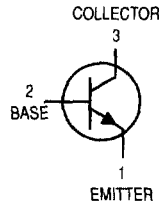


**Amplifier Transistors**  
NPN Silicon

**2N5209**  
**2N5210**



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

**MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CE0}$	50	Vdc
Collector-Base Voltage	$V_{CB0}$	50	Vdc
Emitter-Base Voltage	$V_{EB0}$	4.0	Vdc
Collector Current — Continuous	$I_C$	50	mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	625 5.0	mW mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	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	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	83.3	$^\circ\text{C}/\text{W}$

**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, $I_B = 0$ )	$V_{(BR)CE0}$	50	—	Vdc
Collector-Base Breakdown Voltage ( $I_C = 0.1$ mAdc, $I_E = 0$ )	$V_{(BR)CB0}$	50	—	Vdc
Collector Cutoff Current ( $V_{CB} = 35$ Vdc, $I_E = 0$ )	$I_{CB0}$	—	50	nAdc
Emitter Cutoff Current ( $V_{EB} = 3.0$ Vdc, $I_C = 0$ )	$I_{EB0}$	—	50	nAdc

## 2N5209 2N5210

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

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

### SMALL–SIGNAL CHARACTERISTICS

Current–Gain — Bandwidth Product ( $I_C = 500\ \mu\text{A}$ , $V_{CE} = 5.0\ \text{Vdc}$ , $f = 20\ \text{MHz}$ )	$f_T$	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 ( $I_C = 1.0\ \text{mA}$ , $V_{CE} = 5.0\ \text{Vdc}$ , $f = 1.0\ \text{kHz}$ )	$h_{fe}$	150	600	—
	2N5209	250	900	
	2N5210			
Noise Figure ( $I_C = 20\ \mu\text{A}$ , $V_{CE} = 5.0\ \text{Vdc}$ , $R_S = 22\ \text{k}\Omega$ , $f = 1.0\ \text{kHz}$ )	NF	—	3.0	dB
	2N5209	—	2.0	
	2N5210	—	4.0	
	2N5210	—	3.0	

1. Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle = 2.0%.

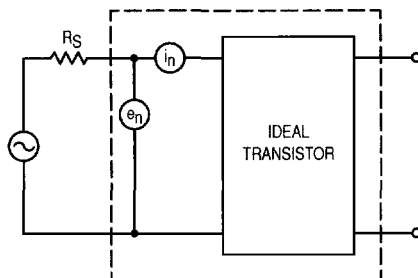


Figure 1. Transistor Noise Model

**NOISE CHARACTERISTICS**

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

**NOISE VOLTAGE**

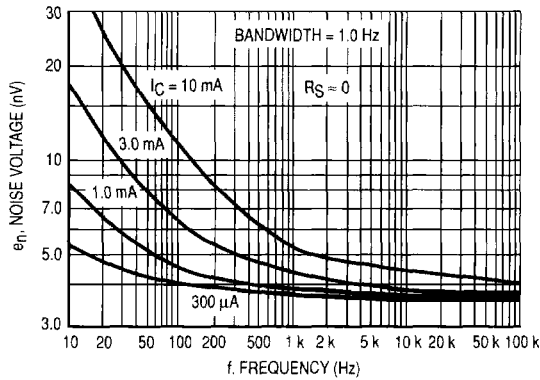


Figure 2. Effects of Frequency

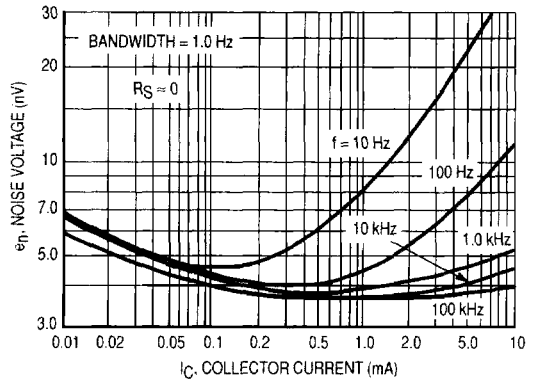


Figure 3. Effects of Collector Current

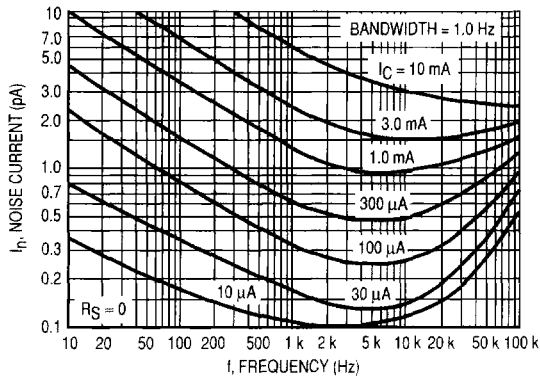


Figure 4. Noise Current

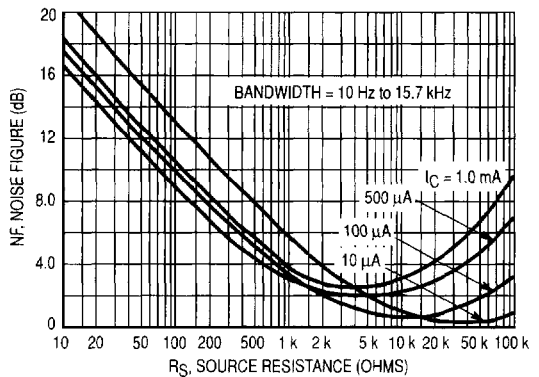


Figure 5. Wideband Noise Figure

**100 Hz NOISE DATA**

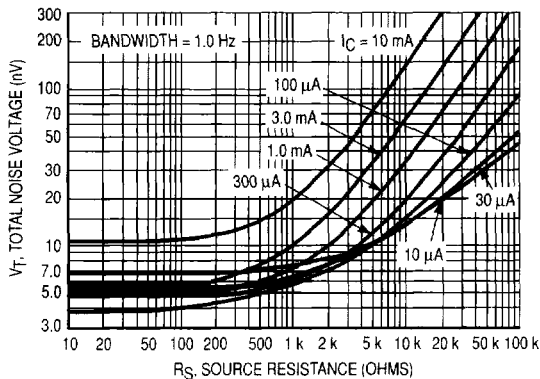


Figure 6. Total Noise Voltage

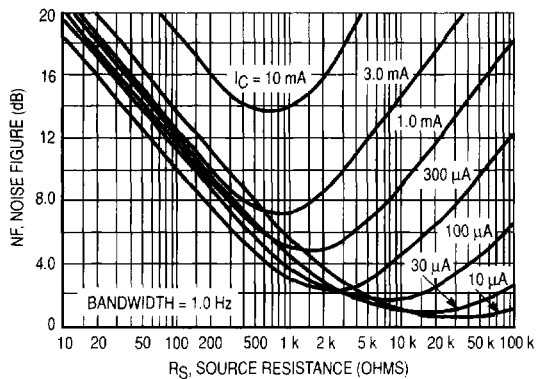


Figure 7. Noise Figure

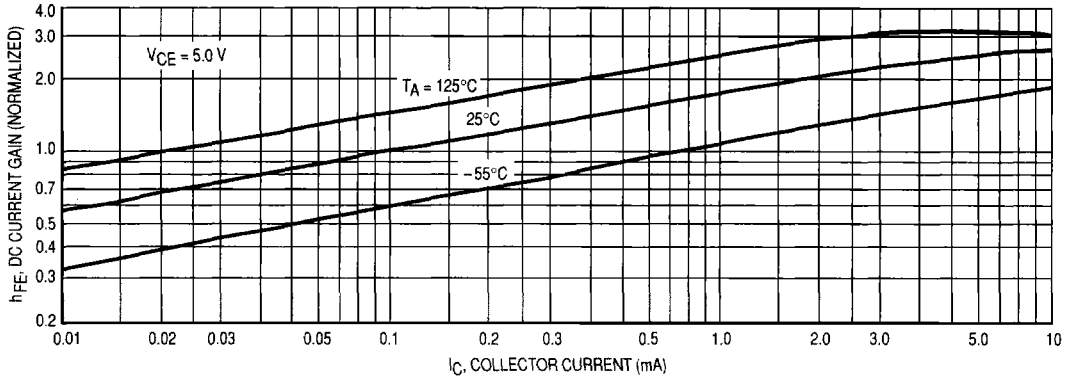


Figure 8. DC Current Gain

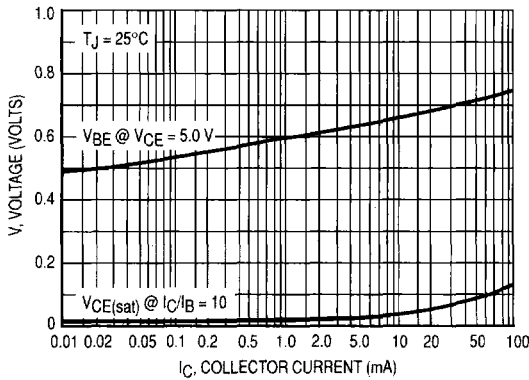


Figure 9. "On" Voltages

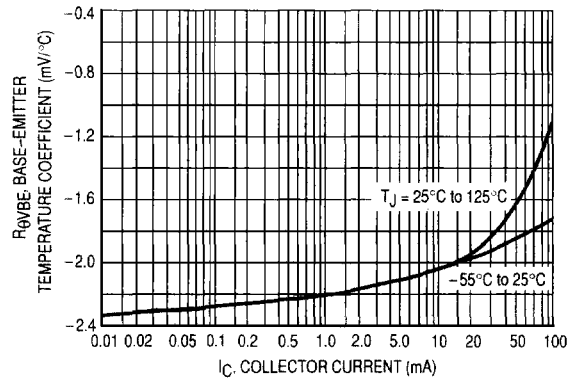


Figure 10. Temperature Coefficients

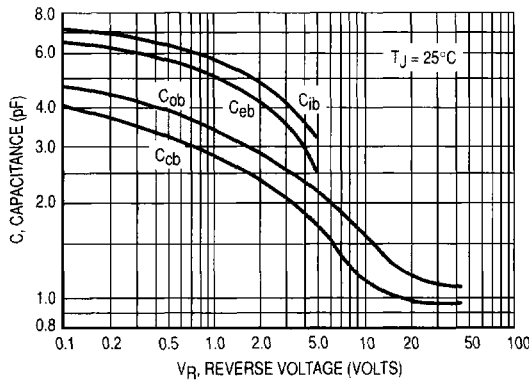


Figure 11. Capacitance

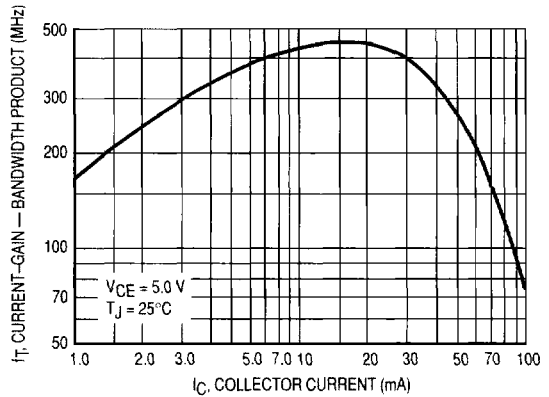


Figure 12. Current-Gain — Bandwidth Product