MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

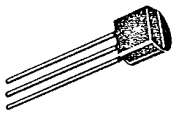
NPN Silicon High Frequency Transistors

MPS911
MXR911
MMBR911

LOW NOISE
HIGH RF GAIN

. . . designed for low noise, wide dynamic range front-end amplifiers and low-noise VCO's. Available in two surface-mountable plastic package styles, as well as the popular TO-92 package. This Motorola series of small-signal plastic transistors offers superior quality and performance at low cost.

- High Gain-Bandwidth Product
  f_T = 7 GHz (Typ) @ 30 mA
- Low Noise Figure
  NF = 1.7 dB (Typ) @ 500 MHz
- High Gain
  G_{NF} = 17 dB (Typ) @ 10 mA/500 MHz
- State-of-the-Art Technology
  Fine Line Geometry
  Ion-Implanted Arsenic Emitters
  Gold Top Metallization and Wires
  Silicon Nitride Passivation
- Tape and Reel Packaging Options
- MMBR911 Available in Low Profile, Add L Suffix



TO-92
CASE 29
MPS911

SOT-89
CASE 345
MXR911

SOT-23
CASE 318
MMBR911
Standard and Low Profile

MAXIMUM RATINGS

Ratings	Symbol	MPS911	MXR911	MMBR911	Unit
Collector-Emitter Voltage	V_{CEO}	12			Vdc
Collector-Base Voltage	V_{CBO}	20			Vdc
Emitter-Base Voltage	V_{EBO}	3			Vdc
Collector Current — Continuous	I_C	60			mA
Power Dissipation @ T_A = 25°C	P_D	625	400 (Free Air)	200 (Free Air)	mW
Storage Temperature	T_{stg}	−55 to +150			°C

MOTOROLA

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)			$V_{(BR)CEO}$	12	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 0.1 mAdc, I_E = 0)			$V_{(BR)CBO}$	20	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 0.1 mA, I_C = 0)			$V_{(BR)EBO}$	3	—	—	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 (V_{CB} = 10 Vdc, I_E = 0, f = 1 MHz)			C_{cb}	—	—	1	pF
Current Gain-Bandwidth Product (V_{CE} = 10 Vdc, I_C = 30 mAdc, f = 1 GHz)	MPS911		f_T	—	7	—	GHz
	MXR911			—	7	—	
	MMBR911			—	6	—	
FUNCTIONAL TESTS							
Gain @ Noise Figure (I_C = 10 mAdc, V_{CE} = 10 Vdc)	MPS911	f = 0.5 GHz	G_{NF}	—	16.5	—	dB
		f = 1 GHz		—	11	—	
	MXR911	f = 0.5 GHz		—	16	—	
		f = 1 GHz		—	8.5	—	
	MMBR911	f = 0.5 GHz		—	17	—	
		f = 1 GHz		—	11	—	
Noise Figure (I_C = 10 mAdc, V_{CE} = 10 Vdc)	MPS911	f = 0.5 GHz	NF	—	1.7	—	dB
		f = 1 GHz		—	2.7	—	
	MXR911	f = 0.5 GHz		—	2	—	
		f = 1 GHz		—	2.6	—	
	MMBR911	f = 0.5 GHz		—	2	—	
		f = 1 GHz		—	2.9	—	

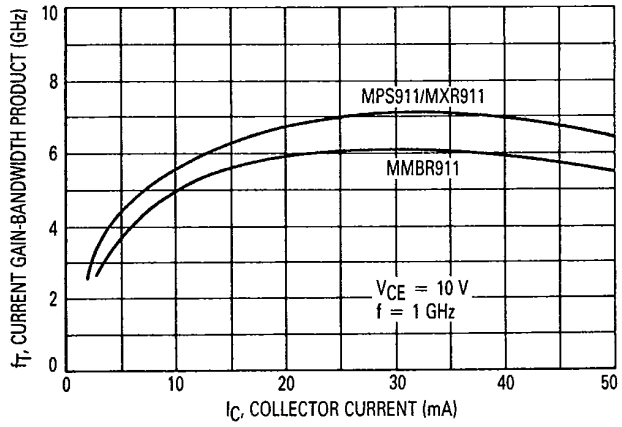
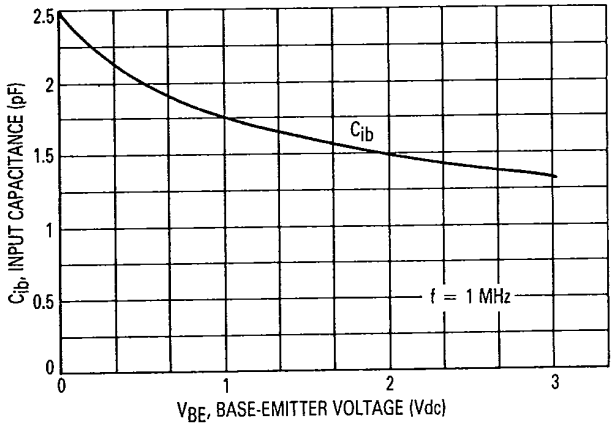
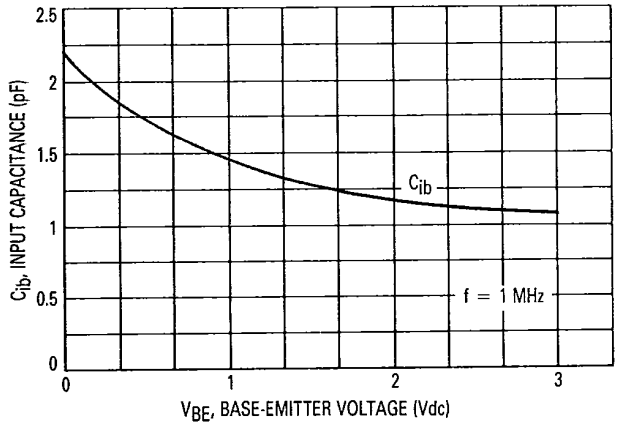


Figure 1. Current Gain-Bandwidth versus Collector Current @ 1 GHz

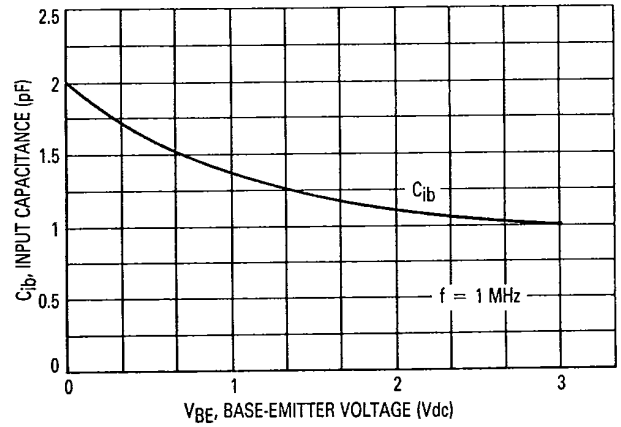
Figure 2. Input Capacitance versus Base-Emitter Voltage



(a) TO-92 MPS911

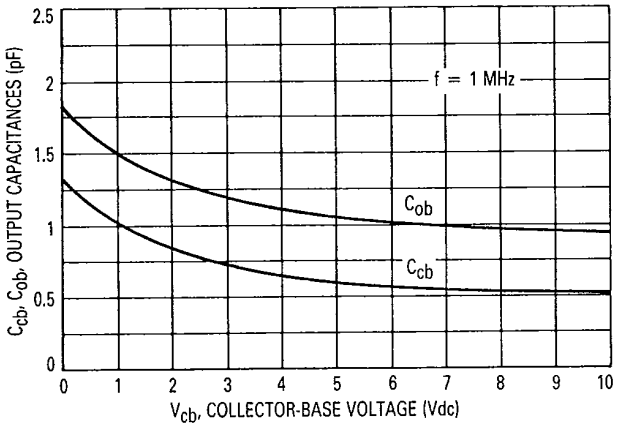


(b) SOT-89 MXR911

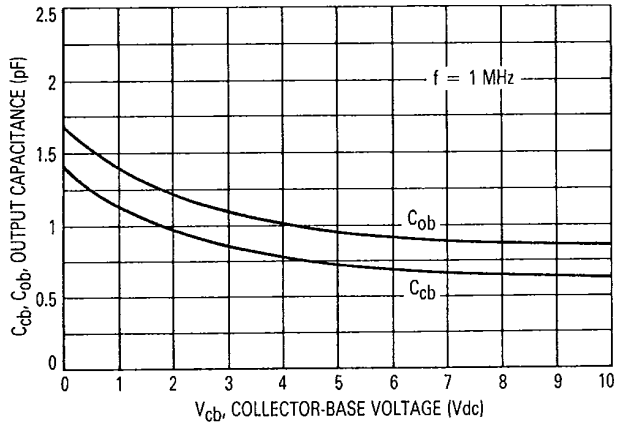


(c) SOT-23 MMBR911

Figure 3. Output Capacitances versus Collector-Base Voltage



(a) TO-92 MPS911



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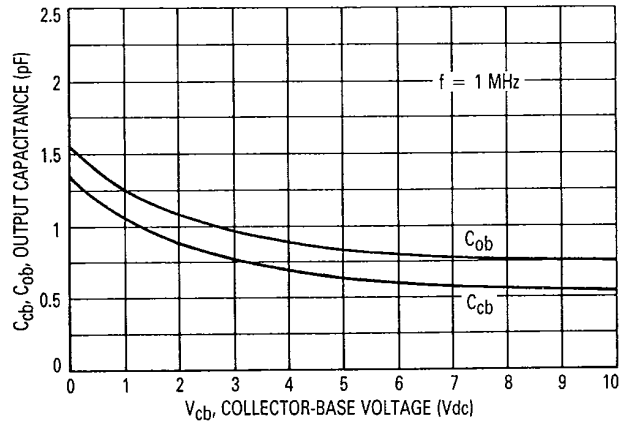
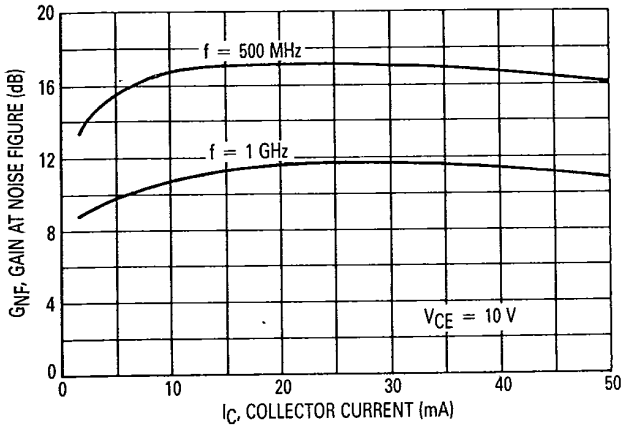
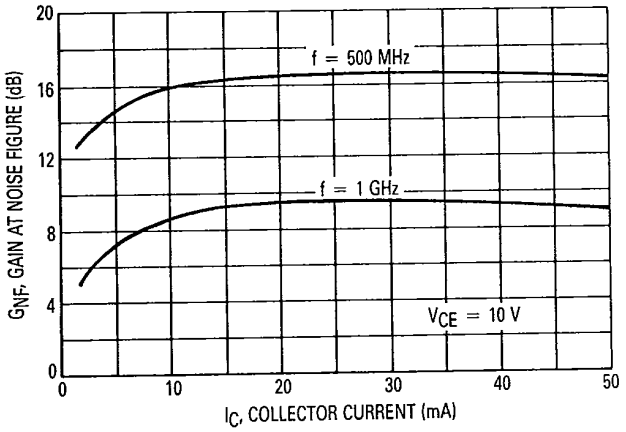


(c) SOT-23 MMBR911

Figure 4. Gain at Noise Figure versus Collector Current



(a) TO-92 MPS911



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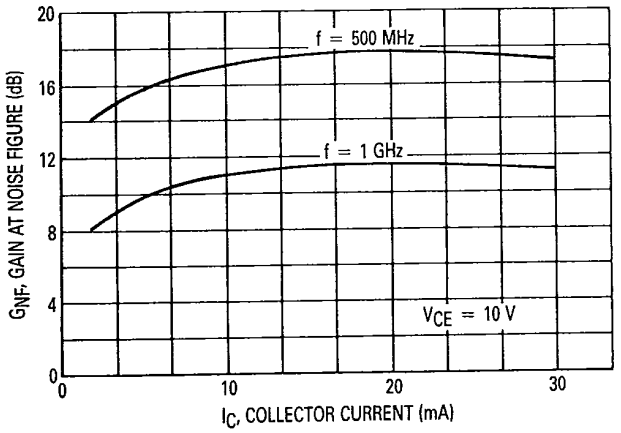
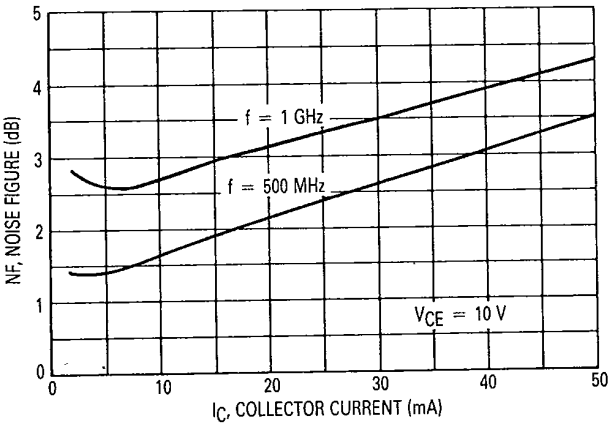
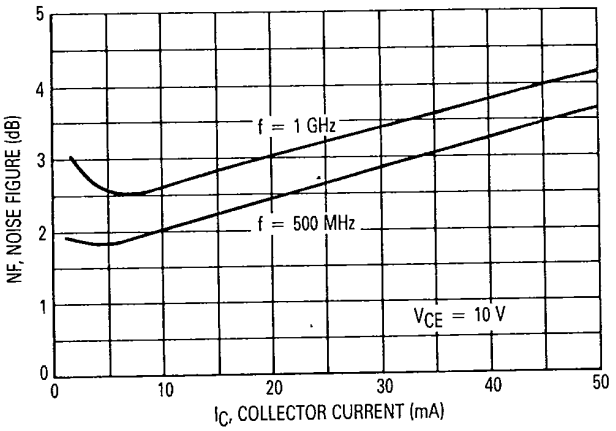


(c) SOT-23 MMBR911

Figure 5. Noise Figure versus Collector Current



(a) TO-92 MPS911



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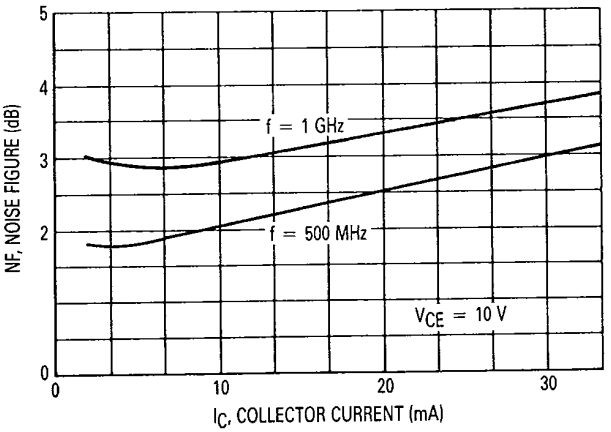
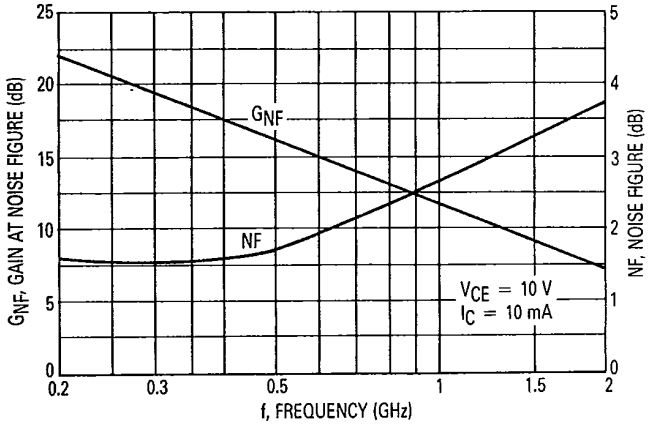
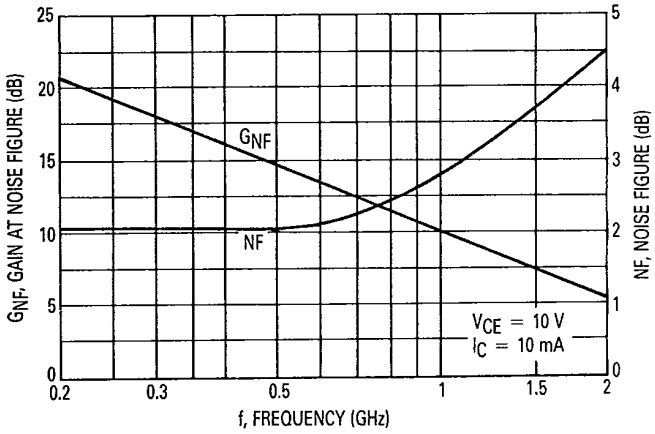


(c) SOT-23 MMBR911

Figure 6. Gain at Noise Figure and Noise Figure versus Frequency



(a) TO-92 MPS911



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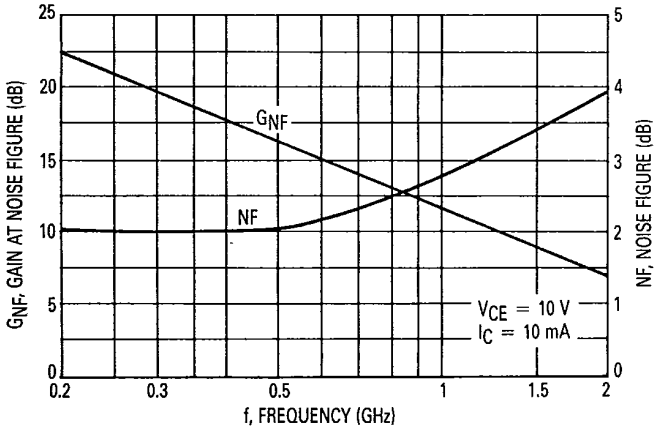
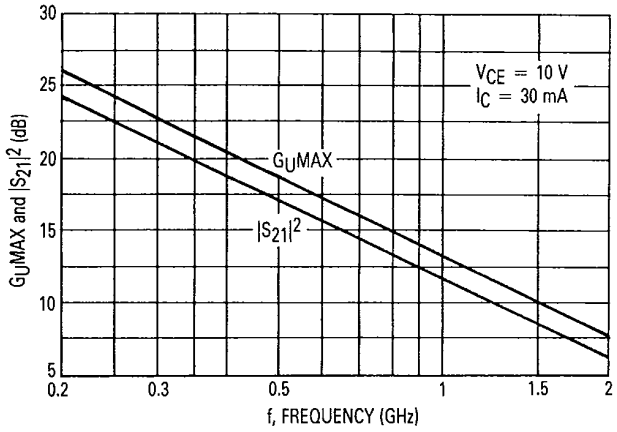
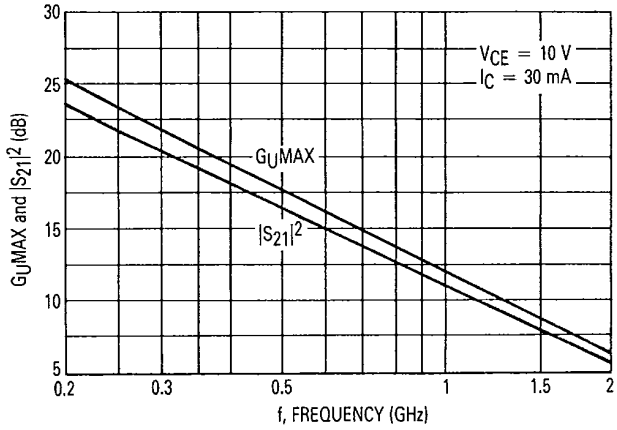


(c) SOT-23 MMBR911

Figure 7. Maximum Unilateral Gain and Insertion Gain versus Frequency



(a) TO-92 MPS911



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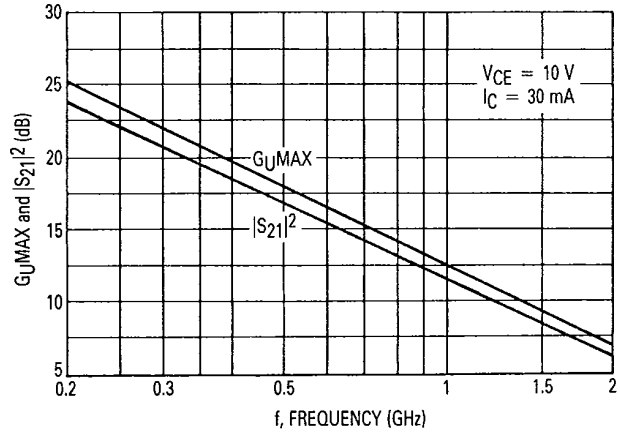
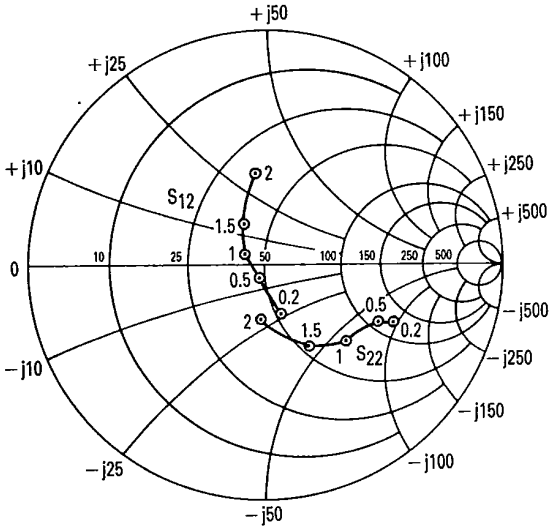
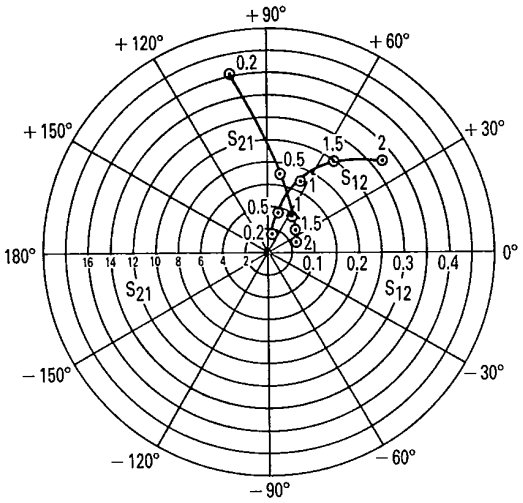


(c) SOT-23 MMBR911

TO-92 MPS911



INPUT AND OUTPUT REFLECTION COEFFICIENTS versus FREQUENCY
V_{CE} = 10 V, I_C = 30 mA

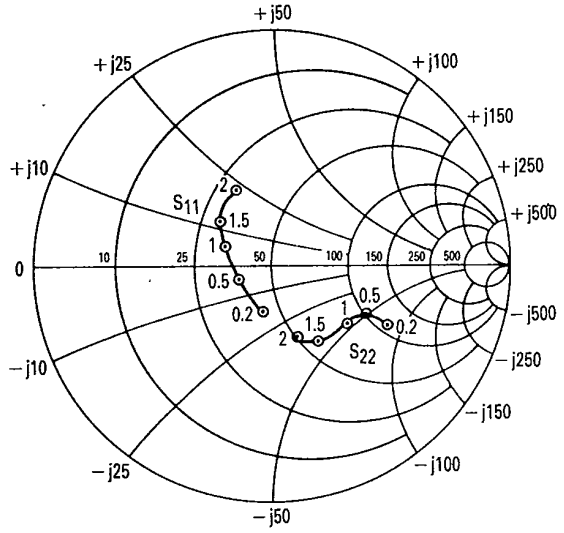


FORWARD AND REVERSE TRANSMISSION COEFFICIENTS versus FREQUENCY
V_{CE} = 10 V, I_C = 30 mA

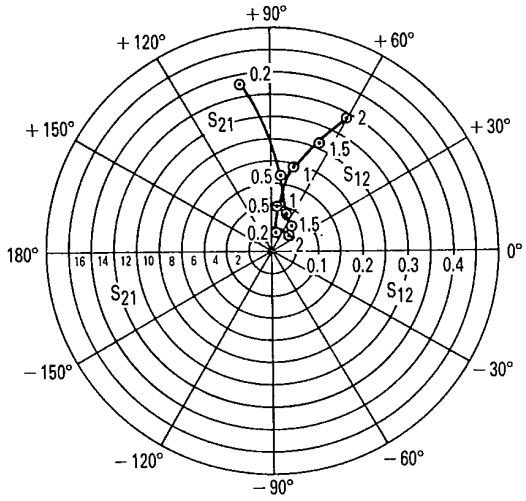
COMMON EMITTER S-PARAMETERS

V_{CE} (Volts)	I_C (mA)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\|S_{11}\|$	$\angle\phi$	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
10	2	200	0.78	−46	4.42	134	0.06	69	0.95	−18
		500	0.46	−107	3.35	98	0.10	56	0.78	−30
		1000	0.30	172	2.23	61	0.14	54	0.66	−48
		1500	0.41	118	1.66	34	0.20	51	0.57	−70
		2000	0.60	89	1.43	11	0.29	45	0.46	−107
	5	200	0.72	−55	8.75	126	0.05	68	0.87	−23
		500	0.31	−107	5.23	92	0.09	63	0.68	−31
		1000	0.18	178	3.05	61	0.15	60	0.57	−46
		1500	0.27	122	2.22	38	0.22	52	0.50	−66
		2000	0.45	94	1.90	17	0.30	43	0.38	−97
	10	200	0.48	−64	12.79	114	0.04	73	0.74	−24
		500	0.16	−100	6.19	85	0.09	71	0.60	−29
		1000	0.09	165	3.45	59	0.17	63	0.50	−44
		1500	0.22	112	2.50	36	0.25	50	0.41	−65
		2000	0.41	90	2.14	16	0.32	38	0.26	−98
	20	200	0.29	−67	15.30	106	0.04	78	0.65	−23
		500	0.08	−92	6.76	82	0.09	75	0.55	−27
		1000	0.06	144	3.71	58	0.17	64	0.46	−43
		1500	0.20	108	2.65	30	0.25	51	0.37	−63
		2000	0.38	89	2.25	18	0.32	38	0.23	−94
	30	200	0.20	−70	16.04	103	0.04	80	0.61	−22
		500	0.05	−97	6.90	81	0.09	77	0.53	−25
		1000	0.07	138	3.76	58	0.17	66	0.46	−41
		1500	0.20	109	2.68	38	0.25	52	0.37	−61
		2000	0.38	90	2.28	20	0.32	40	0.24	−91
	50	200	0.13	−78	15.26	99	0.04	82	0.62	−18
		500	0.03	−145	6.48	79	0.09	78	0.56	−23
		1000	0.11	126	3.55	56	0.17	67	0.49	−40
		1500	0.24	105	2.56	36	0.25	53	0.39	−62
		2000	0.43	87	2.17	17	0.32	40	0.25	−95

SOT-89 MXR911



INPUT/OUTPUT REFLECTION COEFFICIENTS
versus FREQUENCY
V_{CE} = 10 V, I_C = 30 mA

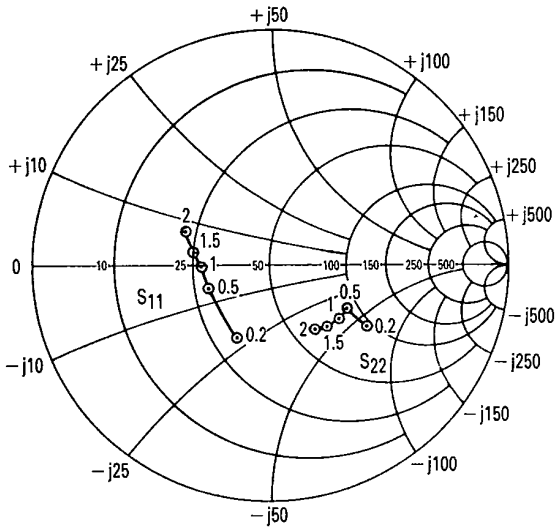


FORWARD AND REVERSE TRANSMISSION
COEFFICIENTS versus FREQUENCY
V_{CE} = 10 V, I_C = 30 mA

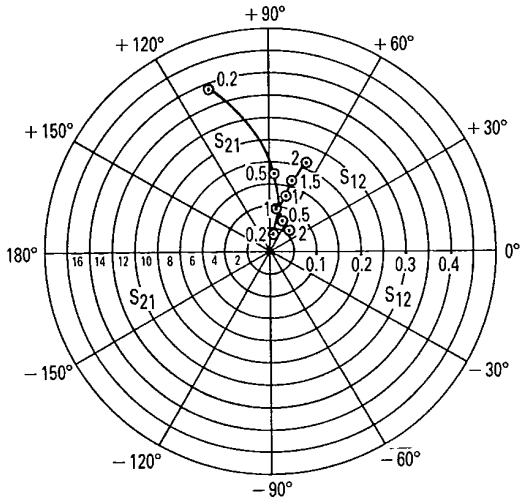
COMMON EMITTER S-PARAMETERS

V_{CE} (Volts)	I_C (mA)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\|S_{11}\|$	$\angle\phi$	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
10	2	200	0.80	−46	5.04	130	0.07	67	0.91	−18
		500	0.52	−100	3.58	100	0.11	56	0.74	−27
		1000	0.36	−173	2.32	72	0.16	59	0.64	−37
		1500	0.41	147	1.71	51	0.21	63	0.59	−50
		2000	0.48	118	1.36	37	0.27	65	0.56	−64
	5	200	0.65	−60	8.65	128	0.06	67	0.81	−24
		500	0.34	−115	5.10	93	0.10	65	0.61	−30
		1000	0.26	177	2.90	71	0.17	67	0.54	−38
		1500	0.32	143	2.11	53	0.23	64	0.49	−50
		2000	0.40	116	1.67	39	0.30	62	0.45	−65
	10	200	0.44	−72	11.87	118	0.05	70	0.70	−27
		500	0.21	−123	6.04	89	0.10	71	0.53	−31
		1000	0.19	171	3.27	70	0.18	70	0.47	−39
		1500	0.27	140	2.35	53	0.25	65	0.42	−53
		2000	0.35	115	1.88	41	0.32	60	0.38	−68
	20	200	0.27	−83	14.16	108	0.05	74	0.59	−28
		500	0.13	−138	6.57	85	0.10	75	0.47	−29
		1000	0.16	161	3.48	69	0.19	72	0.42	−39
		1500	0.24	135	2.49	53	0.26	65	0.37	−54
		2000	0.33	113	1.98	41	0.34	59	0.33	−71
	30	200	0.18	−95	14.93	103	0.04	77	0.54	−26
		500	0.11	−153	6.70	83	0.10	76	0.44	−27
		1000	0.16	156	3.52	68	0.19	73	0.41	−38
		1500	0.24	133	2.50	54	0.26	66	0.36	−54
		2000	0.33	112	2.00	42	0.34	60	0.32	−71
	50	200	0.15	−111	14.26	101	0.04	79	0.53	−22
		500	0.12	−160	6.45	82	0.09	77	0.46	−24
		1000	0.19	152	3.39	68	0.18	73	0.43	−37
		1500	0.27	130	2.41	53	0.26	67	0.38	−51
		2000	0.35	110	1.92	41	0.33	61	0.34	−68

SOT-23 MMBR911



INPUT/OUTPUT REFLECTION COEFFICIENTS
versus FREQUENCY
V_{CE} = 10 V, I_C = 30 mA



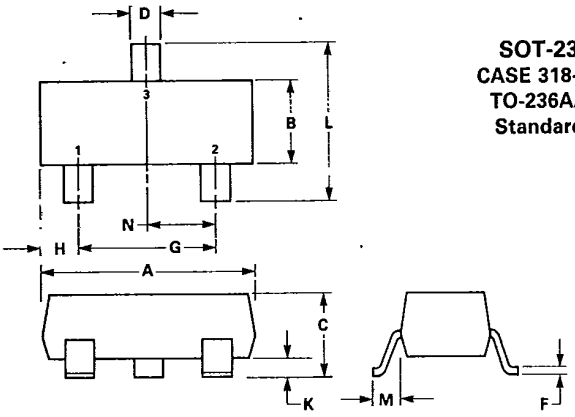
FORWARD AND REVERSE TRANSMISSION
COEFFICIENTS versus FREQUENCY
V_{CE} = 10 V, I_C = 30 mA

COMMON EMITTER S-PARAMETERS

V_{CE} (Volts)	I_C (mA)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\|S_{11}\|$	$\angle\phi$	$\|S_{21}\|$	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
10	2	200	0.82	−45	4.14	145	0.06	66	0.88	−16
		500	0.60	−96	3.23	112	0.09	49	0.71	−27
		1000	0.47	−149	2.16	85	0.11	49	0.62	−34
		1500	0.46	−179	1.59	71	0.13	55	0.58	−43
		2000	0.47	162	1.35	57	0.16	62	0.56	−51
	5	200	0.66	−63	8.63	134	0.05	64	0.75	−25
		500	0.43	−117	5.29	100	0.07	58	0.55	−31
		1000	0.37	−163	3.05	82	0.11	63	0.48	−36
		1500	0.38	176	2.17	70	0.15	65	0.45	−44
		2000	0.40	160	1.81	57	0.19	65	0.43	−51
	10	200	0.49	−83	12.70	124	0.04	65	0.62	−30
		500	0.33	−134	6.42	94	0.07	66	0.44	−32
		1000	0.32	−171	3.53	80	0.12	70	0.41	−36
		1500	0.35	173	2.46	69	0.16	69	0.38	−45
		2000	0.37	159	2.04	58	0.20	66	0.35	−52
	20	200	0.36	−103	15.25	114	0.03	69	0.52	−32
		500	0.28	−149	6.95	90	0.06	72	0.39	−30
		1000	0.29	−176	3.73	78	0.12	73	0.37	−35
		1500	0.33	172	2.60	68	0.17	71	0.34	−43
		2000	0.36	158	2.14	58	0.21	67	0.32	−52
	30	200	0.32	−114	15.64	109	0.03	71	0.48	−29
		500	0.27	−156	6.92	88	0.06	73	0.38	−27
		1000	0.29	−178	3.71	78	0.12	74	0.37	−33
		1500	0.34	170	2.58	68	0.16	72	0.34	−44
		2000	0.37	156	2.13	57	0.21	68	0.32	−51

OUTLINE DIMENSIONS

SOT-23
CASE 318-02
TO-236AA
Standard

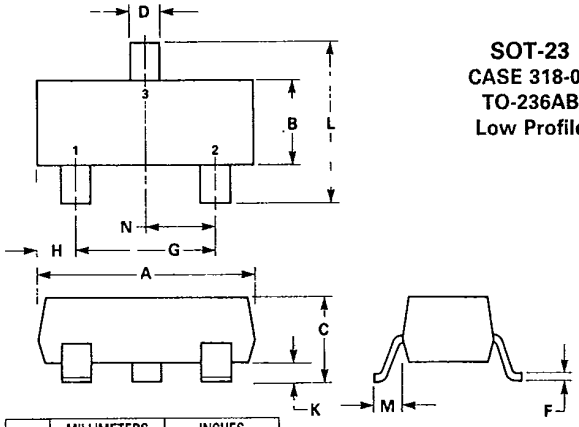


DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2 80	3 04	0.1102	0.1197
B	1.20	1.40	0.0472	0.0551
C	0 85	1 20	0.033	0.0472
D	0.37	0 46	0 0150	0.0177
F	0 085	0.130	0 0034	0 0051
G	1.78	2.04	0 0701	0 0807
H	0 51	0 60	0 0200	0 0236
K	0.10	0 25	0.0040	0 0098
L	2.10	2.50	0 0830	0.0984
M	0.45	0 60	0.0180	0 0236
N	0.89	1.02	0.0350	0.0401

STYLE 6:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI
2. Y14.5M, 1982
CONTROLLING DIMENSION MILLIMETERS

SOT-23
CASE 318-03
TO-236AB
Low Profile



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.80	3 04	0 1102	0.1197
B	1 20	1 40	0.0472	0 0551
C	0 89	1.11	0.035	0.044
D	0 37	0.46	0.015	0 0177
F	0 085	0.130	0.0034	0.0051
G	1 78	2.04	0.0701	0 0807
H	0 51	0 60	0.0200	0 0236
K	0.013	0.100	0.0005	0.0040
L	2.10	2 50	0 0830	0.0984
M	0.45	0 60	0.018	0 0236
N	0.89	1.02	0 0350	0.0401

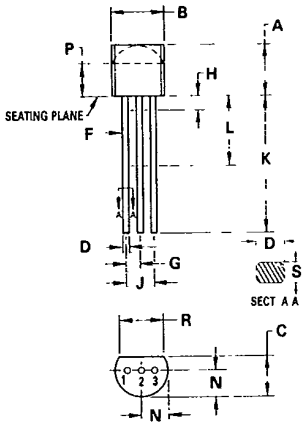
STYLE 6:
PIN 1. BASE
2 EMITTER
3. COLLECTOR

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI
2. Y14.5M, 1982.
CONTROLLING DIMENSION MILLIMETERS.

NOTES:
1. CONTOUR OF PACKAGE BEYOND ZONE "P" IS UNCONTROLLED.
2. DIM "F" APPLIES BETWEEN "H" AND "L". DIM "D" & "S" APPLIES BETWEEN "L" & 12.70 mm (0.5") FROM SEATING PLANE. LEAD DIM IS UNCONTROLLED IN "H" & BEYOND 12.70 mm (0.5") FROM SEATING PLANE.

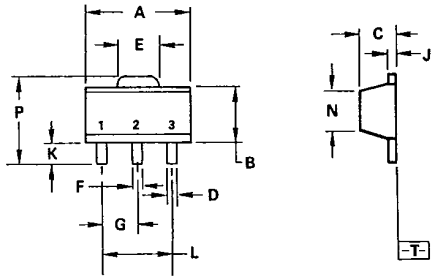
TO-92
CASE 29-02
TO-226AA
PLASTIC

STYLE 2:
PIN 1. BASE
2. EMMITTER
3. COLLECTOR



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.32	5.33	0.170	0.210
B	4.44	5.21	0.175	0.205
C	3.18	4.19	0.125	0.165
D	0.41	0.56	0.016	0.022
F	0.41	0.48	0.016	0.019
G	1.14	1.40	0.045	0.055
H	—	2.54	—	0.100
J	2.41	2.67	0.095	0.105
K	12.70	—	0.500	—
L	6 35	—	0.250	—
N	2 03	2.67	0.080	0.105
P	2.92	—	0.115	—
R	3.43	—	0.135	—
S	0.36	0.41	0 014	0.016

SOT-89
CASE 345-01
PLASTIC



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.40	4.60	0.174	0.181
B	2 29	2 60	0 091	0.102
C	1.40	1 60	0.056	0.062
D	0 36	0 48	0 015	0.018
E	1.62	1.80	0.064	0 070
F	0 44	0 53	0 018	0.020
G	1 50 BSC		0 059 BSC	
J	0 35	0.44	0.014	0.017
K	0.80	1.04	0.032	0.040
L	3.00 BSC		0.118 BSC	
N	2.04	2 28	0 081	0.089
P	3 94	4 25	0.156	0.167

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

NOTES:
1. DIMENSIONS A AND B ARE DATUMS.
2 -T- IS SEATING PLANE.
3 POSITIONAL TOLERANCE FOR LEADS:
⌀ | 0.10 (0 004) Ⓜ | T | BⓈ | AⓈ
4. DIMENSIONING AND TOLERANCING PER ANSI Y14 5, 1973
5 CONTROLLING DIM: MILLIMETERS.