



7N60

Power MOSFET

7.4 Amps, 600/650 Volts N-CHANNEL POWER MOSFET

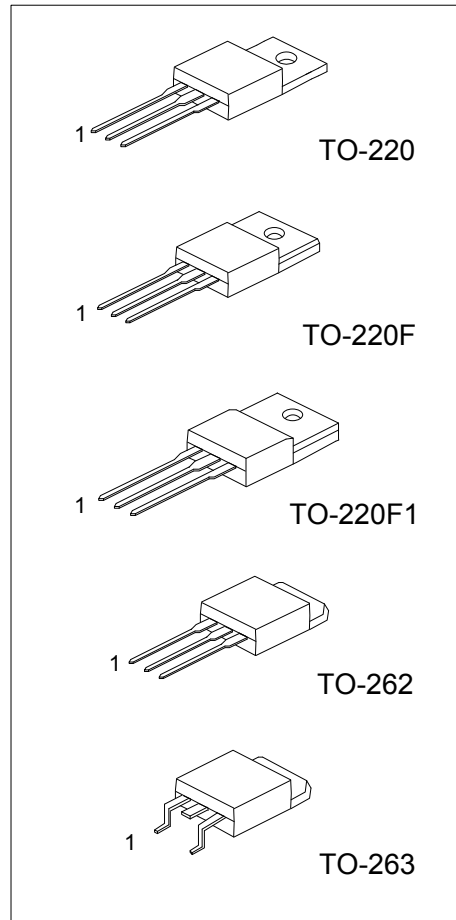
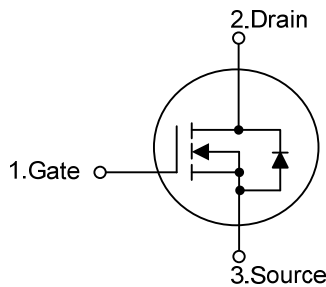
DESCRIPTION

The UTC **7N60** 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 switching power supplies and adaptors.

FEATURES

- * $R_{DS(ON)} = 1.0\Omega$ @ $V_{GS} = 10\text{ V}$ (7N60/7N60-R)
- $R_{DS(ON)} = 1.2\Omega$ @ $V_{GS} = 10\text{ V}$ (7N60-F/7N60-M/7N60-Q)
- * Ultra Low Gate Charge (Typical 29 nC)
- * Low Reverse Transfer Capacitance ($C_{RSS} =$ typical 16pF)
- * Fast Switching Capability
- * Avalanche Energy Tested
- * Improved dv/dt Capability, High Ruggedness

SYMBOL



ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|-----------------|---------------|----------|----------------|---|---|-----------|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| 7N60L-x-TA3-T | 7N60G-x-TA3-T | TO-220 | G | D | S | Tube |
| 7N60L-x-TF3-T | 7N60G-x-TF3-T | TO-220F | G | D | S | Tube |
| 7N60L-x-TF1-T | 7N60G-x-TF1-T | TO-220F1 | G | D | S | Tube |
| 7N60L-x-T2Q-T | 7N60G-x-T2Q-T | TO-262 | G | D | S | Tube |
| 7N60L-x-TQ2-R | 7N60G-x-TQ2-R | TO-263 | G | D | S | Tape Reel |
| 7N60L-x-TQ2-T | 7N60G-x-TQ2-T | TO-263 | G | D | S | Tube |

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

| | |
|--|---|
| <p>7N60L-x-TA3-T</p> <p>(1) Packing Type (2) Package Type (3) Drain-Source Voltage (4) Lead Free</p> | <p>(1) R: Tape Reel, T: Tube (2) TA3: TO-220, TF1: TO220-F1, TF3: TO-220F T2Q: TO-262, TQ2: TO-263 (3) A: 600V, B: 650V (4) G: Halogen Free, L: Lead Free</p> |
|--|---|

■ ABSOLUTE MAXIMUM RATINGS (T_C = 25°C, unless otherwise specified)

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|------------------------------------|------------------------|------------------|------------|------|
| Drain-Source Voltage | 7N60-A | V _{DSS} | 600 | V |
| | 7N60-B | | 650 | V |
| Gate-Source Voltage | | V _{GSS} | ±30 | V |
| Avalanche Current (Note 2) | | I _{AR} | 7.4 | A |
| Drain Current | Continuous | I _D | 7.4 | A |
| | Pulsed (Note 2) | I _{DM} | 29.6 | A |
| Avalanche Energy | Single Pulsed (Note 3) | E _{AS} | 530 | mJ |
| | Repetitive (Note 2) | E _{AR} | 14.2 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | | dv/dt | 4.5 | V/ns |
| Power Dissipation | TO-220/TO-262/TO-263 | P _D | 142 | W |
| | TO-220F/TO-220F1 | | 48 | 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

3. L = 19.5mH, I_{AS} = 7.4A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C

4. I_{SD} ≤ 7.4A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---------------------|----------------------|-----------------|---------|------|
| Junction to Ambient | TO-220/TO-262/TO-263 | θ _{JA} | 62.5 | °C/W |
| | TO-220F/TO-220F1 | | 62.5 | °C/W |
| Junction to Case | TO-220/TO-262/TO-263 | θ _{JC} | 0.88 | °C/W |
| | TO-220F/TO-220F1 | | 2.6 | °C/W |

■ ELECTRICAL CHARACTERISTICS (T_C = 25°C, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---------|-------------------------------------|---|--------|------|---------|
| OFF CHARACTERISTICS | | | | | | |
| Drain-Source Breakdown Voltage | 7N60-A | BV _{DSS} | V _{GS} = 0V, I _D = 250μA | 600 | | V |
| | 7N60-B | | | 650 | | V |
| Drain-Source Leakage Current | | I _{DSS} | V _{DS} = 600V, V _{GS} = 0V | | 1 | μA |
| Gate- Source Leakage Current | Forward | I _{GSS} | V _{GS} = 30V, V _{DS} = 0V | | 100 | nA |
| | Reverse | | V _{GS} = -30V, V _{DS} = 0V | | -100 | nA |
| Breakdown Voltage Temperature Coefficient | | ΔBV _{DSS} /ΔT _J | I _D = 250μA, Referenced to 25°C | 0.67 | | V/°C |
| ON CHARACTERISTICS | | | | | | |
| Gate Threshold Voltage | | V _{GS(TH)} | V _{DS} = V _{GS} , I _D = 250μA | 2.0 | | 4.0 V |
| Static Drain-Source On-State Resistance | | R _{DS(ON)} | V _{GS} = 10V, I _D = 3.7A | 7N60 | | 1.0 Ω |
| | | | | 7N60-F | | 1.2 Ω |
| | | | | 7N60-M | | 1.2 Ω |
| | | | | 7N60-Q | | 1.2 Ω |
| | | | | 7N60-R | | 1.0 Ω |
| DYNAMIC CHARACTERISTICS | | | | | | |
| Input Capacitance | | C _{ISS} | V _{DS} = 25V, V _{GS} = 0V, f = 1.0 MHz | | | 1400 pF |
| Output Capacitance | | C _{OSS} | | | | 180 pF |
| Reverse Transfer Capacitance | | C _{RSS} | | | 16 | 21 |
| SWITCHING CHARACTERISTICS | | | | | | |
| Turn-On Delay Time | | t _{D(ON)} | V _{DD} = 300V, I _D = 7.4A, R _G = 25Ω (Note 1, 2) | | | 70 ns |
| Turn-On Rise Time | | t _R | | | | 170 ns |
| Turn-Off Delay Time | | t _{D(OFF)} | | | | 140 ns |
| Turn-Off Fall Time | | t _F | | | | 130 ns |

■ ELECTRICAL CHARACTERISTICS(Cont.)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|----------|--|-----|------|------|---------|
| SWITCHING CHARACTERISTICS | | | | | | |
| Total Gate Charge | Q_G | $V_{DS}=480V, I_D=7.4A, V_{GS}=10V$ (Note 1, 2) | | 29 | 38 | nC |
| Gate-Source Charge | Q_{GS} | | | 7 | | nC |
| Gate-Drain Charge | Q_{GD} | | | 14.5 | | nC |
| DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS | | | | | | |
| Drain-Source Diode Forward Voltage | V_{SD} | $V_{GS} = 0V, I_S = 7.4 A$ | | | 1.4 | V |
| Maximum Continuous Drain-Source Diode Forward Current | I_S | | | | 7.4 | A |
| Maximum Pulsed Drain-Source Diode Forward Current | I_{SM} | | | | 29.6 | A |
| Reverse Recovery Time | t_{RR} | $V_{GS} = 0V, I_S = 7.4 A,$ | | 320 | | ns |
| Reverse Recovery Charge | Q_{RR} | $di_F / dt = 100A/\mu s$ (Note 1) | | 2.4 | | μC |

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

2. Essentially independent of operating temperature

■ CLASSIFICATION OF $R_{DS(ON)}$

| RANK | - | F | M | Q | R |
|-------|--------------|--------------|--------------|--------------|--------------|
| VALUE | 1.0 Ω | 1.2 Ω | 1.2 Ω | 1.2 Ω | 1.0 Ω |

■ TEST CIRCUITS AND WAVEFORMS

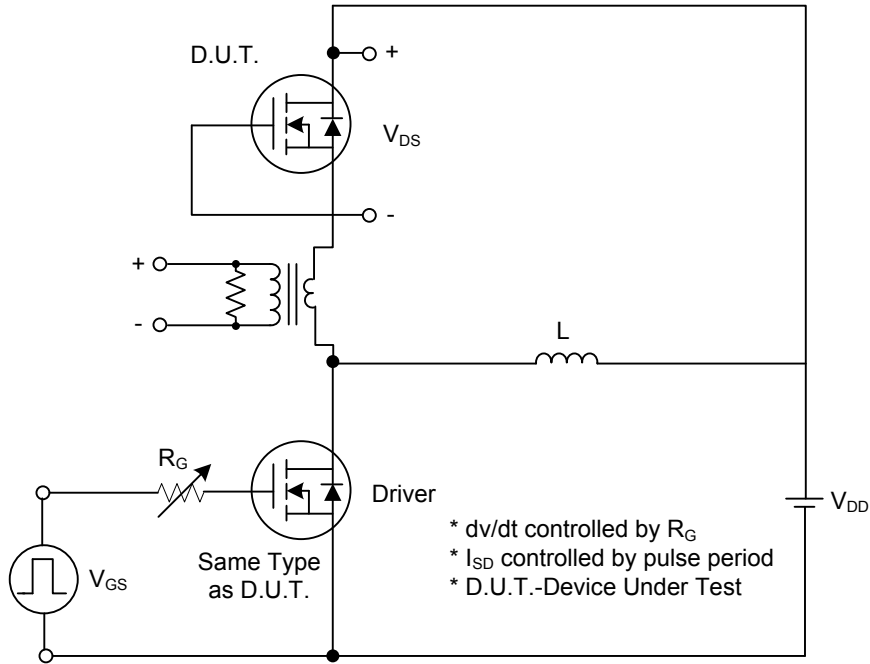


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

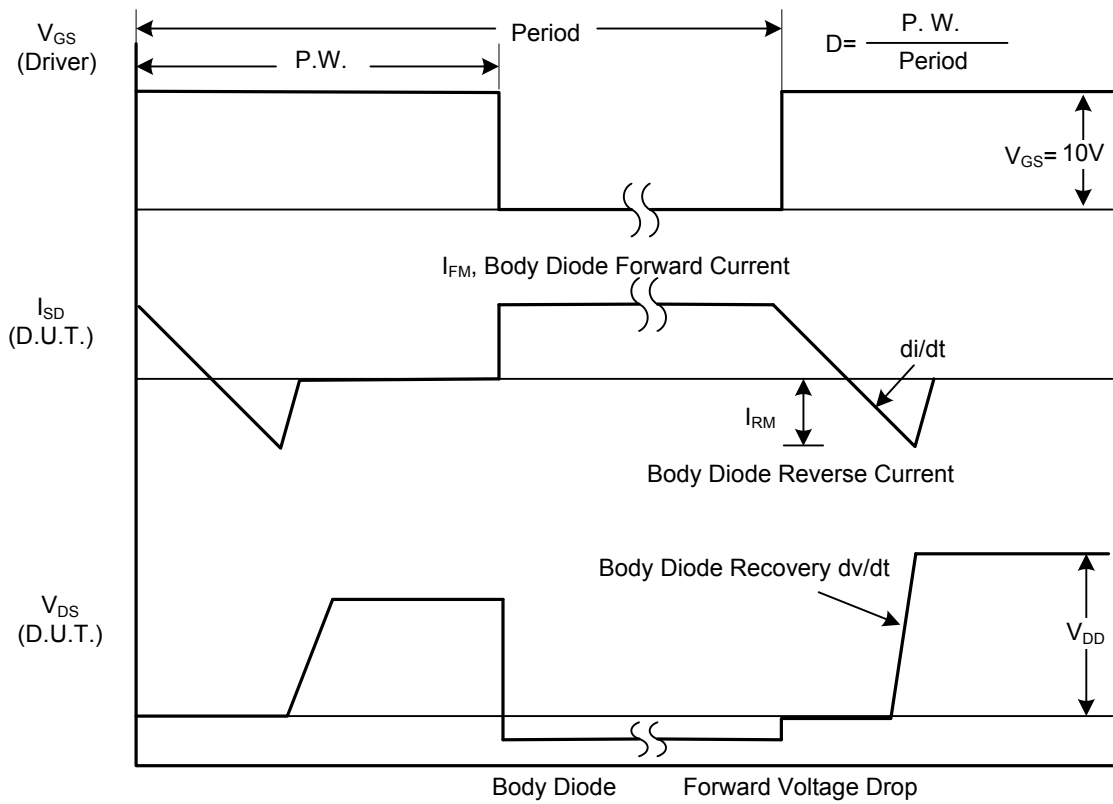


Fig. 1B Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

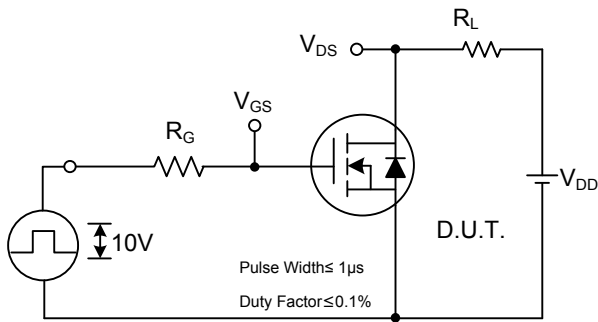


Fig. 2A Switching Test Circuit

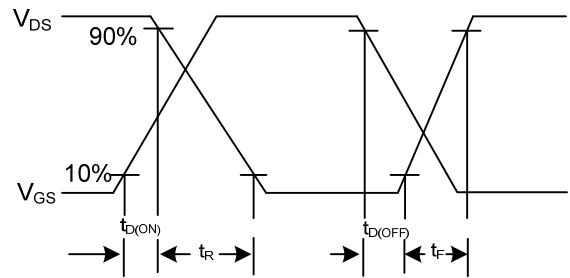


Fig. 2B Switching Waveforms

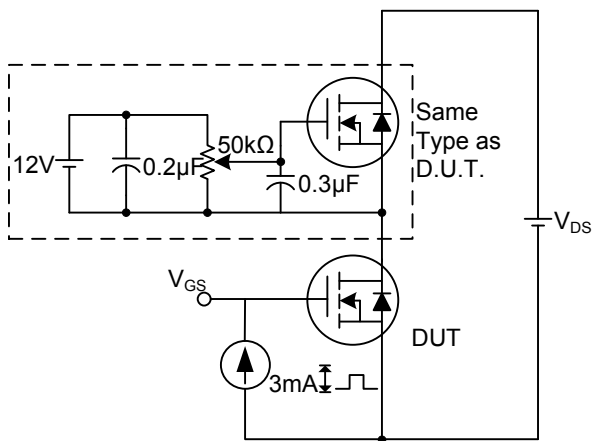


Fig. 3A Gate Charge Test Circuit

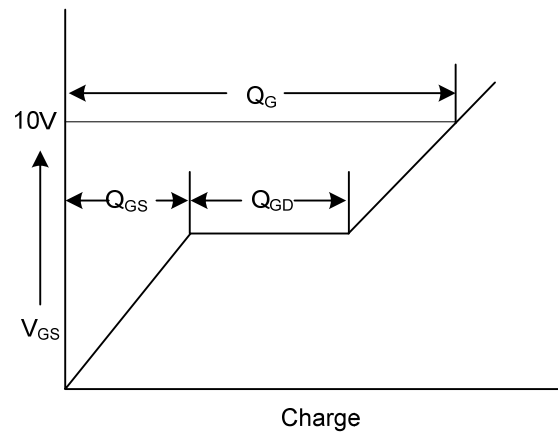


Fig. 3B Gate Charge Waveform

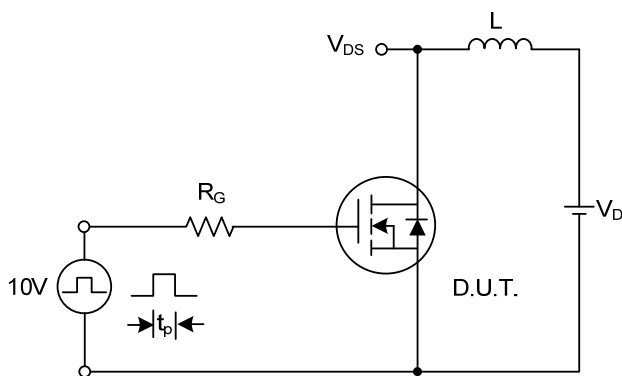


Fig. 4A Unclamped Inductive Switching Test Circuit

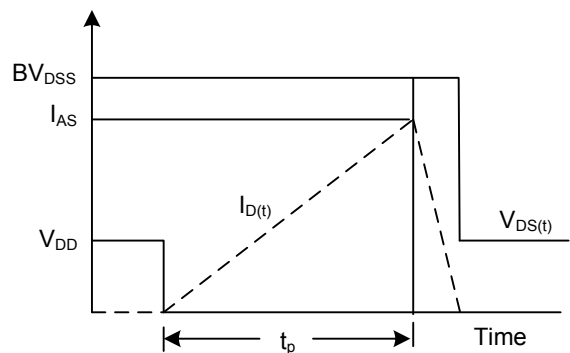


Fig. 4B Unclamped Inductive Switching Waveforms

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