

## High voltage fast-switching NPN power transistor

### Features

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

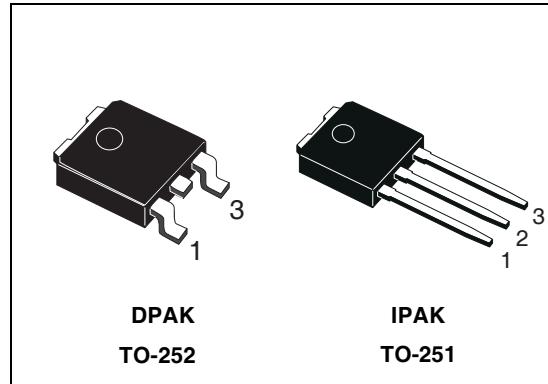
### Description

The device is manufactured using high voltage Multi-Epitaxial Planar technology for high switching speeds and high voltage capability.

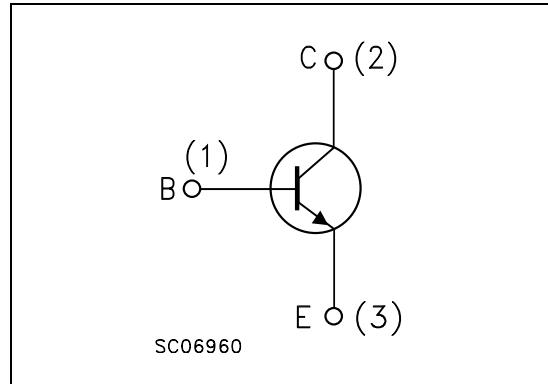
Thanks to an increased intermediate layer, it has an intrinsic ruggedness which enables the transistor to withstand an high collector current level during breakdown condition, without using the transil protection usually necessary in typical converters for lamp ballast.

### Applications

- Electronic ballast for fluorescent lighting
- Switch mode power supplies.



**Figure 1. Internal schematic diagram**



**Table 1. Device summary**

| Order codes | Marking | Package | Packaging   |
|-------------|---------|---------|-------------|
| BULD741T4   | BULD741 | DPAK    | Tape & reel |
| BULD741-1   | BULD741 | IPAK    | Tube        |

# 1 Electrical ratings

**Table 2. Absolute maximum rating**

| Symbol    | Parameter                                                      | Value         | Unit |
|-----------|----------------------------------------------------------------|---------------|------|
| $V_{CES}$ | Collector-emitter voltage ( $V_{BE} = 0$ )                     | 1050          | V    |
| $V_{CEO}$ | Collector-emitter voltage ( $I_B = 0$ )                        | 400           | V    |
| $V_{EBO}$ | Emitter-base voltage ( $I_C = 0$ , $I_B = 2A$ , $t_P < 10ms$ ) | $V_{(BR)EBO}$ | V    |
| $I_C$     | Collector current                                              | 2.5           | A    |
| $I_{CM}$  | Collector peak current ( $t_P < 5ms$ )                         | 5             | A    |
| $I_B$     | Base current                                                   | 1.5           | A    |
| $I_{BM}$  | Base peak current ( $t_P < 5ms$ )                              | 3             | A    |
| $P_{tot}$ | Total dissipation at $T_c = 25^\circ C$                        | 30            | 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 | 4.16  | °C/W |

## 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

| Symbol               | Parameter                                          | Test conditions                                                                                                                   | Min.     | Typ.        | Max.       | Unit                         |
|----------------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------|-------------|------------|------------------------------|
| $I_{CES}$            | Collector cut-off current ( $V_{BE} = 0\text{V}$ ) | $V_{CE} = 1050\text{V}$                                                                                                           |          | 0.2         | 10         | $\mu\text{A}$                |
| $I_{CEO}$            | Collector cut-off current ( $I_B = 0$ )            | $V_{CE} = 400\text{V}$                                                                                                            |          | 10          | 250        | $\mu\text{A}$                |
| $V_{(BR)EBO}$        | Emitter-base breakdown voltage ( $I_C = 0$ )       | $I_E = 1\text{mA}$                                                                                                                | 15       | 19          | 24         | $\text{V}$                   |
| $V_{CEO(sus)}^{(1)}$ | Collector-emitter sustaining voltage ( $I_B = 0$ ) | $I_C = 10\text{mA}$                                                                                                               | 400      | 450         |            | $\text{V}$                   |
| $V_{CE(sat)}^{(1)}$  | Collector-emitter saturation voltage               | $I_C = 0.7\text{A}$ $I_B = 0.14\text{A}$<br>$I_C = 2\text{A}$ $I_B = 0.6\text{A}$                                                 |          | 0.15<br>0.5 | 0.5<br>1.5 | $\text{V}$<br>$\text{V}$     |
| $V_{BE(sat)}^{(1)}$  | Base-emitter saturation voltage                    | $I_C = 2\text{A}$ $I_B = 0.6\text{A}$                                                                                             |          | 1.1         | 1.5        | $\text{V}$                   |
| $h_{FE}$             | DC current gain                                    | $I_C = 0.1\text{A}$ $V_{CE} = 5\text{V}$<br>$I_C = 0.45\text{A}$ $V_{CE} = 3\text{V}$                                             | 48<br>25 | 70<br>35    | 100<br>50  |                              |
| $t_s$<br>$t_f$       | Resistive load<br>Storage time<br>Fall time        | $V_{CC} = 125\text{V}$ $I_C = 1\text{A}$<br>$I_{B1} = -I_{B2} = 0.2\text{A}$ $t_p = 300\mu\text{s}$<br>$V_{BE(off)} = -5\text{V}$ |          | 2.5<br>350  | 3.5<br>500 | $\mu\text{s}$<br>$\text{ns}$ |
| $E_{ar}$             | Repetitive avalanche energy                        | $L = 2\text{mH}$ $C = 1.8\text{nF}$<br>$V_{BE(off)} = -5\text{V}$                                                                 | 5        |             |            | $\text{mJ}$                  |

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

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

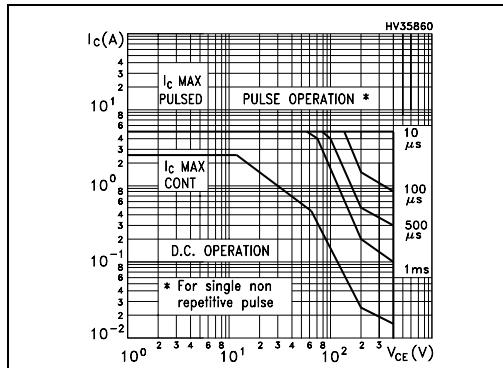


Figure 3. Derating curve

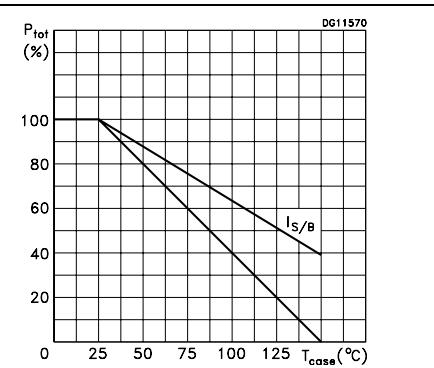


Figure 4. Output characteristics

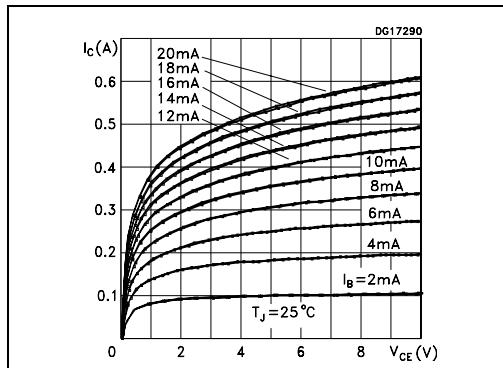


Figure 5. Reverse biased safe operating area

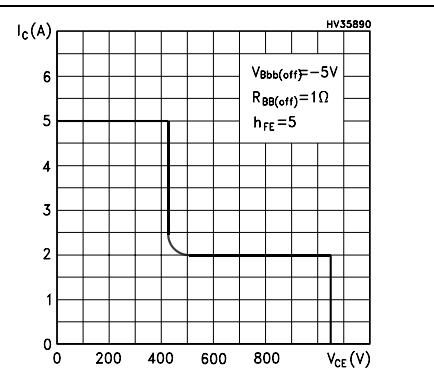


Figure 6. DC current gain

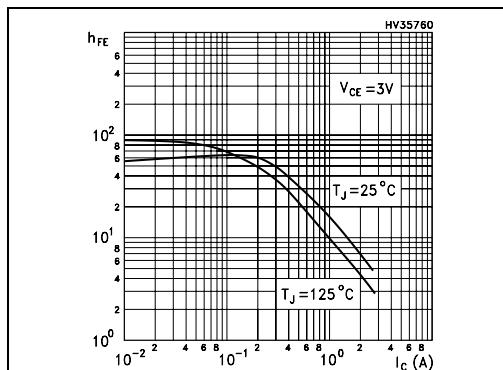
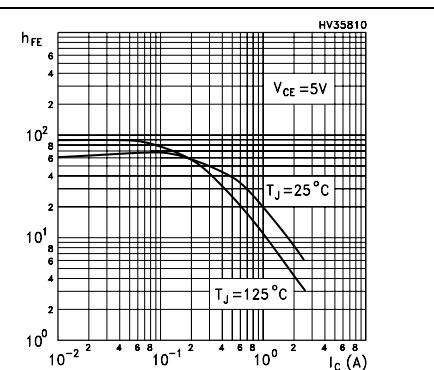
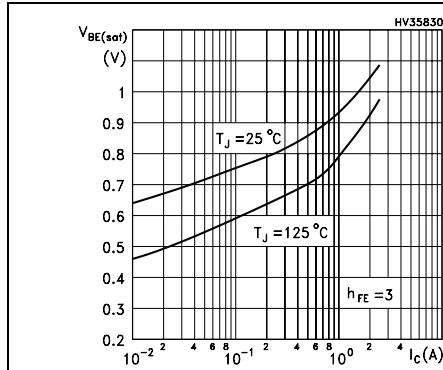
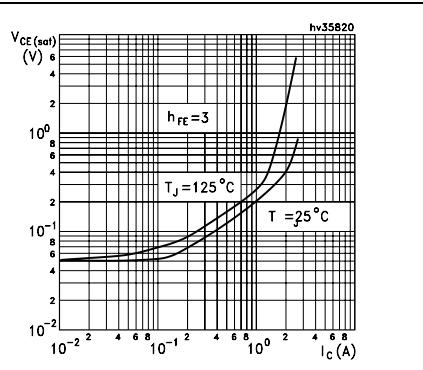
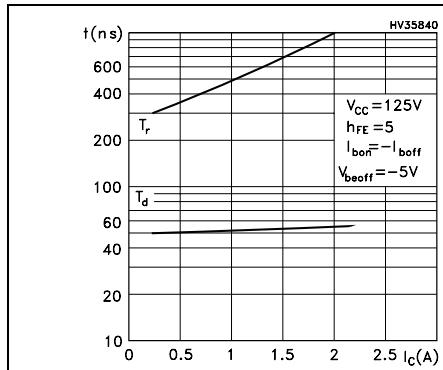
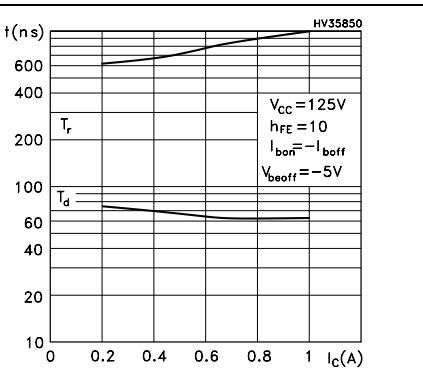
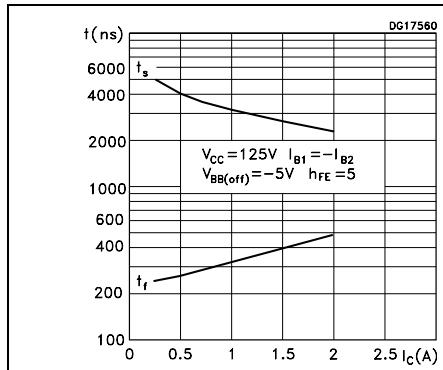
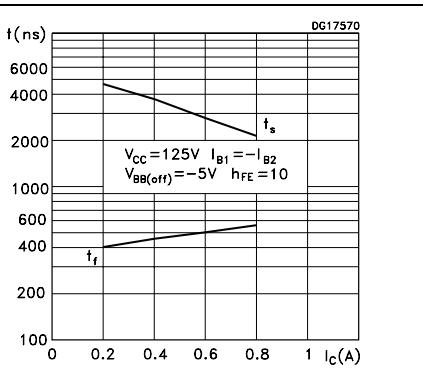


Figure 7. DC current gain



**Figure 8. Base-emitter saturation voltage****Figure 9. Collector-emitter saturation voltage****Figure 10. Resistive load switching on times****Figure 11. Resistive load switching on times****Figure 12. Resistive load switching off times****Figure 13. Resistive load switching off times**

## 2.2 Test circuits

Figure 14. Resistive load switching test circuit

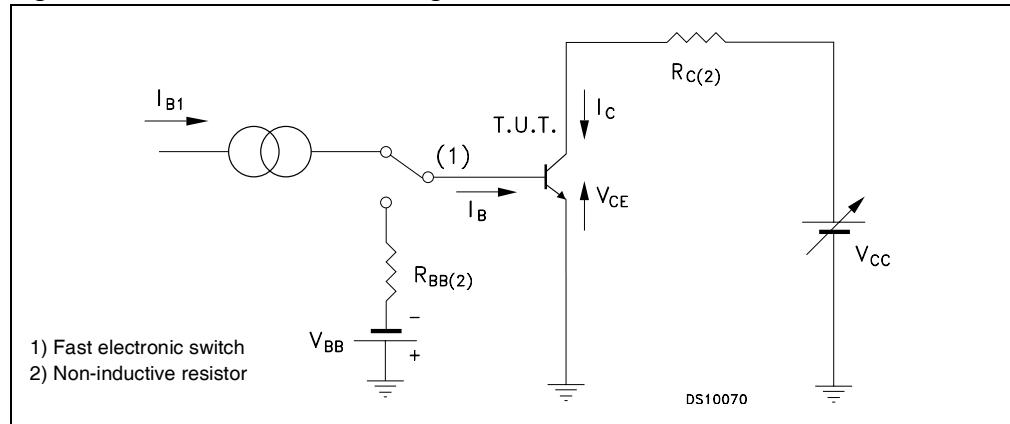
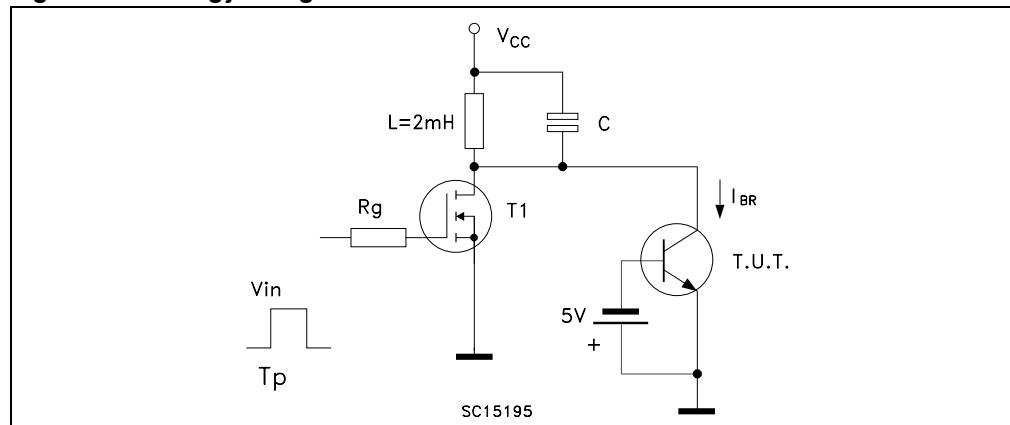


Figure 15. Energy rating test circuit

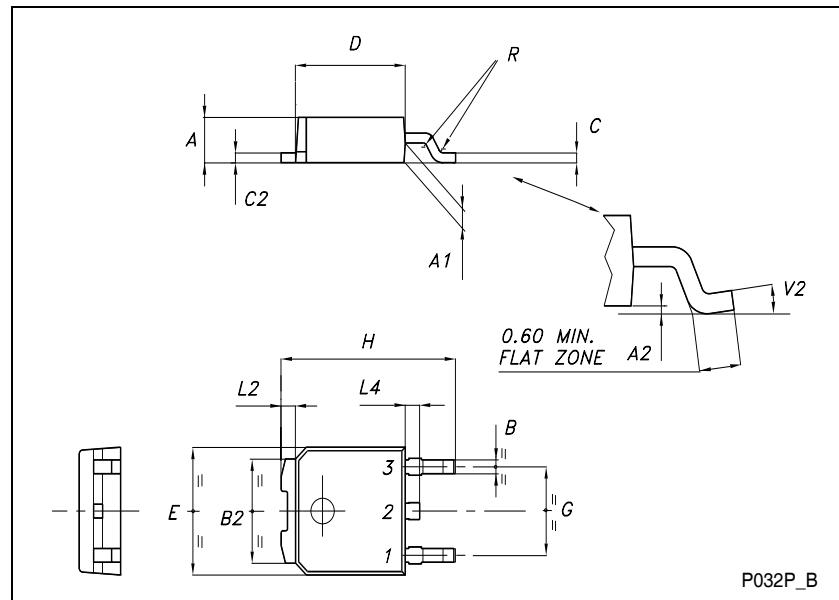


### 3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com)

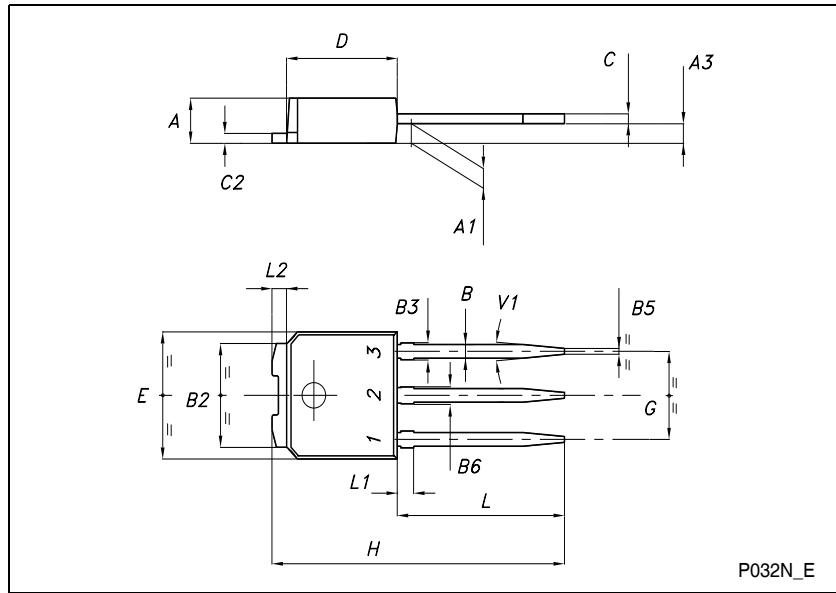
## TO-252 (DPAK) MECHANICAL DATA

| DIM. | mm   |      |       | inch  |       |       |
|------|------|------|-------|-------|-------|-------|
|      | MIN. | TYP. | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 2.20 |      | 2.40  | 0.087 |       | 0.094 |
| A1   | 0.90 |      | 1.10  | 0.035 |       | 0.043 |
| A2   | 0.03 |      | 0.23  | 0.001 |       | 0.009 |
| B    | 0.64 |      | 0.90  | 0.025 |       | 0.035 |
| B2   | 5.20 |      | 5.40  | 0.204 |       | 0.213 |
| C    | 0.45 |      | 0.60  | 0.018 |       | 0.024 |
| C2   | 0.48 |      | 0.60  | 0.019 |       | 0.024 |
| D    | 6.00 |      | 6.20  | 0.236 |       | 0.244 |
| E    | 6.40 |      | 6.60  | 0.252 |       | 0.260 |
| G    | 4.40 |      | 4.60  | 0.173 |       | 0.181 |
| H    | 9.35 |      | 10.10 | 0.368 |       | 0.398 |
| L2   |      | 0.8  |       |       | 0.031 |       |
| L4   | 0.60 |      | 1.00  | 0.024 |       | 0.039 |
| V2   | 0°   |      | 8°    | 0°    |       | 0°    |



## TO-251 (IPAK) MECHANICAL DATA

| DIM. | mm    |      |       | inch  |       |       |
|------|-------|------|-------|-------|-------|-------|
|      | MIN.  | TYP. | MAX.  | MIN.  | TYP.  | MAX.  |
| A    | 2.20  |      | 2.40  | 0.087 |       | 0.094 |
| A1   | 0.90  |      | 1.10  | 0.035 |       | 0.043 |
| A3   | 0.70  |      | 1.30  | 0.028 |       | 0.051 |
| B    | 0.64  |      | 0.90  | 0.025 |       | 0.035 |
| B2   | 5.20  |      | 5.40  | 0.204 |       | 0.213 |
| B3   |       |      | 0.85  |       |       | 0.033 |
| B5   |       | 0.30 |       |       | 0.012 |       |
| B6   |       |      | 0.95  |       |       | 0.037 |
| C    | 0.45  |      | 0.60  | 0.018 |       | 0.024 |
| C2   | 0.48  |      | 0.60  | 0.019 |       | 0.024 |
| D    | 6.00  |      | 6.20  | 0.237 |       | 0.244 |
| E    | 6.40  |      | 6.60  | 0.252 |       | 0.260 |
| G    | 4.40  |      | 4.60  | 0.173 |       | 0.181 |
| H    | 15.90 |      | 16.30 | 0.626 |       | 0.642 |
| L    | 9.00  |      | 9.40  | 0.354 |       | 0.370 |
| L1   | 0.80  |      | 1.20  | 0.031 |       | 0.047 |
| L2   |       | 0.80 | 1.00  |       | 0.031 | 0.039 |
| V1   |       | 10°  |       |       | 10°   |       |



## 4 Revision history

**Table 5. Revision history**

| Date        | Revision | Changes                                                                    |
|-------------|----------|----------------------------------------------------------------------------|
| 20-Dec-2006 | 1        | Initial release.                                                           |
| 09-Jul-2007 | 2        | Updated package names in page 1, added figure 4, updated figure 12 and 13. |

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