



## 4N90-FCQ

Preliminary

Power MOSFET

## 4A, 900V N-CHANNEL POWER MOSFET

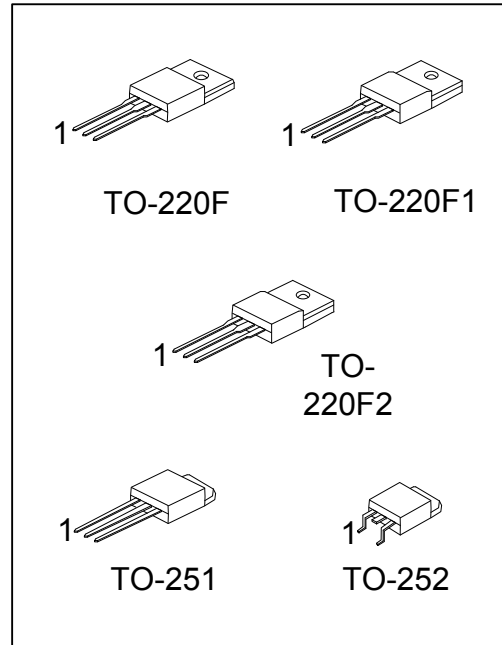
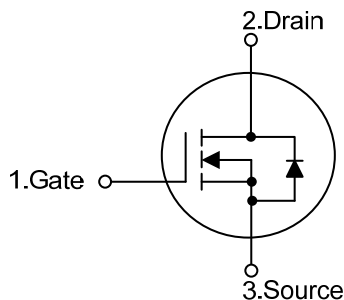
### DESCRIPTION

The UTC 4N90-FCQ provide excellent  $R_{DS(ON)}$ , low gate charge and operation with low gate voltages. This device is suitable for use as a load switch or in PWM applications.

### FEATURES

- \*  $R_{DS(ON)} \leq 5.4 \Omega$  @  $V_{GS}=10V$ ,  $I_D=2.0A$
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

### SYMBOL



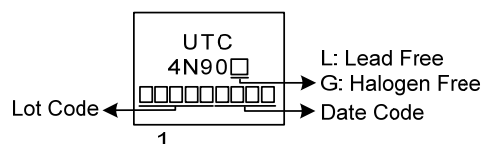
### ORDERING INFORMATION

| Ordering Number |              | Package  | Pin Assignment |   |   | Packing   |
|-----------------|--------------|----------|----------------|---|---|-----------|
| Lead Free       | Halogen Free |          | 1              | 2 | 3 |           |
| 4N90L-TF1-T     | 4N90G-TF1-T  | TO-220F1 | G              | D | S | Tube      |
| 4N90L-TF2-T     | 4N90G-TF2-T  | TO-220F2 | G              | D | S | Tube      |
| 4N90L-TF3-T     | 4N90G-TF3-T  | TO-220F  | G              | D | S | Tube      |
| 4N90L-TM3-T     | 4N90G-TM3-T  | TO-251   | G              | D | S | Tube      |
| 4N90L-TN3-R     | 4N90G-TN3-R  | TO-252   | G              | D | S | Tape Reel |

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

|                                                                                             |                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>4N90G-TF1-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) TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2</p> <p>TM3: TO-251, TN3: TO-252</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p> |
|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### MARKING



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

| PARAMETER                          |                  | SYMBOL    | RATINGS    | UNIT               |
|------------------------------------|------------------|-----------|------------|--------------------|
| Drain-Source Voltage               |                  | $V_{DS}$  | 900        | V                  |
| Gate-Source Voltage                |                  | $V_{GS}$  | $\pm 30$   | V                  |
| Continuous Drain Current           |                  | $I_D$     | 4          | A                  |
| Pulsed Drain Current (Note 2)      |                  | $I_{DM}$  | 8          | A                  |
| Avalanche Energy (Note 3)          | Single Pulsed    | $E_{AS}$  | 92         | mJ                 |
| Peak Diode Recovery dv/dt (Note 4) |                  | dv/dt     | 2.89       | V/ns               |
| Power Dissipation                  | TO-220F/TO-220F1 | $P_D$     | 26         | W                  |
|                                    | TO-220F2         |           |            |                    |
|                                    | TO-251/TO-252    |           | 46         | W                  |
| Junction Temperature               |                  | $T_J$     | +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.  $L=30\text{mH}$ ,  $I_{AS}=2.47\text{A}$ ,  $V_{DD}=100\text{V}$ ,  $R_G=25\ \Omega$ , Starting  $T_J = 25^{\circ}\text{C}$

4.  $I_{SD}\leq 4.0\text{A}$ ,  $di/dt\leq 200\text{A}/\mu\text{s}$ ,  $V_{DD}\leq BV_{DSS}$ , Starting  $T_J = 25^{\circ}\text{C}$

■ **THERMAL DATA**

| PARAMETER           |                  | SYMBOL        | RATING     | UNIT                        |
|---------------------|------------------|---------------|------------|-----------------------------|
| Junction to Ambient | TO-220F/TO-220F1 | $\theta_{JA}$ | 62.5       | $^{\circ}\text{C}/\text{W}$ |
|                     | TO-220F2         |               |            |                             |
|                     | TO-251/TO-252    |               | 110        | $^{\circ}\text{C}/\text{W}$ |
| Junction to Case    | TO-220F/TO-220F1 | $\theta_{JC}$ | 4.81       | $^{\circ}\text{C}/\text{W}$ |
|                     | TO-220F2         |               |            |                             |
|                     | TO-251/TO-252    |               | 2.7 (Note) | $^{\circ}\text{C}/\text{W}$ |

Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

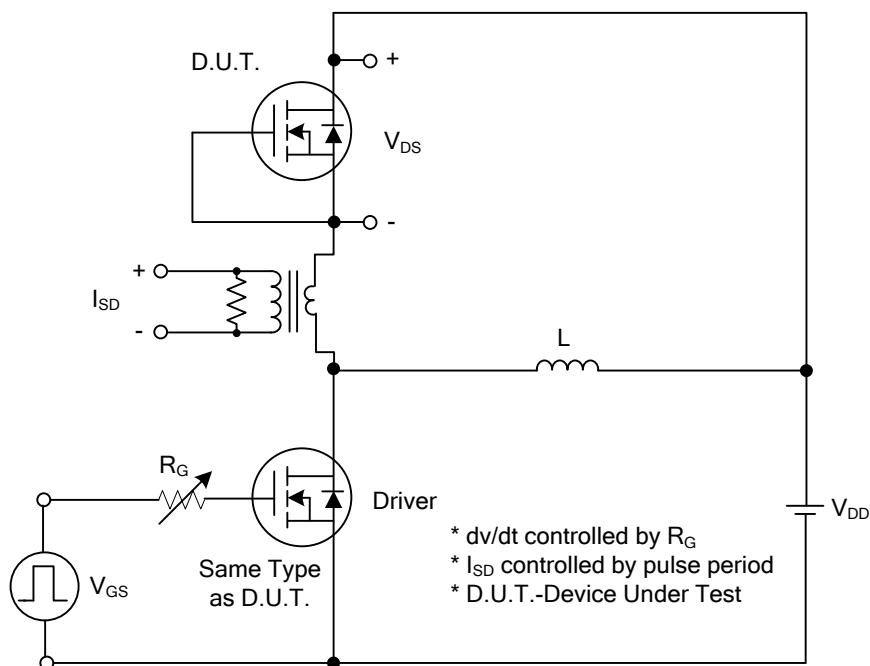
■ **ELECTRICAL CHARACTERISTICS** ( $T_J=25^{\circ}\text{C}$ , unless otherwise specified)

| PARAMETER                               |         | SYMBOL       | TEST CONDITIONS                                             | MIN | TYP  | MAX  | UNIT     |
|-----------------------------------------|---------|--------------|-------------------------------------------------------------|-----|------|------|----------|
| OFF CHARACTERISTICS                     |         |              |                                                             |     |      |      |          |
| Drain-Source Breakdown Voltage          |         | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$                                   | 900 |      |      | V        |
| Drain-Source Leakage Current            |         | $I_{DSS}$    | $V_{DS}=900V, V_{GS}=0V$                                    |     |      | 10   | $\mu A$  |
| Gate-Source Leakage Current             | Forward | $I_{GSS}$    | $V_{GS}=30V, V_{DS}=0V$                                     |     |      | 100  | nA       |
|                                         | Reverse |              | $V_{GS}=-30V, V_{DS}=0V$                                    |     |      | -100 | nA       |
| ON CHARACTERISTICS                      |         |              |                                                             |     |      |      |          |
| Gate Threshold Voltage                  |         | $V_{GS(TH)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$                               | 3.0 |      | 5.0  | V        |
| Static Drain-Source On-State Resistance |         | $R_{DS(ON)}$ | $V_{GS}=10V, I_D=2.0A$                                      |     |      | 5.4  | $\Omega$ |
| DYNAMIC CHARACTERISTICS                 |         |              |                                                             |     |      |      |          |
| Input Capacitance                       |         | $C_{ISS}$    | $V_{DS}=25V, V_{GS}=0V, f=1MHz$                             |     | 516  |      | pF       |
| Output Capacitance                      |         | $C_{OSS}$    |                                                             |     | 52   |      | pF       |
| Reverse Transfer Capacitance            |         | $C_{RSS}$    |                                                             |     | 1.5  |      | pF       |
| SWITCHING CHARACTERISTICS               |         |              |                                                             |     |      |      |          |
| Total Gate Charge                       |         | $Q_G$        | $V_{DS}=720V, V_{GS}=10V, I_D=4A, I_G=1mA$ (Note 1, 2)      |     | 14.4 |      | nC       |
| Gate-Source Charge                      |         | $Q_{GS}$     |                                                             |     | 7.6  |      | nC       |
| Gate-Drain Charge                       |         | $Q_{GD}$     |                                                             |     | 1.6  |      | nC       |
| Turn-On Delay Time                      |         | $t_{D(ON)}$  | $V_{DD}=100V, V_{GS}=10V, I_D=4A, R_G=25\Omega$ (Note 1, 2) |     | 9.6  |      | ns       |
| Turn-On Rise Time                       |         | $t_R$        |                                                             |     | 14.5 |      | ns       |
| Turn-Off Delay Time                     |         | $t_{D(OFF)}$ |                                                             |     | 20   |      | ns       |
| Turn-Off Fall Time                      |         | $t_F$        |                                                             |     | 27   |      | ns       |
| DRAIN-SOURCE DIODE CHARACTERISTICS      |         |              |                                                             |     |      |      |          |
| Maximum Body-Diode Continuous Current   |         | $I_S$        |                                                             |     |      | 4    | A        |
| Continuous Drain-Source Current         |         | $I_{SD}$     |                                                             |     |      | 8    | A        |
| Drain-Source Diode Forward Voltage      |         | $V_{SD}$     | $I_S=4A, V_{GS}=0V$                                         |     |      | 1.4  | V        |
| Reverse Recovery Time                   |         | $t_{rr}$     | $I_F=4A, di/dt=100A/\mu s$                                  |     | 450  |      | ns       |
| Reverse Recovery Charge                 |         | $Q_{rr}$     |                                                             |     | 6.9  |      | $\mu C$  |

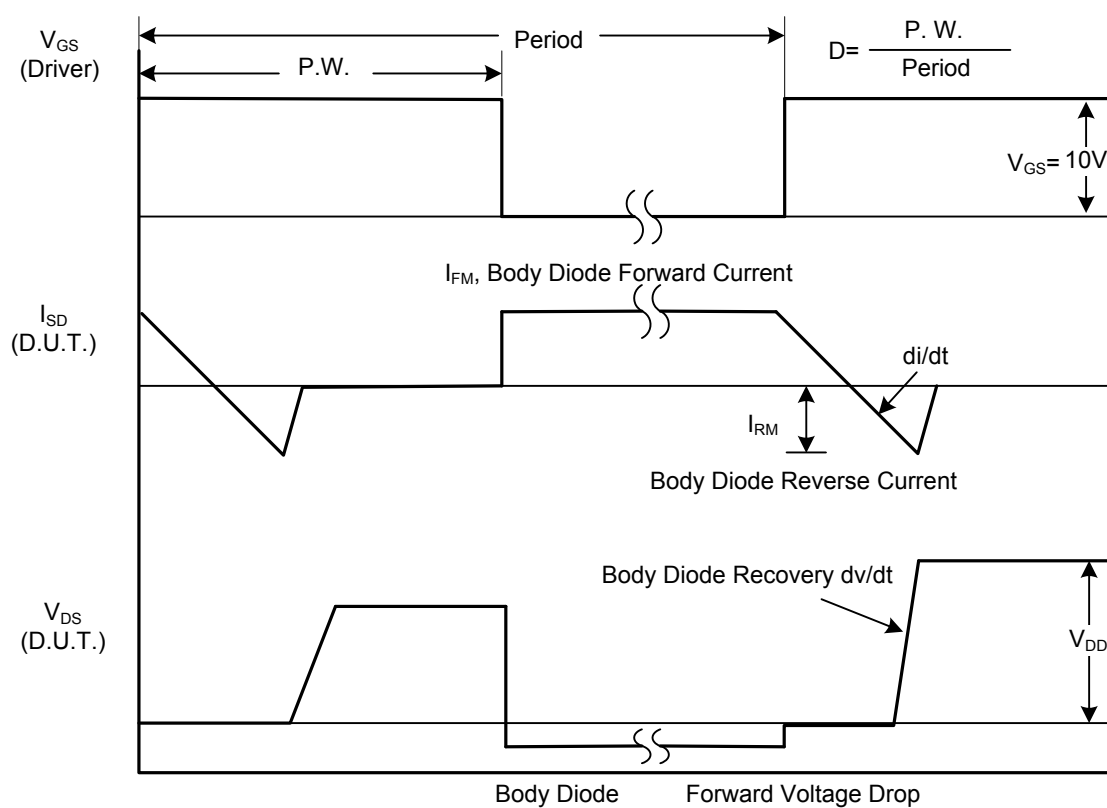
Notes: 1. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$ .

2. Essentially independent of operating temperature.

# ■ TEST CIRCUITS AND WAVEFORMS

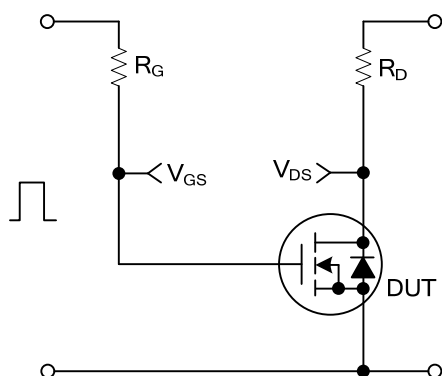


Peak Diode Recovery  $dv/dt$  Test Circuit

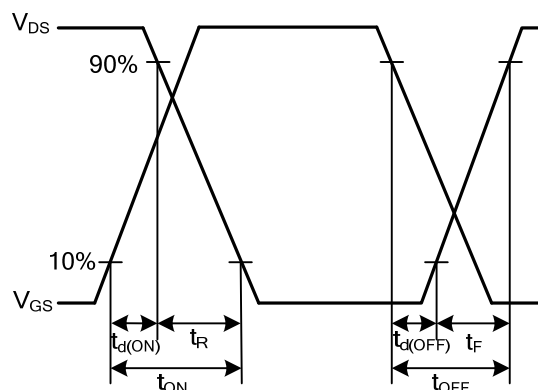


Peak Diode Recovery  $dv/dt$  Waveforms

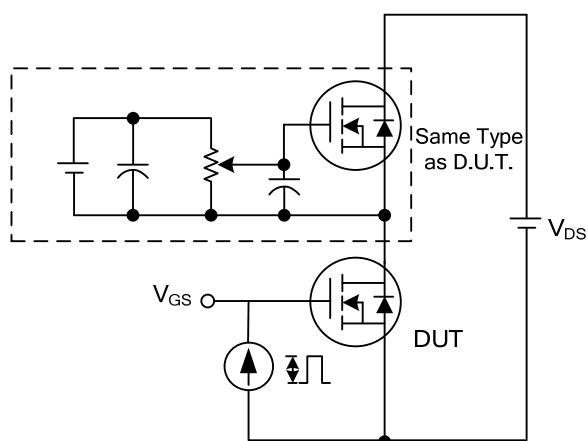
## ■ TEST CIRCUITS AND WAVEFORMS



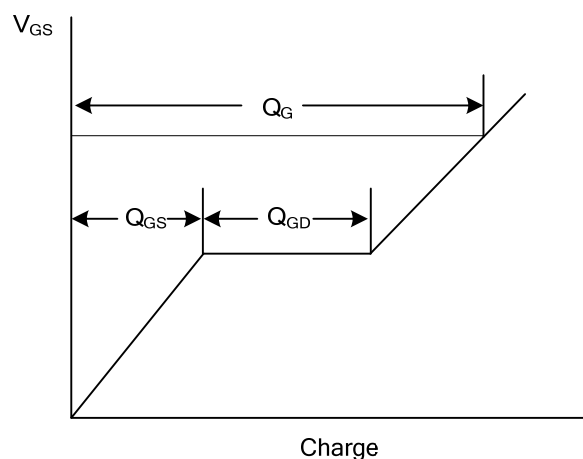
Switching Test Circuit



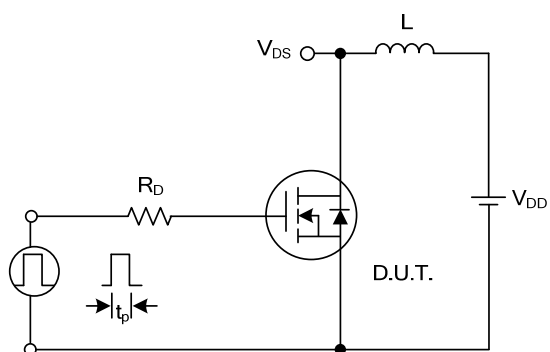
Switching Waveforms



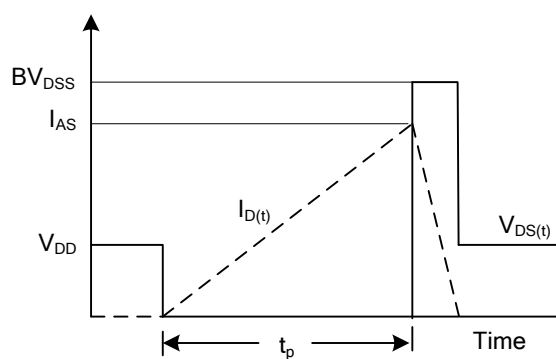
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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