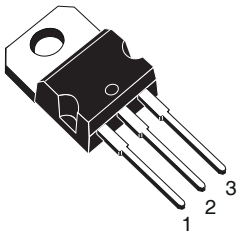
# BUL3N7

## MEDIUM VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

## Features

- MEDIUM VOLTAGE CAPABILITY
- LOW SPREAD OF DYNAMIC PARAMETERS
- MINIMUM LOT-TO-LOT SPREAD FOR RELIABLE OPERATION
- VERY HIGH SWITCHING SPEED




**TO-220**

## Applications

- ELECTRONIC BALLASTS FOR FLUORESCENT LIGHTING

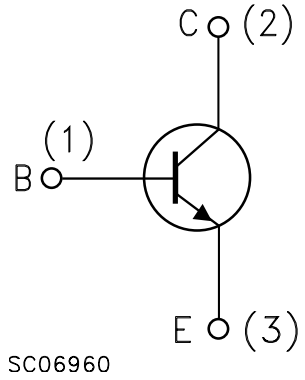
## Description

The BUL3N7 is manufactured using high voltage Multi-Epitaxial Planar technology for high switching speeds and medium voltage capability.

It uses a Cellular Emitter structure with planar edge termination to enhance switching speeds while maintaining the wide RBSOA.

The device is expressly designed for a new solution to be used in compact fluorescent lamps, H.F. ballast voltage FED where it is coupled with the BUL3P5, its complementary PNP transistor.

## Internal Schematic Diagram




## Order Codes

| Part Number | Marking | Package | Packing |
|---|---|---|---|
| BUL3N7 | BUL3N7 | TO-220 | TUBE |

# 1 Absolute Maximum Ratings

**Table 1. Absolute Maximum Rating**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage ($V_{BE}$ = 0) | 700 | V |
| $V_{CEO}$ | Collector-Emitter Voltage ($I_B$ = 0) | 400 | V |
| $V_{EBO}$ | Emitter-Base Voltage ($I_C$ = 0, $I_B$ = -0.75 A, $t_p$ < 100ms, $T_j$ < 150°C) | $V_{(BR)EBO}$ | V |
| $I_C$ | Collector Current | 3 | A |
| $I_{CM}$ | Collector Peak Current ($t_P$ < 5ms) | 6 | A |
| $I_B$ | Base Current | 1.5 | A |
| $I_{BM}$ | Base Peak Current ($t_P$ < 5ms) | 3 | A |
| $P_{TOT}$ | Total dissipation at $T_c$ = 25°C | 60 | W |
| $T_{stg}$ | Storage Temperature | -65 to 150 | °C |
| $T_J$ | Max. Operating Junction Temperature | 150 | °C |

**Table 2. Thermal Data**

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $R_{thJ\text{-}case}$ | Thermal Resistance Junction-Case | Max | 2.08 | °C/W |
| $R_{thJ\text{-}amb}$ | Thermal Resistance Junction-Ambient | Max | 62.5 | °C/W |

# 2 Electrical Characteristics

**Table 3. 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) | $V_{CE}$ = 700 V<br>$V_{CE}$ = 700 V $T_C$ = 125°C | | | 0.1<br>0.5 | mA<br>mA |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage ($I_C$ = 0) | $I_E$ = 10 mA | 10 | | 18 | V |
| $V_{CEO(sus)}$ *Note: 1* | Collector-Emitter Sustaining Voltage ($I_B$ = 0) | $I_C$ = 100 mA | 400 | | | V |
| $V_{CE(sat)}$ *Note: 1* | Collector-Emitter Saturation Voltage | $I_C$ = 0.7 A $I_B$ = 0.1A<br>$I_C$ = 1 A $I_B$ = 0.2 A | | | 0.5<br>0.5 | V<br>V |
| $V_{BE(sat)}$ *Note: 1* | Base-Emitter Saturation Voltage | $I_C$ = 0.5A $I_B$ = 0.1 A<br>$I_C$ = 1A $I_B$ = 0.2 A<br>$I_C$ = 2A $I_B$ = 0.4 A | | | 1.1<br>1.2<br>1.3 | V<br>V<br>V |
| $h_{FE}$ | DC Current Gain | $I_C$ = 10 mA $V_{CE}$ = 5 V<br>$I_C$ = 0.7A $V_{CE}$ = 5 V<br>$I_C$ = 2A $V_{CE}$ = 5 V | 10<br>18<br>4 | | 34 | |
| $t_r$<br>$t_s$<br>$t_f$ | RESISTIVE LOAD<br>Rise Time<br>Storage Time<br>Fall Time | $I_C$ = 0.7 A $V_{CC}$ = 250 V<br>$I_{B1}$ = 0.14 A $I_{B2}$ = -0.14 A<br>$T_p$ = 30 µs | | 80<br>2.4<br>100 | | ns<br>µs<br>ns |
| $t_s$<br>$t_f$ | INDUCTIVE LOAD<br>Storage Time<br>Fall Time | $I_C$ = 1 A $I_{B1}$ = 0.2 A<br>$V_{BE(off)}$ = -5 V $R_{bb}$ = 0 Ω<br>L = 1 mH $V_{clamp}$ = 200 V | | 450<br>120 | | ns<br>ns |

*Note: 1 Pulsed duration = 300 µs, duty cycle ≤1.5%.*

## 2.1 Typical Characteristics

**Figure 1. Safe Operating Area**

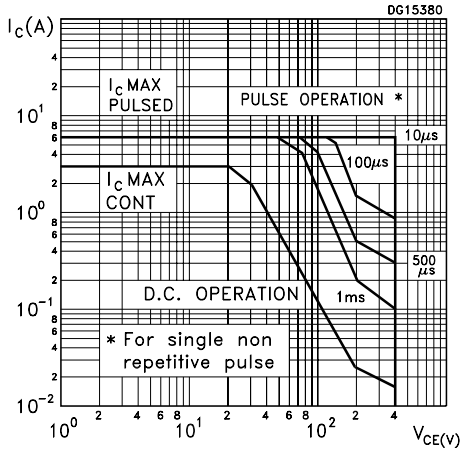



**Figure 2. DC Current Gain**

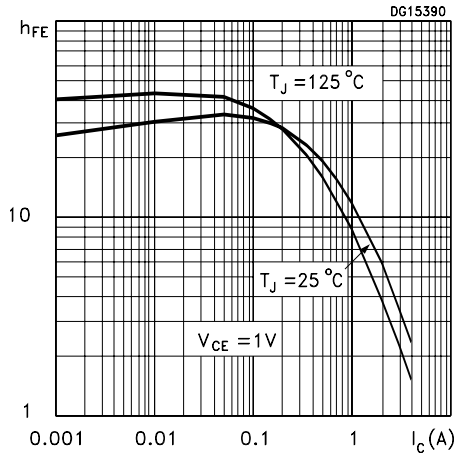



**Figure 3. DC Current Gain**

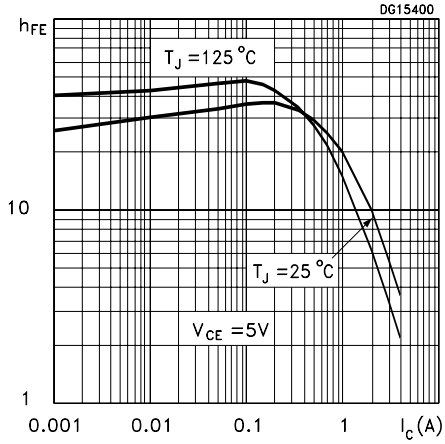



**Figure 4. Collector Emitter Saturation Voltage**

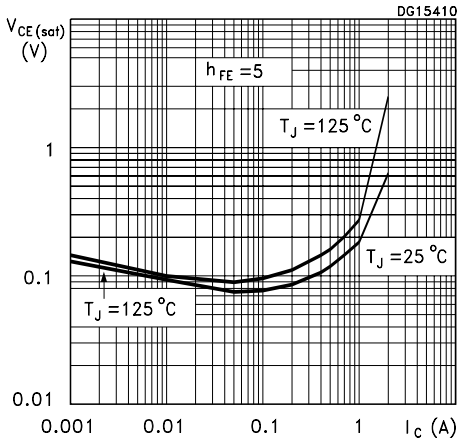



**Figure 5. Base Emitter Saturation Voltage**

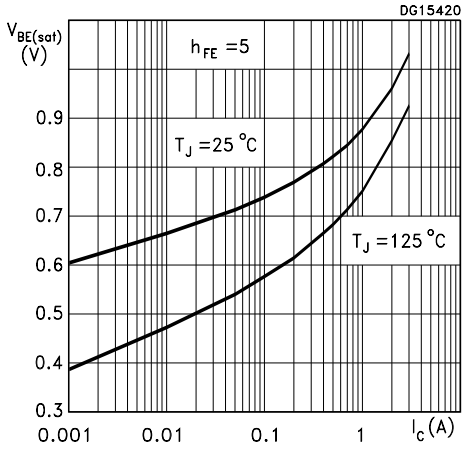



**Figure 6. Switching Times Resistive Load**

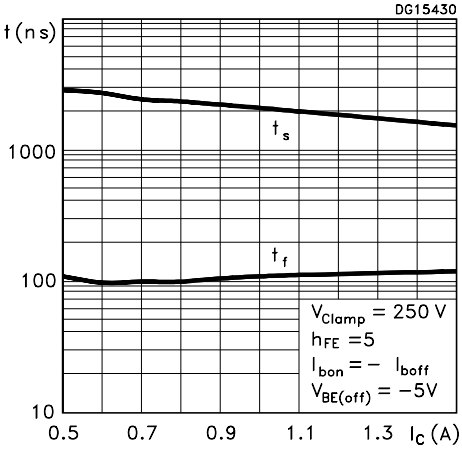


**Figure 7. Switching Times Inductive Load**

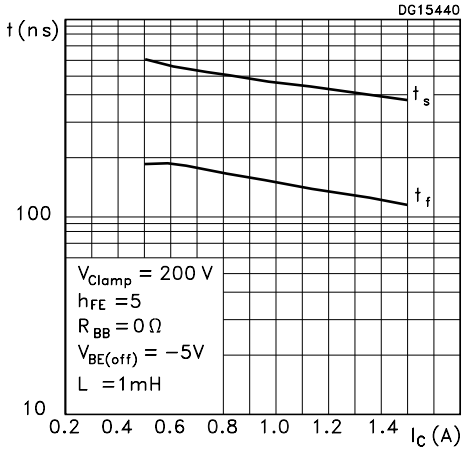
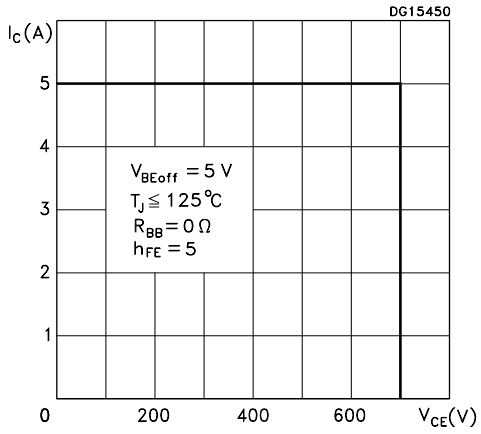



**Figure 8. Reverse Bised SOA**



# 3 Test Circuits

**Figure 9. Inductive Load Switching Test Circuit**

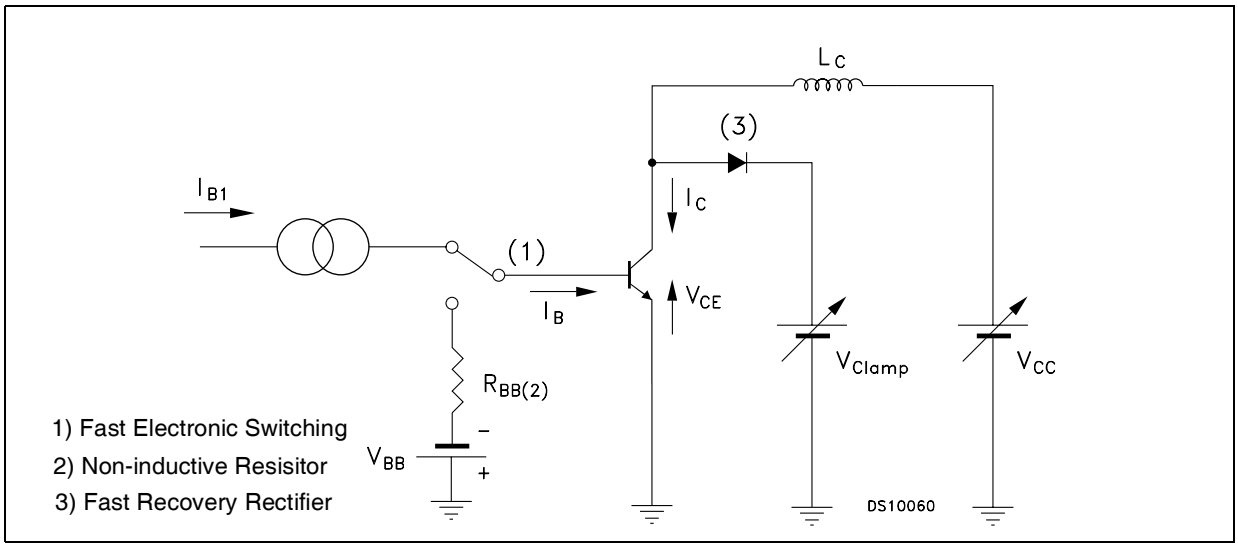
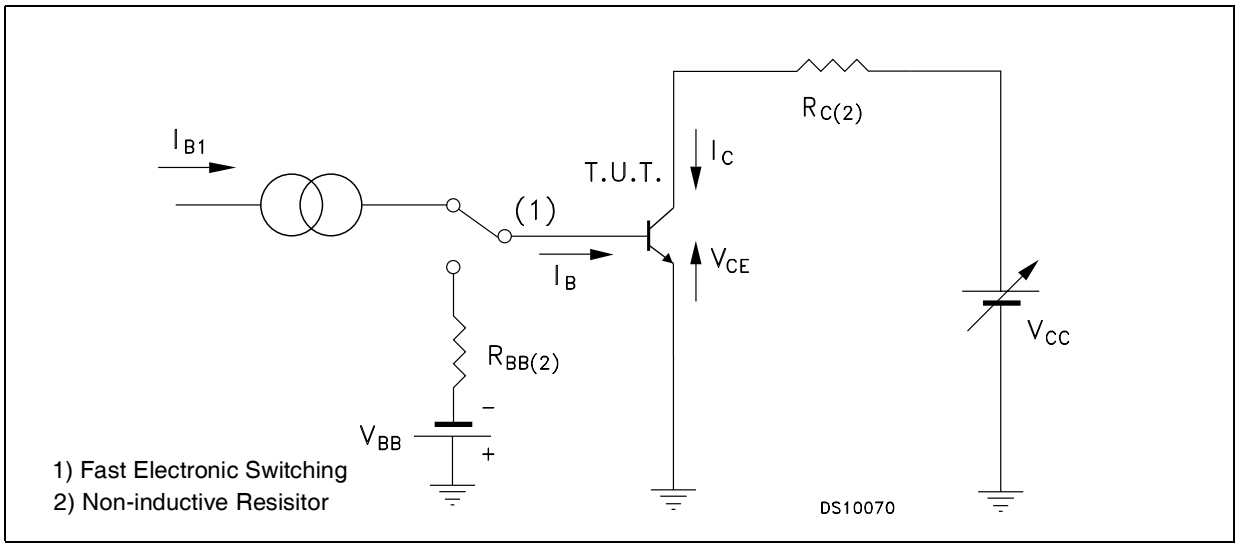



**Figure 10. Resistive Load Switching Test Circuits**

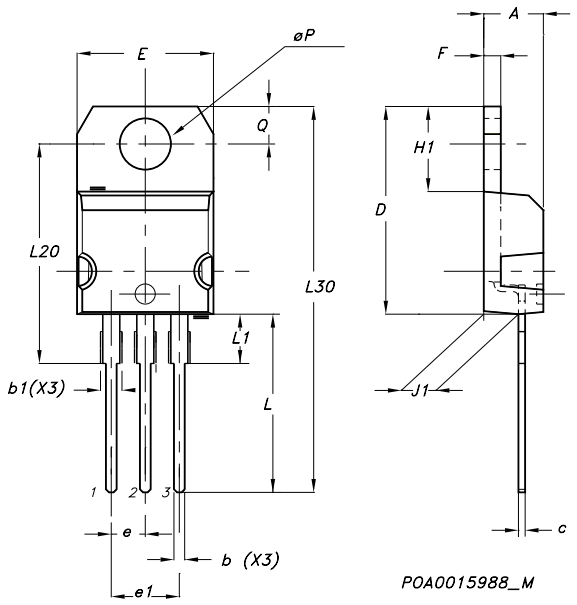


# 4 Package Mechanical Data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect . The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

## TO-220 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| b | 0.61 | | 0.88 | 0.024 | | 0.034 |
| b1 | 1.15 | | 1.70 | 0.045 | | 0.066 |
| c | 0.49 | | 0.70 | 0.019 | | 0.027 |
| D | 15.25 | | 15.75 | 0.60 | | 0.620 |
| E | 10 | | 10.40 | 0.393 | | 0.409 |
| e | 2.40 | | 2.70 | 0.094 | | 0.106 |
| e1 | 4.95 | | 5.15 | 0.194 | | 0.202 |
| F | 1.23 | | 1.32 | 0.048 | | 0.052 |
| H1 | 6.20 | | 6.60 | 0.244 | | 0.256 |
| J1 | 2.40 | | 2.72 | 0.094 | | 0.107 |
| L | 13 | | 14 | 0.511 | | 0.551 |
| L1 | 3.50 | | 3.93 | 0.137 | | 0.154 |
| L20 | | 16.40 | | | 0.645 | |
| L30 | | 28.90 | | | 1.137 | |
| øP | 3.75 | | 3.85 | 0.147 | | 0.151 |
| Q | 2.65 | | 2.95 | 0.104 | | 0.116 |



# 5 Revision History

| Date | Revision | Changes |
|---|---|---|
| 09-Dec-2005 | 1 | Initial Relase |