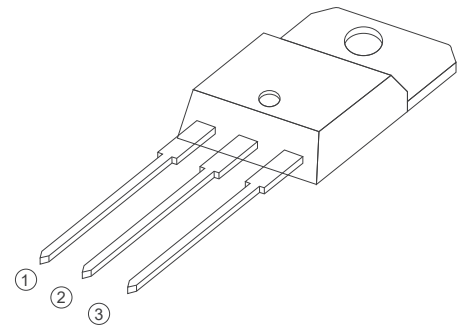
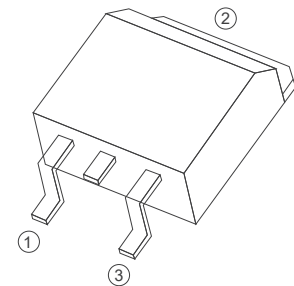


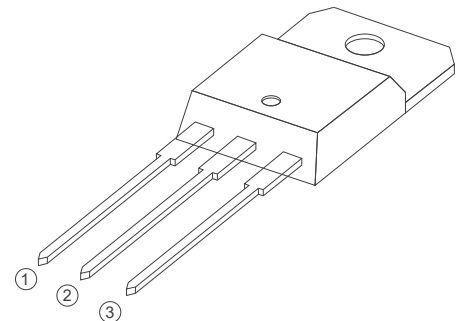
|           |            |      |
|-----------|------------|------|
| IT(RMS)   |            | 12A  |
| VDRM/VRRM | BCR12PM-12 | 600V |
|           | BCR12PM-14 | 800V |
| VTM       |            | 1.5V |



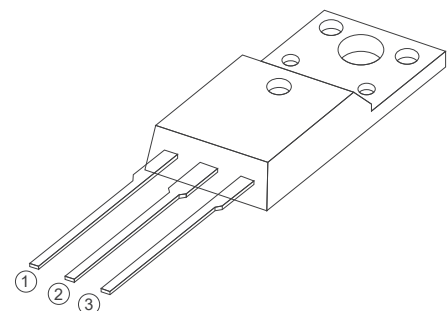
TO-220B Non-Insulated



TO-263



TO-220A Insulated



TO-220F Insulated

## FEATURES

IT(RMS): 12A

VGT: 1.5V

VDRM VRRM: 600~800V

## APPLICATIONS

Heater Control

Motor Speed Controller

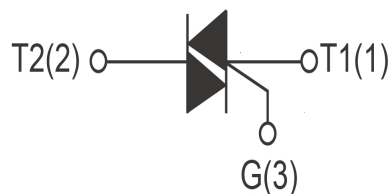
Washing machine

Vacuums

Solid state relay

General purpose motor controls

General purpose switching



**Absolute Maximum Ratings** (T<sub>J</sub>=25°C unless otherwise specified)

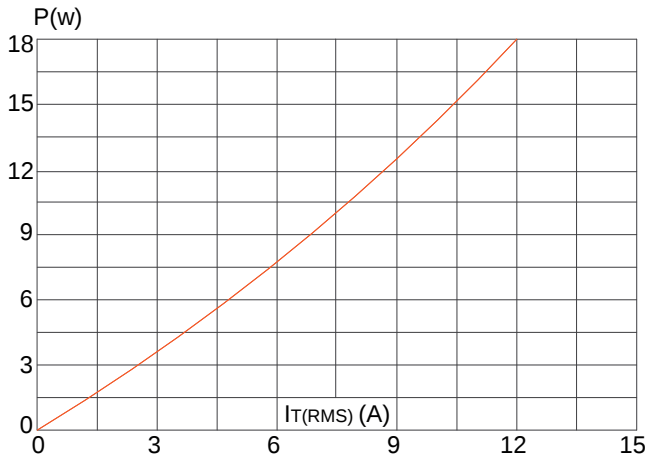
| Symbol                               | Parameter                         | Conditions                                    | Ratings | Unit             |
|--------------------------------------|-----------------------------------|-----------------------------------------------|---------|------------------|
| V <sub>DRM</sub><br>V <sub>RRM</sub> | Repetitive Peak Off-State Voltage | 12                                            | 600     | V                |
|                                      |                                   | 14                                            | 800     | V                |
| I <sub>T(RMS)</sub>                  | R.M.S On-State Current            | T <sub>c</sub> =85°C                          | 12      | A                |
| I <sub>TSM</sub>                     | Surge On-State Current            | t <sub>p</sub> =16.7ms / T <sub>p</sub> =10ms | 120/128 | A                |
| I <sup>2</sup> t                     | I <sup>2</sup> t for fusing       | T <sub>p</sub> =10ms                          | 72      | A <sup>2</sup> s |
| P <sub>G(AV)</sub>                   | Average Gate Power Dissipation    | T <sub>J</sub> =150°C                         | 0.5     | W                |
| I <sub>GM</sub>                      | Peak Gate Current                 | T <sub>J</sub> =150°C                         | 2       | A                |
| T <sub>J</sub>                       | Operating Junction Temperature    |                                               | ~40~150 | °C               |
| T <sub>STG</sub>                     | Storage Temperature               |                                               | ~40~150 | °C               |

**Electrical Characteristics** (T<sub>J</sub>=25°C unless otherwise specified)

| Symbol               | Parameter                                    | Test Conditions                                                                                    | Value |      |       | Unit |
|----------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------|-------|------|-------|------|
|                      |                                              |                                                                                                    | C1    | C2   | C3    |      |
| I <sub>DRM</sub>     | Repetitive Peak Off-State Current            | T <sub>J</sub> =150°C                                                                              | 2.0   |      |       | mA   |
| I <sub>RRM</sub>     | Repetitive Peak Reverse Current              | T <sub>J</sub> =150°C                                                                              | 3     |      |       | mA   |
| V <sub>TM</sub>      | Forward "on" voltage                         | I <sub>T</sub> =20A t <sub>p</sub> =380us                                                          | ≤1.5  |      |       | V    |
| V <sub>GT</sub>      | Gate trigger voltage                         | V <sub>D</sub> =12V ,R <sub>L</sub> =30Ω                                                           | ≤1.5  |      |       | V    |
| di/dt                | Critical rate of rise of on-state current    | I,II,III F=120Hz,T <sub>J</sub> =125°C<br>I <sub>G</sub> =2xI <sub>GT</sub> ,t <sub>r</sub> ≤100ns | ≥50   |      |       | A/us |
| I <sub>GT</sub>      | Gate trigger current                         | I,II,III V <sub>D</sub> =12V R <sub>L</sub> =30Ω                                                   | ≤10   | ≤20  | ≤30   | mA   |
| I <sub>H</sub>       | Holding current                              | I <sub>T</sub> =0.2A                                                                               | ≤30   | ≤45  | ≤60   | mA   |
| V <sub>DG</sub>      | Gate non-trigger voltage                     | ALL V <sub>D</sub> =V <sub>DRM</sub> T <sub>J</sub> =125°C                                         | ≥0.2  |      |       | V    |
| (dv/dt) <sub>c</sub> | Critical-rate of rise of commutation voltage | T <sub>J</sub> =150°C V <sub>D</sub> =400V<br>(di/dt) <sub>c</sub> =-5.0A/mS                       | 5     | 15   | 20    | V/us |
| dv/dt                | Critical-rate of rise of off-state voltage   | V <sub>D</sub> =67% V <sub>DRM</sub> ,gate open,T <sub>J</sub> =150°C                              | ≥200  | ≥500 | ≥1000 | V/us |
| R <sub>th(j-c)</sub> | Thermal resistance                           | Junction to case                                                                                   | 2.5   |      |       | °C/W |

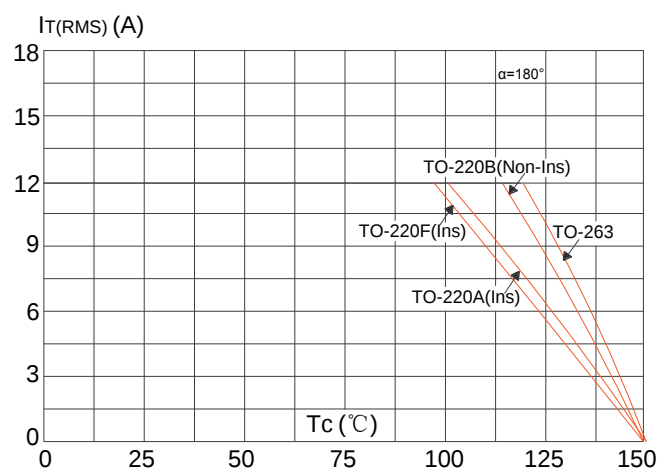
**FIG1**

Maximum power dissipation versus RMS on-state current



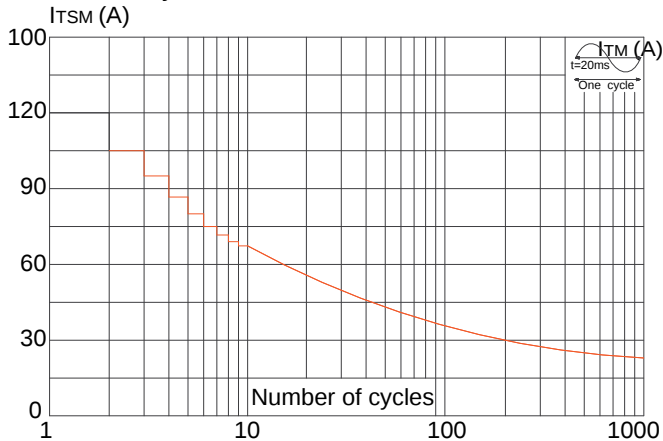
**FIG2**

RMS on-state current versus case temperature



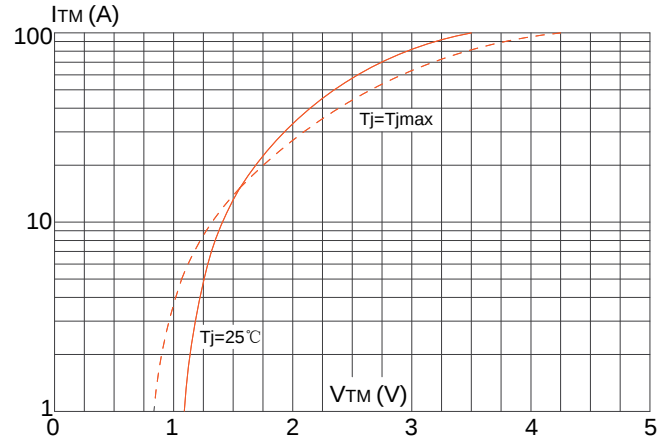
**FIG3**

Surge peak on-state current versus number of cycles



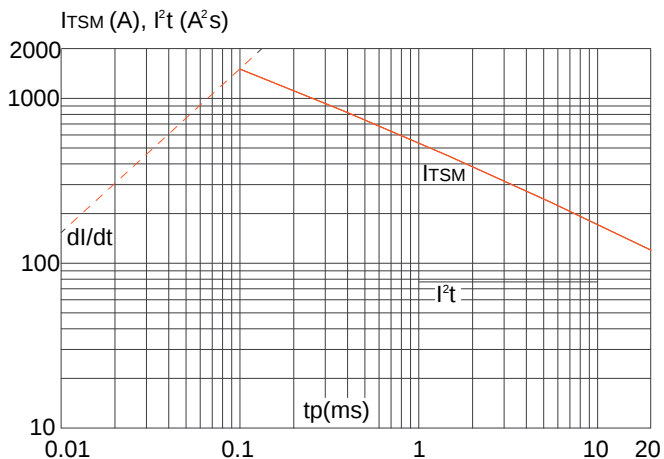
**FIG4**

On-state characteristics (maximum values)



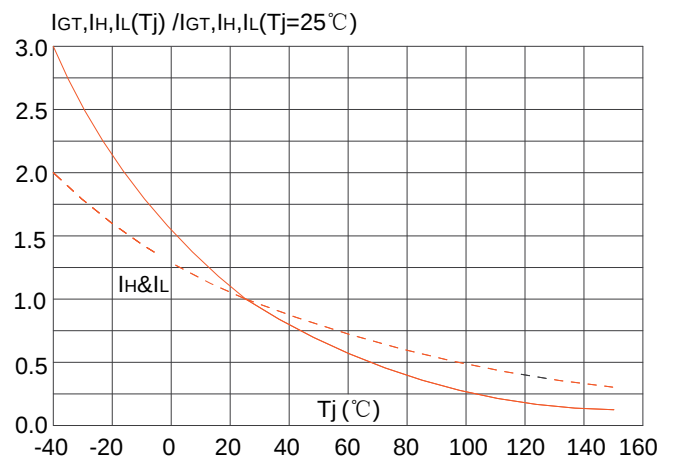
**FIG5**

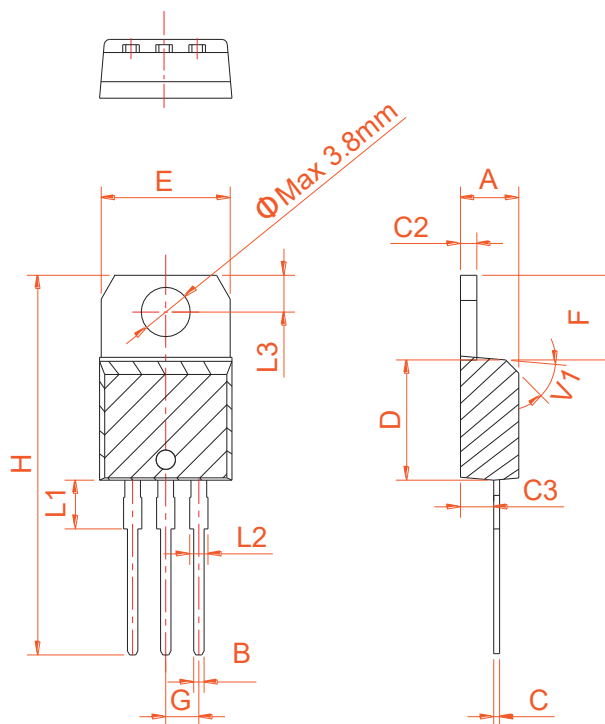
Non-repetitive surge peak on-state current for a sinusoidal pulse with width  $t_p < 20\text{ms}$ , and corresponding value of  $I^2t$  ( $dI/dt < 100\text{A}/\mu\text{s}$ )



**FIG6**

**FIG.6:** Relative variations of gate trigger current, holding current and latching current versus junction temperature

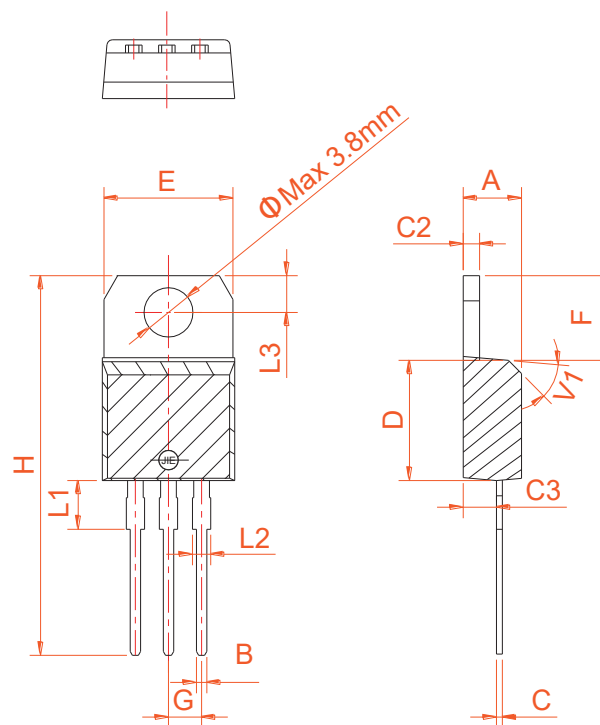


**PACKAGE MECHANICAL DATA**


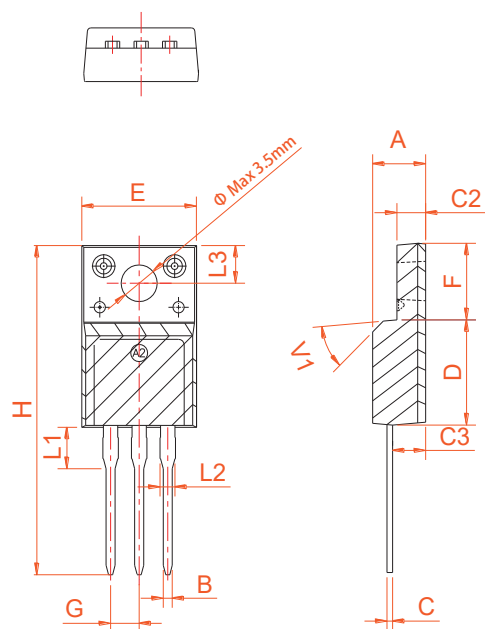
TO-220A Ins

| Ref. | Dimensions  |      |      |        |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Millimeters |      |      | Inches |       |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    | 4.40        |      | 4.60 | 0.173  |       | 0.181 |
| B    | 0.61        |      | 0.88 | 0.024  |       | 0.035 |
| C    | 0.46        |      | 0.70 | 0.018  |       | 0.028 |
| C2   | 1.21        |      | 1.32 | 0.048  |       | 0.052 |
| C3   | 2.40        |      | 2.72 | 0.094  |       | 0.107 |
| D    | 8.60        |      | 9.70 | 0.339  |       | 0.382 |
| E    | 9.80        |      | 10.4 | 0.386  |       | 0.409 |
| F    | 6.55        |      | 6.95 | 0.258  |       | 0.274 |
| G    |             | 2.54 |      |        | 0.1   |       |
| H    | 28.0        |      | 29.8 | 1.102  |       | 1.173 |
| L1   |             | 3.75 |      |        | 0.148 |       |
| L2   | 1.14        |      | 1.70 | 0.045  |       | 0.067 |
| L3   | 2.65        |      | 2.95 | 0.104  |       | 0.116 |
| V1   |             | 45°  |      |        | 45°   |       |

| Ref. | Dimensions  |      |      |        |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Millimeters |      |      | Inches |       |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    | 4.40        |      | 4.60 | 0.173  |       | 0.181 |
| B    | 0.61        |      | 0.88 | 0.024  |       | 0.035 |
| C    | 0.46        |      | 0.70 | 0.018  |       | 0.028 |
| C2   | 1.21        |      | 1.32 | 0.048  |       | 0.052 |
| C3   | 2.40        |      | 2.72 | 0.094  |       | 0.107 |
| D    | 8.60        |      | 9.70 | 0.339  |       | 0.382 |
| E    | 9.60        |      | 10.4 | 0.378  |       | 0.409 |
| F    | 6.20        |      | 6.60 | 0.244  |       | 0.260 |
| G    |             | 2.54 |      |        | 0.1   |       |
| H    | 28.0        |      | 29.8 | 1.102  |       | 1.173 |
| L1   |             | 3.75 |      |        | 0.148 |       |
| L2   | 1.14        |      | 1.70 | 0.045  |       | 0.067 |
| L3   | 2.65        |      | 2.95 | 0.104  |       | 0.116 |
| V1   |             | 45°  |      |        | 45°   |       |



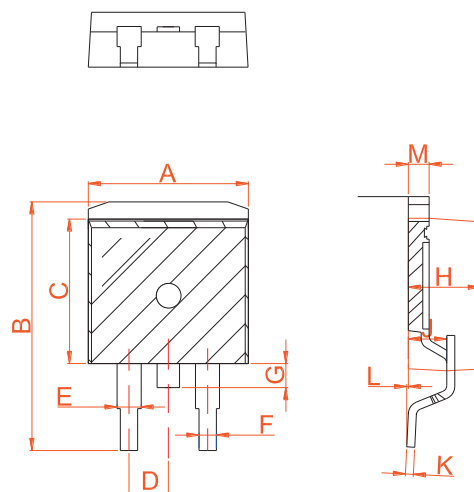
TO-220B Non-Ins

**PACKAGE MECHANICAL DATA**


TO-220F Ins

| Ref. | Dimensions  |      |      |        |       |       |
|------|-------------|------|------|--------|-------|-------|
|      | Millimeters |      |      | Inches |       |       |
|      | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A    | 4.50        |      | 4.90 | 0.177  |       | 0.193 |
| B    | 0.74        | 0.80 | 0.83 | 0.029  | 0.031 | 0.033 |
| C    | 0.47        |      | 0.65 | 0.019  |       | 0.026 |
| C2   | 2.45        |      | 2.75 | 0.096  |       | 0.108 |
| C3   | 2.60        |      | 3.00 | 0.102  |       | 0.118 |
| D    | 8.80        |      | 9.30 | 0.346  |       | 0.366 |
| E    | 9.80        |      | 10.4 | 0.386  |       | 0.410 |
| F    | 6.40        |      | 6.80 | 0.252  |       | 0.268 |
| G    |             | 2.54 |      |        | 0.1   |       |
| H    | 28.0        |      | 29.8 | 1.102  |       | 1.173 |
| L1   |             | 3.63 |      |        | 0.143 |       |
| L2   | 1.14        |      | 1.70 | 0.045  |       | 0.067 |
| L3   |             | 3.30 |      |        | 0.130 |       |
| V1   |             | 45°  |      |        | 45°   |       |

| Ref. | Dimensions  |      |       |        |       |       |
|------|-------------|------|-------|--------|-------|-------|
|      | Millimeters |      |       | Inches |       |       |
|      | Min.        | Typ. | Max.  | Min.   | Typ.  | Max.  |
| A    | 9.90        |      | 10.20 | 0.390  |       | 0.402 |
| B    | 14.70       |      | 15.80 | 0.579  |       | 0.622 |
| C    | 9.4         |      | 9.6   | 0.37   |       | 0.378 |
| D    |             | 2.54 |       |        | 0.100 |       |
| E    | 1.20        |      | 1.40  | 0.047  |       | 0.055 |
| F    | 0.75        |      | 0.85  | 0.029  |       | 0.033 |
| G    |             |      | 1.75  |        |       | 0.069 |
| H    | 4.40        |      | 4.70  | 0.173  |       | 0.185 |
| J    | 2.30        |      | 2.70  | 0.091  |       | 0.106 |
| K    | 0.38        |      | 0.55  | 0.015  |       | 0.022 |
| L    | 0           | 0.10 | 0.25  | 0      | 0.004 | 0.010 |
| M    | 1.25        |      | 1.35  | 0.049  |       | 0.053 |



TO-263