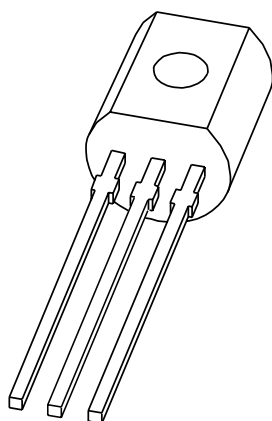


# DATA SHEET



**2N4401**

**NPN switching transistor**

Product specification  
Supersedes data of 1999 Apr 23

2004 Oct 28

NPN switching transistor

2N4401

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 40 V).

APPLICATIONS

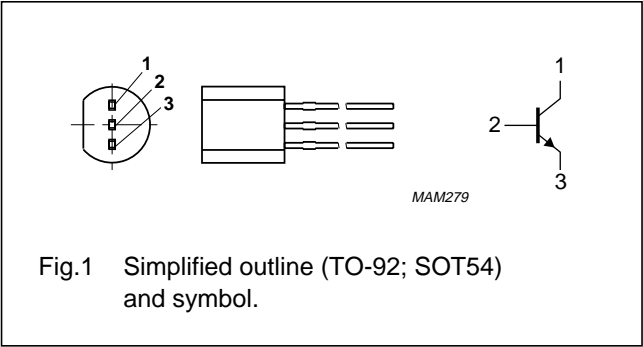
- Industrial and consumer switching applications.

DESCRIPTION

NPN switching transistor in a TO-92; SOT54 plastic package. PNP complement: 2N4403.

PINNING

PIN	DESCRIPTION
1	collector
2	base
3	emitter



ORDERING INFORMATION

TYPE NUMBER	PACKAGE		
	NAME	DESCRIPTION	VERSION
2N4401	SC-43A	plastic single-ended leaded (through hole) package; 3 leads	SOT54

LIMITING VALUES

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{CBO}$	collector-base voltage	open emitter	–	60	V
$V_{CEO}$	collector-emitter voltage	open base	–	40	V
$V_{EBO}$	emitter-base voltage	open collector	–	6	V
$I_C$	collector current (DC)		–	600	mA
$I_{CM}$	peak collector current		–	800	mA
$I_{BM}$	peak base current		–	200	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ }^{\circ}\text{C}$ ; note 1	–	630	mW
$T_{stg}$	storage temperature		–65	+150	$^{\circ}\text{C}$
$T_j$	junction temperature		–	150	$^{\circ}\text{C}$
$T_{amb}$	ambient temperature		–65	+150	$^{\circ}\text{C}$

Note

1. Transistor mounted on an FR4 printed-circuit board.

## NPN switching transistor

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## THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th(j-a)}$	thermal resistance from junction to ambient	note 1	200	K/W

## Note

1. Transistor mounted on an FR4 printed-circuit board.

## CHARACTERISTICS

$T_{amb} = 25\text{ }^{\circ}\text{C}$  unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$I_{CBO}$	collector-base cut-off current	$V_{CB} = 60\text{ V}$ ; $I_E = 0\text{ A}$	—	50	nA
$I_{EBO}$	emitter-base cut-off current	$V_{EB} = 6\text{ V}$ ; $I_C = 0\text{ A}$	—	50	nA
$h_{FE}$	DC current gain	$V_{CE} = 1\text{ V}$ ; see Fig.2			
		$I_C = 0.1\text{ mA}$	20	—	
		$I_C = 1\text{ mA}$	40	—	
		$I_C = 10\text{ mA}$	80	—	
		$I_C = 150\text{ mA}$ ; note 1	100	300	
		$V_{CE} = 2\text{ V}$ ; $I_C = 500\text{ mA}$ ; note 1	40	—	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 150\text{ mA}$ ; $I_B = 15\text{ mA}$ ; note 1	—	400	mV
		$I_C = 500\text{ mA}$ ; $I_B = 50\text{ mA}$ ; note 1	—	750	mV
$V_{BEsat}$	base-emitter saturation voltage	$I_C = 150\text{ mA}$ ; $I_B = 15\text{ mA}$ ; note 1	—	950	mV
		$I_C = 500\text{ mA}$ ; $I_B = 50\text{ mA}$ ; note 1	—	1.2	V
$C_c$	collector capacitance	$V_{CB} = 5\text{ V}$ ; $I_E = i_e = 0\text{ A}$ ; $f = 1\text{ MHz}$	—	6.5	pF
$C_e$	emitter capacitance	$V_{EB} = 500\text{ mV}$ ; $I_C = i_c = 0\text{ A}$ ; $f = 1\text{ MHz}$	—	30	pF
$f_T$	transition frequency	$V_{CE} = 10\text{ V}$ ; $I_C = 20\text{ mA}$ ; $f = 100\text{ MHz}$	250	—	MHz
<b>Switching times (between 10 % and 90 % levels); see Fig.3</b>					
$t_{on}$	turn-on time	$I_{Con} = 150\text{ mA}$ ; $I_{Bon} = 15\text{ mA}$ ; $I_{Boff} = -15\text{ mA}$	—	35	ns
$t_d$	delay time		—	15	ns
$t_r$	rise time		—	20	ns
$t_{off}$	turn-off time		—	250	ns
$t_s$	storage time		—	200	ns
$t_f$	fall time		—	60	ns

## Note

1. Pulse test:  $t_p \leq 300\text{ }\mu\text{s}$ ;  $\delta \leq 0.02$ .

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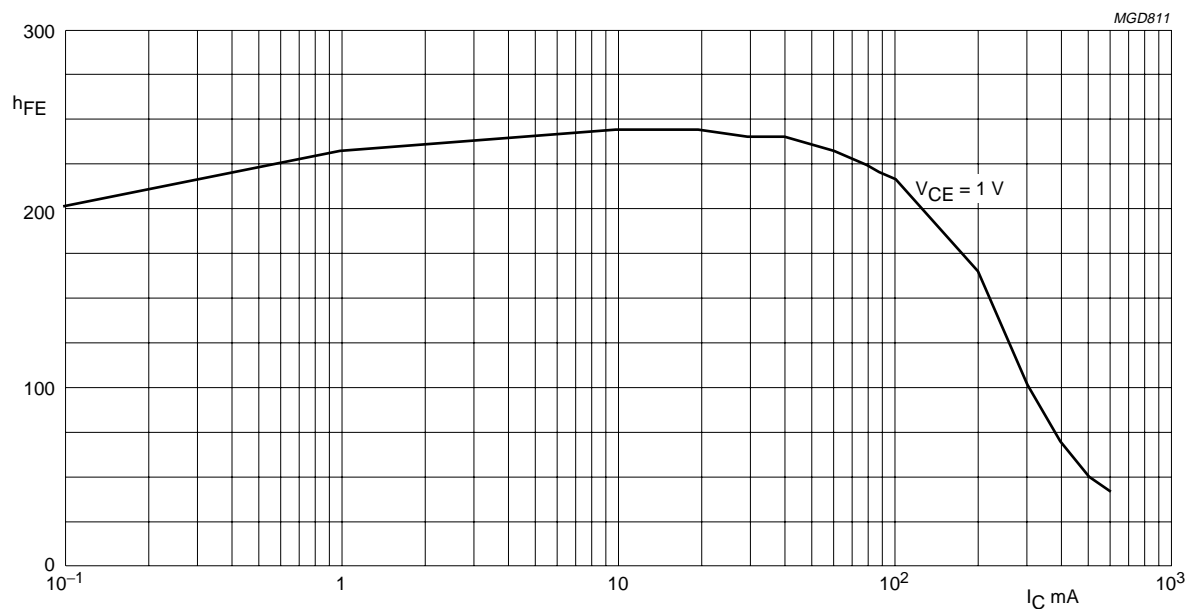
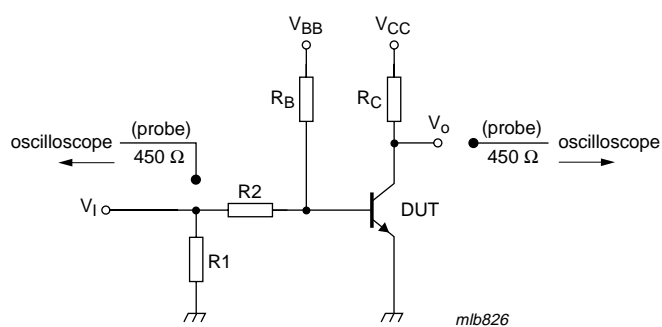


Fig.2 DC current gain; typical values.



$V_I = 9.5 \text{ V}$ ;  $T = 500 \text{ } \mu\text{s}$ ;  $t_p = 10 \text{ } \mu\text{s}$ ;  $t_r = t_f \leq 3 \text{ ns}$ .  
 $R_1 = 68 \text{ } \Omega$ ;  $R_2 = 325 \text{ } \Omega$ ;  $R_B = 325 \text{ } \Omega$ ;  $R_C = 160 \text{ } \Omega$ .  
 $V_{BB} = -3.5 \text{ V}$ ;  $V_{CC} = 29.5 \text{ V}$ .  
 Oscilloscope: input impedance  $Z_i = 50 \text{ } \Omega$ .

Fig.3 Test circuit for switching times.

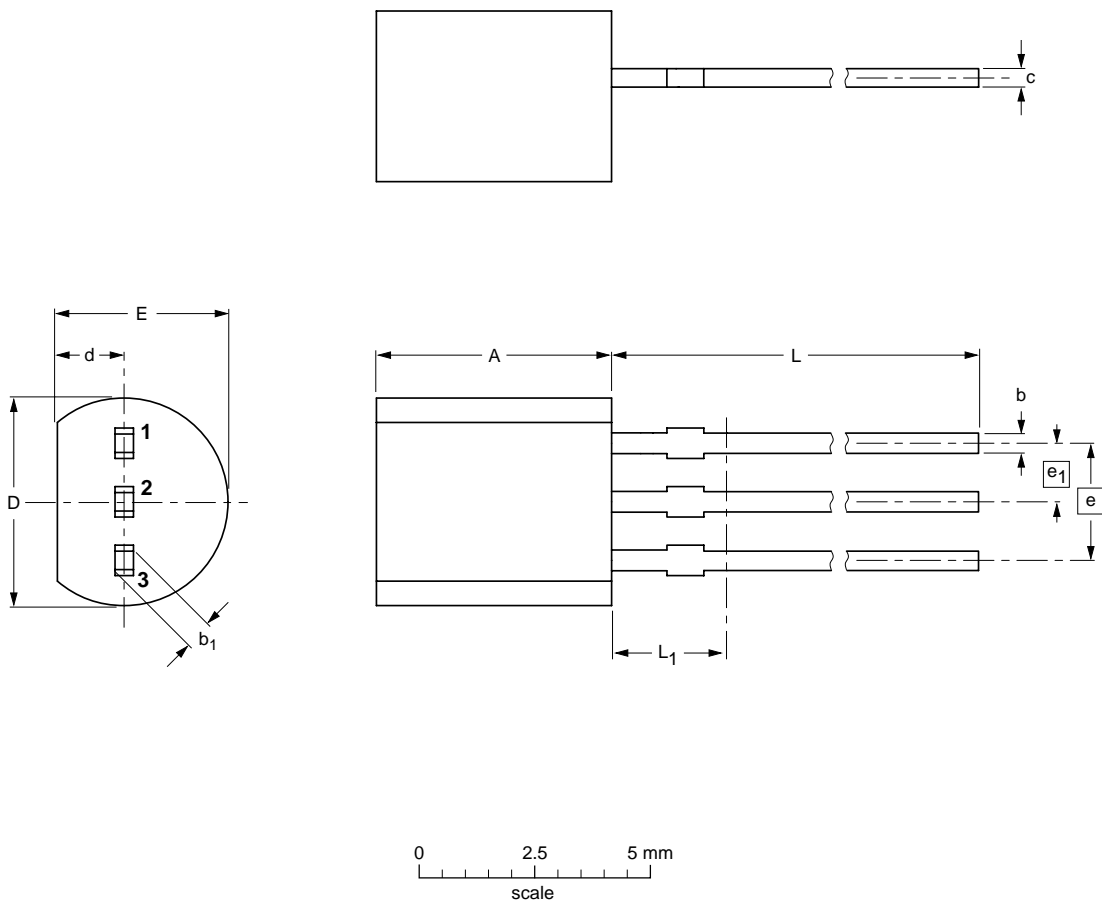
NPN switching transistor

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PACKAGE OUTLINE

Plastic single-ended leaded (through hole) package; 3 leads

SOT54




DIMENSIONS (mm are the original dimensions)

UNIT	A	b	b <sub>1</sub>	c	D	d	E	e	e <sub>1</sub>	L	L <sub>1</sub> <sup>(1)</sup> max.
mm	5.2 5.0	0.48 0.40	0.66 0.55	0.45 0.38	4.8 4.4	1.7 1.4	4.2 3.6	2.54	1.27	14.5 12.7	2.5

Note

1. Terminal dimensions within this zone are uncontrolled to allow for flow of plastic and terminal irregularities.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT54		TO-92	SC-43A			-97-02-28 04-06-28

## NPN switching transistor

2N4401

## DATA SHEET STATUS

LEVEL	DATA SHEET STATUS <sup>(1)</sup>	PRODUCT STATUS <sup>(2)(3)</sup>	DEFINITION
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