

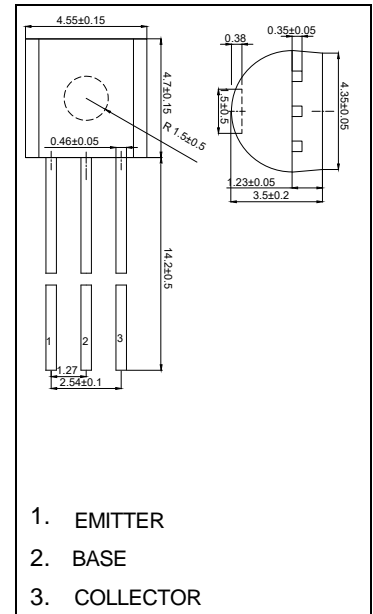


# TO-92 Plastic-Encapsulate Transistors

## 2N3904-338 TRANSISTOR (NPN)

### 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 (Ta=25°C unless otherwise noted)

SYMBOL	CHARACTERISTIC	RATING	UNIT
V <sub>CBO</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	200	mA
I <sub>B</sub>	Base Current	50	mA
P <sub>C</sub>	Collector Power Dissipation	T <sub>a</sub> =25 °C	625 mW
		T <sub>c</sub> =25 °C	1.5 W
T <sub>j</sub>	Junction Temperature	150	°C
T <sub>stg</sub>	Storage Temperature Range	-55 ~ 150	°C

### ELECTRICAL CHARACTERISTICS (Ta=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
Emitter cut-off current	I <sub>CEO</sub>	V <sub>CE</sub> =40V, I <sub>E</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	hFE(1)	V <sub>CE</sub> =1V, I <sub>C</sub> =0.1mA	40			
	hFE(2)	V <sub>CE</sub> =1V, I <sub>C</sub> =1mA	70			
	hFE(3)	V <sub>CE</sub> =1V, I <sub>C</sub> =10mA	100		400	
	hFE(4)	V <sub>CE</sub> =1V, I <sub>C</sub> =50mA	60			
	hFE(5)	V <sub>CE</sub> =1V, I <sub>C</sub> =100mA	30			
Collector-emitter saturation voltage	V <sub>CE(sat)</sub>	I <sub>C</sub> =10mA, I <sub>B</sub> =1mA			0.2	V
		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> =10mA, I <sub>B</sub> =1mA	0.65		0.85	V
		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>FE</sub>

RANK	O	Y	G
RANGE	100-200	200-300	300-400

# Typical Characteristics

# 2N3904-338

