

High voltage fast-switching NPN power transistor

Datasheet - production data

Features

- Low spread of dynamic parameters
- Minimum lot-to-lot spread for reliable operation
- Very high switching speed

Applications

- Electronic ballast for fluorescent lighting
- Switch mode power supplies

Description

This 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 a wide RBSOA.

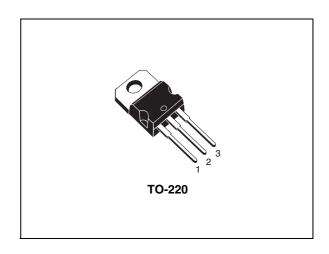


Figure 1. Internal schematic diagram

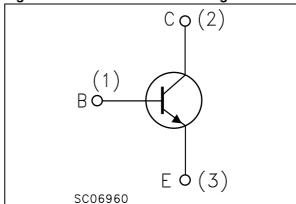


Table 1. Device summary

| Order code | Marking ⁽¹⁾ | Package | Packaging |
|------------|------------------------|---------|-----------|
| | 13005 A | | |
| | 13005 C | | |
| ST13005 | 13005 D | TO-220 | Tube |
| | 13005 E | | |
| | 13005 F | | |

^{1.} Product is pre-selected in DC current gain (group A, C, D, E and F). STMicroelectronics reserves the right to ship either groups according to production availability. Please contact your nearest STMicroelectronics sales office for delivery details.

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ST13005 Electrical ratings

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 | 4 | Α |
| I _{CM} | Collector peak current (t _P < 5 ms) | 8 | Α |
| I _B | Base current | 2 | Α |
| I _{BM} | Base peak current (t _P < 5 ms) | 4 | Α |
| P _{TOT} | Total dissipation at T _c ⊴25 °C | 75 | 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 _{thj-case} | Thermal resistance junction-case max | 1.7 | °C/W |
| R _{thj-amb} | Thermal resistance junction-amb max | 62.5 | °C/W |

Electrical characteristics ST13005

2 Electrical characteristics

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

Table 4. Electrical characteristics

| Symbol | Parameter | Test conditions | Min. | Тур. | Max. | Unit |
|---------------------------|---|---|------|------|--------|----------|
| I _{CES} | Collector cut-off current (V _{BF} = 0) | V _{CE} = 700 V V _{CF} = 700 V T _C =125 °C | | | 1 5 | mA mA |
| I _{EBO} | Emitter cut-off current (I _C = 0) | V _{EB} = 9 V | | | 1 | mA |
| V _{CEO(sus)} (1) | Collector-emitter sustaining voltage (I _B = 0) | I _C =10 mA | 400 | | | V |
| | Collector-emitter | $I_C = 1 A$ $I_B = 0.2 A$ | | | 0.5 | V |
| V _{CE(sat)} (1) | saturation voltage | $I_C = 2 A$ $I_B = 0.5 A$ | | | 0.6 | V |
| | oataration romage | $I_C = 4 A$ $I_B = 1 A$ | | | 1 | V |
| V (1) | Base-emitter saturation | $I_C = 1 A$ $I_B = 0.2 A$ | | | 1.2 | V |
| V _{BE(sat)} (1) | voltage | $I_C = 2 A$ $I_B = 0.5 A$ | | | 1.6 | V |
| | | I _C = 1 A V _{CE} = 5 V | | | | |
| | | Group A | 15 | | 32 | |
| | | Group C | 16 | | 22 | |
| h _{FE} (1)(2) | DC current gain | Group D | 21 | | 27 | |
| | | Group E | 26 | | 32 | |
| | | Group F | 31 | | 37 | |
| | | $I_C = 2 A$ $V_{CE} = 5 V$ | 8 | | 40 | |
| | Resistive load | $I_C = 2 A$ $V_{CC} = 125 A$ | | | | |
| t _s | Storage time | I _{B1} = - I _{B2} =0.4 A | 1.5 | | 3 | μs |
| t _f | Fall time | t _p = 30 μs | | 0.2 | | μs |

^{1.} Pulse test: pulse duration = 300 μ s, duty cycle \leq %.

^{2.} Product is pre-selected in DC current gain (group A, C, D, E and F). STMicroelectronics reserves the right to ship either groups according to production availability. Please contact your nearest STMicroelectronics sales office for delivery details

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

Figure 3. Derating curve

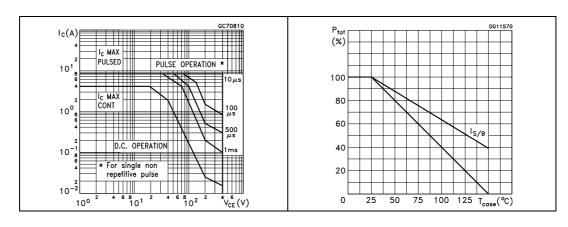


Figure 4. DC current gain ($V_{CE} = 1.5 \text{ V}$) Figure 5. DC current gain ($V_{CE} = 5 \text{ V}$)

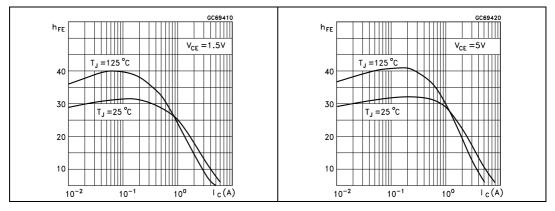
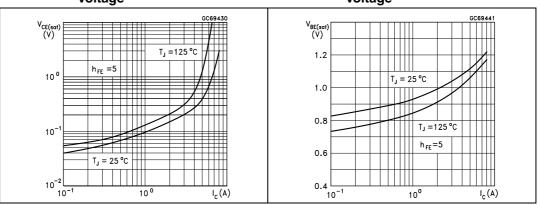


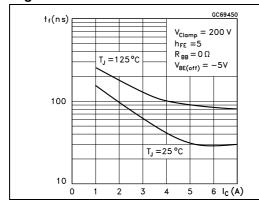
Figure 6. Collector-emitter saturation Figure 7. Base-emitter saturation voltage voltage



Electrical characteristics ST13005

Figure 8. Inductive load fall time

Figure 9. Inductive load storage time



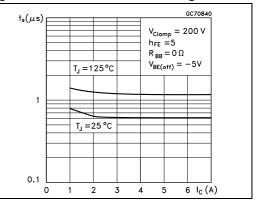
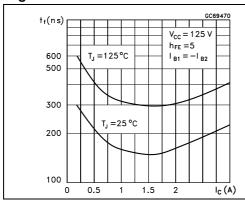


Figure 10. Resistive load fall time

Figure 11. Resistive load storage time



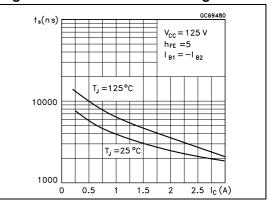
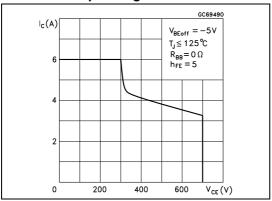


Figure 12. Reverse biased safe operating area



2.2 Test circuits

Figure 13. Inductive load switching test circuit

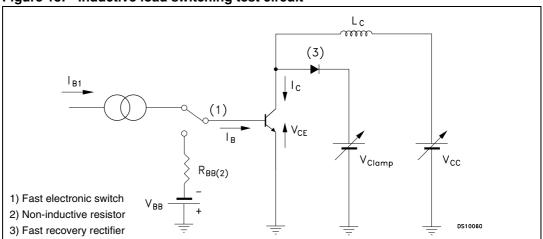
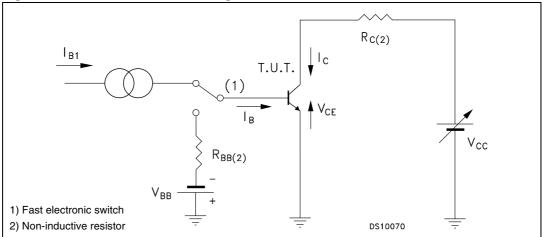


Figure 14. Resistive load switching test circuit



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.

Table 5. TO-220 type A mechanical data

| Dim | mm. | | |
|------|-------|-------|-------|
| Dim. | Min. | Тур. | Max. |
| Α | 4.40 | | 4.60 |
| b | 0.61 | | 0.88 |
| b1 | 1.14 | | 1.70 |
| С | 0.48 | | 0.70 |
| D | 15.25 | | 15.75 |
| D1 | | 1.27 | |
| Е | 10 | | 10.40 |
| е | 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 | |
| ØP | 3.75 | | 3.85 |
| Q | 2.65 | | 2.95 |

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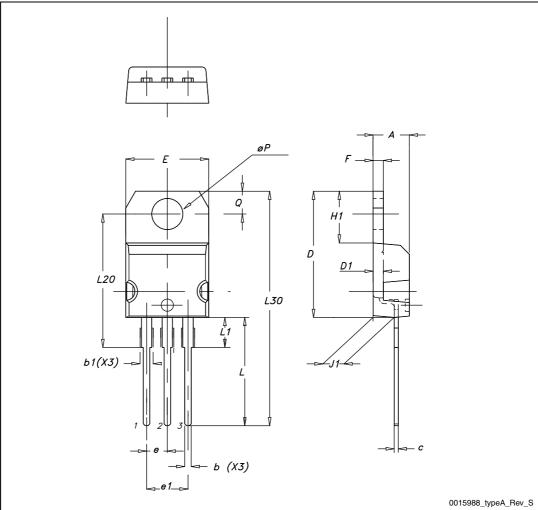


Figure 15. TO-220 type A drawing

ST13005 Revision history

4 Revision history

Table 6. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 21-Jun-2004 | 6 | |
| 22-Aug-2007 | 7 | Updated mechanical data according to PCN APM-PWR/07/2804 |
| 12-Oct-2007 | 8 | Updated marking in <i>Table 1</i> |
| 15-Feb-2012 | 9 | Updated marking in <i>Table 1</i> Inserted: <i>Table 3</i> Modified: h_{FE} in <i>Table 4</i> Updated mechanical data |
| 15-May-2012 | 10 | Updated marking in <i>Table 1</i> and <i>4</i> |

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