MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MRF2369

2

The RF Line
NPN Silicon High Frequency Transistor

f_T = 6 GHz @ 50 mA
NF = 1.5 dB @ 1 GHz
HIGH FREQUENCY TRANSISTOR
NPN SILICON

. . . designed for low-noise, wide dynamic range front end amplifiers, low-noise VCO's and microwave power multipliers.

- Low Noise
- High Gain
- Available in Low Cost Plastic
- State-of-the-Art Technology
  - Fine Line Geometry
  - Ion Implanted Arsenic Emitters
  - Gold Top Metallization and Wires
  - Silicon Nitride Passivation
- Fully Characterized
- Higher Voltage Version of MRF571
- Internally Ballasted for Improved Ruggedness

MACRO-X
CASE 317-01, STYLE 2

MAXIMUM RATINGS

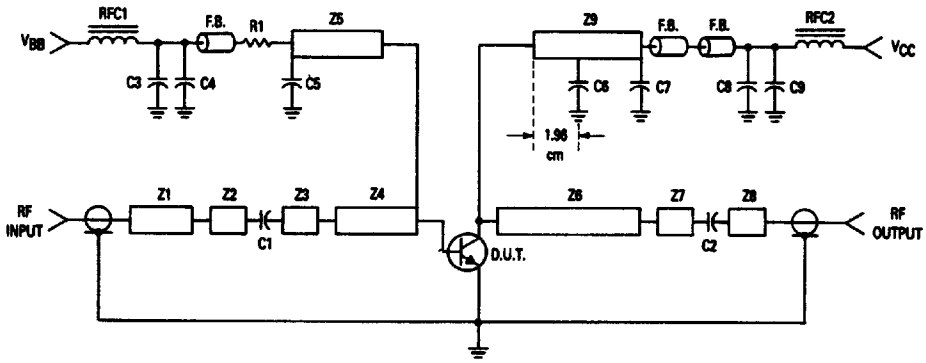
Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	15	Vdc
Collector-Base Voltage	V_{CBO}	30	Vdc
Emitter-Base Voltage	V_{EBO}	2.5	Vdc
Collector Current — Continuous	I_C	70	mAdc
Total Device Dissipation @ T_C = 50°C (1) Derate above 50°C	P_D	0.75 7.5	Watt mW/°C
Storage Temperature	T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	133	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted.)

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector-Emitter Breakdown Voltage (I_C = 1 mAdc, I_B = 0)		$V_{(BR)CEO}$	15	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 0.1 mAdc, I_E = 0)		$V_{(BR)CBO}$	30	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 50 μAdc, I_C = 0)		$V_{(BR)EBO}$	2.5	—	—	Vdc
Collector Cutoff Current (V_{CB} = 15 Vdc, I_E = 0)		I_{CBO}	—	—	10	μAdc
ON CHARACTERISTICS						
DC Current Gain (I_C = 30 mAdc, V_{CE} = 5 Vdc)		h_{FE}	50	—	300	—
DYNAMIC CHARACTERISTICS						
Collector-Base Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1 MHz)		C_{cb}	—	0.7	1	pF
Current Gain — Bandwidth Product (V_{CE} = 10 Vdc, I_C = 40 mA, f = 1 GHz)		f_T	—	6	—	GHz
FUNCTIONAL TESTS						
Gain @ Noise Figure (I_C = 5 mAdc, V_{CE} = 10 Vdc)	f = 0.5 GHz f = 1 GHz	G_{NF}	— 10	16.5 12	— —	dB
Noise Figure (I_C = 5 mAdc, V_{CE} = 10 Vdc)	f = 0.5 GHz f = 1 GHz f = 2 GHz	NF	— — —	1 1.5 2.8	— 2 —	dB

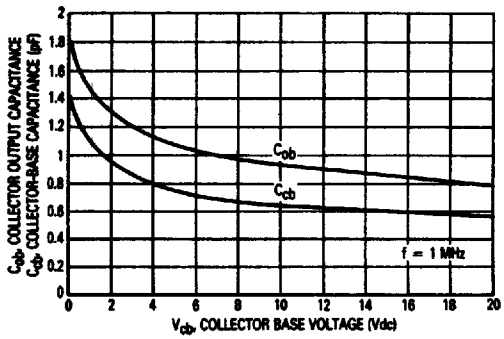


C1, C2, C6	560 pF Chip Capacitor	RFC1, RFC2	VK-200, Ferroxcube
C5, C7	0.018 μF Chip Capacitor	Z1–Z9	Microstrip, See Photomaster
C3, C8	0.1 μF Mylar Capacitor	Bead	Ferrite Bead, Ferroxcube 56-590-65/3B
C4, C9	1 μF Electrolytic Capacitor	Board Material	0.0625" Teflon Fiberglass ϵ_r = 2.5 ± 0.05
R1	2.7 kΩ		

Figure 1. 1 GHz Test Circuit

2

TYPICAL CHARACTERISTICS



C_{ob}, Collector Output Capacitance
Figure 2. C_{cb}, Collector-Base Capacitance versus Voltage

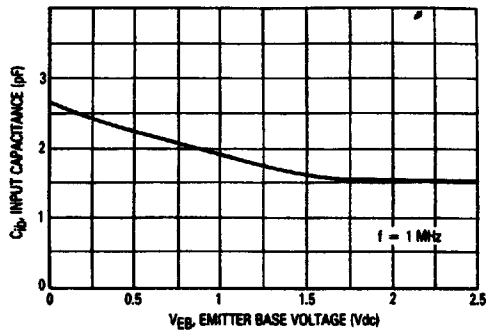


Figure 3. C_{ib}, Input Capacitance versus Emitter Base Voltage

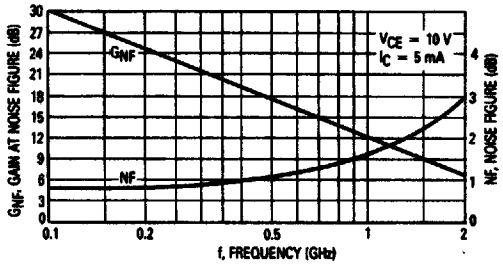


Figure 4. Gain at Noise Figure and Noise Figure versus Frequency

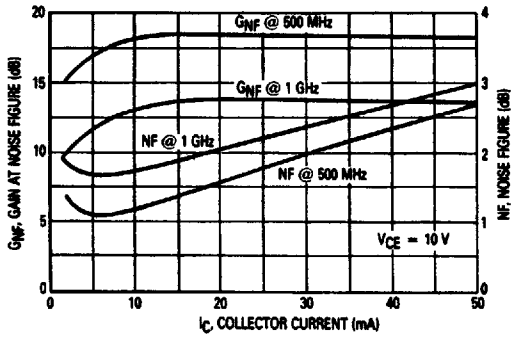


Figure 5. Gain at Noise Figure and Noise Figure versus Collector Current

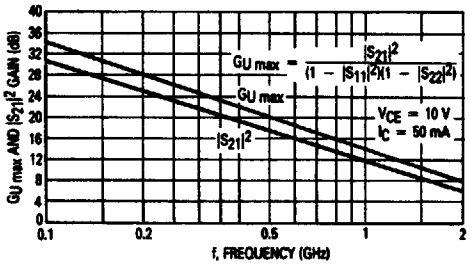


Figure 6. $G_{U\ max}$ and $|S_{21}|^2$ versus Frequency

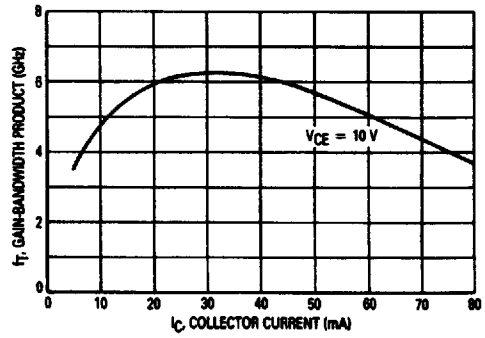
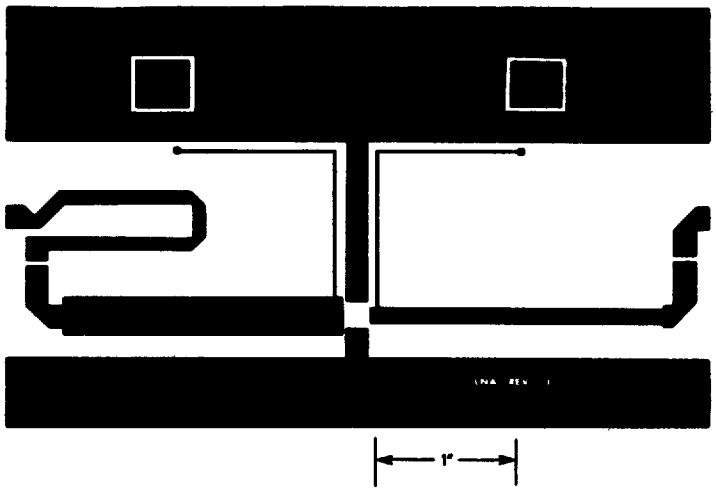


Figure 7. Gain-Bandwidth Product versus Collector Current

V_{CE} (Volts)	I_C (mA)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\|S_{11}\|$	$\angle\phi$	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
5	5	100	0.83	−45	14.1	152	0.03	69	0.88	−24
		200	0.70	−81	10.5	130	0.06	51	0.74	−37
		500	0.63	−140	5.7	98	0.08	35	0.47	−57
		1000	0.59	175	3	72	0.10	38	0.36	−68
		1500	0.57	150	2	56	0.12	45	0.35	−85
		2000	0.56	128	1.5	43	0.15	50	0.37	−96
	10	100	0.72	−63	21.2	142	0.03	61	0.83	−33
		200	0.63	−103	14.4	122	0.05	49	0.60	−51
		500	0.59	−156	7	93	0.07	42	0.35	−69
		1000	0.56	166	3.6	71	0.09	50	0.24	−79
		1500	0.55	143	2.4	57	0.12	55	0.24	−95
		2000	0.53	123	1.8	45	0.16	55	0.26	−101
	25	100	0.54	−93	29.1	132	0.02	63	0.68	−47
		200	0.57	−132	17.9	111	0.03	50	0.45	−66
		500	0.57	−173	7.9	88	0.05	53	0.23	−83
		1000	0.55	157	3.9	70	0.09	62	0.15	−93
		1500	0.54	137	2.6	57	0.13	62	0.16	−109
		2000	0.52	118	2	46	0.18	59	0.18	−109
	50	100	0.51	−118	31.6	126	0.02	63	0.58	−52
		200	0.57	−150	17.9	106	0.03	50	0.36	−66
		500	0.59	178	7.6	85	0.05	61	0.19	−76
		1000	0.58	153	3.7	68	0.09	67	0.15	−82
		1500	0.57	135	2.5	55	0.13	67	0.16	−100
		2000	0.55	116	1.9	44	0.17	63	0.19	−103
10	5	100	0.87	−39	14	155	0.03	70	0.89	−22
		200	0.75	−74	10.8	133	0.05	55	0.78	−32
		500	0.64	−134	6.1	100	0.08	37	0.53	−47
		1000	0.57	179	3.2	73	0.09	40	0.42	−57
		1500	0.56	153	2.1	56	0.11	47	0.41	−73
		2000	0.54	130	1.6	44	0.13	54	0.44	−83
	10	100	0.76	−57	21.9	145	0.02	70	0.83	−28
		200	0.64	−95	15.1	124	0.04	52	0.64	−43
		500	0.57	−151	7.5	94	0.06	43	0.40	−55
		1000	0.54	169	3.8	72	0.08	52	0.30	−61
		1500	0.53	146	2.5	57	0.11	57	0.30	−76
		2000	0.51	125	1.9	45	0.15	59	0.33	−84
	25	100	0.60	−82	30.4	133	0.02	60	0.73	−40
		200	0.56	−123	19.1	114	0.03	49	0.48	−53
		500	0.54	−168	8.5	89	0.05	54	0.28	−60
		1000	0.52	159	4.3	70	0.08	63	0.21	−64
		1500	0.52	139	2.8	57	0.12	64	0.22	−79
		2000	0.50	120	2.1	46	0.16	63	0.25	−84
	50	100	0.54	−104	33.5	127	0.01	60	0.63	−44
		200	0.55	−141	19.4	107	0.02	51	0.40	−51
		500	0.55	−177	8.3	85	0.04	61	0.26	−52
		1000	0.54	155	4.1	68	0.08	68	0.22	−56
		1500	0.54	137	2.7	55	0.11	69	0.23	−73
		2000	0.52	118	2	45	0.18	66	0.27	−81

Figure 8. Common Emitter S-Parameters

2



NOTE: The Printed Circuit Board shown is 75% of the original.

Figure 9. Photomaster of Circuit Layout

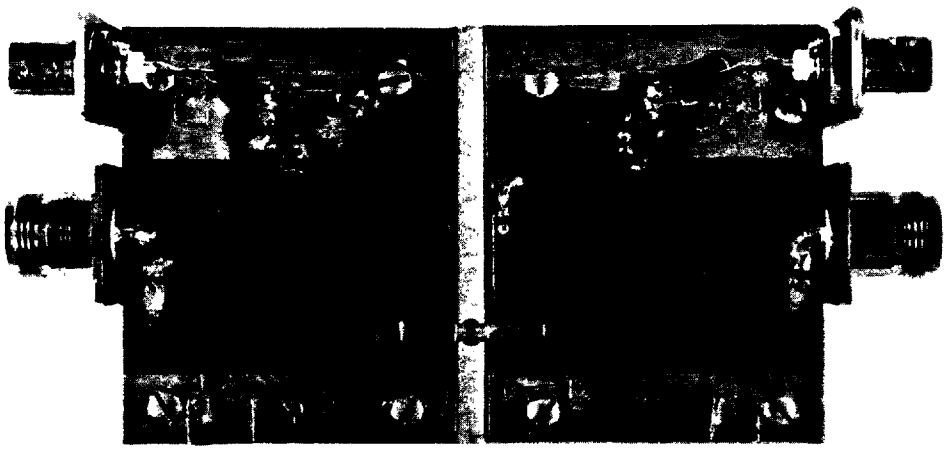


Figure 10. Test Circuit