

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

T-31-01
2N5835
2N5836
2N5837

The RF Line

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

*MAXIMUM RATINGS

Rating	Symbol	2N5835	2N5836	2N5837	Unit
Collector-Emitter Voltage	V_{CE0}	10	10	5.0	Vdc
Collector-Base Voltage	V_{CB0}	15	15	10	Vdc
Emitter-Base Voltage	V_{EB0}	3.5	3.5	3.5	Vdc
Collector Current — Continuous	I_C	15	200	300	mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	200 1.14	300 —	300 —	mW mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 100^\circ\text{C}$ Derate above 100°C	P_D	—	0.75 7.5	0.75 7.5	Watts mW/ $^\circ\text{C}$
Storage Junction Temperature Range	T_{stg}	-65 to +200			$^\circ\text{C}$

*Indicates JEDEC Registered Data

SEATING PLANE

STYLE 10
PIN 1 EMITTER
2 BASE
3 COLLECTOR
4 CASE

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

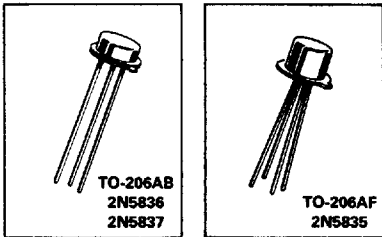
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	5.31	5.84	0.209	0.230
B	4.52	4.95	0.178	0.195
C	4.32	5.33	0.170	0.210
D	0.41	0.53	0.016	0.021
E	—	0.75	—	0.030
F	0.41	0.48	0.016	0.019
G	2.54 BSC		0.100 BSC	
H	0.91	1.17	0.036	0.046
J	0.71	1.22	0.028	0.048
K	12.70	—	0.500	—
L	6.35	—	0.250	—
M	45° BSC		45° BSC	
N	1.27 BSC		0.050 BSC	
P	—	1.27	—	0.050

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

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

HIGH FREQUENCY
TRANSISTORS

NPN SILICON



SEATING PLANE

STYLE 1
PIN 1 EMITTER
2 BASE
3 COLLECTOR

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	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)

2

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

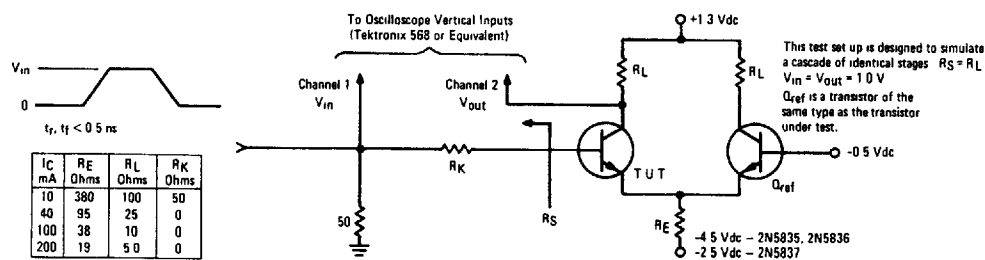
Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Base Breakdown Voltage ($I_C = 10\text{ }\mu\text{A}$, $I_E = 0$)	$V_{(BR)CBO}$	15	—	—	Vdc
($I_C = 100\text{ }\mu\text{A}$, $I_E = 0$)		15	—	—	
		10	—	—	
Emitter-Base Breakdown Voltage ($I_E = 100\text{ }\mu\text{A}$, $I_C = 0$)	$V_{(BR)EBO}$	3.5	—	—	Vdc
Collector Cutoff Current ($V_{CB} = 7.5\text{ Vdc}$, $I_E = 0$)	I_{CBO}	—	—	0.01	μA
($V_{CB} = 10\text{ Vdc}$, $I_E = 0$)		—	—	10	
($V_{CB} = 5.0\text{ Vdc}$, $I_E = 0$)		—	—	10	
Emitter Cutoff Current ($V_{EB} = 3.0\text{ Vdc}$, $I_C = 0$)	I_{EBO}	—	—	100	μA
ON CHARACTERISTICS					
DC Current Gain ($I_C = 10\text{ mA}$, $V_{CE} = 6.0\text{ Vdc}$)	h_{FE}	25	—	—	—
($I_C = 50\text{ mA}$, $V_{CE} = 6.0\text{ Vdc}$)		25	—	—	
($I_C = 100\text{ mA}$, $V_{CE} = 3.0\text{ Vdc}$)		25	—	—	
Base-Emitter On Voltage ($I_C = 10\text{ mA}$, $V_{CE} = 6.0\text{ Vdc}$)	$V_{BE(on)}$	—	—	0.9	Vdc
($I_C = 50\text{ mA}$, $V_{CE} = 6.0\text{ Vdc}$)		—	—	0.9	
($I_C = 100\text{ mA}$, $V_{CE} = 3.0\text{ Vdc}$)		—	—	0.9	
DYNAMIC CHARACTERISTICS					
Current-Gain-Bandwidth Product ① ($I_C = 10\text{ mA}$, $V_{CE} = 6.0\text{ Vdc}$, $f = 200\text{ MHz}$)	f_T	25	—	—	GHz
($I_C = 50\text{ mA}$, $V_{CE} = 6.0\text{ Vdc}$, $f = 200\text{ MHz}$)		20	—	—	
($I_C = 100\text{ mA}$, $V_{CE} = 3.0\text{ Vdc}$, $f = 200\text{ MHz}$)		17	—	—	
Collector-Base Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f = 0.1$ to 1.0 MHz)	C_{cb}	—	—	0.8	pF
		—	—	3.5	
($V_{CB} = 5.0\text{ Vdc}$, $I_E = 0$, $f = 0.1$ to 1.0 MHz)		—	—	5.0	
Collector-Base Time Constant ② ($I_C = 10\text{ mA}$, $V_{CE} = 6.0\text{ Vdc}$, $f = 63.6\text{ MHz}$)	$\tau_b C_c$	—	5.0	—	ps
($I_C = 50\text{ mA}$, $V_{CE} = 6.0\text{ Vdc}$, $f = 63.6\text{ MHz}$)		—	6.0	—	
($I_C = 100\text{ mA}$, $V_{CE} = 3.0\text{ Vdc}$, $f = 63.6\text{ MHz}$)		—	6.0	—	
SWITCHING CHARACTERISTICS ②					
Rise Time (See Figure 1) ($I_C = 10\text{ mA}$)	t_r	—	250	—	ps
($I_C = 40\text{ mA}$)		—	320	—	
($I_C = 100\text{ mA}$)		—	650	—	

* Indicates JEDEC Registered Data

① f_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



2N5835, 2N5836, 2N5837

MOTOROLA SC (XSTRS/R F) 46E D 6367254 0094097 1 MOT6

FIGURE 2 - SWITCHING TIME

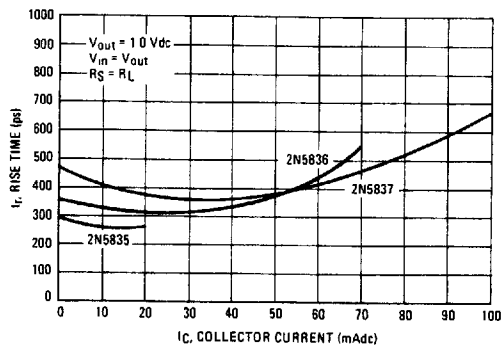


FIGURE 3 - CURRENT-GAIN-BANDWIDTH PRODUCT

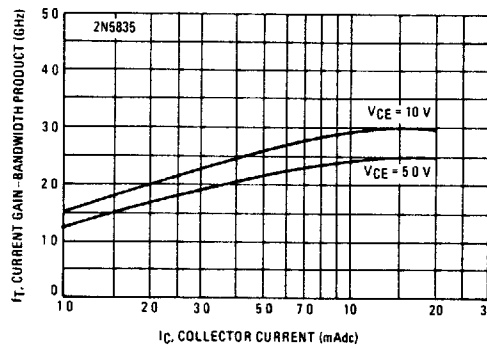


FIGURE 4 - CURRENT-GAIN-BANDWIDTH PRODUCT

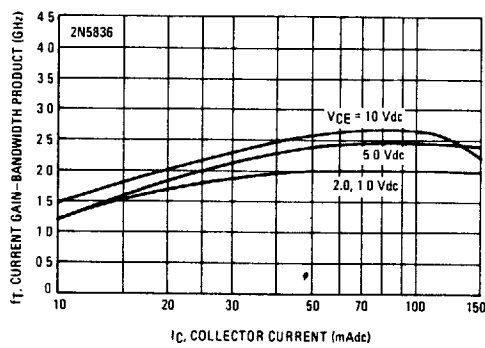


FIGURE 5 - CURRENT-GAIN-BANDWIDTH PRODUCT

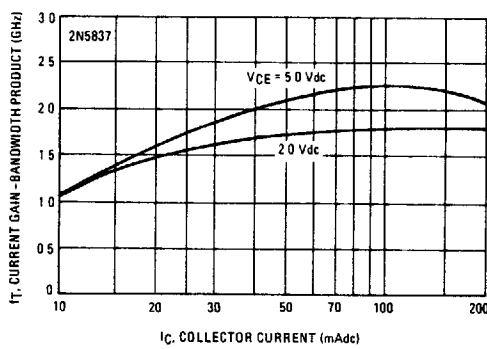


FIGURE 6 - COLLECTOR-BASE TIME CONSTANT

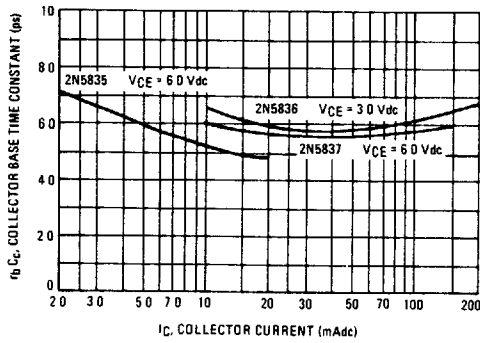
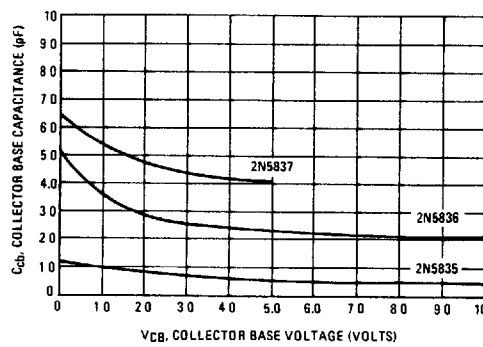
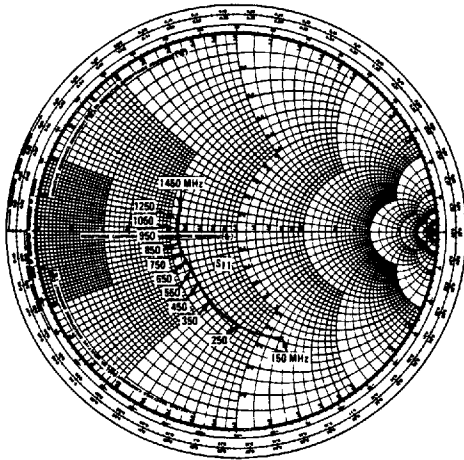
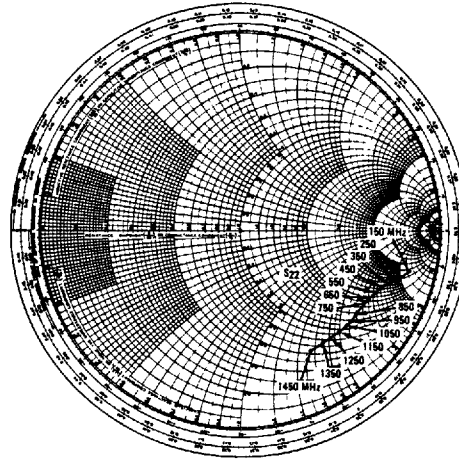
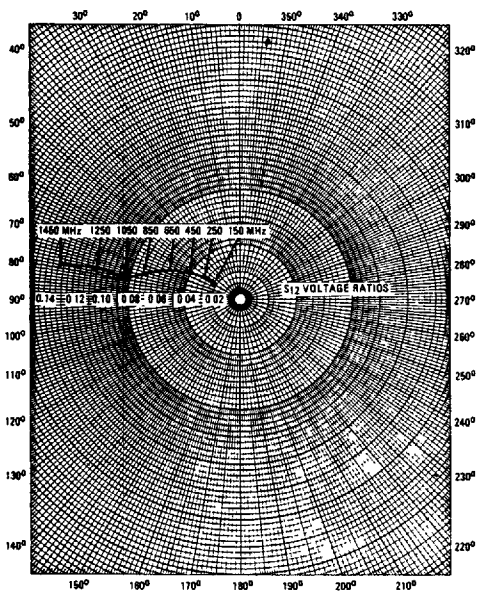
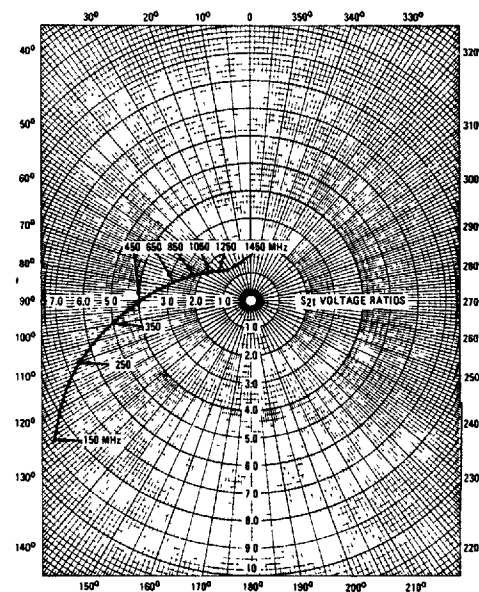


FIGURE 7 - COLLECTOR-BASE CAPACITANCE



2N5835, 2N5836, 2N5837

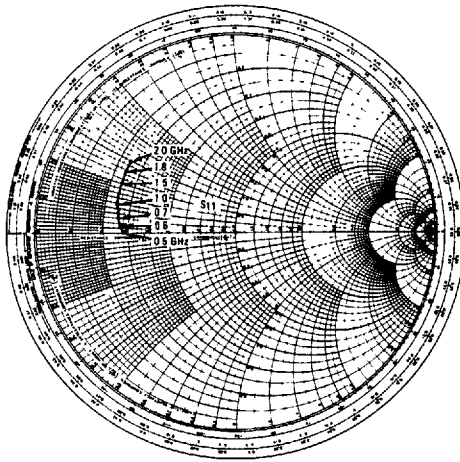
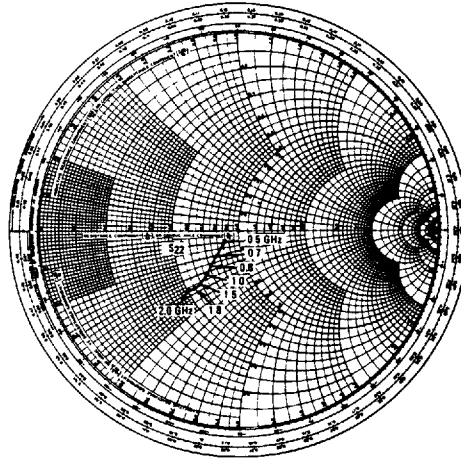
MOTOROLA SC (XSTRS/R F) 46E D ■ 6367254 0094098 3 ■ MOT6

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**

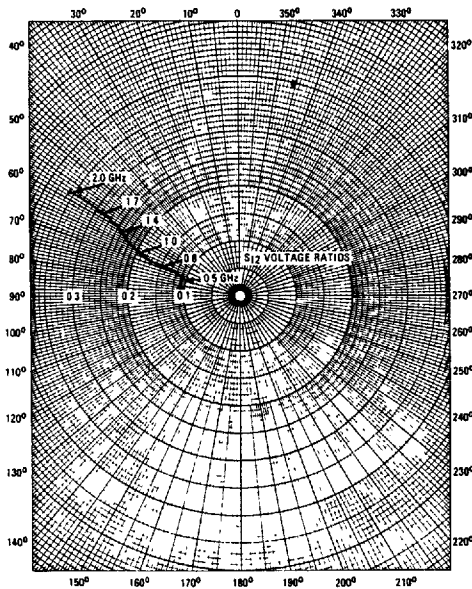
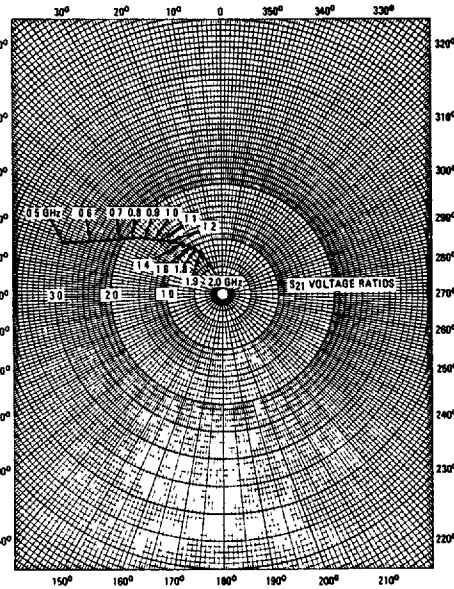
2N5835, 2N5836, 2N5837

MOTOROLA SC (XSTRS/R F) 46E D ■ 6367254 0094099 5 ■ M0T6

2N5836 SCATTERING PARAMETERS

(I_C = 100 mA_{dc}, V_{CE} = 10 V_{dc}, Z_G = Z_L = 50 Ohms)FIGURE 12 – S₁₁, INPUT REFLECTION COEFFICIENTFIGURE 13 – S₂₂, OUTPUT REFLECTION COEFFICIENT

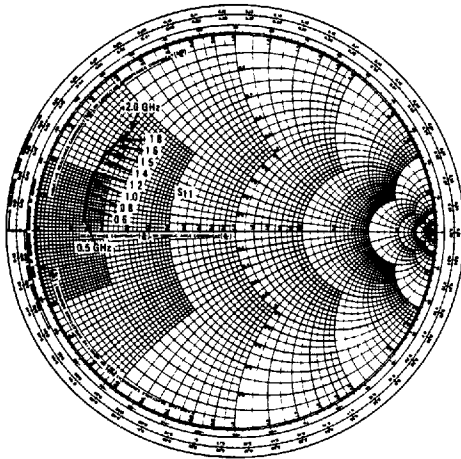
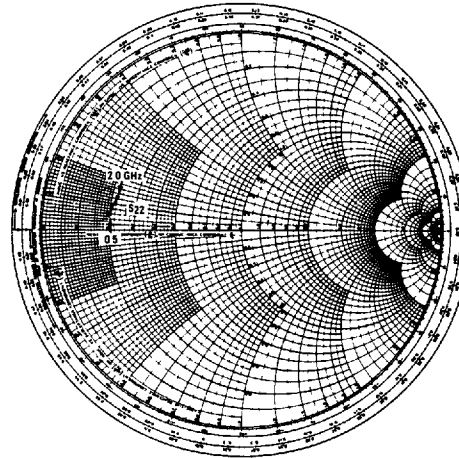
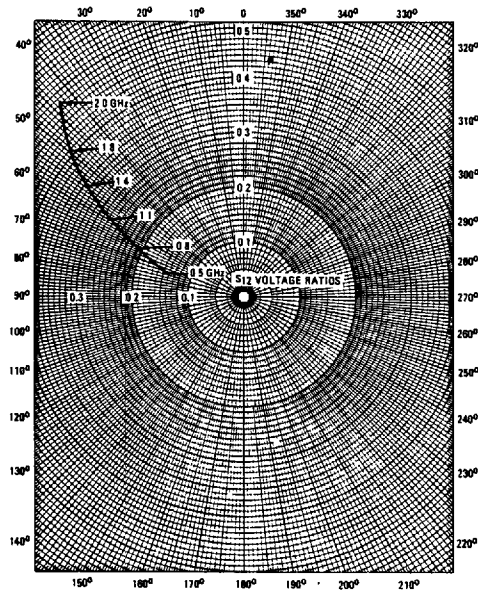
2

FIGURE 14 – S₁₂, REVERSE TRANSMISSION COEFFICIENTFIGURE 15 – S₂₁, FORWARD TRANSMISSION COEFFICIENT

2N5835, 2N5836, 2N5837

MOTOROLA SC (XSTRS/R F) 46E D ■ 6367254 0094100 & ■ MOT6

2N5837 SCATTERING PARAMETERS

(I_C = 100 mA_{dc}, V_{CE} = 3.0 V_{dc}, Z_G = Z_L = 50 Ohms)FIGURE 16 – S₁₁, INPUT REFLECTION COEFFICIENTFIGURE 17 – S₂₂, OUTPUT REFLECTION COEFFICIENTFIGURE 18 – S₁₂, REVERSE TRANSMISSION COEFFICIENTFIGURE 19 – S₂₁, FORWARD TRANSMISSION COEFFICIENT