PHE13005X

Silicon diffused power transistor Rev. 02 — 20 November 2009

Product data sheet

Product profile 1.

1.1 General description

High-voltage, high-speed planar-passivated, NPN power switching transistor in a full pack plastic package for use in high frequency electronic lighting ballast applications

Isolated package

Low thermal resistance

1.2 Features and benefits

- Fast switching
- High voltage capability of 700 V

1.3 Applications

Electronic lighting ballasts

1.4 Quick reference data

Table 1.	Quick reference					
Symbol	Parameter	Conditions	Min	Тур	Max	Unit
I _C	collector current	DC; see <u>Figure 3</u> , <u>1</u> and <u>2</u>	-	-	4	А
P _{tot}	total power dissipation	T _h ≤ 25 °C; see <u>Figure 4</u>	-	-	26	W
V _{CESM}	collector-emitter peak voltage	$V_{BE} = 0 V$	-	-	700	V
Static ch	aracteristics					
h _{FE}	DC current gain	I _C = 1 A; V _{CE} = 5 V; T _h = 25 °C; see <u>Figure 11</u>	12	20	40	
		$V_{CE} = 5 \text{ V}; I_C = 2 \text{ A};$ $T_h = 25 \text{ °C}; \text{ see } \frac{\text{Figure 11}}{1}$	10	17	28	



2. Pinning information

Table 2.	Pinning	information	
Pin	Symbol	Description	Simplified outline Graphic symbol
1	В	base	
2	С	collector	mb C
3	Е	emitter	в-К
3 mb	n.c.	isolated	E sym123 1 2 3 SOT186A (TO-220F)

3. Ordering information

Table 3.Ordering information

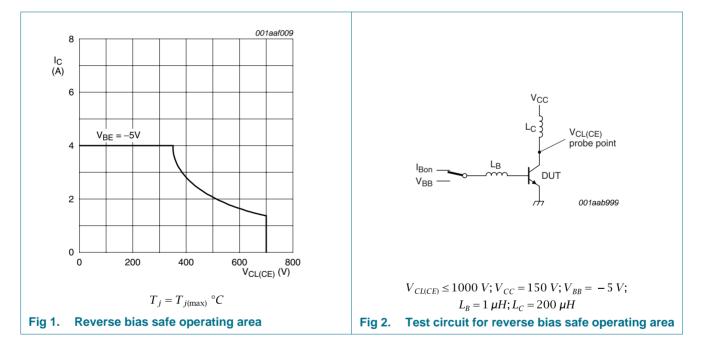
Type number	er Package				
	Name	Description	Version		
PHE13005X	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"	SOT186A		

4. Limiting values

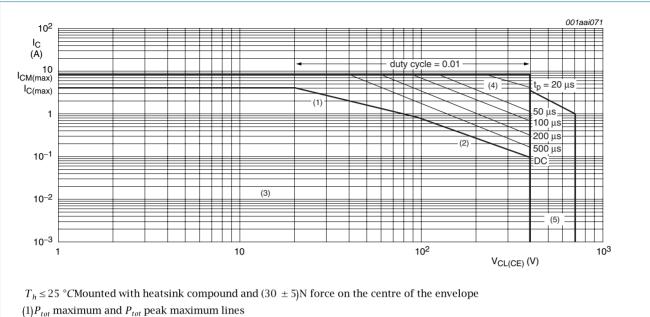
Table 4. Limiting values

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

Symbol	Parameter	Conditions	Min	Мах	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 <u>Figure 3</u> , <u>1</u> and <u>2</u>	-	4	А
I _{CM}	peak collector current		-	8	А
I _B	base current		-	2	А
I _{BM}	peak base current		-	4	А
P _{tot}	total power dissipation	T _h ≤ 25 °C; see <u>Figure 4</u>	-	26	W
T _{stg}	storage temperature		-65	150	°C
Tj	junction temperature		-	150	°C



PHE13005X



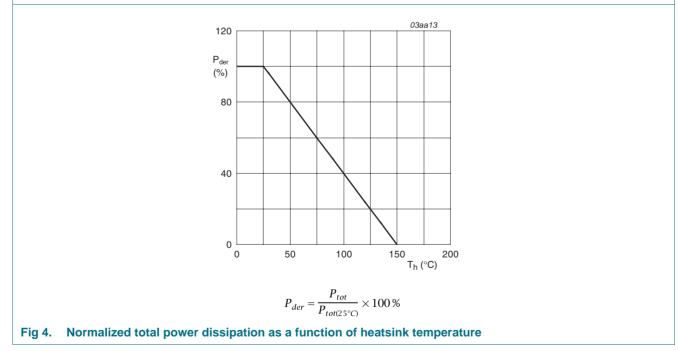
(2)Second breakdown limits

(3)Region of permissible DC operation

(4)Extension of operating region for repetitive pulse operation

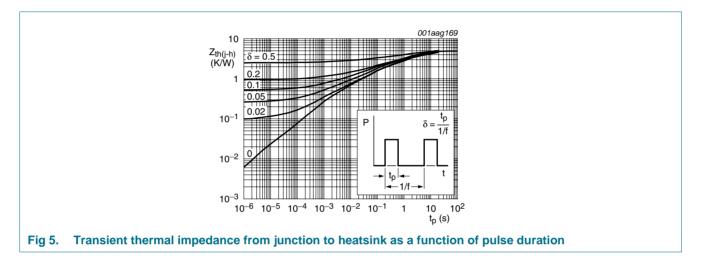
(5)Extension of operating region during turn-on in single transistor converters provided that $R_{BE} \le 100 \Omega$ and $t_p \le 0.6 \mu s$

Fig 3. Forward bias safe operating area



5. Thermal characteristics

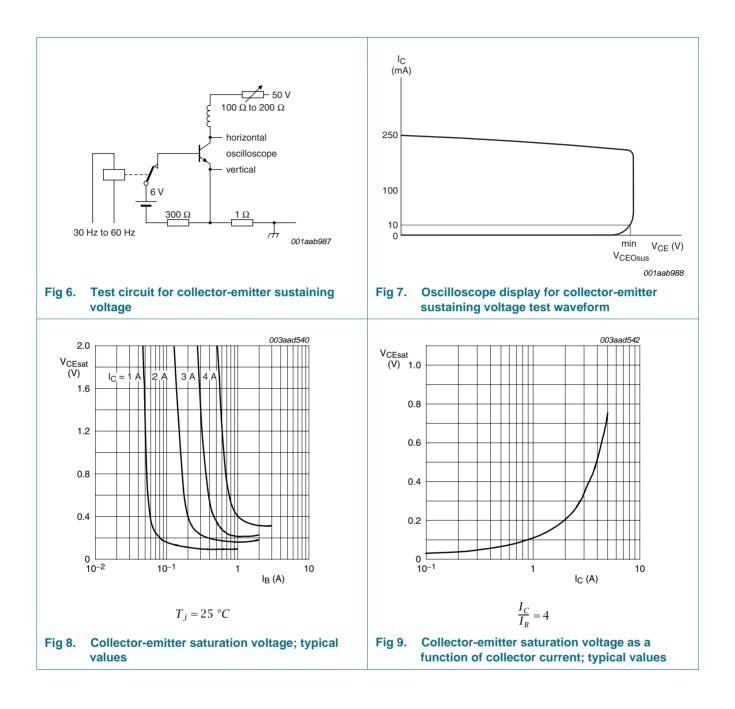
Table 5.	Thermal characteristics	\$				
Symbol	Parameter	Conditions	Min	Тур	Мах	Unit
R _{th(j-h)}	thermal resistance from junction to heatsink	with heatsink compound; see Figure 5	-	-	4.8	K/W
R _{th(j-a)}	thermal resistance from junction to ambient		-	55	-	K/W



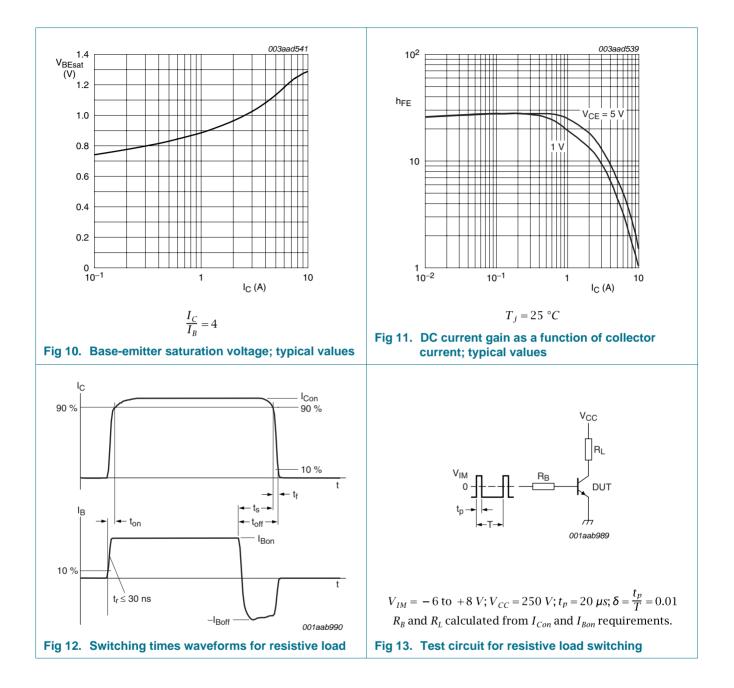
6. Characteristics

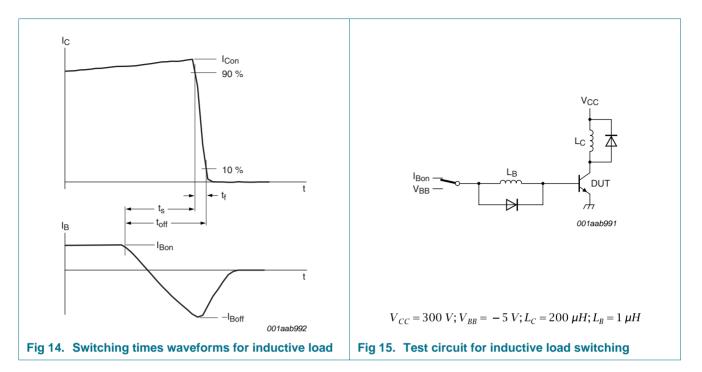
Table 6.	Characteristics					
Symbol	Parameter	Conditions	Min	Тур	Мах	Unit
Static cha	aracteristics					
I _{CES} collector-emitter cut-off		V_{BE} = 0 V; V_{CE} = 700 V; T_j = 25 °C	-	-	1	mA
	current	V_{BE} = 0 V; V_{CE} = 700 V; T_j = 100 °C	-	-	5	mA
I _{CBO}	collector-base cut-off current	V_{CB} = 700 V; I _E = 0 A; T _h = 25 °C	-	-	1	mA
I _{CEO}	collector-emitter cut-off current	V_{CE} = 400 V; I _B = 0 A; T _h = 25 °C	-	-	0.1	mA
I _{EBO}	emitter-base cut-off current	$V_{EB} = 9 \text{ V}; I_{C} = 0 \text{ A}; T_{h} = 25 \text{ °C}$	-	-	1	mA
V _{CEOsus}	collector-emitter sustaining voltage	$I_B = 0 \text{ A}; I_C = 10 \text{ mA}; L_C = 25 \text{ mH};$ $T_h = 25 \text{ °C}; \text{ see } \frac{\text{Figure 6}}{1000 \text{ cm}} \text{ and } \frac{7}{1000 \text{ cm}}$	400	-	-	V
V _{CEsat}	collector-emitter saturation voltage	$I_{C} = 1 \text{ A}; I_{B} = 0.2 \text{ A}; T_{h} = 25 \text{ °C};$ see <u>Figure 8</u> and <u>9</u>	-	0.1	0.5	V
		$I_C = 2 \text{ A}; I_B = 0.5 \text{ A}; T_h = 25 \text{ °C};$ see Figure 8 and 9	-	0.2	0.6	V
		$I_C = 4 \text{ A}; I_B = 1 \text{ A}; T_h = 25 \text{ °C};$ see Figure 8 and 9	-	0.3	1	V
V _{BEsat} base-emitter saturation voltage	I _C = 1 A; I _B = 0.2 A; T _h = 25 °C; see <u>Figure 10</u>	-	0.85	1.2	V	
		$I_{C} = 2 \text{ A}; I_{B} = 0.5 \text{ A}; T_{h} = 25 \text{ °C};$ see <u>Figure 10</u>	-	0.92	1.6	V
h _{FE}	DC current gain	I _C = 1 A; V _{CE} = 5 V; T _h = 25 °C; see <u>Figure 11</u>	12	20	40	
		I _C = 2 A; V _{CE} = 5 V; T _h = 25 °C; see <u>Figure 11</u>	10	17	28	
Dynamic	characteristics					
t _s storage time		$ I_C = 2 \text{ A}; I_{Bon} = 0.4 \text{ A}; I_{Boff} = -0.4 \text{ A}; R_L = 75 \Omega; T_h = 25 °C; resistive load; see Figure 12 and 13$	-	2.7	4	μs
		$\begin{split} I_{C} &= 2 \text{ A}; \ I_{Bon} = 0.4 \text{ A}; \ V_{BB} = -5 \text{ V}; \\ L_{B} &= 1 \mu\text{H}; \ T_{h} = 25 ^\circ\text{C}; \ \text{inductive load}; \\ \text{see } \overline{\text{Figure 14}} \text{ and } \underline{15} \end{split}$	-	1.2	2	μs
		$\begin{split} I_{C} &= 2 \text{ A}; I_{Bon} = 0.4 \text{ A}; \text{V}_{BB} = \textbf{-5 V}; \\ I_{B} &= 1 \mu\text{H}; T_{h} = 100 ^{\circ}\text{C}; \text{ inductive load}; \\ \text{see } \underline{\text{Figure 14}} \text{ and } \underline{15} \end{split}$	-	1.4	4	μs
t _f	fall time	$\begin{split} I_{C} &= 2 \text{ A}; \ I_{Bon} = 0.4 \text{ A}; \ I_{Boff} = -0.4 \text{ A}; \\ R_{L} &= 75 \ \Omega; \ T_{h} = 25 \ ^{\circ}C; \ resistive \ load; \\ see \ \overline{Figure \ 13} \ and \ \underline{12} \end{split}$	-	0.3	0.9	μs
		$\begin{split} I_C &= 2 \text{ A}; I_{Bon} = 0.4 \text{ A}; \text{V}_{BB} = \text{-5 V}; \\ I_B &= 1 \mu\text{H}; T_h = 25 ^\circ\text{C}; \text{ inductive load}; \\ \text{see } \underline{\text{Figure 14}} \text{ and } \underline{15} \end{split}$	-	0.1	0.5	μs
		$I_C = 2 \text{ A}$; $I_{Bon} = 0.4 \text{ A}$; $V_{BB} = -5 \text{ V}$; $L_B = 1 \mu\text{H}$; $T_h = 100 ^\circ\text{C}$; inductive load; see Figure 14 and 15	-	0.16	0.9	μs

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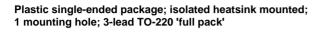
7. Isolation characteristics

Table 7.	Isolation characteristic	S				
Symbol	Parameter	Conditions	Min	Тур	Max	Unit
V _{isol(RMS)}	RMS isolation voltage	50 Hz \leq f \leq 60 Hz; RH \leq 65 %; T _h = 25 °C; from all terminals to external heatsink; clean and dust free	-	-	2500	V
C _{isol}	isolation capacitance	from collector to external heatsink; f = 1 MHz; $T_h = 25 \text{ °C}$	-	10	-	pF

SOT186A

Silicon diffused power transistor

8. Package outline



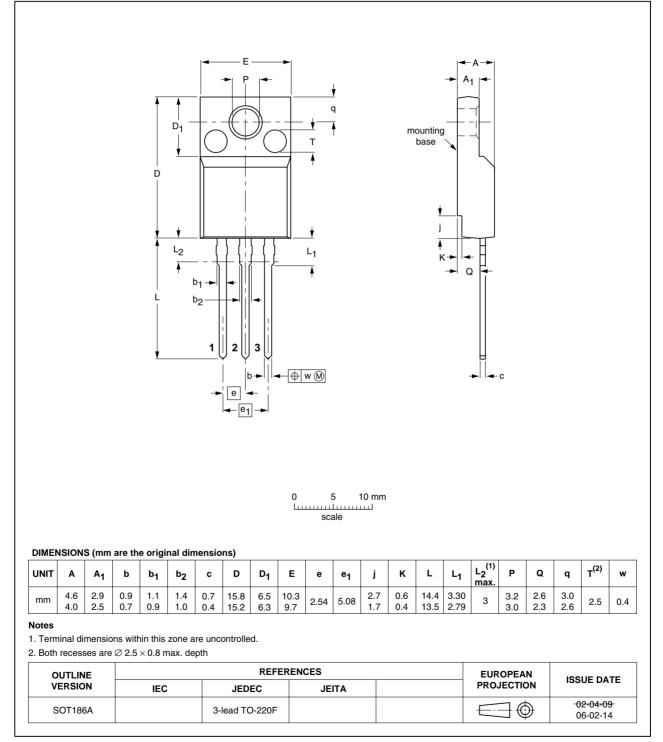


Fig 16. Package outline SOT186A (TO-220F)

9. Revision history

Table 8. Revision h	istory			
Document ID	Release date	Data sheet status	Change notice	Supersedes
PHE13005X_2	20091120	Product data sheet	-	PHE13005X_1
Modifications:	 Various cha 	anges to content.		
PHE13005X_1	20080515	Product data sheet	-	-

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10.1 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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