

## Complementary power Darlington transistors

### Features

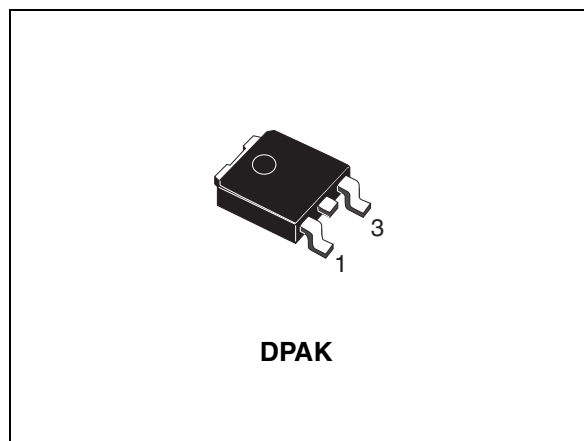
- Low collector-emitter saturation voltage
- Integrated antiparallel collector-emitter diode

### Applications

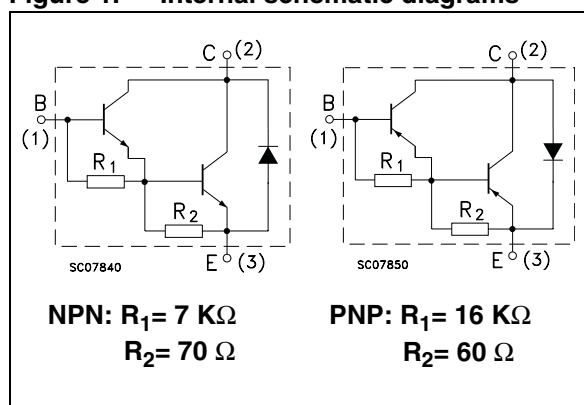
- General purpose linear and switching

### Description

The devices are manufactured in planar technology with “base island” layout and monolithic Darlington configuration. The resulting transistors show exceptional high gain performance coupled with very low saturation voltage.



**Figure 1. Internal schematic diagrams**



**Table 1. Device summary**

| Order codes | Marking | Polarity | Package | Packaging     |
|-------------|---------|----------|---------|---------------|
| MJD122T4    | MJD122  | NPN      | DPAK    | Tape and reel |
| MJD127T4    | MJD127  | PNP      |         |               |

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol    | Parameter                                          | Value      | Unit             |
|-----------|----------------------------------------------------|------------|------------------|
| $V_{CBO}$ | Collector-base voltage ( $I_E = 0$ )               | 100        | V                |
| $V_{CEO}$ | Collector-emitter voltage ( $I_B = 0$ )            | 100        | V                |
| $V_{EBO}$ | Emitter-base voltage ( $I_C = 0$ )                 | 5          | V                |
| $I_C$     | Collector current                                  | 8          | A                |
| $I_{CM}$  | Collector peak current                             | 16         | A                |
| $I_B$     | Base current                                       | 0.12       | A                |
| $P_{TOT}$ | Total dissipation at $T_{case} = 25^\circ\text{C}$ | 20         | W                |
| $T_{stg}$ | Storage temperature                                | -65 to 150 | $^\circ\text{C}$ |
| $T_J$     | Max. operating junction temperature                | 150        | $^\circ\text{C}$ |

*Note:* For PNP types voltage and current values are negative.

**Table 3. Thermal data**

| Symbol      | Parameter                             | Value | Unit               |
|-------------|---------------------------------------|-------|--------------------|
| $R_{thj-c}$ | Thermal resistance junction-case max. | 6.25  | $^\circ\text{C/W}$ |

## 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

| Symbol                      | Parameter                                                      | Test conditions                                                                                                        | Min.        | Typ. | Max.   | Unit          |
|-----------------------------|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-------------|------|--------|---------------|
| $I_{\text{CBO}}$            | Collector cut-off current<br>( $I_{\text{E}} = 0$ )            | $V_{\text{CB}} = 100\text{ V}$                                                                                         |             | -    | 10     | $\mu\text{A}$ |
| $I_{\text{CEO}}$            | Collector cut-off current<br>( $I_{\text{B}} = 0$ )            | $V_{\text{CE}} = 50\text{ V}$                                                                                          |             | -    | 10     | $\mu\text{A}$ |
| $I_{\text{EBO}}$            | Emitter cut-off current<br>( $I_{\text{C}} = 0$ )              | $V_{\text{EB}} = 5\text{ V}$                                                                                           |             | -    | 2      | mA            |
| $V_{\text{CEO(sus)}}^{(1)}$ | Collector-emitter<br>sustaining voltage ( $I_{\text{B}} = 0$ ) | $I_{\text{C}} = 30\text{ mA}$                                                                                          | 100         | -    |        | V             |
| $V_{\text{CE(sat)}}^{(1)}$  | Collector-emitter<br>saturation voltage                        | $I_{\text{C}} = 4\text{ A}$ $I_{\text{B}} = 16\text{ mA}$<br>$I_{\text{C}} = 8\text{ A}$ $I_{\text{B}} = 80\text{ mA}$ |             | -    | 2<br>4 | V<br>V        |
| $V_{\text{BE(sat)}}^{(1)}$  | Base-emitter saturation<br>voltage                             | $I_{\text{C}} = 8\text{ A}$ $I_{\text{B}} = 80\text{ mA}$                                                              |             | -    | 4.5    | V             |
| $V_{\text{BE(on)}}^{(1)}$   | Base-emitter on voltage                                        | $I_{\text{C}} = 4\text{ A}$ $V_{\text{CE}} = 4\text{ V}$                                                               |             | -    | 2.8    | V             |
| $h_{\text{FE}}^{(1)}$       | DC current gain                                                | $I_{\text{C}} = 4\text{ A}$ $V_{\text{CE}} = 4\text{ V}$<br>$I_{\text{C}} = 8\text{ A}$ $V_{\text{CE}} = 4\text{ V}$   | 1000<br>100 | -    | 12000  |               |

1. Pulsed duration = 300  $\mu\text{s}$ , duty cycle  $\leq 1.5\%$

**Note:** For PNP types voltage and current values are negative.

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

Figure 3. Derating curve

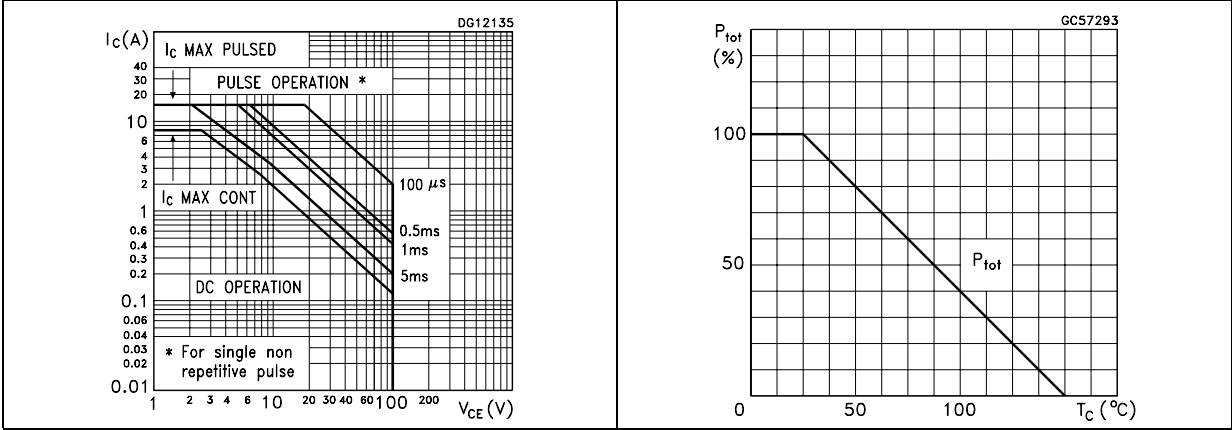


Figure 4. DC current gain for NPN type

Figure 5. DC current gain for PNP type

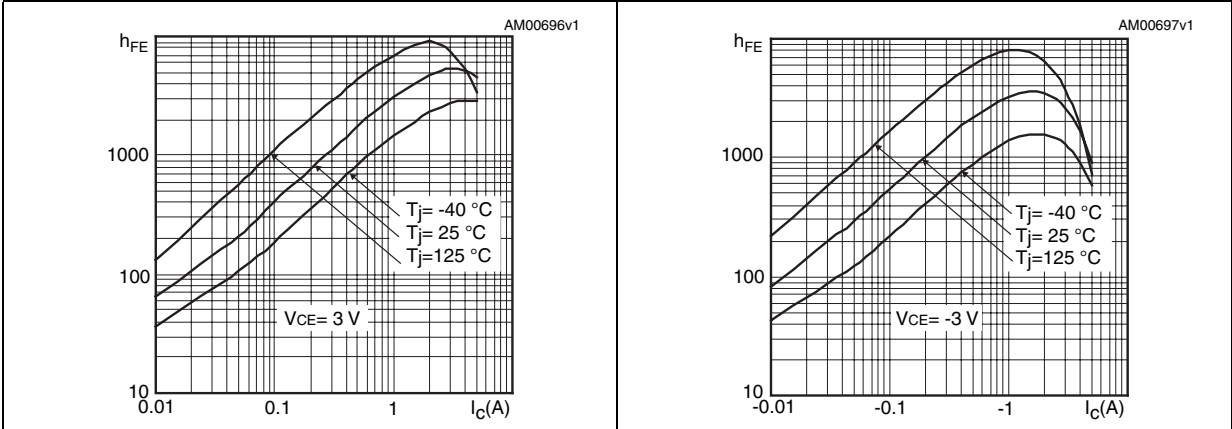


Figure 6. Collector-emitter saturation voltage for NPN type

Figure 7. Collector-emitter saturation voltage for PNP type

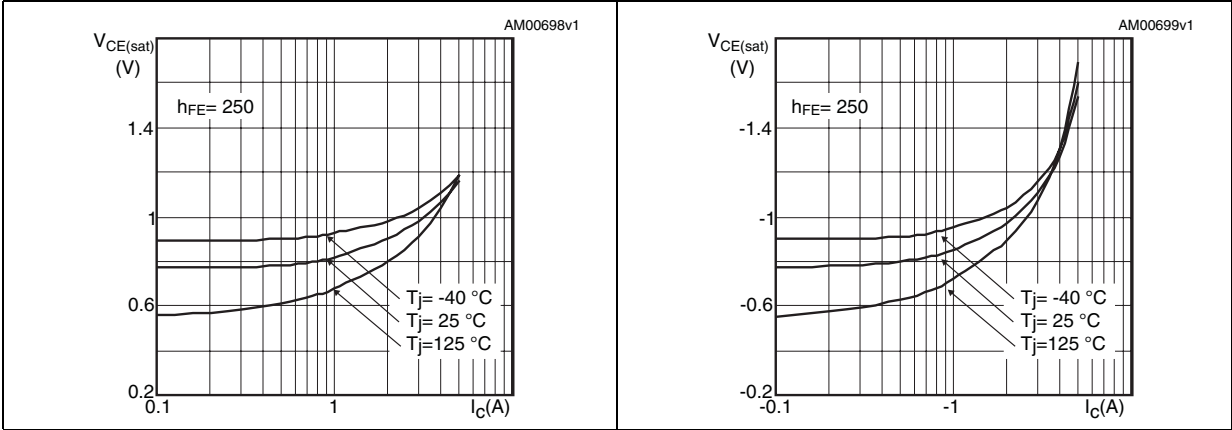


Figure 8. Base-emitter saturation voltage for NPN type

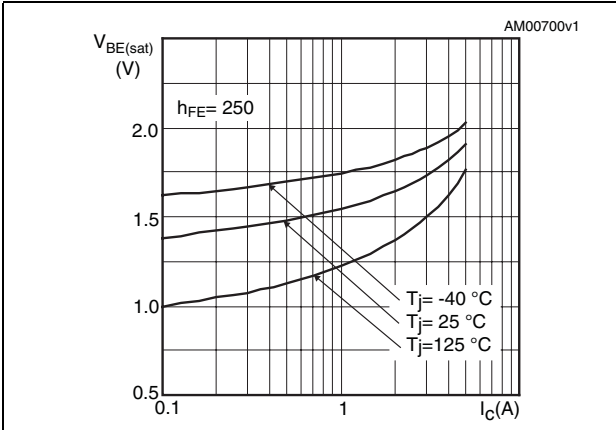


Figure 9. Base-emitter saturation voltage for PNP type

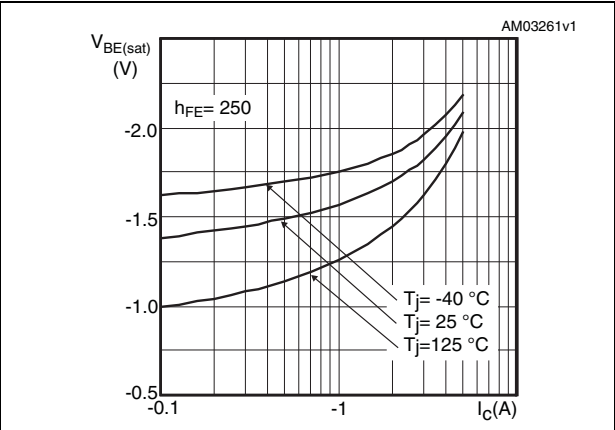


Figure 10. Base-emitter on voltage for NPN type

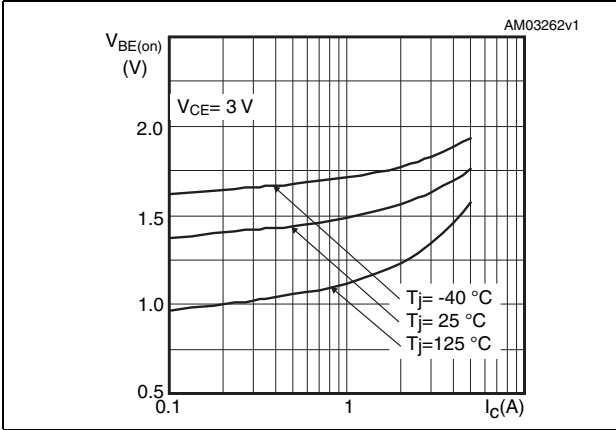


Figure 11. Base-emitter on voltage for PNP type

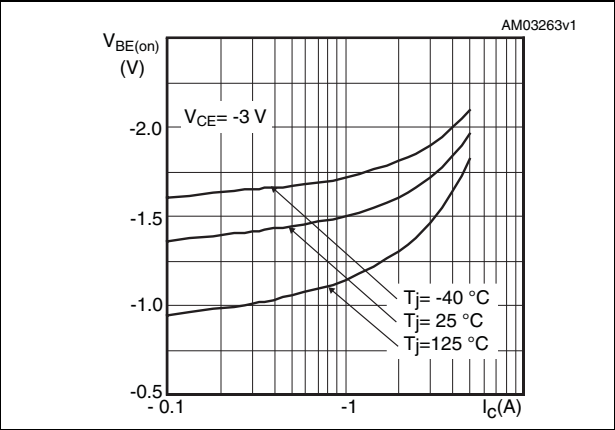


Figure 12. Resistive load switching times for NPN type (on)

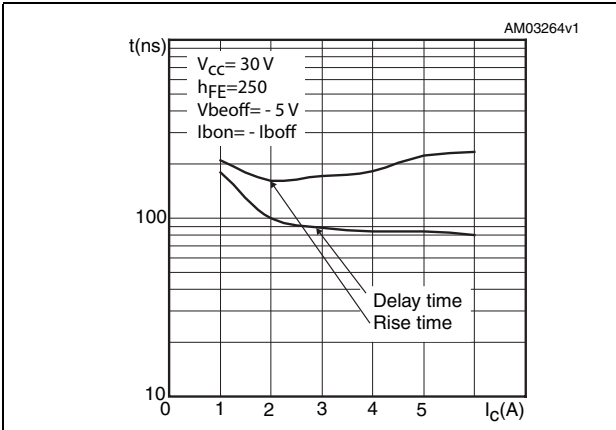


Figure 13. Resistive load switching times for PNP type (on)

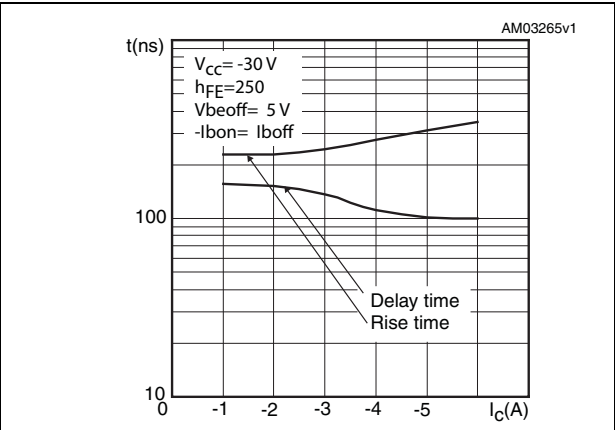


Figure 14. Resistive load switching times for NPN type (off)

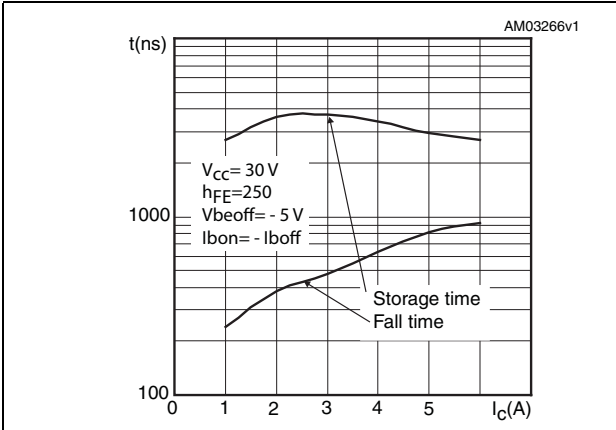


Figure 15. Resistive load switching times for PNP type (off)

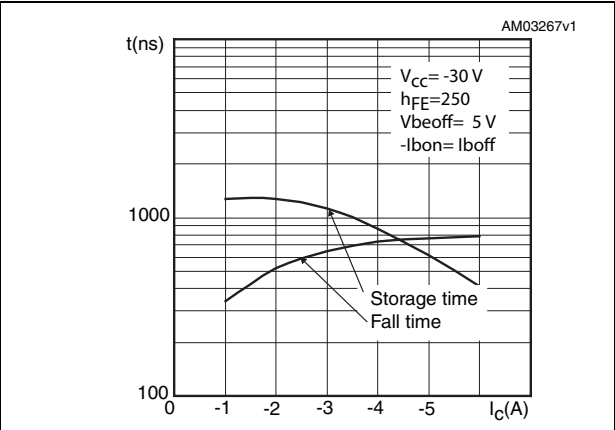


Figure 16. Capacitances for NPN type

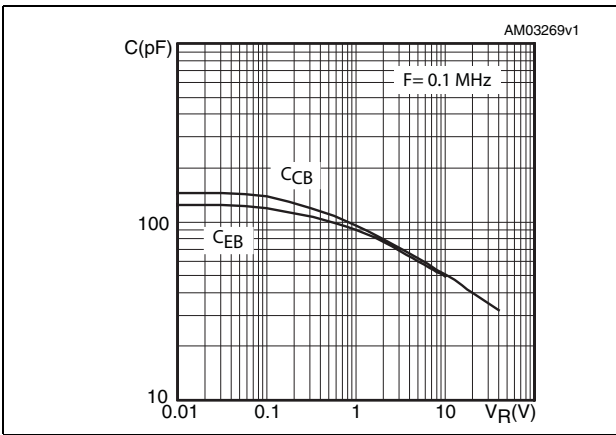
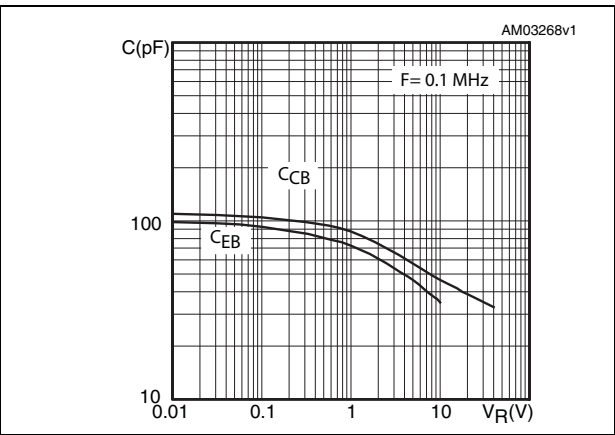
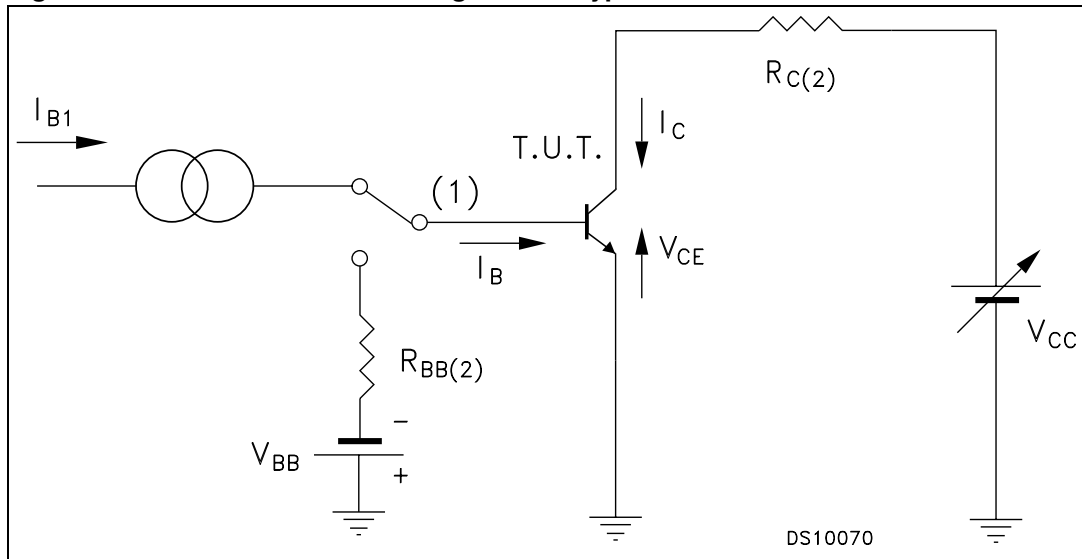


Figure 17. Capacitances for PNP type



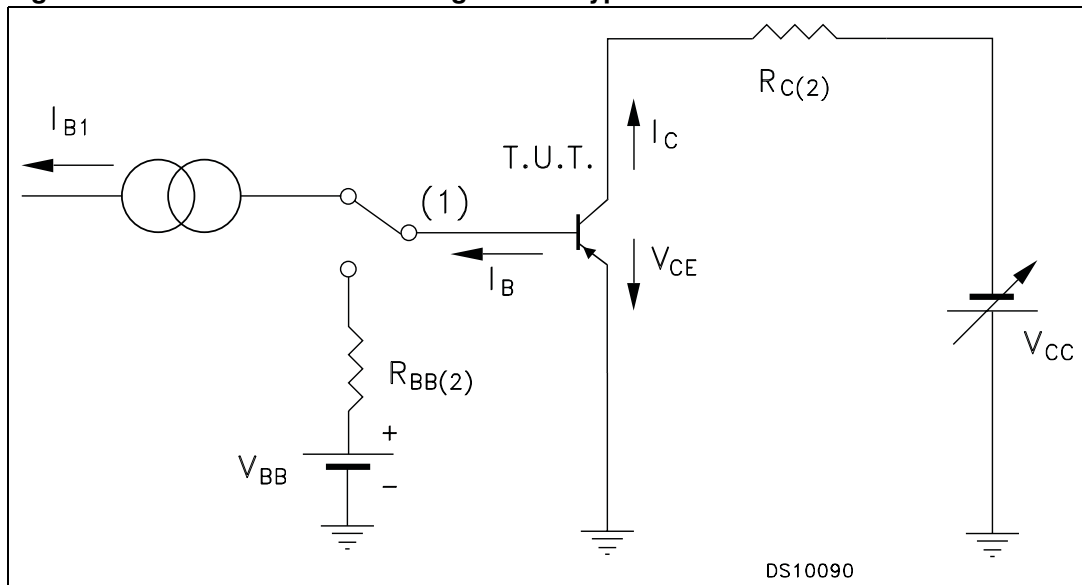
### 3 Test circuits

**Figure 18. Resistive load switching for NPN type**



1. Fast electronic switch
2. Non-inductive resistor

**Figure 19. Resistive load switching for PNP type**



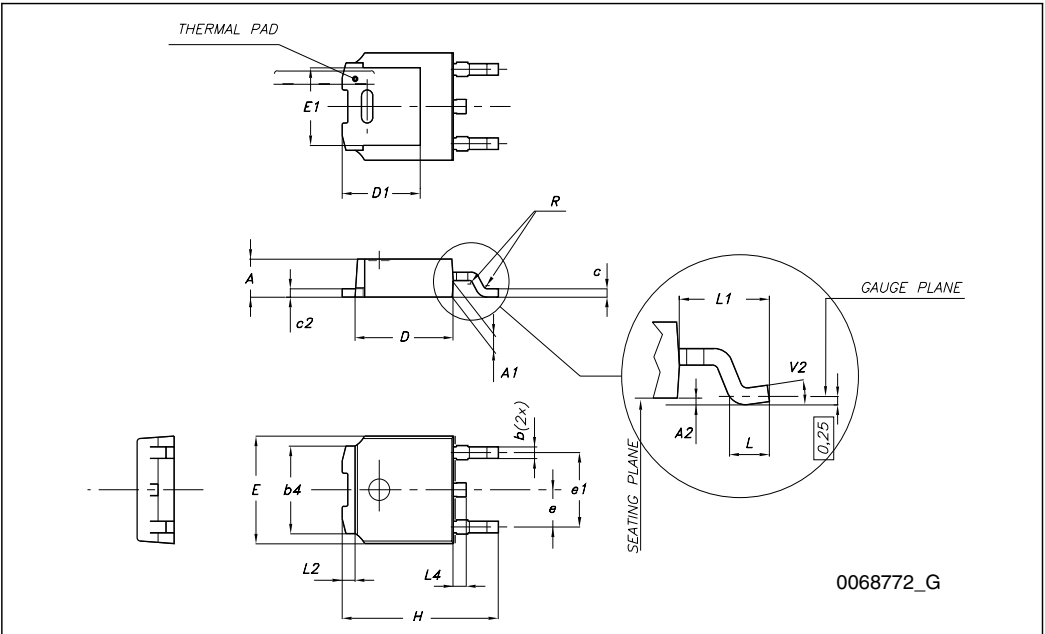
1. Fast electronic switch
2. Non-inductive resistor

## 4 Package mechanical data

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

TO-252 (DPAK) mechanical data

| DIM. | mm.  |      |       |
|------|------|------|-------|
|      | min. | typ  | max.  |
| A    | 2.20 |      | 2.40  |
| A1   | 0.90 |      | 1.10  |
| A2   | 0.03 |      | 0.23  |
| b    | 0.64 |      | 0.90  |
| b4   | 5.20 |      | 5.40  |
| c    | 0.45 |      | 0.60  |
| c2   | 0.48 |      | 0.60  |
| D    | 6.00 |      | 6.20  |
| D1   |      | 5.10 |       |
| E    | 6.40 |      | 6.60  |
| E1   |      | 4.70 |       |
| e    |      | 2.28 |       |
| e1   | 4.40 |      | 4.60  |
| H    | 9.35 |      | 10.10 |
| L    | 1    |      |       |
| L1   |      | 2.80 |       |
| L2   |      | 0.80 |       |
| L4   | 0.60 |      | 1     |
| R    |      | 0.20 |       |
| V2   | 0 °  |      | 8 °   |



## 5 Revision history

**Table 5. Document revision history**

| Date        | Revision | Changes                                                                                                                  |
|-------------|----------|--------------------------------------------------------------------------------------------------------------------------|
| 01-Aug-2002 | 8        |                                                                                                                          |
| 01-Oct-2007 | 9        | Collector current limits have been improved                                                                              |
| 03-Oct-2007 | 10       | Package mechanical data updated                                                                                          |
| 21-Apr-2009 | 11       | The device MJD127 has been inserted<br><a href="#">Section 2.1: Electrical characteristics (curves)</a> has been updated |

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