

## HIGH EFFICIENCY FAST RECOVERY RECTIFIER DIODES

### MAIN PRODUCT CHARACTERISTICS

|               |          |
|---------------|----------|
| $I_F(AV)$     | 2 x 10 A |
| $V_{RRM}$     | 200 V    |
| $T_j(max)$    | 150 °C   |
| $V_F(max)$    | 0.85 V   |
| $t_{rr}(max)$ | 25 ns    |

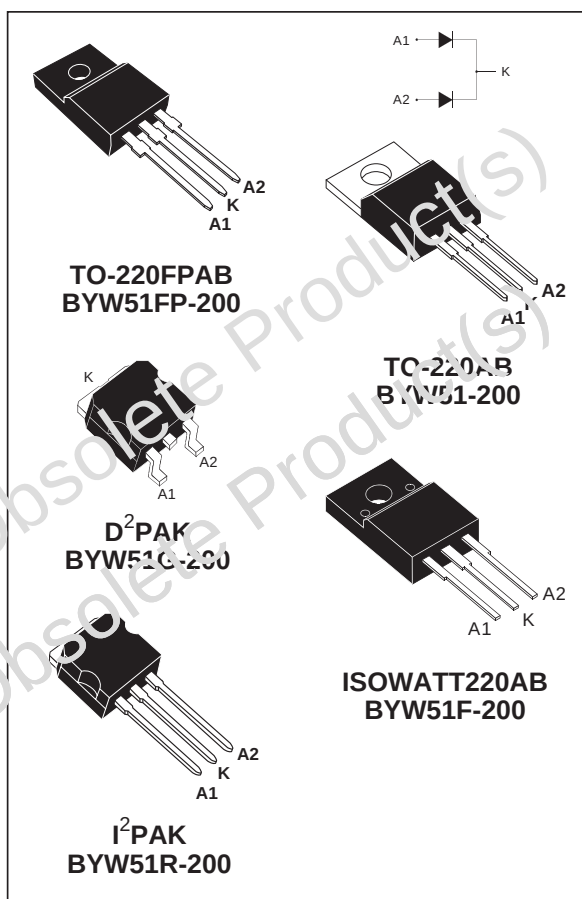
### FEATURES AND BENEFITS

- SUITED FOR SMPS
- VERY LOW FORWARD LOSSES
- NEGLIGIBLE SWITCHING LOSSES
- HIGH SURGE CURRENT CAPABILITY
- INSULATED PACKAGES (ISOWATT220AB / TO-220FP) :  
Insulation voltage = 2000 V DC  
Capacitance = 12 pF

### DESCRIPTION

Dual center tap rectifier suited for Switched Mode Power Supplies and high frequency DC to DC converters.

Packaged in TO-220AB, ISOWATT220AB, TO-220FP, D<sup>2</sup>PAK or I<sup>2</sup>PAK, this device is intended for use in low voltage, high frequency inverters, free wheeling and polarity protection applications.



### ABSOLUTE RATINGS (limiting values, per diode)

| Symbol              | Parameter                              |                                                     |                    |            | Value         | Unit |
|---------------------|----------------------------------------|-----------------------------------------------------|--------------------|------------|---------------|------|
| V <sub>RRM</sub>    | Repetitive peak reverse voltage        |                                                     |                    |            | 200           | V    |
| I <sub>F(RMS)</sub> | RMS forward current                    |                                                     |                    |            | 20            | A    |
| I <sub>F(AV)</sub>  | Average forward current<br>δ = 0.5     | TO-220AB / D <sup>2</sup> PAK<br>I <sup>2</sup> PAK | Tc=120°C           | Per diode  | 10            | A    |
|                     |                                        |                                                     |                    | Per device | 20            |      |
|                     |                                        | ISOWATT220AB                                        | Tc=95°C            | Per diode  | 10            |      |
|                     |                                        |                                                     |                    | Per device | 20            |      |
|                     |                                        | TO-220FPAB                                          | Tc=85°C            | Per diode  | 10            |      |
|                     |                                        |                                                     |                    | Per device | 20            |      |
| I <sub>FSM</sub>    | Surge non repetitive forward current   |                                                     | tp=10ms sinusoidal |            | 100           | A    |
| Tstg                | Storage temperature range              |                                                     |                    |            | - 65 to + 150 | °C   |
| Tj                  | Maximum operating junction temperature |                                                     |                    |            | 150           | °C   |

# BYW51/F/G/FP/R-200

## THERMAL RESISTANCES

| Symbol        | Parameter        |                                                    |           | Value | Unit |
|---------------|------------------|----------------------------------------------------|-----------|-------|------|
| $R_{th(j-c)}$ | Junction to case | TO-220AB / D <sup>2</sup> PAK / I <sup>2</sup> PAK | Per diode | 2.5   | °C/W |
|               |                  |                                                    | Total     | 1.4   |      |
|               |                  | ISOWATT220AB                                       | Per diode | 5.1   |      |
|               |                  |                                                    | Total     | 4.05  |      |
|               |                  | TO-220FPAB                                         | Per diode | 5.7   |      |
|               |                  |                                                    | Total     | 4.6   |      |
| $R_{th(c)}$   | Coupling         | TO-220AB / D <sup>2</sup> PAK / I <sup>2</sup> PAK |           | 0.25  | °C/W |
|               |                  | ISOWATT220AB                                       |           | 3.0   |      |
|               |                  | TO-220FPAB                                         |           | 3.5   |      |

When diodes 1 and 2 are used simultaneously :

$$\Delta T_c (\text{diode 1}) = P(\text{diode 1}) \times R_{th(j-c)} (\text{Per diode}) + P(\text{diode 2}) \times R_{th(c)}$$

## STATIC ELECTRICAL CHARACTERISTICS (Per diode)

| Symbol     | Parameter               | Test Conditions           |                     | Min. | Typ. | Max. | Unit          |
|------------|-------------------------|---------------------------|---------------------|------|------|------|---------------|
| $I_R^*$    | Reverse leakage current | $T_j = 25^\circ\text{C}$  | $V_R = V_{RRM}$     |      |      | 15   | $\mu\text{A}$ |
|            |                         | $T_j = 100^\circ\text{C}$ |                     |      |      | 1    | mA            |
| $V_F^{**}$ | Forward voltage drop    | $T_j = 125^\circ\text{C}$ | $I_F = 8\text{ A}$  |      |      | 0.85 | V             |
|            |                         | $T_j = 125^\circ\text{C}$ | $I_F = 16\text{ A}$ |      |      | 1.05 |               |
|            |                         | $T_j = 25^\circ\text{C}$  | $I_F = 16\text{ A}$ |      |      | 1.15 |               |

Pulse test : \*  $t_p = 5\text{ ms}$ ,  $\delta \leq 2\%$

\*\*  $t_p = 380\text{ }\mu\text{s}$ ,  $\delta \leq 2\%$

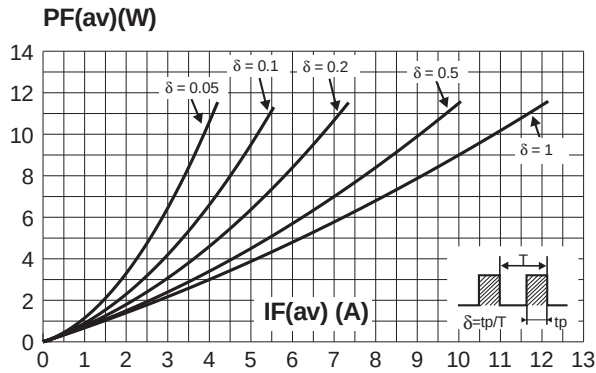
To evaluate the conduction losses use the following equation :

$$P = 0.65 \times I_{E(AV)} + 0.025 \times I_F^2 (\text{RMS})$$

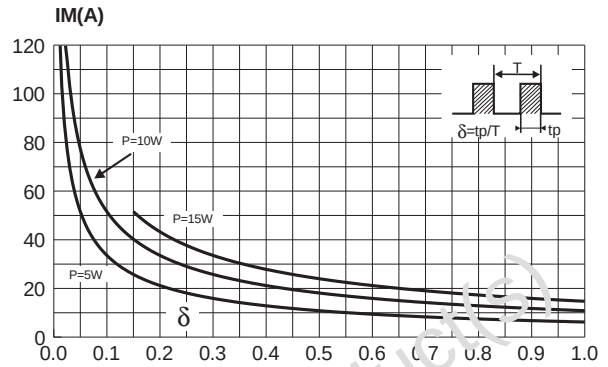
## RECOVERY CHARACTERISTICS

| Symbol   | Test Conditions          |                                                             |                                      | Typ. | Max. | Unit |
|----------|--------------------------|-------------------------------------------------------------|--------------------------------------|------|------|------|
| trr      | $T_j = 25^\circ\text{C}$ | $I_F = 0.5\text{ A}$<br>$I_R = 1\text{ A}$                  | $I_{rr} = 0.25\text{ A}$             |      | 25   | ns   |
|          |                          | $I_F = 1\text{ A}$<br>$V_R = 30\text{ V}$                   | $dI_F/dt = -50\text{ A}/\mu\text{s}$ |      | 35   |      |
| tfr      | $T_j = 25^\circ\text{C}$ | $I_F = 1\text{ A}$<br>$V_{FR} = 1.1 \times V_F \text{ max}$ | $dI_F/dt = -50\text{ A}/\mu\text{s}$ | 15   |      | ns   |
| $V_{FP}$ | $T_j = 25^\circ\text{C}$ | $I_F = 1\text{ A}$                                          | $dI_F/dt = -50\text{ A}/\mu\text{s}$ | 2    |      | V    |

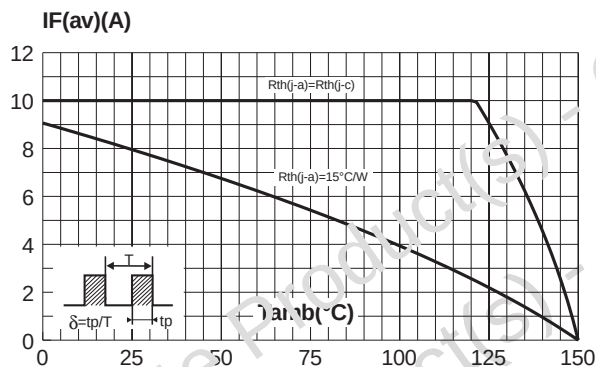
**Fig. 1:** Average forward power dissipation versus average forward current (per diode).



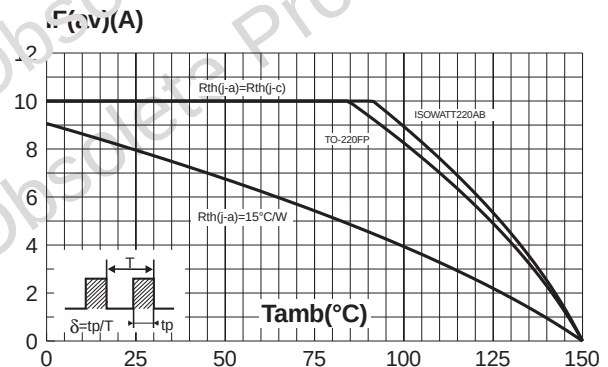
**Fig. 2:** Peak current versus form factor (per diode).



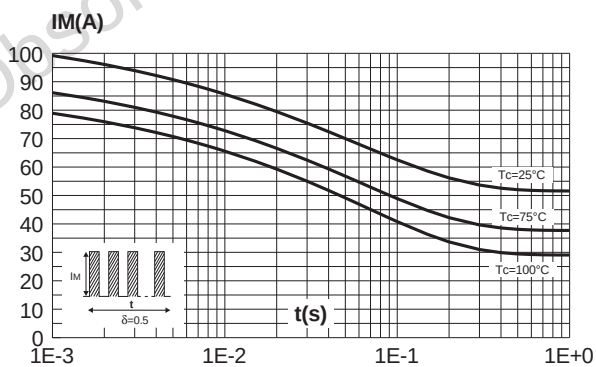
**Fig. 3-1:** Average forward current versus ambient temperature ( $\delta = 0.5$ , D<sup>2</sup>PAK, TO-220AB).



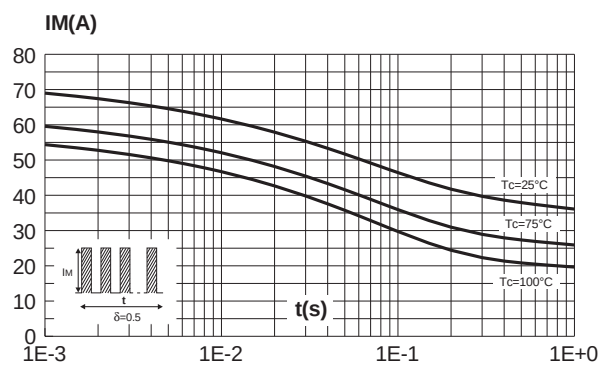
**Fig. 3-2:** Average forward current versus ambient temperature ( $\delta = 0.5$ , ISOWATT220AB, TO-220FPAZ).



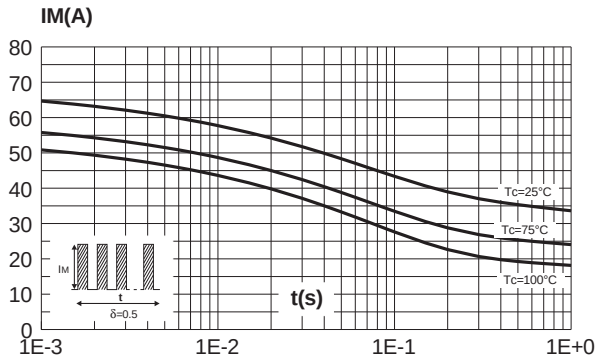
**Fig. 4-1:** Non repetitive surge peak forward current versus overload duration (D<sup>2</sup>PAK, TO-220AB).



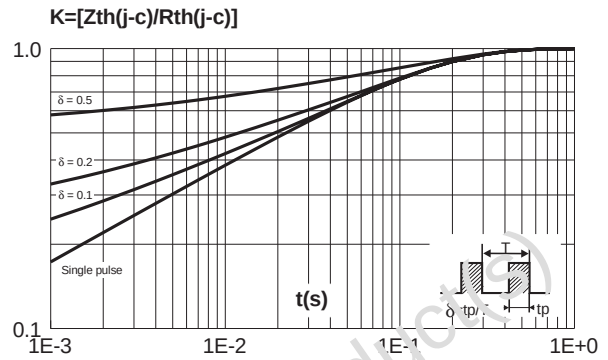
**Fig. 4-2:** Non repetitive surge peak forward current versus overload duration (ISOWATT220AB).



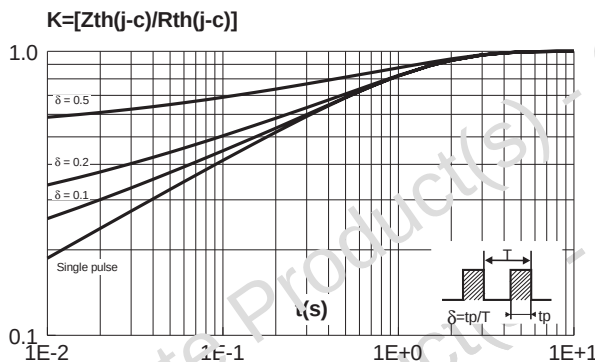
**Fig. 4-3:** Non repetitive surge peak forward current versus overload duration (TO-220FPAB).



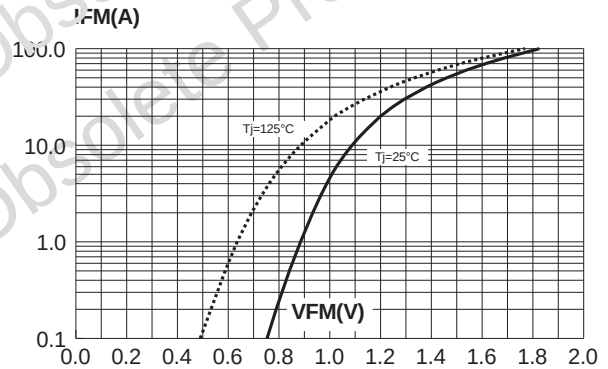
**Fig. 5-1:** Relative variation of thermal impedance junction to case versus pulse duration (D<sup>2</sup>PAK, TO-220AB).



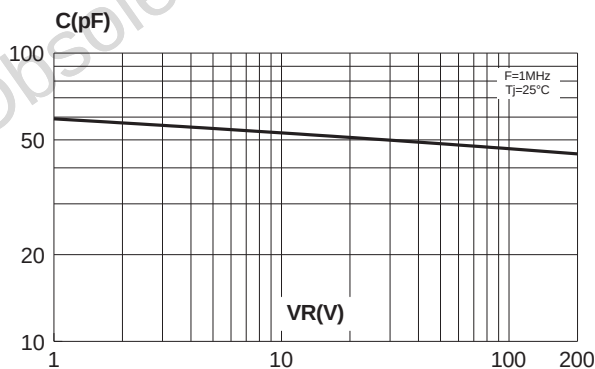
**Fig. 5-2:** Relative variation of thermal impedance junction to case versus pulse duration (ISOWATT220AB, TO-220FPAB).



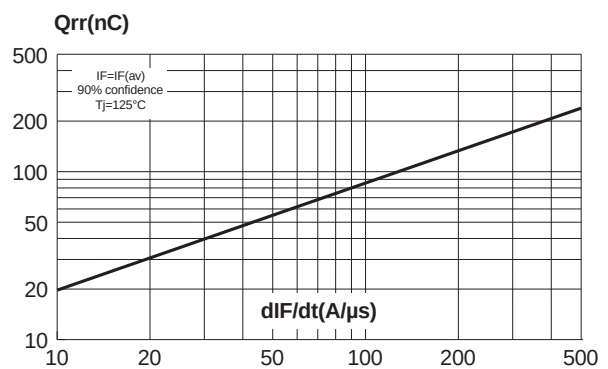
**Fig. 6:** Forward voltage drop versus forward current (maximum values, per diode).



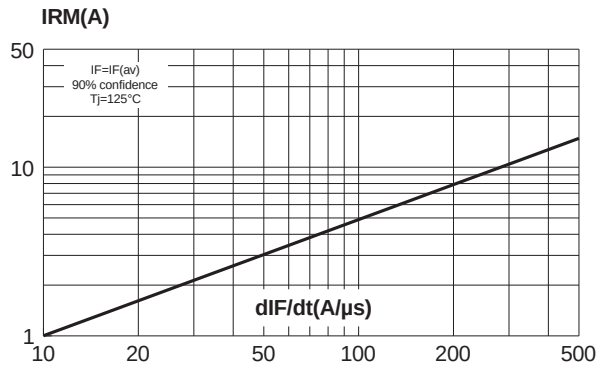
**Fig. 7:** Junction capacitance versus reverse voltage applied (typical values, per diode).



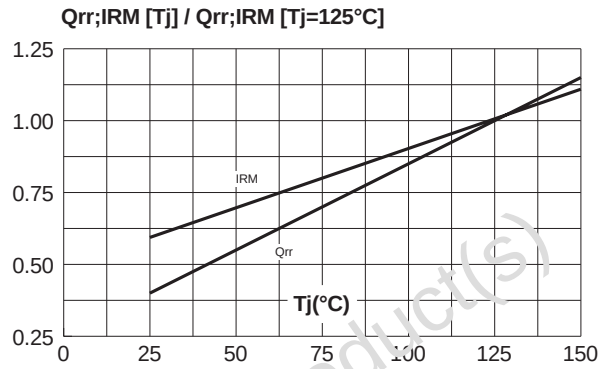
**Fig. 8:** Reverse recovery charges versus  $dI_F/dt$  (per diode).



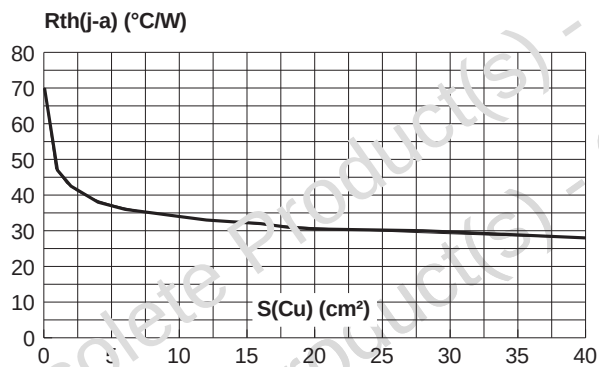
**Fig. 9:** Peak reverse recovery current versus  $dI_F/dt$  (per diode).



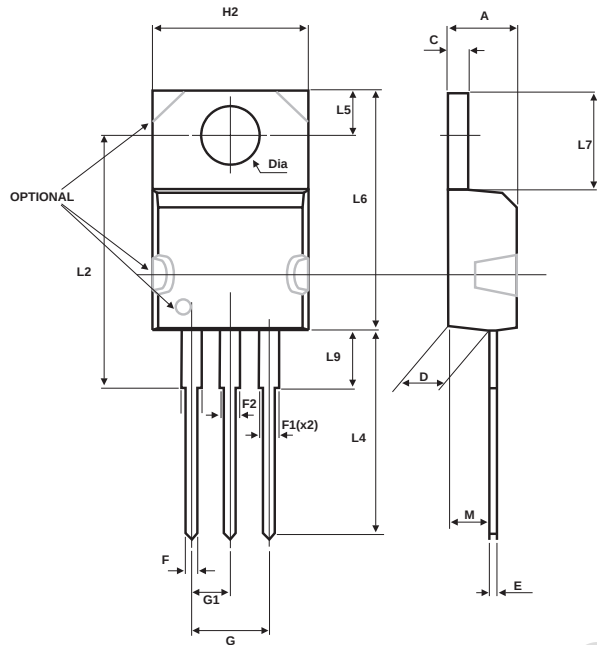
**Fig. 10:** Dynamic parameters versus junction temperature.



**Fig. 11:** Thermal resistance junction to ambient versus copper surface under tab (Epoxy printed circuit board FR4, copper thickness:  $35\mu m$ ) ( $D^2PAK$ ).

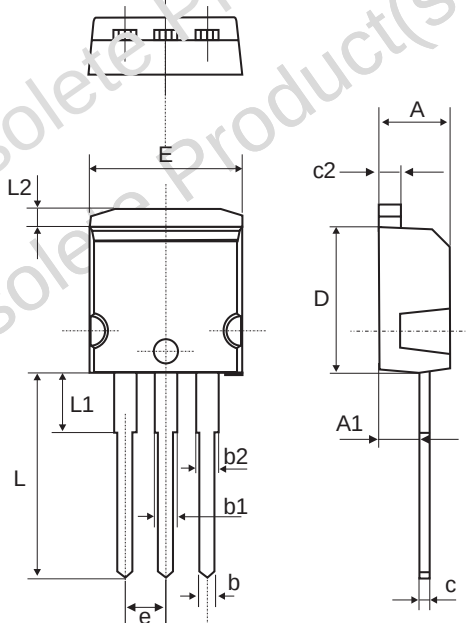


**PACKAGE MECHANICAL DATA**  
TO-220AB (JEDEC compatible)



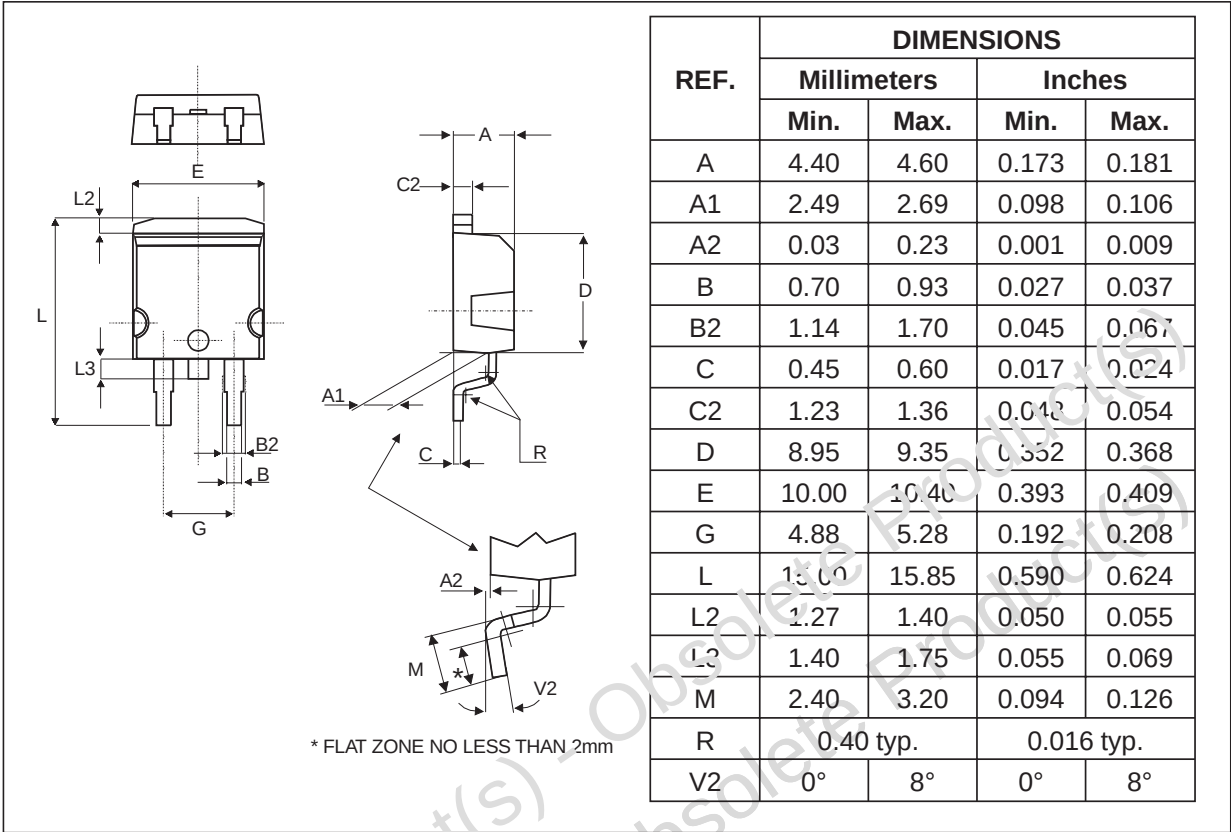
| REF. | DIMENSIONS  |       |            |       |
|------|-------------|-------|------------|-------|
|      | Millimeters |       | Inches     |       |
|      | Min.        | Max.  | Min.       | Max.  |
| A    | 4.30        | 4.60  | 0.169      | 0.181 |
| C    | 1.22        | 1.32  | 0.048      | 0.052 |
| D    | 2.40        | 2.72  | 0.094      | 0.107 |
| E    | 0.33        | 0.70  | 0.013      | 0.028 |
| F    | 0.61        | 0.93  | 0.024      | 0.037 |
| F1   | 1.14        | 1.70  | 0.045      | 0.067 |
| F2   | 1.14        | 1.70  | 0.045      | 0.067 |
| G    | 4.95        | 5.15  | 0.195      | 0.202 |
| G1   | 2.40        | 2.70  | 0.094      | 0.106 |
| H2   | 10.00       | 10.40 | 0.394      | 0.409 |
| L2   | 16.00 Typ.  |       | 0.630 Typ. |       |
| L4   | 13.00       | 14.00 | 0.512      | 0.551 |
| L5   | 2.65        | 2.95  | 0.104      | 0.116 |
| L6   | 14.30       | 15.75 | 0.563      | 0.620 |
| L7   | 6.20        | 6.60  | 0.244      | 0.260 |
| L9   | 3.40        | 3.94  | 0.134      | 0.155 |
| M    | 2.60 Typ.   |       | 0.102 Typ. |       |
| Dia. | 3.75        | 3.89  | 0.148      | 0.153 |

**PACKAGE MECHANICAL DATA**  
I<sup>2</sup>PAK

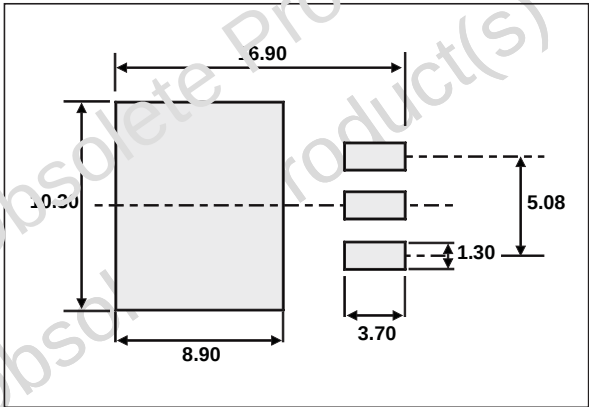


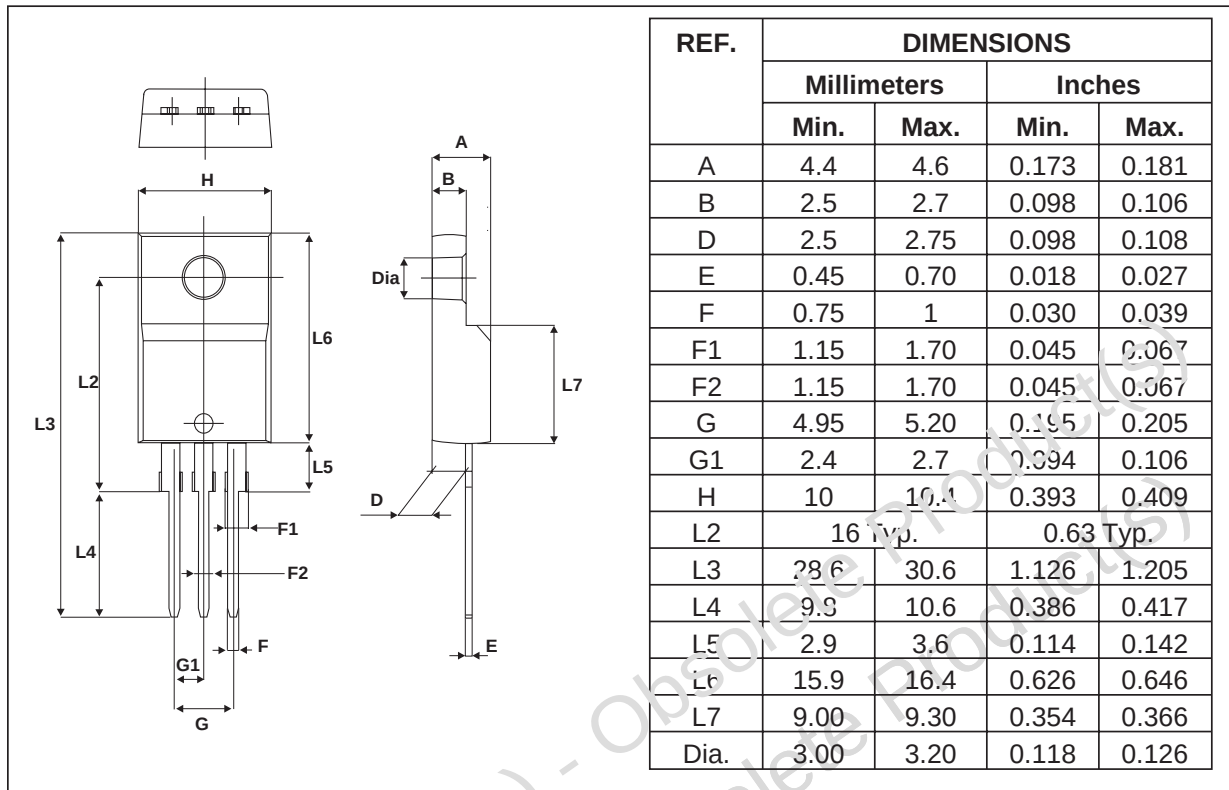
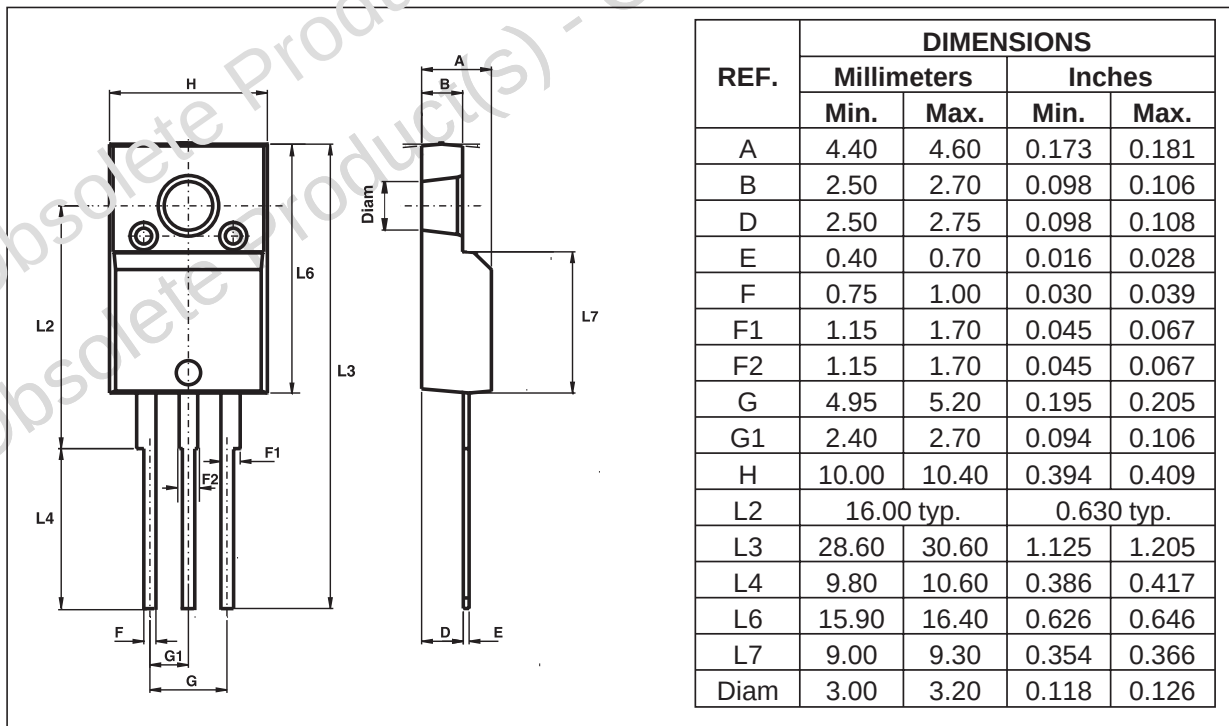
| REF. | DIMENSIONS  |      |        |       |
|------|-------------|------|--------|-------|
|      | Millimeters |      | Inches |       |
|      | Min.        | Max. | Min.   | Max.  |
| A    | 4.40        | 4.60 | 0.173  | 0.181 |
| A1   | 2.49        | 2.69 | 0.098  | 0.106 |
| b    | 0.70        | 0.93 | 0.028  | 0.037 |
| b1   | 1.14        | 1.17 | 0.044  | 0.046 |
| b2   | 1.14        | 1.17 | 0.044  | 0.046 |
| c    | 0.45        | 0.60 | 0.018  | 0.024 |
| c2   | 1.23        | 1.36 | 0.048  | 0.054 |
| D    | 8.95        | 9.35 | 0.352  | 0.368 |
| e    | 2.40        | 2.70 | 0.094  | 0.106 |
| E    | 10.0        | 10.4 | 0.394  | 0.409 |
| L    | 13.1        | 13.6 | 0.516  | 0.535 |
| L1   | 3.48        | 3.78 | 0.137  | 0.149 |
| L2   | 1.27        | 1.40 | 0.050  | 0.055 |

PACKAGE MECHANICAL DATA  
D<sup>2</sup>PAK



FOOT PRINT (in millimeters)  
D<sup>2</sup>PAK



**PACKAGE MECHANICAL DATA**  
**TO-220FPAB**

**PACKAGE MECHANICAL DATA**  
**ISOWATT220AB (JEDEC compatible)**




| Ordering code | Marking     | Package            | Weight  | Base qty | Delivery mode |
|---------------|-------------|--------------------|---------|----------|---------------|
| BYW51-200     | BYW51-200   | TO220AB            | 2.2 g.  | 50       | Tube          |
| BYW51F-200    | BYW51F-200  | ISOWATT220AB       | 2.08 g. | 50       | Tube          |
| BYW51G-200    | BYW51G-200  | D <sup>2</sup> PAK | 1.48 g. | 50       | Tube          |
| BYW51FP-200   | BYW51FP-200 | TO-220FPAB         | 2g      | 50       | Tube          |
| BYW51R-200    | BYW51R-200  | I <sup>2</sup> PAK | 1.49 g  | 50       | Tube          |

- Recommended torque value (TO-220AB): 0.8 N.m.
- Maximum torque value (TO-220AB): 1.0 N.m.
- Recommended torque value (ISOWATT220AB / TO-220FPAB): 0.55 N.m.
- Maximum torque value (ISOWATT220AB / TO-220FPAB): 0.70 N.m.
- Epoxy meets UL94,V0

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