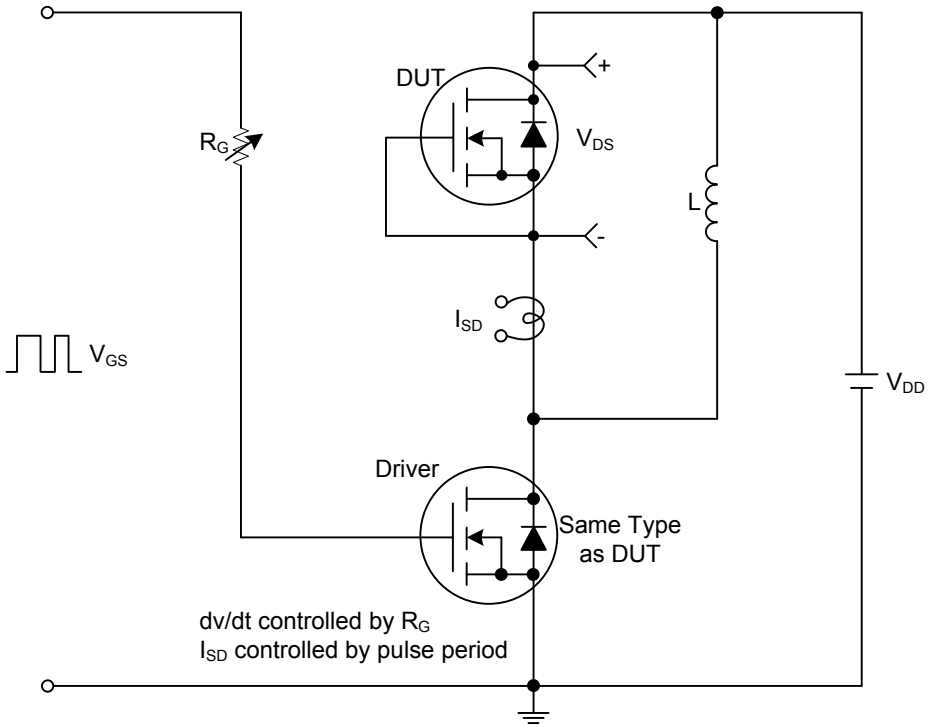
Note: The data tested by surface mounted on a 1 inch$^2$ FR-4 board with 2OZ copper.

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

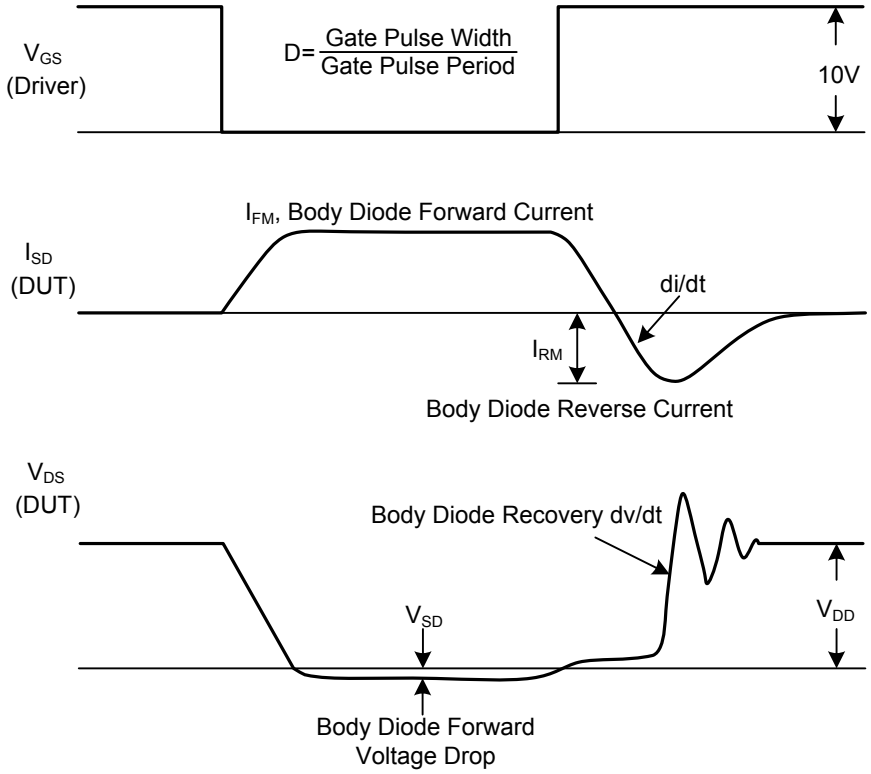
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$ =0V, $I_D$ =-250μA | -30 | | | V |
| Drain-Source Leakage Current | $I_{DSS}$ | $V_{DS}$ =-30V,$V_{GS}$ =0V, $T_J$ = 25°C | | | -1 | μA |
| | | $V_{DS}$ =-24V,$V_{GS}$ =0V, $T_J$ = 125°C | | | -10 | μA |
| Gate-Source Leakage Current | $I_{GSS}$ | $V_{GS}$ =±20V, $V_{DS}$ =0V | | | ±100 | nA |
| **ON CHARACTERISTICS** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{DS}$ =$V_{GS}$, $I_D$ =-250μA | -1.2 | | -2.5 | V |
| Static Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$ =-10V, $I_D$ =-3.0A | | | 75 | mΩ |
| | | $V_{GS}$ =-4.5V, $I_D$ =-2.0A | | | 120 | mΩ |
| **DYNAMIC PARAMETERS**[b] | | | | | | |
| Input Capacitance | $C_{ISS}$ | $V_{DS}$ =-25V, $V_{GS}$ =0V, f =1.0MHz | | 425 | | pF |
| Output Capacitance | $C_{OSS}$ | | | 53 | | pF |
| Reverse Transfer Capacitance | $C_{RSS}$ | | | 45 | | pF |
| **SWITCHING PARAMETERS**[b] | | | | | | |
| Total Gate Charge (Note 1) | $Q_G$ | $V_{DS}$ =-10V, $V_{GS}$ =-4.5V, $I_D$ =-3.0A | | 24 | | nC |
| Gate Source Charge | $Q_{GS}$ | | | 4 | | nC |
| Gate Drain Charge | $Q_{GD}$ | | | 5 | | nC |
| Turn-ON Delay Time (Note 1) | $t_{D(ON)}$ | $V_{DS}$ =-10V, $V_{GS}$ =-4.5V, $I_D$ =-1.0A $R_G$ =10Ω | | 30 | | ns |
| Turn-ON Rise Time | $t_R$ | | | 68 | | ns |
| Turn-OFF Delay Time | $t_{D(OFF)}$ | | | 106 | | ns |
| Turn-OFF Fall-Time | $t_F$ | | | 186 | | ns |
| **SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS** | | | | | | |
| Maximum Body-Diode Continuous Current | $I_S$ | $V_G$=$V_D$=0V , Force Current | | | -3.7 | A |
| Maximum Body-Diode Pulsed Current | $I_{SM}$ | | | | -14.8 | A |
| Drain-Source Diode Forward Voltage | $V_{SD}$ | $I_S$=-3.7A, $V_{GS}$=0V, $T_J$ = 25°C | | | 1.4 | V |

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

## ■ TEST CIRCUITS AND WAVEFORMS



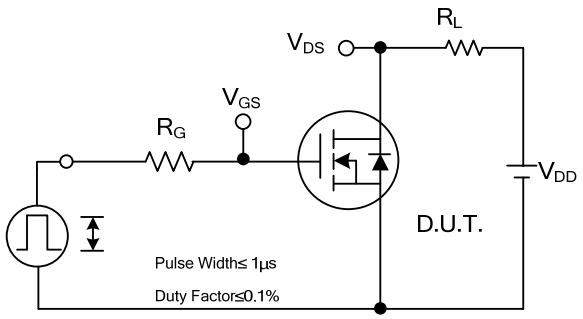

**Peak Diode Recovery dv/dt Test Circuit**



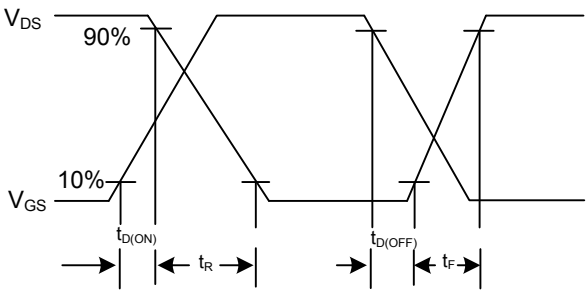

Peak Diode Recovery dv/dt Test Circuit and Waveforms

**Peak Diode Recovery dv/dt Waveforms**

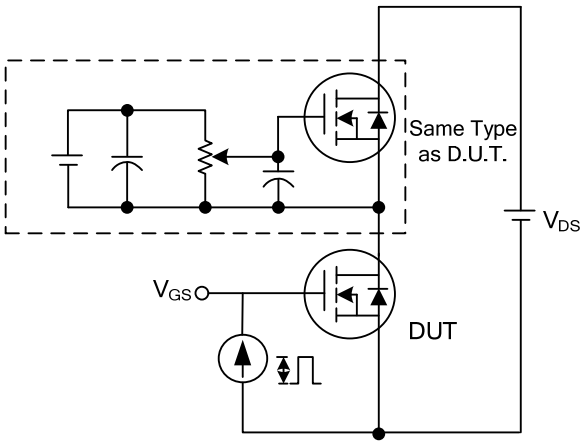
## ■ TEST CIRCUITS AND WAVEFORMS



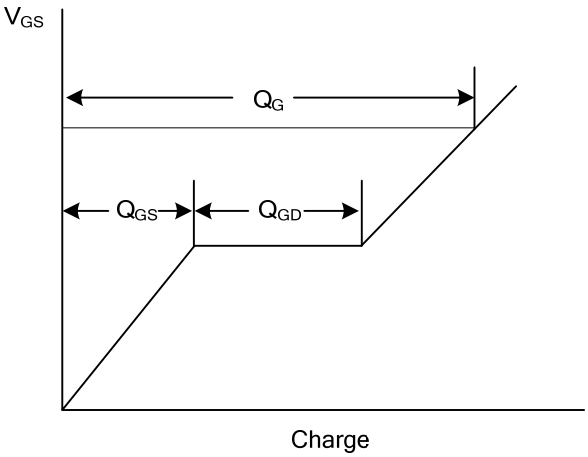

**Switching Test Circuit**



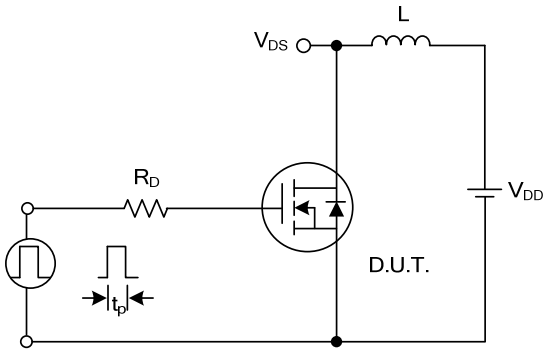

**Switching Waveforms**



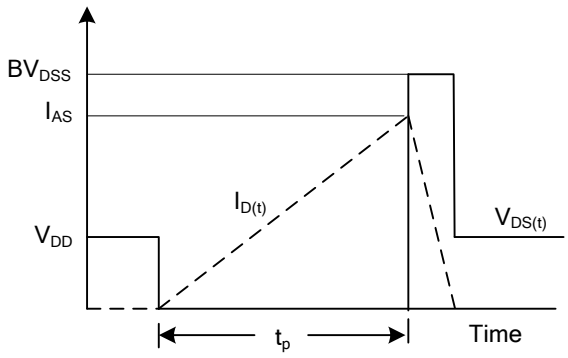

**Gate Charge Test Circuit**




**Gate Charge Waveform**




**Unclamped Inductive Switching Test Circuit**




**Unclamped Inductive Switching Waveforms**