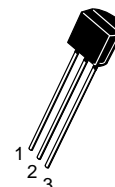
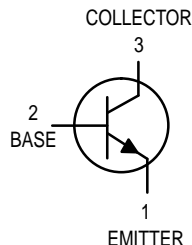


Amplifier Transistors

NPN Silicon

2N5209
2N5210



CASE 29-04, STYLE 1
TO-92 (TO-226AA)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	V_{CEO}	50	Vdc
Collector–Base Voltage	V_{CBO}	50	Vdc
Emitter–Base Voltage	V_{EBO}	4.0	Vdc
Collector Current — Continuous	I_C	50	mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	625 5.0	mW mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	1.5 12	Watts mW/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–55 to +150	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	200	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	83.3	$^\circ\text{C/W}$

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage ($I_C = 1.0$ mAdc, $I_E = 0$)	$V_{(BR)CEO}$	50	—	Vdc
Collector–Base Breakdown Voltage ($I_C = 0.1$ mAdc, $I_E = 0$)	$V_{(BR)CBO}$	50	—	Vdc
Collector Cutoff Current ($V_{CB} = 35$ Vdc, $I_E = 0$)	I_{CBO}	—	50	nAdc
Emitter Cutoff Current ($V_{EB} = 3.0$ Vdc, $I_C = 0$)	I_{EBO}	—	50	nAdc

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted) (Continued)

Characteristic	Symbol	Min	Max	Unit
ON CHARACTERISTICS				
DC Current Gain ($I_C = 100\ \mu\text{Adc}$, $V_{CE} = 5.0\ \text{Vdc}$)	h_{FE}	2N5209 2N5210	100 200	300 600
($I_C = 1.0\ \text{mAdc}$, $V_{CE} = 5.0\ \text{Vdc}$)		2N5209 2N5210	150 250	— —
($I_C = 10\ \text{mAdc}$, $V_{CE} = 5.0\ \text{Vdc}$) ⁽¹⁾		2N5209 2N5210	150 250	— —
Collector–Emitter Saturation Voltage ($I_C = 10\ \text{mAdc}$, $I_B = 1.0\ \text{mAdc}$)	$V_{CE(sat)}$	—	0.7	Vdc
Base–Emitter On Voltage ($I_C = 1.0\ \text{mAdc}$, $V_{CE} = 5.0\ \text{mAdc}$)	$V_{BE(on)}$	—	0.85	Vdc

SMALL–SIGNAL CHARACTERISTICS

Current–Gain — Bandwidth Product ($I_C = 500\ \mu\text{Adc}$, $V_{CE} = 5.0\ \text{Vdc}$, $f = 20\ \text{MHz}$)	f_T	30	—	MHz
Collector–Base Capacitance ($V_{CB} = 5.0\ \text{Vdc}$, $I_E = 0$, $f = 1.0\ \text{MHz}$)	C_{cb}	—	4.0	pF
Small–Signal Current Gain ($I_C = 1.0\ \text{mAdc}$, $V_{CE} = 5.0\ \text{Vdc}$, $f = 1.0\ \text{kHz}$)	h_{fe}	2N5209 2N5210	150 250	600 900
Noise Figure ($I_C = 20\ \mu\text{Adc}$, $V_{CE} = 5.0\ \text{Vdc}$, $R_S = 22\ \text{k}\Omega$, $f = 1.0\ \text{kHz}$)	NF	2N5209 2N5210	— —	3.0 2.0
($I_C = 20\ \mu\text{Adc}$, $V_{CE} = 5.0\ \text{Vdc}$, $R_S = 10\ \text{k}\Omega$, $f = 1.0\ \text{kHz}$)		2N5209 2N5210	— —	4.0 3.0

1. Pulse Test: Pulse Width = 300 μs , Duty Cycle = 2.0%.

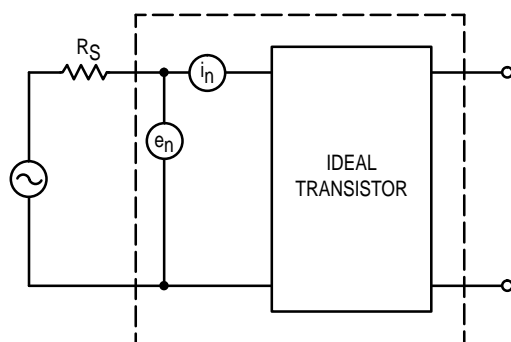


Figure 1. Transistor Noise Model

NOISE CHARACTERISTICS

 $(V_{CE} = 5.0 \text{ Vdc}, T_A = 25^\circ\text{C})$

NOISE VOLTAGE

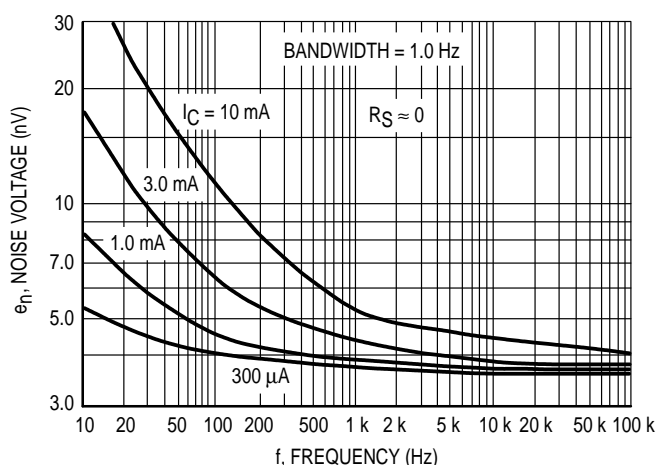


Figure 2. Effects of Frequency

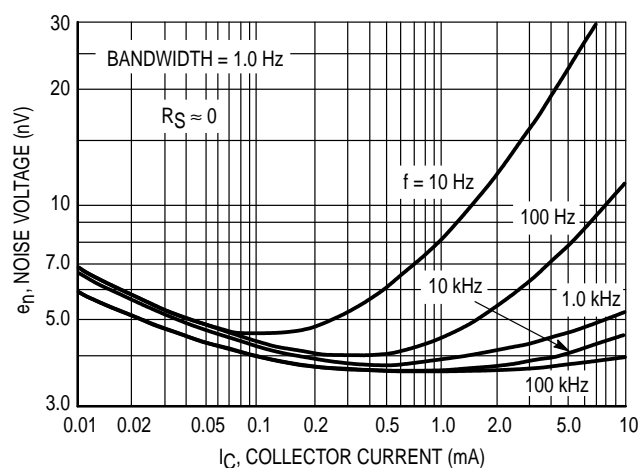


Figure 3. Effects of Collector Current

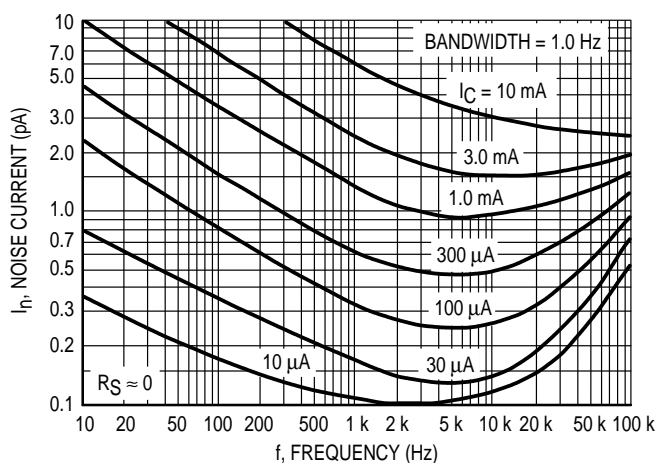


Figure 4. Noise Current

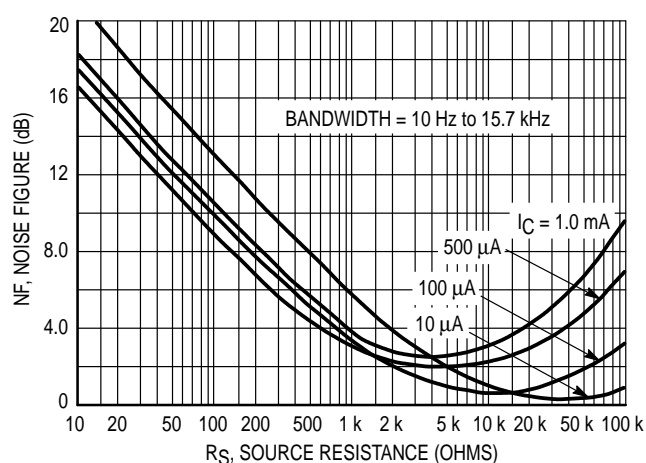


Figure 5. Wideband Noise Figure

100 Hz NOISE DATA

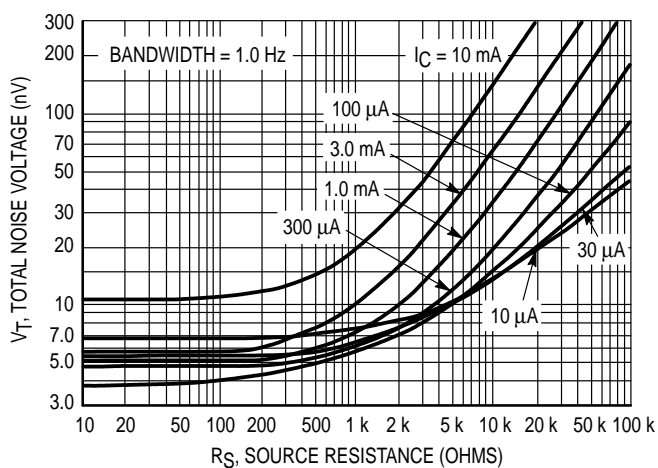


Figure 6. Total Noise Voltage

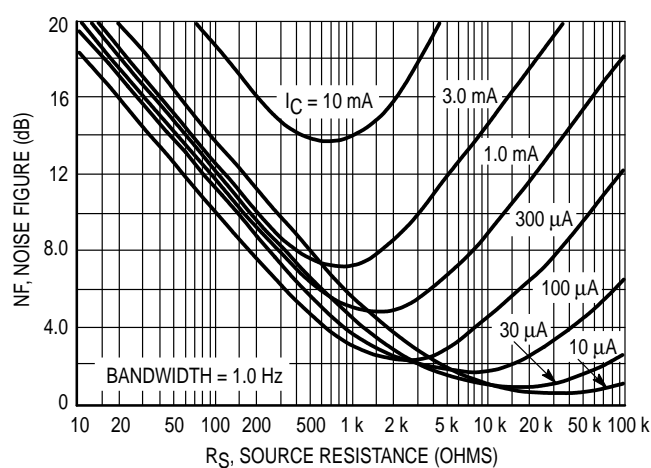


Figure 7. Noise Figure

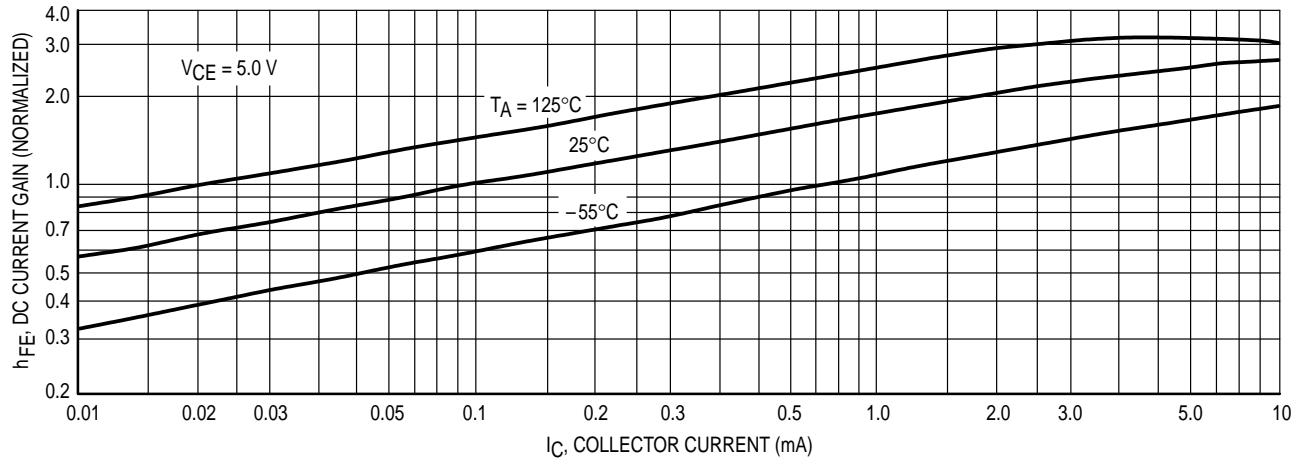


Figure 8. DC Current Gain

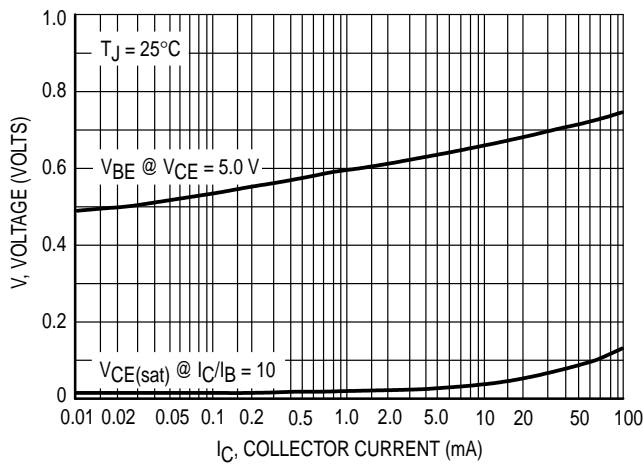


Figure 9. "On" Voltages

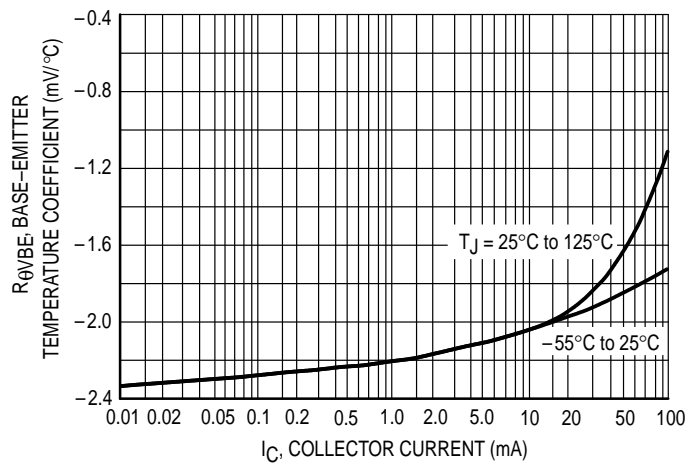


Figure 10. Temperature Coefficients

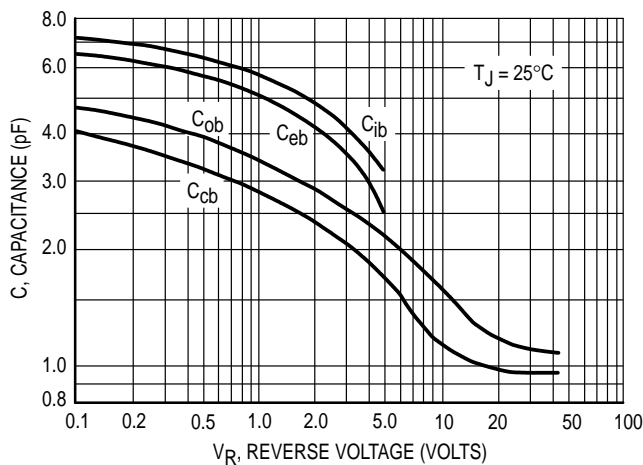


Figure 11. Capacitance

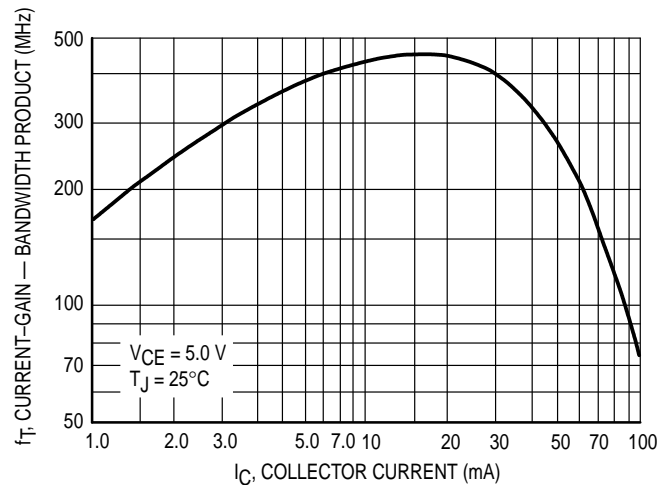
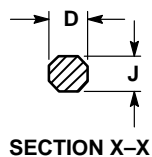
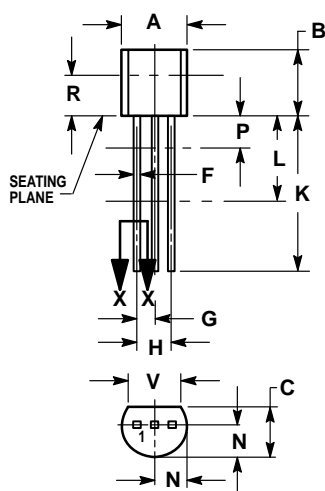


Figure 12. Current-Gain — Bandwidth Product

PACKAGE DIMENSIONS



SECTION X-X

**CASE 029-04
(TO-226AA)
ISSUE AD**


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. DIMENSION F APPLIES BETWEEN P AND L. DIMENSION D AND J APPLY BETWEEN L AND K. MINIMUM LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.022	0.41	0.55
F	0.016	0.019	0.41	0.48
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	—	12.70	—
L	0.250	—	6.35	—
N	0.080	0.105	2.04	2.66
P	—	0.100	—	2.54
R	0.115	—	2.93	—
V	0.135	—	3.43	—

STYLE 1:

1. PIN 1. EMITTER
2. BASE
3. COLLECTOR

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