IMPORTANT NOTICE

10 December 2015

1. Global joint venture starts operations as WeEn Semiconductors

Dear customer,

As from November 9th, 2015 NXP Semiconductors N.V. and Beijing JianGuang Asset Management Co. Ltd established Bipolar Power joint venture (JV), **WeEn Semiconductors**, which will be used in future Bipolar Power documents together with new contact details.

In this document where the previous NXP references remain, please use the new links as shown below.

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Thank you for your cooperation and understanding,

WeEn Semiconductors

founded by NXP

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)
- Electronic lighting ballasts
- Inverters
- Off-line self-oscillating power supplies

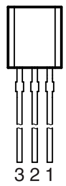
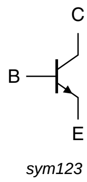
1.4 Quick reference data

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	$T_{lead} \leq 25$ °C; see Figure 1	-	-	2.1	W
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0$ V	-	-	700	V
Static characteristics						
h_{FE}	DC current gain	$I_C = 0.8$ A; $V_{CE} = 5$ V; $T_{lead} = 25$ °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		
2	C	collector		
3	E	emitter		
			SOT54 (TO-92)	

3. Ordering information

Table 3. Ordering information

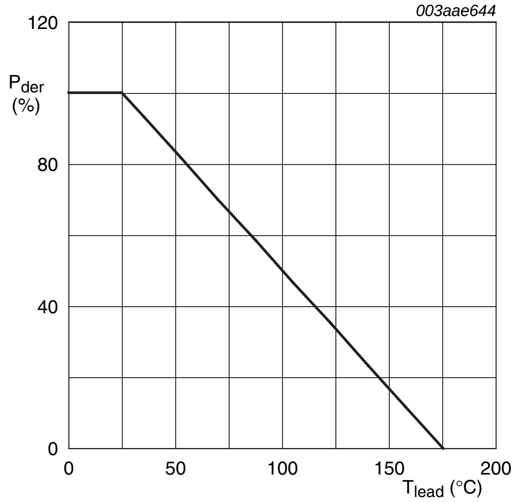
Type number	Package		
	Name	Description	Version
PHE13003A	TO-92	plastic single-ended leaded (through hole) package; 3 leads	SOT54

4. Limiting values

Table 4. Limiting values

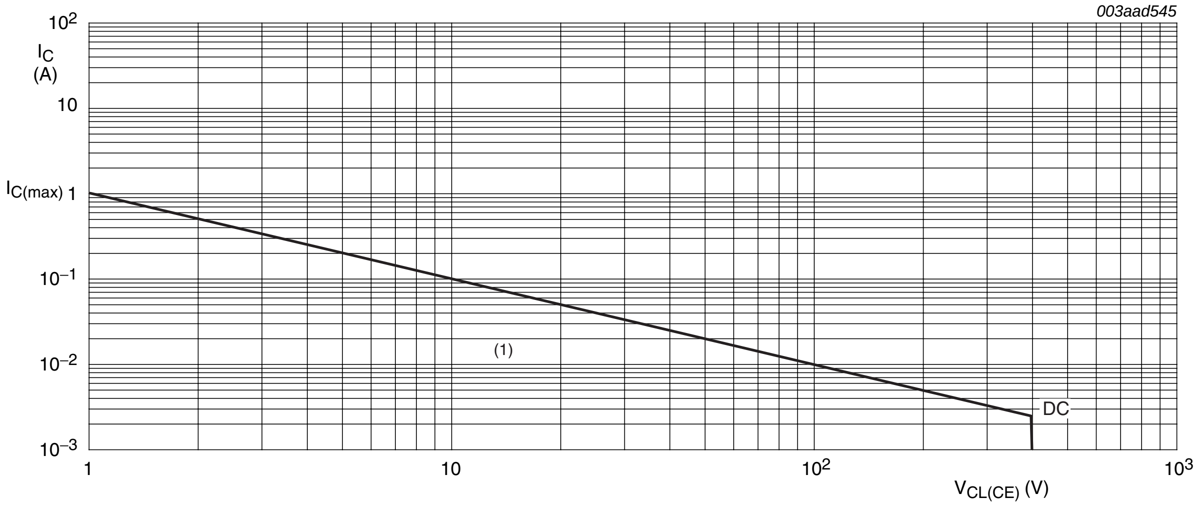
In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CESM}	collector-emitter peak voltage	V_{BE} = 0 V	-	700	V
V_{CBO}	collector-base voltage	I_E = 0 A	-	700	V
V_{CEO}	collector-emitter voltage	I_B = 0 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} ≤ 25 °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 A; I(Emitter) = 10 mA	-	9	V



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

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



$T_{lead} \leq 25$ °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
$R_{th(j\text{-}lead)}$	thermal resistance from junction to lead	see Figure 3	-	-	60	K/W
$R_{th(j\text{-}a)}$	thermal resistance from junction to ambient	printed-circuit board mounted; lead length = 4 mm	-	150	-	K/W

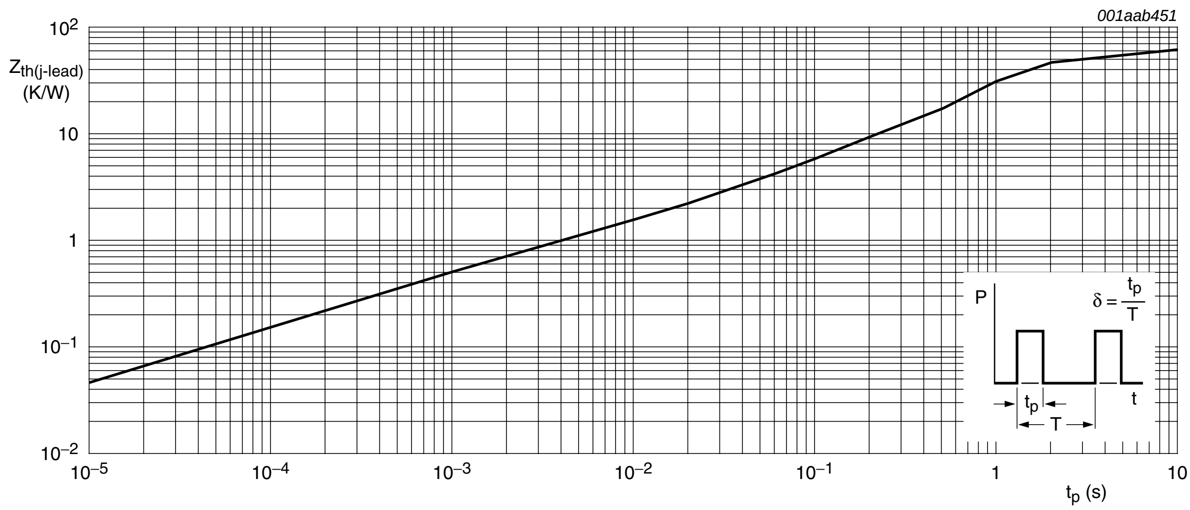


Fig 3. Transient thermal impedance from junction to lead as a function of pulse width

6. Characteristics

Table 6. Characteristics

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

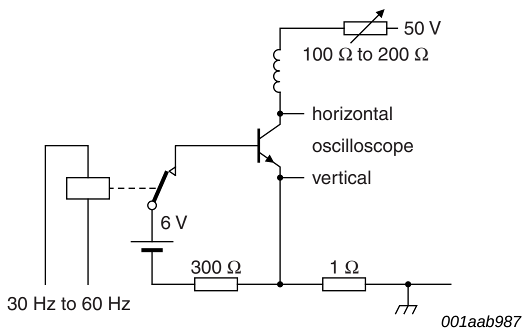


Fig 4. Test circuit for collector-emitter sustaining voltage

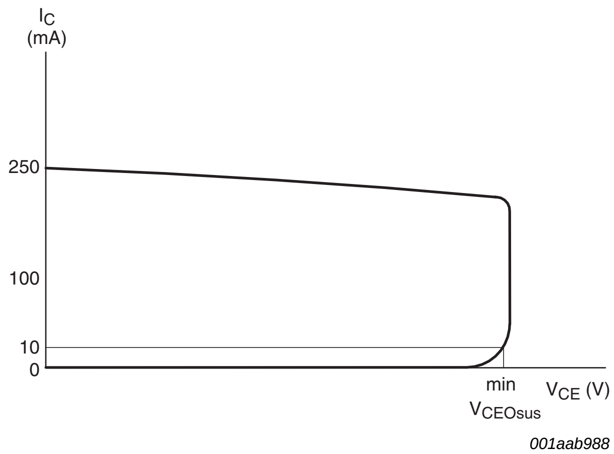
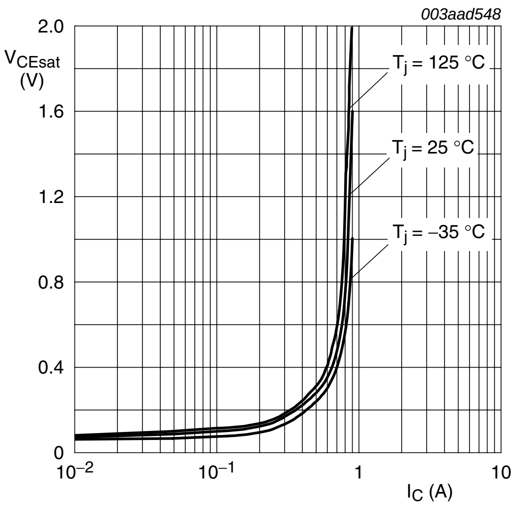
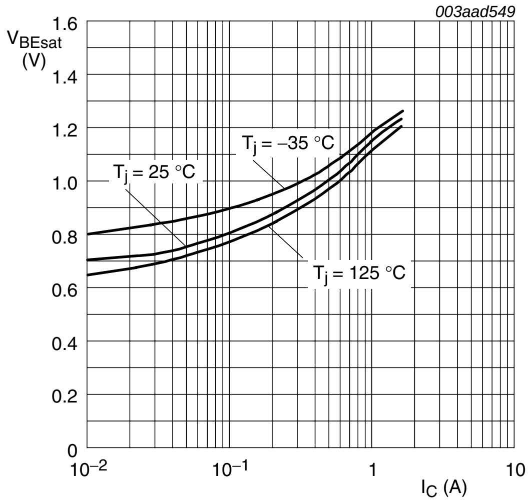


Fig 5. Oscilloscope display for collector-emitter sustaining voltage test waveform



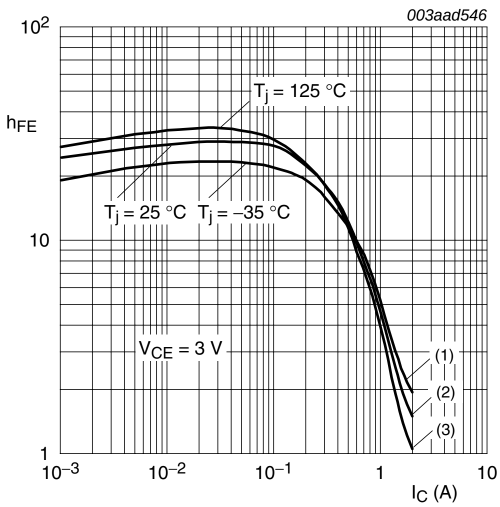
$$\frac{I_C}{I_B} = 5$$

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



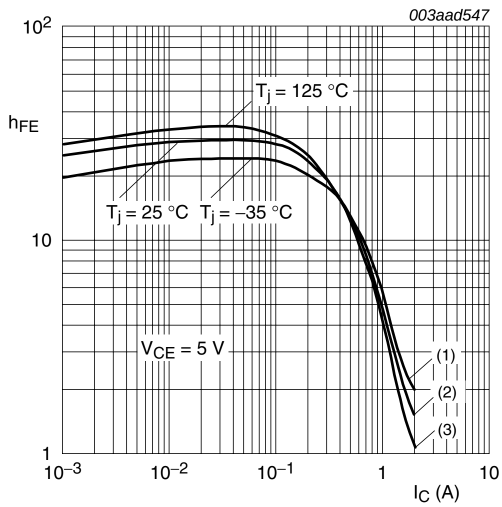
$$\frac{I_C}{I_B} = 5$$

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



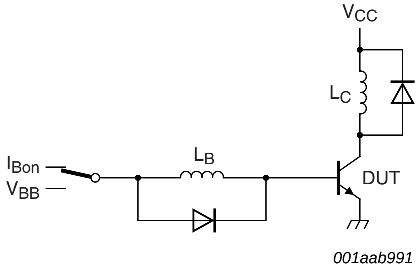
$$(1)\ T_j = -35\ °C\ (2)\ T_j = 25\ °C\ (3)\ T_j = 125\ °C$$

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



$$(1)\ T_j = -35\ °C\ (2)\ T_j = 25\ °C\ (3)\ T_j = 125\ °C$$

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



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

Fig 10. Test circuit for inductive load switching

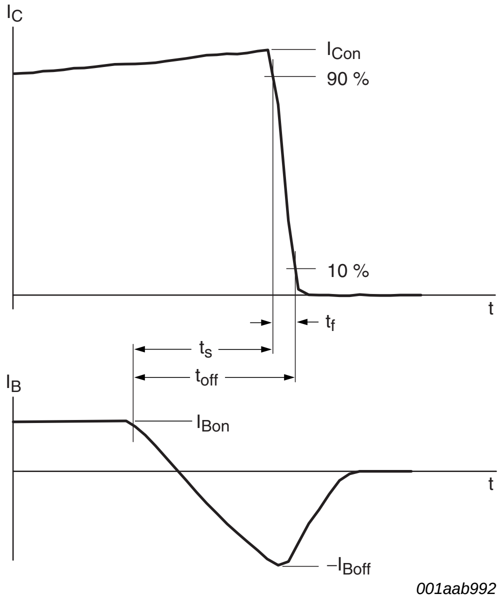
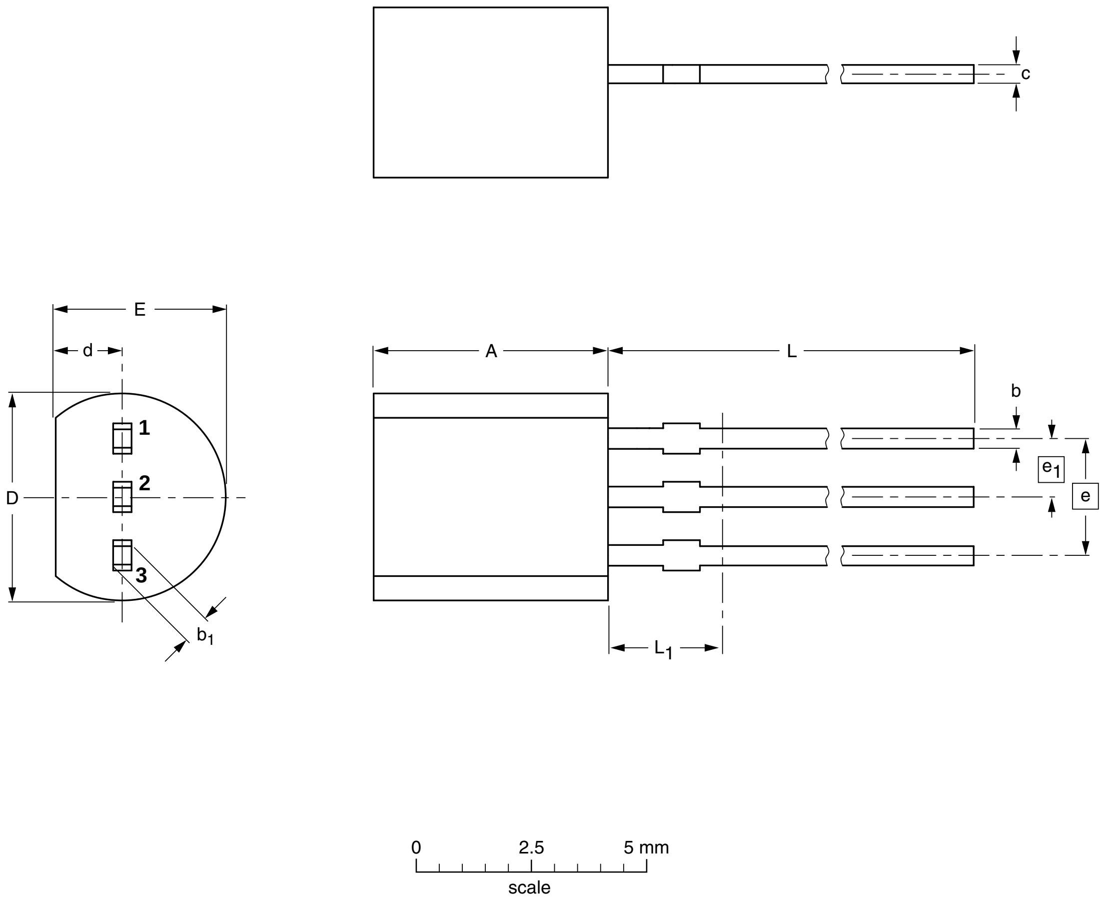


Fig 11. Switching times waveforms for inductive load

7. Package outline

Plastic single-ended leaded (through hole) package; 3 leads **SOT54**



DIMENSIONS (mm are the original dimensions)

UNIT	A	b	b_1	c	D	d	E	e	e_1	L	L_1[(1)] max.
mm	5.2 5.0	0.48 0.40	0.66 0.55	0.45 0.38	4.8 4.4	1.7 1.4	4.2 3.6	2.54	1.27	14.5 12.7	2.5

Note

1. Terminal dimensions within this zone are uncontrolled to allow for flow of plastic and terminal irregularities.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT54		TO-92	SC-43A			~~04-06-28~~ 04-11-16

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".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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