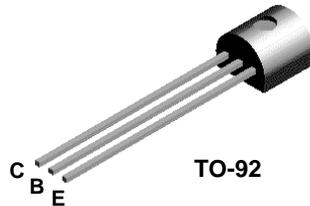
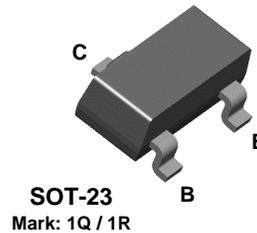


2N5088
2N5089



MMBT5088
MMBT5089



NPN General Purpose Amplifier

This device is designed for low noise, high gain, general purpose amplifier applications at collector currents from 1μA to 50 mA.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units	
V _{CEO}	Collector-Emitter Voltage	2N5088	30	V
		2N5089	25	V
V _{CBO}	Collector-Base Voltage	2N5088	35	V
		2N5089	30	V
V _{EBO}	Emitter-Base Voltage	4.5	V	
I _C	Collector Current - Continuous	100	mA	
T _J , T _{stg}	Operating and Storage Junction Temperature Range	-55 to +150	°C	

*These ratings are limiting values above which the serviceability of any semiconductor device may be impaired.

NOTES:

- 1) These ratings are based on a maximum junction temperature of 150 degrees C.
- 2) These are steady state limits. The factory should be consulted on applications involving pulsed or low duty cycle operations.

Thermal Characteristics

TA = 25°C unless otherwise noted

Symbol	Characteristic	Max		Units
		2N5088 2N5089	* MMBT5088 * MMBT5089	
P _D	Total Device Dissipation Derate above 25°C	625	350	mW
		5.0	2.8	mW/°C
R _{θJC}	Thermal Resistance, Junction to Case	83.3		°C/W
R _{θJA}	Thermal Resistance, Junction to Ambient	200	357	°C/W

*Device mounted on FR-4 PCB 1.6" X 1.6" X 0.06."

NPN General Purpose Amplifier

(continued)

Electrical Characteristics

TA = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHARACTERISTICS					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage*	$I_C = 1.0 \text{ mA}, I_B = 0$	5088	30	V
			5089	25	V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	$I_C = 100 \mu\text{A}, I_E = 0$	5088	35	V
			5089	30	V
I_{CBO}	Collector Cutoff Current	$V_{CB} = 20 \text{ V}, I_E = 0$	5088	50	nA
		$V_{CB} = 15 \text{ V}, I_E = 0$	5089	50	nA
I_{EBO}	Emitter Cutoff Current	$V_{EB} = 3.0 \text{ V}, I_C = 0$		50	nA
		$V_{EB} = 4.5 \text{ V}, I_C = 0$		100	nA

ON CHARACTERISTICS

h_{FE}	DC Current Gain	$I_C = 100 \mu\text{A}, V_{CE} = 5.0 \text{ V}$	5088	300	900	
			5089	400	1200	
		$I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V}$	5088	350		
			5089	450		
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_C = 10 \text{ mA}, I_B = 1.0 \text{ mA}$		0.5	V	
$V_{BE(on)}$	Base-Emitter On Voltage	$I_C = 10 \text{ mA}, V_{CE} = 5.0 \text{ V}$		0.8	V	

SMALL SIGNAL CHARACTERISTICS

f_T	Current Gain - Bandwidth Product	$I_C = 500 \mu\text{A}, V_{CE} = 5.0 \text{ mA},$ $f = 20 \text{ MHz}$		50		MHz
C_{cb}	Collector-Base Capacitance	$V_{CB} = 5.0 \text{ V}, I_E = 0, f = 100 \text{ kHz}$			4.0	pF
C_{eb}	Emitter-Base Capacitance	$V_{BE} = 0.5 \text{ V}, I_C = 0, f = 100 \text{ kHz}$			10	pF
h_{fe}	Small-Signal Current Gain	$I_C = 1.0 \text{ mA}, V_{CE} = 5.0 \text{ V},$	5088	350	1400	
		$f = 1.0 \text{ kHz}$	5089	450	1800	
NF	Noise Figure	$I_C = 100 \mu\text{A}, V_{CE} = 5.0 \text{ V},$	5088		3.0	dB
		$R_S = 10 \text{ k}\Omega,$ $f = 10 \text{ Hz to } 15.7 \text{ kHz}$	5089		2.0	dB

*Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2.0\%$

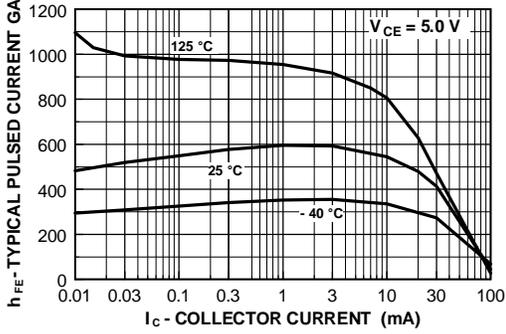
Spice Model

NPN (Is=5.911f Xti=3 Eg=1.11 Vaf=62.37 Bf=1.122K Ne=1.394 Ise=5.911f Ikf=14.92m Xtb=1.5 Br=1.271 Nc=2 Isc=0 Ikr=0 Rc=1.61 Cjc=4.017p Mjc=.3174 Vjc=.75 Fc=.5 Cje=4.973p Mje=.4146 Vje=.75 Tr=4.673n Tf=821.7p Itf=.35 Vtf=4 Xtf=7 Rb=10)

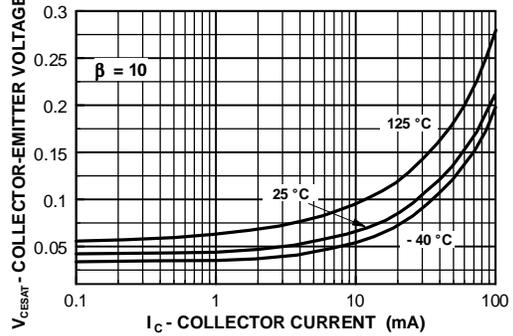
2N5088 / MMBT5088 / 2N5089 / MMBT5089

Typical Characteristics

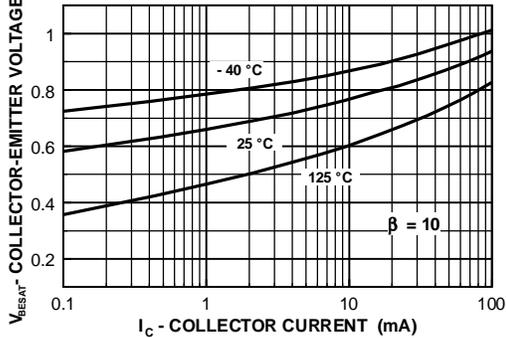
Typical Pulsed Current Gain vs Collector Current



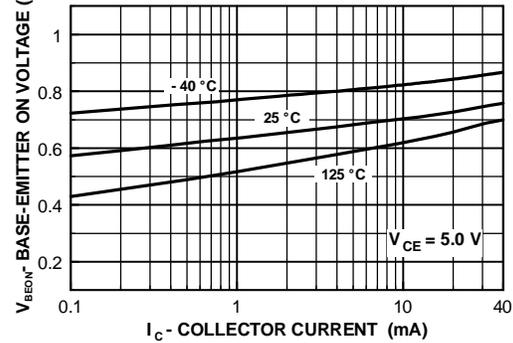
Collector-Emitter Saturation Voltage vs Collector Current



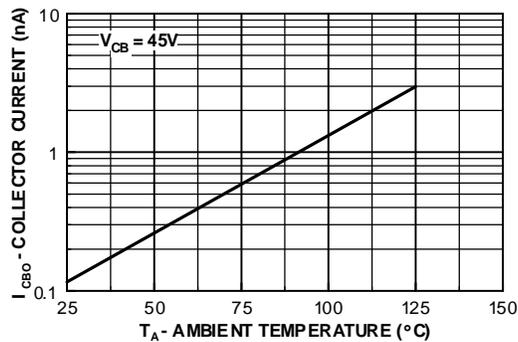
Base-Emitter Saturation Voltage vs Collector Current



Base-Emitter ON Voltage vs Collector Current



Collector-Cutoff Current vs Ambient Temperature



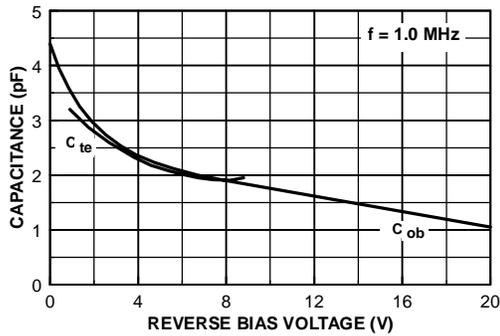
NPN General Purpose Amplifier

(continued)

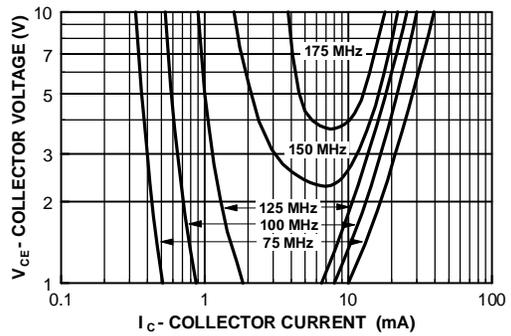
2N5088 / MMBT5088 / 2N5089 / MMBT5089

Typical Characteristics (continued)

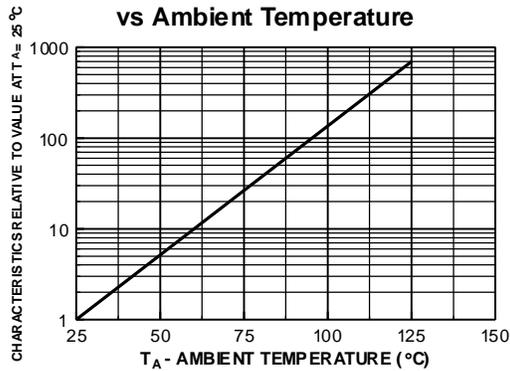
Input and Output Capacitance vs Reverse Bias Voltage



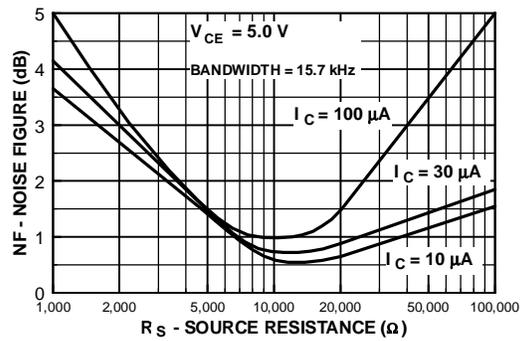
Contours of Constant Gain Bandwidth Product (f_T)



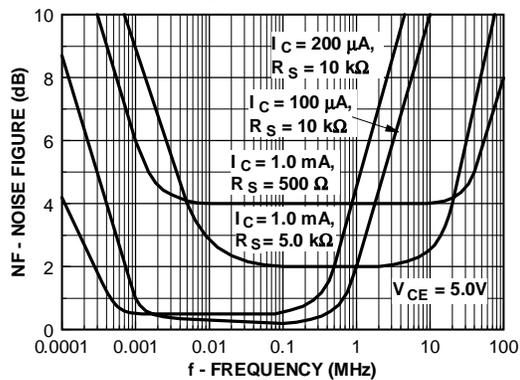
Normalized Collector-Cutoff Current vs Ambient Temperature



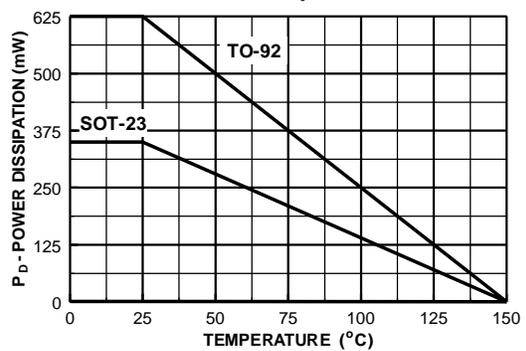
Wideband Noise Frequency vs Source Resistance



Noise Figure vs Frequency

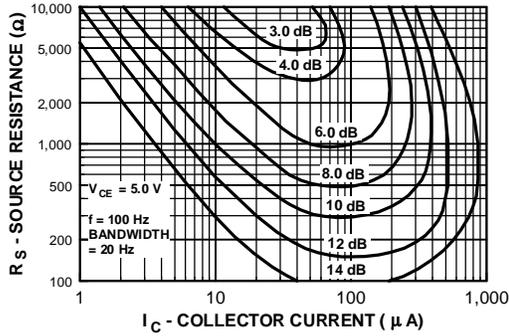


Power Dissipation vs Ambient Temperature

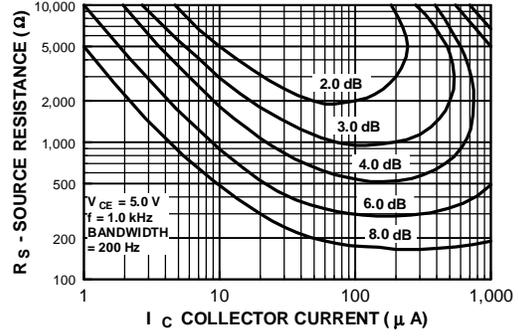


Typical Characteristics (continued)

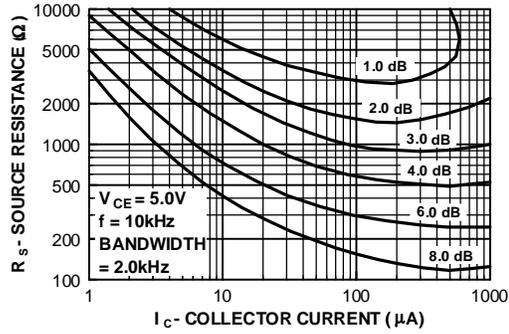
Contours of Constant
Narrow Band Noise Figure



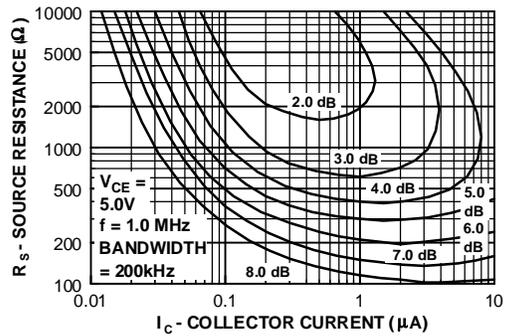
Contours of Constant
Narrow Band Noise Figure



Contours of Constant
Narrow Band Noise Figure



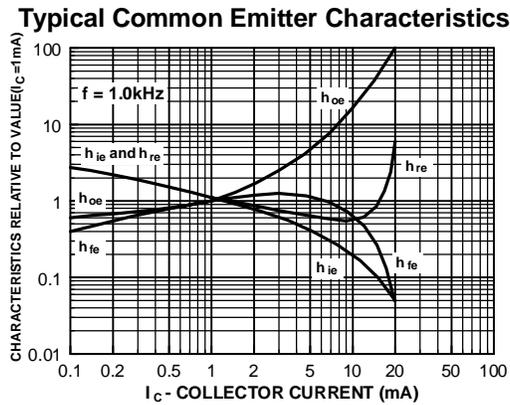
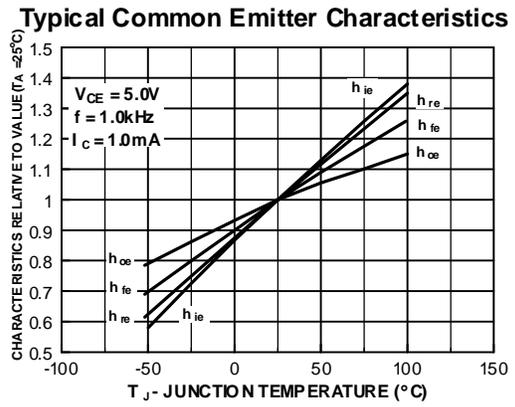
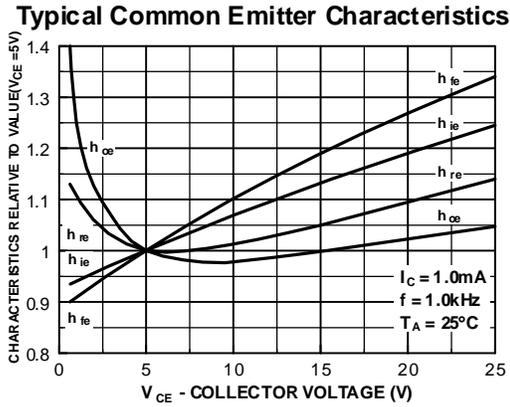
Contours of Constant
Narrow Band Noise Figure



NPN General Purpose Amplifier
(continued)

2N5088 / MMBT5088 / 2N5089 / MMBT5089

Typical Common Emitter Characteristics (f = 1.0 kHz)



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