

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

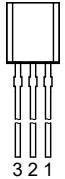
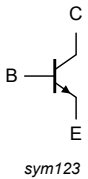
4. Quick reference data

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	
		$I_C = 1\text{ A}$; $V_{CE} = 2\text{ V}$; $T_{lead} = 25\text{ °C}$	5	9	15	

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

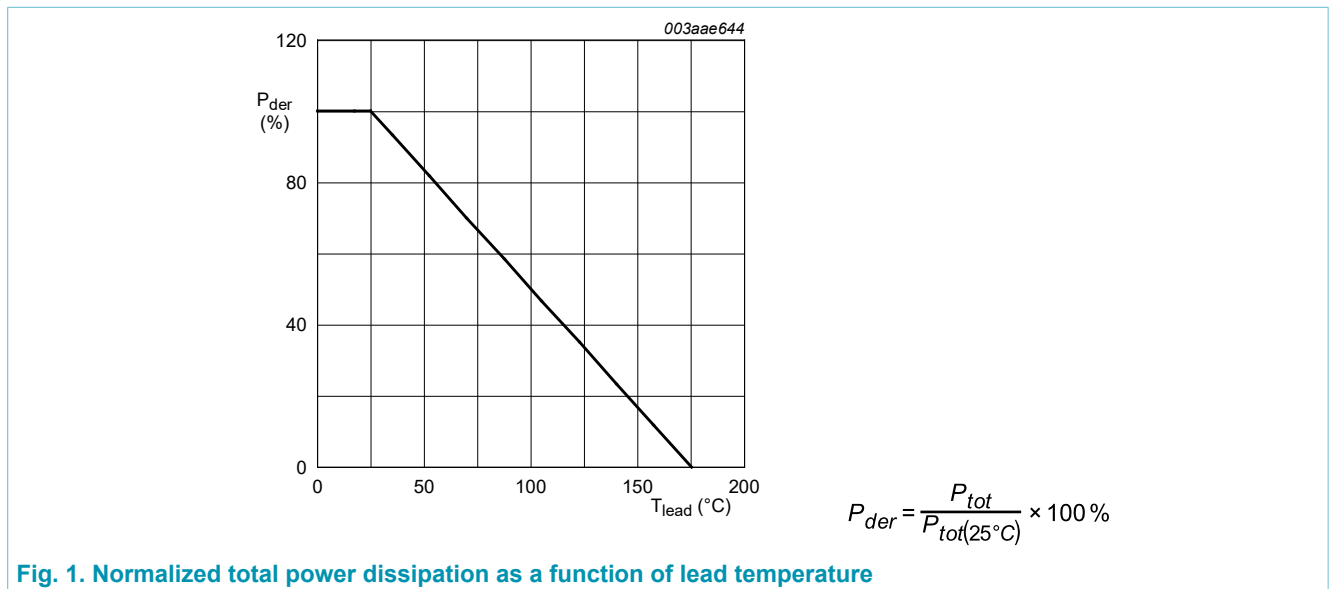
Type number	Package		
	Name	Description	Version
PHE13003C	TO-92	plastic single-ended leaded (through hole) package; 3 leads	SOT54

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 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
V _{EBO}	emitter-base voltage	I _C = 0 A; I(Emmitter) = 10 mA	-	9	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} ≤ 25 °C; Fig. 1	-	2.1	W
T _{stg}	storage temperature		-65	150	°C
T _j	junction temperature		-	150	°C



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 free air	in free air; printed circuit board mounted; lead length = 4 mm	-	150	-	K/W

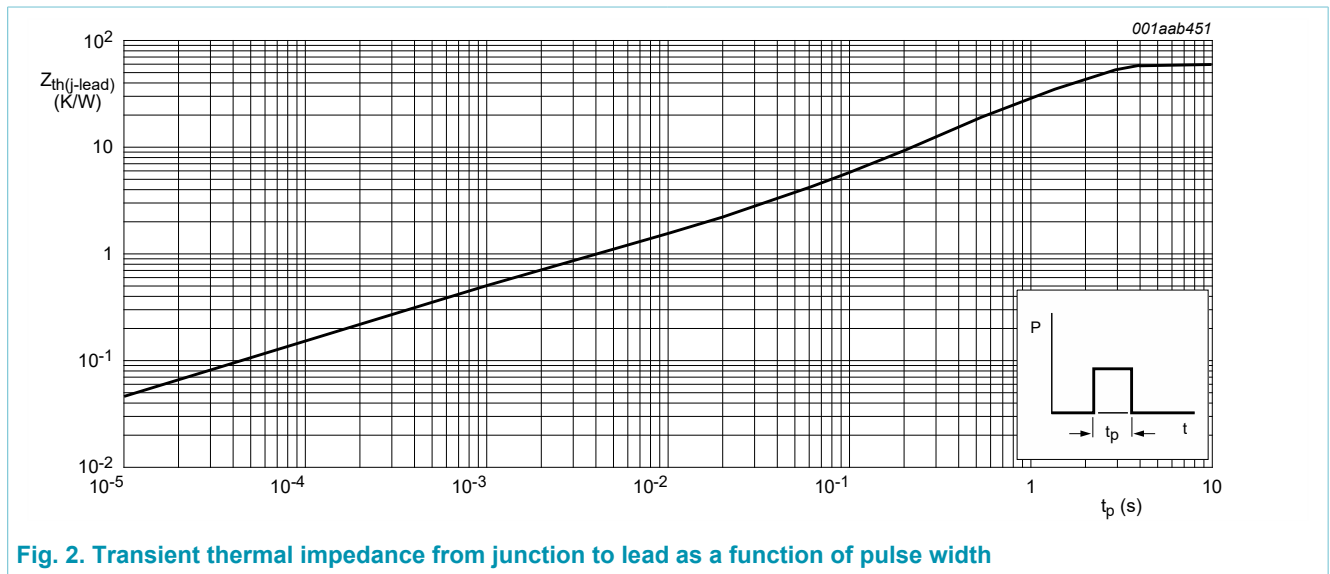


Fig. 2. Transient thermal impedance from junction to lead as a function of pulse width

9. Characteristics

Table 6. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I_{CES}	collector-emitter cut-off current (base shorted)	$V_{BE} = 0\text{ V}; V_{CE} = 700\text{ V}; T_j = 125\text{ }^\circ\text{C}$	-	-	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 (base open)	$V_{CE} = 400\text{ V}; I_B = 0\text{ A}; T_{lead} = 25\text{ }^\circ\text{C}$	-	-	0.1	mA
I_{EBO}	emitter-base cut-off current (collector open)	$V_{EB} = 9\text{ V}; I_C = 0\text{ A}; T_{lead} = 25\text{ }^\circ\text{C}$	-	-	1	mA
V_{CEOsus}	collector-emitter sustaining voltage (base open)	$I_B = 0\text{ A}; I_C = 1\text{ mA}; L_C = 25\text{ mH}; T_{lead} = 25\text{ }^\circ\text{C};$ 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	
Dynamic characteristics						
t_{on}	turn-on time	$I_C = 1\text{ A}; I_{Bon} = 0.2\text{ A}; I_{Boff} = -0.2\text{ A}; R_L = 75\text{ }\Omega; T_{lead} = 25\text{ }^\circ\text{C};$ resistive load; Fig. 5 ; Fig. 6	-	-	1	μs
t_s	storage time		$I_C = 1\text{ A}; I_{Bon} = 0.2\text{ A}; V_{BB} = -5\text{ V}; L_B = 1\text{ }\mu\text{H}; T_{lead} = 25\text{ }^\circ\text{C};$ inductive load; Fig. 7 ; Fig. 8	-	0.8	-
		t_f	fall time	$I_C = 1\text{ A}; I_{Bon} = 0.2\text{ A}; I_{Boff} = -0.2\text{ A}; R_L = 75\text{ }\Omega; T_{lead} = 25\text{ }^\circ\text{C};$ resistive load; Fig. 5 ; Fig. 6	-	-
$I_C = 0.5\text{ A}; I_{Bon} = 0.1\text{ A}; V_{BB} = -5\text{ V}; L_B = 1\text{ }\mu\text{H}; T_{lead} = 25\text{ }^\circ\text{C};$ inductive load; Fig. 7 ; Fig. 8	-			0.1	-	μs

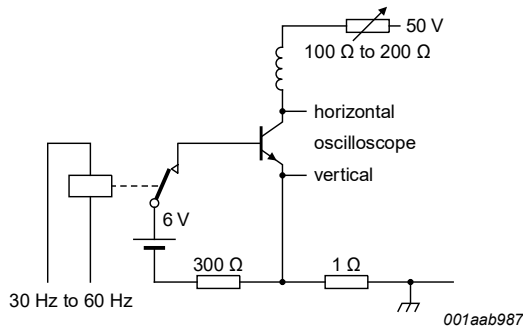


Fig. 3. Test circuit for collector-emitter sustaining voltage

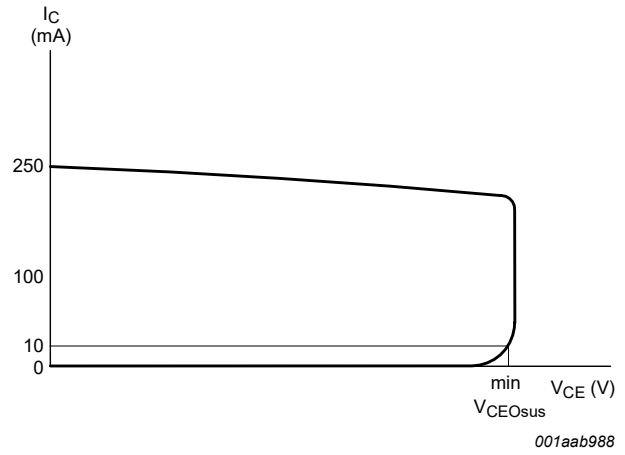
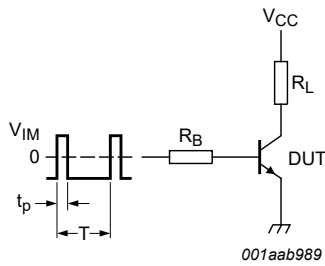


Fig. 4. Oscilloscope display for collector-emitter sustaining voltage test waveform



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

Fig. 5. Test circuit for resistive load switching

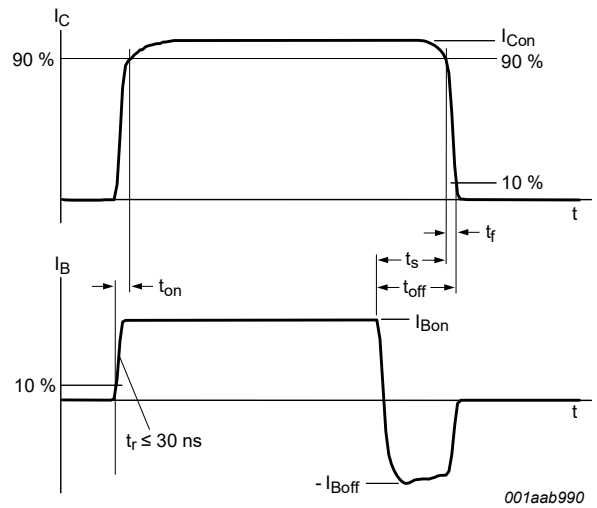


Fig. 6. Switching times waveforms for resistive load

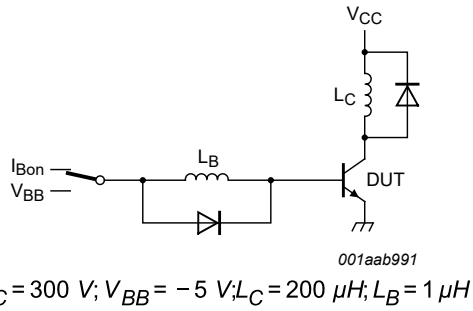


Fig. 7. Test circuit for inductive load switching

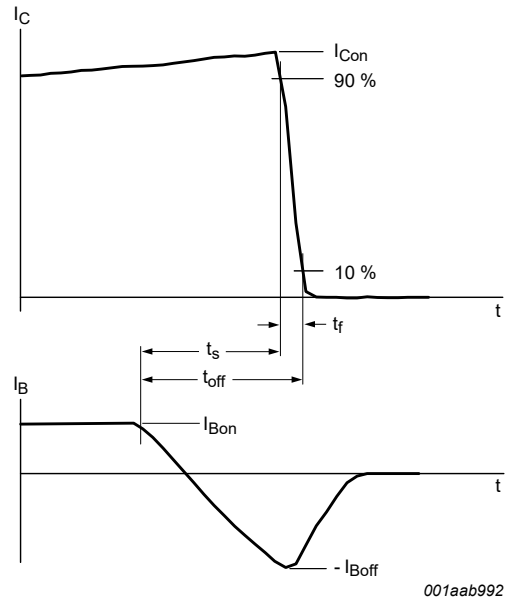


Fig. 8. Switching times waveforms for inductive load

10. Package outline

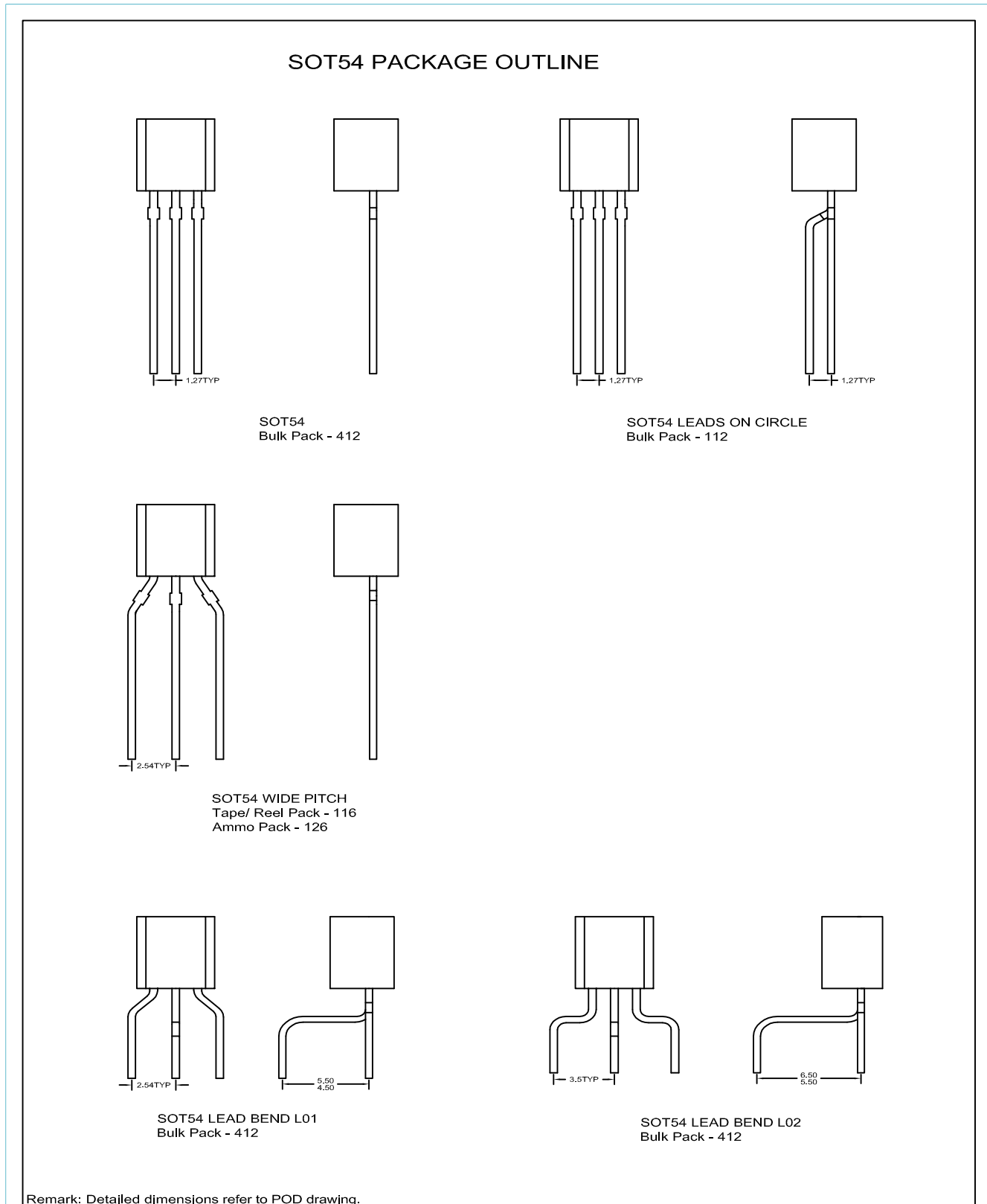


Fig. 9. Package outline TO-92 (SOT54)

11. Legal information

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Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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Product [short] data sheet	Production	This document contains the product specification.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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