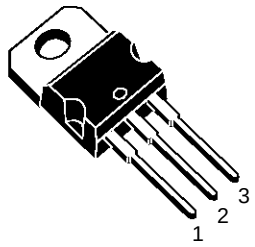
SGS-THOMSON MICROELECTRONICS

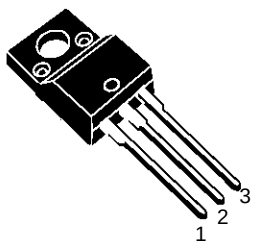
# BUL310
# BUL310PI

## HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTORS

- SGS-THOMSON PREFERRED SALESTYPES
- NPN TRANSISTOR
- HIGH VOLTAGE CAPABILITY
- LOW SPREAD OF DYNAMIC PARAMETERS
- MINIMUM LOT-TO-LOT SPREAD FOR RELIABLE OPERATION
- VERY HIGH SWITCHING SPEED
- FULLY CHARACTERISED AT 125°C
- LARGE RBSOA
- U.L. RECOGNISED ISOWATT220 PACKAGE (U.L. FILE # E81734 (N)): ISOLATION VOLTAGE 1500$V_{RMS}$

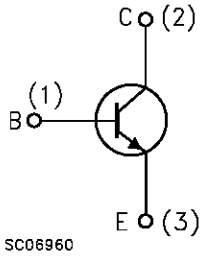



**TO-220**




**ISOWATT220**

**INTERNAL SCHEMATIC DIAGRAM**




### APPLICATIONS

- ELECTRONIC BALLASTS FOR FLUORESCENT LIGHTING
- FLYBACK AND FORWARD SINGLE TRANSISTOR LOW POWER CONVERTERS

### DESCRIPTION

The BUL310 and BUL310PI are manufactured using high voltage Multi Epitaxial Planar technology for high switching speeds and high voltage capability. They use a Cellular Emitter structure with planar edge termination to enhance switching speeds while maintaining a wide RBSOA.

The BUL series is designed for use in lighting applications and low cost switch-mode power supplies.

### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | | Unit |
|---|---|---|---|---|
| | | BUL310 | BUL310PI | |
| $V_{CES}$ | Collector-Emitter Voltage ($V_{BE}$ = 0) | 1000 | | V |
| $V_{CEO}$ | Collector-Emitter Voltage ($I_B$ = 0) | 500 | | V |
| $V_{EBO}$ | Emitter-Base Voltage ($I_C$ = 0) | 9 | | V |
| $I_C$ | Collector Current | 5 | | V |
| $I_{CM}$ | Collector Peak Current ($t_p$ <5 ms) | 10 | | A |
| $I_B$ | Base Current | 3 | | A |
| $I_{BM}$ | Base Peak Current ($t_p$ <5 ms) | 4 | | A |
| $P_{tot}$ | Total Dissipation at Tc = 25 °C | 75 | 35 | W |
| $T_{stg}$ | Storage Temperature | -65 to 150 | | °C |
| $T_j$ | Max. Operating Junction Temperature | 150 | | °C |

## THERMAL DATA

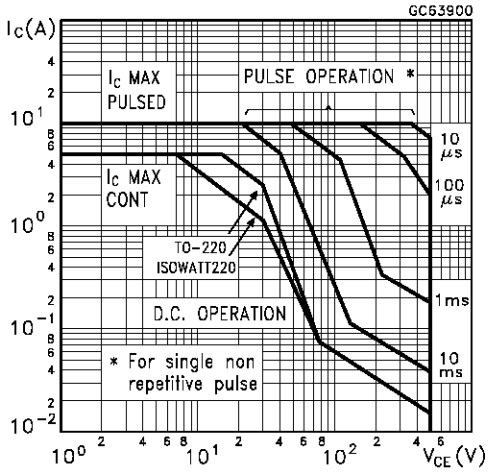
| | | TO-220 | ISOWATT220 | |
|---|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal Resistance Junction-Case Max | 1.65 | 3.58 | °C/W |
| $R_{thj\text{-}amb}$ | Thermal Resistance Junction-Ambient Max | 62.5 | 62.5 | °C/W |

## ELECTRICAL CHARACTERISTICS ($T_{case}$ = 25 °C unless otherwise specified)

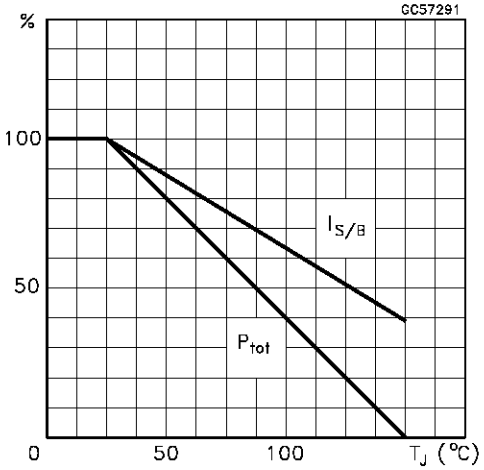
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{CES}$ | Collector Cut-off Current ($V_{BE}$ = 0) | $V_{CE}$ = 1000 V<br>$V_{CE}$ = 1000 V $T_j$ = 125 °C | | | 100<br>500 | µA<br>µA |
| $I_{CEO}$ | Collector Cut-off Current ($I_B$ = 0) | $V_{EC}$ = 400 V | | | 250 | µA |
| $V_{CEO(sus)}$ | Collector-Emitter Sustaining Voltage | $I_C$ = 100 mA L= 25 mH | 500 | | | V |
| $V_{EBO}$ | Emitter-Base Voltage ($I_C$ = 0) | $I_E$ = 10 mA | 9 | | | V |
| $V_{CE(sat)}$* | Collector-Emitter Saturation Voltage | $I_C$ = 1 A $I_B$ = 0.2 A<br>$I_C$ = 2 A $I_B$ = 0.4 A<br>$I_C$ = 3 A $I_B$ = 0.6 A | | | 0.5<br>0.7<br>1.1 | V<br>V<br>V |
| $V_{BE(sat)}$* | Base-Emitter Saturation Voltage | $I_C$ = 1 A $I_B$ = 0.2 A<br>$I_C$ = 2 A $I_B$ = 0.4 A<br>$I_C$ = 3 A $I_B$ = 0.6 A | | | 1<br>1.1<br>1.2 | V<br>V<br>V |
| $h_{FE}$* | DC Current Gain | $I_C$ = 10 mA $V_{CE}$ = 5 V<br>$I_C$ = 3 A $V_{CE}$ = 2.5 V | 10 | <br>10 | | |
| $t_s$<br>$t_f$ | INDUCTIVE LOAD<br>Storage Time<br>Fall Time | $I_C$ = 2 A $I_{B1}$ = 0.4 A<br>$V_{BE(off)}$ = -5 V $R_{BB}$ = 0 Ω<br>$V_{CL}$ = 250 V L = 200 µH | | <br>1.2<br>80 | <br>1.9<br>160 | <br>µs<br>ns |
| $t_s$<br>$t_f$ | INDUCTIVE LOAD<br>Storage Time<br>Fall Time | $I_C$ = 2 A $I_{B1}$ = 0.4 A<br>$V_{BE(off)}$ = -5V $R_{BB}$ = 0 Ω<br>$V_{CL}$ = 250 V L = 200 µH<br>$T_j$ = 125 °C | | <br>1.8<br>150 | | <br>µs<br>ns |

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

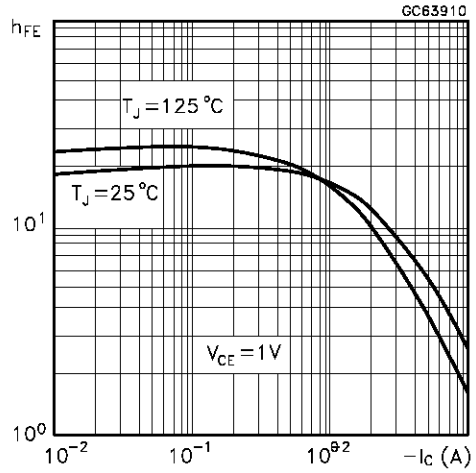
Safe Operating Areas



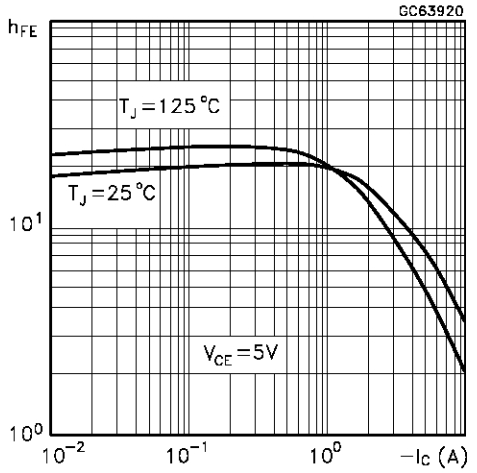

Derating Curve



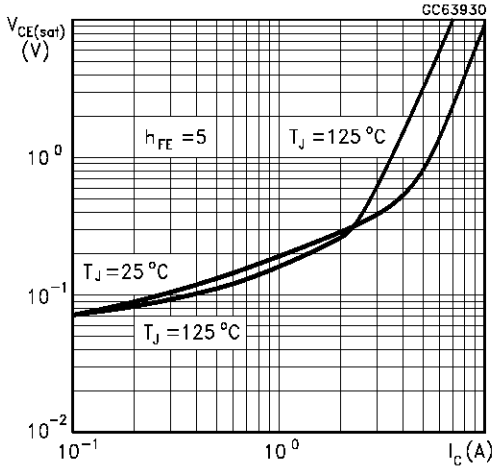
DC Current Gain



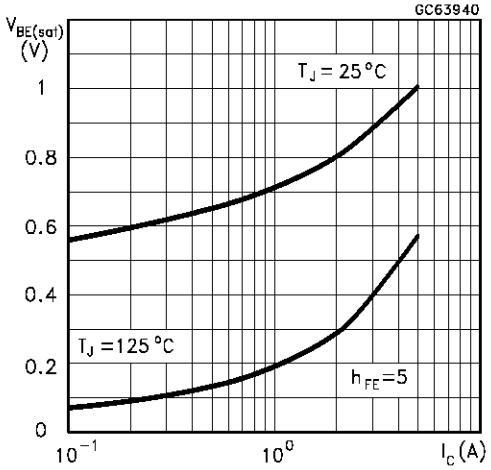

DC Current Gain



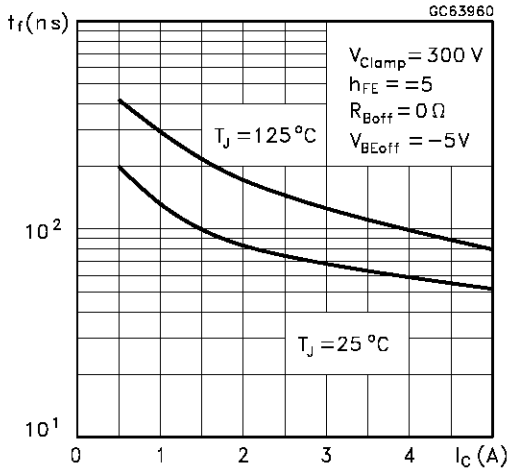

Collector Emitter Saturation Voltage



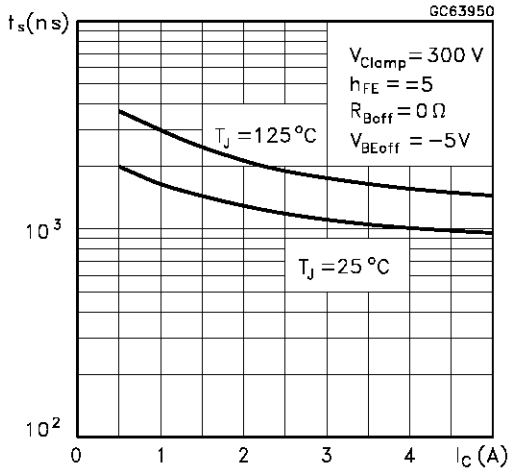

Base Emitter Saturation Voltage



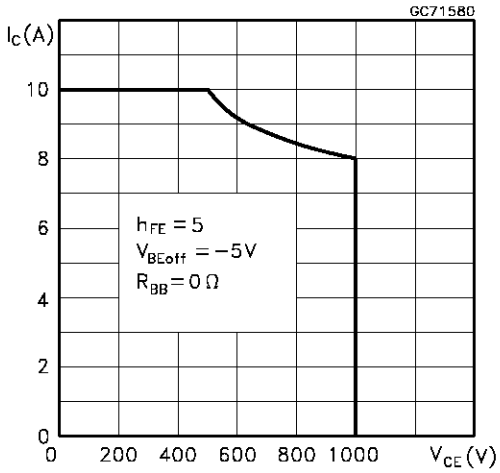

Inductive Fall Time



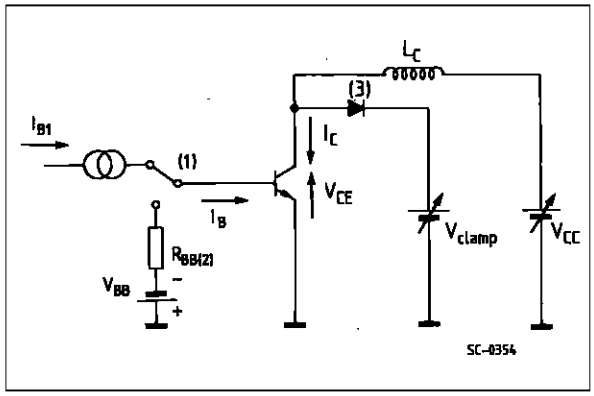

Inductive Storage Time



Reverse Biased SOA



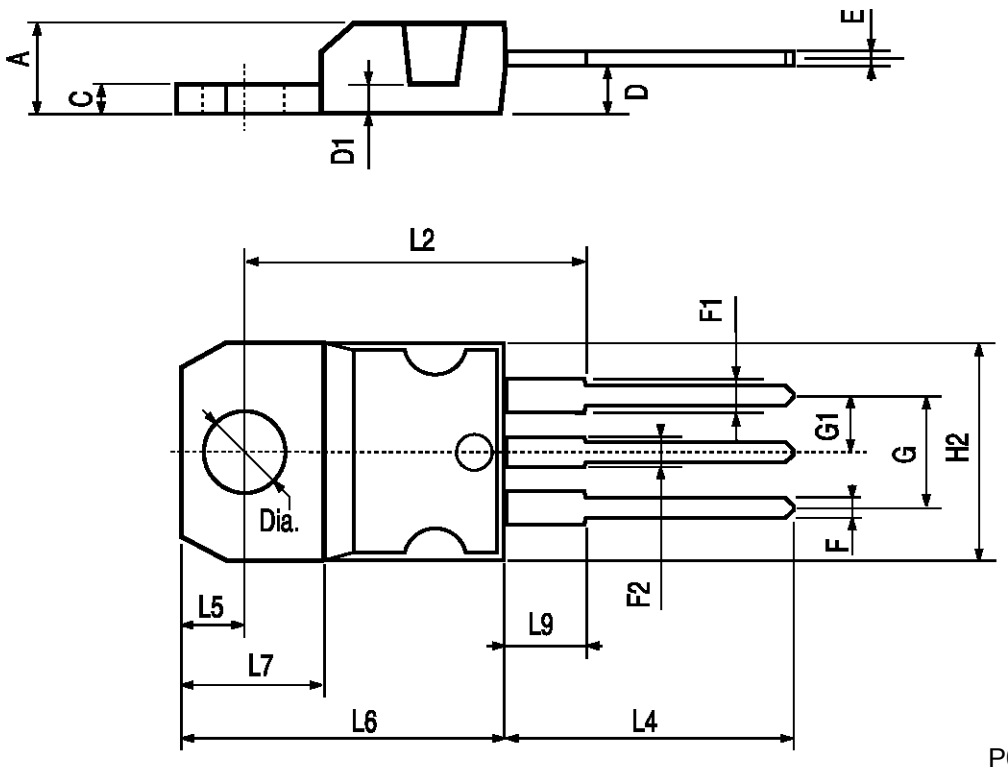

RBSOA and Inductive Load Switching Test Circuit




(1) Fast electronic switch
(2) Non-inductive Resistor
(3) Fast recovery rectifier

# TO-220 MECHANICAL DATA

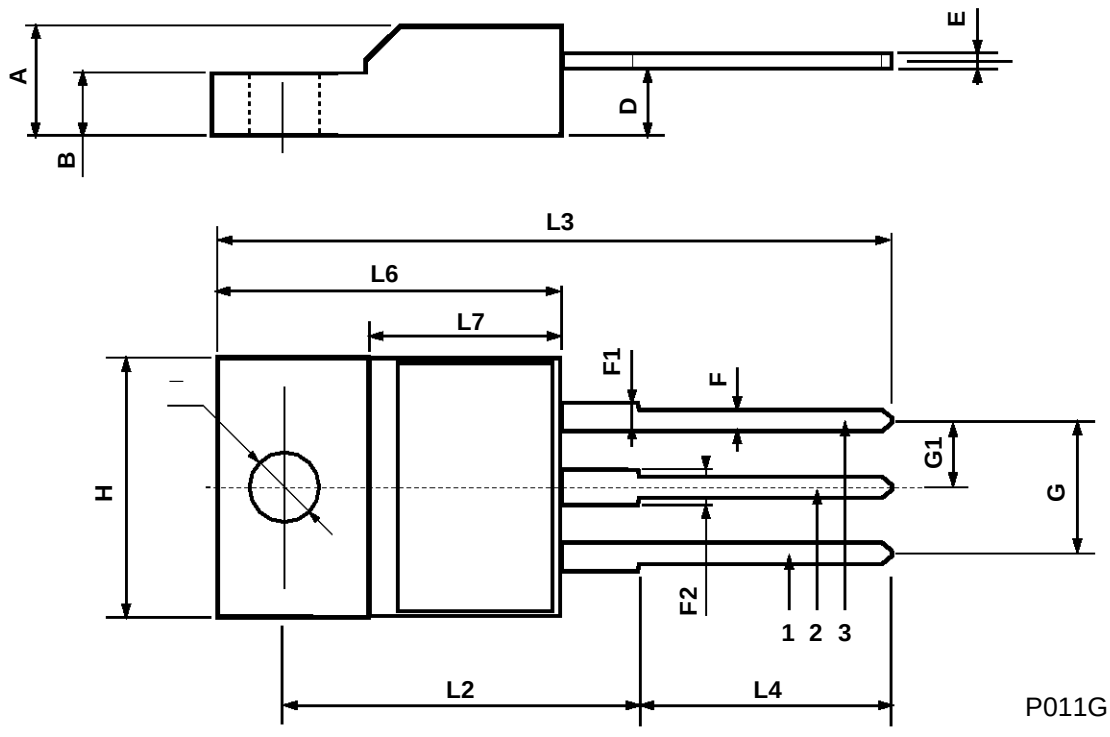
| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| C | 1.23 | | 1.32 | 0.048 | | 0.051 |
| D | 2.40 | | 2.72 | 0.094 | | 0.107 |
| D1 | | 1.27 | | | 0.050 | |
| E | 0.49 | | 0.70 | 0.019 | | 0.027 |
| F | 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 |




P011C

## 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 |
| Ø | 3 | | 3.2 | 0.118 | | 0.126 |



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