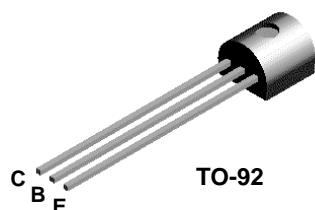




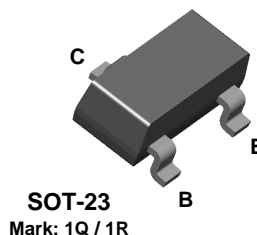
ON Semiconductor®

2N5088
2N5089



TO-92

MMBT5088
MMBT5089



SOT-23
Mark: 1Q / 1R

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 5.0	350 2.8	mW 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."

2N5088 / MMBT5088 / 2N5089 / MMBT5089

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 mA, I _B = 0	5088	30	V
			5089	25	V
V _{(BR)CBO}	Collector-Base Breakdown Voltage	I _C = 100 µA, I _E = 0	5088	35	V
			5089	30	V
I _{CBO}	Collector Cutoff Current	V _{CB} = 20 V, I _E = 0	5088		nA
		V _{CB} = 15 V, I _E = 0	5089	50	nA
I _{EBO}	Emitter Cutoff Current	V _{EB} = 3.0 V, I _C = 0		50	nA
		V _{EB} = 4.5 V, I _C = 0		100	nA

ON CHARACTERISTICS

h _{FE}	DC Current Gain	I _C = 100 µA, V _{CE} = 5.0 V	5088	300	900	
			5089	400	1200	
		I _C = 1.0 mA, V _{CE} = 5.0 V	5088	350		
			5089	450		
		I _C = 10 mA, V _{CE} = 5.0 V*	5088	300		
			5089	400		
V _{CE(sat)}	Collector-Emitter Saturation Voltage	I _C = 10 mA, I _B = 1.0 mA			0.5	V
V _{BE(on)}	Base-Emitter On Voltage	I _C = 10 mA, V _{CE} = 5.0 V			0.8	V

SMALL SIGNAL CHARACTERISTICS

f _T	Current Gain - Bandwidth Product	I _C = 500 µA, V _{CE} = 5.0 mA, f = 20 MHz		50		MHz
C _{cb}	Collector-Base Capacitance	V _{CB} = 5.0 V, I _E = 0, f = 100 kHz			4.0	pF
C _{eb}	Emitter-Base Capacitance	V _{BE} = 0.5 V, I _C = 0, f = 100 kHz			10	pF
h _{fe}	Small-Signal Current Gain	I _C = 1.0 mA, V _{CE} = 5.0 V, f = 1.0 kHz	5088	350	1400	
			5089	450	1800	
NF	Noise Figure	I _C = 100 µA, V _{CE} = 5.0 V, R _S = 10 kΩ, f = 10 Hz to 15.7 kHz	5088		3.0	dB
			5089		2.0	dB

*Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%

Spice Model

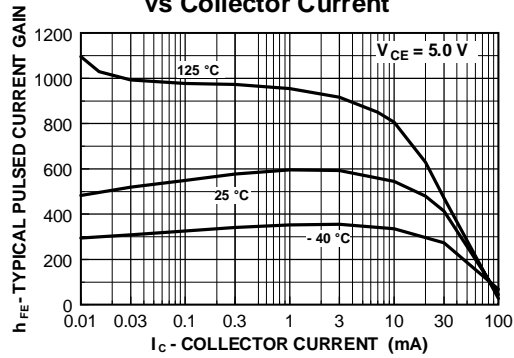
NPN (Is=5.911f Xti=3 Eg=1.11 Vaf=62.37 Bf=1.122K Ne=1.394 Ise=5.911f Ikf=14.92m Xtb=1.5 Br=1.271 Nc=2 Isc=0 Ikr=0 Rc=1.61 Cjc=4.017p Mjc=.3174 Vjc=.75 Fc=.5 Cje=4.973p Mje=.4146 Vje=.75 Tr=4.673n Tf=821.7p Itf=.35 Vtf=4 Xtf=7 Rb=10)

NPN General Purpose Amplifier (continued)

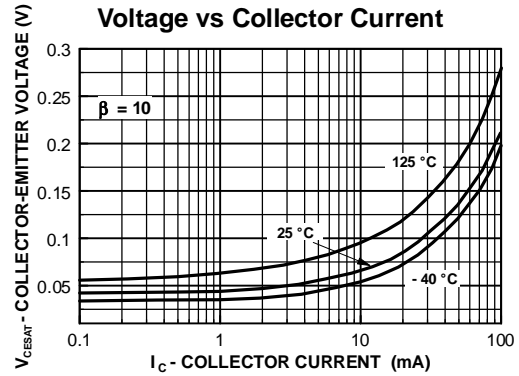
2N5088 / MMBT5088 / 2N5089 / MMBT5089

Typical Characteristics

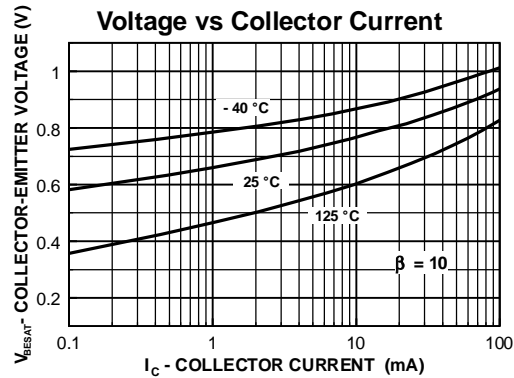
Typical Pulsed Current Gain
vs Collector Current



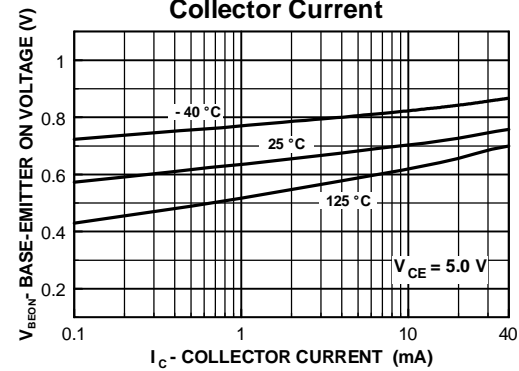
Collector-Emitter Saturation
Voltage vs Collector Current



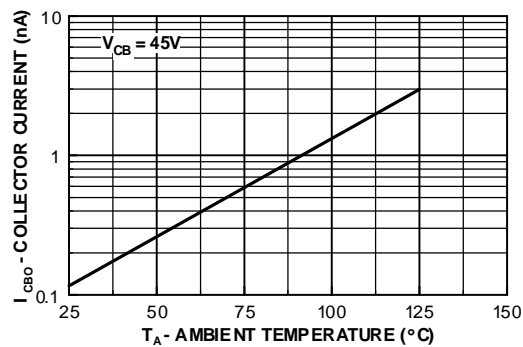
Base-Emitter Saturation
Voltage vs Collector Current



Base-Emitter ON Voltage vs
Collector Current



Collector-Cutoff Current
vs Ambient Temperature

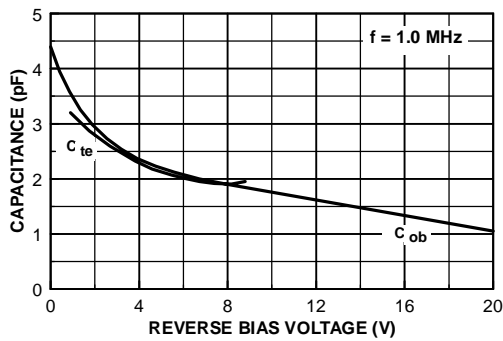


NPN General Purpose Amplifier (continued)

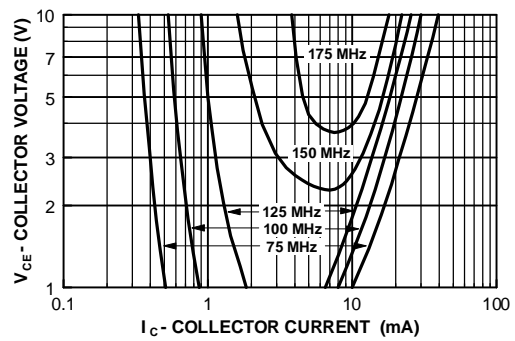
2N5088 / MMBT5088 / 2N5089 / MMBT5089

Typical Characteristics (continued)

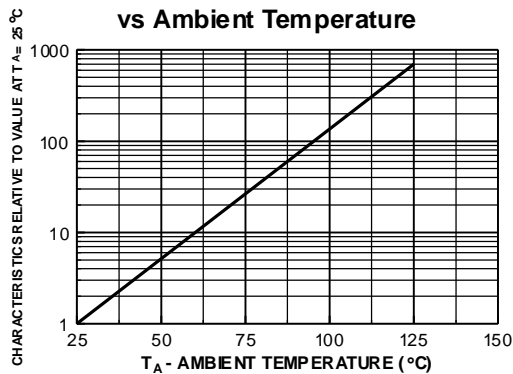
Input and Output Capacitance
vs Reverse Bias Voltage



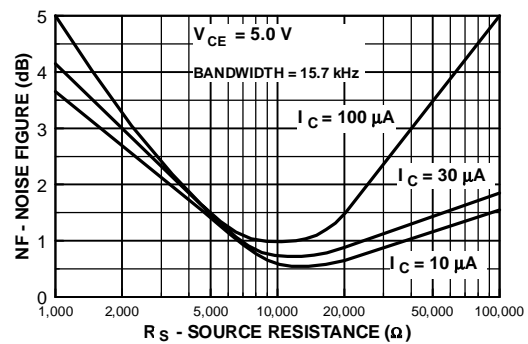
Contours of Constant Gain
Bandwidth Product (f_T)



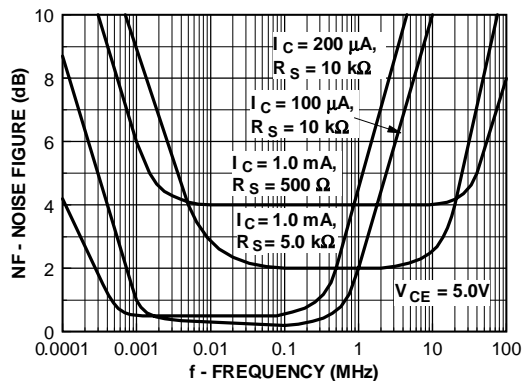
Normalized Collector-Cutoff Current
vs Ambient Temperature



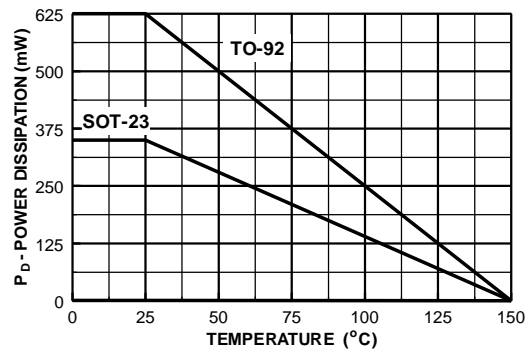
Wideband Noise Frequency
vs Source Resistance



Noise Figure vs Frequency



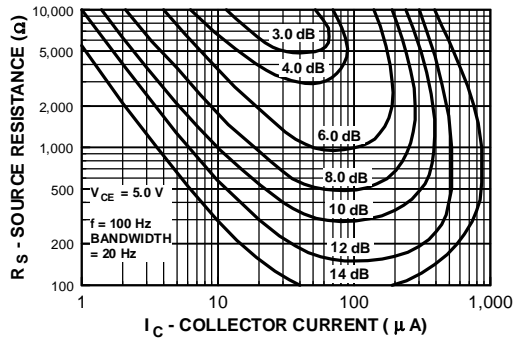
Power Dissipation vs
Ambient Temperature



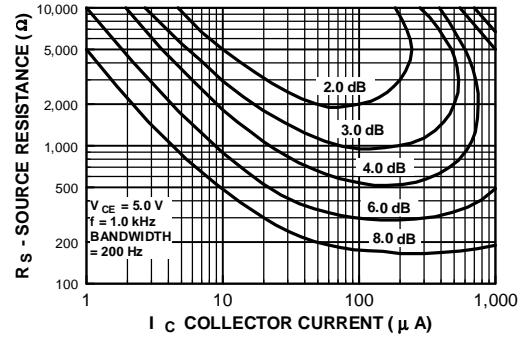
NPN General Purpose Amplifier (continued)

Typical Characteristics (continued)

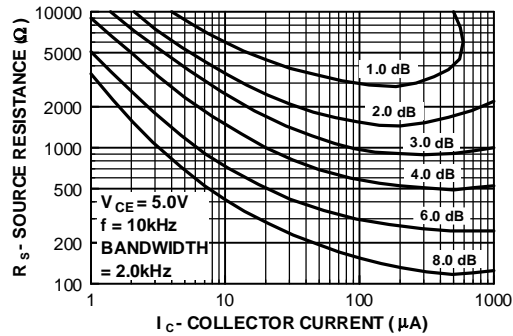
Contours of Constant
Narrow Band Noise Figure



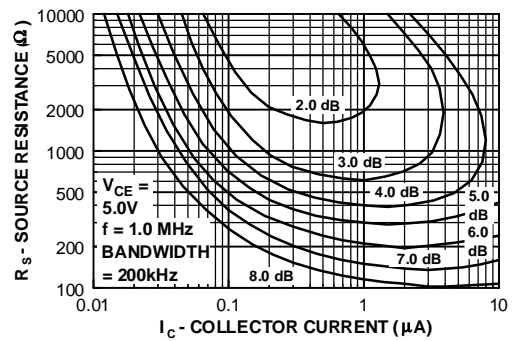
Contours of Constant
Narrow Band Noise Figure



Contours of Constant
Narrow Band Noise Figure

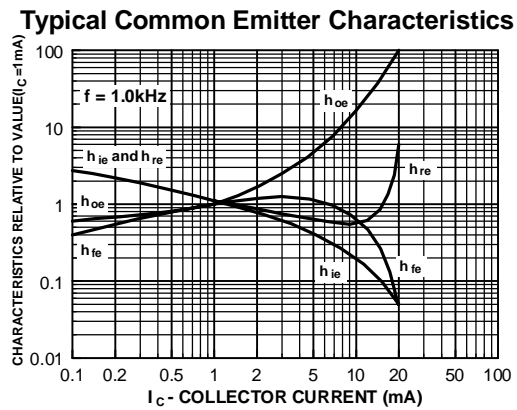
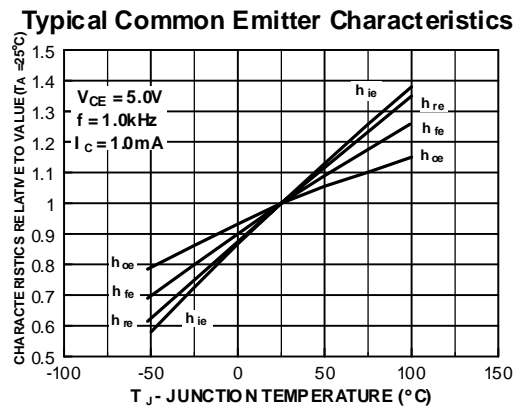
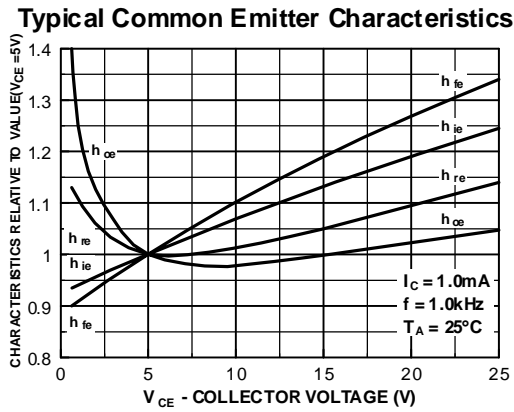


Contours of Constant
Narrow Band Noise Figure




NPN General Purpose Amplifier (continued)

Typical Common Emitter Characteristics (f = 1.0 kHz)



2N5088 / MMBT5088 / 2N5089 / MMBT5089

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada

Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910

Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com

Order Literature: <http://www.onsemi.com/orderlit>

For additional information, please contact your local
Sales Representative