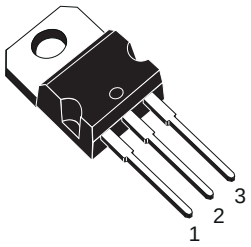
# ST13007D

## HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTOR

- IMPROVED SPECIFICATION:
  - LOWER LEAKAGE CURRENT
  - TIGHTER GAIN RANGE
  - DC CURRENT GAIN PRESELECTION
  - TIGHTER STORAGE TIME RANGE
- HIGH VOLTAGE CAPABILITY
- INTEGRATED FREE-WHEELING DIODE
- LOW SPREAD OF DYNAMIC PARAMETERS
- MINIMUM LOT-TO-LOT SPREAD FOR RELIABLE OPERATION
- VERY HIGH SWITCHING SPEED
- FULLY CHARACTERIZED AT 125 $^{o}$C
- LARGE RBSOA




**TO-220**

**APPLICATIONS**

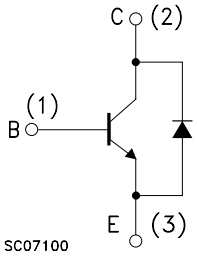
- UP TO 120W ELECTRONIC TRANSFORMERS FOR HALOGEN LAMPS
- SWITCH MODE POWER SUPPLIES

**DESCRIPTION**

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

It uses a Cellular Emitter structure to enhance switching speeds.

**INTERNAL SCHEMATIC DIAGRAM**




**ABSOLUTE MAXIMUM RATINGS**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{CEV}$ | Collector-Emitter Voltage ($V_{BE}$ = -1.5V) | 700 | V |
| $V_{CEO}$ | Collector-Emitter Voltage ($I_B$ = 0) | 400 | V |
| $V_{EBO}$ | Emitter-Base Voltage ($I_C$ = 0) | 9 | V |
| $I_C$ | Collector Current | 8 | A |
| $I_{CM}$ | Collector Peak Current | 16 | A |
| $I_B$ | Base Current | 4 | A |
| $I_{BM}$ | Base Peak Current | 8 | A |
| $P_{tot}$ | Total Dissipation at $T_c \leq 25$ $^{o}$C | 80 | W |
| $T_{stg}$ | Storage Temperature | -65 to 150 | $^{o}$C |
| $T_j$ | Max. Operating Junction Temperature | 150 | $^{o}$C |

## THERMAL DATA

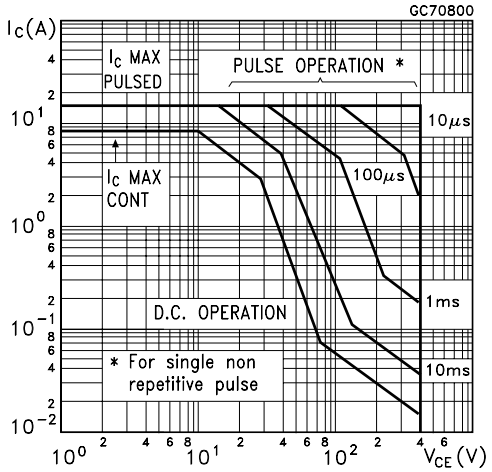
| | | | | |
|---|---|---|---|---|
| $R_{thj\text{-}case}$ | Thermal Resistance Junction-case | Max | 1.56 | $^oC/W$ |
| $R_{thj\text{-}amb}$ | Thermal Resistance Junction-ambient | Max | 62.5 | $^oC/W$ |

## ELECTRICAL CHARACTERISTICS ($T_{case}$ = 25 $^oC$ unless otherwise specified)

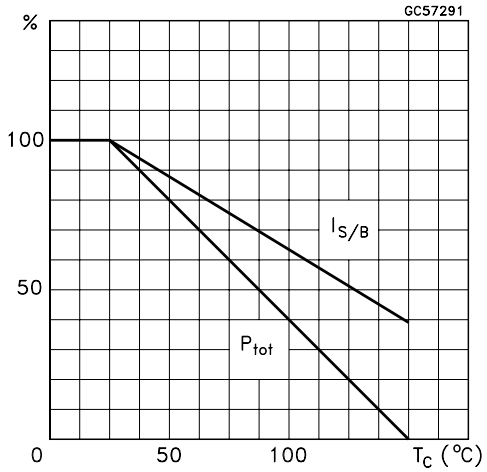
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{CES}$ | Collector Cut-off Current ($V_{BE}$ = 0) | $V_{CE}$ = 700 V<br>$V_{CE}$ = 700 V $T_c$ = 100 $^oC$ | | | 10<br>0.5 | µA<br>mA |
| $I_{CEO}$ | Collector Cut-off Current ($I_B$ = 0) | $V_{CE}$ = 400 V | | | 100 | µA |
| $I_{EBO}$ | Emitter Cut-off Current ($I_C$ = 0) | $V_{EB}$ = 9 V | | | 100 | µA |
| $V_{CEO(sus)}$* | Collector-Emitter Sustaining Voltage ($I_B$ = 0) | $I_C$ = 10 mA | 400 | | | V |
| $V_{CE(sat)}$* | Collector-Emitter Saturation Voltage | $I_C$ = 2 A $I_B$ = 0.4 A<br>$I_C$ = 5 A $I_B$ = 1 A<br>$I_C$ = 8 A $I_B$ = 2 A<br>$I_C$ = 5 A $I_B$ = 1 A $T_c$ = 100 $^oC$ | | | 0.8<br>1.5<br>2<br>3 | V<br>V<br>V<br>V |
| $V_{BE(sat)}$* | Base-Emitter Saturation Voltage | $I_C$ = 2 A $I_B$ = 0.4 A<br>$I_C$ = 5 A $I_B$ = 1 A<br>$I_C$ = 5 A $I_B$ = 1 A $T_c$ = 100 $^oC$ | | | 1.2<br>1.6<br>1.5 | V<br>V<br>V |
| $h_{FE}$* | DC Current Gain | $I_C$ = 2 A $V_{CE}$ = 5 V<br>$I_C$ = 5 A $V_{CE}$ = 5 V | 18<br>8 | | 40<br>25 | |
| $V_f$ | Diode Forward Voltage | $I_C$ = 3 A | | | 2.5 | V |
| $t_s$<br>$t_f$ | INDUCTIVE LOAD<br>Storage Time<br>Fall Time | $I_C$ = 5 A $V_{CL}$ = 250 V $R_{BB}$ = 0Ω<br>$I_{B1}$ = 1 A $V_{BE(off)}$ = -5 V<br>L = 200 µH (see figure 1) | | <br>1.7<br>90 | <br>2.3<br>150 | <br>µs<br>ns |
| $t_s$<br>$t_f$ | INDUCTIVE LOAD<br>Storage Time<br>Fall Time | $I_C$ = 5 A $V_{CL}$ = 250 V $R_{BB}$ = 0Ω<br>$I_{B1}$ = 1 A $V_{BE(off)}$ = -5 V<br>L = 200 µH $T_C$ = 125 $^oC$<br>(see figure 1) | | <br>2.2<br>150 | | <br>µs<br>ns |

* Pulsed: Pulse duration = 300 µs, duty cycle 2 %.

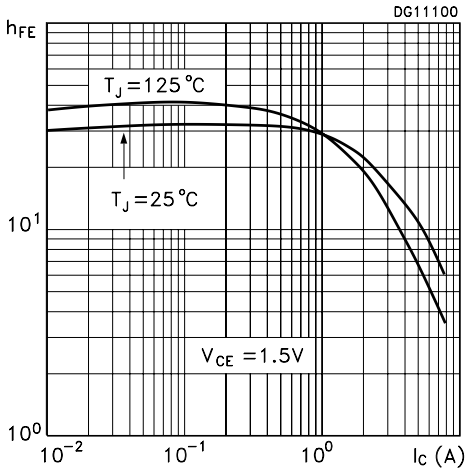
Safe Operating Area



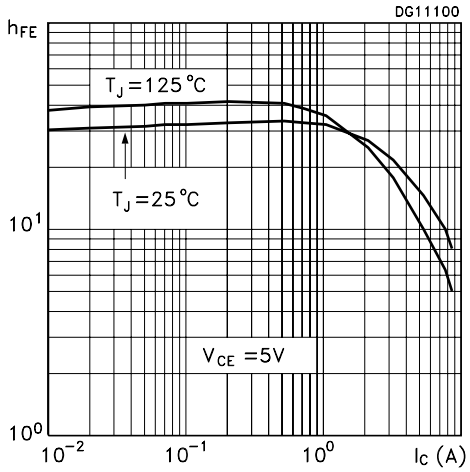

Derating Curve



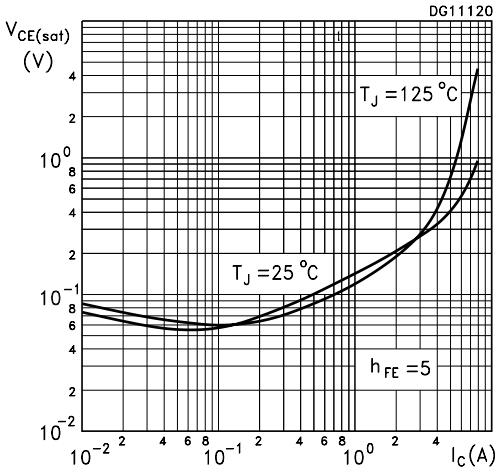

DC Current Gain



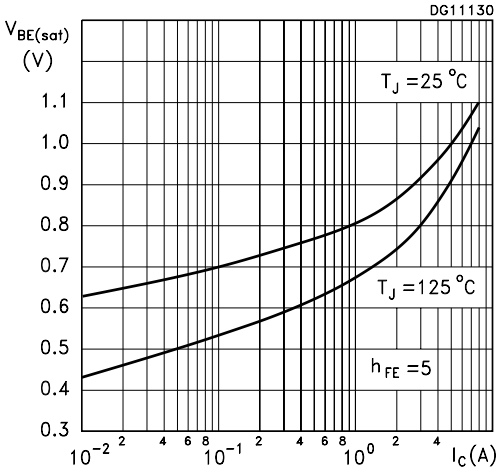

DC Current Gain



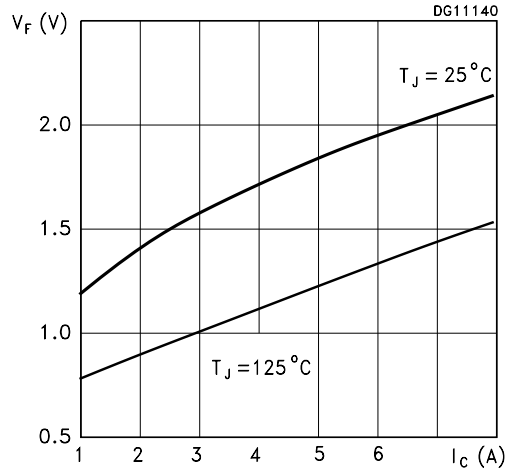

Collector Emitter Saturation Voltage



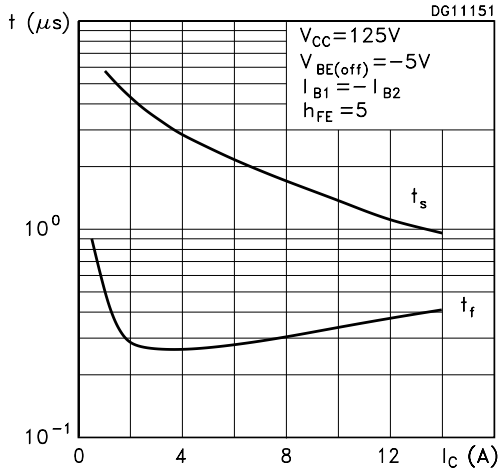

Base Emitter Saturation Voltage



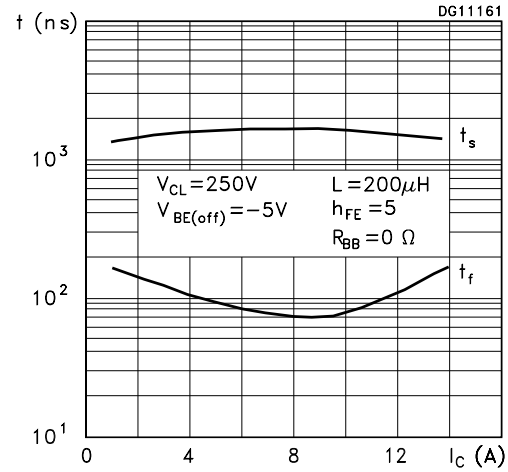
Diode Forward Voltage




Switching Time Resistive Load




Switching Time Inductive Load




Reverse Biased SOA

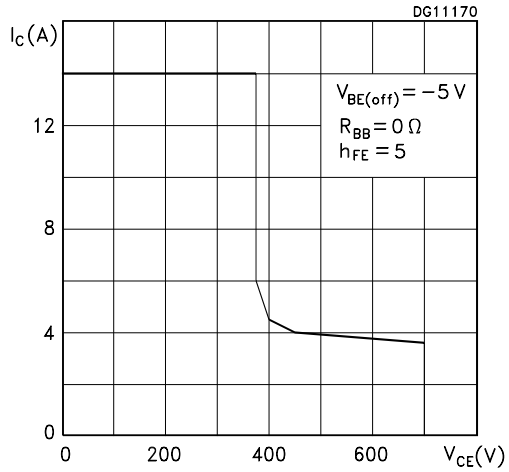


**Figure 1:** Inductive Load Switching Test Circuit.

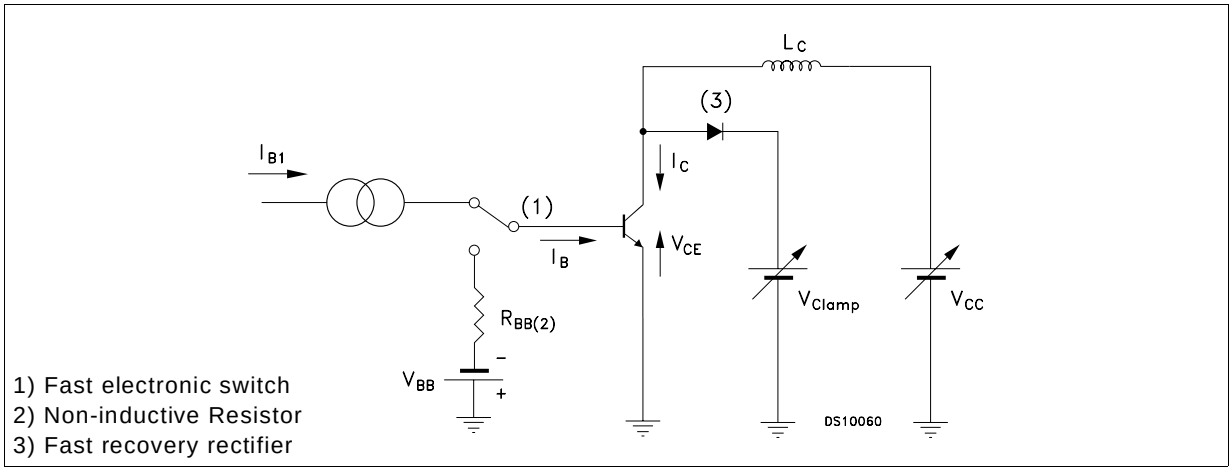
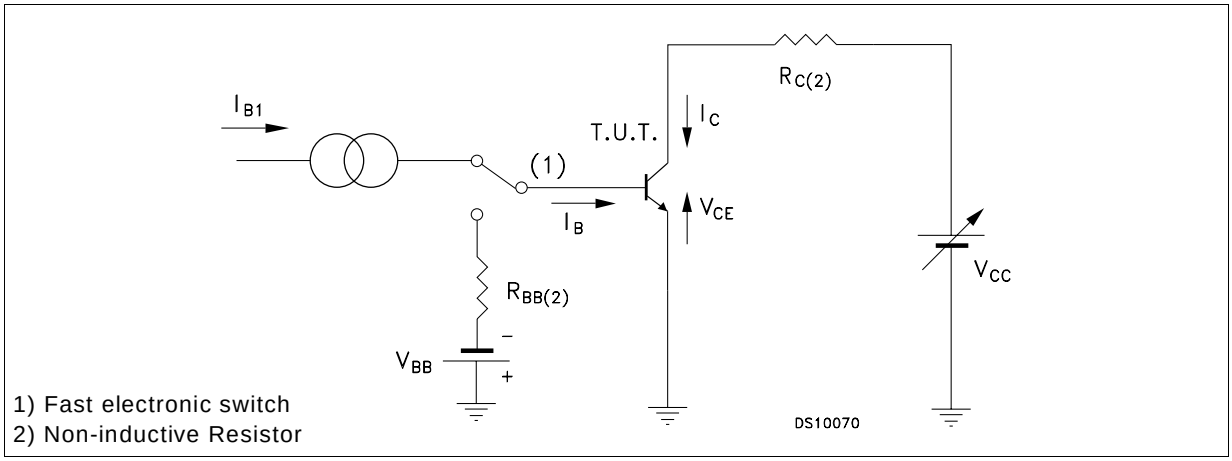
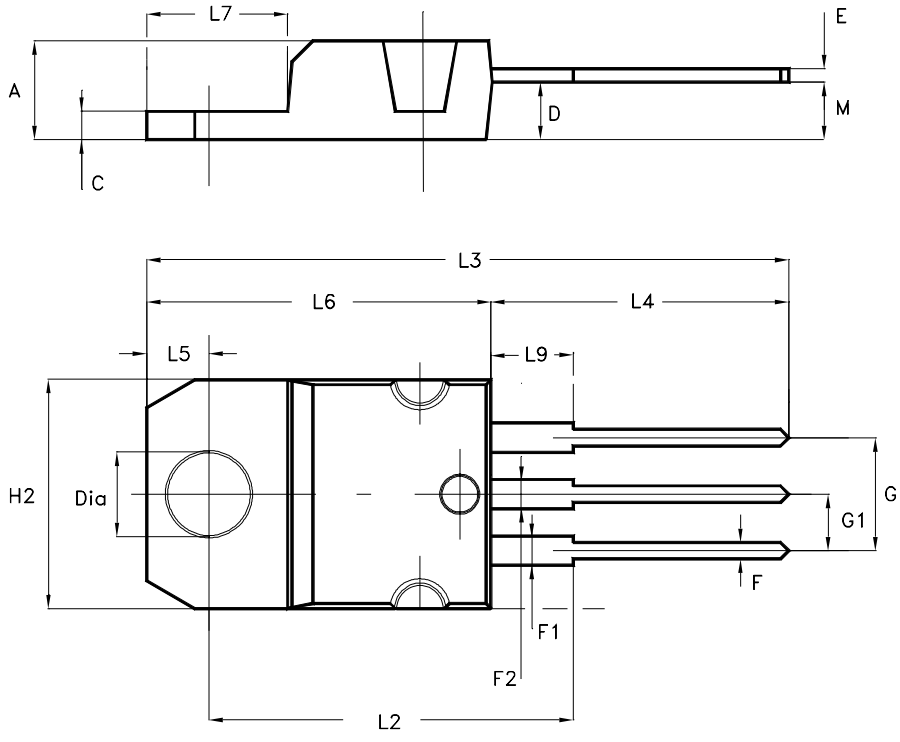



**Figure 2:** Resistive Load Switching Test Circuit.



## 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 | | 0.052 |
| D | 2.40 | | 2.72 | 0.094 | | 0.107 |
| 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 | | 0.202 |
| G1 | 2.40 | | 2.70 | 0.094 | | 0.106 |
| H2 | 10.00 | | 10.40 | 0.394 | | 0.409 |
| L2 | | 16.40 | | | 0.645 | |
| L4 | 13.00 | | 14.00 | 0.511 | | 0.551 |
| L5 | 2.65 | | 2.95 | 0.104 | | 0.116 |
| L6 | 15.25 | | 15.75 | 0.600 | | 0.620 |
| L7 | 6.20 | | 6.60 | 0.244 | | 0.260 |
| L9 | 3.50 | | 3.93 | 0.137 | | 0.154 |
| M | | 2.60 | | | 0.102 | |
| DIA. | 3.75 | | 3.85 | 0.147 | | 0.151 |




P011CI

Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specification mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

The ST logo is a trademark of STMicroelectronics

© 2003 STMicroelectronics – Printed in Italy – All Rights Reserved

STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - Canada - China - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States.

**http://www.st.com**