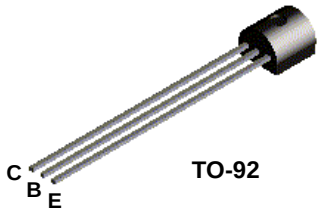
FAIRCHILD
SEMICONDUCTOR TM

# 2N3905




TO-92

## PNP General Purpose Amplifier

This device is designed for use as general purpose amplifiers and switches requiring collector currents to 100 mA.

### 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 |
|---|---|---|---|
| | | **2N3905** | |
| $P_D$ | Total Device Dissipation<br>Derate above 25°C | 625<br>5.0 | mW<br>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 |

## PNP General Purpose Amplifier
(continued)

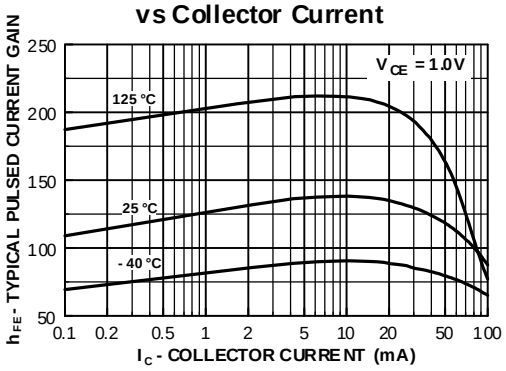
### Electrical Characteristics
TA = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Max | Units |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage* | $I_C$ = 1.0 mA, $I_B$ = 0 | 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 |
| $I_{CEX}$ | Collector Cutoff Current | $V_{CE}$ = 30 V, $V_{OB}$ = 3.0 V | | 50 | nA |
| $I_{BL}$ | Base Cutoff Current | $V_{CE}$ = 30 V, $V_{OB}$ = 3.0 V | | 50 | nA |
| **ON CHARACTERISTICS*** | | | | | |
| $h_{FE}$ | DC Current Gain | $V_{CE}$ = 1.0 V, $I_C$ = 0.1 mA<br>$V_{CE}$ = 1.0 V, $I_C$ = 1.0 mA<br>$V_{CE}$ = 1.0 V, $I_C$ = 10 mA<br>$V_{CE}$ = 1.0 V, $I_C$ = 50 mA<br>$V_{CE}$ = 1.0 V, $I_C$ = 100 mA | 30<br>40<br>50<br>30<br>15 | <br><br>150<br><br> | |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_C$ = 10 mA, $I_B$ = 1.0 mA<br>$I_C$ = 50 mA, $I_B$ = 5.0 mA | | 0.25<br>0.40 | V<br>V |
| $V_{BE(sat)}$ | Base-Emitter Saturation Voltage | $I_C$ = 10 mA, $I_B$ = 1.0 mA<br>$I_C$ = 50 mA, $I_B$ = 5.0 mA | 0.65 | 0.85<br>0.95 | V<br>V |
| **SMALL SIGNAL CHARACTERISTICS** | | | | | |
| $C_{ob}$ | Output Capacitance | $V_{CB}$ = 5.0 V, f = 1.0 MHz | | 4.5 | pF |
| $C_{ib}$ | Input Capacitance | $V_{EB}$ = 0.5 V, f = 1.0 MHz | | 10 | pF |
| $h_{fe}$ | Small-Signal Current Gain | $I_C$ = 10 mA, $V_{CE}$ = 20 V, f = 100 MHz | 2.0 | | |
| $h_{fe}$ | Small-Signal Current Gain | $I_C$ = 1.0 mA, $V_{CE}$ =10 V, f = 1.0 KHz | 50 | 200 | |
| $h_{re}$ | Voltage Feedback Ratio | | 0.1 | 5.0 | x10 $^{-4}$ |
| $h_{ie}$ | Input Impedance | | 0.5 | 8.0 | kΩ |
| $h_{oe}$ | Output Impedance | | 1.0 | 40 | µmhos |
| NF | Noise Figure | $V_{CE}$ = 5.0 V, $I_C$ = 100 µA, $R_S$ = 1.0 kΩ, $B_W$ = 10 Hz to 15.7 KHz | | 5.0 | dB |
| **SWITCHING CHARACTERISTICS** | | | | | |
| $t_d$ | Delay Time | $V_{CC}$ = 3.0 V, $I_{CS}$ = 10 mA, $I_{B1}$ = 1.0 mA ,$V_{OB\,(off)}$ = 3.0 V | | 35 | ns |
| $t_r$ | Rise Time | | | 35 | ns |
| $t_s$ | Storage Time | $V_{CC}$ = 3.0 V, $I_{CS}$ = 10 mA, $I_{B1}$ = $I_{B2}$ = 1.0 mA | | 200 | ns |
| $t_f$ | Fall Time | | | 60 | ns |

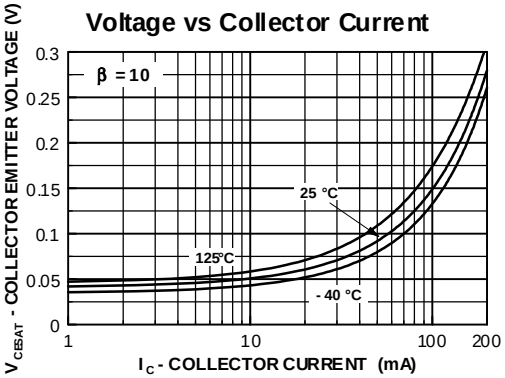
*Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2.0%

## Typical Characteristics

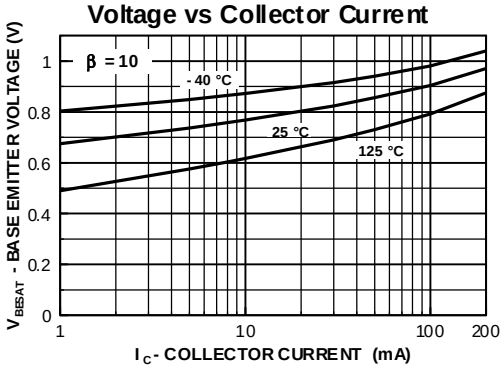
**Typical Pulsed Current Gain vs Collector Current**



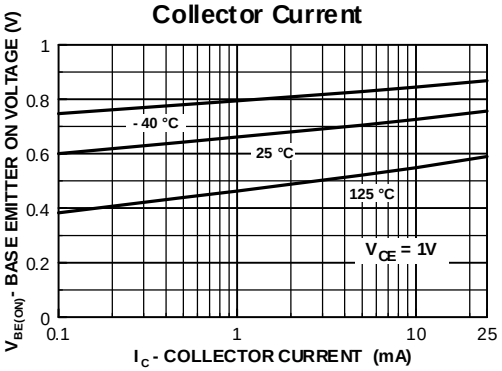

**Collector-Emitter Saturation Voltage vs Collector Current**



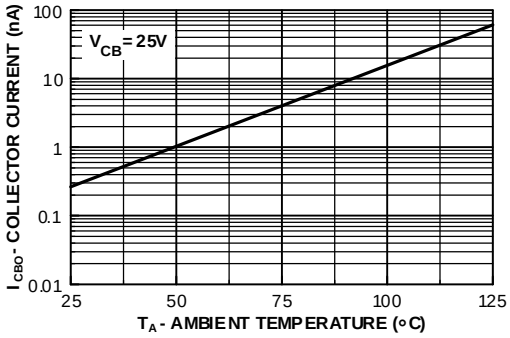

**Base-Emitter Saturation Voltage vs Collector Current**



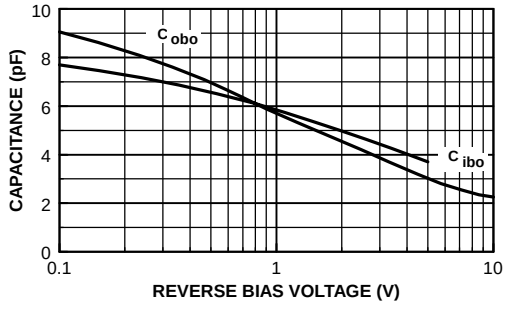

**Base Emitter ON Voltage vs Collector Current**




**Collector-Cutoff Current vs Ambient Temperature**

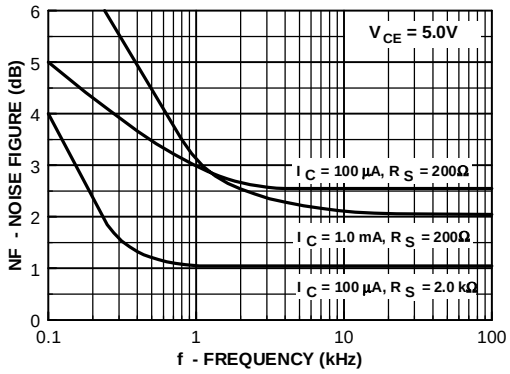



**Common-Base Open Circuit Input and Output Capacitance vs Reverse Bias Voltage**

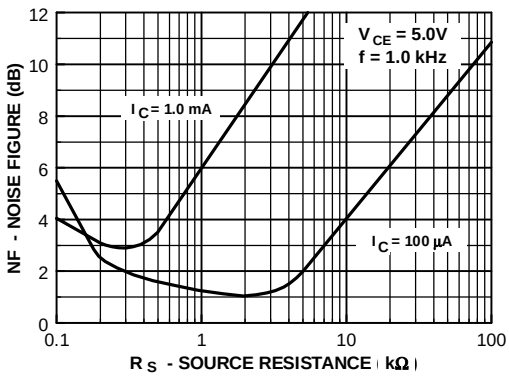


## Typical Characteristics (continued)

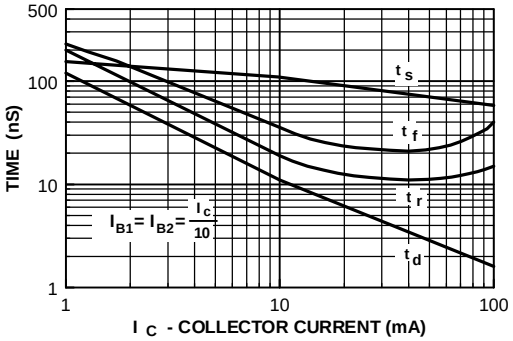
### Noise Figure vs Frequency



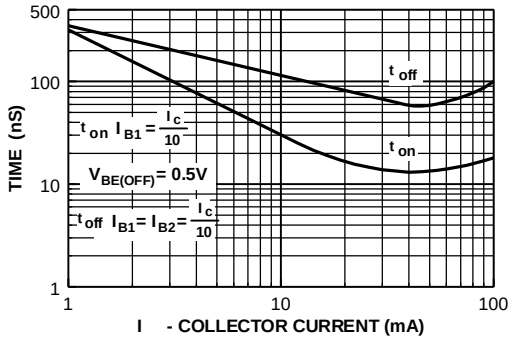

### Noise Figure vs Source Resistance



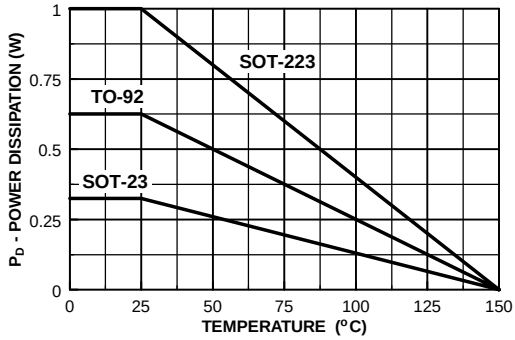

### Switching Times vs Collector Current




### Turn On and Turn Off Times vs Collector Current

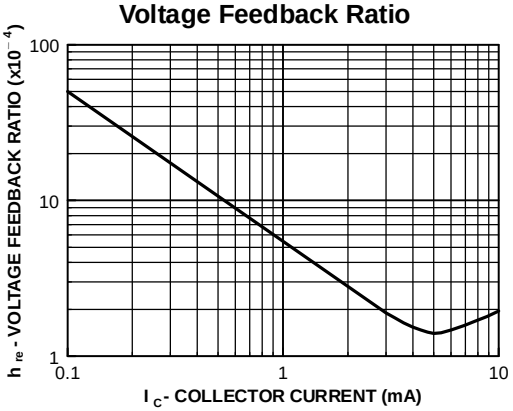



### Power Dissipation vs Ambient Temperature

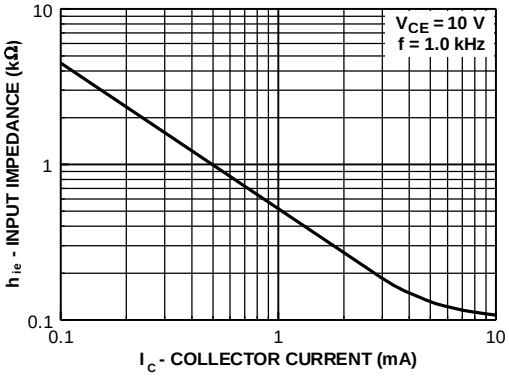


## Typical Characteristics (continued)

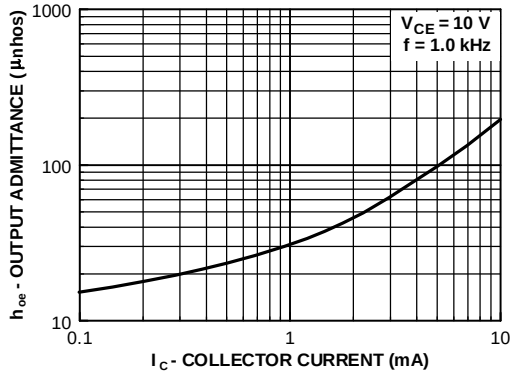
### Voltage Feedback Ratio



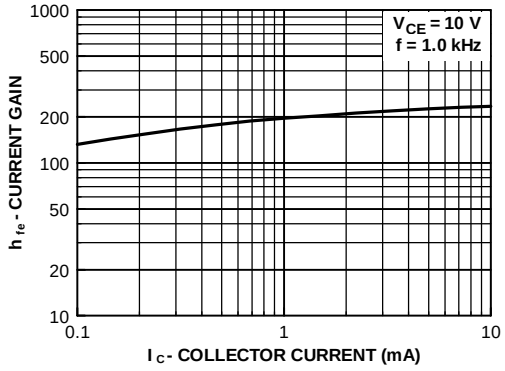

### Input Impedance




### Output Admittance




### Current Gain



## TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACEx™
Bottomless™
CoolFET™
*CROSSVOLT*™
DOME™
$E^2CMOS^{TM}$
EnSigna™
FACT™
FACT Quiet Series™
FAST®
FASTr™
GlobalOptoisolator™
GTO™
HiSeC™
ISOPLANAR™
MICROWIRE™
OPTOLOGIC™
OPTOPLANAR™
PACMAN™
POP™
PowerTrench®
QFET™
QS™
QT Optoelectronics™
Quiet Series™
SILENT SWITCHER®
SMART START™
SuperSOT™-3
SuperSOT™-6
SuperSOT™-8
SyncFET™
TinyLogic™
UHC™
VCX™

## DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

## LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.
As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

## PRODUCT STATUS DEFINITIONS

### 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. |
| 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. |