

**HIGH VOLTAGE FAST-SWITCHING  
NPN POWER TRANSISTORS**

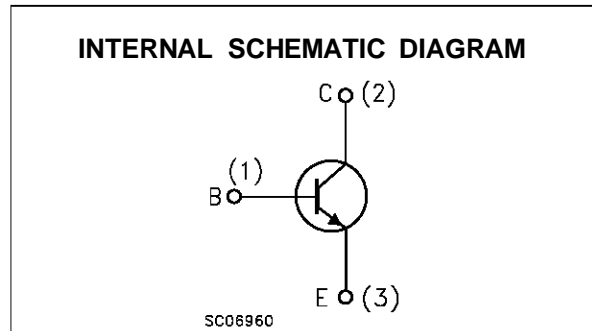
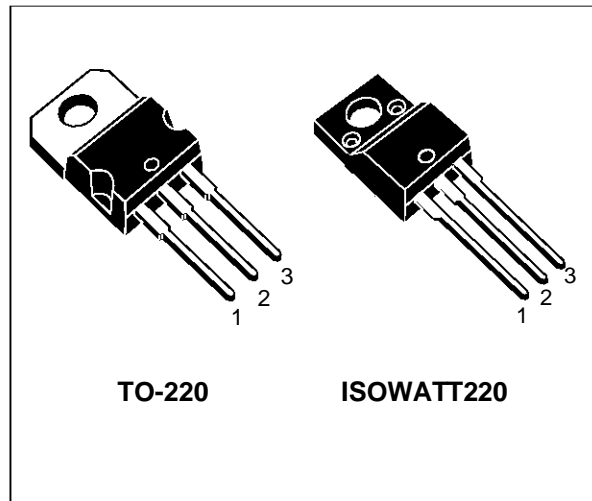
- HIGH VOLTAGE CAPABILITY (450V  $V_{CE0}$ )
- VERY HIGH SWITCHING SPEED:  $t_f = 35\text{ns}$   
TYPICAL AT  $I_C = 2.5\text{A}$ ,  $I_{B1} = 0.5\text{A}$ ,  $V_{BE\text{off}} = -5\text{V}$
- LOW SATURATION VOLTAGE
- COMPLETE CHARACTERIZATION AT 100 °C
- U.L. RECOGNISED ISOWATT220 PACKAGE  
(U.L. FILE # E81734 (N)).

**APPLICATION**

- SWITCH MODE POWER SUPPLIES
- FLYBACK AND FORWARD SINGLE  
TRANSISTOR LOW POWER CONVERTERS

**DESCRIPTION**

The SGSF313 and SGSF313PI are high voltage NPN FASTSWITCHING transistors designed to be used as switch in high efficiency OFF-LINE (220V mains) switching power supplies for consumer applications like sets VCR's and monitors.



**ABSOLUTE MAXIMUM RATINGS**

| Symbol    | Parameter   | Value      |           | Unit |
|-----------|---|------------|-----------|------|
|           |   | SGSF313    | SGSF313PI |      |
| $V_{CEX}$ | Collector-Emitter Voltage ( $V_{BE} = -2.5\text{V}$ ) | 1000       |           | V    |
| $V_{CES}$ | Collector-Emitter Voltage ( $V_{BE} = 0$ )            | 1000       |           | V    |
| $V_{CEO}$ | Collector-Emitter Voltage ( $I_B = 0$ )               | 450        |           | V    |
| $V_{EBO}$ | Emitter-Base Voltage ( $I_C = 0$ )                    | 10         |           | V    |
| $I_C$     | Collector Current                                     | 7          |           | A    |
| $I_{CM}$  | Collector Peak Current ( $t_p < 5\text{ ms}$ )        | 10         |           | A    |
| $I_B$     | Base Current  | 3          |           | A    |
| $I_{BM}$  | Base Peak Current ( $t_p < 5\text{ ms}$ )             | 6          |           | A    |
| $P_{tot}$ | Total Dissipation at $T_c = 25\text{ °C}$             | 70         | 35        | W    |
| $T_{stg}$ | Storage Temperature                                   | -65 to 150 |           | °C   |
| $T_j$     | Max. Operating Junction Temperature                   | 150        |           | °C   |

**THERMAL DATA**

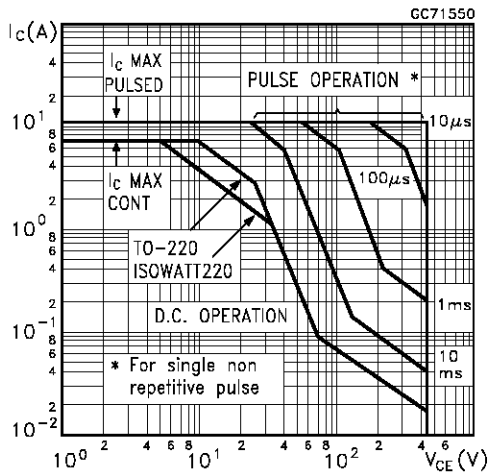
|                       |                                  |     | TO-220 | ISOWATT221 |      |
|-----------------------|----------------------------------|-----|--------|------------|------|
| R <sub>thj-case</sub> | Thermal Resistance Junction-Case | Max | 1.78   | 3.57       | °C/W |

**ELECTRICAL CHARACTERISTICS** (T<sub>case</sub> = 25 °C unless otherwise specified)

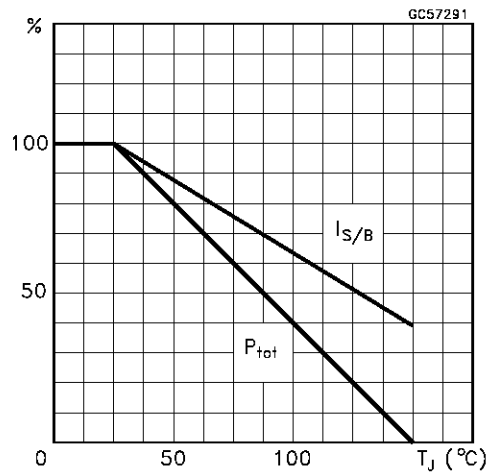
| Symbol  | Parameter   | Test Conditions   | Min.                | Typ.               | Max.                              | Unit                  |
|---|---|---|---------------------|--------------------|-----------------------------------|-----------------------|
| I <sub>CES</sub>                                    | Collector Cut-off Current (V <sub>BE</sub> = 0)             | V <sub>CE</sub> = 1000 V<br>V <sub>CE</sub> = 1000 V T <sub>j</sub> = 125 °C  |                     |                    | 10<br>100                         | μA<br>μA              |
| I <sub>CEO</sub>                                    | Collector Cut-off Current (I <sub>B</sub> = 0)              | V <sub>EC</sub> = 450 V   |                     |                    | 100                               | μA                    |
| V <sub>CEO(sus)</sub>                               | Collector-Emitter Sustaining Voltage                        | I <sub>C</sub> = 100 mA L = 25 mH   | 450                 |                    |                                   | V                     |
| V <sub>CE(sat)*</sub>                               | Collector-Emitter Saturation Voltage                        | I <sub>C</sub> = 1 A I <sub>B</sub> = 0.1 A<br>I <sub>C</sub> = 2 A I <sub>B</sub> = 0.4 A<br>I <sub>C</sub> = 2.5 A I <sub>B</sub> = 0.5 A<br>I <sub>C</sub> = 1 A I <sub>B</sub> = 0.1 A T <sub>j</sub> = 125 °C<br>I <sub>C</sub> = 2 A I <sub>B</sub> = 0.4 A T <sub>j</sub> = 125 °C   |                     |                    | 0.5<br>0.45<br>0.75<br>0.6<br>0.8 | V<br>V<br>V<br>V<br>V |
| V <sub>BE(sat)*</sub>                               | Base-Emitter Saturation Voltage                             | I <sub>C</sub> = 1 A I <sub>B</sub> = 0.1 A<br>I <sub>C</sub> = 2 A I <sub>B</sub> = 0.4 A<br>I <sub>C</sub> = 2.5 A I <sub>B</sub> = 0.5 A   |                     |                    | 1.1<br>1.25<br>1.3                | V<br>V<br>V           |
| h <sub>FE*</sub>                                    | DC Current Gain   | I <sub>C</sub> = 1 A V <sub>CE</sub> = 2.5 V<br>I <sub>C</sub> = 1 A V <sub>CE</sub> = 5 V<br>I <sub>C</sub> = 2 A V <sub>CE</sub> = 1 V<br>I <sub>C</sub> = 5 mA V <sub>CE</sub> = 5 V<br>I <sub>C</sub> = 1 A V <sub>CE</sub> = 2.5 V T <sub>j</sub> = 125 °C<br>I <sub>C</sub> = 1 A V <sub>CE</sub> = 5 V T <sub>j</sub> = 125 °C<br>I <sub>C</sub> = 2 A V <sub>CE</sub> = 1 V T <sub>j</sub> = 125 °C | 12<br>15<br>6<br>10 | 30                 | 45                                |                       |
| t <sub>ON</sub><br>t <sub>s</sub><br>t <sub>f</sub> | RESISTIVE LOAD<br>Turn-on Time<br>Storage Time<br>Fall Time | V <sub>CC</sub> = 250 V I <sub>C</sub> = 2.5 A<br>I <sub>B1</sub> = 0.5 A I <sub>B2</sub> = -1 A  |                     | 0.5<br>1.5<br>0.18 | 1<br>2.5<br>0.3                   | μs<br>μs<br>μs        |
| t <sub>ON</sub><br>t <sub>s</sub><br>t <sub>f</sub> | RESISTIVE LOAD<br>Turn-on Time<br>Storage Time<br>Fall Time | V <sub>CC</sub> = 250 V I <sub>C</sub> = 2.5 A<br>I <sub>B1</sub> = 0.5 A I <sub>B2</sub> = -1 A<br>With Antisaturation Network   |                     | 0.5<br>1.1<br>0.13 |                                   | μs<br>μs<br>μs        |
| t <sub>ON</sub><br>t <sub>s</sub><br>t <sub>f</sub> | RESISTIVE LOAD<br>Turn-on Time<br>Storage Time<br>Fall Time | V <sub>CC</sub> = 250 V I <sub>C</sub> = 2.5 A<br>I <sub>B1</sub> = 0.5 A V <sub>BE(off)</sub> = -5 V   |                     | 0.5<br>1.1<br>0.13 |                                   | μs<br>μs<br>μs        |
| t <sub>s</sub><br>t <sub>f</sub>                    | INDUCTIVE LOAD<br>Storage Time<br>Fall Time                 | I <sub>C</sub> = 2.5 A h <sub>FE</sub> = 5A<br>V <sub>BE(off)</sub> = -5 V R <sub>BB</sub> = 2 Ω<br>V <sub>CL</sub> = 300 V L = 300 μH  |                     | 1<br>0.1           | 2<br>0.2                          | μs<br>μs              |
| t <sub>s</sub><br>t <sub>f</sub>                    | INDUCTIVE LOAD<br>Storage Time<br>Fall Time                 | I <sub>C</sub> = 2.5 A h <sub>FE</sub> = 5A<br>V <sub>BE(off)</sub> = -5 V R <sub>BB</sub> = 2 Ω<br>V <sub>CL</sub> = 300 V L = 300 μH<br>T <sub>j</sub> = 100 °C   |                     |                    | 3<br>0.3                          | μs<br>μs              |

\* Pulsed: Pulse duration = 300 μs, duty cycle 1.5 %

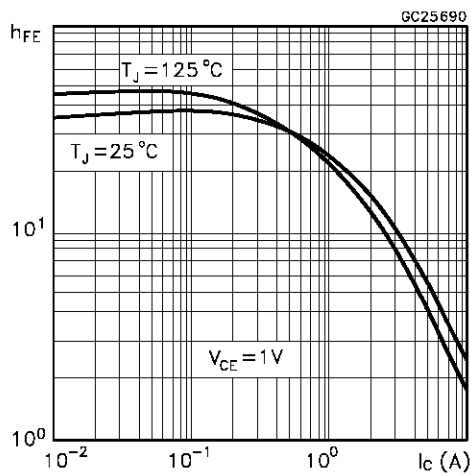
Safe Operating Area Thermal Impedance



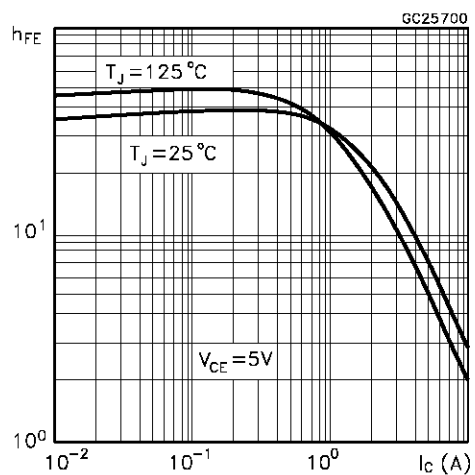
Derating Curve



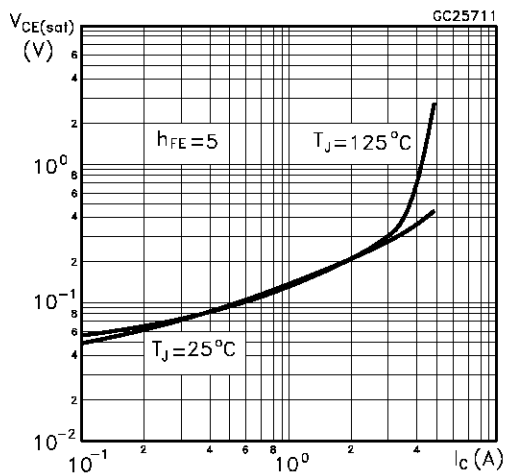
DC Current Gain



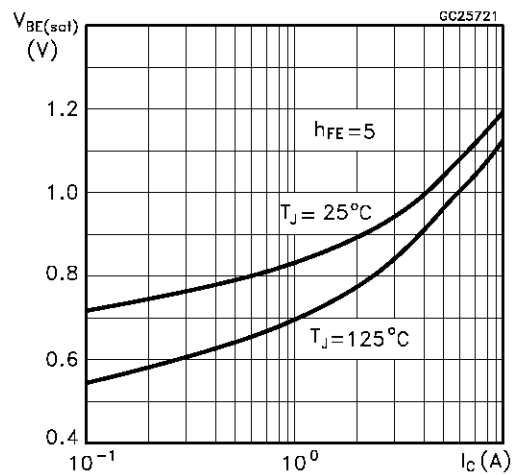
DC Current Gain



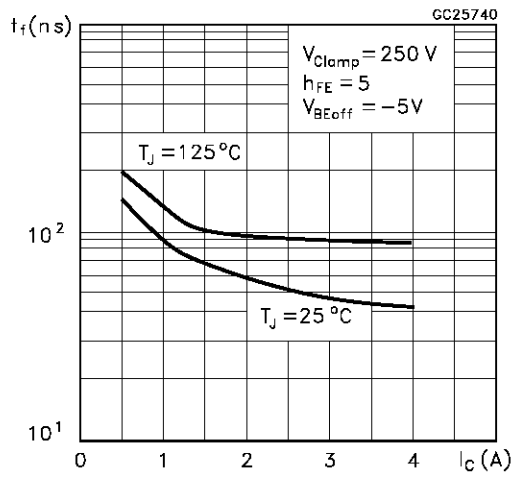
Collector Emitter Saturation Voltage



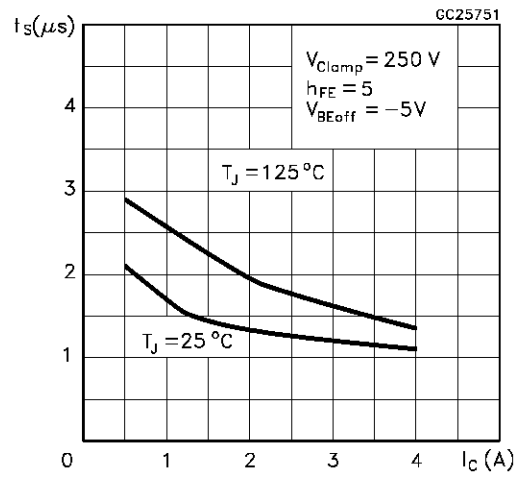
Base Emitter Saturation Voltage



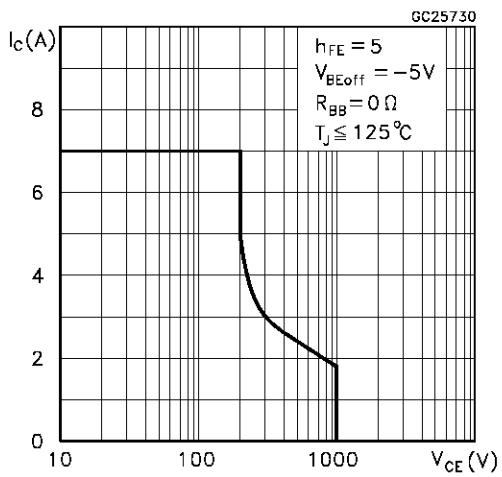
Inductive Fall Time



Inductive Storage Time

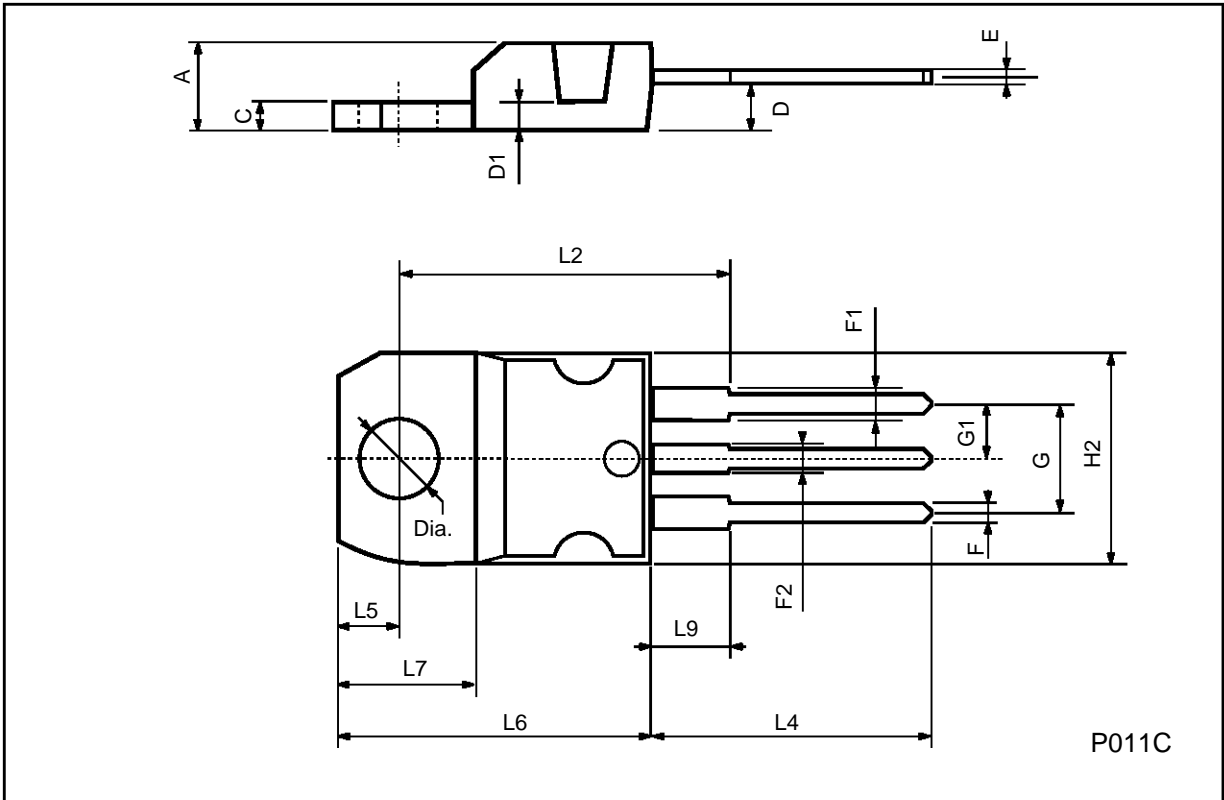


Reverse Biased SOA



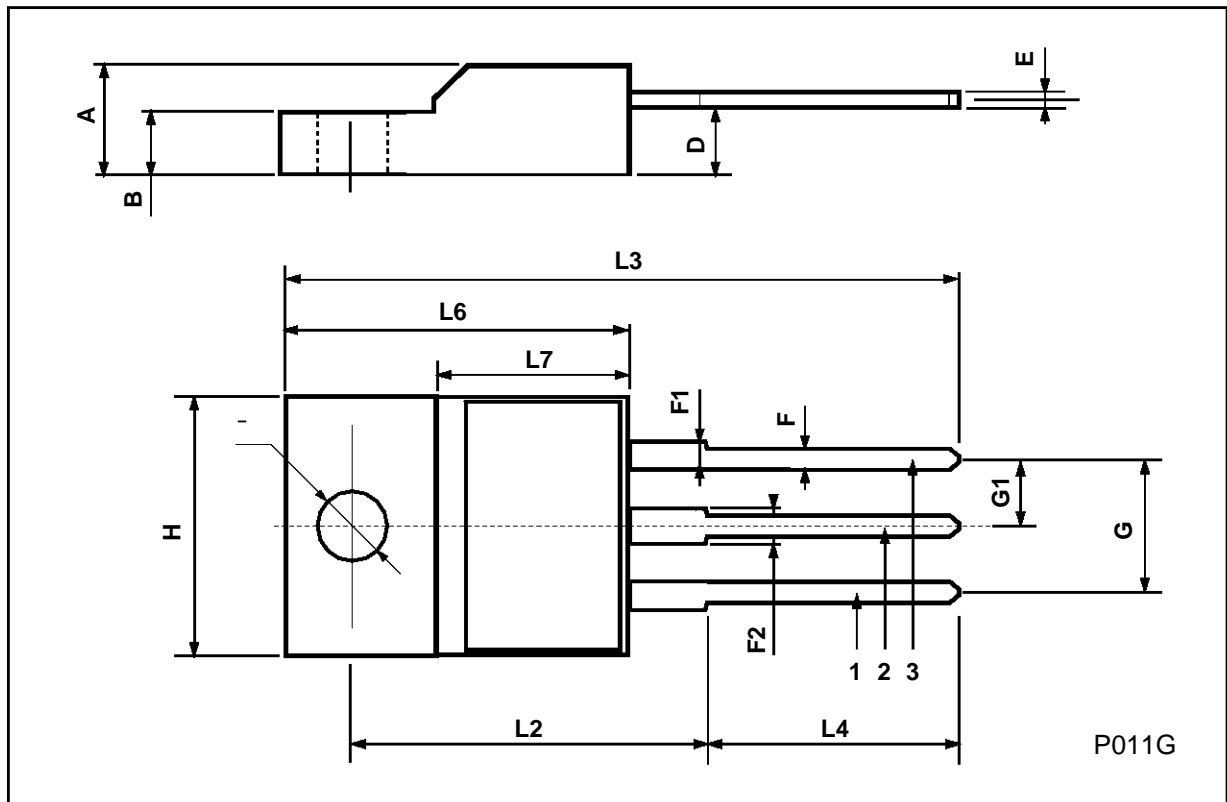
**TO-220 MECHANICAL DATA**

| DIM. | mm    |      |       | inch  |       |       |
|------|-------|------|-------|-------|-------|-------|
|      | MIN.  | TYP. | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 4.40  |      | 4.60  | 0.173 |       | 0.181 |
| C    | 1.23  |      | 1.32  | 0.048 |       | 0.051 |
| D    | 2.40  |      | 2.72  | 0.094 |       | 0.107 |
| D1   |       | 1.27 |       |       | 0.050 |       |
| E    | 0.49  |      | 0.70  | 0.019 |       | 0.027 |
| F    | 0.61  |      | 0.88  | 0.024 |       | 0.034 |
| F1   | 1.14  |      | 1.70  | 0.044 |       | 0.067 |
| F2   | 1.14  |      | 1.70  | 0.044 |       | 0.067 |
| G    | 4.95  |      | 5.15  | 0.194 |       | 0.203 |
| G1   | 2.4   |      | 2.7   | 0.094 |       | 0.106 |
| H2   | 10.0  |      | 10.40 | 0.393 |       | 0.409 |
| L2   |       | 16.4 |       |       | 0.645 |       |
| L4   | 13.0  |      | 14.0  | 0.511 |       | 0.551 |
| L5   | 2.65  |      | 2.95  | 0.104 |       | 0.116 |
| L6   | 15.25 |      | 15.75 | 0.600 |       | 0.620 |
| L7   | 6.2   |      | 6.6   | 0.244 |       | 0.260 |
| L9   | 3.5   |      | 3.93  | 0.137 |       | 0.154 |
| DIA. | 3.75  |      | 3.85  | 0.147 |       | 0.151 |



**ISOWATT220 MECHANICAL DATA**

| DIM. | mm   |      |      | inch  |       |       |
|------|------|------|------|-------|-------|-------|
|      | MIN. | TYP. | MAX. | MIN.  | TYP.  | MAX.  |
| A    | 4.4  |      | 4.6  | 0.173 |       | 0.181 |
| B    | 2.5  |      | 2.7  | 0.098 |       | 0.106 |
| D    | 2.5  |      | 2.75 | 0.098 |       | 0.108 |
| E    | 0.4  |      | 0.7  | 0.015 |       | 0.027 |
| F    | 0.75 |      | 1    | 0.030 |       | 0.039 |
| F1   | 1.15 |      | 1.7  | 0.045 |       | 0.067 |
| F2   | 1.15 |      | 1.7  | 0.045 |       | 0.067 |
| G    | 4.95 |      | 5.2  | 0.195 |       | 0.204 |
| G1   | 2.4  |      | 2.7  | 0.094 |       | 0.106 |
| H    | 10   |      | 10.4 | 0.393 |       | 0.409 |
| L2   |      | 16   |      |       | 0.630 |       |
| L3   | 28.6 |      | 30.6 | 1.126 |       | 1.204 |
| L4   | 9.8  |      | 10.6 | 0.385 |       | 0.417 |
| L6   | 15.9 |      | 16.4 | 0.626 |       | 0.645 |
| L7   | 9    |      | 9.3  | 0.354 |       | 0.366 |
| ∅    | 3    |      | 3.2  | 0.118 |       | 0.126 |



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