

High-Power Silicon N-P-N Overlay Transistor

For Class C, AM Operation in VHF Circuits

Features:

- 15 W output min. at 136 MHz
- For 24 V aircraft communication
- Load mismatch protection
- High voltage ratings
- Emitter grounded to case

RCA-2N5102* is an epitaxial silicon n-p-n planar transistor of the overlay emitter-electrode construction. It is especially designed with integral ballast resistors in each emitter site to provide high power as a class C rf amplifier for vhf aircraft communications service (108 to 150 MHz) with amplitude modulation and 24-volt power supply.

The transistor features complete protection against any load mismatch. Each unit is tested at 118 MHz with full modulation and no current limiting for all load-mismatch conditions from short-circuit to open-circuit.

In the overlay structure, a number of individual emitter sites are connected in parallel and used in conjunction with a common collector region. When compared with other structures, this arrangement provides a substantial increase in emitter periphery for higher current or power, and a corresponding decrease in emitter and collector areas for lower input and output capacitances. The overlay structure thus offers greater power output, gain efficiency, frequency capability, and linearity.

*Formerly RCA Dev. No. TA2791

MAXIMUM RATINGS, Absolute-Maximum Values:

*COLLECTOR-TO-BASE VOLTAGE	V _{CB0}	90	V
COLLECTOR-TO-EMITTER VOLTAGE:			
With base-emitter junction reverse-biased, V _{BE} = -1.5 V	V _{CEV}	100	V
*With external base-to-emitter resistance, R _{BE} = 5 Ω	V _{CER}	50	V
*EMITTER-TO-BASE VOLTAGE	V _{EBO}	4	V
*CONTINUOUS COLLECTOR CURRENT	I _C	3.3	A
PEAK COLLECTOR CURRENT		10	A
*CONTINUOUS BASE CURRENT	I _B	1	A
*TRANSISTOR DISSIPATION:	P _T		
At case temperatures up to 25°C		70	W
At case temperatures above 25°C		See Fig. 6	
*TEMPERATURE RANGE:			
Storage & Operating (Junction)		-65 to 200	°C
*LEAD TEMPERATURE (During soldering):			
At distances ≥ 1/32 in. (0.8 mm) from insulating wafer for 10 s max		230	°C

*In accordance with JEDEC registration data.

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

CHARACTERISTIC	SYMBOL	TEST CONDITIONS						LIMITS		UNITS
		VOLTAGE V dc			CURRENT mA dc			MIN.	MAX.	
		V _{CB}	V _{CE}	V _{BE}	I _E	I _B	I _C			
Collector Cutoff Current: With base-emitter junction reverse biased At $T_C = 150^\circ\text{C}$	I _{CEV}		83	-1.5				-	20	mA
With external base-to-emitter resistance (R_{BE}) = 5 Ω			30	-1.5				-	10	
Emitter Cutoff Current	I _{EBO}			-4				-	10	
Collector-to-Emitter Sustaining Voltage: With base-emitter junction reverse biased	V _{CEV(sus)}			-1.5			600 ^a	100	-	V
With external base-to-emitter resistance (R_{BE}) = 5 Ω	V _{CER(sus)}						200 ^a	50	-	
With base open	V _{CEO(sus)}				0	200 ^a		35	-	
Emitter-to-Base Breakdown Voltage	V(BR)EBO				10		0	4	-	V
DC Forward Current Transfer Ratio	h _{FE}		4 4				3 A 0.5 A	10 10	- 100	
Magnitude of Common-Emitter, Small-Signal, Short-Circuit Forward Current Transfer Ratio (f = 150 MHz)	h _{fe}		24				500	1	-	
Output Capacitance (f = 1 MHz)	C _{ob}	30			0			-	85	pF
Available Amplifier Signal Input Power ^b (P _O = 15 W, Z _G = 50 Ω , f = 136 MHz)	P _i							-	6	W
Collector Circuit Efficiency (P _I E = 6 W, Z _G = 50 Ω , f = 136 MHz)	η_C							70	-	%
Modulation ^c (f = 118 MHz)	M		24 (V _{CC})					80	-	%
Load Mismatch ^d (f = 118 MHz)	LM		24 (V _{CC})				1100	Will not be damaged		
Dynamic Input Impedance (See Fig. 10) (P _I E = 6 W, f = 150 MHz)	Z _{IN}		24 (V _{CC})					1.7 + j 2.6 (typ)		Ω
Thermal Resistance (Junction to Case)	R _{θJC}							-	2.5	$^\circ\text{C}/\text{W}$

* In accordance with JEDEC registration data.

^a Pulsed through a 9-mH inductor; duty factor = 50%.

^b Unmodulated carrier.

^c See Figs. 9 & 10. Carrier Power, P_{CAR}, = 15 W;

$$V_{CC} \text{ modulation} = 100\%; M = \sqrt{\frac{2(P_{AM} - P_{CAR})}{P_{CAR}}} \times 100\%.$$

^d Under conditions of footnote c, the transistor is subjected to all conditions of load mismatch from short-circuit to open-circuit.

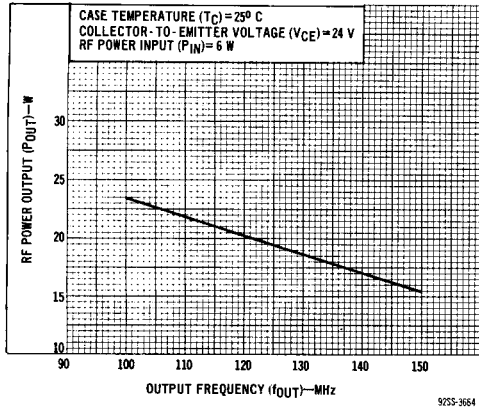


Fig. 1—Typical power output vs. frequency.

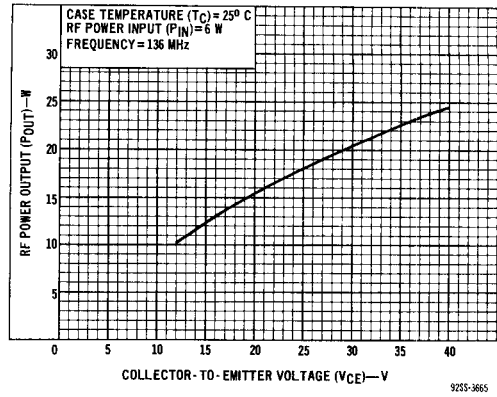


Fig. 2—Typical rf power output vs. collector-to-emitter voltage.

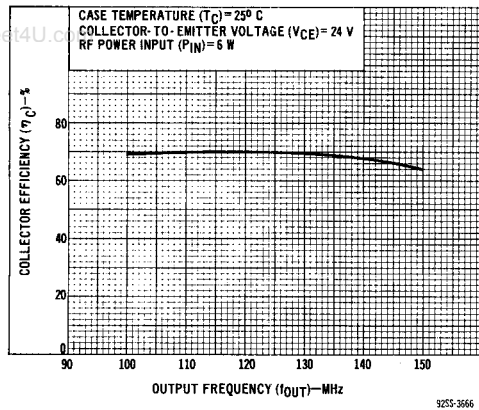


Fig. 4—Typical power output vs. power input.

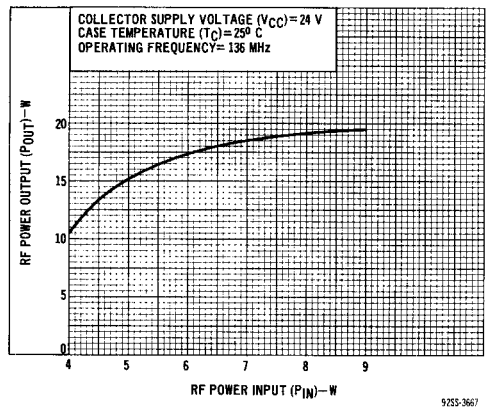


Fig. 3—Typical collector efficiency vs. frequency.

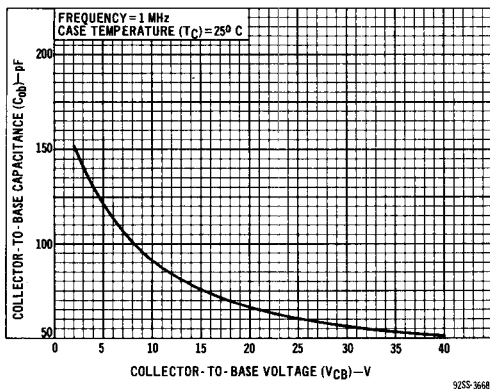


Fig. 5—Typical variation of collector-to-base capacitance.

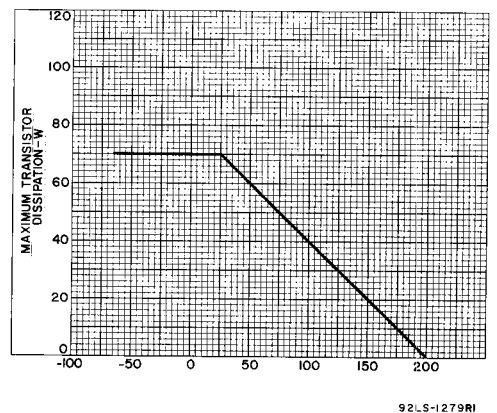
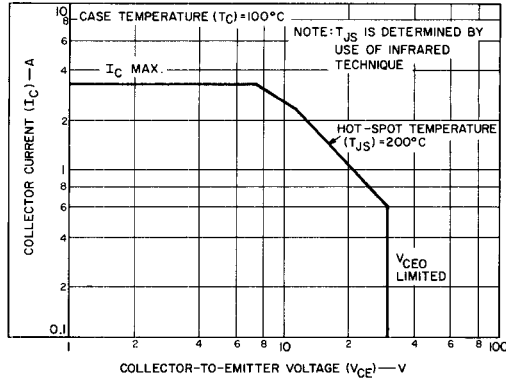


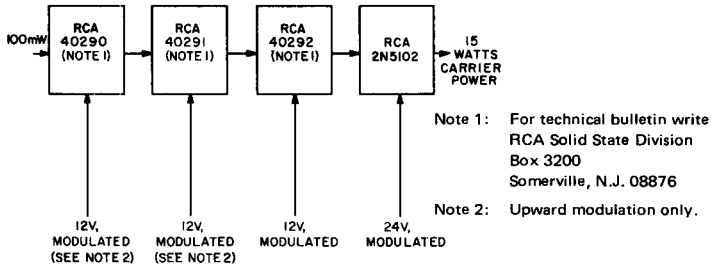
Fig. 6—Dissipation derating curve.



92CS-19139

Fig. 7—Safe operation area with dc forward bias.

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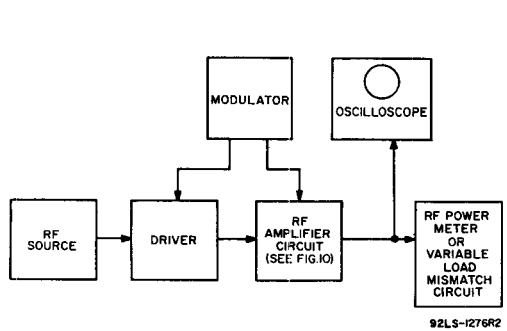


Note 1: For technical bulletin write
RCA Solid State Division
Box 3200
Somerville, N.J. 08876

Note 2: Upward modulation only.

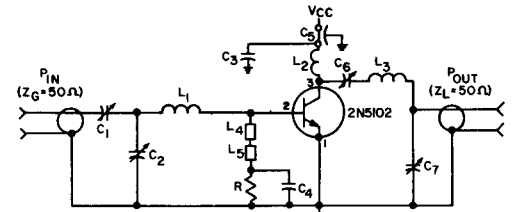
92LS-1277R2

Fig. 8—Block diagram of a typical narrowband aircraft radio transmitter chain.



92LS-1276R2

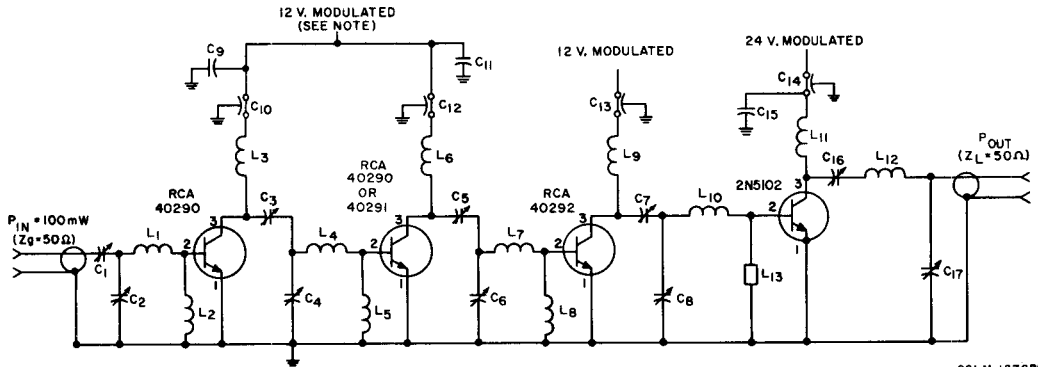
Fig. 9—Block diagram for modulation test.



92LS-1275R2

- C₁, C₆: 3-35 pF
- C₂, C₇: 7-100 pF
- C₃: 0.1 μF
- C₄: 0.05 μF
- C₅: 1,000 pF
- L₁: 3 1/4 turns, 1/8 in. (3.17 mm) dia. No. 14 wire
- L₂: 2 turns, 3/8 in. (9.52 mm) dia. No. 14 wire
- L₃: 4 turns, 3/8 in. (9.52 mm) dia. No. 14 wire
- L₄, L₅: 350 Ω Ferrite choke, Ferroxcube # VK200 01-3B
- R: 1 Ω wire wound

Fig. 10—RF amplifier circuit for power output test.



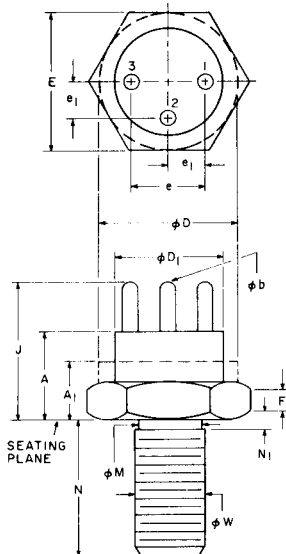
92LM-1278R2

- C1, C3, C5, C7, C16: 3-35 pF
- C2, C4, C6, C8, C17: 8-60 pF
- C9, C11, C13: 0.03 μF
- C10, C12, C14: 1,000 pF
- C15: 0.1 μF
- L1, Lg: 3 turns, 1/4 in. (6.35 mm) dia., No. 16 wire
- L2, L5: Ferrite choke, Z = 450 ohms, Ferroxcube # VK200 01-4B
- L3: RF choke, 1.5 μH
- L4, L7: 4 turns, 1/4 in. (6.35 mm) dia., No. 16 wire
- L6: RF choke, 1.0 μH
- L8: wire-wound resistor, R = 2.4 ohms
- L10: 3 turns, 1/8 in. (3.17 mm) dia., No. 14 wire
- L11: 2 turns, 1/2 in. (12.7 mm) dia., No. 16 wire
- L12: 4 turns, 1/2 in. (12.7 mm) dia., No. 16 wire
- L13: 350 Ω ferrite choke, Ferroxcube # VK200 01-3B

Note: Upward modulation only.

Fig. 11 - Circuit diagram of a typical narrowband aircraft radio transmitter chain.

**DIMENSIONAL OUTLINE
JEDEC TO-60**



TERMINAL CONNECTIONS
Case, Pin No. 1 - Emitter
Pin No. 2 - Base
Pin No. 3 - Collector

SYMBOL	INCHES		MILLIMETERS		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	0.215	0.320	5.46	8.13	
A ₁	-	0.165	-	4.19	2
φb	0.030	0.046	0.762	1.17	4
φD	0.360	0.437	9.14	11.10	2
φD ₁	0.320	0.360	8.13	9.14	
E	0.424	0.437	10.77	11.10	
e	0.185	0.215	4.70	5.46	
e ₁	0.090	0.110	2.29	2.79	
F	0.090	0.135	2.29	3.43	1
J	0.355	0.480	9.02	12.19	
φM	0.163	0.189	4.14	4.80	
N	0.375	0.455	9.53	11.56	
N ₁	-	0.078	-	1.98	
φW	0.1658	0.1697	4.212	4.310	3, 5

- NOTES:
1. Dimension does not include sealing flanges
 2. Package contour optional within dimensions specified
 3. Pitch diameter - 10-32 UNF 2A thread (coated)
 4. Pin spacing permits insertion in any socket having a pin-circle diameter of 0.200 in. (5.08 mm) and contacts which will accommodate pins with a diameter of 0.030 in. (0.762 mm) min., 0.046 in. (1.17 mm) max.
 5. The torque applied to a 10-32 hex nut assembled on the thread during installation should not exceed 12 inch-pounds.