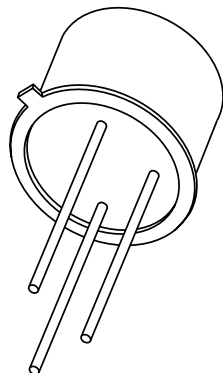


# DATA SHEET



## **2N2369A** NPN switching transistor

Product specification  
Supersedes data of September 1994  
File under Discrete Semiconductors, SC04

1997 May 06

## NPN switching transistor

2N2369A

## FEATURES

- Low current (max. 200 mA)
- Low voltage (max. 15 V).

## APPLICATIONS

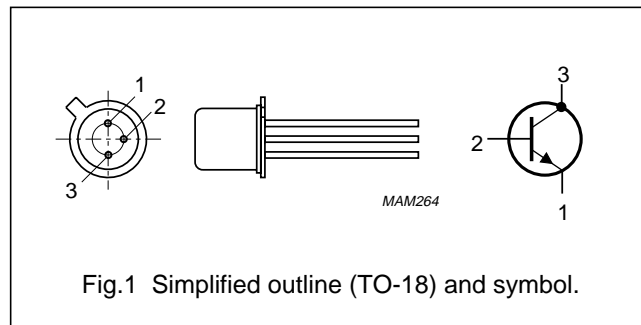
- High-speed saturated switching and high frequency amplifier applications.

## DESCRIPTION

NPN switching transistor in a TO-18 metal package.

## PINNING

PIN	DESCRIPTION
1	emitter
2	base
3	collector, connected to case



## QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{CBO}$	collector-base voltage	open emitter	–	40	V
$V_{CEO}$	collector-emitter voltage	open base	–	15	V
$I_C$	collector current (DC)		–	200	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ }^\circ\text{C}$	–	360	mW
$h_{FE}$	DC current gain	$I_C = 10\text{ mA}; V_{CE} = 350\text{ mV}$	40	–	
		$I_C = 10\text{ mA}; V_{CE} = 1\text{ V}$	–	120	
$f_T$	transition frequency	$I_C = 10\text{ mA}; V_{CE} = 10\text{ V}; f = 100\text{ MHz}$	500	–	MHz
$t_{off}$	turn-off time	$I_{Con} = 10\text{ mA}; I_{Bon} = 3\text{ mA}; I_{Boff} = -1.5\text{ mA}$	–	30	ns

## NPN switching transistor

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**LIMITING VALUES**

In accordance with the Absolute Maximum Rating System (IEC 134).

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$V_{CBO}$	collector-base voltage	open emitter	–	40	V
$V_{CEO}$	collector-emitter voltage	open base	–	15	V
$V_{EBO}$	emitter-base voltage	open collector; $I_C = 10 \mu\text{A}$ to 10 mA	–	4.5	V
$I_C$	collector current (DC)		–	200	mA
$I_{CM}$	peak collector current		–	300	mA
$I_{BM}$	peak base current		–	100	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25 \text{ }^\circ\text{C}$	–	360	mW
		$T_{case} \leq 25 \text{ }^\circ\text{C}$	–	1.2	W
		$T_{case} \leq 100 \text{ }^\circ\text{C}$	–	680	mW
$T_{stg}$	storage temperature		–65	+150	$^\circ\text{C}$
$T_j$	junction temperature		–	200	$^\circ\text{C}$
$T_{amb}$	operating ambient temperature		–65	+150	$^\circ\text{C}$

**THERMAL CHARACTERISTICS**

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
$R_{th\ j-a}$	thermal resistance from junction to ambient	in free air	486	K/W
$R_{th\ j-c}$	thermal resistance from junction to case		146	K/W

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$I_{CBO}$	collector cut-off current	$I_E = 0; V_{CB} = 20 \text{ V}$	–	400	nA
		$I_E = 0; V_{CB} = 20 \text{ V}; T_{amb} = 150 \text{ }^\circ\text{C}$	–	30	$\mu\text{A}$
$I_{EBO}$	emitter cut-off current	$I_C = 0; V_{EB} = 4 \text{ V}$	–	100	nA
$h_{FE}$	DC current gain	$I_C = 10 \text{ mA}; V_{CE} = 350 \text{ mV}; \text{note 1}$	40	–	
		$I_C = 10 \text{ mA}; V_{CE} = 350 \text{ mV}; T_{amb} = -55 \text{ }^\circ\text{C}; \text{note 1}$	20	–	
		$I_C = 10 \text{ mA}; V_{CE} = 1 \text{ V}; \text{note 1}$	–	120	
		$I_C = 30 \text{ mA}; V_{CE} = 400 \text{ mV}; \text{note 1}$	30	–	
		$I_C = 100 \text{ mA}; V_{CE} = 1 \text{ V}; \text{note 1}$	20	–	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = 10 \text{ mA}; I_B = 1 \text{ mA}$	–	200	mV
		$I_C = 10 \text{ mA}; I_B = 1 \text{ mA}; T_{amb} = 125 \text{ }^\circ\text{C}$	–	300	mV
		$I_C = 30 \text{ mA}; I_B = 3 \text{ mA}$	–	250	mV
		$I_C = 100 \text{ mA}; I_B = 10 \text{ mA}$	–	500	mV

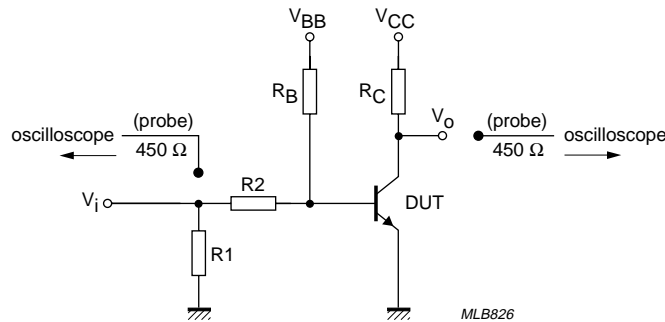
NPN switching transistor

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SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>BEsat</sub>	base-emitter saturation voltage	I <sub>C</sub> = 10 mA; I <sub>B</sub> = 1 mA	700	850	mV
		I <sub>C</sub> = 10 mA; I <sub>B</sub> = 1 mA; T <sub>amb</sub> = 125 °C	590	–	mV
		I <sub>C</sub> = 10 mA; I <sub>B</sub> = 1 mA; T <sub>amb</sub> = –55 °C	–	1.02	V
		I <sub>C</sub> = 30 mA; I <sub>B</sub> = 3 mA	–	1.15	V
		I <sub>C</sub> = 100 mA; I <sub>B</sub> = 10 mA	–	1.6	V
C <sub>C</sub>	collector capacitance	I <sub>E</sub> = I <sub>e</sub> = 0; V <sub>CB</sub> = 5 V; f = 1 MHz	–	4	pF
f <sub>T</sub>	transition frequency	I <sub>C</sub> = 10 mA; V <sub>CE</sub> = 10 V; f = 100 MHz	500	–	MHz
<b>Switching times (between 10% and 90% levels); see Fig.2</b>					
t <sub>on</sub>	turn-on time	I <sub>Con</sub> = 10 mA; I <sub>Bon</sub> = 3 mA; I <sub>Boff</sub> = –1.5 mA	–	10	ns
t <sub>d</sub>	delay time		–	4	ns
t <sub>r</sub>	rise time		–	6	ns
t <sub>off</sub>	turn-off time		–	30	ns
t <sub>s</sub>	storage time		–	15	ns
t <sub>f</sub>	fall time		–	15	ns

**Note**

1. Pulse test: t<sub>p</sub> ≤ 300 μs; δ ≤ 0.02.



V<sub>i</sub> = 0.5 V to 4.2 V; T = 500 μs; t<sub>p</sub> = 10 μs; t<sub>r</sub> = t<sub>f</sub> ≤ 1 ns.  
 R<sub>1</sub> = 56 Ω; R<sub>2</sub> = 1 kΩ; R<sub>B</sub> = 1 kΩ; R<sub>C</sub> = 270 Ω.  
 V<sub>BB</sub> = 0.2 V; V<sub>CC</sub> = 2.7 V.  
 Oscilloscope: input impedance Z<sub>i</sub> = 50 Ω.

Fig.2 Test circuit for switching times.

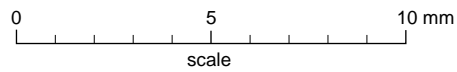
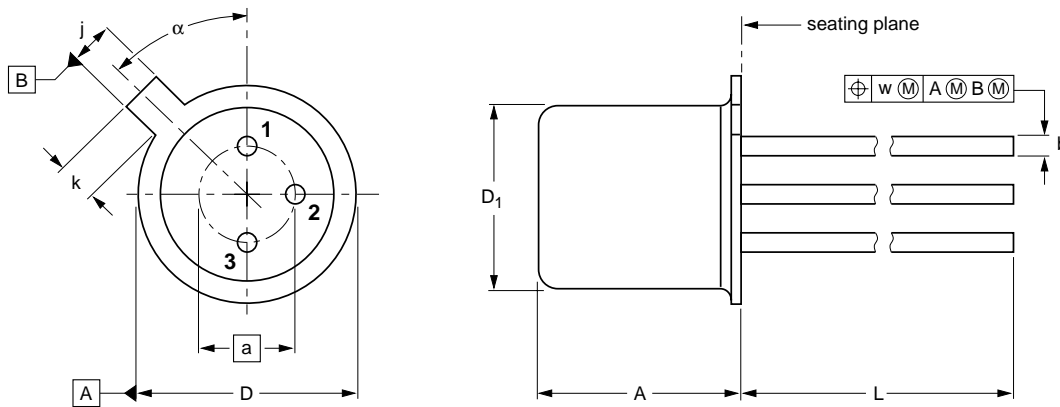
NPN switching transistor

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PACKAGE OUTLINE

Metal-can cylindrical single-ended package; 3 leads

SOT18/13



DIMENSIONS (millimetre dimensions are derived from the original inch dimensions)

UNIT	A	a	b	D	D <sub>1</sub>	j	k	L	w	α
mm	5.31 4.74	2.54	0.47 0.41	5.45 5.30	4.70 4.55	1.03 0.94	1.1 0.9	15.0 12.7	0.40	45°

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ		
SOT18/13	B11/C7 type 3	TO-18			97-04-18

## NPN switching transistor

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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 given are 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 the 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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NPN switching transistor

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