



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.

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Thank you for your cooperation and understanding,

WeEn Semiconductors





PHE13003C

NPN power transistor

7 October 2013

Product data sheet

1. General description

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

2. Features and benefits

- Fast switching
- High typical DC current gain
- High voltage capability of 700 V
- Very low switching and conduction losses

3. Applications

- Compact fluorescent lamps (CFL)
- Low power electronic lighting ballasts
- Off-line self-oscillating power supplies (SOPS) for battery charging

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_C	collector current	DC	-	-	1.5	A
P_{tot}	total power dissipation	$T_{lead} \leq 25\text{ °C}$; Fig. 1	-	-	2.1	W
V_{CESM}	collector-emitter peak voltage	$V_{BE} = 0\text{ V}$	-	-	700	V
Static characteristics						
h_{FE}	DC current gain	$I_C = 0.5\text{ A}$; $V_{CE} = 2\text{ V}$; $T_{lead} = 25\text{ °C}$	8	17	25	

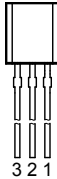
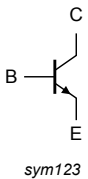


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5. Pinning information

Table 2. Pinning information

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

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
PHE13003C	TO-92	plastic single-ended leaded (through hole) package; 3 leads	SOT54

7. 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	-	1.5	A
I_{CM}	peak collector current		-	3	A
I_B	base current	DC	-	0.75	A
I_{BM}	peak base current		-	1.5	A
P_{tot}	total power dissipation	$T_{lead} \leq 25\text{ °C}$; Fig. 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

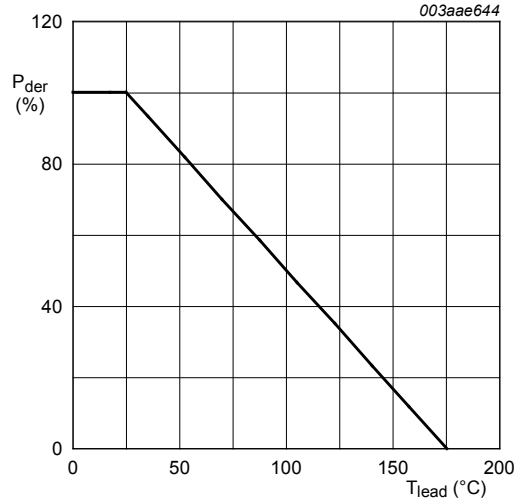


Fig. 1. Normalized total power dissipation as a function of lead temperature

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

8. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
R _{th(j-lead)}	thermal resistance from junction to lead	Fig. 2	-	-	60	K/W
R _{th(j-a)}	thermal resistance from junction to ambient	in free air; printed circuit board mounted; lead length = 4 mm	-	150	-	K/W

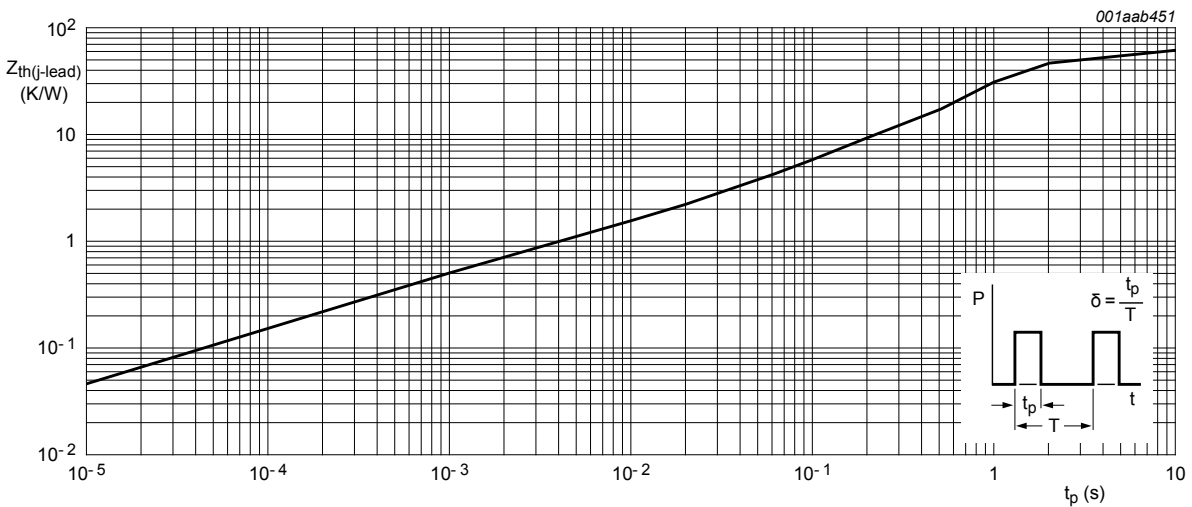


Fig. 2. Transient thermal impedance from junction to lead as a function of pulse width

9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Dynamic characteristics						
t_{on}	turn-on time	$I_C = 1\text{ A}$; $I_{B(on)} = 0.2\text{ A}$; $I_{B(off)} = -0.2\text{ A}$; $R_L = 75\ \Omega$; $T_{lead} = 25\text{ }^\circ\text{C}$; resistive load; Fig. 5 ; Fig. 6	-	-	1	μs
t_s	storage time	$I_C = 1\text{ A}$; $I_{B(on)} = 0.2\text{ A}$; $V_{BB} = -5\text{ V}$; $L_B = 1\ \mu\text{H}$; $T_{lead} = 25\text{ }^\circ\text{C}$; inductive load; Fig. 7 ; Fig. 8	-	0.8	-	μs
		$I_C = 1\text{ A}$; $I_{B(on)} = 0.2\text{ A}$; $I_{B(off)} = -0.2\text{ A}$; $R_L = 75\ \Omega$; $T_{lead} = 25\text{ }^\circ\text{C}$; resistive load; Fig. 5 ; Fig. 6	-	-	4	μs
t_f	fall time	$I_C = 0.5\text{ A}$; $I_{B(on)} = 0.1\text{ A}$; $V_{BB} = -5\text{ V}$; $L_B = 1\ \mu\text{H}$; $T_{lead} = 25\text{ }^\circ\text{C}$; inductive load; Fig. 7 ; Fig. 8	-	0.1	-	μs
		$I_C = 1\text{ A}$; $I_{B(on)} = 0.2\text{ A}$; $I_{B(off)} = -0.2\text{ A}$; $R_L = 75\ \Omega$; $T_{lead} = 25\text{ }^\circ\text{C}$; resistive load; Fig. 5 ; Fig. 6	-	-	0.7	μs
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
		$V_{BE} = 0\text{ V}$; $V_{CE} = 700\text{ V}$; $T_j = 25\text{ }^\circ\text{C}$	-	-	1	mA
I_{CEO}	collector-emitter cut-off current	$V_{CE} = 400\text{ V}$; $I_B = 0\text{ A}$; $T_{lead} = 25\text{ }^\circ\text{C}$	-	-	0.1	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	$I_B = 0\text{ A}$; $I_C = 1\text{ mA}$; $L_C = 25\text{ mH}$; $T_{lead} = 25\text{ }^\circ\text{C}$; Fig. 3 ; Fig. 4	400	-	-	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 0.5\text{ A}$; $I_B = 0.1\text{ A}$; $T_{lead} = 25\text{ }^\circ\text{C}$	-	-	0.5	V
		$I_C = 1\text{ A}$; $I_B = 0.25\text{ A}$; $T_{lead} = 25\text{ }^\circ\text{C}$	-	-	1	V
		$I_C = 1.5\text{ A}$; $I_B = 0.5\text{ A}$; $T_{lead} = 25\text{ }^\circ\text{C}$	-	-	1.5	V
V_{BEsat}	base-emitter saturation voltage	$I_C = 0.5\text{ A}$; $I_B = 0.1\text{ A}$; $T_{lead} = 25\text{ }^\circ\text{C}$	-	-	1	V
		$I_C = 1\text{ A}$; $I_B = 0.25\text{ A}$; $T_{lead} = 25\text{ }^\circ\text{C}$	-	-	1.2	V
h_{FE}	DC current gain	$I_C = 0.5\text{ A}$; $V_{CE} = 2\text{ V}$; $T_{lead} = 25\text{ }^\circ\text{C}$	8	17	25	
		$I_C = 1\text{ A}$; $V_{CE} = 2\text{ V}$; $T_{lead} = 25\text{ }^\circ\text{C}$	5	9	15	

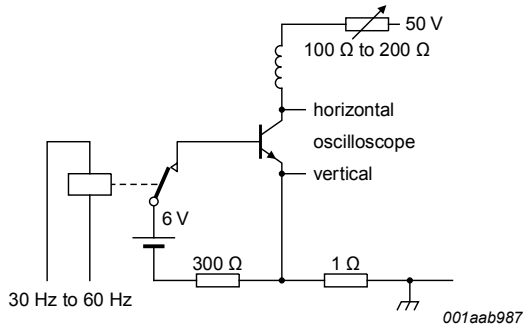


Fig. 3. Test circuit for collector-emitter sustaining voltage

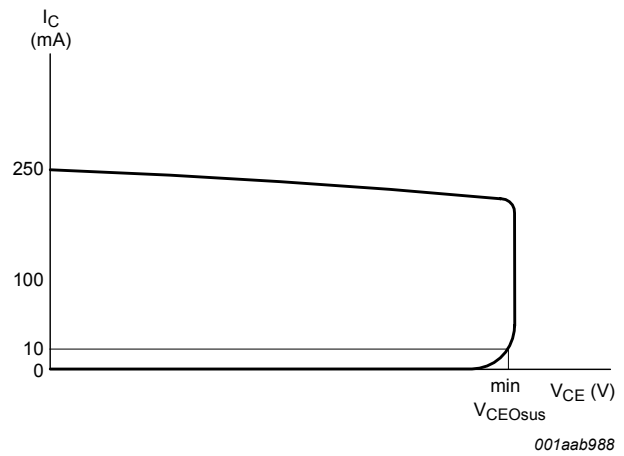


Fig. 4. Oscilloscope display for collector-emitter sustaining voltage test waveform

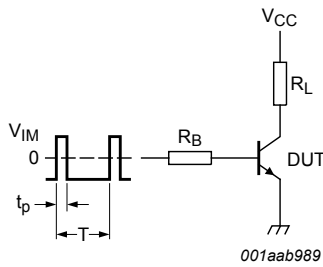


Fig. 5. Test circuit for resistive load switching

$V_{IM} = -6 \text{ to } +8 \text{ V}; V_{CC} = 250 \text{ V}; t_p = 20 \mu\text{s}; \delta = \frac{t_p}{T} = 0.01$
 R_B and R_L calculated from I_{Con} and I_{Bon} requirements.

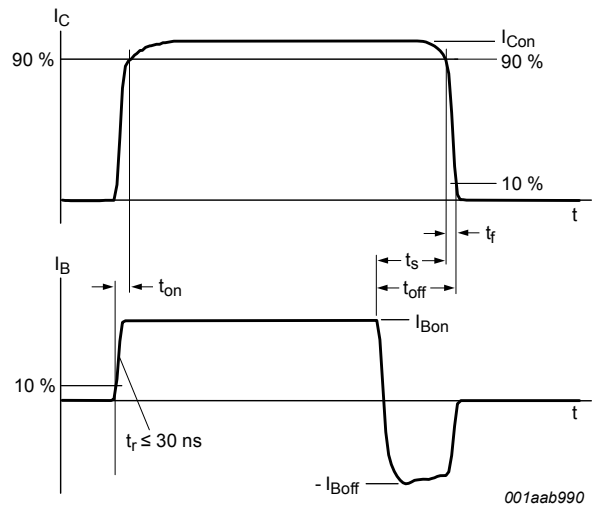


Fig. 6. Switching times waveforms for resistive load

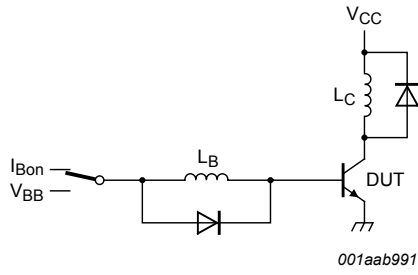


Fig. 7. Test circuit for inductive load switching

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

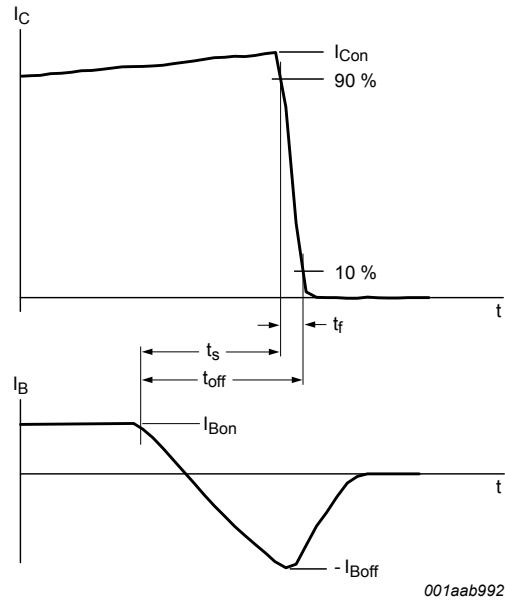


Fig. 8. Switching times waveforms for inductive load

10. Package outline

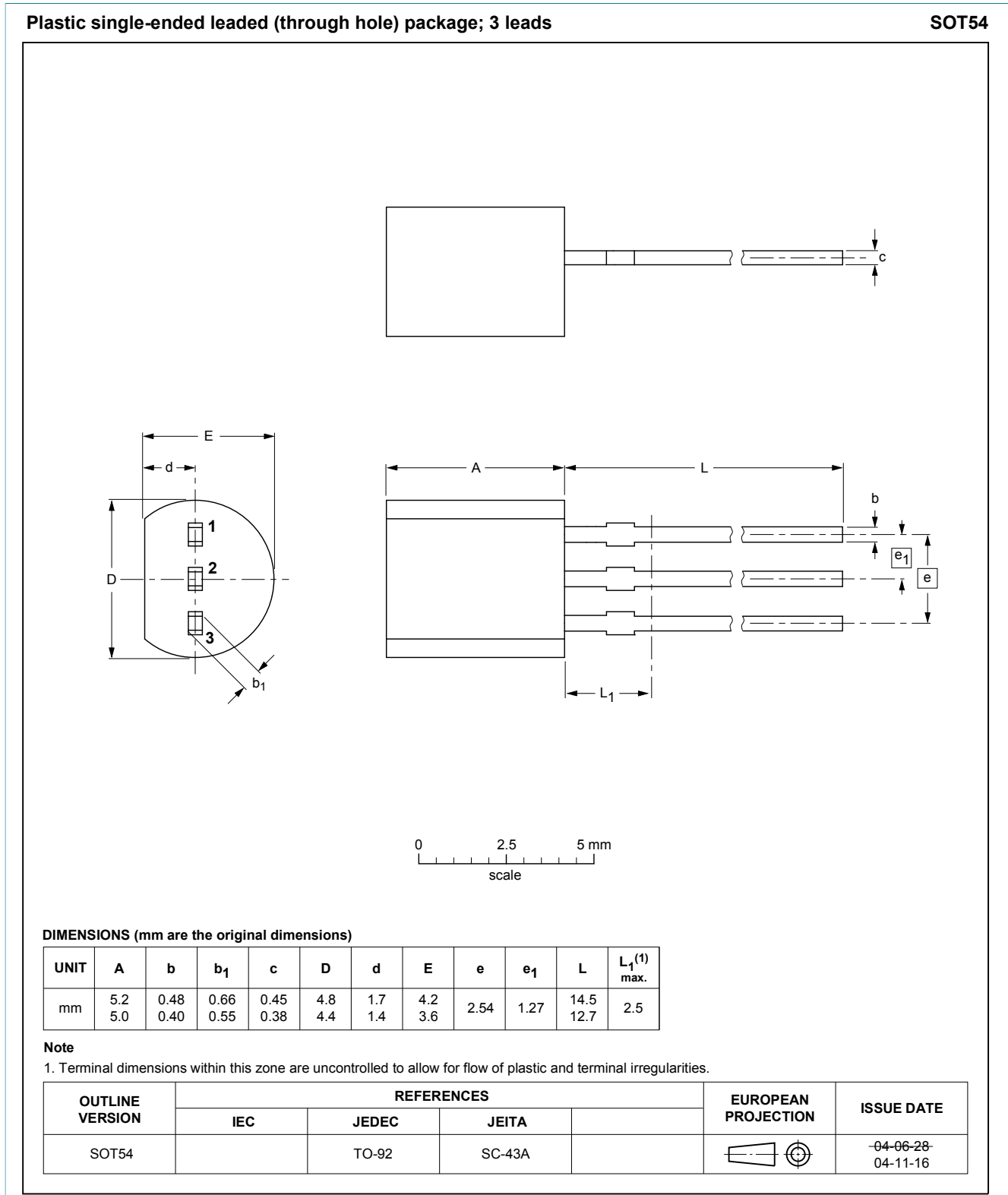


Fig. 9. Package outline TO-92 (SOT54)

11. Legal information

11.1 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.

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