

## High voltage fast-switching NPN power transistor

### General features

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

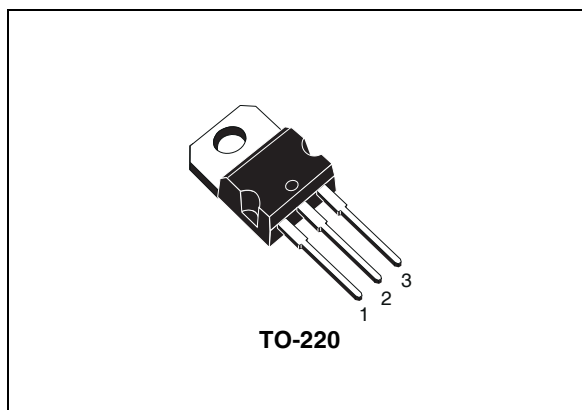
### Description

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

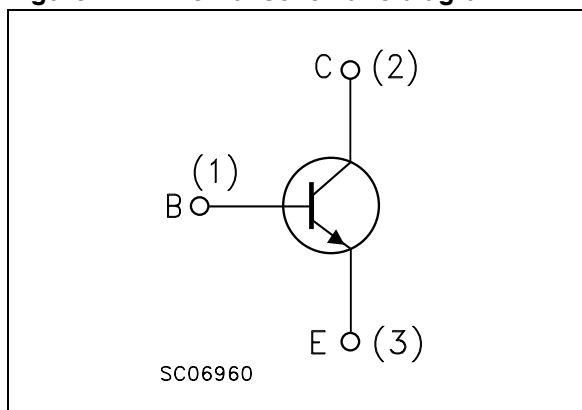
Thanks to an increased intermediate layer, it has an intrinsic ruggedness which enables the transistor to withstand an high collector current level during breakdown condition, without using the transil protection usually necessary in typical converters for lamp ballast.

### Applications

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



**Figure 1. Internal schematic diagram**



**Table 1. Device summary**

Order code	Marking	Package	Packaging
BUL741	BUL741	TO-220	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 $T_C = 25^\circ C$	60	W
$T_{stg}$	Storage temperature	-65 to 150	$^\circ C$
$T_J$	Max. operating junction temperature	150	$^\circ C$

**Table 3. Thermal data**

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	2.08	$^\circ C/W$

## 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

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

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

## 2.1 Typical characteristic

Figure 2. Safe operating area

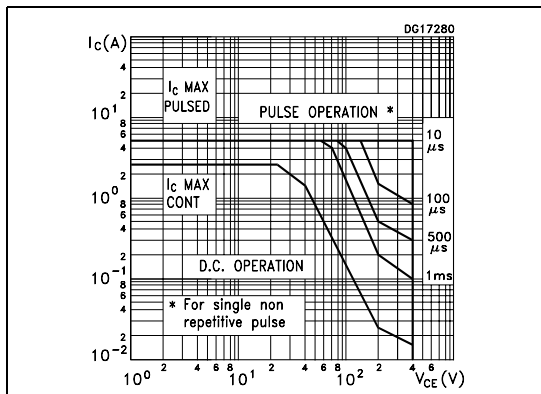


Figure 3. Derating curve

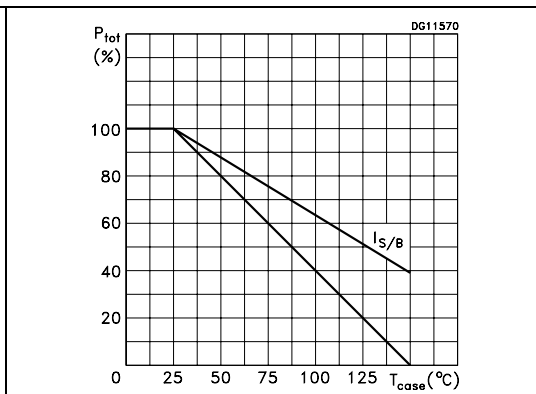


Figure 4. Output characteristics

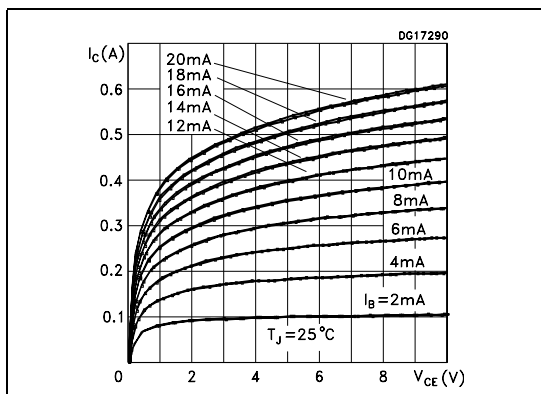


Figure 5. Reverse biased safe operating area

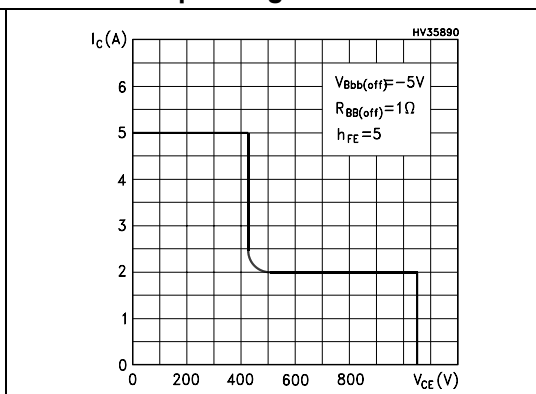


Figure 6. DC current gain

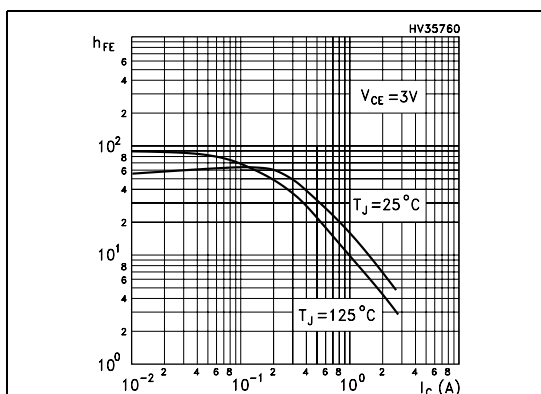
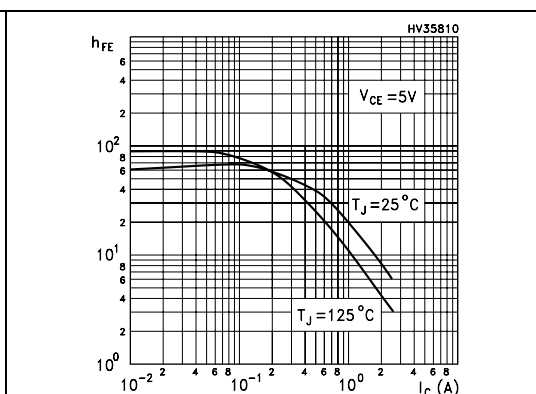
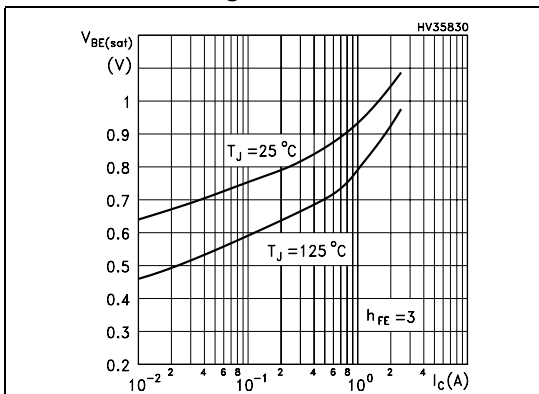


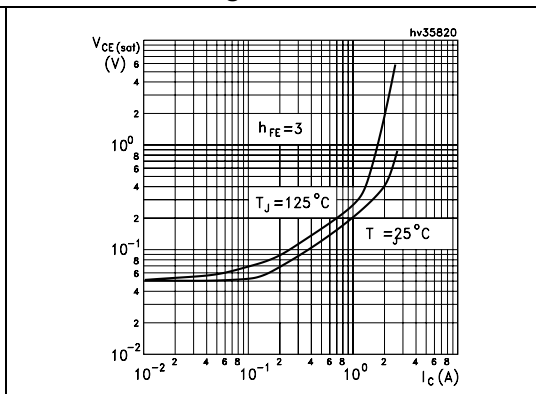
Figure 7. DC current gain



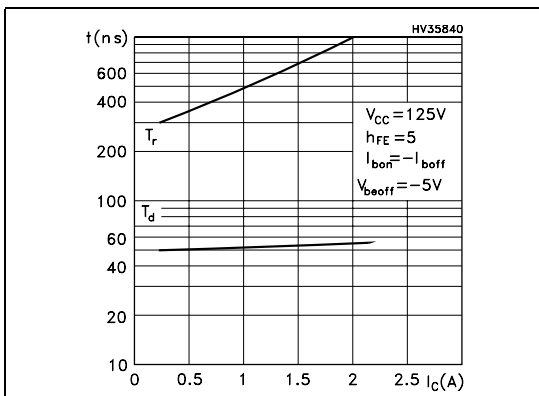
**Figure 8. Base-emitter saturation voltage**



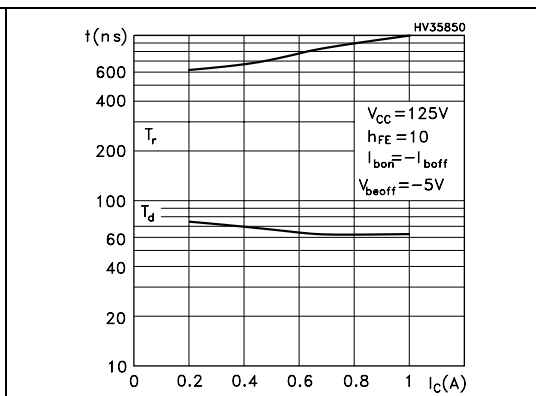
**Figure 9. Collector-emitter saturation voltage**



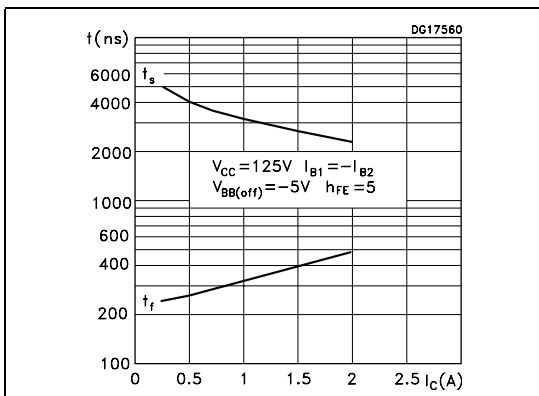
**Figure 10. Resistive load switching on times**



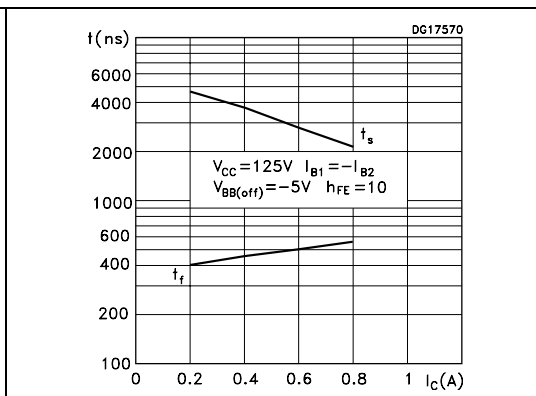
**Figure 11. Resistive load switching on times**



**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

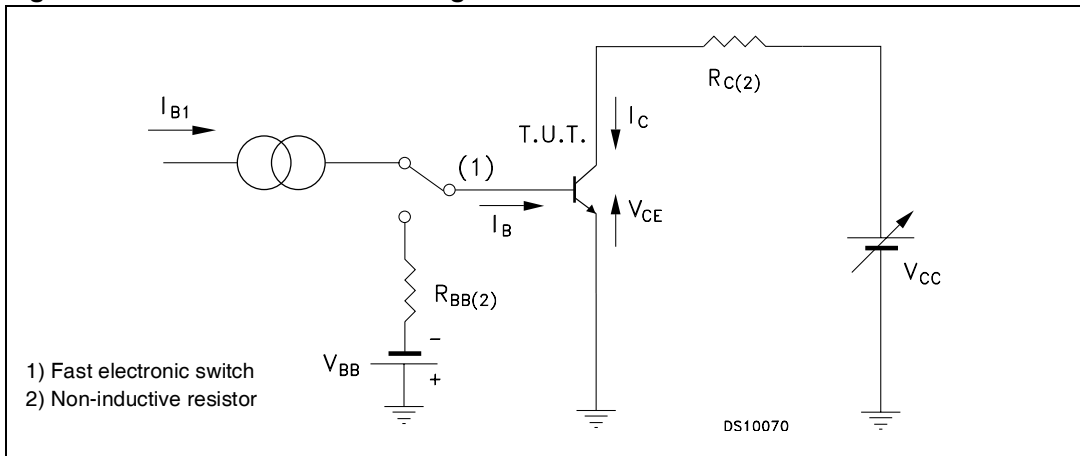
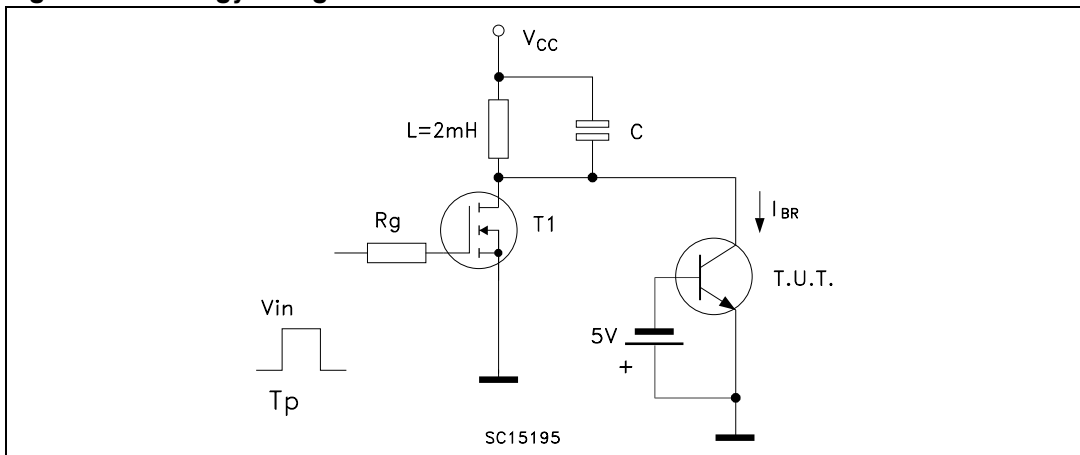


Figure 15. Energy rating test circuit

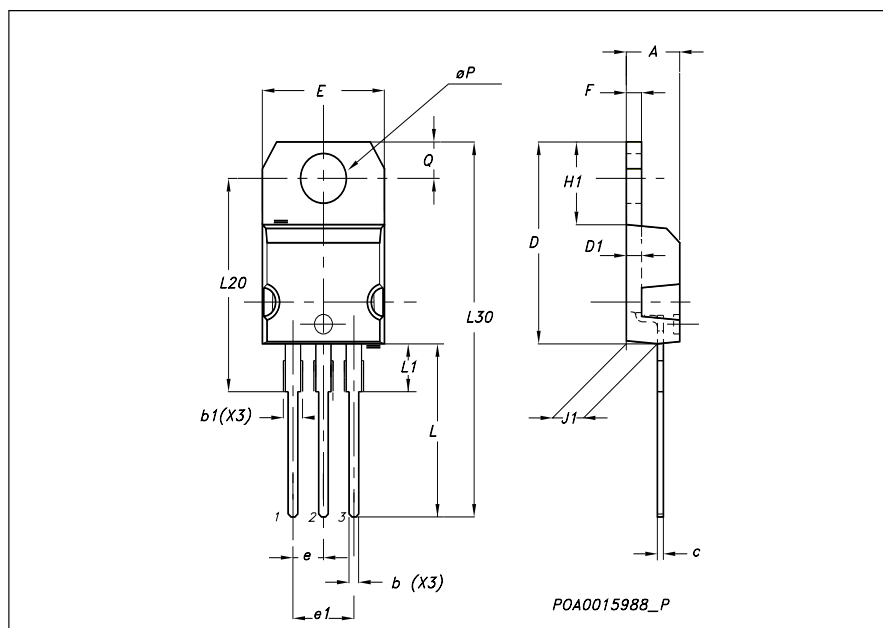


### 3 Package mechanical data

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-220 Mechanical data**

DIM.	mm.		
	MIN.	TYP	MAX.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.49		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	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





## 4 Revision history

**Table 5. Revision history**

Date	Revision	Changes
11-Apr-2007	1	Initial release.
10-Jul-2007	2	Figure 12 and 13 have been updated.

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