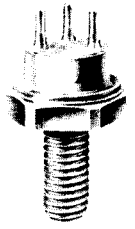
2N5016



JEDEC TO-60 H-1307

High-Power Silicon N-P-N Overlay Transistor

For VHF/UHF Communications Equipment

Features:

- For class B or C vhf/uhf military and industrial communications
- 15 W output (min.) at 400 MHz
- 23 W output (typ.) at 225 MHz
- *Emitter grounded to case*

RCA 2N5016* is an epitaxial silicon n-p-n planar transistor of the "overlay" emitter-electrode construction. It is intended for large-signal, high-power, class B and C rf amplifiers for military and industrial communications service (200 to 700 MHz).

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. Type TA2675.

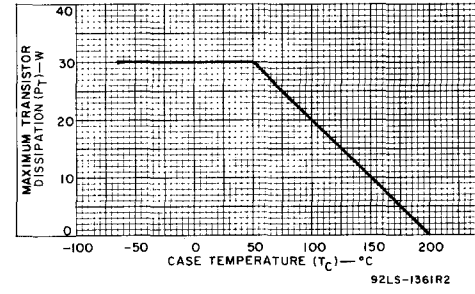


Fig. 1—Dissipation derating curve.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

*COLLECTOR-TO-BASE VOLTAGE	V_{CBO}	65	V
COLLECTOR-TO-EMITTER VOLTAGE:			
With base-emitter junction reverse-biased, V_{BE} = −1.5 V	V_{CEV}	65	V
With external base-to-emitter resistance, R_{BE} = 30 Ω	V_{CER}	40	V
* With base open	V_{CEO}	30	V
*EMITTER-TO-BASE VOLTAGE	V_{EBO}	4	V
*CONTINUOUS COLLECTOR CURRENT	I_C	4.5	A
*CONTINUOUS BASE CURRENT	I_B	1.5	A
*TRANSISTOR DISSIPATION:	P_T		
At case temperatures up to 50°C		30	W
At case temperatures above 50°C		See Fig. 1	
*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, *Case Temperature (T_C) = 25°C*

STATIC

CHARACTERISTIC	SYMBOL	TEST CONDITIONS: DC COLLECTOR OR BASE VOLTAGE – V			TEST CONDITIONS: DC CURRENT mA			LIMITS		UNITS
		V_{CB}	V_{CE}	V_{BE}	I_E	I_B	I_C	MIN.	MAX.	
Collector-Cutoff Current With base open	I_{CEO}		30			0		–	10	mA
* With base-emitter junction reverse-biased	I_{CEV}		60	-1.5				–	10	mA
* T_C = 150°C	I_{CEV}		30	-1.5				–	10	mA
* Emitter Cutoff Current V_{BE} = 4 V	I_{EBO}							–	5	mA
Collector-to-Emitter Sustaining Voltage With base open	$V_{CEO(sus)}$					0	200[a]	30	–	V
* With external base-to-emitter resistance (R_{BE}) = 30 Ω	$V_{CER(sus)}$					0	200[a]	40	–	V
With base-emitter junction reverse-biased	$V_{CEV(sus)}$			-1.5			200[a]	65	–	V
Emitter-to-Base Breakdown Voltage	$V_{(BR)EBO}$				5		0	4	–	V
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$					400	2000	–	1	V
* DC Forward Current Transfer Ratio	h_{FE}		4 4				4500 500	3 10	– 200	
Thermal Resistance: Junction-to-Case	$R\theta_{J\text{-}C}$							–	5	°C/W

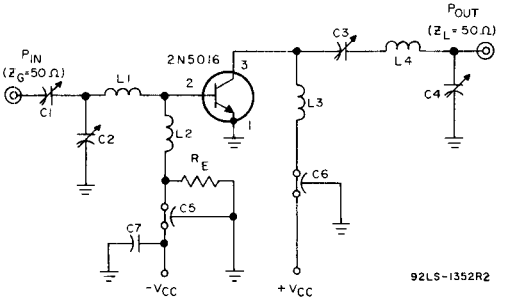
DYNAMIC

* Available Amplifier Signal Input Power (P_{OE} = 15 W, Z_{IN} = 50 Ω, V_{CC} = 28 V, f = 400 MHz) See Fig. 3	P_i							–	5	W
* Collector Efficiency (P_{IE} = 5 W, P_{OE} = 15 W, Z_L = 50 Ω, f = 400 MHz) See Fig. 3	η_C							50	–	%
* Magnitude of Common-Emitter, Small-Signal, Short-Circuit, Forward Current Transfer Ratio (f = 400 MHz)	$\lvert h_{fe} \rvert$		15				500	1.25	–	
Gain-Bandwidth Product	f_T		15				500	600 (typ.)		MHz
* Collector-to-Base Capacitance (f = 1 MHz)	C_{ob}	30			0			–	25	pF

TYPICAL APPLICATION INFORMATION

RF Power Output Amplifier, Unneutralized At 225 MHz (See Fig.2) 400 MHz (See Fig.3)	P_{OE}		28 28					23[b] (typ.) 15[c]	– –	W
Dynamic Input Impedance at 400 MHz (See Fig.3)	Z_{IN}		28					2.5 + j5 (typ.)[c]		Ω

[a] Pulsed through an inductor (25 mH); duty factor = 50%.
[b] For P_{IE} = 5.0 W; minimum efficiency = 60%.
[c] For P_{IE} = 5.0 W; minimum efficiency = 50%.
*In accordance with JEDEC registration data.



C_1: 4-40 pF trimmer, ARCO 422*
C_2: 7-100 pF trimmer, ARCO 423*
C_3: 3-35 pF trimmer, ARCO 403*
C_4: 8-60 pF trimmer, ARCO 404*
C_5,C_6: 1500 pF feedthrough
C_7: 0.01 μF disc, ceramic
R_E: 0.68 Ω wire-wound 1W
L_1: 1.5 turns No. 16 wire 1/4 in. (6.35 mm) ID, 3/16 in. (4.76 mm) long
L_2: Ferrite choke, Z = 750 Ω
L_3: 1.5 turns No. 16 wire, 1/4 in. (6.35 mm) ID
L_4: 4.5 turns No. 16 wire, 1/4 in. (6.35 mm) ID, 3 in. (76.20 mm) long

* Or equivalent.

Fig.2--RF amplifier circuit for power output test at 225 MHz.

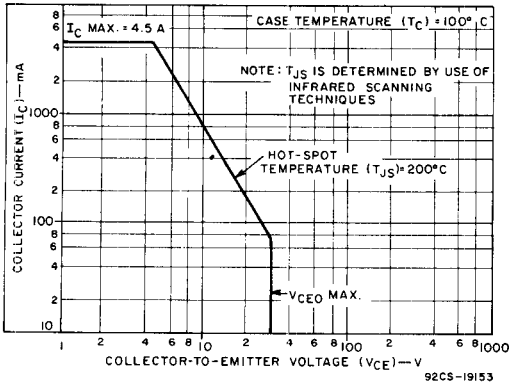
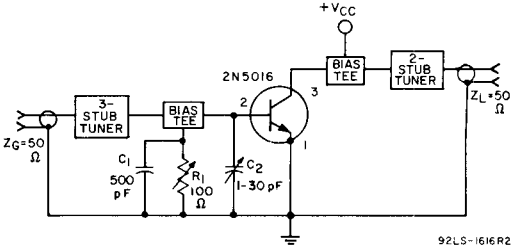


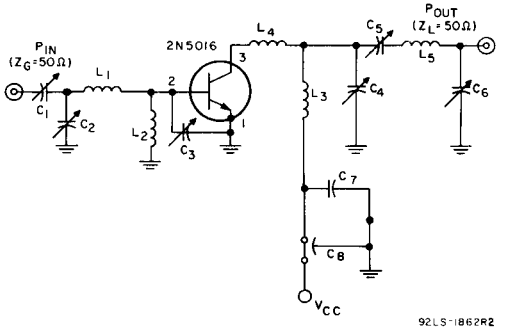
Fig.4—Safe area for dc operation.



Note 1: For optimum performance, C_2 in Fig. 3 should be mounted between emitter and base with minimum lead lengths.

Note 2: The emitter resistor, R_E, in Fig. 2 provides self bias and is recommended for improved stability and collector efficiency.

Fig.3—RF amplifier circuit for power output test at 400 MHz.



C_1: 0.1-10 pF piston capacitor
C_2,C_3,C_4,C_5,C_6: 1.0-30 pF piston capacitor (Note 2)
C_7: 0.01 μF disc ceramic
C_8: 1000 pF feedthrough
L_1: 1/4 in. (6.35 mm) OD copper tubing; 1-1/4 in. (31.75 mm) long (Note 1)
L_2: 0.12 μH choke
L_3: 0.27 Ω wire-wound
L_4: 1/8 x 1/32 x 5/8 in. (3.17 x 0.79 x 15.87 mm) long copper strap
L_5: 1/4 in. (6.35 mm) OD copper tubing, 2-1/4 in. (57.15 mm) long (Note 1)

Note 1: L_1 and L_5 are mounted coaxially within a 1-5/8 x 1-5/8 x 6 in. (41.27 x 41.27 x 152.40 mm) box.

Note 2: For optimum performance, C_3 should be mounted between emitter and base with minimum lead lengths.

Fig.5— Typical 400-MHz rf amplifier circuit,

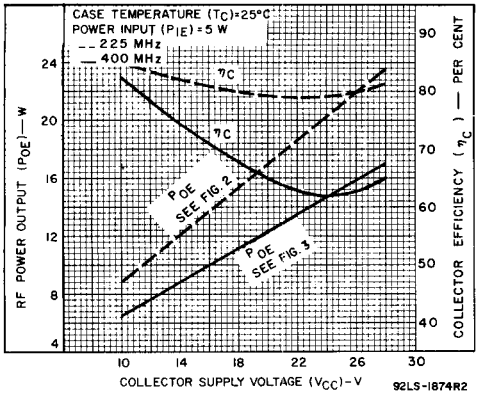


Fig.6—Typical power output and collector efficiency vs. collector supply voltage.

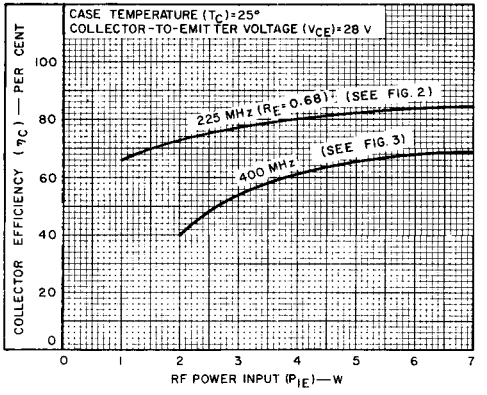


Fig.8—Collector efficiency vs. power input.

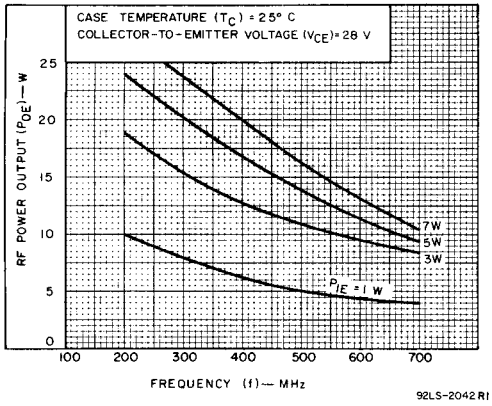


Fig.9—Typical power output vs. frequency.

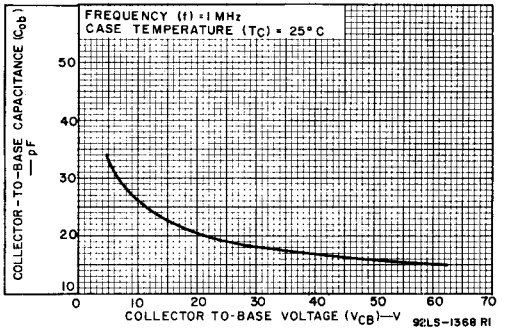
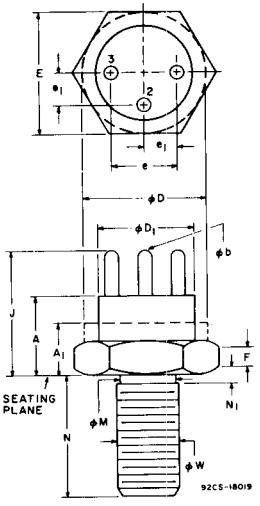


Fig.7—Typical variation of collector-to-base capacitance.

DIMENSIONAL OUTLINE

(JEDEC TO-60)



TERMINAL CONNECTIONS

Case, Pin No. 1 — Emitter
Pin No. 2 — Base
Pin No. 3 — Collector

SYMBOL	INCHES MIN.	INCHES MAX.	MILLIMETERS MIN.	MILLIMETERS MAX.	NOTES
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. (1.17mm) max.
5. The torque applied to a 10-32 hex nut assembled on the thread during installation should not exceed 12 inch-pounds.