

Features

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

Applications

- 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 hollow emitter structure to enhance switching speeds.

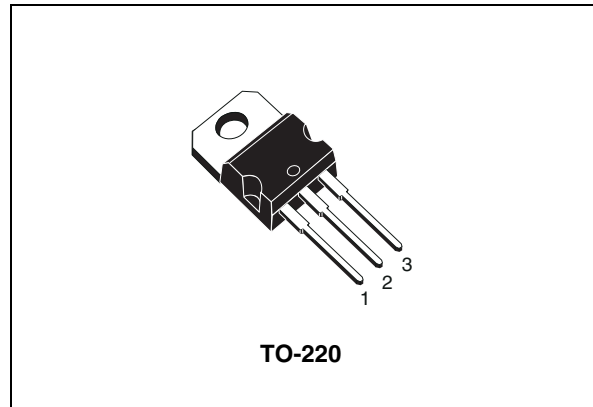


Figure 1. Internal schematic diagram

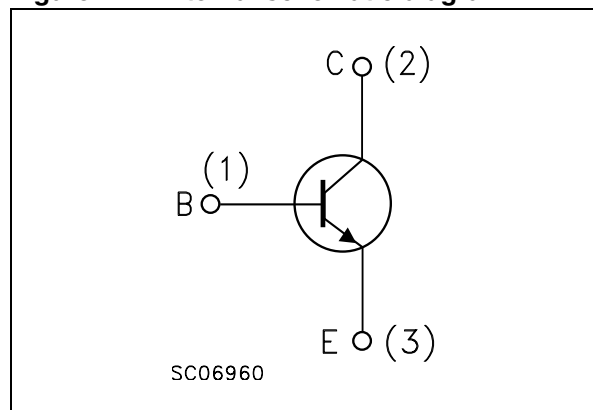


Table 1. Device summary

| Order code | Marking ⁽¹⁾ | Package | Packaging |
|------------|------------------------|---------|-----------|
| ST13009 | 13009 L 13009 H | TO-220 | Tube |

1. Product is pre-selected in DC current gain (group L and group H). STMicroelectronics reserves the right to ship either groups according to production availability. Please contact your nearest STMicroelectronics sales office for delivery details.

Contents

| | | |
|----------|---|-----------|
| 1 | Electrical ratings | 3 |
| 2 | Electrical characteristics | 4 |
| | 2.1 Electrical characteristics (curves) | 5 |
| 3 | Test circuit | 7 |
| 4 | Package mechanical data | 8 |
| 5 | Revision history | 10 |

1 Electrical ratings

Table 2. Absolute maximum ratings

| Symbol | Parameter | Value | Unit |
|-----------|--|------------|------------------|
| V_{CEV} | Collector-emitter voltage ($V_{BE} = -1.5\text{ V}$) | 700 | V |
| V_{CEO} | Collector-emitter voltage ($I_B = 0$) | 400 | V |
| V_{EBO} | Emitter-base voltage ($I_C = 0$) | 12 | V |
| I_C | Collector current | 12 | A |
| I_{CM} | Collector peak current ($t_P < 5\text{ms}$) | 24 | A |
| I_B | Base current | 6 | A |
| I_{BM} | Base peak current ($t_P < 5\text{ms}$) | 12 | A |
| P_{tot} | Total dissipation at $T_C = 25^\circ\text{C}$ | 100 | W |
| T_{stg} | Storage temperature | -65 to 150 | $^\circ\text{C}$ |
| T_J | Max. operating junction temperature | 150 | $^\circ\text{C}$ |

Table 3. Thermal data

| Symbol | Parameter | Value | Unit |
|----------------|----------------------------------|----------|--------------------|
| $R_{thj-case}$ | Thermal resistance junction-case | Max 1.25 | $^\circ\text{C/W}$ |

2 Electrical characteristics

($T_{case} = 25^{\circ}C$ unless otherwise specified)

Table 4. Electrical characteristics

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|----------------------|--|--|------|------|------|---------|
| I_{CEV} | Collector cut-off current ($V_{BE} = -1.5 V$) | $V_{CE} = 700 V$ | | | 10 | μA |
| | | $V_{CE} = 700 V \quad T_C = 100^{\circ}C$ | | | 500 | μA |
| I_{EBO} | Emitter cut-off current ($I_C = 0$) | $V_{EB} = 10 V$ | | | 10 | 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 | $I_C = 4 A \quad I_B = 0.8 A$ | | | 0.85 | V |
| | | $I_C = 5 A \quad I_B = 1 A$ | | | 0.9 | V |
| | | $I_C = 8 A \quad I_B = 1.6 A$ | | | 1.25 | V |
| | | $I_C = 12 A \quad I_B = 3 A$ | | | 2.5 | V |
| $V_{BE(sat)}^{(1)}$ | Base-emitter saturation voltage | $I_C = 5 A \quad I_B = 1 A$ | | | 1.2 | V |
| | | $I_C = 8 A \quad I_B = 1.6 A$ | | | 1.6 | V |
| $h_{FE}^{(1)(2)}$ | DC current gain | $I_C = 5 A \quad V_{CE} = 5 V$ | | | | |
| | | Group L | 15 | | 31 | |
| | | Group H | 26 | | 39 | |
| | | $I_C = 8 A \quad V_{CE} = 5 V$ | 10 | | 30 | |
| t_s | Inductive load Storage time | $I_C = 5 A \quad V_{CC} = 250 V$ $I_{B1} = 1 A \quad I_{B2} = -2 A$ $L = 200 \mu H$ see Figure 9 | | | | |
| | | | | 1.6 | 2.5 | μs |
| t_f | Fall time | | 60 | 110 | ns | |
| t_s | Inductive load Storage time | $I_C = 5 A \quad V_{CC} = 125 V$ $I_{B1} = -I_{B2} = 1.6 A$ $L = 200 \mu H \quad t_c = 125^{\circ}C$ see Figure 9 | | | | |
| | | | | 2.3 | | μs |
| | | | | 110 | | ns |
| t_f | Fall time | | | | | |

1. Pulsed duration = 300 μs , duty cycle $\leq 2\%$
2. Product is pre-selected in DC current gain (group L and group H). 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

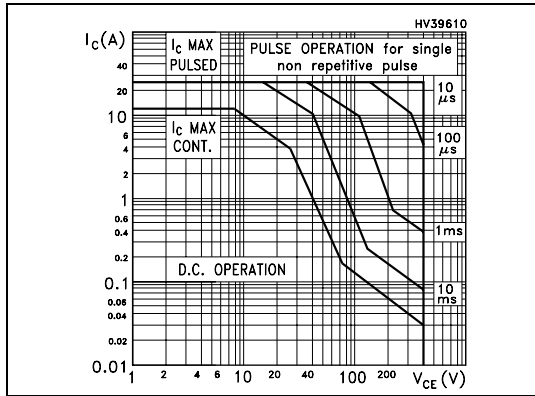


Figure 3. Derating curve

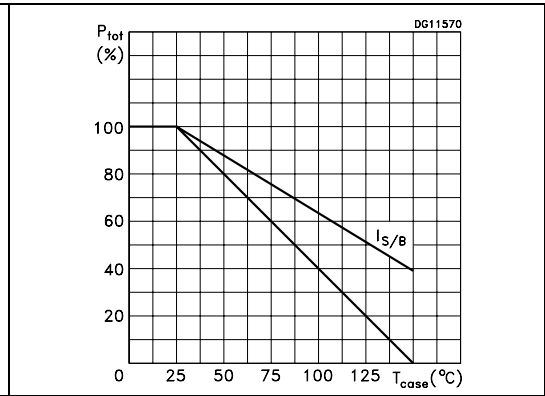


Figure 4. DC current gain

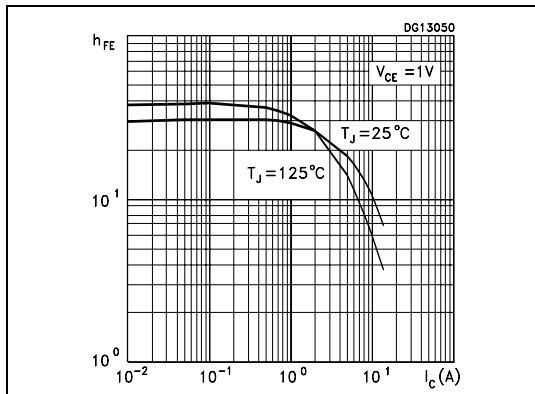


Figure 5. DC current gain

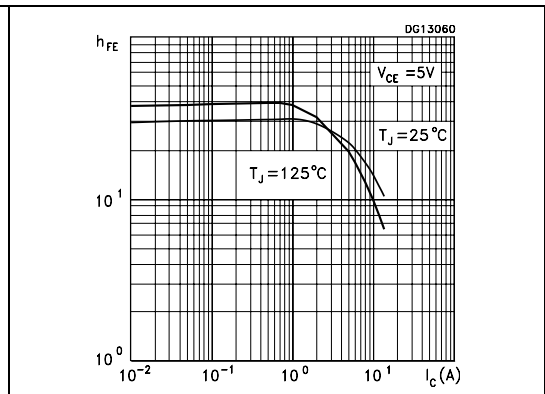


Figure 6. Collector-emitter saturation voltage

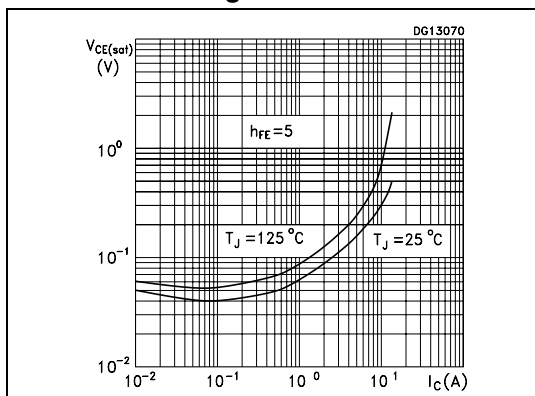


Figure 7. Base-emitter saturation voltage

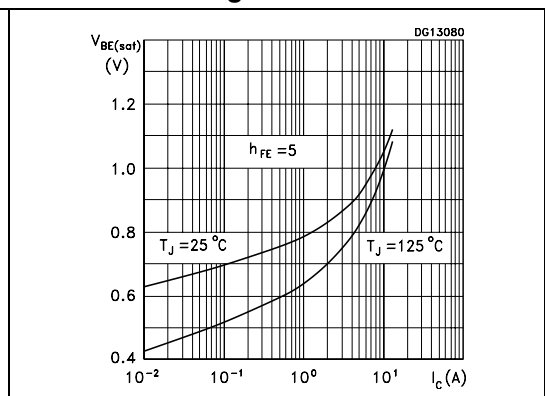
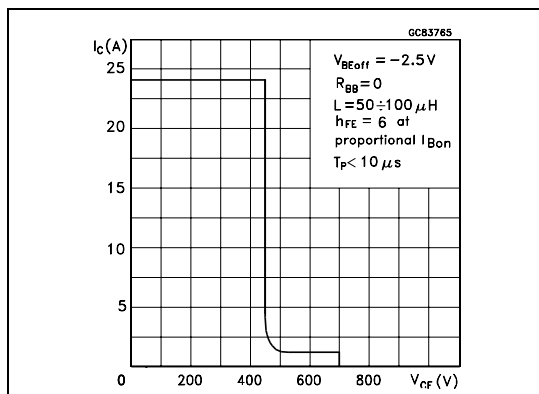
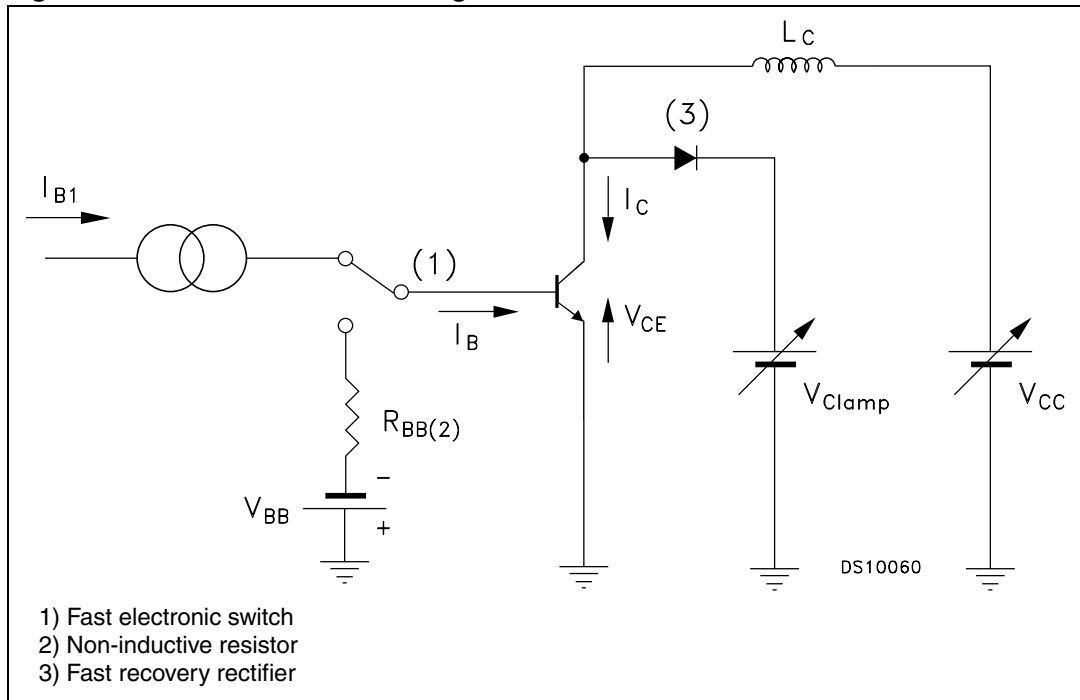


Figure 8. Reverse biased operating area



3 Test circuit

Figure 9. Inductive load switching

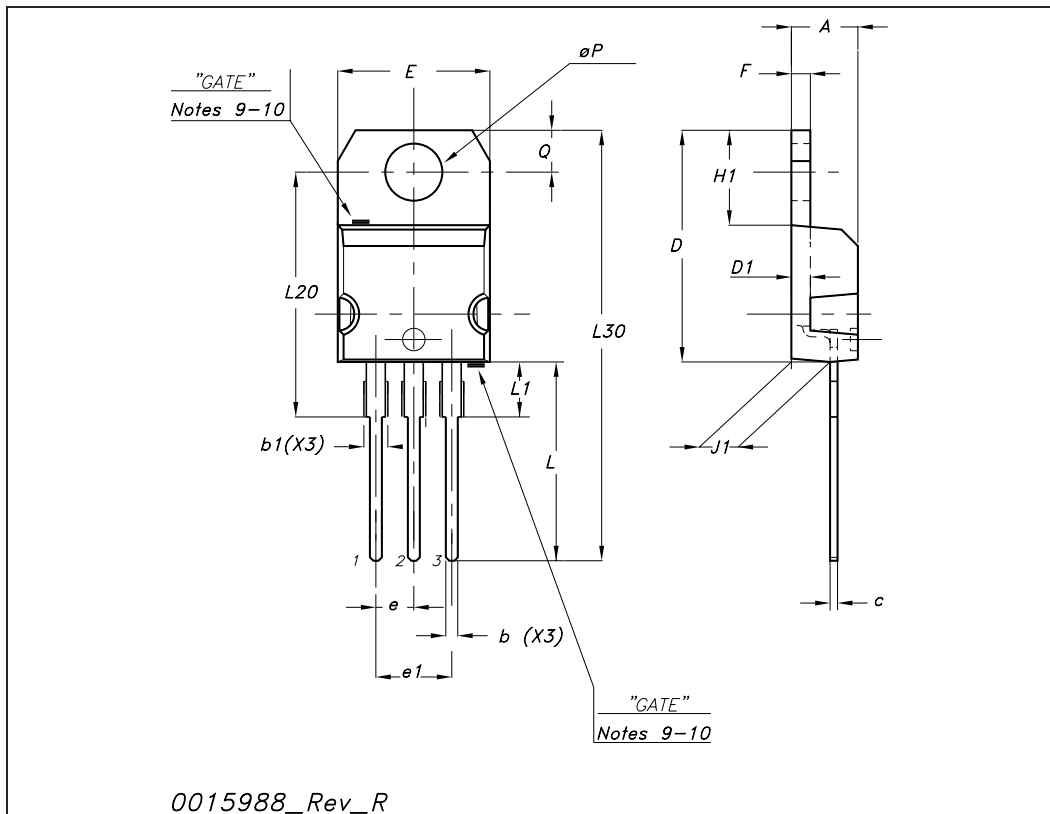


4 Package mechanical data

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 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 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| c | 0.48 | | 0.70 | 0.019 | | 0.027 |
| D | 15.25 | | 15.75 | 0.6 | | 0.62 |
| D1 | | 1.27 | | | 0.050 | |
| 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 | | 0.051 |
| 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 | |
| ∅P | 3.75 | | 3.85 | 0.147 | | 0.151 |
| Q | 2.65 | | 2.95 | 0.104 | | 0.116 |



5 Revision history

Table 5. Document revision history

| Date | Revision | Changes |
|-------------|----------|--|
| 12-Jun-2005 | 1 | First version |
| 23-Aug-2007 | 2 | Added figures: 2 , and 3 |
| 30-Jun-2009 | 3 | Updated value for h_{FE} see Table 4: Electrical characteristics |

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