



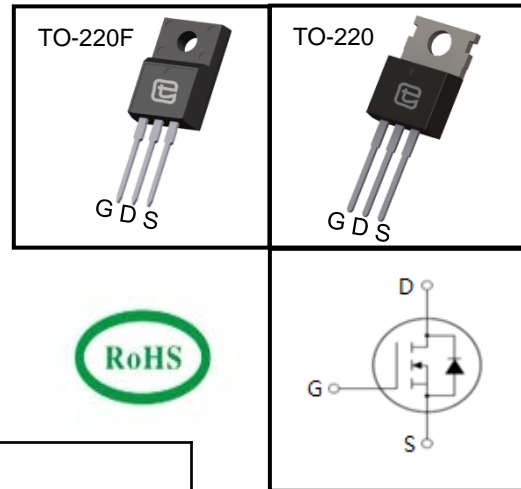
# 1000V N-Channel MOSFET

## FEATURES

- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

## APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)



| Device Marking and Package Information |           |           |
|--|-----------|-----------|
| Device                                 | TMA4N100H | TMP4N100H |
| Package                                | TO-220F   | TO-220    |
| Marking                                | A4N100H   | P4N100H   |

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

| Parameter   | Symbol                    | Value    |         | Unit             |
|---|---------------------------|----------|---------|------------------|
|   |                           | TO-220   | TO-220F |                  |
| Drain-Source Voltage ( $V_{GS} = 0\text{V}$ )                           | $V_{DSS}$                 | 1000     |         | V                |
| Continuous Drain Current  | $T_C = 25^\circ\text{C}$  | 4        |         | A                |
|   | $T_C = 100^\circ\text{C}$ | 2.4      |         |                  |
| Pulsed Drain Current (note1)  | $I_{DM}$                  | 16       |         | A                |
| Gate-Source Voltage   | $V_{GSS}$                 | $\pm 30$ |         | V                |
| Single Pulse Avalanche Energy (note2)                                   | $E_{AS}$                  | 125      |         | mJ               |
| Avalanche Current (note1)   | $I_{AR}$                  | 4        |         | A                |
| Repetitive Avalanche Energy (note1)                                     | $E_{AR}$                  | 14       |         | mJ               |
| Power Dissipation ( $T_C = 25^\circ\text{C}$ )                          | $P_D$                     | 74.8     | 36      | W                |
| Reverse diode dv/dt, $V_{DS} = 0 \dots 480\text{V}$ , $I_{SD} \leq I_D$ | dv/dt                     | 5        |         | V/ns             |
| Operating Junction and Storage Temperature Range                        | $T_J, T_{stg}$            | -55~+150 |         | $^\circ\text{C}$ |

## Thermal Resistance

| Parameter                               | Symbol     | Value  |         | Unit               |
|---|------------|--------|---------|--------------------|
|   |            | TO-220 | TO-220F |                    |
| Thermal Resistance, Junction-to-Case    | $R_{thJC}$ | 1.67   | 3.47    | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction-to-Ambient | $R_{thJA}$ | 60     | 62.5    |                    |



| Specifications $T_J = 25^\circ\text{C}$ , unless otherwise noted |               |  |       |      |           |          |
|--|---------------|--|-------|------|-----------|----------|
| Parameter  | Symbol        | Test Conditions  | Value |      |           | Unit     |
|  |               |  | Min.  | Typ. | Max.      |          |
| <b>Static</b>  |               |  |       |      |           |          |
| Drain-Source Breakdown Voltage                                   | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = 250\mu A$                            | 1000  | --   | --        | V        |
| Zero Gate Voltage Drain Current                                  | $I_{DSS}$     | $V_{DS} = 1000V, V_{GS} = 0V, T_J = 25^\circ\text{C}$    | --    | --   | 1         | $\mu A$  |
| Gate-Source Leakage  | $I_{GSS}$     | $V_{GS} = \pm 30V$                                       | --    | --   | $\pm 100$ | nA       |
| Gate-Source Threshold Voltage                                    | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = 250\mu A$                        | 3.0   | --   | 4.0       | V        |
| Drain-Source On-Resistance (Note3)                               | $R_{DS(on)}$  | $V_{GS} = 10V, I_D = 2A$                                 | --    | 3.6  | 4.3       | $\Omega$ |
| Forward Transconductance (Note3)                                 | $g_{fs}$      | $V_{DS} = 10V, I_D = 2A$                                 | --    | 5    | --        | S        |
| <b>Dynamic</b>   |               |  |       |      |           |          |
| Input Capacitance  | $C_{iss}$     | $V_{GS} = 0V,$<br>$V_{DS} = 25V,$<br>$f = 1.0\text{MHz}$ | --    | 688  | --        | pF       |
| Output Capacitance   | $C_{oss}$     |  | --    | 71   | --        |          |
| Reverse Transfer Capacitance                                     | $C_{rss}$     |  | --    | 14   | --        |          |
| Total Gate Charge  | $Q_g$         | $V_{DD} = 800V, I_D = 4A,$<br>$V_{GS} = 10V$             | --    | 30   | --        | nC       |
| Gate-Source Charge   | $Q_{gs}$      |  | --    | 2.8  | --        |          |
| Gate-Drain Charge  | $Q_{gd}$      |  | --    | 7.2  | --        |          |
| Turn-on Delay Time   | $t_{d(on)}$   | $V_{DD} = 500V, I_D = 4A,$<br>$R_G = 25\Omega$           | --    | 57   | --        | ns       |
| Turn-on Rise Time  | $t_r$         |  | --    | 62   | --        |          |
| Turn-off Delay Time  | $t_{d(off)}$  |  | --    | 137  | --        |          |
| Turn-off Fall Time   | $t_f$         |  | --    | 43   | --        |          |
| <b>Drain-Source Body Diode Characteristics</b>                   |               |  |       |      |           |          |
| Continuous Body Diode Current                                    | $I_S$         | $T_C = 25^\circ\text{C}$                                 | --    | --   | 4         | A        |
| Pulsed Diode Forward Current                                     | $I_{SM}$      |  | --    | --   | 12        |          |
| Body Diode Voltage   | $V_{SD}$      | $T_J = 25^\circ\text{C}, I_{SD} = 4A, V_{GS} = 0V$       | --    | --   | 1.4       | V        |
| Reverse Recovery Time  | $t_{rr}$      | $V_R = 500V, I_F = I_S,$<br>$di_F/dt = 100A/\mu s$       | --    | 1.1  | --        | us       |
| Reverse Recovery Charge  | $Q_{rr}$      |  | --    | 2.2  | --        | $\mu C$  |

**Notes**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2.  $I_{AS} = 5A, V_{DD} = 50V, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$
3. Pulse Test: Pulse width  $\leq 300\mu s$ , Duty Cycle  $\leq 1\%$



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

Figure 1. Output Characteristics ( $T_J = 25^\circ\text{C}$ )

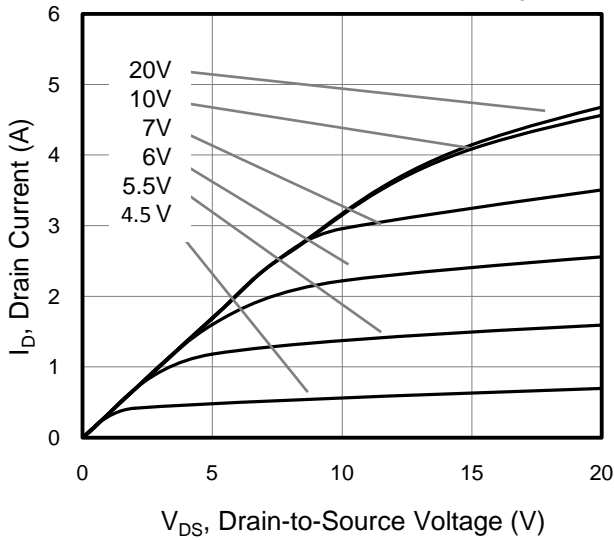


Figure 2. Transfer Characteristics

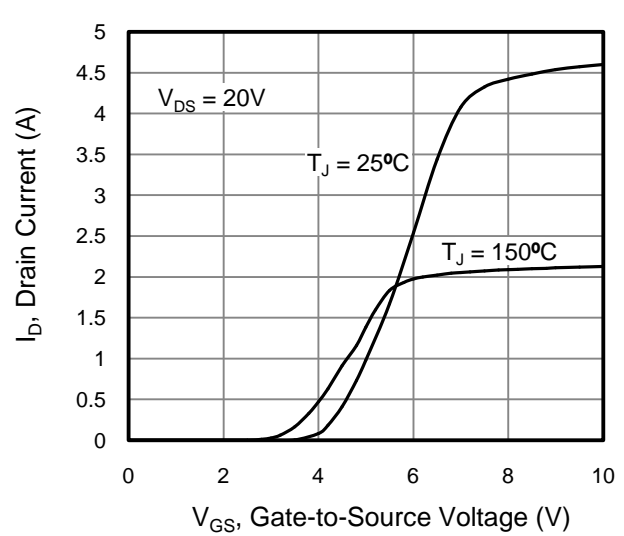


Figure 3. On-Resistance vs. Drain Current

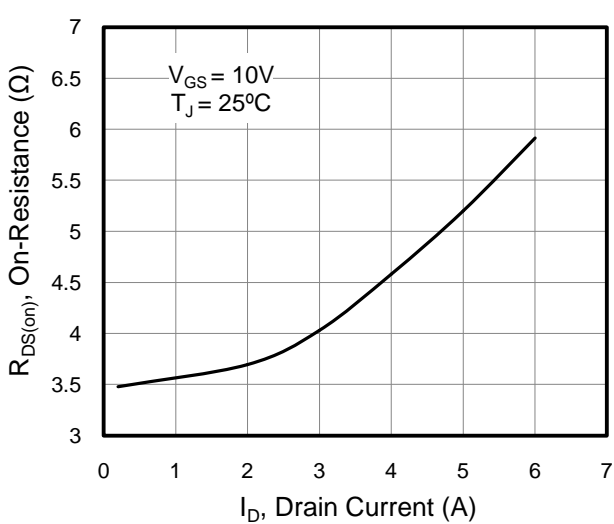


Figure 4. Capacitance

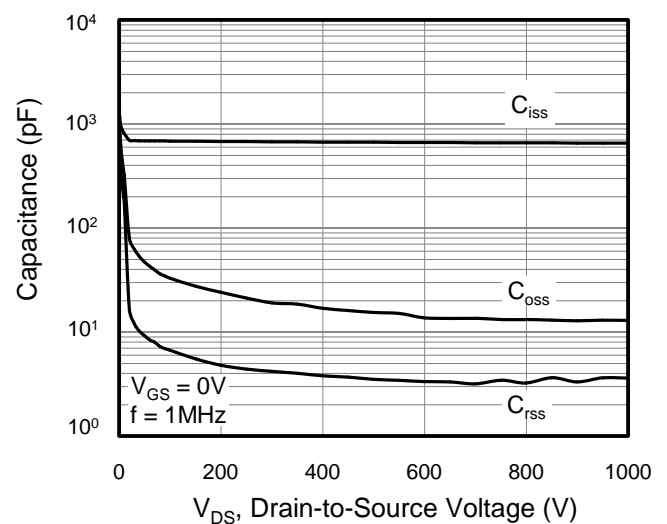


Figure 5. Gate Charge

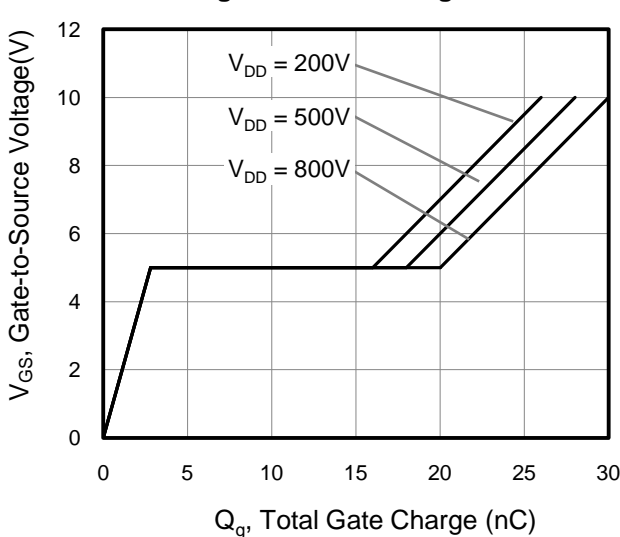
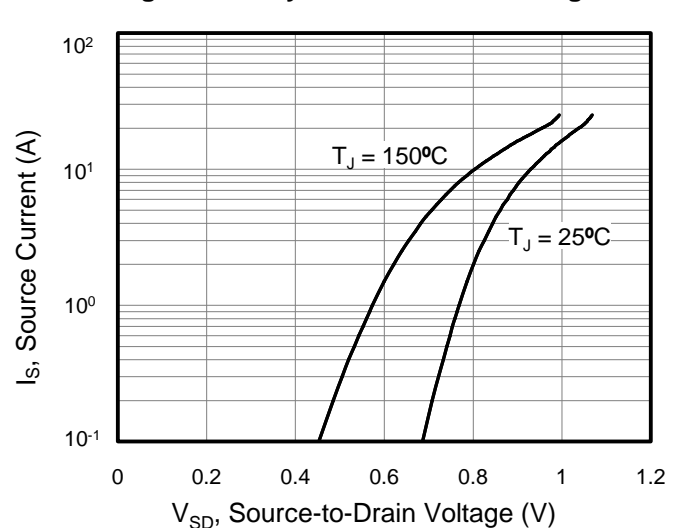


Figure 6. Body Diode Forward Voltage





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

Figure 7. On-Resistance vs. Temperature

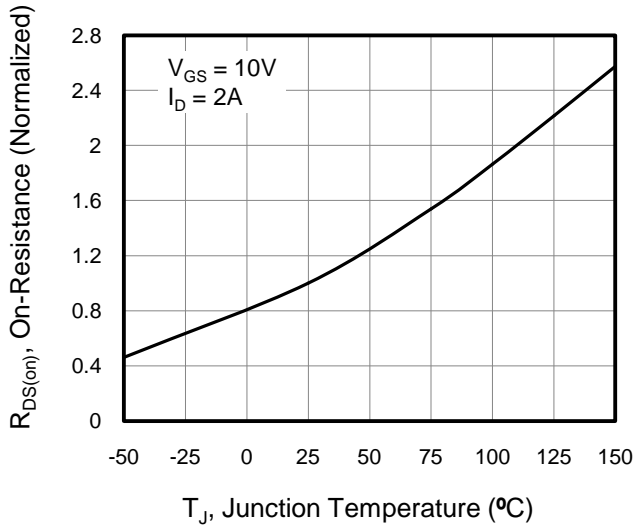


Figure 8. Threshold Voltage vs. Junction Temperature

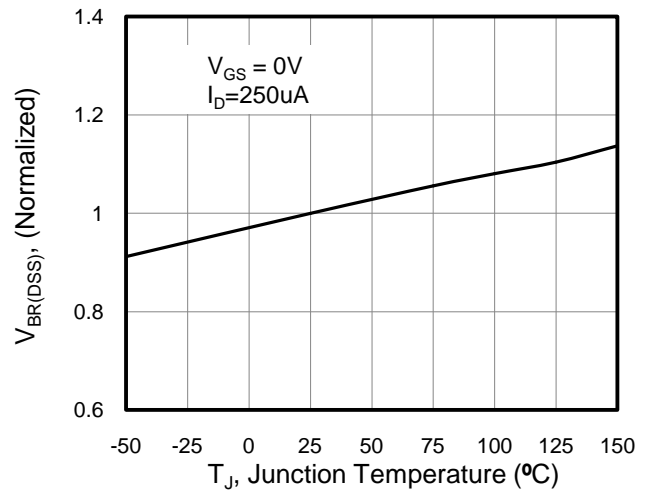


Figure 9. Transient Thermal Impedance TO-220

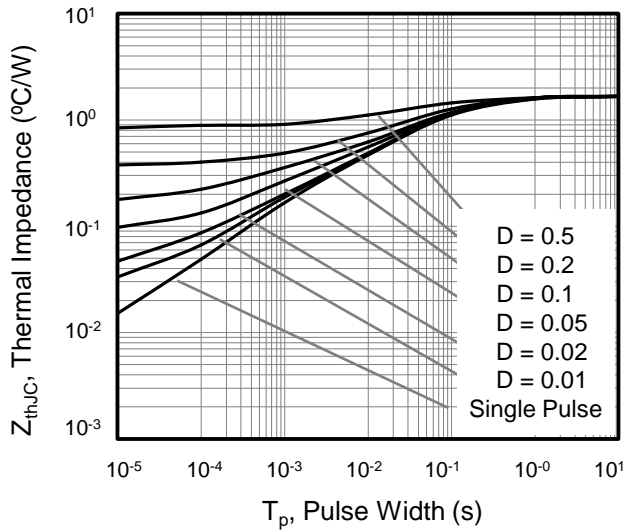


Figure 10. Transient Thermal Impedance TO-220F

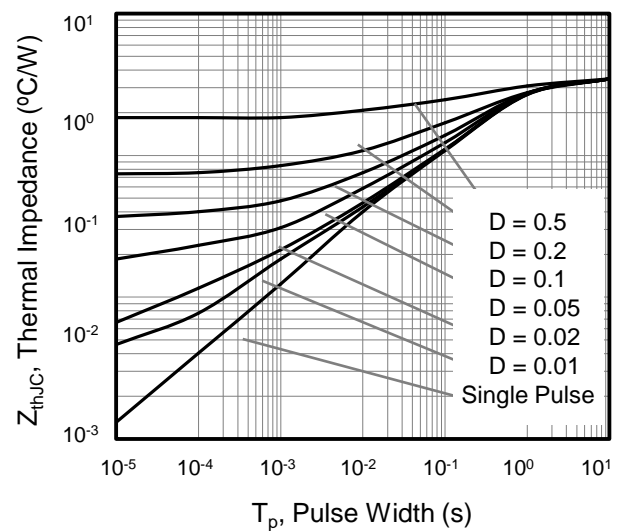


Figure 11. Safe operation area for TO-220

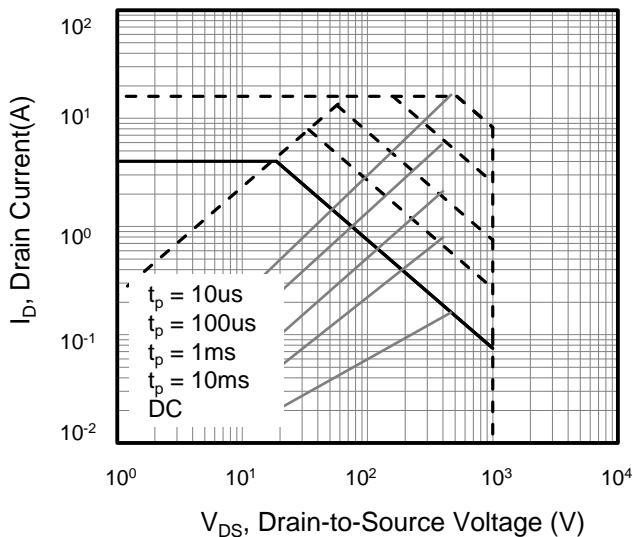


Figure 12. Safe operation area for TO-220F

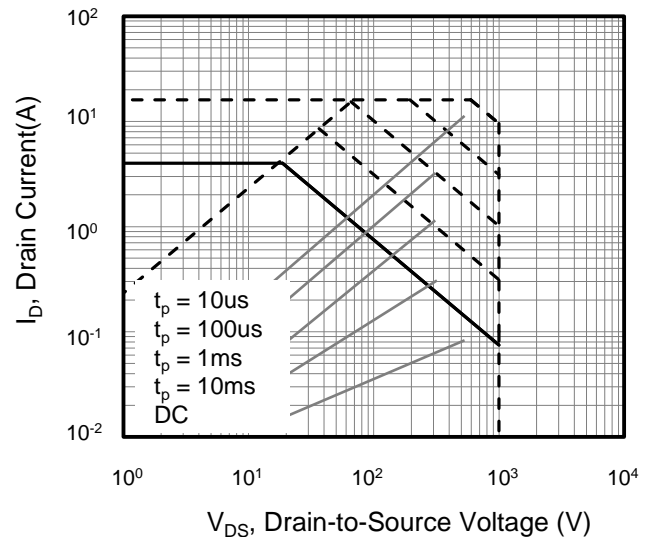




Figure A: Gate Charge Test Circuit and Waveform



Figure B: Resistive Switching Test Circuit and Waveform

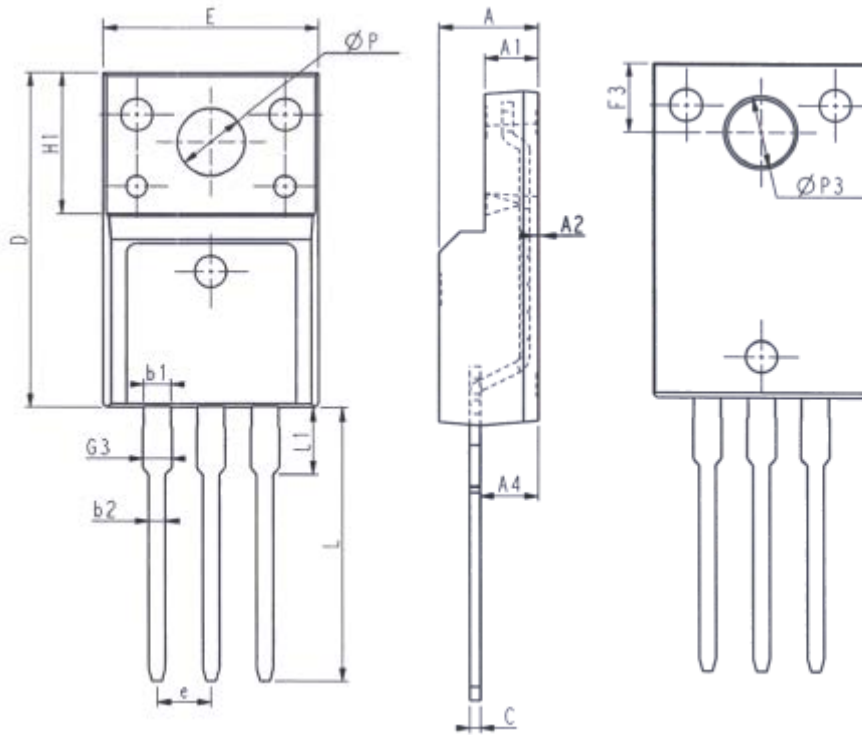


Figure C: Unclamped Inductive Switching Test Circuit and Waveform





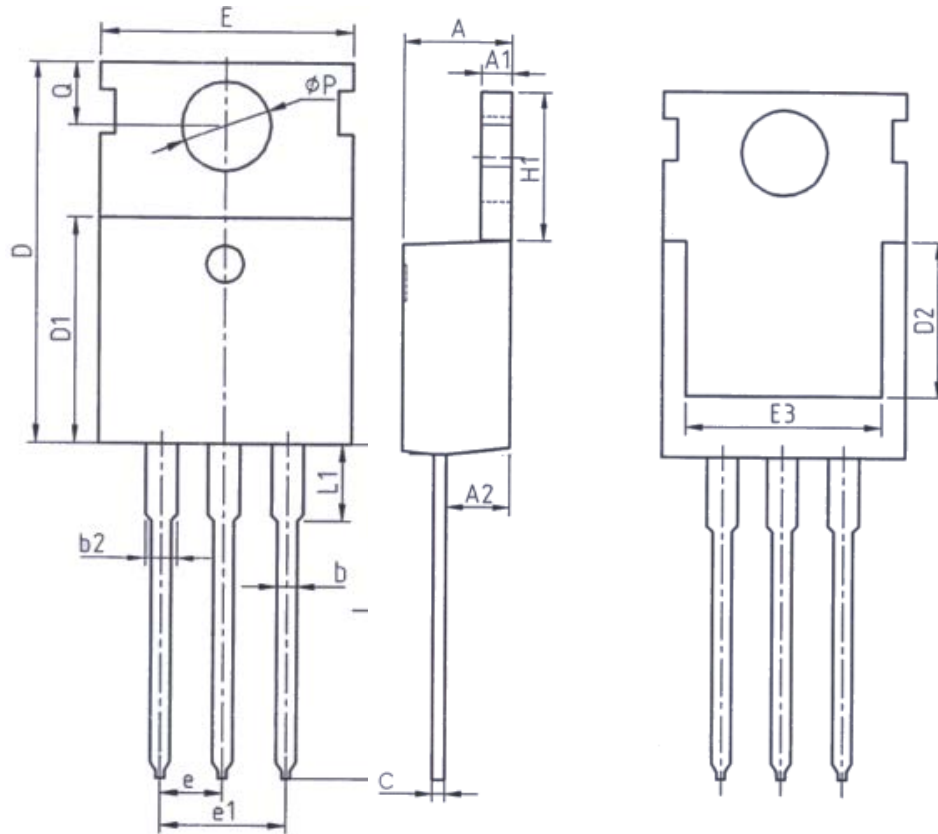
### TO-220F



| Unit: mm |         |       | Unit: mm |       |       |
|----------|---------|-------|----------|-------|-------|
| Symbol   | Min.    | Max.  | Symbol   | Min.  | Max.  |
| E        | 9.96    | 10.36 | L        | 12.68 | 13.28 |
| A        | 4.50    | 4.90  | L1       | 2.93  | 3.13  |
| A1       | 2.34    | 2.74  | P        | 3.03  | 3.38  |
| A2       | 0.30    | 0.60  | P3       | 3.15  | 3.65  |
| A4       | 2.56    | 2.96  | F3       | 3.15  | 3.45  |
| c        | 0.40    | 0.65  | G3       | 1.25  | 1.55  |
| D        | 15.57   | 16.17 | b1       | 1.18  | 1.43  |
| H1       | 6.70REF |       | b2       | 0.70  | 0.95  |
| e        | 2.54BSC |       |          |       |       |



### TO-220



| Unit: mm |       |       |
|----------|-------|-------|
| Symbol   | Min.  | Max.  |
| A        | 4.37  | 4.77  |
| A1       | 1.25  | 1.45  |
| A2       | 2.20  | 2.60  |
| b        | 0.70  | 0.95  |
| b2       | 1.17  | 1.47  |
| c        | 0.40  | 0.65  |
| D        | 15.10 | 16.10 |
| D1       | 8.80  | 9.40  |
| D2       | 5.50  | -     |

| Unit: mm |         |       |
|----------|---------|-------|
| Symbol   | Min.    | Max.  |
| E        | 9.70    | 10.30 |
| E3       | 7.00    | -     |
| e        | 2.54BSC |       |
| e1       | 5.08BSC |       |
| H1       | 6.25    | 6.85  |
| L        | 12.75   | 13.80 |
| L1       | -       | 3.40  |
| P        | 3.40    | 3.80  |
| Q        | 2.60    | 3.00  |



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