2N6604

The RF Line

NF = 2.7 dB @ 1.0 GHz

HIGH FREQUENCY TRANSISTOR

NPN SILICON

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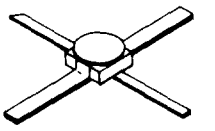
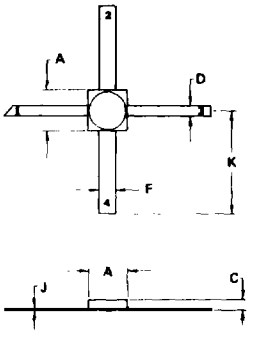
NPN SILICON HIGH FREQUENCY TRANSISTOR

. . . designed for use in high-frequency, low-noise, small-signal, narrow and wideband amplifiers. Ideal for use in microstrip thin and thick film applications.

- Low Noise Figure – NF = 2.7 dB (Typ) @ f = 1.0 GHz
- High Power Gain – G_U(max) = 16 dB (Typ) @ f = 1.0 GHz
- High Current – Specified Performance @ I_C = 30 mA
- Ion Implantation and Gold Metallization
- Metal/Ceramic Hermetic Package
- JAN, JTXV Available





STYLE 1
PIN 1 COLLECTOR
2 EMITTER
3 BASE
4 EMITTER

NOTE
1. DIMENSION "K" APPLIES TO ALL LEADS.
2. DIRECTION OF 45° CUT ON PIN 1 IS VENDOR OPTION.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	2.29	2.67	0.090	0.105
C	0.89	1.40	0.035	0.055
D	0.41	0.61	0.016	0.024
F	0.89	1.09	0.035	0.043
J	0.08	0.15	0.003	0.006
K	4.45	5.84	0.175	0.230

CASE 303-01

***MAXIMUM RATINGS (T_A = 25°C Free Air Temperature)**

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	15	Vdc
Collector-Base Voltage	V_{CBO}	25	Vdc
Emitter-Base Voltage	V_{EBO}	3.0	Vdc
Collector Current–Continuous	I_C	50	mAdc
Total Device Dissipation @ T_C = 125°C Derate Above 75°C	P_D	500 6.66	mW mW/°C
Storage Temperature Range	T_{stg}	-65 to +200	°C

*Indicates JEDEC Registered Data.

Specifications and Package Options

Devices using the same die type as the 2N6604:

MRF911 – 4 Lead Plastic Macro-T Case 302-01
MRF914 – TO-72
MMBR930 – MiniBloc Plastic (SOT-23) TO-236
BFR91 – 3 Lead Plastic Macro-T Case 302A-01
BFRC91 – Unencapsulated Chip

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ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
***OFF CHARACTERISTICS**					
Collector-Emitter Breakdown Voltage (I_C = 1.0 mAdc, I_B = 0)	$V_{(BR)CEO}$	15	–	–	Vdc
Collector-Base Breakdown Voltage (I_C = 0.1 mAdc, I_E = 0)	$V_{(BR)CBO}$	25	–	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 0.1 mAdc, I_C = 0)	$V_{(BR)EBO}$	3.0	–	–	Vdc
Collector Cutoff Current (V_{CB} = 15 Vdc, I_E = 0)	I_{CBO}	–	–	50	nAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 30 mAdc, V_{CE} = 10 Vdc)	h_{FE}	30	–	200	–
***DYNAMIC CHARACTERISTICS**					
Collector-Base Capacitance (1) (V_{CB} = 10 Vdc, I_E = 0, 0.1 MHz ≤ f ≤ 1.0 MHz)	C_{cb}	0.30	–	0.80	pF
***FUNCTIONAL TEST**					
Common-Emitter Amplifier Power Gain (Figure 2) (V_{CE} = 10 Vdc, I_C = 30 mAdc, f = 1.0 GHz)	G_{pe}	15	–	21	dB
Spot Noise Figure (R_S = Optimum – Figure 2) (V_{CE} = 10 Vdc, I_C = 5.0 mAdc, f = 1.0 GHz)	NF	1.5	–	3.0	dB
Power Gain at Optimum Noise Figure (V_{CE} = 10 Vdc, I_C = 5.0 mAdc, f = 1.0 GHz)	G_{NF}	9.0	–	–	dB
TYPICAL 2 GHz PERFORMANCE					
Maximum Unilateral Gain (Figure 2) (2) (V_{CE} = 10 Vdc, I_C = 30 mAdc, f = 2.0 GHz)	$G_U(max)$	–	10	–	dB
Noise Figure (R_S = Optimum – Figure 2) (V_{CE} = 10 Vdc, I_C = 5.0 mAdc, f = 2.0 GHz)	NF	–	4.3	–	dB

*Indicates JEDEC Registered Data.

(1) C_{cb} measurement employs a three-terminal capacitance bridge incorporating a guard circuit. The emitter terminal shall be connected to the guard terminal of the bridge.

(2) $G_U(max)$ is calculated from the S Parameters using the equation $G_U(max) = \frac{|S_{21}|^2}{(1-|S_{11}|^2)(1-|S_{22}|^2)}$

FIGURE 1 – BLOCK DIAGRAM FOR POWER GAIN AND NOISE FIGURE

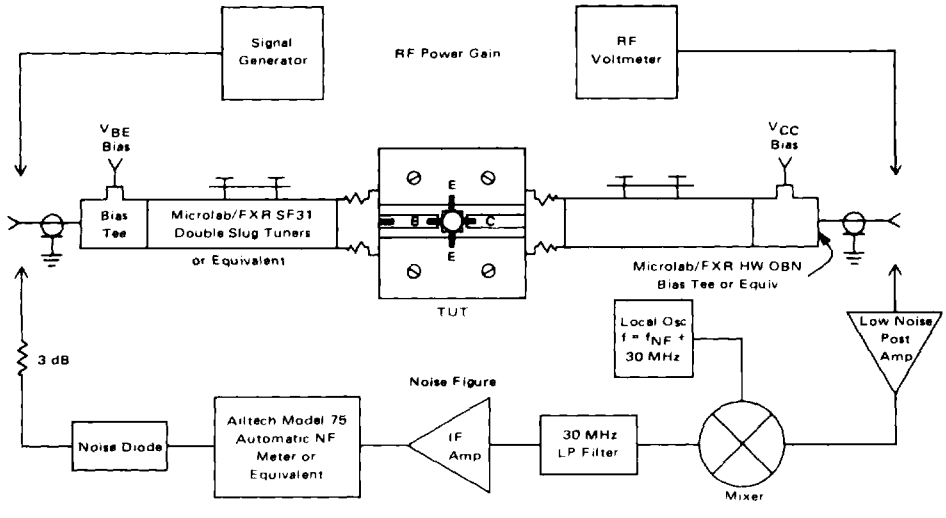


FIGURE 2 – POWER GAIN AND NOISE FIGURE versus FREQUENCY

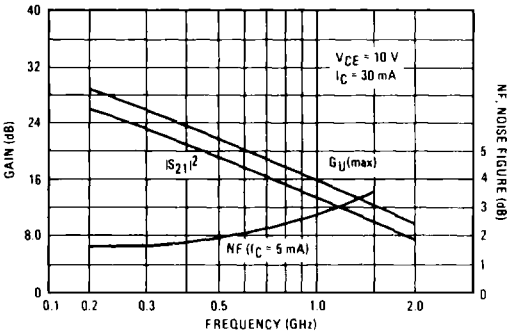


FIGURE 3 – OUTPUT CAPACITANCE versus VOLTAGE

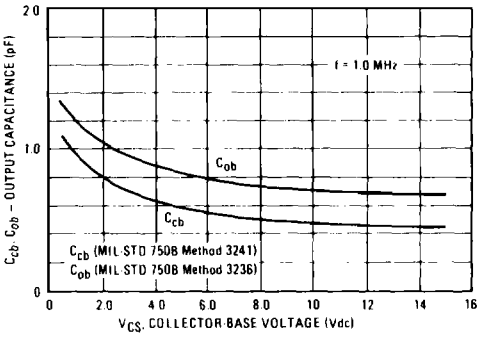


FIGURE 4 – CURRENT GAIN–BANDWIDTH PRODUCT versus COLLECTOR CURRENT

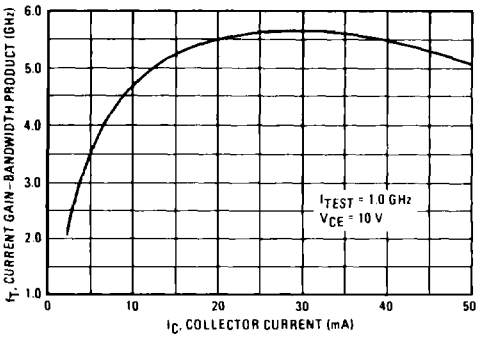


FIGURE 5 – POWER GAIN versus COLLECTOR CURRENT

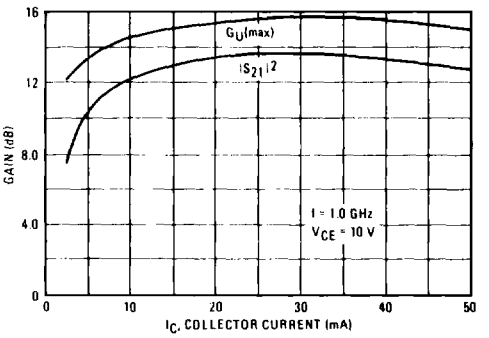
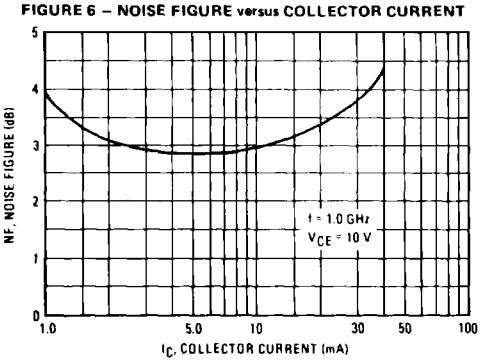


FIGURE 6 – NOISE FIGURE versus COLLECTOR CURRENT



COMMON EMITTER SCATTERING PARAMETERS

FIGURE 7 – INPUT AND OUTPUT REFLECTION COEFFICIENTS versus FREQUENCY

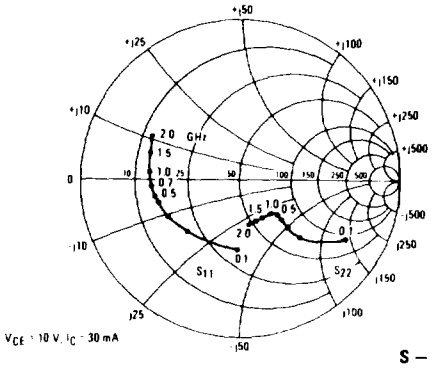
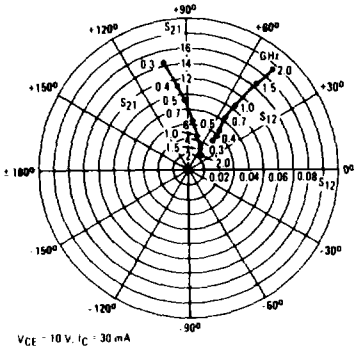


FIGURE 8 – FORWARD AND REVERSE TRANSMISSION COEFFICIENTS versus FREQUENCY



S – PARAMETERS

V_{CE} (Volts)	I_C (mA)	Frequency (MHz)	S11		S21		S12		S22	
			|S11|	∠Φ	|S21|	∠Φ	|S12|	∠Φ	|S22|	∠Φ
5.0	5	100	0.72	-40	12.37	153	0.028	67	0.91	-18
		200	0.65	-78	10.38	133	0.048	51	0.76	-32
		500	0.61	-137	5.75	100	0.067	34	0.50	-45
		1000	0.61	-168	3.13	78	0.082	31	0.41	-54
		2000	0.63	161	1.58	47	0.112	30	0.41	-80
	10	100	0.57	-60	19.54	146	0.024	63	0.85	-27
		200	0.55	-105	14.70	125	0.038	47	0.64	-43
		500	0.59	-155	7.12	95	0.051	39	0.37	-55
		1000	0.61	-178	3.77	76	0.069	40	0.29	-62
		2000	0.64	156	1.91	50	0.106	39	0.30	-86
	30	100	0.43	-111	30.58	135	0.016	57	0.72	-39
		200	0.53	-145	19.35	114	0.022	49	0.46	-57
		500	0.62	-173	8.42	91	0.035	51	0.24	-69
		1000	0.63	172	4.36	75	0.058	54	0.18	-76
		2000	0.67	151	2.19	52	0.099	49	0.21	-99
	50	100	0.46	-134	32.34	129	0.013	57	0.64	-42
		200	0.57	-158	19.19	110	0.018	51	0.40	-56
		500	0.64	-178	8.13	89	0.031	57	0.22	-62
		1000	0.65	170	4.17	74	0.053	58	0.19	-70
		2000	0.70	150	2.10	52	0.092	54	0.22	-97
10	5	100	0.74	-36	12.34	154	0.023	69	0.93	-15
		200	0.67	-71	10.56	135	0.040	54	0.81	-25
		500	0.59	-131	6.09	102	0.058	37	0.57	-36
		1000	0.58	-164	3.32	79	0.073	33	0.50	-44
		2000	0.60	164	1.67	48	0.098	32	0.49	-69
	10	100	0.60	-52	19.75	148	0.020	65	0.87	-21
		200	0.56	-95	15.30	127	0.032	49	0.69	-33
		500	0.56	-149	7.69	97	0.044	41	0.45	-41
		1000	0.58	-174	4.07	77	0.061	42	0.39	-47
		2000	0.61	159	2.03	50	0.095	40	0.39	-70
	30	100	0.44	-94	32.03	136	0.014	59	0.75	-31
		200	0.50	-135	20.76	115	0.021	49	0.52	-41
		500	0.57	-168	9.13	91	0.032	52	0.33	-43
		1000	0.59	175	4.71	75	0.052	54	0.29	-48
		2000	0.64	154	2.34	52	0.089	49	0.30	-72
	50	100	0.44	-117	33.56	129	0.012	59	0.68	-31
		200	0.52	-150	19.94	109	0.017	50	0.47	-36
		500	0.59	-174	8.52	89	0.028	56	0.34	-35
		1000	0.61	173	4.38	75	0.049	57	0.32	-43
		2000	0.66	152	2.21	51	0.083	52	0.34	-70