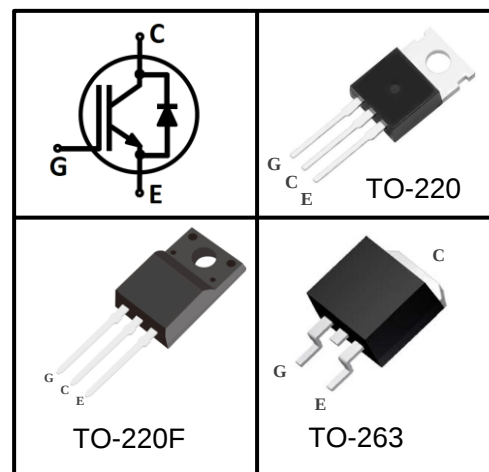


## Features

- Easy parallel switching capability due to positive temperature coefficient in  $V_{CEsat}$
- Low  $V_{CEsat}$ , fast switching
- High ruggedness, good thermal stability
- Very tight parameter distribution

## Applications

- Motor Drives



| Type        | Marking   | Package Code |
|-------------|-----------|--------------|
| MPBP15N65EF | MP15N65EF | TO-220-3     |
| MPBA15N65EF | MP15N65EF | TO-220F-3    |
| MPBC15N65EF | MP15N65EF | TO-263       |

## Maximum Rated Values <sup>1</sup>

| Parameter                                                                                              | Symbol             | Value   |      |     | Unit |
|--------------------------------------------------------------------------------------------------------|--------------------|---------|------|-----|------|
|                                                                                                        |                    | 220     | 220F | 263 |      |
| Collector-emitter voltage                                                                              | V <sub>CE</sub>    | 650     |      |     | V    |
| DC collector current <sup>2</sup>                                                                      |                    |         |      |     | A    |
| T <sub>C</sub> =25℃                                                                                    | I <sub>C</sub>     | 30      |      |     |      |
| T <sub>C</sub> =100℃                                                                                   |                    | 15      |      |     |      |
| Pulsed collector current <sup>3</sup>                                                                  | I <sub>Cpuls</sub> | 45      |      |     |      |
| Diode forward current <sup>2</sup>                                                                     |                    |         |      |     |      |
| T <sub>C</sub> =25℃                                                                                    | I <sub>F</sub>     | 30      |      |     |      |
| T <sub>C</sub> =100℃                                                                                   |                    | 15      |      |     |      |
| Diode pulsed current <sup>3</sup>                                                                      | I <sub>Fpuls</sub> | 45      |      |     |      |
| Short circuit withstanding time<br>V <sub>GE</sub> = 15V, V <sub>CC</sub> ≤ 400V, T <sub>J</sub> ≤150℃ | t <sub>SC</sub>    | 5       |      |     | us   |
| Gate-emitter voltage                                                                                   | V <sub>GE</sub>    | ±20     |      |     | V    |
| Transient Gate-emitter voltage (t <sub>p</sub> ≤10us)                                                  |                    | ±30     |      |     |      |
| Power dissipation                                                                                      |                    |         |      |     | W    |
| T <sub>C</sub> =25℃                                                                                    | P <sub>tot</sub>   | 125     | 52   | 107 |      |
| T <sub>C</sub> =100℃                                                                                   |                    | 63      | 26   | 54  |      |
| Operating junction temperature                                                                         | T <sub>j</sub>     | -55~175 |      |     | ℃    |
| Storage temperature                                                                                    | T <sub>sta</sub>   | -55~150 |      |     |      |

1:Reference standard: JESD-022 2: limited by  $T_{jmax}$  3:  $T_p$  limited by  $T_{jmax}$  ;

## Thermal Characteristics

| Parameter                               | Symbol      | Max |      |     | Unit |
|-----------------------------------------|-------------|-----|------|-----|------|
|                                         |             | 220 | 220F | 263 |      |
| IGBT thermal resistance, junction-case  | $R_{thJC}$  | 1.2 | 2.9  | 1.4 | K/W  |
| Diode thermal resistance, junction-case | $R_{thJCD}$ | 2.0 | 4.6  | 2.8 |      |
| Thermal Resistance, junction-ambient    | $R_{thJA}$  | 65  | 65   | 65  |      |

## Electrical Characteristics (at $T_j=25^\circ\text{C}$ , unless otherwise specified)

### Static Characteristics

| Parameter                            | Symbol        | Conditions                                         | Min | Typ  | Max  | Unit |
|--------------------------------------|---------------|----------------------------------------------------|-----|------|------|------|
| Collector-emitter breakdown voltage  | $V_{(BR)CES}$ | $V_{GE}=0V, I_C=0.25mA$                            | 650 | -    | -    | V    |
| Collector-emitter saturation voltage | $V_{CE(sat)}$ | $V_{GE}=15V, I_C=15A$<br>$T_j=25^\circ\text{C}$    | -   | 1.30 | 1.80 |      |
|                                      |               | $T_j=125^\circ\text{C}$                            | -   | 1.55 | -    |      |
|                                      |               | $T_j=150^\circ\text{C}$                            | -   | 1.65 | -    |      |
| Diode forward voltage                | $V_F$         | $V_{GE}=0V, I_F=15A$<br>$T_j=25^\circ\text{C}$     | -   | 1.50 | 1.80 |      |
|                                      |               | $T_j=125^\circ\text{C}$                            | -   | 1.40 | -    |      |
|                                      |               | $T_j=150^\circ\text{C}$                            | -   | 1.30 | -    |      |
| G-E threshold voltage                | $V_{GE(th)}$  | $I_C=250\mu A, V_{CE}=V_{GE}$                      | 4.5 | 5.8  | 6.5  | mA   |
| C-E leakage current                  | $I_{CES}$     | $V_{CE}=650V, V_{GE}=0V$<br>$T_j=25^\circ\text{C}$ | -   | -    | 0.01 |      |
|                                      |               | $T_j=150^\circ\text{C}$                            | -   | -    | 1.0  |      |
| G-E leakage current                  | $I_{GES}$     | $V_{CE}=0V, V_{GE}=20V$                            | -   | -    | 250  | nA   |

## Dynamic Characteristics

| Parameter                    | Symbol    | Conditions                                  | Min | Typ  | Max | Unit |
|------------------------------|-----------|---------------------------------------------|-----|------|-----|------|
| Input capacitance            | $C_{iss}$ | $V_{CE}=25V$ ,<br>$V_{GE}=0V$ ,<br>$f=1MHz$ | -   | 2091 | -   | pF   |
| Output capacitance           | $C_{oss}$ |                                             | -   | 69   | -   |      |
| Reverse transfer capacitance | $C_{rss}$ |                                             | -   | 32   | -   |      |
| Gate charge                  | $Q_G$     | $V_{CC}=300V$ , $I_C=15A$ ,<br>$V_{GE}=15V$ | -   | 113  | -   | nC   |

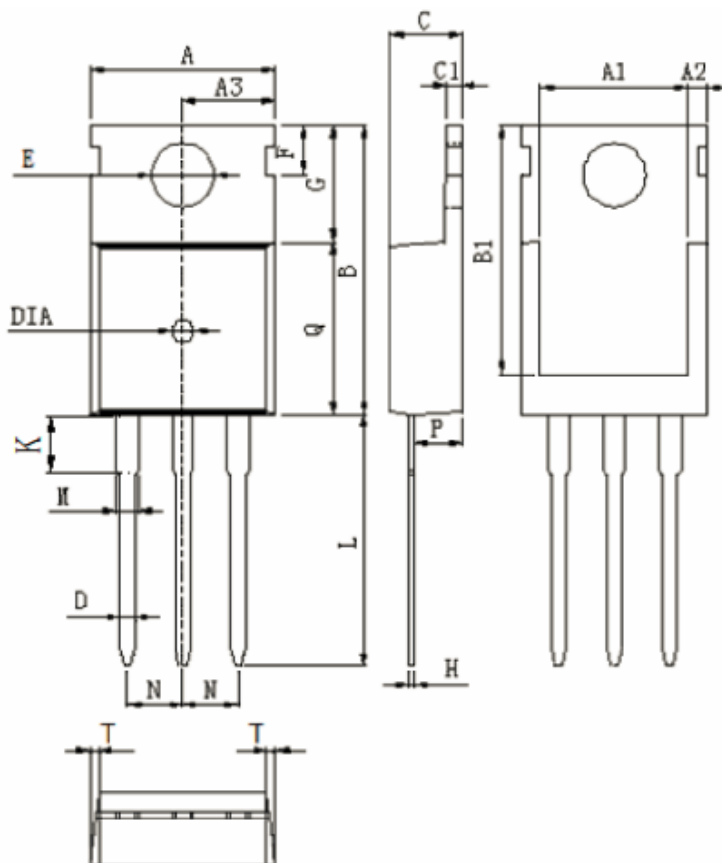
## IGBT Switching Characteristics

| Parameter              | Symbol       | Conditions                                                                                                      | Min | Typ  | Max | Unit |
|------------------------|--------------|-----------------------------------------------------------------------------------------------------------------|-----|------|-----|------|
| Turn-on delay time     | $t_{d(on)}$  | $T_j=25^{\circ}C$ ,<br>$V_{CC}=400V$ ,<br>$I_C=15A$ ,<br>$V_{GE}=0/15V$ ,<br>$R_G=10\Omega$ ,<br>Inductive load | -   | 68   | -   | ns   |
| Rise time              | $t_r$        |                                                                                                                 | -   | 30   | -   |      |
| Turn-off delay time    | $t_{d(off)}$ |                                                                                                                 | -   | 174  | -   |      |
| Fall time              | $t_f$        |                                                                                                                 | -   | 58   | -   |      |
| Turn-on energy         | $E_{on}$     |                                                                                                                 | -   | 0.26 | -   | mJ   |
| Turn-off energy        | $E_{off}$    |                                                                                                                 | -   | 0.31 | -   |      |
| Total switching energy | $E_{ts}$     |                                                                                                                 | -   | 0.57 | -   |      |

## Diode Characteristics

| Parameter                           | Symbol    | Conditions                                                                 | Min | Typ   | Max | Unit    |
|-------------------------------------|-----------|----------------------------------------------------------------------------|-----|-------|-----|---------|
| Diode reverse recovery time         | $t_{rr}$  | $T_j=25^{\circ}C$ ,<br>$V_R=400V$ ,<br>$I_F=15A$ ,<br>$di_F/dt=570A/\mu s$ | -   | 78    | -   | ns      |
| Diode reverse recovery charge       | $Q_{rr}$  |                                                                            | -   | 0.458 | -   | $\mu C$ |
| Diode peak reverse recovery current | $I_{rrm}$ |                                                                            | -   | 10.1  | -   | A       |

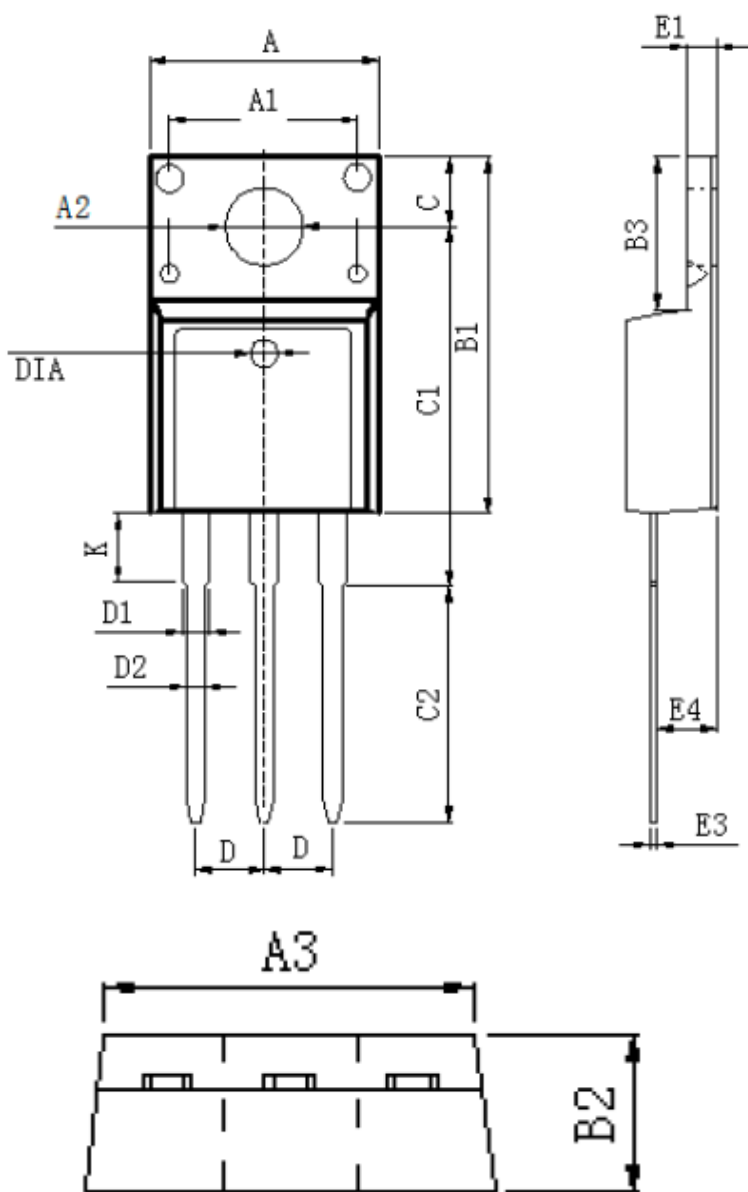
## TO-220-3L



| 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

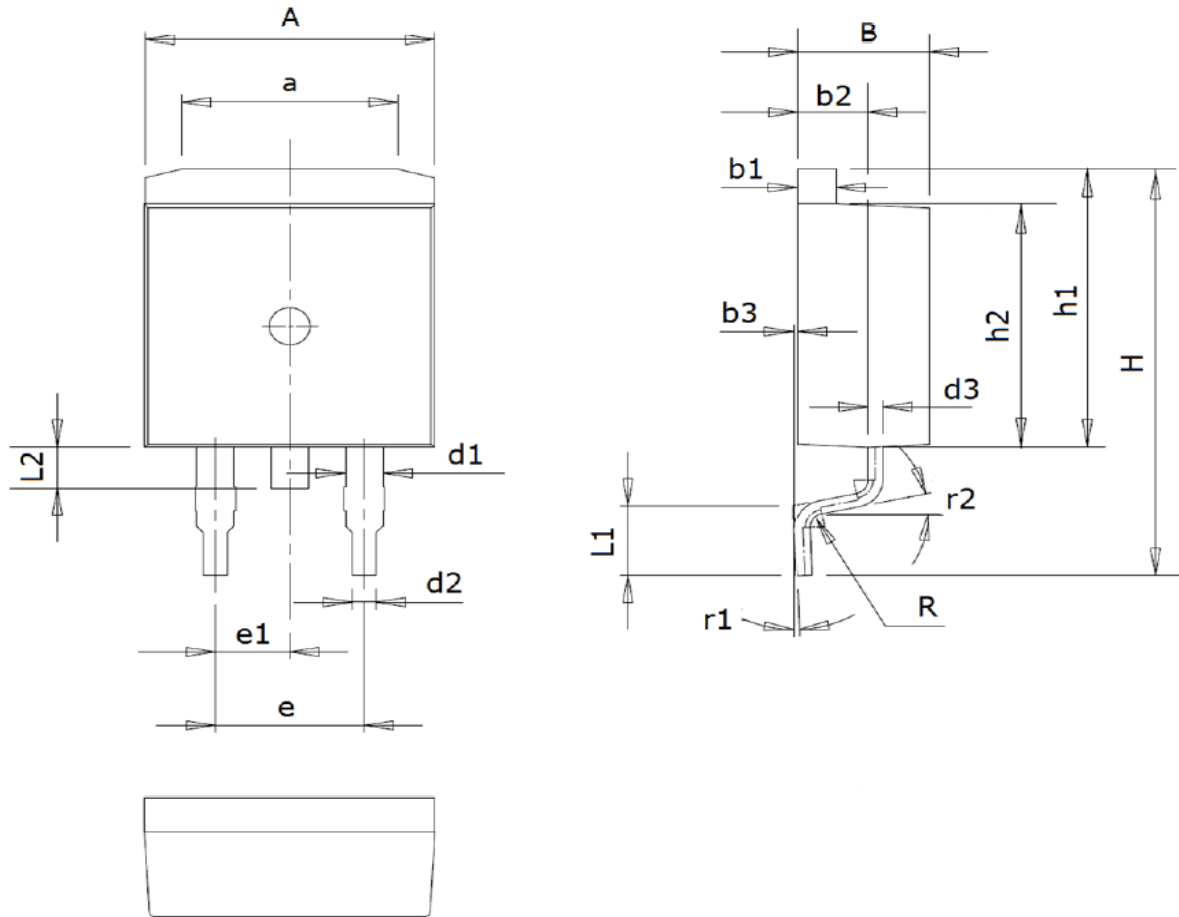
## TO-220F-3L



| 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

# TO-263



| Symbol | Dimensions (mm) | Symbol | Dimensions (mm) | Symbol | Dimensions (mm) |
|--------|-----------------|--------|-----------------|--------|-----------------|
| A      | 9.86~10.26      | d2     | 0.7~0.96        | L1     | 2.0~2.6         |
| a      | 7.0~7.8         | d3     | 0.3~0.53        | L2     | 1.3~1.8         |
| B      | 4.37~4.77       | e      | 5.08            | R      | 0.5             |
| b1     | 1.22~1.42       | e1     | 2.54            | r1     | 0-9°            |
| b2     | 2.2~2.6         | H      | 14.7~15.5       | r2     | 12°             |
| b3     | 0~0.25          | h1     | 10.3~10.7       |        |                 |
| d1     | 1.17~1.47       | h2     | 9.1~9.4         |        |                 |



## Revision History:

| Revision | Date    | Subjects (major changes since last revision) |
|----------|---------|----------------------------------------------|
| 1.0      | 2022-01 | Initial version                              |



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