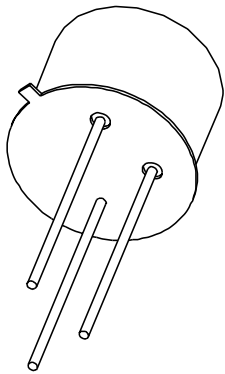


# DATA SHEET



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## **2N2905; 2N2905A** PNP switching transistors

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

1997 May 28

# PNP switching transistors

# 2N2905; 2N2905A

### 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-39 metal package.  
NPN complements: 2N2219 and 2N2219A.

### PINNING

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

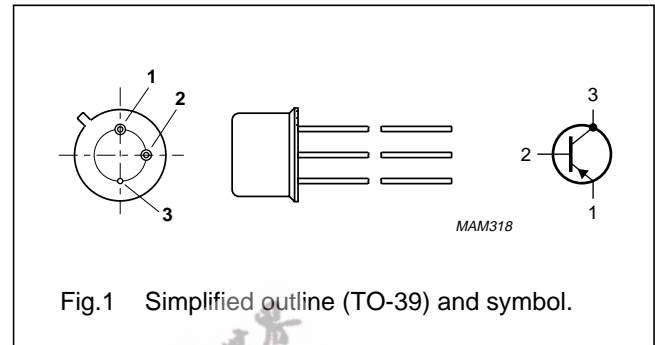


Fig.1 Simplified outline (TO-39) and symbol.

### 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	–	–40	V
			–	–60	V
$I_C$	collector current (DC)		–	–600	mA
$P_{tot}$	total power dissipation	$T_{amb} \leq 25\text{ °C}$	–	600	mW
$h_{FE}$	DC current gain	$I_C = -150\text{ mA}; V_{CE} = -10\text{ V}$	100	300	
$f_T$	transition frequency	$I_C = -50\text{ mA}; V_{CE} = -20\text{ V}; f = 100\text{ MHz}$	200	–	MHz
$t_{off}$	turn-off time	$I_{Con} = -150\text{ mA}; I_{Bon} = -15\text{ mA}; I_{Boff} = 15\text{ mA}$	–	300	ns

## PNP switching transistors

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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	–	–60	V
$V_{CEO}$	collector-emitter voltage 2N2905 2N2905A	open base	–	–40	V
			–	–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	$T_{amb} \leq 25\text{ °C}$	–	600	mW
		$T_{case} \leq 25\text{ °C}$	–	3	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	292	K/W
$R_{th\ j-c}$	thermal resistance from junction to case		58	K/W

## PNP switching transistors

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## CHARACTERISTICS

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

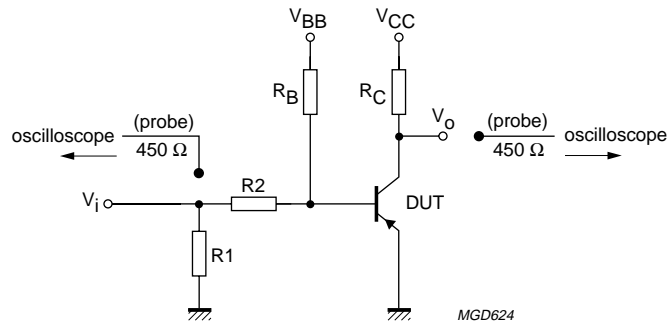
SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
$I_{CBO}$	collector cut-off current 2N2905	$I_E = 0; V_{CB} = -50\text{ V}$	–	–20	nA
		$I_E = 0; V_{CB} = -50\text{ V}; T_{amb} = 150\text{ °C}$	–	–20	$\mu\text{A}$
$I_{CBO}$	collector cut-off current 2N2905A	$I_E = 0; V_{CB} = -50\text{ V}$	–	–10	nA
		$I_E = 0; V_{CB} = -50\text{ V}; T_{amb} = 150\text{ °C}$	–	–10	$\mu\text{A}$
$I_{EBO}$	emitter cut-off current	$I_C = 0; V_{EB} = -5\text{ V}$	–	50	nA
$h_{FE}$	DC current gain 2N2905	$V_{CE} = -10\text{ V}$ $I_C = -0.1\text{ mA}$	35	–	
		$I_C = -1\text{ mA}$	50	–	
		$I_C = -10\text{ mA}$	75	–	
		$I_C = -150\text{ mA}; \text{note 1}$	100	300	
		$I_C = -500\text{ mA}; \text{note 1}$	30	–	
$h_{FE}$	DC current gain 2N2905A	$V_{CE} = -10\text{ V}$ $I_C = -0.1\text{ mA}$	75	–	
		$I_C = -1\text{ mA}$	100	–	
		$I_C = -10\text{ mA}$	100	–	
		$I_C = -150\text{ mA}; \text{note 1}$	100	300	
		$I_C = -500\text{ mA}; \text{note 1}$	50	–	
$V_{CEsat}$	collector-emitter saturation voltage	$I_C = -150\text{ mA}; I_B = -15\text{ mA}; \text{note 1}$	–	–400	mV
		$I_C = -500\text{ mA}; I_B = -50\text{ mA}; \text{note 1}$	–	–1.6	V
$V_{BEsat}$	base-emitter saturation voltage	$I_C = -150\text{ mA}; I_B = -15\text{ mA}; \text{note 1}$	–	–1.3	V
		$I_C = -500\text{ mA}; I_B = -50\text{ mA}; \text{note 1}$	–	–2.6	V
$C_c$	collector capacitance	$I_E = I_E = 0; V_{CB} = -10\text{ V}; f = 1\text{ MHz}$	–	8	pF
$C_e$	emitter capacitance	$I_C = I_C = 0; V_{EB} = -2\text{ V}; f = 1\text{ MHz}$	–	30	pF
$f_T$	transition frequency	$I_C = -50\text{ mA}; V_{CE} = -20\text{ V}; f = 100\text{ MHz}; \text{note 1}$	200	–	MHz
<b>Switching times (between 10% and 90% levels); see Fig.2</b>					
$t_{on}$	turn-on time	$I_{Con} = -150\text{ mA}; I_{Bon} = -15\text{ mA}; I_{Boff} = 15\text{ mA}$	–	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:  $t_p \leq 300\text{ }\mu\text{s}$ ;  $\delta \leq 0.02$ .

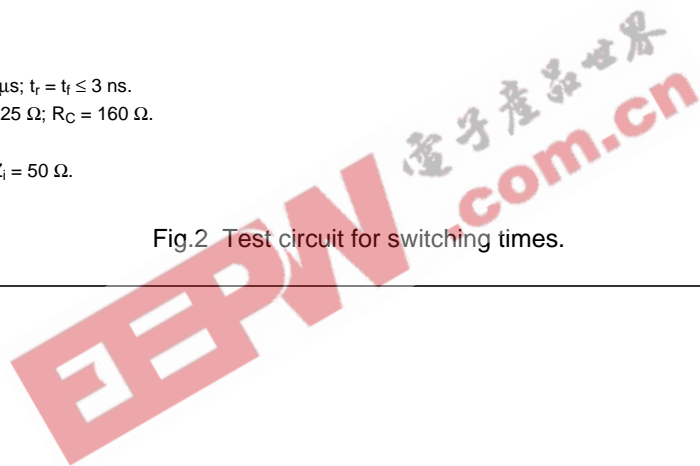
PNP switching transistors

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

Fig.2 Test circuit for switching times.



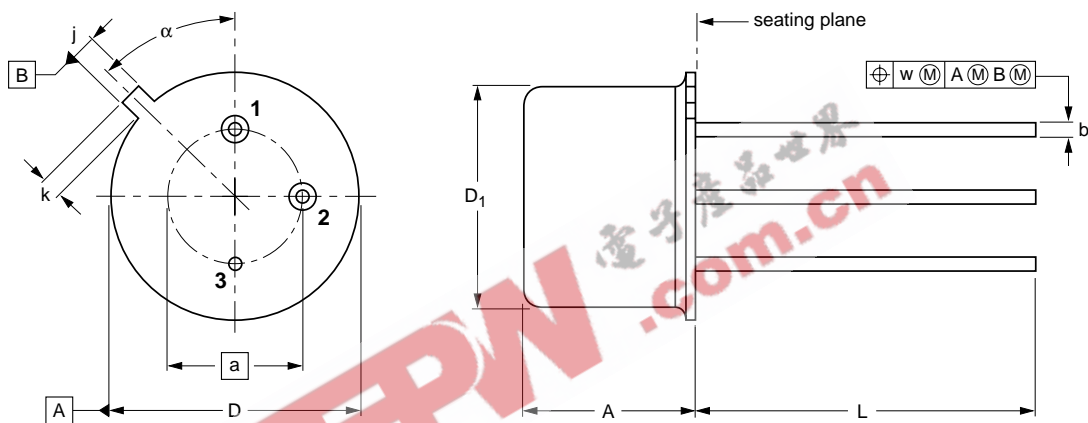
PNP switching transistors

2N2905; 2N2905A

PACKAGE OUTLINE

Metal-can cylindrical single-ended package; 3 leads

SOT5/11



DIMENSIONS (mm are the original dimensions)

UNIT	A	a	b	D	D <sub>1</sub>	j	k	L	w	α
mm	6.60 6.35	5.08	0.48 0.41	9.39 9.08	8.33 8.18	0.85 0.75	0.95 0.75	14.2 12.7	0.2	45°

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT5/11		TO-39				97-04-11

## PNP switching transistors

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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>	
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