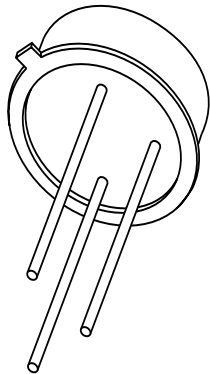


# DATA SHEET



## **2N2222; 2N2222A** NPN switching transistors

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

1997 May 29

## NPN switching transistors

## 2N2222; 2N2222A

## FEATURES

- High current (max. 800 mA)
- Low voltage (max. 40 V).

## APPLICATIONS

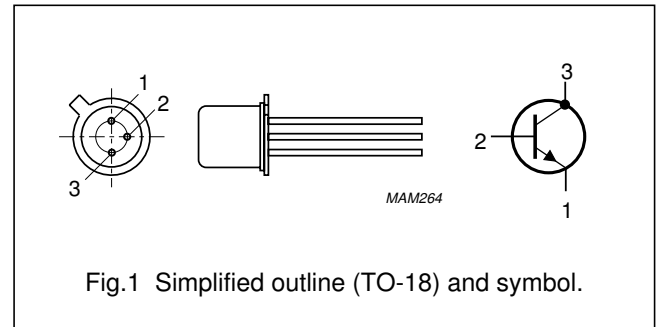
- Linear amplification and switching.

## DESCRIPTION

NPN switching transistor in a TO-18 metal package.  
PNP complement: 2N2907A.

## 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			
	2N2222		–	60	V
	2N2222A		–	75	V
$V_{CEO}$	collector-emitter voltage	open base			
	2N2222		–	30	V
	2N2222A		–	40	V
$I_C$	collector current (DC)		–	800	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ }^\circ\text{C}$	–	500	mW
$h_{FE}$	DC current gain	$I_C = 10\text{ mA}; V_{CE} = 10\text{ V}$	75	–	
$f_T$	transition frequency	$I_C = 20\text{ mA}; V_{CE} = 20\text{ V}; f = 100\text{ MHz}$			
	2N2222		250	–	MHz
	2N2222A		300	–	MHz
$t_{off}$	turn-off time	$I_{Con} = 150\text{ mA}; I_{Bon} = 15\text{ mA}; I_{Boff} = -15\text{ mA}$	–	250	ns

## NPN switching transistors

## 2N2222; 2N2222A

**LIMITING VALUES**

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V <sub>CBO</sub>	collector-base voltage	open emitter	–	60	V
	2N2222			75	V
V <sub>CEO</sub>	collector-emitter voltage	open base	–	30	V
	2N2222A			40	V
V <sub>EBO</sub>	emitter-base voltage	open collector	–	5	V
	2N2222A			6	V
I <sub>C</sub>	collector current (DC)		–	800	mA
I <sub>CM</sub>	peak collector current		–	800	mA
I <sub>BM</sub>	peak base current		–	200	mA
P <sub>tot</sub>	total power dissipation	T <sub>amb</sub> ≤ 25 °C	–	500	mW
		T <sub>case</sub> ≤ 25 °C	–	1.2	W
T <sub>stg</sub>	storage temperature		–65	+150	°C
T <sub>j</sub>	junction temperature		–	200	°C
T <sub>amb</sub>	operating ambient temperature		–65	+150	°C

**THERMAL CHARACTERISTICS**

SYMBOL	PARAMETER	CONDITIONS	VALUE	UNIT
R <sub>th j-a</sub>	thermal resistance from junction to ambient	in free air	350	K/W
R <sub>th j-c</sub>	thermal resistance from junction to case		146	K/W

## NPN switching transistors

## 2N2222; 2N2222A

## CHARACTERISTICS

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

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$I_{CBO}$	collector cut-off current 2N2222	$I_E = 0; V_{CB} = 50\text{ V}$	–	10	nA
		$I_E = 0; V_{CB} = 50\text{ V}; T_{amb} = 150\text{ }^\circ\text{C}$	–	10	A
$I_{CBO}$	collector cut-off current 2N2222A	$I_E = 0; V_{CB} = 60\text{ V}$	–	10	nA
		$I_E = 0; V_{CB} = 60\text{ V}; T_{amb} = 150\text{ }^\circ\text{C}$	–	10	A
$I_{EBO}$	emitter cut-off current	$I_C = 0; V_{EB} = 3\text{ V}$	–	10	nA
$h_{FE}$	DC current gain	$I_C = 0.1\text{ mA}; V_{CE} = 10\text{ V}$	35	–	
		$I_C = 1\text{ mA}; V_{CE} = 10\text{ V}$	50	–	
		$I_C = 10\text{ mA}; V_{CE} = 10\text{ V}$	75	–	
		$I_C = 150\text{ mA}; V_{CE} = 1\text{ V}; \text{note 1}$	50	–	
		$I_C = 150\text{ mA}; V_{CE} = 10\text{ V}; \text{note 1}$	100	300	
$h_{FE}$	DC current gain 2N2222A	$I_C = 10\text{ mA}; V_{CE} = 10\text{ V}; T_{amb} = -55\text{ }^\circ\text{C}$	35	–	
$h_{FE}$	DC current gain 2N2222 2N2222A	$I_C = 500\text{ mA}; V_{CE} = 10\text{ V}; \text{note 1}$	30	–	
			40	–	
$V_{CEsat}$	collector-emitter saturation voltage 2N2222	$I_C = 150\text{ mA}; I_B = 15\text{ mA}; \text{note 1}$	–	400	mV
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}; \text{note 1}$	–	1.6	V
$V_{CEsat}$	collector-emitter saturation voltage 2N2222A	$I_C = 150\text{ mA}; I_B = 15\text{ mA}; \text{note 1}$	–	300	mV
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}; \text{note 1}$	–	1	V
$V_{BEsat}$	base-emitter saturation voltage 2N2222	$I_C = 150\text{ mA}; I_B = 15\text{ mA}; \text{note 1}$	–	1.3	V
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}; \text{note 1}$	–	2.6	V
$V_{BEsat}$	base-emitter saturation voltage 2N2222A	$I_C = 150\text{ mA}; I_B = 15\text{ mA}; \text{note 1}$	0.6	1.2	V
		$I_C = 500\text{ mA}; I_B = 50\text{ mA}; \text{note 1}$	–	2	V
$C_c$	collector capacitance	$I_E = i_e = 0; V_{CB} = 10\text{ V}; f = 1\text{ MHz}$	–	8	pF
$C_e$	emitter capacitance 2N2222A	$I_C = i_c = 0; V_{EB} = 500\text{ mV}; f = 1\text{ MHz}$	–	25	pF
$f_T$	transition frequency 2N2222 2N2222A	$I_C = 20\text{ mA}; V_{CE} = 20\text{ V}; f = 100\text{ MHz}$	250	–	MHz
			300	–	MHz
F	noise figure 2N2222A	$I_C = 200\text{ }\mu\text{A}; V_{CE} = 5\text{ V}; R_S = 2\text{ k}\Omega;$ $f = 1\text{ kHz}; B = 200\text{ Hz}$	–	4	dB

NPN switching transistors

2N2222; 2N2222A

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
<b>Switching times (between 10% and 90% levels); see Fig.2</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		–	10	ns
$t_r$	rise time		–	25	ns
$t_{off}$	turn-off time		–	250	ns
$t_s$	storage time		–	200	ns
$t_f$	fall time		–	60	ns

**Note**

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

