

## High voltage fast-switching NPN power transistor

### Features

- High voltage capability
- Low spread of dynamic parameters
- Very high switching speed
- Integrated antiparallel collector-emitter diode

### Applications

- Electronic ballast for fluorescent lighting
- Flyback and forward single transistor low power converters

### Description

These devices are high voltage fast-switching NPN power transistors. They are manufactured using high voltage multi epitaxial planar technology for high switching speeds and medium voltage capability.

They use a cellular emitter structure with planar edge termination to enhance switching speeds while maintaining the wide RBSOA. The devices are designed for use in lighting applications and low cost switch-mode power supplies.

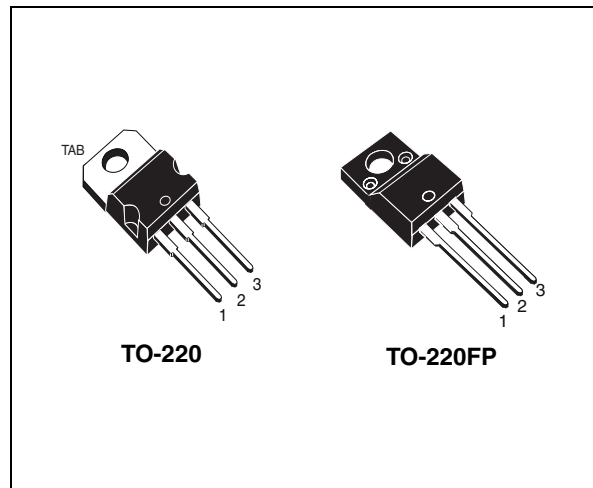


Figure 1. Internal schematic diagram

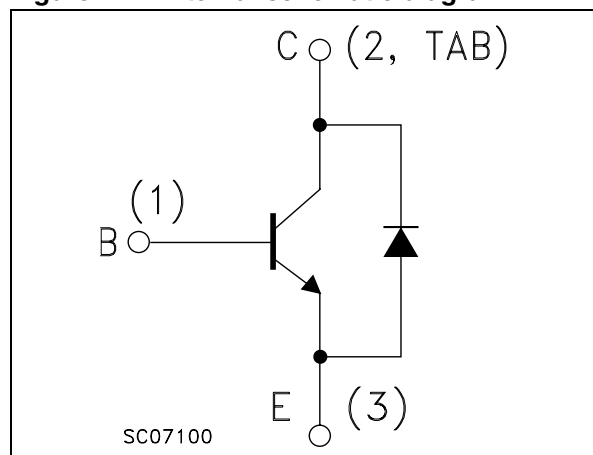


Table 1. Device summary

Order codes	Marking	Packages	Packaging
STL128D	L128D	TO-220	Tube
STL128DFP	L128DFP	TO-220FP	Tube

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		TO-220	TO-220FP	
$V_{CES}$	Collector-emitter voltage ( $V_{BE} = 0$ )	700		V
$V_{CEO}$	Collector-emitter voltage ( $I_B = 0$ )	400		V
$V_{EBO}$	Emitter-base voltage ( $I_C = 0$ )	$V_{(BR)EBO}$		V
$I_C$	Collector current	4		A
$I_{CM}$	Collector peak current ( $t_p < 5$ ms)	8		A
$I_B$	Base current	2		A
$I_{BM}$	Base peak current ( $t_p < 5$ ms)	4		A
$V_{ISOL}$	Insulation withstand voltage (RMS) from all three leads to external heatsink		1500	V
$P_{TOT}$	Total dissipation at $T_C = 25$ °C	65	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
		TO-220	TO-220FP	
$R_{thJ-case}$	Thermal resistance junction-case max	1.92	4.17	°C/W
$R_{thJ-amb}$	Thermal resistance junction-ambient max	62.5		°C/W

## 2 Electrical characteristics

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

**Table 4. Electrical characteristics**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{\text{CES}}$	Collector cut-off current ( $V_{\text{BE}} = 0$ )	$V_{\text{CE}} = 700\text{ V}$			100	$\mu\text{A}$
		$V_{\text{CE}} = 700\text{ V}$ $T_{\text{c}} = 125\text{ °C}$			500	$\mu\text{A}$
$I_{\text{CEO}}$	Collector cut-off current ( $I_{\text{B}} = 0$ )	$V_{\text{CE}} = 400\text{ V}$			250	$\mu\text{A}$
$V_{(\text{BR})\text{EBO}}$	Emitter-base breakdown voltage ( $I_{\text{C}} = 0$ )	$I_{\text{E}} = 10\text{ mA}$	9		18	V
$V_{\text{CEO(sus)}}^{(1)}$	Collector-emitter sustaining voltage ( $I_{\text{B}} = 0$ )	$I_{\text{C}} = 100\text{ mA}$	400			V
$V_{\text{CE(sat)}}^{(1)}$	Collector-emitter saturation voltage	$I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 0.2\text{ A}$			1	V
		$I_{\text{C}} = 2.5\text{ A}$ $I_{\text{B}} = 0.5\text{ A}$			1.5	V
		$I_{\text{C}} = 3.5\text{ A}$ $I_{\text{B}} = 0.7\text{ A}$		0.5		V
$V_{\text{BE(sat)}}^{(1)}$	Base-emitter saturation voltage	$I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 0.2\text{ A}$			1.2	V
		$I_{\text{C}} = 2.5\text{ A}$ $I_{\text{B}} = 0.5\text{ A}$			1.3	V
$h_{\text{FE}}^{(1)}$	DC current gain	$I_{\text{C}} = 10\text{ mA}$ $V_{\text{CE}} = 5\text{ V}$	10			
		$I_{\text{C}} = 2\text{ A}$ $V_{\text{CE}} = 5\text{ V}$	10		32	
$t_{\text{s}}$ $t_{\text{f}}$	Inductive load Storage time Fall time	$V_{\text{CC}} = 200\text{ V}$ $I_{\text{C}} = 2\text{ A}$				
		$I_{\text{B1}} = 0.4\text{ A}$ $V_{\text{BE(off)}} = -5\text{ V}$ $R_{\text{BB}} = 0$ $L = 200\text{ }\mu\text{H}$		0.6 0.1		$\mu\text{s}$ $\mu\text{s}$

1. Pulse test: pulse duration  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 1.5\%$ .

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

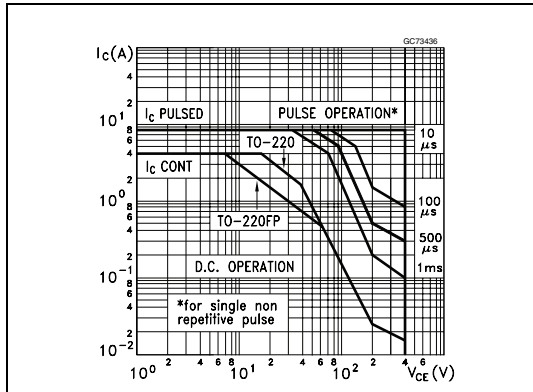


Figure 3. Derating curve

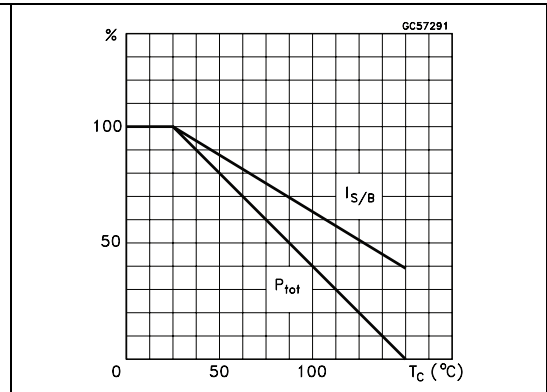


Figure 4. DC current gain ( $V_{CE} = 1.5$  V)

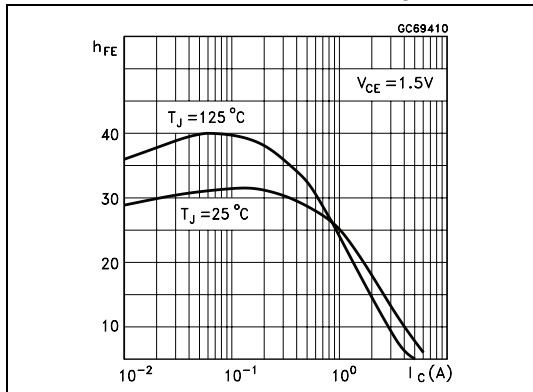


Figure 5. DC current gain ( $V_{CE} = 5$  V)

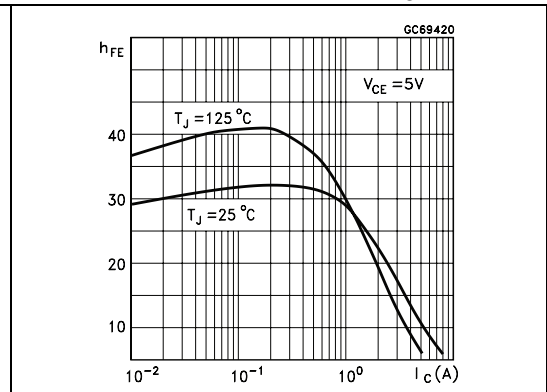


Figure 6. Collector-emitter saturation voltage

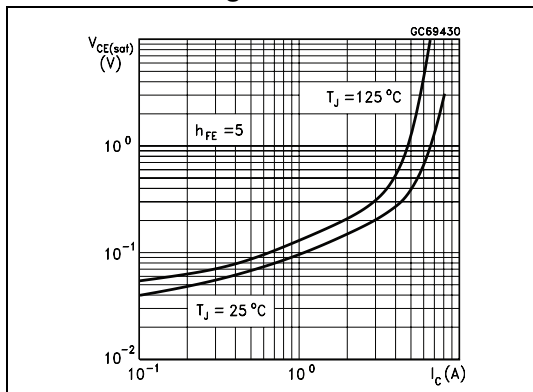


Figure 7. Base-emitter saturation voltage

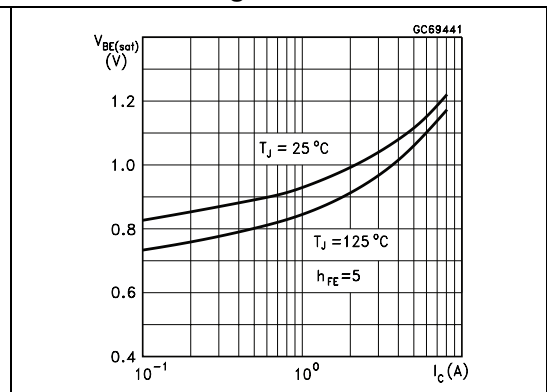


Figure 8. Inductive load fall time

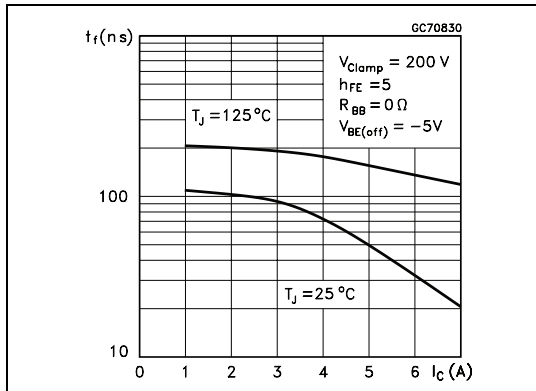


Figure 9. Inductive load storage time

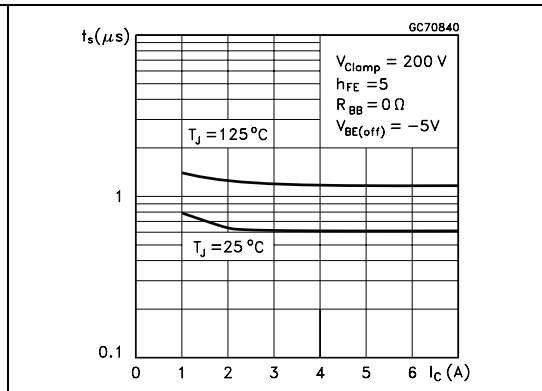


Figure 10. Resistive load fall time

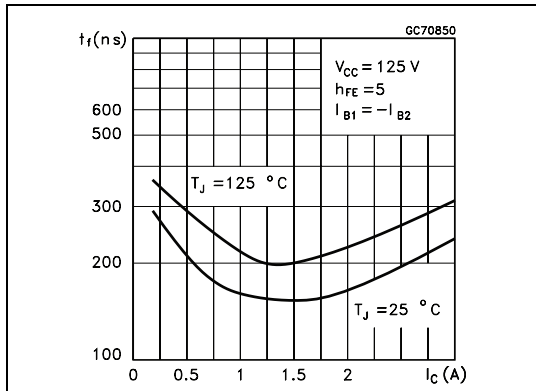


Figure 11. Resistive load storage time

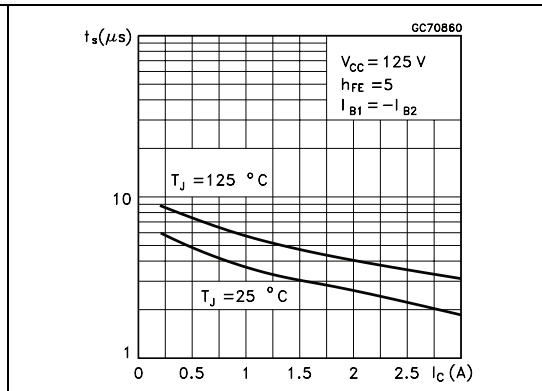
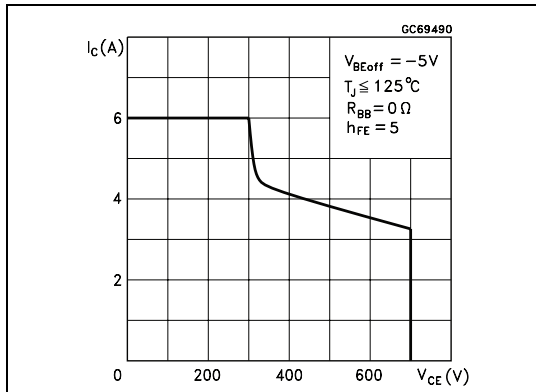


Figure 12. Reverse biased SOA



### 3 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](http://www.st.com). ECOPACK is an ST trademark.

Table 5. TO-220 type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		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	
∅P	3.75		3.85
Q	2.65		2.95



Figure 13. TO-220 type A drawing

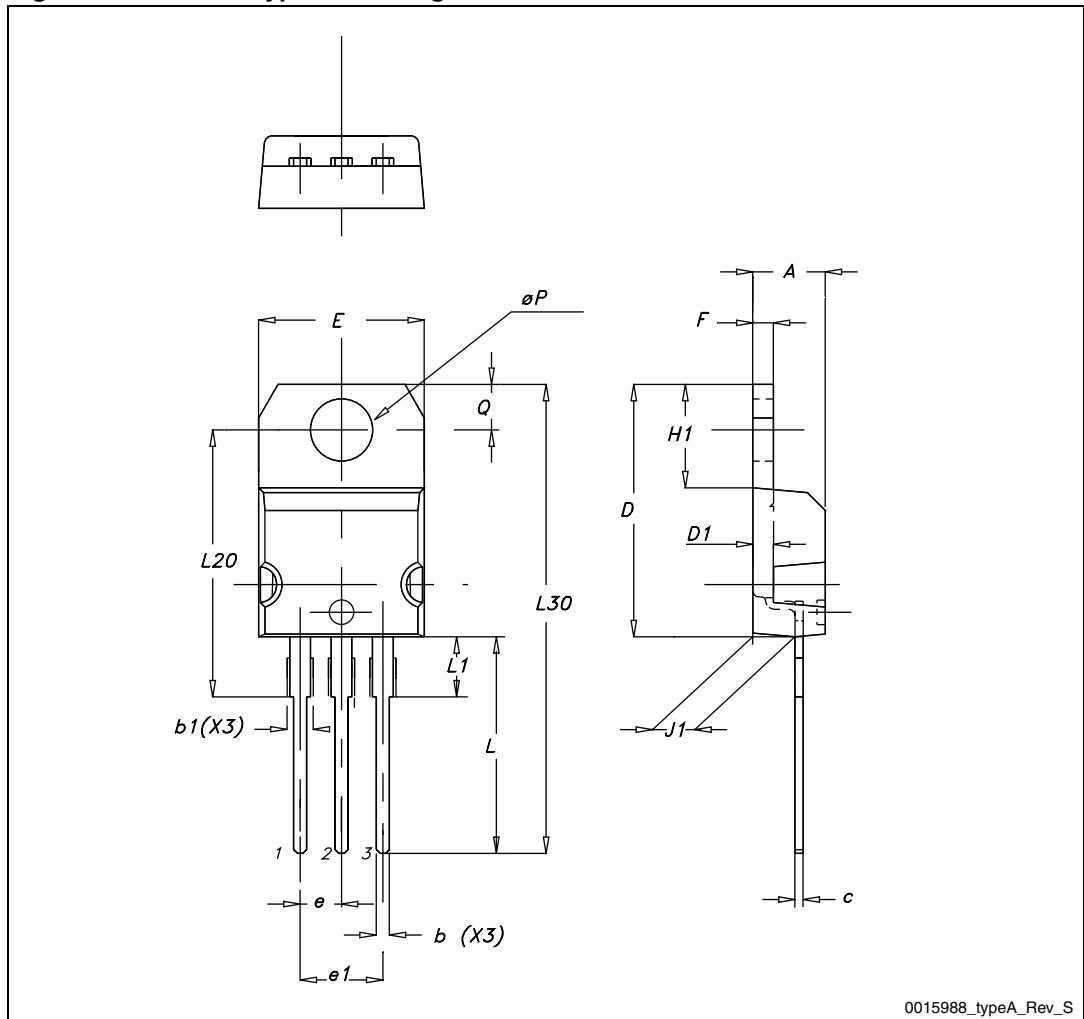
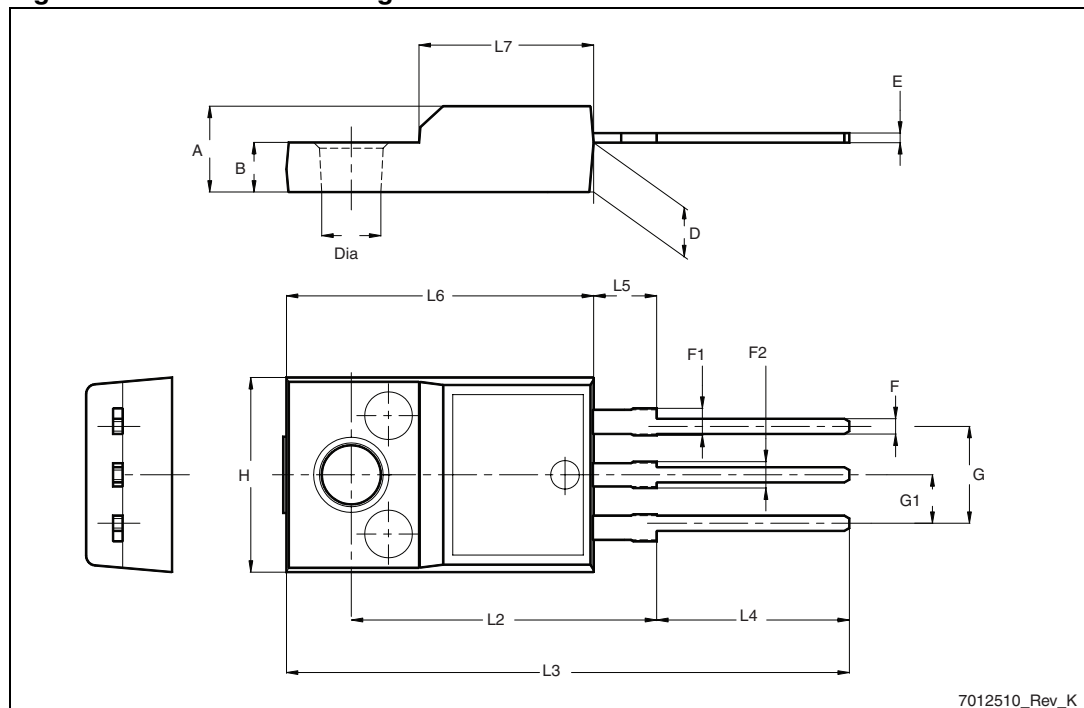


Table 6. TO-220FP mechanical data

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 14. TO-220FP drawing



7012510\_Rev\_K

## 4 Revision history

Table 7. Document revision history

Date	Revision	Changes
27-Jun-2011	1	First release

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### Наши контакты:

**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331