

## High voltage fast-switching NPN power transistor

### Features

- Integrated antiparallel collector-emitter diode
- High voltage capability
- Minimum lot-to-lot spread for reliable operation
- Very high switching speed

### 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.

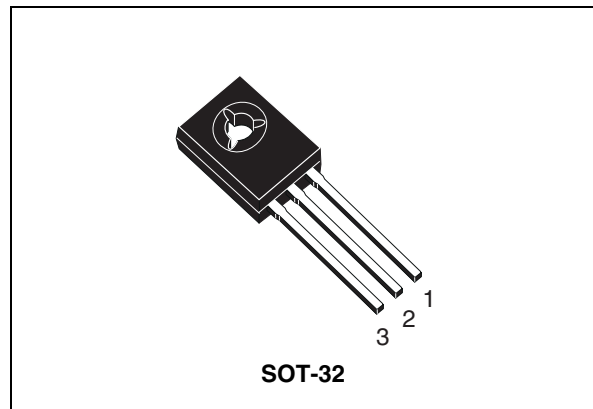


Figure 1. Internal schematic diagram

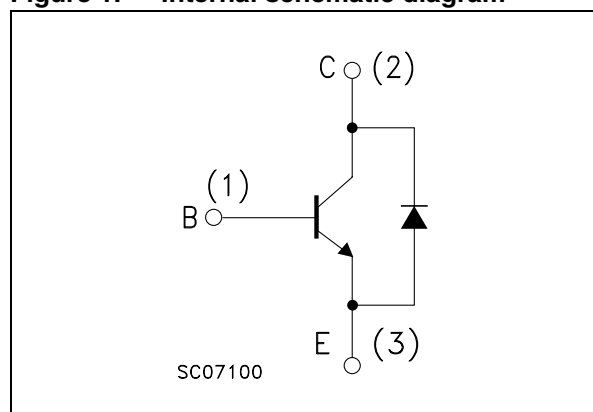


Table 1. Device summary

Order codes	Marking	Package	Packaging
STT13005D	T13005D	SOT-32	Tube
STT13005D-K	T13005D	SOT-32	Bag

# 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 ( $I_C = 0$ )	9	V
$I_C$	Collector current	2	A
$I_{CM}$	Collector peak current ( $t_p < 5$ ms)	4	A
$I_B$	Base current	1	A
$I_{BM}$	Base peak current ( $t_p < 5$ ms)	2	A
$P_{TOT}$	Total dissipation at $T_c = 25$ °C	45	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
$R_{thJC}$	Thermal resistance junction-case	Max 2.8	°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	$\mu\text{A}$
$V_{\text{EBO}}$	Emitter-base voltage ( $I_{\text{C}} = 0$ )	$I_{\text{E}} = 10\text{ mA}$	9			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	$I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 125\text{ mA}$			0.5	V
		$I_{\text{C}} = 0.8\text{ A}$ $I_{\text{B}} = 0.2\text{ A}$			1	V
		$I_{\text{C}} = 1.6\text{ A}$ $I_{\text{B}} = 0.4\text{ A}$			1.5	V
$V_{\text{BE(sat)}}^{(1)}$	Base-emitter saturation voltage	$I_{\text{C}} = 0.5\text{ A}$ $I_{\text{B}} = 125\text{ mA}$			1	V
		$I_{\text{C}} = 0.8\text{ A}$ $I_{\text{B}} = 0.2\text{ A}$			1.3	V
		$I_{\text{C}} = 1.6\text{ A}$ $I_{\text{B}} = 0.4\text{ A}$			1.5	V
$h_{\text{FE}}^{(1)}$	DC current gain	$I_{\text{C}} = 0.5\text{ A}$ $V_{\text{CE}} = 5\text{ V}$	10		50	
		$I_{\text{C}} = 2\text{ A}$ $V_{\text{CE}} = 5\text{ V}$	8			
$t_{\text{r}}$ $t_{\text{s}}$ $t_{\text{f}}$	Resistive load Rise time Storage time Fall time	$I_{\text{C}} = 1\text{ A}$ $V_{\text{CC}} = 125\text{ V}$ $I_{\text{B1}} = -I_{\text{B2}} = 0.2\text{ A}$		0.4	0.7	$\mu\text{s}$
				3.2	4.5	$\mu\text{s}$
				0.25	0.4	$\mu\text{s}$
$t_{\text{s}}$ $t_{\text{f}}$	Inductive load Storage time Fall time	$I_{\text{C}} = 1\text{ A}$ $I_{\text{B1}} = 0.2\text{ A}$ $V_{\text{BE(off)}} = -5\text{ V}$ $L = 50\text{ mH}$ $V_{\text{Clamp}} = 300\text{ V}$		0.8		$\mu\text{s}$
				0.16		$\mu\text{s}$
$V_{\text{F}}$	Diode forward voltage	$I_{\text{F}} = 1\text{ A}$			2.5	V

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

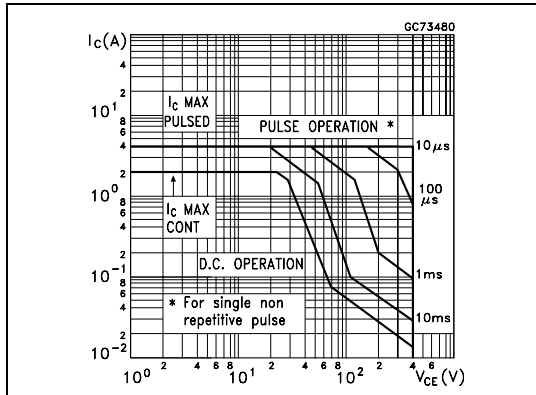


Figure 3. Derating curve

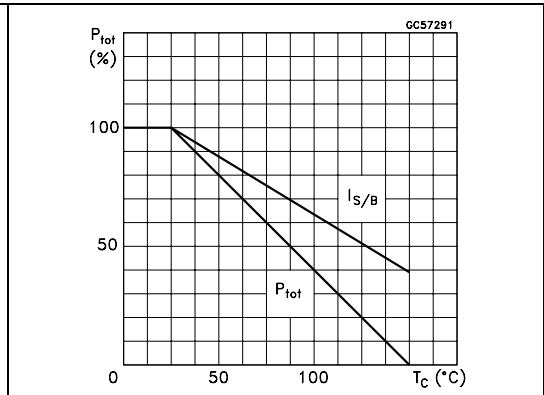


Figure 4. DC current gain ( $V_{CE} = 1$  V)

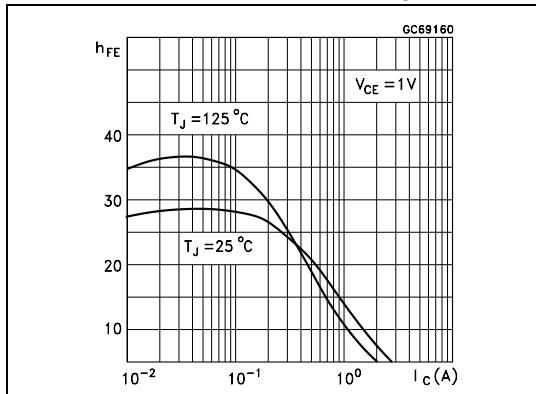


Figure 5. DC current gain ( $V_{CE} = 5$  V)

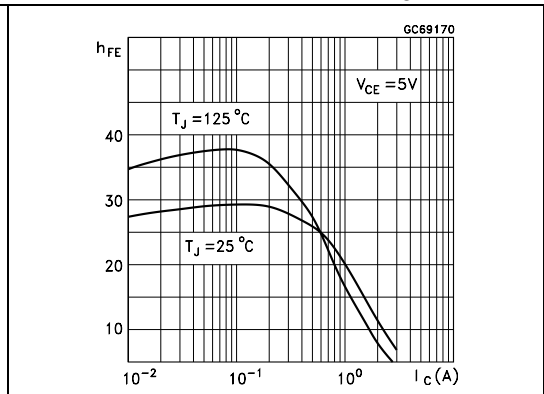


Figure 6. Collector-emitter saturation voltage

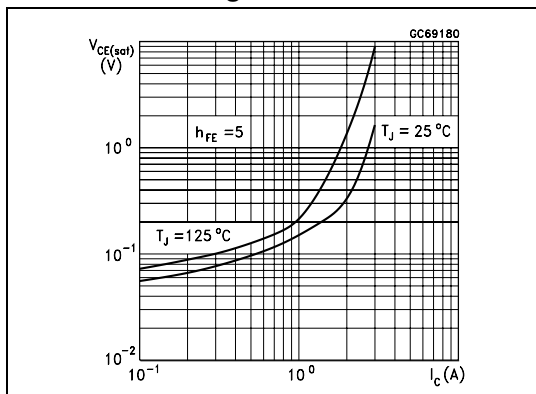


Figure 7. Base-emitter saturation voltage

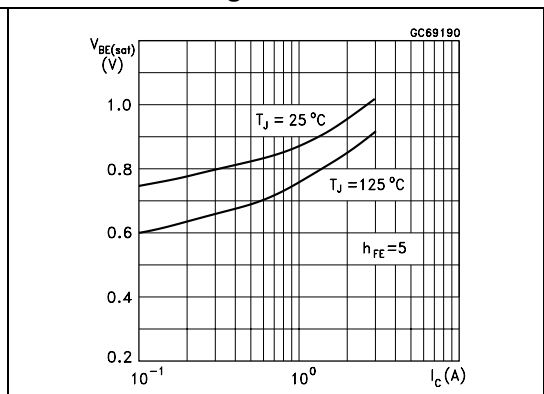


Figure 8. Inductive load fall time

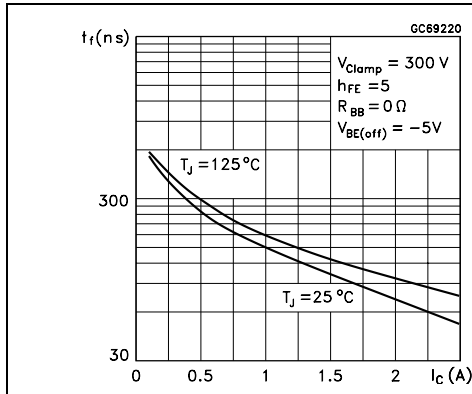


Figure 9. Inductive load storage time

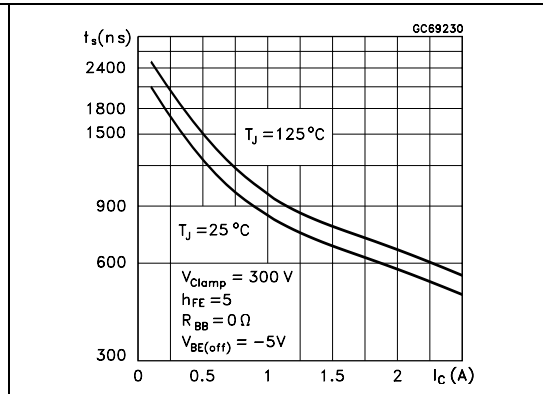


Figure 10. Resistive load fall time

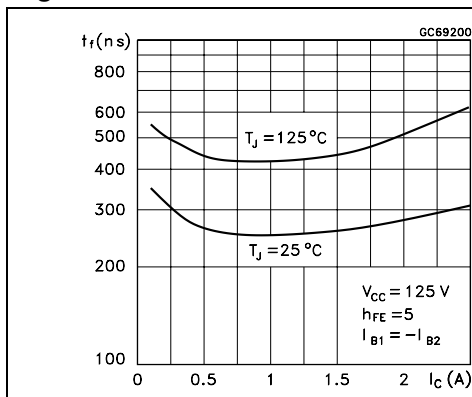


Figure 11. Resistive load storage time

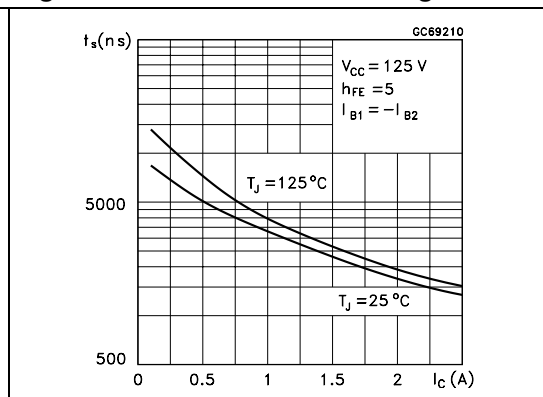
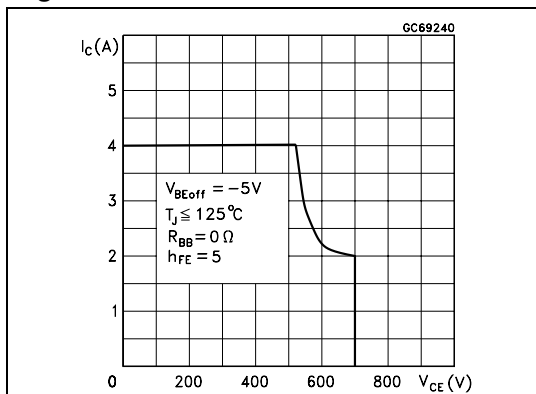
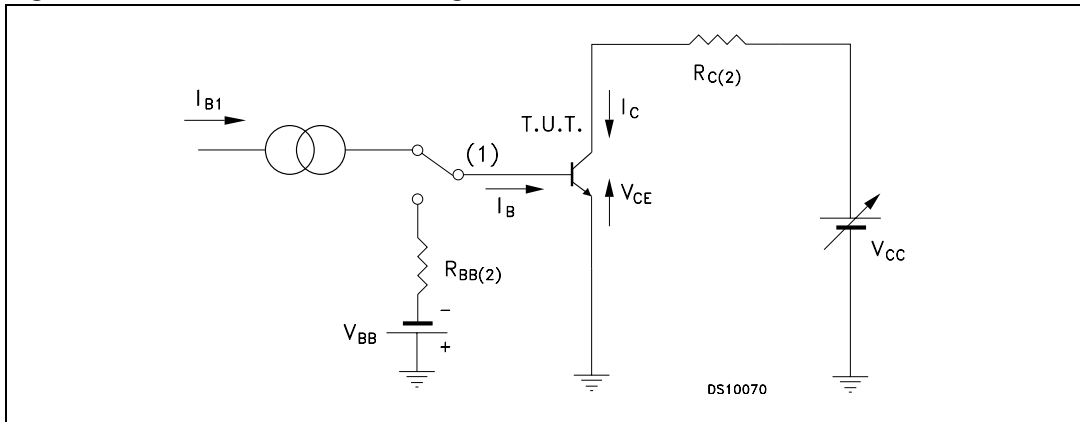


Figure 12. Reverse biased SOA



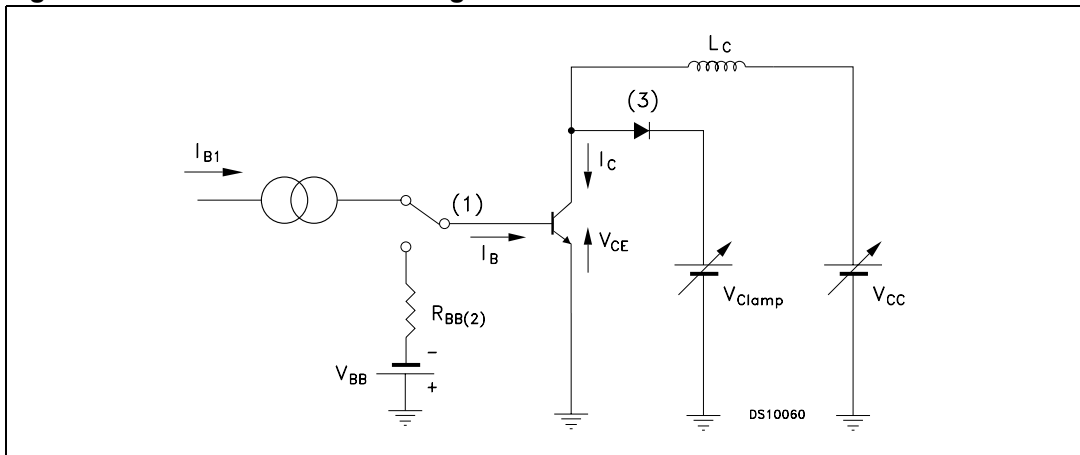
## 2.2 Test circuits

**Figure 13. Resistive load switching test circuit**



1. Fast electronic switch
2. Non-inductive resistor

**Figure 14. Inductive load switching test circuit**



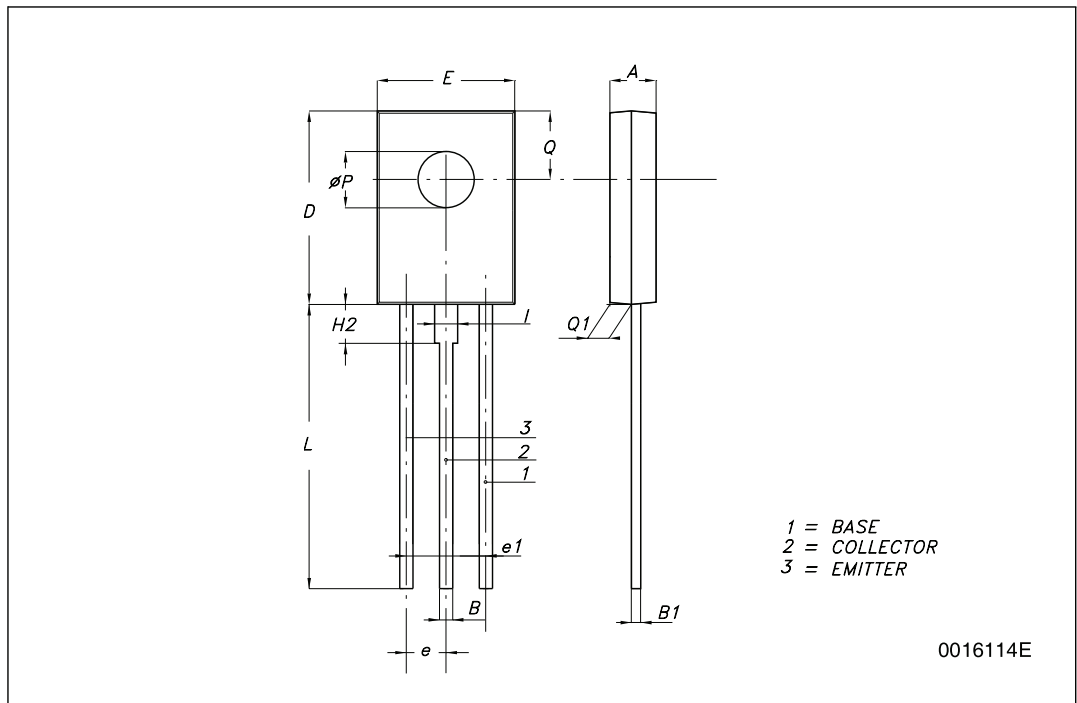
1. Fast electronic switch
2. Non-inductive resistor
3. Fast recovery rectifier

### 3 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.

**SOT-32 (TO-126) MECHANICAL DATA**

DIM.	mm.		
	MIN.	TYP	MAX.
A	2.4		2.9
B	0.64		0.88
B1	0.39		0.63
D	10.5		11.05
E	7.4		7.8
e	2.04	2.29	2.54
e1	4.07	4.58	5.08
L	15.3		16
P	2.9		3.2
Q		3.8	
Q1	1		1.52
H2		2.15	
I		1.27	





## 4 Revision history

**Table 5. Document revision history**

Date	Revision	Changes
10-Jul-2008	1	Initial release.
03-Nov-2009	2	Added order code STT13005D-K <a href="#">Table 1 on page 1</a> .

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