

**UT20P05**

Preliminary

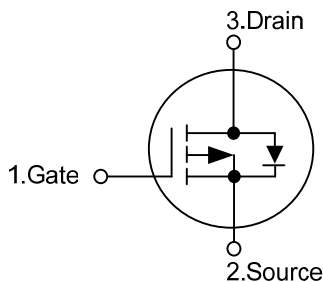
**POWER MOSFET****-20A, -50V P-CHANNEL  
POWER MOSFET****DESCRIPTION**

The UTC **UT20P05** is a P-channel MOS Field Effect Transistor. it uses UTC's advanced technology to provide the customers with high switching speed and a minimum on-state resistance.

The UTC **UT20P05** is suitable for high voltage switching applications.

**FEATURES**

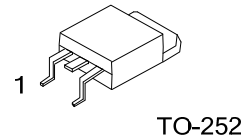
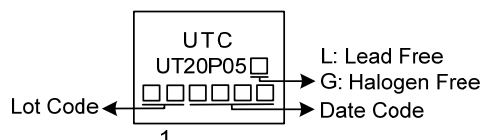
- \*  $R_{DS(ON)} \leq 33 \text{ m}\Omega$  @  $V_{GS} = -10\text{V}$ ,  $I_D = -10\text{A}$
- $R_{DS(ON)} \leq 49 \text{ m}\Omega$  @  $V_{GS} = -4.5\text{V}$ ,  $I_D = -10\text{A}$
- \* High switching speed
- \* Low input capacitance

**SYMBOL****ORDERING INFORMATION**

| Ordering Number |                | Package | Pin Assignment |   |   | Packing   |
|-----------------|----------------|---------|----------------|---|---|-----------|
| Lead Free       | Halogen Free   |         | 1              | 2 | 3 |           |
| UT20P05L-TN3-R  | UT20P05G-TN3-R | TO-252  | G              | D | S | Tape Reel |

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

|                                                                                             |                                                                                                       |
|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| <p>UT20P05G-TN3-R</p> <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Green Package</p> | <p>(1) R: Tape Reel</p> <p>(2) TN3: TO-252</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p> |
|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|

**MARKING**

■ **ABSOLUTE MAXIMUM RATING** ( $T_C=25^{\circ}\text{C}$  unless otherwise specified)

| PARAMETER                 |                        | SYMBOL    | RATINGS    | UNIT               |
|---------------------------|------------------------|-----------|------------|--------------------|
| Drain-Source Voltage      |                        | $V_{DSS}$ | -50        | V                  |
| Gate-Source Voltage       |                        | $V_{GSS}$ | $\pm 20$   | V                  |
| Drain Current             | DC                     | $I_D$     | -20        | A                  |
|                           | Pulsed (Note 2)        | $I_{DM}$  | -40        | A                  |
| Avalanche Energy          | Single Pulsed (Note 3) | $E_{AS}$  | 50.6       | mJ                 |
| Power Dissipation         |                        | $P_D$     | 45         | W                  |
| Junction Temperature      |                        | $T_J$     | +150       | $^{\circ}\text{C}$ |
| Storage Temperature Range |                        | $T_{STG}$ | -55 ~ +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.  $L = 0.1\text{mH}$ ,  $I_{AS} = -31.8\text{A}$ ,  $V_{DD} = -50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^{\circ}\text{C}$

■ **THERMAL DATA**

| PARAMETER           | SYMBOL        | RATINGS | UNIT                 |
|---------------------|---------------|---------|----------------------|
| Junction to Ambient | $\theta_{JA}$ | 50      | $^{\circ}\text{C/W}$ |
| Junction to Case    | $\theta_{JC}$ | 2.78    | $^{\circ}\text{C/W}$ |

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

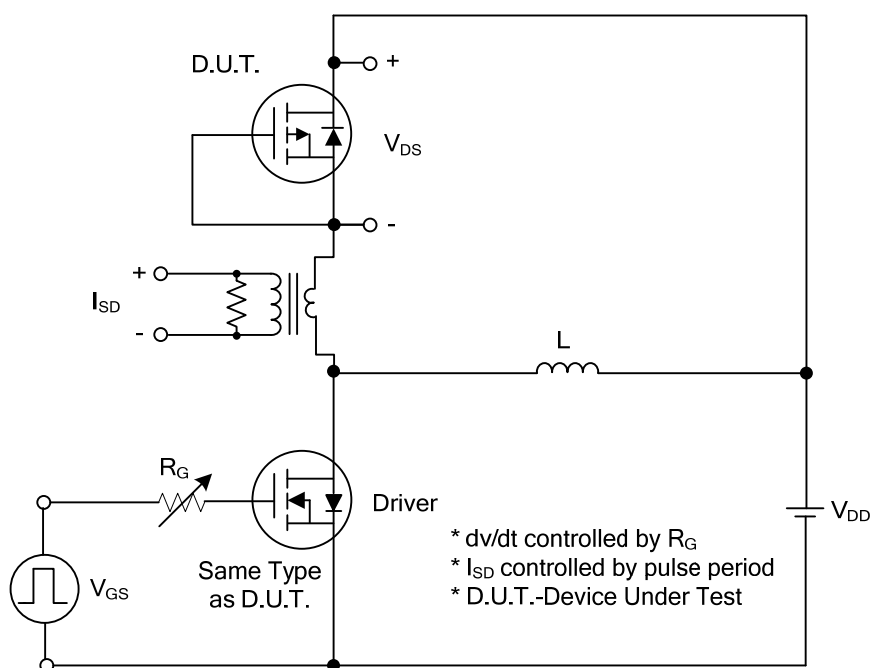
■ **ELECTRICAL CHARACTERISTICS** ( $T_J=25^{\circ}\text{C}$  unless otherwise specified)

| PARAMETER                                             |         | SYMBOL              | TEST CONDITIONS                                                                                      | MIN  | TYP  | MAX  | UNIT |
|-------------------------------------------------------|---------|---------------------|------------------------------------------------------------------------------------------------------|------|------|------|------|
| OFF CHARACTERISTICS                                   |         |                     |                                                                                                      |      |      |      |      |
| Drain-Source Breakdown Voltage                        |         | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V, I <sub>D</sub> =-250μA                                                          | -50  |      |      | V    |
| Drain-Source Leakage Current                          |         | I <sub>DSS</sub>    | V <sub>DS</sub> =-50V, V <sub>GS</sub> =0V                                                           |      |      | -1   | μA   |
| Gate-Source Leakage Current                           | Forward | I <sub>GSS</sub>    | V <sub>GS</sub> =+20V, V <sub>DS</sub> =0V                                                           |      |      | +100 | nA   |
|                                                       | Reverse |                     | V <sub>GS</sub> =-20V, V <sub>DS</sub> =0V                                                           |      |      | -100 | nA   |
| ON CHARACTERISTICS                                    |         |                     |                                                                                                      |      |      |      |      |
| Gate Threshold Voltage                                |         | V <sub>GS(TH)</sub> | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> =-250μA                                           | -1.0 |      | -3.0 | V    |
| Static Drain-Source On-State Resistance               |         | R <sub>DS(ON)</sub> | V <sub>GS</sub> =-10V, I <sub>D</sub> =-10A                                                          |      |      | 33   | mΩ   |
|                                                       |         |                     | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-10A                                                         |      |      | 49   | mΩ   |
| DYNAMIC PARAMETERS                                    |         |                     |                                                                                                      |      |      |      |      |
| Input Capacitance                                     |         | C <sub>ISS</sub>    | V <sub>GS</sub> =0V, V <sub>DS</sub> =-25V, f=1.0MHz                                                 |      | 1550 |      | pF   |
| Output Capacitance                                    |         | C <sub>OSS</sub>    |                                                                                                      |      | 143  |      | pF   |
| Reverse Transfer Capacitance                          |         | C <sub>RSS</sub>    |                                                                                                      |      | 129  |      | pF   |
| SWITCHING PARAMETERS                                  |         |                     |                                                                                                      |      |      |      |      |
| Total Gate Charge                                     |         | Q <sub>G</sub>      | V <sub>DS</sub> =-40V, V <sub>GS</sub> =-10V, I <sub>D</sub> =-20A, I <sub>D</sub> =-1mA (Note 1, 2) |      | 36.6 |      | nC   |
| Gate to Source Charge                                 |         | Q <sub>GS</sub>     |                                                                                                      |      | 11   |      | nC   |
| Gate to Drain Charge                                  |         | Q <sub>GD</sub>     |                                                                                                      |      | 5.8  |      | nC   |
| Turn-ON Delay Time                                    |         | t <sub>D(ON)</sub>  | V <sub>DS</sub> =-25V, V <sub>GS</sub> =-10V, I <sub>D</sub> =-20A, R <sub>G</sub> =3Ω (Note 1, 2)   |      | 8.4  |      | ns   |
| Rise Time                                             |         | t <sub>R</sub>      |                                                                                                      |      | 16.9 |      | ns   |
| Turn-OFF Delay Time                                   |         | t <sub>D(OFF)</sub> |                                                                                                      |      | 31.3 |      | ns   |
| Fall-Time                                             |         | t <sub>F</sub>      |                                                                                                      |      | 20.3 |      | ns   |
| SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS        |         |                     |                                                                                                      |      |      |      |      |
| Maximum Continuous Drain-Source Diode Forward Current |         | I <sub>S</sub>      |                                                                                                      |      |      | -20  | A    |
| Maximum Pulsed Drain-Source Diode Forward Current     |         | I <sub>SM</sub>     |                                                                                                      |      |      | -40  | A    |
| Diode Forward Voltage                                 |         | V <sub>SD</sub>     | I <sub>F</sub> =-20A, V <sub>GS</sub> =0V                                                            |      |      | -1.4 | V    |
| Body Diode Reverse Recovery Time                      |         | t <sub>rr</sub>     | I <sub>F</sub> =-20A, V <sub>GS</sub> =0V, di/dt=100A/μs                                             |      | 35   |      | ns   |
| Body Diode Reverse Recovery Charge                    |         | Q <sub>rr</sub>     |                                                                                                      |      | 43   |      | nC   |

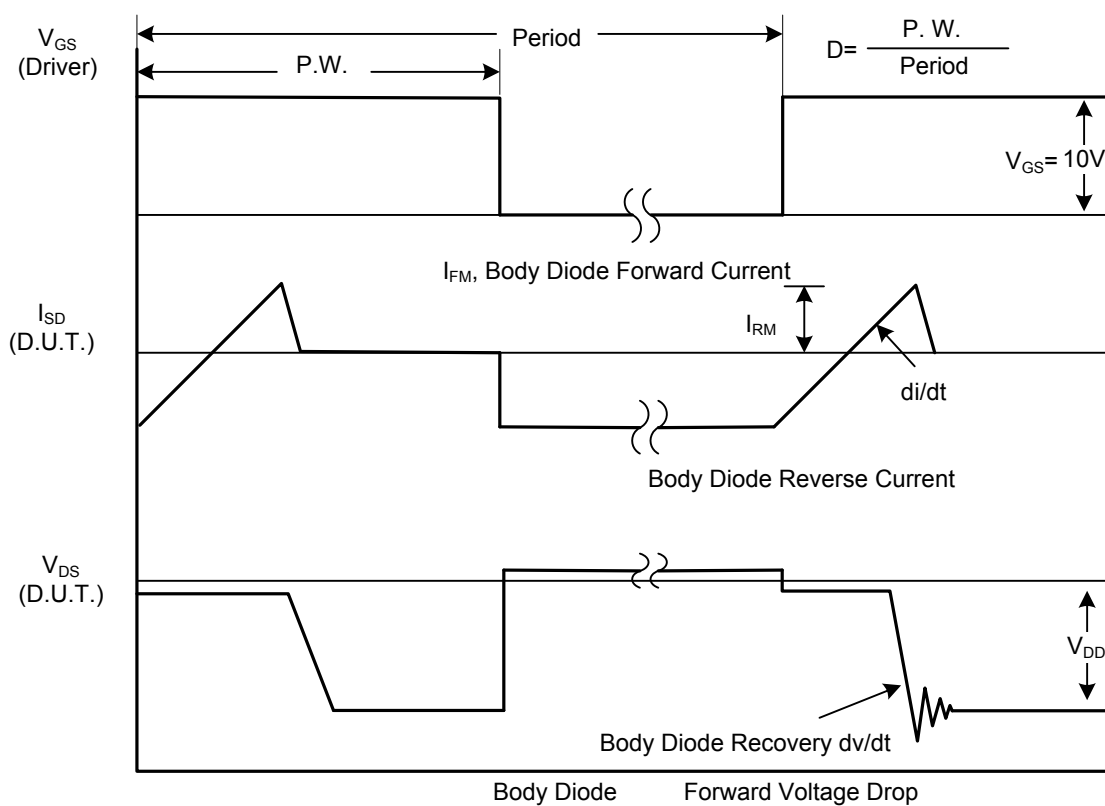
Notes: 1. Pulse Test: Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$ .

2. Essentially independent of operating temperature.

## ■ TEST CIRCUITS AND WAVEFORMS

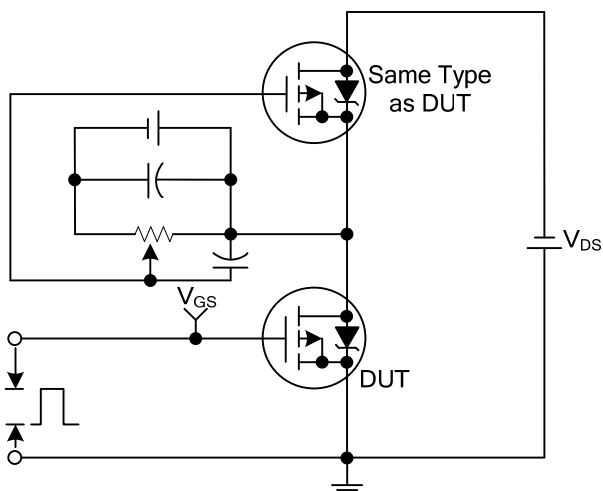


Peak Diode Recovery  $dv/dt$  Test Circuit

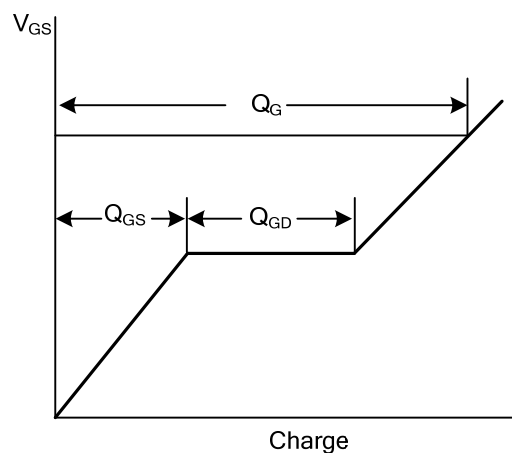


Peak Diode Recovery  $dv/dt$  Waveforms

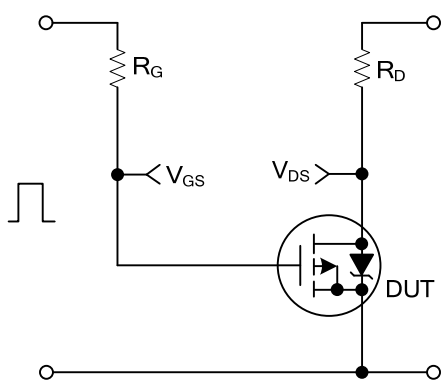
## ■ TEST CIRCUITS AND WAVEFORMS



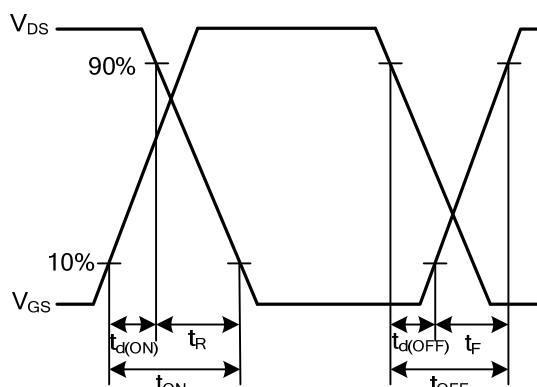
Gate Charge Test Circuit



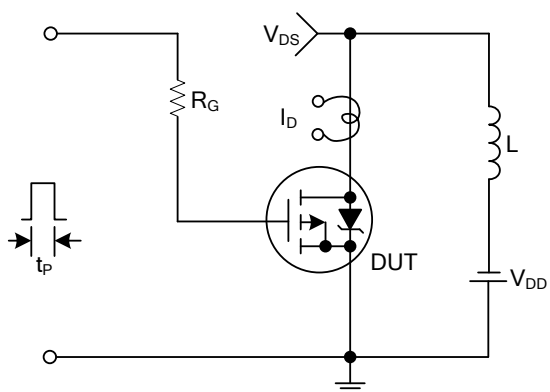
Gate Charge Waveforms



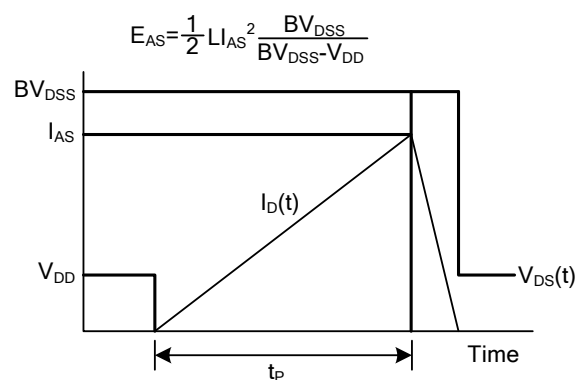
Resistive Switching Test Circuit



Resistive Switching Waveforms



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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