## ST13003, ST13003-K

## High voltage fast-switching NPN power transistor

Datasheet - production data

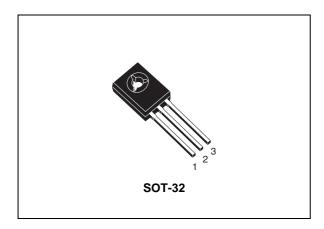
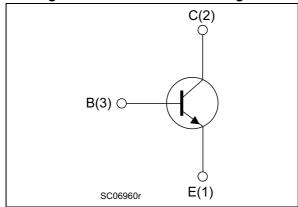


Figure 1. Internal schematic diagram



#### **Features**

- High voltage capability
- Low spread of dynamic parameters
- · Very high switching speed

### **Applications**

- Electronic ballast for fluorescent lighting (CFL)
- SMPS for battery charger

#### **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.

Table 1. Device summary

Part number	Marking	Package	Packaging
ST13003	13003	SOT-32	Tube
ST13003-K	13003	SOT-32	Bag

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Electrical ratings ST13003, ST13003-K

# 1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-emitter voltage (V <sub>BE</sub> = 0)	700	V
V <sub>CEO</sub>	Collector-emitter voltage (I <sub>B</sub> = 0)	400	V
V <sub>EBO</sub>	Emitter-base voltage ( $I_C = 0$ , $I_B = 0.75$ A, $t_P < 10 \mu$ s)	V <sub>(BR)EBO</sub>	V
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>C</sub> = 25 °C	40	W
T <sub>STG</sub>	Storage temperature	-55 to 150	°C
T <sub>J</sub>	Operating junction temperature	-40 to 150	°C

Table 3. Thermal data

	Symbol	Parameter	Value	Unit
ĺ	$R_{thJC}$	Thermal resistance junction-case max.	3.1	°C/W



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## 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>BE</sub> = 0)	V <sub>CE</sub> = 700 V V <sub>CE</sub> = 700 V	T <sub>C</sub> = 125 °C			1 5	mA mA
V <sub>(BR)EBO</sub> Emitter-Base breakdown voltage (I <sub>C</sub> = 0)		I <sub>E</sub> = 10 mA		9		18	V
V <sub>CEO(sus)</sub> (1)	Collector-emitter sustaining voltage (I <sub>B</sub> = 0)	I <sub>C</sub> = 10 mA		400			V
V <sub>CE(sat)</sub> (1)	Collector-emitter saturation voltage	$I_C = 0.5 A$ $I_C = 1 A$ $I_C = 1.5 A$	$I_B = 0.25 A$			0.5 1 1.5	< < <
V <sub>BE(sat)</sub> (1)	Base-emitter saturation voltage	$I_C = 0.5 A$ $I_C = 1 A$	_			1 1.2	V V
h <sub>FE</sub>	DC current gain	I <sub>C</sub> = 0.5 A I <sub>C</sub> = 1 A	~=	8 5		20 25	
t <sub>r</sub> t <sub>s</sub>	Resistive load Rise time Storage time Fall time	$V_{CC} = 125 \text{ V}$ $I_{B1} = 0.2 \text{ A}$ $t_p = 25 \mu \text{s}$	-			1 4 0.7	μs μs
t <sub>s</sub>	Inductive load Storage time	$I_C = 1 A$ $V_{BE} = -5 V$ $V_{Clamp} = 300 V$	L = 50 mH		0.8		μs

<sup>1.</sup> Pulsed duration = 300  $\mu$ s, duty cycle  $\leq$  1.5%



Electrical characteristics ST13003, ST13003-K

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating areas

Ic(A)

A = Area of permissible operation driving turn-on provided R<sub>RE</sub>=100 Ohm and tr≤ 100ns

10<sup>1</sup>

B | C MAX | PULSE OPERATION \* |

PULSED | 100µs | 10µs |

100°s | 1 C MAX | 10µs | 10µs |

100°s | 1 C MAX | 10µs | 10µs |

100°s | 1 C MAX | 10µs | 10µs |

100°s | 1 C MAX | 10µs | 10µs |

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100°s | 1 C MAX | 10µs | 10µs | 10µs | 10µs |

100°s | 1 C MAX | 10µs | 10µs | 10µs | 10µs |

100°s | 1 C MAX | 10µs | 10µs | 10µs | 10µs | 10µs |

100°s | 1 C MAX | 10µs | 1

Figure 3. Derating curve

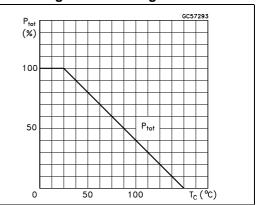
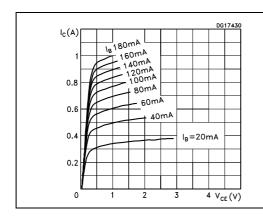


Figure 4. Output characteristics

Figure 5. Reverse biased safe operating areas



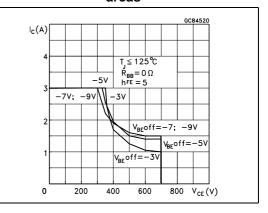


Figure 6. DC current gain  $(V_{CE} = 1 V)$ 

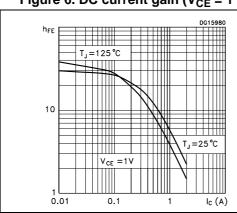
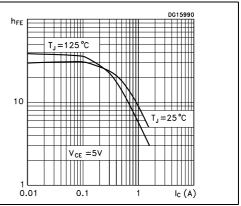


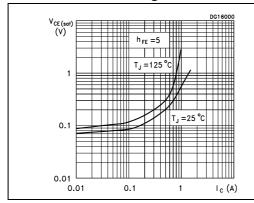
Figure 7. DC current gain  $(V_{CE} = 5 V)$ 



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Figure 8. Collector-emitter saturation voltage

Figure 9. Base-emitter saturation voltage



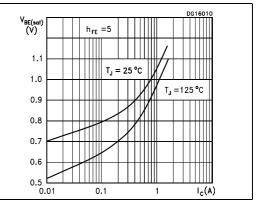
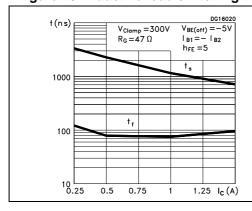
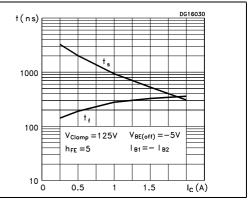


Figure 10. Inductive load switching time Figu

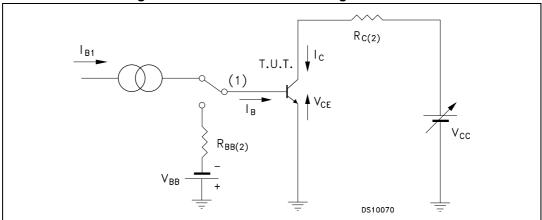
Figure 11. Resistive load switching time





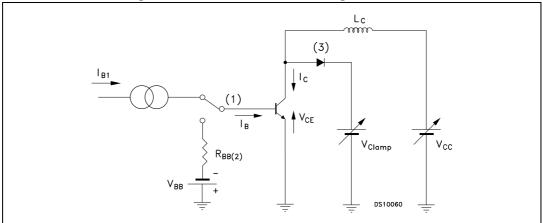
## 2.2 Test circuits

Figure 12. Resistive load switching test circuit



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

Figure 13. Inductive load switching test circuit



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

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# 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.

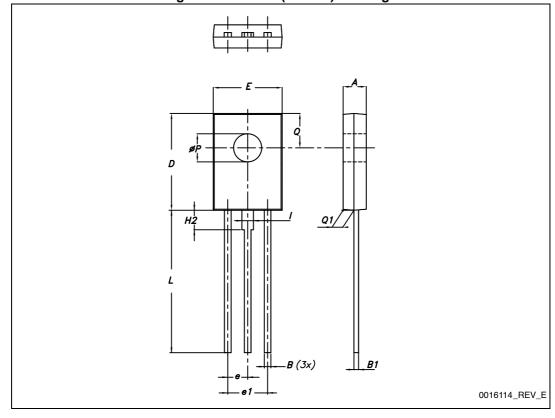


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Table 5. SOT-32 (TO-126) mechanical data

Dim.	mm.				
Dim.	Min.	Тур.	Max.		
Α	2.4		2.9		
В	0.64		0.88		
B1	0.39		0.63		
D	10.5		11.05		
E	7.4		7.8		
е	2.04	2.29	2.54		
e1	4.07	4.58	5.08		
L	15.3		16		
Р	2.9		3.2		
Q		3.8			
Q1	1		1.52		
H2		2.15			
I		1.27			

Figure 14. SOT-32 (TO-126) drawings



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ST13003, ST13003-K Revision history

# 4 Revision history

**Table 6. Document revision history** 

Date	Revision	Changes
23-May-2007	1	Initial release.
09-Jul-2008	2	Added Table 1 on page 1.
15-Dec-2009	3	Added Table 3: Thermal data on page 2.
15-Jun-2011	4	Modified: Table 2
18-Jun-2013	5	Added device ST13003.

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