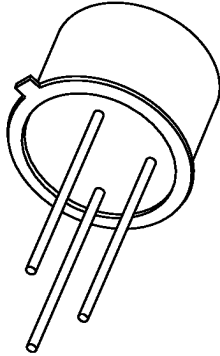


DATA SHEET



2N2222; 2N2222A NPN switching transistors

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

1997 May 29

Philips
Semiconductors



PHILIPS

NPN switching transistors

2N2222; 2N2222A

FEATURES

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

APPLICATIONS

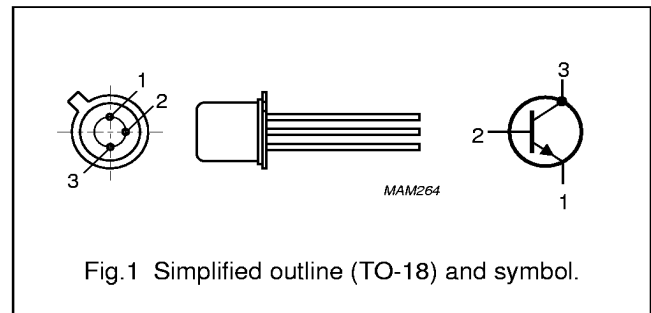
- Linear amplification and switching.

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 _{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
V _{EBO}	emitter-base voltage	open collector			
	2N2222		–	5	V
	2N2222A		–	6	V
I _C	collector current (DC)		–	800	mA
I _{CM}	peak collector current		–	800	mA
I _{BM}	peak base current		–	200	mA
P _{tot}	total power dissipation	T _{amb} ≤ 25 °C	–	500	mW
		T _{case} ≤ 25 °C	–	1.2	W
T _{stg}	storage temperature		–65	+150	°C
T _j	junction temperature		–	200	°C
T _{amb}	operating ambient temperature		–65	+150	°C

THERMAL CHARACTERISTICS

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

NPN switching transistors

2N2222; 2N2222A

CHARACTERISTICS $T_j = 25\text{ °C}$ 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
		$I_E = 0; V_{CB} = 50\text{ V}; T_{amb} = 150\text{ °C}$	–	10	μA
I_{CBO}	collector cut-off current 2N2222A	$I_E = 0; V_{CB} = 60\text{ V}$	–	10	nA
		$I_E = 0; V_{CB} = 60\text{ V}; T_{amb} = 150\text{ °C}$	–	10	μA
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	$I_C = 10\text{ mA}; V_{CE} = 10\text{ V}; T_{amb} = -55\text{ °C}$	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

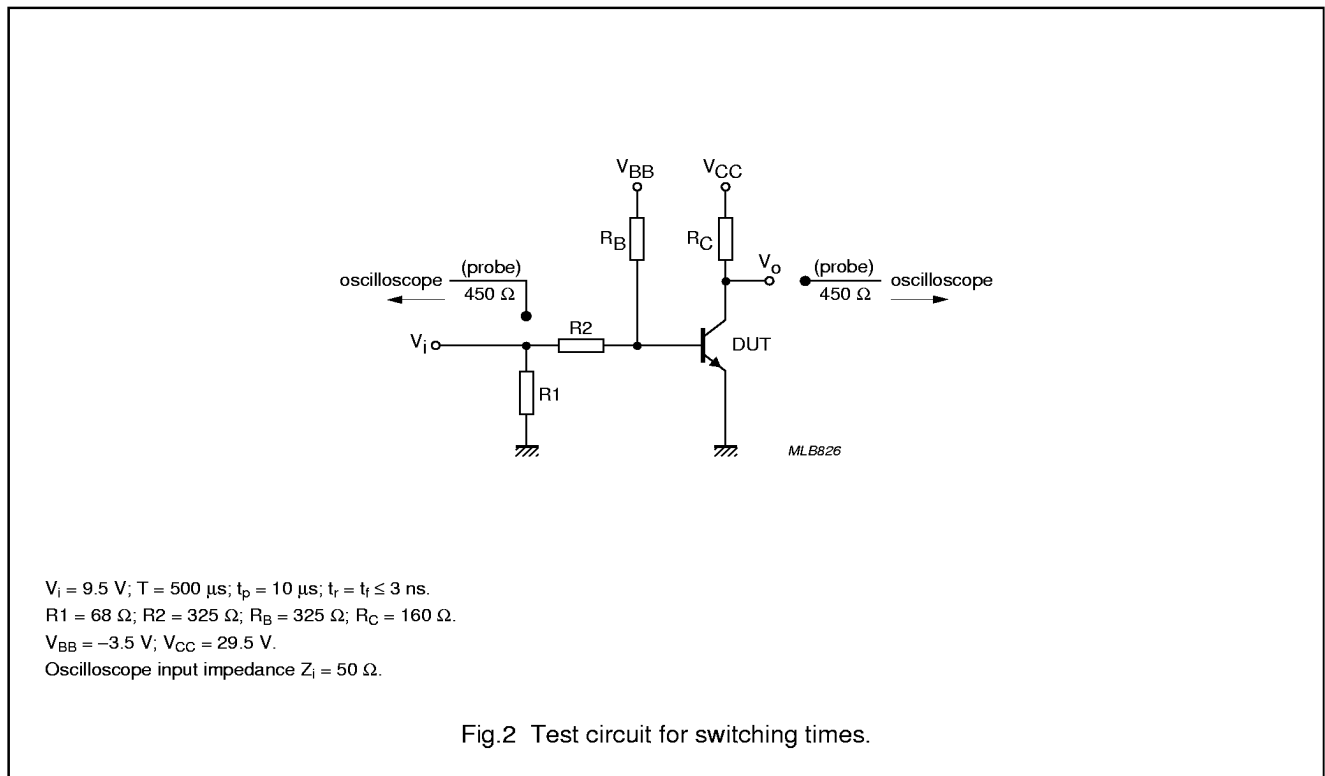
NPN switching transistors

2N2222; 2N2222A

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
Switching times (between 10% and 90% levels); see Fig.2					
t_{on}	turn-on time	$I_{C_{on}} = 150 \text{ mA}; I_{B_{on}} = 15 \text{ mA}; I_{B_{off}} = -15 \text{ mA}$	–	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: $t_p \leq 300 \mu\text{s}; \delta \leq 0.02$.



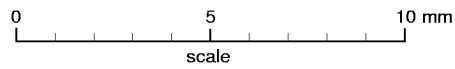
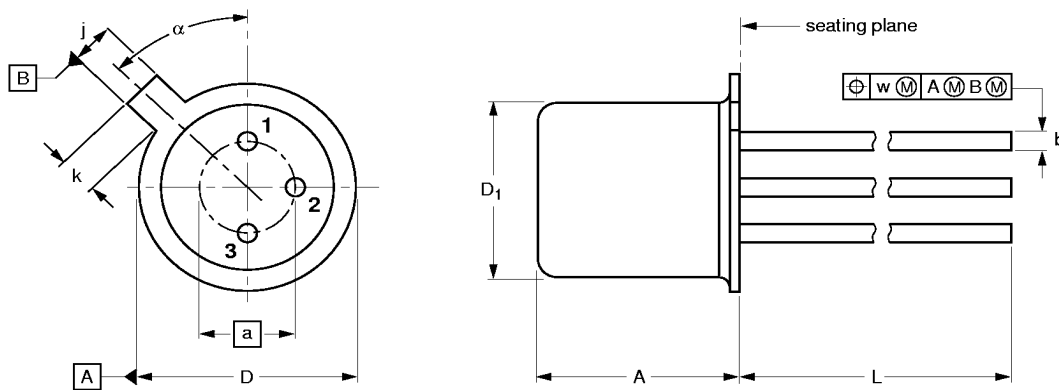
NPN switching transistors

2N2222; 2N2222A

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 ₁	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