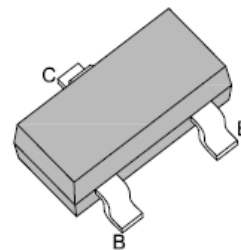
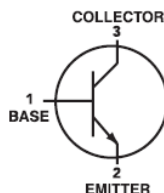


## SMD General Purpose Transistor (NPN)

### Features

- NPN Silicon Epitaxial Planar Transistor for Switching and Amplifier Applications



### Mechanical Data

<b>Case:</b>	SOT-23, Plastic Package
<b>Terminals:</b>	Solderable per MIL-STD-202G, Method 208
<b>Weight:</b>	0.008 gram

SOT-23



### Maximum Ratings ( $T_{Ambient}=25^{\circ}C$ unless noted otherwise)

Symbol	Description	MMBT9013	Unit	Conditions
<b>V<sub>CEO</sub></b>	Collector-Emitter Voltage	20	V	
<b>V<sub>CBO</sub></b>	Collector-Base Voltage	40	V	
<b>V<sub>EBO</sub></b>	Emitter-Base Voltage	5.0	V	
<b>I<sub>C</sub></b>	Collector Current	0.5	A	
<b>P<sub>D</sub></b>	Total Device Power Dissipation (Note 1)	225	mW	T <sub>A</sub> =25 °C
		1.8	mW/°C	Derate above 25 °C
<b>R<sub>θJA</sub></b>	Thermal Resistance, Junction to Ambient	556	°C /W	
<b>P<sub>D</sub></b>	Total Device Power Dissipation, Alumina Substrate (Note 2)	300	mW	T <sub>A</sub> =25 °C
		2.4	mW/°C	Derate above 25 °C
<b>R<sub>θJA</sub></b>	Thermal Resistance, Junction to Ambient	417	°C /W	
<b>T<sub>J</sub></b>	Junction Temperature	-55 to +150	°C	
<b>T<sub>STG</sub></b>	Storage Temperature Range	-55 to +150	°C	

**Note:** 1. FR-5 Board=25.4 x 19.05 x 1.58 mm (1.0 x 0.75 x 0.062 inches.)

2. Alumina Substrate=10.16 x 7.62 x 0.61 mm (0.4 x 0.3 x 0.024 inches.) 99.5% alumina.

# SMD General Purpose Transistor (NPN)

## MMBT9013

### Electrical Characteristics ( $T_{Ambient}=25^{\circ}C$ unless noted otherwise)

#### Off Characteristics

Symbol	Description	Min.	Max.	Unit	Conditions
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	20	-	V	$I_C=1mA, I_B=0$
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	40	-	V	$I_C=0.1mA, I_E=0$
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	5.0	-	V	$I_E=0.1mA, I_C=0$
$I_{CBO}$	Base Cut-off Current	-	0.15	$\mu A$	$V_{CB}=35V, I_E=0$
$I_{EBO}$	Emitter Cut-off Current	-	0.15	$\mu A$	$V_{EB}=4V, I_C=0$

#### On Characteristics

Symbol	Description	Min.	Max.	Unit	Conditions
$h_{FE}$	D.C. Current Gain	100	600	-	$V_{CE}=1V, I_C=50mA$
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	-	0.6	V	$I_C=500mA, I_B=50mA$

#### Classification Of $h_{FE}$

Rank	P	Q	R	S
Range	100-200	150-300	200-400	300-600
Marking	13P	13Q	13R	13S

# SMD General Purpose Transistor (NPN)

## MMBT9013

### Typical Characteristics Curves

Fig.1- Static Characteristic

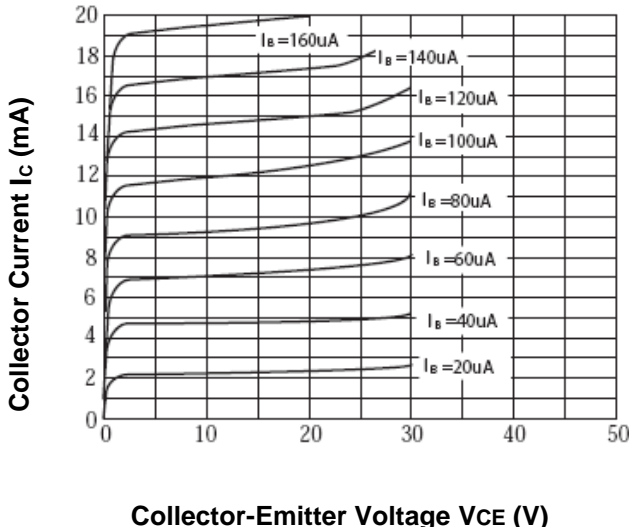


Fig.2- DC Current Gain

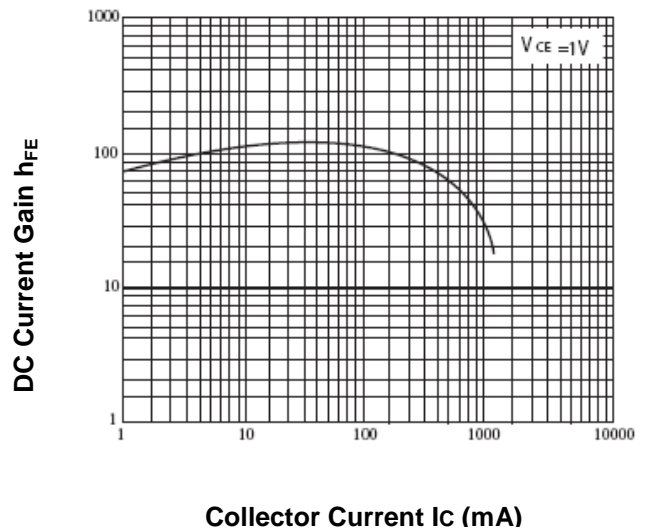


Fig.3- Collector-Emitter Saturation Voltage  
Base-Emitter Saturation Voltage

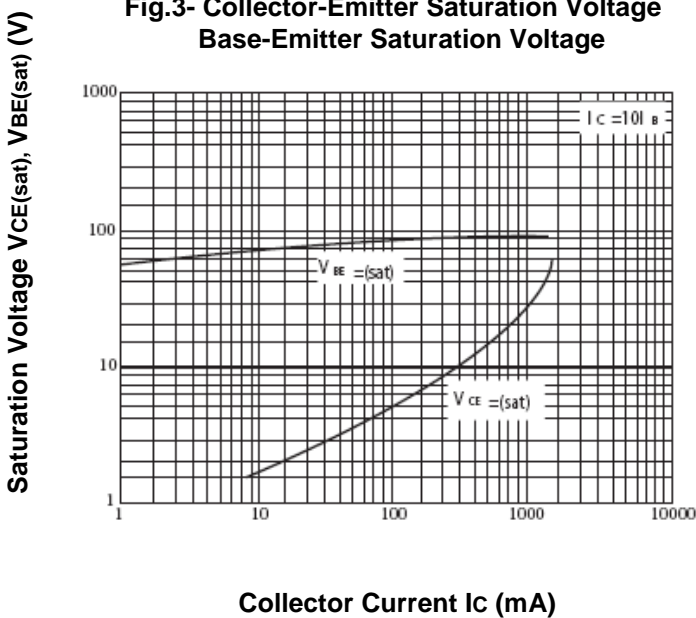
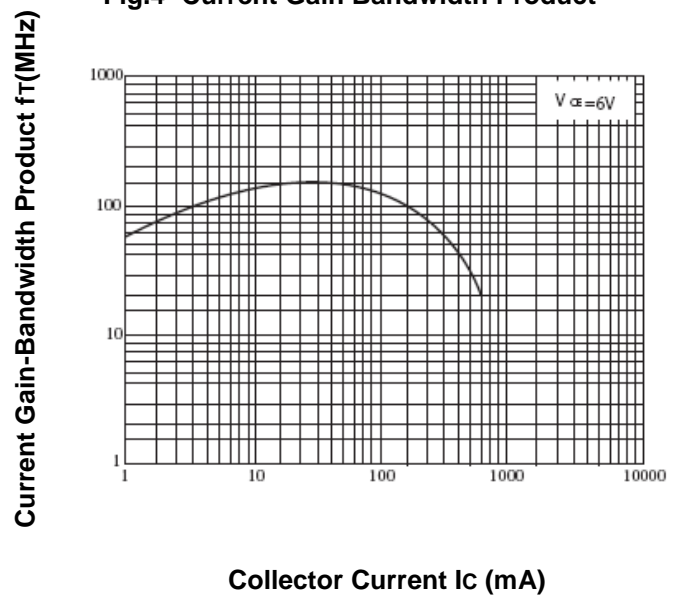


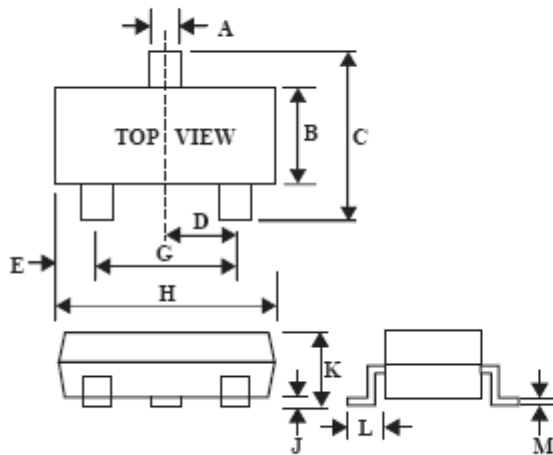
Fig.4- Current Gain Bandwidth Product



# SMD General Purpose Transistor (NPN)

## MMBT9013

### Dimensions in mm



SOT-23		
Dim	Min	Max
A	0.35	0.51
B	1.19	1.40
C	2.10	3.00
D	0.85	1.05
E	0.46	1.00
G	1.70	2.10
H	2.70	3.10
J	0.01	0.13
K	0.89	1.10
L	0.30	0.61
M	0.076	0.25

SOT-23

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