



UT36P15

Power MOSFET

-36A, -150V P-CHANNEL POWER MOSFET

DESCRIPTION

The UTC **UT36P15** is a P-channel power MOSFET using UTC's advanced technology to provide the customers with high switching speed and a minimum on-state resistance, and it can also withstand high energy in the avalanche.

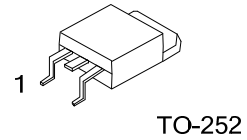
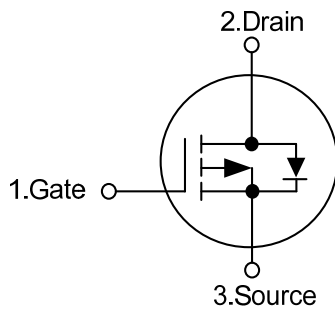
This UTC **UT36P15** is suitable for motor drivers, high-side switch and 12V board net, etc.

FEATURES

* $R_{DS(ON)} \leq 110 \text{ m}\Omega$ @ $V_{GS} = -10\text{V}$, $I_D = -18\text{A}$

* High Switching Speed

SYMBOL



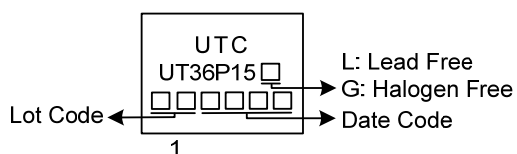
ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|-----------------|----------------|---------|----------------|---|---|-----------|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| UT36P15L-TN3-R | UT36P15G-TN3-R | TO-252 | G | D | S | Tape Reel |

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

| | | |
|----------------|-------------------|--|
| UT36P15G-TN3-R | (1) Packing Type | (1) R: Tape Reel |
| | (2) Package Type | (2) TN3: TO-252 |
| | (3) Green Package | (3) G: Halogen Free and Lead Free L: Lead Free |

MARKING



■ ABSOLUTE MAXIMUM RATINGS ($T_c=25^{\circ}\text{C}$, unless otherwise specified)

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|--------------------------------------|------------------------|-----------|-----------------|--------------------|
| Drain-Source Voltage | | V_{DS} | -150 | V |
| Gate-Source Voltage | | V_{GS} | ± 20 | V |
| Drain Current | Continuous | I_D | -36 | A |
| | Pulsed | I_{DM} | -72 | A |
| Avalanche Energy | Single Pulsed (Note 3) | E_{AS} | 64 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | | dv/dt | 18.6 | V/ns |
| Power Dissipation | | P_D | 50 | W |
| Junction Temperature | | T_J | $-55 \sim +150$ | $^{\circ}\text{C}$ |
| Storage Temperature | | T_{STG} | $-55 \sim +150$ | $^{\circ}\text{C}$ |

- 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. $L = 0.1\text{mH}$, $I_{AS} = -36\text{A}$, $V_{DD} = -50\text{V}$, $R_G = 25\ \Omega$ Starting $T_J = 25^{\circ}\text{C}$
4. $I_{SD} \leq -30\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DS}$, Starting $T_J = 25^{\circ}\text{C}$

■ THERMAL DATA

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---------------------|---------------|---------|-----------------------------|
| Junction to Ambient | θ_{JA} | 110 | $^{\circ}\text{C}/\text{W}$ |
| Junction to Case | θ_{JC} | 2.5 | $^{\circ}\text{C}/\text{W}$ |

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} | I _D =-250μA, V _{GS} =0V | -150 | | | V |
| Drain-Source Leakage Current | | I _{DSS} | V _{DS} =-150V, V _{GS} =0V | | | -1 | 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 | | -4.5 | V |
| Static Drain-Source On-State Resistance | | R _{DS(ON)} | V _{GS} =-10V, I _D =-18A | | | 110 | mΩ |
| DYNAMIC PARAMETERS | | | | | | | |
| Input Capacitance | | C _{ISS} | V _{DS} =-25V, V _{GS} =0V, f=1MHz | | 6450 | | pF |
| Output Capacitance | | C _{OSS} | | | 265 | | pF |
| Reverse Transfer Capacitance | | C _{RSS} | | | 212 | | pF |
| SWITCHING PARAMETERS | | | | | | | |
| Total Gate Charge | | Q _G | V _{DS} =-120V, V _{GS} =-10V, I _D =-36A (Note 1, 2) | | 98 | | nC |
| Gate to Source Charge | | Q _{GS} | | | 31 | | nC |
| Gate to Drain Charge | | Q _{GD} | | | 32 | | nC |
| Turn-ON Delay Time | | t _{D(ON)} | V _{DS} =-100V, V _{GS} =-10V, I _D =-36A, R _G =3Ω (Note 1, 2) | | 25 | | ns |
| Rise Time | | t _R | | | 21 | | ns |
| Turn-OFF Delay Time | | t _{D(OFF)} | | | 78 | | ns |
| Fall-Time | | t _F | | | 27 | | ns |
| SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS | | | | | | | |
| Maximum Body-Diode Continuous Current | | I _S | | | | -36 | A |
| Maximum Body-Diode Pulsed Current | | I _{SM} | | | | -72 | A |
| Drain-Source Diode Forward Voltage (Note 1) | | V _{SD} | I _S =-36A, V _{GS} =0V | | | 1.4 | V |
| Reverse Recovery Time (Note 1) | | t _{rr} | I _S =-30A, V _{GS} =0V | | 100 | | ns |
| Reverse Recovery Charge | | Q _{rr} | dI _F /dt=100A/μs (Note1) | | 0.4 | | μC |

Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

D.U.T.

V_{DS}

I_{SD}

L

V_{DD}

Driver

R_G

V_{GS}

Same Type as D.U.T.

- * dv/dt controlled by R_G
- * I_{SD} controlled by pulse period
- * D.U.T.-Device Under Test

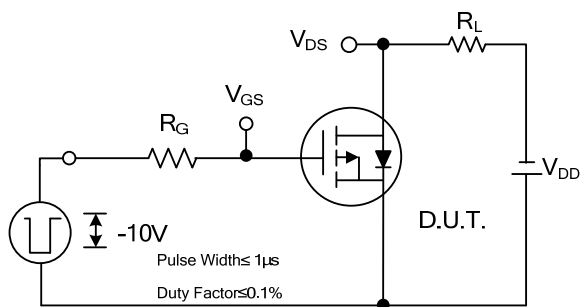
Timing diagram for a MOSFET switching a load inductor. The diagram shows three waveforms: V_{GS} (Driver), I_{SD} (D.U.T.), and V_{DS} (D.U.T.).

- V_{GS} is a square wave with pulse width $P.W.$ and period $Period$. The duty cycle is $D = \frac{P.W.}{Period}$. The peak voltage is $V_{GS} = 10V$.
- I_{SD} shows the source-drain current. During the on-state, it is the forward current I_{FM} . During the off-state, it is the reverse current I_{RM} (Body Diode Reverse Current). The slope of the reverse current is labeled di/dt .
- V_{DS} shows the drain-source voltage. During the on-state, it is the forward voltage drop. During the off-state, it shows the recovery dv/dt (Body Diode Recovery dv/dt).

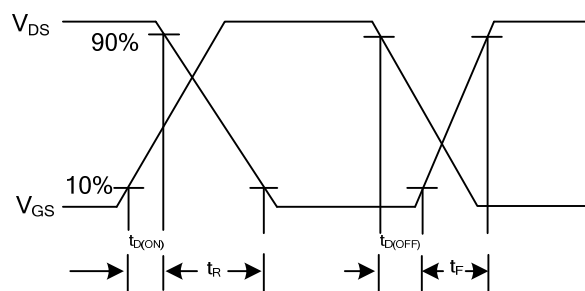
The diagram is divided into two regions: **Body Diode** (during the off-state) and **Forward Voltage Drop** (during the on-state).

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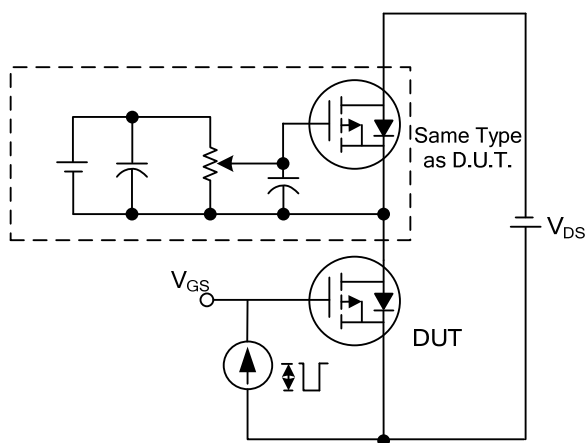
■ TEST CIRCUITS AND WAVEFORMS



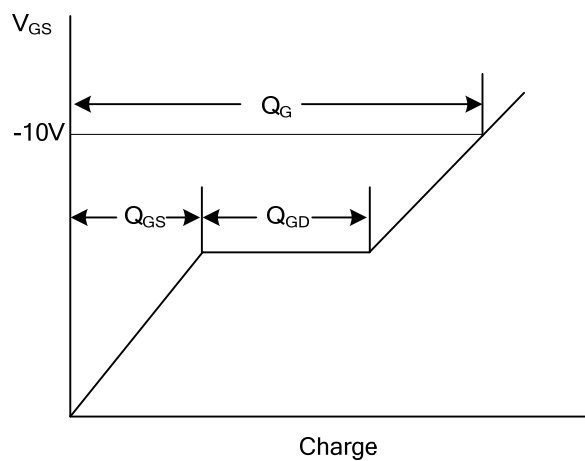
Switching Test Circuit



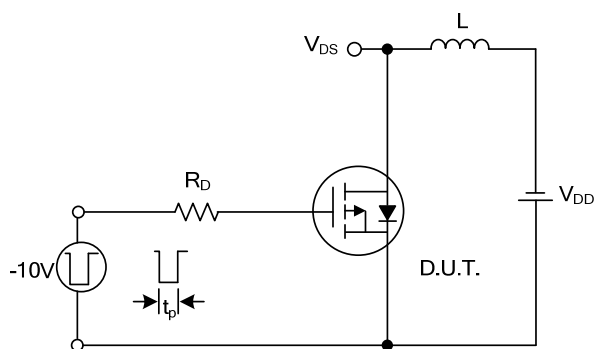
Switching Waveforms



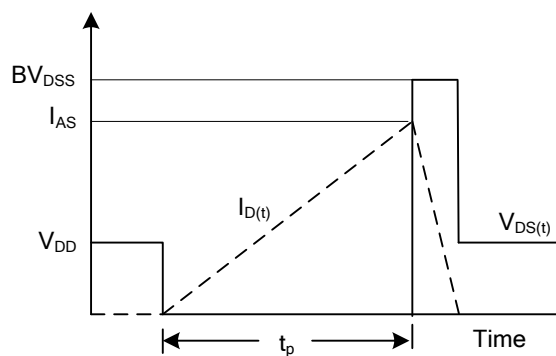
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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