

UNISONIC TECHNOLOGIES CO., LTD

# 3N50-CBQ

Preliminary

# 3.0A, 500V N-CHANNEL POWER MOSFET

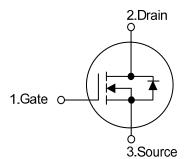
# DESCRIPTION

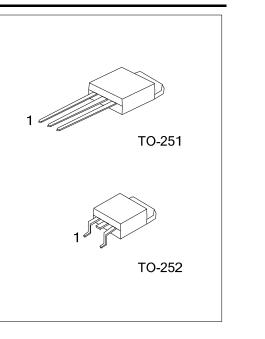
The UTC **3N50-CBQ** is a high voltage and high current power MOSFET, designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

# FEATURES

- \*  $R_{DS(ON)}$  < 3.5 $\Omega$  @  $V_{GS}$  = 10 V,  $I_D$  = 1.5A
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

#### SYMBOL





#### ORDERING INFORMATION

| Ordering   | Deekage  | Pin Assignment    |         |     | Decking |                     |
|--|--|-------------------|---------|-----|---------|---------------------|
| Lead Free  | Halogen Free                                     | Package           | 1       | 2   |         | Packing             |
| 3N50L-TM3-T                                      | 3N50G-TM3-T                                      | TO-251            | G       | D   | S       | Tube                |
| 3N50L-TN3-R                                      | 3N50G-TN3-R                                      | TO-252            | G       | D   | S       | Tape Reel           |
| Note: Pin Assignment: G: G                       | ate D: Drain S: Source                           | 9                 |         |     |         |                     |
| 3N50L- <u>TN3</u> -T                             | - (1)Packing Type                                | (1) T: Tube, R: 1 | Tape Re | el  |         |                     |
|  | (2) TM3: TO-251, TN3: TO-252                     |                   |         |     |         |                     |
|  | (3) L: Lead Free, G: Halogen Free and Lead Free  |                   |         |     |         |                     |
|  | L: Lead Free<br>▶ G: Halogen Free<br>▶ Data Code | B BAIRS A         | 68      | .co |         |                     |
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### Preliminary

#### ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub>=25°C, unless otherwise specified)

| PARAMETER                          |                        | SYMBOL           | RATINGS    | UNIT |  |
|------------------------------------|------------------------|------------------|------------|------|--|
| Drain-Source Voltage               |                        | V <sub>DSS</sub> | 500        | V    |  |
| Gate-Source Voltage                |                        | V <sub>GSS</sub> | ss ±30     |      |  |
| Drain Current                      | Continuous             | ID               | 3.0        | А    |  |
|                                    | Pulsed (Note 2)        | I <sub>DM</sub>  | 12         | А    |  |
| Avalanche Energy                   | Single Pulsed (Note 3) | E <sub>AS</sub>  | 26.45      | mJ   |  |
| Peak Diode Recovery dv/dt (Note 4) |                        | dv/dt            | 4.1        | V/ns |  |
| Power Dissipation                  |                        | PD               | 50         | W    |  |
| Junction Temperature               |                        | TJ               | +150       | °C   |  |
| Storage Temperature                |                        | T <sub>STG</sub> | -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=10mH,  $I_{AS}$ =2.3A,  $V_{DD}$ =50V,  $R_G$ =25  $\Omega$ , Starting  $T_J$  = 25°C.

4. I<sub>SD</sub>≤3.0A, di/dt≤200A/µs, V<sub>DD</sub>≤BV<sub>DSS</sub>, Starting T<sub>J</sub>=25°C.

#### THERMAL DATA

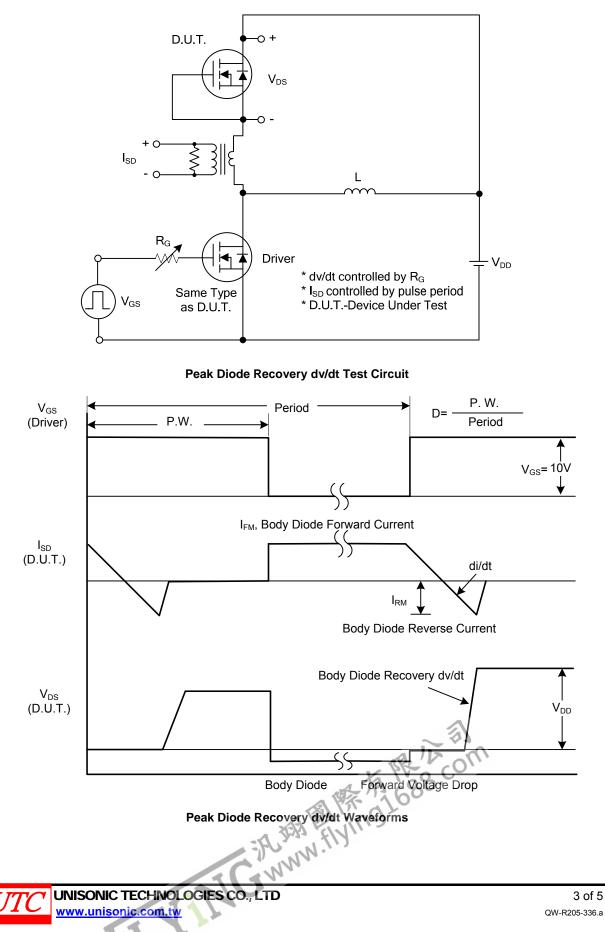
| PARAMETER           | SYMBOL            | RATINGS | UNIT |  |
|---------------------|-------------------|---------|------|--|
| Junction to Ambient | $\theta_{JA}$     | 110     | °C/W |  |
| Junction to Case    | $\theta_{\rm JC}$ | 2.5     | °C/W |  |

#### ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C, unless otherwise specified)

| <u>.</u>                                    |            |                     |   |          | -    | -    |      |
|---|------------|---------------------|---|----------|------|------|------|
| PARAMETER                                   |            | SYMBOL              | TEST CONDITIONS   | MIN      | TYP  | MAX  | UNIT |
| OFF CHARACTERISTICS                         |            |                     |   |          |      |      |      |
| Drain-Source Breakdown Voltage              |            | BV <sub>DSS</sub>   | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 µA  | 500      |      |      | V    |
| Drain-Source Leakage Current                |            | I <sub>DSS</sub>    | V <sub>DS</sub> = 500 V, V <sub>GS</sub> = 0 V  |          |      | 10   | μA   |
| Gate-Source Leakage Current                 | Forward    |                     | V <sub>GS</sub> = 30 V, V <sub>DS</sub> = 0 V   |          |      | 100  | nA   |
|   | Reverse    | I <sub>GSS</sub>    | V <sub>GS</sub> = -30 V, V <sub>DS</sub> = 0 V  |          |      | -100 | nA   |
| ON CHARACTERISTICS                          |            |                     |   |          |      |      | ÷    |
| Gate Threshold Voltage                      |            | V <sub>GS(TH)</sub> | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA   | 2.0      |      | 4.0  | V    |
| Static Drain-Source On-State Resistance     |            | R <sub>DS(ON)</sub> | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 1.5A   |          |      | 3.5  | Ω    |
| DYNAMIC CHARACTERISTICS                     |            |                     |   |          |      |      |      |
| nput Capacitance                            |            | CISS                |   |          | 249  |      | pF   |
| Output Capacitance                          |            | Coss                | V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V,<br>f = 1MHz  |          | 33   |      | pF   |
| Reverse Transfer Capacitance                |            | C <sub>RSS</sub>    | 1 - 1101112   |          | 6    |      | pF   |
| SWITCHING CHARACTERISTIC                    | s          |                     |   |          |      |      |      |
| Total Gate Charge (Note 1)                  |            | $Q_{G}$             |   |          | 9.9  |      | nC   |
| Gate to Source Charge                       |            | $Q_{GS}$            | V <sub>DS</sub> =50V, V <sub>GS</sub> =10V, I <sub>D</sub> =1.3A ,<br>I <sub>G</sub> =100μA (Note 1, 2) |          | 1.5  |      | nC   |
| Gate to Drain Charge                        |            | $Q_{GD}$            |   |          | 2.4  |      | nC   |
| Turn-ON Delay Time (Note 1)                 |            | t <sub>D(ON)</sub>  |   |          | 38   |      | ns   |
| Rise Time                                   |            | t <sub>R</sub>      | V <sub>DD</sub> =30V, V <sub>GS</sub> =10V, I <sub>D</sub> =0.5A,<br>R <sub>G</sub> =25Ω (Note 1, 2)    |          | 40   |      | ns   |
| Turn-OFF Delay Time                         |            | t <sub>D(OFF)</sub> |   |          | 186  |      | ns   |
| Fall-Time                                   |            | t <sub>F</sub>      |   |          | 54   |      | ns   |
| SOURCE- DRAIN DIODE RATIN                   | IGS AND CH | ARACTERI            | STICS   |          |      |      |      |
| Maximum Body-Diode Continuous Current       |            | I <sub>S</sub>      |   | 0        |      | 3.0  | Α    |
| Maximum Body-Diode Pulsed Current           |            | I <sub>SM</sub>     | The COL   | <i>p</i> |      | 12   | Α    |
| Drain-Source Diode Forward Voltage (Note 1) |            | $V_{SD}$            | $V_{GS} = 0 V, I_S = 3.0 A$   |          |      | 1.4  | V    |
| Body Diode Reverse Recovery Time (Note 1)   |            | t <sub>rr</sub>     | V <sub>GS</sub> =0V, 1 <sub>S</sub> =3.0A   |          | 170  |      | ns   |
| Body Diode Reverse Recovery Charge          |            | Qrr                 | dl <sub>F</sub> /dt=100A/µs   |          | 0.64 |      | μC   |
| Notes: 1 Pulse Test: Pulse width            |            | v cvcle < 2%        | 3 - 21/11   |          |      |      |      |

Notes: 1. Pulse Test: Pulse width  $\leq$  300µs, Duty cycle $\leq$ 2% 2. Essentially independent of operating temperature

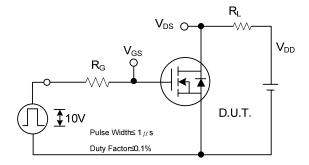
### TEST CIRCUITS AND WAVEFORMS

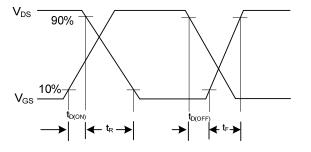


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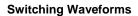
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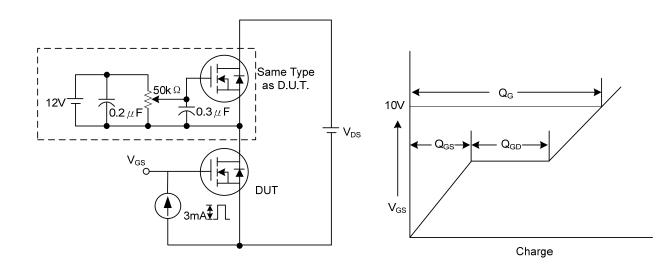
# **TEST CIRCUITS AND WAVEFORMS (Cont.)**





**Switching Test Circuit** 

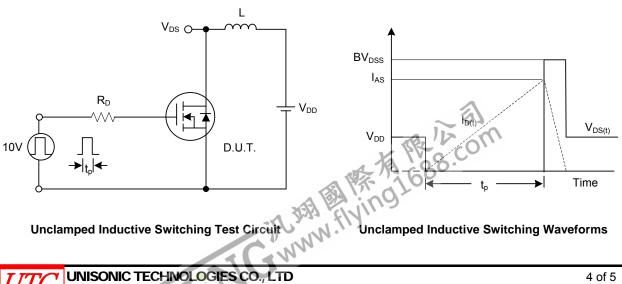




**Gate Charge Test Circuit** 

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**Gate Charge Waveform** 



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