



12N70K-MT

Power MOSFET

12A, 700V N-CHANNEL POWER MOSFET

■ DESCRIPTION

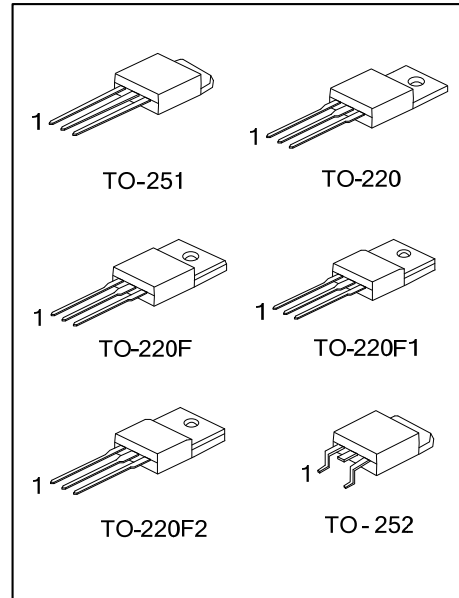
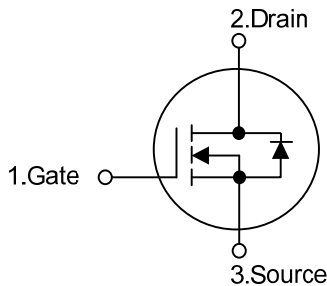
The UTC **12N70K-MT** are N-Channel enhancement mode power MOSFET which are produced using UTC's proprietary, planar stripe, DMOS technology.

These devices are suited for high efficiency switch mode power supply. To minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode the advanced technology has been especially tailored.

■ FEATURES

- * $R_{DS(ON)} < 0.83\Omega @ V_{GS} = 10V, I_D = 6.0A$
- * Fast switching capability
- * Avalanche energy specified
- * Improved dv/dt capability, high ruggedness

■ SYMBOL



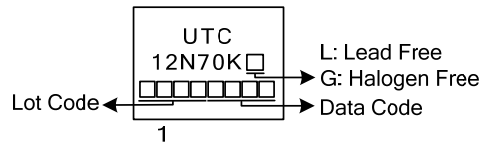
■ ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|-----------------|---------------|----------|----------------|---|---|-----------|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| 12N70KL-TA3-T | 12N70KG-TA3-T | TO-220 | G | D | S | Tube |
| 12N70KL-TF1-T | 12N70KG-TF1-T | TO-220F1 | G | D | S | Tube |
| 12N70KL-TF3-T | 12N70KG-TF3-T | TO-220F2 | G | D | S | Tube |
| 12N70KL-TF3-T | 12N70KG-TF3-T | TO-220F | G | D | S | Tube |
| 12N70KL-TM3-R | 12N70KG-TM3-R | TO-251 | G | D | S | Tape Reel |
| 12N70KL-TN3-R | 12N70KG-TN3-R | TO-252 | G | D | S | Tape Reel |

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

| | |
|--|--|
| <p>12N50KL-TA3-T</p> <p>(1)Packing Type</p> <p>(2)Package Type</p> <p>(3)Green Package</p> | <p>(1) T: Tube, R: Tape Reel</p> <p>(2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TM3: TO-251, TN3: TO-252</p> <p>(3) L: Lead Free, G: Halogen Free and Lead Free</p> |
|--|--|

■ MARKING



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

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|------------------------------------|------------------------|-----------|------------|------------------|
| Drain-Source Voltage | | V_{DSS} | 700 | V |
| Gate-Source Voltage | | V_{GSS} | ± 30 | V |
| Drain Current | Continuous | I_D | 12 | A |
| | Pulsed (Note 2) | I_{DM} | 48 | A |
| Avalanche Energy | Single Pulsed (Note 3) | E_{AS} | 220 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | | dv/dt | 2.55 | V/ns |
| Power Dissipation | TO-220 | P_D | 225 | W |
| | TO-220F/ TO-220F1 | | 52 | W |
| | TO-220F2 | | 55 | W |
| | TO-251/TO-252 | | 50 | W |
| Junction Temperature | | T_J | +150 | $^\circ\text{C}$ |
| Operating Temperature | | T_{OPR} | -55 ~ +150 | $^\circ\text{C}$ |
| Storage Temperature | | 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. $L=3\text{mH}$, $I_{AS}=12\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\Omega$, Starting $T_J=25^\circ\text{C}$

4. $I_{SD} \leq 12\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J=25^\circ\text{C}$

■ THERMAL DATA

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---------------------|-------------------|---------------|---------|---------------------------|
| Junction to Ambient | TO-220/TO-220F | θ_{JA} | 62.5 | $^\circ\text{C}/\text{W}$ |
| | TO-220F1/TO-220F2 | | | |
| | TO-251/TO-252 | | | |
| Junction to Case | TO-220 | θ_{JC} | 0.56 | $^\circ\text{C}/\text{W}$ |
| | TO-220F/ TO-220F1 | | 2.4 | $^\circ\text{C}/\text{W}$ |
| | TO-220F2 | | 2.27 | $^\circ\text{C}/\text{W}$ |
| | TO-251/TO-252 | | 2.5 | $^\circ\text{C}/\text{W}$ |

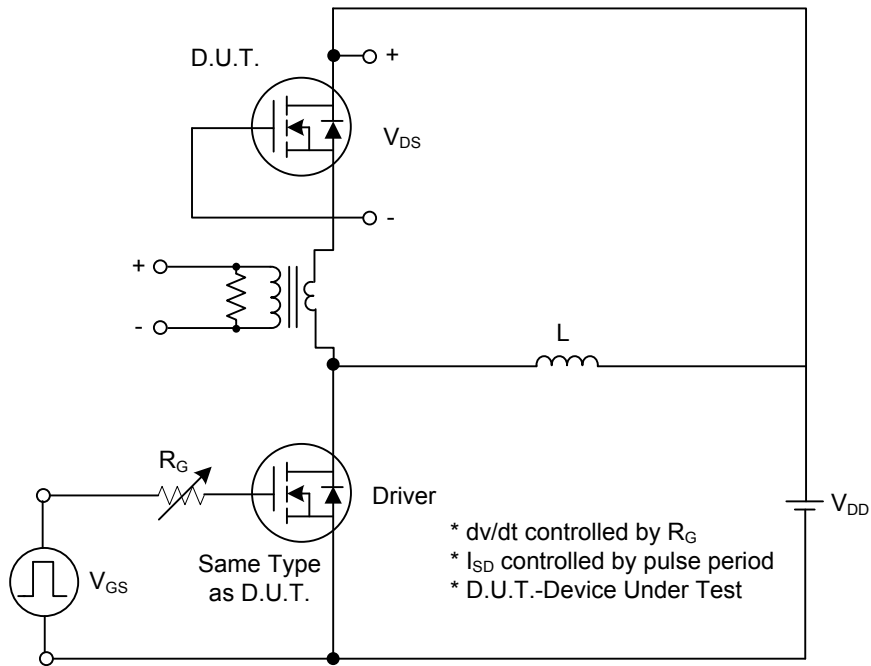
■ ELECTRICAL CHARACTERISTICS (T_C=25°C, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--|-------------------------------------|---|-----|------|------|------|
| OFF CHARACTERISTICS | | | | | | |
| Drain-Source Breakdown Voltage | BV _{DSS} | V _{GS} = 0 V, I _D = 250 μA | 700 | | | V |
| Drain-Source Leakage Current | I _{DSS} | V _{DS} = 700 V, V _{GS} = 0 V | | | 10 | μA |
| Gate-Source Leakage Current | I _{GSS} | V _{GS} = ±30 V, V _{DS} = 0 V | | | ±100 | nA |
| Breakdown Voltage Temperature Coefficient | ΔBV _{DSS} /ΔT _J | I _D = 250 μA, Referenced to 25°C | | 0.7 | | V/°C |
| ON CHARACTERISTICS | | | | | | |
| Gate Threshold Voltage | V _{GS(TH)} | V _{DS} = V _{GS} , I _D = 250 μA | 2.0 | | 4.0 | V |
| Static Drain-Source On-State Resistance | R _{DS(ON)} | V _{GS} = 10V, I _D = 6.0A | | 0.70 | 0.83 | Ω |
| DYNAMIC CHARACTERISTICS | | | | | | |
| Input Capacitance | C _{ISS} | V _{DS} = 25 V, V _{GS} = 0 V, f = 1MHz | | 1600 | 1900 | pF |
| Output Capacitance | C _{OSS} | | | 160 | 270 | pF |
| Reverse Transfer Capacitance | C _{RSS} | | | 9 | 18 | pF |
| SWITCHING CHARACTERISTICS | | | | | | |
| Total Gate Charge | Q _G | V _{DS} =50V, V _{GS} =1.0V, I _D =1.3A (Note 1, 2) | | 44 | 60 | nC |
| Gate-Source Charge | Q _{GS} | | | 10 | | nC |
| Gate-Drain Charge | Q _{GD} | | | 17 | | nC |
| Turn-On Delay Time | t _{D(ON)} | V _{DD} = 30V, I _D = 0.5A, R _G = 25Ω (Note 1, 2) | | 96 | 120 | ns |
| Turn-On Rise Time | t _R | | | 122 | 135 | ns |
| Turn-Off Delay Time | t _{D(OFF)} | | | 184 | 200 | ns |
| Turn-Off Fall Time | t _F | | | 102 | 135 | ns |
| SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS | | | | | | |
| Maximum Continuous Drain-Source Diode Forward Current | I _S | | | | 12 | A |
| Maximum Pulsed Drain-Source Diode Forward Current | I _{SM} | | | | 48 | A |
| Drain-Source Diode Forward Voltage | V _{SD} | V _{GS} = 0 V, I _S = 12A | | | 1.4 | V |
| Reverse Recovery Time | t _{rr} | I _S = 12A, V _{GS} = 0V di/dt = 200A/μs (Note 1) | | 534 | | ns |
| Reverse Recovery Charge | Q _{RR} | | | | 5.7 | |

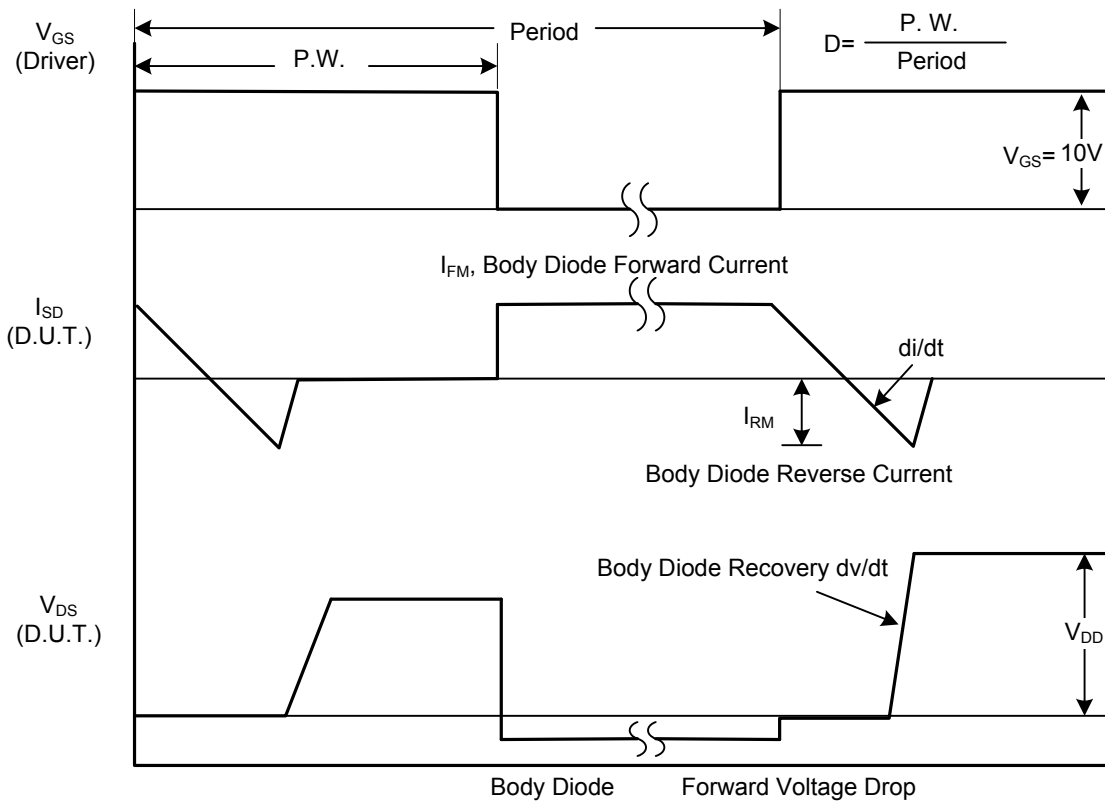
Notes: 1. Pulse Test: Pulse width ≤ 300 μs, Duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

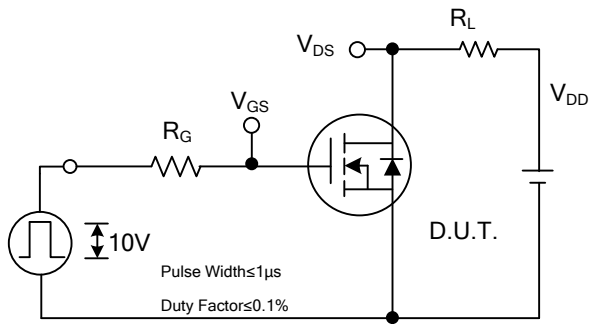


Peak Diode Recovery dv/dt Test Circuit

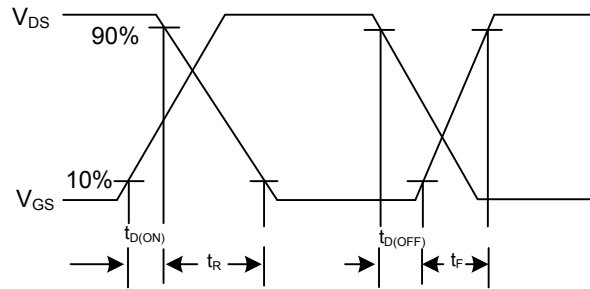


Peak Diode Recovery dv/dt Waveforms

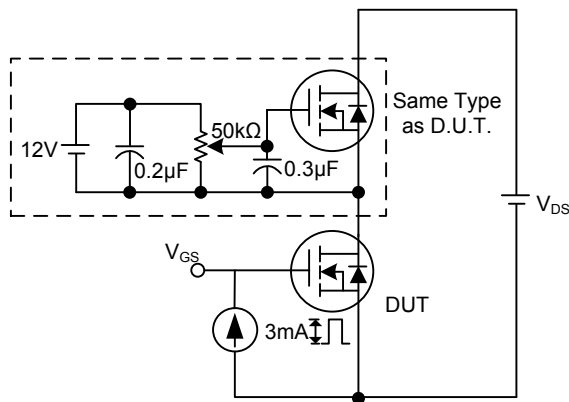
TEST CIRCUITS AND WAVEFORMS (Cont.)



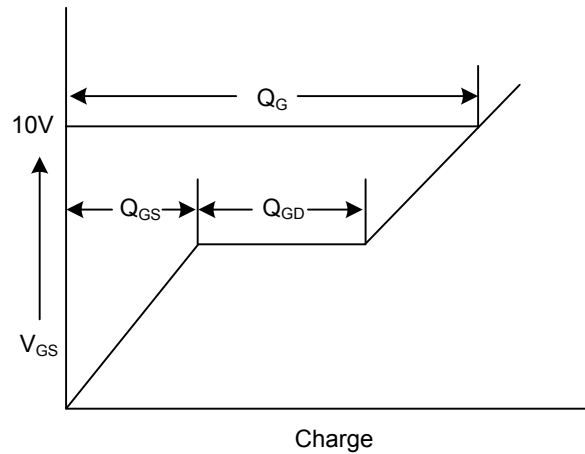
Switching Test Circuit



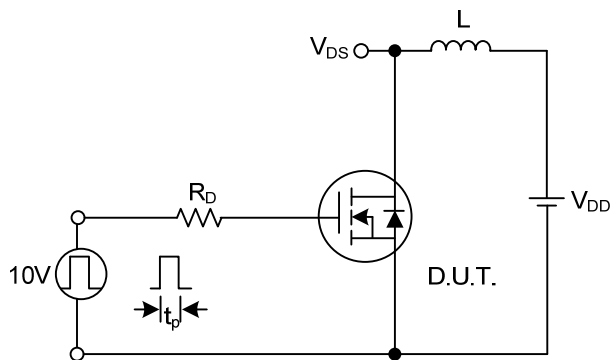
Switching Waveforms



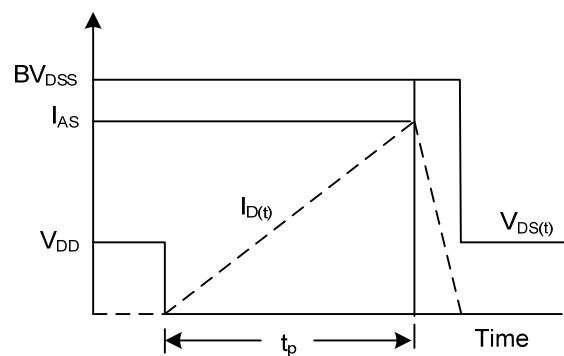
Gate Charge Test Circuit



Gate Charge Waveform

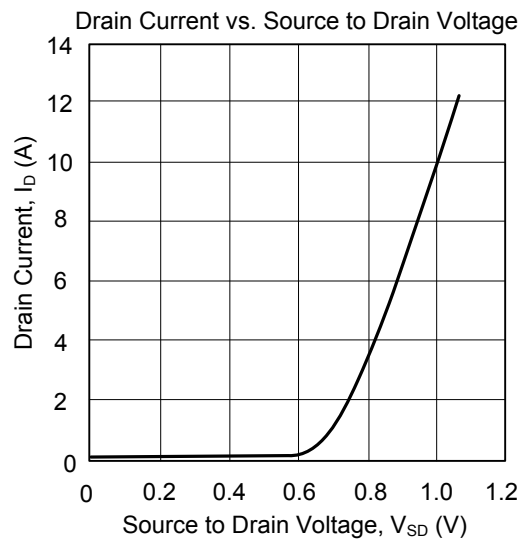
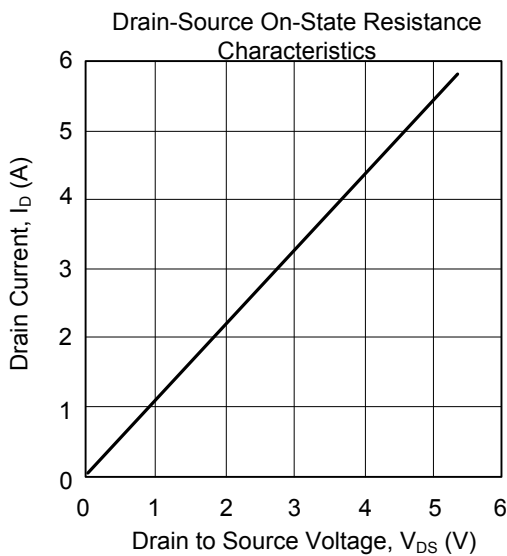
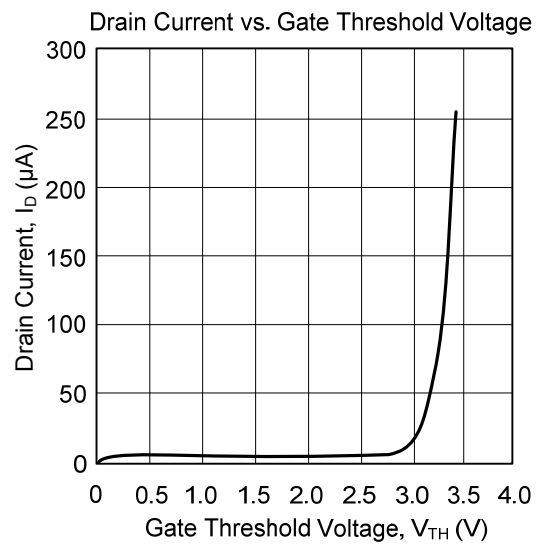
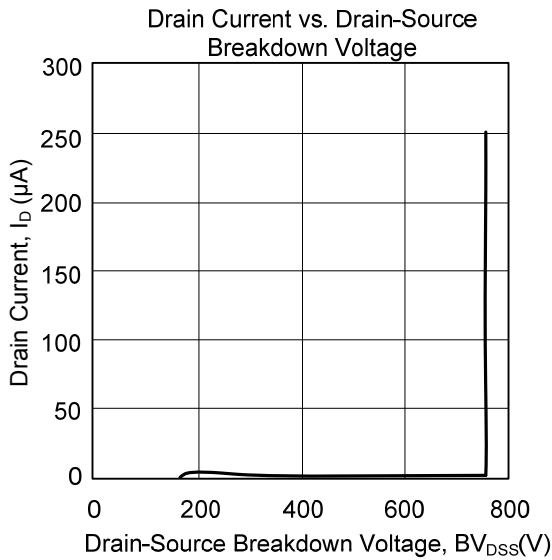


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS



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