

## PRODUCT CHARACTERISTICS

|                             |      |
|-----------------------------|------|
| VDSS                        | 650V |
| $R_{DS(on)max}(V_{GS}=10V)$ | 0.8Ω |
| Qg@type                     | 42nC |
| ID                          | 12A  |

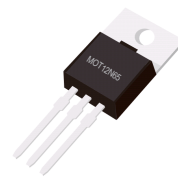
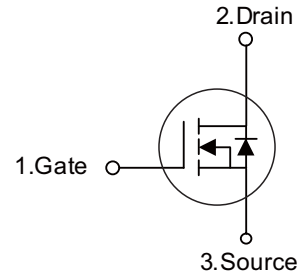
## APPLICATIONS

- High frequency switching mode power supply
- Electronic lamp ballasts based on half bridge
- LED power supplies

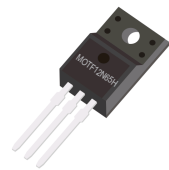
## FEATURES

- \*  $R_{DS(ON)} = 0.82\Omega @ V_{GS} = 10V$
- \* Ultra low gate charge
- \* Low reverse transfer capacitance
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

## Symbol



TO-220



TO-220F

## ORDER INFORMATION

| Order codes  |            | Package | Packing        |
|--------------|------------|---------|----------------|
| Halogen-Free | Halogen    |         |                |
| N/A          | MOTF12N65H | TO-220F | 50 pieces/Tube |
| N/A          | MOT12N65A  | TO-220  | 50 pieces/Tube |

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

| PARAMETER                          |                        | SYMBOL           | RATINGS    | UNIT |
|------------------------------------|------------------------|------------------|------------|------|
| Drain-Source Voltage               |                        | V <sub>DSS</sub> | 650        | V    |
| Gate-Source Voltage                |                        | V <sub>GSS</sub> | ±30        | V    |
| Avalanche Current (Note 2)         |                        | I <sub>AR</sub>  | 12         | A    |
| Drain Current                      | Continuous             | I <sub>D</sub>   | 12         | A    |
|                                    | Pulsed (Note 2)        | I <sub>DM</sub>  | 48         | A    |
| Avalanche Energy                   | Single Pulsed (Note 3) | E <sub>AS</sub>  | 790        | mJ   |
|                                    | Repetitive (Note 2)    | E <sub>AR</sub>  | 24         | mJ   |
| Peak Diode Recovery dv/dt (Note 4) |                        | dv/dt            | 4.5        | V/ns |
| Power Dissipation                  | TO-220                 | P <sub>D</sub>   | 225        | W    |
|                                    | TO-220F                |                  | 51         | W    |
| Junction Temperature               |                        | T <sub>J</sub>   | +150       | °C   |
| Operating Temperature              |                        | T <sub>OPR</sub> | -55 ~ +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<sub>AS</sub> = 12A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25Ω, Starting T<sub>J</sub> = 25°C

4. I<sub>SD</sub> ≤ 12A, di/dt ≤ 200A/s, V<sub>DD</sub> ≤ BV<sub>DSS</sub> Starting T<sub>J</sub> = 25°C

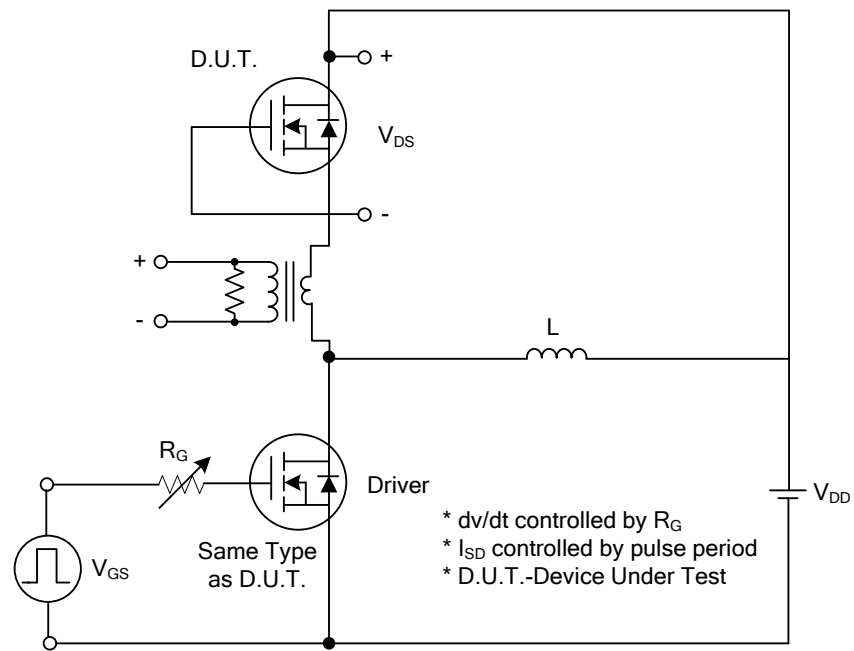
■ ELECTRICAL CHARACTERISTICS ( $T_C=25^\circ\text{C}$ , unless otherwise noted)

| 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                                     | 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> =250μA,Referenced to 25°C                                           |     | 0.7  |      | V/°C |
| ON CHARACTERISTICS                                    |                                     |                                                                                    |     |      |      |      |
| Gate Threshold Voltage                                | V <sub>GS(TH)</sub>                 | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                         | 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                                       |     | 0.75 | 0.8  | Ω    |
| DYNAMIC CHARACTERISTICS                               |                                     |                                                                                    |     |      |      |      |
| 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   |
| SWITCHING CHARACTERISTICS                             |                                     |                                                                                    |     |      |      |      |
| 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   |
| 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   |
| SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS       |                                     |                                                                                    |     |      |      |      |
| Drain-Source Diode Forward Voltage                    | V <sub>SD</sub>                     | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 12A                                        |     |      | 1.4  | V    |
| 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    |
| Reverse Recovery Time                                 | t <sub>RR</sub>                     | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 12A,                                       |     | 380  |      | ns   |
| Reverse Recovery Charge                               | Q <sub>RR</sub>                     | dl <sub>F</sub> /dt = 100 A/μs (Note 1)                                            |     | 3.5  |      | μC   |

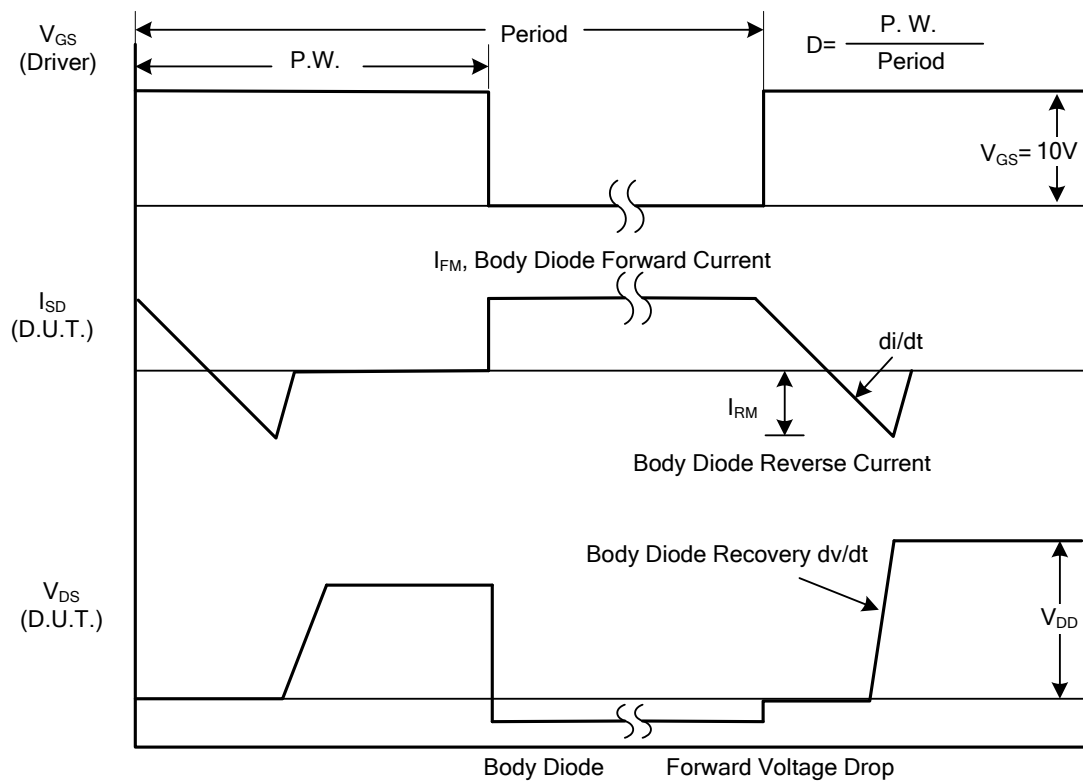
Notes: 1. Pulse Test : Pulse width  $\leq 300\mu\text{s}$ , Duty cycle  $\leq 2\%$ 

2. Essentially independent of operating temperature.

# TEST CIRCUITS AND WAVEFORMS

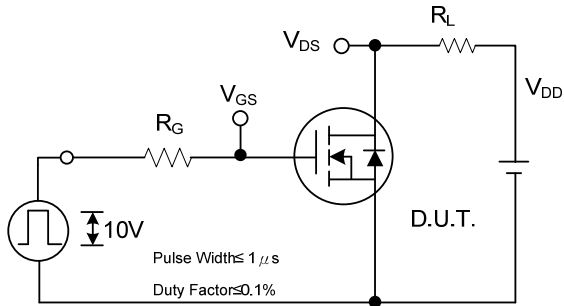


Peak Diode Recovery  $dv/dt$  Test Circuit

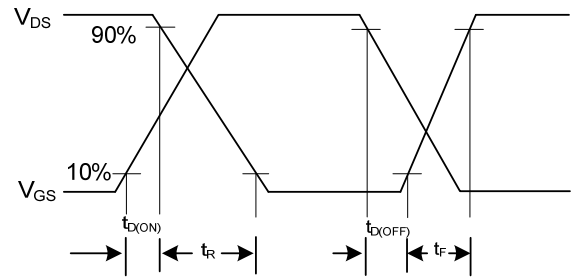


Peak Diode Recovery  $dv/dt$  Waveforms

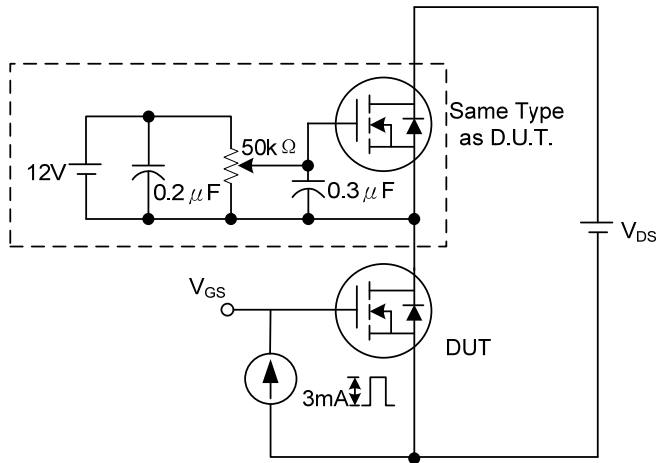
# TEST CIRCUITS AND WAVEFORMS(Cont.)



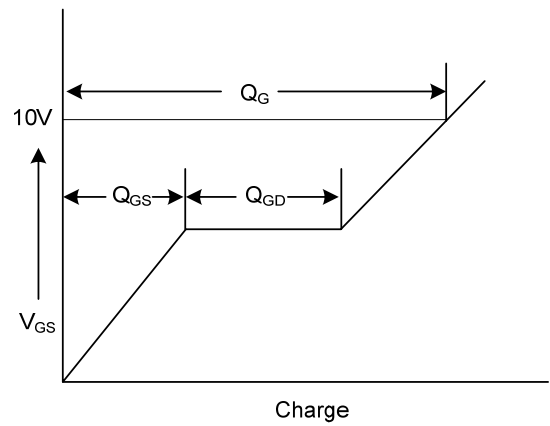
Switching Test Circuit



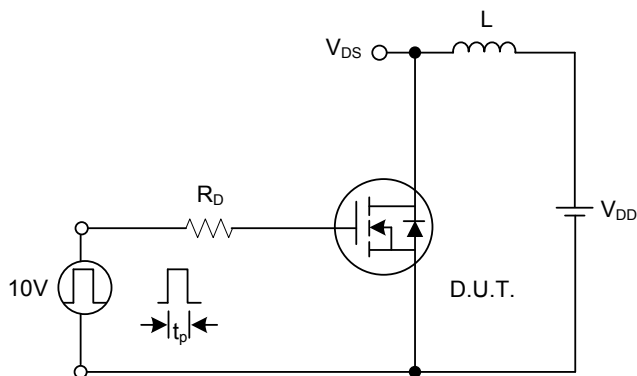
Switching Waveforms



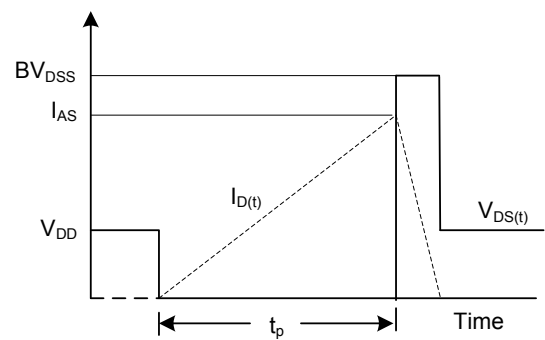
Gate Charge Test Circuit



Gate Charge Waveform

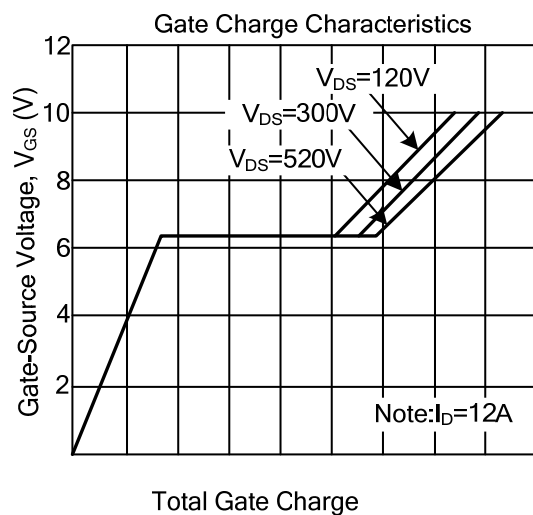
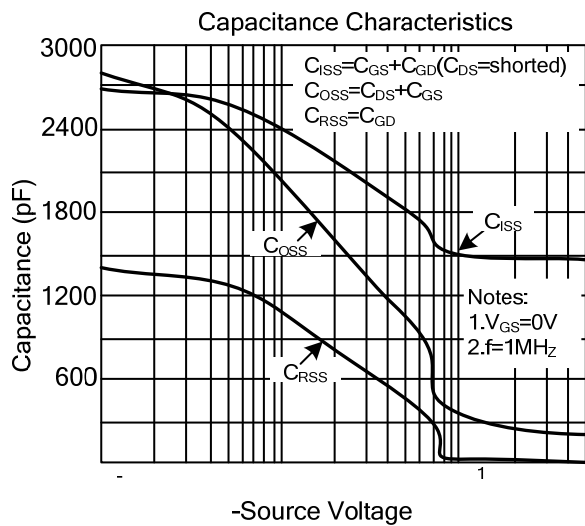
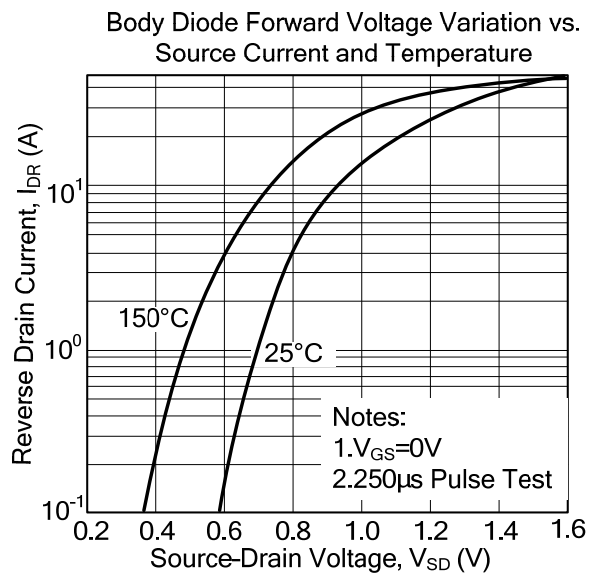
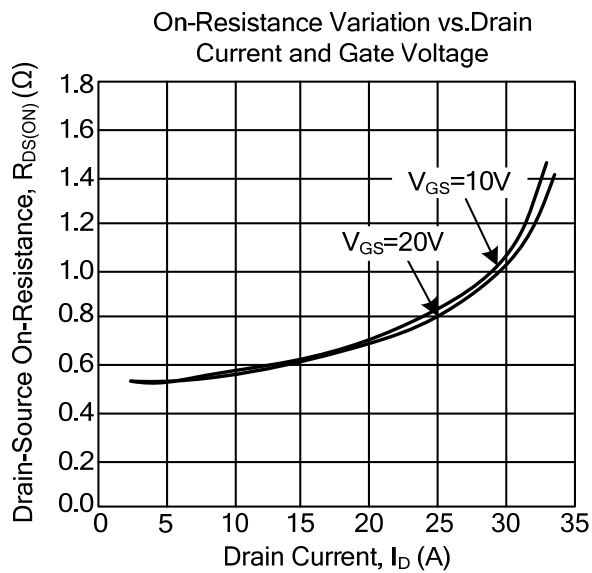
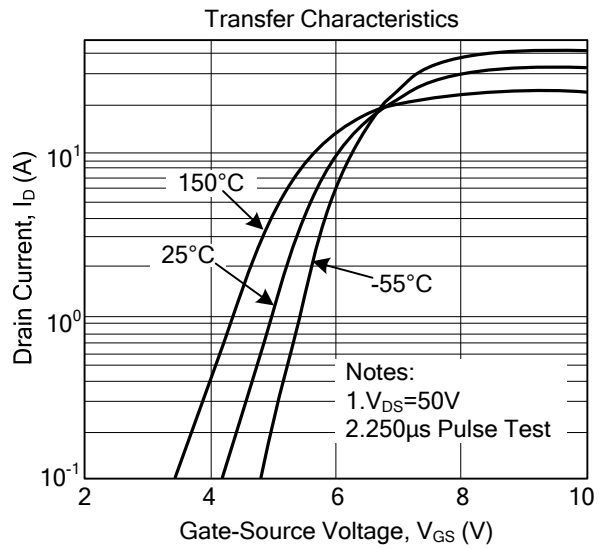
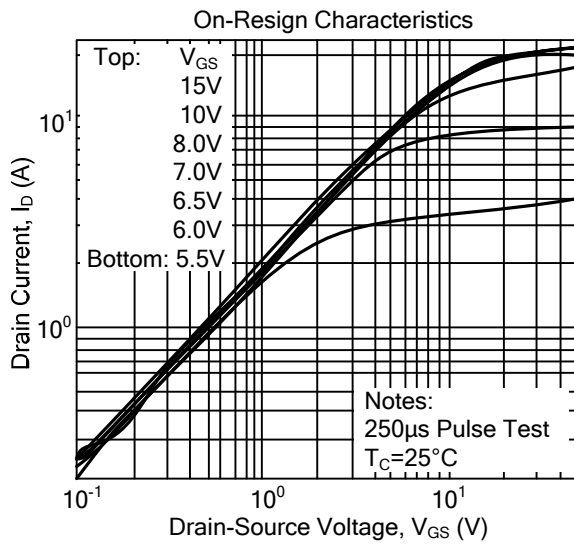


Unclamped Inductive Switching Test Circuit

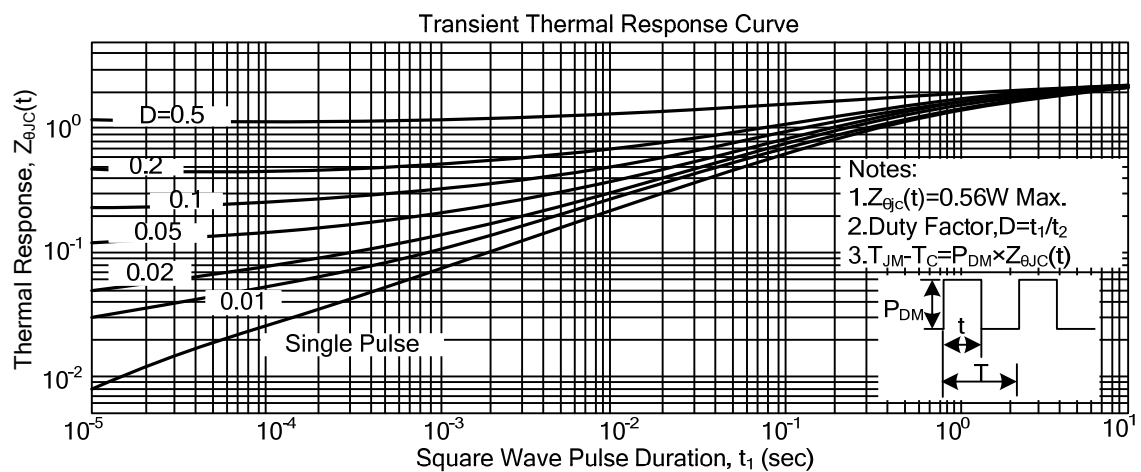
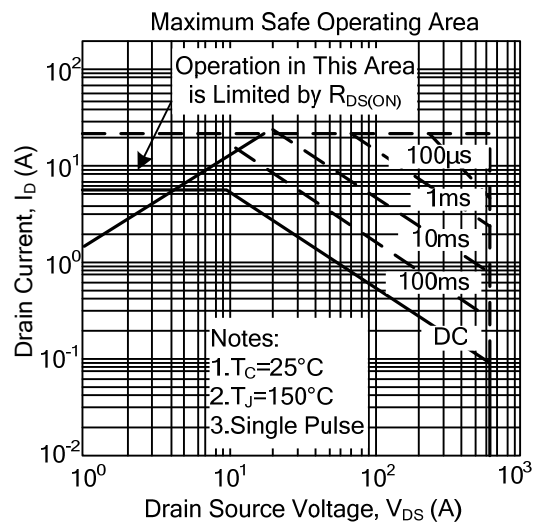


Unclamped Inductive Switching Waveforms

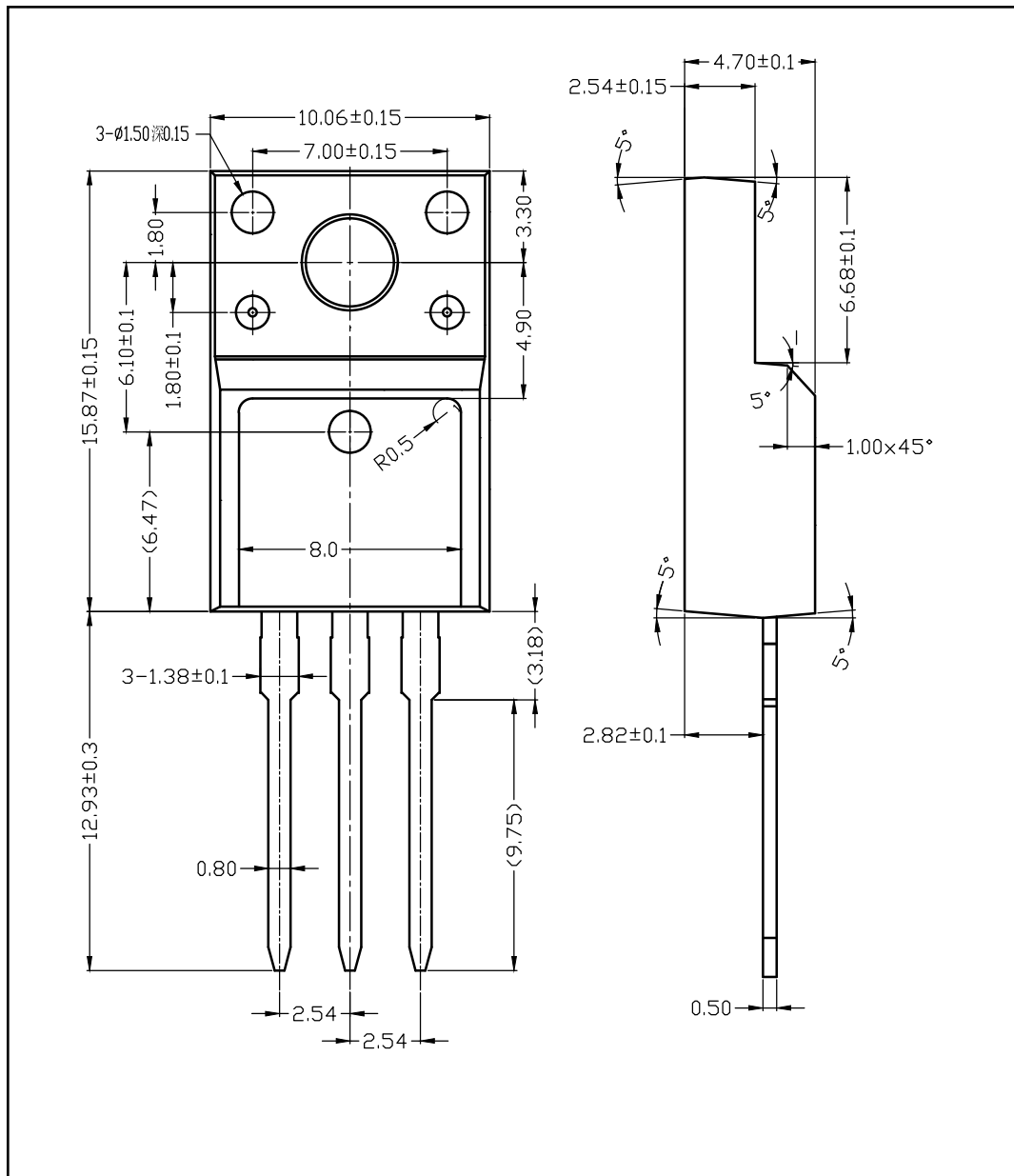
# TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS



■ TO-220F-3L PACKAGE OUTLINE DIMENSIONS



■ TO-220-3L PACKAGE OUTLINE DIMENSIONS

