

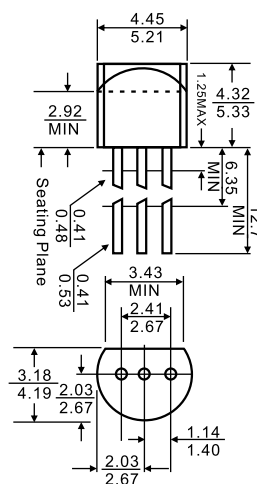
# 2N3904(NPN)

TO-92 Bipolar Transistors



- 1. EMITTER
- 2. BASE
- 3. COLLECTOR

## TO-92



Dimensions in inches and (millimeters)

## Features

- ✧ NPN silicon epitaxial planar transistor for switching and Amplifier applications
- ✧ As complementary type, the PNP transistor 2N3906 is Recommended
- ✧ This transistor is also available in the SOT-23 case with the type designation MMBT3904

## MAXIMUM RATINGS (T<sub>A</sub>=25°C unless otherwise noted)

Symbol	Parameter	Value	Units
V <sub>CB0</sub>	Collector-Base Voltage	60	V
V <sub>CEO</sub>	Collector-Emitter Voltage	40	V
V <sub>EBO</sub>	Emitter-Base Voltage	6	V
I <sub>C</sub>	Collector Current -Continuous	0.2	A
P <sub>C</sub>	Collector Power Dissipation	0.625	W
T <sub>J</sub>	Junction Temperature	150	°C
T <sub>stg</sub>	Storage Temperature	-55-150	°C

## ELECTRICAL CHARACTERISTICS (T<sub>amb</sub>=25°C unless otherwise specified)

Parameter	Symbol	Test conditions	MIN	TYP	MAX	UNIT
Collector-base breakdown voltage	V <sub>(BR)CBO</sub>	I <sub>C</sub> =10μA, I <sub>E</sub> =0	60			V
Collector-emitter breakdown voltage	V <sub>(BR)CEO</sub>	I <sub>C</sub> = 1mA, I <sub>B</sub> =0	40			V
Emitter-base breakdown voltage	V <sub>(BR)EBO</sub>	I <sub>E</sub> = 10μA, I <sub>C</sub> =0	6			V
Collector cut-off current	I <sub>CBO</sub>	V <sub>CB</sub> =60V, I <sub>E</sub> =0			0.1	μA
Collector cut-off current	I <sub>CEO</sub>	V <sub>CE</sub> = 40V, I <sub>B</sub> =0			0.1	μA
Emitter cut-off current	I <sub>EBO</sub>	V <sub>EB</sub> = 5V, I <sub>C</sub> =0			0.1	μA
DC current gain	h <sub>FE1</sub>	V <sub>CE</sub> =1V, I <sub>C</sub> =10mA	100		400	
	h <sub>FE2</sub>	V <sub>CE</sub> =1V, I <sub>C</sub> =50mA	60			
	h <sub>FE3</sub>	V <sub>CE</sub> =1V, I <sub>C</sub> =100mA	30			
Collector-emitter saturation voltage	V <sub>CE(sat)</sub>	I <sub>C</sub> =50mA, I <sub>B</sub> =5mA			0.3	V
Base-emitter saturation voltage	V <sub>BE(sat)</sub>	I <sub>C</sub> =50mA, I <sub>B</sub> =5mA			0.95	V
Transition frequency	f <sub>T</sub>	V <sub>CE</sub> =20V, I <sub>C</sub> =10mA, f=100MHz	300			MHz
Delay Time	t <sub>d</sub>	V <sub>CC</sub> =3V, V <sub>BE</sub> =0.5V,			35	ns
Rise Time	t <sub>r</sub>	I <sub>C</sub> =10mA, I <sub>B1</sub> =1mA			35	ns
Storage Time	t <sub>s</sub>	V <sub>CC</sub> =3V, I <sub>C</sub> =10mA			200	ns
Fall Time	t <sub>f</sub>	I <sub>B1</sub> =I <sub>B2</sub> =1mA			50	ns

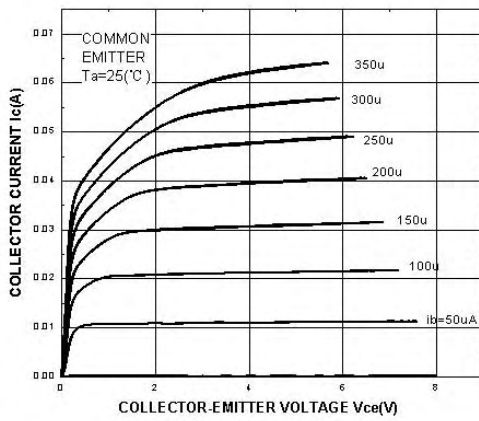
## CLASSIFICATION OF h<sub>FE1</sub>

Rank	O	Y	G
Range	100-200	200-300	300-400

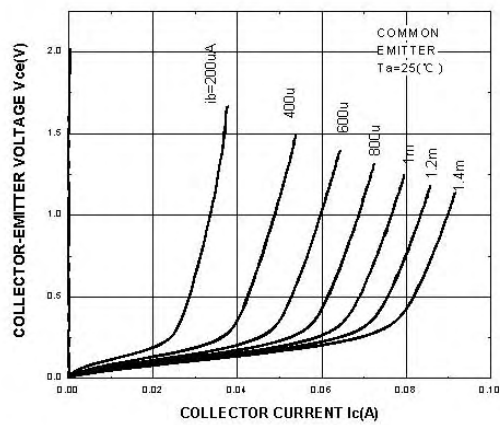


## Typical Characteristics

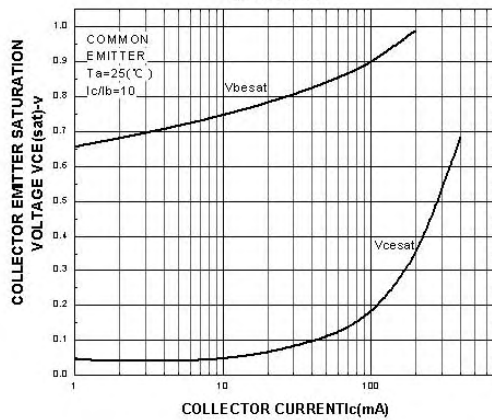
Ic-Vce



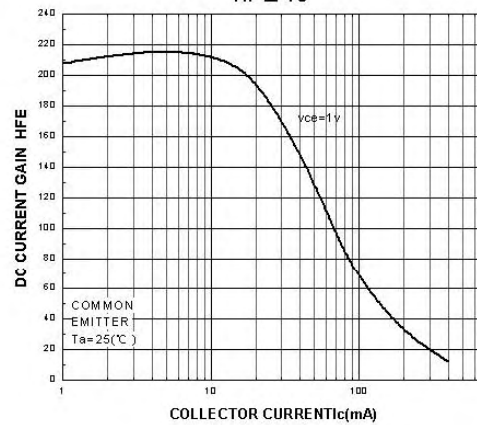
Vce-Ic



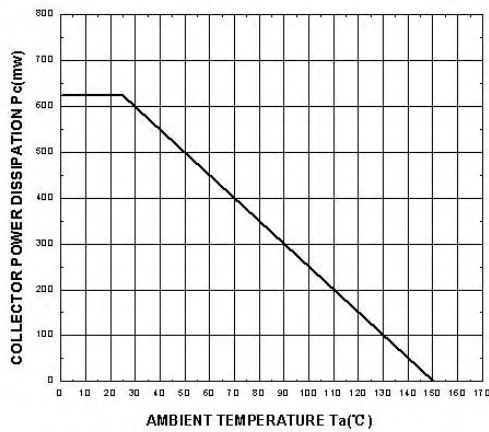
Vcesat-Ic  
Vbesat-Ic



hFE-Ic



Pc-Ta



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