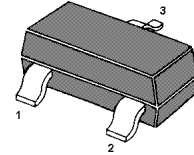


## Low Noise Transistors

### NPN Silicon



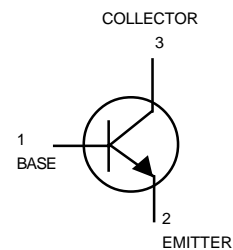
1.Base 2.Emitter 3.Collector  
SOT-23 Plastic Package

#### MAXIMUM RATINGS

Rating	Symbol	5088	5089	Unit
Collector-Emitter Voltage	$V_{CEO}$	30	25	Vdc
Collector-Base Voltage	$V_{CBO}$	35	30	Vdc
Emitter-Base Voltage	$V_{EBO}$	4.5		Vdc
Collector Current—Continuous	$I_C$	50		mAdc

#### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR-5 Board (1) $T_A=25^\circ\text{C}$	$P_D$	225	mW
Derate above $25^\circ\text{C}$		1.8	mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	556	$^\circ\text{C}/\text{W}$
Total Device Dissipation Alumina Substrate,(2) $T_A=25^\circ\text{C}$	$P_D$	300	mW
Derate above $25^\circ\text{C}$		2.4	mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	417	$^\circ\text{C}/\text{W}$
Junction and Storage Temperature	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$



#### DEVICE MARKING

MMBT5088 = 1Q; MMBT5089 = 1R

#### ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

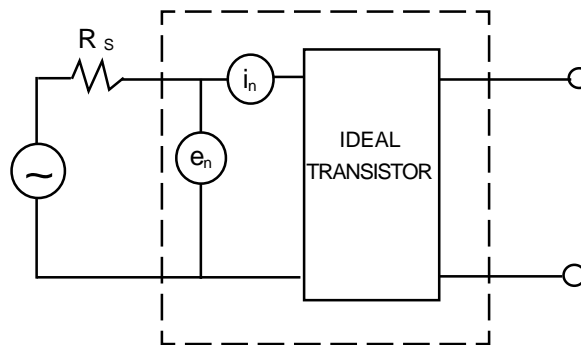
Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Emitter Breakdown Voltage ( $I_C = 1.0 \text{ mAdc}, I_B = 0$ )	$V_{(BR)CEO}$			Vdc
	MMBT5088	30	—	
	MMBT5089	25	—	
Collector-Base Breakdown Voltage ( $I_C = 100 \mu\text{Adc}, I_E = 0$ )	$V_{(BR)CBO}$			Vdc
	MMBT5088	35	—	
	MMBT5089	30	—	
Collector Cutoff Current ( $V_{CB} = 20 \text{ Vdc}, I_E = 0$ )	$I_{CBO}$			nAdc
	MMBT5088	—	50	
	MMBT5089	—	50	
Emitter Cutoff Current	$I_{EBO}$			nAdc
( $V_{EB(off)} = 3.0 \text{ Vdc}, I_C = 0$ )	MMBT5088	—	50	
( $V_{EB(off)} = 4.5 \text{ Vdc}, I_C = 0$ )	MMBT5089	—	100	

1. FR-5 = 1.0 x 0.75 x 0.062 in.

2. Alumina = 0.4 x 0.3 x 0.024 in. 99.5% alumina.

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted) (Continued)

Characteristic	Symbol	Min	Max	Unit
<b>ON CHARACTERISTICS</b>				
DC Current Gain ( $I_C=100\mu\text{Adc}, V_{CE}=5.0\text{Vdc}$ )	$h_{FE}$			—
	MMBT5088	300	900	
( $I_C=1.0\text{mAdc}, V_{CE}=5.0\text{Vdc}$ )	MMBT5089	400	1200	
	MMBT5088	350	—	
( $I_C = 10\text{mAdc}, V_{CE}=5.0\text{Vdc}$ )	MMBT5089	450	—	
	MMBT5088	300	—	
MMBT5089	400	—		
Collector–Emitter Saturation Voltage ( $I_C=10\text{mAdc}, I_B=1.0\text{mAdc}$ )	$V_{CE(sat)}$	—	0.5	Vdc
Base–Emitter Saturation Voltage ( $I_C = 10\text{mAdc}, I_B=1.0\text{mAdc}$ )	$V_{BE(sat)}$	—	0.8	Vdc
<b>SMALL–SIGNAL CHARACTERISTICS</b>				
Current–Gain — Bandwidth Product ( $I_C= 500 \mu\text{Adc}, V_{CE}=5.0\text{Vdc}, f=20\text{MHz}$ )	$f_T$	50	—	MHz
Collector–Base Capacitance ( $V_{CB}=5.0\text{Vdc}, I_E=0, f=1.0\text{MHz}$ emitter guarded)	$C_{cb}$	—	4.0	pF
Emitter–Base Capacitance ( $V_{EB}=0.5\text{Vdc}, I_C=0, f=1.0\text{MHz}$ collector guarded)	$C_{eb}$	—	10	pF
Small Signal Current Gain ( $I_C=1.0\text{mAdc}, V_{CE}=5.0\text{Vdc}, f=1.0\text{kHz}$ )	$h_{fe}$			—
	MMBT5088	350	1400	
Noise Figure ( $I_C=100\mu\text{Adc}, V_{CE}=5.0\text{Vdc}, R_S=10\text{k}\Omega, f=1.0\text{kHz}$ )	NF			dB
	MMBT5089	—	3.0	
MMBT5088	—	2.0		



**Figure 1. Transistor Noise Model**

## Typical Characteristics

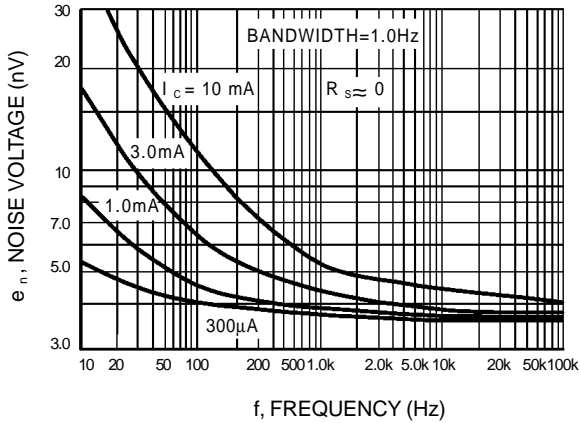


Figure 2. Effects of Frequency

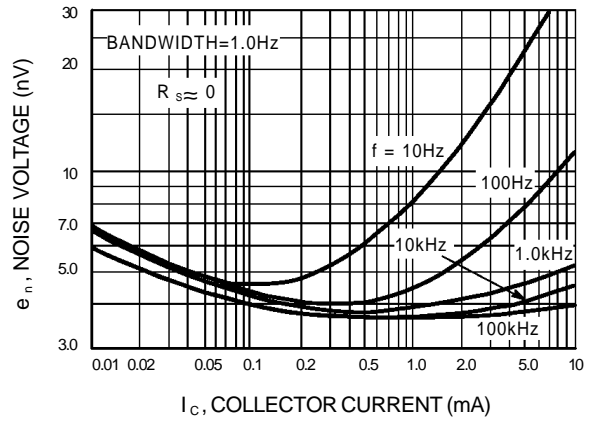


Figure 3. Effects of Collector Current

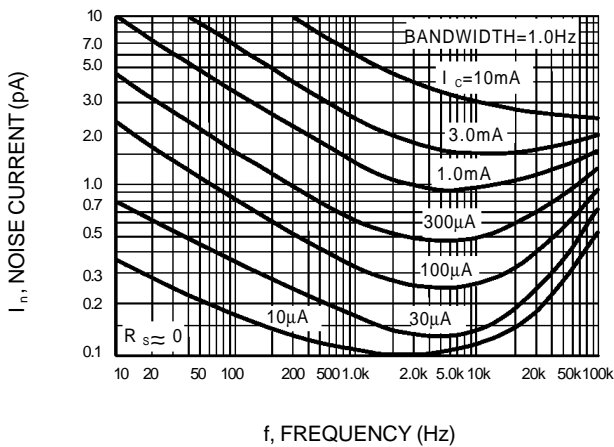


Figure 4. Noise Current

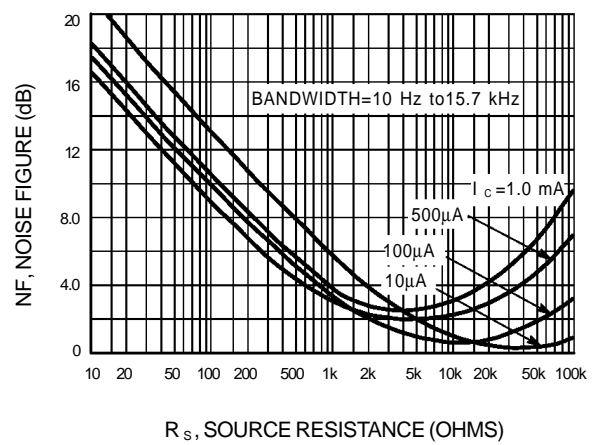


Figure 5. Wideband Noise Figure

### 100 Hz NOISE DATA

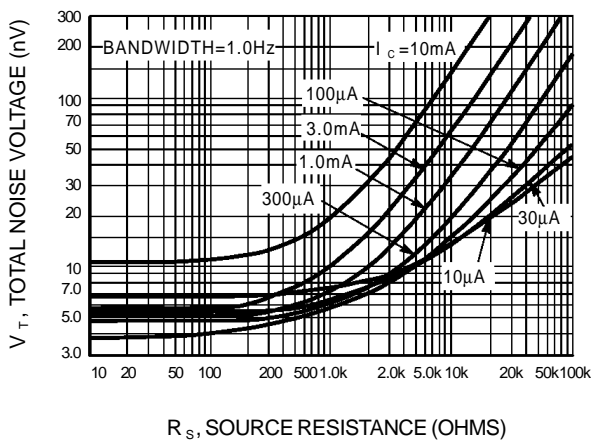


Figure 6. Total Noise Voltage

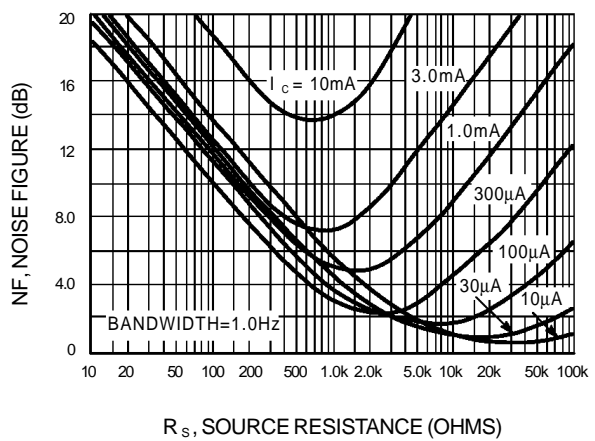


Figure 7. Noise Figure

## Typical Characteristics

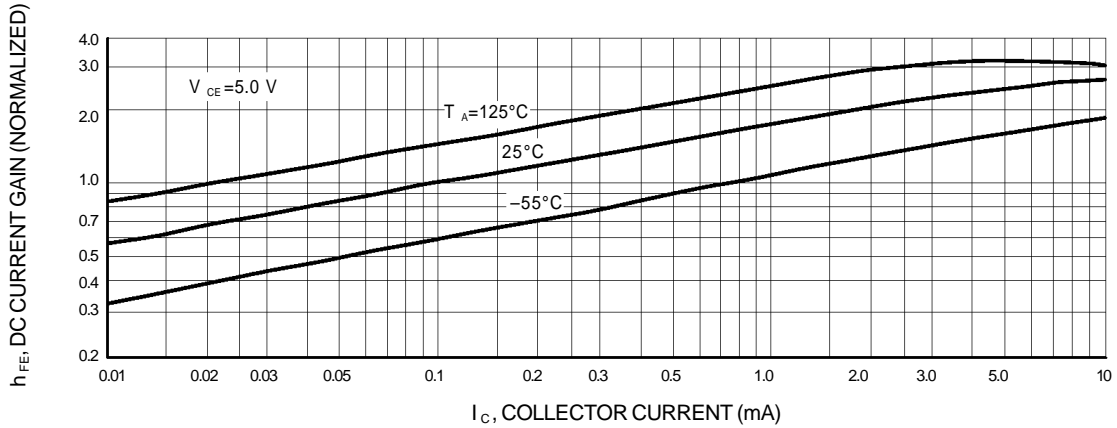


Figure 8. DC Current Gain

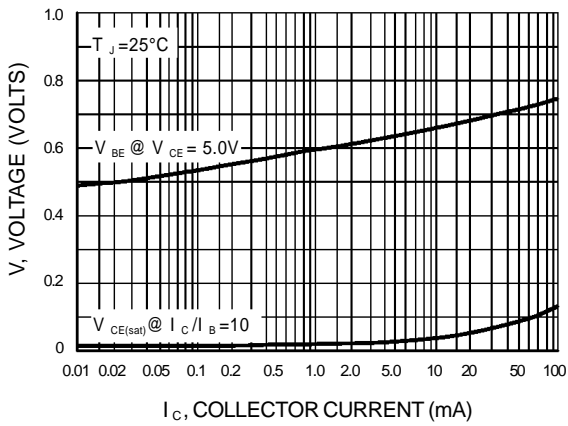


Figure 9. "On" Voltages

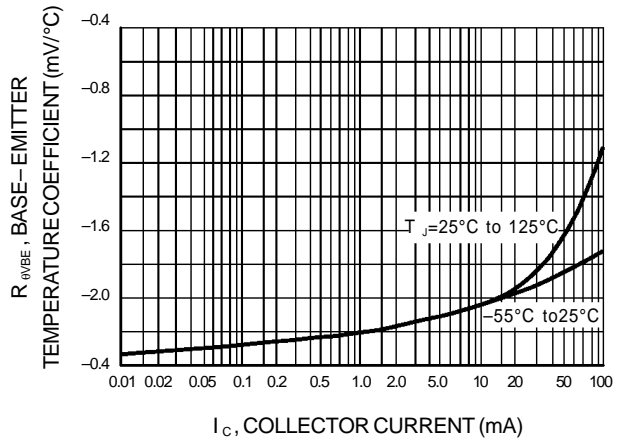


Figure 10. Temperature Coefficients

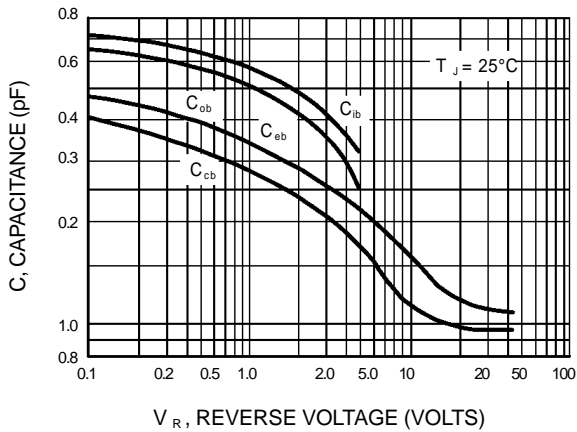


Figure 11. Capacitance

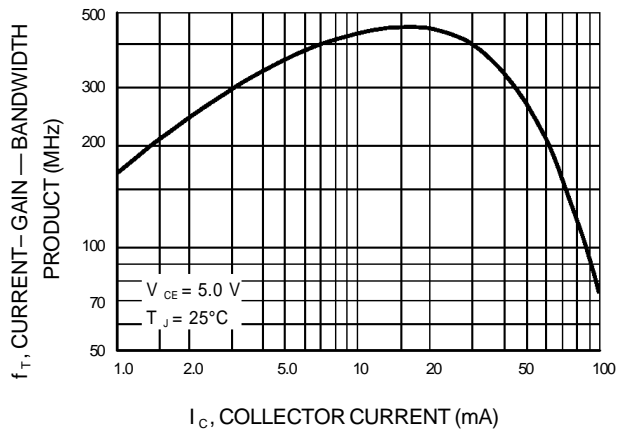
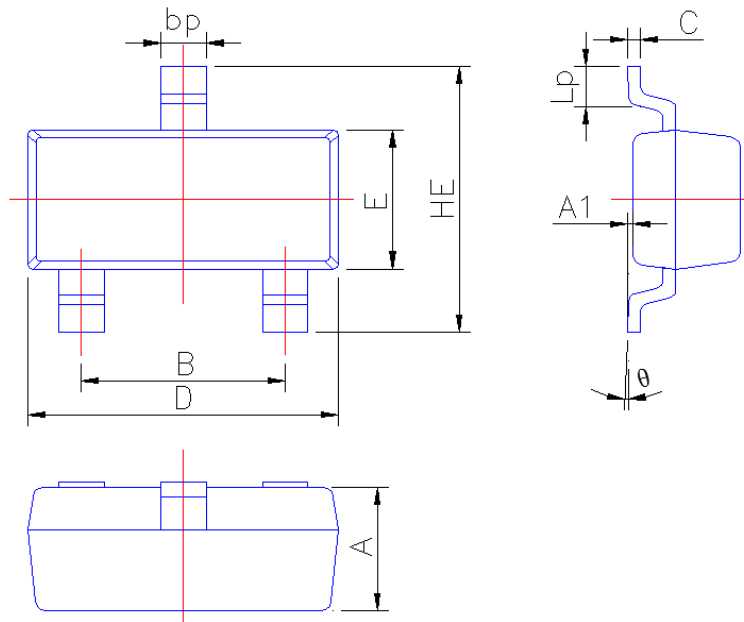


Figure 12. Current-Gain Bandwidth Product

## PACKAGE OUTLINE

Plastic surface mounted package; 3 leads

SOT-23



Symbol	Dimension in Millimeters	
	Min	Max
A	0.90	1.10
A1	0.013	0.100
B	1.80	2.00
bp	0.35	0.50
C	0.09	0.150
D	2.80	3.00
E	1.20	1.40
HE	2.20	2.80
Lp	0.20	0.50
θ	0°	5°