2N5835
2N5836
2N5837

The RF Line

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

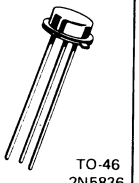
HIGH FREQUENCY TRANSISTORS

NPN SILICON

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)



TO-46
2N5836
2N5837

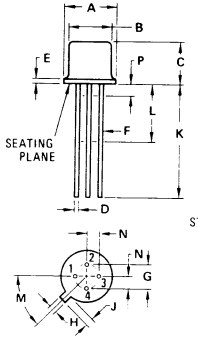
TO-72
2N5835

3

*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	– –	– –	mW mW/°C
Total Device Dissipation@T_C=100°C Derate above 100°C	P_D	– –	**.75 7.5**	**.75 7.5**	Watts mW/°C
Storage Junction Temperature Range	T_{stg}	← -65 to +200 →			°C

*Indicates JEDEC Registered Data.

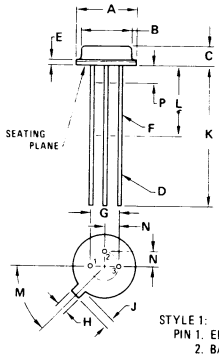


STYLE 10
PIN 1. EMITTER
2. BASE
3. COLLECTOR
4. CASE

DIM	MILLIMETERS MIN	MAX	INCHES 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	–	0.76	–	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

ALL JEDEC dimensions and notes apply

CASE 20-03
TO-72



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

DIM	MILLIMETERS MIN	MAX	INCHES 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

All JEDEC dimensions and notes apply

CASE 26-03
TO-46

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

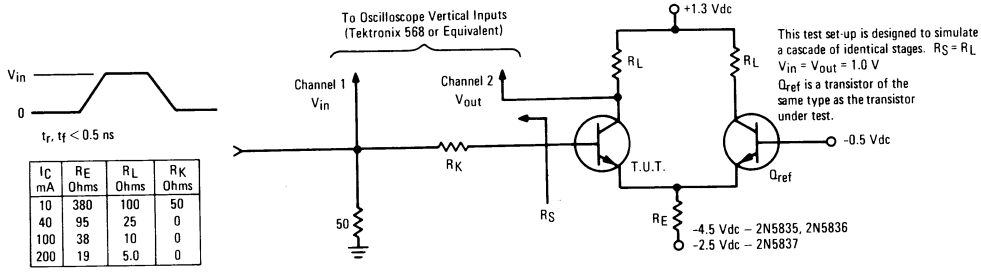
Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector-Base Breakdown Voltage		$V_{(BR)CBO}$				Vdc
(I_C = 10 μAdc, I_E = 0)	2N5835		15	–	–	
(I_C = 100 μAdc, I_E = 0)	2N5836		15	–	–	
	2N5837		10	–	–	
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$	3.5	–	–	Vdc
(I_E = 100 μAdc, I_C = 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

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



I_C mA	R_E Ohms	R_L Ohms	R_K Ohms
10	380	100	50
40	95	25	0
100	38	10	0
200	19	5.0	0

FIGURE 2 – SWITCHING TIME

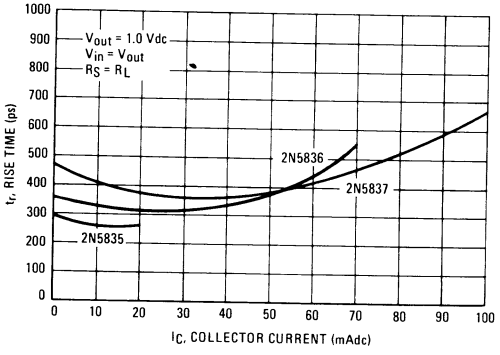


FIGURE 3 – CURRENT-GAIN–BANDWIDTH PRODUCT

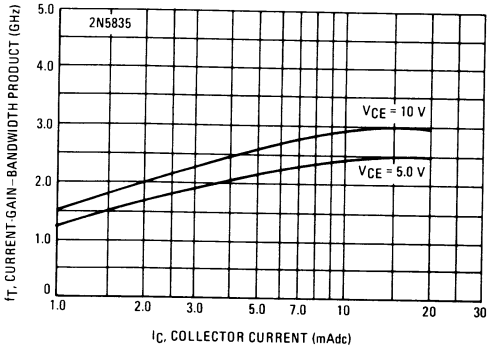


FIGURE 4 – CURRENT-GAIN–BANDWIDTH PRODUCT

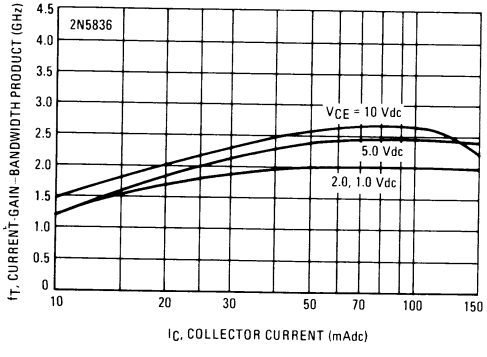


FIGURE 5 – CURRENT-GAIN–BANDWIDTH PRODUCT

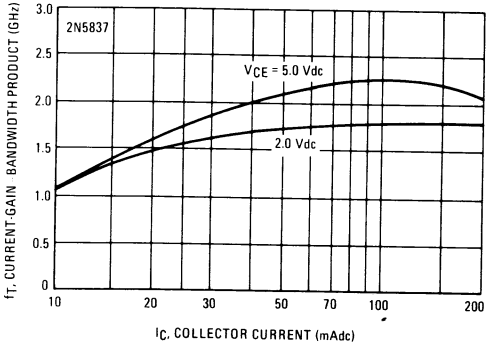


FIGURE 6 – COLLECTOR-BASE TIME CONSTANT

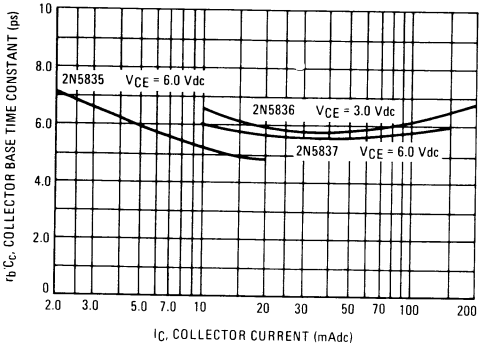
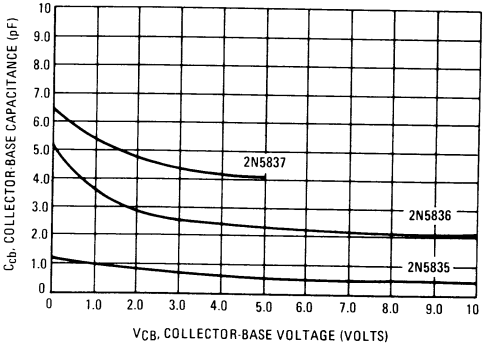


FIGURE 7 – COLLECTOR-BASE CAPACITANCE



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

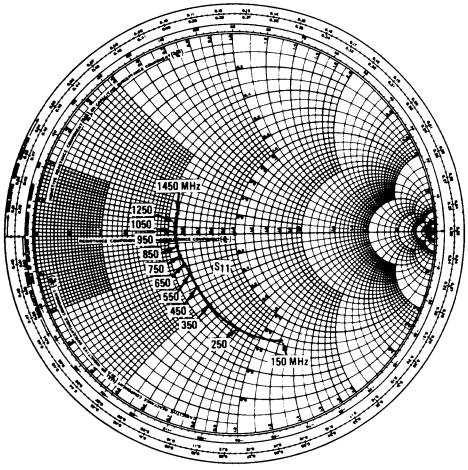


FIGURE 9 – S_{22}, OUTPUT REFLECTION COEFFICIENT

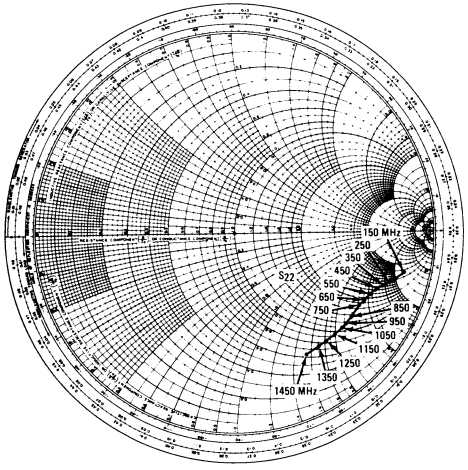


FIGURE 10 – S_{12}, REVERSE TRANSMISSION COEFFICIENT

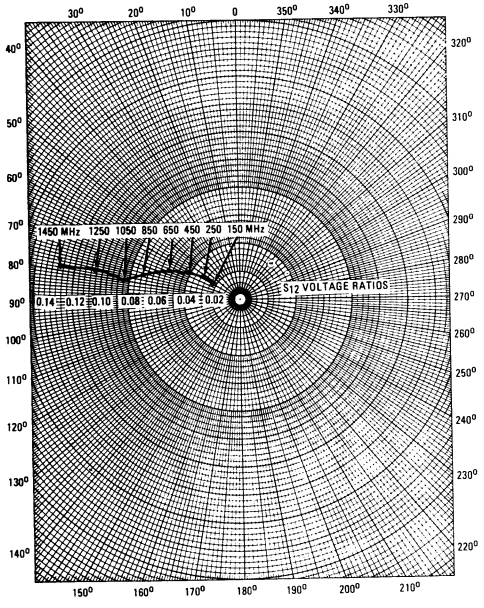
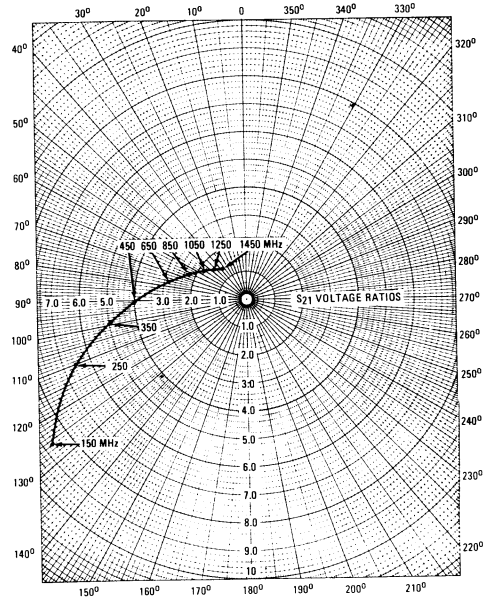


FIGURE 11 – S_{21}, FORWARD TRANSMISSION COEFFICIENT



2N5836 SCATTERING PARAMETERS

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

FIGURE 12 – S_{11}, INPUT REFLECTION COEFFICIENT

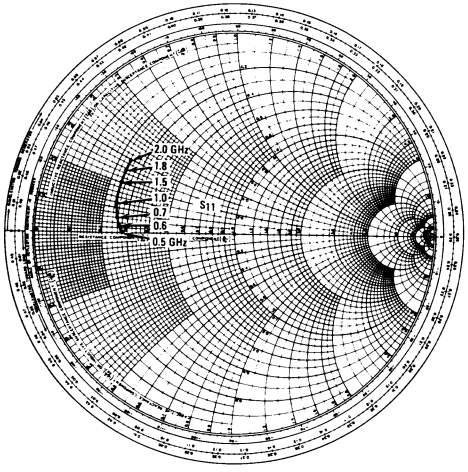


FIGURE 13 – S_{22}, OUTPUT REFLECTION COEFFICIENT

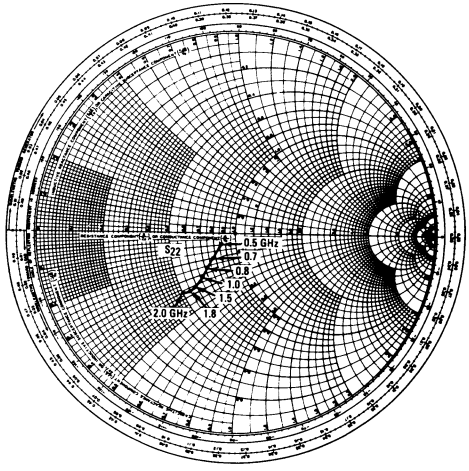


FIGURE 14 – S_{12}, REVERSE TRANSMISSION COEFFICIENT

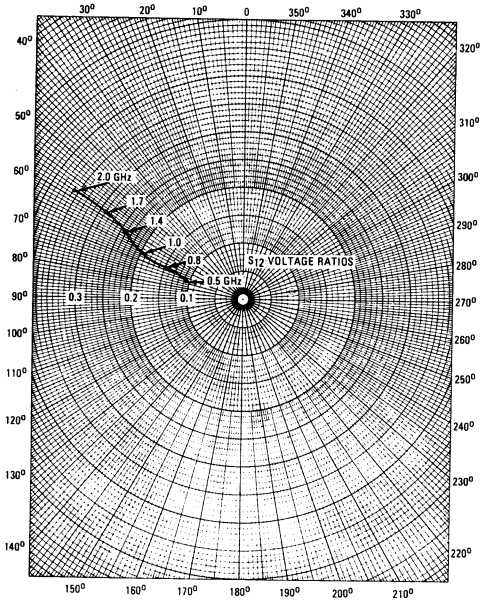
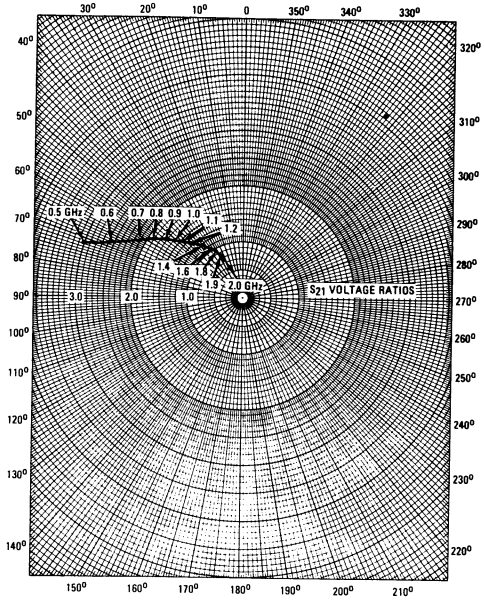


FIGURE 15 – S_{21}, FORWARD TRANSMISSION COEFFICIENT



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

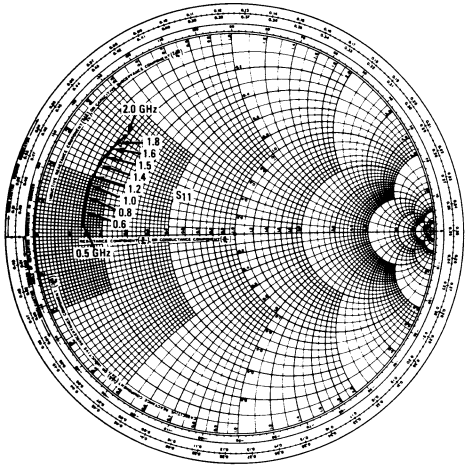


FIGURE 17 – S_{22}, OUTPUT REFLECTION COEFFICIENT

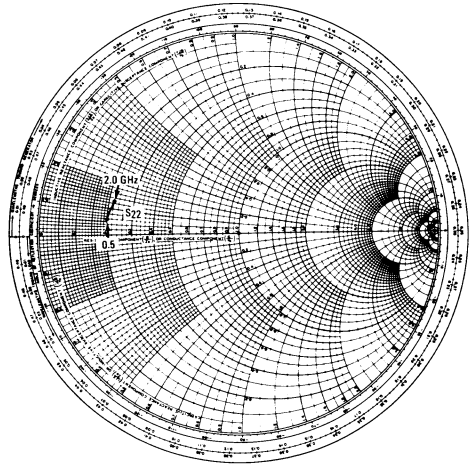


FIGURE 18 – S_{12}, REVERSE TRANSMISSION COEFFICIENT

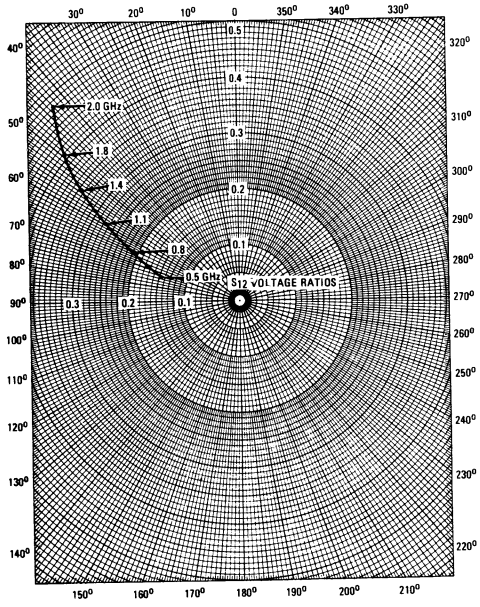
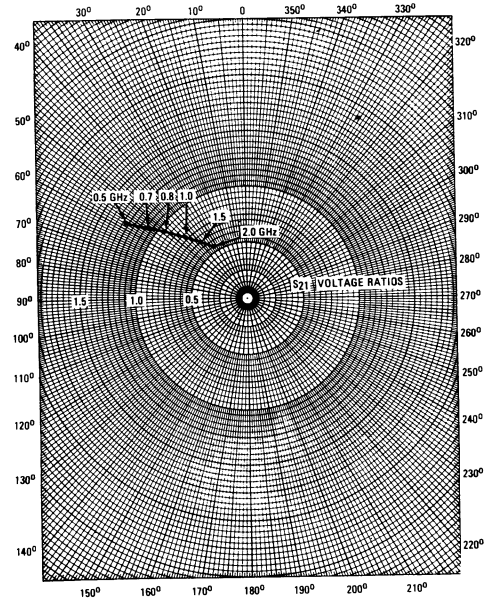


FIGURE 19 – S_{21}, FORWARD TRANSMISSION COEFFICIENT



2N5849

The RF Line

NPN SILICON RF POWER TRANSISTOR

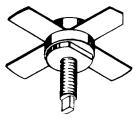
40 W–50 MHz

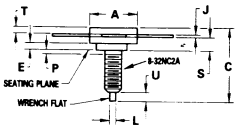
RF POWER TRANSISTOR

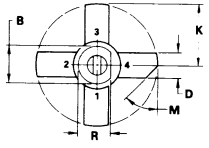
NPN SILICON

. . . designed primarily for use in large-signal amplifier output stages, the 2N5849 is intended for use in industrial communications equipment operating at frequencies to 80 MHz.

- Specified 12.5 Volt, 50 MHz Characteristics –
  Output Power = 40 Watts
  Minimum Gain = 7.5 dB
  Efficiency = 50%







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

DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	9.40	9.78	0.370	0.385
B	8.13	8.38	0.320	0.330
C	17.02	20.07	0.670	0.790
D	5.46	5.97	0.215	0.235
E	1.78	—	0.070	—
J	0.08	0.18	0.003	0.007
K	12.45	—	0.490	—
L	1.40	1.78	0.055	0.070
M	45° NOM		45° NOM	
P	—	1.27	—	0.050
R	7.59	7.80	0.299	0.307
S	4.01	4.52	0.158	0.178
T	2.11	2.54	0.083	0.100
U	2.49	3.35	0.098	0.132

CASE 145A-09

*MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	24	Vdc
Collector-Base Voltage	V_{CB}	48	Vdc
Emitter-Base Voltage	V_{EB}	4.0	Vdc
Collector Current — Continuous	I_C	7.0	Adc
Total Device Dissipation @ $T_C = 25^oC$ Derate above 25^oC	P_D	100 571	Watts $mW/^oC$
Storage Temperature Range	T_{stg}	-65 to +200	^oC

*Indicates JEDEC Registered Data.

This device is designed for RF operation. The total device dissipation rating applies only when the device is operated as an RF amplifier.

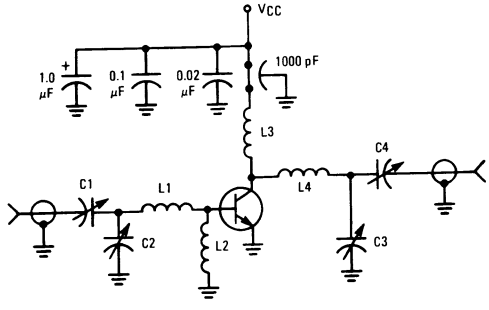
*ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage(1) (I_C = 200 mAdc, I_B = 0)	$V_{(BR)CEO}$	24	–	–	Vdc
Collector-Emitter Breakdown Voltage(1) (I_C = 100 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	48	–	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 10 mAdc, I_C = 0)	$V_{(BR)EBO}$	4.0	–	–	Vdc
Collector Cutoff Current (V_{CE} = 15 Vdc, V_{BE} = 0, T_A = +125°C)	I_{CES}	–	–	10	mAdc
Collector Cutoff Current (V_{CB} = 15 Vdc, I_E = 0)	I_{CBO}	–	–	1.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 2.4 Adc, V_{CE} = 5.0 Vdc)	h_{FE}	3.0	–	–	–
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 12.5 Vdc, I_E = 0, f = 0.1 to 1.0 MHz)	C_{ob}	–	180	230	pF
FUNCTIONAL TEST					
Common-Emitter Amplifier Power Gain (P_{out} = 40 W, V_{CC} = 12.5 Vdc, f = 50 MHz)	G_{PE}	7.5	–	–	dB
Collector Efficiency (P_{out} = 40 W, V_{CC} = 12.5 Vdc, f = 50 MHz)	η	50	–	–	%

*Indicates JEDEC Registered Data.
(1)Pulsed thru a 25 mH Inductor.

3

FIGURE 1 – 50 MHz POWER GAIN TEST CIRCUIT



C1 25-280 pF, Arco 464 or Equivalent
C2 80-480 pF, Arco 466 or Equivalent
C3 0-75 pF, Hammarlund MAPC 75 or Equivalent
C4 0-50 pF, Hammarlund MAPC 50 or Equivalent
L1 1 Turn #14 AWG 5/16" I.D.
L2 2-1/2 Turns #22 AWG on 3/8" Ferrite Bead
L3 18 Turns #18 AWG 3/8" I.D. 2 Layers, 9 Turns Each
L4 4 Turns #14 AWG 7/16" I.D. 7/16" Long

FIGURE 2 – POWER OUTPUT versus POWER INPUT

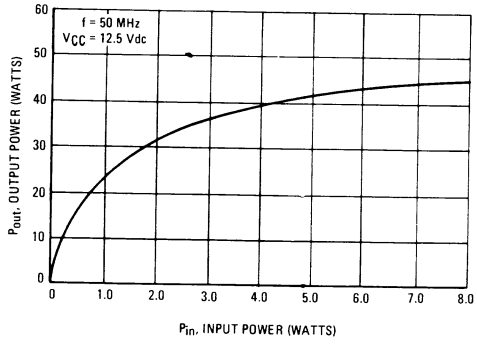


FIGURE 3 – POWER OUTPUT versus FREQUENCY

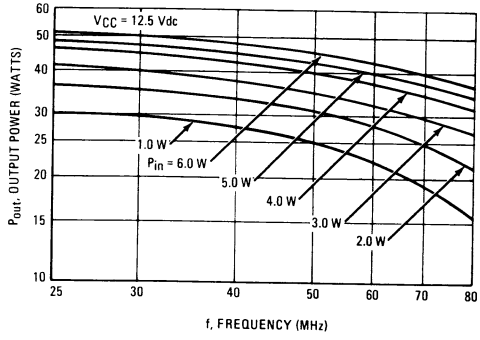


FIGURE 4 – PARALLEL EQUIVALENT INPUT RESISTANCE versus FREQUENCY

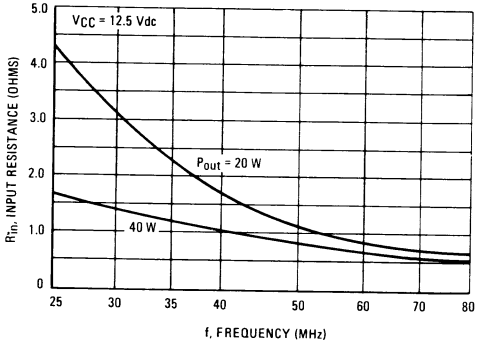


FIGURE 5 – PARALLEL EQUIVALENT INPUT CAPACITANCE versus FREQUENCY

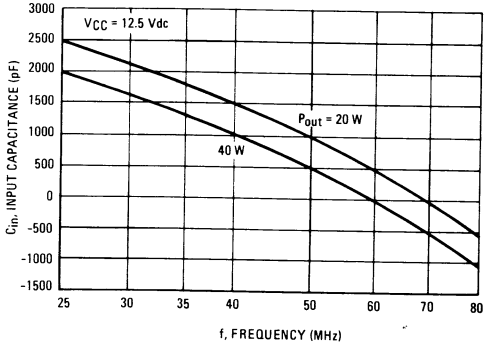


FIGURE 6 – PARALLEL EQUIVALENT OUTPUT CAPACITANCE versus FREQUENCY

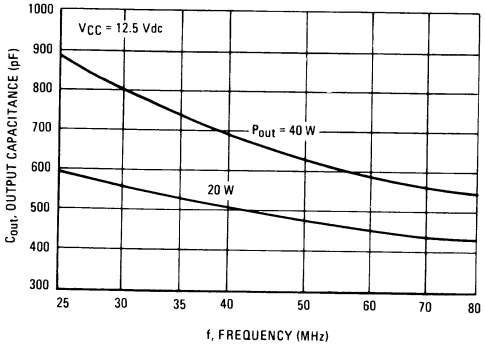
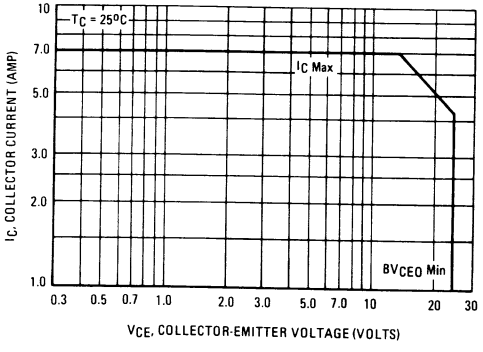
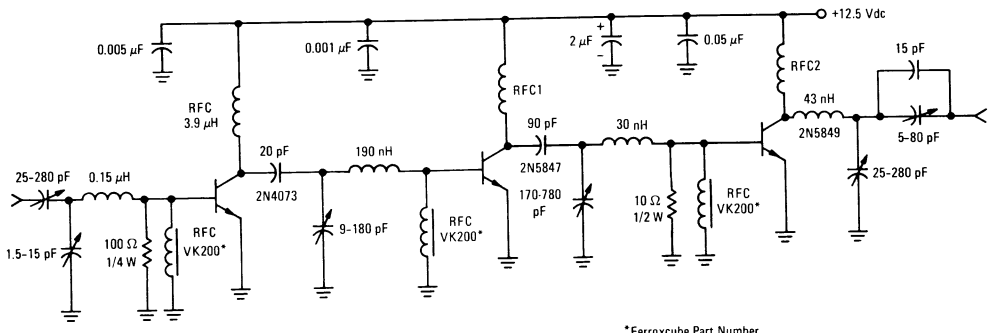


FIGURE 7 – DC SAFE OPERATING AREA



3

40 WATT, 50 MHz TRANSMITTER SCHEMATIC



P_o = 40 W
P_{in} = 20 mW
Overall Gain = 33 dB
Overall Efficiency = 59.2%

*Ferroxcube Part Number
RFC1 – 20 Turns #18 AWG, 3/16" I.D., 2 Layers, 10 Turns Each, Close Wound.
RFC2 – 18 Turns, #18 AWG, 3/16" I.D., 2 Layers, 9 Turns Each, Close Wound.

3

2N5943

The RF Line

NPN SILICON HIGH-FREQUENCY TRANSISTOR

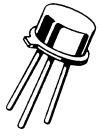
. . . designed specifically for broadband applications requiring low cross-modulation distortion and low-noise figure. Characterized for use in CATV applications.

- Low Noise Figure – @ f = 200 MHz
  NF (Narrowband) = 3.4 dB (Typ)
  NF (Broadband) = 6.8 dB (Typ)
- High Current-Gain – Bandwidth Product –
  f_T = 1200 MHz (Min) @ I_C = 50 mAdc
- Completely Characterized with s and y-Parameters

1.2 GHz – 50 mAdc

NPN SILICON HIGH-FREQUENCY TRANSISTOR

NPN SILICON

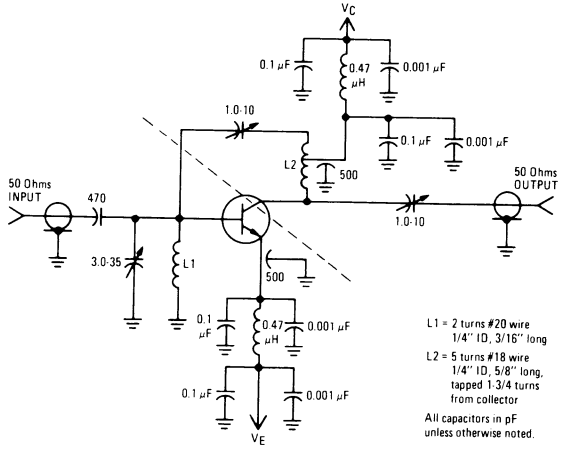


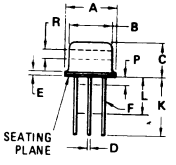
***MAXIMUM RATINGS**

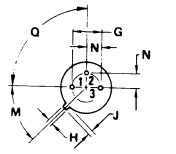
Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	30	Vdc
Collector-Base Voltage	V_{CBO}	40	Vdc
Emitter-Base Voltage	V_{EBO}	3.5	Vdc
Collector Current – Continuous	I_C	400	mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	1.0 5.7	Watt mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	3.5 0.02	Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200	°C

*Indicates JEDEC Registered Data.

FIGURE 1 – NARROW-BAND TEST CIRCUIT







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

DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	8.89	9.40	0.350	0.370
B	8.00	8.51	0.315	0.335
C	6.10	6.60	0.240	0.260
D	0.406	0.533	0.016	0.021
E	0.229	3.18	0.009	0.125
F	0.406	0.483	0.016	0.019
G	4.83	5.33	0.190	0.210
H	0.711	0.864	0.028	0.034
J	0.737	1.02	0.029	0.040
K	12.70	–	0.500	–
L	6.35	–	0.250	–
M	45° NOM		45° NOM	
P	–	1.27	–	0.050
Q	90° NOM		90° NOM	
R	2.54	–	0.100	–

All JEDEC dimensions and notes apply.

CASE 79-02
TO-39

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 5.0 mAdc, I_B = 0)	$V_{(BR)CEO}$	30	–	–	Vdc
Collector-Base Breakdown Voltage (I_C = 100 μAdc, I_E = 0)	$V_{(BR)CBO}$	40	–	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 100 μAdc, I_C = 0)	$V_{(BR)EBO}$	3.5	–	–	Vdc
Collector Cutoff Current (V_{CE} = 20 Vdc, I_B = 0)	I_{CEO}	–	–	50	μAdc
Collector Cutoff Current (V_{CB} = 15 Vdc, I_E = 0)	I_{CBO}	–	–	10	μAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 50 mAdc, V_{CE} = 15 Vdc)	h_{FE}	25	–	300	–
Collector-Emitter Saturation Voltage (I_C = 100 mAdc, I_B = 10 mAdc)	$V_{CE(sat)}$	–	0.15	0.2	Vdc
Base-Emitter Saturation Voltage (I_C = 100 mAdc, I_B = 10 mAdc)	$V_{BE(sat)}$	–	0.88	1.0	Vdc
DYNAMIC CHARACTERISTICS					
Current-Gain – Bandwidth Product (Figure 2) (I_C = 25 mAdc, V_{CE} = 15 Vdc, f = 200 MHz) (I_C = 50 mAdc, V_{CE} = 15 Vdc, f = 200 MHz) (I_C = 100 mAdc, V_{CE} = 15 Vdc, f = 200 MHz)	f_T	 1000 1200 1000	 1350 1550 1425	 – 2400 –	MHz
Collector-Base Capacitance (Figure 5) (V_{CB} = 30 Vdc, I_E = 0, f = 100 kHz)	C_{cb}	1.0	1.6	2.5	pF
Emitter-Base Capacitance (Figure 5) (V_{EB} = 0.5 Vdc, I_C = 0, f = 100 kHz)	C_{eb}	–	8.4	15	pF
Small-Signal Current Gain (I_C = 50 mAdc, V_{CE} = 15 Vdc, f = 1.0 kHz)	h_{fe}	25	–	350	–
Collector-Base Time Constant (I_E = 50 mAdc, V_{CB} = 15 Vdc, f = 31.8 MHz)	$r_b'C_c$	2.0	5.5	20	ps
Noise Figure (I_C = 30 mAdc, V_{CE} = 15 Vdc, f = 200 MHz) (Figure 1) (I_C = 35 mAdc, V_{CE} = 15 Vdc, f = 200 MHz) (Figures 6, 11, 14) (1)	NF	 – –	 3.4 6.8	 – 8.0	dB
FUNCTIONAL TEST					
Common-Emitter Amplifier Power Gain (I_C = 10 mAdc, V_{CE} = 15 Vdc, f = 200 MHz) (Figure 1) (I_C = 50 mAdc, V_{CE} = 15 Vdc, f = 250 MHz) (Figure 6)	G_{pe}	 – 7.0	 11.4 7.6	 – –	dB
Intermodulation Distortion (Figure 7) (I_C = 50 mAdc, V_{CE} = 15 Vdc, V_{out} = +50 dBmV)	IM	–	–	-50	dB
Cross Modulation Distortion (Figure 8) (I_C = 50 mAdc, V_{CE} = 15 Vdc, V_{out} = +40 dBmV) (I_C = 50 mAdc, V_{CE} = 15 Vdc, V_{out} = +50 dBmV)	XM	 – –	 -67 -45	 – -42	dB

*Indicates JEDEC Registered Data.

(1) Includes noise figure of post-amplifier and matching pad.

FIGURE 2 – CURRENT-GAIN – BANDWIDTH PRODUCT

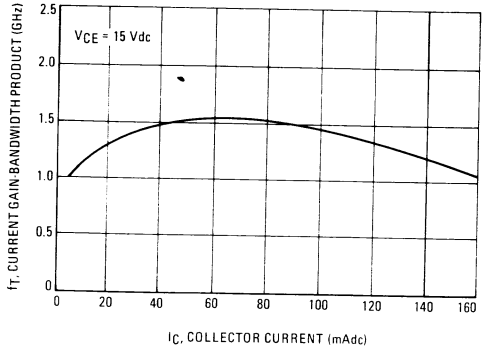


FIGURE 3 – COLLECTOR-BASE TIME CONSTANT

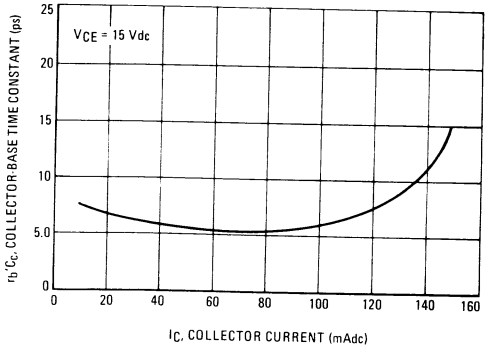


FIGURE 4 – SATURATION VOLTAGES

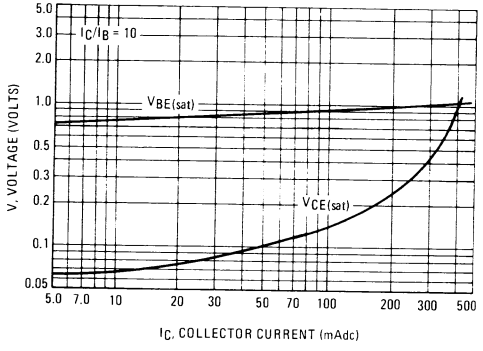


FIGURE 5 – CAPACITANCES versus REVERSE VOLTAGE

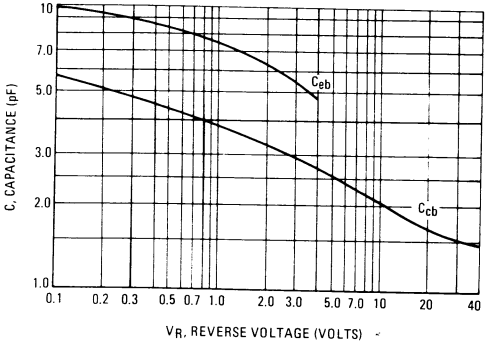
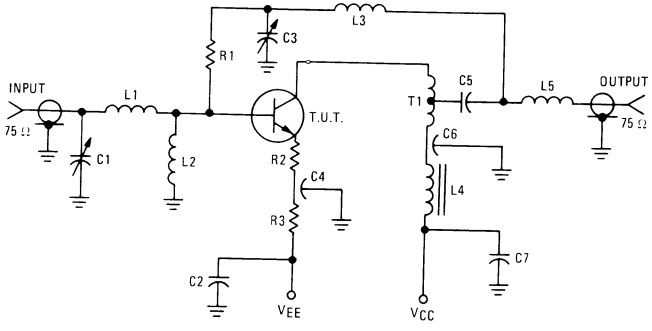


FIGURE 6 – BROADBAND TEST CIRCUIT



C1	1.0-10 pF	JOHANSON 2951 OR EQUIVALENT
C2, C7	0.01 μF	
C3	0.5-6.0 pF	JOHANSON 4642 OR EQUIVALENT
C4, C6	1500 pF	
C5	470 pF	
L1	2 TURNS AWG #26, 5/32" I.D.	
L2	1 μH MOLDED CHOKE	
L3	5 TURNS AWG #26, 3/32" I.D.	
L4	FERRITE CHOKE, 3 TURNS #30 ON STACKPOLE 57-0156 BEAD	
L5	2 TURNS AWG #26, 3/32" I.D.	
T1	AWG #30 TRIFILAR WOUND 1-9-9 ON STACKPOLE 57-0985, #11 TOROID	
R1	270 OHMS	
R2	18 OHMS	
R3	150 OHMS	

GARLOCK TEFLON SOCKET

3

FIGURE 7 – CROSS-MODULATION DISTORTION versus COLLECTOR CURRENT

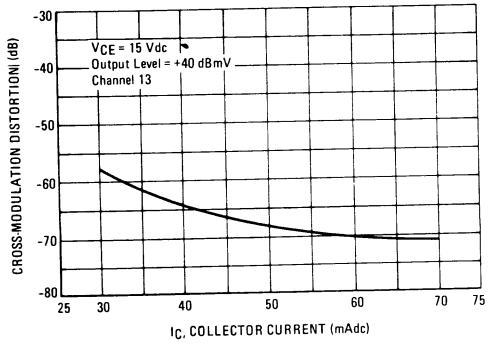


FIGURE 8 – CROSS-MODULATION DISTORTION versus OUTPUT LEVEL

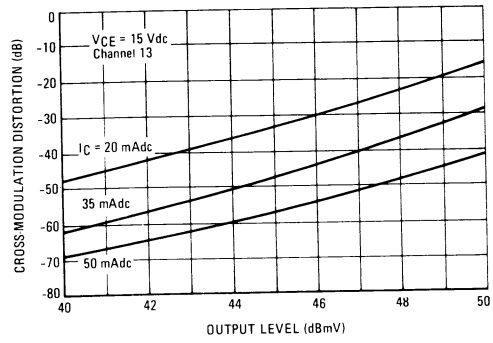


FIGURE 9 – NARROWBAND NOISE FIGURE versus COLLECTOR CURRENT

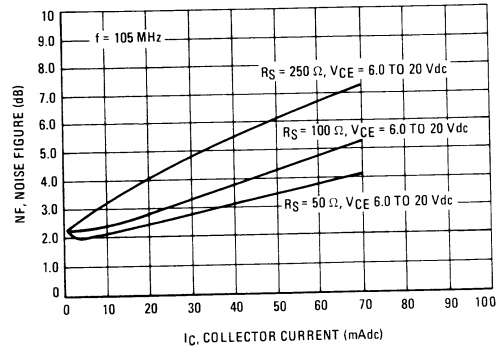


FIGURE 10 – NARROWBAND NOISE FIGURE versus COLLECTOR CURRENT

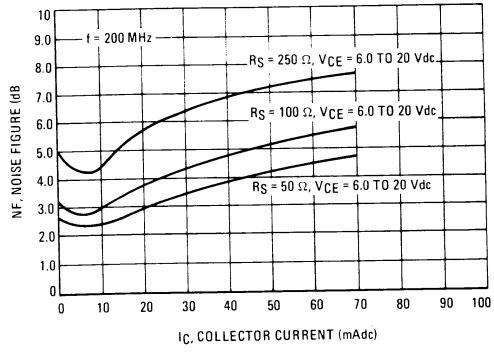


FIGURE 11 – BROADBAND NOISE FIGURE versus COLLECTOR CURRENT

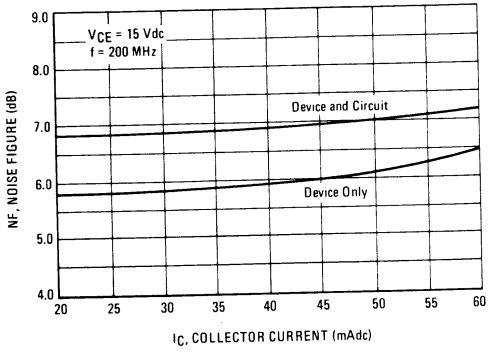


FIGURE 12 – NARROWBAND NOISE FIGURE versus FREQUENCY

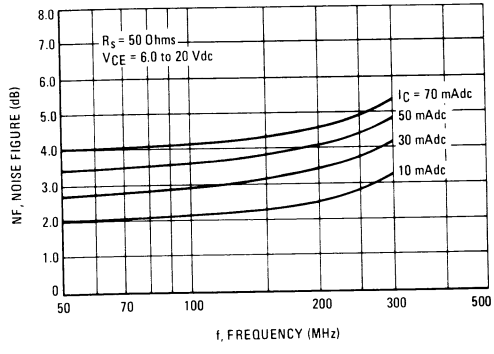


FIGURE 13 – INPUT ADMITTANCE versus FREQUENCY

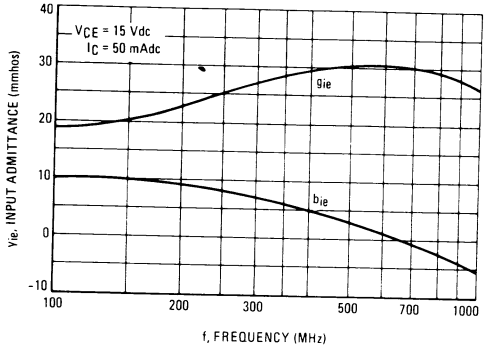


FIGURE 14 – INPUT ADMITTANCE versus COLLECTOR CURRENT

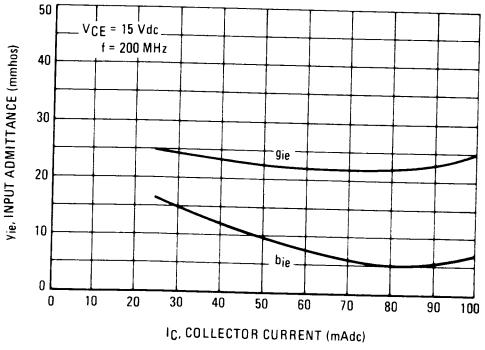


FIGURE 15 – REVERSE TRANSFER ADMITTANCE versus FREQUENCY

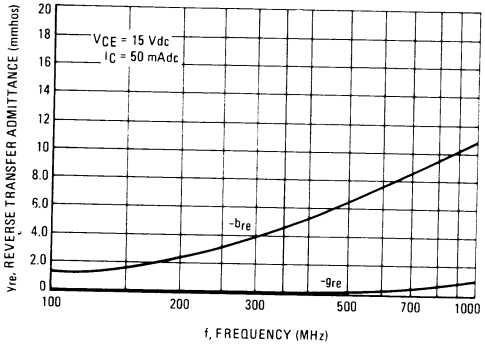


FIGURE 16 – REVERSE TRANSFER ADMITTANCE versus COLLECTOR CURRENT

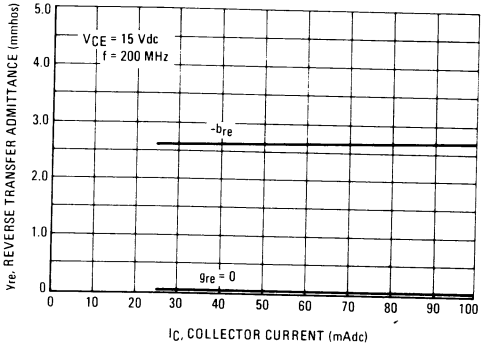


FIGURE 17 – FORWARD TRANSFER ADMITTANCE versus FREQUENCY

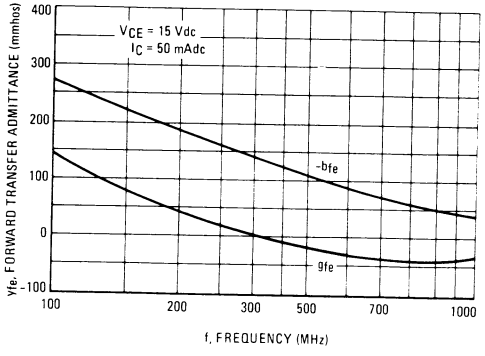


FIGURE 18 – FORWARD TRANSFER ADMITTANCE versus COLLECTOR CURRENT

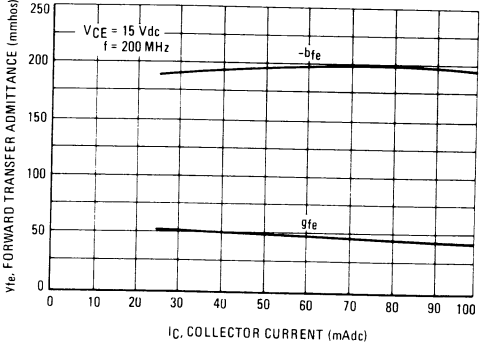


FIGURE 19 – OUTPUT ADMITTANCE versus FREQUENCY

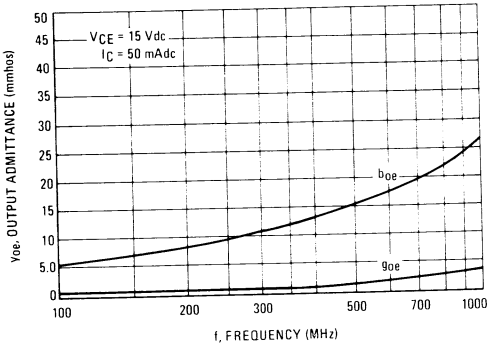


FIGURE 20 – OUTPUT ADMITTANCE versus COLLECTOR CURRENT

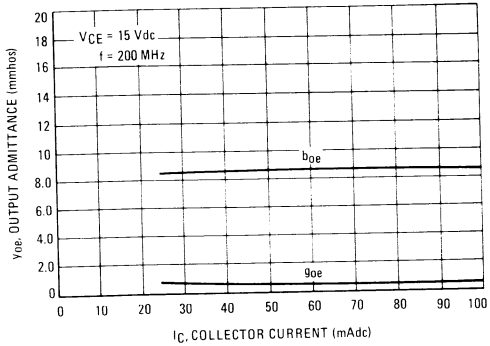


FIGURE 21 – INPUT REFLECTION COEFFICIENT versus FREQUENCY

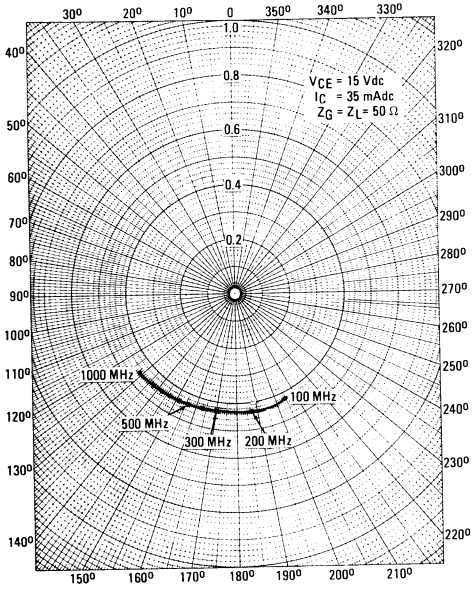


FIGURE 22 – OUTPUT REFLECTION COEFFICIENT versus FREQUENCY

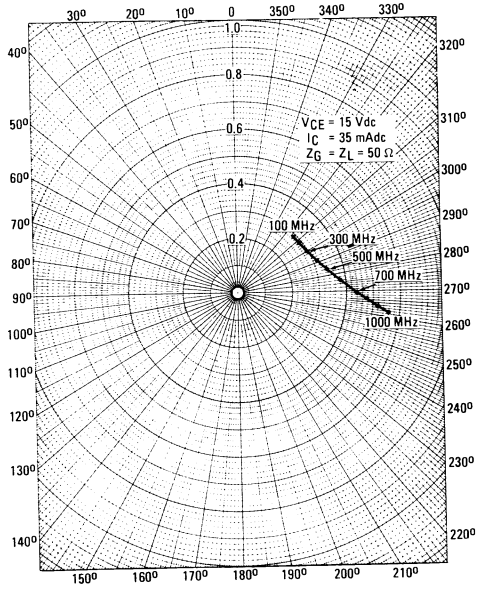


FIGURE 23 – REVERSE TRANSMISSION COEFFICIENT versus FREQUENCY

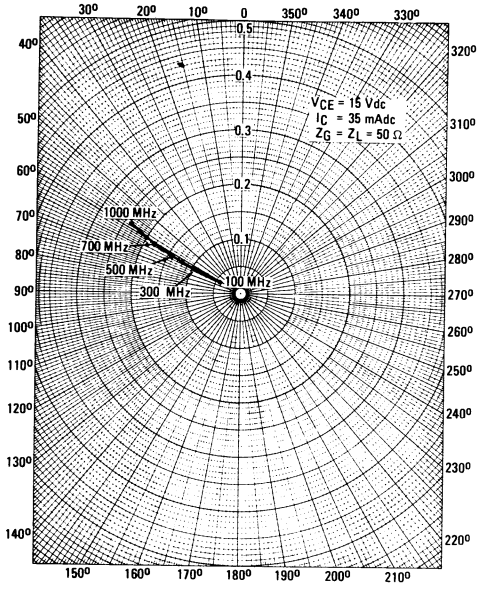


FIGURE 24 – FORWARD TRANSMISSION COEFFICIENT versus FREQUENCY

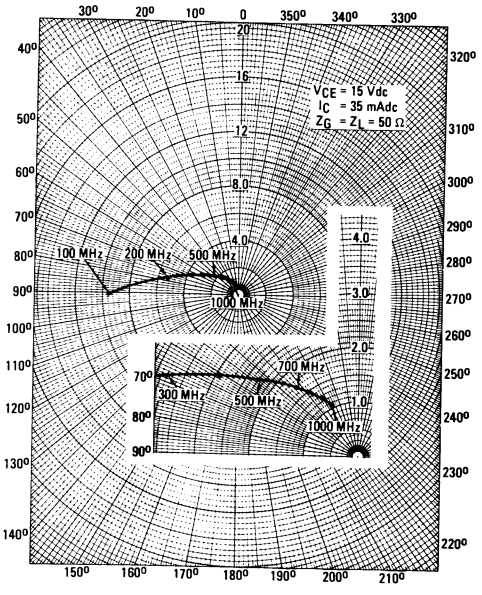
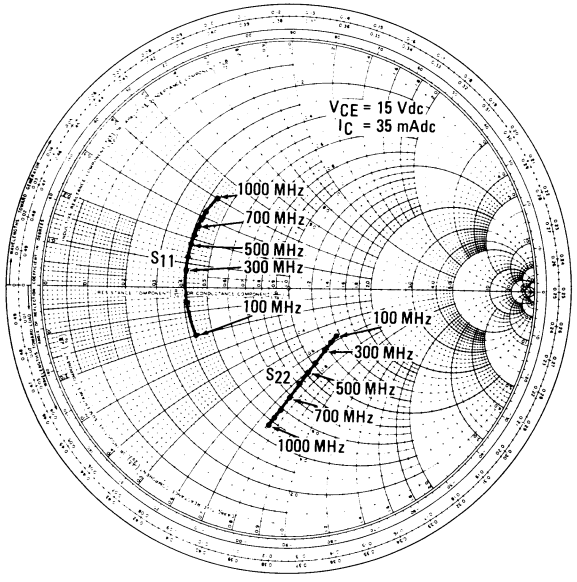


FIGURE 25 – INPUT REFLECTION COEFFICIENT AND OUTPUT REFLECTION COEFFICIENT versus FREQUENCY



2N5944
2N5945
2N5946

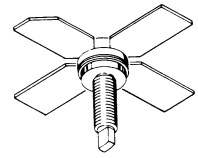
The RF Line

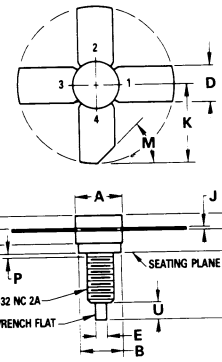
NPN SILICON RF POWER TRANSISTORS

. . . designed for 7.0 to 15 Volts, UHF large signal amplifier applications required in industrial and commercial FM equipment operating in the 400 to 960 MHz range.

- Specified 12.5 Volt, 470 MHz Characteristics –
  Power Output = 2.0 W – 2N5944
  4.0 W – 2N5945
  10 W – 2N5946
  Minimum Gain = 9.0 dB – 2N5944
  8.0 dB – 2N5945
  6.0 dB – 2N5946
  Efficiency = 60% Minimum
- Characterized with series equivalent large-signal impedance parameters

2.0, 4.0, 10 W – 470 MHz
RF POWER
TRANSISTORS
NPN SILICON





DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	7.06	7.26	0.278	0.286
B	6.20	6.50	0.244	0.256
C	14.99	16.51	0.590	0.650
D	5.46	5.96	0.215	0.235
E	1.40	1.65	0.055	0.065
F	1.52	—	0.060	—
J	0.08	0.17	0.003	0.007
K	11.05	—	0.435	—
M	45° NOM		45° NOM	
P	—	1.27	—	0.050
S	3.00	3.25	0.118	0.128
T	1.40	1.77	0.055	0.070
U	2.92	3.68	0.115	0.145

CASE 244-04

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

MAXIMUM RATINGS

Rating	Symbol	2N5944	2N5945	2N5946	Unit
*Collector-Emitter Voltage	V_{CEO}	← 16 →			Vdc
*Collector-Base Voltage	V_{CBO}	← 36 →			Vdc
*Emitter-Base Voltage	V_{EBO}	← 4.0 →			Vdc
*Collector Current – Continuous	I_C	0.4	0.8	2.0	Adc
*Total Device Dissipation @ $T_C = 25^oC$(1)	P_D	5.0	15	37.5	Watts
Derate above 25^oC		28.5	85.5	214	$mW/^oC$
*Storage Temperature Range	T_{stg}	← −65 to +200 →			^oC
Stud Torque(2)	–	← 6.5 →			in-lbs.

*Indicates JEDEC Registered Data
(1) These devices are designed for RF operation. The total device dissipation rating applies only when the devices are operated as RF amplifiers.
(2) For repeated assembly use 5 in-lbs.

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

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector-Emitter Breakdown Voltage		$V_{(BR)CEO}$				Vdc
(I_C = 50 mAdc, I_B = 0)	2N5944		16	–	–	
(I_C = 100 mAdc, I_B = 0)	2N5945		16	–	–	
(I_C = 200 mAdc, I_B = 0)	2N5946		16	–	–	
Collector-Emitter Breakdown Voltage		$V_{(BR)CES}$				Vdc
(I_C = 50 mAdc, V_{BE} = 0)	2N5944		36	–	–	
(I_C = 100 mAdc, V_{BE} = 0)	2N5945		36	–	–	
(I_C = 200 mAdc, V_{BE} = 0)	2N5946		36	–	–	
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$				Vdc
(I_E = 1.0 mAdc, I_C = 0)	2N5944		4.0	–	–	
(I_E = 2.0 mAdc, I_C = 0)	2N5945		4.0	–	–	
(I_E = 4.0 mAdc, I_C = 0)	2N5946		4.0	–	–	
Collector Cutoff Current		I_{CES}				mAdc
(V_{CE} = 15 Vdc, V_{BE} = 0, T_C = 55°C)	2N5944		–	0.2	10	
	2N5945,2N5946		–	0.5	20	
Collector Cutoff Current		I_{CBO}				mAdc
(V_{CB} = 15 Vdc, I_E = 0)	2N5944,2N5945		–	–	1.0	
	2N5946		–	–	2.0	
ON CHARACTERISTICS						
DC Current Gain		h_{FE}				–
(I_C = 100 mAdc, V_{CE} = 5.0 Vdc)	2N5944		20	80	–	
(I_C = 200 mAdc, V_{CE} = 5.0 Vdc)	2N5945		20	80	–	
(I_C = 500 mAdc, V_{CE} = 5.0 Vdc)	2N5946		20	80	–	
DYNAMIC CHARACTERISTICS						
Output Capacitance		C_{ob}				pF
(V_{CB} = 12.5 Vdc, I_E = 0, f = 1.0 MHz)	2N5944		–	11	15	
	2N5945		–	18	25	
	2N5946		–	38	45	
FUNCTIONAL TEST (Figures 20 and 21).						
Common-Emitter Amplifier Power Gain		G_{PE}				dB
(V_{CC} = 12.5 Vdc, P_{out} = 2.0 W, I_C(max) = 267 mAdc, f = 470 MHz)	2N5944		9.0	10	–	
(V_{CC} = 12.5 Vdc, P_{out} = 4.0 W, I_C(max) = 533 mAdc, f = 470 MHz)	2N5945		8.0	9.0	–	
(V_{CC} = 12.5 Vdc, P_{out} = 10 W, I_C(max) = 1.33 Adc, f = 470 MHz)	2N5946		6.0	7.0	–	
Collector Efficiency		η				%
(V_{CC} = 12.5 Vdc, P_{out} = 2.0 W, I_C(max) = 240 mAdc, f = 470 MHz)	2N5944		60	–	–	
(V_{CC} = 12.5 Vdc, P_{out} = 4.0 W, I_C(max) = 500 mAdc, f = 470 MHz)	2N5945		60	–	–	
(V_{CC} = 12.5 Vdc, P_{out} = 10 W, I_C(max) = 1.3 Adc, f = 470 MHz)	2N5946		60	–	–	

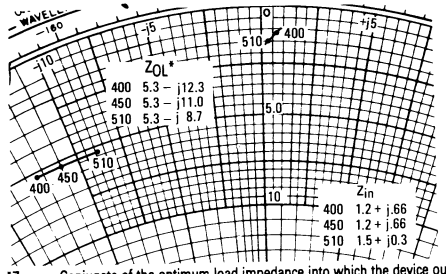
*Indicates JEDEC Registered Data

These devices are available in various packages, such as a studless stripline package, TO-39, and also in chip form on beryllium oxide carriers for hybrid assemblies.

For further information, contact your nearest Motorola representative or the factory representative.

2N5944
TYPICAL PERFORMANCE DATA

FIGURE 1 – SERIES EQUIVALENT IMPEDANCE



*Z_{OL} = Conjugate of the optimum load impedance into which the device output operates at a given output power, voltage and frequency.
V_{CC} = 12.5 Vdc, P_{out} = 2.0 W

FIGURE 2 – OUTPUT POWER versus SUPPLY VOLTAGE

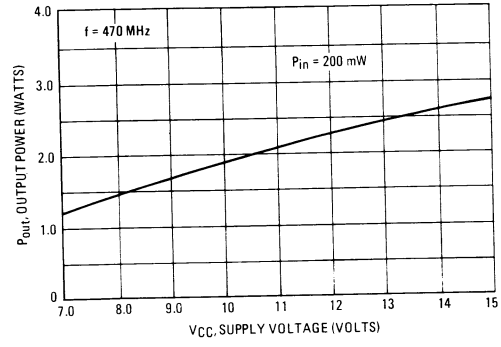


FIGURE 3 – OUTPUT POWER versus INPUT POWER

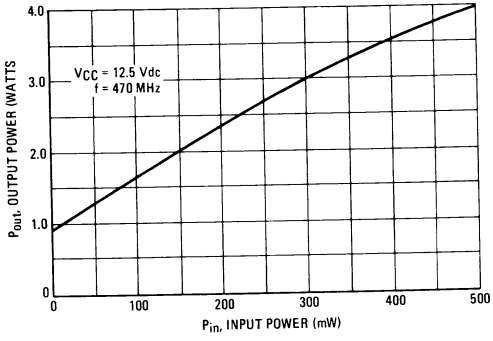


FIGURE 4 – OUTPUT POWER versus FREQUENCY

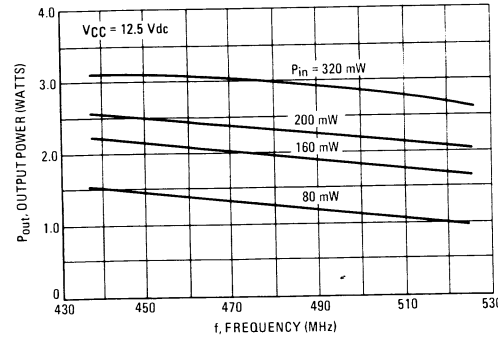


FIGURE 5 – OUTPUT POWER versus INPUT POWER

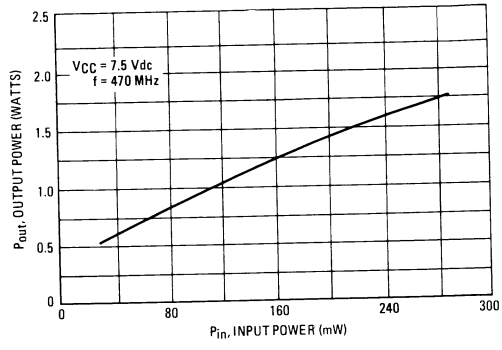
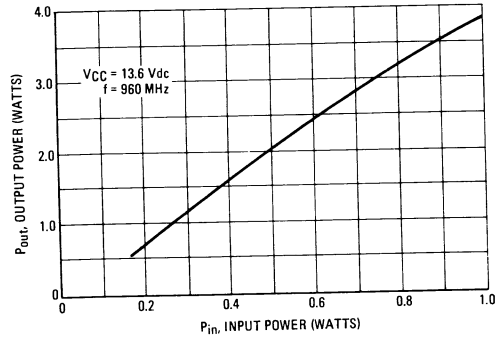
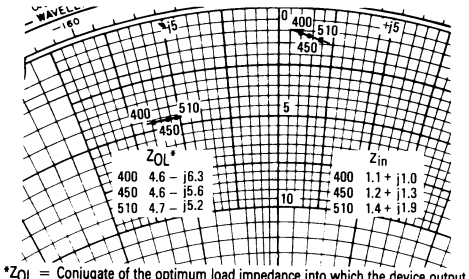


FIGURE 6 – OUTPUT POWER versus INPUT POWER



2N5945
TYPICAL PERFORMANCE DATA

FIGURE 7 – SERIES EQUIVALENT IMPEDANCE



*Z_{OL} = Conjugate of the optimum load impedance into which the device output operates at a given output power, voltage and frequency.

V_{CC} = 12.5 Vdc, P_{out} = 4.0 W

FIGURE 8 – OUTPUT POWER versus SUPPLY VOLTAGE

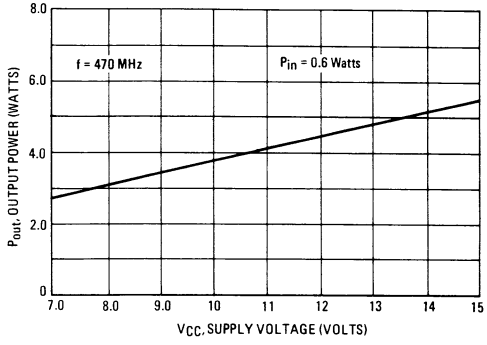


FIGURE 9 – OUTPUT POWER versus INPUT POWER

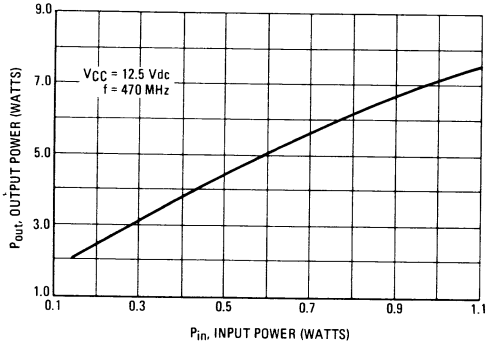


FIGURE 10 – OUTPUT POWER versus FREQUENCY

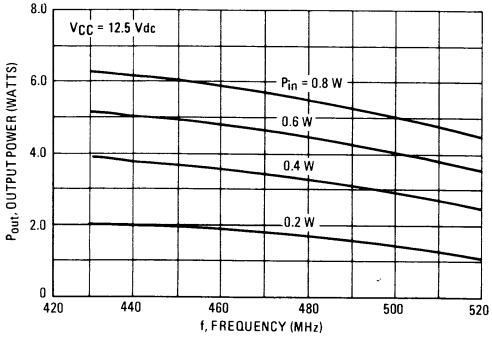


FIGURE 11 – OUTPUT POWER versus INPUT POWER

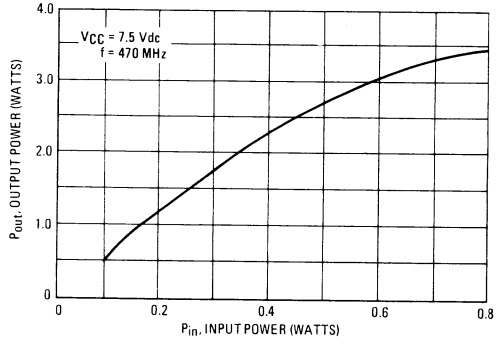
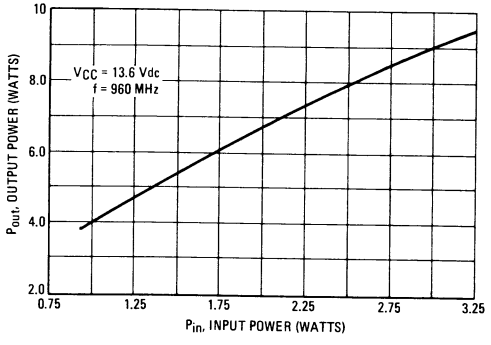


FIGURE 12 – OUTPUT POWER versus INPUT POWER



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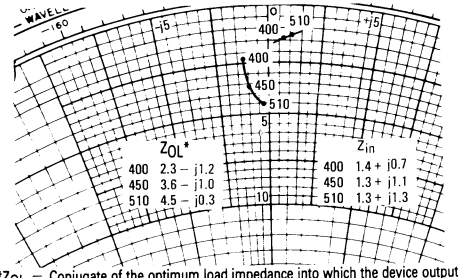
2N5946
TYPICAL PERFORMANCE DATA

FIGURE 13 – SERIES EQUIVALENT IMPEDANCE



*Z_{OL} = Conjugate of the optimum load impedance into which the device output operates at a given output power, voltage and frequency.
V_{CC} = 12.5 Vdc, P_{out} = 12 W

FIGURE 14 – OUTPUT POWER versus SUPPLY VOLTAGE

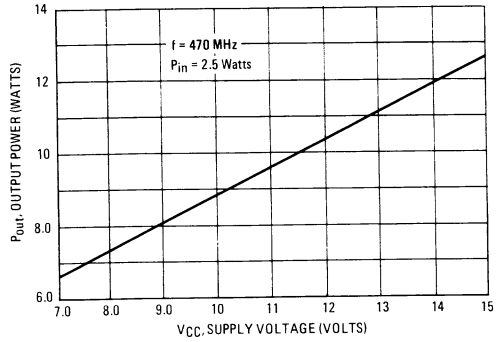


FIGURE 15 – OUTPUT POWER versus INPUT POWER

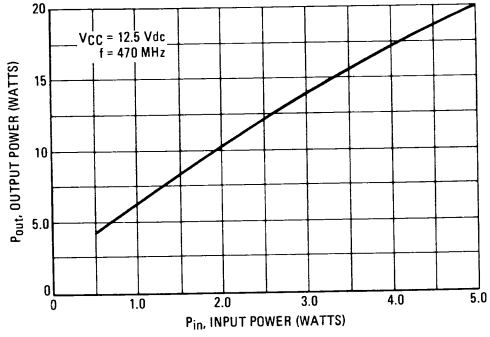


FIGURE 16 – OUTPUT POWER versus FREQUENCY

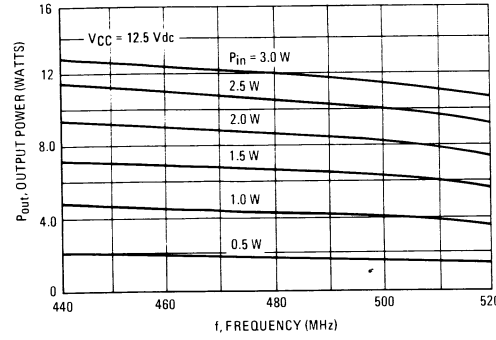
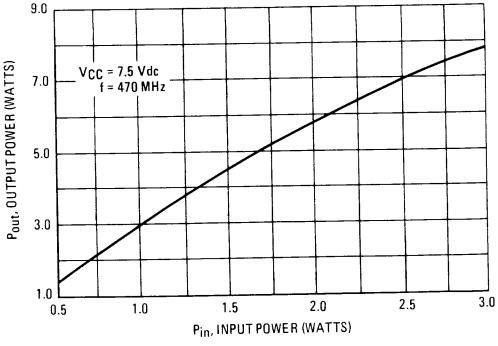
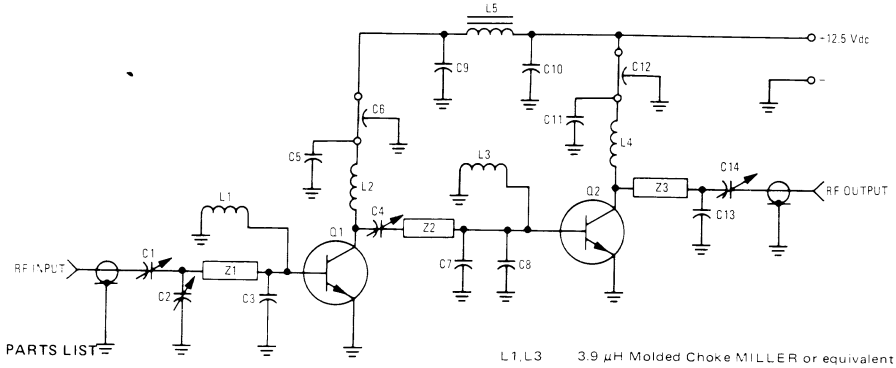


FIGURE 17 – OUTPUT POWER versus INPUT POWER



10-WATT BROADBAND UHF AMPLIFIER

FIGURE 18



PARTS LIST

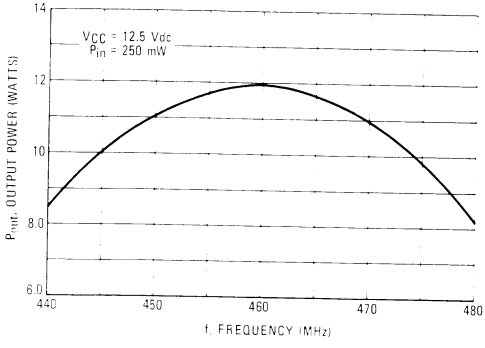
C1,C2,C4,C13,C14	0.9-7.0 pF ARCO 400 or equivalent
C3,C7,C8	25 pF UNELCO or equivalent
C5,C11	0.1 μF Ceramic 35 V
C6,C12	680 pF ALLEN BRADLEY Feedthru
C9,C10	1.0 μF, 35 V Tantalum
L1,L3	3.9 μH Molded Choke MILLER or equivalent
L2,L4	5 Turns #18 AWG Enameled 0.2" I.D.
L5	FERROXCUBE Ferrite Choke VK200 20/4B
Z1,Z2,Z3	Microstrip Lines (See Template Below)
Q1	2N5944
Q2	2N5946

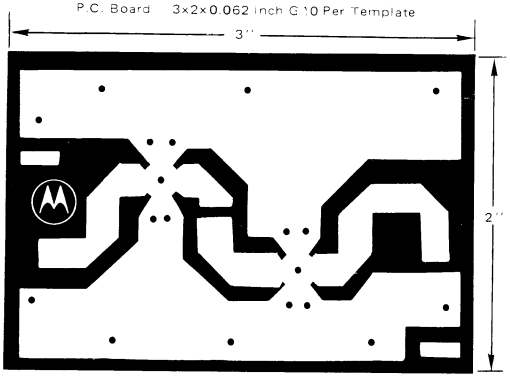
10 W AMPLIFIER PERFORMANCE

V_{CC} = 12.5 Vdc

Frequency MHz	P_{in} mW	P_{out} W	I_C Amp
440	250	8.5	1.5
450	250	11	1.6
460	250	12	1.6
470	250	10.9	1.5
480	250	8.2	1.2

FIGURE 19 – OUTPUT POWER versus FREQUENCY





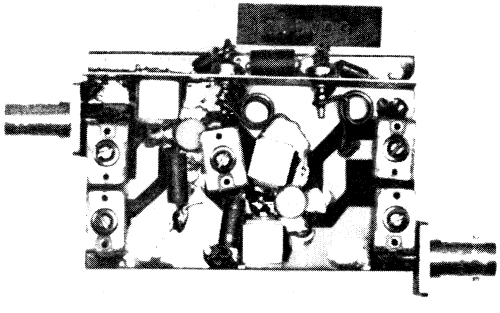
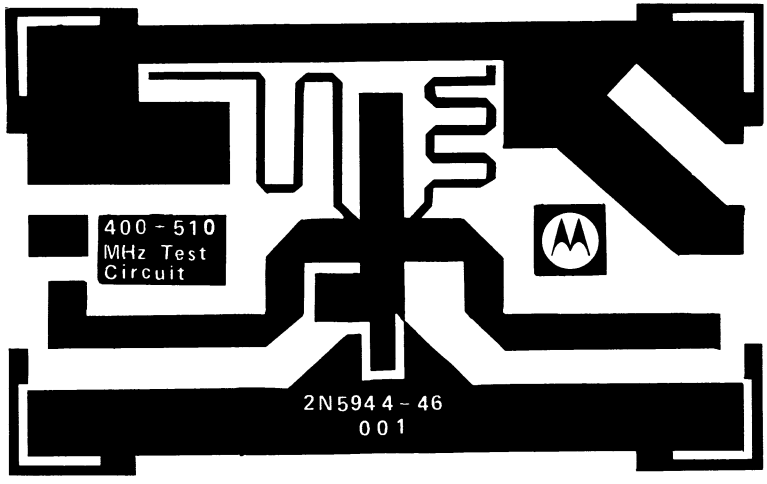


FIGURE 20 — 470 MHz TEST CIRCUIT



NOTE: The Printed Circuit Board shown is 75% of the original.

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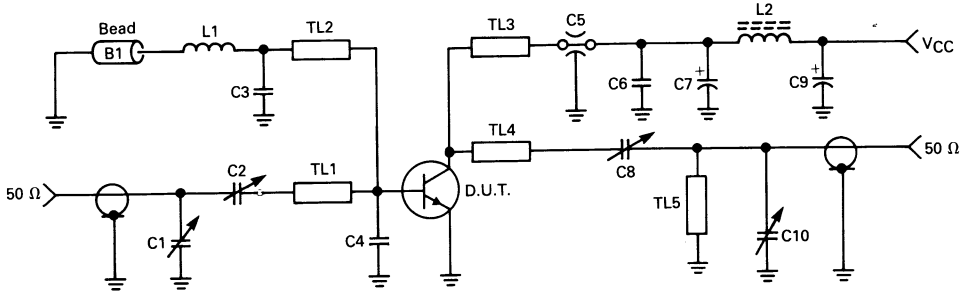
FIGURE 21 — 470 MHz TEST CIRCUIT SCHEMATIC



C1, C2, C8, C10 — Johanson Trimmer, JMC #5501
C3 — 100 pF Unelco 350 Vdc J101
C4 — 15 pF Unelco
C5 — 680 pF Allen Bradley Feed-Thru
C6 — 0.1 μF Monolithic
C7 — 1 μF Tantalum Sprague ±10% 35 Vdc
C9 — 5 μF Electrolytic 5–25 Vdc

TL1 — Micro Strip 0.26″ x 2.9″
TL2 — Micro Strip 0.055″ x 3.9″
TL3 — Micro Strip 0.055″ x 2.9″
TL4 — Micro Strip 0.26″ x 2.9″
TL5 — Micro Strip 0.50″ x 1.2″
L1 — #18 AWG Wire 0.750″ Long
L2 — VK200 20/4B
B1 — Ferroxcube Bead, 56-590-65-3B

Board — 0.062″ Glass Teflon
2 oz. Cu CLAD
ϵ_r = 2.55