MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

T-31-01

2N5835
2N5836
2N5837

The RF Line

2.5 GHz @ 10 mAdc – 2N5835
2.0 GHz @ 50 mAdc – 2N5836
1.7 GHz @ 100 mAdc – 2N5837

HIGH FREQUENCY TRANSISTORS

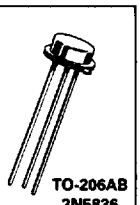
NPN SILICON

2

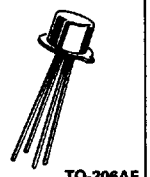
NPN SILICON HIGH-FREQUENCY TRANSISTORS

. . . designed primarily for use in fact current-mode switching circuits in military and industrial equipment. Suitable for use in general high-frequency amplifier applications to 1.5 GHz.

- 2N5835 — 10 mAdc, 6.0 Vdc Characteristics
  f_T = 2.5 GHz (Min)
  $r_B'C_C$ = 5.0 ps (Typ)
  t_r = 250 ps (Typ)
- 2N5836 — 50 mAdc, 6.0 Vdc Characteristics —
  f_T = 2.0 GHz (Min)
  $r_b'C_C$ = 6.0 ps (Typ)
  t_r = 320 ps (Typ)
- 2N5837 — 100 mAdc, 3.0 Vdc Characteristics —
  f_T = 1.7 GHz (Min)
  $r_b'C_C$ = 6.0 ps (Typ)
  t_r = 650 ps (Typ)
- MIL-S-19500 Processed Versions Available as MRF5836HX, MRF5836HXV



TO-206AB
2N5836
2N5837

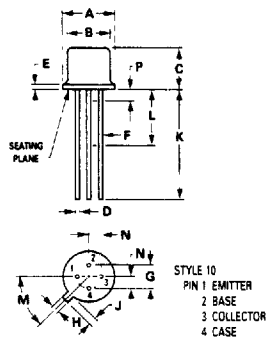


TO-206AF
2N5835

*MAXIMUM RATINGS

Rating	Symbol	2N5835	2N5836	2N5837	Unit
Collector-Emitter Voltage	V_{CEO}	10	10	5.0	Vdc
Collector-Base Voltage	V_{CBO}	15	15	10	Vdc
Emitter-Base Voltage	V_{EBO}	3.5	3.5	3.5	Vdc
Collector Current – Continuous	I_C	15	200	300	mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	200 1.14	300 —	300 —	mW mW/°C
Total Device Dissipation @ T_C = 100°C Derate above 100°C	P_D	– –	0.75 7.5	0.75 7.5	Watts mW/°C
Storage Junction Temperature Range	T_{stg}	← -65 to +200 →			°C

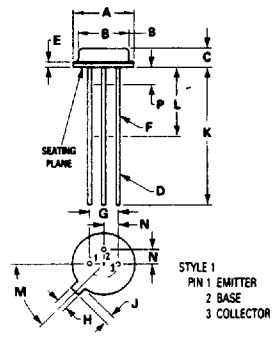
*Indicates JEDEC Registered Data



NOTE ALL RULES AND NOTES ASSOCIATED WITH TO 72 OUTLINE SHALL APPLY

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	5.31	5.84	0.209	0.230
B	4.52	4.95	0.178	0.195
C	4.32	5.33	0.170	0.210
D	0.41	0.53	0.016	0.021
E	—	0.76	—	0.030
F	0.41	0.48	0.016	0.019
G	2.54 BSC		0.100 BSC	
H	0.91	1.17	0.036	0.046
J	0.71	1.22	0.028	0.048
K	12.70	—	0.500	—
L	6.35	—	0.250	—
M	45° BSC		45° BSC	
N	1.27 BSC		0.050 BSC	
P	—	1.27	—	0.050

CASE 20-03
TO-206AF
(TO-72)



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	5.31	5.84	0.209	0.230
B	4.52	4.95	0.178	0.195
C	1.65	2.16	0.065	0.085
D	0.406	0.533	0.016	0.021
E	—	1.02	—	0.040
F	0.305	0.483	0.012	0.019
G	2.54 BSC		0.100 BSC	
H	0.914	1.17	0.036	0.046
J	0.711	1.22	0.028	0.048
K	12.70	—	0.500	—
L	6.35	—	0.250	—
M	45° BSC		45° BSC	
N	1.27 BSC		0.050 BSC	
P	—	1.27	—	0.050

CASE 26-03
TO-206AB
(TO-46)

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

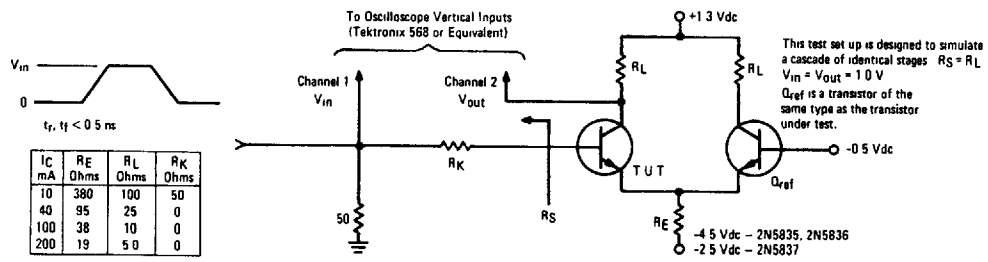
Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$				Vdc
(I_C = 10 μAdc, I_E = 0)	2N5835		15	–	–	
(I_C = 100 μAdc, I_E = 0)	2N5836		15	–	–	
	2N5837		10	–	–	
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	3 5	–	–	Vdc
(I_E = 100 μAdc, I_C = 0)						
Collector Cutoff Current		I_{CBO}				μAdc
(V_{CB} = 7 5 Vdc, I_E = 0)	2N5835		–	–	0 01	
(V_{CB} = 10 Vdc, I_E = 0)	2N5836		–	–	10	
(V_{CB} = 5 0 Vdc, I_E = 0)	2N5837		–	–	10	
Emitter Cutoff Current		I_{EBO}	–	–	100	μAdc
(V_{EB} = 3.0 Vdc, I_C = 0)						
ON CHARACTERISTICS						
DC Current Gain		h_{FE}				–
(I_C = 10 mAdc, V_{CE} = 6.0 Vdc)	2N5835		25	–	–	
(I_C = 50 mAdc, V_{CE} = 6.0 Vdc)	2N5836		25	–	–	
(I_C = 100 mAdc, V_{CE} = 3 0 Vdc)	2N5837		25	–	–	
Base-Emitter On Voltage		$V_{BE(on)}$				Vdc
(I_C = 10 mAdc, V_{CE} = 6.0 Vdc)	2N5835		–	–	0 9	
(I_C = 50 mAdc, V_{CE} = 6.0 Vdc)	2N5836		–	–	0 9	
(I_C = 100 mAdc, V_{CE} = 3 0 Vdc)	2N5837		–	–	0 9	
DYNAMIC CHARACTERISTICS						
Current-Gain—Bandwidth Product ①		f_T				GHz
(I_C = 10 mAdc, V_{CE} = 6 0 Vdc, f = 200 MHz)	2N5835		2 5	–	–	
(I_C = 50 mAdc, V_{CE} = 6 0 Vdc, f = 200 MHz)	2N5836		2 0	–	–	
(I_C = 100 mAdc, V_{CE} = 3.0 Vdc, f = 200 MHz)	2N5837		1 7	–	–	
Collector-Base Capacitance		C_{cb}				pF
(V_{CB} = 10 Vdc, I_E = 0, f = 0 1 to 1.0 MHz)	2N5835		–	–	0 8	
	2N5836		–	–	3 5	
(V_{CB} = 5 0 Vdc, I_E = 0, f = 0 1 to 1 0 MHz)	2N5837		–	–	5 0	
Collector-Base Time Constant ②		$r_b C_c$				ps
(I_C = 10 mAdc, V_{CE} = 6 0 Vdc, f = 63.6 MHz)	2N5835		–	5 0	–	
(I_C = 50 mAdc, V_{CE} = 6 0 Vdc, f = 63.6 MHz)	2N5836		–	6 0	–	
(I_C = 100 mAdc, V_{CE} = 3 0 Vdc, f = 63.6 MHz)	2N5837		–	6 0	–	
SWITCHING CHARACTERISTICS ②						
Rise Time (See Figure 1)	(I_C = 10 mAdc) 2N5835	t_r	–	250	–	ps
	(I_C = 40 mAdc) 2N5836		–	320	–	
	(I_C = 100 mAdc) 2N5837		–	650	–	

*Indicates JEDEC Registered Data

①f_T is defined as the frequency at which $|h_{fe}|$ extrapolates to unity

② Typical values shown in addition to JEDEC Registered Data

FIGURE 1 – SWITCHING TIME TEST CIRCUIT



IC mA	RE Ohms	RL Ohms	RK Ohms
10	380	100	50
40	95	25	0
100	38	10	0
200	19	5 0	0

FIGURE 2 – SWITCHING TIME

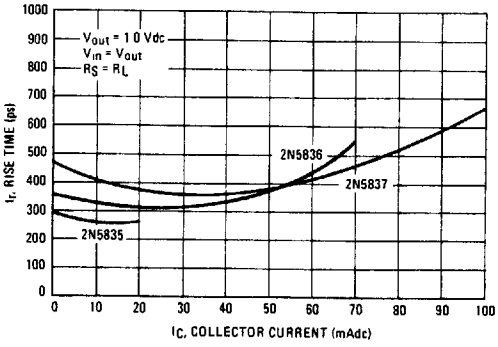


FIGURE 3 – CURRENT-GAIN–BANDWIDTH PRODUCT

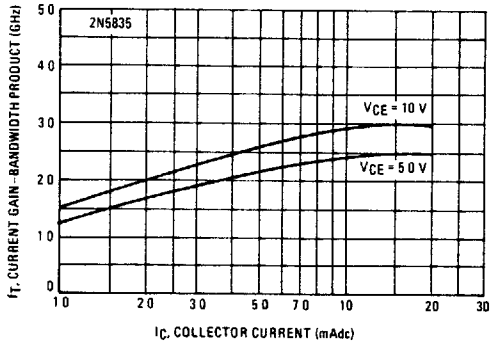


FIGURE 4 – CURRENT-GAIN–BANDWIDTH PRODUCT

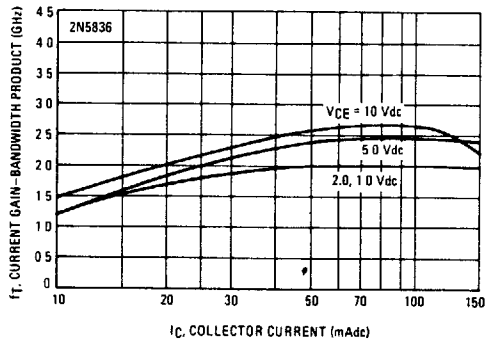


FIGURE 5 – CURRENT-GAIN–BANDWIDTH PRODUCT

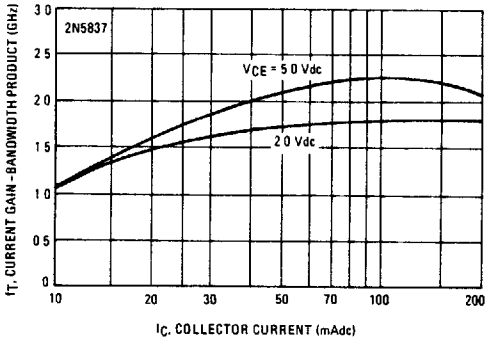


FIGURE 6 – COLLECTOR-BASE TIME CONSTANT

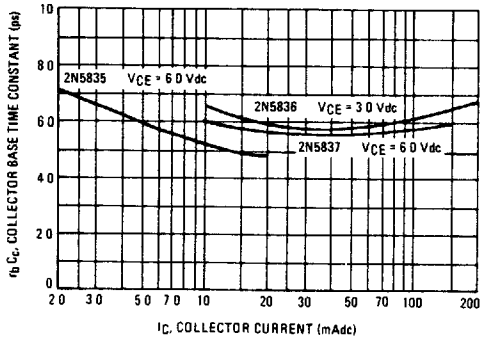
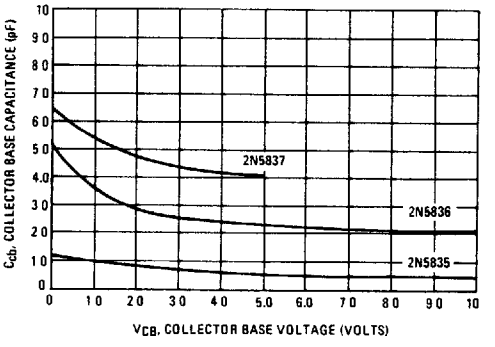


FIGURE 7 – COLLECTOR-BASE CAPACITANCE



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2N5835 SCATTERING PARAMETERS
(I_C = 5.0 mAdc, V_{CE} = 6.0 Vdc, Z_G = Z_L = 50 Ohms)

FIGURE 8 – S_{11}, INPUT REFLECTION COEFFICIENT

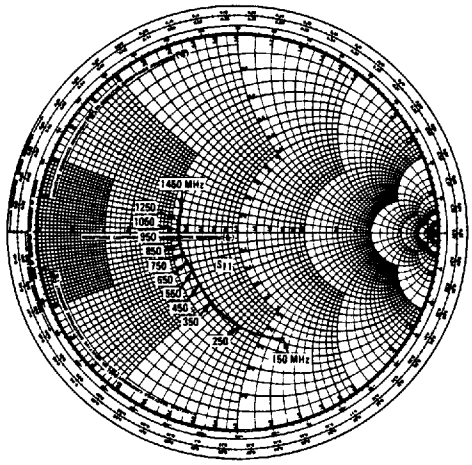


FIGURE 9 – S_{22}, OUTPUT REFLECTION COEFFICIENT

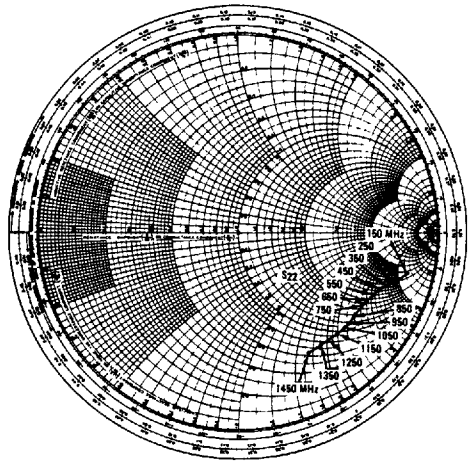


FIGURE 10 – S_{12}, REVERSE TRANSMISSION COEFFICIENT

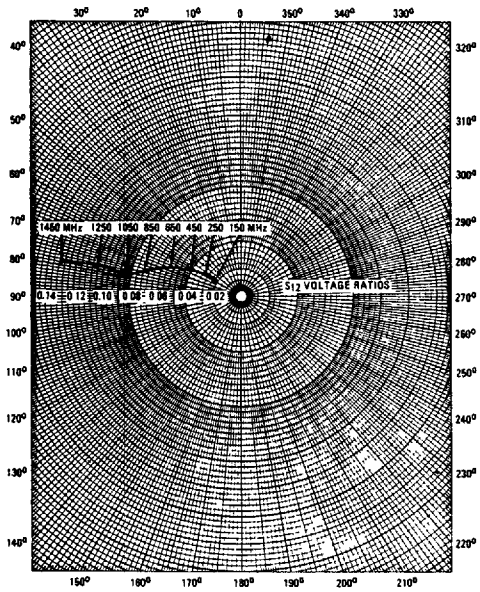
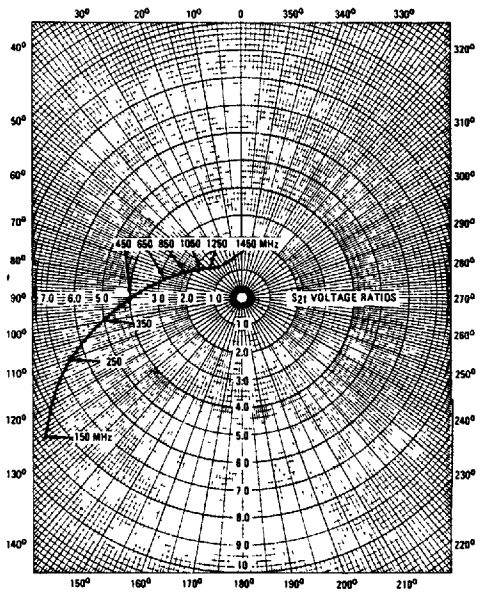


FIGURE 11 – S_{21}, FORWARD TRANSMISSION COEFFICIENT



2N5836 SCATTERING PARAMETERS

(I_C = 100 mAdc, V_{CE} = 10 Vdc, Z_G = Z_L = 50 Ohms)

FIGURE 12 – S_{11}, INPUT REFLECTION COEFFICIENT

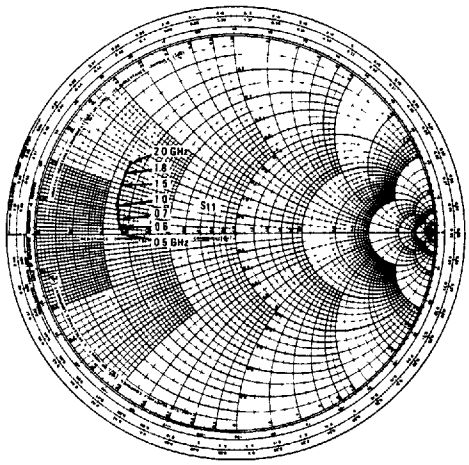


FIGURE 13 – S_{22}, OUTPUT REFLECTION COEFFICIENT

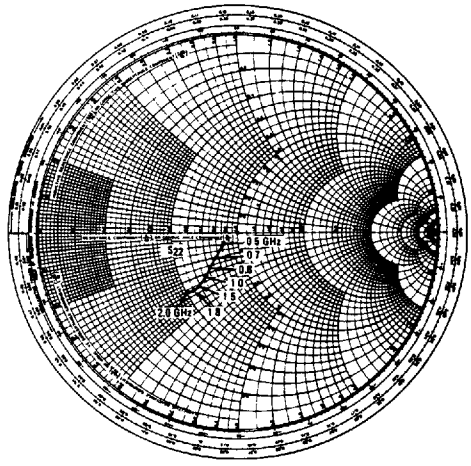


FIGURE 14 – S_{12}, REVERSE TRANSMISSION COEFFICIENT

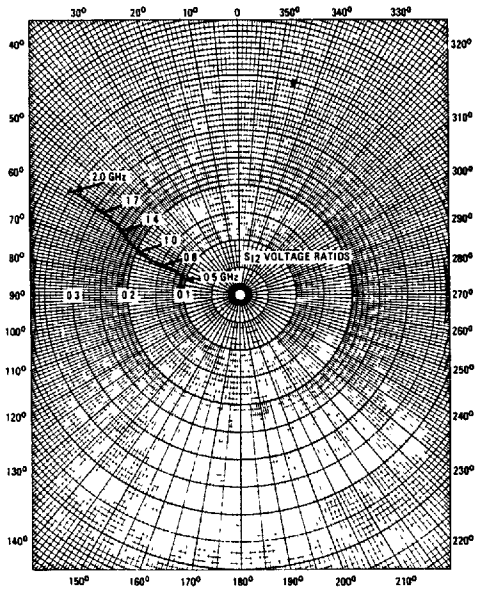
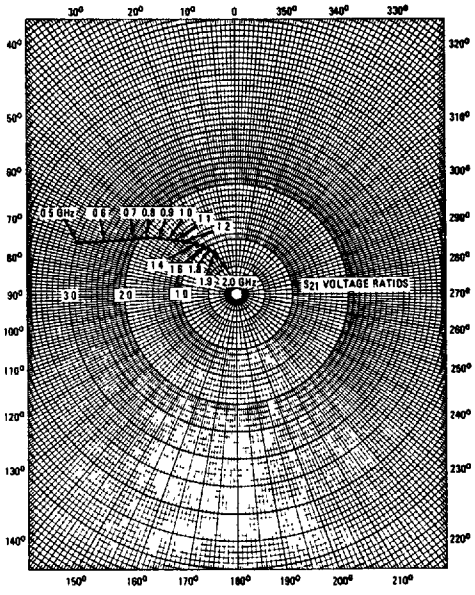


FIGURE 15 – S_{21}, FORWARD TRANSMISSION COEFFICIENT



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2N5837 SCATTERING PARAMETERS
(I_C = 100 mAdc, V_{CE} = 3.0 Vdc, $Z_G = Z_L$ = 50 Ohms)

FIGURE 16 – S_{11}, INPUT REFLECTION COEFFICIENT

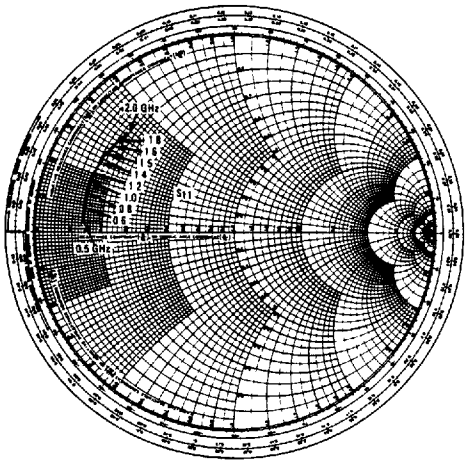

FIGURE 17 – S_{22}, OUTPUT REFLECTION COEFFICIENT

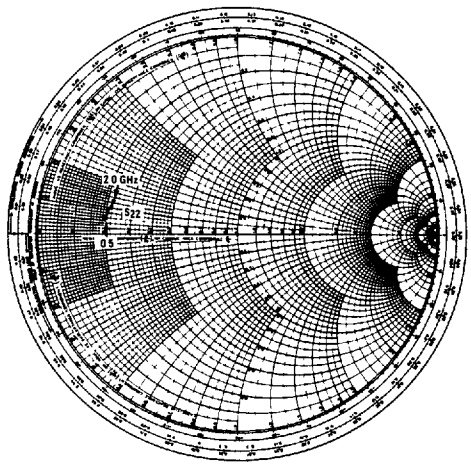

FIGURE 18 – S_{12}, REVERSE TRANSMISSION COEFFICIENT

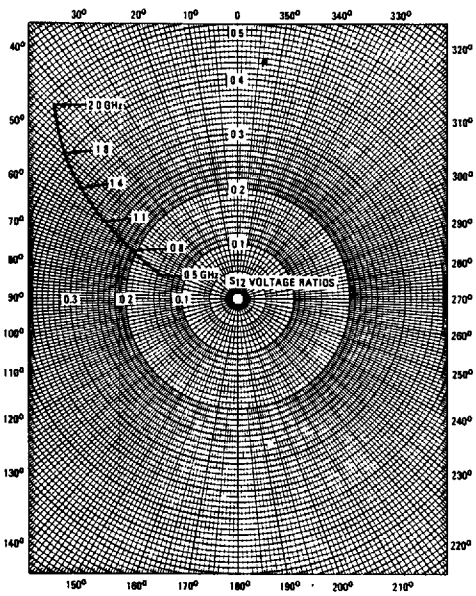

FIGURE 19 – S_{21}, FORWARD TRANSMISSION COEFFICIENT