RF Power Transistors

2N6104
2N6105

30-W 400-MHz Broadband Emitter-Ballasted Silicon N-P-N Overlay Transistors

Features:

- 5-dB gain (min.) at 400 MHz with 30 watts (min.) output
- Emitter-ballasting resistors
- Broadband performance (225-400 MHz)
- Low-inductance ceramic-metal hermetic package
- Radial leads for microstripline circuits
- All electrodes isolated from the stud (2N6105)
- Flange is emitter lead (2N6104)

RCA types 2N6104 and 2N6105● are expitaxial silicon n-p-n planar transistors with overlay multiple-emitter-site construction and emitter-ballasting resistors. These transistors are intended for use in large-signal high-power cw and pulsed amplifiers in vhf/uhf communications equipment.

The ceramic-metal hermetic packages have low parasitic inductances, and are ideally suited for use in microstripline and lumped-constant broadband and narrow-band amplifiers.

● Formerly RCA Dev. Nos. TA7707 and TA7706, respectively.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

* COLLECTOR-TO-EMITTER VOLTAGE:			
With base open	V_{CEO}	30	V
* COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	65	V
* EMITTER-TO-BASE VOLTAGE	V_{EBO}	4	V
* CONTINUOUS COLLECTOR CURRENT	I_C	4.5	A
* TRANSISTOR DISSIPATION	P_T		
At case temperatures up to 75° C		36	W
At case temperatures above 75° C		Derate linearly at 0.288	W/°C
* TEMPERATURE RANGE:			
Storage & Operating (Junction)		−65 to +200	°C
* CASE TEMPERATURE (During soldering):			
For 10 s max.		230	°C

* In accordance with JEDEC registration data format JS-6 RDF-3/JS-9 RDF-7.

ELECTRICAL CHARACTERISTICS, *at Case Temperature (T_C) = 25°C unless otherwise specified*

STATIC

	CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS		UNITS
			DC Voltage V		DC Current mA				
			V_{CE}	V_{BE}	I_E	I_C	MIN.	MAX.	
*	Collector-to-Emitter Cutoff Current: Base connected to emitter, T_C=55°C	I_{CES}	30	0			–	10	mA
*	Collector-to-Emitter Breakdown Voltage: With base connected to emitter	$V_{(BR)CES}$		0		200[a]	65	–	V
	With base open	$V_{(BR)CEO}$				200[a]	30	–	V
*	Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$			5	0	4	–	V
	Thermal Resistance (Junction-to-Case)	$R_{\theta JC}$						3.5	°C/W

[a]Pulsed through a 25-mH inductor; duty factor = 50%.

DYNAMIC

	CHARACTERISTIC	SYMBOL	TEST CONDITIONS				LIMITS		UNITS
			DC Collector Supply (V_{CC})-V	Input Power (P_{IE})-W	Output Power (P_{OE})-W	Frequency (f)–MHz	Min.	Max.	
	Output Power (See Fig. 10)	P_{OE}	28	9.5		400	30	–	W
	Overdrive Test (See Fig. 10)	P_{OEO}	28	12.0		400	34	—	W
*	Power Gain	G_{PE}	28		30	400	5	–	dB
*	Collector Efficiency	η_C	28	9.5		400	65	–	%
*	Collector-to-Base Output Capacitance	C_{obo}	30 (V_{CB})			1	–	35	pF

*In accordance with JEDEC registration data format JS-6 RDF-3/JS-9 RDF-7.

TYPICAL APPLICATION INFORMATION

CIRCUIT	COLLECTOR SUPPLY VOLTAGE (V_{CC})–V	OUTPUT POWER (P_{OE})–W	INPUT POWER (P_{IE})–W	COLLECTOR EFFICIENCY (η_C) – %	FIG. NO.
225-400 MHz (2N6105)▲ Broadband Amplifier	28 20	30 20	5 – 7.5 5 – 7	69 – 77 70 – 82	13 13
400 MHz (2N6104-5) Narrow-Band Amplifier	28	34	9.5	78	10
225-400 MHz (2N6105)▲ Push-Pull Amplifier	28	60	11.5 – 18	72 – 84	16

▲ Similar performance can be obtained with the 2N6104.

RCA Application Notes

AN-4421 "16– and 25–Watt Broadband Power Amplifiers Using RCA–2N5918, 2N5919, and TA7706 UHF/Microwave Power Transistors."

AN-6010 "Characteristics and Broadband (225-to-400-MHz) Applications of the RCA-2N6104 and 2N6105 UHF Power Transistors."

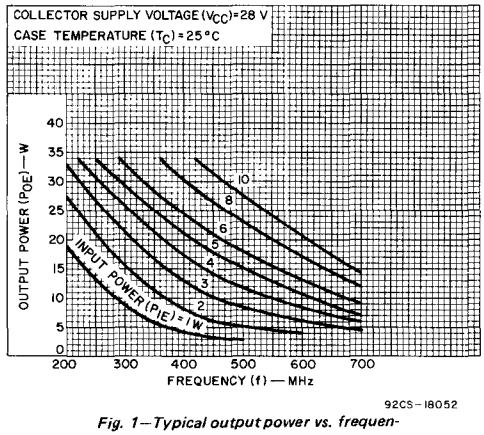


Fig. 1—Typical output power vs. frequency for both types.

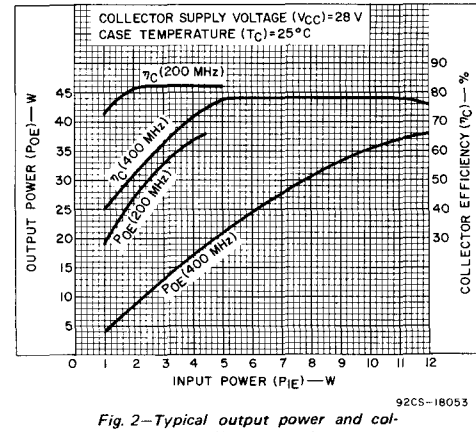


Fig. 2—Typical output power and collector efficiency vs. input power for both types.

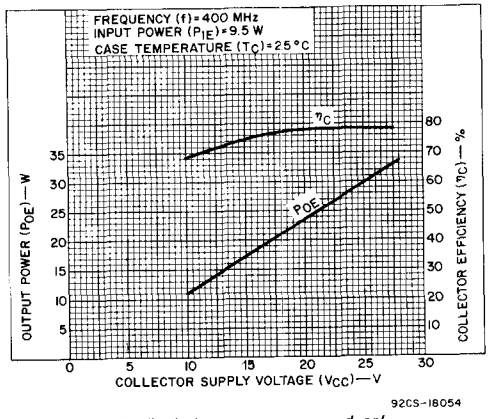


Fig. 3—Typical output power and collector efficiency vs. collector supply voltage for both types.

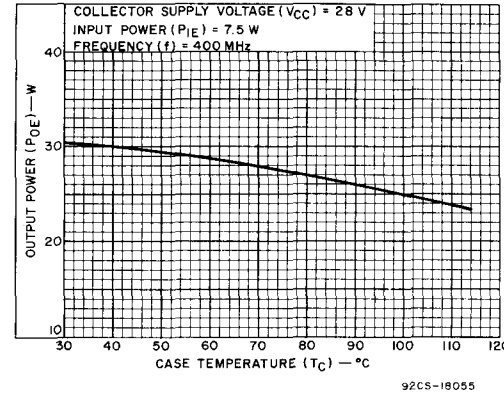


Fig. 4—Typical output power vs. case temperature for both types.

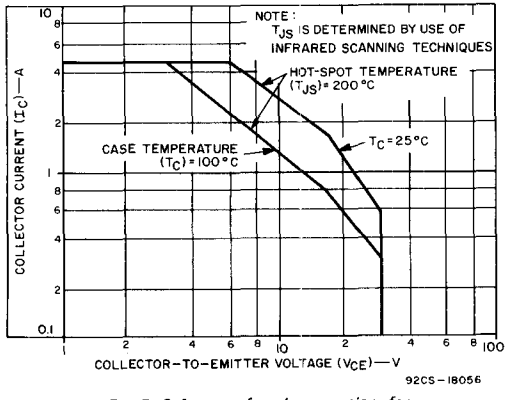


Fig. 5—Safe area for dc operation for both types.

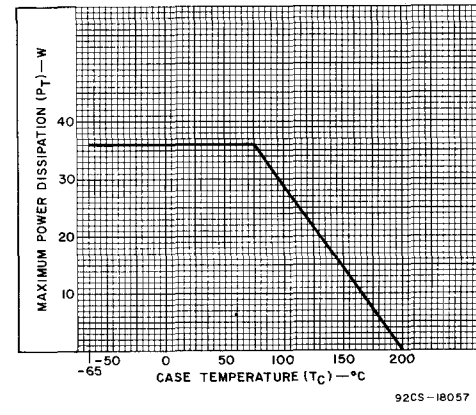


Fig. 6—Dissipation derating for class C operation for both types.

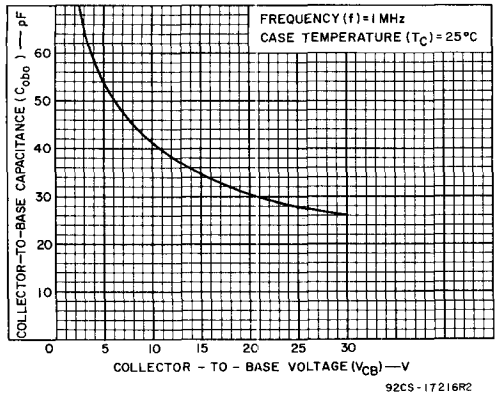


Fig. 7—Typical variation of collector-to-base capacitance vs. collector-to-base voltage for both types.

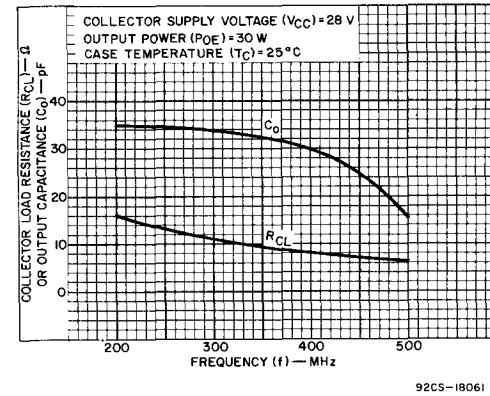


Fig. 8—Typical large-signal parallel collector load resistance and parallel output capacitance vs. frequency for both types.

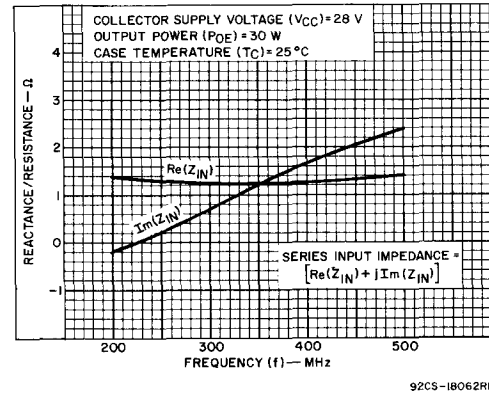


Fig. 9—Typical large-signal series input impedance vs. frequency for both types.

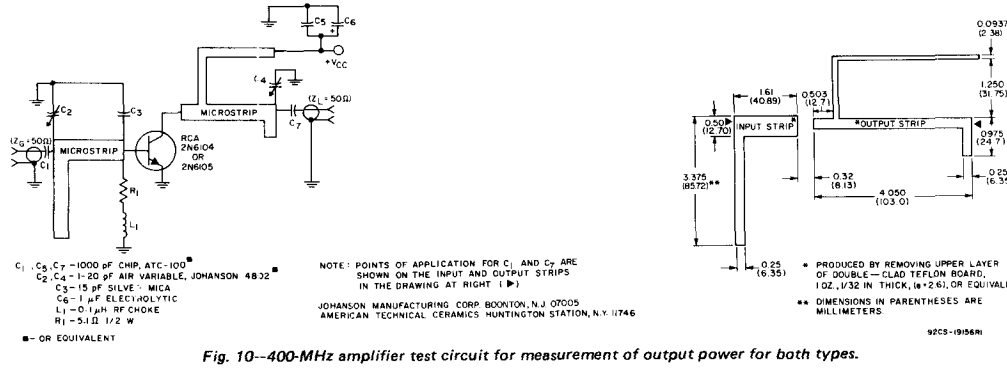


Fig. 10--400-MHz amplifier test circuit for measurement of output power for both types.

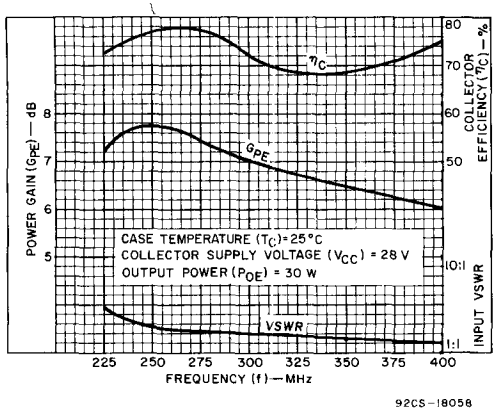


Fig. 11—Typical performance of a 225-400-MHz amplifier using RCA 2N6105 in circuit of Fig. 13, at V_{CC} = 28 V.

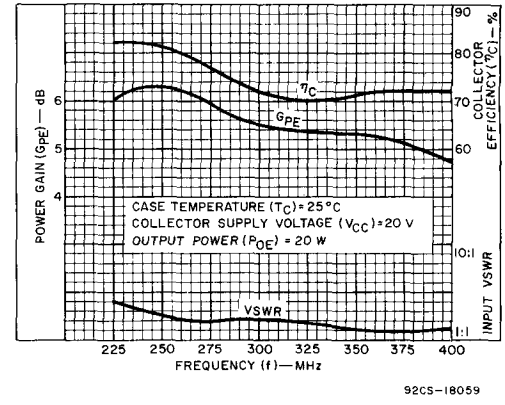
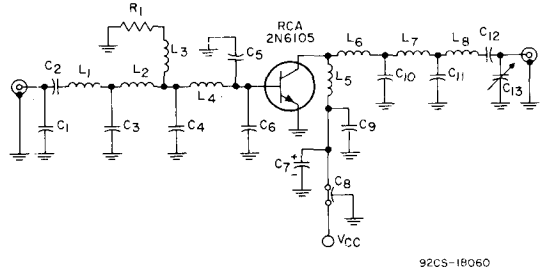


Fig. 12—Typical performance of a 225-400-MHz amplifier using RCA 2N6105 in circuit of Fig. 13, at V_{CC} = 20 V.



C_1: 8.2 pF chip, Allen-Bradley•
C_2: 18 pF silver mica
C_3: 33 pF chip, Allen-Bradley•
C_4: 47 pF chip, Allen-Bradley•
C_5: 68 pF chip, ATC-100•
C_6: 62 pF chip, ATC-100•
C_7: 1 μF electrolytic
C_8: 1000 pF feedthrough
C_9, C_{12}: 1000 pF chip, Allen-Bradley•
C_{10}: 22 pF chip, Allen-Bradley•
C_{11}: 6.9 pF chip, Allen-Bradley•
C_{13}: 0.8-10 pF variable air, Johanson No.3957•
L_1: 2 turns, 5/32 in. (3.968 mm) I.D. coil
L_2: 17/32 in. (13.49 mm) long wire
L_3: RFC, 0.1 μH, Nytronics•
L_4: 5/32 in. (3.968 mm) long transistor base lead
L_5, L_7: 13/16 in. (20.638 mm) long wire
L_6: 9/16 in. (14.287 mm) long wire
L_8: 7/8 in. (22.225 mm) long wire
R_1: 5.0 Ω, 1/4 W
All wire is No.20 AWG

•Or equivalent.

Fig. 13—225-400-MHz amplifier using RCA 2N6105.

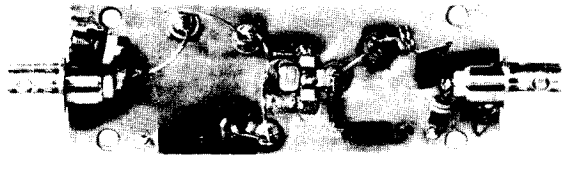


Fig. 14—Photograph of 225-400-MHz amplifier.

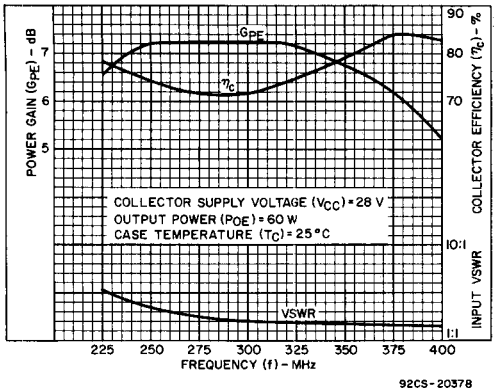
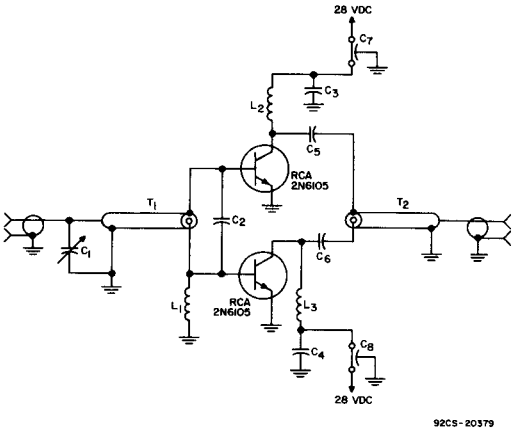


Fig.15—Typical performance of a 225-400-MHz push-pull amplifier using two RCA 2N6105's in circuit of Fig.16.



C_1	=	2 – 18 pF, Amperex HT10MA/218•
C_2	=	56-pF chip, ATC-100•
C_3,C_4, C_5,C_6	=	1000-pF chip, Allen-Bradley type•
C_7,C_8	=	1000 pF, feedthrough
L_1	=	0.18 μH RFC, Nytronics type•
L_2, L_3	=	No. 20 wire, 0.75 in.(19.05 mm)long
T_1	=	coaxial line, Z_O = 25Ω, 3.75 in. (95.25 mm) long
T_2	=	coaxial line, Z_O = 25Ω, 4.50 in. (114.30 mm) long

•or equivalent

Fig. 16—225-to-400-MHz push-pull amplifier using two RCA 2N6105's.

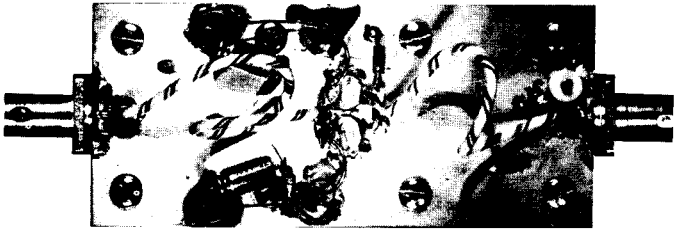


Fig. 17—Photograph of 225-400-MHz push-pull amplifier