

## STN93003

# High voltage fast-switching PNP power transistor

#### **Features**

- High voltage capability
- Very high switching speed

### **Application**

■ Electronics ballasts for fluorescent lighting

### **Description**

The device is manufactured using high voltage multi-epitaxial planar technology for high switching speeds and high voltage capability. It uses a cellular emitter structure with planar edge termination to enhance switching speeds while maintaining the wide RBSOA. The STN93003 is expressly designed for a new solution to be used in compact fluorescent lamps, where it is coupled with the STN83003, its complementary NPN transistor.

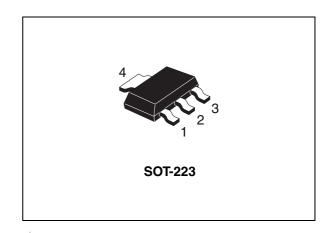


Figure 1. Internal schematic diagram

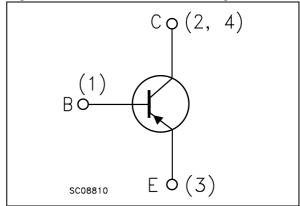


Table 1. Device summary

Part Number	Marking	Package	Packaging
STN93003	N93003	SOT-223	Tape and reel

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STN93003 Electrical ratings

# 1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-emitter voltage (V <sub>BE</sub> = 0)	-500	V
V <sub>CEO</sub>	Collector-emitter voltage (I <sub>B</sub> = 0)	-400	V
V <sub>EBO</sub>	Emitter-base voltage $(I_C = 0, I_B = 0.75 \text{ A}, t_P < 10 \text{ µs})$	V <sub>(BR)EBO</sub>	٧
I <sub>C</sub>	Collector current	-1.5	Α
I <sub>CM</sub>	Collector peak current (t <sub>P</sub> < 5 ms)	-3	Α
I <sub>B</sub>	Base current	-0.75	Α
I <sub>BM</sub>	Base peak current (t <sub>P</sub> < 5 ms)	-1.5	Α
P <sub>TOT</sub>	Total dissipation at T <sub>a</sub> = 25 °C	1.6	W
T <sub>STG</sub>	Storage temperature	-65 to 150	°C
TJ	Max. operating junction temperature	150	°C

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R <sub>thJA</sub>	Thermal resistance junction-ambient (1) max	78	°C/W

<sup>1.</sup> Device mounted on PCB area of 1 cm<sup>2</sup>.

Electrical characteristics STN93003

## 2 Electrical characteristics

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

Table 4. Electrical characteristics

Symbol	Parameter	Test conditions	Min.	Тур.	Max.	Unit
I <sub>CES</sub>	Collector cut-off current	V <sub>CE</sub> = -500 V			-1	mA
	(V <sub>BE</sub> = 0)	$V_{CE} = -500 \text{ V}$ $T_{C} = 125 ^{\circ}\text{C}$			-5	mA
V <sub>(BR)EBO</sub>	Emitter-base breakdown voltage (I <sub>C</sub> = 0)	I <sub>E</sub> = -10 mA	-5		-10	V
V <sub>CE(sus)</sub> (1)	Collector-emitter sustaining voltage (I <sub>B</sub> = 0)	I <sub>C</sub> = -10 mA	-400			V
V (1)	Collector-emitter	$I_C = -0.35 \text{ A}$ $I_B = -50 \text{ mA}$			-0.5	V
V <sub>CE(sat)</sub> (1)	saturation voltage	$I_C = -0.5 \text{ A}$ $I_B = -0.1 \text{ A}$			-0.5	V
V <sub>BE(sat)</sub> (1)	Base-emitter saturation voltage	$I_C = -0.5 \text{ A}$ $I_B = -0.1 \text{ A}$			-1	V
		$I_C = -10 \text{ mA}$ $V_{CE} = -5 \text{ V}$	10			
h <sub>FE</sub>	DC current gain	$I_C = -0.35 \text{ A}$ $V_{CE} = -5 \text{ V}$	16	25	32	
		$I_C = -1 A$ $V_{CE} = -5 V$	4			
	Resistive load					
t <sub>r</sub>	Rise time	$I_C = -0.35 \text{ A}$ $V_{CC} = 125 \text{ V}$		90		ns
t <sub>s</sub>	Storage time	$I_{B1} = -I_{B2} = -70 \text{ mA}$	1.5	2.2	2.9	μs
t <sub>f</sub>	Fall time	$t_P \ge 25 \ \mu s$		0.1		μs
	Inductive load	$I_C = 0.5 \text{ A}$ $I_{B1} = 0.1 \text{ A}$				
t <sub>s</sub>	Storage time	$V_{BE(off)} = -5 V$ L = 10 mH		400		ns
t <sub>f</sub>	Fall time	V <sub>Clamp</sub> = 300 V		40		ns
E <sub>sb</sub>	Avalanche energy	L = 4 mH 25 °C< T <sub>C</sub> < 125 °C I <sub>BR</sub> ≤ -2.5 A C = 1.8 nF	12			mJ

<sup>1.</sup> Pulse test: pulse duration  $\leq$  300  $\mu$ s, duty cycle  $\leq$  2 %.

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

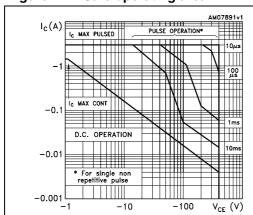


Figure 3. Derating curve

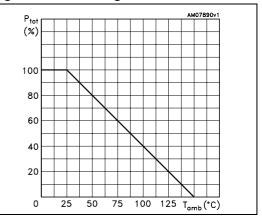
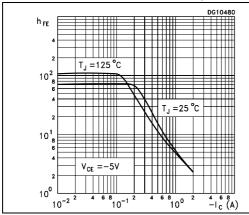


Figure 4. DC current gain ( $V_{CE} = -5 \text{ V}$ ) Figure 5. DC current gain ( $V_{CE} = -1 \text{ V}$ )



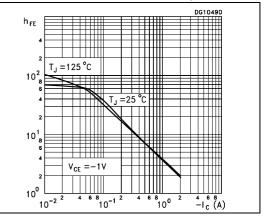
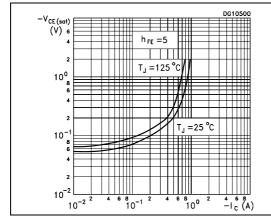
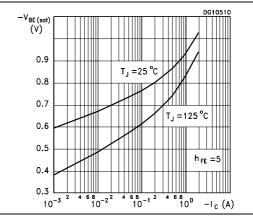


Figure 6. Collector-emitter saturation voltage

Figure 7. Base-emitter saturation voltage

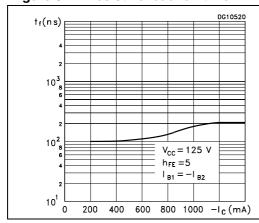




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Figure 8. Resistive load fall time

Figure 9. Resistive load storage time



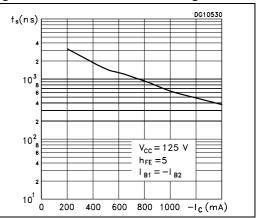
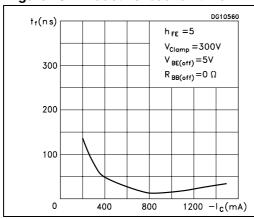


Figure 10. Inductive load fall time

Figure 11. Inductive load storage time



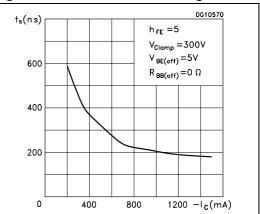
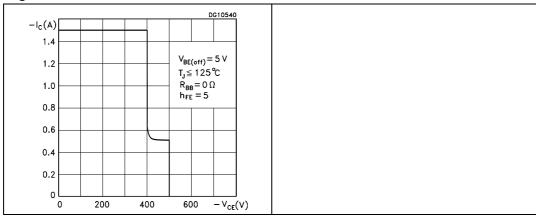
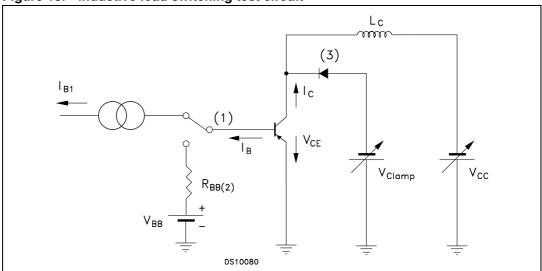


Figure 12. Reverse biased SOA



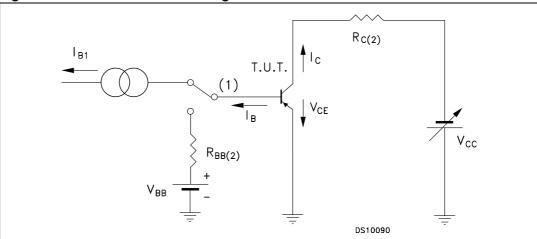
### 2.2 Test circuits

Figure 13. Inductive load switching test circuit



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

Figure 14. Resistive load switching test circuit



- 1. Fast electronic switching
- 2. Non-inductive resistor

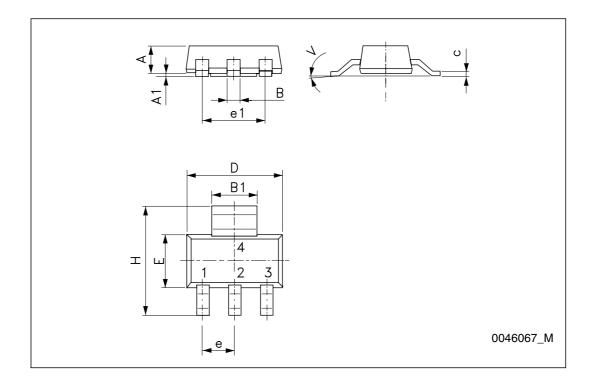
# 3 Package mechanical data

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: <a href="https://www.st.com">www.st.com</a>. ECOPACK<sup>®</sup> is an ST trademark.

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#### SOT-223 mechanical data

Dim.		mm.	
	Min.	Тур.	Max.
Α			1.80
A1	0.02		0.1
В	0.60	0.70	0.85
B1	2.90	3.00	3.15
С	0.24	0.26	0.35
D	6.30	6.50	6.70
е		2.30	
e1		4.60	
E	3.30	3.50	3.70
Н	6.70	7.00	7.30
V			10 °



Revision history STN93003

# 4 Revision history

Table 5. Revision history

Date	Revision	Changes	
11-May-2006	1	Initial release.	
29-Nov-2010	2	Updated package mechanical data on page 9.	

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