



5N60

Power MOSFET

4.5 Amps, 600 Volts N-CHANNEL MOSFET

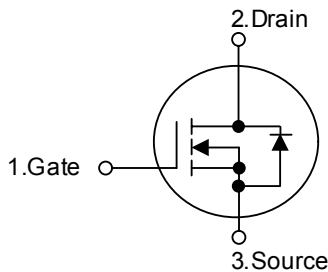
DESCRIPTION

The UTC 5N60 is a high voltage MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

FEATURES

- * $R_{DS(ON)} = 2.5\Omega @ V_{GS} = 10V$
- * Ultra low gate charge (typical 15 nC)
- * Low reverse transfer Capacitance ($C_{RSS} =$ typical 6.5 pF)
- * Fast switching capability
- * Avalanche energy Specified
- * Improved dv/dt capability, high ruggedness

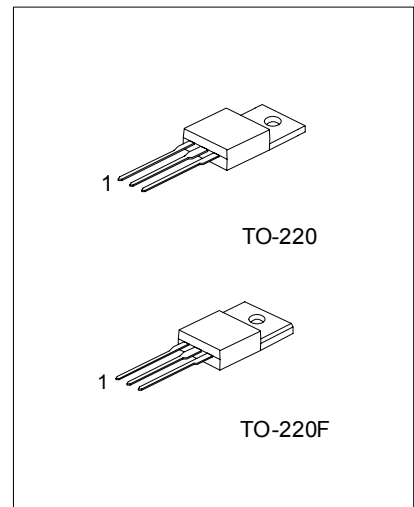
SYMBOL



ORDERING INFORMATION

| Order Number | | Package | Pin Assignment | | | Packing |
|--------------|-------------------|---------|----------------|---|---|---------|
| Normal | Lead Free Plating | | 1 | 2 | 3 | |
| 5N60-TA3-T | 5N60L-TA3-T | TO-220 | G | D | S | Tube |
| 5N60-TF3-T | 5N60L-TF3-T | TO-220F | G | D | S | Tube |

| | |
|---|--|
| <p>5N60L-TA3-T</p> <p>(1)Packing Type (2)Package Type (3)Lead Plating</p> | <p>(1) T: Tube (2) TA3: TO-220, TF3: TO-220F (3) L: Lead Free Plating Blank: Pb/Sn</p> |
|---|--|



*Pb-free plating product number: 5N60L

■ ABSOLUTE MAXIMUM RATING ($T_C = 25$ unless otherwise specified)

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|--|-----------------|-----------|------------|------|
| Drain-Source Voltage | | V_{DSS} | 600 | V |
| Gate-Source Voltage | | V_{GSS} | ± 30 | V |
| Avalanche Current (Note 1) | | I_{AR} | 4.5 | A |
| Continuous Drain Current | $T_C = 25$ | I_D | 4.5 | A |
| | $T_C = 100$ | | 2.6 | A |
| Pulsed Drain Current (Note 1) | | I_{DM} | 18 | A |
| Avalanche Energy, Single Pulsed (Note 2) | | E_{AS} | 210 | mJ |
| Avalanche Energy, Repetitive Limited by $T_{J(MAX)}$ | | E_{AR} | 10 | mJ |
| Peak Diode Recovery dv/dt (Note 3) | | dv/dt | 4.5 | V/ns |
| Power Dissipation | $T_C = 25$ | P_D | 100 | W |
| | Derate above 25 | | 0.8 | W/ |
| Junction Temperature | | T_J | +150 | |
| Operating and Storage Temperature | | T_{STG} | -55 ~ +150 | |

Note 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.

■ THERMAL DATA

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---------------------|--|---------------|---------|----------------------|
| Junction-to-Ambient | | θ_{JA} | 62.5 | $^{\circ}\text{C/W}$ |
| Junction-to-Case | | θ_{JC} | 1.25 | $^{\circ}\text{C/W}$ |
| Case-to-Sink | | θ_{CS} | 0.5 | $^{\circ}\text{C/W}$ |

■ ELECTRICAL CHARACTERISTICS ($T_C = 25$ unless otherwise specified)

| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|------------|----------------|---|-----|-----|------|----------|
| Off Characteristics | | | | | | | |
| Drain-Source Breakdown Voltage | | BV_{DSS} | $V_{GS} = 0V, I_D = 250\mu A$ | 600 | | | V |
| Drain-Source Leakage Current | | I_{DSS} | $V_{DS} = 600V, V_{GS} = 0V$ | | | 1 | μA |
| | | | $V_{DS} = 480V, T_C = 125$ | | | 10 | μA |
| Breakdown Voltage Temperature Coefficient | | BV_{DSS}/T_J | $I_D = 250\mu A$, Referenced to 25 | | 0.6 | | V/ |
| Gate-Body Leakage Current | Forward | I_{GSS} | $V_{GS} = 30V, V_{DS} = 0V$ | | | 100 | nA |
| | Reverse | | $V_{GS} = -30V, V_{DS} = 0V$ | | | -100 | nA |
| On Characteristics | | | | | | | |
| Gate Threshold Voltage | | $V_{GS(TH)}$ | $V_{DS} = V_{GS}, I_D = 250\mu A$ | 2.0 | | 4.0 | V |
| Static Drain-Source On-Resistance | | $R_{DS(ON)}$ | $V_{GS} = 10V, I_D = 2.25A$ | | 2.0 | 2.5 | Ω |
| Forward Transconductance | | g_{FS} | $V_{DS} = 40V, I_D = 2.25A$ (Note 4) | | 4.7 | | S |
| Dynamic Characteristics | | | | | | | |
| Input Capacitance | | C_{ISS} | $V_{DS} = 25V, V_{GS} = 0V,$ $f = 1.0MHz$ | | 515 | 670 | pF |
| Output Capacitance | | C_{OSS} | | | 55 | 72 | pF |
| Reverse Transfer Capacitance | | C_{RSS} | | | 6.5 | 8.5 | pF |
| Switching Characteristics | | | | | | | |
| Turn-On | Delay Time | $t_{D(ON)}$ | $V_{DD} = 300V, I_D = 4.5 A,$ $R_G = 25\Omega$ (Note 4, 5) | | 10 | 30 | ns |
| | Rise Time | t_R | | | 42 | 90 | ns |
| Turn-Off | Delay Time | $t_{D(OFF)}$ | | | 38 | 85 | ns |
| | Fall Time | t_F | | | 46 | 100 | ns |
| Total Gate Charge | | Q_G | $V_{DS} = 480 V, I_D = 4.5A,$ $V_{GS} = 10 V$ (Note 4, 5) | | 15 | 19 | nC |
| Gate-Source Charge | | Q_{GS} | | | 2.5 | | nC |
| Gate-Drain Charge | | Q_{GD} | | | 6.6 | | nC |

■ ELECTRICAL CHARACTERISTICS(Cont.)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|----------|---|-----|-----|-----|---------------|
| Drain-Source Diode Characteristics and Maximum Ratings | | | | | | |
| Drain-Source Diode Forward Voltage | V_{SD} | $V_{GS} = 0\text{ V}, I_S = 4.5\text{ A}$ | | | 1.4 | V |
| Maximum Continuous Drain-Source Diode Forward Current | I_S | | | | 4.5 | A |
| Maximum Pulsed Drain-Source Diode Forward Current | I_{SM} | | | | 18 | A |
| Reverse Recovery Time | t_{RR} | $V_{GS} = 0\text{ V}, I_S = 4.5\text{ A},$ | | 300 | | ns |
| Reverse Recovery Charge | Q_{RR} | $dI_F / dt = 100\text{ A}/\mu\text{s}$ (Note 4) | | 2.2 | | μC |

Note 1. Repetitive Rating : Pulse width limited by T_J

2. $L = 18.9\text{mH}, I_{AS} = 4.5\text{ A}, V_{DD} = 50\text{V}, R_G = 25\ \Omega$, Starting $T_J = 25$

3. $I_{SD} \leq 4.5\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25$

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

5. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

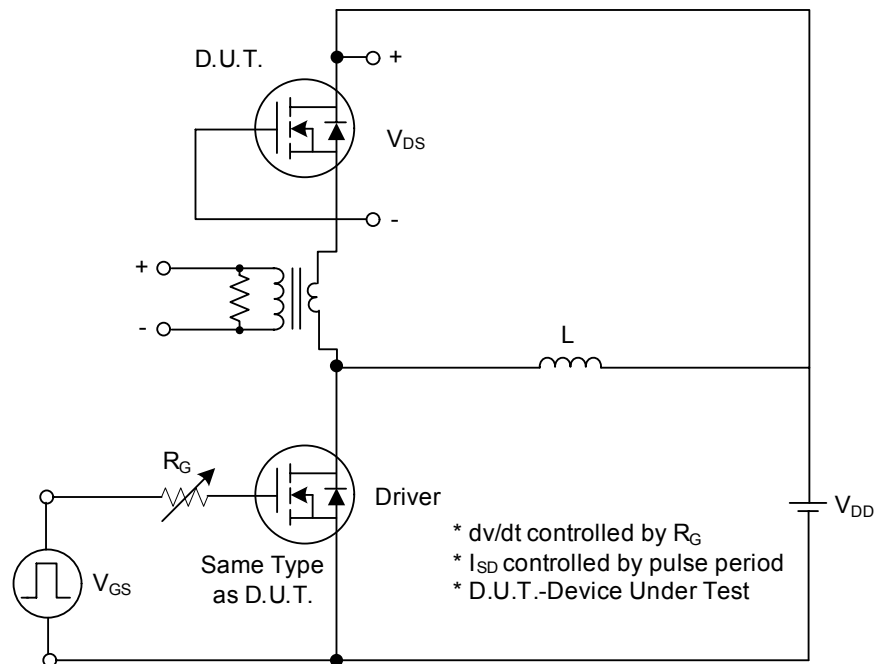


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

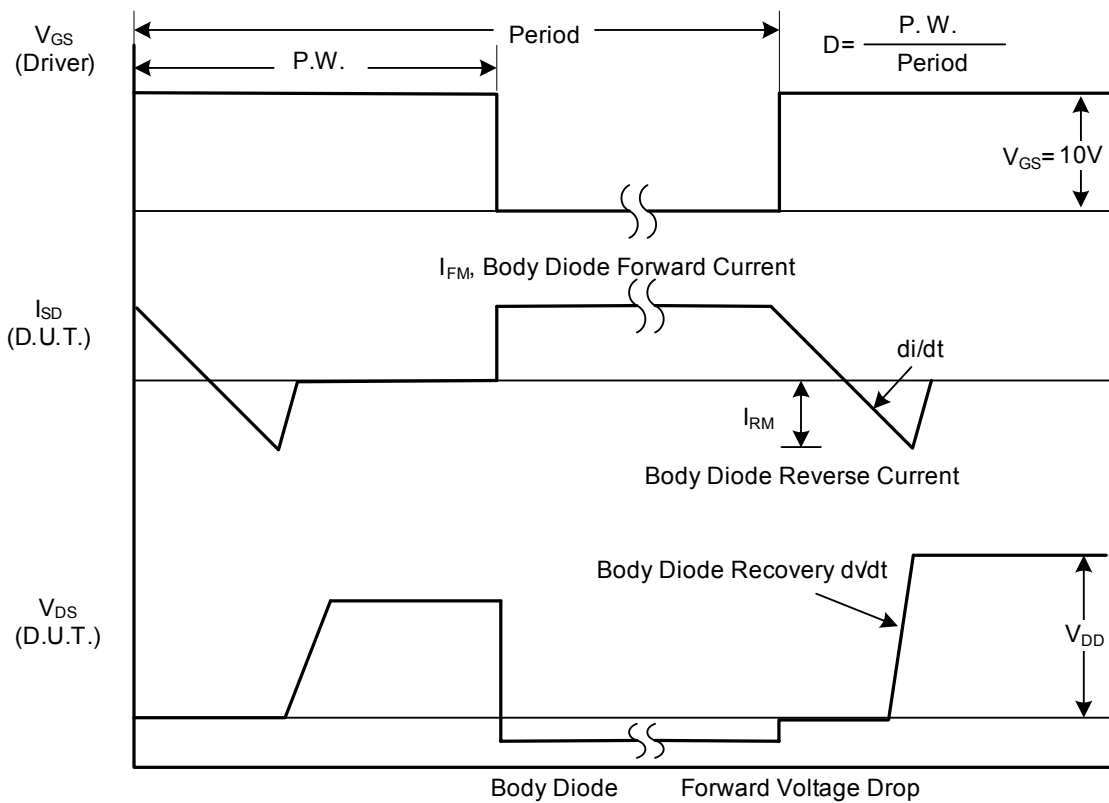


Fig. 1B Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

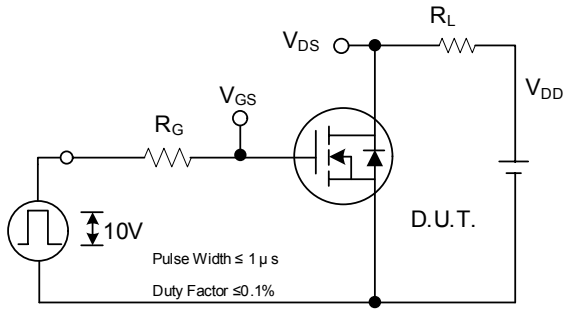


Fig. 2A Switching Test Circuit

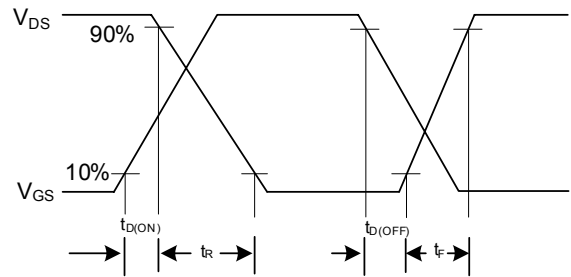


Fig. 2B Switching Waveforms

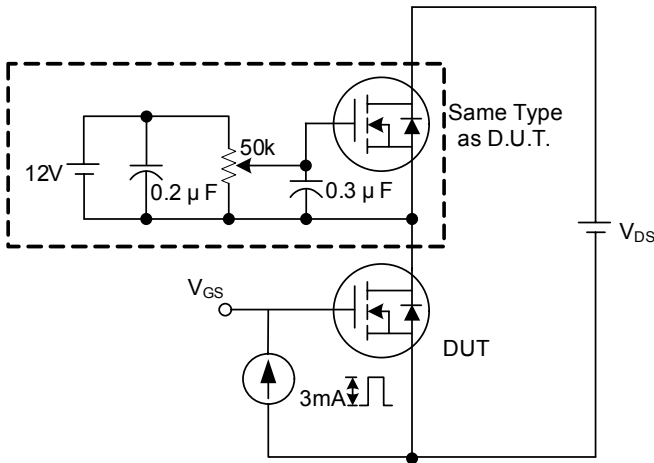


Fig. 3A Gate Charge Test Circuit

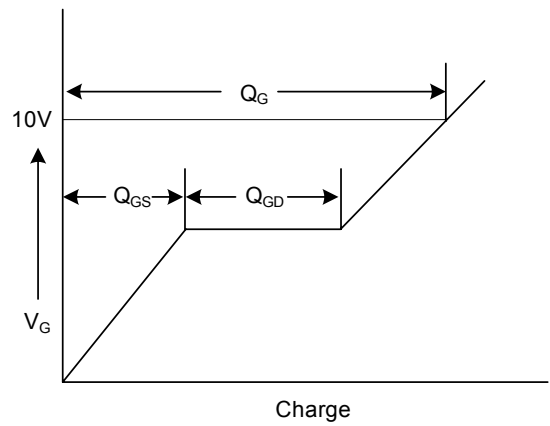


Fig. 3B Gate Charge Waveform

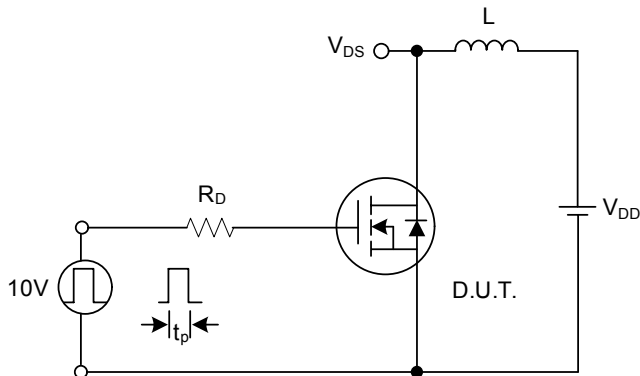


Fig. 4A Unclamped Inductive Switching Test Circuit

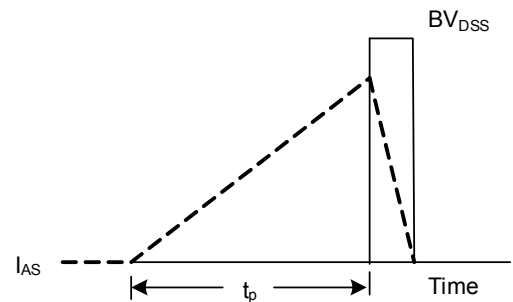
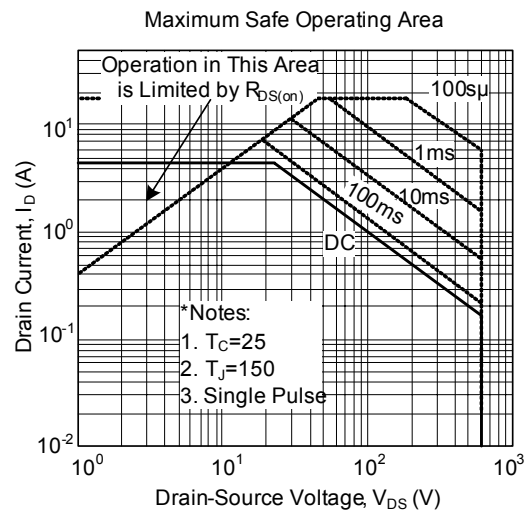
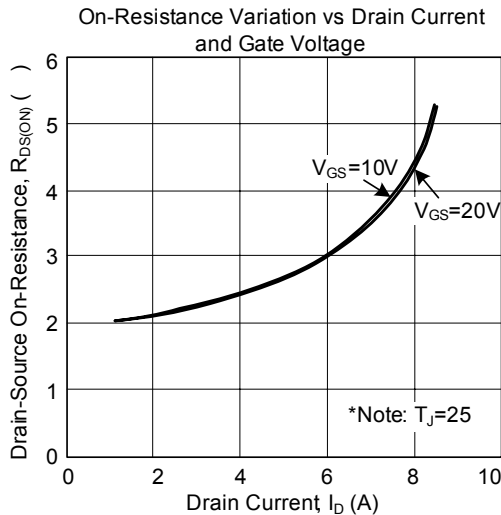
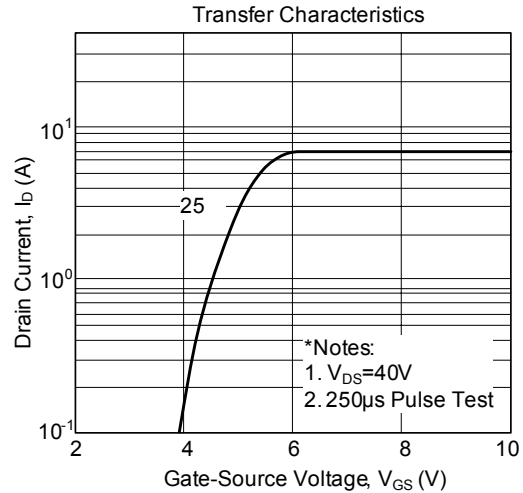
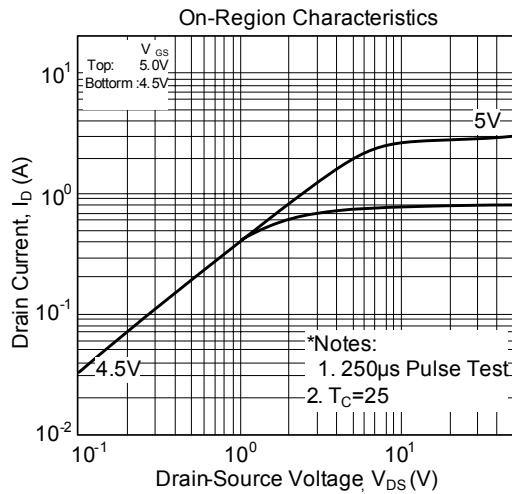


Fig. 4B Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS



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