

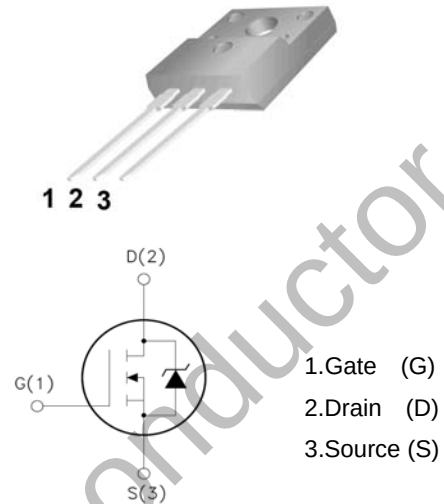


## WGF7N65SE

**Features:**

- ☐ Low Intrinsic Capacitances.
- ☐ Excellent Switching Characteristics.
- ☐ Extended Safe Operating Area.
- ☐ Unrivalled Gate Charge :Qg=29nC (Typ.).
- ☐ BVDSS=650V, I<sub>D</sub>=7A
- ☐ R<sub>DS(on)</sub> : 1.30Ω (Max) @V<sub>G</sub>=10V
- ☐ 100% Avalanche Tested

TO-220F



- 1.Gate (G)
- 2.Drain (D)
- 3.Source (S)

**Absolute Maximum Ratings** (Ta=25°C unless otherwise noted)

| Symbol               | Parameter                                                                    | Value                 | Unit |
|----------------------|------------------------------------------------------------------------------|-----------------------|------|
| V <sub>DSS</sub>     | Drain-Source Voltage                                                         | 650                   | V    |
| I <sub>D</sub>       | Drain Current                                                                | T <sub>j</sub> =25°C  | A    |
|                      |                                                                              | T <sub>j</sub> =100°C |      |
| V <sub>GSS(TH)</sub> | Gate Threshold Voltage                                                       | ±30                   | V    |
| E <sub>AS</sub>      | Single Pulse Avalanche Energy (note1)                                        | 150                   | mJ   |
| I <sub>AR</sub>      | Avalanche Current (note2)                                                    | 7.0                   | A    |
| P <sub>D</sub>       | Power Dissipation (T <sub>j</sub> =25°C)                                     | 50                    | W    |
| T <sub>j</sub>       | Junction Temperature(Max)                                                    | 150                   | °C   |
| T <sub>stg</sub>     | Storage Temperature                                                          | -55~+150              | °C   |
| TL                   | Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds | 300                   | °C   |

**Thermal Characteristics**

| Symbol           | Parameter                               | Typ. | Max. | Unit |
|------------------|-----------------------------------------|------|------|------|
| R <sub>θJC</sub> | Thermal Resistance, Junction to Case    | -    | 2.4  | °C/W |
| R <sub>θJA</sub> | Thermal Resistance, Junction to Ambient | -    | 62.5 | °C/W |

**Electrical Characteristics** (Ta=25°C unless otherwise noted)

| Symbol                                                 | Parameter                                 | Test Condition                                                              | Min. | Typ. | Max. | Unit |
|--------------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------|------|------|------|------|
| Off Characteristics                                    |                                           |                                                                             |      |      |      |      |
| BV <sub>DSS</sub>                                      | Drain-Source Breakdown Voltage            | I <sub>D</sub> =250μA, V <sub>GS</sub> =0                                   | 650  | -    | -    | V    |
| ΔBVDSS/ΔT <sub>J</sub>                                 | Breakdown Voltage Temperature Coefficient | I <sub>D</sub> =250μA ,Reference to 25℃                                     | -    | 0.67 | -    | V/℃  |
| I <sub>DSS</sub>                                       | Zero Gate Voltage Drain Current           | V <sub>DS</sub> =650V, V <sub>GS</sub> =0V                                  | -    | -    | 10   | μA   |
|                                                        |                                           | V <sub>DS</sub> =520V, T <sub>j</sub> =125℃                                 |      |      | 100  |      |
| I <sub>GSSF</sub>                                      | Gate-body leakage Current, Forward        | V <sub>GS</sub> =+30V, V <sub>DS</sub> =0V                                  | -    | -    | 100  | nA   |
| I <sub>GSSR</sub>                                      | Gate-body leakage Current, Reverse        | V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V                                  | -    | -    | -100 |      |
| On Characteristics                                     |                                           |                                                                             |      |      |      |      |
| V <sub>GS(TH)</sub>                                    | Date Threshold Voltage                    | I <sub>D</sub> =250μA,V <sub>DS</sub> =V <sub>GS</sub>                      | 2    | -    | 4    | V    |
| R <sub>DS(ON)</sub>                                    | Static Drain-Source On-Resistance         | I <sub>D</sub> =3.5A,V <sub>GS</sub> =10V                                   | -    | 1.05 | 1.30 | Ω    |
| Dynamic Characteristics                                |                                           |                                                                             |      |      |      |      |
| C <sub>iss</sub>                                       | Input Capacitance                         | V <sub>DS</sub> =25V, V <sub>GS</sub> =0, f=1.0MHz                          | -    | 1010 | -    | pF   |
| C <sub>oss</sub>                                       | Output Capacitance                        |                                                                             | -    | 135  | -    |      |
| C <sub>rss</sub>                                       | Reverse Transfer Capacitance              |                                                                             | -    | 16   | -    |      |
| Switching Characteristics                              |                                           |                                                                             |      |      |      |      |
| T <sub>d(on)</sub>                                     | Turn-On Delay Time                        | V <sub>DD</sub> =325V, I <sub>D</sub> =7A<br>R <sub>G</sub> =25Ω (Note 3,4) | -    | 30   | 70   | nS   |
| Tr                                                     | Turn-On Rise Time                         |                                                                             | -    | 80   | 170  |      |
| T <sub>d(off)</sub>                                    | Turn-Off Delay Time                       |                                                                             | -    | 65   | 140  |      |
| T <sub>f</sub>                                         | Turn-Off Rise Time                        |                                                                             | -    | 60   | 130  |      |
| Q <sub>g</sub>                                         | Total Gate Charge                         | V <sub>DS</sub> =520V,V <sub>GS</sub> =10V, I <sub>D</sub> =7A (Note 3,4)   | -    | 29   | 38   | nC   |
| Q <sub>gs</sub>                                        | Gate-Source Charge                        |                                                                             | -    | 7    | -    |      |
| Q <sub>gd</sub>                                        | Gate-Drain Charge                         |                                                                             | -    | 14.5 | -    |      |
| Drain-Source Diode Characteristics and Maximum Ratings |                                           |                                                                             |      |      |      |      |
| I <sub>S</sub>                                         | Max. Diode Forward Current                | -                                                                           | -    | -    | 7    | A    |
| I <sub>SM</sub>                                        | Max. Pulsed Forward Current               | -                                                                           | -    | -    | 28   |      |
| V <sub>SD</sub>                                        | Diode Forward Voltage                     | I <sub>D</sub> =7A                                                          | -    | -    | 1.4  | V    |
| T <sub>rr</sub>                                        | Reverse Recovery Time                     | I <sub>S</sub> =7A,V <sub>GS</sub> =0V<br>diF/dt=100A/μs                    | -    | 320  | -    | nS   |
| Q <sub>rr</sub>                                        | Reverse Recovery Charge                   | (Note3)                                                                     | -    | 2.4  | -    | μC   |

Notes : 1, L=17.1mH, I<sub>AS</sub>=7A, V<sub>DD</sub>=50V, R<sub>G</sub>=25Ω, Starting T<sub>J</sub>=25°C

2, Repetitive Rating : Pulse width limited by maximum junction temperature

3, Pulse Test : Pulse Width ≤ 300μs, Duty Cycle ≤ 2%

4, Essentially Independent of Operating Temperature

## Typical Characteristics

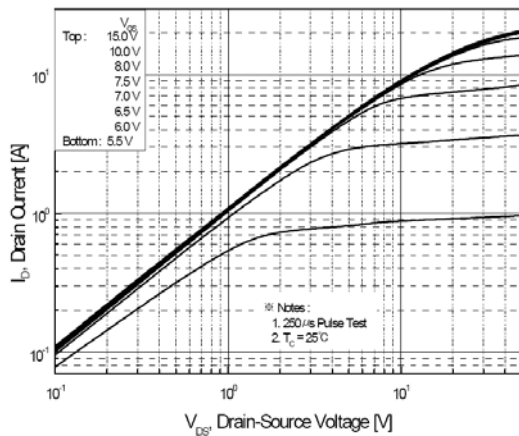


Figure 1. On-Region Characteristics

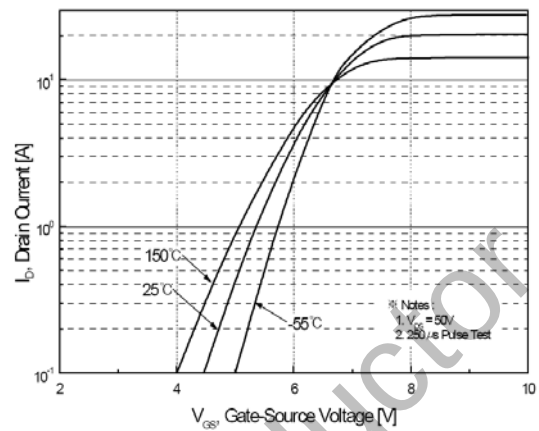


Figure 2. Transfer Characteristics

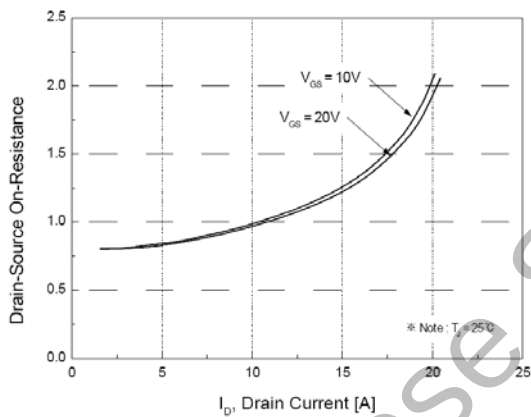


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

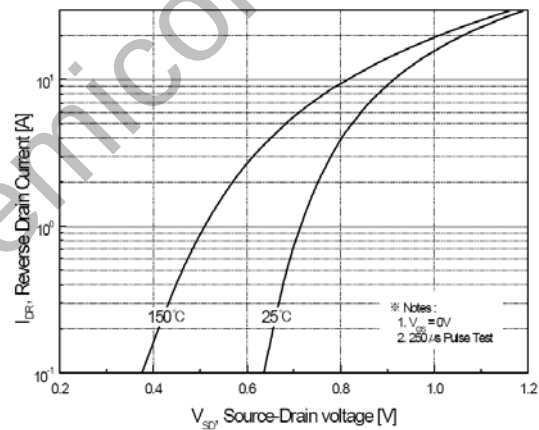


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

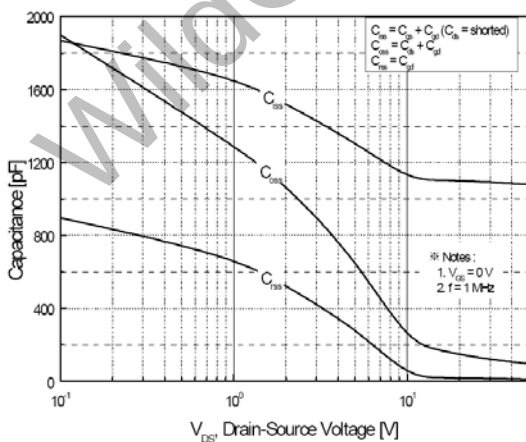


Figure 5. Capacitance Characteristics

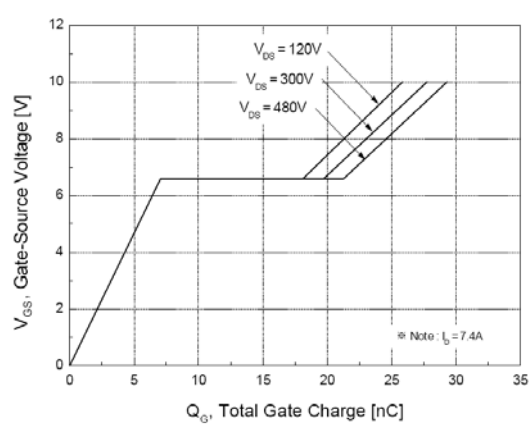


Figure 6. Gate Charge Characteristics

## Typical Characteristics (Continued)

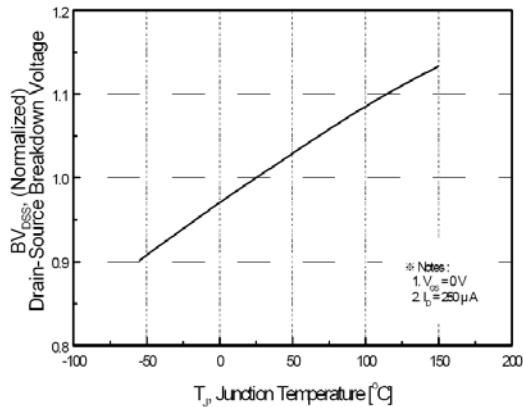


Figure 7. Breakdown Voltage Variation vs Temperature

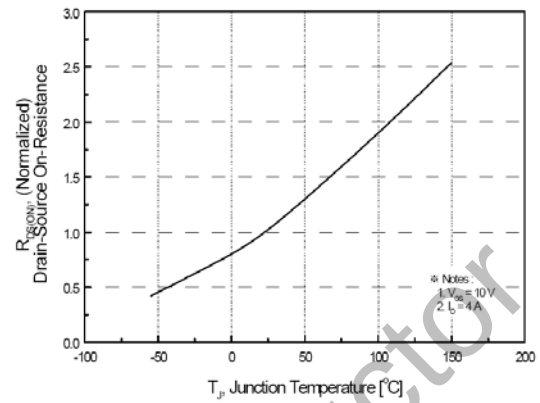


Figure 8. On-Resistance Variation vs Temperature

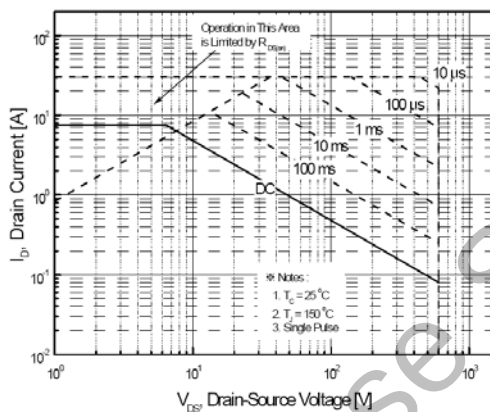


Figure 9-2. Maximum Safe Operating Area

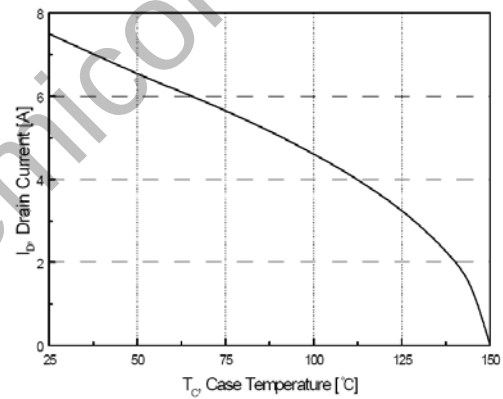


Figure 10. Maximum Drain Current vs Case Temperature

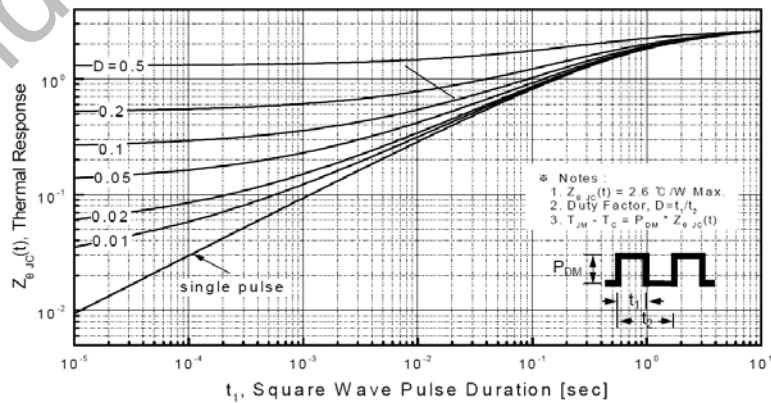
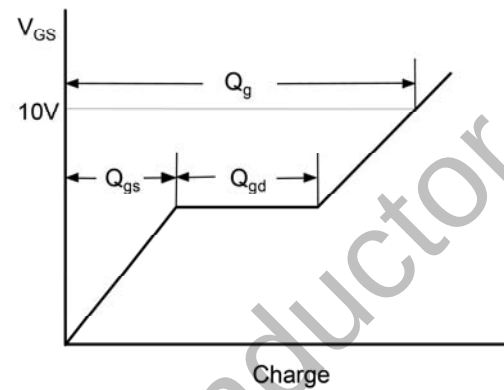
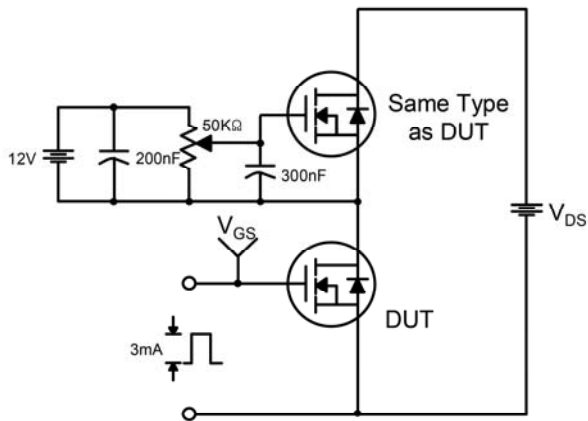
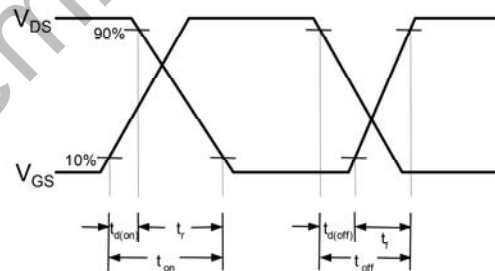
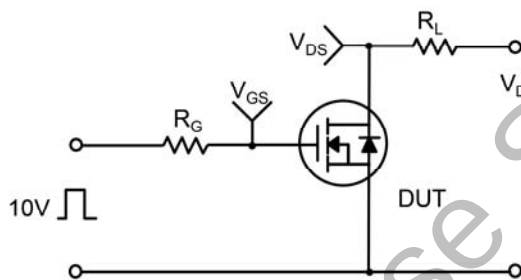


Figure 11-2. Transient Thermal Response Curve

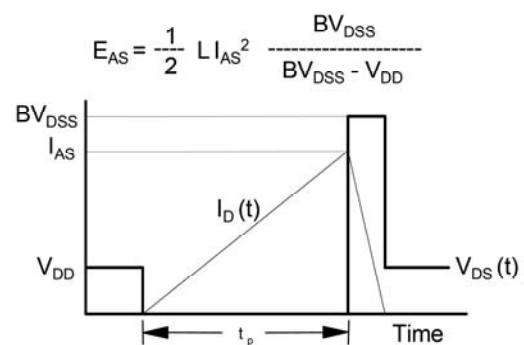
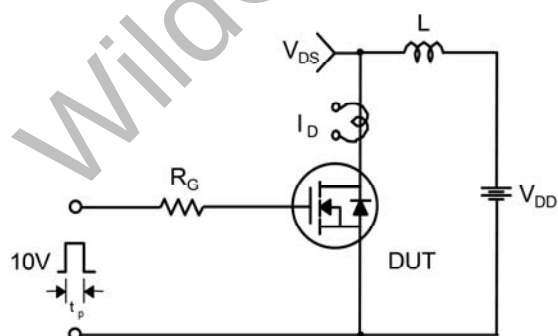
## Gate Charge Test Circuit &amp; Waveform



## Resistive Switching Test Circuit &amp; Waveforms

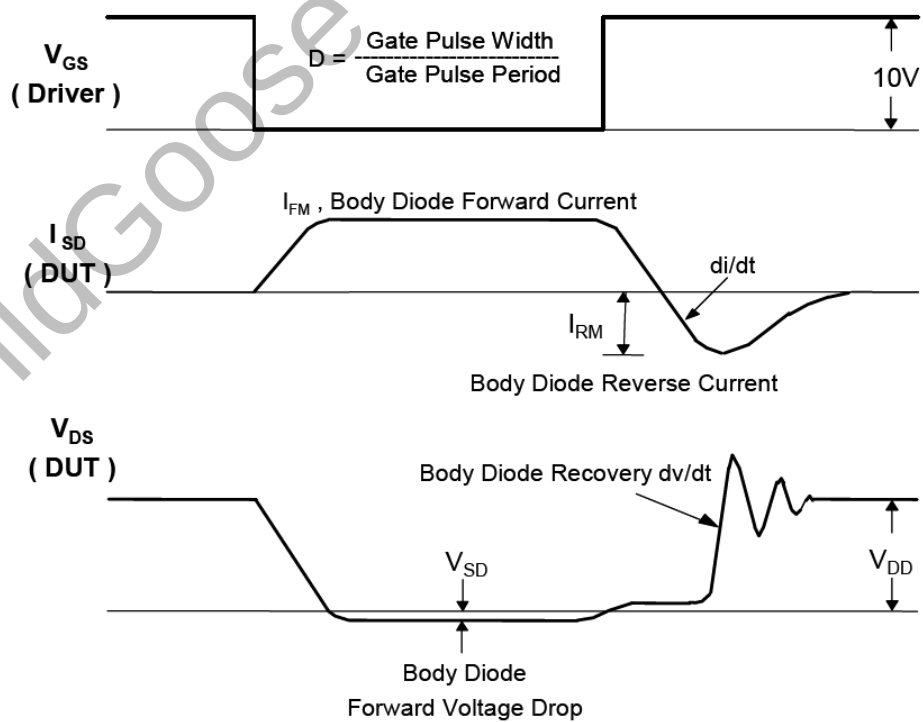


## Unclamped Inductive Switching Test Circuit &amp; Waveforms



The diagram shows a switching circuit. A load inductor  $L$  is connected between the drain of a MOSFET driver and the drain of a MOSFET DUT. The source of the driver is connected to ground through a resistor  $R_G$ . The gate of the driver is driven by a pulse  $V_{GS}$ . The DUT's source is connected to ground, and its drain is connected to the load inductor. The DUT's gate is connected to its drain. The DUT's drain voltage is  $V_{DS}$  and its source-drain current is  $I_{SD}$ . The driver is labeled "Same Type as DUT".

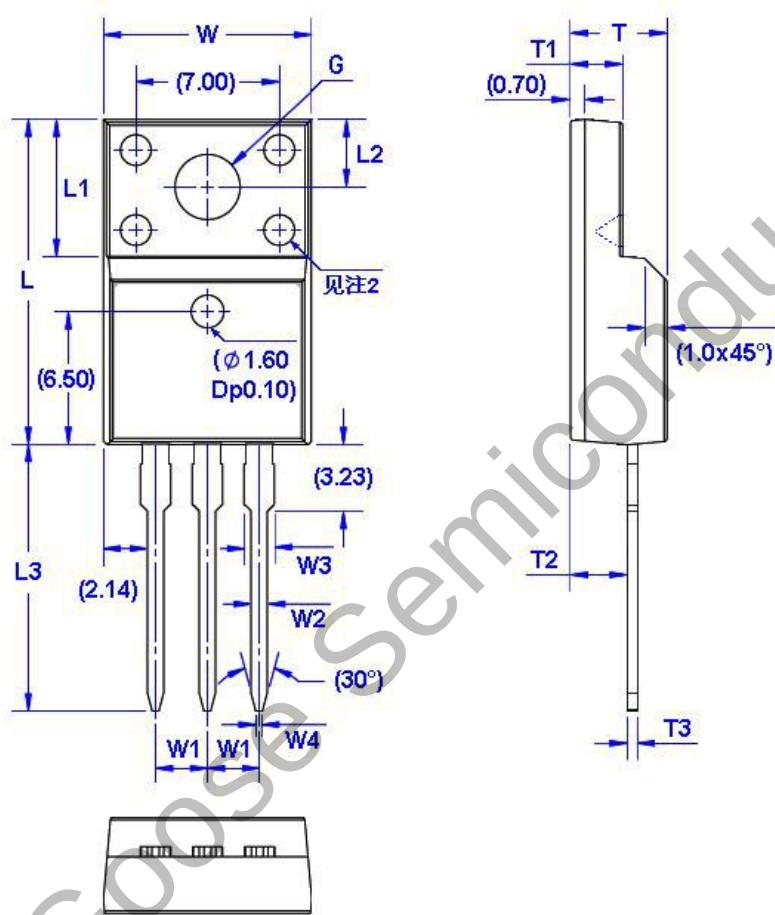
- $dv/dt$  controlled by  $R_G$
- $I_{SD}$  controlled by pulse period



Package Dimension

TO-220F

Unit: mm



| Symbol | Size       |       | Symbol | Size  |       | Symbol | Size  |       | Symbol | Size |      |
|--------|------------|-------|--------|-------|-------|--------|-------|-------|--------|------|------|
|        | Min        | Max   |        | Min   | Max   |        | Min   | Max   |        | Min  | Max  |
| W      | 9.96       | 10.36 | W4     | 0.25  | 0.45  | L3     | 12.78 | 13.18 | T3     | 0.45 | 0.60 |
| W1     | 2.54 (TYP) |       | L      | 15.67 | 16.07 | T      | 4.50  | 4.90  | G(Φ)   | 3.08 | 3.28 |
| W2     | 0.70       | 0.90  | L1     | 6.48  | 6.88  | T1     | 2.34  | 2.74  |        |      |      |
| W3     | 1.24       | 1.47  | L2     | 3.20  | 3.40  | T2     | 2.56  | 2.96  |        |      |      |