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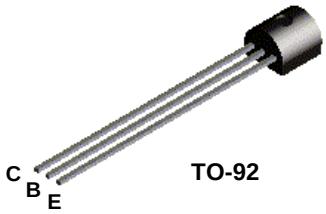
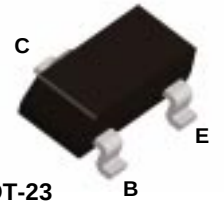
PN100 PN100A

MMBT100 MMBT100A



TO-92



SOT-23
Mark: NA / NA1

NPN General Purpose Amplifier

This device is designed for general purpose amplifier applications at collector currents to 300 mA. Sourced from Process 10.

Absolute Maximum Ratings*

TA=25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	45	V
V_{CBO}	Collector-Base Voltage	75	V
V_{EBO}	Emitter-Base Voltage	6.0	V
I_C	Collector Current - Continuous	500	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
		PN100A	*MMBT100A	
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."

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NPN General Purpose Amplifier
(continued)

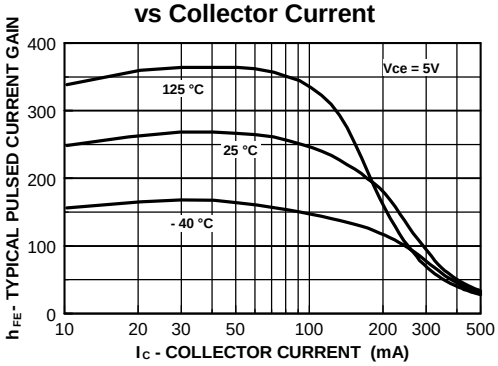
Electrical Characteristics
TA= 25°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min	Max	Units
OFF CHARACTERISTICS						
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 10 µA, I_B = 0		75		V
BV_{CEO}	Collector-Emitter Breakdown Voltage*	I_C = 1 mA, I_E = 0		45		V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0		6.0		V
I_{CBO}	Collector Cutoff Current	V_{CB} = 60 V			50	nA
I_{CES}	Collector Cutoff Current	V_{CE} = 40 V			50	nA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 4 V			50	nA
ON CHARACTERISTICS						
h_{FE}	DC Current Gain	I_C = 100 µA, V_{CE} = 1.0 V	**100**	80		
			100A	240		
		I_C = 10 mA, V_{CE} = 1.0 V	**100**	100	450	
			100A	300	600	
		I_C = 100 mA, V_{CE} = 1.0 V*		100		
		I_C = 150 mA, V_{CE} = 5.0 V*	**100**	100	350	
			100A	100		
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA			0.2	V
		I_C = 200 mA, I_B = 20 mA*			0.4	V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA			0.85	V
		I_C = 200 mA, I_B = 20 mA*			1.0	V
SMALL SIGNAL CHARACTERISTICS						
f_T	Current Gain - Bandwidth Product	V_{CE} = 20 V, I_C = 20 mA		250		MHz
C_{obo}	Output Capacitance	V_{CB} = 5.0 V, f = 1.0 MHz			4.5	pF
NF	Noise Figure	I_C = 100 µA, V_{CE} = 5.0 V,	**100**		5.0	dB
		R_G = 2.0 kΩ, f = 1.0 kHz	**100A**		4.0	dB

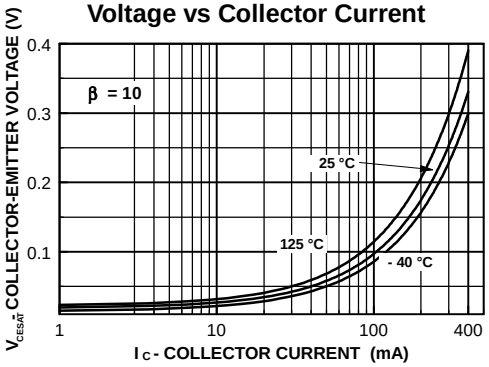
*Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%

Typical Characteristics

Typical Pulsed Current Gain vs Collector Current



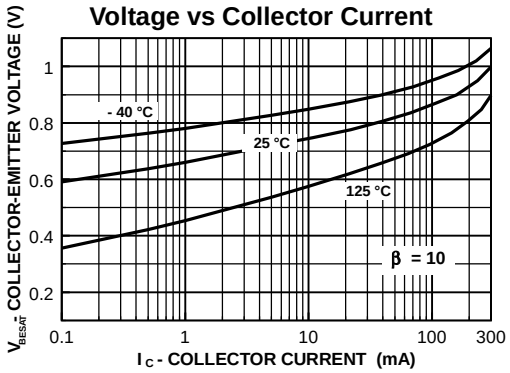
Collector-Emitter Saturation Voltage vs Collector Current



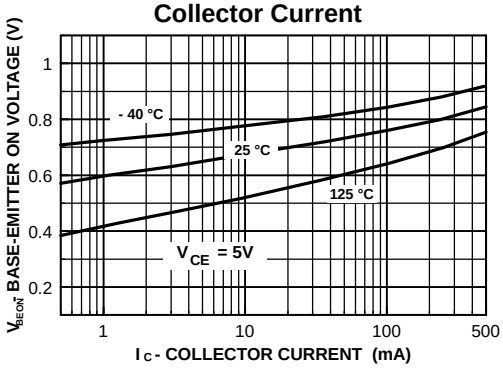
NPN General Purpose Amplifier
(continued)

Typical Characteristics (continued)

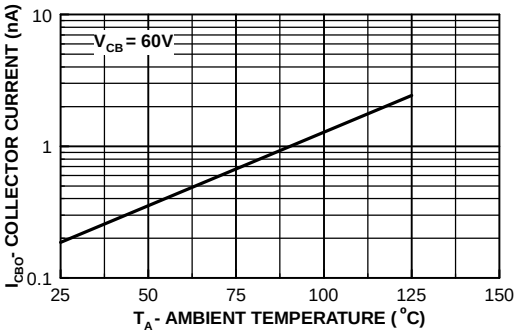
Base-Emitter Saturation Voltage vs Collector Current



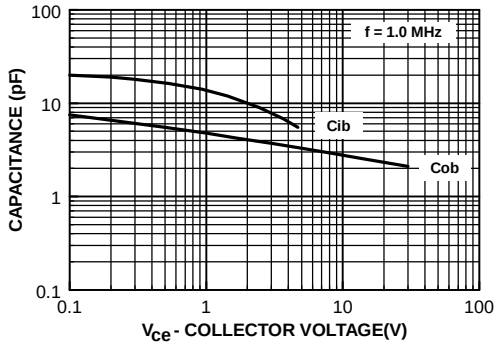
Base-Emitter ON Voltage vs Collector Current



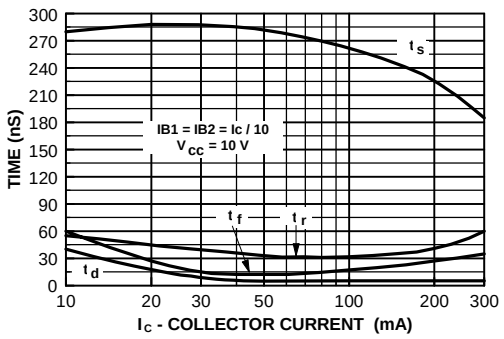
Collector-Cutoff Current vs Ambient Temperature



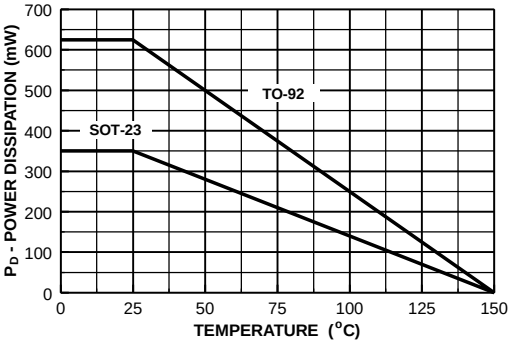
Input and Output Capacitance vs Reverse Voltage



Switching Times vs Collector Current



Power Dissipation vs Ambient Temperature



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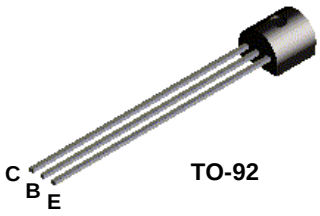
PN200 PN200A

MMBT200 MMBT200A



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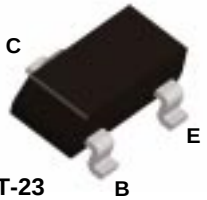

SOT-23
Mark: N2 / N2A

PNP General Purpose Amplifier

This device is designed for general purpose amplifier applications at collector currents to 300 mA. Sourced from Process 68.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	45	V
V_{CBO}	Collector-Base Voltage	75	V
V_{EBO}	Emitter-Base Voltage	6.0	V
I_C	Collector Current - Continuous	500	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
		PN200A	*MMBT200A	
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."

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PNP General Purpose Amplifier
(continued)

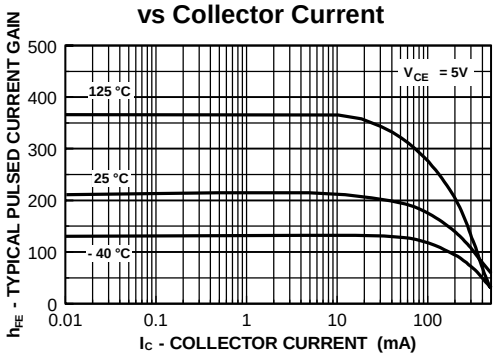
Electrical Characteristics
TA = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min	Max	Units
OFF CHARACTERISTICS						
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 10 µA, I_B = 0		60		V
BV_{CEO}	Collector-Emitter Breakdown Voltage*	I_C = 1.0 mA, I_E = 0		45		V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0		6.0		V
I_{CBO}	Collector Cutoff Current	V_{CB} = 50 V, I_E = 0			50	nA
I_{CES}	Collector Cutoff Current	V_{CE} = 40 V, I_E = 10			50	nA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 4.0 V, I_C = 0			50	nA
ON CHARACTERISTICS						
h_{FE}	DC Current Gain	I_C = 100 µA, V_{CE} = 1.0 V	**200**	80		
			200A	240		
		I_C = 10 mA, V_{CE} = 1.0 V	**200**	100	450	
			200A	300	600	
		I_C = 100 mA, V_{CE} = 1.0 V*	**200A**	100		
		I_C = 150 mA, V_{CE} = 5.0 V*	**200**	100	350	
			200A	100		
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA			0.2	V
		I_C = 200 mA, I_B = 20 mA*			0.4	V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA			0.85	V
		I_C = 200 mA, I_B = 20 mA*			1.0	V
SMALL SIGNAL CHARACTERISTICS						
f_T	Current Gain - Bandwidth Product	V_{CE} = 20 V, I_C = 20 mA		250		MHz
C_{obo}	Output Capacitance	V_{CB} = 10 V, f = 1.0 MHz			6.0	pF
NF	Noise Figure	I_C = 100 µA, V_{CE} = 5.0 V,	**200**		5.0	dB
		R_G = 2.0 kΩ, f = 1.0 kHz	**200A**		4.0	dB

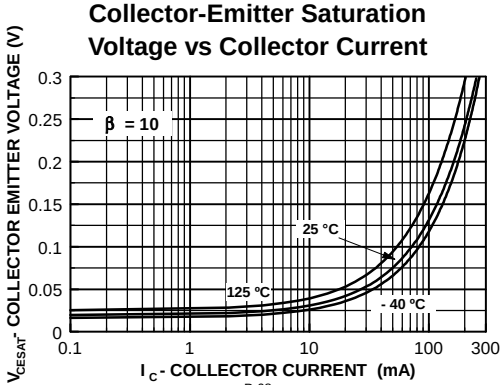
*Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%

Typical Characteristics

Typical Pulsed Current Gain vs Collector Current



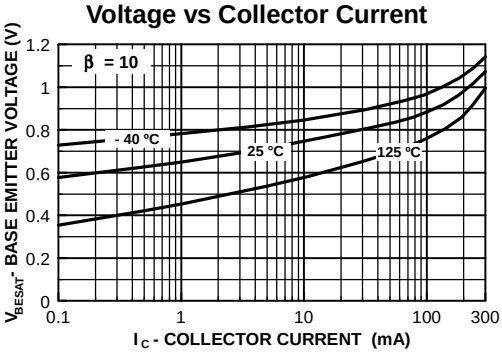
Collector-Emitter Saturation Voltage vs Collector Current



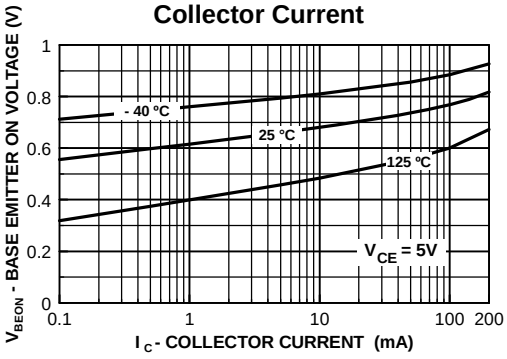
PNP General Purpose Amplifier
(continued)

Typical Characteristics (continued)

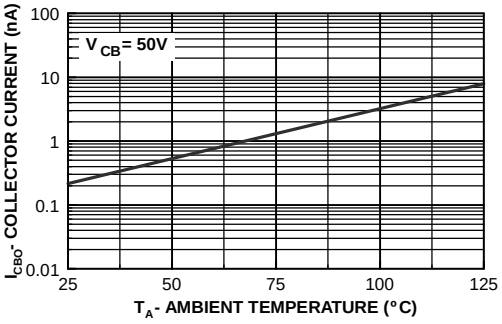
Base-Emitter Saturation Voltage vs Collector Current



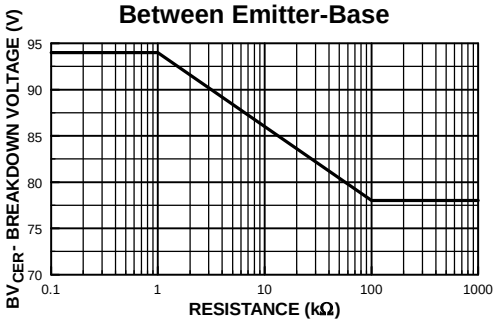
Base Emitter ON Voltage vs Collector Current



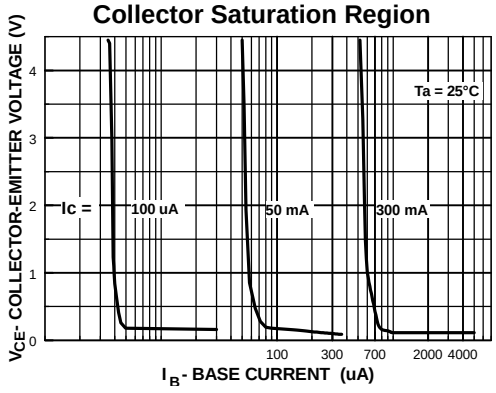
Collector-Cutoff Current vs. Ambient Temperature



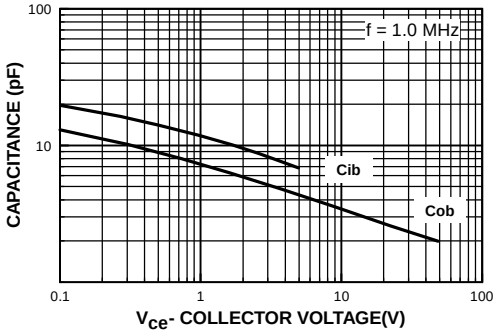
Collector-Emitter Breakdown Voltage with Resistance Between Emitter-Base



Collector Saturation Region



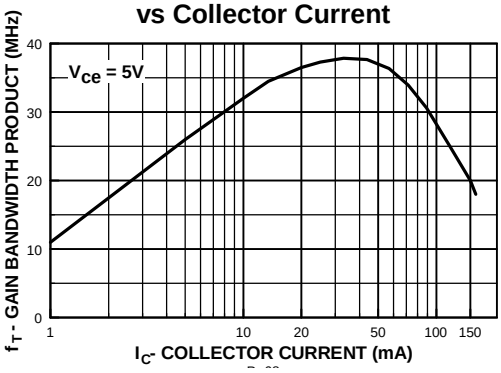
Input and Output Capacitance vs Reverse Voltage



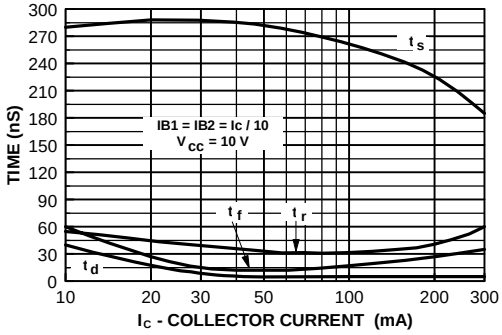
PNP General Purpose Amplifier
(continued)

Typical Characteristics (continued)

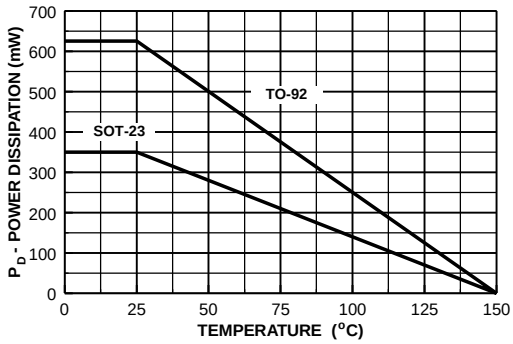
Gain Bandwidth Product vs Collector Current



Switching Times vs Collector Current



Power Dissipation vs Ambient Temperature



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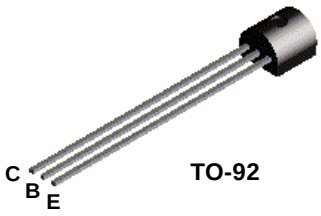
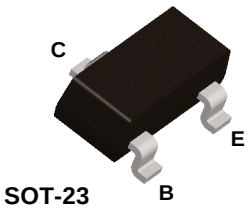
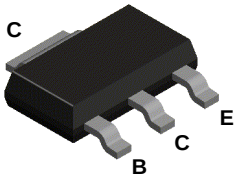
PN2222A MMBT2222A PZT2222A



TO-92

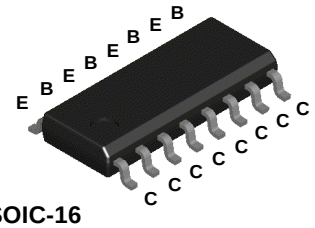


SOT-23
Mark: 1P

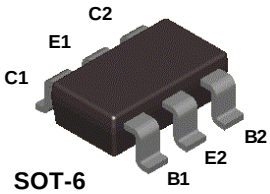


SOT-223

MMPQ2222 NMT2222



SOIC-16



SOT-6
Mark: .1B

NPN General Purpose Amplifier

This device is for use as a medium power amplifier and switch requiring collector currents up to 500 mA. Sourced from Process 19.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	40	V
V_{CBO}	Collector-Base Voltage	75	V
V_{EBO}	Emitter-Base Voltage	6.0	V
I_C	Collector Current - Continuous	1.0	A
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.

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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 = 10 mA, I_B = 0	40		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	75		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	6.0		V
I_{CEX}	Collector Cutoff Current	V_{CE} = 60 V, $V_{EB(OFF)}$ = 3.0 V		10	nA
I_{CBO}	Collector Cutoff Current	V_{CB} = 60 V, I_E = 0 V_{CB} = 60 V, I_E = 0, T_A = 150°C		0.01 10	µA µA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 3.0 V, I_C = 0		10	nA
I_{BL}	Base Cutoff Current	V_{CE} = 60 V, $V_{EB(OFF)}$ = 3.0 V		20	nA
ON CHARACTERISTICS					
h_{FE}	DC Current Gain	I_C = 0.1 mA, V_{CE} = 10 V I_C = 1.0 mA, V_{CE} = 10 V I_C = 10 mA, V_{CE} = 10 V I_C = 10 mA, V_{CE} = 10 V, T_A = -55°C I_C = 150 mA, V_{CE} = 10 V* I_C = 150 mA, V_{CE} = 1.0 V* I_C = 500 mA, V_{CE} = 10 V*	35 50 75 35 100 50 40	 300 	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage*	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA		0.3 1.0	V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage*	I_C = 150 mA, I_B = 1.0 mA I_C = 500 mA, I_B = 5.0 mA	0.6	1.2 2.0	V V
SMALL SIGNAL CHARACTERISTICS (except MMPQ2222 and NMT2222)					
f_T	Current Gain - Bandwidth Product	I_C = 20 mA, V_{CE} = 20 V, f = 100 MHz	300		MHz
C_{obo}	Output Capacitance	V_{CB} = 10 V, I_E = 0, f = 100 kHz		8.0	pF
C_{ibo}	Input Capacitance	V_{EB} = 0.5 V, I_C = 0, f = 100 kHz		25	pF
$rb'C_C$	Collector Base Time Constant	I_C = 20 mA, V_{CB} = 20 V, f = 31.8 MHz		150	pS
NF	Noise Figure	I_C = 100 µA, V_{CE} = 10 V, R_S = 1.0 kΩ, f = 1.0 kHz		4.0	dB
$Re(h_{ie})$	Real Part of Common-Emitter High Frequency Input Impedance	I_C = 20 mA, V_{CE} = 20 V, f = 300 MHz		60	Ω
SWITCHING CHARACTERISTICS (except MMPQ2222 and NMT2222)					
t_d	Delay Time	V_{CC} = 30 V, $V_{BE(OFF)}$ = 0.5 V,		10	ns
t_r	Rise Time	I_C = 150 mA, I_{B1} = 15 mA		25	ns
t_s	Storage Time	V_{CC} = 30 V, I_C = 150 mA,		225	ns
t_f	Fall Time	I_{B1} = I_{B2} = 15 mA		60	ns

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

Spice Model

NPN (Is=14.34f Xti=3 Eg=1.11 Vaf=74.03 Bf=255.9 Ne=1.307 Ise=14.34f Ikf=.2847 Xtb=1.5 Br=6.092 Nc=2 Isc=0 Ikr=0 Rc=1 Cjc=7.306p Mjc=.3416 Vjc=.75 Fc=.5 Cje=22.01p Mje=.377 Vje=.75 Tr=46.91n Tf=411.1p Itf=.6 Vtf=1.7 Xtf=3 Rb=10)

NPN General Purpose Amplifier

(continued)

Thermal Characteristics

TA = 25°C unless otherwise noted

Symbol	Characteristic	Max		Units
		PN2222A	*PZT2222A	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	1,000 8.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	125	°C/W

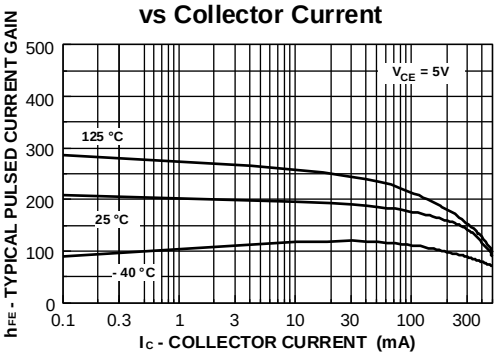
Symbol	Characteristic	Max		Units
		**MMBT2222A	MMPQ2222	
P_D	Total Device Dissipation Derate above 25°C	350 2.8	1,000 8.0	mW mW/°C
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient Effective 4 Die Each Die	357	 125 240	°C/W °C/W °C/W

*Device mounted on FR-4 PCB 36 mm X 18 mm X 1.5 mm; mounting pad for the collector lead min. 6 cm^2.

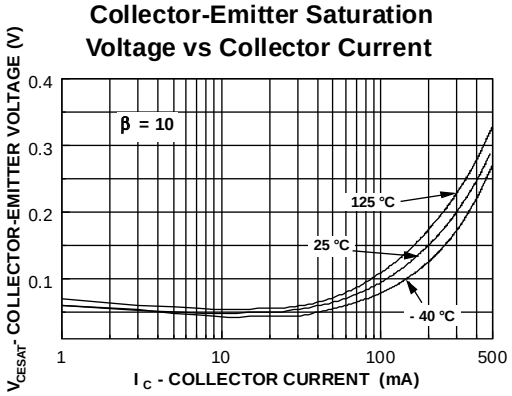
**Device mounted on FR-4 PCB 1.6" X 1.6" X 0.06."

Typical Characteristics

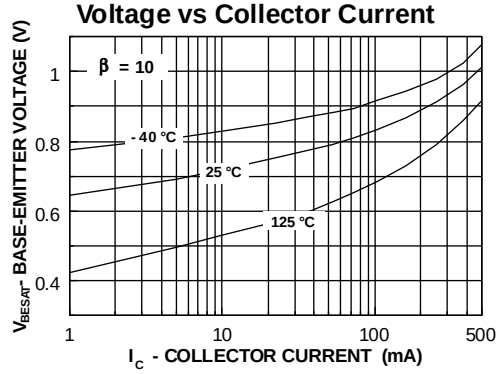
Typical Pulsed Current Gain vs Collector Current



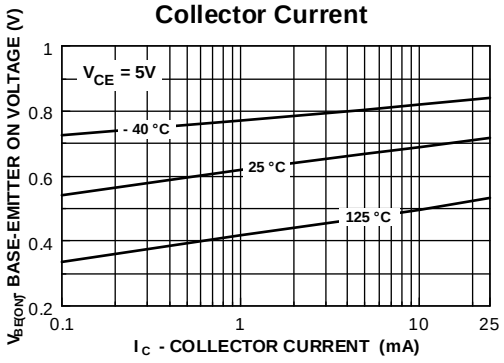
Collector-Emitter Saturation Voltage vs Collector Current



Base-Emitter Saturation Voltage vs Collector Current

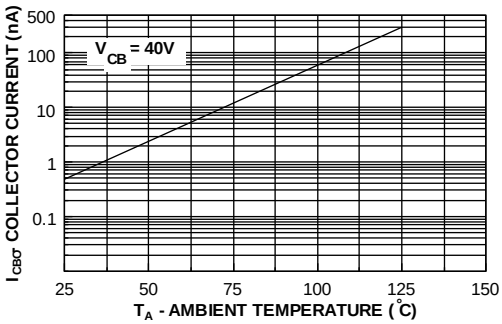


Base-Emitter ON Voltage vs Collector Current

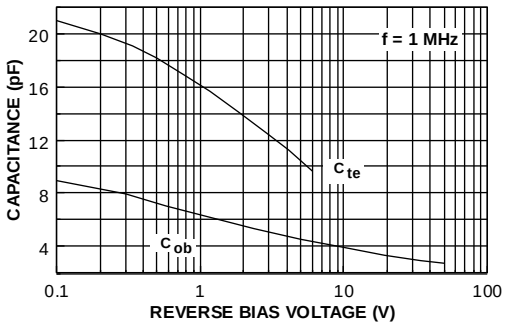


Typical Characteristics (continued)

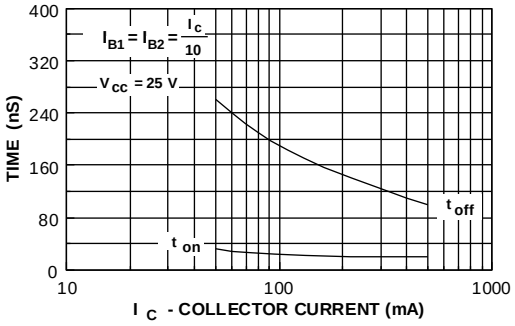
Collector-Cutoff Current vs Ambient Temperature



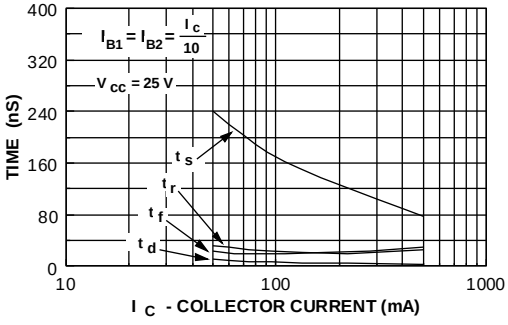
Emitter Transition and Output Capacitance vs Reverse Bias Voltage



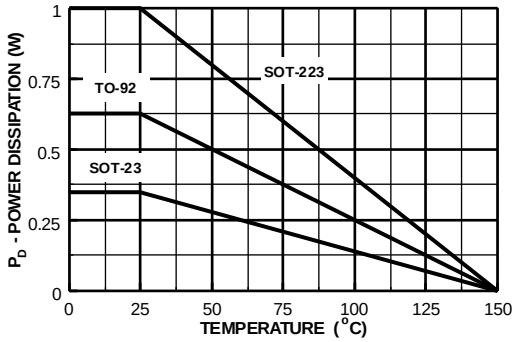
Turn On and Turn Off Times vs Collector Current



Switching Times vs Collector Current



Power Dissipation vs Ambient Temperature



NPN General Purpose Amplifier
(continued)

Test Circuits

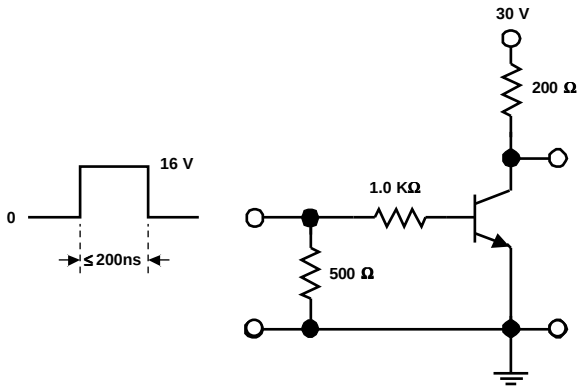


FIGURE 1: Saturated Turn-On Switching Time

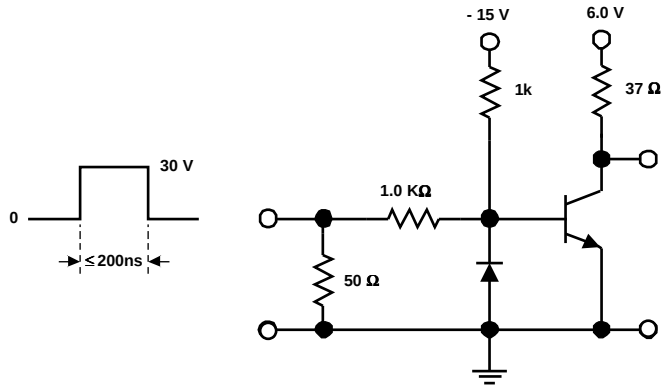
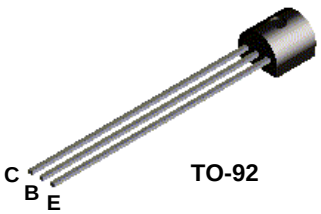


FIGURE 2: Saturated Turn-Off Switching Time

FAIRCHILD SEMICONDUCTOR™

Discrete POWER & Signal Technologies

PN2369A MMBT2369A MMPQ2369



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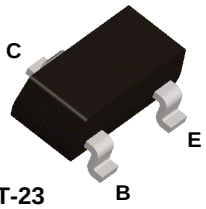
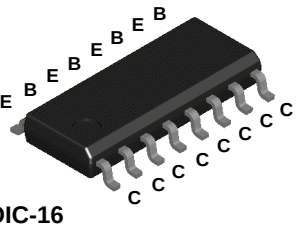


SOT-23
Mark: 1S



SOIC-16

NPN Switching Transistor

This device is designed for high speed saturation switching at collector currents of 10 mA to 100 mA. Sourced from Process 21.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	15	V
V_{CBO}	Collector-Base Voltage	40	V
V_{EBO}	Emitter-Base Voltage	4.5	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
		PN2369A	MMBT2369A*	MMPQ2369	
P_D	Total Device Dissipation Derate above 25°C	350 2.8	225 1.8	1,000 8.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	125			°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient Effective 4 Die Each Die	357	556	 125 240	°C/W °C/W °C/W

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

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NPN Switching Transistor
(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 = 10 mA, I_B = 0	15		V
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	I_C = 10 µA, V_{BE} = 0	40		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	40		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	4.5		V
I_{CBO}	Collector Cutoff Current	V_{CB} = 20 V, I_E = 0 V_{CB} = 20 V, I_E = 0, T_A = 125°C		0.4 30	µA µA
ON CHARACTERISTICS					
h_{FE}	DC Current Gain*	I_C = 10 mA, V_{CE} = 1.0 V I_C = 10 mA,V_{CE} = 0.35 V,T_A = -55°C I_C = 100 mA, V_{CE} = 2.0 V	40 20 20	120	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage*	I_C = 10 mA, I_B = 1.0 mA I_C = 10 mA, I_B = 1.0 mA,T_A = 125°C I_C = 30 mA, I_B = 3.0 mA I_C = 100 mA, I_B = 10 mA		0.2 0.3 0.25 0.5	V V V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA I_C = 10 mA, I_B = 1.0 mA,T_A = -55°C I_C = 10 mA, I_B = 1.0 mA,T_A = 125°C I_C = 30 mA, I_B = 3.0 mA I_C = 100 mA, I_B = 10 mA	0.7 0.59	0.85 1.02 1.15 1.6	V V V V V
SMALL SIGNAL CHARACTERISTICS					
C_{obo}	Output Capacitance	V_{CB} = 5.0 V, I_E = 0, f = 1.0 MHz		4.0	pF
C_{ibo}	Input Capacitance	V_{EB} = 0.5 V, I_C = 0, f = 1.0 MHz		5.0	pF
h_{fe}	Small-Signal Current Gain	I_C = 10 mA, V_{CE} = 10 V, R_G = 2.0 kΩ, f = 100 MHz	5.0		
SWITCHING CHARACTERISTICS (except MMPQ2369)					
t_s	Storage Time	I_{B1} = I_{B2} = I_C = 10 mA		13	ns
t_{on}	Turn-On Time	V_{CC} = 3.0 V, I_C = 10 mA, I_{B1} = 3.0 mA		12	ns
t_{off}	Turn-Off Time	V_{CC} = 3.0 V, I_C = 10 mA, I_{B1} = 3.0 mA, I_{B2} = 1.5 mA		18	ns

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

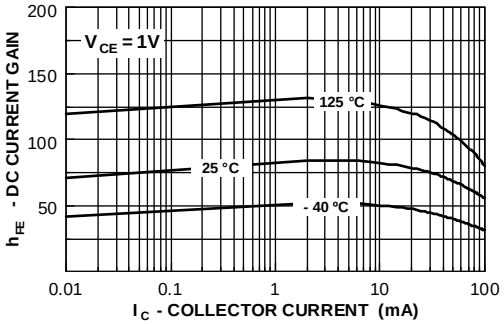
Spice Model

NPN (Is=44.14f Xti=3 Eg=1.11 Vaf=100 Bf=78.32 Ne=1.389 Ise=91.95f Ikf=.3498 Xtb=1.5 Br=12.69m Nc=2 Isc=0 Ikr=0 Rc=.6 Cjc=2.83p Mjc=86.19m Vjc=.75 Fc=.5 Cje=4.5p Mje=.2418 Vje=.75 Tr=1.073u Tf=227.6p Itf=.3 Vtf=4 Xtf=4 Rb=10)

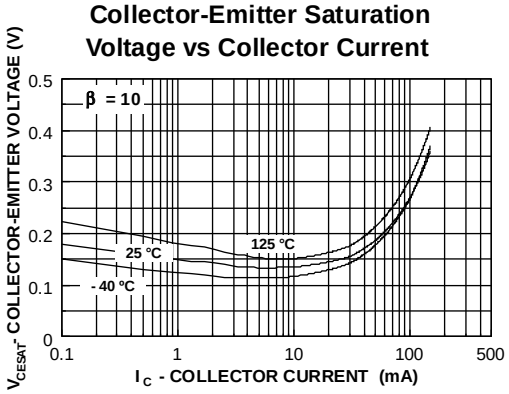
NPN Switching Transistor
(continued)

DC Typical Characteristics

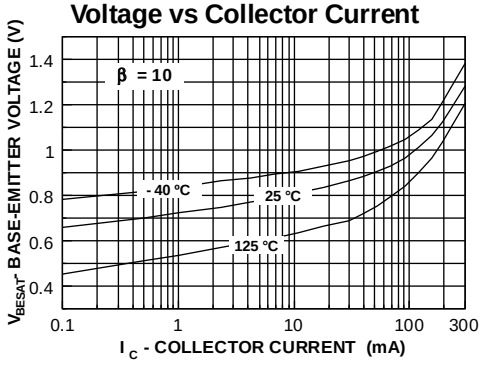
DC Current Gain vs Collector Current



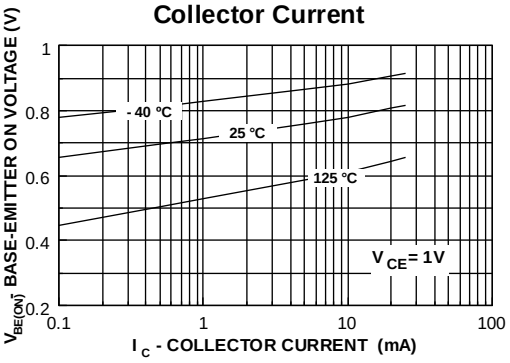
Collector-Emitter Saturation Voltage vs Collector Current



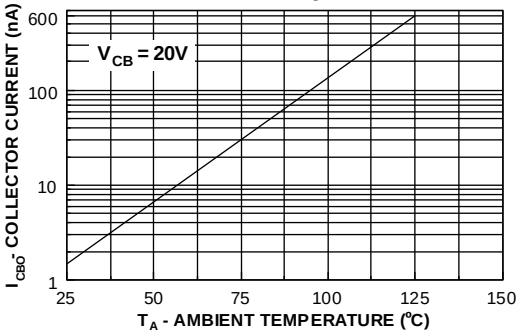
Base-Emitter Saturation Voltage vs Collector Current



Base-Emitter ON Voltage vs Collector Current

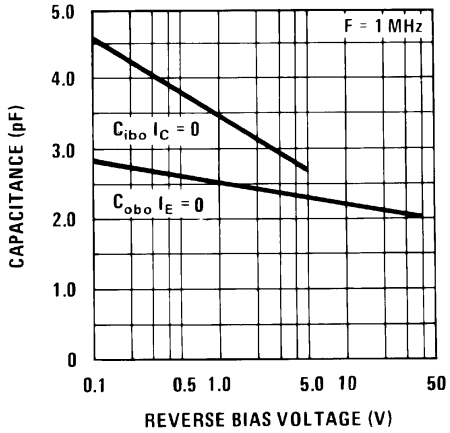


Collector-Cutoff Current vs Ambient Temperature

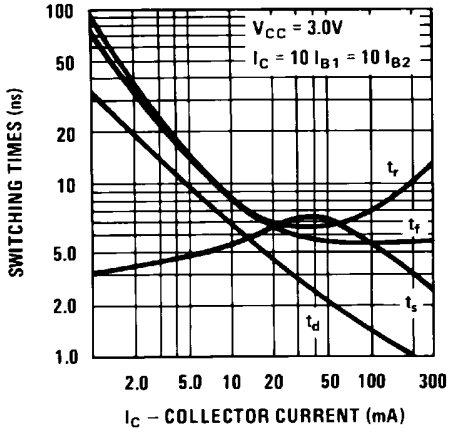


AC Typical Characteristics

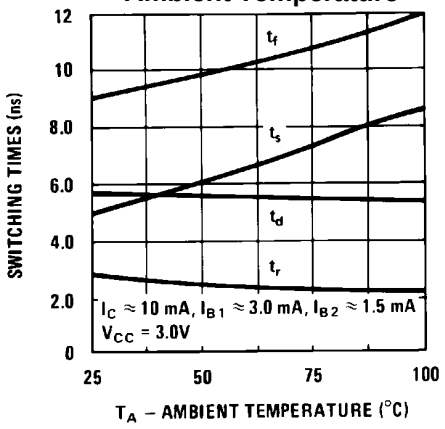
Output Capacitances vs. Reverse Bias Voltage



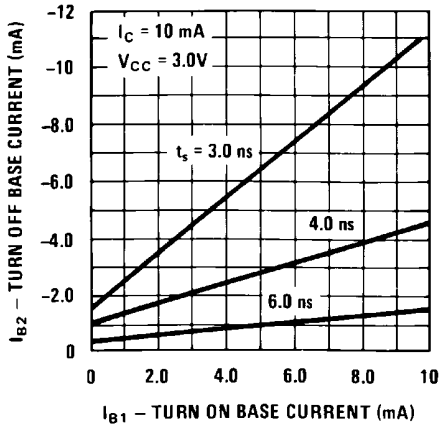
Switching Times vs. Collector Current



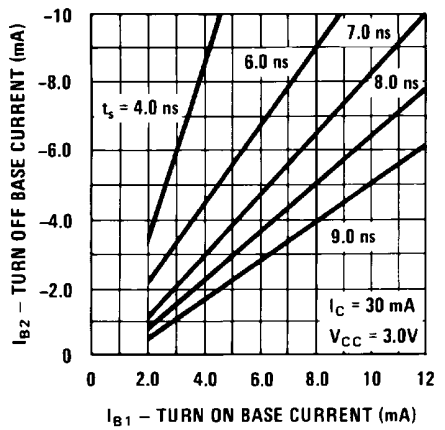
Switching Times vs. Ambient Temperature



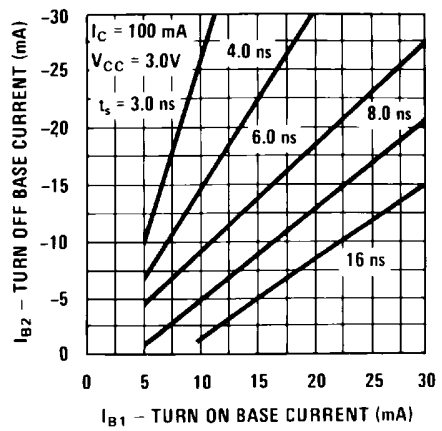
Storage Time vs. Turn On and Turn Off Base Currents



Storage Time vs. Turn On and Turn Off Base Currents

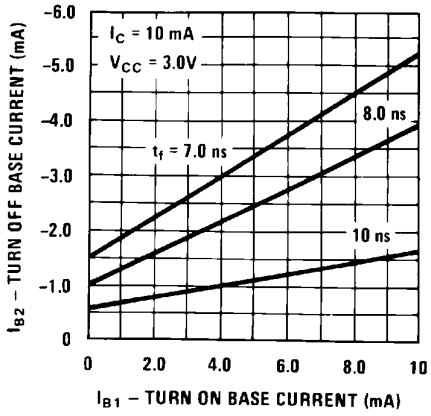


Storage Time vs. Turn On and Turn Off Base Currents

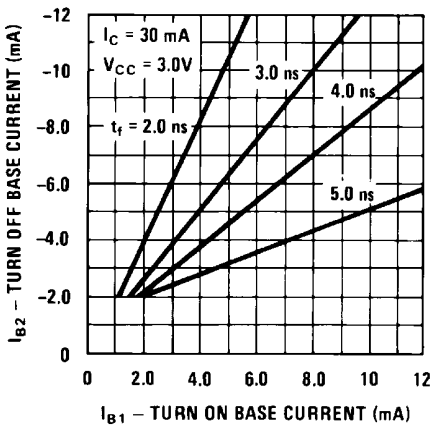


AC Typical Characteristics (continued)

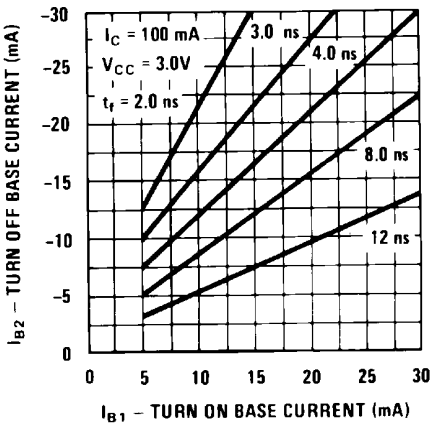
Fall Time vs. Turn On and Turn Off Base Currents



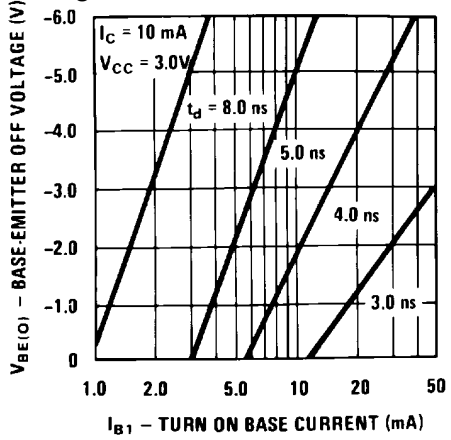
Fall Time vs. Turn On and Turn Off Base Currents



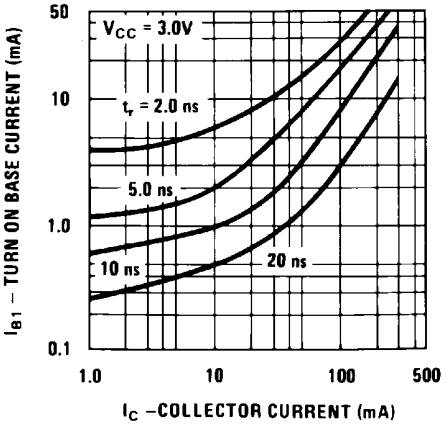
Fall Time vs. Turn On and Turn Off Base Currents



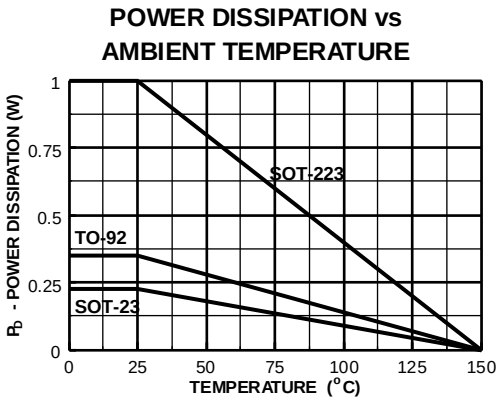
Delay Time vs. Base-Emitter OFF Voltage and Turn On Base Current



Rise Time vs. Turn On Base Current and Collector Current



AC Typical Characteristics (continued)



Test Circuits

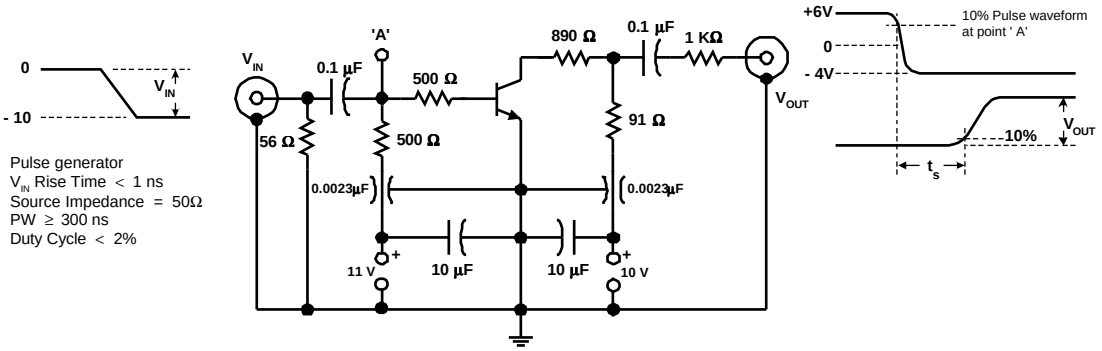


FIGURE 1: Charge Storage Time Measurement Circuit

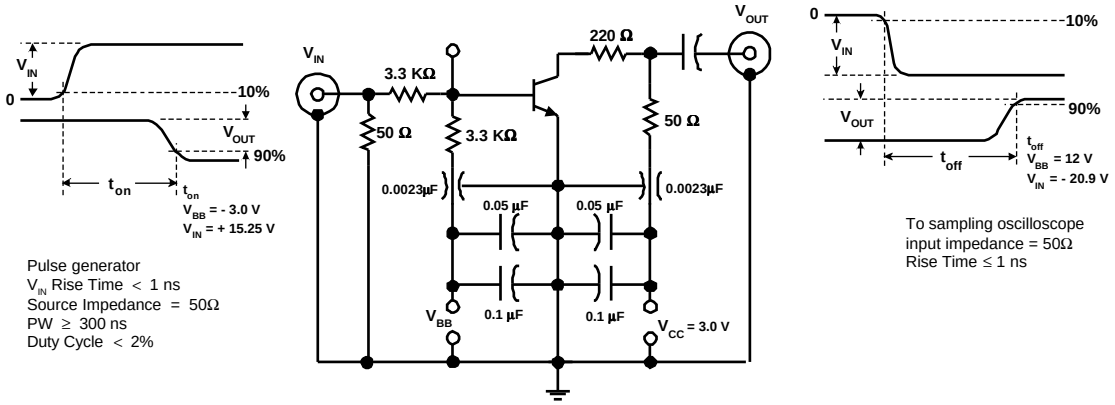


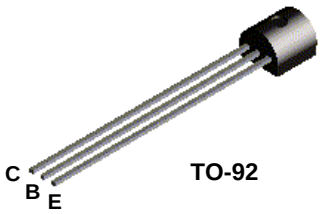
FIGURE 2: t_{ON}, t_{OFF} Measurement Circuit

FAIRCHILD SEMICONDUCTOR™

Discrete POWER & Signal Technologies

PN2484

MMBT2484



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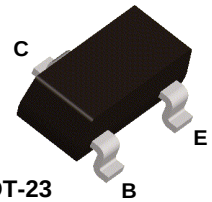

SOT-23
Mark: 1U

NPN General Purpose Amplifier

This device is designed for low noise, high gain, general purpose amplifier applications at collector currents from 1µ to 50 mA. Sourced from Process 07. See 2N5088 for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	60	V
V_{CBO}	Collector-Base Voltage	60	V
V_{EBO}	Emitter-Base Voltage	5.0	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
		PN2484	*MMBT2484	
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."

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NPN General Purpose Amplifier
(continued)

Electrical Characteristics
TA = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHARACTERISTICS					
BV_{CBO}	Collector-Base Breakdown Voltage	I_C = 10 µA, I_B = 0	60		V
BV_{CEO}	Collector-Emitter Breakdown Voltage*	I_C = 10 mA, I_E = 0	60		V
BV_{EBO}	Emitter-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	5.0		V
I_{CBO}	Collector Cutoff Current	V_{CB} = 45 V, I_E = 0 V_{CB} = 45 V, I_E = 0, T_A = 150°C		10 10	nA µA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 5.0 V, I_C = 0		10	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*	250	 800	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 1.0 mA, I_B = 0.1 mA		0.35	V
$V_{BE(on)}$	Base-Emitter On Voltage	I_C = 1.0 mA, V_{CE} = 5.0 V		0.95	V
SMALL SIGNAL CHARACTERISTICS					
C_{obo}	Output Capacitance	V_{CB} =5.0 V, f = 140 kHz		6.0	pF
C_{ibo}	Input Capacitance	V_{EB} = 0.5 V, f = 140 kHz		6.0	pF
NF	Noise Figure	I_C = 10 µA, V_{CE} = 5.0 V, R_S = 10k,f = 1.0 kHz,BW =200 Hz		3.0	dB

*Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 3.0%

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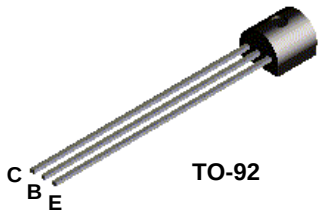
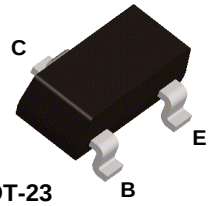
PN2907 MMBT2907



TO-92



SOT-23
Mark: 2B

PNP General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 500 mA. Sourced from Process 63. See PN2907A for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	40	V
V_{CBO}	Collector-Base Voltage	60	V
V_{EBO}	Emitter-Base Voltage	5.0	V
I_C	Collector Current - Continuous	800	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
		PN2907	*MMBT2907	
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."

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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 = 10 mA, I_B = 0	40		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	60		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	5.0		V
I_{CEX}	Collector Cutoff Current	V_{CE} = 30 V		50	nA
I_B	Base Cutoff Current	V_{BE} = 0.5 V		50	nA
I_{CBO}	Collector Cutoff Current	V_{CB} = 50 V, I_E = 0 V_{CB} = 50 V, I_E = 0, T_A = 150 °C		20 20	nA µA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 10 V, I_C = 0.1 mA V_{CE} = 10 V, I_C = 1.0 mA V_{CE} = 10 V, I_C = 10 mA V_{CE} = 10 V, I_C = 150 mA V_{CE} = 10 V, I_C = 500 mA	35 50 75 100 30	 300 	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA		0.4 1.6	V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA		1.3 2.6	V V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 10 V, f = 1.0 MHz		8.0	pF
C_{ib}	Input Capacitance	V_{EB} = 2.0 V, f = 1.0 MHz		30	pF
h_{fe}	Small-Signal Current Gain	I_C = 50 mA, V_{CE} = 20 V, f = 100 MHz	2.0		
SWITCHING CHARACTERISTICS					
t_{on}	Turn-on Time	V_{CC} = 30 V, I_C = 150 mA,		45	ns
t_d	Delay Time	I_{B1} = 15 mA , PW = 200 ns		10	ns
t_r	Rise Time			40	ns
t_{off}	Turn-off Time	V_{CC} = 6.0 V, I_C = 150 mA		100	ns
t_s	Storage Time	I_{B1} = I_{B2} = 15 mA		80	ns
t_f	Fall Time			30	ns

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

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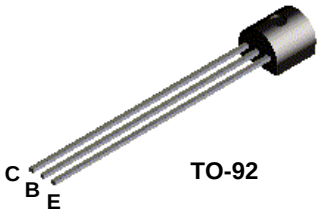
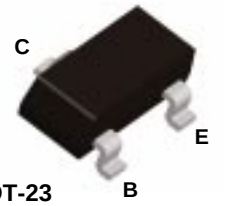
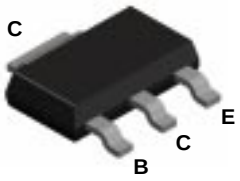
PN2907A MMBT2907A PZT2907A



TO-92

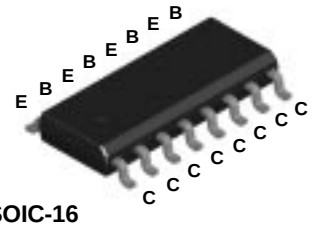


SOT-23
Mark: 2F

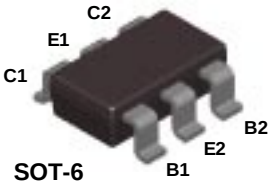


SOT-223

MMPQ2907 NMT2907



SOIC-16



SOT-6
Mark: .2B

PNP General Purpose Amplifier

This device is designed for use as a general purpose amplifier and switch requiring collector currents to 500 mA. Sourced from Process 63.

Absolute Maximum Ratings* TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	60	V
V_{CBO}	Collector-Base Voltage	60	V
V_{EBO}	Emitter-Base Voltage	5.0	V
I_C	Collector Current - Continuous	800	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.

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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 = 10 mA, I_B = 0	60		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	60		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	5.0		V
I_B	Base Cutoff Current	V_{CB} = 30 V, V_{EB} = 0.5 V		50	nA
I_{CEX}	Collector Cutoff Current	V_{CE} = 30 V, V_{BE} = 0.5 V		50	nA
I_{CBO}	Collector Cutoff Current	V_{CB} = 50 V, I_E = 0 V_{CB} = 50 V, I_E = 0, T_A = 150°C		0.02 20	µA µA
ON CHARACTERISTICS					
h_{FE}	DC Current Gain	I_C = 0.1 mA, V_{CE} = 10 V I_C = 1.0 mA, V_{CE} = 10 V I_C = 10 mA, V_{CE} = 10 V I_C = 150 mA, V_{CE} = 10 V* I_C = 500 mA, V_{CE} = 10 V*	75 100 100 100 50	 300 	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage*	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA		0.4 1.6	V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 150 mA, I_B = 15 mA* I_C = 500 mA, I_B = 50 mA		1.3 2.6	V V
SMALL SIGNAL CHARACTERISTICS (except MMPQ2907 and NMT2907)					
f_T	Current Gain - Bandwidth Product	I_C = 50 mA, V_{CE} = 20 V, f = 100 MHz	200		MHz
C_{obo}	Output Capacitance	V_{CB} = 10 V, I_E = 0, f = 100 kHz		8.0	pF
C_{ibo}	Input Capacitance	V_{EB} = 2.0 V, I_C = 0, f = 100 kHz		30	pF
SWITCHING CHARACTERISTICS (except MMPQ2907 and NMT2907)					
t_{on}	Turn-on Time	V_{CC} = 30 V, I_C = 150 mA, I_{B1} = 15 mA		45	ns
t_d	Delay Time			10	ns
t_r	Rise Time			40	ns
t_{off}	Turn-off Time	V_{CC} = 6.0 V, I_C = 150 mA, I_{B1} = I_{B2} = 15 mA		100	ns
t_s	Storage Time			80	ns
t_f	Fall Time			30	ns

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

Spice Model

PNP (Is=650.6E-18 Xti=3 Eg=1.11 Vaf=115.7 Bf=231.7 Ne=1.829 Ise=54.81f Ikf=1.079 Xtb=1.5 Br=3.563 Nc=2 Isc=0 Ikr=0 Rc=.715 Cjc=14.76p Mjc=.5383 Vjc=.75 Fc=.5 Cje=19.82p Mje=.3357 Vje=.75 Tr=111.3n Tf=603.7p Itf=.65 Vtf=5 Xtf=1.7 Rb=10)

PNP General Purpose Amplifier
(continued)

Thermal Characteristics
TA = 25°C unless otherwise noted

Symbol	Characteristic	Max		Units
		PN2907A	*PZT2907A	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	1,000 8.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	125	°C/W

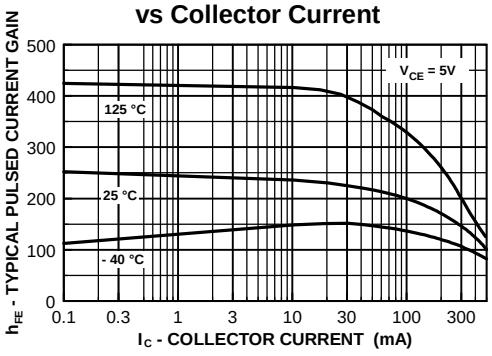
Symbol	Characteristic	Max		Units
		**MMBT2907A	MMPQ2907	
P_D	Total Device Dissipation Derate above 25°C	350 2.8	1,000 8.0	mW mW/°C
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient Effective 4 Die Each Die	357	 125 240	°C/W °C/W °C/W

*Device mounted on FR-4 PCB 36 mm X 18 mm X 1.5 mm; mounting pad for the collector lead min. 6 cm^2.

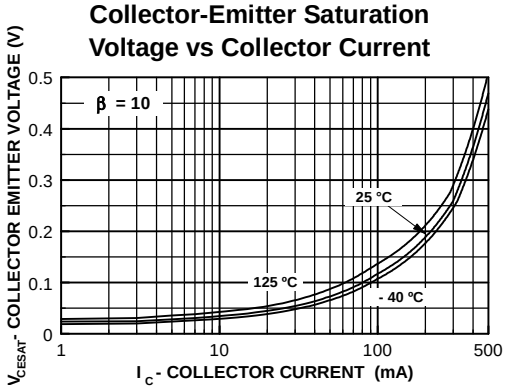
**Device mounted on FR-4 PCB 1.6" X 1.6" X 0.06."

Typical Characteristics

Typical Pulsed Current Gain vs Collector Current



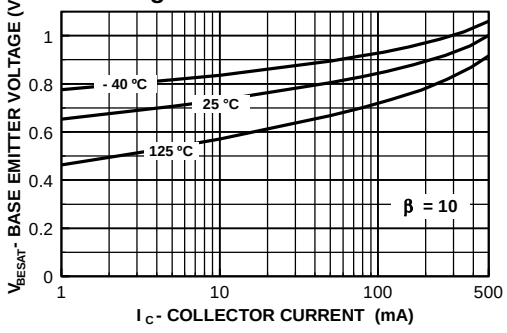
Collector-Emitter Saturation Voltage vs Collector Current



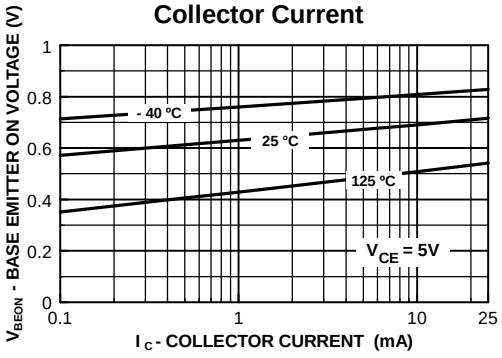
PNP General Purpose Amplifier
(continued)

Typical Characteristics (continued)

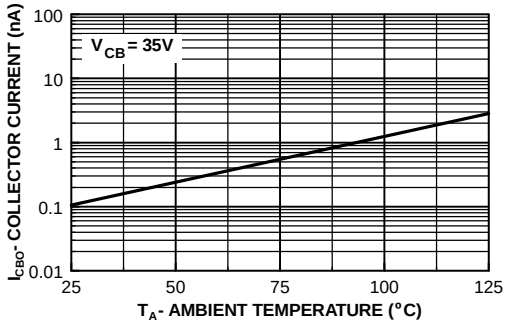
Base-Emitter Saturation Voltage vs Collector Current



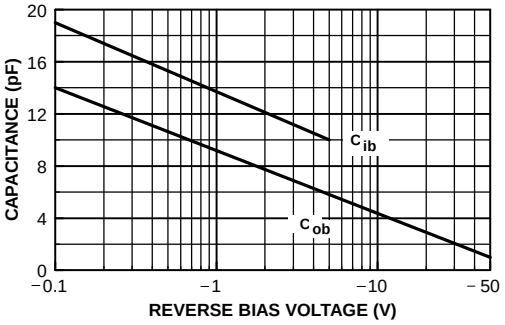
Base Emitter ON Voltage vs Collector Current



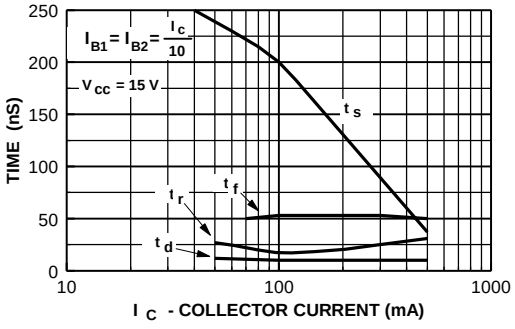
Collector-Cutoff Current vs. Ambient Temperature



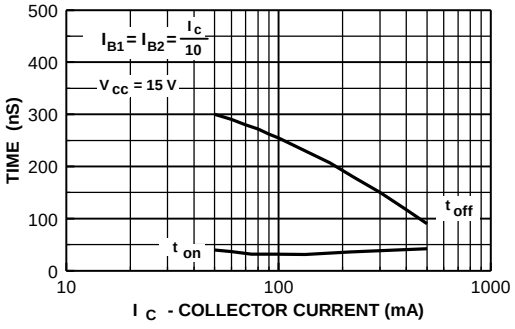
Input and Output Capacitance vs Reverse Bias Voltage



Switching Times vs Collector Current

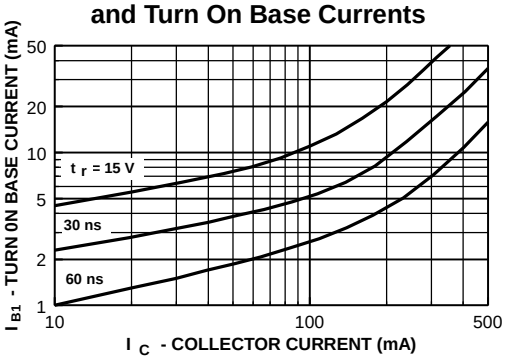


Turn On and Turn Off Times vs Collector Current

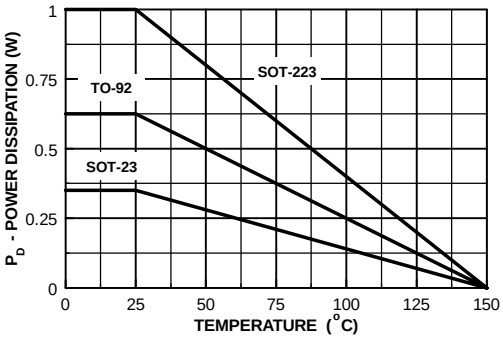


Typical Characteristics (continued)

Rise Time vs Collector and Turn On Base Currents



Power Dissipation vs Ambient Temperature



Test Circuits

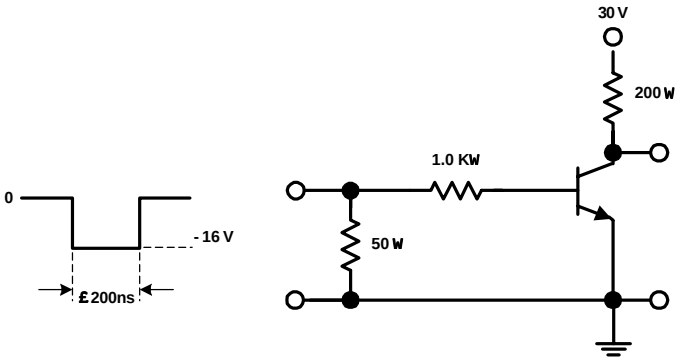


FIGURE 1: Saturated Turn-On Switching Time Test Circuit

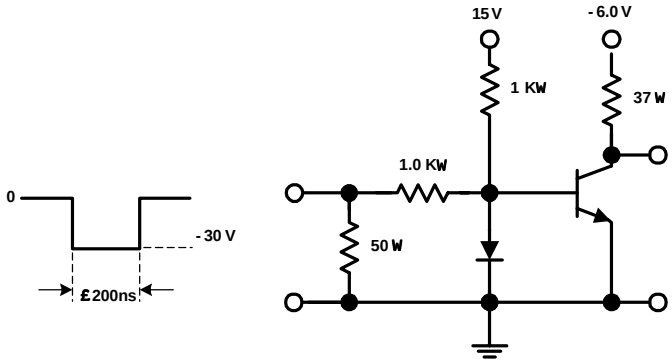


FIGURE 2: Saturated Turn-Off Switching Time Test Circuit

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PRODUCT STATUS DEFINITIONS

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Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.

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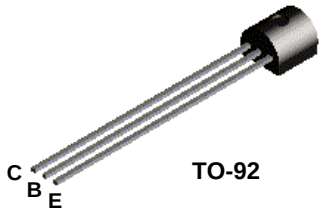
PN3563



TO-92

NPN RF Amplifier

This device is designed for use as RF amplifiers, oscillators and multipliers with collector currents in the 1.0 mA to 30 mA range. Sourced from Process 43. See PN918 for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	15	V
V_{CBO}	Collector-Base Voltage	30	V
V_{EBO}	Emitter-Base Voltage	2.0	V
I_C	Collector Current - Continuous	50	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
		PN3563	
P_D	Total Device Dissipation Derate above 25°C	350 2.8	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	125	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	357	°C/W

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NPN RF Amplifier
(continued)

Electrical Characteristics
TA= 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHARACTERISTICS					
$V_{CEO(SUS)}$	Collector-Emitter Sustaining Voltage*	I_C = 3.0 mA, I_B = 0	15		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 100 µA, I_E = 0	30		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	2.0		V
I_{CBO}	Collector Cutoff Current	V_{CB} = 15 V, I_E = 0 V_{CB} = 15 V, T_A = 150°C		0.05 5.0	µA nA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	I_C = 8.0 mA, V_{CE} = 10 V	20	200	
SMALL SIGNAL CHARACTERISTICS					
f_T	Current Gain - Bandwidth Product	I_C = 8.0 mA, V_{CE} = 10 V, f = 100 MHz	600	1500	MHz
C_{obo}	Output Capacitance	V_{CB} = 10 V, I_E = 0, f = 1.0 MHz V_{CB} = 0, I_E = 0, f = 1.0 MHz		1.7 3.0	pF pF
C_{ibo}	Input Capacitance	V_{BE} = 0.5 V, I_C = 0, f = 140 MHz		2.0	pF
h_{fe}	Small-Signal Current Gain	I_C = 8.0 mA, V_{CE} = 10 V, f = 1.0 kHz	20	250	
rb'C_C	Collector Base Time Constant	I_C = 8.0 mA, V_{CE} = 10 V, f = 79.8 MHz	8.0	25	pS
FUNCTIONAL TEST					
G_{pe}	Amplifier Power Gain	I_C = 8.0 mA, V_{CB} = 10 V, f = 200 MHz	14	26	dB

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

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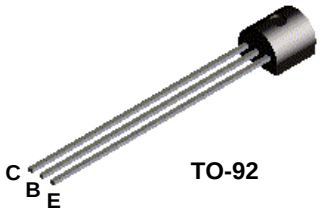
PN3565



TO-92

NPN General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 300 mA. Sourced from Process 10. See PN100 for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	25	V
V_{CBO}	Collector-Base Voltage	30	V
V_{EBO}	Emitter-Base Voltage	6.0	V
I_C	Collector Current - Continuous	500	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
		PN3565	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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NPN General Purpose Amplifier
(continued)

Electrical Characteristics
TA = 25°C unless otherwise noted

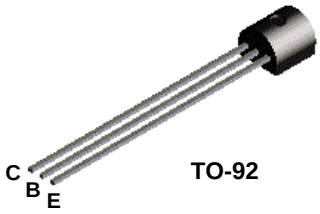
Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHARACTERISTICS					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage*	I_C = 2.0 mA, I_B = 0	25		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 100 µA, I_E = 0	30		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	6.0		V
I_{CBO}	Collector Cutoff Current	V_{CB} = 25 V, I_E = 0		50	nA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 10 V, I_C = 1.0 mA	150	600	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 1.0 mA, I_B = 0.1 mA		0.35	V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 5.0 V		4.0	pF
h_{ie}	Input Impedance	I_C = 1.0 mA, V_{CE} = 5.0 V, f = 1.0 kHz	2.0	20	kΩ
h_{oe}	Output Admittance	I_C = 1.0 mA, V_{CE} = 5.0 V, f = 1.0 kHz	0.5	35	µmhos
h_{fe}	Small-Signal Current Gain	I_C = 1.0 mA, V_{CE} = 5.0 V, f = 20 MHz I_C = 1.0 mA, V_{CE} = 5.0 V, f = 1.0 kHz	2.0 120	12 750	

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

FAIRCHILD SEMICONDUCTOR™

Discrete POWER & Signal Technologies

PN3568



TO-92

NPN General Purpose Amplifier

This device is designed for general purpose, medium power amplifiers and switches requiring collector currents to 500 mA. Sourced from Process 12. SeeTN3019A for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	60	V
V_{CBO}	Collector-Base Voltage	80	V
V_{EBO}	Emitter-Base Voltage	5.0	V
I_C	Collector Current - Continuous	1.0	A
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
		PN3568	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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NPN General Purpose Amplifier
(continued)

Electrical Characteristics
TA = 25°C unless otherwise noted

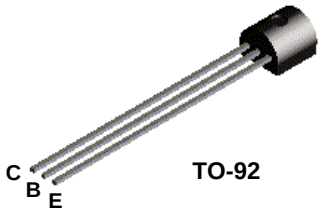
Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHARACTERISTICS					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage*	I_C = 30 mA, I_B = 0	60		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 100 µA, I_E = 0	80		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	5.0		V
I_{CBO}	Collector Cutoff Current	V_{CB} = 40 V, I_E = 0 V_{CB} = 40 V, I_E = 0, T_A = 75 °C		50 5.0	nA µA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 4.0 V, I_C = 0		25	nA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 1.0 V, I_C = 30 mA V_{CE} = 1.0 V, I_C = 150 mA	40 40	 120	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 150 mA, I_B = 15 mA		0.25	V
$V_{BE(on)}$	Base-Emitter On Voltage	V_{CE} = 1.0 V, I_C = 150 mA		1.1	V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 10 V, f = 1.0 MHz		20	pF
C_{ib}	Input Capacitance	V_{EB} = 0.5 V, f = 1.0 MHz		80	pF
h_{fe}	Small-Signal Current Gain	I_C = 50 mA, V_{CE} = 10 V, f = 20 MHz	3.0	30	

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

FAIRCHILD SEMICONDUCTOR TM

Discrete POWER & Signal Technologies

PN3638
PN3638A



TO-92

PNP General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 500 mA. Sourced from Process 63. See PN2907A for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	25	V
V_{CBO}	Collector-Base Voltage	25	V
V_{EBO}	Emitter-Base Voltage	4.9	V
I_C	Collector Current - Continuous	800	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
		PN3638/A	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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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 = 10 mA, I_B = 0	25		V
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage*	I_C = 100 µA, I_B = 0	25		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	25		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	4.0		V
I_{CES}	Collector-Cutoff Current	V_{CE} = 15 V, I_E = 0 V_{CE} = 15 V, I_E = 0, T_A = 65°C		35 2.0	nA µA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 1.0 V, I_C = 50 mA **PN3638** **PN3638A** V_{CE} = 2.0 V, I_C = 300 mA **PN3638** **PN3638A** V_{CE} = 10 V, I_C = 100 mA **PN3638** **PN3638A** V_{CE} = 10 V, I_C = 1.0 mA **PN3638A**	 30 100 30 20 20 80 100		
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 50 mA, I_B = 2.5 mA I_C = 300 mA, I_B = 30 mA		0.25 1.0	V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 50 mA, I_B = 2.5 mA I_C = 300 mA, I_B = 30 mA	 0.8	1.1 2.0	V V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 10 V, f = 1.0 MHz **PN3638** **PN3638A**		 20 10	 pF pF
C_{ib}	Input Capacitance	V_{BE} = 0.5 V, f = 1.0 MHz **PN3638** **PN3638A**		 65 25	 pF pF
h_{fe}	Small-Signal Current Gain	I_C = 50 mA, V_{CE} = 3.0 V, f = 100 MHz **PN3638** **PN3638A** I_C = 10 mA, V_{CE} = 10 V, f = 1.0 kHz **PN3638** **PN3638A**	 1.0 1.5 25 100		
h_{ie}	Input Impedance	I_C = 10 mA, V_{CE} = 10 V,		2.0	kΩ
h_{oe}	Output Admittance	f = 1.0 kHz		1.2	µmhos
h_{re}	Voltage Feedback Ratio	**PN3638** **PN3638A**		26 15	$x10^{-4}$ $x10^{-4}$
SWITCHING CHARACTERISTICS					
t_{on}	Turn-on Time	V_{CC} = 10 V, I_C = 300 mA,	75		ns
t_d	Delay Time	I_{B1} = 30 mA	20		ns
t_r	Rise Time		70		ns
t_{off}	Turn-off Time	V_{CC} = 10 V, I_C = 300 mA	170		ns
t_s	Storage Time	I_{B1} = I_{B2} = 30 mA	140		ns
t_f	Fall Time		70		ns

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

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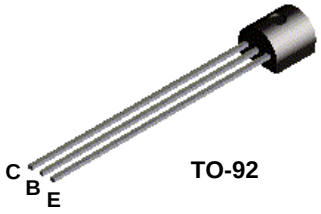
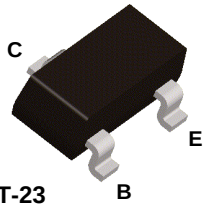
Discrete POWER & Signal Technologies

PN3640

MMBT3640



TO-92



SOT-23
Mark: 2J

PNP Switching Transistor

This device is designed for very high speed saturate switching at collector currents to 100 mA. Sourced from Process 65. See PN4258 for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	12	V
V_{CBO}	Collector-Base Voltage	12	V
V_{EBO}	Emitter-Base Voltage	4.0	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
		PN3640	*MMBT3640	
P_D	Total Device Dissipation Derate above 25°C	350 2.8	225 1.8	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	125		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	357	556	°C/W

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

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PNP Switching Transistor
(continued)

Electrical Characteristics
TA = 25°C unless otherwise noted

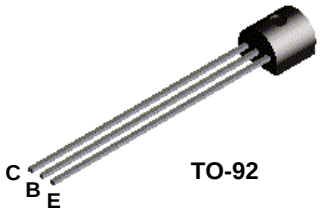
Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHARACTERISTICS					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage*	I_C = 10 mA, I_B = 0	12		V
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	I_C = 100 µA, V_{BE} = 0	12		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 100 µA, I_E = 0	12		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 100 µA, I_C = 0	4.0		V
I_{CES}	Collector Cutoff Current	V_{CE} = 6.0 V, V_{BE} = 0 V_{CE} = 6.0 V, V_{BE} = 0, T_A = 65°C		0.01 1.0	µA µA
I_B	Base Current	V_{CE} = 6.0 V, V_{BE} = 0		10	nA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	I_C = 10 mA, V_{CE} = 0.3 V I_C = 50 mA, V_{CE} = 1.0 V	30 20	120	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 0.5 mA I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA I_C= 10 mA, I_B= 1.0 mA,T_A =65°C		0.3 0.2 0.6 0.25	V V V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10 mA, I_B = 0.5 mA I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA	0.75 0.8	0.95 1.0 1.5	V V V
SMALL SIGNAL CHARACTERISTICS					
f_T	Current Gain - Bandwidth Product	I_C = 10 mA, V_{CE} = 5.0 V, f = 100 MHz	500		MHz
C_{obo}	Output Capacitance	V_{CB} = 5.0 V, I_E = 0, f = 1.0 MHz		3.5	pF
C_{ibo}	Input Capacitance	V_{BE} = 0.5 V, I_C = 0, f = 1.0 MHz		3.5	pF
SWITCHING CHARACTERISTICS					
t_d	Delay Time	V_{CC} = 6.0 V, $V_{BE(off)}$ = 1.9 V,		10	ns
t_r	Rise Time	I_C = 50 mA, I_{B1} = 5.0 mA		20	ns
t_s	Storage Time	V_{CC} = 6.0 V, I_C = 50 mA,		20	ns
t_f	Fall Time	I_{B1} = I_{B2} = 5.0 mA		12	ns
t_{on}	Turn-On Time	V_{CC} = 6.0 V, $V_{BE(off)}$ = 1.9 V, I_C = 50 mA, I_{B1} = 5.0 mA		25	ns
		V_{CC} = 1.5 V, I_C = 10 mA, I_{B1} = I_{B2} = 0.5 mA		60	ns
t_{off}	Turn-Off Time	V_{CC} = 6.0 V, $V_{BE(off)}$ = 1.9 V, I_C = 50 mA, I_{B1} = 5.0 mA		35	ns
		V_{CC} = 1.5 V, I_C = 10 mA, I_{B1} = I_{B2} = 0.5 mA		75	ns

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

FAIRCHILD SEMICONDUCTOR TM

Discrete POWER & Signal Technologies

PN3642



TO-92

NPN General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 300 mA. Sourced from Process 10. See PN100 for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	45	V
V_{CBO}	Collector-Base Voltage	60	V
V_{EBO}	Emitter-Base Voltage	5.0	V
I_C	Collector Current - Continuous	500	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
		PN3642	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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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 = 10 mA, I_B = 0	45		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	60		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	5.0		V
I_{CES}	Collector Cutoff Current	V_{CE} = 50 V, I_E = 0, V_{CE} = 50 V, I_E = 0, T_A = 65 °C		50 1.0	nA µA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 10 V, I_C = 150 mA V_{CE} = 10 V, I_C = 500 mA	40 15	120	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 150 mA, I_B = 15 mA		0.22	V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 10 V, f = 140 kHz		8.0	pF
h_{fe}	Small-Signal Current Gain	I_C = 50 mA, V_{CE} = 5.0 V, f = 100 MHz	1.5		
G_{pe}	Amplifier Power Gain	V_{CE} = 15 V, I_C = 0, R_g = 140 Ω, f = 30 MHz, RL = 260 Ω	10		dB
η	Collector Efficiency	V_{CE} = 15 V, I_C = 0, R_S = 140 Ω, f = 30 MHz, RL = 260 Ω	60		%

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

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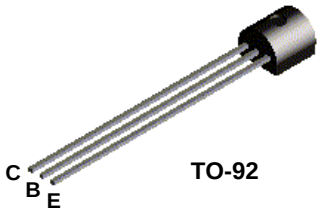
Discrete POWER & Signal Technologies

PN3643



TO-92

NPN General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 300 mA. Sourced from Process 10. See PN100 for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	30	V
V_{CBO}	Collector-Base Voltage	60	V
V_{EBO}	Emitter-Base Voltage	5.0	V
I_C	Collector Current - Continuous	500	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
		PN3643	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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NPN General Purpose Amplifier
(continued)

Electrical Characteristics
TA = 25°C unless otherwise noted

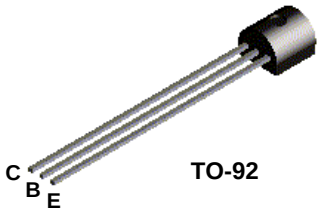
Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHARACTERISTICS					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage*	I_C = 10 mA, I_B = 0	30		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	60		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	5.0		V
I_{CES}	Collector Cutoff Current	V_{CE} = 50 V, I_E = 0 V_{CE} = 50 V, I_E = 0, T_A = +65 °C		50 1.0	nA µA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 10 V, I_C = 150 mA V_{CE} = 10 V, I_C = 500 mA	100 20	300	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 150 mA, I_B = 15 mA		0.22	V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 10 V, f = 140 kHz,		8.0	pF
η	Collector Efficiency	V_{CE} = 15 V, f = 30 MHz, Rg = 140 Ω, RL = 260 Ω	60		%
G_{pe}	Amplifier Power Gain	V_{CE} = 15 V, f = 30 MHz, Rg = 140 Ω, RL = 260 Ω	10		dB
h_{fe}	Small-Signal Current Gain	I_C = 50 mA, V_{CE} = 5.0 V, f = 100 MHz	2.5		

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

FAIRCHILD SEMICONDUCTOR TM

Discrete POWER & Signal Technologies

PN3644



TO-92

PNP General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 500 mA. Sourced from Process 63. See PN2907A for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	45	V
V_{CBO}	Collector-Base Voltage	45	V
V_{EBO}	Emitter-Base Voltage	5.0	V
I_C	Collector Current - Continuous	800	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
		PN3644	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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PNP General Purpose Amplifier
(continued)

Electrical Characteristics
TA = 25°C unless otherwise noted

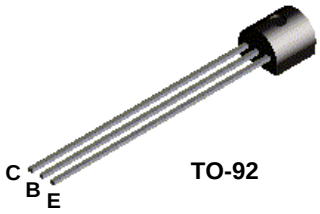
Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHARACTERISTICS					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage*	I_C = 10 mA, I_B = 0	45		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 100 µA, I_E = 0	45		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	5.0		V
I_{CES}	Collector-Cutoff Current	V_{CB} = 30 V, I_E = 0 V_{CB} = 30 V, I_E = 0, T_A = 65°C		35 2.0	nA µA
I_{BL}	Base-Cutoff Current	V_{CE} = 30 V, I_C = 0		35	nA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 10 V, I_C = 0.1 mA V_{CE} = 10 V, I_C = 1.0 mA V_{CE} = 10 V, I_C = 10 mA V_{CE} = 10 V, I_C = 150 mA V_{CE} = 2.0 V, I_C = 300 mA V_{CE} = 1.0 V, I_C = 50 mA	40 80 100 100 20 80	 300 240	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 50 mA, I_B = 2.5 mA I_C = 150 mA, I_B = 15 mA		0.25 0.4	V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 50 mA, I_B = 2.5 mA I_C = 150 mA, I_B = 15 mA		1.0 1.3	V V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 10 V, f = 140 kHz		8.0	pF
C_{ib}	Input Capacitance	V_{BE} = 0.5 V, f = 140 kHz		35	pF
h_{fe}	Small-Signal Current Gain	I_C = 20 mA, V_{CE} = 20 V, f = 100 MHz	2.0		
SWITCHING CHARACTERISTICS					
t_{on}	Turn-on Time	V_{CC} = 30 V, I_C = 300 mA, I_{B1} = 30 mA		40	ns
t_d	Delay Time			25	ns
t_r	Rise Time			35	ns
t_{off}	Turn-off Time	V_{CC} = 30 V, I_C = 300 mA, I_{B1} = I_{B2} = 30 mA		100	ns
t_s	Storage Time			70	ns
t_f	Fall Time			50	ns

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

FAIRCHILD SEMICONDUCTOR™

Discrete POWER & Signal Technologies

PN3645



TO-92

PNP General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 500 mA. Sourced from Process 63. See PN2907A for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	60	V
V_{CBO}	Collector-Base Voltage	60	V
V_{EBO}	Emitter-Base Voltage	5.0	V
I_C	Collector Current - Continuous	800	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
		PN3645	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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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 = 10 mA, I_B = 0	60		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 100 µA, I_E = 0	60		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	5.0		V
I_{CES}	Collector-Cutoff Current	V_{CB} = 50 V, I_E = 0 V_{CB} = 50 V, I_E = 0, T_A = 65°C		35 2.0	nA µA
I_{BL}	Base-Cutoff Current	V_{CE} = 50 V, I_C = 0		35	nA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 10 V, I_C = 0.1 mA V_{CE} = 10 V, I_C = 1.0 mA V_{CE} = 10 V, I_C = 10 mA V_{CE} = 10 V, I_C = 150 mA V_{CE} = 2.0 V, I_C = 300 mA V_{CE} = 1.0 V, I_C = 50 mA	40 80 100 100 20 80	 300 240	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 50 mA, I_B = 2.5 mA I_C = 150 mA, I_B = 15 mA		0.25 0.4	V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 50 mA, I_B = 2.5 mA I_C = 150 mA, I_B = 15 mA		1.0 1.3	V V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 10 V, f = 140 kHz		8.0	pF
C_{ib}	Input Capacitance	V_{BE} = 0.5 V, f = 140 kHz		35	pF
h_{fe}	Small-Signal Current Gain	I_C = 20 mA, V_{CE} = 20 V, f = 100 MHz	2.0		
SWITCHING CHARACTERISTICS					
t_{on}	Turn-on Time	V_{CC} = 30 V, I_C = 300 mA,		40	ns
t_d	Delay Time	I_{B1} = 30 mA		25	ns
t_r	Rise Time			35	ns
t_{off}	Turn-off Time	V_{CC} = 30 V, I_C = 300 mA		100	ns
t_s	Storage Time	I_{B1} = I_{B2} = 30 mA		70	ns
t_f	Fall Time			50	ns

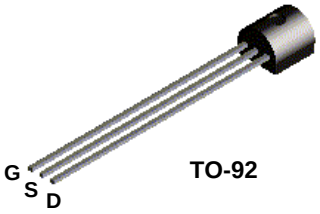
*Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%

FAIRCHILD SEMICONDUCTOR TM

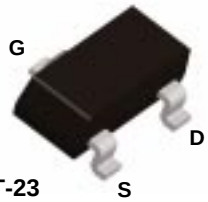
Discrete POWER & Signal Technologies

PN4117 PN4118 PN4119

MMBF4117 MMBF4118 MMBF4119



TO-92



SOT-23

Mark: 61A / 61C / 61E

N-Channel Switch

This device is designed for low current DC and audio applications. These devices provide excellent performance as input stages for sub-picoamp instrumentation or any high impedance signal sources. Sourced from Process 53.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{DG}	Drain-Gate Voltage	40	V
V_{GS}	Gate-Source Voltage	- 40	V
I_{GF}	Forward Gate Current	50	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
		PN4117	*MMBF4117	
P_D	Total Device Dissipation Derate above 25°C	350 2.8	225 1.8	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	125		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	357	556	°C/W

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

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N-Channel Switch
(continued)

Electrical Characteristics
TA = 25°C unless otherwise noted

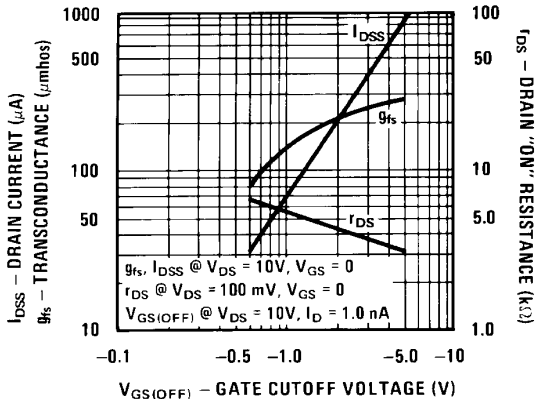
Symbol	Parameter	Test Conditions		Min	Max	Units
OFF CHARACTERISTICS						
$V_{(BR)GSS}$	Gate-Source Breakdown Voltage	I_G = 1.0 µA, V_{DS} = 0		- 40		V
I_{GSS}	Gate Reverse Current	V_{GS} = 20 V, V_{DS} = 0			- 10	pA
		V_{GS} = 20 V, V_{DS} = 0, T_A = 150°C			- 25	nA
$V_{GS(off)}$	Gate-Source Cutoff Voltage	V_{DS} = 10 V, I_D = 1.0 nA	**PN4117**	- 0.6	- 1.8	V
			PN4118	- 1.0	- 3.0	V
			PN4119	- 2.0	- 6.0	V
ON CHARACTERISTICS						
I_{DSS}	Zero-Gate Voltage Drain Current*	V_{DS} = 10 V, V_{GS} = 0	**PN4117**	30	90	µA
			PN4118	80	240	µA
			PN4119	200	600	µA
SMALL-SIGNAL CHARACTERISTICS						
g_{fs}	Common-Source Forward Transconductance	V_{DS} = 10 V V_{GS} = 0, f= 1.0 kHz				
			PN4117	70	210	µmhos
			PN4118	80	250	µmhos
			PN4119	100	330	µmhos
g_{oss}	Common-Source Output Conductance	V_{DS} = 10 V V_{GS} = 0, f= 1.0 kHz				
			PN4117		3.0	µmhos
			PN4118		5.0	µmhos
			PN4119		10	µmhos
$R_{e(yfs)}$	Common-Source Forwad Transconductance	V_{DS} = 10 V, V_{GS} = 0, f= 30 MHz				
			PN4117	60		µmhos
			PN4118	70		µmhos
			PN4119	90		µmhos
C_{iss}	Input Capacitance	V_{DS} = 10 V, V_{GS} = 0, f= 1.0 kHz			3.0	pF
C_{rss}	Reverse Transfer Capacitance	V_{DS} = 10 V, V_{GS} = 0, f= 1.0 MHz,			1.5	pF

*Pulse Test: Pulse Width £ 300 ms, Duty Cycle £ 1.0%

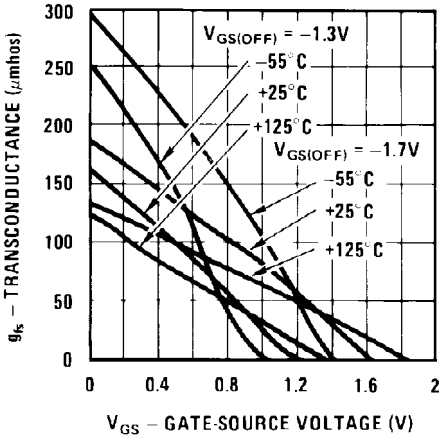
N-Channel Switch
(continued)

Typical Characteristics

Parameter Interactions



Transfer Characteristics



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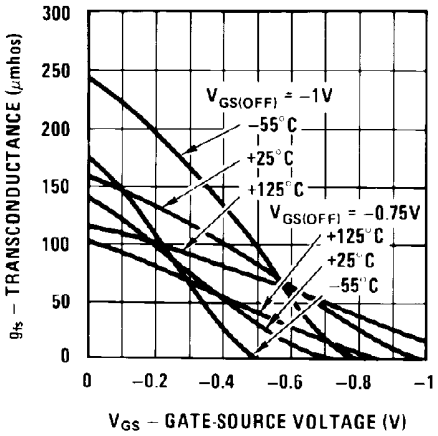
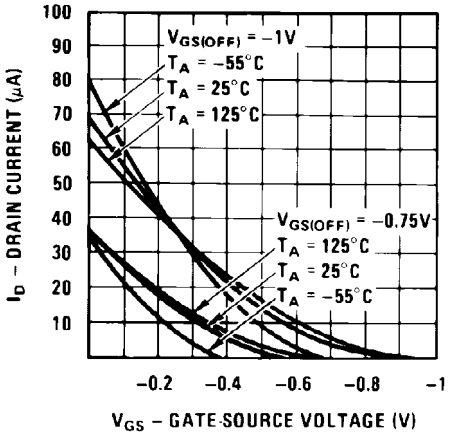
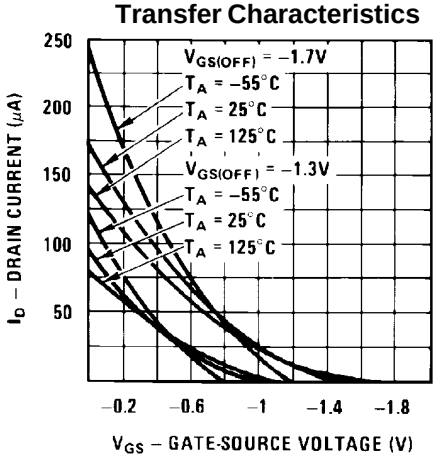


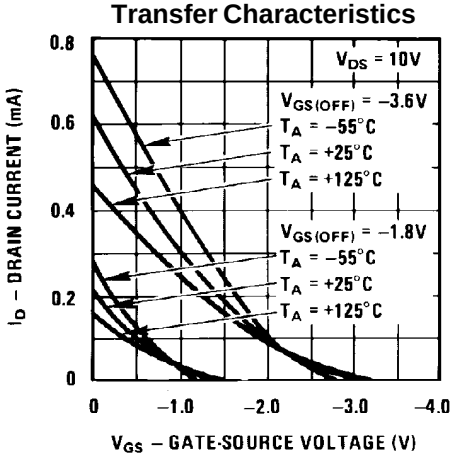
Transfer Characteristics



Transfer Characteristics

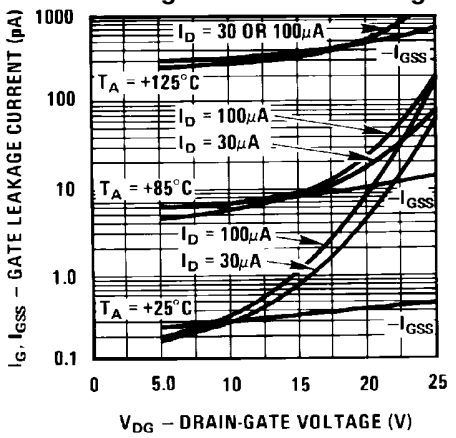


Transfer Characteristics

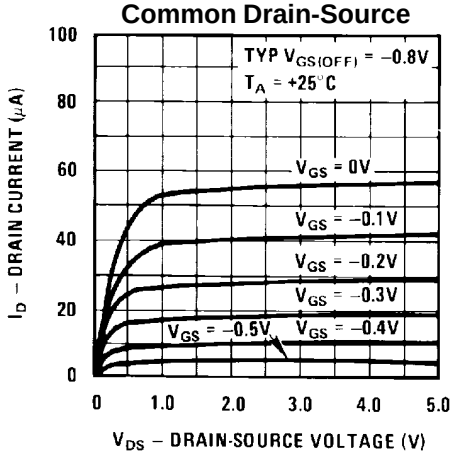


Typical Characteristics (continued)

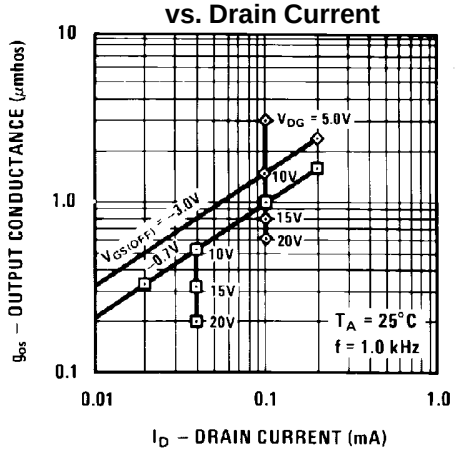
Leakage Current vs. Voltage



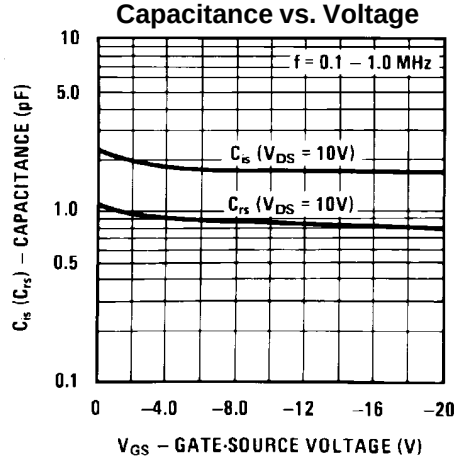
Common Drain-Source



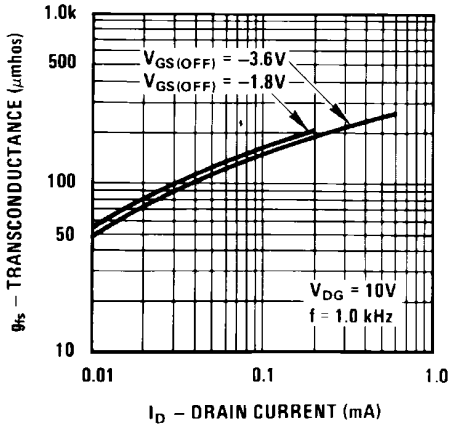
Output Conductance vs. Drain Current



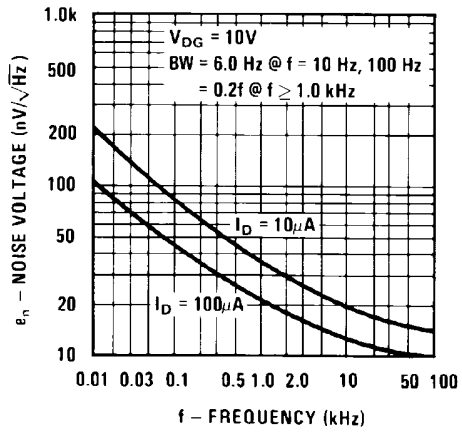
Capacitance vs. Voltage



Transconductance vs. Drain Current



Noise Voltage vs. Frequency

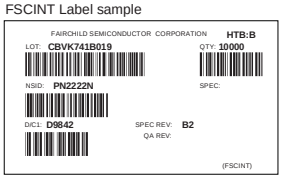


TO-92 Tape and Reel Data and Package Dimensions

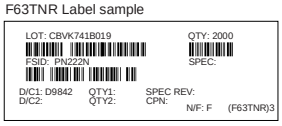
FAIRCHILD SEMICONDUCTOR TM

TO-92 Packaging
Configuration: Figure 1.0

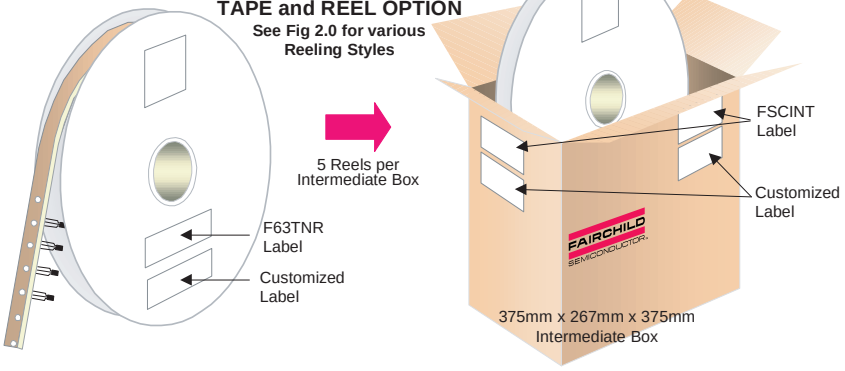
FSCINT Label sample



F63TNR Label sample



TAPE and REEL OPTION
See Fig 2.0 for various Reeling Styles

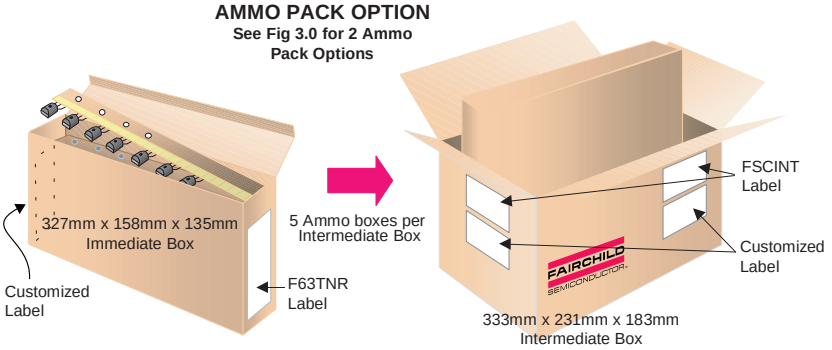


TO-92 TNR/AMMO PACKING INFROMATION

Packing	Style	Quantity	EOL code
Reel	A	2,000	D26Z
	E	2,000	D27Z
Ammo	M	2,000	D74Z
	P	2,000	D75Z

Unit weight = 0.22 gm
Reel weight with components = 1.04 kg
Ammo weight with components = 1.02 kg
Max quantity per intermediate box = 10,000 units

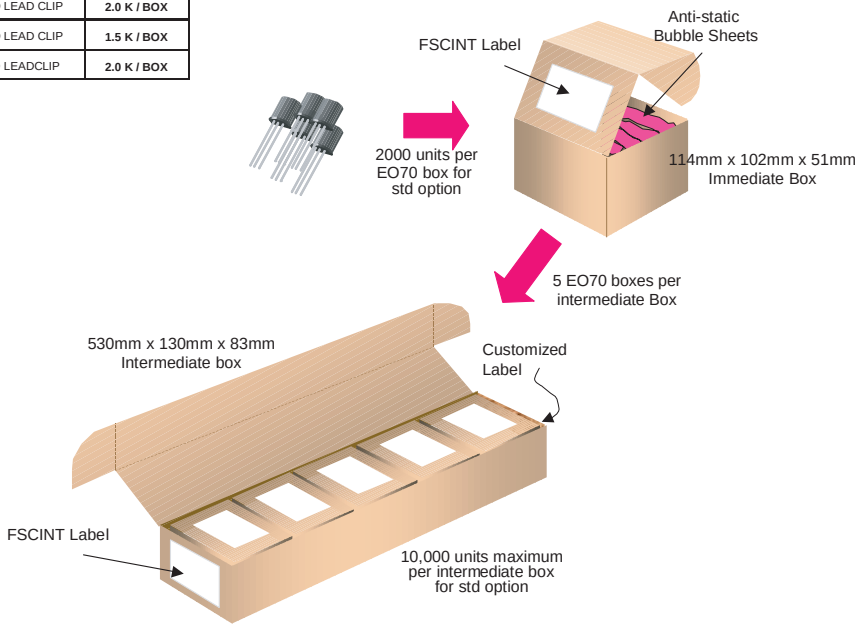
AMMO PACK OPTION
See Fig 3.0 for 2 Ammo Pack Options



(TO-92) BULK PACKING INFORMATION

EOL CODE	DESCRIPTION	LEADCLIP DIMENSION	QUANTITY
J18Z	TO-18 OPTION STD	NO LEAD CLIP	2.0 K / BOX
J05Z	TO-5 OPTION STD	NO LEAD CLIP	1.5 K / BOX
NO EOL CODE	TO-92 STANDARD STRAIGHT	NO LEADCLIP	2.0 K / BOX

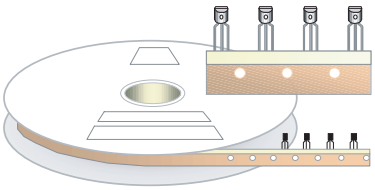
BULK OPTION
See Bulk Packing Information table



TO-92 Tape and Reel Data and Package Dimensions, continued

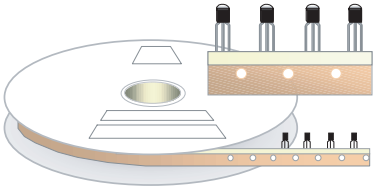
TO-92 Reeling Style
Configuration: Figure 2.0

Machine Option “A” (H)



Style “A”, D26Z, D70Z (s/h)

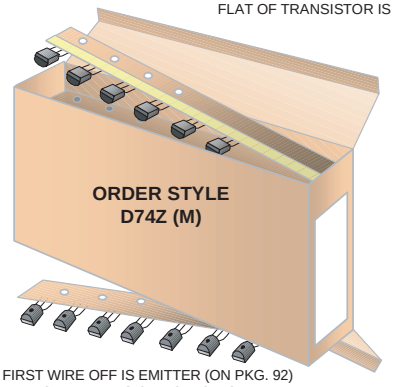
Machine Option “E” (J)



Style “E”, D27Z, D71Z (s/h)

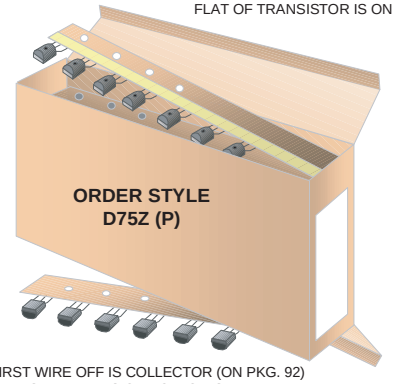
TO-92 Radial Ammo Packaging
Configuration: Figure 3.0

FIRST WIRE OFF IS COLLECTOR
ADHESIVE TAPE IS ON THE TOP SIDE
FLAT OF TRANSISTOR IS ON TOP



FIRST WIRE OFF IS EMITTER (ON PKG. 92)
ADHESIVE TAPE IS ON BOTTOM SIDE
FLAT OF TRANSISTOR IS ON BOTTOM

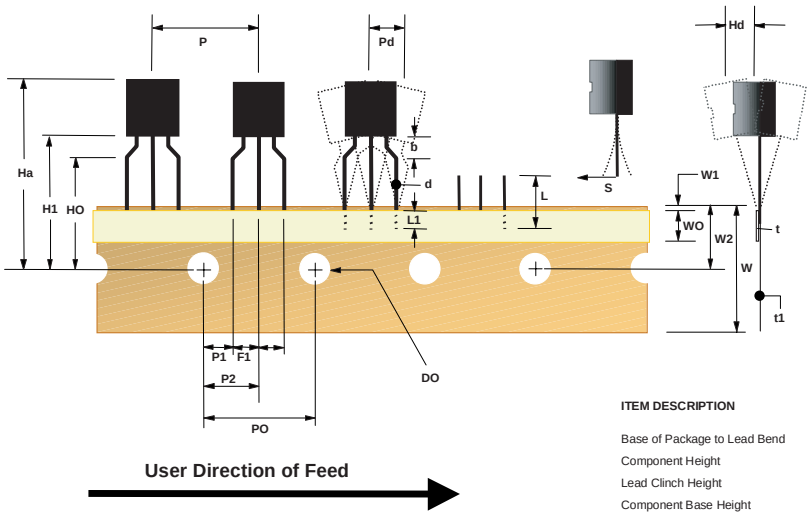
FIRST WIRE OFF IS EMITTER
ADHESIVE TAPE IS ON THE TOP SIDE
FLAT OF TRANSISTOR IS ON BOTTOM



FIRST WIRE OFF IS COLLECTOR (ON PKG. 92)
ADHESIVE TAPE IS ON BOTTOM SIDE
FLAT OF TRANSISTOR IS ON TOP

TO-92 Tape and Reel Data and Package Dimensions, continued

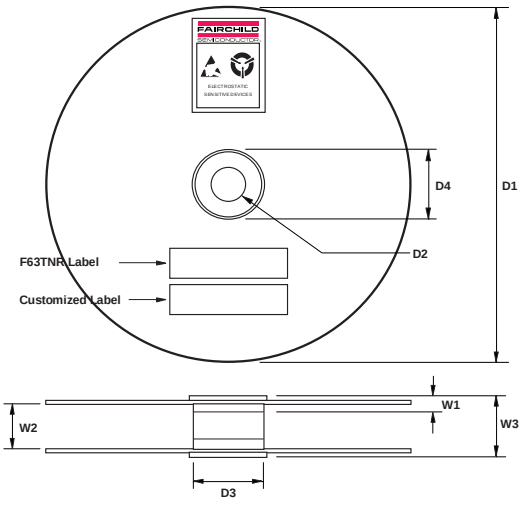
TO-92 Tape and Reel Taping
Dimension Configuration: Figure 4.0



ITEM DESCRIPTION	SYMBOL	DIMENSION
Base of Package to Lead Bend	b	0.098 (max)
Component Height	Ha	0.928 (+/- 0.025)
Lead Clinch Height	HO	0.630 (+/- 0.020)
Component Base Height	H1	0.748 (+/- 0.020)
Component Alignment (side/side)	Pd	0.040 (max)
Component Alignment (front/back)	Hd	0.031 (max)
Component Pitch	P	0.500 (+/- 0.020)
Feed Hole Pitch	PO	0.500 (+/- 0.008)
Hole Center to First Lead	P1	0.150 (+0.009, -0.010)
Hole Center to Component Center	P2	0.247 (+/- 0.007)
Lead Spread	F1/F2	0.104 (+/- 0 .010)
Lead Thickness	d	0.018 (+0.002, -0.003)
Cut Lead Length	L	0.429 (max)
Taped Lead Length	L1	0.209 (+0.051, -0.052)
Taped Lead Thickness	t	0.032 (+/- 0.006)
Carrier Tape Thickness	t1	0.021 (+/- 0.006)
Carrier Tape Width	W	0.708 (+0.020, -0.019)
Hold - down Tape Width	WO	0.236 (+/- 0.012)
Hold - down Tape position	W1	0.035 (max)
Feed Hole Position	W2	0.360 (+/- 0.025)
Sprocket Hole Diameter	DO	0.157 (+0.008, -0.007)
Lead Spring Out	S	0.004 (max)

Note : All dimensions are in inches.

TO-92 Reel
Configuration: Figure 5.0

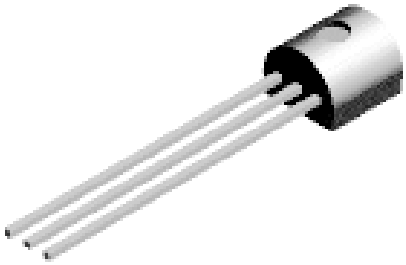


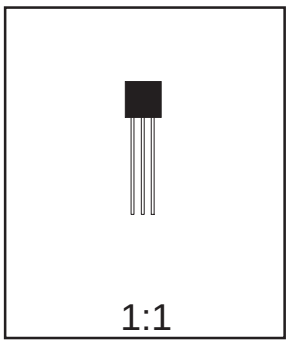
ITEM DESCRIPTION	SYSMBOL	MINIMUM	MAXIMUM
Reel Diameter	D1	13.975	14.025
Arbor Hole Diameter (Standard)	D2	1.160	1.200
(Small Hole)	D2	0.650	0.700
Core Diameter	D3	3.100	3.300
Hub Recess Inner Diameter	D4	2.700	3.100
Hub Recess Depth	W1	0.370	0.570
Flange to Flange Inner Width	W2	1.630	1.690
Hub to Hub Center Width	W3		2.090

Note: All dimensions are inches

TO-92 Tape and Reel Data and Package Dimensions, continued

TO-92 (FS PKG Code 92, 94, 96)





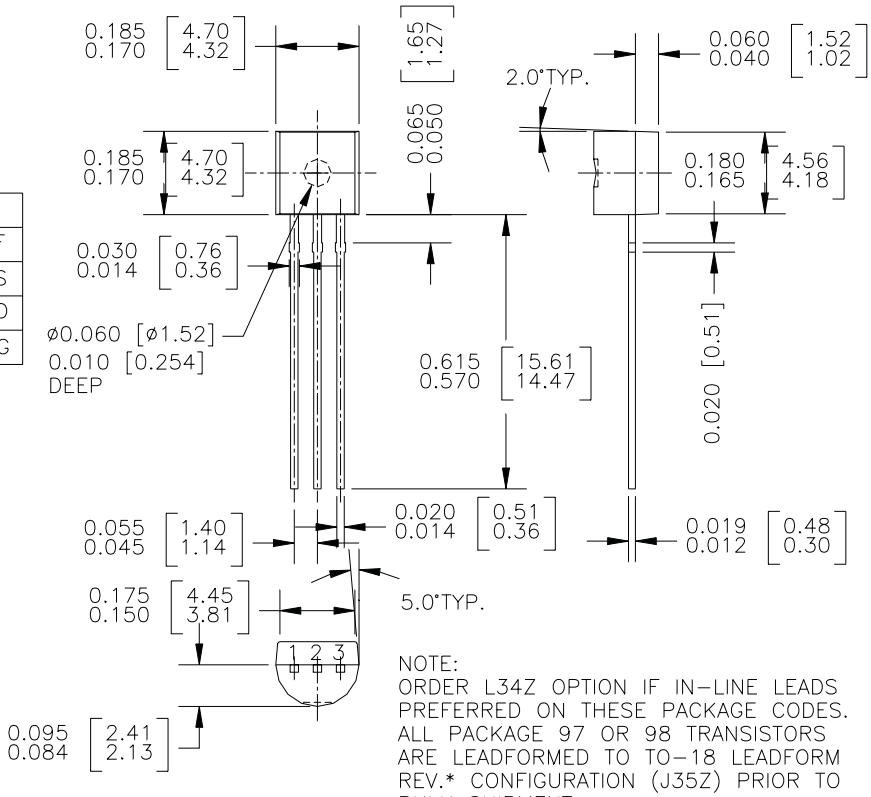
Scale 1:1 on letter size paper

Dimensions shown below are in:
inches [millimeters]

Part Weight per unit (gram): 0.1977

TO−92 (92,94,96)

PIN	92		94		96	
	B	F	B	F	B	F
1	E	D	E	D	B	S
2	B	S	C	G	E	D
3	C	G	B	S	C	G

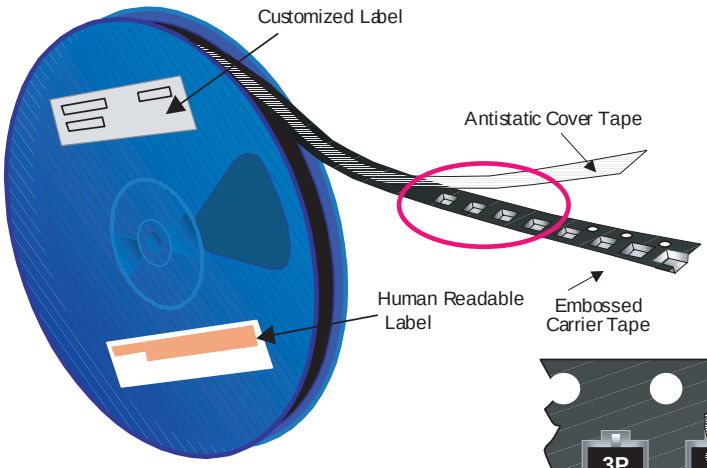


NOTE:
ORDER L34Z OPTION IF IN−LINE LEADS PREFERRED ON THESE PACKAGE CODES. ALL PACKAGE 97 OR 98 TRANSISTORS ARE LEADFORMED TO TO−18 LEADFORM REV.* CONFIGURATION (J35Z) PRIOR TO BULK SHIPMENT.

SOT-23 Tape and Reel Data and Package Dimensions

FAIRCHILD SEMICONDUCTOR™

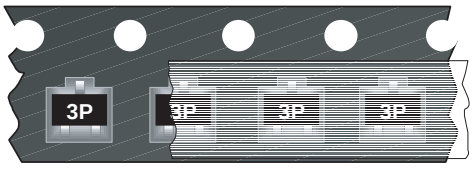
SOT-23 Packaging Configuration: Figure 10



Packaging Description:

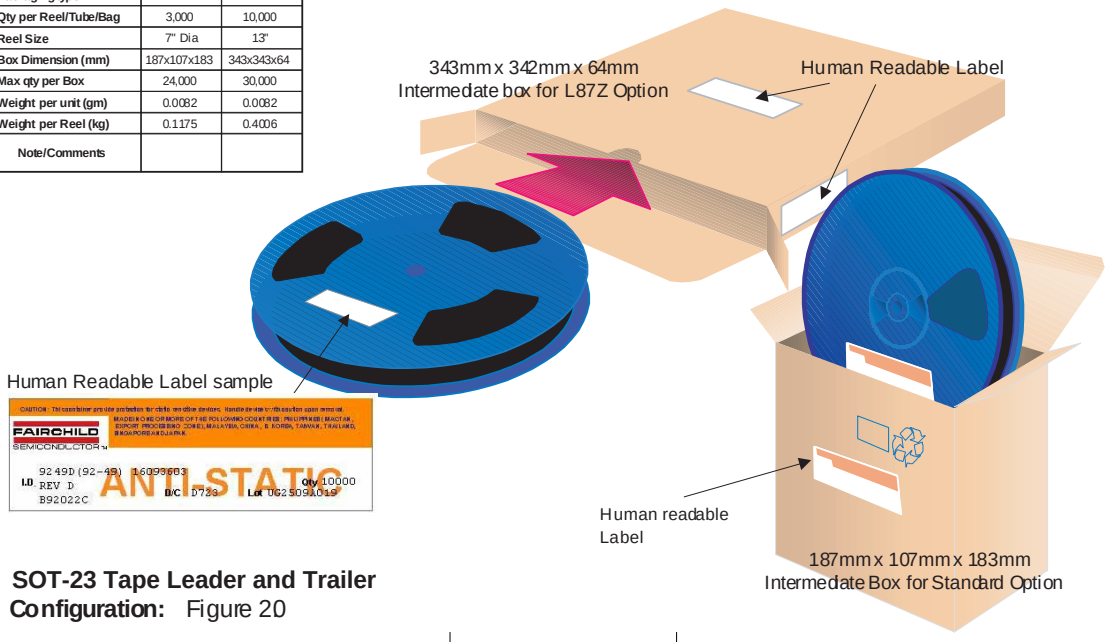
SOT-23 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 3,000 units per 7" or 177cm diameter reel. The reels are dark blue in color and is made of polystyrene plastic (anti-static coated). Other option comes in 10,000 units per 13" or 330cm diameter reel. This and some other options are described in the Packaging Information table.

These full reels are individually labeled and placed inside a standard intermediate made of recyclable corrugated brown paper with a Fairchild logo printing. One pizza box contains eight reels maximum. And these intermediate boxes are placed inside a labeled shipping box which comes in different sizes depending on the number of parts shipped.

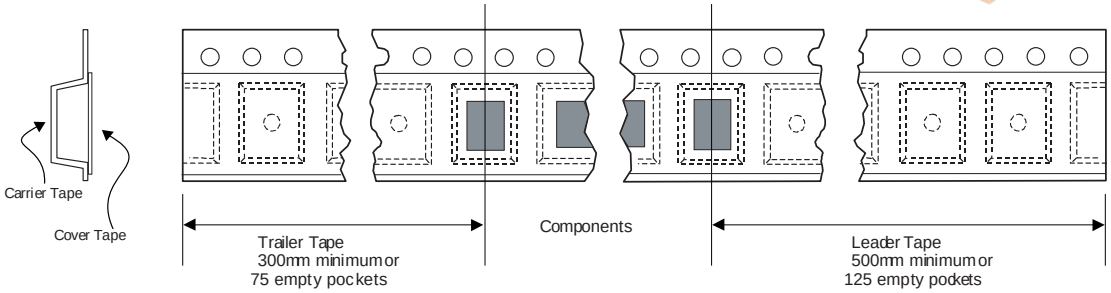


SOT-23 Packaging Information		
Packaging Option	Standard (no flow code)	D87Z
Packaging type	TNR	TNR
Qty per Reel/Tube/Bag	3,000	10,000
Reel Size	7" Dia	13"
Box Dimension (mm)	187x107x183	343x343x64
Max qty per Box	24,000	30,000
Weight per unit (gm)	0.0082	0.0082
Weight per Reel (kg)	0.1175	0.4006
Note/Comments		

SOT-23 Unit Orientation

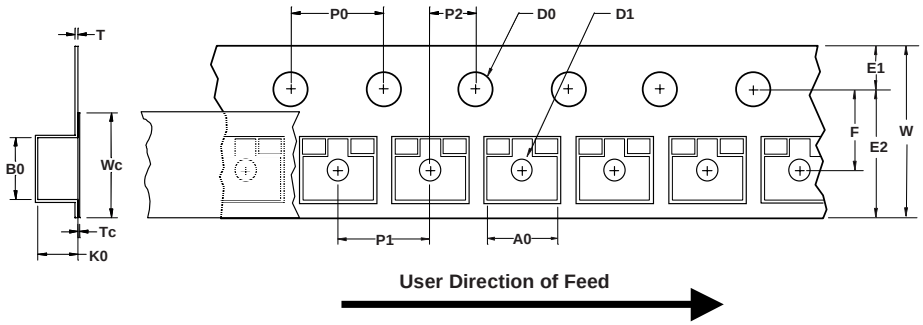


SOT-23 Tape Leader and Trailer Configuration: Figure 20



SOT-23 Tape and Reel Data and Package Dimensions, continued

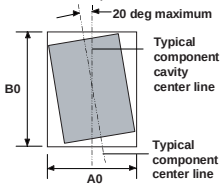
SOT-23 Embossed Carrier Tape
Configuration: Figure 3.0



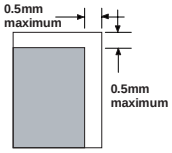
Dimensions are in millimeter														
Pkg type	**A0**	**B0**	**W**	**D0**	**D1**	**E1**	**E2**	**F**	**P1**	**P0**	**K0**	**T**	**Wc**	**Tc**
SOT-23 (8mm)	3.15 +/-0.10	2.77 +/-0.10	8.0 +/-0.3	1.55 +/-0.05	1.125 +/-0.125	1.75 +/-0.10	6.25 min	3.50 +/-0.05	4.0 +/-0.1	4.0 +/-0.1	1.30 +/-0.10	0.228 +/-0.013	5.2 +/-0.3	0.06 +/-0.02

Notes: A0, B0, and K0 dimensions are determined with respect to the EIA/Jedec RS-481 rotational and lateral movement requirements (see sketches A, B, and C).

Sketch A (Side or Front Sectional View)
Component Rotation

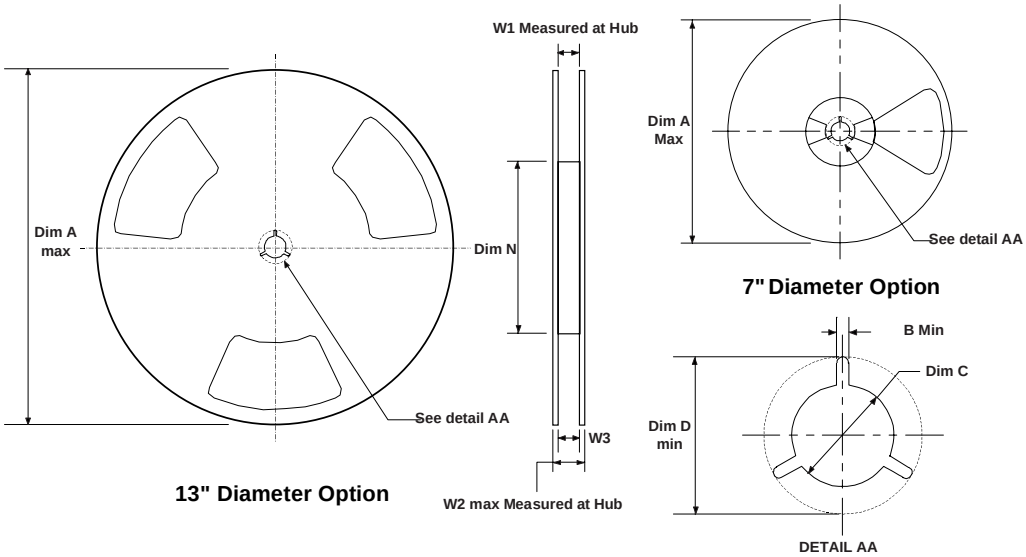


Sketch B (Top View)
Component Rotation



Sketch C (Top View)
Component lateral movement

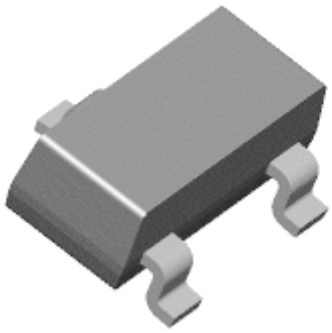
SOT-23 Reel Configuration: Figure 4.0

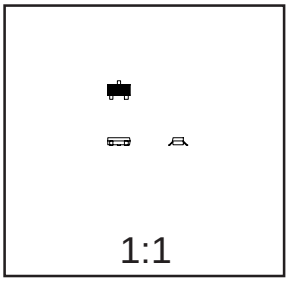


Dimensions are in inches and millimeters									
Tape Size	**Reel Option**	**Dim A**	**Dim B**	**Dim C**	**Dim D**	**Dim N**	**Dim W1**	**Dim W2**	**Dim W3 (LSL-USL)**
8mm	7" Dia	7.00 177.8	0.059 1.5	512 +0.020/-0.008 13 +0.5/-0.2	0.795 20.2	2.165 55	0.331 +0.059/-0.000 8.4 +1.5/0	0.567 14.4	0.311 – 0.429 7.9 – 10.9
8mm	13" Dia	13.00 330	0.059 1.5	512 +0.020/-0.008 13 +0.5/-0.2	0.795 20.2	4.00 100	0.331 +0.059/-0.000 8.4 +1.5/0	0.567 14.4	0.311 – 0.429 7.9 – 10.9

SOT-23 Tape and Reel Data and Package Dimensions, continued

SOT-23 (FS PKG Code 49)

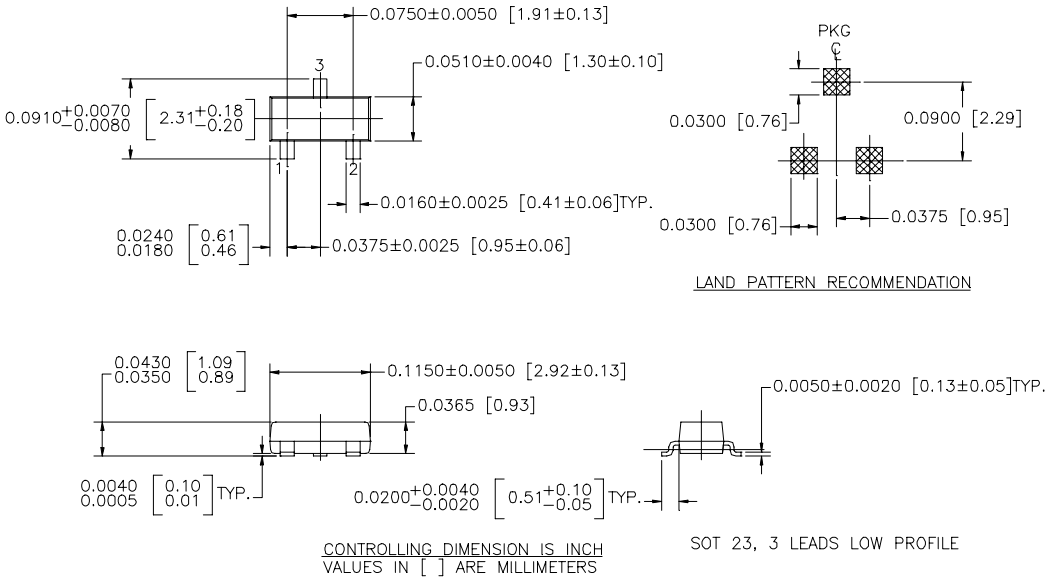




Scale 1:1 on letter size paper

Dimensions shown below are in:
inches [millimeters]

Part Weight per unit (gram): 0.0082



NOTE : UNLESS OTHERWISE SPECIFIED

1. STANDARD LEAD FINISH 150 MICROINCHES / 3.81 MICROMETERS MINIMUM TIN / LEAD (SOLDER) ON ALLOY 42
2. REFERENCE JEDEC REGISTRATION TO−236, VARIATION AB, ISSUE G, DATED JUL 1993

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Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice in order to improve design.
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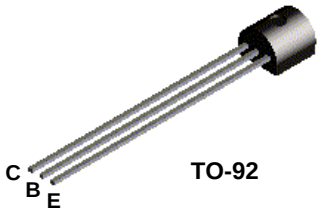
Discrete POWER & Signal Technologies

PN4122



TO-92

PNP General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 100 mA. Sourced from Process 66. See 2N3906 for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	40	V
V_{CBO}	Collector-Base Voltage	40	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
		PN4122	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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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 = 10 mA, I_B = 0	40		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	40		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	5.0		V
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	I_C = 10 µA	40		nA
I_B	Base Cutoff Current	V_{CE} = 30 V		25	nA
I_{CES}	Collector Cutoff Current	V_{CE} = 30 V V_{CE} = 30 V, T_A = 65 °C		25 25	nA µA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 1.0 V, I_C = 100 µA V_{CE} = 1.0 V, I_C = 1.0 mA V_{CE} = 1.0 V, I_C = 10 mA V_{CE} = 1.0 V, I_C = 50 mA	100 150 150 30	 300 	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 1.0 mA, I_B = 0.1 mA I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA		0.13 0.14 0.30	V V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 1.0 mA, I_B = 0.1 mA I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA	 0.70 	0.75 0.90 1.10	V V V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 10 V, f = 1.0 MHz		4.5	pF
C_{ib}	Input Capacitance	V_{EB} = 0.5 V, f = 1.0 MHz		8.0	pF
h_{fe}	Small-Signal Current Gain	I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz I_C = 1.0 mA, V_{CE} = 10 V, f = 1 kHz	4.5 150	 450	
h_{ie}	Input Impedance	I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz	4.0	12	kΩ
h_{re}	Voltage Feedback Ratio			4.0	x10^{-4}
h_{oe}	Output Admittance		8.0	40	µmhos
rb'Cc	Collector-Base Time Constant	V_{CE} = 20 V, I_C = 10 mA, f = 80 MHz		50	ps
NF	Noise Figure	V_{CE} = 5.0 V, I_C = 1.0 mA, R_S = 100 Ω, f = 100 MHz, B_W = 15 MHz V_{CE} = 5.0 V, I_C = 100 µA, R_S = 1.0 kΩ, PB_W = 15.7 kHz		6.0 4.0	dB dB
SWITCHING CHARACTERISTICS					
t_{on}	Turn-on Time	V_{CC} = 30 V, I_C = 50 mA, I_{B1} = 5.0 mA, $V_{BE(off)}$ = 3.0 V		40	ns
t_d	Delay Time			15	ns
t_r	Rise Time			40	ns
t_{off}	Turn-off Time	V_{CC} = 30 V, I_C = 50 mA, I_{B1} = I_{B2} = 5.0 mA		150	ns
t_s	Storage Time			140	ns
t_f	Fall Time			40	ns

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

FAIRCHILD SEMICONDUCTOR TM

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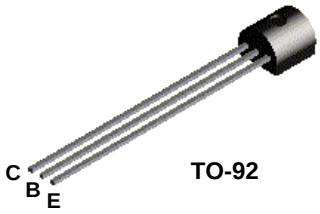
PN4141



TO-92

NPN General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 300 mA. Sourced from Process 10. See PN100 for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	30	V
V_{CBO}	Collector-Base Voltage	60	V
V_{EBO}	Emitter-Base Voltage	5.0	V
I_C	Collector Current - Continuous	500	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
		PN4141	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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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 = 10 mA, I_B = 0	30		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	60		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	5.0		V
I_{CEX}	Collector Cutoff Current	V_{CE} = 40 V, V_{OB} = 3.0 V		50	nA
I_{BL}	Base Cutoff Current	V_{CE} = 40 V, V_{OB} = 3.0 V		50	nA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 10 V, I_C = 100 µA V_{CE} = 10 V, I_C = 1.0 mA V_{CE} = 10 V, I_C = 10 mA V_{CE} = 10 V, I_C = 150 mA V_{CE} = 10 V, I_C = 500 mA V_{CE} = 1.0 V, I_C = 150 mA	35 50 75 100 30 50	 300 	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA		0.4 1.6	V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA		1.3 2.6	V V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 10 V, f = 100 kHz		8.0	pF
h_{fe}	Small-Signal Current Gain	I_C = 20 mA, V_{CE} = 20 V, f = 100 MHz	2.5		
SWITCHING CHARACTERISTICS					
t_d	Delay Time	V_{CC} = 30 V, I_C = 150 mA,		10	ns
t_r	Rise Time	I_{B1} = 15 mA, $V_{OB\ (off)}$ = 0.5 V		40	ns
t_s	Storage Time	V_{CC} = 30 V, I_C = 150 mA,		250	ns
t_f	Fall Time	I_{B1} = I_{B2} = 15 mA		60	ns

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

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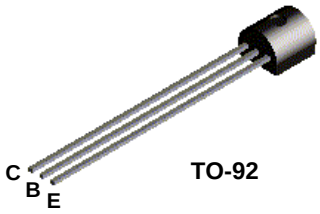

TO-92

PNP General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 500 mA. Sourced from Process 63. See PN2907A for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	40	V
V_{CBO}	Collector-Base Voltage	60	V
V_{EBO}	Emitter-Base Voltage	5.0	V
I_C	Collector Current - Continuous	800	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
		PN4143	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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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 = 10 mA, I_B = 0	40		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	60		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	5.0		V
I_{CEX}	Collector Cutoff Current	V_{CE} = 30 V, V_{OB} = 0.5 V		50	nA
I_{BL}	Base Cutoff Current	V_{CE} = 30 V, V_{OB} = 0.5 V		50	nA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 10 V, I_C = 100 µA V_{CE} = 10 V, I_C = 1.0 mA V_{CE} = 10 V, I_C = 10 mA V_{CE} = 10 V, I_C = 150 mA V_{CE} = 10 V, I_C = 500 mA V_{CE} = 1.0 V, I_C = 150 mA	35 50 75 100 30 50	 300 	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA		0.4 1.6	V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA		1.3 2.6	V V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 10 V, f = 100 kHz		8.0	pF
C_{ib}	Input Capacitance	V_{EB} = 2.0 V, f = 100 kHz		30	pF
h_{fe}	Small-Signal Current Gain	I_C = 50 mA, V_{CE} = 20 V, f = 100 MHz	2.0		
SWITCHING CHARACTERISTICS					
t_{on}	Turn-on Time	V_{CC} = 30 V, I_C = 150 mA, I_{B1} = 15 mA		45	ns
t_d	Delay Time			10	ns
t_r	Rise Time			40	ns
t_{off}	Turn-off Time	V_{CC} = 30 V, I_C = 150 mA, I_{B1} = I_{B2} = 15 mA		100	ns
t_s	Storage Time			80	ns
t_f	Fall Time			30	ns

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

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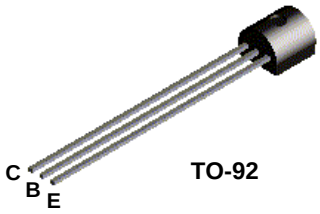
Discrete POWER & Signal Technologies

PN4249



TO-92

PNP General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 300 mA. Sourced from Process 68. See PN200 for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	60	V
V_{CBO}	Collector-Base Voltage	60	V
V_{EBO}	Emitter-Base Voltage	5.0	V
I_C	Collector Current - Continuous	500	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
		PN4249	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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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 = 5.0 mA, I_B = 0	60		V
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage*	I_C = 10 µA, I_B = 0	60		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	60		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} = 40 V, I_E = 0		10	nA
I_{EBO}	Emitter-Cutoff Current	V_{EB} = 3.0 V, I_C = 0		20	nA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 5.0 V, I_C = 100 µA	100	300	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 0.5 mA		0.25	V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 5.0 V, f = 1.0 MHz		6.0	pF
h_{ie}	Input Impedance	V_{CE} = 5.0 V, I_C = 1.0 mA, f = 1.0 kHz	2.5	17	kΩ
h_{oe}	Output Admittance		5.0	40	µmhos
h_{re}	Voltage Feedback Ratio			10	$x10^{-4}$
NF	Noise Figure	V_{CE} = 5.0 V, I_C = 250 µA, R_S = 1.0 kΩ, f = 1.0 kHz, B_W = 150 Hz		3.0	dB
		V_{CE} = 5.0 V, I_C = 20 µA, R_S = 10 kΩ, f = 1.0 kHz, B_W = 150 Hz		3.0	dB

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

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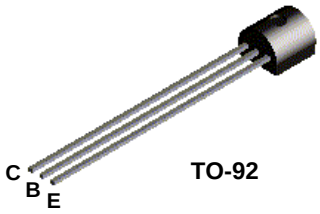
Discrete POWER & Signal Technologies

PN4250



TO-92

PNP General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 300 mA. Sourced from Process 68. See PN200 for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	40	V
V_{CBO}	Collector-Base Voltage	40	V
V_{EBO}	Emitter-Base Voltage	5.0	V
I_C	Collector Current - Continuous	500	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
		PN4250	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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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 = 5.0 mA, I_B = 0	40		V
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage*	I_C = 10 µA, I_B = 0	40		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	40		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} = 40 V, I_E = 0		10	nA
I_{EBO}	Emitter-Cutoff Current	V_{EB} = 3.0 V, I_C = 0		20	nA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 5.0 V, I_C = 100 µA	250	700	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 0.5 mA		0.25	V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 5.0 V, f = 1.0 MHz		6.0	pF
h_{ie}	Input Impedance	V_{CE} = 5.0 V, I_C = 1.0 mA, f = 1.0 kHz	6.0	20	kΩ
h_{oe}	Output Admittance		5.0	50	µmhos
h_{re}	Voltage Feedback Ratio			10	$x10^{-4}$
NF	Noise Figure	V_{CE} = 5.0 V, I_C = 250 µA, R_S = 1.0 kΩ, f = 1.0 kHz, B_W = 150 Hz		2.0	dB
		V_{CE} = 5.0 V, I_C = 20 µA, R_S = 10 kΩ, f = 1.0 kHz, B_W = 150 Hz		2.0	dB

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

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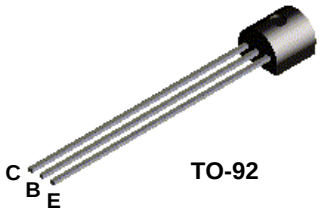
PN4250A



TO-92

PNP General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 300 mA. Sourced from Process 68. See PN200 for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	60	V
V_{CBO}	Collector-Base Voltage	60	V
V_{EBO}	Emitter-Base Voltage	5.0	V
I_C	Collector Current - Continuous	500	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
		PN4250A	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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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 = 5.0 mA, I_B = 0	60		V
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage*	I_C = 10 µA, I_B = 0	60		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	60		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} = 50 V, I_E = 0		10	nA
I_{EBO}	Emitter-Cutoff Current	V_{EB} = 3.0 V, I_C = 0		20	nA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 5.0 V, I_C = 100 µA	250	700	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 0.5 mA		0.25	V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 5.0 V, f = 1.0 MHz		6.0	pF
h_{fe}	Small-signal Current Gain	V_{CE} = 5.0 V, I_C = 1.0 mA, f = 1.0 kHz	250	800	
h_{ie}	Input Impedance		6.0	20	kΩ
h_{oe}	Output Admittance		5.0	50	µmhos
h_{re}	Voltage Feedback Ratio			10	$x10^{-4}$
NF	Noise Figure	V_{CE} = 5.0 V, I_C = 250 µA, R_S = 1.0 kΩ, f = 1.0 kHz, B_W = 150 Hz		2.0	dB
		V_{CE} = 5.0 V, I_C = 20 µA, R_S = 10 kΩ, f = 1.0 kHz, B_W = 150 Hz		2.0	dB

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

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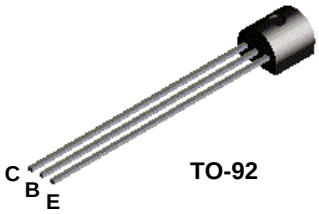
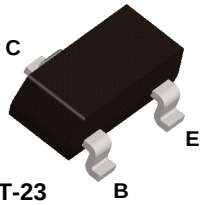
Discrete POWER & Signal Technologies

PN4258



TO-92

MMBT4258



SOT-23
Mark: 78

PNP Switching Transistor

This device is designed for very high speed saturate switching at collector currents to 100 mA. Sourced from Process 65.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	12	V
V_{CBO}	Collector-Base Voltage	12	V
V_{EBO}	Emitter-Base Voltage	4.5	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
		PN4258	*MMBT4258	
P_D	Total Device Dissipation Derate above 25°C	350 2.8	225 1.8	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	125		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	357	556	°C/W

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

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PNP Switching Transistor
(continued)

Electrical Characteristics
TA = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHARACTERISTICS					
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage*	I_C = 100 µA, V_{BE} = 0	12		V
$V_{CEO(sus)}$	Collector-Emitter Sustaining Voltage*	I_C = 3.0 mA, I_B = 0	12		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 100 µA, I_E = 0	12		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 100 µA, I_C = 0	4.5		V
I_{CES}	Collector Cutoff Current	V_{CE} = 6.0 V, V_{BE} = 0 V_{CE} = 6.0 V, V_{BE} = 0, T_A = 65°C		0.01 5.0	µA µA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	I_C = 1.0 mA, V_{CE} = 0.5 V I_C = 10 mA, V_{CE} = 3.0 V I_C = 50 mA, V_{CE} = 1.0 V	15 30 30	 120 	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA		0.15 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	0.75	0.95 1.5	V V
SMALL SIGNAL CHARACTERISTICS					
f_T	Current Gain - Bandwidth Product	I_C = 10 mA, V_{CE} = 5.0 V, f = 100 MHz I_C = 10 mA, V_{CE} = 10 V, f = 100 MHz	700 700	 	MHz MHz
C_{ibo}	Input Capacitance	V_{BE} = 0.5 V, I_C = 0, f = 1.0 MHz		3.5	pF
C_{cb}	Collector-Base Capacitance	V_{CB} = 5.0 V, I_E = 0, f = 1.0 MHz		3.0	pF
SWITCHING CHARACTERISTICS					
t_{on}	Turn-On Time	V_{CC} = 1.5 V, $V_{BE(off)}$ = 0 V,		15	ns
t_d	Delay Time	I_C = 10 mA, I_{B1} = 1.0 mA		10	ns
t_r	Rise Time			15	ns
t_{off}	Turn-Off Time	V_{CC} = 1.5 V, I_C = 10mA		20	ns
t_s	Storage Time	I_{B1} = I_{B2} = 1.0 mA		20	ns
t_f	Fall Time			10	ns
t_s	Storage Time	I_C = 10 mA, I_{B1} = I_{B2} = 10 mA		20	ns

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

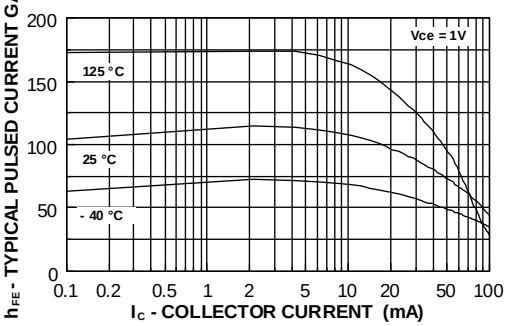
Spice Model

PNP (Is=545.6E-18 Xti=3 Eg=1.11 Vaf=100 Bf=61.42 Ne=1.5 Ise=0 Ikf=50m Xtb=1.5 Br=1.426 Nc=2 Isc=0 Ikr=0 Rc=3.75 Cjc=2.77p Mjc=.1416 Vjc=.75 Fc=.5 Cje=2.65p Mje=.3083 Vje=.75 Tr=4.109n Tf=118.5p Itf=.5 Vtf=3 Xtf=6 Rb=10)

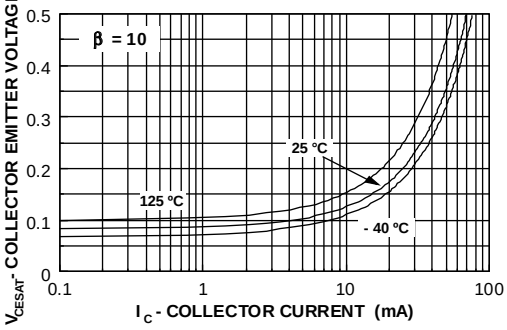
PNP Switching Transistor
(continued)

DC Typical Characteristics

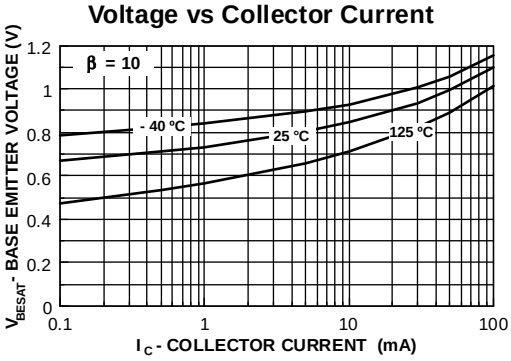
Typical Pulsed Current Gain vs Collector Current



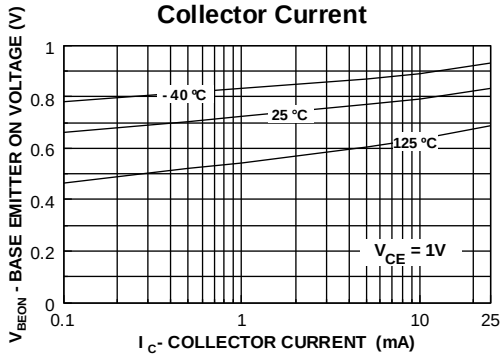
Collector-Emitter Saturation Voltage vs Collector Current



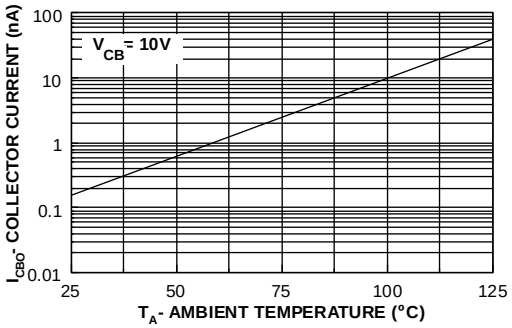
Base-Emitter Saturation Voltage vs Collector Current



Base Emitter ON Voltage vs Collector Current

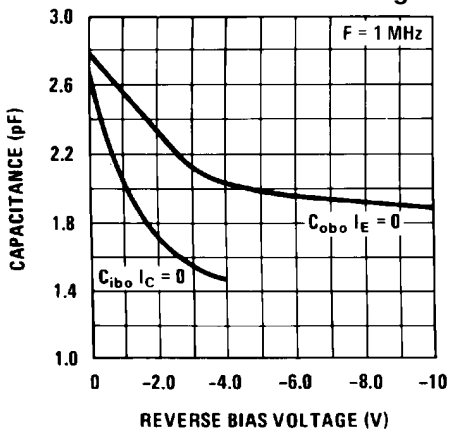


Collector-Cutoff Current vs. Ambient Temperature

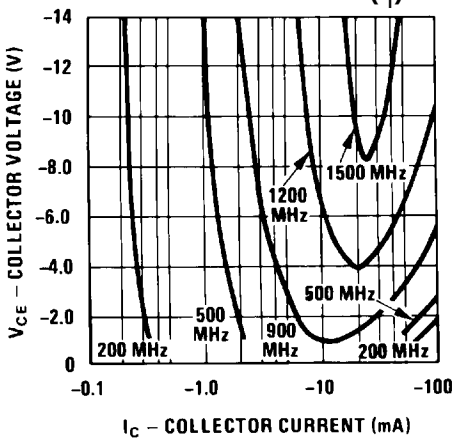


AC Typical Characteristics

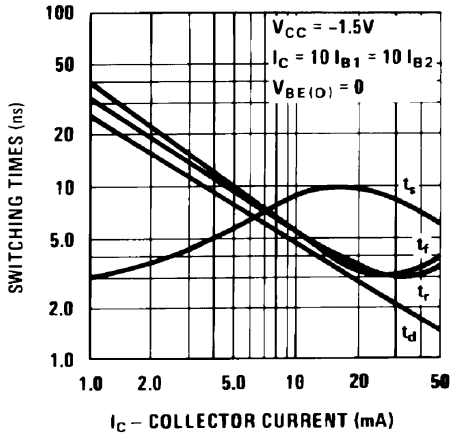
Input / Output Capacitance vs. Reverse Bias Voltage



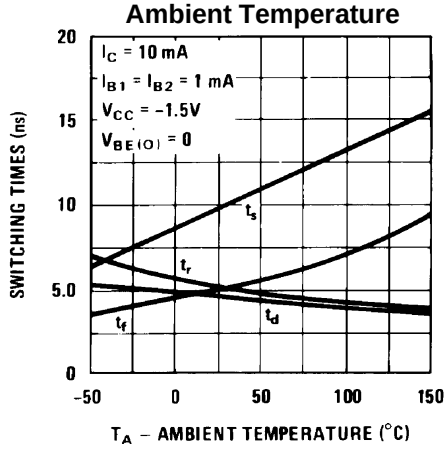
Contours of Constant Gain Bandwidth Product (f_T)



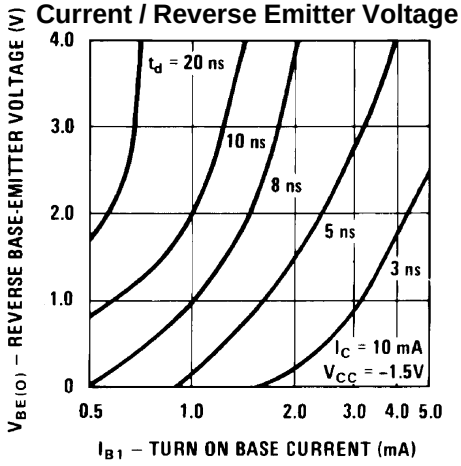
Switching Times vs. Collector Current



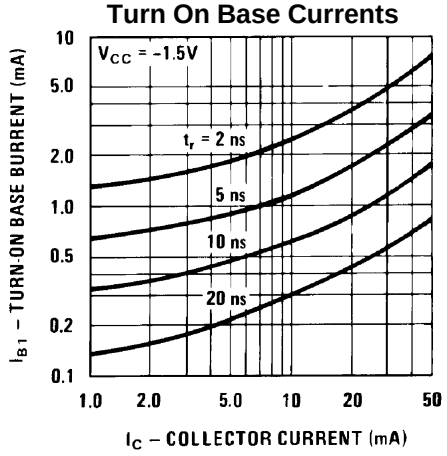
Switching Times vs. Ambient Temperature



Delay Time vs. Turn On Base Current / Reverse Emitter Voltage

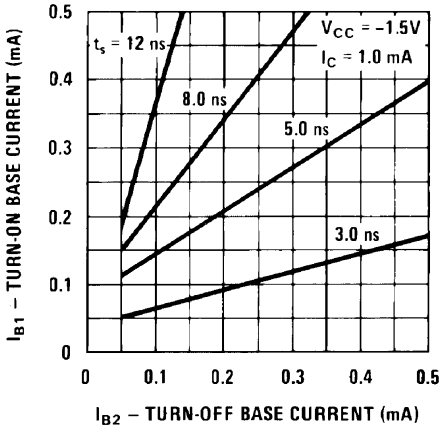


Rise Time vs. Collector and Turn On Base Currents

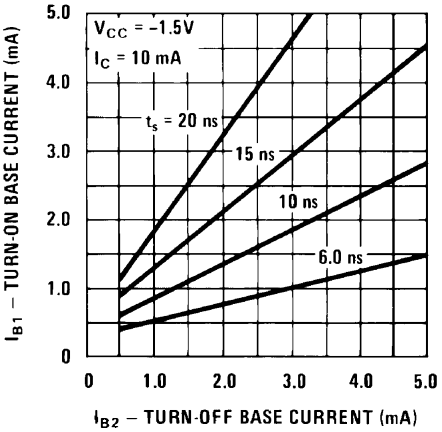


AC Typical Characteristics (continued)

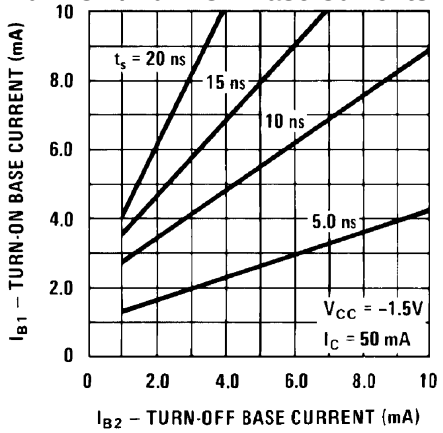
Storage Time vs. Turn On / Turn Off Base Currents



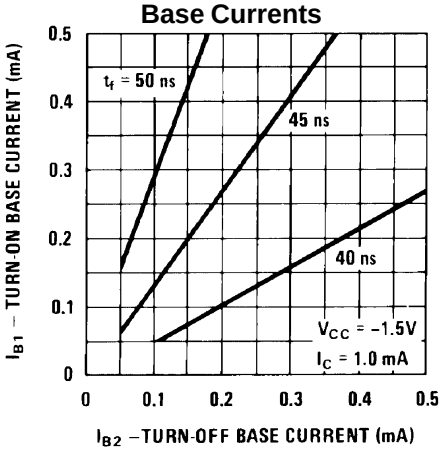
Storage Time vs. Turn On / Turn Off Base Currents



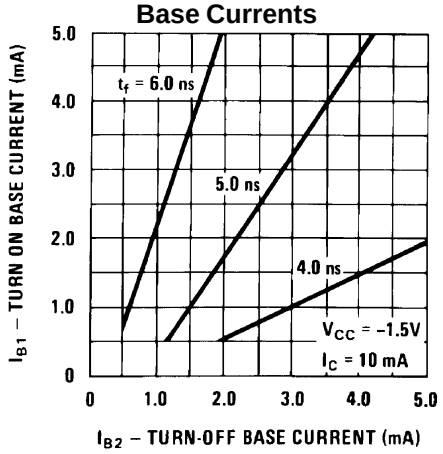
Storage Time vs. Turn On / Turn Off Base Currents



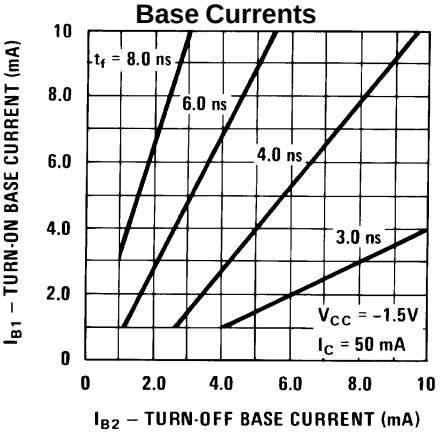
Fall Time vs. Turn On / Turn Off Base Currents



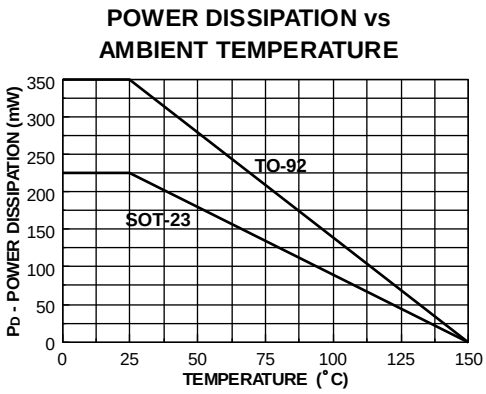
Fall Time vs. Turn On / Turn Off Base Currents



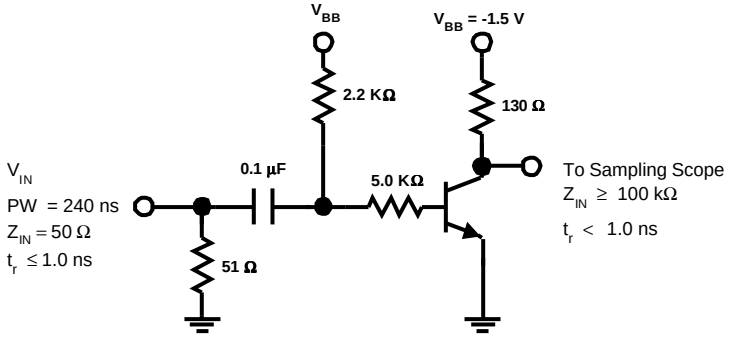
Fall Time vs. Turn On / Turn Off Base Currents



AC Typical Characteristics (continued)



Test Circuit



t_{ON}	t_{OFF}
V_{BB} = ground	V_{BB} = - 8.0 V
V_{IN} = - 5.8 V	V_{IN} = 9.8 V

I_C = 10 mA, I_{B1} = 1.0 mA, I_{B2} = 1.0 mA

FIGURE 1: t_{ON}, t_{OFF} Test Circuit

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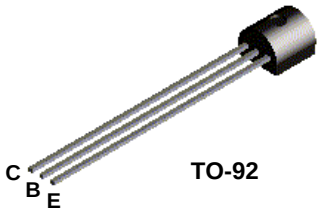
Discrete POWER & Signal Technologies

PN4275



TO-92

NPN Switching Transistor

This device is designed for high speed saturated switching applications at currents to 100 mA. Sourced from Process 21. See PN2369A for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	15	V
V_{CBO}	Collector-Base Voltage	40	V
V_{EBO}	Emitter-Base Voltage	4.5	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
		PN4275	
P_D	Total Device Dissipation Derate above 25°C	350 2.8	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	125	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	357	°C/W

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NPN Switching Transistor
(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 = 10 mA, I_B = 0	15		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	40		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	4.5		V
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	I_C = 10 µA, I_B = 0	40		V
I_B	Base Cutoff Current	V_{CE} = 20 V		0.4	µA
I_{CBO}	Collector Cutoff Current	V_{CB} = 20 V, I_E = 0, T_A = 65 °C		10	µA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	I_C = 10 mA, V_{CE} = 1.0 V I_C = 30 mA, V_{CE} = 0.4 V I_C = 100 mA, V_{CE} = 1.0 V	35 30 18	120	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA I_C = 30 mA, I_B = 3.0 mA I_C = 10 mA, I_B = 3.3 mA I_C = 100 mA, I_B = 10 mA I_C = 10 mA, I_B = 1.0 mA, T_A = 65 °C		0.20 0.25 0.18 0.50 0.30	V V V V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA I_C = 30 mA, I_B = 3.0 mA I_C = 10 mA, I_B = 3.3 mA I_C = 100 mA, I_B = 10 mA	0.72 0.74 	0.85 1.15 1.0 1.6	V V V V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 5.0 V, f = 1.0 MHz		4.0	pF
h_{fe}	Small-Signal Current Gain	I_C = 10 mA, V_{CE} = 10 V, f = 100 MHz	4.0		
SWITCHING CHARACTERISTICS					
t_{on}	Turn-on Time	V_{CC} = 3.0 V, I_C = 10 mA,		12	ns
t_d	Delay Time	I_{B1} = 3.3 mA,		9.0	ns
t_r	Rise Time	$V_{BE\ (off)}$ = -3.0 V		7.0	ns
t_{off}	Turn-off Time	V_{CC} = 3.0 V, I_C = 10 mA		12	ns
t_s	Storage Time	I_{B1} = I_{B2} = 3.3 mA		8.0	ns
t_f	Fall Time	$V_{BE\ (off)}$ = -3.0 V		8.0	ns
t_s	Storage Time	I_C = I_{B1} = I_{B2} = 10 mA		13	ns

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

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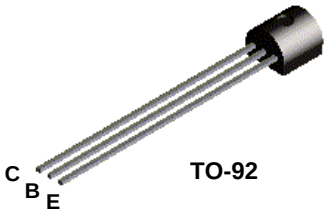
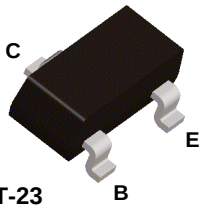
Discrete POWER & Signal Technologies

PN4355



TO-92

MMBT4355



SOT-23
Mark: 81

PNP General Purpose Amplifier

This device is designed for use as a general purpose amplifier and switch requiring collector currents to 500 mA. Sourced from Process 67. See TN4033A for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	60	V
V_{CBO}	Collector-Base Voltage	60	V
V_{EBO}	Emitter-Base Voltage	10	V
I_C	Collector Current - Continuous	800	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
		PN4355	*MMBT4355	
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."

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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 Sustaining Voltage*	I_C = 1.0 mA, I_B = 0	60		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	60		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} = 50 V, I_E = 0		50	nA
I_{EBO}	Emitter-Cutoff Current	V_{EB} = 5.0 V, V_{CE} = 0 V_{EB} = 4.0 V, I_C = 0		10 100	µA nA
ON CHARACTERISTICS					
h_{FE}	DC Current Gain	I_C = 100 µA, V_{CE} = 10 V I_C = 1.0mA, V_{CE} = 10 V I_C = 10 mA, V_{CE} = 10 V I_C = 100 mA, V_{CE} = 10 V I_C = 500 mA, V_{CE} = 10 V	60 75 100 75 75	400	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA I_C = 1.0 A, I_B = 100 mA		0.15 0.50 1.0	V V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA I_C = 1.0 A, I_B = 100 mA		0.9 1.1 1.2	V V V
$V_{BE(on)}$	Base-Emitter On Voltage	I_C = 500 mA, V_{CE} = 0.5 V I_C = 1.0 A, V_{CE} = 1.0 V		1.1 1.2	V V
SMALL SIGNAL CHARACTERISTICS					
C_{obo}	Output Capacitance	V_{CB} = 10 V, I_E = 0, f = 1.0 MHz		30	pF
C_{ibo}	Input Capacitance	V_{EB} = 0.5 V, I_C = 0, f = 1.0 MHz		110	pF
h_{fe}	Small-Signal Current Gain	I_C = 50 mA, V_{CE} = 10 V, f = 100 MHz	1.0	5.0	
NF	Noise Figure	I_C = 100 µA, V_{CE} = 10 V, R_S = 1.0 kΩ, f = 1.0 kHz, BW = 1.0 Hz	1.0	3.0	dB
SWITCHING CHARACTERISTICS					
t_{on}	Turn-On Time	I_C = 500 mA, V_{CC} = 500 mA		100	ns
t_{off}	Turn-Off Time	I_{B1} = I_{B2} = 50 mA		400	ns

*Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 1.0%

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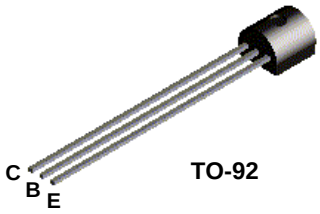
Discrete POWER & Signal Technologies

PN4356



TO-92

PNP General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 500 mA. Sourced from Process 67. See TN4033A for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	80	V
V_{CBO}	Collector-Base Voltage	80	V
V_{EBO}	Emitter-Base Voltage	5.0	V
I_C	Collector Current - Continuous	1.0	A
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
		PN4356	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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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 = 10 mA, I_B = 0	80		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	80		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} = 50 V, I_E = 0 V_{CB} = 50 V, I_E = 0, T_A = 75 °C		50 5.0	nA µA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 5.0 V, I_C = 0 V_{EB} = 4.0 V, I_C = 0		10 100	µA nA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 10 V, I_C = 100 µA V_{CE} = 10 V, I_C = 1.0 mA V_{CE} = 10 V, I_C = 10 mA V_{CE} = 10 V, I_C = 100 mA V_{CE} = 10 V, I_C = 500 mA	25 40 50 40 30	 250 	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA		0.15 0.50	V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 150 mA, I_B = 15 mA I_C = 500 mA, I_B = 50 mA		0.90 1.10	V V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 10 V, f = 1.0 MHz		30	pF
C_{ib}	Input Capacitance	V_{EB} = 0.5 V, f = 1.0 MHz		110	pF
h_{fe}	Small-Signal Current Gain	I_C = 50 mA, V_{CE} = 10 V, f = 100 MHz	1.0	5.0	
NF	Noise Figure	V_{CE} = 10 V, I_C = 100 µA, R_S = 1.0 kΩ, f = 1.0 kHz, B_W = 1.0 Hz		3.0	dB
SWITCHING CHARACTERISTICS					
t_{on}	Turn-on Time	V_{CC} = 30 V, I_C = 500 mA,		100	ns
t_{off}	Turn-off Time	I_{B1} = I_{B2} = 50 mA		400	ns

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

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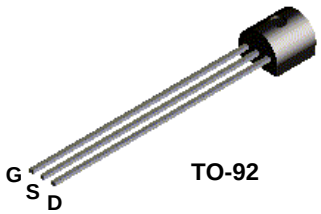
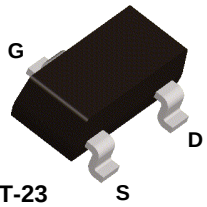
Discrete POWER & Signal Technologies

PN4391 PN4392 PN4393

MMBF4391 MMBF4392 MMBF4393



TO-92



SOT-23
Mark: 6J / 6K / 6G

N-Channel Switch

This device is designed for low level analog switching, sample and hold circuits and chopper stabalized amplifiers. Sourced from Process 51. See J111 for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{DG}	Drain-Gate Voltage	30	V
V_{GS}	Gate-Source Voltage	- 30	V
I_{GF}	Forward Gate Current	50	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
		PN4391	*MMBF4391	
P_D	Total Device Dissipation Derate above 25°C	350 2.8	225 1.8	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	125		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	357	556	°C/W

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

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N-Channel Switch
(continued)

Electrical Characteristics
TA = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions		Min	Max	Units
OFF CHARACTERISTICS						
$V_{(BR)GSS}$	Gate-Source Breakdown Voltage	I_G = 1.0 µA, V_{DS} = 0		- 30		V
I_{GSS}	Gate Reverse Current	V_{GS} = 15 V, V_{DS} = 0			- 1.0	nA
		V_{GS} = 15 V, V_{DS} = 0, T_A = 150°C			- 0.2	µA
$V_{GS(off)}$	Gate-Source Cutoff Voltage	V_{DS} = 20 V, I_D = 1.0 nA	**PN4391**	- 4.0	- 10	V
			PN4392	- 2.0	- 5.0	V
			PN4393	- 0.5	- 3.0	V
$V_{GS(f)}$	Gate-Source Forward Voltage	I_G = 1.0 mA, V_{DS} = 0			1.0	V
$I_{D(off)}$	Drain Cutoff Leakage Current	V_{DS} = 20 V, V_{GS} = 12 V	**PN4391**		0.1	nA
		V_{DS} = 20 V, V_{GS} = 7.0 V	**PN4392**		0.1	nA
		V_{DS} = 20 V, V_{GS} = 5.0 V	**PN4393**		0.1	nA
		V_{DS} = 20 V, V_{GS} = 12 V, T_A = 150°C	**PN4391**		0.2	µA
		V_{DS} = 20 V, V_{GS} = 7.0 V, T_A = 150°C	**PN4392**		0.2	µA
		V_{DS} = 20 V, V_{GS} = 5.0 V, T_A = 150°C	**PN4393**		0.2	µA
ON CHARACTERISTICS						
I_{DSS}	Zero-Gate Voltage Drain Current*	V_{DS} = 20 V, V_{GS} = 0	**PN4391**	50	150	mA
			PN4392	25	75	mA
			PN4393	5.0	30	mA
$V_{DS(on)}$	Drain-Source On Voltage	I_D = 12 mA, V_{GS} = 0	**PN4391**		0.4	V
		I_D = 6.0 mA, V_{GS} = 0	**PN4392**		0.4	V
		I_D = 3.0 mA, V_{GS} = 0	**PN4393**		0.4	V
$r_{DS(on)}$	Drain-Source On Resistance	I_D = 1.0 mA, V_{GS} = 0	**PN4391**		30	Ω
			PN4392		60	Ω
			PN4393		100	Ω
SMALL-SIGNAL CHARACTERISTICS						
$r_{ds(on)}$	Drain-Source On Resistance	V_{DS} = V_{GS} = 0, f= 1.0 kHz	**PN4391**		30	Ω
			PN4392		60	Ω
			PN4393		100	Ω
C_{iss}	Input Capacitance	V_{DS} = 20, V_{GS} = 0, f = 1.0 MHz			14	pF
C_{rss}	Reverse Transfer Capacitance	V_{GS} = 12 V, f = 1.0 MHz	**PN4391**		3.5	pF
		V_{GS} = 7.0 V, f = 1.0 MHz	**PN4392**		3.5	pF
		V_{GS} = 5.0 V, f = 1.0 MHz	**PN4393**		3.5	pF
SWITCHING CHARACTERISTICS						
t_r	Rise Time	$I_{D(on)}$ = 12 mA	**PN4391**		5.0	ns
		$I_{D(on)}$ = 6.0 mA	**PN4392**		5.0	ns
		$I_{D(on)}$ = 3.0 mA	**PN4393**		5.0	ns
t_f	Fall Time	$V_{GS(off)}$ = 12 V	**PN4391**		15	ns
		$V_{GS(off)}$ = 6.0 V	**PN4392**		20	ns
		$V_{GS(off)}$ = 3.0 V	**PN4393**		30	ns
t_{on}	Turn-On Time	$I_{D(on)}$ = 12 mA	**PN4391**		15	ns
		$I_{D(on)}$ = 6.0 mA	**PN4392**		15	ns
		$I_{D(on)}$ = 3.0 mA	**PN4393**		15	ns
t_{off}	Turn-Off Time	$V_{GS(off)}$ = 12 V	**PN4391**		20	ns
		$V_{GS(off)}$ = 6.0 V	**PN4392**		35	ns
		$V_{GS(off)}$ = 3.0 V	**PN4393**		50	ns

*Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 1.0%

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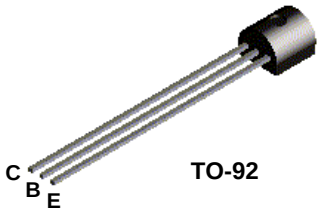
PN4917



TO-92

PNP General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 100 mA. Sourced from Process 66. See 2N3906 for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	30	V
V_{CBO}	Collector-Base Voltage	30	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
		PN4917	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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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 = 10 mA, I_B = 0	30		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	30		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	5.0		V
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	I_C = 10 µA	30		V
I_B	Base Cutoff Current	V_{CE} = 15 V		25	nA
I_{CES}	Collector Cutoff Current	V_{CE} = 15 V V_{CE} = 15 V, T_A = 65 °C		25 25	nA µA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 1.0 V, I_C = 100 µA V_{CE} = 1.0 V, I_C = 1.0 mA V_{CE} = 1.0 V, I_C = 10 mA V_{CE} = 1.0 V, I_C = 50 mA	100 150 150 30	 300 	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 1.0 mA, I_B = 0.1 mA I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA		0.13 0.14 0.30	V V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 1.0 mA, I_B = 0.1 mA I_C = 10 mA, I_B = 1.0 mA I_C = 50 mA, I_B = 5.0 mA	 0.70 0.75	0.75 0.90 1.10	V V V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 10 V, f = 1.0 MHz		4.5	pF
C_{ib}	Input Capacitance	V_{EB} = 0.5 V, f = 1.0 MHz		8.0	pF
h_{fe}	Small-Signal Current Gain	I_C = 10 mA, V_{CE} = 20 V, f = 100 MHz	4.5		
rb'Cc	Collector-Base Time Constant	V_{CE} = 20 V, I_C = 10 mA f = 80 MHz		50	ps
NF	Noise Figure	V_{CE} = 5.0 V, I_C = 1.0 mA, R_S = 100 Ω, f = 100 MHz V_{CE} = 5.0 V, I_C = 100 µA, R_S = 1.0 kΩ		6.0 4.0	dB dB
SWITCHING CHARACTERISTICS					
t_{on}	Turn-on Time	V_{CC} = 10 V, I_C = 50 mA, I_{B1} = 5.0 mA		40	ns
t_d	Delay Time			15	ns
t_r	Rise Time			40	ns
t_{off}	Turn-off Time	V_{CC} = 10 V, I_C = 50 mA I_{B1} = I_{B2} = 5.0 mA		150	ns
t_s	Storage Time			140	ns
t_f	Fall Time			40	ns

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

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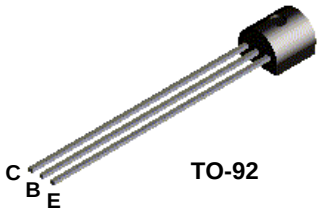
Discrete POWER & Signal Technologies

PN5134



TO-92

PNP General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 300 mA. Sourced from Process 68. See PN200 for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	10	V
V_{CBO}	Collector-Base Voltage	20	V
V_{EBO}	Emitter-Base Voltage	3.5	V
I_C	Collector Current - Continuous	500	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
		PN5134	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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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 = 10 mA, I_B = 0	10		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	20		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	3.5		V
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	I_C = 10 µA	20		V
I_{CBO}	Collector Cutoff Current	V_{CB} = 15 V, I_E = 0, T_A = 65 °C		10	µA
I_{CES}	Collector Cutoff Current	V_{CE} = 15 V, I_C = 0		0.4	µA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 1.0 V, I_C = 10 mA V_{CE} = 0.4 V, I_C = 30 mA	20 15	150	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA I_C = 10 mA, I_B = 3.3 mA		0.25 0.20	V V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA I_C = 10 mA, I_B = 3.3 mA	0.70 0.72	0.9 1.1	V V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 5.0 V, f = 1.0 MHz		4.0	pF
h_{fe}	Small-Signal Current Gain	I_C = 10 mA, V_{CE} = 10 V, f = 100 MHz	2.5		
SWITCHING CHARACTERISTICS					
t_s	Storage Time	$I_C = I_{B1} = I_{B2}$ = 10 mA		18	ns
t_{on}	Turn-on Time	V_{CC} = 3.0 V, I_C = 10 mA,		18	ns
t_d	Delay Time	I_{B1} = 3.3 mA		14	ns
t_r	Rise Time			12	ns
t_{off}	Turn-off Time	V_{CC} = 3.0V, I_C = 10 mA		18	ns
t_s	Storage Time	$I_{B1} = I_{B2}$ = 3.3 mA		13	ns
t_f	Fall Time			13	ns

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

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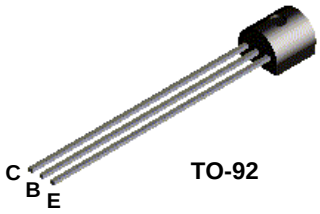
Discrete POWER & Signal Technologies

PN5138



TO-92

PNP General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 300 mA. Sourced from Process 68. See PN200 for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	30	V
V_{CBO}	Collector-Base Voltage	30	V
V_{EBO}	Emitter-Base Voltage	5.0	V
I_C	Collector Current - Continuous	500	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
		PN5138	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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PNP General Purpose Amplifier
(continued)

Electrical Characteristics
TA = 25°C unless otherwise noted

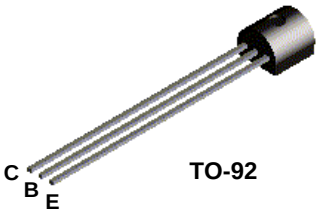
Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHARACTERISTICS					
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage*	I_C = 10 mA, I_B = 0	30		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 100 µA, I_E = 0	30		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 100 µA, I_C = 0	5.0		V
I_{CBO}	Collector Cutoff Current	V_{CB} = 20 V, I_E = 0 V_{CB} = 20 V, I_E = 0, T_A = 65 °C		50 3.0	nA µA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 10 V, I_C = 0.1 µA V_{CE} = 10 V, I_C = 1.0 mA V_{CE} = 10 V, I_C = 10 mA	50 50 50	800	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 0.5 mA		0.3	V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10 mA, I_B = 0.5 mA		1.0	V
$V_{BE(on)}$	Base-Emitter On Voltage	V_{CE} = 10 V, I_C = 10 mA		1.0	V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 5.0 V, f = 1.0 MHz		7.0	pF
C_{ib}	Input Capacitance	V_{EB} = 0.5 V, f = 1.0 MHz		30	pF
h_{fe}	Small-Signal Current Gain	I_C = 1.0 mA, V_{CE} = 10 V, f = 1.0 kHz I_C = 0.5 mA, V_{CE} = 5.0 V, f = 20 MHz	40 1.5	1000	

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

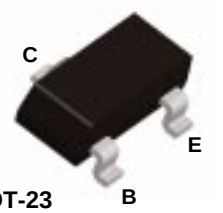
FAIRCHILD SEMICONDUCTOR TM

Discrete POWER & Signal Technologies

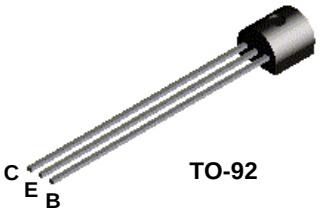
MPS5179 MMBT5179 PN5179



TO-92



SOT-23
Mark: 3C



TO-92

NPN RF Transistor

This device is designed for use in low noise UHF/VHF amplifiers with collector currents in the 100 µA to 30 mA range in common emitter or common base mode of operation, and in low frequency drift, high ouput UHF oscillators. Sourced from Process 40.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	12	V
V_{CBO}	Collector-Base Voltage	20	V
V_{EBO}	Emitter-Base Voltage	2.5	V
I_C	Collector Current - Continuous	50	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
		PN/MPS5179	*MMBT5179	
P_D	Total Device Dissipation Derate above 25°C	350 2.8	225 1.8	mW mW/°C
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	357	556	°C/W

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

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NPN RF Transistor
(continued)

Electrical Characteristics
TA = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHARACTERISTICS					
$V_{CEO(sus)}$	Collector-Emitter Sustaining Voltage*	I_C = 3.0 mA, I_B = 0	12		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 1.0 μA, I_E = 0	20		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 μA, I_C = 0	2.5		V
I_{CBO}	Collector Cutoff Current	V_{CB} = 15 V, I_E = 0 V_{CB} = 15 V, T_A = 150°C		0.02 1.0	μA μA
ON CHARACTERISTICS					
h_{FE}	DC Current Gain	I_C = 3.0 mA, V_{CE} = 1.0 V	25	250	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA		0.4	V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA		1.0	V
SMALL SIGNAL CHARACTERISTICS					
f_T	Current Gain - Bandwidth Product	I_C = 5.0 mA, V_{CE} = 6.0 V, f = 100 MHz	900	2000	MHz
C_{cb}	Collector-Base Capacitance	V_{CB} = 10 V, I_E = 0, f = 0.1 to 1.0 MHz		1.0	pF
h_{fe}	Small-Signal Current Gain	I_C = 2.0 mA, V_{CE} = 6.0 V, f = 1.0 kHz	25	300	
$rb'C_c$	Collector Base Time Constant	I_C = 2.0 mA, V_{CB} = 6.0 V, f = 31.9 MHz	3.0	14	ps
NF	Noise Figure	I_C = 1.5 mA, V_{CE} = 6.0 V, R_S = 50Ω, f = 200 MHz		5.0	dB
FUNCTIONAL TEST					
G_{pe}	Amplifier Power Gain	V_{CE} = 6.0 V, I_C = 5.0 mA, f = 200 MHz	15		dB
P_O	Power Output	V_{CB} = 10 V, I_E = 12 mA, f ≥ 500 MHz	20		mW

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

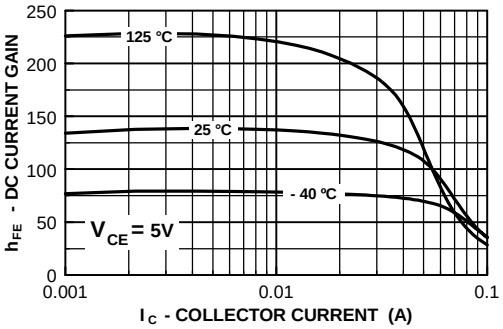
Spice Model

NPN (Is=69.28E-18 Xti=3 Eg=1.11 Vaf=100 Bf=282.1 Ne=1.177 Ise=69.28E-18 Ikf=22.03m Xtb=1.5 Br=1.176 Nc=2 Isc=0 Ikr=0 Rc=4 Cjc=1.042p Mjc=.2468 Vjc=.75 Fc=.5 Cje=1.52p Mje=.3223 Vje=.75 Tr=1.588n Tf=135.6p Itf=.27 Vtf=10 Xtf=30 Rb=10)

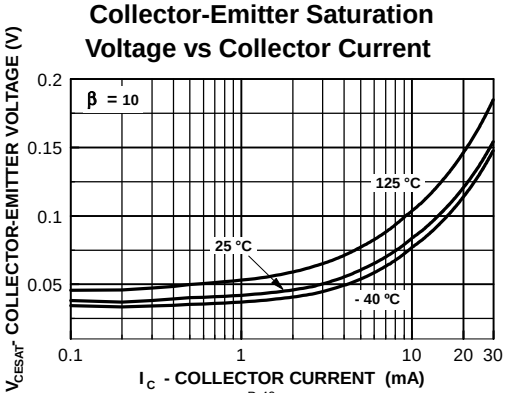
NPN RF Transistor
(continued)

DC Typical Characteristics

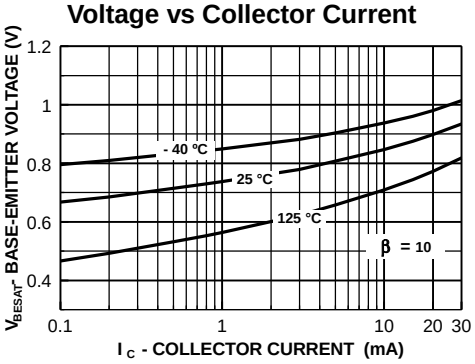
DC Current Gain vs Collector Current



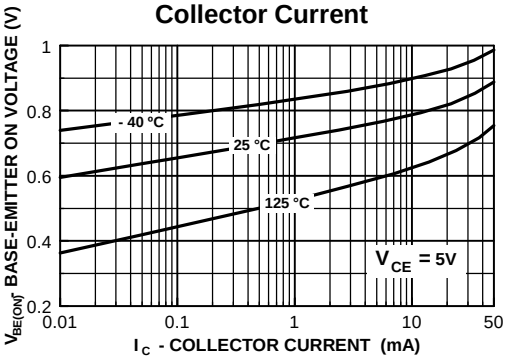
Collector-Emitter Saturation Voltage vs Collector Current



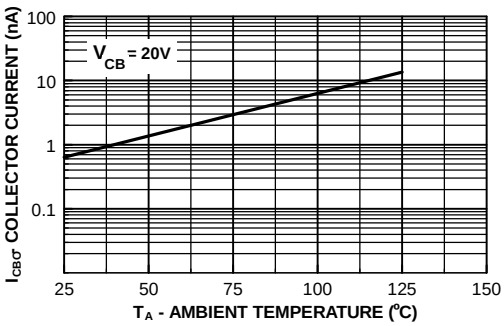
Base-Emitter Saturation Voltage vs Collector Current



Base-Emitter ON Voltage vs Collector Current

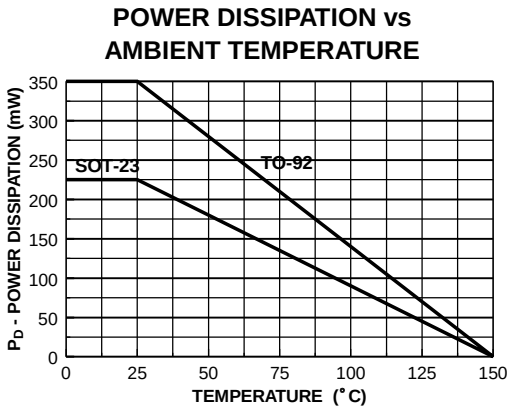


Collector-Cutoff Current vs Ambient Temperature



NPN RF Transistor
(continued)

AC Typical Characteristics



Test Circuit

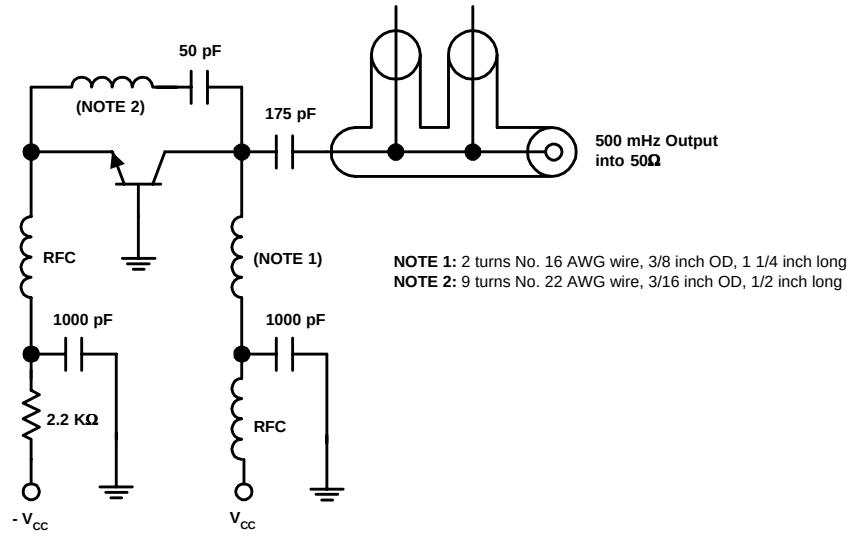
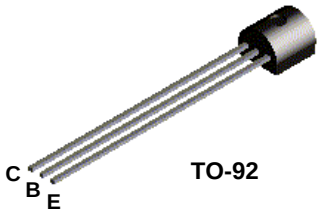


FIGURE 1: 500 MHz Oscillator Circuit

FAIRCHILD SEMICONDUCTOR™

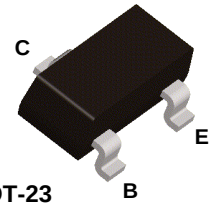
Discrete POWER & Signal Technologies

PN918



TO-92

MMBT918



SOT-23
Mark: 3B

NPN RF Transistor

This device is designed for use as RF amplifiers, oscillators and multipliers with collector currents in the 1.0 mA to 30 mA range. Sourced from Process 43.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	15	V
V_{CBO}	Collector-Base Voltage	30	V
V_{EBO}	Emitter-Base Voltage	3.0	V
I_C	Collector Current - Continuous	50	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
		PN918	*MMBT918	
P_D	Total Device Dissipation Derate above 25°C	350 2.8	225 1.8	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	125		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	357	556	°C/W

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

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NPN RF Transistor
(continued)

Electrical Characteristics
TA = 25°C unless otherwise noted

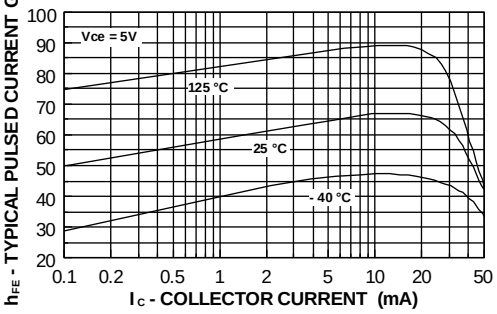
Symbol	Parameter	Test Conditions	Min	Max	Units
OFF CHARACTERISTICS					
$V_{CEO(sus)}$	Collector-Emitter Sustaining Voltage*	I_C = 3.0 mA, I_B = 0	15		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 1.0 µA, I_E = 0	30		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 µA, I_C = 0	3.0		V
I_{CBO}	Collector Cutoff Current	V_{CB} = 15 V, I_E = 0 V_{CB} = 15 V, T_A = 150°C		0.01 1.0	µA µA
ON CHARACTERISTICS					
h_{FE}	DC Current Gain	I_C = 3.0 mA, V_{CE} = 1.0 V	20		
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA		0.4	V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10 mA, I_B = 1.0 mA		1.0	V
SMALL SIGNAL CHARACTERISTICS					
f_T	Current Gain - Bandwidth Product	I_C = 4.0 mA, V_{CE} = 10 V, f = 100 MHz	600		MHz
C_{obo}	Output Capacitance	V_{CB} = 10 V, I_E = 0, f = 1.0 MHz V_{CB} = 0, I_E = 0, f = 1.0 MHz		1.7 3.0	pF pF
C_{ibo}	Input Capacitance	V_{BE} = 0.5 V, I_C = 0, f = 1.0 MHz		2.0	pF
NF	Noise Figure	I_C = 1.0 mA, V_{CE} = 6.0 V, R_G = 400Ω, f = 60 MHz		6.0	dB
FUNCTIONAL TEST					
G_{pe}	Amplifier Power Gain	V_{CB} = 12 V, I_C = 6.0 mA, f = 200 MHz	15		dB
P_O	Power Output	V_{CB} = 15 V, I_C = 8.0 mA, f = 500 MHz	30		mW
η	Collector Efficiency	V_{CB} = 15 V, I_C = 8.0 mA, f = 500 MHz	25		%

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

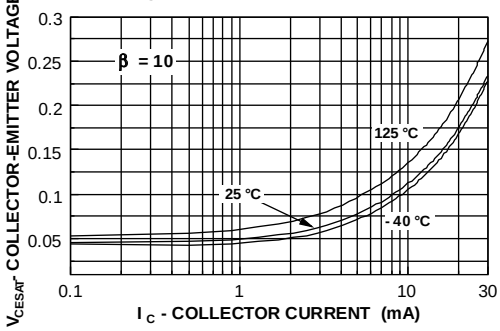
NPN RF Transistor
(continued)

DC Typical Characteristics

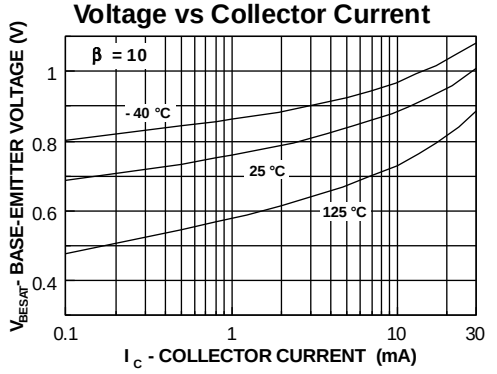
Typical Pulsed Current Gain vs Collector Current



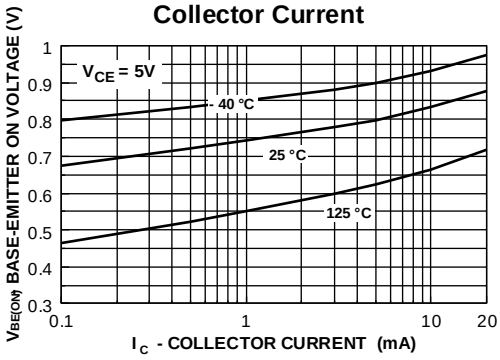
Collector-Emitter Saturation Voltage vs Collector Current



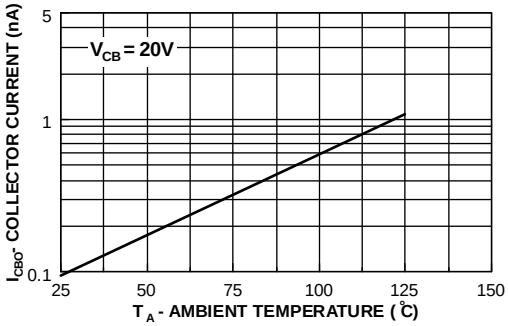
Base-Emitter Saturation Voltage vs Collector Current



Base-Emitter ON Voltage vs Collector Current



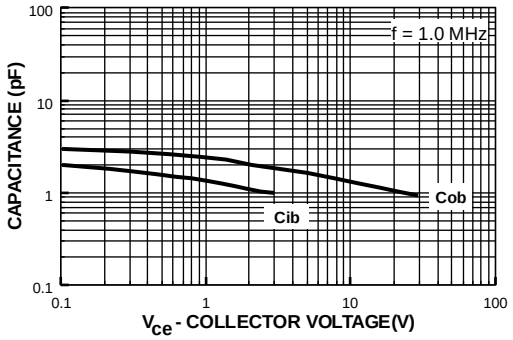
Collector-Cutoff Current vs Ambient Temperature



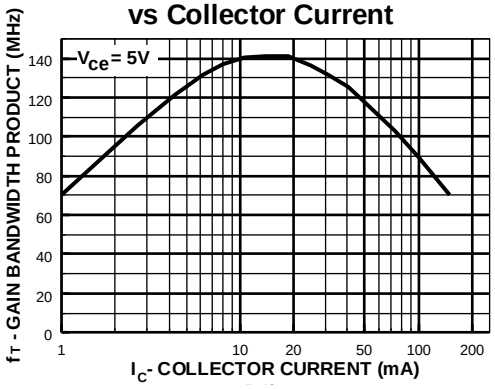
NPN RF Transistor
(continued)

AC Typical Characteristics

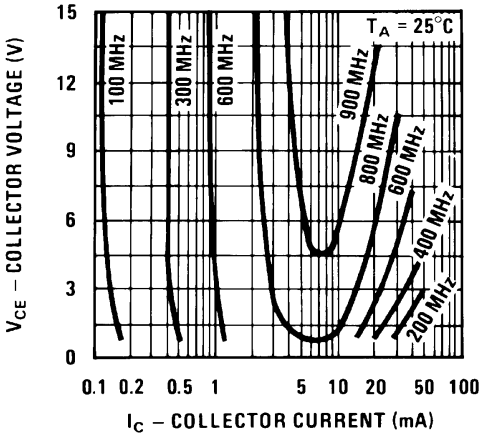
Input and Output Capacitance vs Reverse Voltage



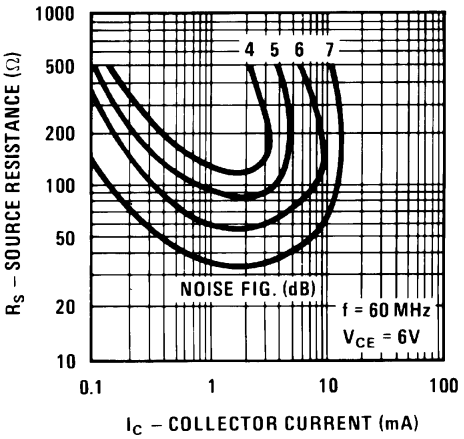
Gain Bandwidth Product vs Collector Current



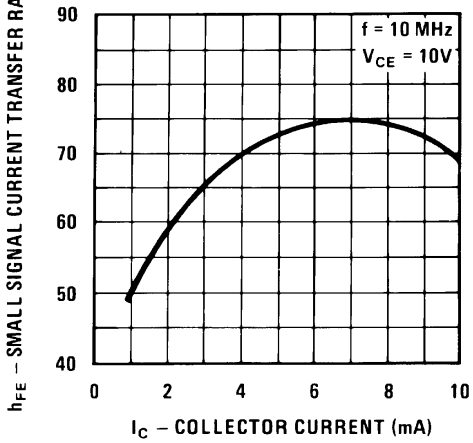
Contours of Constant Gain Bandwidth Product (f_T)



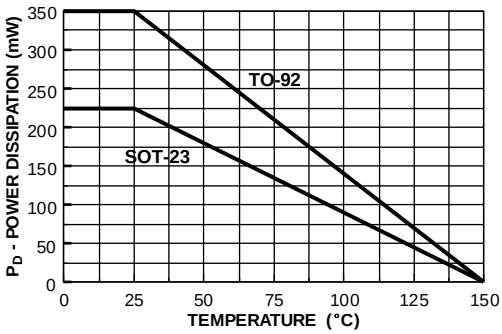
Contours of Constant Noise Figure



Small Signal Current Gain vs. Collector Current



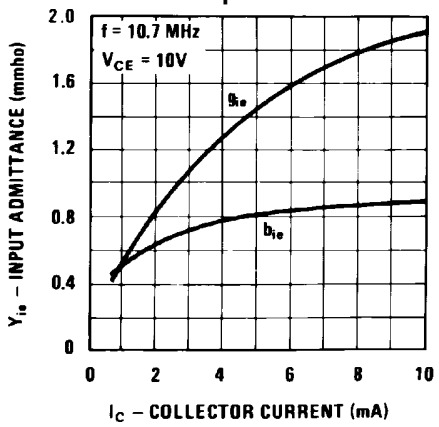
POWER DISSIPATION vs AMBIENT TEMPERATURE



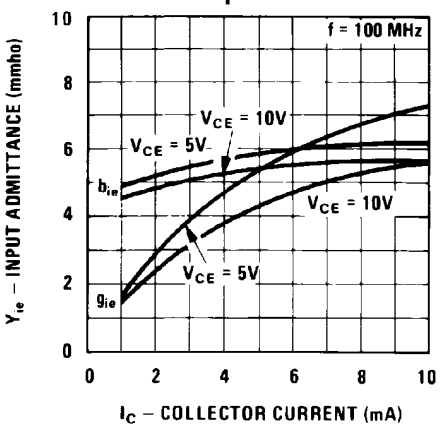
NPN RF Transistor
(continued)

Common Emitter Y Parameters vs. Frequency

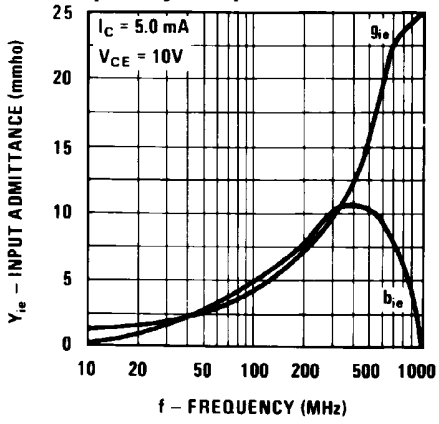
Input Admittance vs. Collector Current-Output Short Circuit



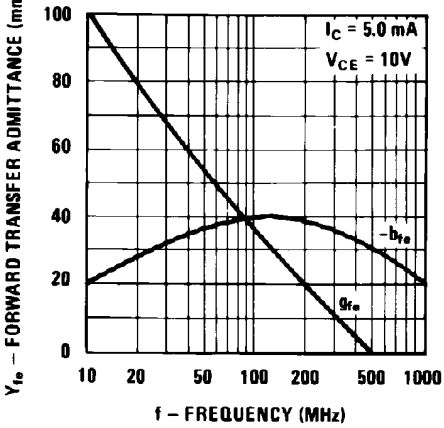
Input Admittance vs. Collector Current-Output Short Circuit



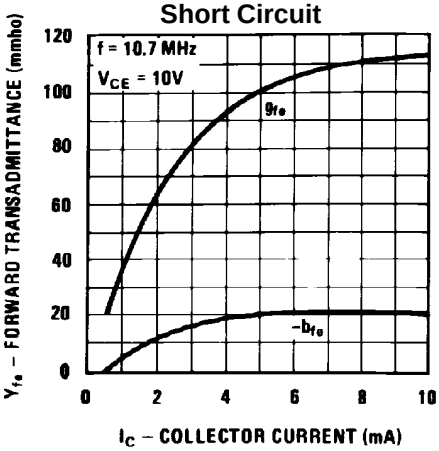
Input Admittance vs. Frequency-Output Short Circuit



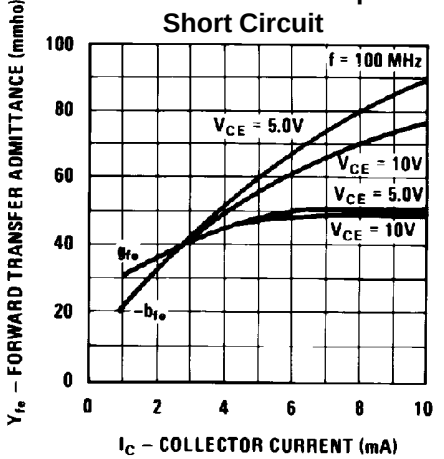
Forward Transfer Admittance vs. Frequency-Output Open Circuit



Forward Transfer Admittance vs. Collector Current-Output Short Circuit

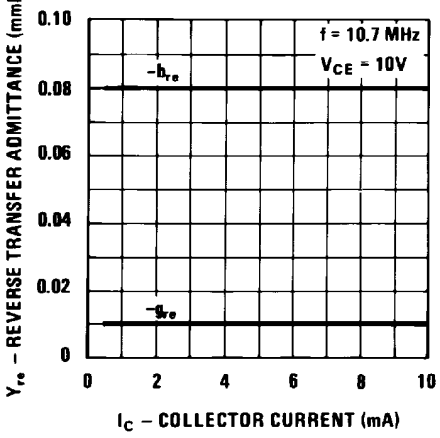


Forward Transfer Admittance vs. Collector Current-Output Short Circuit

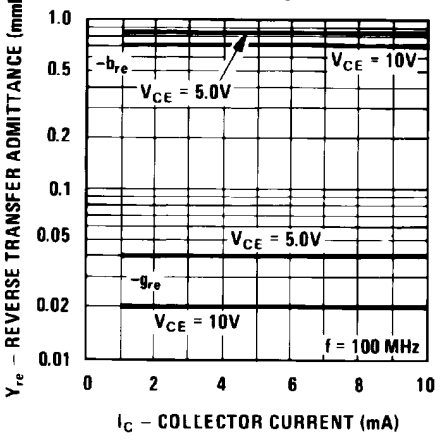


Common Emitter Y Parameters vs. Frequency (continued)

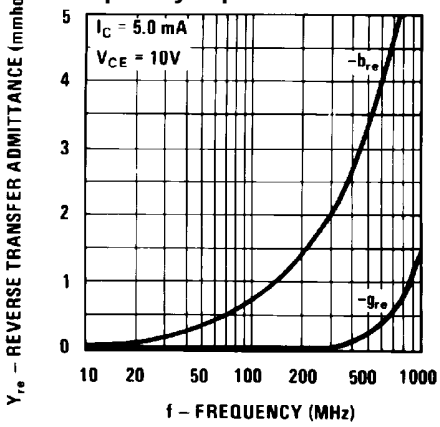
Reverse Transfer Admittance vs. Collector Current-Input Short Circuit



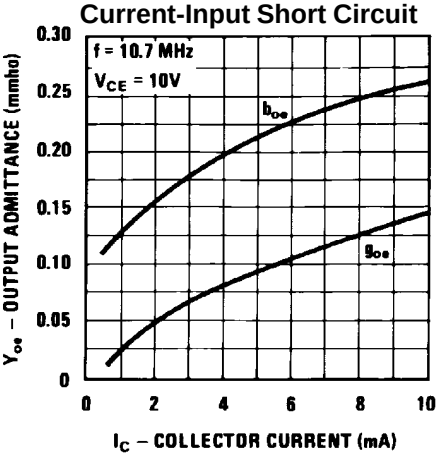
Reverse Transfer Admittance vs. Collector Current-Input Short Circuit



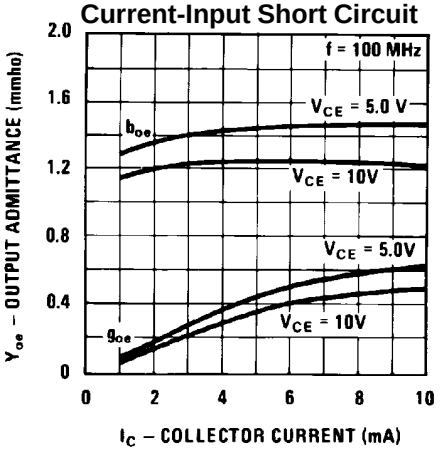
Reverse Transfer Admittance vs. Frequency-Input Short Circuit



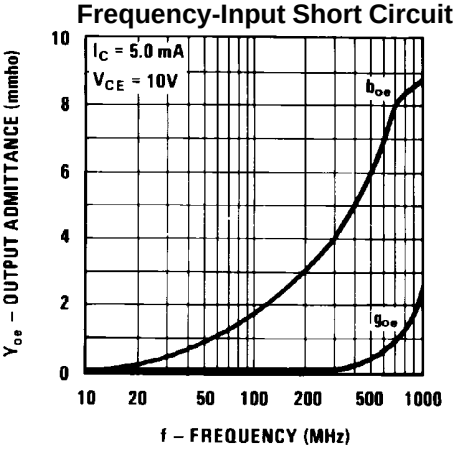
Output Admittance vs. Collector Current-Input Short Circuit



Output Admittance vs. Collector Current-Input Short Circuit



Output Admittance vs. Frequency-Input Short Circuit



NPN RF Transistor
(continued)

Test Circuit

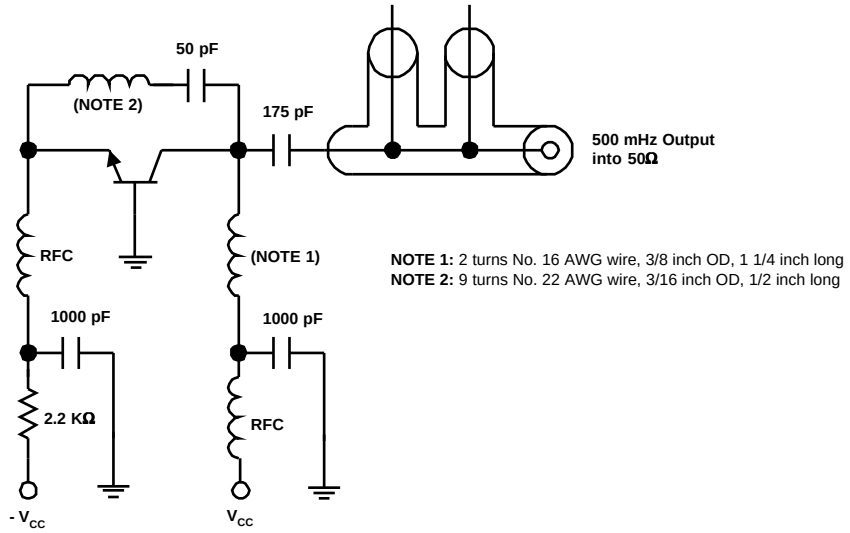
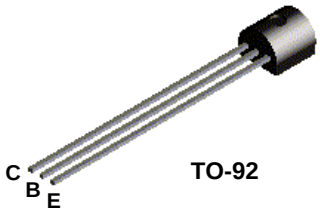


FIGURE 1: 500 MHz Oscillator Circuit

FAIRCHILD SEMICONDUCTOR TM

Discrete POWER & Signal Technologies

PN930



TO-92

NPN General Purpose Amplifier

This device is designed for low noise, high gain, general purpose applications at collector currents from 1µ to 50 mA. Sourced from Process 07. See 2N5088 for characteristics.

Absolute Maximum Ratings*

TA = 25°C unless otherwise noted

Symbol	Parameter	Value	Units
V_{CEO}	Collector-Emitter Voltage	45	V
V_{CBO}	Collector-Base Voltage	45	V
V_{EBO}	Emitter-Base Voltage	5.0	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
		PN930	
P_D	Total Device Dissipation Derate above 25°C	625 5.0	mW mW/°C
$R_{\theta JC}$	Thermal Resistance, Junction to Case	83.3	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	200	°C/W

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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 = 10 mA, I_B = 0	45		V
$V_{(BR)CBO}$	Collector-Base Breakdown Voltage	I_C = 10 µA, I_E = 0	45		V
$V_{(BR)EBO}$	Emitter-Base Breakdown Voltage	I_E = 10 nA, I_C = 0	5.0		V
I_{CEO}	Collector Cutoff Current	V_{CE} = 5.0 V		2.0	nA
I_{CBO}	Collector Cutoff Current	V_{CB} = 45 V, I_E = 0		10	nA
I_{CES}	Collector Cutoff Current	V_{CE} = 45 V, I_E = 0 V_{CE} = 45 V, I_E = 0, T_A = 170 °C		10 10	nA µA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 5.0 V, I_C = 0		10	nA
ON CHARACTERISTICS*					
h_{FE}	DC Current Gain	V_{CE} = 5.0 V, I_C = 10 µA V_{CE} = 5.0 V, I_C = 10 µA, T = – 55 °C V_{CE} = 5.0 V, I_C = 500 µA V_{CE} = 5.0 V, I_C = 10 mA	100 20 150	300 600	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_C = 10 mA, I_B = 0.5 mA		1.0	V
$V_{BE(sat)}$	Base-Emitter Saturation Voltage	I_C = 10 mA, I_B = 0.5 mA	0.6	1.0	V
SMALL SIGNAL CHARACTERISTICS					
C_{ob}	Output Capacitance	V_{CB} = 5.0 V, f = 1.0 MHz		8.0	pF
h_{fe}	Small-Signal Current Gain	I_C = 500 µA, V_{CE} = 5.0 V, f = 20 MHz I_C = 1.0 mA, V_{CE} = 5.0 V, f = 1.0 kHz	1.5 150	 600	
h_{ib}	Input Impedance	I_C = 1.0 mA, V_{CE} = 5.0 V, f = 1.0 kHz	25	32	Ω
h_{rb}	Voltage Feedback Ratio			600	$x10^{-6}$
h_{ob}	Output Admittance			1.0	µmho
NF	Noise Figure	V_{CE} = 5.0 V, I_C = 10 µA, R_g = 10 kΩ, B_W = 15.7 kHz		3.0	dB

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