

3NM50

# **UTC** UNISONIC TECHNOLOGIES CO., LTD

# Preliminary

# 3.0A, 500V N-CHANNEL SUPER-JUNCTION MOSFET

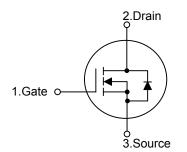
### DESCRIPTION

The UTC 3NM50 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**

- \*  $R_{DS(ON)}$  < 1.8 $\Omega$  @  $V_{GS}$ =10V,  $I_D$ =1.5A
- \* High Switching Speed
- \* 100% Avalanche Tested

### **SYMBOL**

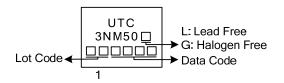


# TO-252

### ORDERING INFORMATION

| Ordering                  | Daakaga  | Pin  | Assignm | nent | Dooking   |   |
|---------------------------|--|--|---------|------|-----------|---|
| Lead Free                 | Package  | 1  | 2       | 3    | Packing   |   |
| 3NM50L-TN3-R              | TO-252   | G  | D       | S    | Tape Reel |   |
| ote: Pin Assignment: G: C | Gate D: Drain S: Sourc                                       | e  |         |      |           |   |
| 3NM50L- <u>TN3</u> -R     | <ul> <li>(1)Packing Type</li> <li>(2)Package Type</li> </ul> | (1) R: Tape Red<br>(2) TN3: TO-25              |         |      |           |   |
|                           | - (3)Green Package   | (3) L: Lead Free, G: Halogen Free and Lead Fre |         |      | ead Free  |   |
|                           | TCW  | AT BELLAN                                      | 168     | 2.co | m         |   |
| ww.unisonic.com.tw        |  |  |         |      |           | 1 |

## MARKING





### ■ ABSOLUTE MAXIMUM RATINGS (Tc=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> | ±30        | V    |  |
| Drain Current (T <sub>C</sub> =25°C) | Continuous      | I <sub>D</sub>   | 3.0        | А    |  |
|                                      | Pulsed (Note 2) | I <sub>DM</sub>  | 12         | А    |  |
| Avalanche Current (Note 2)           |                 | I <sub>AR</sub>  | 2.4        | А    |  |
| Avalanche Energy (Note 3)            | Single Pulsed   | E <sub>AS</sub>  | 29         | mJ   |  |
| Peak Diode Recovery dv/dt (Note 4)   |                 | dv/dt            | 5.3        | 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,  $I_{AS}$ =2.4A,  $V_{DD}$ =50V,  $R_G$ =25  $\Omega$ , Starting  $T_J$  = 25°C.

4.  $I_{SD} \leq 3.0A$ , di/dt $\leq 200A/\mu s$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J=25^{\circ}C$ .

### THERMAL DATA

| PARAMETER           | SYMBOL          | RATINGS | UNIT |  |
|---------------------|-----------------|---------|------|--|
| Junction to Ambient | θ <sub>JA</sub> | 110     | °C/W |  |
| Junction to Case    | θ <sub>JC</sub> | 2.5     | °C/W |  |

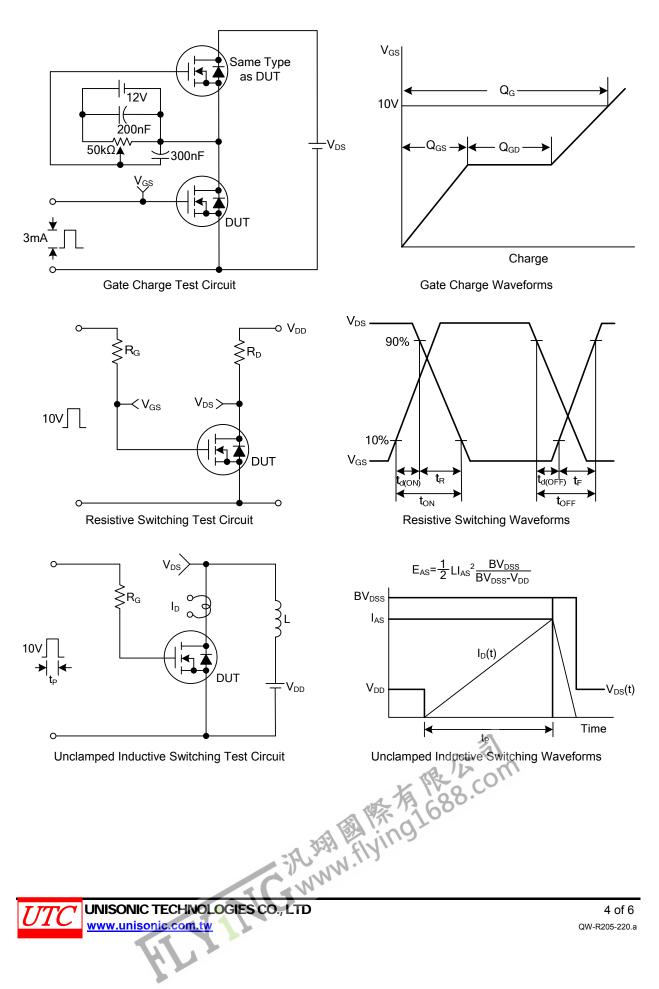
### ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C, unless otherwise noted)

| $\begin{array}{ c c c c c c } \hline Drain-Source Leakage Current & I_{DSS} & V_{DS}=500V, V_{GS}=0V & 10 & \mu \\ \hline \\ \hline \\ \hline \\ Gate-Source Leakage Current & Forward \\ \hline \\ $  | PARAMETER                                   |             | SYMBOL              | TEST CONDITIONS  | MIN | TYP | MAX  | UNIT |
|--|---|-------------|---------------------|--|-----|-----|------|------|
| $\begin{array}{ c c c c c c } \hline Drain-Source Leakage Current & I_{DSS} & V_{DS}=500V, V_{GS}=0V & 10 & \mu \\ \hline Gate- Source Leakage Current & Forward \\ \hline Reverse & I_{GSS} & V_{DS}=0V & +100 & r \\ \hline ON CHARACTERISTICS & & & & & & & & & & & & & & & & & & &$  | OFF CHARACTERISTICS                         |             |                     |  |     |     |      |      |
| $ \begin{array}{ c c c c c c c c c c c c c c c c c c c$  | Drain-Source Breakdown Voltage              |             | BV <sub>DSS</sub>   | I <sub>D</sub> =250μA, V <sub>GS</sub> =0V   | 500 |     |      | V    |
| Gate- Source Leakage Current<br>ReverseIGSS $V_{GS}=-30V, V_{DS}=0V$ -100rON CHARACTERISTICSGate Threshold Voltage $V_{GS}(TH)$ $V_{DS}=V_{GS}, I_D=250\muA$ 2.54.51.8Static Drain-Source On-State Resistance $R_{DS(ON)}$ $V_{GS}=10V, I_D=1.5A$ 1.81.8DYNAMIC PARAMETERSInput Capacitance $C_{ISS}$ $V_{GS}=0V, V_{DS}=25V, I_137$ 1.55pOutput Capacitance $C_{OSS}$ f=1.0MHz2.54.5SwitcHing Parameters $C_{RSS}$ f=250V, $V_{GS}=10V, I_D=1.3A, I_37$ gGate to Source Charge $Q_{GS}$ $Q_{GS}$ 1.6 = 250µA (Note 1, 2)7.5Gate to Drain Charge $Q_{GD}$ $V_{DS}=30V, V_{GS}=10V, I_D$ 37rTurn-ON Delay Time (Note 1) $t_{D(ON)}$ $V_{DD}=30V, V_{GS}=10V, I_D$ 37rRise Time $t_R$ $0.5A, R_G=25\Omega$ (Note 1, 2)44rSOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS313Maximum Body-Diode Continuous Current $I_S$ 31  |   |             | I <sub>DSS</sub>    | V <sub>DS</sub> =500V, V <sub>GS</sub> =0V   |     |     | 10   | μA   |
| InstructionReverse $V_{GS}=.30V$ , $V_{DS}=0V$ $I-100$ rON CHARACTERISTICSGate Threshold Voltage $V_{GS(TH)}$ $V_{DS}=V_{GS}$ , $I_D=250\muA$ 2.54.5Static Drain-Source On-State Resistance $R_{DS(ON)}$ $V_{GS}=10V$ , $I_D=1.5A$ 1.81.8DYNAMIC PARAMETERSInput Capacitance $C_{ISS}$ $V_{GS}=0V$ , $V_{DS}=25V$ ,155pOutput Capacitance $C_{OSS}$ $F=1.0MHz$ 2.54.5Switching Parameters $F=1.0MHz$ 25pSwitching Parameters $Q_{GS}$ $V_{DS}=50V$ , $V_{GS}=10V$ , $I_D=1.3A$ ,35rGate to Source Charge $Q_{GS}$ $Q_{GD}$ $I_G=250\mu A$ (Note 1, 2)7.5rGate to Drain Charge $Q_{GD}$ $V_{DD}=30V$ , $V_{GS}=10V$ , $I_D$ 37rTurn-ON Delay Time (Note 1) $t_{D(ON)}$ $V_{DD}=30V$ , $V_{GS}=10V$ , $I_D$ 37rRise Time $t_R$ $0.5A$ , $82$ rTurn-OFF Delay Time $t_{PC}$ $82$ rFall-Time $t_F$ $R_G=25\Omega$ (Note 1, 2)44rSOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS331Maximum Body-Diode Continuous Current $I_S$ 31 | Gate- Source Leakage Current                | Forward     |                     |  |     |     | +100 | nA   |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $  |   | Reverse     | IGSS                | V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V   |     |     | -100 | nA   |
| Static Drain-Source On-State ResistanceRotitionStatic Drain-Source On-State ResistanceRotitionDYNAMIC PARAMETERSInput Capacitance $C_{ISS}$ $V_{GS}=10V, V_{DS}=25V, \\ f=1.0MHz$ 1.8Output Capacitance $C_{OSS}$ $f=1.0MHz$ 137Reverse Transfer Capacitance $C_{RSS}$ $f=1.0MHz$ 25SWITCHING PARAMETERSTotal Gate Charge (Note 1) $Q_G$ $V_{DS}=50V, V_{GS}=10V, I_D=1.3A, \\ Gate to Source ChargeQ_{GS}Gate to Drain ChargeQ_{GD}I_G = 250 \mu A (Note 1, 2)7.5rTurn-ON Delay Time (Note 1)t_D(ON)V_{DD}=30V, V_{GS}=10V, I_D37rRise Timet_R0.5A, R_G=25\Omega (Note 1, 2)82rFall-Timet_FR_G=25\Omega (Note 1, 2)44rSOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS331$   | ON CHARACTERISTICS                          |             |                     |  |     |     |      |      |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $   | Gate Threshold Voltage                      |             | V <sub>GS(TH)</sub> | $V_{DS}=V_{GS}, I_{D}=250\mu A$  |     |     | 4.5  | V    |
| $\begin{array}{ c c c c c c c c c c c c c c c c c c c$   | Static Drain-Source On-State Resistance     |             | R <sub>DS(ON)</sub> | V <sub>GS</sub> =10V, I <sub>D</sub> =1.5A   |     |     | 1.8  | Ω    |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $   | DYNAMIC PARAMETERS                          |             |                     |  |     |     |      |      |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $   | Input Capacitance                           |             | C <sub>ISS</sub>    |  |     | 155 |      | рF   |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $   | Output Capacitance                          |             |                     |  |     | 137 |      | рF   |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $   | Reverse Transfer Capacitance                |             |                     | 1-1.0MHZ   |     | 25  |      | рF   |
|  | SWITCHING PARAMETERS                        |             |                     |  |     |     |      |      |
|  | Total Gate Charge (Note 1)                  |             | $Q_{G}$             |  |     | 35  |      | nC   |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $  | Gate to Source Charge                       |             | $Q_{GS}$            |  |     | 3   |      | nC   |
| $\begin{array}{c c c c c c c c c c c c c c c c c c c $   | Gate to Drain Charge                        |             |                     | $I_{G} = 250 \mu A (100 e^{-1}, 2)$  |     | 7.5 |      | nC   |
| $\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$   | Turn-ON Delay Time (Note 1)                 |             | t <sub>D(ON)</sub>  |  |     | 37  |      | ns   |
| Turn-OFF Delay Time         t <sub>D(OFF)</sub> R <sub>G</sub> =25Ω (Note 1, 2)         82         r           Fall-Time         t <sub>F</sub> R <sub>G</sub> =25Ω (Note 1, 2)         44         r           SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS         3         3         3   | Rise Time                                   |             |                     |  |     | 37  |      | ns   |
| Fall-Time     t <sub>F</sub> RG=2512 (Note 1, 2)     44     r       SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS       Maximum Body-Diode Continuous Current     Is     3   | Turn-OFF Delay Time                         |             | t <sub>D(OFF)</sub> | ,  |     | 82  |      | ns   |
| Maximum Body-Diode Continuous Current Is 3   | Fall-Time                                   |             |                     | NG-2332 (Note 1, 2)  |     | 44  |      | ns   |
|  | SOURCE- DRAIN DIODE RATII                   | NGS AND CHA | RACTERISTIC         | is in the second s |     |     |      |      |
| Maximum Body-Diode Pulsed Current  | Maximum Body-Diode Continuous Current       |             | ls                  | TRE ON   |     |     | 3    | Α    |
|  | Maximum Body-Diode Pulsed Current           |             | I <sub>SM</sub>     | K WOS  |     |     | 12   | Α    |
| Drain-Source Diode Forward Voltage (Note 1) V <sub>SD</sub> I <sub>S</sub> =3.0A, V <sub>6S</sub> =0V 1.4  | Drain-Source Diode Forward Voltage (Note 1) |             | V <sub>SD</sub>     | Is=3.0A, V <sub>GS</sub> =0V   |     |     | 1.4  | V    |
| Reverse Recovery Time (Note 1) $t_{rr}$ $I_s=3.0A$ , $V_{GS}=0V$ ,210r   | Reverse Recovery Time (Note 1)              |             | trr                 | Is=3.0A, V <sub>GS</sub> =0V,  |     | 210 |      | ns   |
|  | Reverse Recovery Charge                     |             | Qn                  |  |     | 1.2 |      | μC   |

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

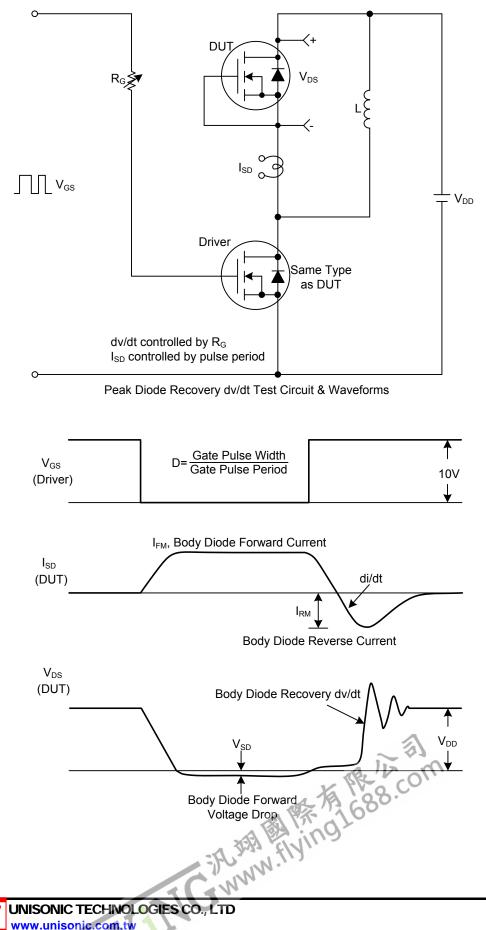
2. Essentially independent of operating temperature.

### TEST CIRCUITS AND WAVEFORMS



# 3NM50

### TEST CIRCUITS AND WAVEFORMS(Cont.)



UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice.

