



## 12N65

### Power MOSFET

## 12A, 650V N-CHANNEL POWER MOSFET

### DESCRIPTION

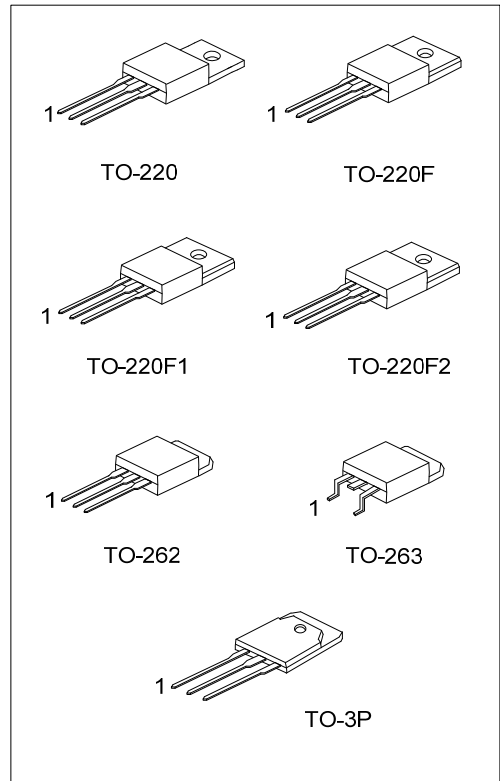
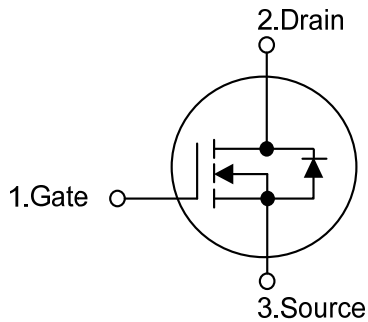
The UTC **12N65** are N-Channel enhancement mode power field effect transistors (MOSFET) which are produced by using UTC's proprietary, planar stripe and DMOS technology.

These devices are suited for high efficiency switch mode power supply. To minimize on-state resistance, provide superior switching performance and withstand high energy pulse in the avalanche and commutation mode, the advanced technology has been especially tailored.

### FEATURES

- \*  $R_{DS(ON)} \leq 0.85 \Omega$  @  $V_{GS} = 10V$ ,  $I_D = 6.0A$
- \* Ultra low gate charge ( typical 42 nC )
- \* Low reverse transfer capacitance (  $C_{RSS} =$  typical 25 pF )
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

### SYMBOL



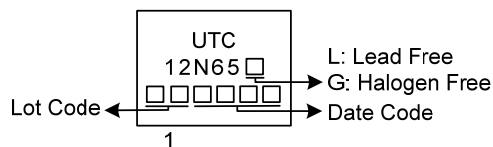
### ORDERING INFORMATION

| Ordering Number |              | Package  | Pin Assignment |   |   | Packing   |
|-----------------|--------------|----------|----------------|---|---|-----------|
| Lead Free       | Halogen Free |          | 1              | 2 | 3 |           |
| 12N65L-TA3-T    | 12N65G-TA3-T | TO-220   | G              | D | S | Tube      |
| 12N65L-TF1-T    | 12N65G-TF1-T | TO-220F1 | G              | D | S | Tube      |
| 12N65L-TF2-T    | 12N65G-TF2-T | TO-220F2 | G              | D | S | Tube      |
| 12N65L-TF3-T    | 12N65G-TF3-T | TO-220F  | G              | D | S | Tube      |
| 12N65L-T2Q-T    | 12N65G-T2Q-T | TO-262   | G              | D | S | Tube      |
| 12N65L-TQ2-T    | 12N65G-TQ2-T | TO-263   | G              | D | S | Tube      |
| 12N65L-TQ2-R    | 12N65G-TQ2-R | TO-263   | G              | D | S | Tape Reel |
| 12N65L-T3P-T    | 12N65G-T3P-T | TO-3P    | G              | D | S | Tube      |

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

|   |  |
|---|--|
| <p>12N65G-TA3-T</p> <p>(1)Packing Type<br/>(2)Package Type<br/>(3)Green Package</p> | <p>(1) T: Tube, R: Tape Reel<br/>(2) TA3: TO-220, TF1: TO-220F1, TF2: TO-220F2<br/>TF3: TO-220F, T2Q: TO-262, TQ2: TO-263<br/>T3P: TO-3P<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                |
| Avalanche Current (Note 2)           |                         | $I_{AR}$  | 12         | A                |
| Drain Current                        | Continuous              | $I_D$     | 12         | A                |
|                                      | Pulsed (Note 2)         | $I_{DM}$  | 48         | A                |
| Avalanche Energy                     | Single Pulsed (Note 3)  | $E_{AS}$  | 790        | mJ               |
|                                      | Repetitive (Note 2)     | $E_{AR}$  | 24         | mJ               |
| Peak Diode Recovery $dv/dt$ (Note 4) |                         | $dv/dt$   | 4.5        | V/ns             |
| Power Dissipation                    | TO-220/TO-262<br>TO-263 | $P_D$     | 225        | W                |
|                                      | TO-220F/TO-220F1        |           | 51         | W                |
|                                      | TO-220F2                |           | 54         | W                |
|                                      | TO-3P                   |           | 260        | 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 maximum junction temperature.

3.  $L = 10\text{mH}$ ,  $I_{AS} = 12\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 12\text{A}$ ,  $di/dt \leq 200\text{A/s}$ ,  $V_{DD} \leq BV_{DSS}$  Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

| PARAMETER               |  | SYMBOL             | RATING        | UNIT               |
|-------------------------|--|--------------------|---------------|--------------------|
| Junction to Ambient     | TO-220/TO-220F<br>TO-220F1/TO-220F2<br>TO-262/TO-263 | $\theta_{JA}$      | 62.5          | $^\circ\text{C/W}$ |
|                         | TO-3P  |                    | 40            | $^\circ\text{C/W}$ |
|                         | Junction to Case                                     |                    | $\theta_{JC}$ | 0.56               |
| TO-220/TO-262<br>TO-263 | 2.43   | $^\circ\text{C/W}$ |               |                    |
| TO-220F/TO-220F1        | 2.31   | $^\circ\text{C/W}$ |               |                    |
| TO-220F2                | 0.48   | $^\circ\text{C/W}$ |               |                    |
| TO-3P                   |  |                    |               |                    |

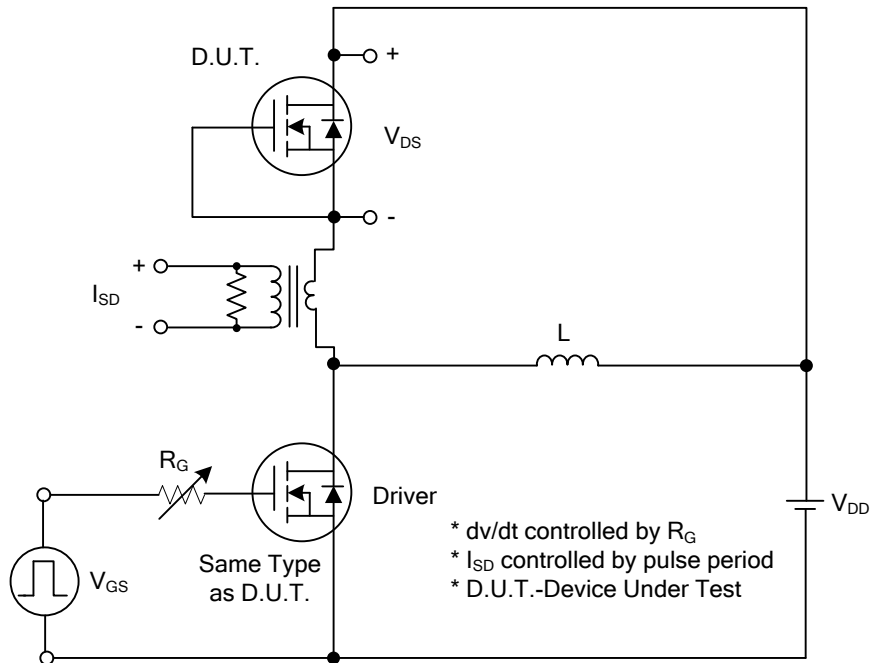
■ ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C, unless otherwise specified)

| PARAMETER  | SYMBOL                              | TEST CONDITIONS   | MIN | TYP  | MAX  | UNIT |
|--|-------------------------------------|---|-----|------|------|------|
| <b>OFF CHARACTERISTICS</b>                             |                                     |   |     |      |      |      |
| Drain-Source Breakdown Voltage                         | BV <sub>DSS</sub>                   | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA  | 650 |      |      | V    |
| Drain-Source Leakage Current                           | I <sub>DSS</sub>                    | V <sub>DS</sub> = 650 V, V <sub>GS</sub> = 0 V  |     |      | 1    | μA   |
| Gate-Source Leakage Current                            | I <sub>GSS</sub>                    | V <sub>GS</sub> = ±30 V, V <sub>DS</sub> = 0 V  |     |      | ±100 | nA   |
| Breakdown Voltage Temperature Coefficient              | ΔBV <sub>DSS</sub> /ΔT <sub>J</sub> | I <sub>D</sub> = 250 μA, Referenced to 25°C   |     | 0.7  |      | V/°C |
| <b>ON CHARACTERISTICS</b>                              |                                     |   |     |      |      |      |
| 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> = 10V, I <sub>D</sub> = 6.0A  |     | 0.65 | 0.85 | Ω    |
| <b>DYNAMIC CHARACTERISTICS</b>                         |                                     |   |     |      |      |      |
| Input Capacitance                                      | C <sub>ISS</sub>                    | V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V,<br>f = 1MHz                              |     | 1480 | 1900 | pF   |
| Output Capacitance                                     | C <sub>OSS</sub>                    |   |     | 200  | 270  | pF   |
| Reverse Transfer Capacitance                           | C <sub>RSS</sub>                    |   |     | 25   | 35   | pF   |
| <b>SWITCHING CHARACTERISTICS</b>                       |                                     |   |     |      |      |      |
| Total Gate Charge                                      | Q <sub>G</sub>                      | V <sub>DS</sub> = 520V, I <sub>D</sub> = 12A,<br>V <sub>GS</sub> = 10 V (Note 1, 2)     |     | 42   | 54   | nC   |
| Gate-Source Charge                                     | Q <sub>GS</sub>                     |   |     | 8.6  |      | nC   |
| Gate-Drain Charge                                      | Q <sub>GD</sub>                     |   |     | 21   |      | nC   |
| Turn-On Delay Time                                     | t <sub>D(ON)</sub>                  | V <sub>DD</sub> = 325V, I <sub>D</sub> = 12A,<br>R <sub>G</sub> = 25Ω (Note 1, 2)       |     | 30   | 70   | ns   |
| Turn-On Rise Time                                      | t <sub>R</sub>                      |   |     | 115  | 240  | ns   |
| Turn-Off Delay Time                                    | t <sub>D(OFF)</sub>                 |   |     | 95   | 200  | ns   |
| Turn-Off Fall Time                                     | t <sub>F</sub>                      |   |     | 85   | 180  | ns   |
| <b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b> |                                     |   |     |      |      |      |
| Maximum Continuous Drain-Source Diode Forward Current  | I <sub>S</sub>                      |   |     |      | 12   | A    |
| Maximum Pulsed Drain-Source Diode Forward Current      | I <sub>SM</sub>                     |   |     |      | 48   | A    |
| Drain-Source Diode Forward Voltage                     | V <sub>SD</sub>                     | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 12A   |     |      | 1.4  | V    |
| Reverse Recovery Time                                  | t <sub>rr</sub>                     | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 12A,<br>dI <sub>F</sub> /dt = 100 A/μs (Note 1) |     | 380  |      | ns   |
| Reverse Recovery Charge                                | Q <sub>rr</sub>                     |   |     | 3.5  |      | μC   |

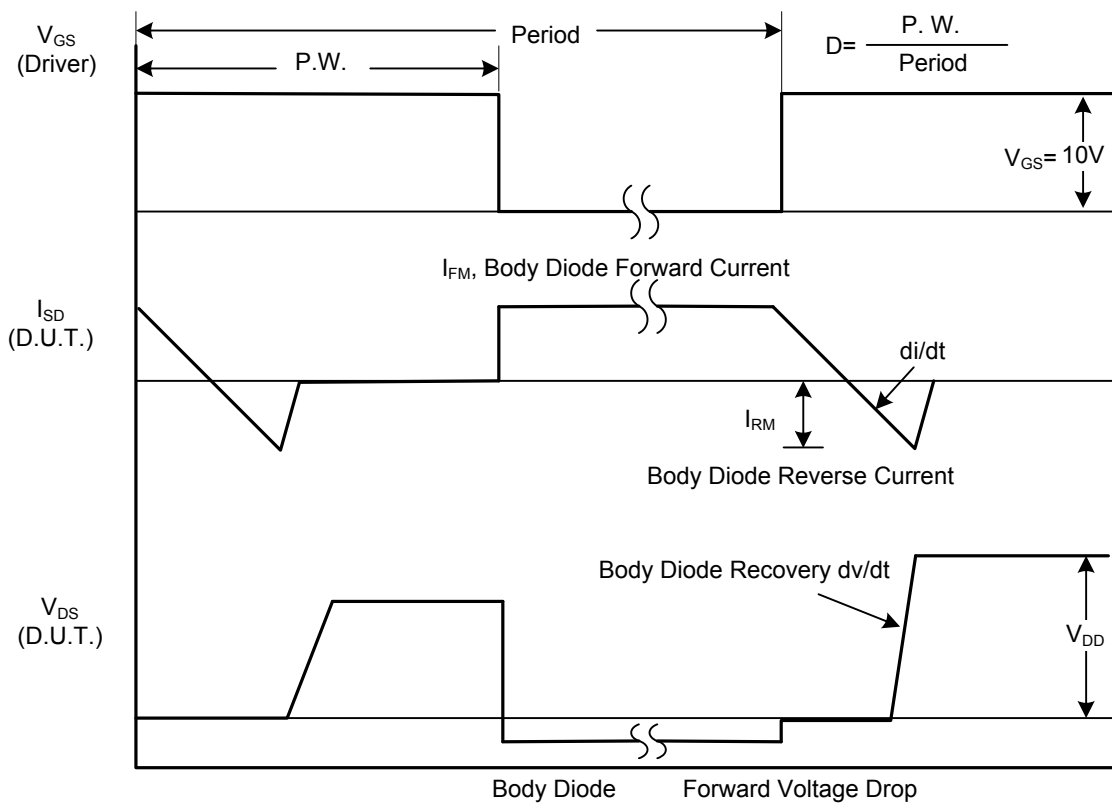
Notes: 1. Pulse Test : Pulse width ≤ 300 μs, Duty cycle ≤ 2%

2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

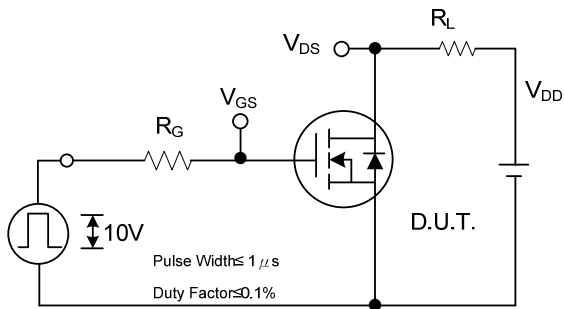


Peak Diode Recovery  $dv/dt$  Test Circuit

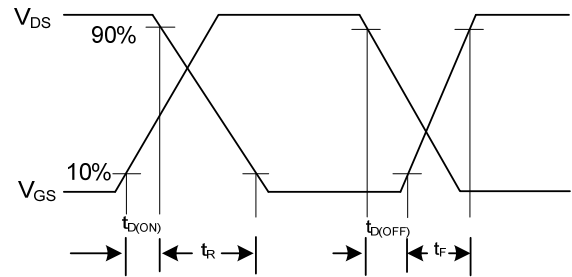


Peak Diode Recovery  $dv/dt$  Waveforms

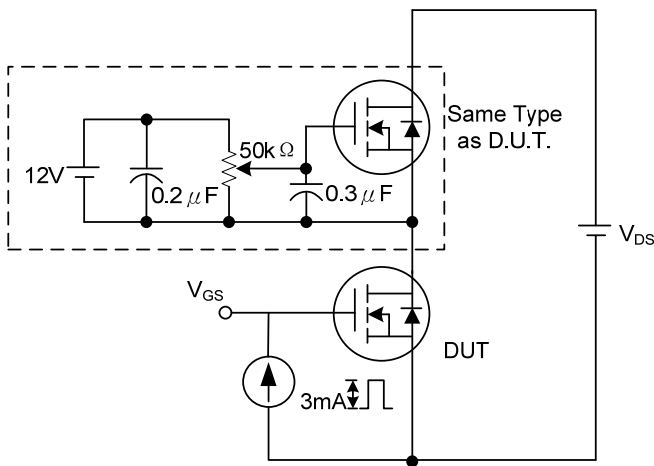
## TEST CIRCUITS AND WAVEFORMS



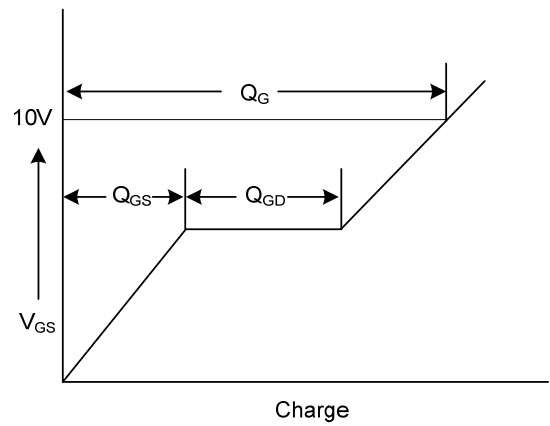
**Switching Test Circuit**



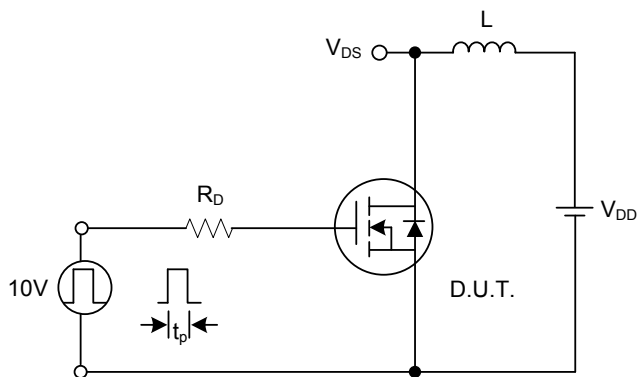
**Switching Waveforms**



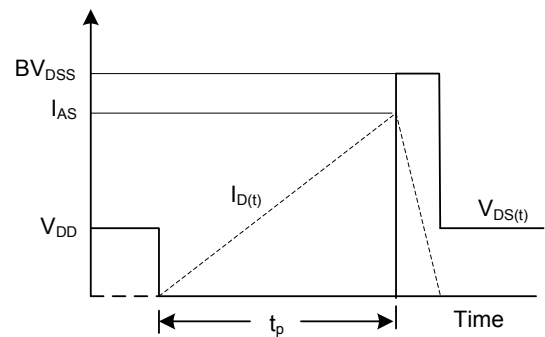
**Gate Charge Test Circuit**



**Gate Charge Waveform**

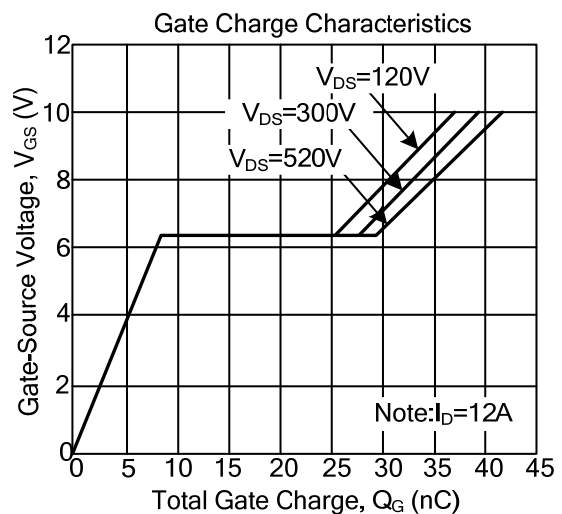
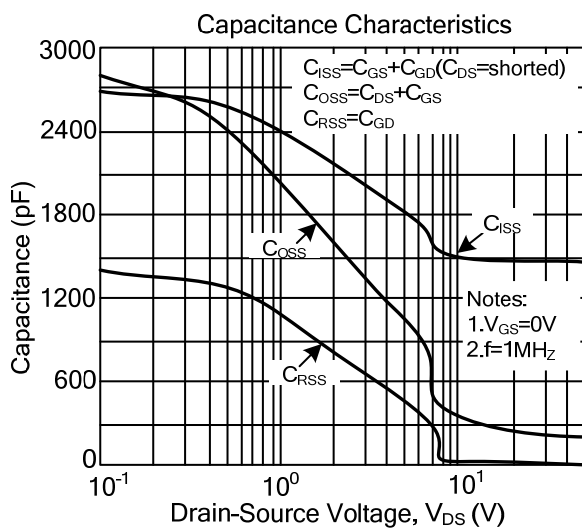
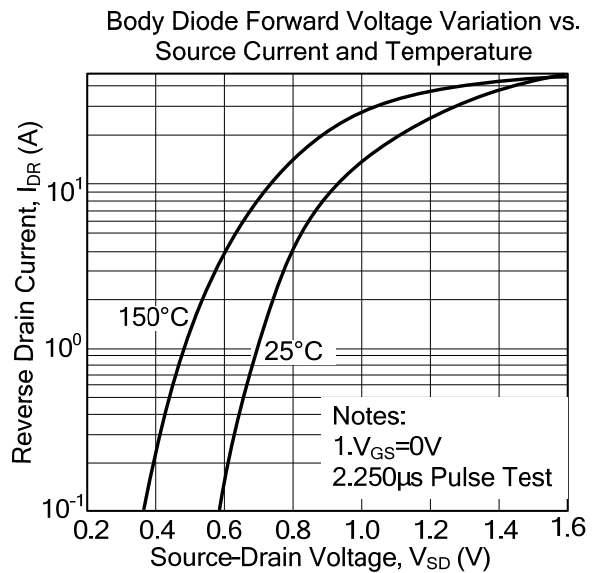
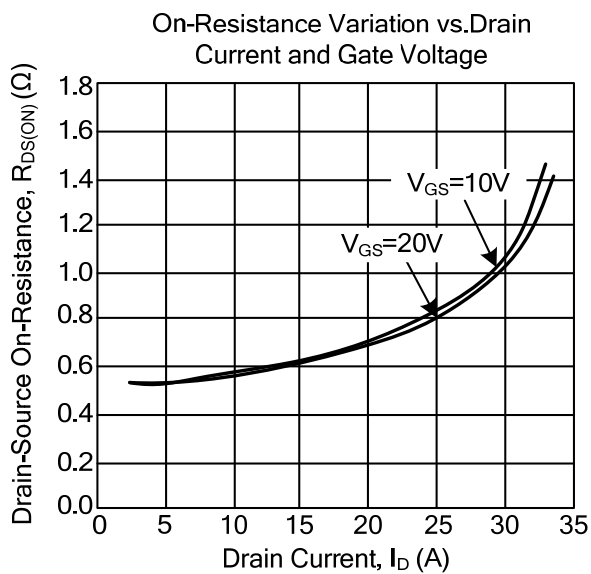
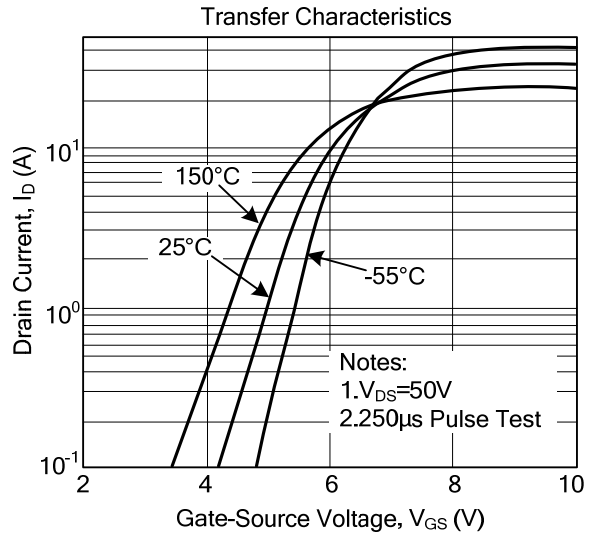
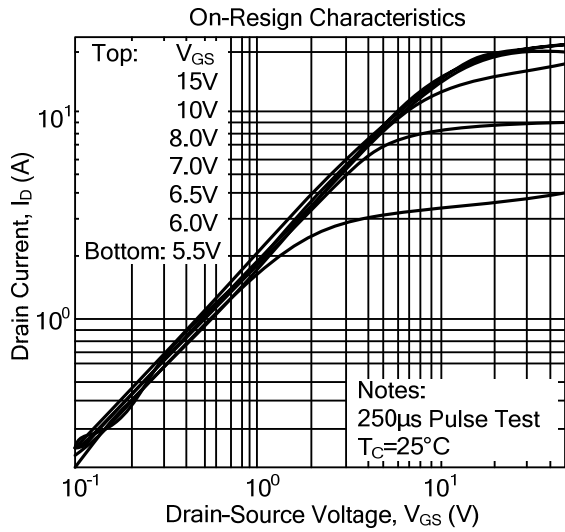


**Unclamped Inductive Switching Test Circuit**

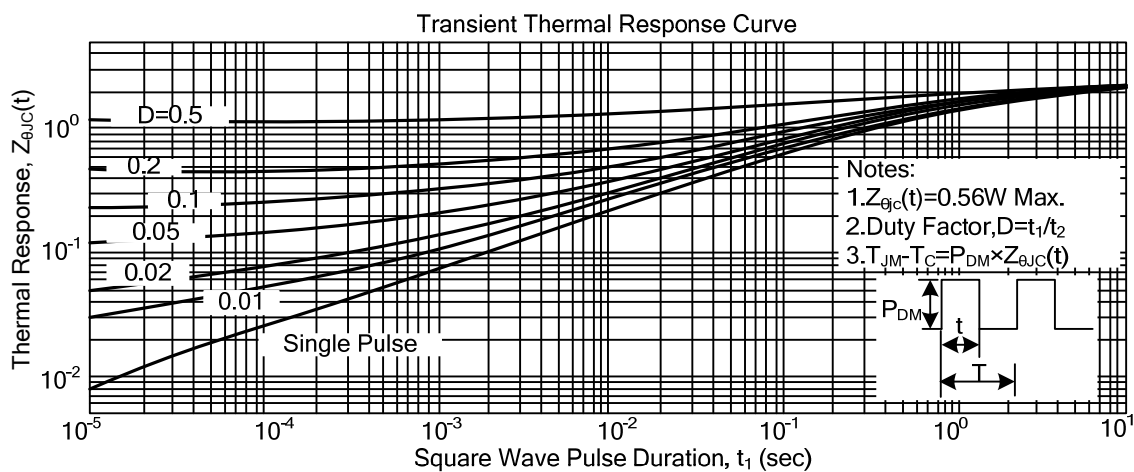
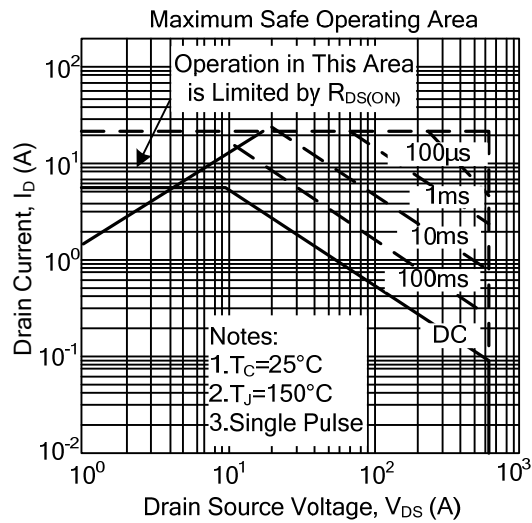


**Unclamped Inductive Switching Waveforms**

## TYPICAL CHARACTERISTICS



## TYPICAL CHARACTERISTICS



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[MCQ7328-TP](#) [SSM3J143TU,LXHF](#) [DMN12M3UCA6-7](#) [PJMF280N65E1\\_T0\\_00201](#) [PJMF380N65E1\\_T0\\_00201](#)  
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