STX13005

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

Applications

- Compact fluorescent lamp (CFL)
- Switch mode power supplies (AC-DC 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.

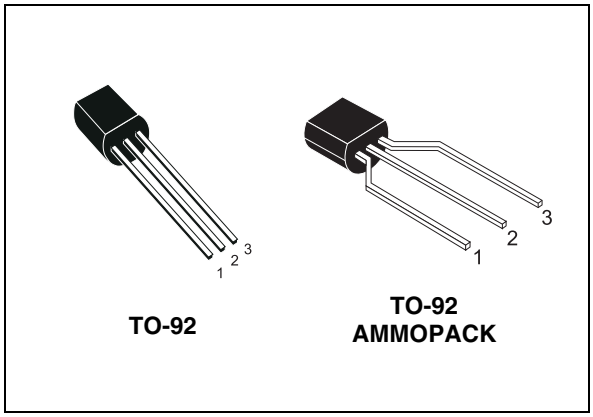


Figure 1. Internal schematic diagram

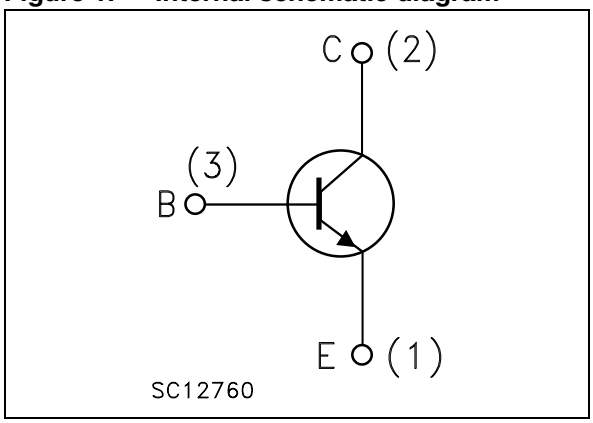


Table 1. Device summary[1]

Order code	Marking	Package	Packaging
STX13005	X13005	TO-92	Bulk
STX13005G	X13005G		
STX13005-AP	X13005		Ammopack
STX13005G-AP	X13005G		

1. The letter "G" in the order code suffix identifies the product as ECOPACK®2 grade. Please see *Section 4* for details.

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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}	Emitter-base voltage (I_C = 0; I_B = 1.5 A; t_p < 10 ms)	$V_{(BR)EBO}$	V
I_C	Collector current	3	A
I_{CM}	Collector peak current (t_P < 5ms)	6	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°C	2.8	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
$R_{thj\text{-}c}$	Thermal resistance junction-case	max	45	°C/W

2 Electrical characteristics

(T_{case} = 25°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)	V_{CE} =700 V V_{CE} =700 V T_C = 125°C			1 5	mA mA
I_{CEO}	Collector-cut-off current (I_B = 0)	V_{CE} = 400 V			1	mA
$V_{(BR)EBO}$	Emitter base breakdown voltage (I_C = 0)	I_E = 10 mA	9		18	V
$V_{CEO(sus)}$ (1)	Collector-emitter sustaining voltage (I_B = 0)	I_C =10 mA	400			V
$V_{CE(sat)}$ (1)	Collector-emitter saturation voltage	I_C = 1A I_B = 200 mA I_C = 2A I_B = 500 mA I_C = 3A I_B = 750 mA			0.5 0.6 5	V V V
$V_{BE(sat)}$ (1)	Base-emitter saturation voltage	I_C = 1A I_B = 200 mA I_C = 2A I_B = 500 mA			1.2 1.6	V V
h_{FE} (1)	DC current gain	I_C = 1 A V_{CE} = 5 V I_C = 2 A V_{CE} = 5 V	10 8		30 24	
 t_s t_f	Resistive load Storage time Fall time	I_C = 2 A V_{CC} = 125 V I_{B1} = $-I_{B2}$ = 400 mA t_p = 30 µs		 1.65 260		 µs ns
 t_s t_f	Inductive load Storage time Fall time	I_C = 1 A V_{clamp} =300 V I_{B1} = 200 mA $V_{BE(off)}$ = -5 V L = 50 mH R_{BB} = 0		 0.8 150		 µs ns

1. Pulse test: pulse duration ≤300 µs, duty cycle ≤2 %

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area @T_C = 25°C

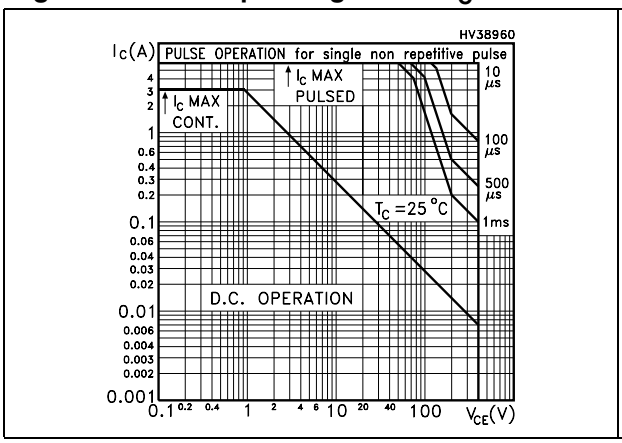


Figure 3. Safe operating area @T_C = 135°C

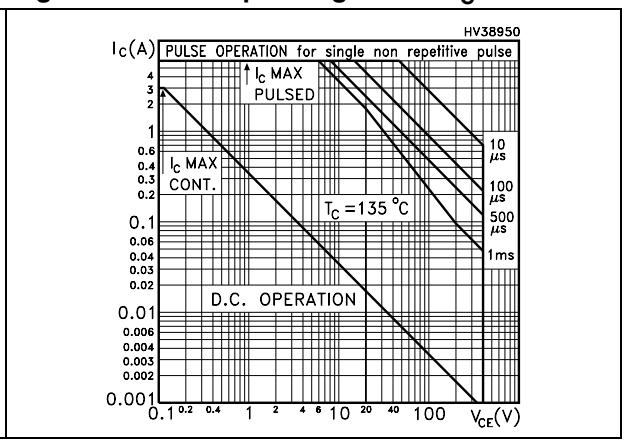


Figure 4. Derating curve

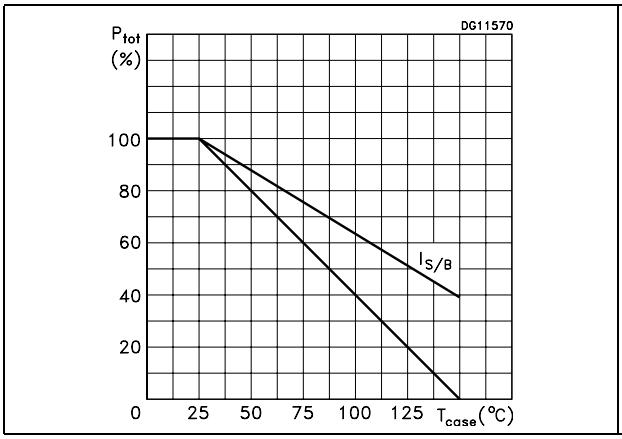


Figure 5. Output characteristics

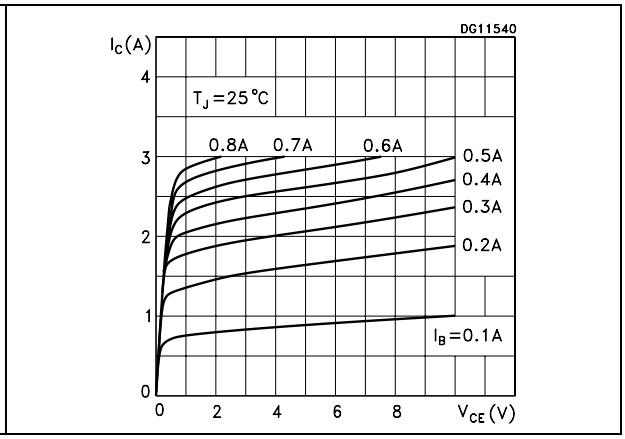


Figure 6. DC current gain @V_{CE} = 1 V

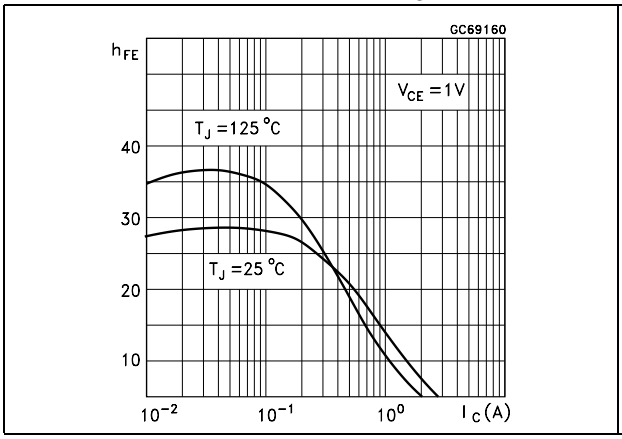


Figure 7. DC current gain @V_{CE} = 5 V

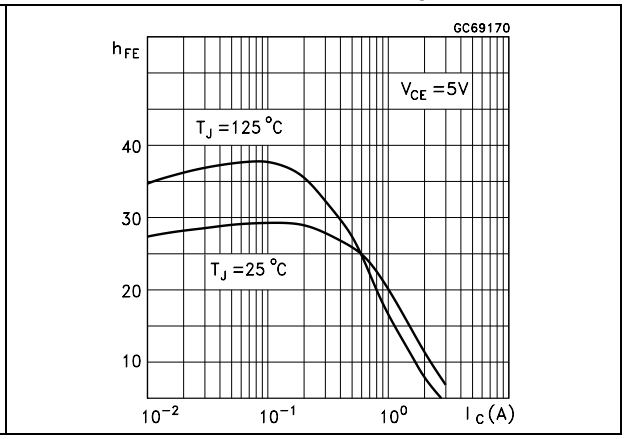


Figure 8. Collector-emitter saturation voltage

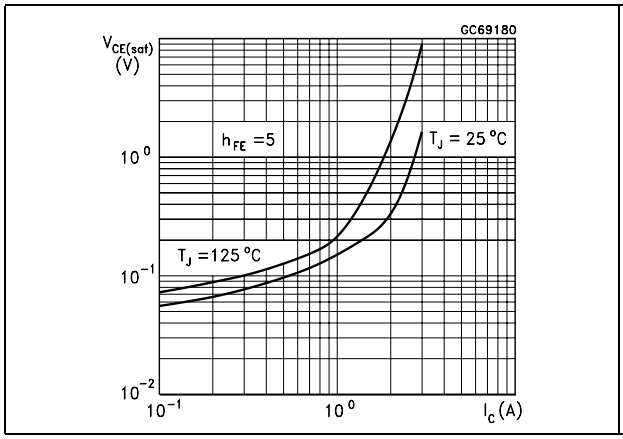


Figure 9. Base-emitter saturation voltage

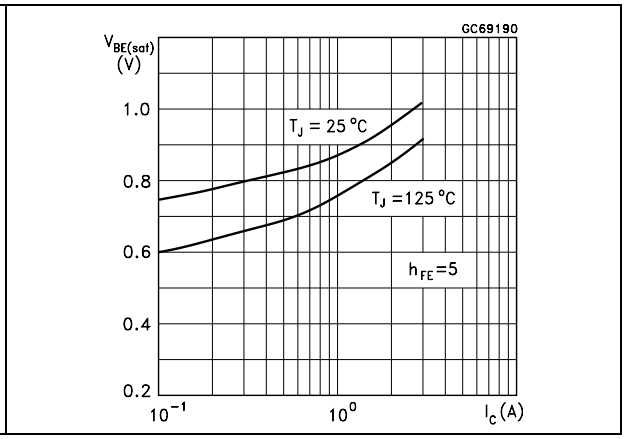


Figure 10. Inductive load fall time

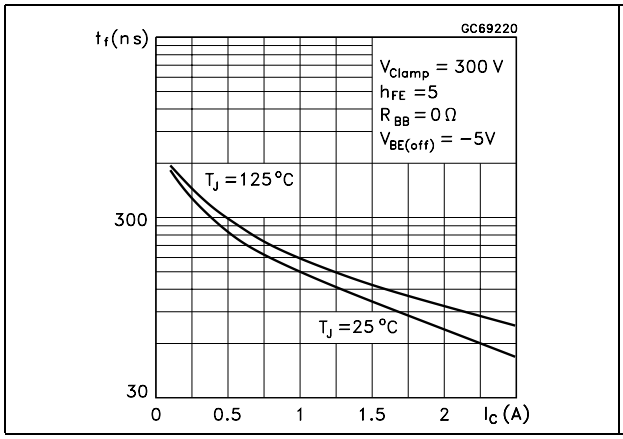


Figure 11. Inductive load storage time

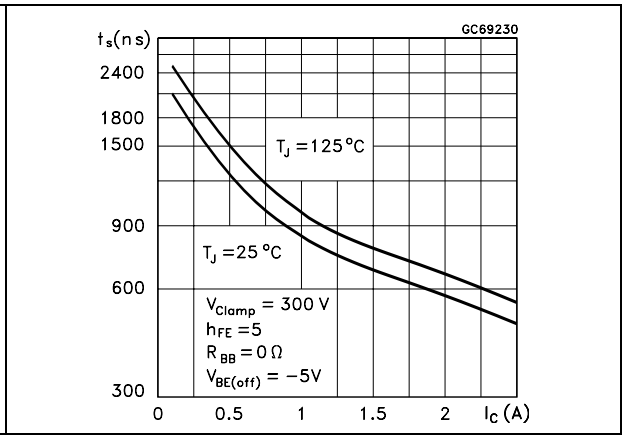


Figure 12. Resistive load fall time

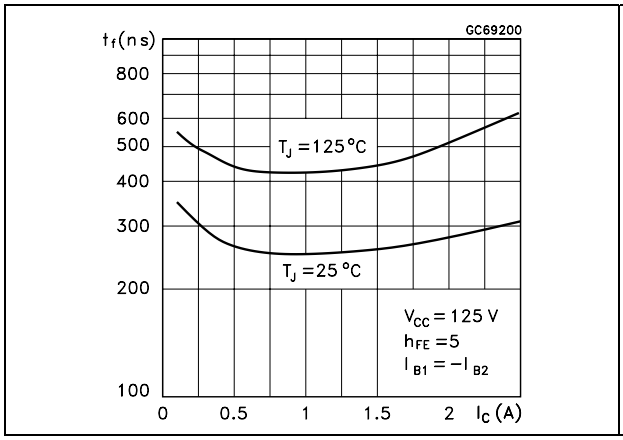


Figure 13. Resistive load storage time

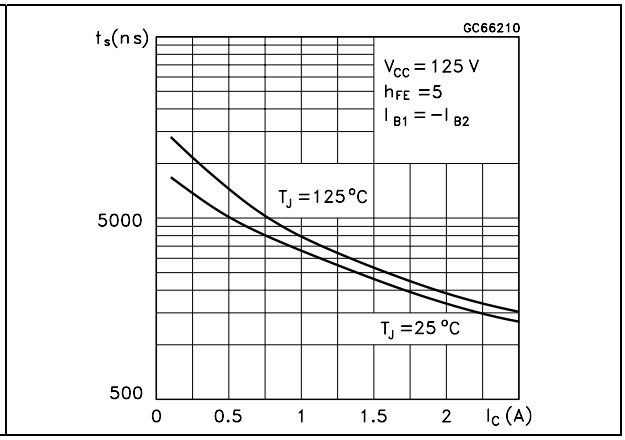
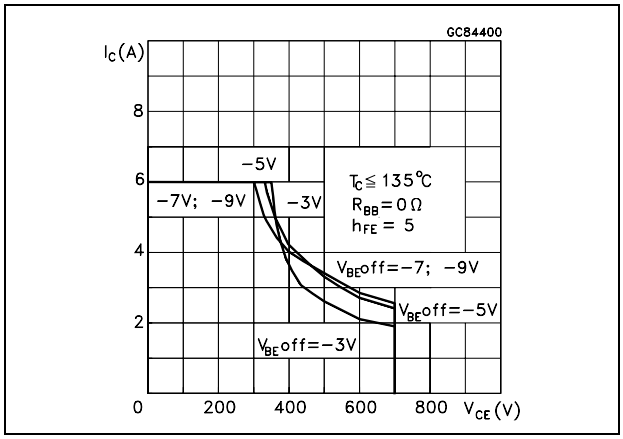
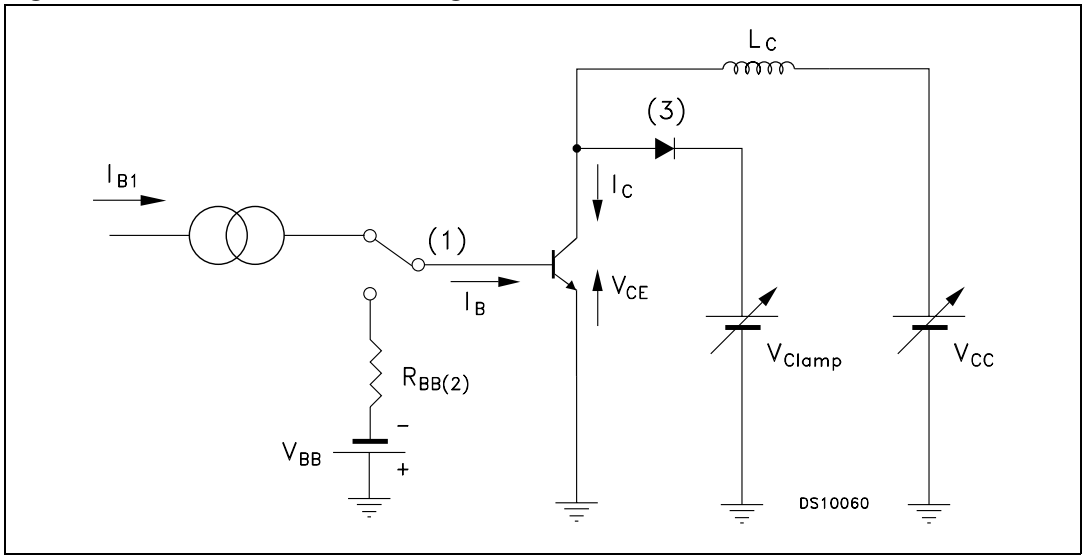


Figure 14. Reverse biased SOA



3 Test circuits

Figure 15. Inductive load switching test circuit

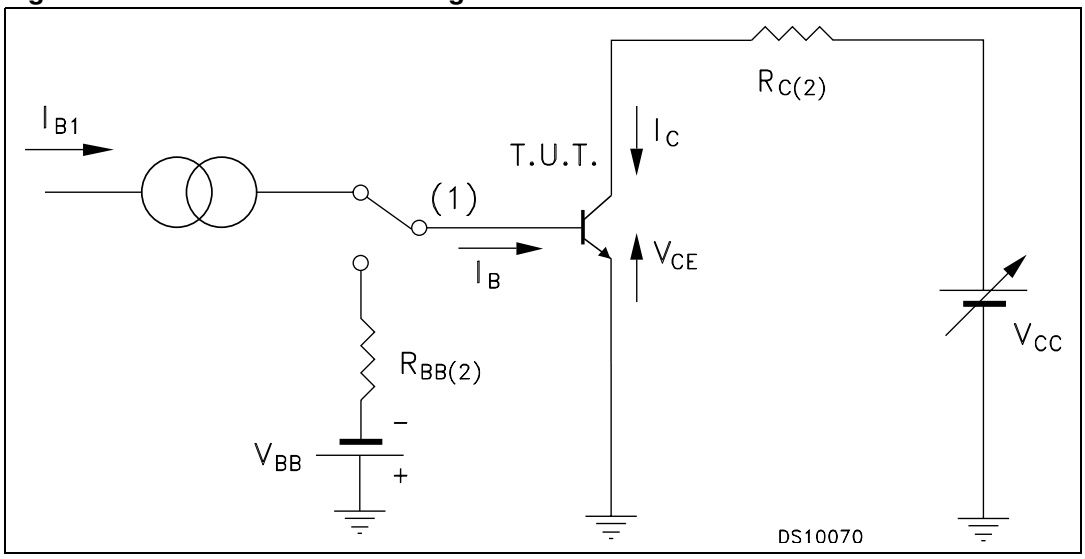


1) Fast electronic switch

2) Non-inductive resistor

3) Fast recovery rectifier

Figure 16. Resistive load switching test circuit



1) Fast electronic switch

2) Non-inductive resistor

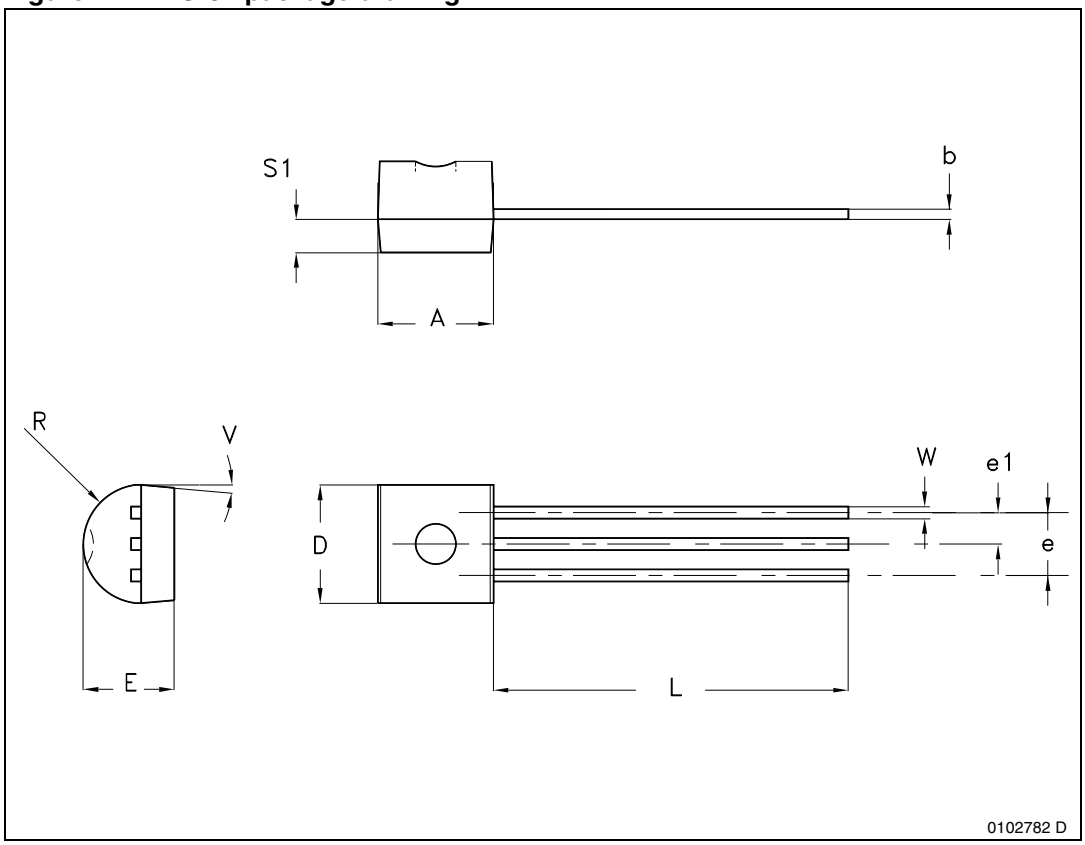
4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK® is an ST trademark.

Table 5. TO-92 package mechanical data

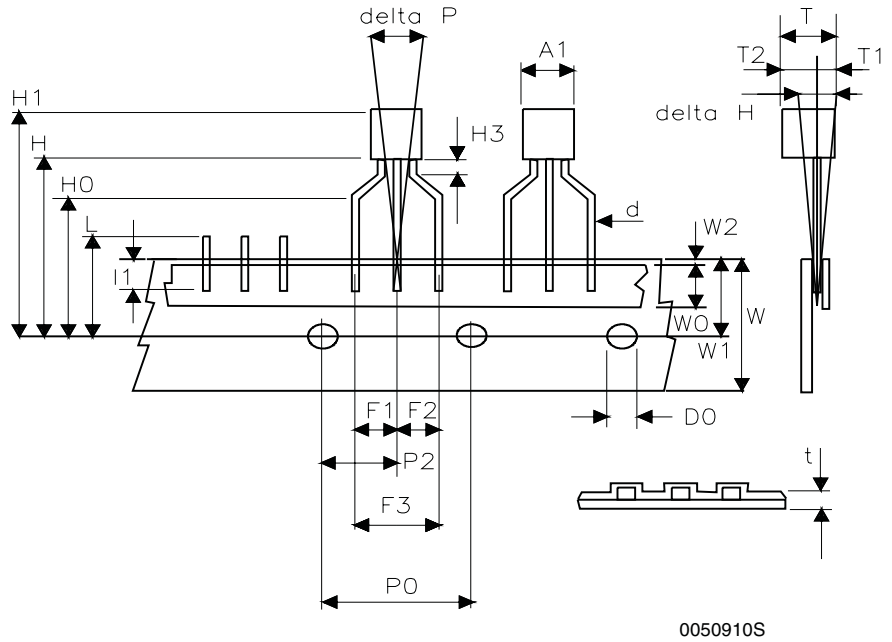
Dim.	mm		
	Min.	Typ.	Max.
A	4.32		4.95
b	0.36		0.51
D	4.45		4.95
E	3.30		3.94
e	2.41		2.67
e1	1.14		1.40
L	12.70		15.49
R	2.16		2.41
S1	0.92		1.52
W	0.41		0.56
V		5°	

Figure 17. TO-92 package drawing



TO-92 ammopack shipment (suffix"-AP") mechanical data

Dim.	mm		
	Min	Typ	Max
A1			4.80
T			3.80
T1			1.60
T2			2.30
d			0.48
P0	12.50	12.70	12.90
P2	5.65	6.35	7.05
F1,F2	2.44	2.54	2.94
F3	4.98	5.08	5.48
delta H	-2.00		2.00
W	17.50	18.00	19.00
W0	5.70	6.00	6.30
W1	8.50	9.00	9.25
W2			0.50
H	18.50		20.50
H3	0.5	1	1.5
H0	15.50	16.00	16.50
H1			25.00
D0	3.80	4.00	4.20
t			0.90
L			11.00
I1	3.00		
delta P	-1.00		1.00



5 Revision history

Table 6. Document revision history

Date	Revision	Changes
01-Jul-2004	1	First release.
11-Feb-2005	2	New table on page 1
02-Aug-2007	3	New *Figure 3* and updated *Figure 14*
28-Sep-2007	4	Updated *Figure 2* and *Figure 3*
16-Dec-2008	5	Added ECOPACK®2 grade products with suffix “G”
11-Aug-2009	6	Updated TO-92 mechanical data and *Figure 1: Internal schematic diagram*

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