

## Complementary power Darlingtons

### Features

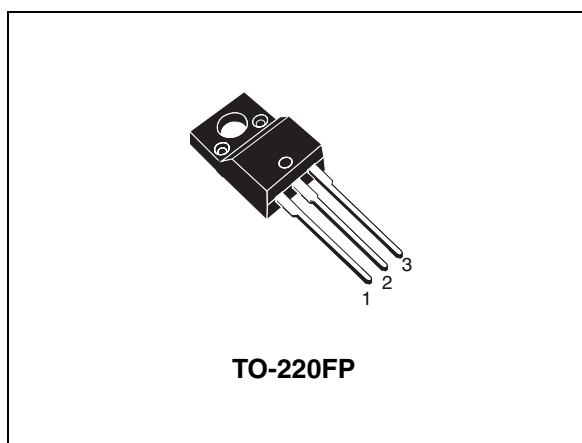
- Low collector-emitter saturation voltage
- Complementary NPN - PNP transistors
- TO-220FP isolated package UL compliant

### Application

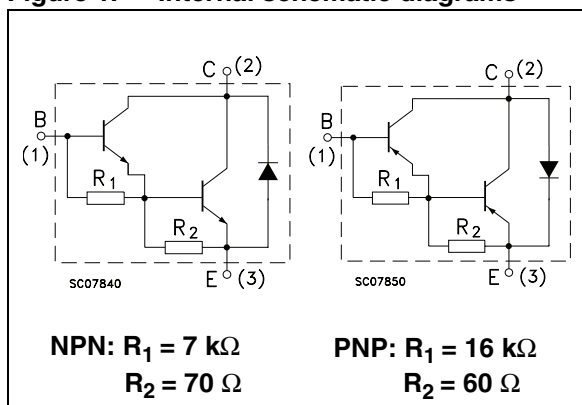
- General purpose linear and switching

### Description

The devices are manufactured in planar technology with “base island” layout and monolithic Darlingtons 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 |
|-------------|----------|----------|----------|-----------|
| TIP122FP    | TIP122FP | NPN      | TO-220FP | Tube      |
| TIP127FP    | TIP127FP | PNP      |          |           |

# 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   | 5          | A    |
| $I_{CM}$  | Collector peak current  | 8          | A    |
| $I_B$     | Base current  | 0.12       | A    |
| $P_{TOT}$ | Total dissipation at $T_c \leq 25\text{ °C}$<br>$T_{amb} \leq 25\text{ °C}$ | 30         | W    |
|           |   | 2          |      |
| $T_{STG}$ | Storage temperature   | -65 to 150 | °C   |
| $T_J$     | Max. operating junction temperature   | 150        |      |

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

**Table 3. Thermal data**

| Symbol     | Parameter                                | Value | Unit |
|------------|--|-------|------|
| $R_{thJC}$ | Thermal resistance junction-case max.    | 4.2   | °C/W |
| $R_{thJA}$ | Thermal resistance junction-ambient max. | 62.5  |      |

## 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

| Symbol                      | Parameter   | Test conditions  | Min.         | Typ. | Max.   | Unit   |
|-----------------------------|---|--|--------------|------|--------|--------|
| $I_{\text{CEO}}$            | Collector cut-off current<br>( $I_{\text{B}} = 0$ )               | $V_{\text{CE}} = 50\text{ V}$  |              |      | 0.5    | mA     |
| $I_{\text{CBO}}$            | Collector cut-off current<br>( $I_{\text{B}} = 0$ )               | $V_{\text{CE}} = 100\text{ V}$   |              |      | 0.2    | mA     |
| $I_{\text{EBO}}$            | 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<br>( $I_{\text{B}} = 0$ ) | $I_{\text{C}} = 30\text{ mA}$  | 100          |      |        | V      |
| $V_{\text{CE(sat)}}^{(1)}$  | Collector-emitter<br>saturation voltage                           | $I_{\text{C}} = 3\text{ A}$ $I_{\text{B}} = 12\text{ mA}$<br>$I_{\text{C}} = 5\text{ A}$ $I_{\text{B}} = 20\text{ mA}$ |              |      | 2<br>4 | V<br>V |
| $V_{\text{BE(on)}}^{(1)}$   | Base-emitter on voltage   | $I_{\text{C}} = 3\text{ A}$ $V_{\text{CE}} = 3\text{ V}$   |              |      | 2.5    | V      |
| $h_{\text{FE}}^{(1)}$       | DC current gain   | $I_{\text{C}} = 0.5\text{ A}$ $V_{\text{CE}} = 3\text{ V}$<br>$I_{\text{C}} = 3\text{ A}$ $V_{\text{CE}} = 3\text{ V}$ | 1000<br>1000 |      |        |        |

1. Pulse test: pulse duration  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

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

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

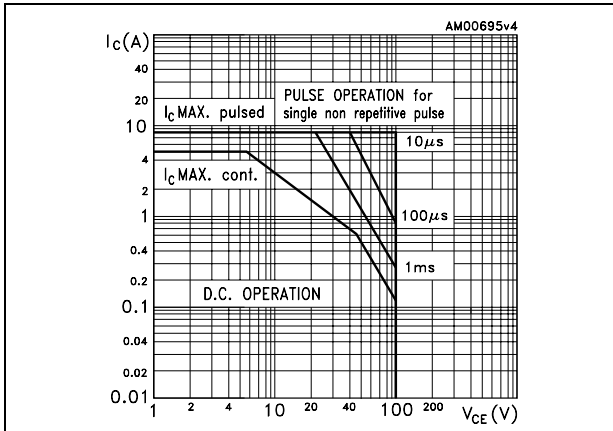


Figure 3. Derating curve

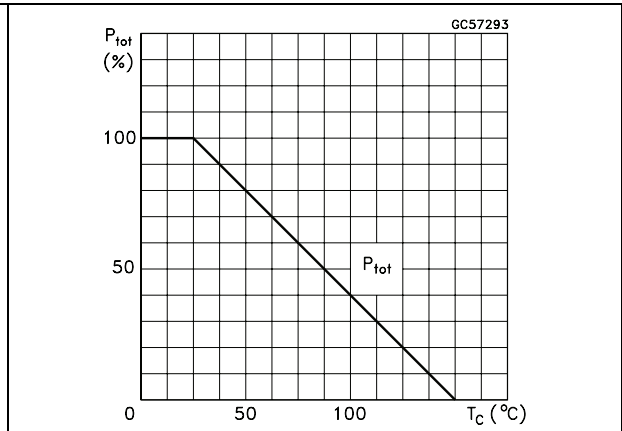


Figure 4. DC current gain for NPN type

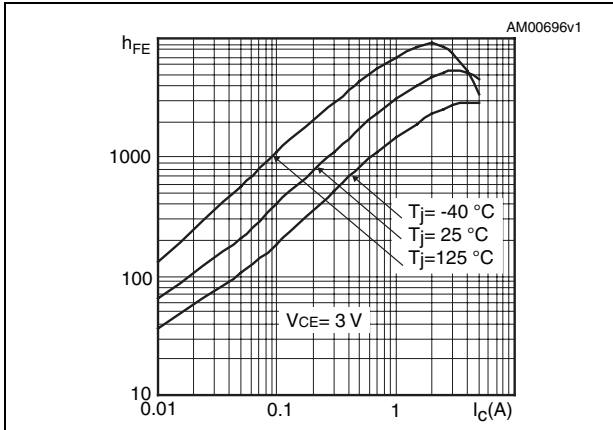


Figure 5. DC current gain for PNP type

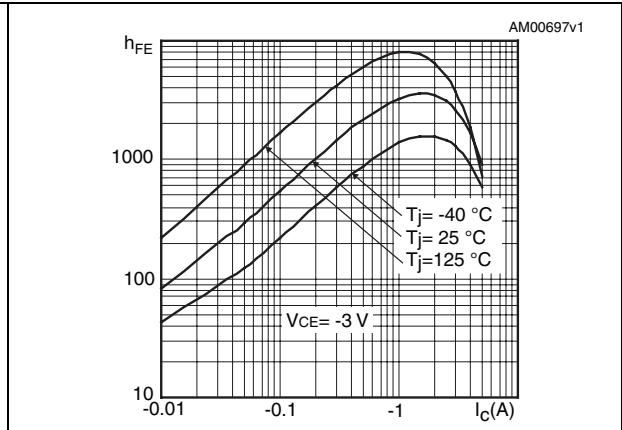


Figure 6. Collector-emitter saturation voltage for NPN type

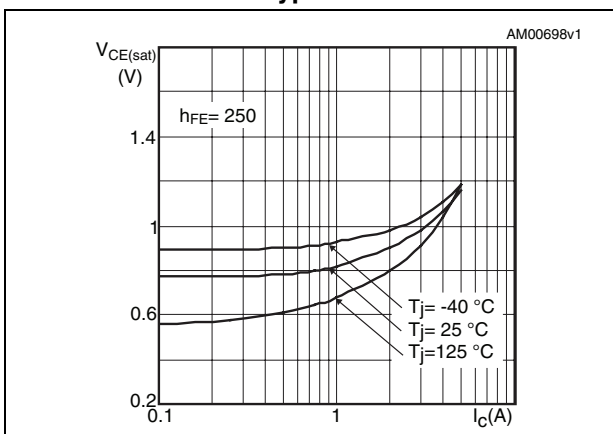


Figure 7. Collector-emitter saturation voltage for PNP type

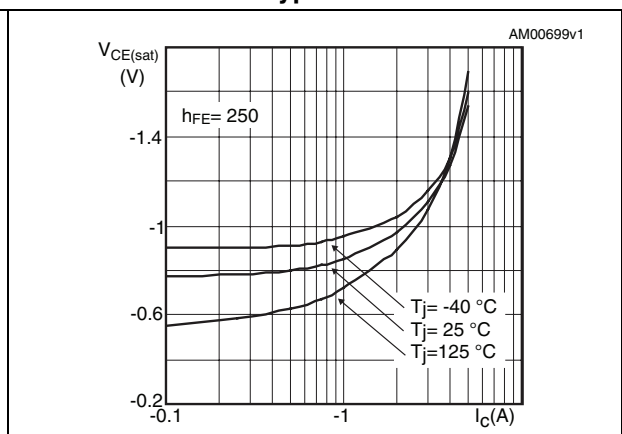


Figure 8. Base-emitter saturation voltage for NPN type

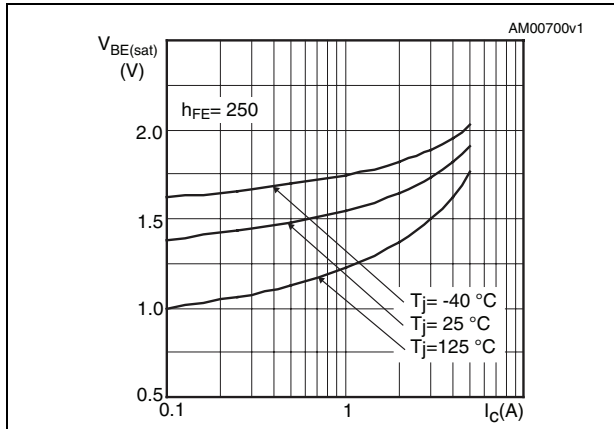


Figure 9. Base-emitter saturation voltage for PNP type

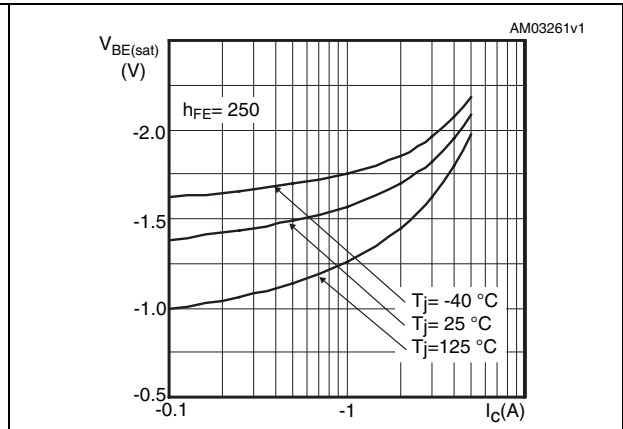


Figure 10. Base-emitter on voltage for NPN type

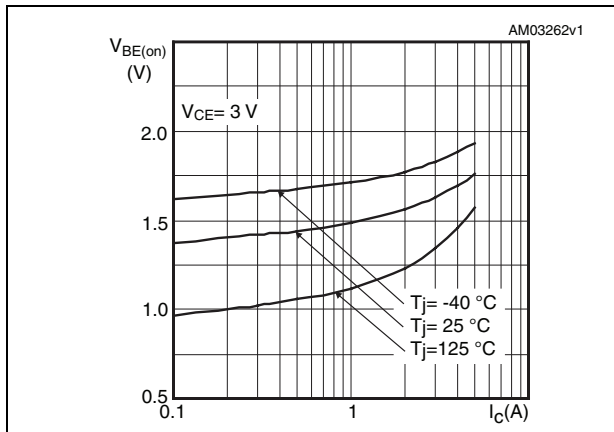


Figure 11. Base-emitter on voltage for PNP type

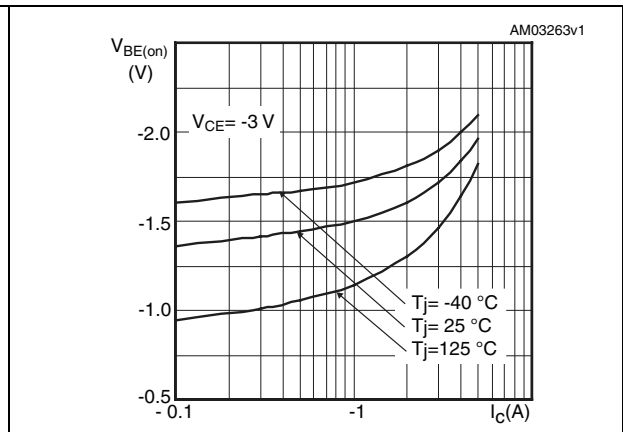


Figure 12. Switching time on resistive load for NPN type (on)

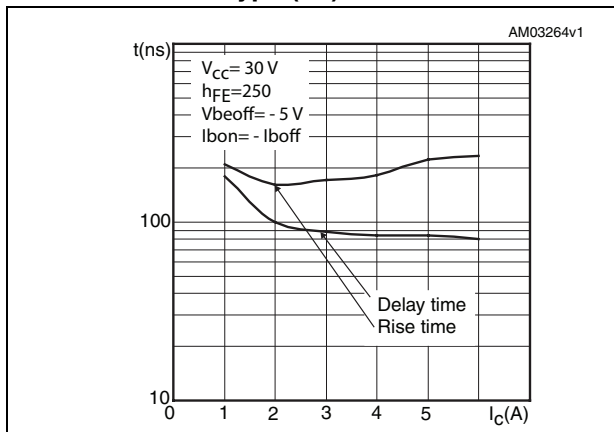


Figure 13. Switching time on resistive load for PNP type (on)

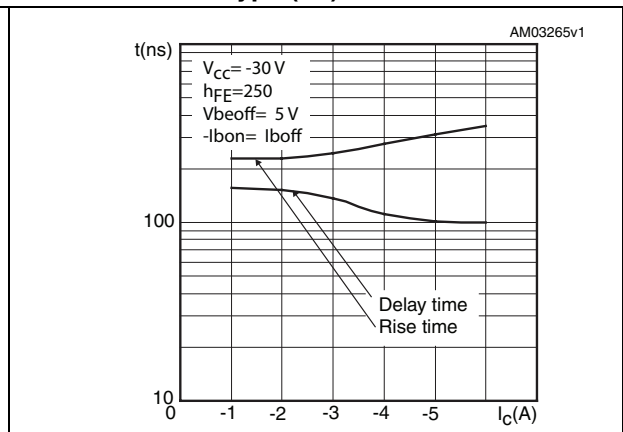


Figure 14. Switching time on resistive load for NPN type (off)

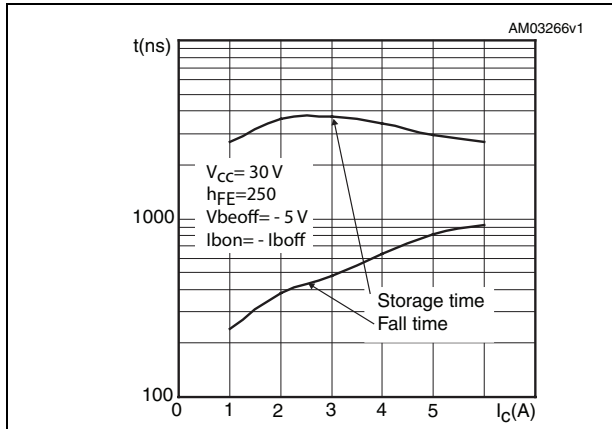


Figure 15. Switching time on resistive load for PNP type (off)

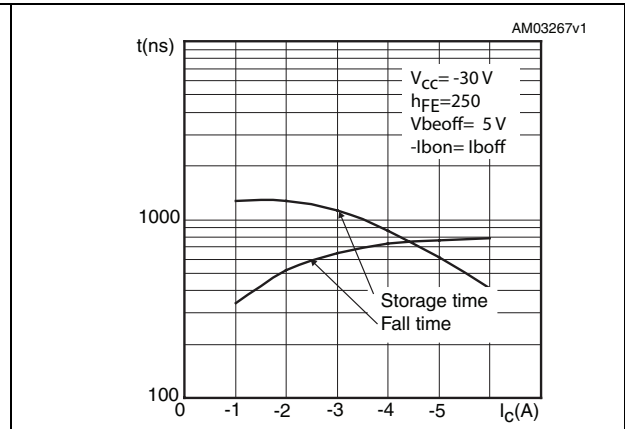


Figure 16. Capacitances for NPN type

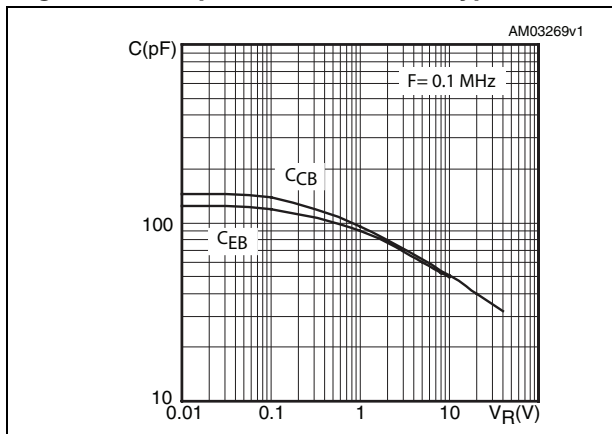
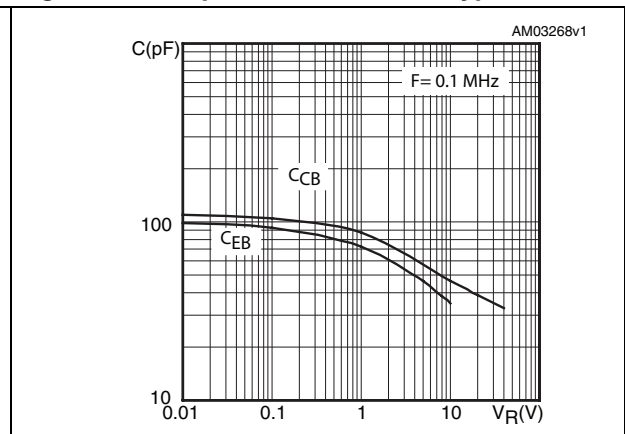
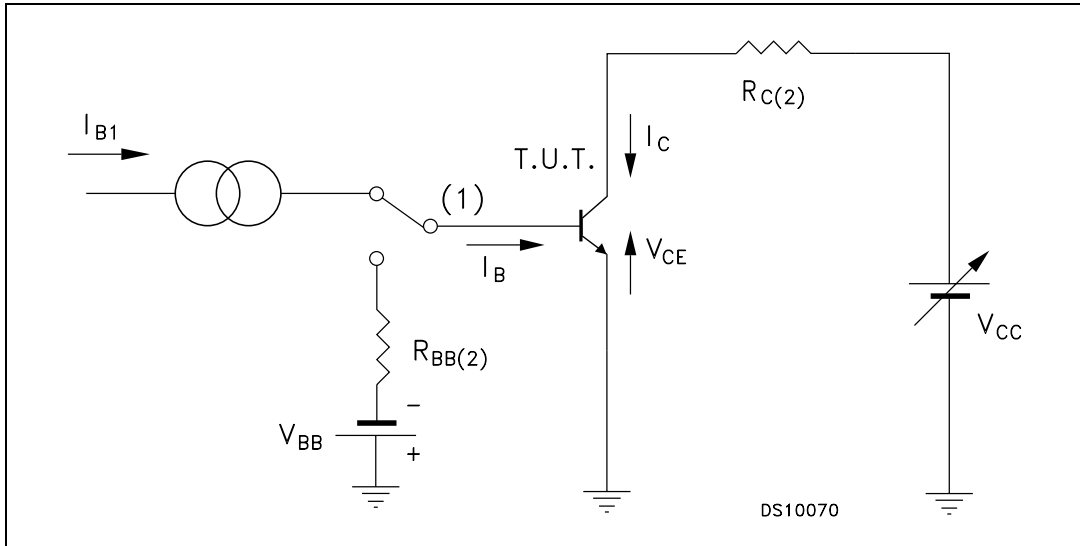


Figure 17. Capacitances for PNP type



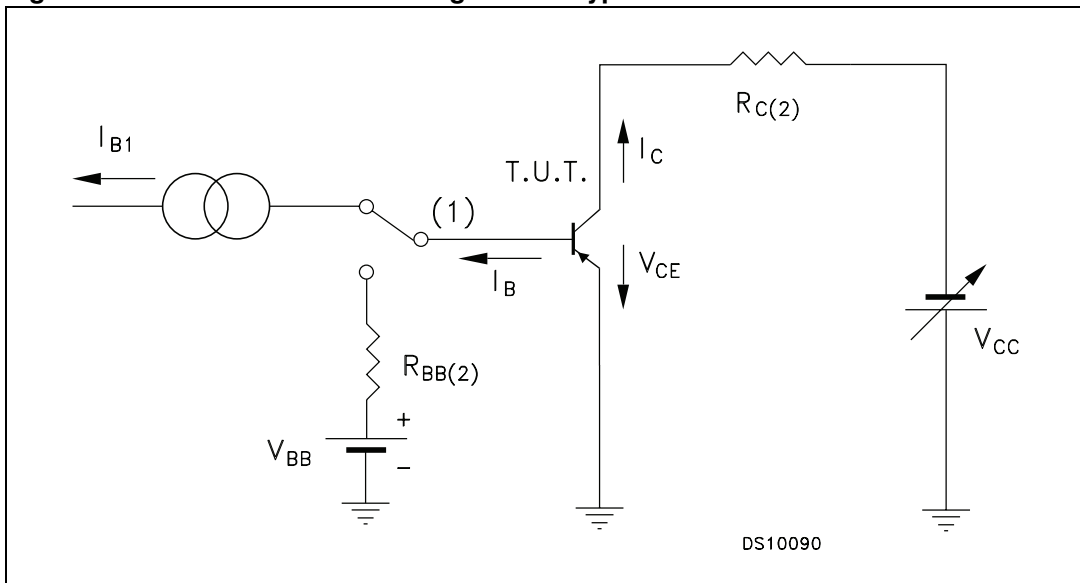
### 3 Test circuits

**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

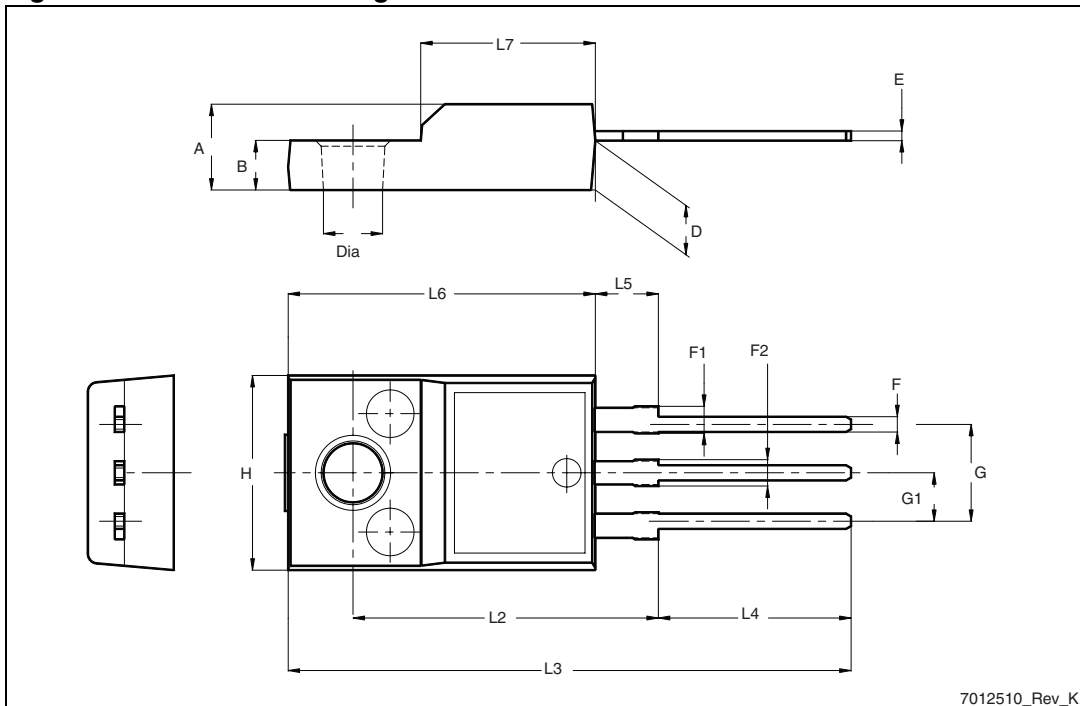
## 4 Package mechanical data

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<sup>®</sup> is an ST trademark.

Table 5. TO-220FP mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    | 4.4  |      | 4.6  |
| B    | 2.5  |      | 2.7  |
| D    | 2.5  |      | 2.75 |
| E    | 0.45 |      | 0.7  |
| F    | 0.75 |      | 1    |
| F1   | 1.15 |      | 1.70 |
| F2   | 1.15 |      | 1.70 |
| G    | 4.95 |      | 5.2  |
| G1   | 2.4  |      | 2.7  |
| H    | 10   |      | 10.4 |
| L2   |      | 16   |      |
| L3   | 28.6 |      | 30.6 |
| L4   | 9.8  |      | 10.6 |
| L5   | 2.9  |      | 3.6  |
| L6   | 15.9 |      | 16.4 |
| L7   | 9    |      | 9.3  |
| Dia  | 3    |      | 3.2  |

Figure 20. TO-220FP drawing



7012510\_Rev\_K

## 5 Revision history

**Table 6. Document revision history**

| Date        | Revision | Changes   |
|-------------|----------|---|
| 21-Jun-2004 | 4        | Document migration, no content change   |
| 02-Dec-2009 | 5        | Updated <a href="#">Section 2.1: Electrical characteristics (curves)</a> and TO-220FP package mechanical data |

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