# ST13007

## High voltage fast-switching NPN power transistor

## Features

- DC current gain classification
- High voltage capability
- Low spread of dynamic parameters
- Very high switching speed

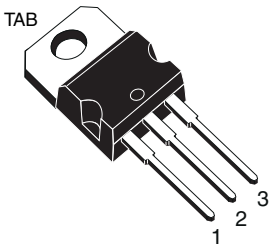
## Applications

- Electronic ballast for fluorescent lighting
- 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 with planar edge termination to enhance switching speeds while maintaining the wide RBSOA.




**TO-220**

**Figure 1. Internal schematic diagram**

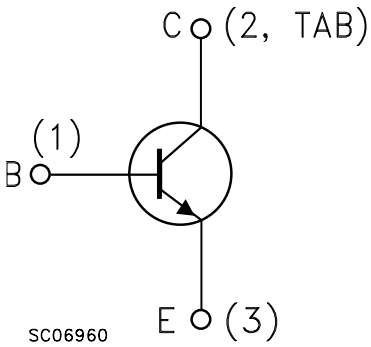



**Table 1. Device summary**

| Order code | Marking [1] | Package | Packaging |
|---|---|---|---|
| ST13007 | ST13007A | TO-220 | Tube |
| | ST13007B | | |

1. The product is classified in DC current gain group A and group B, see *Table 5: hFE classification*. STMicroelectronics reserves the right to ship from any group according to production availability.

# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| 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) | 9 | V |
| $I_C$ | Collector current | 8 | A |
| $I_{CM}$ | Collector peak current ($t_P$ < 5 ms) | 16 | A |
| $I_B$ | Base current | 4 | A |
| $I_{BM}$ | Base peak current ($t_P$ < 5 ms) | 8 | A |
| $P_{TOT}$ | Total dissipation at $T_c$ = 25 °C | 80 | W |
| $T_{STG}$ | Storage temperature | - 65 to 150 | °C |
| $T_J$ | Max. operating junction temperature | 150 | °C |

**Table 3. Thermal data**

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $R_{thJC}$ | Thermal resistance junction-case | max | 1.56 | °C/W |

# 2 Electrical characteristics

$T_{case}$ = 25 °C unless otherwise specified.

**Table 4. Electrical characteristics**

| 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 | | | 10<br>0.5 | µA<br>mA |
| $I_{EBO}$ | Emitter cut-off current ($I_C$ = 0) | $V_{EB}$ = 9 V | | | 100 | µA |
| $V_{CEO(sus)}$ (1) | Collector-emitter sustaining voltage ($I_B$ = 0) | $I_C$ = 10 mA | 400 | | | V |
| $V_{CE(sat)}$ (1) | 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 °C | | | 1<br>2<br>3<br>3 | V<br>V<br>V<br>V |
| $V_{BE(sat)}$ (1) | 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°C | | | 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 | 16<br>5 | | 40<br>30 | |
| $t_s$<br>$t_f$ | Resistive load<br>Storage time<br>Fall time | $V_{CC}$ = 300 V $I_C$ = 2 A<br>$I_{B(on)}$ = - $I_{B(off)}$ = 400 mA<br>$T_P$ = 30 µs | 3 | | 4.5<br>350 | µs<br>ns |
| $t_s$<br>$t_f$ | Inductive load<br>Storage time<br>Fall time | $I_C$ = 5 A $V_{Clamp}$ = 250 V<br>$I_{B(on)}$ = 1 A $I_{B(off)}$ = - 2 A<br>L = 200 µH | | 1.5<br>40 | 2.5<br>110 | µs<br>ns |
| $t_s$<br>$t_f$ | Inductive load<br>Storage time<br>Fall time | $I_C$ = 5 A $V_{Clamp}$ = 250 V<br>$I_{B(on)}$ = 1 A $I_{B(off)}$ = - 2 A<br>L = 200 µH $T_C$ = 125 °C | | 2<br>70 | | µs<br>ns |

1. Pulse test: pulse duration ≤ 300 µs, duty cycle ≤ 2 %

**Table 5. $h_{FE}$ classification**

| Symbol | Parameter | Group | Min. | Max. | Unit |
|---|---|---|---|---|---|
| $h_{FE}$ | DC current gain<br>$I_C$ = 2 A, $V_{CE}$ = 5 V | A | 16 | 30 | |
| | | B | 26 | 40 | |

## 2.1 Electrical characteristics (curves)

**Figure 2. Safe operating area**

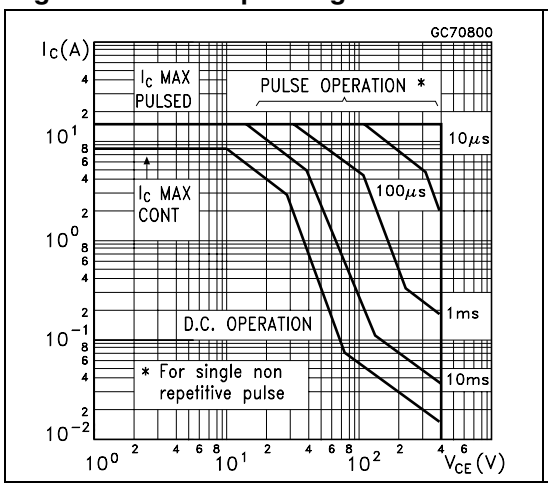



**Figure 3. Derating curve**

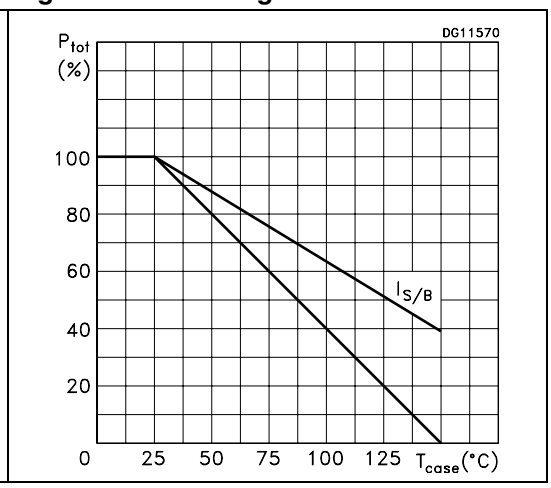



**Figure 4. DC current gain ($V_{CE}$ = 2 V)**

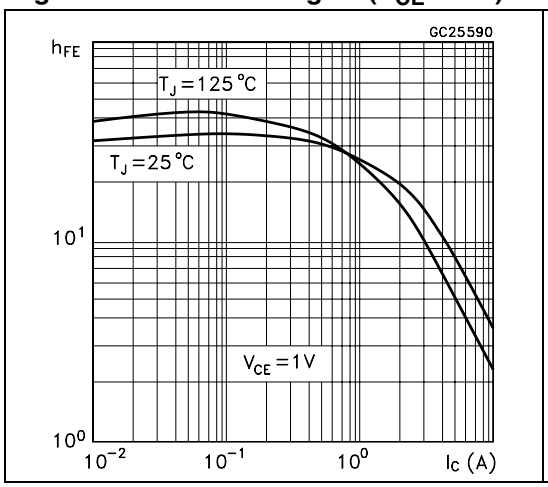



**Figure 5. DC current gain ($V_{CE}$ = 5 V)**

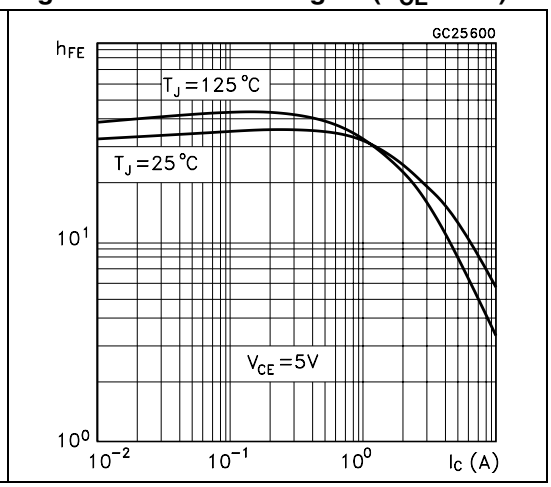



**Figure 6. Collector-emitter saturation voltage**

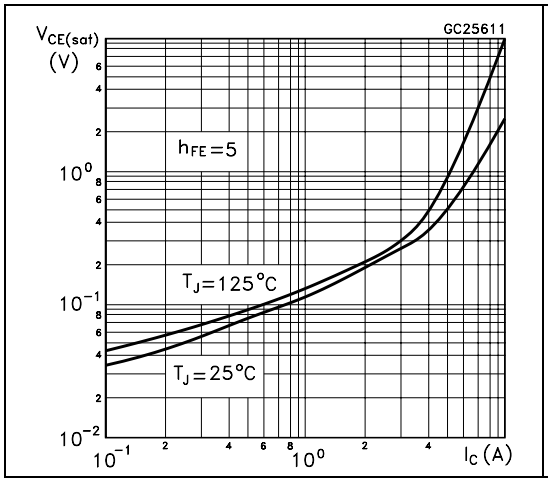



**Figure 7. Base-emitter saturation voltage**

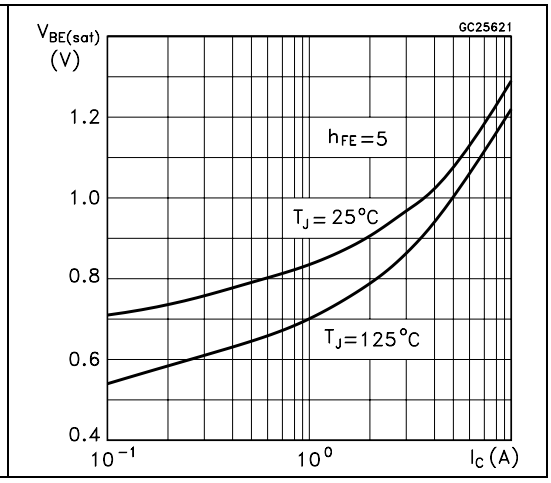


**Figure 8. Inductive fall time**

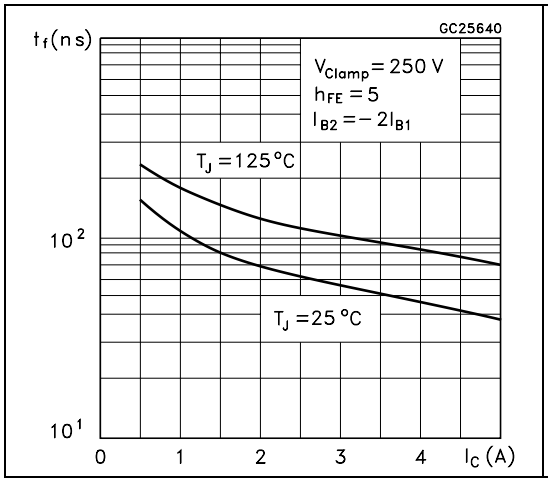



**Figure 9. Inductive storage time**

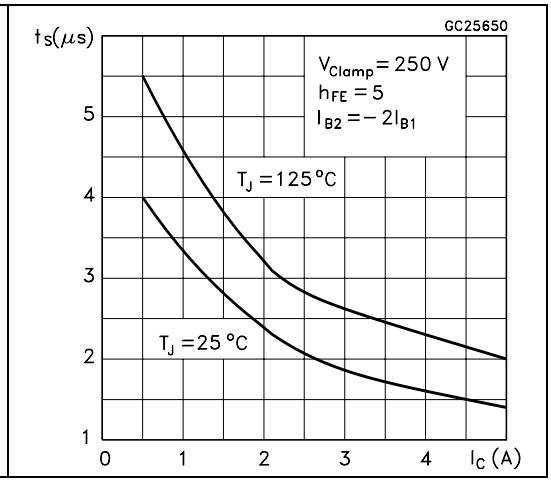
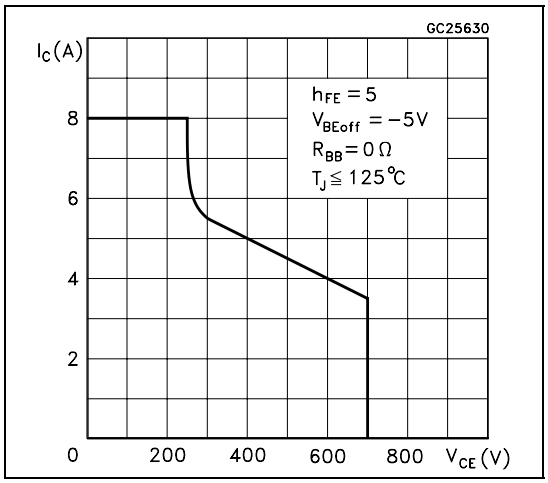
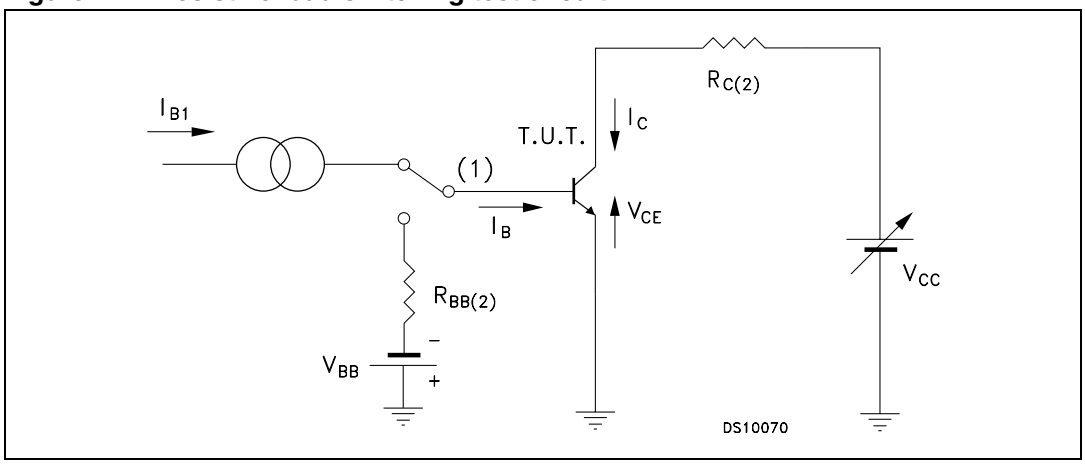



**Figure 10. Reverse biased SOA**



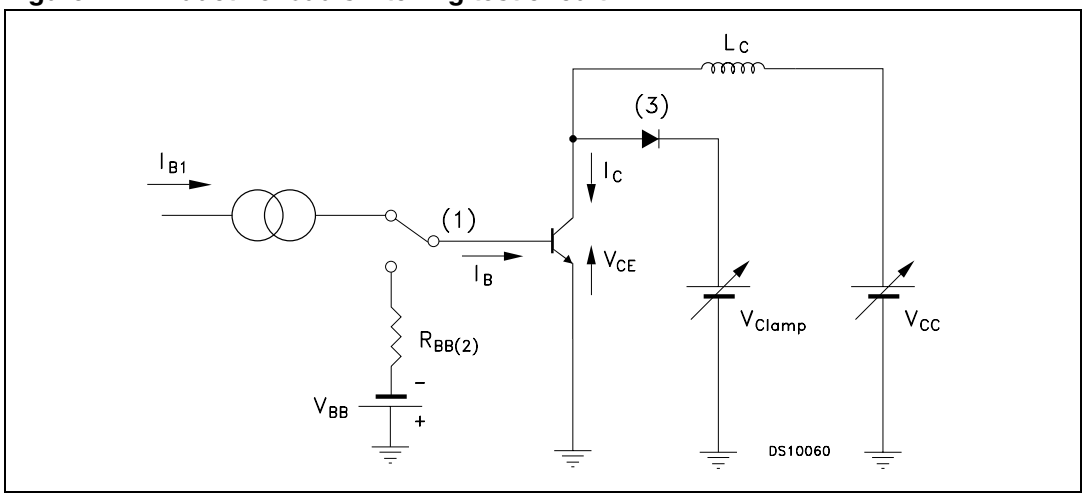
## 2.2 Test circuits

**Figure 11. Resistive load switching test circuit**




1. Fast electronic switch
2. Non-inductive resistor

**Figure 12. Inductive load switching test circuit**



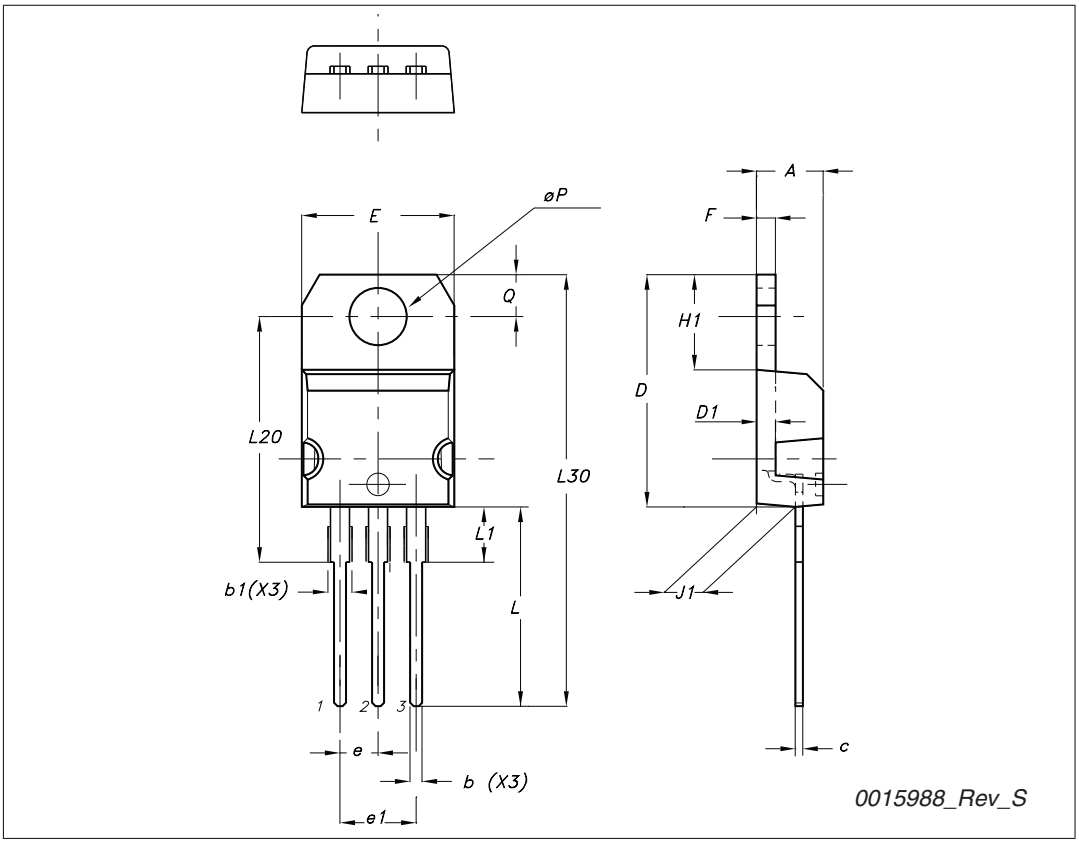

1. Fast electronic switch
2. Non-inductive resistor
3. Fast recovery rectifier

# 3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: *www.st.com*.
ECOPACK® is an ST trademark.

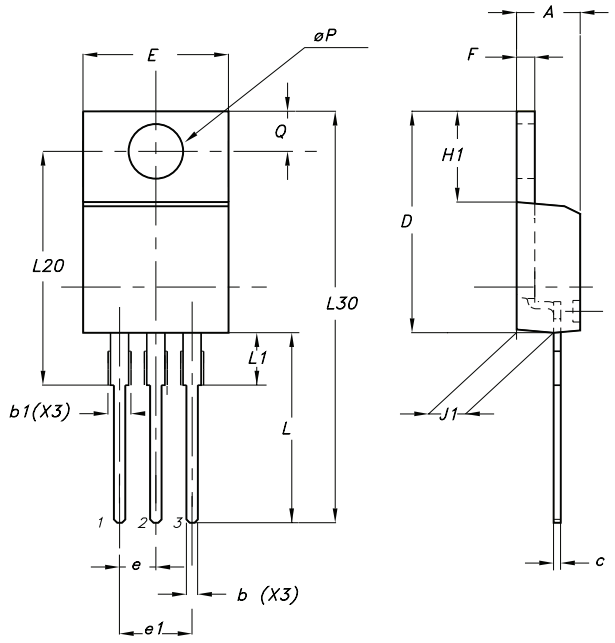
## TO-220 type A mechanical data

| Dim | mm | | |
|---|---|---|---|
| | Min | Typ | Max |
| A | 4.40 | | 4.60 |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.70 |
| c | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 |
| D1 | | 1.27 | |
| E | 10 | | 10.40 |
| e | 2.40 | | 2.70 |
| e1 | 4.95 | | 5.15 |
| F | 1.23 | | 1.32 |
| H1 | 6.20 | | 6.60 |
| J1 | 2.40 | | 2.72 |
| L | 13 | | 14 |
| L1 | 3.50 | | 3.93 |
| L20 | | 16.40 | |
| L30 | | 28.90 | |
| ∅P | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |



## TO-220 type E mechanical data

| DIM. | mm. | | |
|---|---|---|---|
| | MIN. | TYP | MAX. |
| A | 4.47 | | 4.67 |
| b | 0.70 | | 0.91 |
| b1 | 1.17 | | 1.37 |
| c | 0.31 | | 0.53 |
| D | 14.60 | | 15.70 |
| E | 9.96 | | 10.36 |
| e | | 2.54 | |
| e1 | 4.98 | 5.08 | 5.18 |
| F | 1.17 | | 1.37 |
| H1 | 6.10 | | 6.80 |
| J1 | 2.52 | | 2.82 |
| L | 12.70 | | 13.80 |
| L1 | 3.20 | | 3.96 |
| L20 | 15.21 | | 16.77 |
| øP | 3.73 | | 3.94 |
| Q | 2.59 | | 2.89 |



# 4 Revision history

Table 6. Document revision history

| Date | Revision | Changes |
|---|---|---|
| 21-Jun-2004 | 3 | Document migration, no content change. |
| 16-Dec-2009 | 4 | Updated TO-220 package mechanical data. |

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