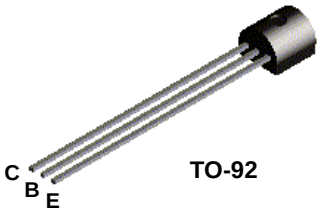
National Semiconductor™

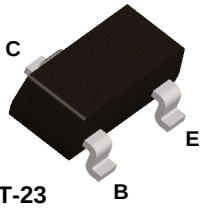
Discrete POWER & Signal Technologies

2N5401



TO-92

MMBT5401



SOT-23
Mark: 2L

PNP General Purpose Amplifier

This device is designed as a general purpose amplifier and switch for applications requiring high voltages. Sourced from Process 74.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	150	V
V_{CBO}	Collector-Base Voltage	160	V
V_{EBO}	Emitter-Base Voltage	5.0	V
I_C	Collector Current - Continuous	200	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
		2N5401	*MMBT5401	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	350 2.8	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	357	°C/W

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

PNP 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	150		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 100 µA, I_E = 0	160		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	5.0		V
I_{CBO}	Collector Cutoff Current	V_{CB} = 120 V, I_E = 0 V_{CB} = 120 V, I_E = 0, T_A = 100°C		50 50	nA µA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 3.0 V, I_C = 0		50	nA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	I_C = 1.0 mA, V_{CE} = 5.0 V I_C = 10 mA, V_{CE} = 5.0 V I_C = 50 mA, V_{CE} = 5.0 V	50 60 50	 240 	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA		0.2 0.5	V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA		1.0 1.0	V V
SMALL SIGNAL CHARACTERISTICS					
f_T	Current Gain - Bandwidth Product	I_C = 10 mA, V_{CE} = 10 V, f = 100 MHz	100	300	MHz
C_{obo}	Output Capacitance	V_{CB} = 10 V, I_E = 0, f = 1.0 MHz		6.0	pF
NF	Noise Figure	I_C = 250 µA, V_{CE} = 5.0 V, R_S = 1.0 kΩ, f = 10 Hz to 15.7 kHz		8.0	dB

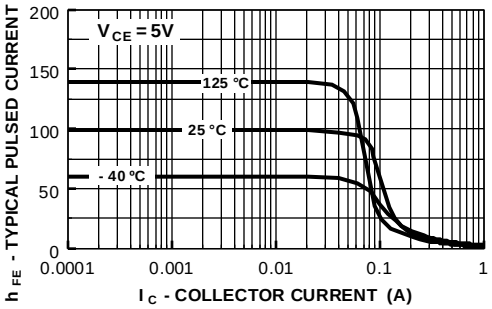
*Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%

Spice Model

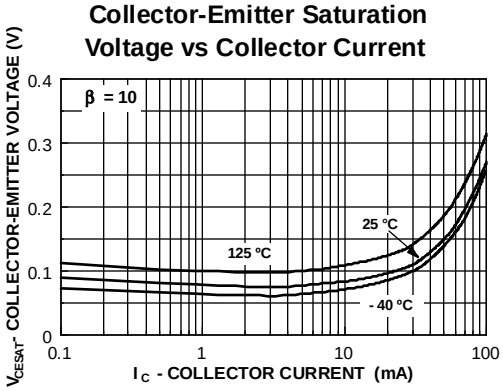
PNP (Is=21.48f Xti=3 Eg=1.11 Vaf=100 Bf=132.1 Ne=1.375 Ise=21.48f Ikf=.1848 Xtb=1.5 Br=3.661 Nc=2 Isc=0 Ikr=0 Rc=1.6 Cjc=17.63p Mjc=.5312 Vjc=.75 Fc=.5 Cje=73.39p Mje=.3777 Vje=.75 Tr=1.476n Tf=641.9p Itf=0 Vtf=0 Xtf=0 Rb=10)

Typical Characteristics

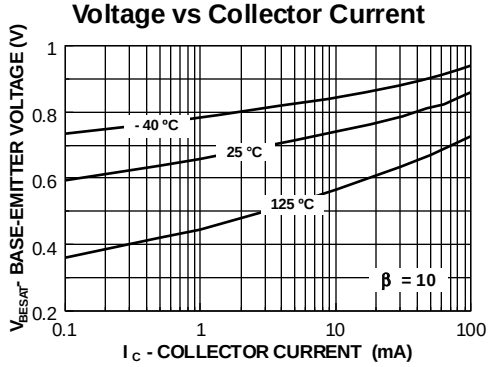
Typical Pulsed Current Gain vs Collector Current



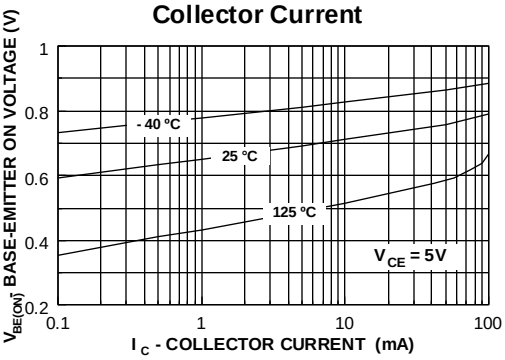
Collector-Emitter Saturation Voltage vs Collector Current



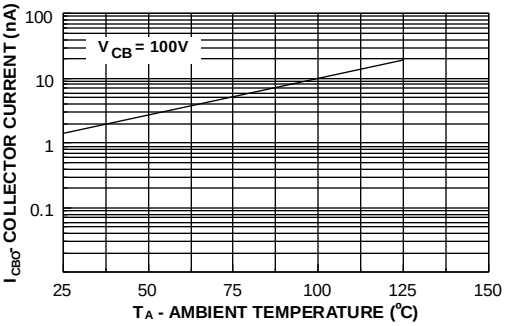
Base-Emitter Saturation Voltage vs Collector Current



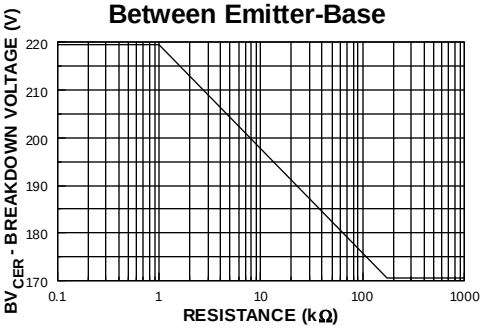
Base-Emitter ON Voltage vs Collector Current



Collector-Cutoff Current vs Ambient Temperature

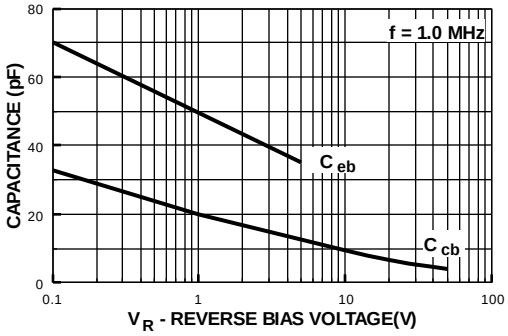


Collector-Emitter Breakdown Voltage with Resistance Between Emitter-Base



Typical Characteristics (continued)

Input and Output Capacitance vs Reverse Voltage



Power Dissipation vs Ambient Temperature