

PHE13003A

NPN power transistor

Rev. 02 — 29 July 2010

Product data sheet

1. Product profile

1.1 General description

High voltage, high speed, planar passivated NPN power switching transistor in a SOT54 (TO-92) 3 leads plastic package.

1.2 Features and benefits

- Fast switching
- High voltage capability of 700 V

1.3 Applications

- Compact fluorescent lamps (CFL)
- Inverters
- Electronic lighting ballasts
- Off-line self-oscillating power supplies

1.4 Quick reference data

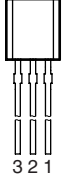
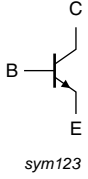
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_C	collector current	DC; see Figure 2	-	-	1	A
P_{tot}	total power dissipation	$T_{lead} \leq 25\text{ °C}$; see Figure 1	-	-	2.1	W
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	-	700	V
Static characteristics						
h_{FE}	DC current gain	$I_C = 0.8\text{ A}$; $V_{CE} = 5\text{ V}$; $T_{lead} = 25\text{ °C}$; see Figure 8 ; see Figure 9	5	7.5	20	



2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 <p>SOT54 (TO-92)</p>	 <p>sym123</p>
2	C	collector		
3	E	emitter		

3. Ordering information

Table 3. Ordering information

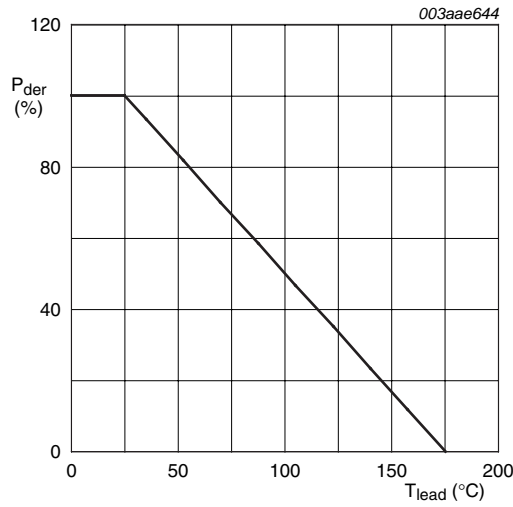
Type number	Package		
	Name	Description	Version
PHE13003A	TO-92	plastic single-ended leaded (through hole) package; 3 leads	SOT54

4. Limiting values

Table 4. Limiting values

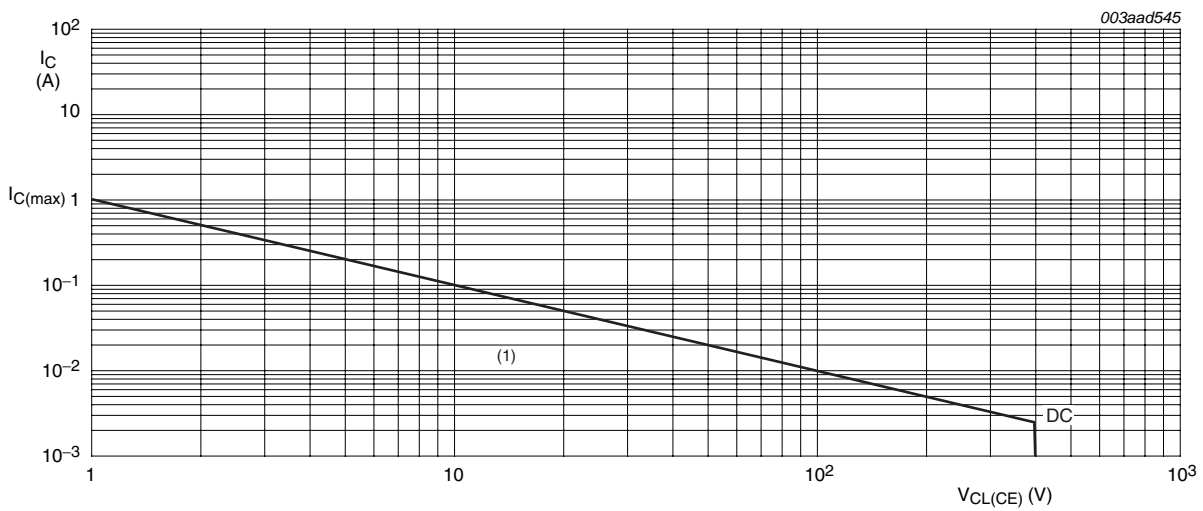
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	700	V
V_{CBO}	collector-base voltage	$I_E = 0\text{ A}$	-	700	V
V_{CEO}	collector-emitter voltage	$I_B = 0\text{ A}$	-	400	V
I_C	collector current	DC; see Figure 2	-	1	A
I_{CM}	peak collector current		-	2	A
I_B	base current	DC	-	0.5	A
I_{BM}	peak base current		-	1	A
P_{tot}	total power dissipation	$T_{lead} \leq 25\text{ °C}$; see Figure 1	-	2.1	W
T_{stg}	storage temperature		-65	150	°C
T_j	junction temperature		-	150	°C
V_{EBO}	emitter-base voltage	$I_C = 0\text{ A}$; $I(\text{Emitter}) = 10\text{ mA}$	-	9	V



$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100\%$$

Fig 1. Normalized total power dissipation as a function of lead temperature



$T_{lead} \leq 25^{\circ}C$ (1) Region of permissible DC operation

Fig 2. Forward bias safe operating area

5. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-lead)}$	thermal resistance from junction to lead	see Figure 3	-	-	60	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	printed-circuit board mounted; lead length = 4 mm	-	150	-	K/W

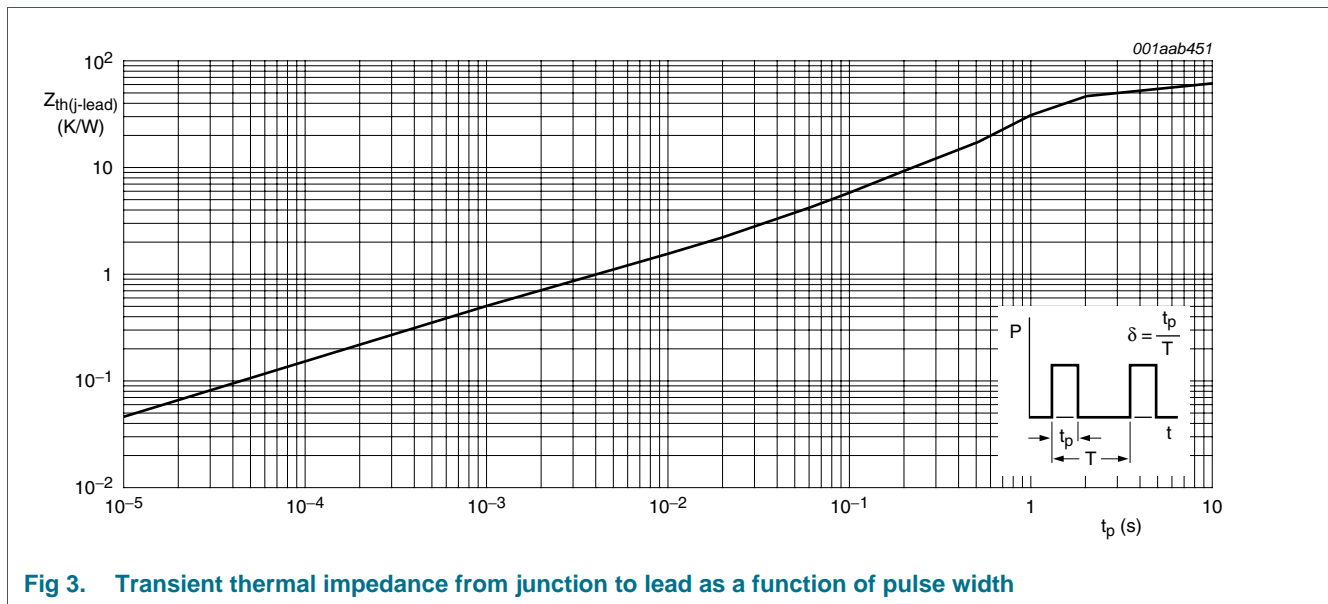


Fig 3. Transient thermal impedance from junction to lead as a function of pulse width

6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I_{CES}	collector-emitter cut-off current	$V_{BE} = 0\text{ V}; V_{CE} = 700\text{ V}; T_j = 125\text{ }^\circ\text{C}$	-	-	5	mA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 9\text{ V}; I_C = 0\text{ A}; T_{lead} = 25\text{ }^\circ\text{C}$	-	-	1	mA
V_{CEOsus}	collector-emitter sustaining voltage	$I_B = 0\text{ A}; I_C = 1\text{ mA}; L_C = 25\text{ mH}; T_{lead} = 25\text{ }^\circ\text{C};$ see Figure 4 ; see Figure 5	400	-	-	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 0.25\text{ A}; I_B = 50\text{ mA}; T_{lead} = 25\text{ }^\circ\text{C};$ see Figure 6	-	0.2	0.5	V
		$I_C = 0.5\text{ A}; I_B = 125\text{ mA}; T_{lead} = 25\text{ }^\circ\text{C};$ see Figure 6	-	0.3	1	V
		$I_C = 0.75\text{ A}; I_B = 250\text{ mA}; T_{lead} = 25\text{ }^\circ\text{C};$ see Figure 6	-	0.4	1.5	V
V_{BEsat}	base-emitter saturation voltage	$I_C = 0.25\text{ A}; I_B = 50\text{ mA}; T_{lead} = 25\text{ }^\circ\text{C};$ see Figure 7	-	-	1	V
		$I_C = 0.5\text{ A}; I_B = 125\text{ mA}; T_{lead} = 25\text{ }^\circ\text{C};$ see Figure 7	-	-	1.2	V
h_{FE}	DC current gain	$I_C = 0.5\text{ mA}; V_{CE} = 2\text{ V}; T_{lead} = 25\text{ }^\circ\text{C};$ see Figure 8 ; see Figure 9	12	-	-	
		$I_C = 0.4\text{ A}; V_{CE} = 5\text{ V}; T_{lead} = 25\text{ }^\circ\text{C};$ see Figure 8 ; see Figure 9	10	-	30	
		$I_C = 0.8\text{ A}; V_{CE} = 5\text{ V}; T_{lead} = 25\text{ }^\circ\text{C};$ see Figure 8 ; see Figure 9	5	7.5	20	
Dynamic characteristics						
t_f	fall time	$I_C = 1\text{ A}; I_{Bon} = 200\text{ mA}; V_{BB} = -5\text{ V}; L_B = 1\text{ }\mu\text{H}; T_{lead} = 25\text{ }^\circ\text{C};$ inductive load; see Figure 10 ; see Figure 11	-	80	-	ns

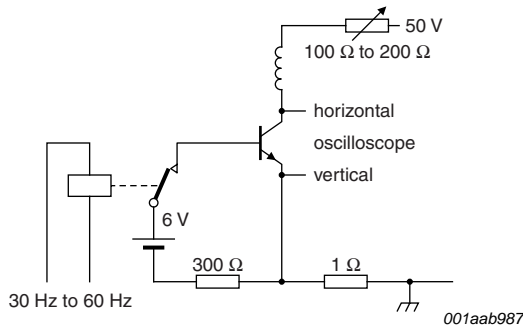


Fig 4. Test circuit for collector-emitter sustaining voltage

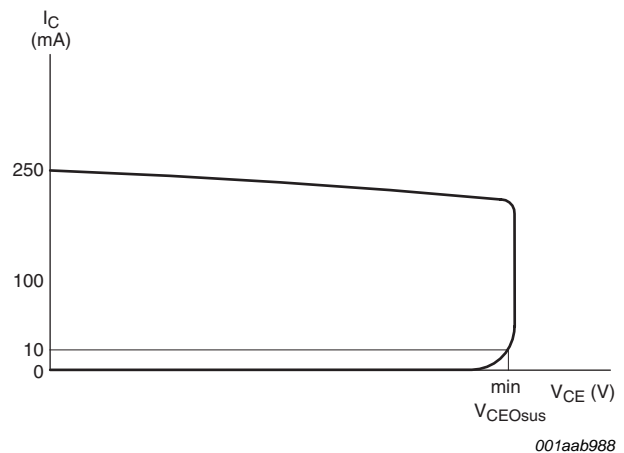


Fig 5. Oscilloscope display for collector-emitter sustaining voltage test waveform

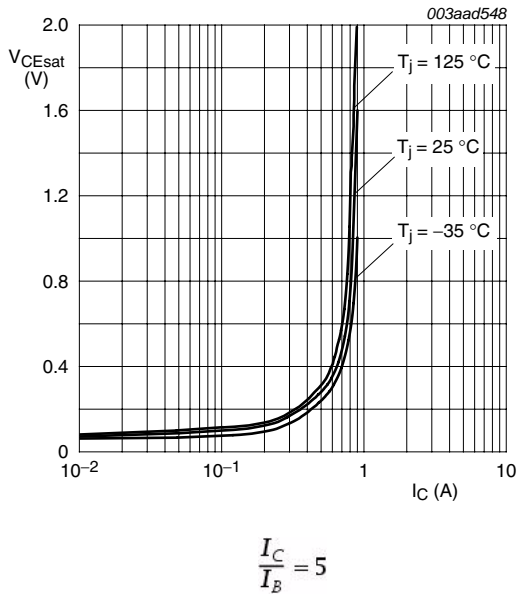


Fig 6. Collector-emitter saturation voltage as a function of collector current; typical values

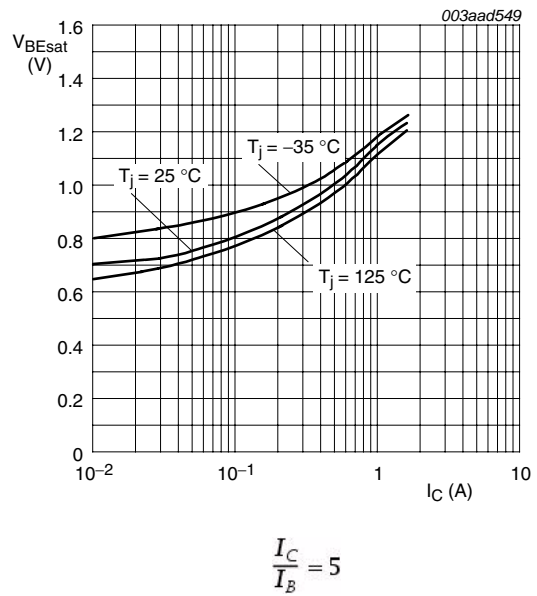


Fig 7. Base-emitter saturation voltage as a function of collector current; typical values

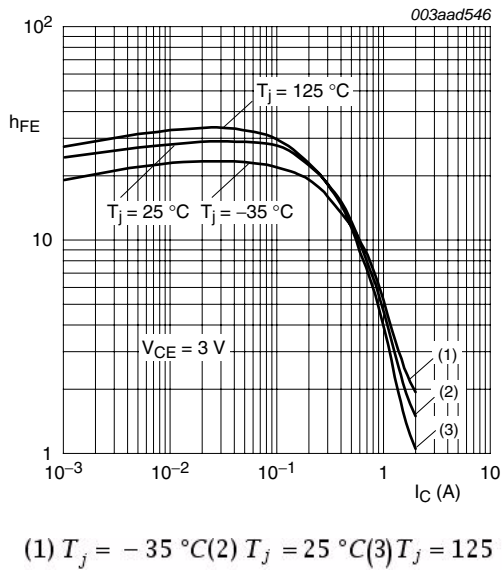


Fig 8. DC current gain as a function of collector current; typical values

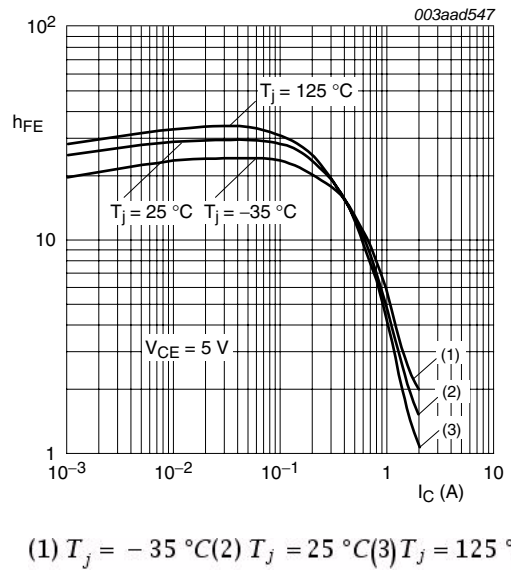
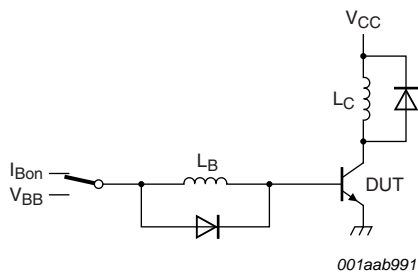


Fig 9. DC current gain as a function of collector current; typical values



$V_{CC} = 300\text{ V}; V_{BB} = -5\text{ V}; L_C = 200\ \mu\text{H}; L_B = 1\ \mu\text{H}$

Fig 10. Test circuit for inductive load switching

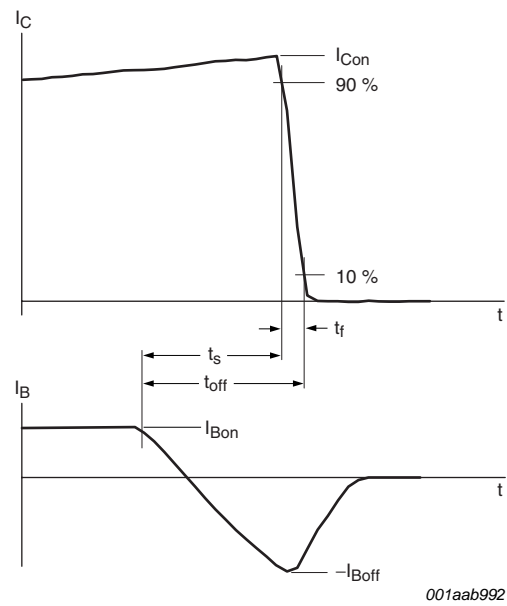


Fig 11. Switching times waveforms for inductive load

7. Package outline

Plastic single-ended leaded (through hole) package; 3 leads

SOT54

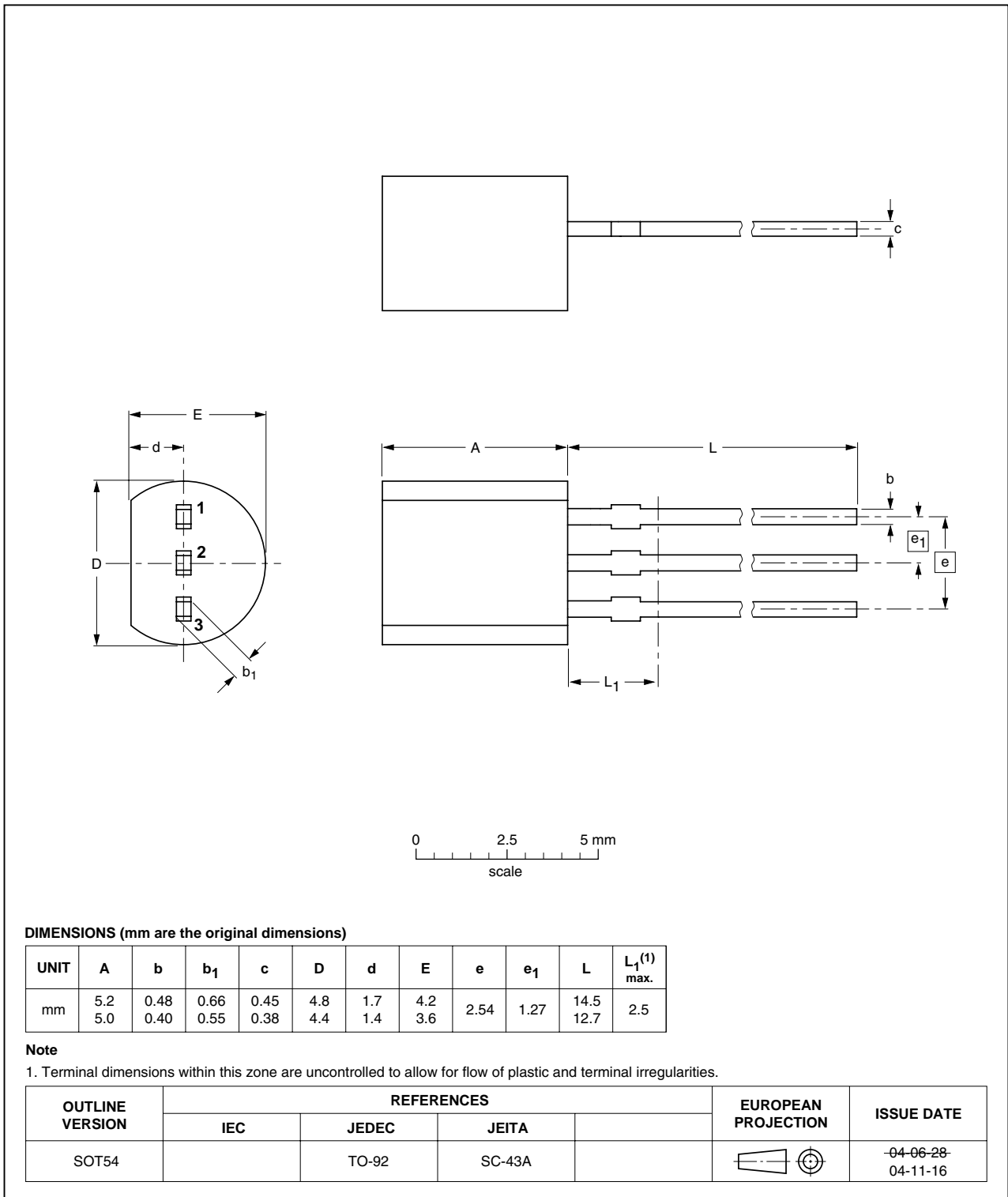


Fig 12. Package outline SOT54 (TO-92)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PHE13003A v.2	20100729	Product data sheet	-	PHE13003A v.1
Modifications:	• Various changes to content.			
PHE13003A v.1	20090813	Product data sheet	-	-

9. Legal information

9.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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