

1. General description

High voltage, high speed, planar passivated NPN power switching transistor with integrated anti-parallel emitter-collector diode in a SOT54 (TO-92) plastic package.

2. Features and benefits

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

3. Applications

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

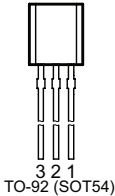
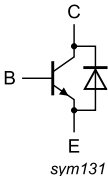
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Values				Unit
Absolute maximum rating							
V _{CESM}	collector-emitter peak voltage	V _{BE} = 0 V	700				V
I _C	collector current	DC	1.5				A
P _{tot}	total power dissipation	T _{lead} ≤ 25 °C; Fig. 1	2.1				W
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
h _{FE}	DC current gain	I _C = 0.5 A; V _{CE} = 2 V; T _J = 25 °C		8	17	25	

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base		
2	C	collector		
3	E	emitter		

6. Ordering information

Table 3. Ordering information

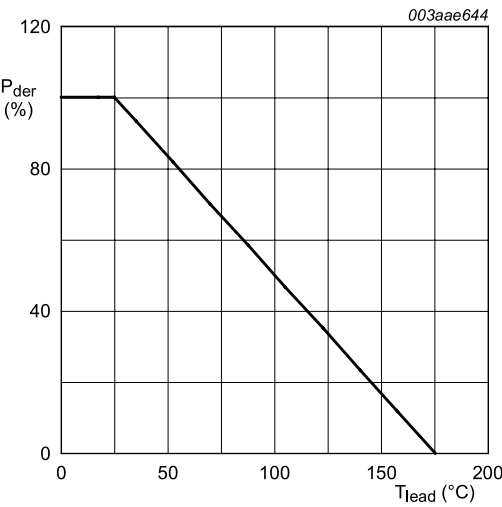
Type number	Package		
	Name	Description	Version
PHD13003C	TO-92	plastic single-ended leaded (through hole) package; 3 leads	SOT54

7. Limiting values

Table 4. Limiting values

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

Symbol	Parameter	Conditions	Values	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 to 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

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

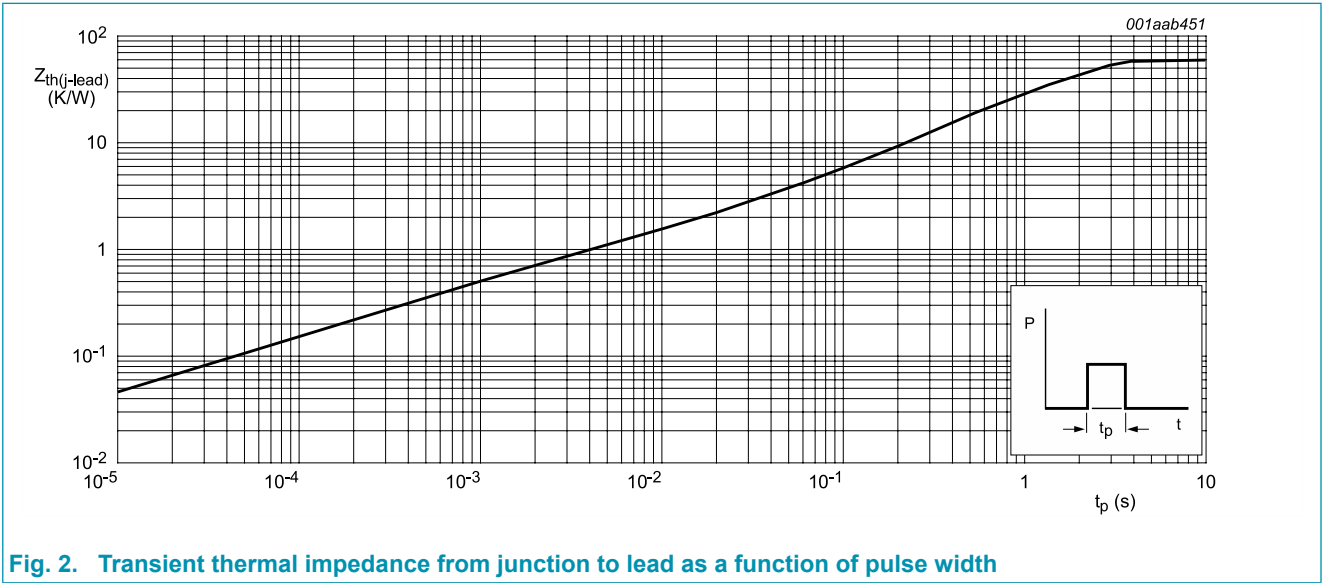


Fig. 2. Transient thermal impedance from junction to lead as a function of pulse width

9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
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 ; Fig. 3 ; Fig. 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; R _L = 75 Ω; T _{lead} = 25 °C; resistive load; Fig. 5 ; Fig. 6		-	-	1	μs
t _s	storage 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; Fig. 5 ; Fig. 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; Fig. 7 ; Fig. 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; Fig. 5 ; Fig. 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; Fig. 7 ; Fig. 8		-	0.1	-	μs

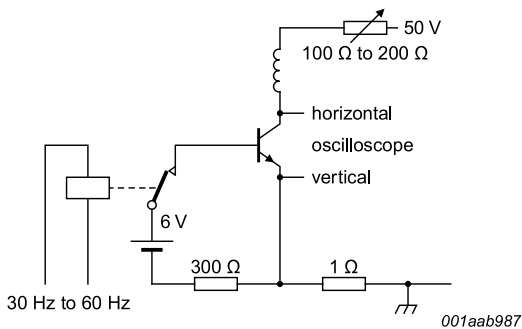


Fig. 3. Test circuit for collector-emitter sustaining voltage

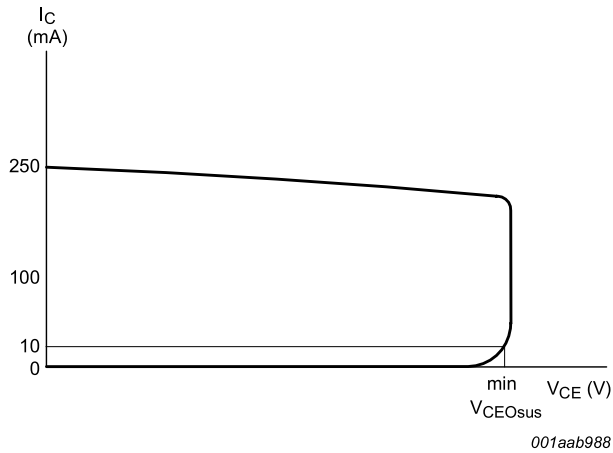
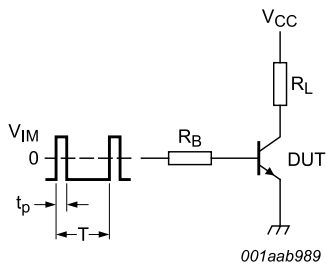


Fig. 4. Oscilloscope display for collector-emitter sustaining voltage test waveform



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

Fig. 5. Test circuit for resistive load switching

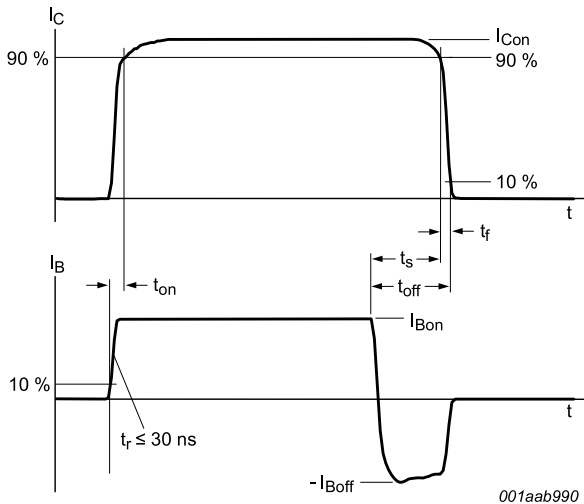
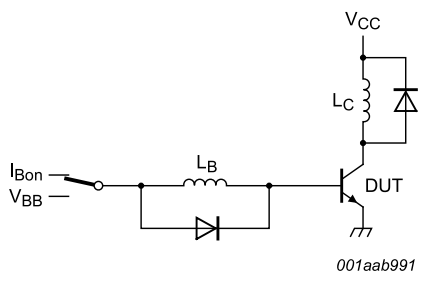


Fig. 6. Switching times waveforms for resistive load



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

Fig. 7. Test circuit for inductive load switching

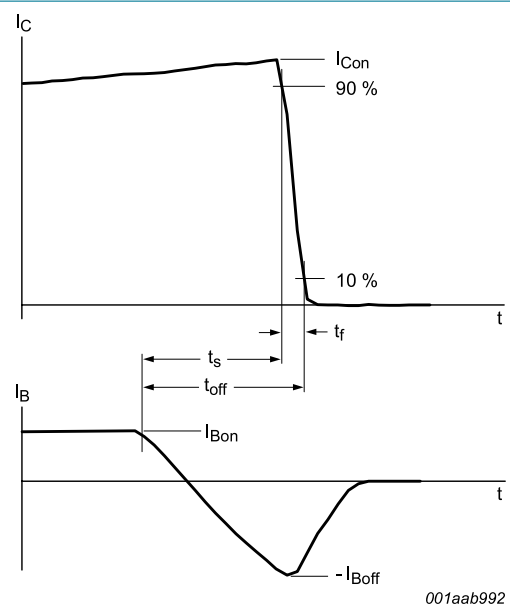
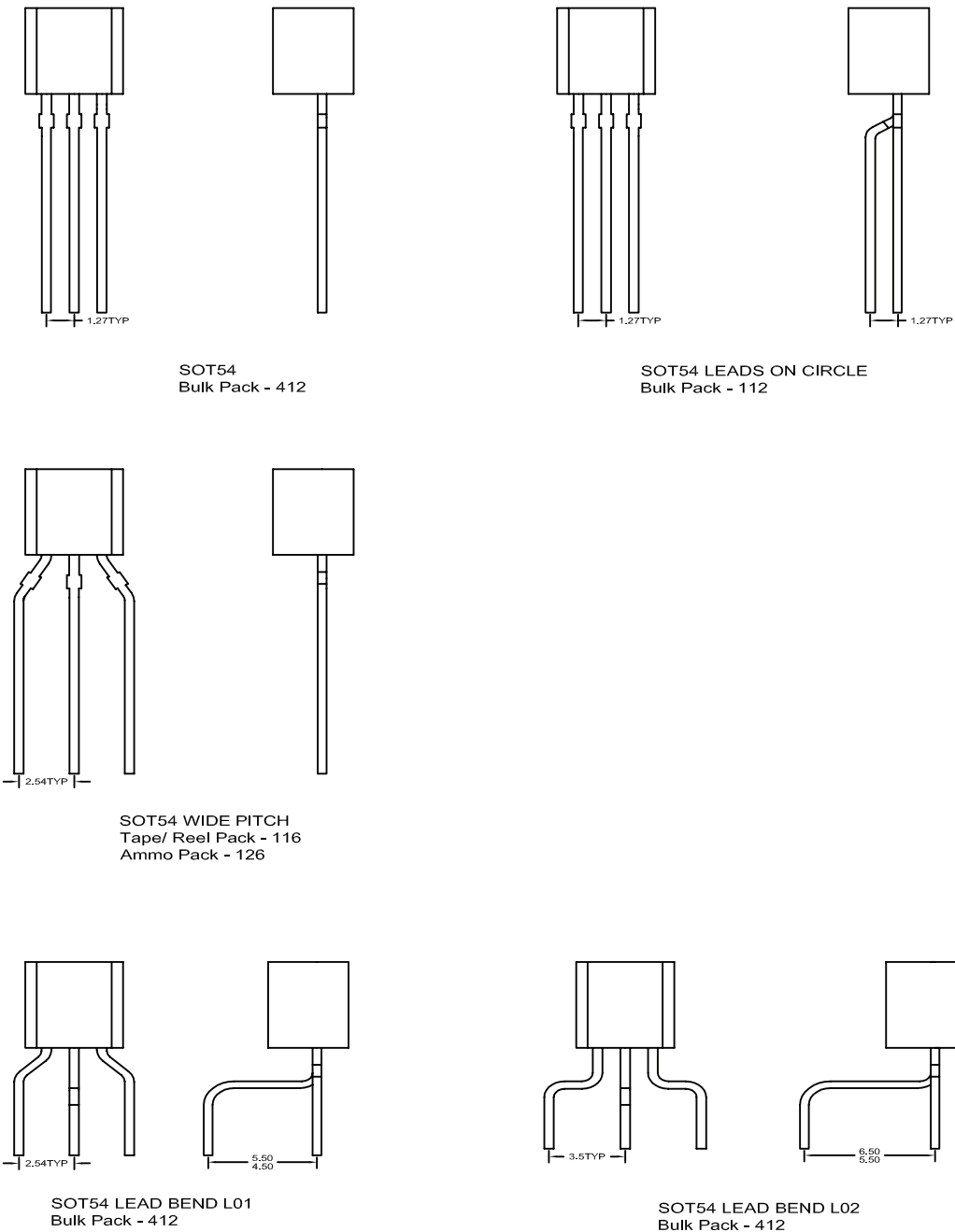


Fig. 8. Switching times waveforms for inductive load

10. Package outline

SOT54 PACKAGE OUTLINE



Remark: Detailed dimensions refer to POD drawing.

11. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
PHD13003C v.2	20180224	Product data sheet	-	PHD13003C v.1
Modifications: Change from NXP version to WeEn version				
PHD13003C v.1	20100729	Product data sheet	-	-

12. Legal information

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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