



# 6NM65-Q

*Power MOSFET*

## 6A, 650V N-CHANNEL SUPER-JUNCTION MOSFET

### DESCRIPTION

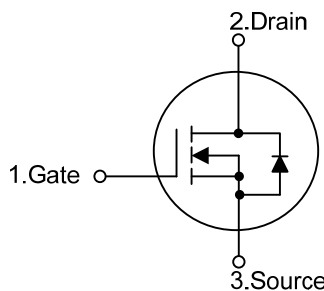
The UTC **6NM65-Q** is a Super Junction MOSFET Structure. It uses UTC advanced planar stripe, DMOS technology to provide customers perfect switching performance, minimal on-state resistance.

The UTC **6NM65-Q** is universally applied in electronic lamp ballasts based on half bridge topology, high efficiency switched mode power supplies, active power factor correction, etc.

### FEATURES

- \*  $R_{DS(on)} < 1.2 \Omega @ V_{GS}=10V, I_D=3.0A$
- \* Improved dv/dt capability
- \* Fast switching
- \* 100% avalanche tested

### SYMBOL

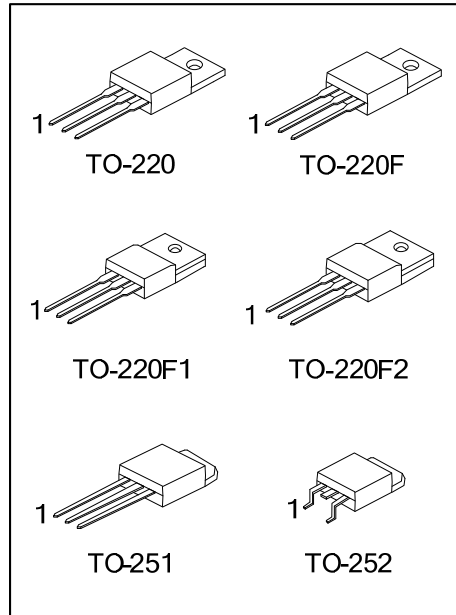


### ORDERING INFORMATION

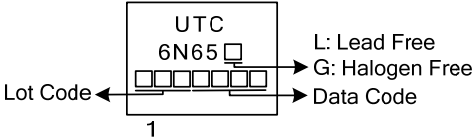
| Ordering Number |              | Package  | Pin Assignment |   |   | Packing   |
|-----------------|--------------|----------|----------------|---|---|-----------|
| Lead Free       | Halogen Free |          | 1              | 2 | 3 |           |
| 6NM65L-TA3-T    | 6NM65G-TA3-T | TO-220   | G              | D | S | Tube      |
| 6NM65L-TF1-T    | 6NM65G-TF1-T | TO-220F1 | G              | D | S | Tube      |
| 6NM65L-TF2-T    | 6NM65G-TF2-T | TO-220F2 | G              | D | S | Tube      |
| 6NM65L-TF3-T    | 6NM65G-TF3-T | TO-220F  | G              | D | S | Tube      |
| 6NM65L-TM3-T    | 6NM65G-TM3-T | TO-251   | G              | D | S | Tube      |
| 6NM65L-TN3-R    | 6NM65G-TN3-R | TO-252   | G              | D | S | Tape Reel |

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

|                     |  |
|---------------------|--|
| <p>6NM65G-TA3-T</p> | <p>(1) T: Tube, R: Tape Reel<br/>                 (2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TM3: TO-251, TN3: TO-252<br/>                 (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               |                        | $V_{DSS}$ | 650        | V                |
| Gate-Source Voltage                |                        | $V_{GSS}$ | $\pm 30$   | V                |
| Drain Current                      | Continuous             | $I_D$     | 6          | A                |
|                                    | Pulsed (Note 2)        | $I_{DM}$  | 24         | A                |
| Avalanche Current (Note 2)         |                        | $I_{AR}$  | 1.6        | A                |
| Avalanche Energy                   | Single Pulsed (Note 3) | $E_{AS}$  | 87         | mJ               |
| Peak Diode Recovery dv/dt (Note 4) |                        | dv/dt     | 3.7        | V/ns             |
| Power Dissipation                  | TO-220                 | $P_D$     | 125        | W                |
|                                    | TO-220F/TO-220F1       |           | 40         | W                |
|                                    | TO-220F2               |           | 55         | W                |
|                                    | TO-251/TO-252          |           |            |                  |
| 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.  $L=144\text{mH}$ ,  $I_{AS}=1.6\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD}\leq 6.0\text{A}$ ,  $di/dt\leq 200\text{A}/\mu\text{s}$ ,  $V_{DD}\leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

| PARAMETER           |                   | SYMBOL        | RATING | UNIT                      |
|---------------------|-------------------|---------------|--------|---------------------------|
| Junction to Ambient | TO-220/TO-220F    | $\theta_{JA}$ | 62.5   | $^\circ\text{C}/\text{W}$ |
|                     | TO-220F1/TO-220F2 |               |        |                           |
|                     | TO-251/TO-252     |               |        |                           |
| Junction to Case    | TO-220            | $\theta_{JC}$ | 1.0    | $^\circ\text{C}/\text{W}$ |
|                     | TO-220F/TO-220F1  |               | 3.13   | $^\circ\text{C}/\text{W}$ |
|                     | TO-220F2          |               |        |                           |
|                     | TO-251/TO-252     |               |        |                           |

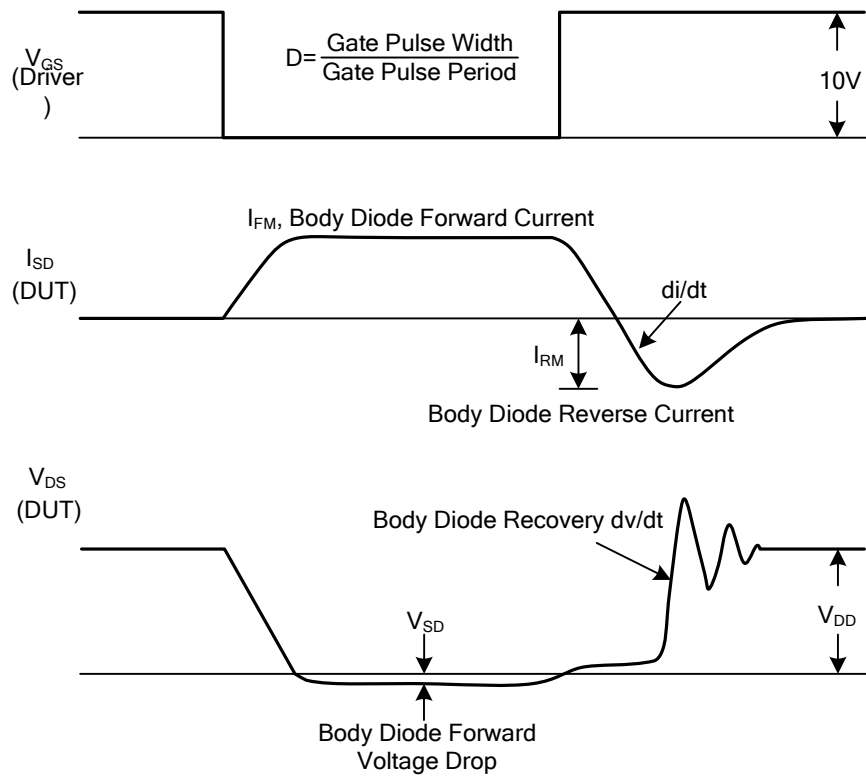
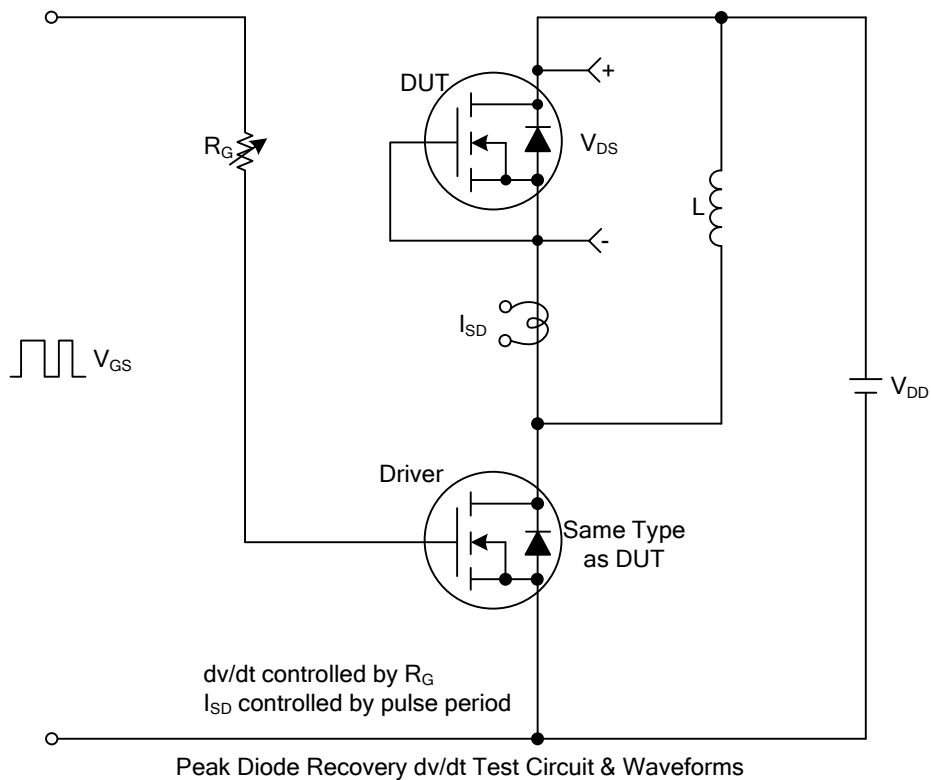
■ ELECTRICAL CHARACTERISTICS ( $T_c = 25^\circ\text{C}$ , unless otherwise specified)

| PARAMETER   | SYMBOL       | TEST CONDITIONS   | MIN | TYP  | MAX  | UNIT     |
|---|--------------|---|-----|------|------|----------|
| <b>OFF CHARACTERISTICS</b>                                    |              |   |     |      |      |          |
| Drain-Source Breakdown Voltage                                | $BV_{DSS}$   | $V_{GS} = 0V, I_D = 250\mu A$                                     | 650 |      |      | V        |
| Drain-Source Leakage Current                                  | $I_{DSS}$    | $V_{DS} = 650V, V_{GS} = 0V$                                      |     |      | 10   | $\mu A$  |
| Gate-Source Leakage Current                                   | Forward      | $V_{GS} = 30V, V_{DS} = 0V$<br>$V_{GS} = -30V, V_{DS} = 0V$       |     |      | 100  | nA       |
|   | Reverse      |   |     |      | -100 | nA       |
| <b>ON CHARACTERISTICS</b>                                     |              |   |     |      |      |          |
| 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                       | $R_{DS(ON)}$ | $V_{GS} = 10V, I_D = 3.0A$  |     |      | 1.2  | $\Omega$ |
| <b>DYNAMIC CHARACTERISTICS</b>                                |              |   |     |      |      |          |
| Input Capacitance   | $C_{ISS}$    | $V_{GS}=0V, V_{DS}=25V, f=1.0MHz$                                 |     | 330  |      | pF       |
| Output Capacitance  | $C_{OSS}$    |   |     | 190  |      | pF       |
| Reverse Transfer Capacitance                                  | $C_{RSS}$    |   |     | 20   |      | pF       |
| <b>SWITCHING CHARACTERISTICS</b>                              |              |   |     |      |      |          |
| Total Gate Charge (Note 1)                                    | $Q_G$        | $V_{DS}=50V, V_{GS}=10V$<br>$I_D=1.3A, I_G=100\mu A$ (Note 1, 2)  |     | 42   |      | nC       |
| Gate to Source Charge   | $Q_{GS}$     |   |     | 4.0  |      | nC       |
| Gate to Drain Charge  | $Q_{GD}$     |   |     | 12   |      | nC       |
| Turn-ON Delay Time (Note 1)                                   | $t_{D(ON)}$  | $V_{DD}=30V, V_{GS}=10V,$<br>$I_D=0.5A, R_G=25\Omega$ (Note 1, 2) |     | 50   |      | nS       |
| Rise Time   | $t_R$        |   |     | 130  |      | nS       |
| Turn-OFF Delay Time   | $t_{D(OFF)}$ |   |     | 270  |      | nS       |
| Fall-Time   | $t_F$        |   |     | 90   |      | nS       |
| <b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b> |              |   |     |      |      |          |
| Maximum Body-Diode Continuous Current                         | $I_S$        |   |     |      | 6    | A        |
| Maximum Body-Diode Pulsed Current                             | $I_{SM}$     |   |     |      | 24   | A        |
| Drain-Source Diode Forward Voltage (Note 1)                   | $V_{SD}$     | $I_S=6.0A, V_{GS}=0V$   |     |      | 1.4  | V        |
| Body Diode Reverse Recovery Time (Note 1)                     | $t_{rr}$     | $I_S=6.0A, V_{GS}=0V,$  |     | 430  |      | nS       |
| Body Diode Reverse Recovery Charge                            | $Q_{rr}$     | $di_F/dt=100A/\mu s$  |     | 3.91 |      | $\mu C$  |

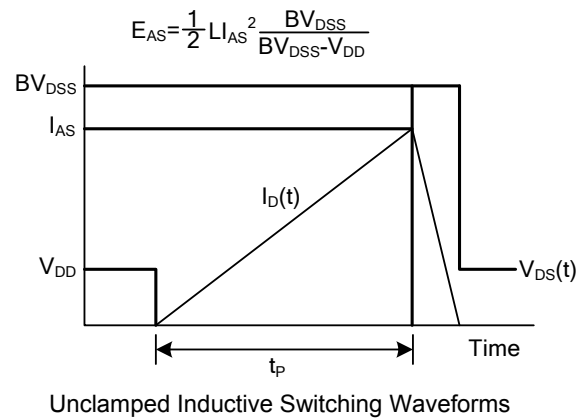
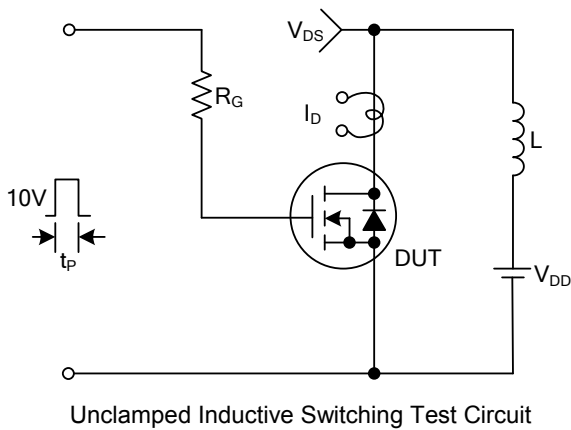
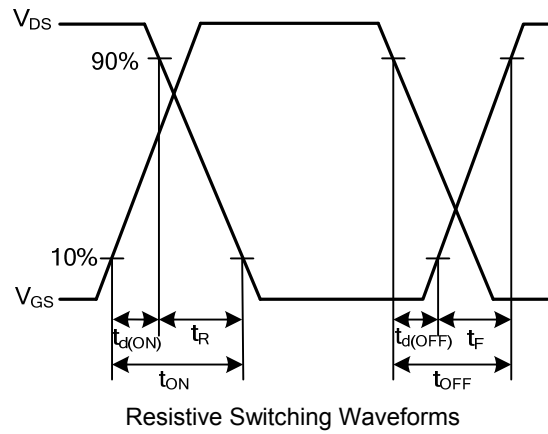
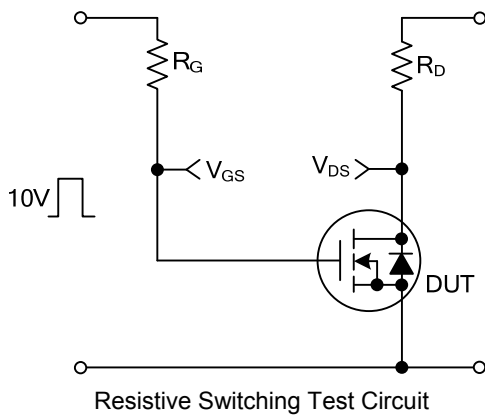
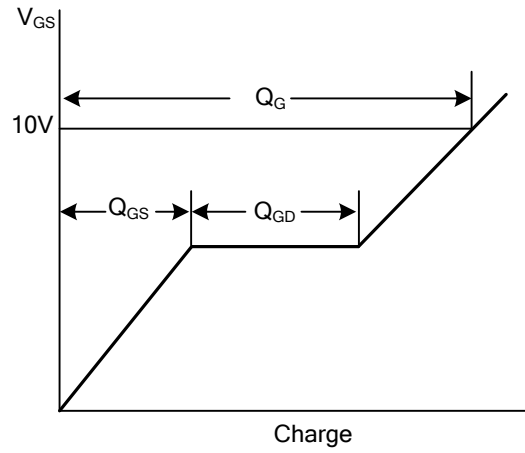
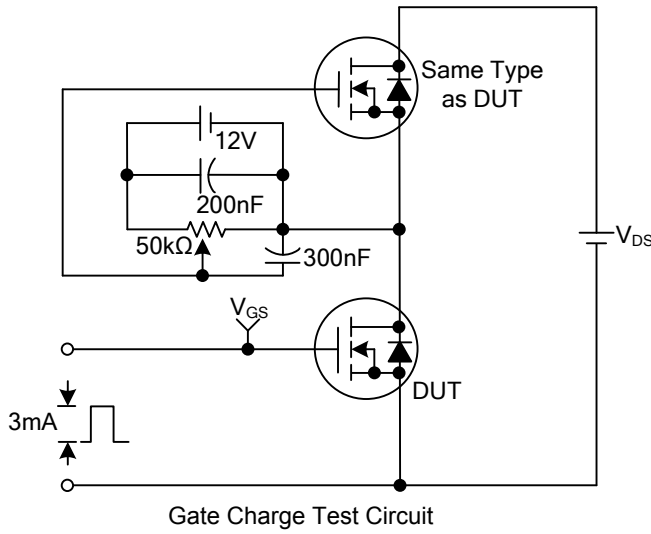
Notes: 1. Pulse Test : Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$

2. Essentially independent of operating ambient temperature

## ■ TEST CIRCUITS AND WAVEFORMS



### TEST CIRCUITS AND WAVEFORMS (Cont.)



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