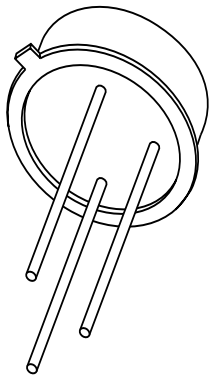
DATA SHEET



2N2906; 2N2906A
PNP switching transistors

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

1997 Jun 02

Philips
Semiconductors

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PNP switching transistors 2N2906; 2N2906A

FEATURES

- High current (max. 600 mA)
- Low voltage (max. 60 V).

APPLICATIONS

- High-speed switching
- Driver applications for industrial service.

DESCRIPTION

PNP switching transistor in a TO-18 metal package.
NPN complements: 2N2222 and 2N2222A.

PINNING

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

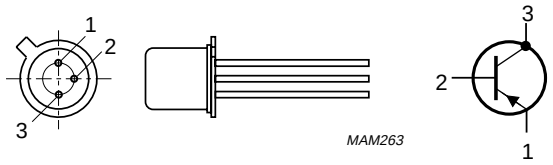


Fig.1 Simplified outline (TO-18) and symbol.

QUICK REFERENCE DATA

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{CBO}	collector-base voltage	open emitter	–	–60	V
V_{CEO}	collector-emitter voltage	open base			
	2N2906		–	–40	V
	2N2906A		–	–60	V
I_C	collector current (DC)		–	–600	mA
P_{tot}	total power dissipation	$T_{amb} \leq 25$ °C	–	400	mW
h_{FE}	DC current gain	I_C = –150 mA; V_{CE} = –10 V	40	120	
f_T	transition frequency	I_C = –50 mA; V_{CE} = –20 V; f = 100 MHz	200	–	MHz
t_{off}	turn-off time	I_{Con} = –150 mA; I_{Bon} = –15 mA; I_{Boff} = 15 mA	–	300	ns

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	–	–60	V
V_{CEO}	collector-emitter voltage	open base			
	2N2906		–	–40	V
	2N2906A		–	–60	V
V_{EBO}	emitter-base voltage	open collector	–	–5	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	$T_{amb} \leq 25$ °C	–	400	mW
		$T_{case} \leq 25$ °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
$R_{th\ j\text{-}a}$	thermal resistance from junction to ambient	in free air	438	K/W
$R_{th\ j\text{-}c}$	thermal resistance from junction to case		146	K/W

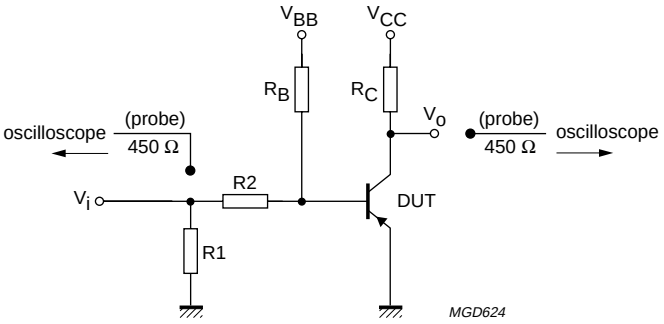
CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{CBO}	collector cut-off current				
	2N2906	I_E = 0; V_{CB} = –50 V	–	–20	nA
		I_E = 0; V_{CB} = –50 V; T_{amb} = 150 °C	–	–20	µA
I_{CBO}	collector cut-off current				
	2N2906A	I_E = 0; V_{CB} = –50 V	–	–10	nA
		I_E = 0; V_{CB} = –50 V; T_{amb} = 150 °C	–	–10	µA
I_{EBO}	emitter cut-off current	I_C = 0; V_{EB} = –5 V	–	–50	nA
h_{FE}	DC current gain	V_{CE} = –10 V			
	2N2906	I_C = –0.1 mA	20	–	
		I_C = –1 mA	25	–	
		I_C = –10 mA	35	–	
		I_C = –150 mA; note 1	40	120	
		I_C = –500 mA; note 1	20		
h_{FE}	DC current gain	V_{CE} = –10 V		–	
	2N2906A	I_C = –0.1 mA	40	–	
		I_C = –1 mA	40	–	
		I_C = –10 mA	40	–	
		I_C = –150 mA; note 1	40	120	
		I_C = –500 mA; note 1	40	–	
V_{CEsat}	collector-emitter saturation voltage	I_C = –150 mA; I_B = –15 mA; note 1		–400	mV
		I_C = –500 mA; I_B = –50 mA; note 1		–1.6	V
V_{BEsat}	base-emitter saturation voltage	I_C = –150 mA; I_B = –15 mA; note 1		–1.3	V
		I_C = –500 mA; I_B = –50 mA; note 1		–2.6	V
C_c	collector capacitance	I_E = i_e = 0; V_{CB} = –10 V; f = 1 MHz	–	8	pF
C_e	emitter capacitance	I_C = i_c = 0; V_{EB} = –2 V; f = 1 MHz	–	30	pF
f_T	transition frequency	I_C = –50 mA; V_{CE} = –20 V; f = 100 MHz; note 1	200	–	MHz
Switching times (between 10% and 90% levels); see Fig.2					
t_{on}	turn-on time	I_{Con} = –150 mA; I_{Bon} = –15 mA; I_{Boff} = 15 mA	–	45	ns
t_d	delay time		–	15	ns
t_r	rise time		–	35	ns
t_{off}	turn-off time		–	300	ns
t_s	storage time		–	250	ns
t_f	fall time		–	50	ns

Note

1. Pulse test: $t_p \leq 300$ µs; $\delta \leq 0.02$.

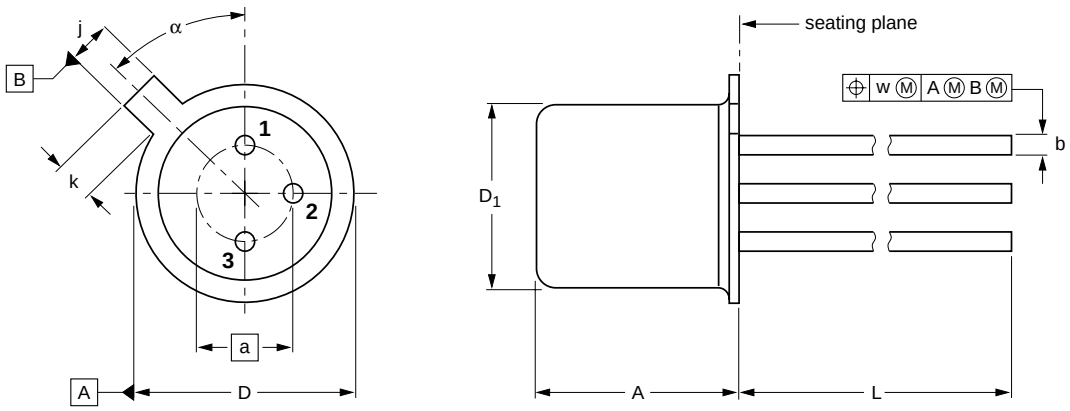


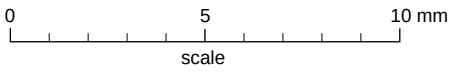
V_i = –9.5 V; T = 500 µs; t_p = 10 µs; $t_r = t_f \leq 3$ ns.
R1 = 68 Ω; R2 = 325 Ω; R_B = 325 Ω; R_C = 160 Ω.
V_{BB} = 3.5 V; V_{CC} = –29.5 V.
Oscilloscope input impedance Z_i = 50 Ω.

Fig.2 Test circuit for switching times.

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

DEFINITIONS

Data sheet status	
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.
Limiting values	
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.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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