

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

T-31-19

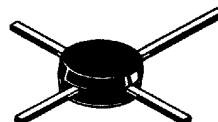
MRF911**The RF Line****NPN SILICON HIGH FREQUENCY TRANSISTOR**

... designed primarily for use in high-gain, low-noise tuned and wideband small-signal amplifiers. Excellent in high-speed switching applications.

- High Current-Gain – Bandwidth Product –
 $f_T = 5.0 \text{ GHz (Typ) @ } f = 1.0 \text{ GHz}$
- High Power Gain –
 $G_{\text{max}} = 12.5 \text{ dB (Typ) @ } f = 1.0 \text{ GHz}$

 $f_T = 5.0 \text{ GHz @ } 30 \text{ mA}$ **HIGH FREQUENCY
TRANSISTOR****NPN SILICON**

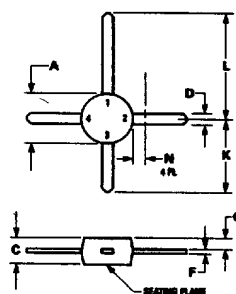
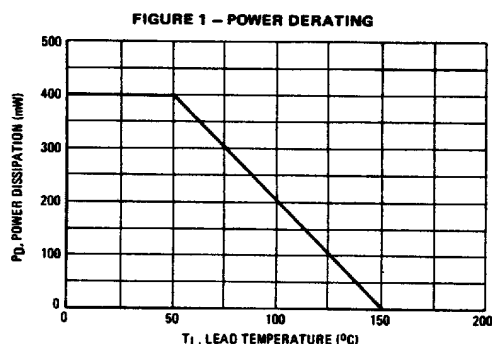
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**MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CE0}	12	Vdc
Collector-Base Voltage	V_{CB0}	20	Vdc
Emitter-Base Voltage	V_{EB0}	2.0	Vdc
Collector Current – Peak	I_C	40	mA dc
Total Device Dissipation @ $T_L = 50^\circ\text{C}$ Derate Above 50°C	P_D	400 4.0	mW mW/ $^\circ\text{C}$
Storage Temperature Range	T_{stg}	-65 to +150	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Lead	$R_{\theta JL}$	250	$^\circ\text{C/W}$

**STYLE 2:**

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

NOTE:
 DIMENSION D NOT APPLICABLE IN ZONE N.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.44	5.21	0.175	0.205
C	1.90	2.54	0.075	0.100
D	0.84	0.99	0.033	0.039
F	0.20	0.30	0.008	0.012
G	0.76	1.14	0.030	0.045
K	7.24	8.13	0.285	0.320
L	10.54	11.43	0.415	0.450
N	—	1.65	—	0.065

CASE 317-01**MOTOROLA RF DEVICE DATA**

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage ($I_C = 1.0\text{ mAdc}$, $I_E = 0$)	$V_{(BR)CEO}$	12	—	—	Vdc
Collector-Base Breakdown Voltage ($I_C = 0.1\text{ mAdc}$, $I_E = 0$)	$V_{(BR)CBO}$	20	—	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = 0.1\text{ mAdc}$, $I_C = 0$)	$V_{(BR)EBO}$	2.0	—	—	Vdc
Collector Cutoff Current ($V_{CB} = 15\text{ Vdc}$, $I_E = 0$)	I_{CBO}	—	—	50	nAde
ON CHARACTERISTICS					
DC Current Gain ($I_C = 30\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$)	h_{FE}	30	—	200	—
DYNAMIC CHARACTERISTICS					
Current-Gain Bandwidth Product ($I_C = 30\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ GHz}$)	f_T	—	5.0	—	GHz
Collector-Base Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$)	C_{cb}	—	0.6	1.0	pF
FUNCTIONAL TESTS					
Noise Figure (Minimum) ($I_C = 5.0\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ GHz}$) ($I_C = 5.0\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f = 2.0\text{ GHz}$)	NF_{MIN}	—	2.5 4.0	—	dB
Power Gain at Optimum Noise Figure ($I_C = 5.0\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ GHz}$) ($I_C = 5.0\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f = 2.0\text{ GHz}$)	GNF	—	10 6.0	—	dB
Maximum Available Power Gain (1) ($I_C = 30\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ GHz}$) ($I_C = 30\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f = 2.0\text{ GHz}$)	G_{max}	—	12.5 7.5	—	dB

$$(1) G_{max} = \frac{|S_{21}|^2}{(1 - |S_{11}|^2)(1 - |S_{22}|^2)}$$

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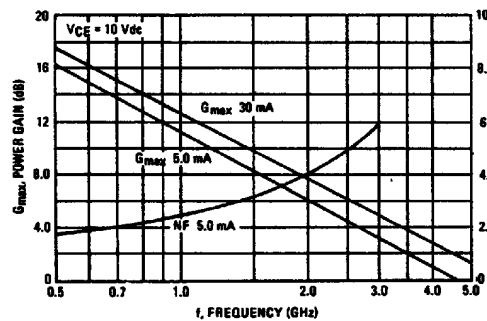
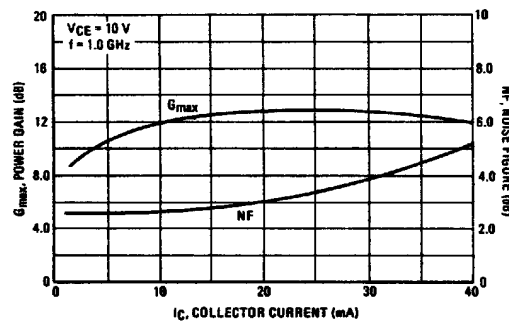
FIGURE 2 — POWER GAIN AND NOISE FIGURE
versus FREQUENCYFIGURE 3 — POWER GAIN AND NOISE FIGURE
versus COLLECTOR CURRENT

FIGURE 4 - S_{11} PARAMETERS

Frequency (MHz)		500		1000		1500		2000	
VCE (Volts)	IC (mA)	S_{11}	$\angle \phi$	S_{11}	$\angle \phi$	S_{11}	$\angle \phi$	S_{11}	$\angle \phi$
5.0	2.0	0.66	-125	0.64	-175	0.68	160	0.73	140
	5.0	0.57	-150	0.58	170	0.62	150	0.66	135
	10	0.54	-165	0.57	160	0.60	145	0.64	130
	20	0.54	-180	0.57	155	0.60	140	0.64	125
	30	0.54	-175	0.57	155	0.61	140	0.65	125
10	2.0	0.66	-120	0.63	-170	0.67	160	0.71	140
	5.0	0.56	-145	0.56	175	0.60	150	0.64	135
	10	0.51	-160	0.53	165	0.57	145	0.61	130
	20	0.49	-175	0.52	160	0.57	145	0.60	130
	30	0.49	-175	0.53	160	0.57	145	0.61	130

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FIGURE 5 - S_{22} PARAMETERS

Frequency (MHz)		500		1000		1500		2000	
VCE (Volts)	IC (mA)	S_{22}	$\angle \phi$	S_{22}	$\angle \phi$	S_{22}	$\angle \phi$	S_{22}	$\angle \phi$
5.0	2.0	0.61	-45	0.50	-60	0.48	-90	0.50	-100
	5.0	0.40	-55	0.31	-65	0.30	-85	0.32	-100
	10	0.27	-60	0.20	-70	0.20	-90	0.23	-105
	20	0.19	-70	0.13	-75	0.14	-95	0.17	-110
	30	0.16	-70	0.11	-75	0.13	-95	0.16	-110
10	2.0	0.66	-35	0.55	-50	0.53	-70	0.54	-90
	5.0	0.47	-45	0.38	-50	0.37	-70	0.38	-75
	10	0.35	-45	0.28	-50	0.27	-65	0.29	-85
	20	0.26	-45	0.22	-50	0.22	-65	0.24	-80
	30	0.25	-40	0.21	-45	0.22	-60	0.24	-80

FIGURE 6 - S_{21} PARAMETERS

Frequency (MHz)		500		1000		1500		2000	
VCE (Volts)	IC (mA)	S_{21}	$\angle \phi$	S_{21}	$\angle \phi$	S_{21}	$\angle \phi$	S_{21}	$\angle \phi$
5.0	2.0	3.24	100	1.84	70	1.23	50	0.96	35
	5.0	4.85	90	2.60	70	1.76	50	1.38	40
	10	5.78	85	3.04	70	2.05	50	1.61	40
	20	6.40	85	3.30	65	2.23	50	1.24	40
	30	6.47	80	3.35	65	2.26	50	1.76	40
10	2.0	3.42	100	1.95	70	1.31	50	1.01	35
	5.0	5.20	95	2.80	70	1.89	50	1.45	40
	10	6.22	90	3.28	70	2.20	55	1.71	40
	20	6.82	85	3.55	65	2.37	55	1.84	40
	30	6.90	85	3.55	65	2.36	50	1.81	40

FIGURE 7 - S_{12} PARAMETERS

Frequency (MHz)		500		1000		1500		2000	
VCE (Volts)	IC (mA)	S_{12}	$\angle \phi$	S_{12}	$\angle \phi$	S_{12}	$\angle \phi$	S_{12}	$\angle \phi$
5.0	2.0	0.11	30	0.12	25	0.11	35	0.13	50
	5.0	0.08	40	0.10	45	0.13	55	0.17	55
	10	0.07	50	0.10	55	0.14	60	0.19	60
	20	0.06	60	0.11	65	0.15	65	0.20	60
	30	0.06	65	0.11	65	0.15	65	0.20	60
10	2.0	0.10	35	0.10	30	0.10	40	0.12	55
	5.0	0.07	40	0.09	45	0.12	55	0.15	60
	10	0.06	50	0.09	55	0.13	60	0.17	60
	20	0.06	60	0.10	65	0.13	65	0.18	60
	30	0.06	60	0.10	65	0.14	65	0.18	65