

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

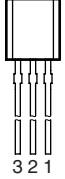
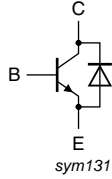
Table 1. Quick reference data

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		
2	C	collector		
3	E	emitter		

SOT54 (TO-92)

3. Ordering information

Table 3. Ordering information

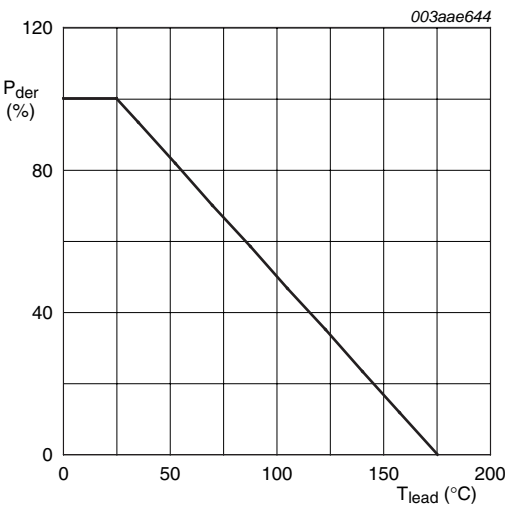
Type number	Package		
	Name	Description	Version
PHD13003C	TO-92	plastic single-ended leaded (through hole) package; 3 leads	SOT54

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



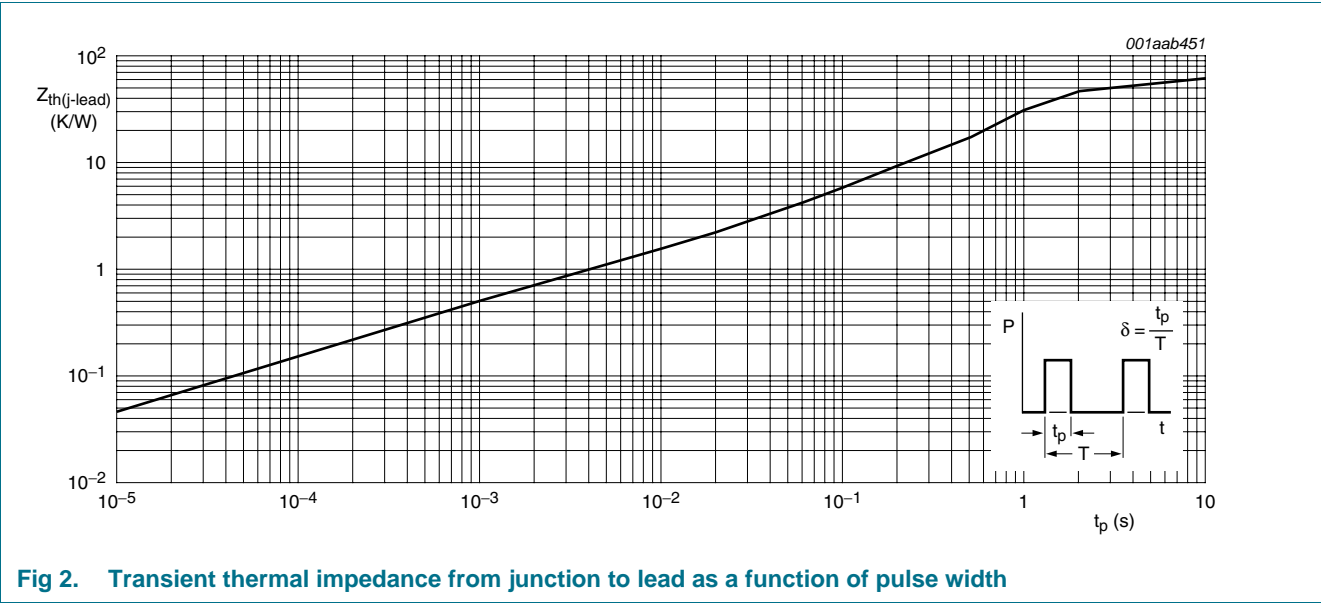
$$P_{der} = \frac{P_{tot}}{P_{tot(25^{\circ}\text{C})}} \times 100\%$$

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 V; V _{CE} = 700 V	-	-	1	mA
		V _{BE} = 0 V; V _{CE} = 700 V; T _j = 100 °C	-	-	5	mA
I _{CEO}	collector-emitter cut-off current	V _{CE} = 400 V; I _B = 0 A; T _{lead} = 25 °C	-	-	0.1	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 3 ; see Figure 4	400	-	-	V
V _{CEsat}	collector-emitter saturation voltage	I _C = 0.5 A; I _B = 0.1 A; T _{lead} = 25 °C	-	-	0.5	V
		I _C = 1 A; I _B = 0.25 A; T _{lead} = 25 °C	-	-	1	V
		I _C = 1.5 A; I _B = 0.5 A; T _{lead} = 25 °C	-	-	1.5	V
V _{BEsat}	base-emitter saturation voltage	I _C = 0.5 A; I _B = 0.1 A; T _{lead} = 25 °C	-	-	1	V
		I _C = 1 A; I _B = 0.25 A; T _{lead} = 25 °C	-	-	1.2	V
V _F	forward voltage	I _F = 0.5 A; T _j = 25 °C	-	-	1.5	V
h _{FE}	DC current gain	I _C = 0.5 A; V _{CE} = 2 V; T _j = 25 °C	8	17	25	
		I _C = 1 A; V _{CE} = 2 V; T _j = 25 °C	5	9	15	
Dynamic characteristics						
t _{on}	turn-on time	I _C = 1 A; I _{Bon} = 0.2 A; I _{Boff} = -0.2 A;	-	-	1	μs
t _s	storage time	R _L = 75 Ω; T _{lead} = 25 °C; resistive load; see Figure 5 ; see Figure 6	-	-	4	μs
		I _C = 1 A; I _{Bon} = 0.2 A; V _{BB} = -5 V; L _B = 1 μH; T _{lead} = 25 °C; inductive load; see Figure 7 ; see Figure 8	-	0.8	-	μs
t _f	fall time	I _C = 1 A; I _{Bon} = 0.2 A; I _{Boff} = -0.2 A; R _L = 75 Ω; T _{lead} = 25 °C; resistive load; see Figure 5 ; see Figure 6	-	-	0.7	μs
		I _C = 0.5 A; I _{Bon} = 0.1 A; V _{BB} = -5 V; L _B = 1 μH; T _{lead} = 25 °C; inductive load; see Figure 7 ; see Figure 8	-	0.1	-	μs

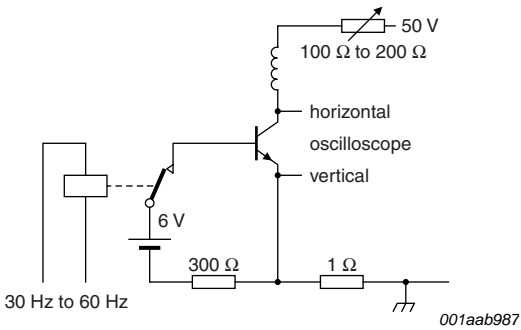


Fig 3. Test circuit for collector-emitter sustaining voltage

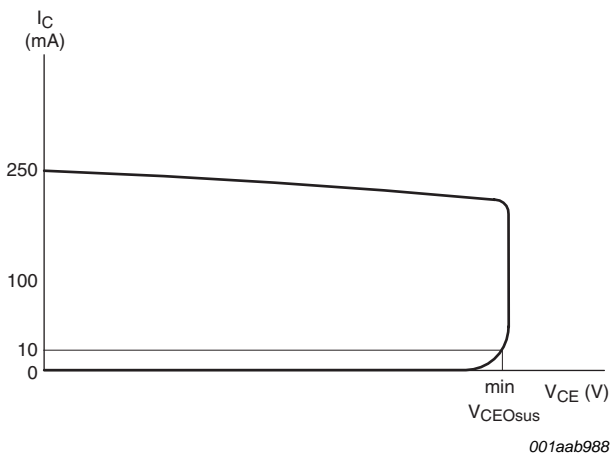
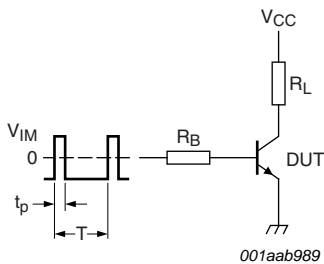


Fig 4. Oscilloscope display for collector-emitter sustaining voltage test waveform



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

Fig 5. Test circuit for resistive load switching

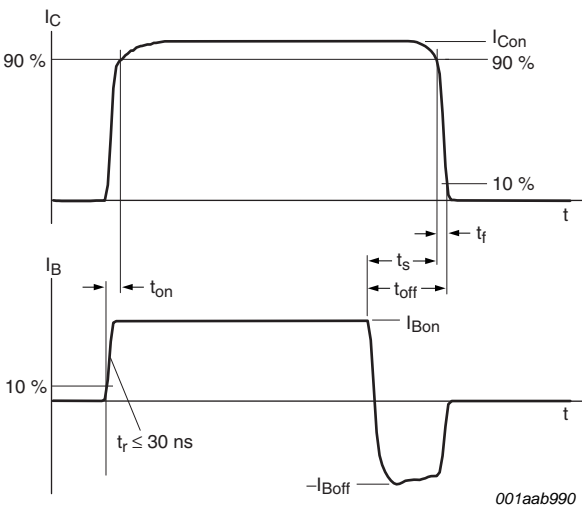
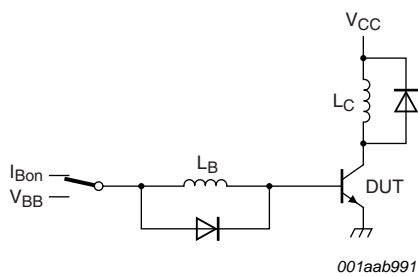


Fig 6. Switching times waveforms for resistive load



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

Fig 7. Test circuit for inductive load switching

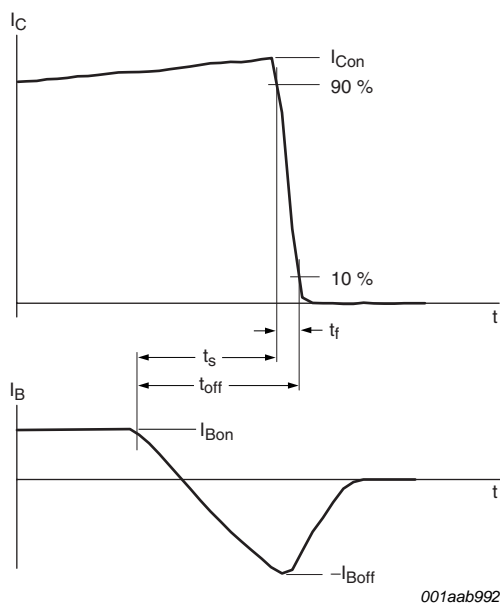


Fig 8. Switching times waveforms for inductive load

7. Package outline

Plastic single-ended leaded (through hole) package; 3 leadsSOT54

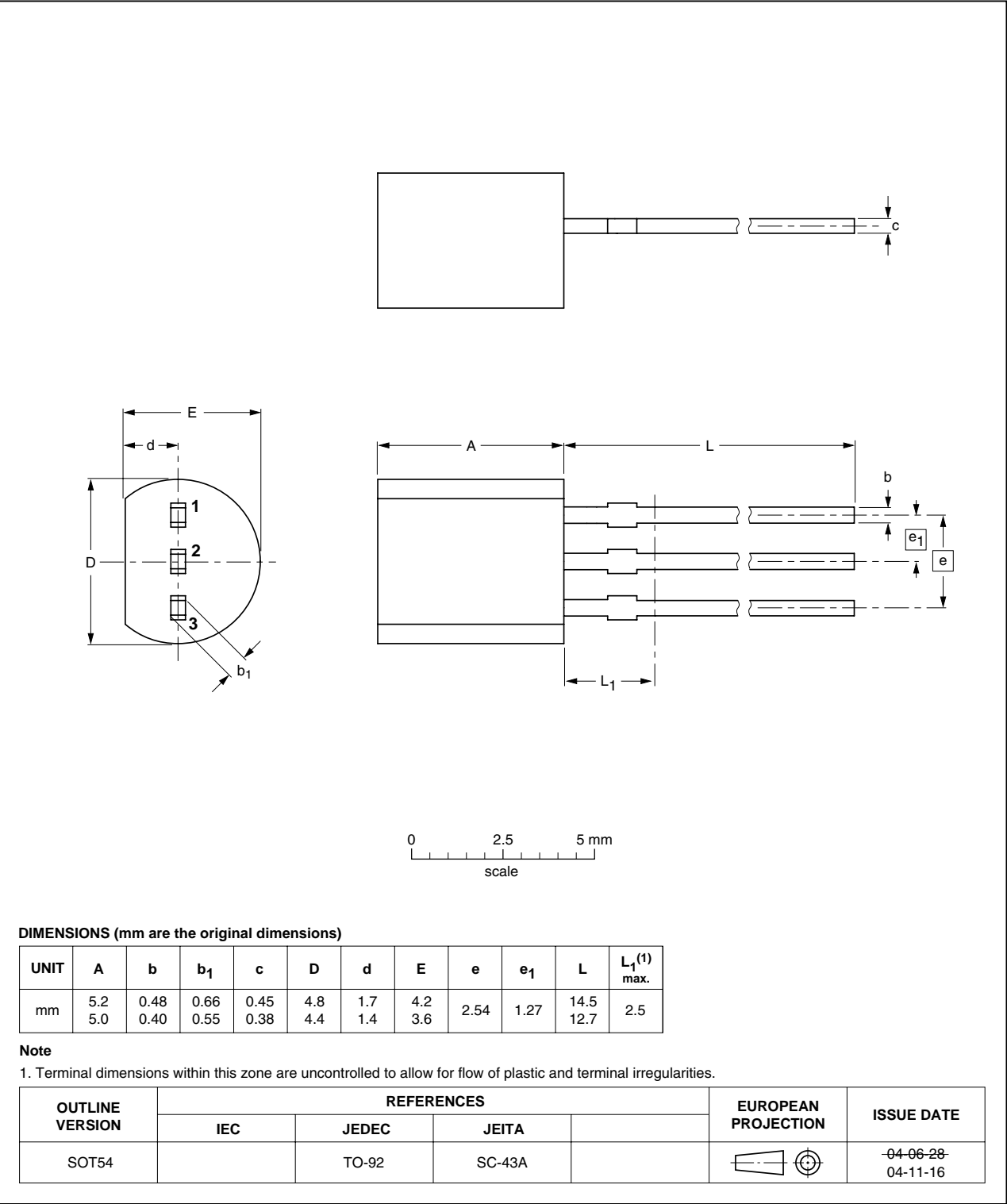


Fig 9. Package outline SOT54 (TO-92)

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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