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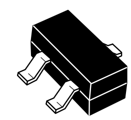
The RF Line
NPN Silicon High-Frequency Transistors

MMBR911LT1
MPS911

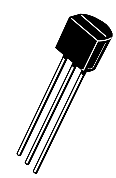
I_C = 60 mA
LOW NOISE
HIGH–FREQUENCY
TRANSISTORS
NPN SILICON

. . . designed for low noise, wide dynamic range front–end amplifiers and low–noise VCO's. Available in a surface–mountable plastic package, as well as the popular TO–226AA (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 = 7.0 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
- Available in tape and reel packaging options by adding suffix:
  T1 suffix = 3,000 units per reel
  T3 suffix = 10,000 units per reel



CASE 318–07, STYLE 6
SOT–23
LOW PROFILE
MMBR911LT1, T3



CASE 29–04, STYLE 2
TO–226AA
(TO–92)
MPS911

MAXIMUM RATINGS

Rating	Symbol	MPS911	MMBR911LT1, T3	Unit
Collector–Emitter Voltage	V_{CEO}	12		Vdc
Collector–Base Voltage	V_{CBO}	20		Vdc
Emitter–Base Voltage	V_{EBO}	2.0		Vdc
Collector Current — Continuous	I_C	60		mA
Power Dissipation @ T_{case} = 75°C Derate linearly above T_{case} = 75°C @	$P_{D(max)}$	625 —	333 4.44	mW mW/°C
Storage Temperature	T_{stg}	–55 to +150		°C
Maximum Junction Temperature	T_{Jmax}	150		°C

THERMAL CHARACTERISTICS

Rating	Symbol	Value	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	225	°C/W

DEVICE MARKING

MMBR911LT1, T3 = 7P

REV 6

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector–Emitter Breakdown Voltage (I_C = 1.0 mA, I_B = 0)	$V_{(BR)CEO}$	12	—	—	Vdc
Collector–Base Breakdown Voltage (I_C = 0.1 mA, I_E = 0)	$V_{(BR)CBO}$	20	—	—	Vdc
Emitter–Base Breakdown Voltage (I_E = 0.1 mA, I_C = 0)	$V_{(BR)EBO}$	2.0	—	—	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 (V_{CB} = 10 Vdc, I_E = 0, f = 1.0 MHz)	C_{cb}	—	—	1.0	pF
Current Gain–Bandwidth Product (V_{CE} = 10 Vdc, I_C = 30 mAdc, f = 1.0 GHz) MPS911	f_T	—	7.0	—	GHz
MMBR911LT1, T3		—	6.0	—	
FUNCTIONAL TESTS					
Gain @ Noise Figure (I_C = 10 mAdc, V_{CE} = 10 Vdc) MPS911 f = 0.5 GHz	G_{NF}	—	16.5	—	dB
f = 1.0 GHz		—	11	—	
MMBR911LT1, T3 f = 0.5 GHz		—	17	—	
f = 1.0 GHz		—	11	—	
Noise Figure (I_C = 10 mAdc, V_{CE} = 10 Vdc) MPS911 f = 0.5 GHz	NF	—	1.7	—	dB
f = 1.0 GHz		—	2.7	—	
MMBR911LT1, T3 f = 0.5 GHz		—	2.0	—	
f = 1.0 GHz		—	2.9	—	

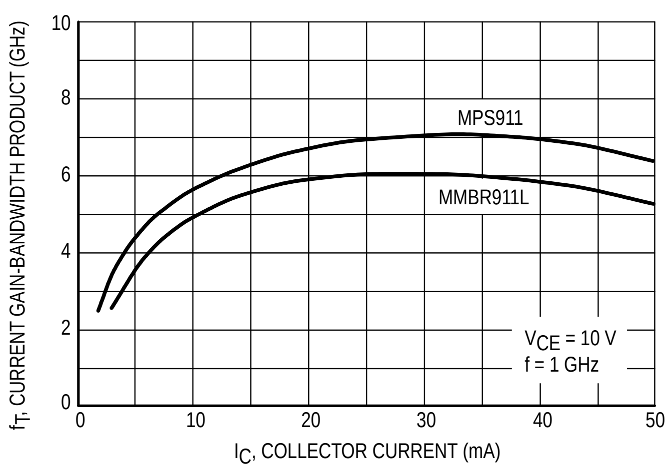


Figure 1. Current Gain–Bandwidth versus Collector Current @ 1.0 GHz

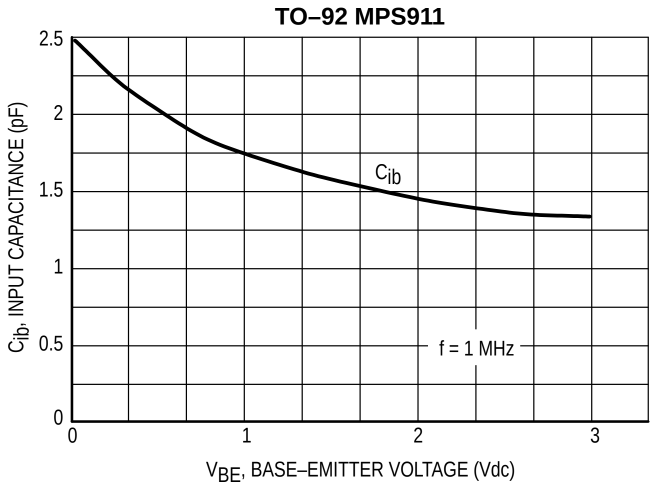


Figure 2. Input Capacitance versus Base–Emitter Voltage

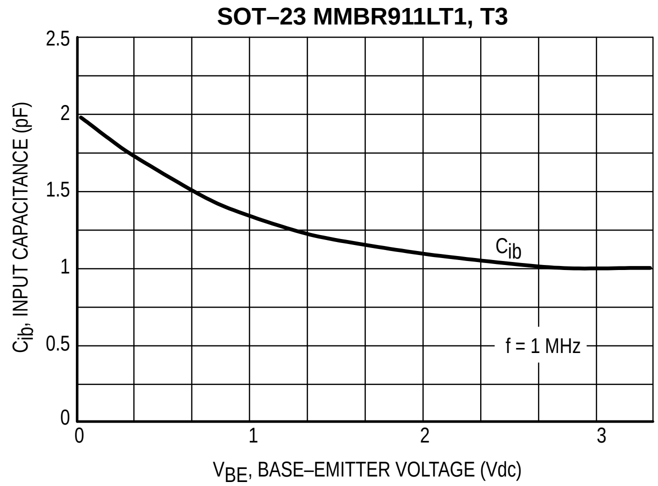


Figure 3. Input Capacitance versus Base–Emitter Voltage

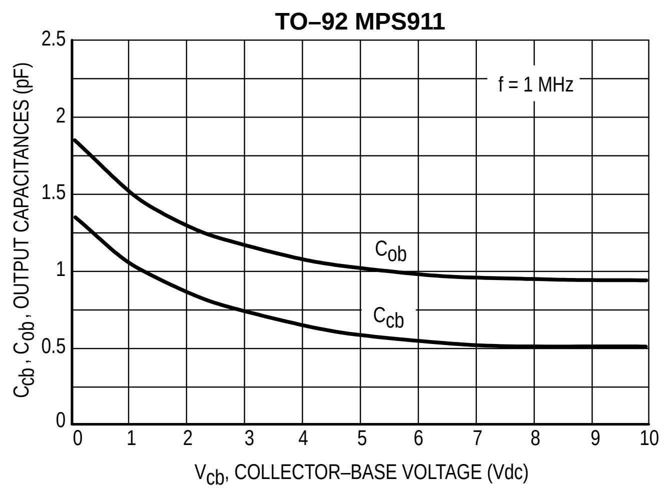


Figure 4. Output Capacitances versus Collector–Base Voltage

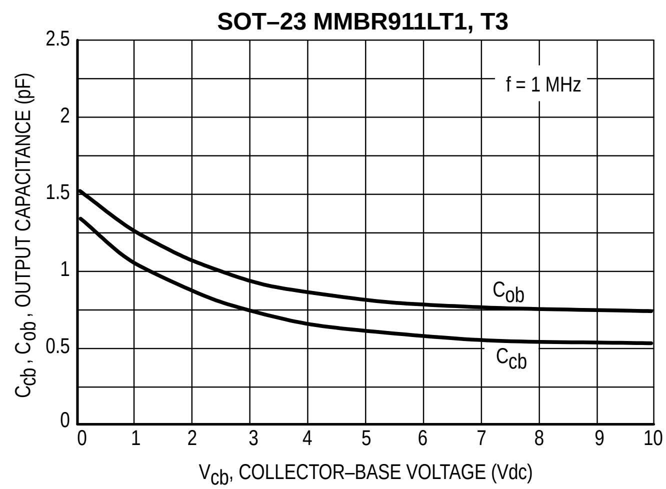


Figure 5. Output Capacitances versus Collector–Base Voltage

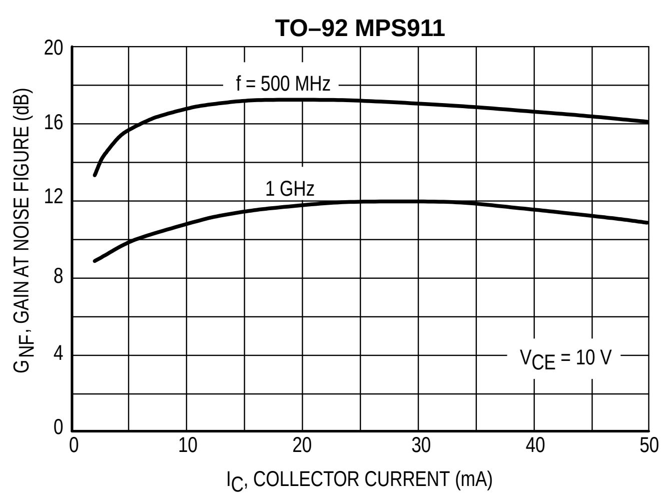


Figure 6. Gain at Noise Figure versus Collector Current

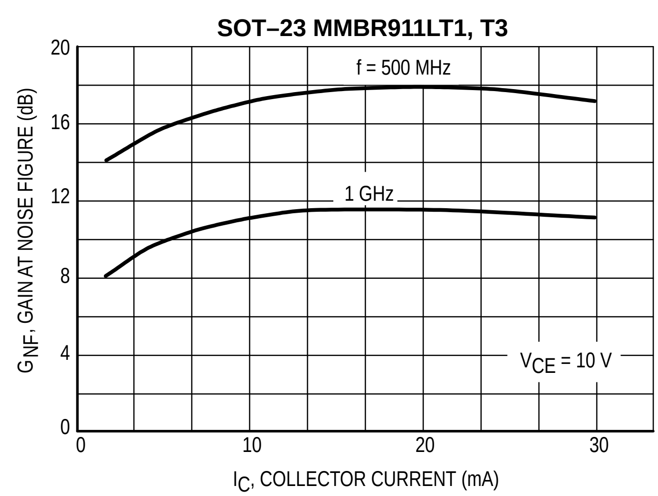


Figure 7. Gain at Noise Figure versus Collector Current

TO–92 MPS911

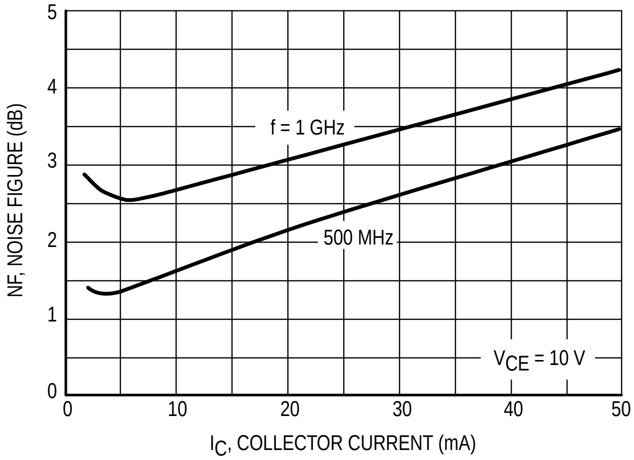


Figure 8. Noise Figure versus Collector Current

SOT–23 MMBR911LT1, T3

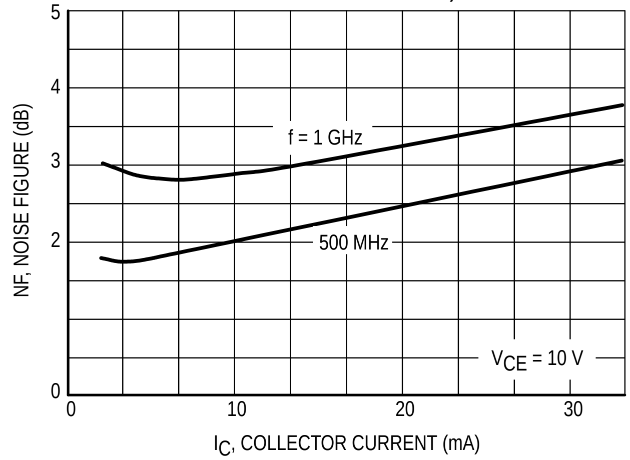


Figure 9. Noise Figure versus Collector Current

TO–92 MPS911

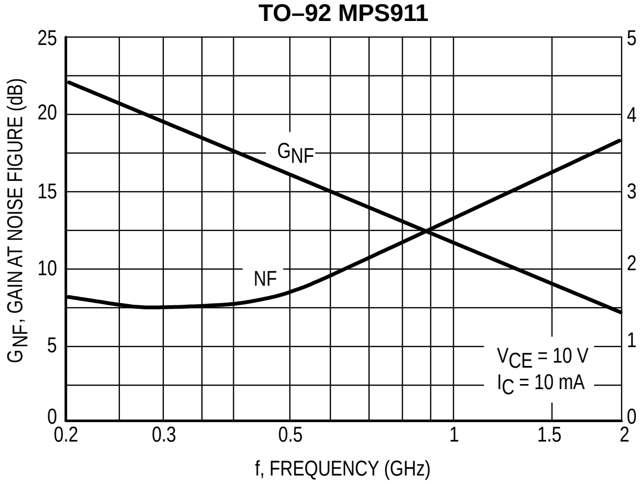


Figure 10. Gain at Noise Figure and Noise Figure versus Frequency

SOT–23 MMBR911LT1, T3

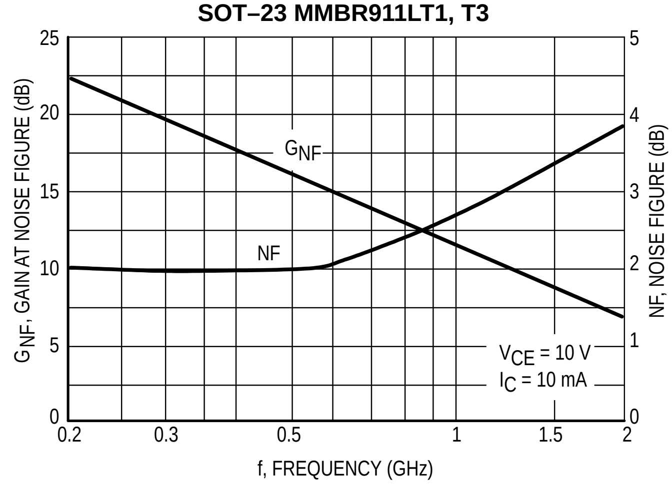


Figure 11. Gain at Noise Figure and Noise Figure versus Frequency

TO–92 MPS911

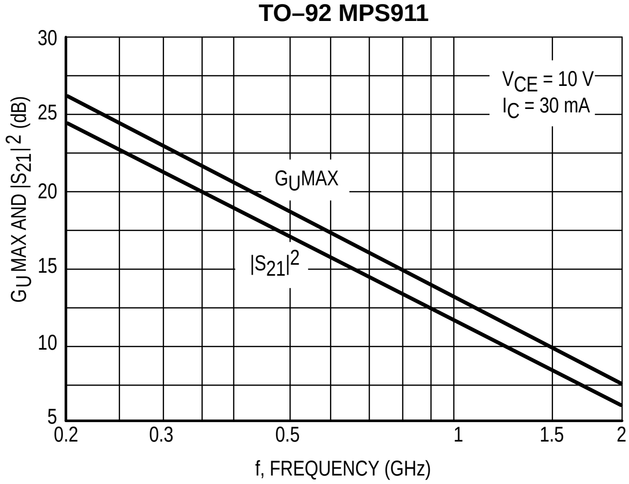


Figure 12. Maximum Unilateral Gain and Insertion Gain versus Frequency

SOT–23 MMBR911LT1, T3

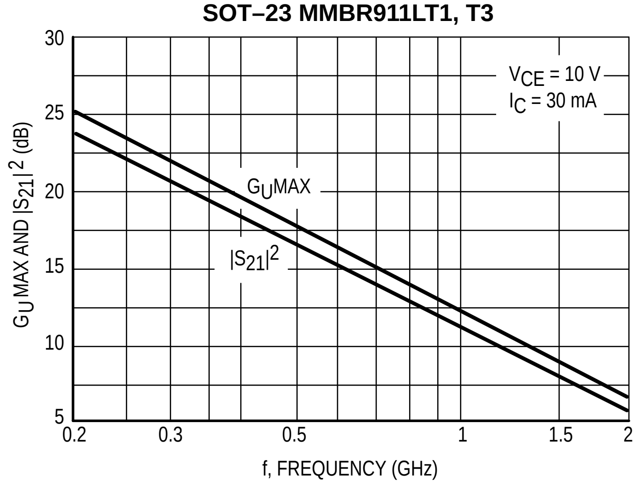


Figure 13. Maximum Unilateral Gain and Insertion Gain versus Frequency

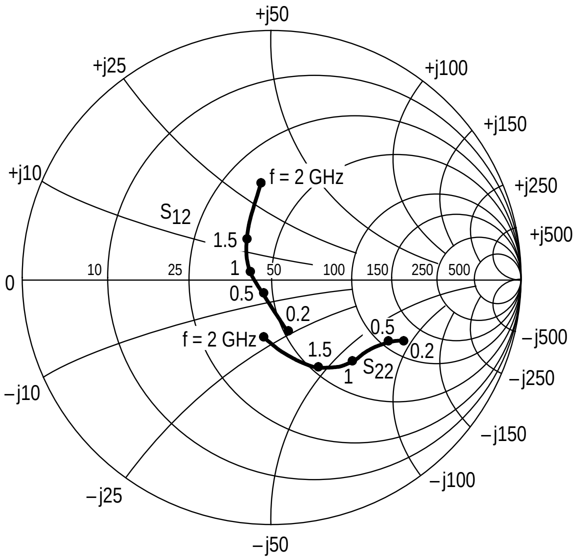


Figure 14. Input and Output Reflection Coefficients versus Frequency V_{CE} = 10 V, I_C = 30 mA

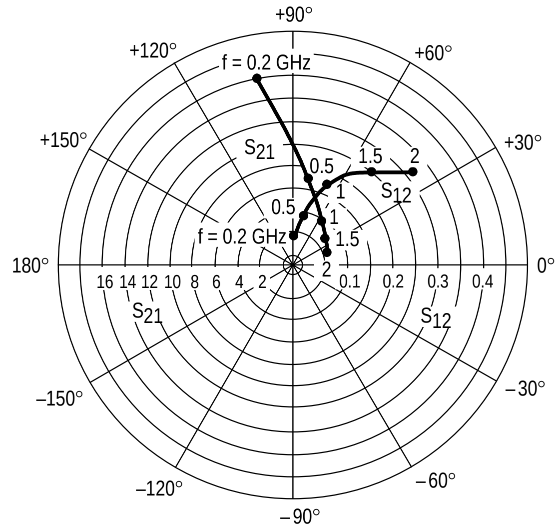


Figure 15. Forward and Reverse Transmission Coefficients versus Frequency V_{CE} = 10 V, I_C = 30 mA

V_{CE} (Volts)	I_C (mA)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\|S_{11}\|$	φ	$\|S_{21}\|$	φ	$\|S_{12}\|$	φ	$\|S_{22}\|$	φ
10	2.0	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
	5.0	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

Table 1. Common Emitter S–Parameters

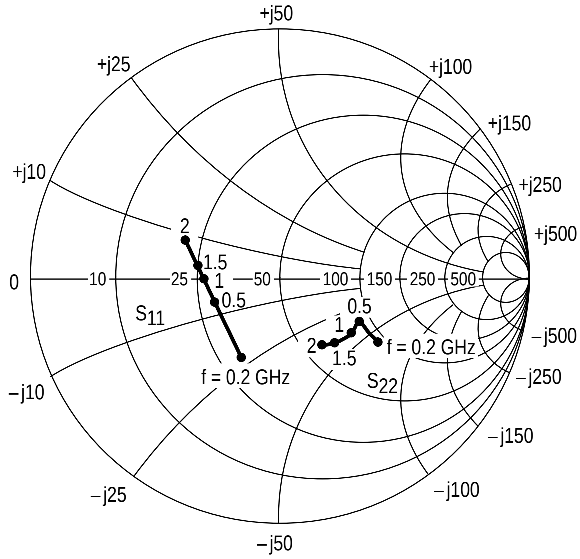


Figure 16. Input and Output Reflection Coefficients versus Frequency V_{CE} = 10 V, I_C = 30 mA

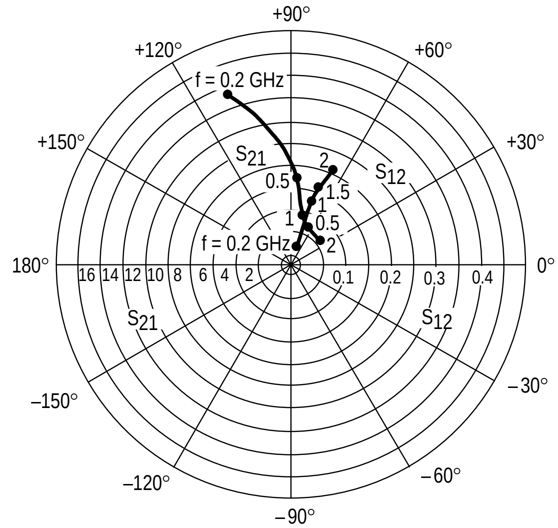
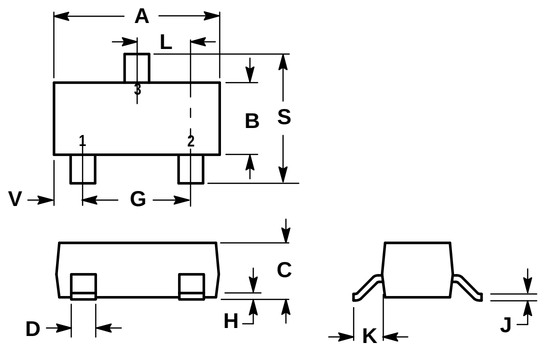


Figure 17. Forward and Reverse Transmission Coefficients versus Frequency V_{CE} = 10 V, I_C = 30 mA

V_{CE} (Volts)	I_C (mA)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\|S_{11}\|$	φ	$\|S_{21}\|$	φ	$\|S_{12}\|$	φ	$\|S_{22}\|$	φ
10	2.0	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
	5.0	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

Table 2. Common Emitter S–Parameters

PACKAGE DIMENSIONS

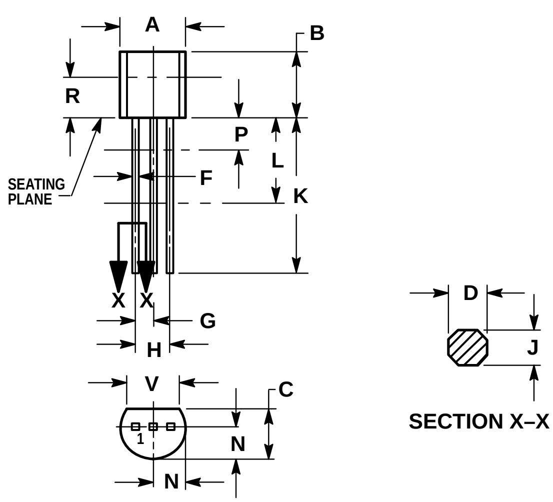


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIUMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.1102	0.1197	2.80	3.04
B	0.0472	0.0551	1.20	1.40
C	0.0350	0.0440	0.89	1.11
D	0.0150	0.0200	0.37	0.50
G	0.0701	0.0807	1.78	2.04
H	0.0005	0.0040	0.013	0.100
J	0.0034	0.0070	0.085	0.177
K	0.0180	0.0236	0.45	0.60
L	0.0350	0.0401	0.89	1.02
S	0.0830	0.0984	2.10	2.50
V	0.0177	0.0236	0.45	0.60

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

CASE 318–07
ISSUE AD
MMBR911LT1, T3



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. DIMENSION F APPLIES BETWEEN P AND L. DIMENSION D AND J APPLY BETWEEN L AND K MINIMUM. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.022	0.41	0.55
F	0.016	0.019	0.41	0.48
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	—	12.70	—
L	0.250	—	6.35	—
N	0.080	0.105	2.04	2.66
P	—	0.100	—	2.54
R	0.115	—	2.93	—
V	0.135	—	3.43	—

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

CASE 29–04
ISSUE AD
MPS911

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