2N6094 thru 2N6097 (SILICON)

The RF Line

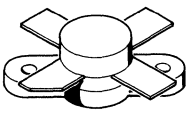
PNP SILICON RF POWER TRANSISTORS

. . . designed for 12.5 Volt VHF large-signal amplifier applications required in military and industrial equipment operating to 250 MHz.

- Balanced Emitter Construction with Isothermal Resistor Design to Provide the Designer with the Optimum in Transistor Ruggedness
- Low Lead Inductance Stripline Packaging for Easier Design and Increased Broadband Capabilities
- Flange Package for Easy Mounting and Better Thermal Conductivity to Heat Sink
- Exceptional Power Output Stability versus Temperature

4.0, 15, 30, 40 WATTS - 175 MHz

PNP SILICON RF POWER TRANSISTORS

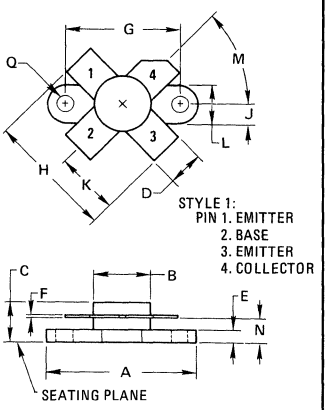


*MAXIMUM RATINGS

Rating	Symbol	2N6094	2N6095	2N6096	2N6097	Unit
Collector-Emitter Voltage	V_{CEO}	← 18 →				Vdc
Collector-Base Voltage	V_{CBO}	← 36 →				Vdc
Emitter-Base Voltage	V_{EBO}	← 4.0 →				Vdc
Collector Current — Continuous	I_C	1.0	2.5	4.0	6.0	Adc
Total Device Dissipation @ $T_C = 25^oC$	P_D(1)	8.0	20	40	60	Watts
Derate above 25^oC		45.7	114	228	343	mW/^oC
Storage Temperature Range	T_{stg}	← -65 to +200 →				^oC

*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.



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	24.64	24.89	0.970	0.980
B	9.47	9.73	0.373	0.383
C	6.07	7.14	0.239	0.281
D	5.59	5.84	0.220	0.230
E	2.16	2.67	0.085	0.105
F	0.10	0.15	0.004	0.006
G	18.29	18.54	0.720	0.730
H	21.59	22.10	0.850	0.870
J	3.12	3.23	0.123	0.127
K	10.80	11.05	0.425	0.435
L	6.22	6.48	0.245	0.255
M	40^0	50^0	40^0	50^0
N	3.81	4.57	0.150	0.180
Q	2.97	3.12	0.117	0.123

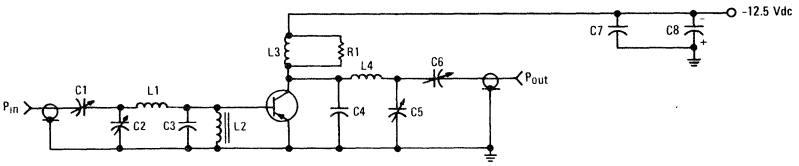
CASE 211-01

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

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Collector-Emitter Breakdown Voltage		BV_{CEO}				Vdc
(I_C = 10 mAdc, I_B = 0)	2N6094		18	–	–	
(I_C = 20 mAdc, I_B = 0)	2N6095		18	–	–	
(I_C = 50 mAdc, I_B = 0)	2N6096		18	–	–	
(I_C = 100 mAdc, I_B = 0)	2N6097		18	–	–	
Collector Emitter Breakdown Voltage		BV_{CES}				Vdc
(I_C = 5.0 mAdc, V_{BE} = 0)	2N6094		36	–	–	
(I_C = 10 mAdc, V_{BE} = 0)	2N6095		36	–	–	
(I_C = 15 mAdc, V_{BE} = 0)	2N6096		36	–	–	
(I_C = 20 mAdc, V_{BE} = 0)	2N6097		36	–	–	
Emitter-Base Breakdown Voltage		BV_{EBO}				Vdc
(I_E = 1.0 mAdc, I_C = 0)	2N6094		4.0	–	–	
(I_E = 2.0 mAdc, I_C = 0)	2N6095		4.0	–	–	
(I_E = 5.0 mAdc, I_C = 0)	2N6096		4.0	–	–	
(I_E = 10 mAdc, I_C = 0)	2N6097		4.0	–	–	
Collector Cutoff Current		I_{CES}				mAdc
(V_{CE} = 15 Vdc, V_{BE} = 0, T_C = 55°C)	2N6094		–	–	5.0	
	2N6095		–	–	8.0	
	2N6096		–	–	10	
	2N6097		–	–	10	
Collector Cutoff Current		I_{CBO}				
(V_{CB} = 15 Vdc, I_E = 0)	2N6094		–	–	250	μAdc
	2N6095		–	–	500	
	2N6096		–	–	1.0	mAdc
	2N6097		–	–	2.5	
ON CHARACTERISTICS						
DC Current Gain		h_{FE}				–
(I_C = 0.25 Adc, V_{CE} = 5.0 Vdc)	2N6094		5.0	–	–	
(I_C = 0.5 Adc, V_{CE} = 5.0 Vdc)	2N6095,2N6096,2N6097		15	–	–	
DYNAMIC CHARACTERISTICS						
Output Capacitance		C_{ob}				pF
(V_{CB} = 12.5 Vdc, I_E = 0, f = 100 kHz)	2N6094		–	17	20	
	2N6095		–	90	120	
	2N6096		–	150	190	
	2N6097		–	300	400	
FUNCTIONAL TEST						
Common-Emitter Amplifier Power Gain (Figure 1)		G_{PE}				dB
(P_{out} = 4.0 W, V_{CC} = 12.5 Vdc, I_C(max) = 0.62 Adc, f = 175 MHz)	2N6094		12	–	–	
				–	–	
(P_{out} = 15 W, V_{CC} = 12.5 Vdc, I_C(max) = 1.9 Adc, f = 175 MHz)	2N6095		6.3	–	–	
				–	–	
(P_{out} = 30 W, V_{CC} = 12.5 Vdc, I_C(max) = 3.4 Adc, f = 175 MHz)	2N6096		5.7			
(P_{out} = 40 W, V_{CC} = 12.5 Vdc, I_C(max) = 4.3 Adc, f = 175 MHz)	2N6097		4.5			
Collector Efficiency (Figure 1)		η				%
(P_{out} = 4.0 W, V_{CC} = 12.5 Vdc, f = 175 MHz)	2N6094		50	–	–	
(P_{out} = 15 W, V_{CC} = 12.5 Vdc, f = 175 MHz)	2N6095		55	–	–	
(P_{out} = 30 W, V_{CC} = 12.5 Vdc, f = 175 MHz)	2N6096		60	–	–	
(P_{out} = 40 W, V_{CC} = 12.5 Vdc, f = 175 MHz)	2N6097		60	–	–	

*Indicates JEDEC Registered Data

FIGURE 1 – 175 MHz TEST CIRCUIT



2N6094
- C1,C2 ARCO 462 or Equivalent
- C3,C4 7.0 pF Unelco J1HF
- C5 ARCO 463 or Equivalent
- C6 ARCO 461 or Equivalent
- C7 1000 pF
- C8 5.0 μF, 50 V
- L1 25 nH, 1 Turn, #18 AWG, 1-1/4" Long, 1/4" I.D.
- L2 VK200 20/4B Ferrite Choke, Ferroxcube
- L3 150 nH, 8 Turns, #18 AWG, 3/4" Long, 3/16" I.D
- L4 36 nH, 1-1/2 Turns, #18 AWG, 1-1/4" Long, 1/4" I.D.
- R1 390 Ohms, 1/2 W

2N6095
- C1,C6 ARCO 462 or Equivalent
- C2 ARCO 464 or Equivalent
- C3,C4 40 pF Unelco J1HF
- C5 ARCO 463 or Equivalent
- C7 1000 pF
- C8 5.0 μF, 50 V
- L1 Copper Strap 1/4" Wide, 1-1/4" Long, Straight
- L2 VK200 20/4B Ferrite Choke, Ferroxcube
- L3 150 nH, 4 Turns, #18 AWG, 3/4" Long, Wound on R1
- L4 1 Turn, #18 AWG, 1-1/4" Long, 1/4" I.D
- R1 390 Ohms, 1 W

2N6096
- C1,C2 ARCO 462 or Equivalent
- C3,C4 100 pF Unelco J1HF
- C5,C6 ARCO 463 or Equivalent
- C7 1000 pF
- C8 5.0 μF, 50 V
- L1 1/2 Turn, #16 AWG, 1-1/4" Long, 1/4" I.D.
- L2 VK200 20/4B Ferrite Choke, Ferroxcube
- L3 4 Turns, #18 AWG, 3/4" Long, Wound on R1
- L4 1 Turn, #16 AWG, 1-1/4" Long, 1/4" I.D
- R1 390 Ohms, 2 W

2N6097
- C1,C2,C5 ARCO 462 or Equivalent
- C6 ARCO 464 or Equivalent
- C3,C4 100 pF Unelco J1HF
- C7 1000 pF
- C8 5.0 μF, 50 V
- L1 18 nH, 1-1/4" Straight, #16 AWG
- L2 VK200 20/4B Ferrite Choke, Ferroxcube
- L3 5 Turns, #18 AWG, 3/4" Long, Wound on R1
- L4 1 Turn, #18 AWG, 1-1/4" Long, 1/4" I.D.
- R1 160 Ohms, 2 W

OUTPUT POWER versus FREQUENCY

(V_{CC} = -12.5 Vdc)

FIGURE 2 – 2N6094

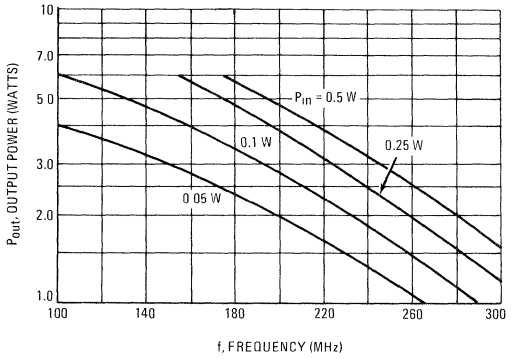


FIGURE 3 – 2N6095

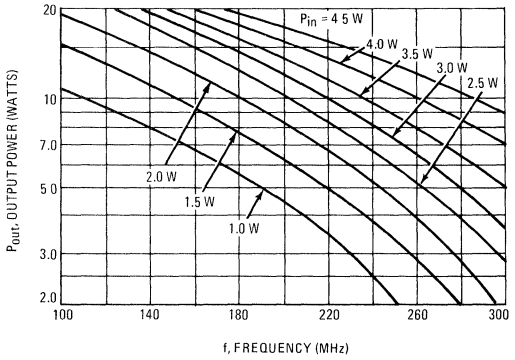


FIGURE 4 – 2N6096

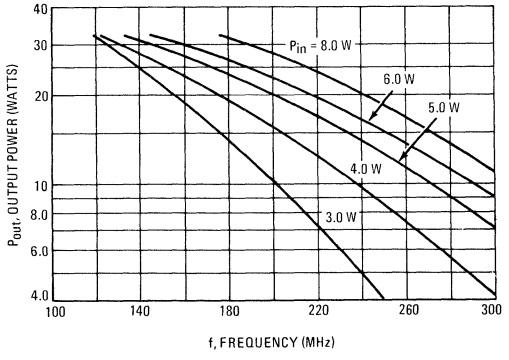
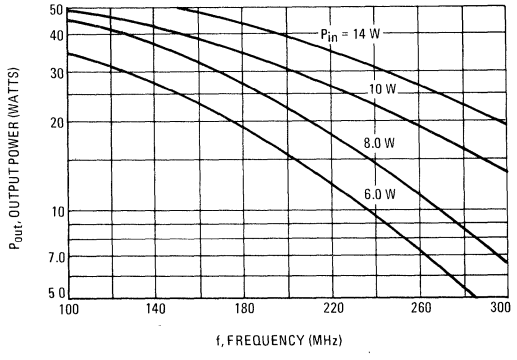


FIGURE 5 – 2N6097



TYPICAL PERFORMANCE DATA

OUTPUT POWER versus INPUT POWER

(V_{CC} = -12.5 Vdc, f = 175 MHz)

FIGURE 6 – 2N6094

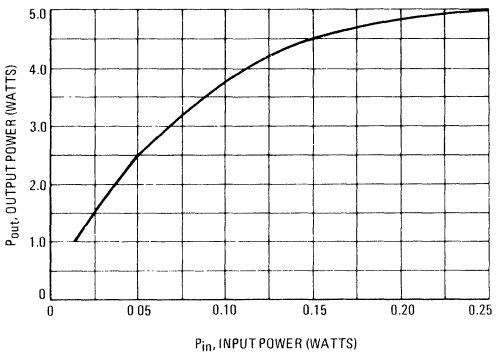


FIGURE 7 – 2N6095

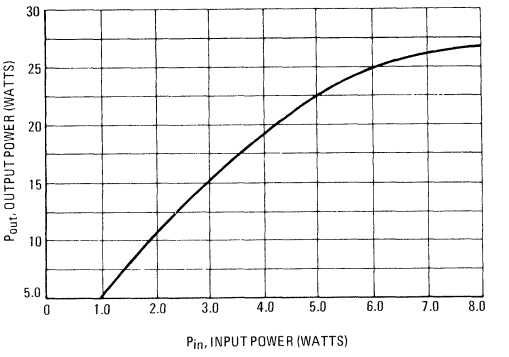


FIGURE 8 – 2N6096

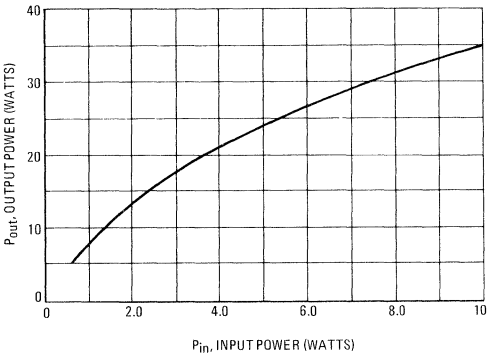
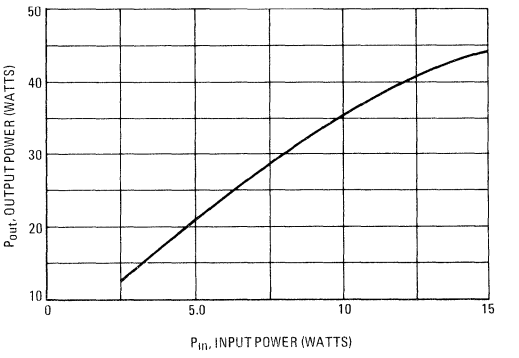


FIGURE 9 – 2N6097



CIRCUIT DESIGN DATA

OUTPUT POWER versus SUPPLY VOLTAGE

(f = 175 MHz)

FIGURE 10 – 2N6094

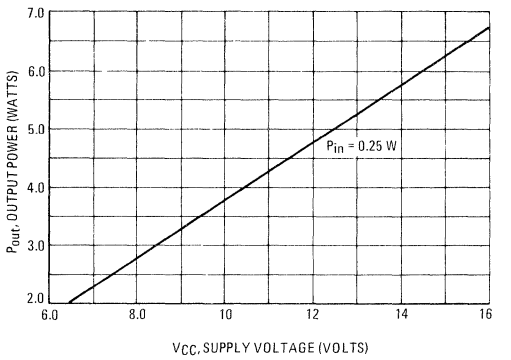
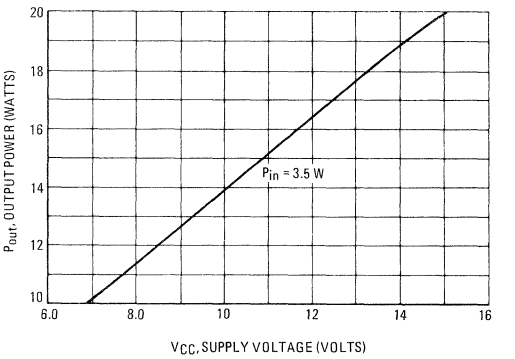


FIGURE 11 – 2N6095



CIRCUIT DESIGN DATA

OUTPUT POWER versus SUPPLY VOLTAGE

(f = 175 MHz)

FIGURE 12 – 2N6096

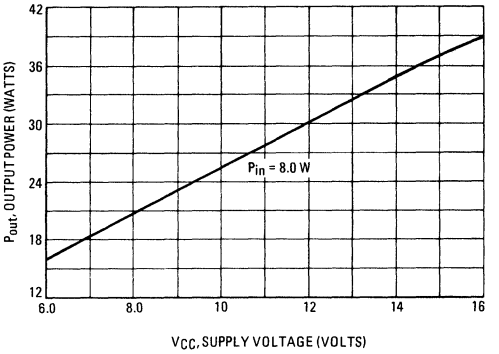
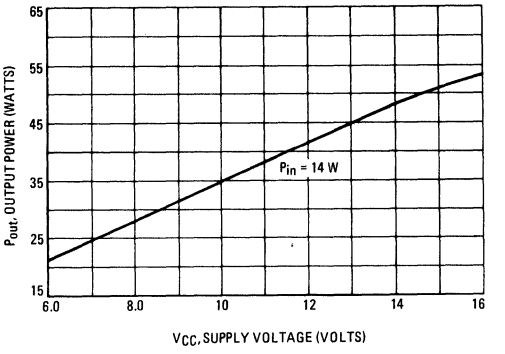


FIGURE 13 – 2N6097



PARALLEL EQUIVALENT INPUT RESISTANCE versus FREQUENCY

(V_{CC} = -12.5 Vdc)

FIGURE 14 – 2N6094

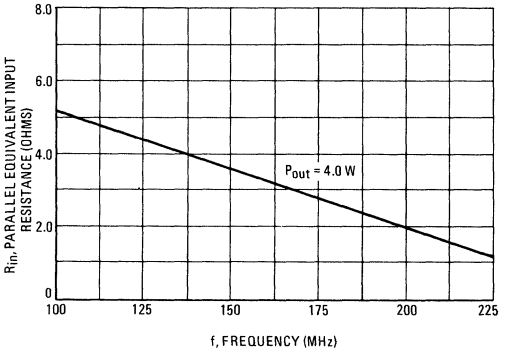


FIGURE 15 – 2N6095

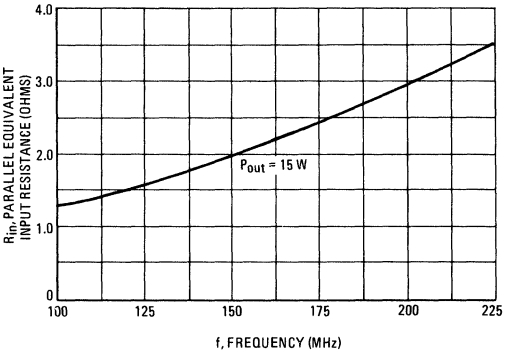


FIGURE 16 – 2N6096

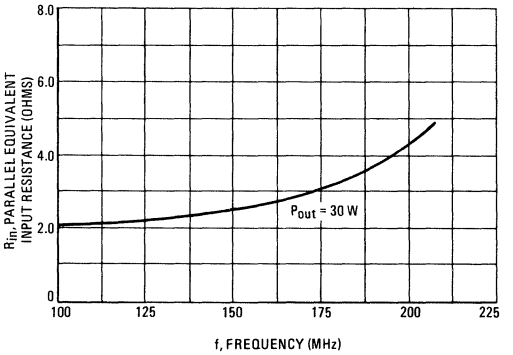
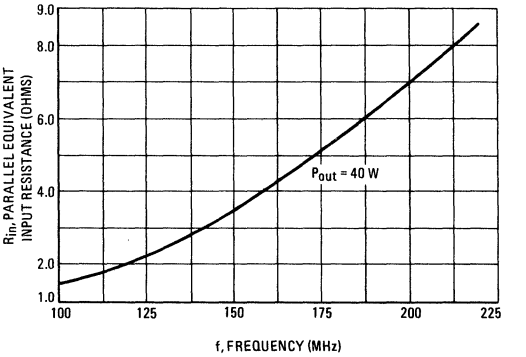


FIGURE 17 – 2N6097



CIRCUIT DESIGN DATA

PARALLEL EQUIVALENT INPUT CAPACITANCE versus FREQUENCY

(V_{CC} = -12.5 Vdc)

FIGURE 18 – 2N6094

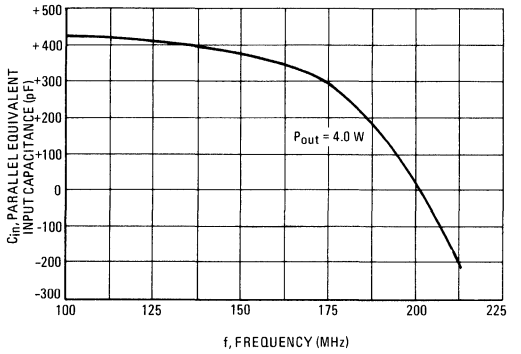


FIGURE 19 – 2N6095

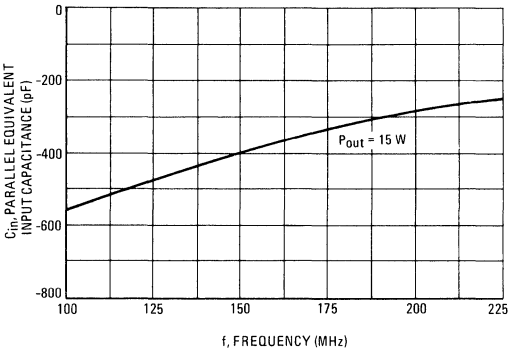


FIGURE 20 – 2N6096

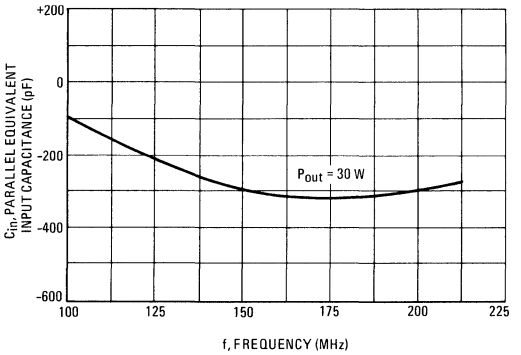
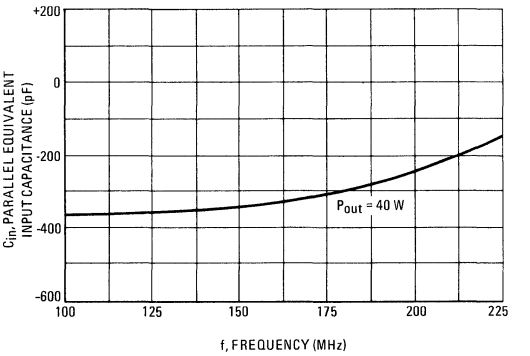


FIGURE 21 – 2N6097



PARALLEL EQUIVALENT OUTPUT CAPACITANCE versus FREQUENCY

(V_{CC} = -12.5 Vdc)

FIGURE 22 – 2N6094

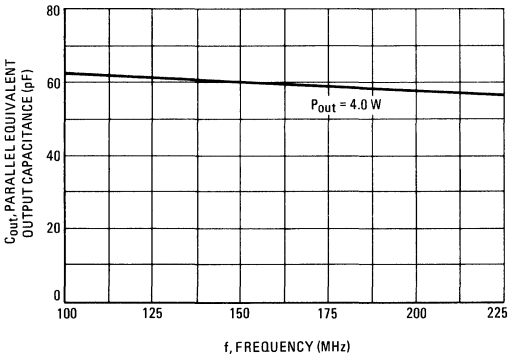
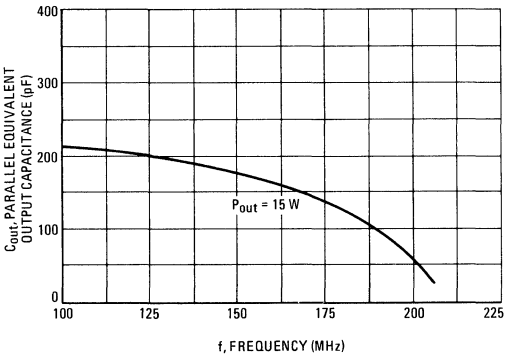


FIGURE 23 – 2N6095



CIRCUIT DESIGN DATA

PARALLEL EQUIVALENT OUTPUT CAPACITANCE versus FREQUENCY

(V_{CC} = -12.5 Vdc)

FIGURE 24 – 2N6096

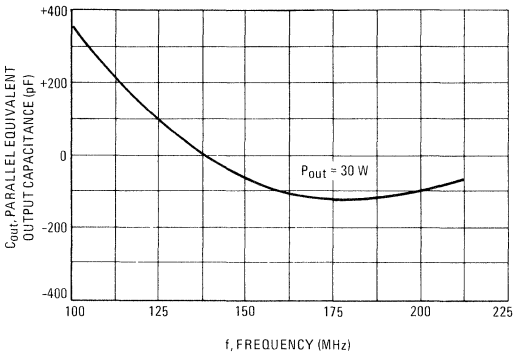
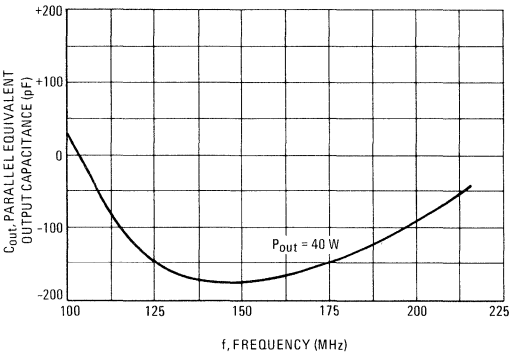


FIGURE 25 – 2N6097



TYPICAL OUTPUT POWER versus STUD TEMPERATURE

(V_{CC} = -12.5 Vdc, f = 175 MHz)

FIGURE 26 – 2N6094

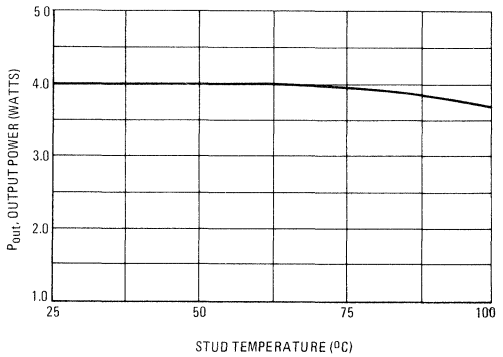


FIGURE 27 – 2N6095

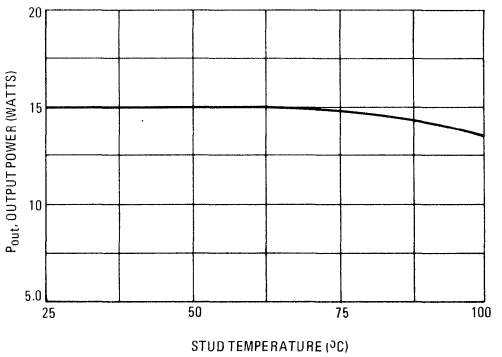


FIGURE 28 – 2N6096

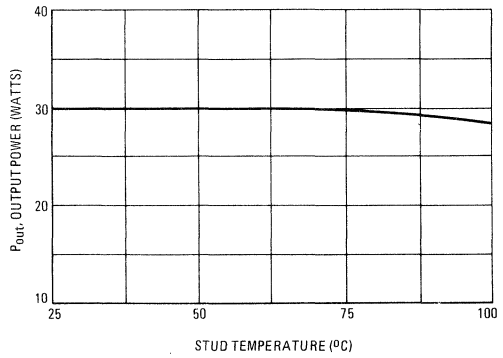


FIGURE 29 – 2N6097

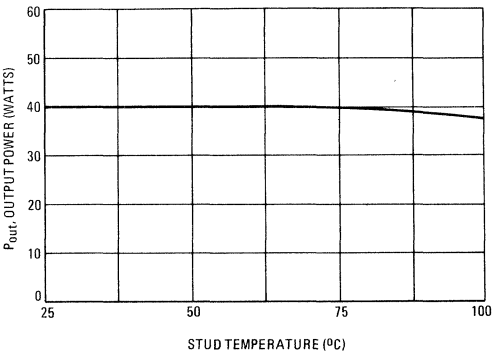
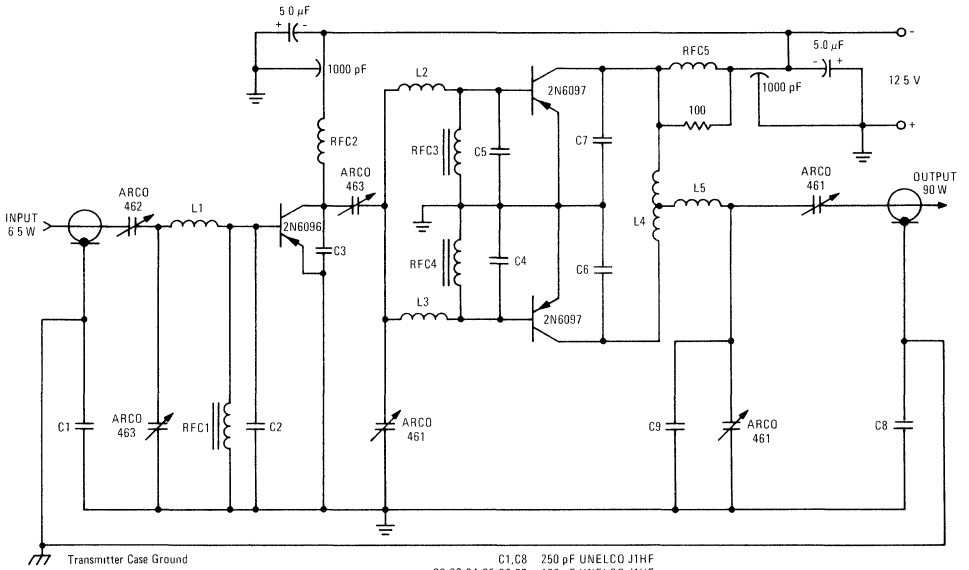


FIGURE 30 – 90-WATT, 175 MHz AMPLIFIER



C1,C8 250 pF UNELCO J1HF
C2,C3,C4,C5,C6,C7 100 pF UNELCO J1HF
C9 25 pF UNELCO J1HF
RFC1 VK200 – 20/4B Ferroxcube
RFC2 4 Turns, #18 AWG, L + Leads 1-1/2", 1/4" I D
RFC3, RFC4 0.15 μH Molded with Ferrite Bead on Ground Leg
RFC5 3 Turns, #16 AWG, on 2 W, 100 Ω Resistor
L1 1 Turn, #20 AWG, 1/4" I.D
L2, L3 ST PC , #18 AWG, 1-1/4" L
L4 1-1/4" x 1/4" x 0.03" Copper Strap Center Tapped
L5 1/2 Turn, #16 AWG, 1/4" I D., 1/2" L

This is an example of a PNP amplifier designed for negative or positive ground operation. Floating the coaxial connectors with bypasses causes no gain loss. The chassis material is Printed Circuit Board which may easily be isolated from the transmitter cabinet.