

# 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

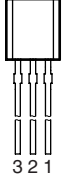
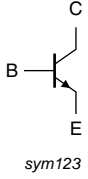
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$I_C$	collector current	DC; see <a href="#">Figure 2</a>	-	-	1	A
$P_{tot}$	total power dissipation	$T_{lead} \leq 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 1</a>	-	-	2.1	W
$V_{CESM}$	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	-	700	V
<b>Static characteristics</b>						
$h_{FE}$	DC current gain	$I_C = 0.8\text{ A}$ ; $V_{CE} = 5\text{ V}$ ; $T_{lead} = 25\text{ }^\circ\text{C}$ ; see <a href="#">Figure 8</a> ; see <a href="#">Figure 9</a>	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**

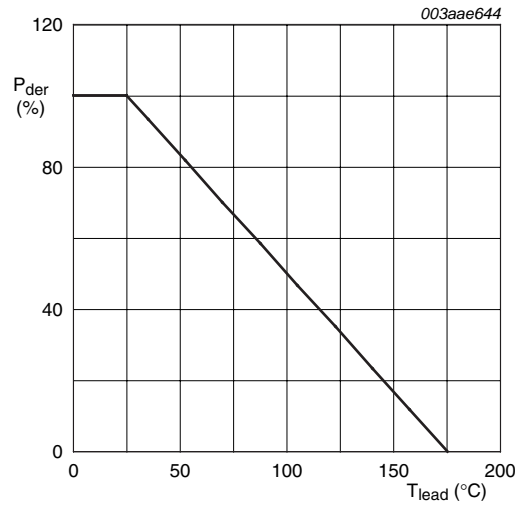
Type number	Package		
	Name	Description	Version
PHE13003A	TO-92	plastic single-ended leaded (through hole) package; 3 leads	SOT54

## 4. Limiting values

**Table 4. Limiting values**

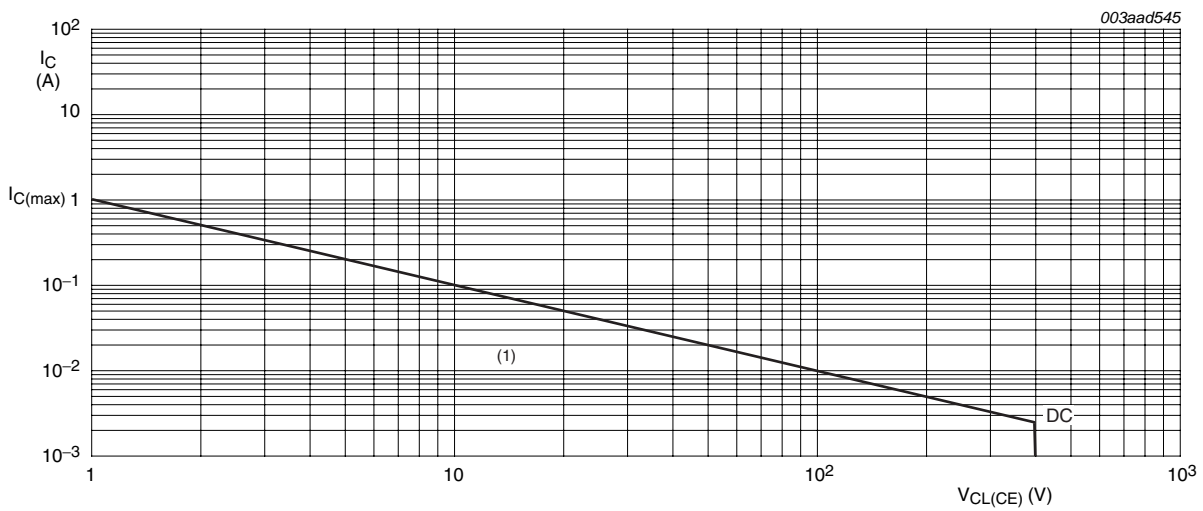
In accordance with the Absolute Maximum Rating System (IEC 60134).

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 <a href="#">Figure 2</a>	-	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 <a href="#">Figure 1</a>	-	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**



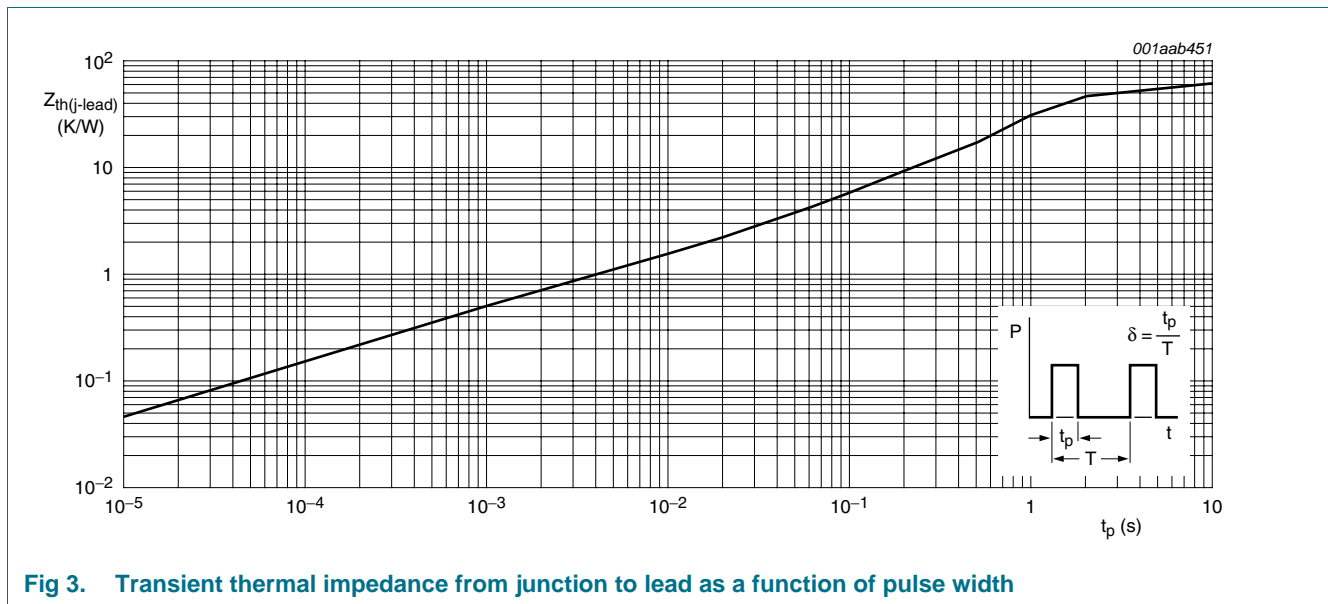
$T_{lead} \leq 25^{\circ}C$  (1) Region of permissible DC operation

**Fig 2. Forward bias safe operating area**

### 5. Thermal characteristics

Table 5. Thermal characteristics

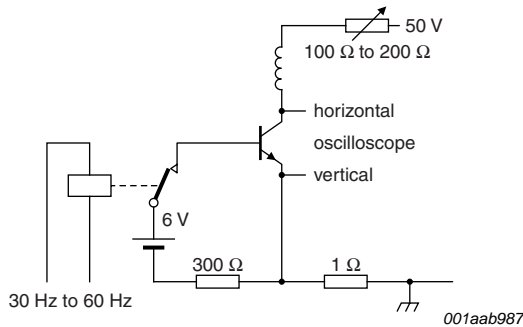
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-lead)}$	thermal resistance from junction to lead	see <a href="#">Figure 3</a>	-	-	60	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	printed-circuit board mounted; lead length = 4 mm	-	150	-	K/W



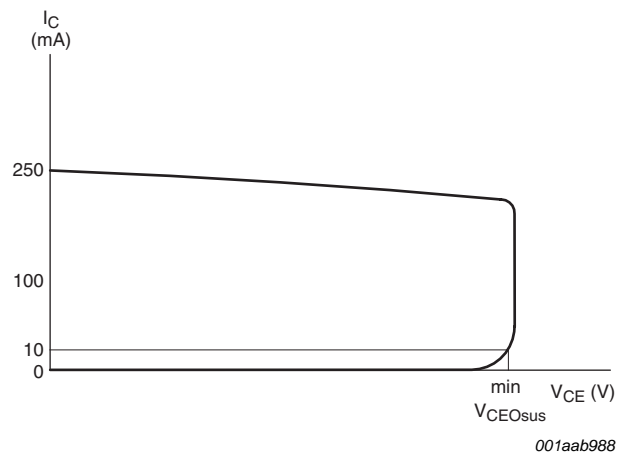
## 6. Characteristics

**Table 6. Characteristics**

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
<b>Static characteristics</b>						
$I_{CES}$	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 <a href="#">Figure 4</a> ; see <a href="#">Figure 5</a>	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 <a href="#">Figure 6</a>	-	0.2	0.5	V
		$I_C = 0.5\text{ A}; I_B = 125\text{ mA}; T_{lead} = 25\text{ }^\circ\text{C};$ see <a href="#">Figure 6</a>	-	0.3	1	V
		$I_C = 0.75\text{ A}; I_B = 250\text{ mA}; T_{lead} = 25\text{ }^\circ\text{C};$ see <a href="#">Figure 6</a>	-	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 <a href="#">Figure 7</a>	-	-	1	V
		$I_C = 0.5\text{ A}; I_B = 125\text{ mA}; T_{lead} = 25\text{ }^\circ\text{C};$ see <a href="#">Figure 7</a>	-	-	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 <a href="#">Figure 8</a> ; see <a href="#">Figure 9</a>	12	-	-	
		$I_C = 0.4\text{ A}; V_{CE} = 5\text{ V}; T_{lead} = 25\text{ }^\circ\text{C};$ see <a href="#">Figure 8</a> ; see <a href="#">Figure 9</a>	10	-	30	
		$I_C = 0.8\text{ A}; V_{CE} = 5\text{ V}; T_{lead} = 25\text{ }^\circ\text{C};$ see <a href="#">Figure 8</a> ; see <a href="#">Figure 9</a>	5	7.5	20	
<b>Dynamic characteristics</b>						
$t_f$	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 <a href="#">Figure 10</a> ; see <a href="#">Figure 11</a>	-	80	-	ns



**Fig 4. Test circuit for collector-emitter sustaining voltage**



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

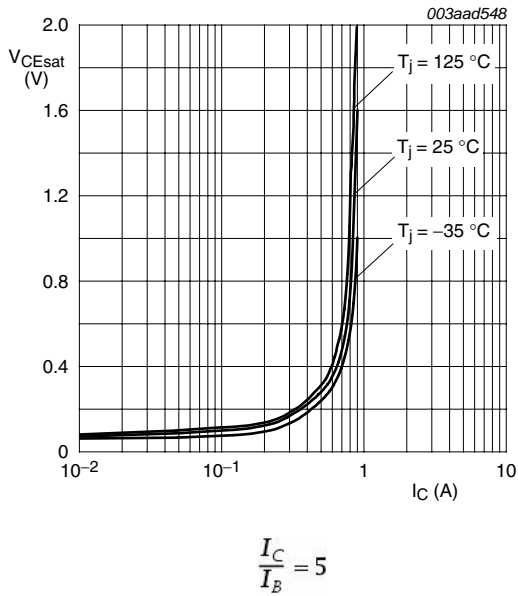


Fig 6. Collector-emitter saturation voltage as a function of collector current; typical values

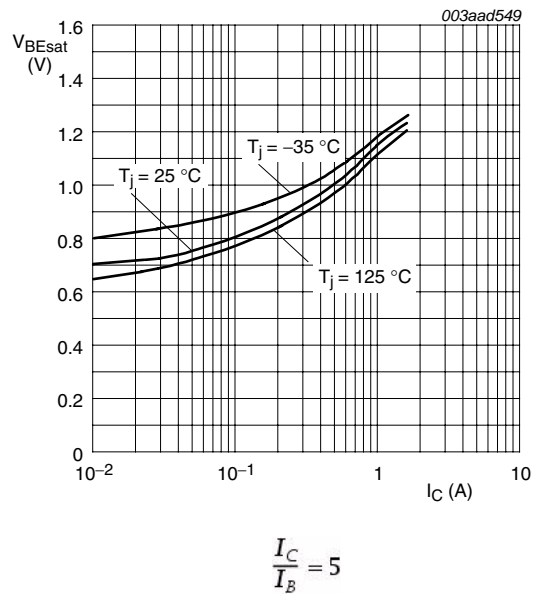


Fig 7. Base-emitter saturation voltage as a function of collector current; typical values

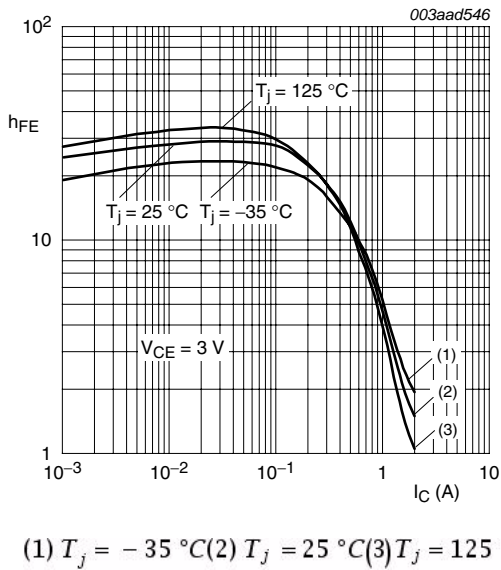


Fig 8. DC current gain as a function of collector current; typical values

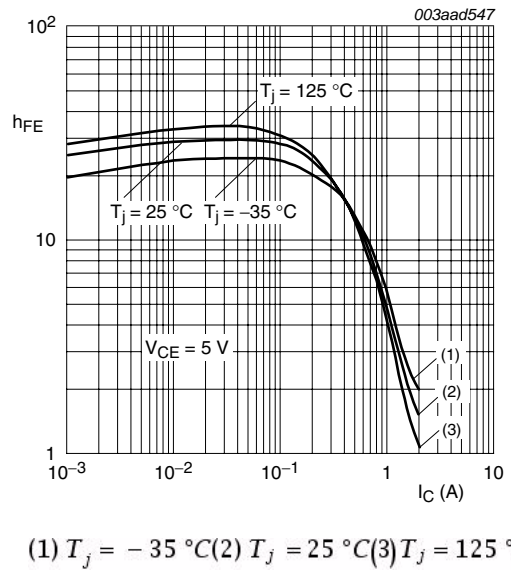
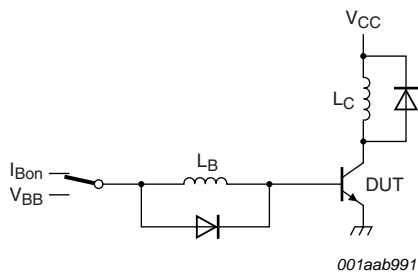
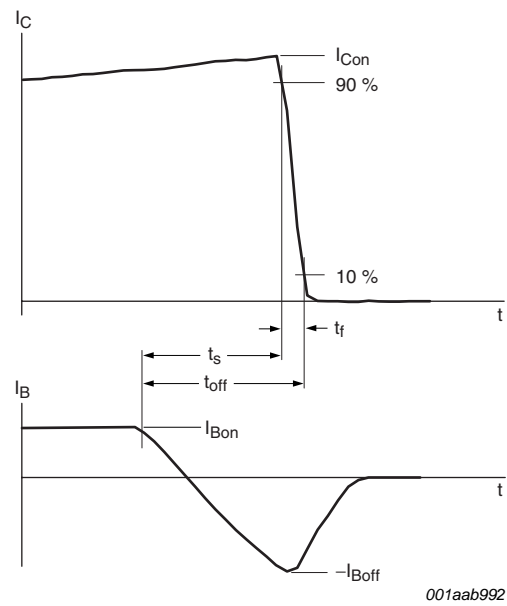


Fig 9. DC current gain as a function of collector current; typical values



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

**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

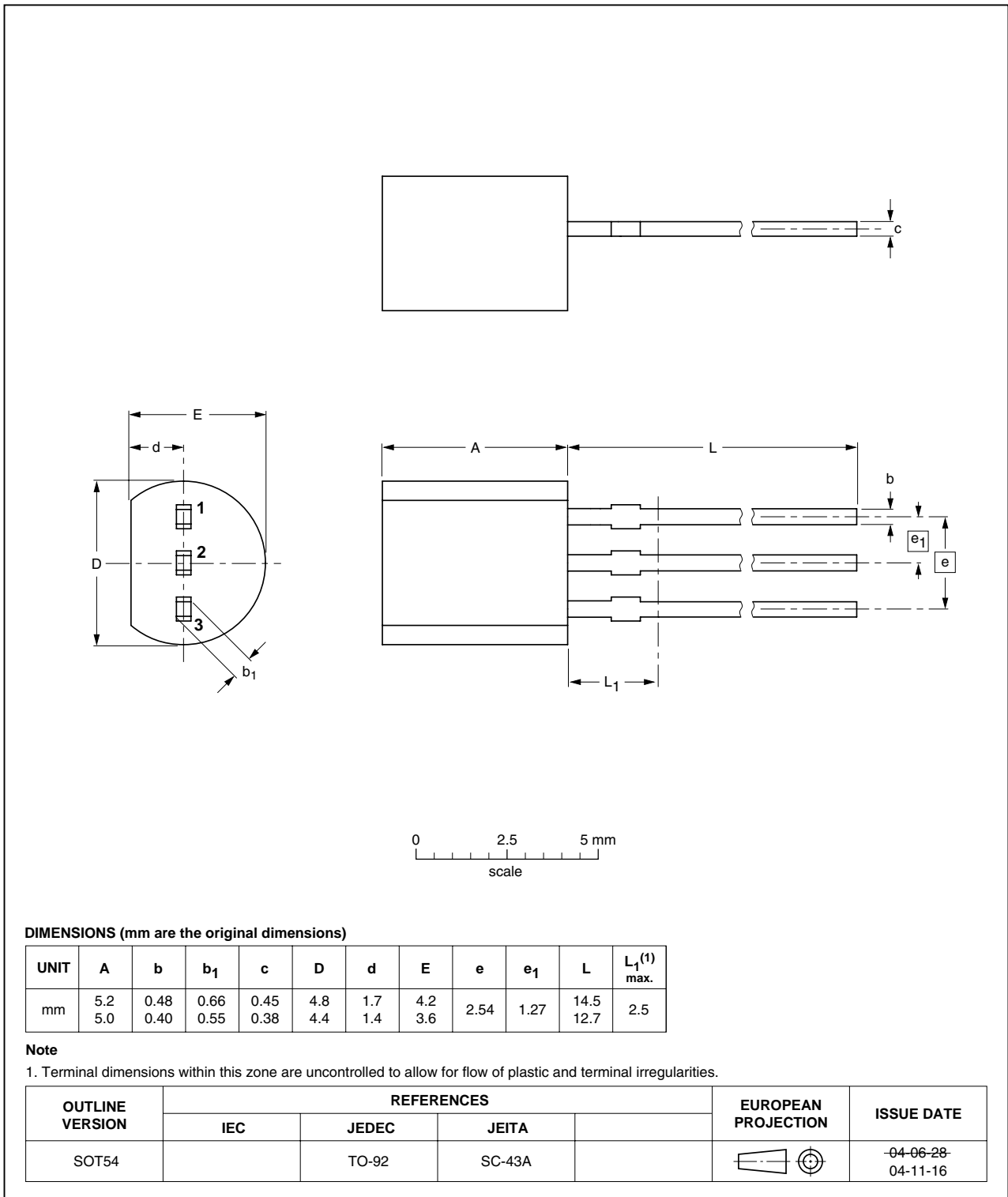


Fig 12. Package outline SOT54 (TO-92)



## 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 <sup>[1][2]</sup>	Product status <sup>[3]</sup>	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.

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

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