

## High voltage fast-switching NPN power transistor

### Features

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

### Applications

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

### Description

The device is manufactured using high voltage multi epitaxial planar technology for high switching speeds and medium voltage capability. It uses a cellular emitter structure with planar edge termination to enhance switching speeds while maintaining the wide RBSOA. The device is designed for use in lighting applications and low cost switch-mode power supplies.

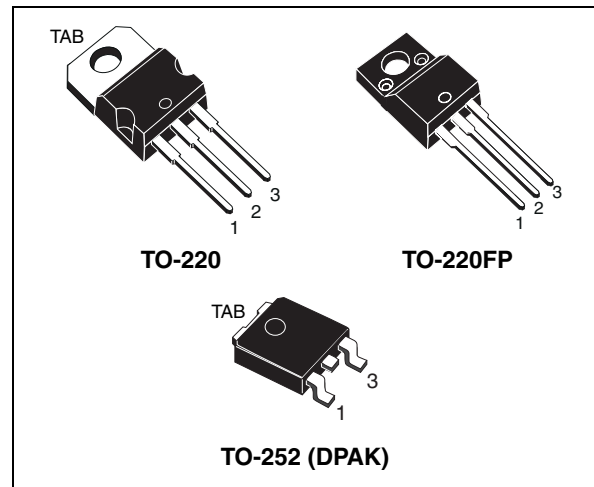


Figure 1. Internal schematic diagram

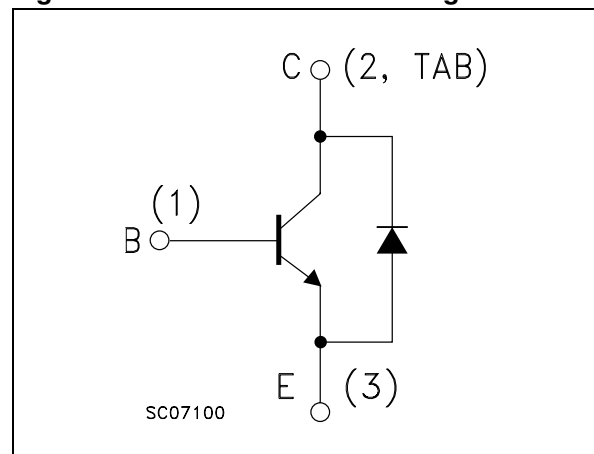


Table 1. Device summary

Order codes	Marking	Packages	Packaging
STL128DN	L128DN	TO-220	Tube
STL128DNFP	L128DNFP	TO-220FP	Tube
STLD128DNT4	LD128DN	DPAK	Tape and reel

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-emitter voltage ( $V_{BE} = 0$ )	700	V
$V_{CEO}$	Collector-emitter voltage ( $I_B = 0$ )	400	V
$V_{EBO}$	Base-emitter voltage ( $I_C = 0$ , $I_B = 2$ A, $t_P < 10$ $\mu$ s)	$V_{(BR)EBO}$	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
$P_{TOT}$	Total dissipation at $T_c = 25$ °C for TO-220	60	W
	Total dissipation at $T_c = 25$ °C for TO-220FP	28	W
	Total dissipation at $T_c = 25$ °C for DPAK	20	W
$T_{stg}$	Storage temperature	-65 to 150	°C
$T_J$	Max. operating junction temperature	150	°C

**Table 3. Thermal data**

Symbol	Parameter	TO-220	TO-220FP	DPAK	Unit
$R_{thJC}$	Thermal resistance junction-case max	2.08	4.46	6.25	°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 ( $I_{\text{B}} = 0$ )	$I_{\text{C}} = 10\text{ mA}$	400			V
$V_{\text{CE(sat)}}^{(1)}$	Collector-emitter saturation voltage	$I_{\text{C}} = 1\text{ A}$ $I_{\text{B}} = 0.2\text{ A}$			0.5	V
		$I_{\text{C}} = 2\text{ A}$ $I_{\text{B}} = 0.4\text{ A}$			1	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
		$I_{\text{C}} = 2\text{ A}$ $I_{\text{B}} = 0.4\text{ A}$			1.3	V
$h_{\text{FE}}^{(1)}$	DC current gain	$I_{\text{C}} = 10\text{ mA}$ $V_{\text{CE}} = 5\text{ V}$	10			
		$I_{\text{C}} = 2\text{ A}$ $V_{\text{CE}} = 5\text{ V}$	8		24	
$V_{\text{F}}$	Diode forward voltage	$I_{\text{F}} = 1\text{ A}$			2.5	V
$t_{\text{s}}$ $t_{\text{f}}$	Resistive load					
	Storage time	$I_{\text{C}} = 1\text{ A}$ $I_{\text{B1}} = -I_{\text{B2}} = 0.2\text{ A}$			4.5	$\mu\text{s}$
	Fall time	$V_{\text{CC}} = 125\text{ V}$ $t_{\text{p}} = 20\text{ }\mu\text{s}$			0.4	$\mu\text{s}$

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

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220

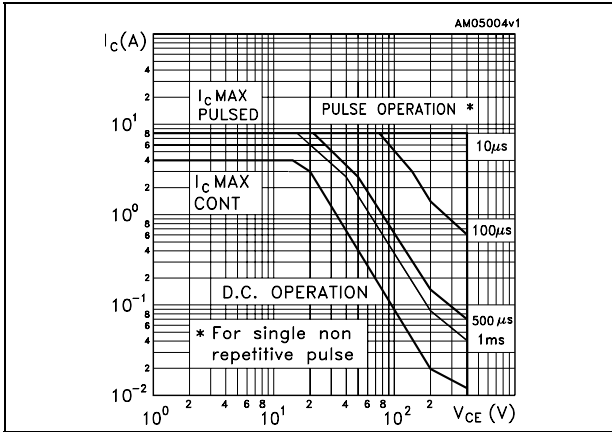


Figure 3. Safe operating area for TO-220FP

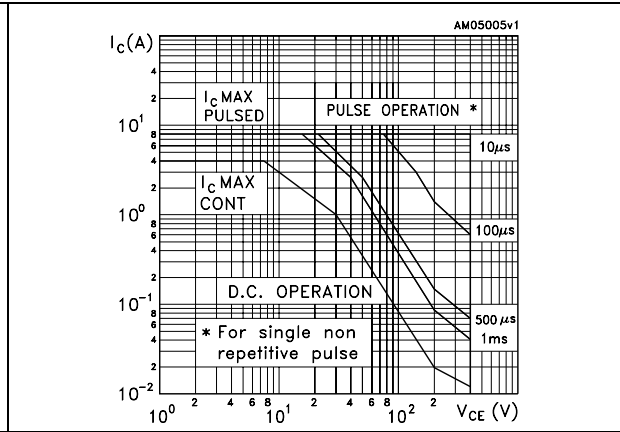


Figure 4. Safe operating area for DPAK

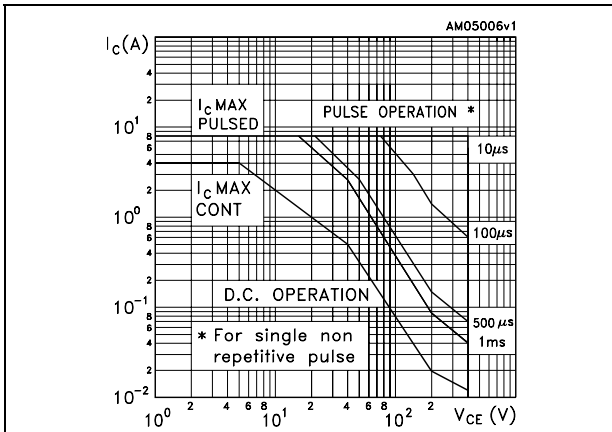


Figure 5. Derating curve

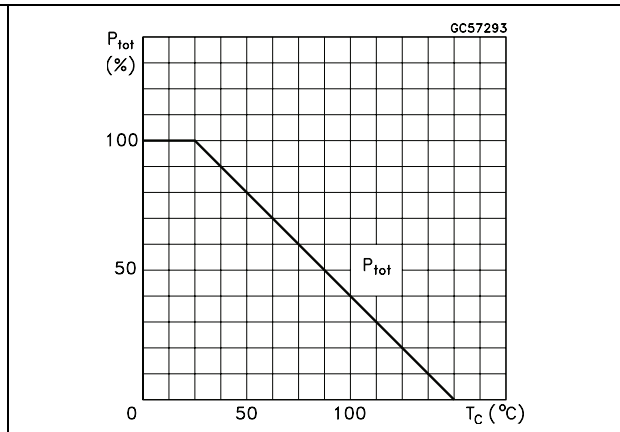


Figure 6. DC current gain ( $V_{CE} = 1$  V)

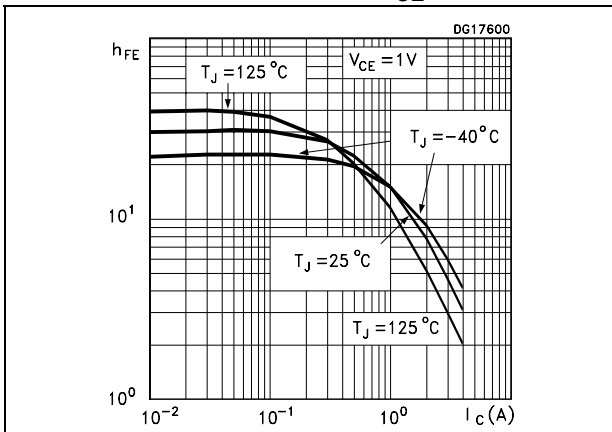


Figure 7. DC current gain ( $V_{CE} = 5$  V)

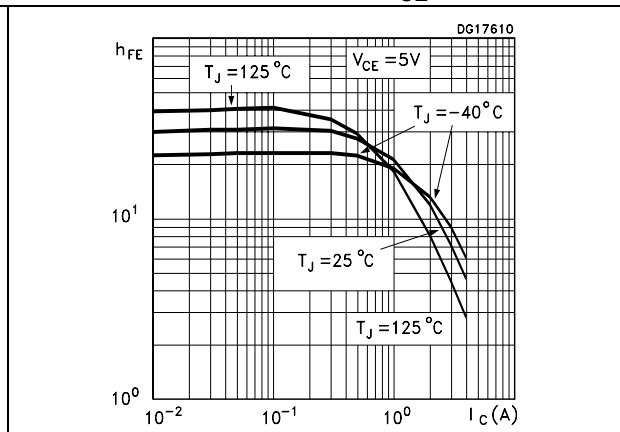


Figure 8. Collector-emitter saturation voltage Figure 9. Base-emitter saturation voltage

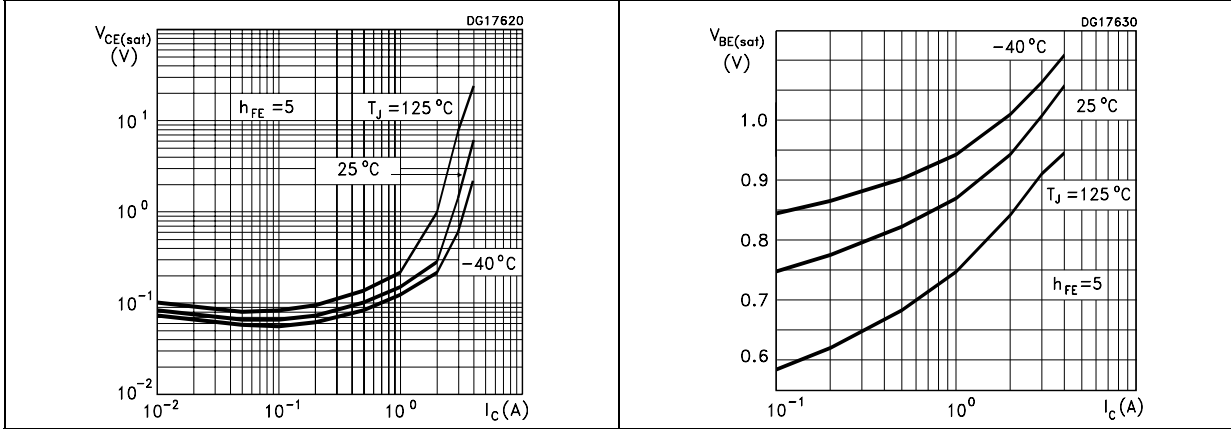


Figure 10. Freewheel diode forward voltage Figure 11. Resistive load switching time

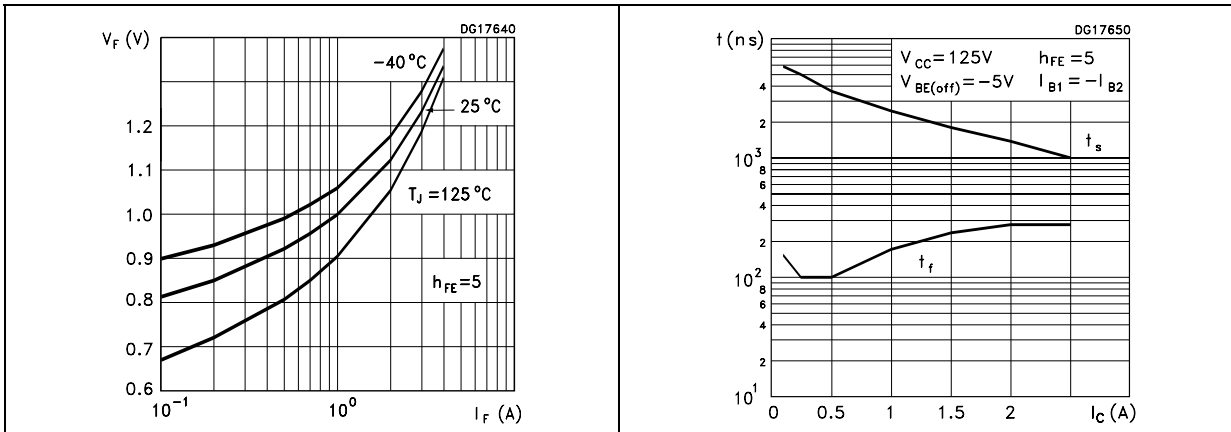
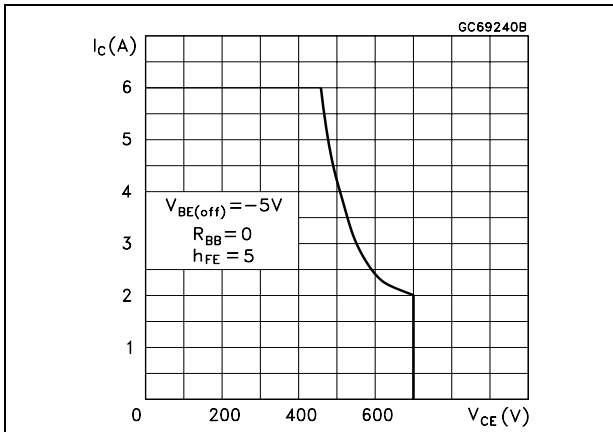
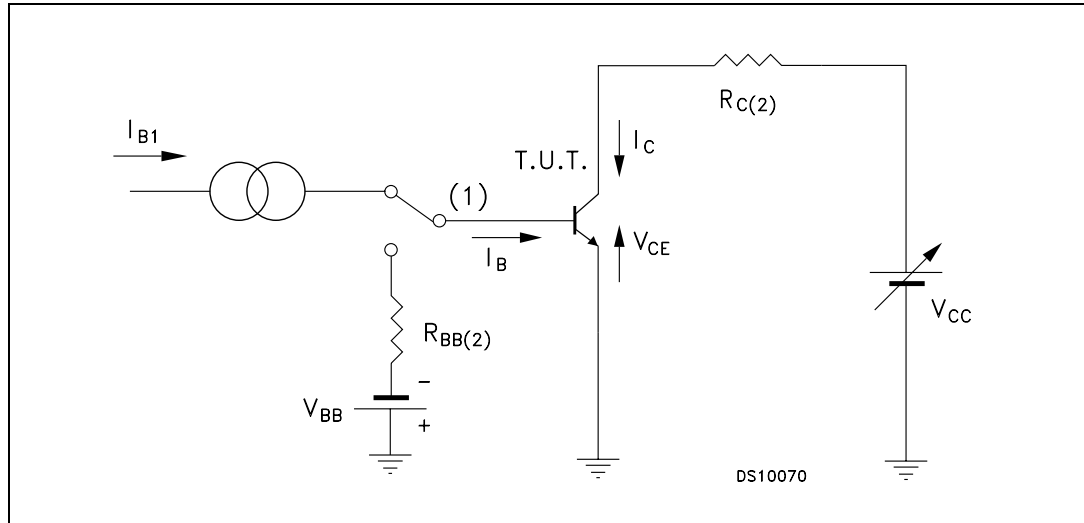


Figure 12. Reverse biased safe operating area



### 3 Test circuit

Figure 13. Resistive load switching test circuit



1. Fast electronic switch
2. Non-inductive resistor

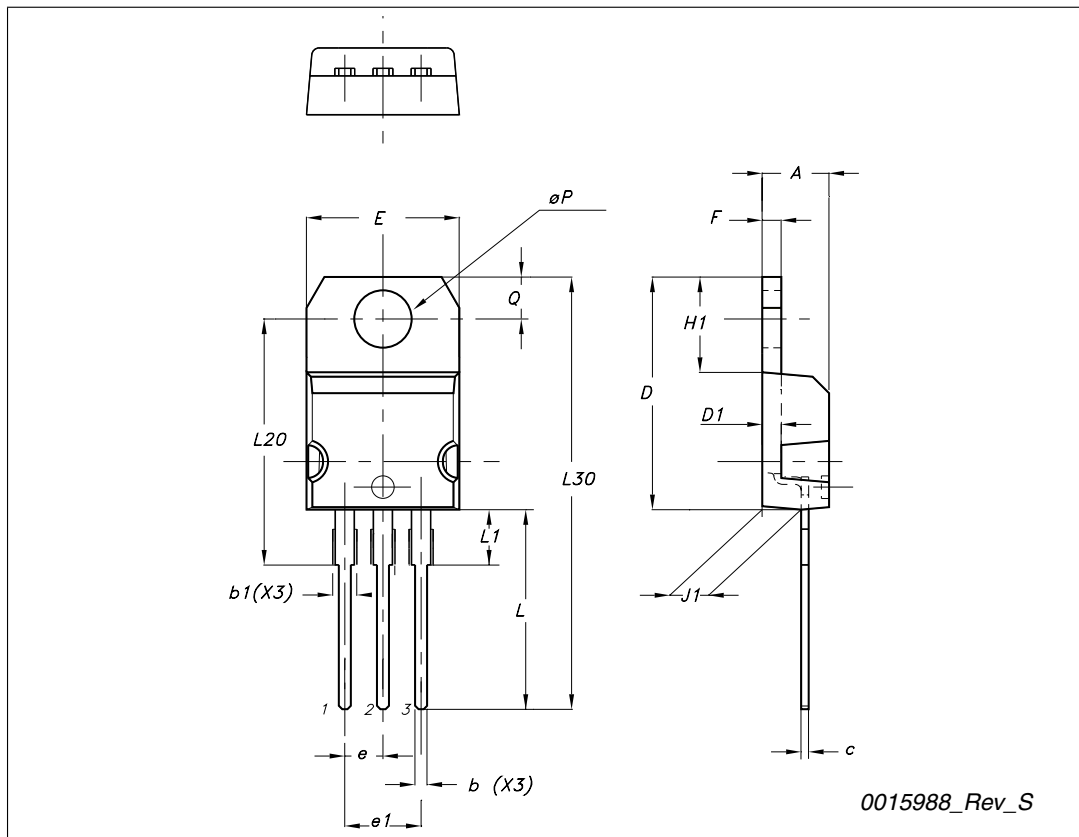
## 4 Package mechanical data

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.



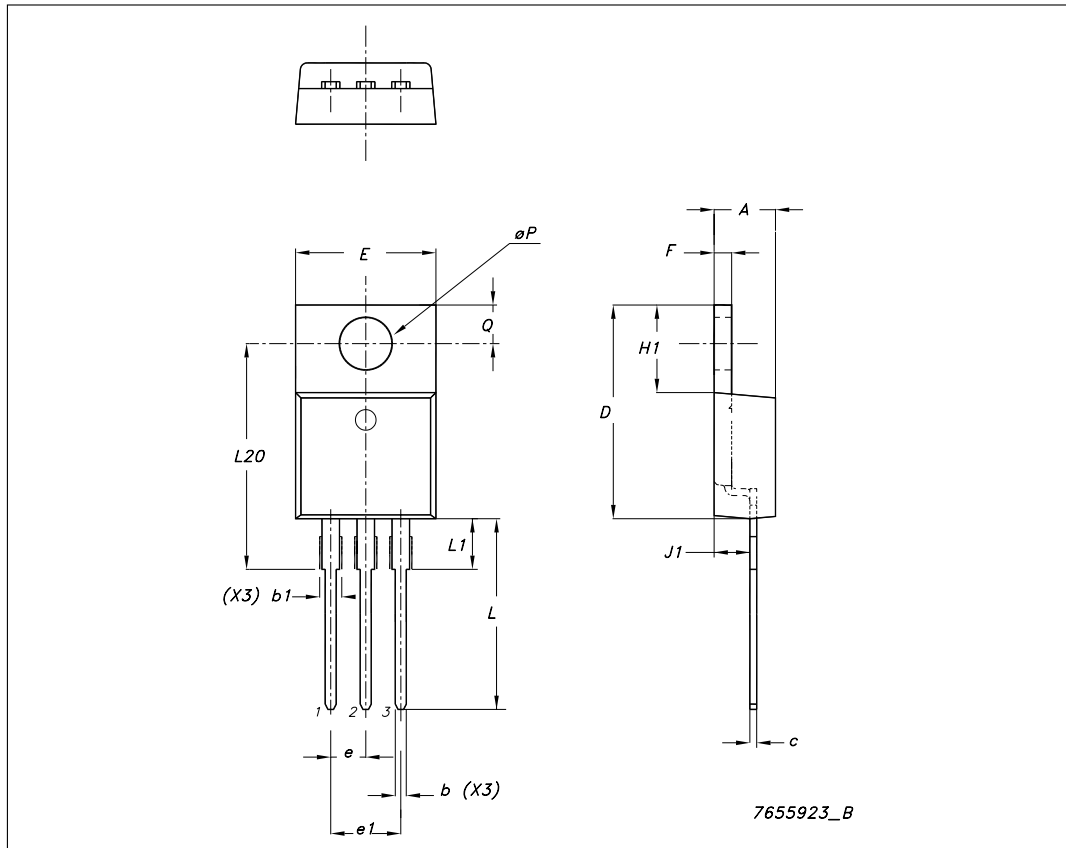
**TO-220 type A mechanical data**

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



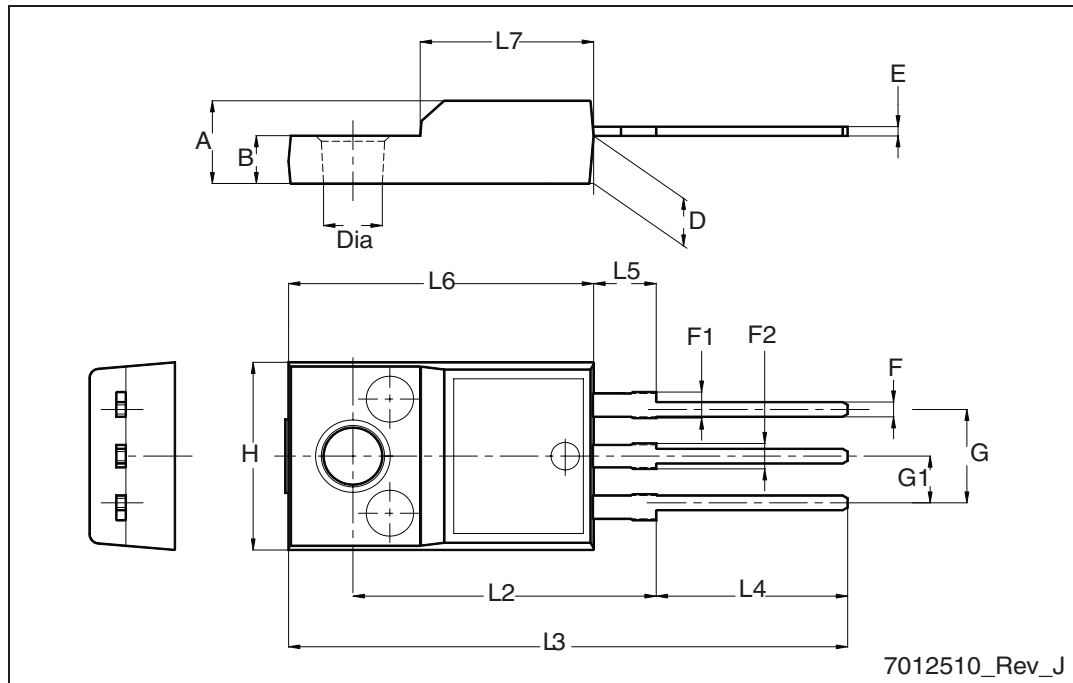
TO-220 type E mechanical data

Dim	mm		
	Min	Typ	Max
A	4.47		4.67
b	0.70		0.91
b1	1.17		1.37
c	0.31		0.53
D	14.60		15.70
E	9.96		10.36
e		2.54	
e1	4.98	5.08	5.18
F	1.17		1.37
H1	6.10		6.80
J1	2.52		2.82
L	12.70		13.80
L1	3.20		3.96
L20	15.21		16.77
øP	3.73		3.94
Q	2.59		2.89



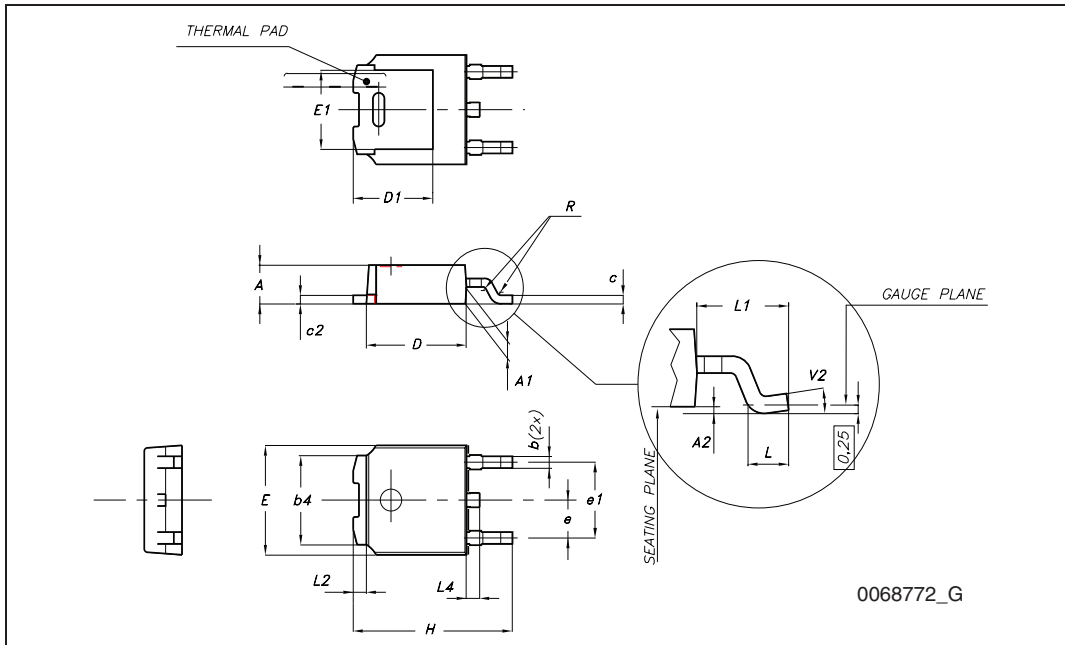
TO-220FP mechanical data

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		1.5
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



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
04-Oct-2007	1	First release
14-Feb-2008	2	Updated TO-220, type E, mechanical data
01-Oct-2009	3	Updated: collector and base current values <a href="#">Table 2 on page 3</a> , $V_{CE(sat)}$ maximum values <a href="#">Table 4 on page 4</a> .

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