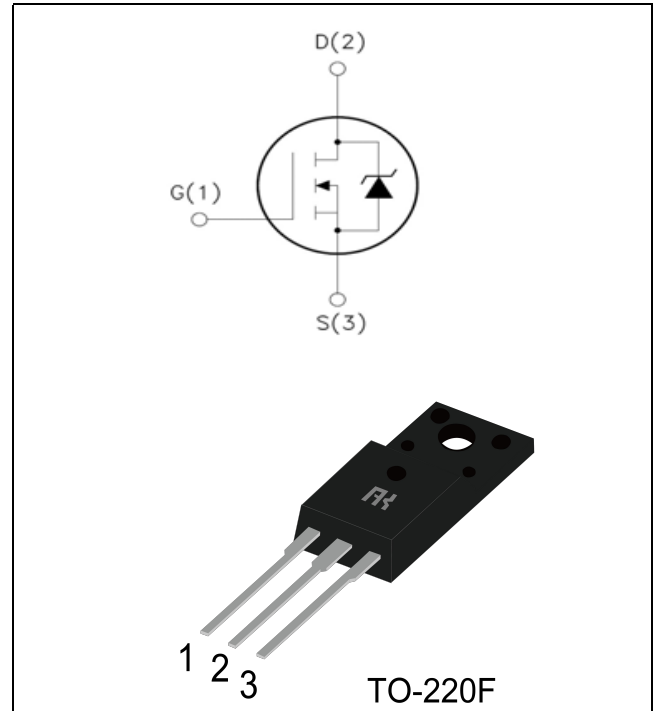


**650V,7A N-CHANNEL POWER MOSFET**
**GENERAL DESCRIPTION**

The AKF7N65P is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics .

**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


**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  | 7.0  |
|                     |                                                                              | T <sub>j</sub> =100°C | 4.7  |
| V <sub>GS(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**

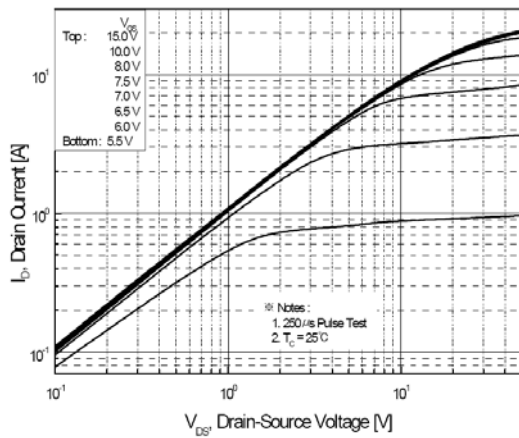
| Symbol           | Parameter                               | Typ. | Max. | Unit |
|------------------|-----------------------------------------|------|------|------|
| R <sub>θJC</sub> | Thermal Resistance, Junction to Case    | -    | 2.4  | °C/W |
| R <sub>θJA</sub> | Thermal Resistance, Junction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

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

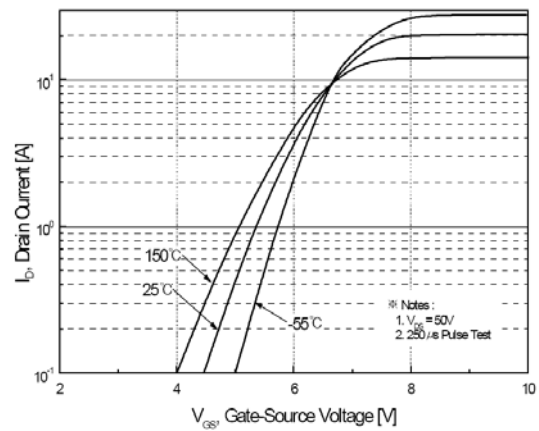
| Symbol                                                        | Parameter                                 | Test Condition                                                              | Min. | Typ. | Max. | Unit |
|---------------------------------------------------------------|-------------------------------------------|-----------------------------------------------------------------------------|------|------|------|------|
| <b>Off Characteristics</b>                                    |                                           |                                                                             |      |      |      |      |
| BV <sub>DSS</sub>                                             | Drain-Source Breakdown Voltage            | I <sub>D</sub> =250μA, V <sub>GS</sub> =0                                   | 650  | -    | -    | V    |
| ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>                           | Breakdown Voltage Temperature Coefficient | I <sub>D</sub> =250μA, Reference to 25°C                                    | -    | 0.67 | -    | V/°C |
| 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°C                                | -    | -    | 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 |      |
| <b>On Characteristics</b>                                     |                                           |                                                                             |      |      |      |      |
| 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    |
| <b>Dynamic Characteristics</b>                                |                                           |                                                                             |      |      |      |      |
| 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   | -    |      |
| <b>Switching Characteristics</b>                              |                                           |                                                                             |      |      |      |      |
| 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   |
| T <sub>r</sub>                                                | 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 | -    |      |
| <b>Drain-Source Diode Characteristics and Maximum Ratings</b> |                                           |                                                                             |      |      |      |      |
| 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

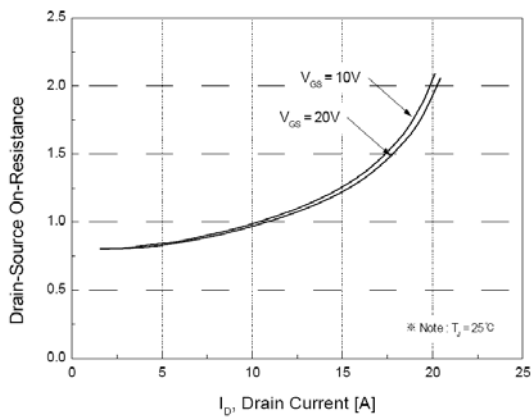
**Typical Characteristics**



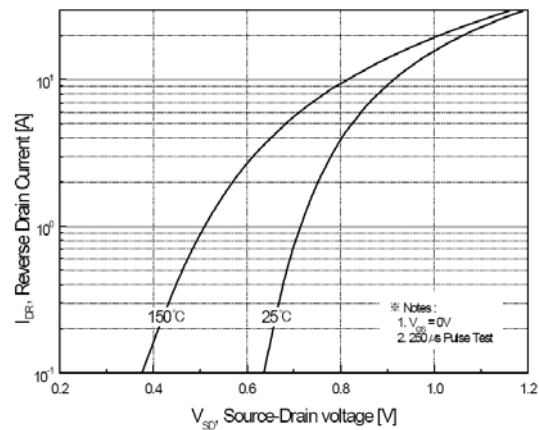
**Figure 1. On-Region Characteristics**



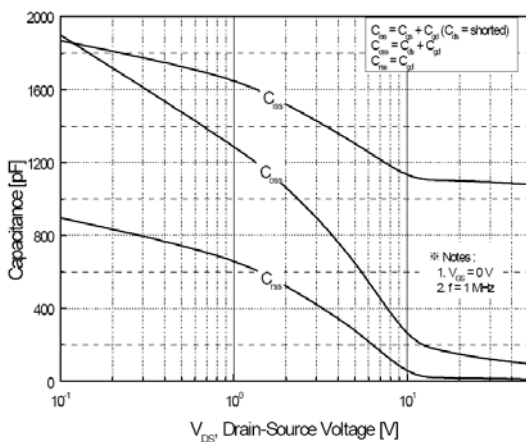
**Figure 2. Transfer Characteristics**



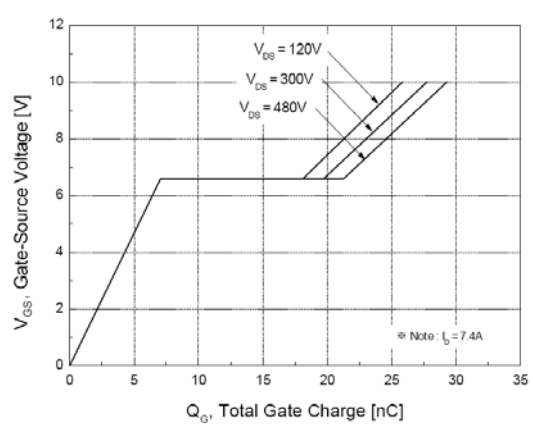
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



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

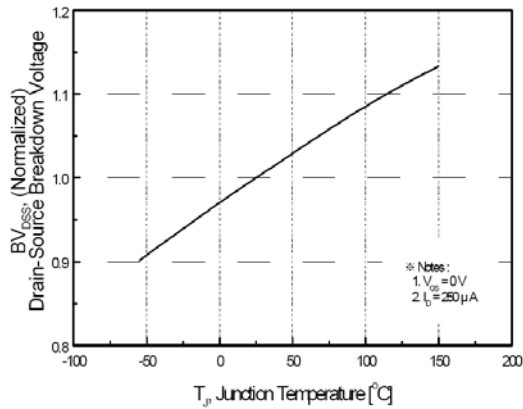


**Figure 5. Capacitance Characteristics**

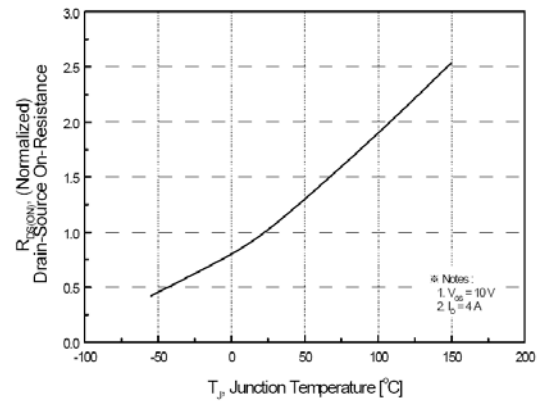


**Figure 6. Gate Charge Characteristics**

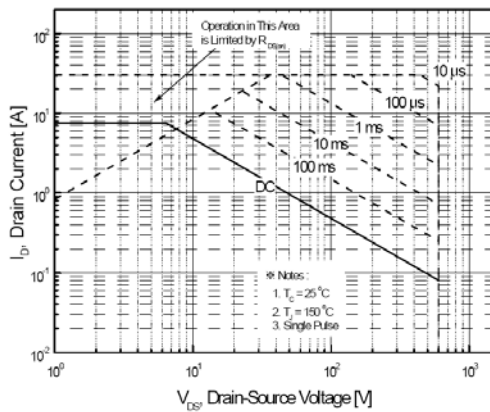
**Typical Characteristics (Continued)**



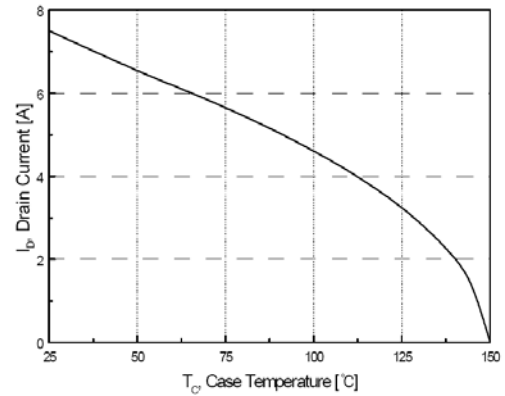
**Figure 7. Breakdown Voltage Variation vs Temperature**



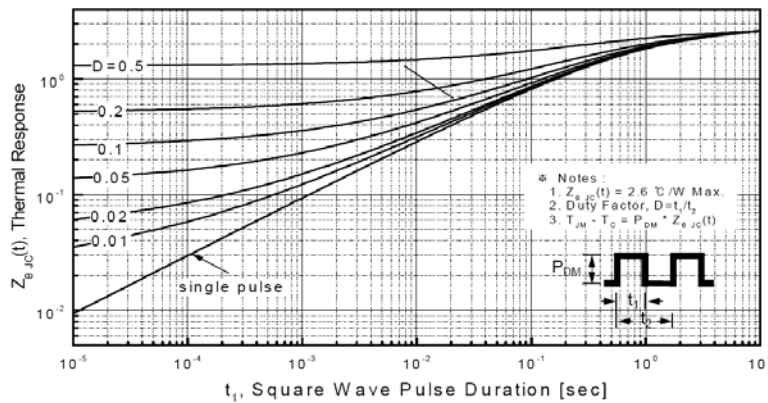
**Figure 8. On-Resistance Variation vs Temperature**



**Figure 9-2. Maximum Safe Operating Area**

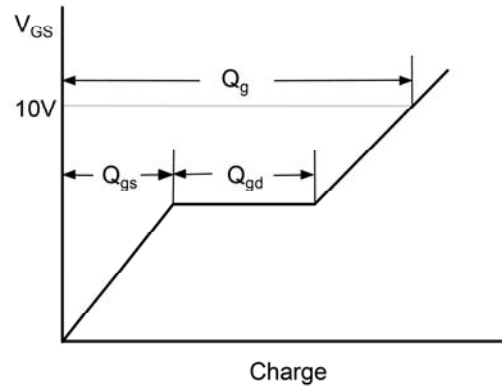
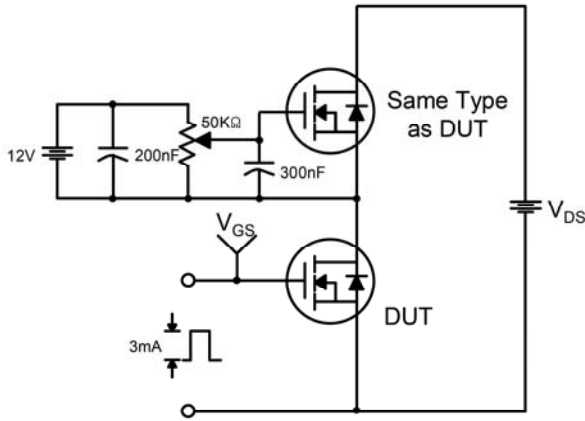


**Figure 10. Maximum Drain Current vs Case Temperature**

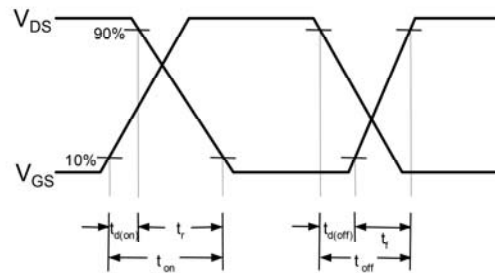
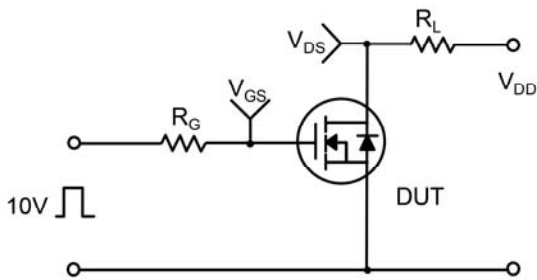


**Figure 11-2. Transient Thermal Response Curve**

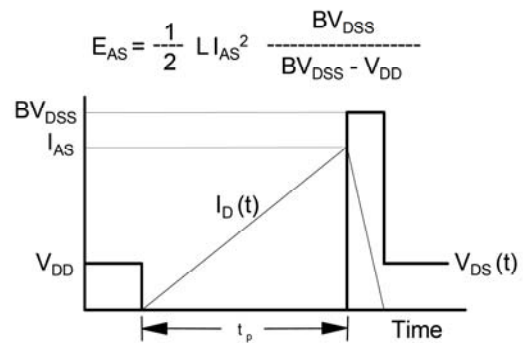
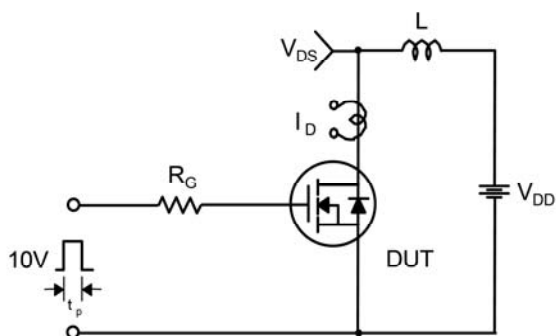
**Gate Charge Test Circuit & Waveform**



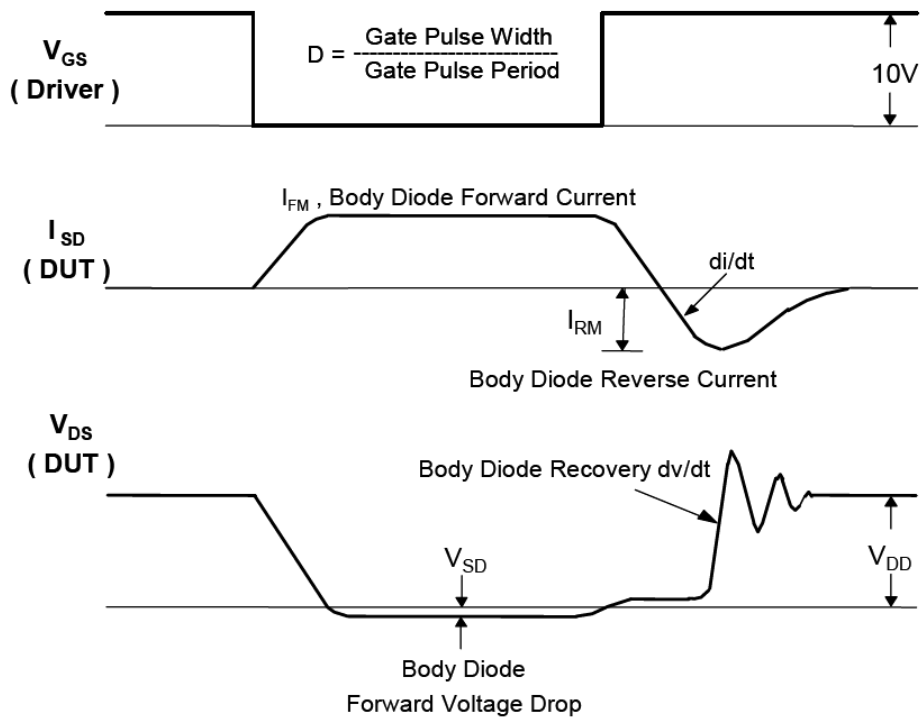
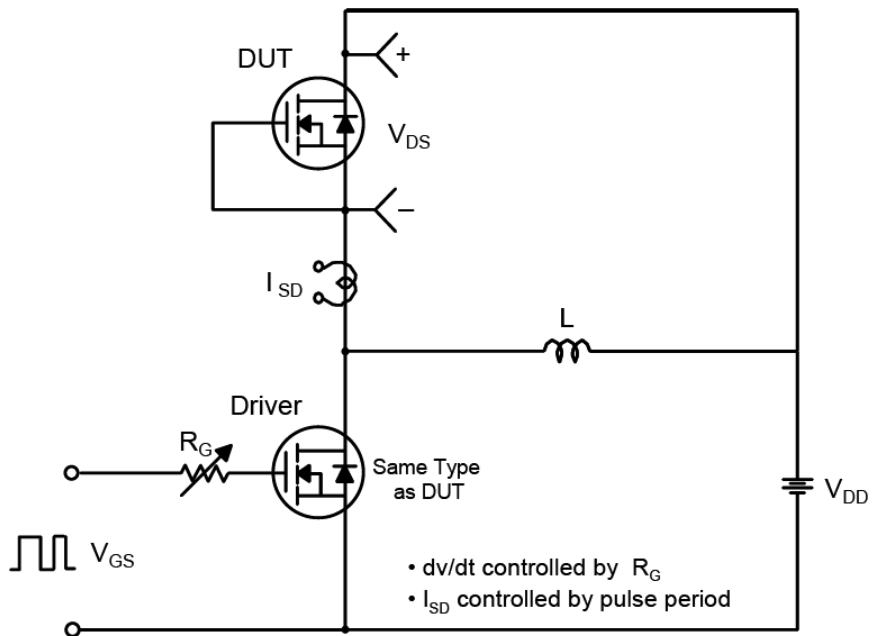
**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

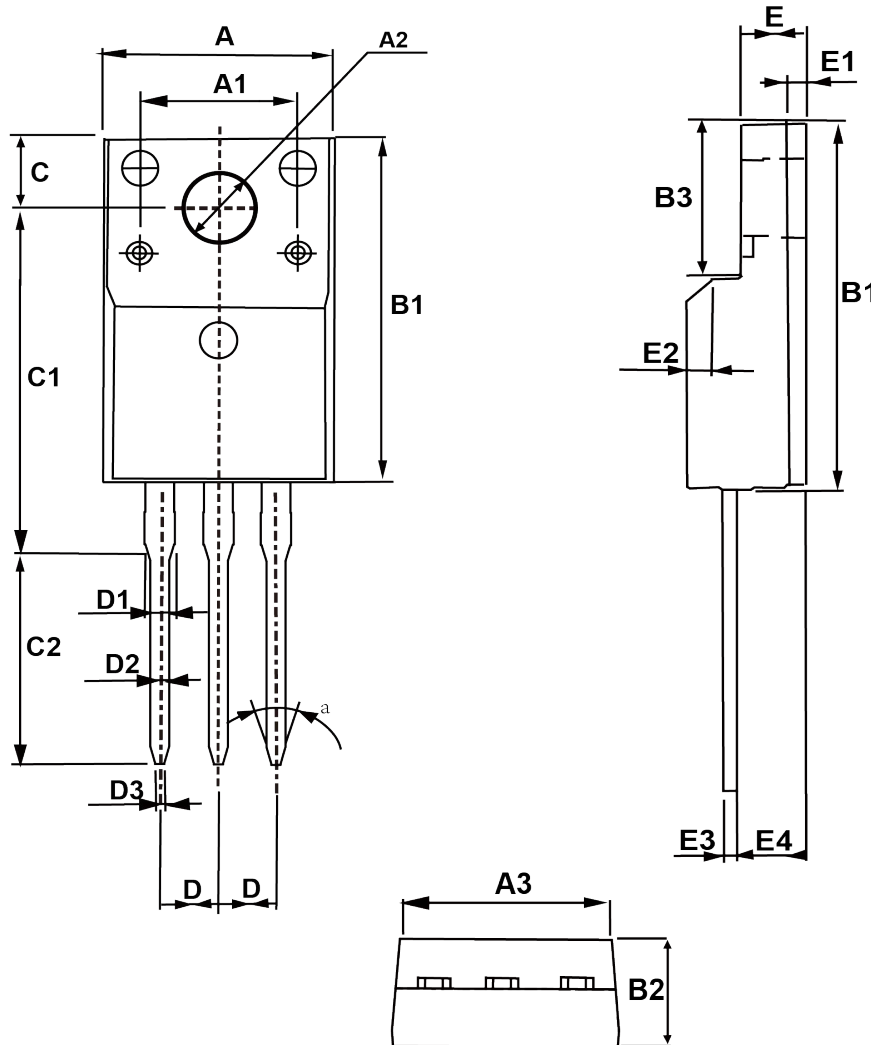


**Peak Diode Recovery dv/dt Test Circuit & Waveform**



**Package Dimension of TO-220F**

Unit: mm



| Symbol | Min   | Max   | Symbol    | Min     | Max  |
|--------|-------|-------|-----------|---------|------|
| A      | 9.96  | 10.36 | D         | 2.54    |      |
| A1     | 7.00  |       | D1        | 1.15    | 1.35 |
| A2     | 3.08  | 3.28  | D2        | 0.70    | 0.90 |
| A3     | 9.25  | 9.65  | D3        | 0.28    | 0.48 |
| B1     | 15.70 | 16.10 | E         | 2.34    | 2.74 |
| B2     | 4.50  | 4.90  | E1        | 0.70    |      |
| B3     | 6.20  | 6.80  | E2        | 1.0×45° |      |
| C      | 3.20  | 3.40  | E3        | 0.36    | 0.65 |
| C1     | 15.20 | 16.00 | E4        | 2.55    | 2.95 |
| C2     | 9.75  | 10.15 | a (angle) | 30°     |      |