



2NM70-Q

Preliminary

Power MOSFET

2A, 700V N-CHANNEL SUPER-JUNCTION MOSFET

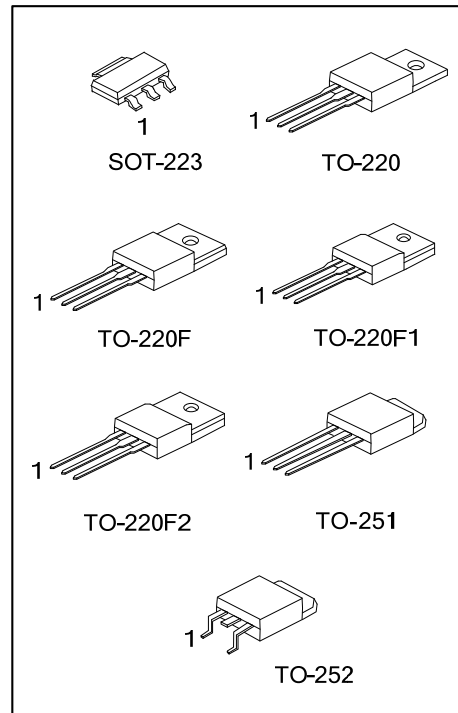
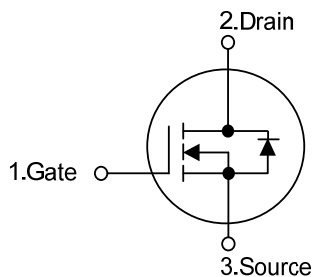
■ DESCRIPTION

The **UTC 2NM70-Q** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at DC-DC, AC-DC converters for power applications.

■ FEATURES

- * $R_{DS(ON)} < 3.3\Omega @ V_{GS} = 10V, I_D = 1.0A$
- * Fast switching capability
- * Avalanche energy specified
- * Improved dv/dt capability, high ruggedness

■ SYMBOL



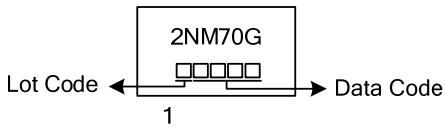
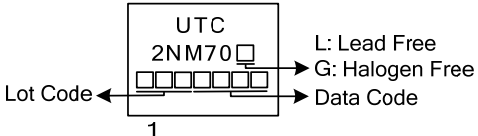
■ ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|-----------------|--------------|----------|----------------|---|---|-----------|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| - | 2NM70G-AA3-R | SOT-223 | G | D | S | Tape Reel |
| 2NM70L-TA3-T | 2NM70G-TA3-T | TO-220 | G | D | S | Tube |
| 2NM70L-TF1-T | 2NM70G-TF1-T | TO-220F1 | G | D | S | Tube |
| 2NM70L-TF2-T | 2NM70G-TF2-T | TO-220F2 | G | D | S | Tube |
| 2NM70L-TF3-T | 2NM70G-TF3-T | TO-220F | G | D | S | Tube |
| 2NM70L-TM3-R | 2NM70G-TM3-R | TO-251 | G | D | S | Tape Reel |
| 2NM70L-TN3-R | 2NM70G-TN3-R | TO-252 | G | D | S | Tape Reel |

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

| | |
|--|--|
| <p>2NM70G-AA3-R</p> <p>(1) Packing Type (2) Package Type (3) Green Package</p> | <p>(1) T: Tube, R: Tape Reel (2) AA3: SOT-223, TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TM3: TO-251, TN3: TO-252 (3) L: Lead Free, G: Halogen Free and Lead Free</p> |
|--|--|

■ MARKING

| SOT-223 | TO-220 / TO-220F / TO-220F1 TO-220F2 / TO-251 / TO-252 |
|---|---|
|  <p>Diagram of SOT-223 marking: A rectangular package with '2NM70G' printed at the top. Below it is a row of five small squares. An arrow labeled 'Lot Code' points left from the first square, and an arrow labeled 'Data Code' points right from the last square. A '1' is printed below the row of squares.</p> |  <p>Diagram of TO-220 marking: A rectangular package with 'UTC' and '2NM70' printed at the top. Below it is a row of five small squares. An arrow labeled 'Lot Code' points left from the first square, and an arrow labeled 'Data Code' points right from the last square. A '1' is printed below the row of squares. To the right of the package, a legend indicates: 'L: Lead Free' and 'G: Halogen Free'.</p> |

■ 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 | 2.0 | A |
| | Pulsed (Note 2) | I_{DM} | 8.0 | A |
| Avalanche Current (Note 2) | | I_{AR} | 1.0 | A |
| Avalanche Energy | Single Pulsed (Note 3) | E_{AS} | 69 | mJ |
| Peak Diode Recovery dv/dt (Note 4) | | dv/dt | 4.7 | V/ns |
| Power Dissipation | SOT-223 | P_D | 10 | W |
| | TO-220 | | 45 | W |
| | TO-220F/TO-220F1 | | 28 | W |
| | TO-220F2 | | 40 | W |
| | TO-251/TO-252 | | 30 | 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 T_J .
 3. $L=138\text{mH}$, $I_{AS}=1.0\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\ \Omega$, Starting $T_J = 25^\circ\text{C}$
 4. $I_{SD}\leq 2.0\text{A}$, $di/dt\leq 200\text{A}/\mu\text{s}$, $V_{DD}\leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---------------------|-------------------|---------------|---------|---------------------------|
| Junction to Ambient | SOT-223 | θ_{JA} | 150 | $^\circ\text{C}/\text{W}$ |
| | TO-220/TO-220F | | 62.5 | $^\circ\text{C}/\text{W}$ |
| | TO-220F1/TO-220F2 | | | |
| | TO-251/TO-252 | | 110 | $^\circ\text{C}/\text{W}$ |
| Junction to Case | SOT-223 | θ_{JC} | 12.5 | $^\circ\text{C}/\text{W}$ |
| | TO-220 | | 2.76 | $^\circ\text{C}/\text{W}$ |
| | TO-220F/TO-220F1 | | 4.46 | $^\circ\text{C}/\text{W}$ |
| | TO-220F2 | | 3.13 | $^\circ\text{C}/\text{W}$ |
| | TO-251/TO-252 | | 4.17 | $^\circ\text{C}/\text{W}$ |

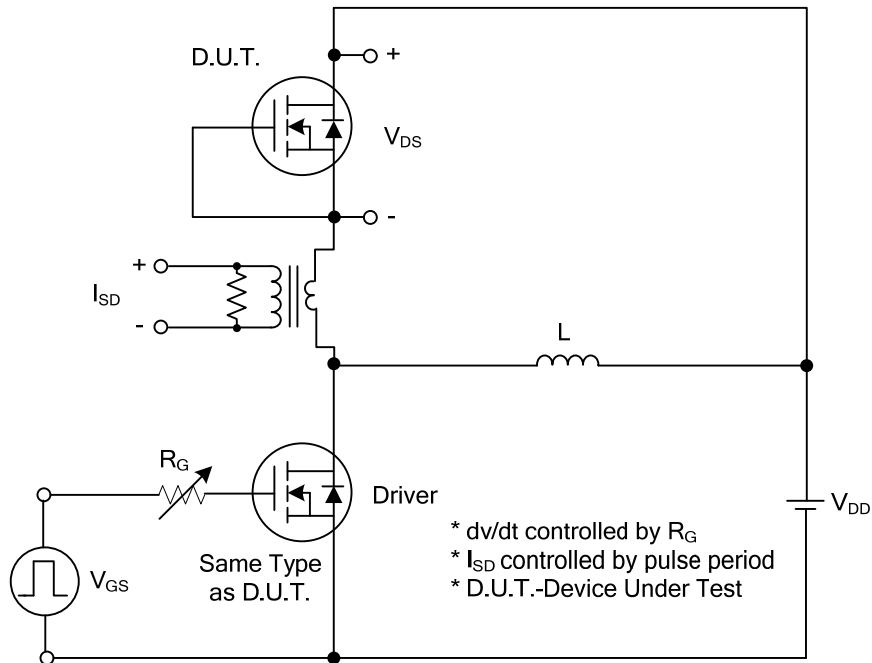
■ ELECTRICAL CHARACTERISTICS ($T_J=25^\circ\text{C}$, unless otherwise specified)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|--------------|---|-----|------|------|----------|
| OFF CHARACTERISTICS | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS} = 0V, I_D = 250\mu A$ | 700 | | | V |
| Drain-Source Leakage Current | I_{DSS} | $V_{DS} = 700V, V_{GS} = 0V$ | | | 10 | μA |
| Gate-Source Leakage Current | Forward | I_{GSS} | | | 100 | nA |
| | Reverse | | | | -100 | nA |
| ON CHARACTERISTICS | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{DS} = V_{GS}, I_D = 250\mu A$ | 2.5 | | 4.5 | V |
| Static Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS} = 10V, I_D = 1.0A$ | | | 3.3 | Ω |
| DYNAMIC CHARACTERISTICS | | | | | | |
| Input Capacitance | C_{ISS} | $V_{DS} = 25V, V_{GS} = 0V, f = 1MHz$ | | 125 | | pF |
| Output Capacitance | C_{OSS} | | | 85 | | pF |
| Reverse Transfer Capacitance | C_{RSS} | | | 10 | | pF |
| SWITCHING CHARACTERISTICS | | | | | | |
| Total Gate Charge | Q_G | $V_{DS} = 50V, V_{GS} = 10V, I_D = 1.3A$ $I_G = 100\mu A$ (Note 1, 2) | | 23 | | nC |
| Gate-Source Charge | Q_{GS} | | | 2.5 | | nC |
| Gate-Drain Charge | Q_{GD} | | | 6 | | nC |
| Turn-On Delay Time | $t_{D(ON)}$ | $V_{DD} = 30V, V_{GS} = 10V, I_D = 0.5A,$ $R_G = 25\Omega$ (Note 1, 2) | | 35 | | ns |
| Turn-On Rise Time | t_R | | | 24 | | ns |
| Turn-Off Delay Time | $t_{D(OFF)}$ | | | 73 | | ns |
| Turn-Off Fall Time | t_F | | | 53 | | ns |
| DRAIN-SOURCE DIODE CHARACTERISTICS | | | | | | |
| Continuous Drain-Source Current | I_S | | | | 2.0 | A |
| Maximum Pulsed Drain-Source Diode Forward Current | I_{SM} | | | | 8.0 | A |
| Drain-Source Diode Forward Voltage | V_{SD} | $I_S = 2.0A, V_{GS} = 0V$ | | | 1.4 | V |
| Body Diode Reverse Recovery Time | t_{RR} | $I_S = 2.0A, V_{GS} = 0V$ $dI/dt = 100A/\mu s$ | | 240 | | nS |
| Body Diode Reverse Recovery Charge | Q_{RR} | | | 1.15 | | μC |

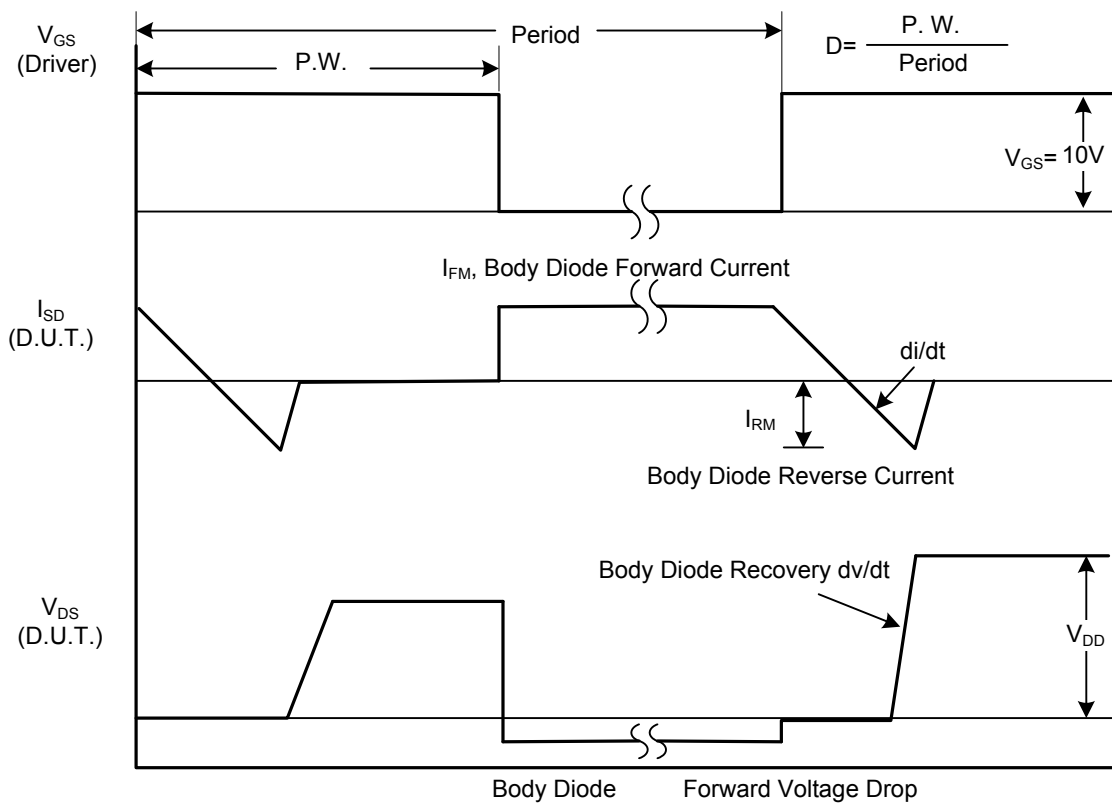
Notes: 1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

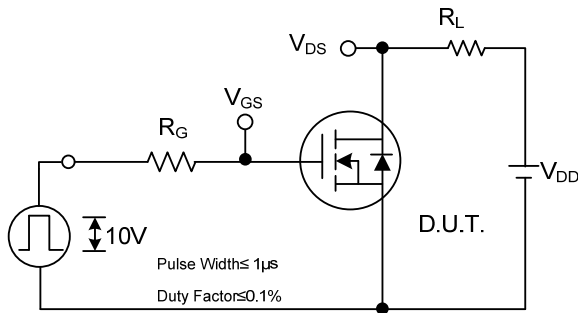


Peak Diode Recovery dv/dt Test Circuit

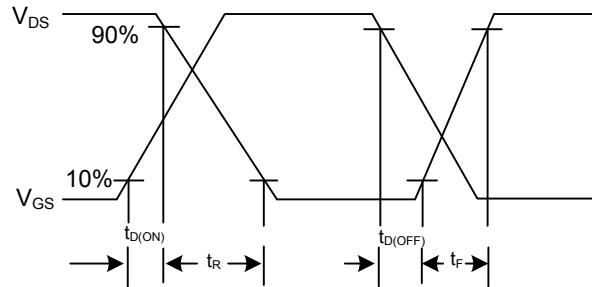


Peak Diode Recovery dv/dt Waveforms

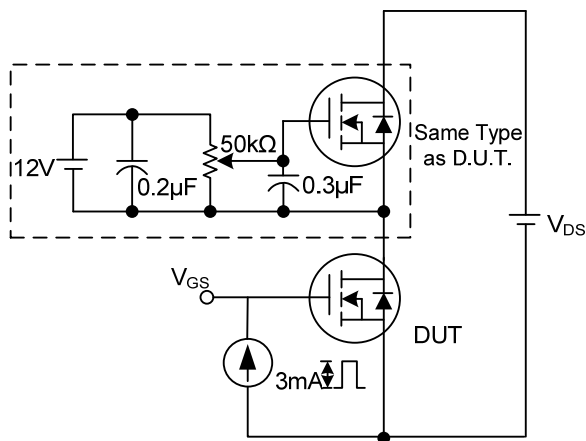
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



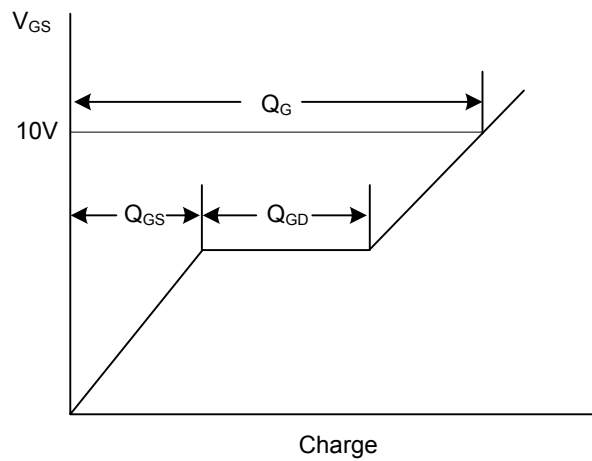
Switching Test Circuit



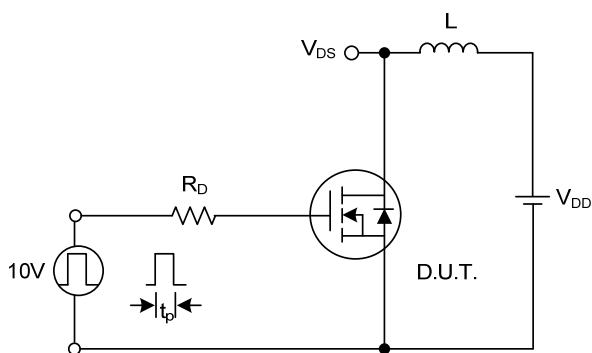
Switching Waveforms



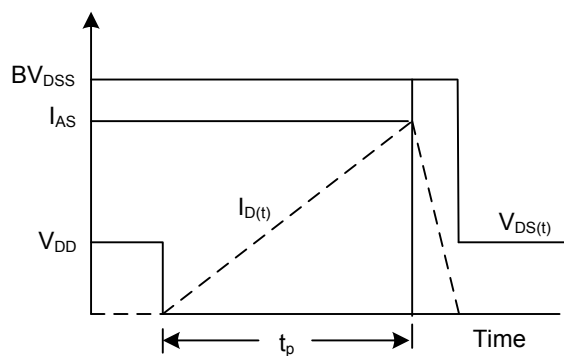
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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