



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



PHD13003C

NPN power transistor with integrated diode

Rev. 01 — 29 July 2010

Product data sheet

1. Product profile

1.1 General description

High voltage, high speed, planar passivated NPN power switching transistor with integrated anti-parallel emitter-collector diode in a SOT54 plastic package

1.2 Features and benefits

- Fast switching
- High typical DC current gain
- High voltage capability
- Integrated anti-parallel E-C diode

1.3 Applications

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

1.4 Quick reference data

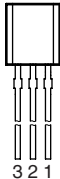
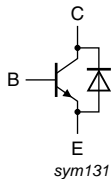
Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_C	collector current	DC	-	-	1.5	A
P_{tot}	total power dissipation	$T_{lead} \leq 25\text{ °C}$; 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	$I_C = 0.5\text{ A}$; $V_{CE} = 2\text{ V}$; $T_j = 25\text{ °C}$	8	17	25	



2. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 <p>SOT54 (TO-92)</p>	 <p>sym131</p>
2	C	collector		
3	E	emitter		

3. Ordering information

Table 3. Ordering information

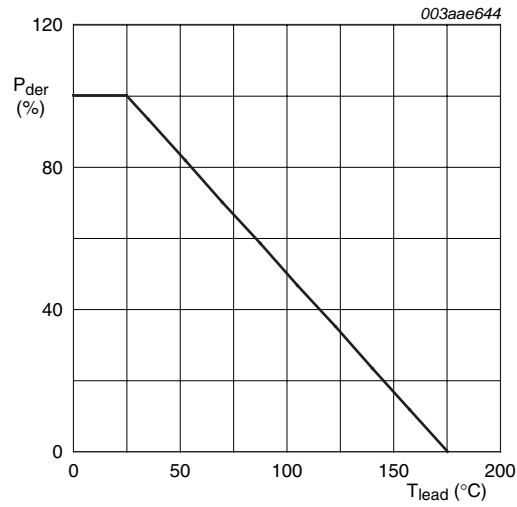
Type number	Package		
	Name	Description	Version
PHD13003C	TO-92	plastic single-ended leaded (through hole) package; 3 leads	SOT54

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	-	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	$T_{lead} \leq 25\text{ °C}$; 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



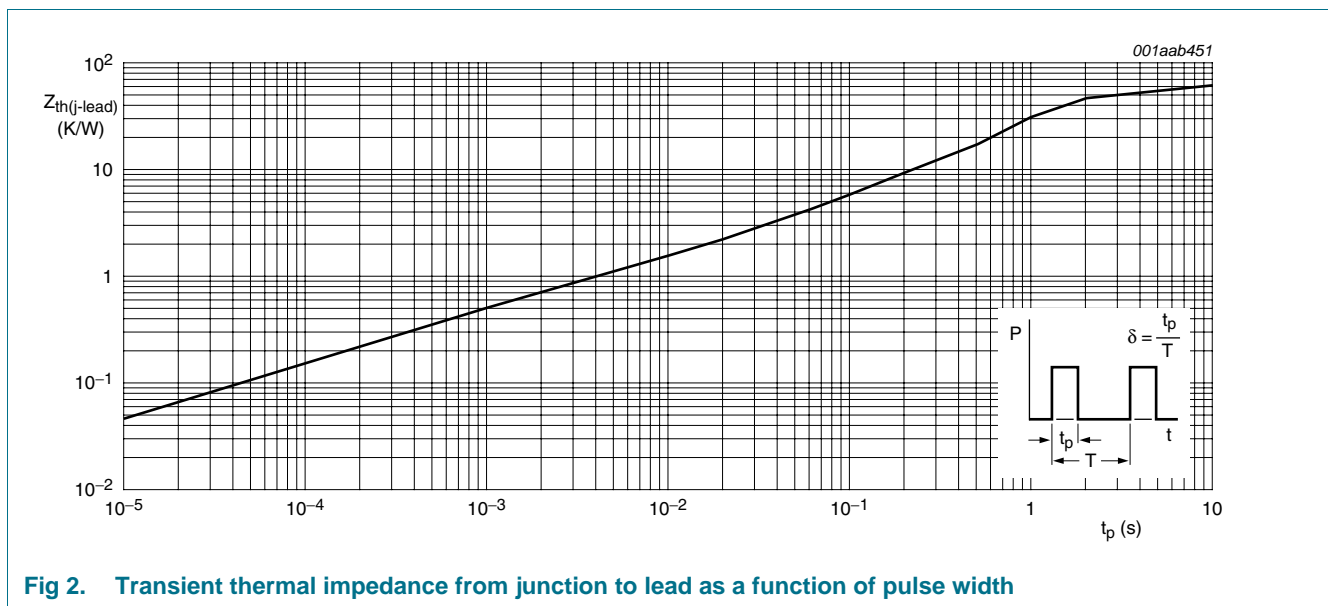
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}C)}} \times 100 \%$$

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

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 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



6. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I_{CES}	collector-emitter cut-off current	$V_{BE} = 0\text{ V}; V_{CE} = 700\text{ V}$	-	-	1	mA
		$V_{BE} = 0\text{ V}; V_{CE} = 700\text{ V}; T_j = 100\text{ °C}$	-	-	5	mA
I_{CEO}	collector-emitter cut-off current	$V_{CE} = 400\text{ V}; I_B = 0\text{ A}; T_{lead} = 25\text{ °C}$	-	-	0.1	mA
I_{EBO}	emitter-base cut-off current	$V_{EB} = 9\text{ V}; I_C = 0\text{ A}; T_{lead} = 25\text{ °C}$	-	-	1	mA
V_{CEOsus}	collector-emitter sustaining voltage	$I_B = 0\text{ A}; I_C = 1\text{ mA}; L_C = 25\text{ mH}; T_{lead} = 25\text{ °C};$ see Figure 3 ; see Figure 4	400	-	-	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 0.5\text{ A}; I_B = 0.1\text{ A}; T_{lead} = 25\text{ °C}$	-	-	0.5	V
		$I_C = 1\text{ A}; I_B = 0.25\text{ A}; T_{lead} = 25\text{ °C}$	-	-	1	V
		$I_C = 1.5\text{ A}; I_B = 0.5\text{ A}; T_{lead} = 25\text{ °C}$	-	-	1.5	V
V_{BEsat}	base-emitter saturation voltage	$I_C = 0.5\text{ A}; I_B = 0.1\text{ A}; T_{lead} = 25\text{ °C}$	-	-	1	V
		$I_C = 1\text{ A}; I_B = 0.25\text{ A}; T_{lead} = 25\text{ °C}$	-	-	1.2	V
V_F	forward voltage	$I_F = 0.5\text{ A}; T_j = 25\text{ °C}$	-	-	1.5	V
h_{FE}	DC current gain	$I_C = 0.5\text{ A}; V_{CE} = 2\text{ V}; T_j = 25\text{ °C}$	8	17	25	
		$I_C = 1\text{ A}; V_{CE} = 2\text{ V}; T_j = 25\text{ °C}$	5	9	15	
Dynamic characteristics						
t_{on}	turn-on time	$I_C = 1\text{ A}; I_{Bon} = 0.2\text{ A}; I_{Boff} = -0.2\text{ A}; R_L = 75\text{ }\Omega; T_{lead} = 25\text{ °C};$ resistive load; see Figure 5 ; see Figure 6	-	-	1	μs
t_s	storage time	$I_C = 1\text{ A}; I_{Bon} = 0.2\text{ A}; V_{BB} = -5\text{ V}; L_B = 1\text{ }\mu\text{H}; T_{lead} = 25\text{ °C};$ inductive load; see Figure 7 ; see Figure 8	-	0.8	-	μs
		$I_C = 1\text{ A}; I_{Bon} = 0.2\text{ A}; I_{Boff} = -0.2\text{ A}; R_L = 75\text{ }\Omega; T_{lead} = 25\text{ °C};$ resistive load; see Figure 5 ; see Figure 6	-	-	0.7	μs
t_f	fall time	$I_C = 0.5\text{ A}; I_{Bon} = 0.1\text{ A}; V_{BB} = -5\text{ V}; L_B = 1\text{ }\mu\text{H}; T_{lead} = 25\text{ °C};$ inductive load; see Figure 7 ; see Figure 8	-	0.1	-	μs
		$I_C = 1\text{ A}; I_{Bon} = 0.2\text{ A}; I_{Boff} = -0.2\text{ A}; R_L = 75\text{ }\Omega; T_{lead} = 25\text{ °C};$ resistive load; see Figure 5 ; see Figure 6	-	-	0.7	μs

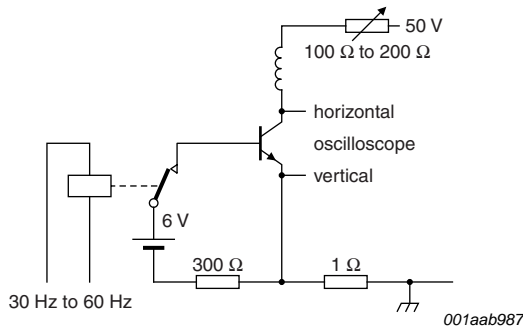


Fig 3. Test circuit for collector-emitter sustaining voltage

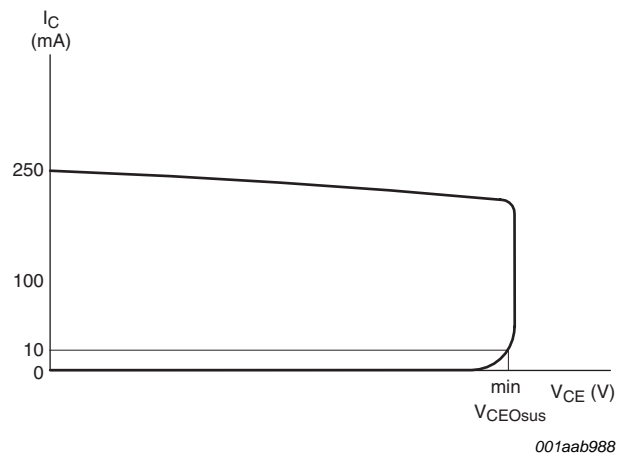
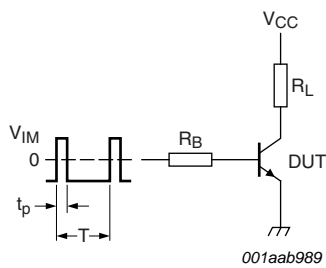


Fig 4. Oscilloscope display for collector-emitter sustaining voltage test waveform



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

Fig 5. Test circuit for resistive load switching

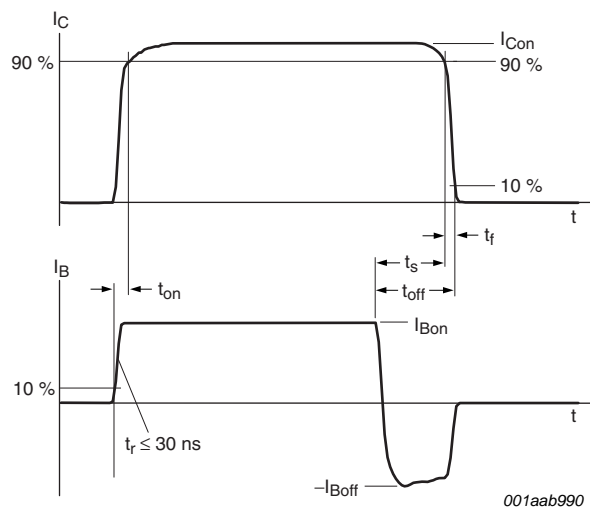
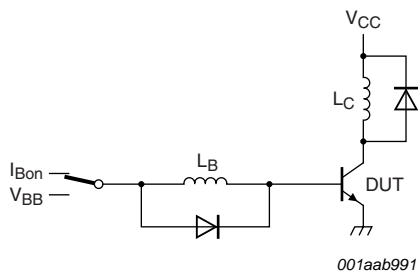


Fig 6. Switching times waveforms for resistive load



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

Fig 7. Test circuit for inductive load switching

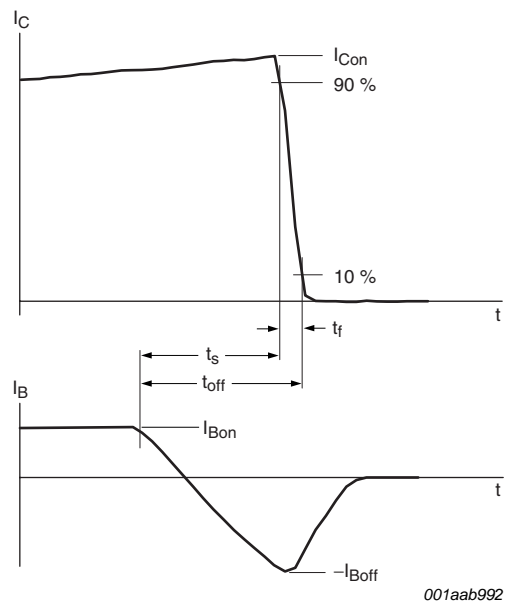


Fig 8. Switching times waveforms for inductive load

7. Package outline

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

SOT54

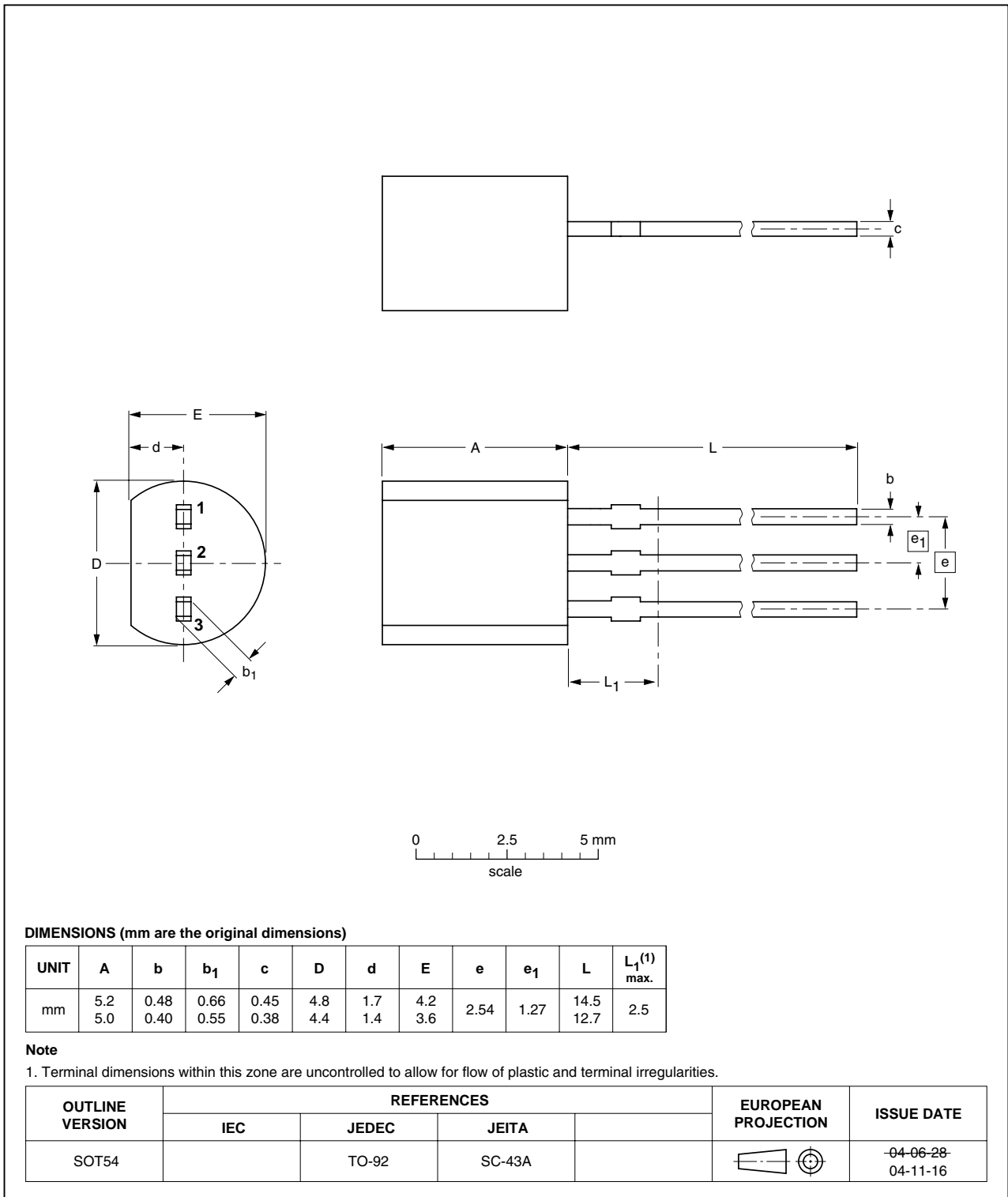


Fig 9. Package outline SOT54 (TO-92)

8. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PHD13003C v.1	20100729	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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