

1. General description

High voltage, high speed, planar passivated NPN power switching transistor in a SOT54 (TO-92) plastic package.

2. Features and benefits

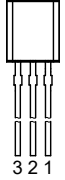
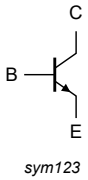
- Fast switching
- High voltage capability
- Very low switching and conduction losses

3. Applications

- Compact fluorescent lamps (CFL)
- Electronic lighting ballasts
- Inverters
- Off-line self-oscillating power supplies

4. Pinning information

Table 1. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	B	base	 <p>TO-92 (SOT54)</p>	 <p>sym123</p>
2	C	collector		
3	E	emitter		

5. Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
PHE13003A	TO-92	plastic single-ended leaded (through hole) package; 3 leads	SOT54

6. Limiting values

Table 3. 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
V_{EBO}	emitter-base voltage	$I_C = 0\text{ A}; I(\text{Emitter}) = 10\text{ mA}$	-	9	V
I_C	collector current	DC; Fig. 1	-	1	A
I_{CM}	peak collector current		-	2	A
I_B	base current	DC	-	0.5	A
I_{BM}	peak base current		-	1	A
P_{tot}	total power dissipation	$T_{lead} \leq 25\text{ °C};$ Fig. 2	-	2.1	W
T_{stg}	storage temperature		-65	150	°C
T_j	junction temperature		-	150	°C

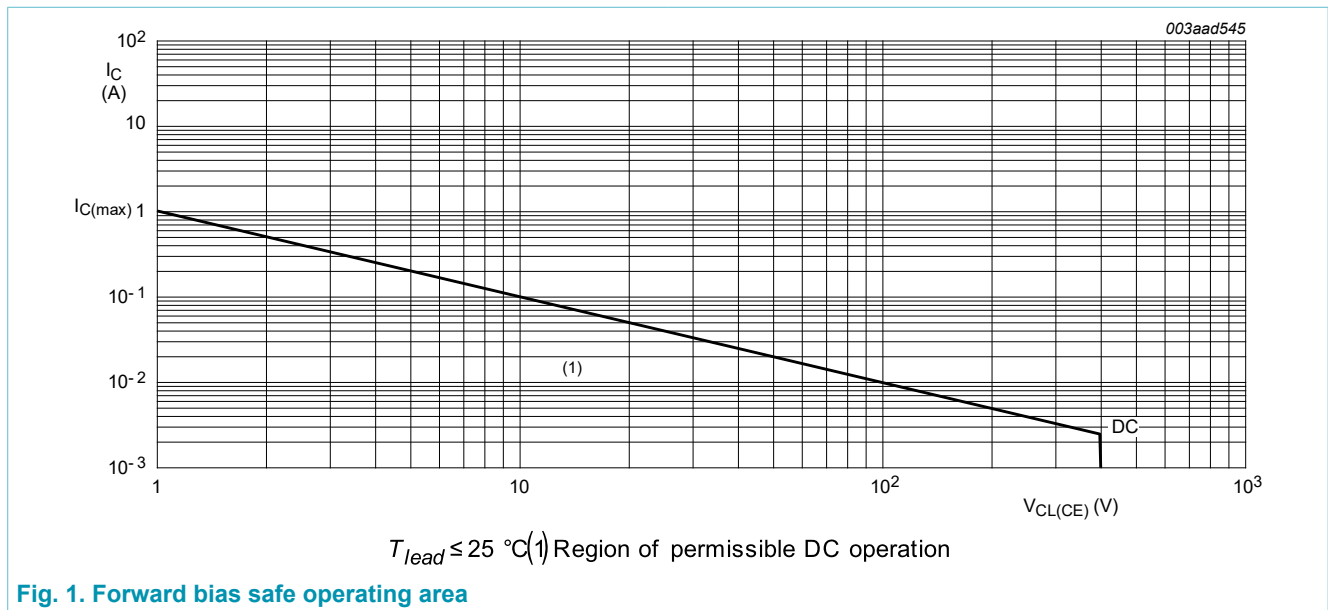
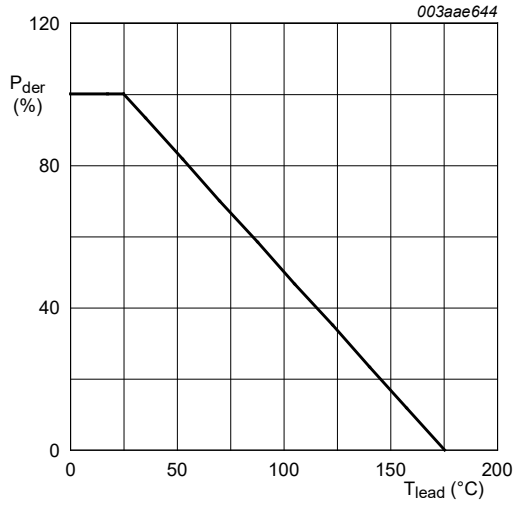


Fig. 1. Forward bias safe operating area



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

Fig. 2. Normalized total power dissipation as a function of lead temperature

7. Thermal characteristics

Table 4. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
R _{th(j-lead)}	thermal resistance from junction to lead	Fig. 3	-	-	60	K/W
R _{th(j-a)}	thermal resistance from junction to ambient free air	printed circuit board mounted; lead length = 4 mm	-	150	-	K/W

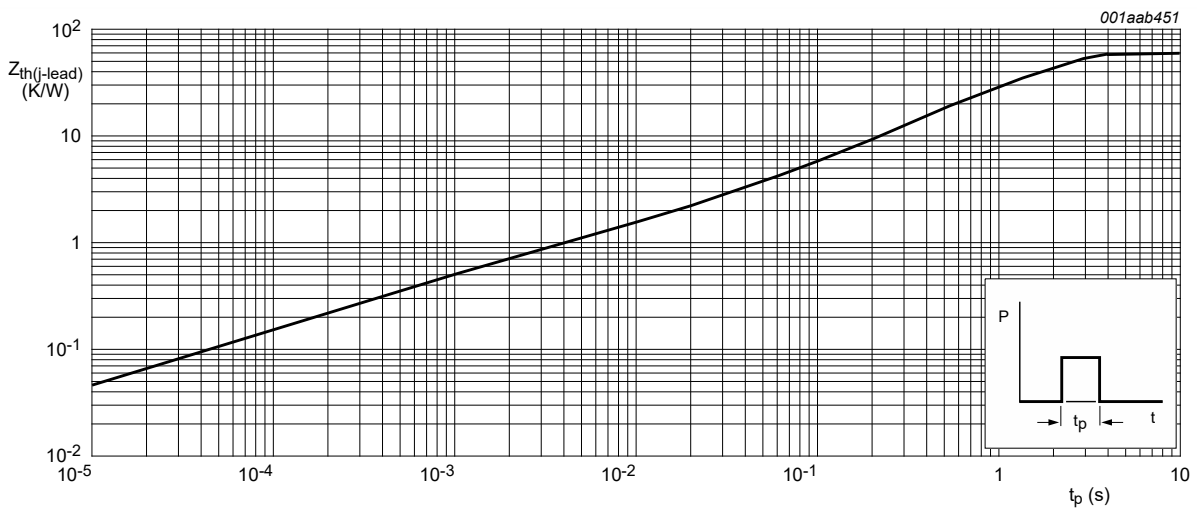


Fig. 3. Transient thermal impedance from junction to lead as a function of pulse width

8. Characteristics

Table 5. Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I_{CES}	collector-emitter cut-off current (base shorted)	$V_{BE} = 0\text{ V}$; $V_{CE} = 700\text{ V}$; $T_j = 125\text{ °C}$	-	-	5	mA
I_{EBO}	emitter-base cut-off current (collector open)	$V_{EB} = 9\text{ V}$; $I_C = 0\text{ A}$; $T_{lead} = 25\text{ °C}$	-	-	1	mA
V_{CE0sus}	collector-emitter sustaining voltage (base open)	$I_B = 0\text{ A}$; $I_C = 1\text{ mA}$; $L_C = 25\text{ mH}$; $T_{lead} = 25\text{ °C}$; Fig. 4 ; Fig. 5	400	-	-	V
V_{CEsat}	collector-emitter saturation voltage	$I_C = 0.25\text{ A}$; $I_B = 50\text{ mA}$; $T_{lead} = 25\text{ °C}$; Fig. 6	-	0.2	0.5	V
		$I_C = 0.5\text{ A}$; $I_B = 125\text{ mA}$; $T_{lead} = 25\text{ °C}$; Fig. 6	-	0.3	1	V
		$I_C = 0.75\text{ A}$; $I_B = 250\text{ mA}$; $T_{lead} = 25\text{ °C}$; Fig. 6	-	0.4	1.5	V
V_{BEsat}	base-emitter saturation voltage	$I_C = 0.25\text{ A}$; $I_B = 50\text{ mA}$; $T_{lead} = 25\text{ °C}$; Fig. 7	-	-	1	V
		$I_C = 0.5\text{ A}$; $I_B = 125\text{ mA}$; $T_{lead} = 25\text{ °C}$; Fig. 7	-	-	1.2	V
h_{FE}	DC current gain	$I_C = 0.5\text{ mA}$; $V_{CE} = 2\text{ V}$; $T_{lead} = 25\text{ °C}$; Fig. 8 ; Fig. 9	12	-	-	
		$I_C = 0.4\text{ A}$; $V_{CE} = 5\text{ V}$; $T_{lead} = 25\text{ °C}$; Fig. 8 ; Fig. 9	10	-	30	
		$I_C = 0.8\text{ A}$; $V_{CE} = 5\text{ V}$; $T_{lead} = 25\text{ °C}$; Fig. 8 ; Fig. 9	5	7.5	20	
Dynamic characteristics						
t_f	fall time	$I_C = 1\text{ A}$; $I_{B0n} = 200\text{ mA}$; $V_{BB} = -5\text{ V}$; $L_B = 1\text{ }\mu\text{H}$; $T_{lead} = 25\text{ °C}$; inductive load; Fig. 10 ; Fig. 11	-	80	-	ns

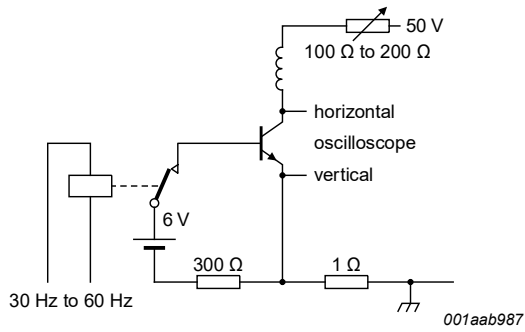


Fig. 4. Test circuit for collector-emitter sustaining voltage

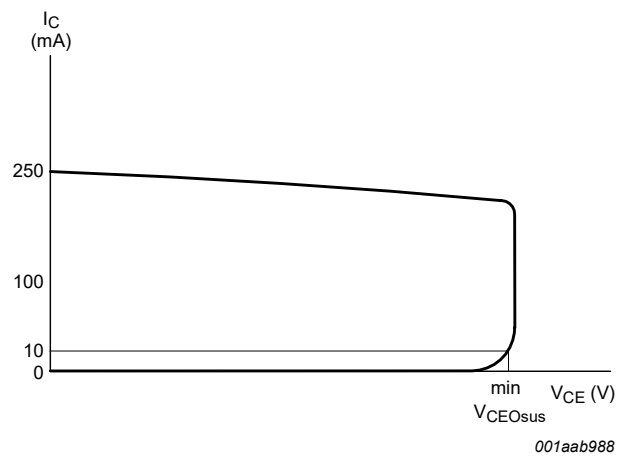


Fig. 5. Oscilloscope display for collector-emitter sustaining voltage test waveform

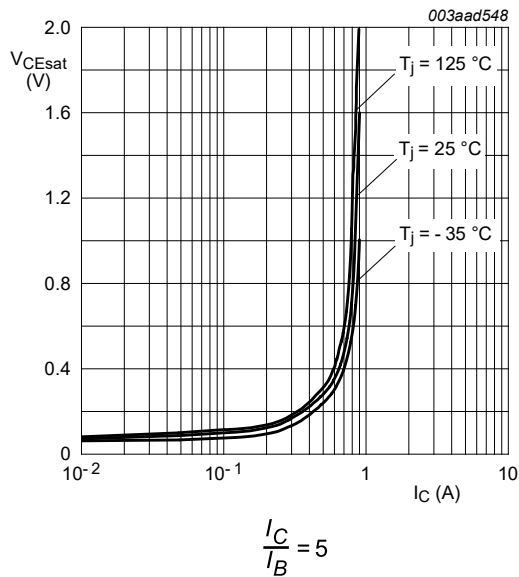


Fig. 6. Collector-emitter saturation voltage as a function of collector current; typical values

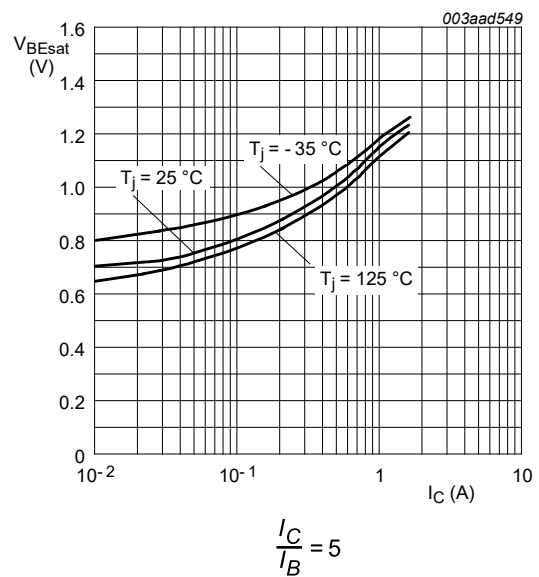
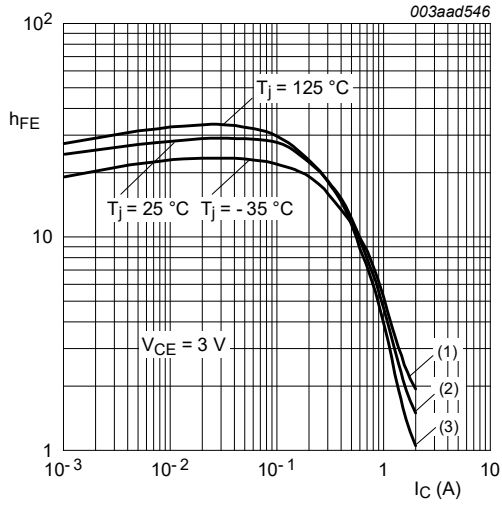
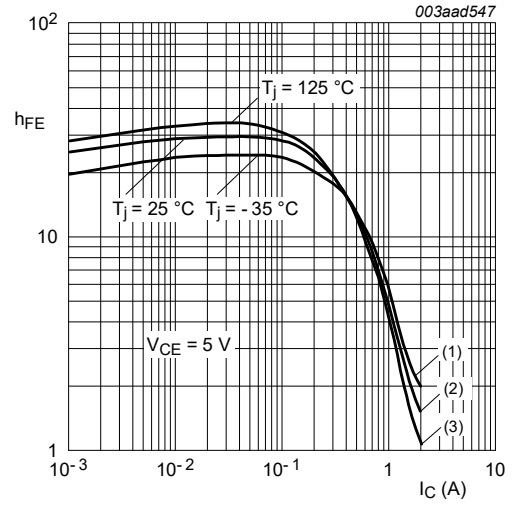


Fig. 7. Base-emitter saturation voltage as a function of collector current; typical values



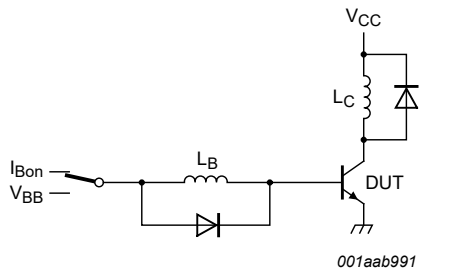
(1) $T_j = -35\text{ °C}$ (2) $T_j = 25\text{ °C}$ (3) $T_j = 125\text{ °C}$

Fig. 8. DC current gain as a function of collector current; typical values



(1) $T_j = -35\text{ °C}$ (2) $T_j = 25\text{ °C}$ (3) $T_j = 125\text{ °C}$

Fig. 9. DC current gain as a function of collector current; typical values



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

Fig. 10. Test circuit for inductive load switching

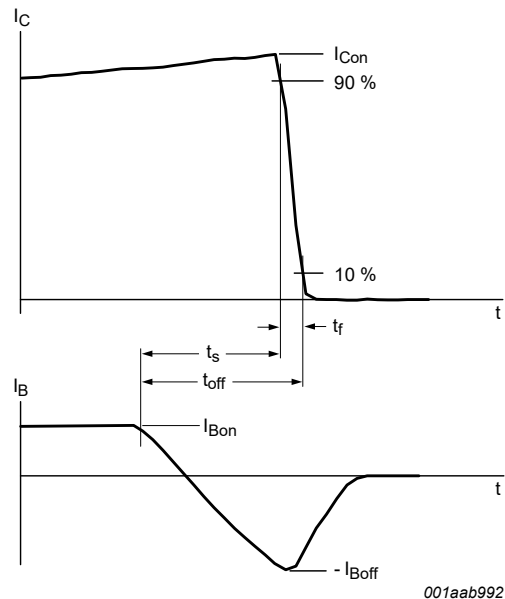


Fig. 11. Switching times waveforms for inductive load

9. Package outline

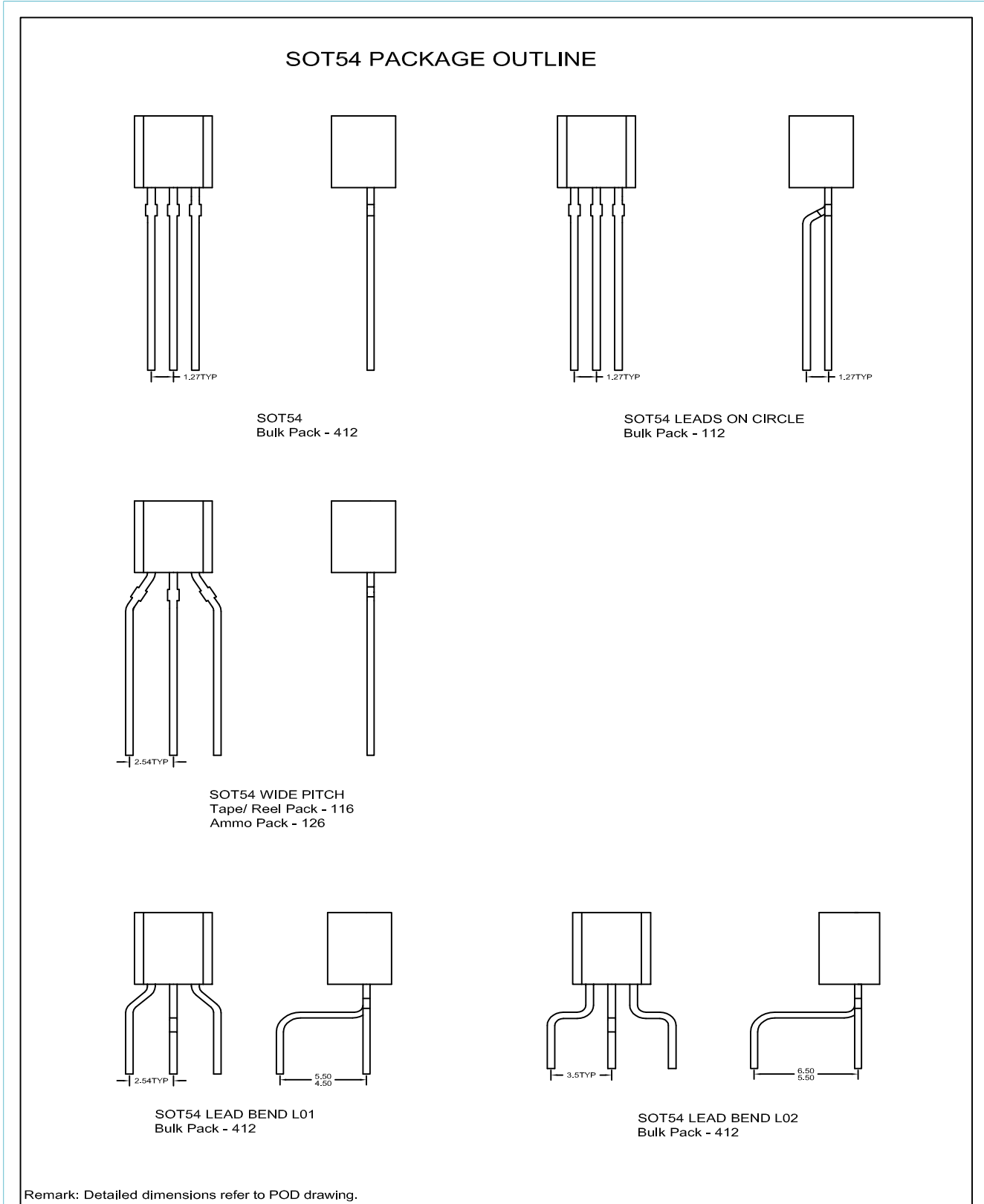


Fig. 12. Package outline TO-92 (SOT54)

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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.

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