

## Silicon Diffused Power Transistor

PHE13005

## GENERAL DESCRIPTION

The PHE13005 is a silicon npn power switching transistor in the TO220AB envelope intended for use in high frequency electronic lighting ballast applications, converters, inverters, switching regulators, motor control systems, etc.

## QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$V_{CESM}$	Collector-emitter voltage peak value	$V_{BE} = 0V$	-	700	V
$V_{CBO}$	Collector-Base voltage (open emitter)		-	700	V
$V_{CEO}$	Collector-emitter voltage (open base)		-	400	V
$V_{EBO}$	Emitter-Base voltage ( $I_B = 0$ )		-	9	V
$I_C$	Collector current (DC)		-	4	A
$I_{CM}$	Collector current peak value		-	8	A
$P_{tot}$	Total power dissipation	$T_{mb} \leq 25^\circ C$	-	75	W
$V_{CESat}$	Collector-emitter saturation voltage	$I_C = 2A; I_B = 0.5A$	0.2	0.6	V
$t_f$	Fall time	$I_C = 2A; I_{B1} = 0.4A; V_{BE(OFF)} = 5V$	0.1	0.5	$\mu s$

## PINNING - TO220AB

PIN	DESCRIPTION
1	base
2	collector
3	emitter
tab	collector

## PIN CONFIGURATION



## SYMBOL



## LIMITING VALUES

Limiting values in accordance with the Absolute Maximum Rating System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{CESM}$	Collector to emitter voltage	$V_{BE} = 0V$	-	700	V
$V_{CEO}$	Collector to emitter voltage (open base)		-	400	V
$V_{CBO}$	Collector to base voltage (open emitter)		-	700	V
$V_{EBO}$	Emitter-Base voltage ( $I_B = 0$ )		-	9	V
$I_C$	Collector current (DC)		-	4	A
$I_{CM}$	Collector current peak value		-	8	A
$I_B$	Base current (DC)		-	2	A
$I_{BM}$	Base current peak value		-	4	A
$P_{tot}$	Total power dissipation	$T_{mb} \leq 25^\circ C$	-	75	W
$T_{stg}$	Storage temperature		-65	150	$^\circ C$
$T_j$	Junction temperature		-	150	$^\circ C$

## THERMAL RESISTANCES8

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
$R_{th\ j-mb}$	Junction to mounting base		-	1.67	K/W
$R_{th\ j-a}$	Junction to ambient	in free air	60	-	K/W

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**STATIC CHARACTERISTICS** $T_{mb} = 25^{\circ}\text{C}$  unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$I_{CEV}$	Collector cut-off current <sup>1</sup>	$V_{BE(off)} = -1.5\text{V}; V_{CE} = V_{CESMmax}$ $V_{BE(off)} = -1.5\text{V}; V_{CE} = V_{CESMmax}$ $T_j = 100^{\circ}\text{C}$	-	-	1.0	mA
$I_{CEV}$			-	-	5.0	mA
$I_{EBO}$	Emitter cut-off current	$V_{EB} = 9\text{V}; I_C = 0\text{A}$	-	-	1	mA
$V_{CEOsust}$	Collector-emitter sustaining voltage	$I_B = 0\text{A}; I_C = 10\text{mA}$	400	-	-	V
$V_{CEsat}$	Collector-emitter saturation voltage	$I_C = 1.0\text{A}; I_B = 0.2\text{A}$	-	0.1	0.5	V
$V_{CEsat}$		$I_C = 2.0\text{A}; I_B = 0.5\text{A}$	-	0.2	0.6	V
$V_{CEsat}$		$I_C = 4.0\text{A}; I_B = 1.0\text{A}$	-	0.3	1.0	V
$V_{BEsat}$	Base-emitter saturation voltage	$I_C = 1.0\text{A}; I_B = 0.2\text{A}$	-	0.85	1.2	V
$V_{BEsat}$		$I_C = 2.0\text{A}; I_B = 0.5\text{A}$	-	0.92	1.6	V
$h_{FE}$	DC current gain	$I_C = 1.0\text{A}; V_{CE} = 5\text{V}$	10	20	60	
$h_{FEsat}$		$I_C = 2.0\text{A}; V_{CE} = 5\text{V}$	8	17	40	

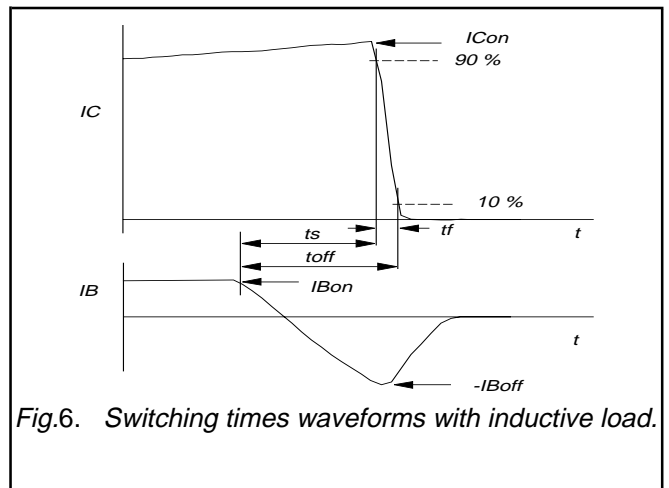
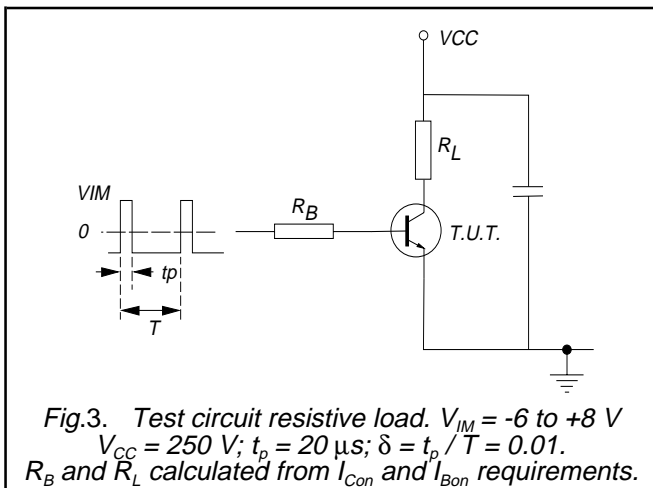
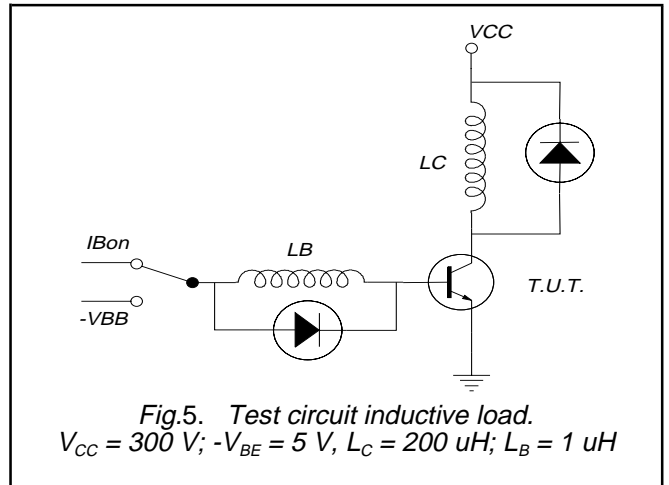
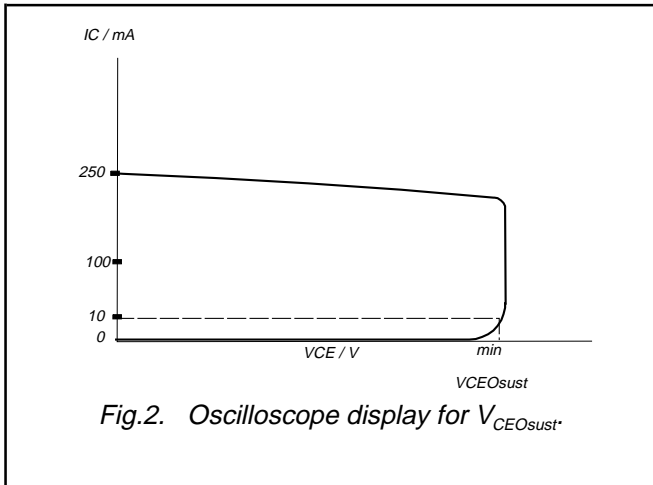
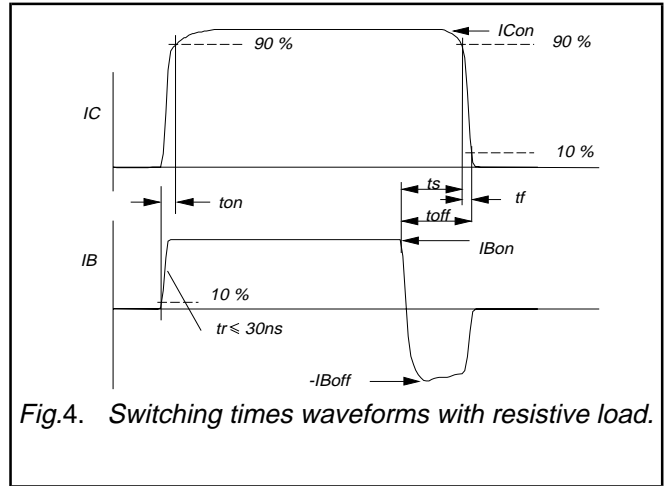
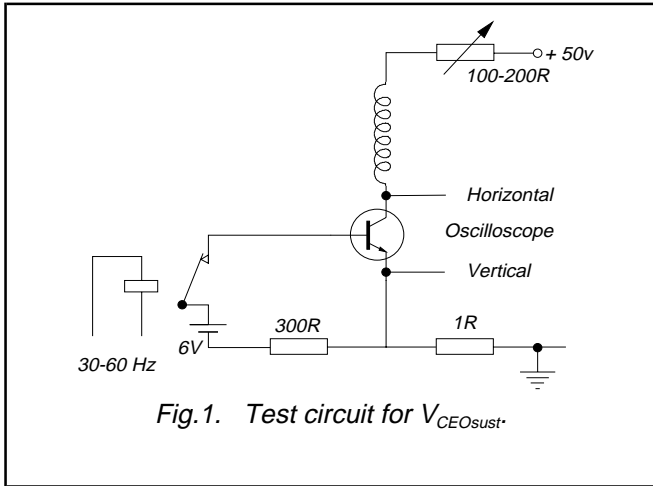
**DYNAMIC CHARACTERISTICS** $T_{mb} = 25^{\circ}\text{C}$  unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	TYP.	MAX.	UNIT
	Switching times (resistive load)	$I_{Con} = 2.0\text{A}; I_{Bon} = -I_{Boff} = 0.4\text{A};$ $R_L = 75\Omega; V_{CC} = 250\text{V}$			
$t_s$	Turn-off storage time		2.7	4	$\mu\text{s}$
$t_f$	Turn-off fall time		0.3	0.9	$\mu\text{s}$
	Switching times (inductive load)	$I_{Con} = 2.0\text{A}; I_{Bon} = 0.4\text{A}; L_B = 1\mu\text{H};$ $-V_{BE(off)} = 5\text{V}$			
$t_s$	Turn-off storage time		1.2	2	$\mu\text{s}$
$t_f$	Turn-off fall time		0.1	0.5	$\mu\text{s}$
	Switching times (inductive load)	$I_{Con} = 2.0\text{A}; I_{Bon} = 0.4\text{A}; L_B = 1\mu\text{H};$ $-V_{BE(off)} = 5\text{V}; T_j = 100^{\circ}\text{C}$			
$t_s$	Turn-off storage time		1.4	4	$\mu\text{s}$
$t_f$	Turn-off fall time		0.16	0.9	$\mu\text{s}$

<sup>1</sup> Measured with half sine-wave voltage (curve tracer).

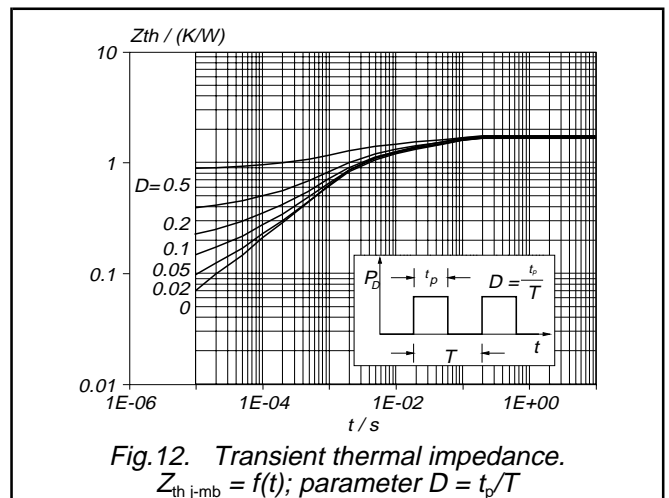
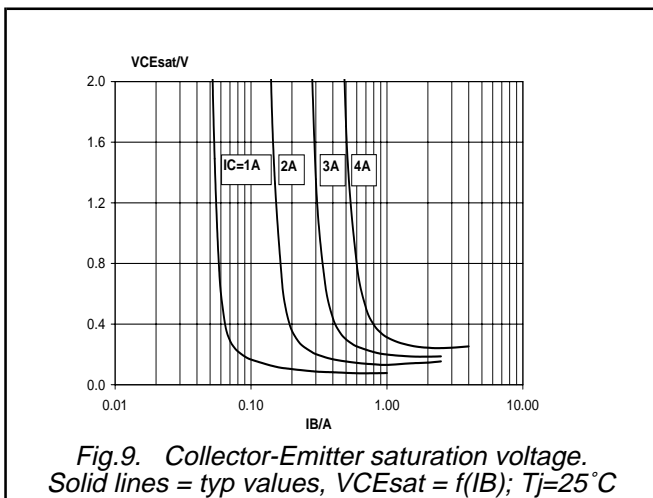
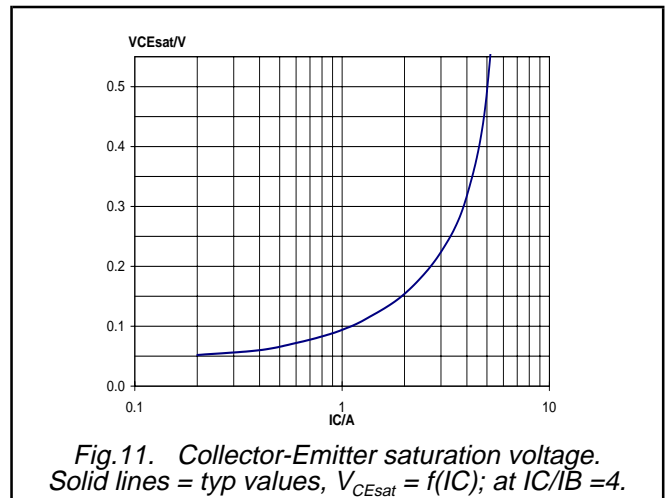
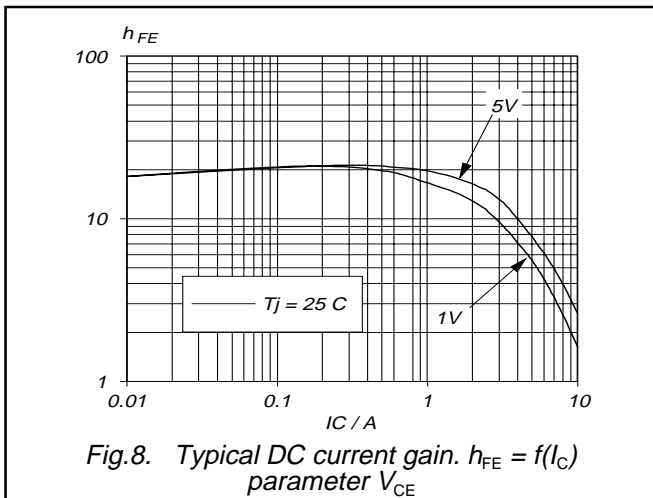
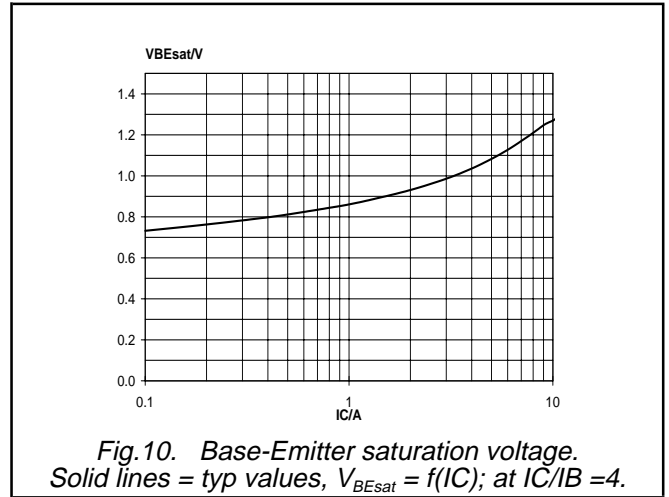
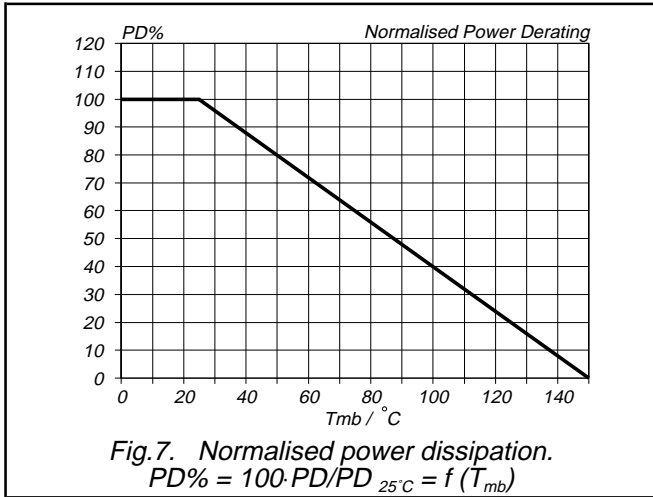
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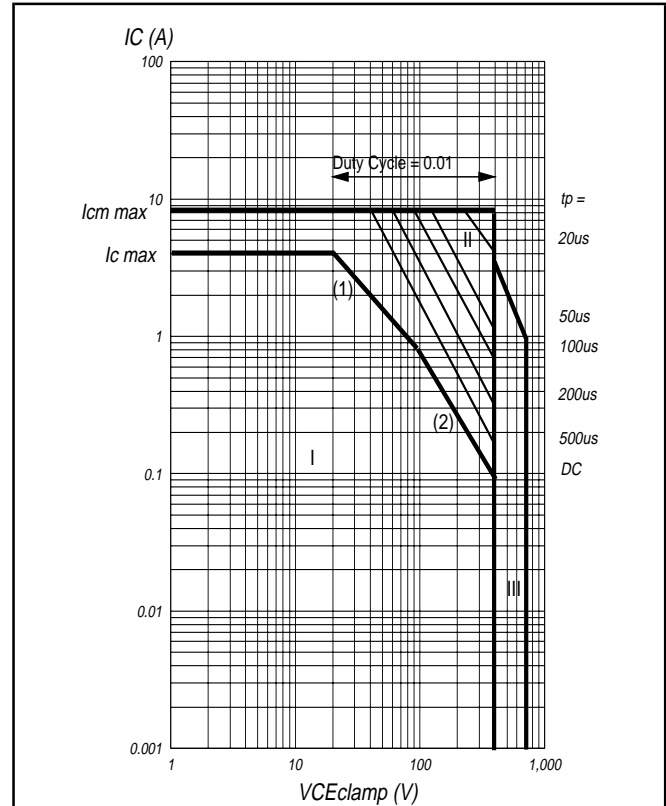
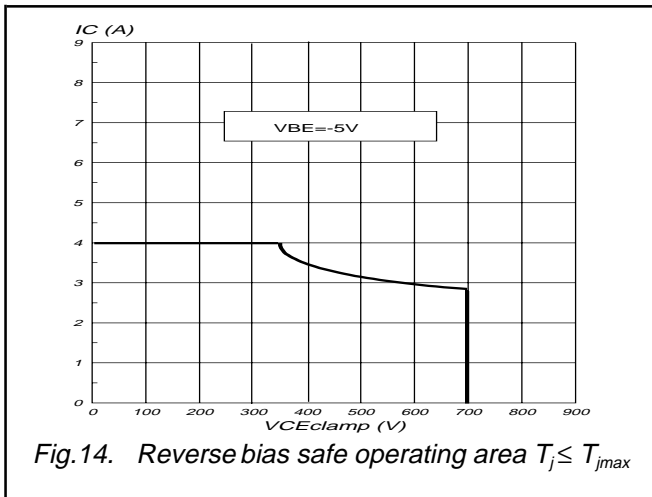
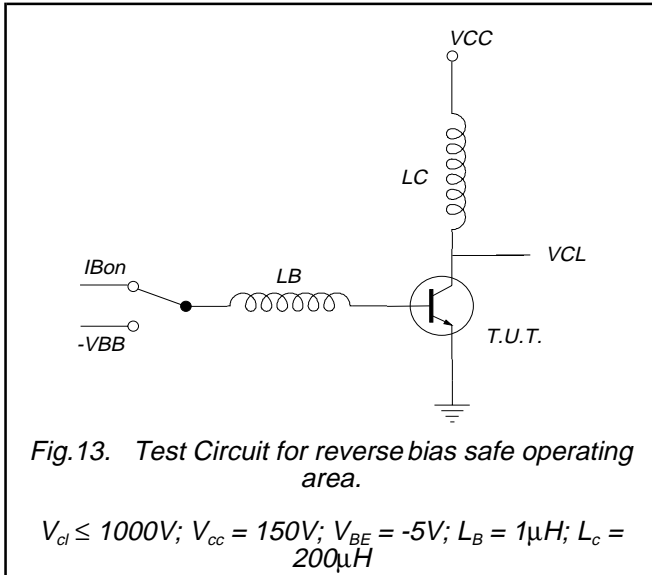
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- (1)  $P_{tot}$  max and  $P_{tot}$  peak max lines.
  - (2) Second breakdown limits.
  - I Region of permissible DC operation.
  - II Extension for repetitive pulse operation.
  - III Extension during turn-on in single transistor converters provided that  $R_{BE} \leq 100 \Omega$  and  $t_p \leq 0.6 \mu s$ .
- NB:** Mounted with heatsink compound and  $30 \pm 5$  newton force on the centre of the envelope.

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**MECHANICAL DATA**

*Dimensions in mm*

*Net Mass: 2 g*

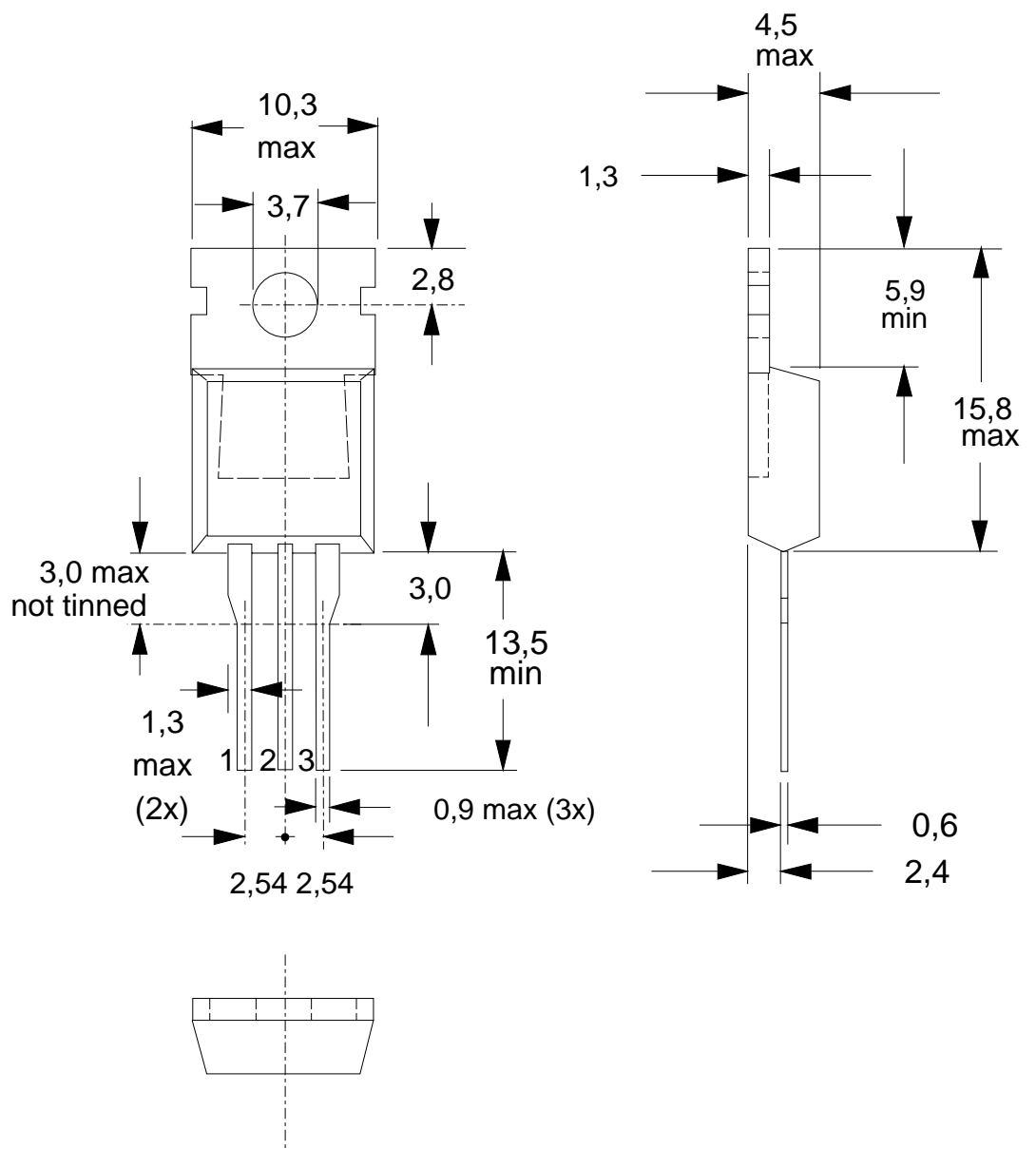


Fig. 16. TO220AB; pin 2 connected to mounting base.

**Notes**

1. Refer to mounting instructions for TO220 envelopes.
2. Epoxy meets UL94 V0 at 1/8".

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**DEFINITIONS**

<b>Data sheet status</b>	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
<b>Limiting values</b>	
Limiting values are given in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of this specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
<b>Application information</b>	
Where application information is given, it is advisory and does not form part of the specification.	
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