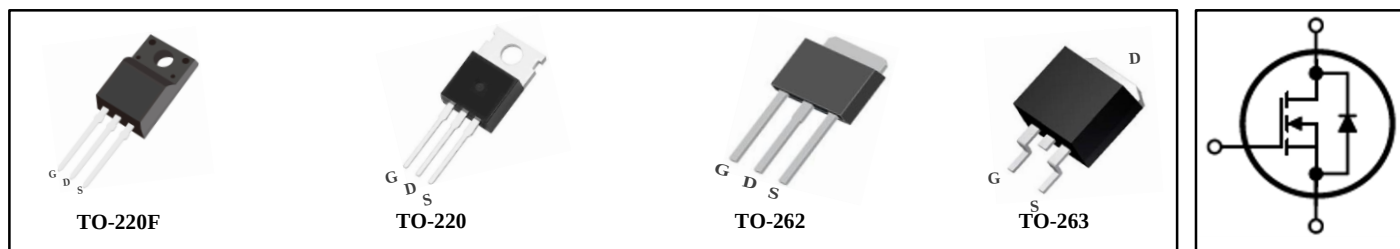


### FEATURES

- $BV_{DSS}$ : 600V,  $I_D=10A$
- $R_{DS(on)}$ :  $0.8\Omega(\text{Max}) @ V_{GS}=10V$
- Very Low FOM ( $R_{DS(on)} * Q_g$ )
- Excellent stability and uniformity

### APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)
- AC to DC Converters



### Ordering Information

| Type NO.   | Marking    | Package Code |
|------------|------------|--------------|
| MPVA10N60B | MPVA10N60B | TO-220F      |
| MPVP10N60B | MPVP10N60B | TO-220       |
| MPVH10N60B | MPVH10N60B | TO-262       |
| MPVC10N60B | MPVC10N60B | TO-263       |

### Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ , unless otherwise noted

| Parameter                                        | Symbol         | Value           |             | Unit             |
|--------------------------------------------------|----------------|-----------------|-------------|------------------|
|                                                  |                | 220F            | 220-262-263 |                  |
| Drain-Source Voltage ( $V_{GS} = 0V$ )           | $V_{DSS}$      | 600             |             | V                |
| Continuous Drain Current                         | $I_D$          | 10              |             | A                |
| Pulsed Drain Current (note1)                     | $I_{DM}$       | 38              |             | A                |
| Gate-Source Voltage                              | $V_{GSS}$      | $\pm 30$        |             | V                |
| Single Pulse Avalanche Energy (note2)            | $E_{AS}$       | 562             |             | mJ               |
| Avalanche Current (note1)                        | $I_{AR}$       | 7.5             |             | A                |
| Repetitive Avalanche Energy (note1)              | $E_{AR}$       | 45              |             | mJ               |
| Power Dissipation ( $T_C = 25^\circ\text{C}$ )   | $P_D$          | 65              | 120         | W                |
| Operating Junction and Storage Temperature Range | $T_J, T_{stg}$ | $-55 \sim +150$ |             | $^\circ\text{C}$ |

### Thermal Resistance

| Parameter                               | Symbol     | Value |             | Unit               |
|-----------------------------------------|------------|-------|-------------|--------------------|
|                                         |            | 220F  | 220-262-263 |                    |
| Thermal Resistance, Junction-to-Case    | $R_{thJC}$ | 1.98  | 1.2         | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction-to-Ambient | $R_{thJA}$ | 62.5  | 60.0        |                    |

| Specifications T <sub>J</sub> = 25°C, unless otherwise noted |                      |                                                                                |       |      |      |      |
|--------------------------------------------------------------|----------------------|--------------------------------------------------------------------------------|-------|------|------|------|
| Parameter                                                    | Symbol               | Test Conditions                                                                | Value |      |      | Unit |
|                                                              |                      |                                                                                | Min.  | Typ. | Max. |      |
| Static                                                       |                      |                                                                                |       |      |      |      |
| Drain-Source Breakdown Voltage                               | V <sub>(BR)DSS</sub> | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA                                   | 600   | --   | --   | V    |
| Zero Gate Voltage Drain Current                              | I <sub>DSS</sub>     | V <sub>DS</sub> = 600V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 25°C            | --    | --   | 1    | μA   |
| Gate-Source Leakage                                          | I <sub>GSS</sub>     | V <sub>GS</sub> = ±30V                                                         | --    | --   | ±100 | nA   |
| Gate-Source Threshold Voltage                                | V <sub>GS(th)</sub>  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                     | 3.0   | --   | 4.0  | V    |
| Drain-Source On-Resistance (Note4)                           | R <sub>DS(on)</sub>  | V <sub>GS</sub> = 10V, I <sub>D</sub> = 5.0A                                   | --    | 0.7  | 0.8  | Ω    |
| Dynamic                                                      |                      |                                                                                |       |      |      |      |
| Input Capacitance                                            | C <sub>iss</sub>     | V <sub>GS</sub> = 0V,<br>V <sub>DS</sub> = 25V,<br>f = 1.0MHz                  | --    | 1562 | --   | pF   |
| Output Capacitance                                           | C <sub>oss</sub>     |                                                                                | --    | 116  | --   |      |
| Reverse Transfer Capacitance                                 | C <sub>rss</sub>     |                                                                                | --    | 12   | --   |      |
| Total Gate Charge                                            | Q <sub>g</sub>       | V <sub>DD</sub> = 400V, I <sub>D</sub> = 10.0A,<br>V <sub>GS</sub> = 10V       | --    | 33   | --   | nC   |
| Gate-Source Charge                                           | Q <sub>gs</sub>      |                                                                                | --    | 7    | --   |      |
| Gate-Drain Charge                                            | Q <sub>gd</sub>      |                                                                                | --    | 17   | --   |      |
| Turn-on Delay Time                                           | t <sub>d(on)</sub>   | V <sub>DD</sub> =300V, I <sub>D</sub> = 10.0A,<br>R <sub>G</sub> = 25Ω         | --    | 23   | --   | ns   |
| Turn-on Rise Time                                            | t <sub>r</sub>       |                                                                                | --    | 15   | --   |      |
| Turn-off Delay Time                                          | t <sub>d(off)</sub>  |                                                                                | --    | 90   | --   |      |
| Turn-off Fall Time                                           | t <sub>f</sub>       |                                                                                | --    | 30   | --   |      |
| Drain-Source Body Diode Characteristics                      |                      |                                                                                |       |      |      |      |
| Continuous Body Diode Current                                | I <sub>S</sub>       | T <sub>C</sub> = 25°C                                                          | --    | --   | 10   | A    |
| Pulsed Diode Forward Current                                 | I <sub>SM</sub>      |                                                                                | --    | --   | 38   |      |
| Body Diode Voltage                                           | V <sub>SD</sub>      | T <sub>J</sub> = 25°C, I <sub>SD</sub> = 10.0A, V <sub>GS</sub> = 0V           | --    | --   | 1.4  | V    |
| Reverse Recovery Time                                        | t <sub>rr</sub>      | V <sub>GS</sub> = 0V, I <sub>F</sub> = 10.0A,<br>di <sub>F</sub> /dt = 100A/μs | --    | 320  | --   | ns   |
| Reverse Recovery Charge                                      | Q <sub>rr</sub>      |                                                                                | --    | 4.2  | --   | μC   |

### Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $I_{AS} = 2A, V_{DD} = 50V, R_G = 25\Omega$ , Starting  $T_J = 25^{\circ}\text{C}$
3. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty Cycle  $\leq 1\%$
4. Essentially independent of operating temperature

Typical Characteristics  $T_J = 25^\circ\text{C}$ , unless otherwise noted

Figure 1. Output Characteristics

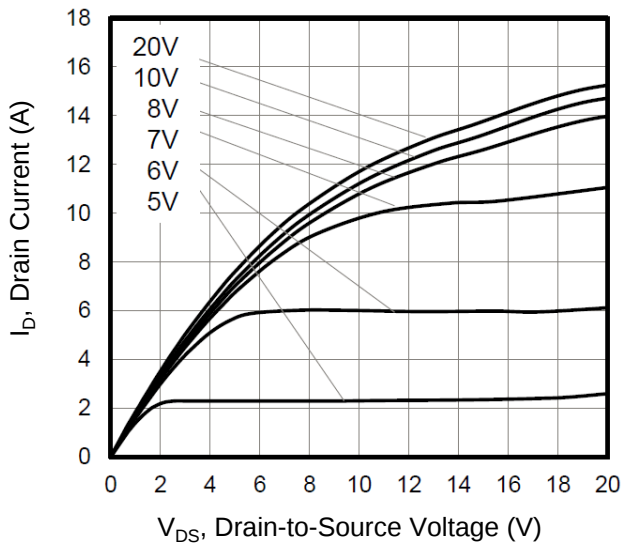


Figure 2. Transfer Characteristics

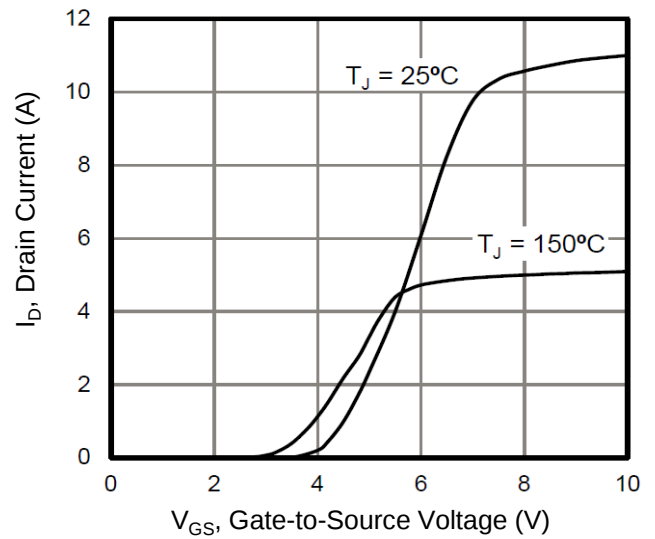


Figure 3. Drain Current vs. Temperature

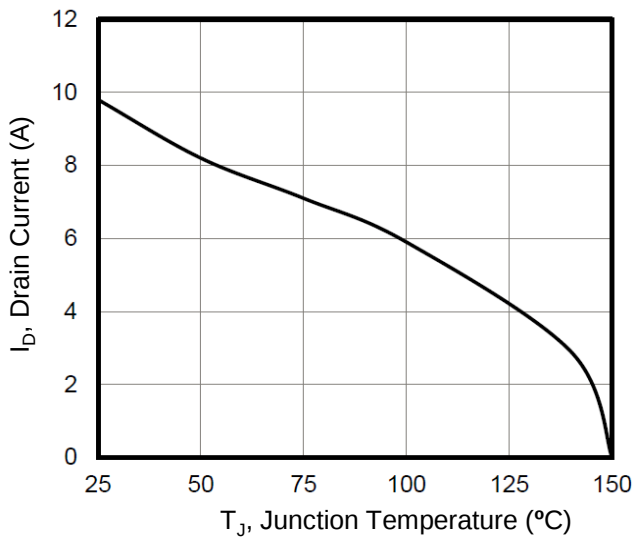


Figure 4. Capacitance

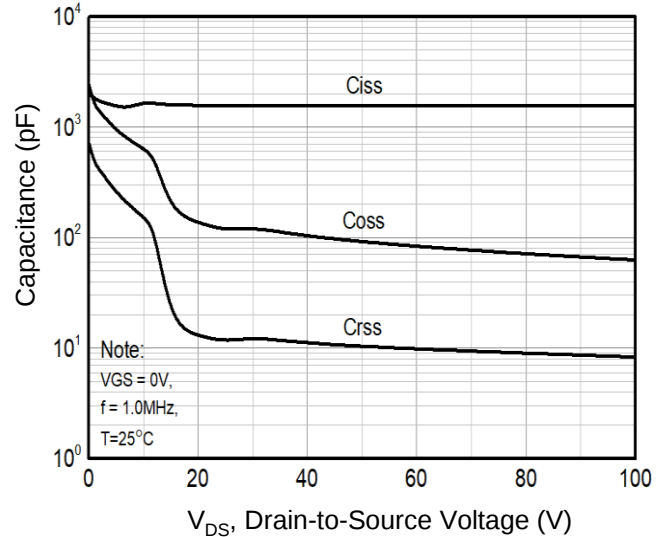


Figure 5. Gate Charge

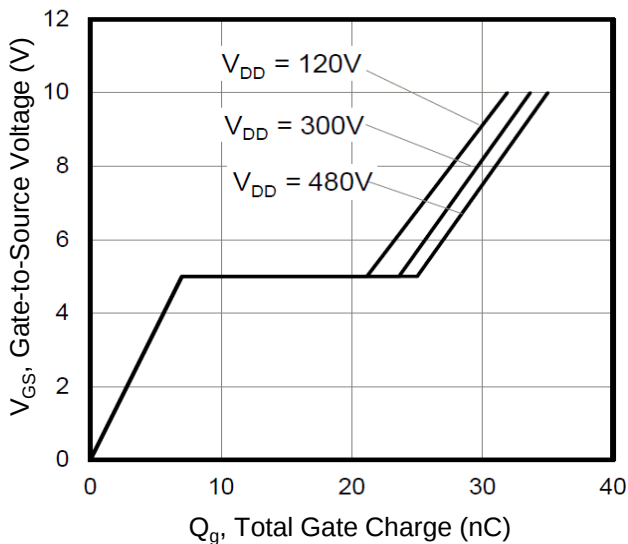
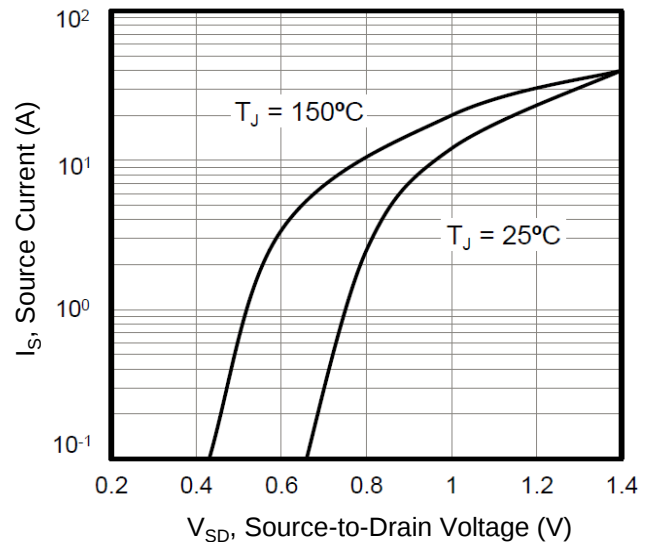
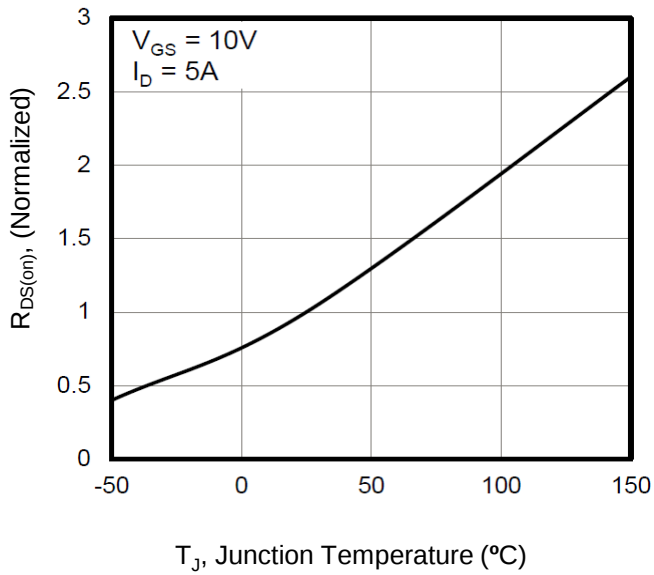


Figure 6. Body Diode Forward Voltage

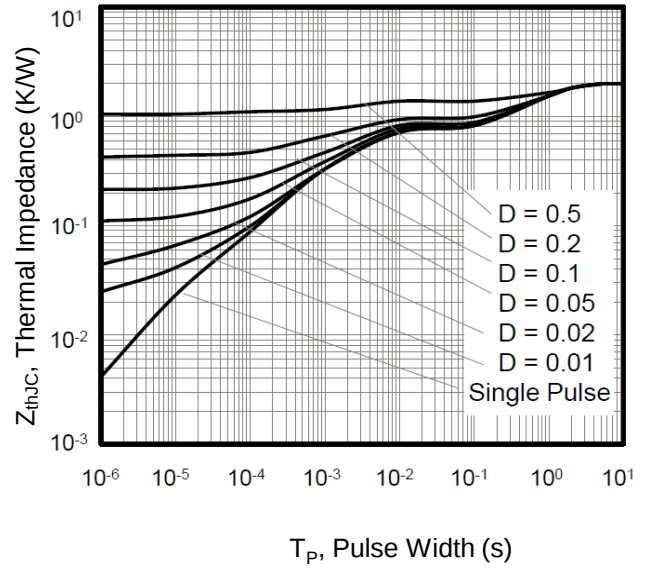


Typical Characteristics  $T_J = 25^\circ\text{C}$ , unless otherwise noted

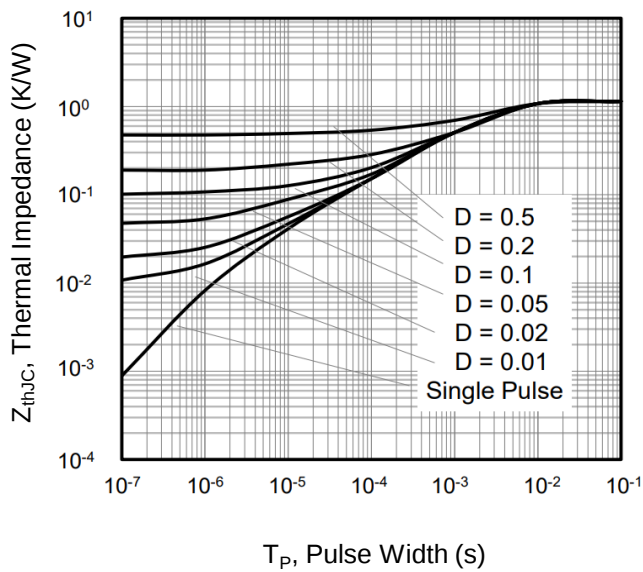
**Figure 7. On-Resistance vs. Temperature**



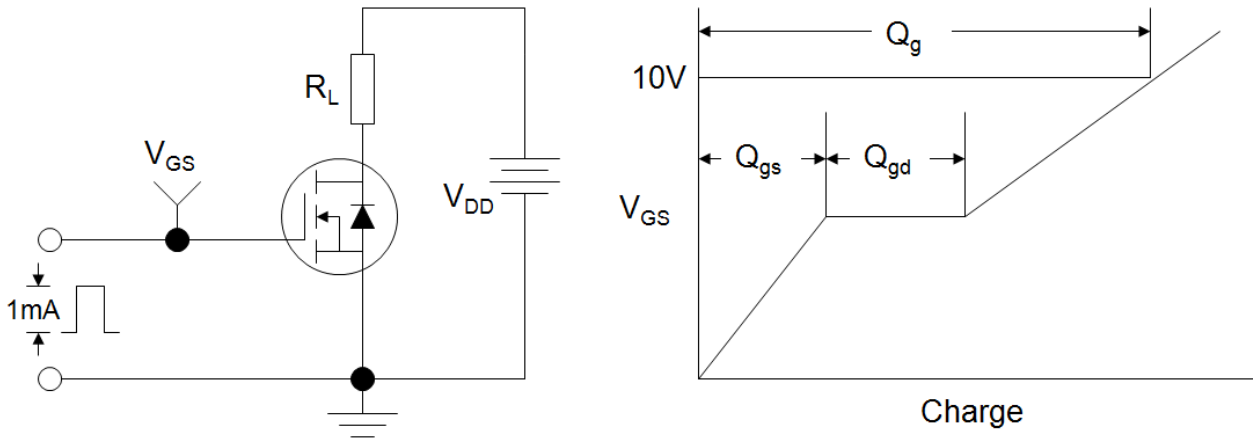
**Figure 8. Transient Thermal Impedance (TO-220F)**



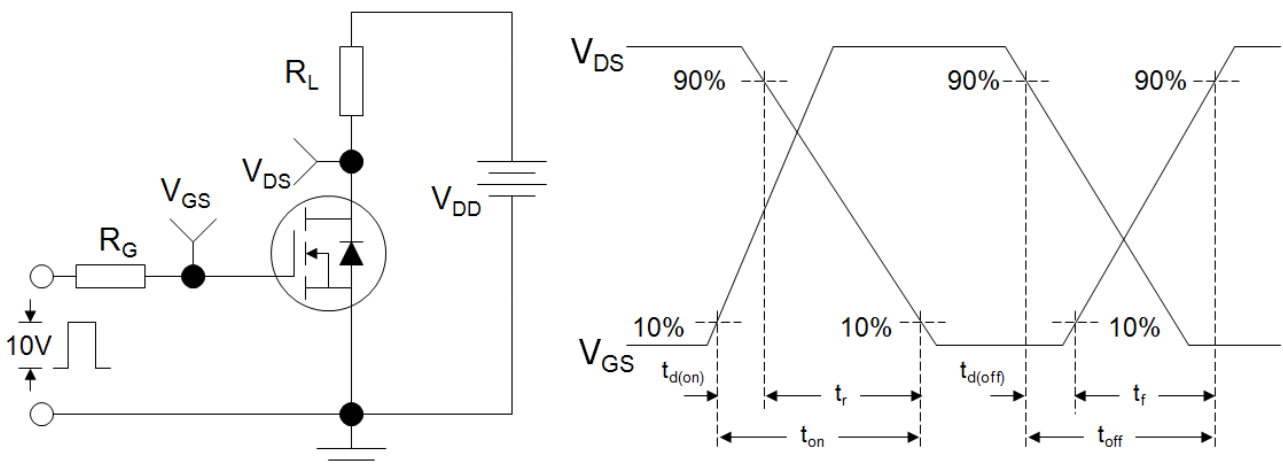
**Figure 9. Transient Thermal Impedance (TO-220 TO-262 TO-263)**



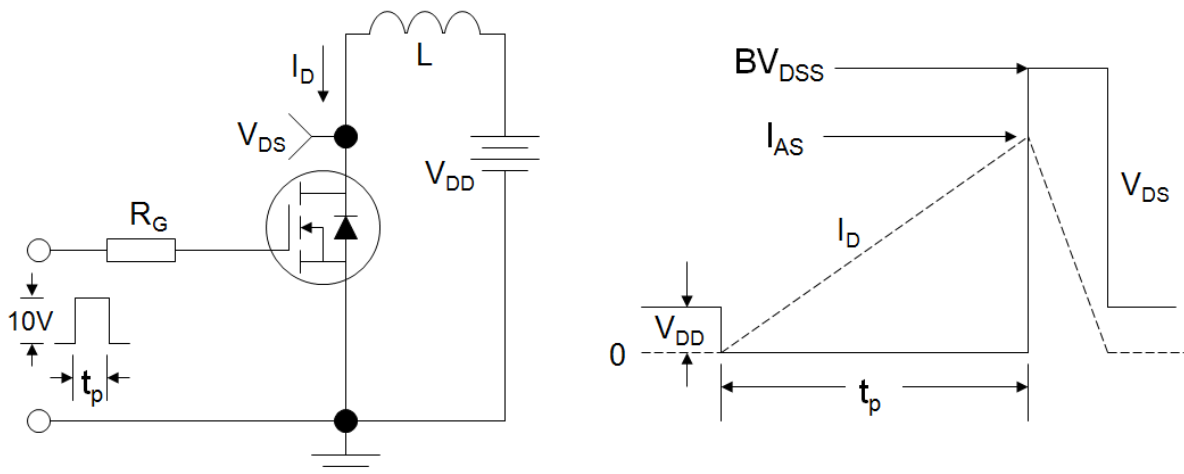
**Figure A: Gate Charge Test Circuit and Waveform**



**Figure B: Resistive Switching Test Circuit and Waveform**



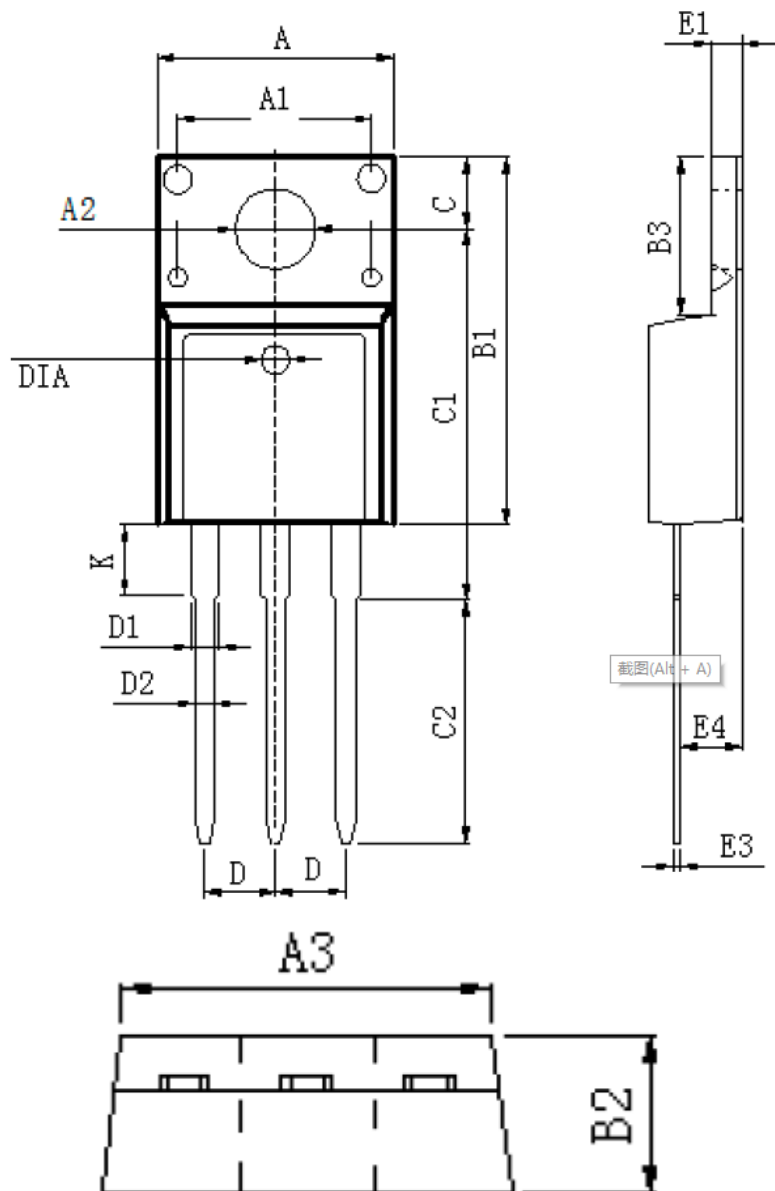
**Figure C: Unclamped Inductive Switching Test Circuit and Waveform**



## Outline Dimension

Unit: mm

### TO-220F



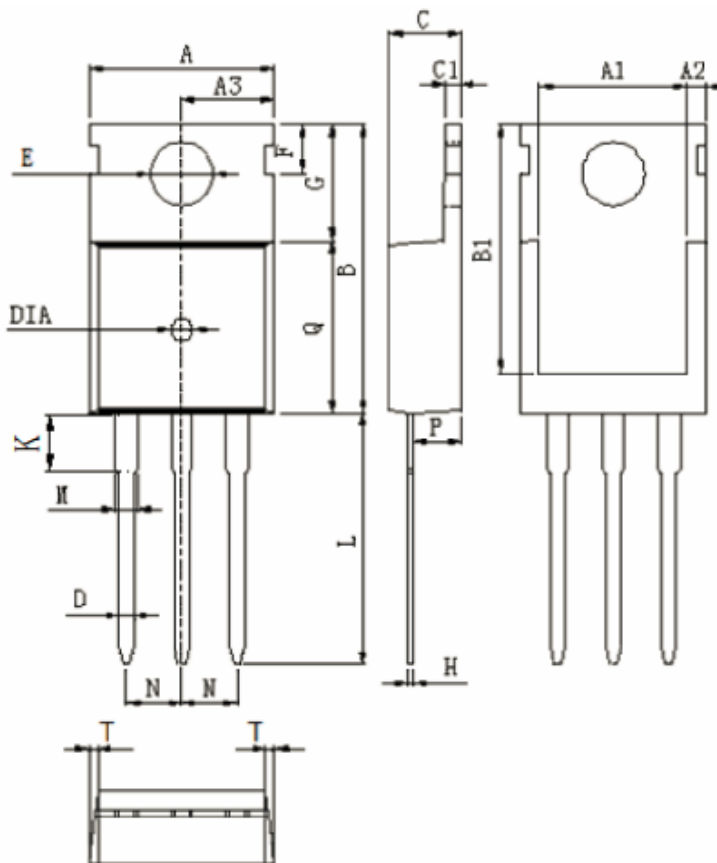
| DIM | MILLIMETERS            |
|-----|------------------------|
| A   | $10.16 \pm 0.3$        |
| A1  | $7.00 \pm 0.1$         |
| A2  | $3.3 \pm 0.2$          |
| A3  | $9.5 \pm 0.2$          |
| B1  | $15.87 \pm 0.3$        |
| B2  | $4.7 \pm 0.2$          |
| B3  | $6.68 \pm 0.4$         |
| C   | $3.3 \pm 0.2$          |
| C1  | $12.57 \pm 0.3$        |
| C2  | $10.02 \pm 0.5$        |
| D   | $2.54 \pm 0.05$        |
| D1  | $1.28 \pm 0.2$         |
| D2  | $0.8 \pm 0.1$          |
| K   | $3.1 \pm 0.3$          |
| E1  | $2.54 \pm 0.1$         |
| E3  | $0.5 \pm 0.1$          |
| E4  | $2.76 \pm 0.2$         |
| DIA | $\odot 1.5$ (deep 0.2) |

Unit :mm

## Outline Dimension

Unit: mm

### TO-220



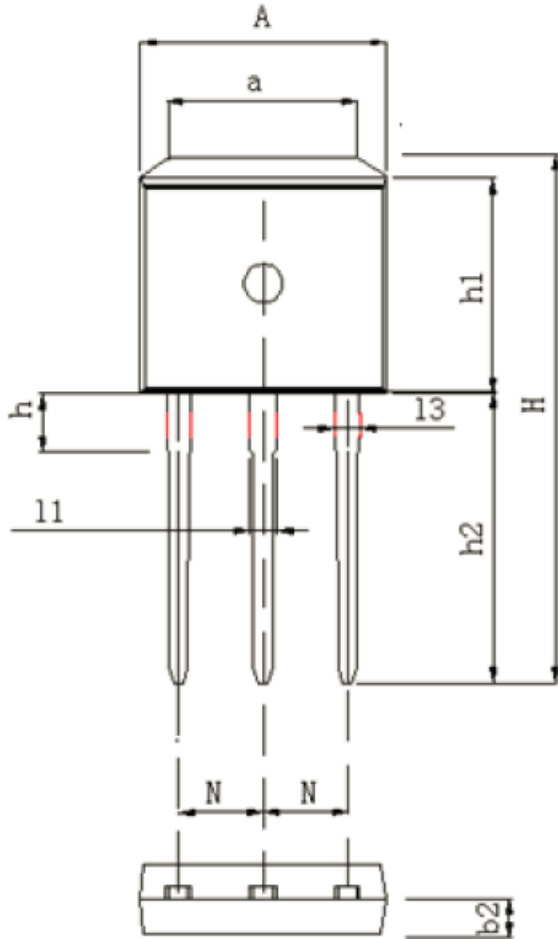
| DIM | MILLIMETERS            |
|-----|------------------------|
| A   | $10.0 \pm 0.3$         |
| A1  | $8.64 \pm 0.2$         |
| A2  | $1.15 \pm 0.1$         |
| A3  | $5.0 \pm 0.2$          |
| B   | $15.8 \pm 0.4$         |
| B1  | $13.2 \pm 0.3$         |
| C   | $4.56 \pm 0.1$         |
| C1  | $1.3 \pm 0.2$          |
| D   | $0.8 \pm 0.2$          |
| E   | $3.6 \pm 0.2$          |
| F   | $2.95 \pm 0.3$         |
| G   | $6.5 \pm 0.3$          |
| H   | $0.5 \pm 0.1$          |
| K   | $3.1 \pm 0.2$          |
| L   | $13.2 \pm 0.4$         |
| M   | $1.25 \pm 0.1$         |
| N   | $2.54 \pm 0.1$         |
| P   | $2.4 \pm 0.3$          |
| Q   | $9.0 \pm 0.3$          |
| T   | W:0.35                 |
| DIA | $\odot 1.5$ (deep 0.2) |

Unit :mm

## Outline Dimension

Unit: mm

### TO-262



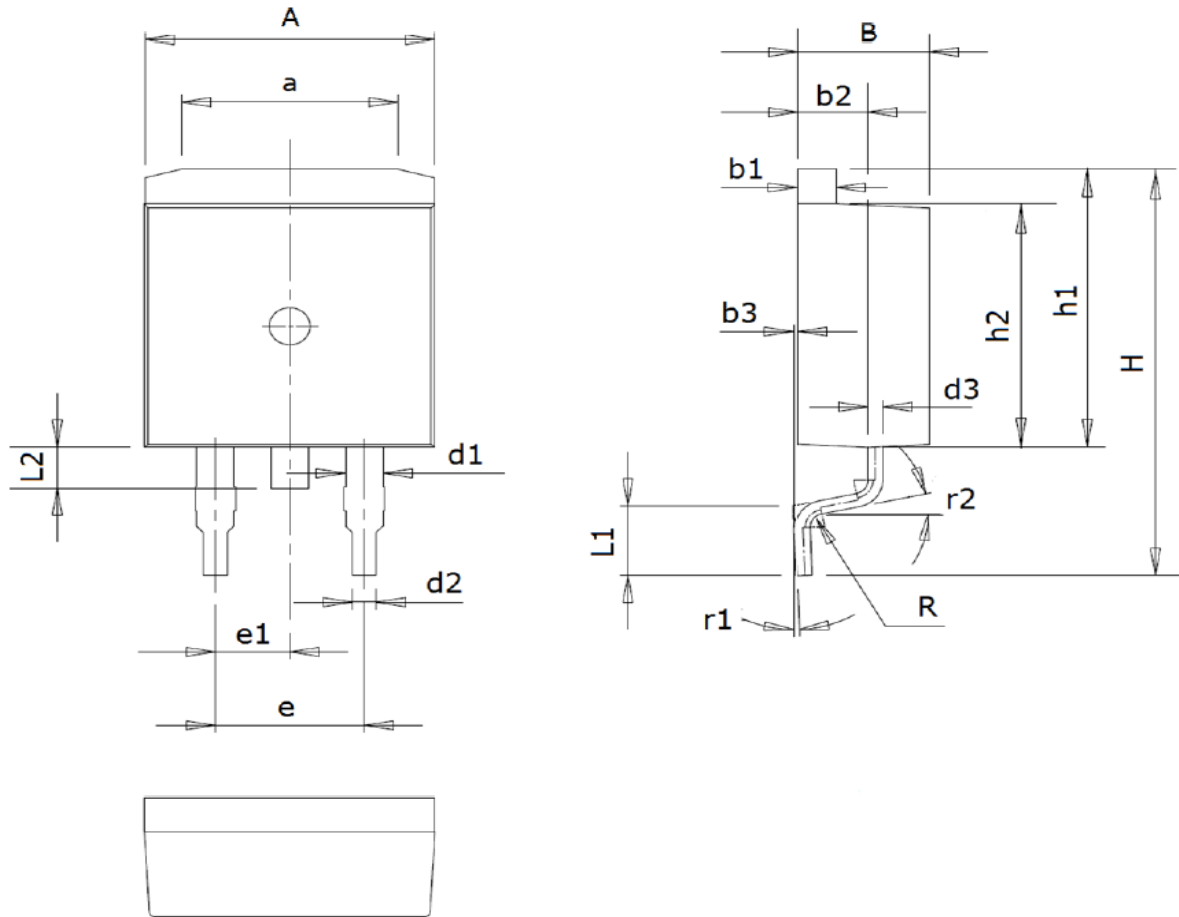
| DIM | MILLIMETERS    |
|-----|----------------|
| A   | $9.98 \pm 0.2$ |
| a   | $7.4 \pm 0.4$  |
| B   | $4.5 \pm 0.2$  |
| b1  | $1.3 \pm 0.05$ |
| b2  | $2.4 \pm 0.2$  |
| H   | $23.9 \pm 0.3$ |
| h   | $3.1 \pm 0.2$  |
| h1  | $9.16 \pm 0.2$ |
| h2  | $13.2 \pm 0.2$ |
| L   | $0.5 \pm 0.1$  |
| l1  | $1.3 \pm 0.1$  |
| l2  | $0.8 \pm 0.1$  |
| N   | $2.45 \pm 0.1$ |

Unit :mm

## Outline Dimension

Unit: mm

### TO-263



| Symbol | Dimensions (mm) | Symbol | Dimensions (mm) | Symbol | Dimensions (mm) |
|--------|-----------------|--------|-----------------|--------|-----------------|
| A      | 9.6~10.0        | d2     | 0.7~0.9         | L1     | 2.4~2.9         |
| a      | 7.0~7.8         | d3     | 0.4~0.6         | L2     | 1.3~1.8         |
| B      | 4.3~4.7         | e      | 5.08 (typ)      | R      | 0.5(typ)        |
| b1     | 1.25~1.35       | e1     | 2.54 (typ)      | r1     | 0~8°            |
| b2     | 2.2~2.6         | H      | 15.2~15.8       | r2     | 12° (typ)       |
| b3     | 0~0.2           | h1     | 10.3~10.7       |        |                 |
| d1     | 1.2~1.4         | h2     | 9.1~9.4         |        |                 |