RCA

Solid State Division

RF Power Transistors

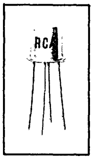
2N918
2N3600

RCA-2N918 and RCA-2N3600 are double-diffused epitaxial planar transistors of the silicon n-p-n type. They are extremely useful in low-noise-amplifier, oscillator, and converter applications at VHF frequencies.

These devices utilize a hermetically sealed four-lead JEDEC TO-72 package. All active elements of the transistor are insulated from the case, which may be grounded by means of the fourth lead in applications requiring minimum feedback capacitance, shielding of the device, or both.

SILICON N-P-N EPITAXIAL PLANAR TRANSISTORS

For VHF Applications In Military, Communications, and Industrial Equipment



JEDEC TO-72

MAXIMUM RATINGS, Absolute-Maximum Values:

	2N918	2N3600		
COLLECTOR-TO-BASE VOLTAGE, V_{CBO}	30	30	max.	V
COLLECTOR-TO-EMITTER VOLTAGE, V_{CEO}	15	15	max.	V
EMITTER-TO-BASE VOLTAGE, V_{EBO}	3	3	max.	V
COLLECTOR CURRENT, I_C	50	*	max.	mA
TRANSISTOR DISSIPATION, P_T:				
For operation with heat sink:				
At case temperatures** up to 25°C	300	300	max.	mW
At case temperatures** above 25°C	Derate at 1.71 mW/°C			
For operation at ambient temperatures:				
At ambient temperatures up to 25°C	200	200	max.	mW
At ambient temperatures above 25°C	Derate at 1.14 mW/°C			
TEMPERATURE RANGE:				
Storage and Operating (Junction)	-65 to +200			°C
LEAD TEMPERATURE (During Soldering):				
At distances ≥ 1/16 inch from seating surface for 60 seconds max.	300	300	max.	°C

* Limited by transistor dissipation.

** Measured at center of seating surface.

FEATURES

- high gain-bandwidth product
- hermetically sealed four-lead package
- low leakage current
- high 200-MHz power gain

2N3600

- low noise figure
  NF = 4.5 dB max. at 200 MHz
- low collector-to-base time constant
  $r_b'C_c$ = 15 ps max.
- high power gain as neutralized amplifier
  G_{pe} = 17 dB min. at 200 MHz

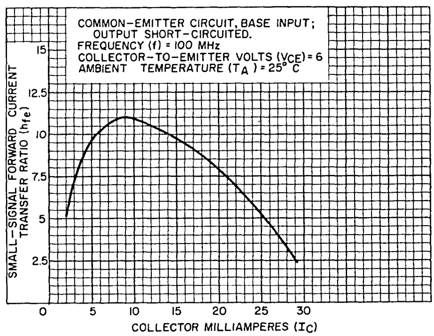


Fig. 1 - Small-signal beta characteristic for types 2N918 and 2N3600.

ELECTRICAL CHARACTERISTICS

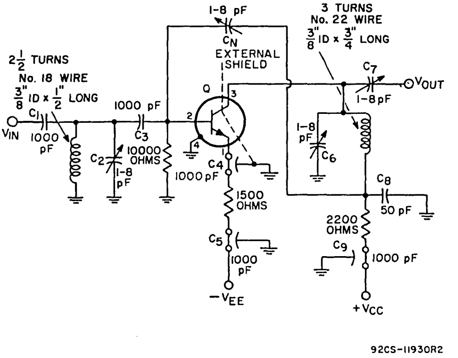
Characteristics	Symbols	TEST CONDITIONS: Ambient Temperature T_A (°C)	Frequency f (MHz)	DC Collector-to-Base Voltage V_{CB} (V)	DC Collector-to-Emitter Voltage V_{CE} (V)	DC Emitter Current I_E (mA)	DC Collector Current I_C (mA)	DC Base Current I_B (mA)	LIMITS Type 2N918 Min.	Typ.	Max.	Type 2N3600 Min.	Typ.	Max.	Units
Collector-Cutoff Current	I_{CBO}	25 150		15 15		0 0			- -	- -	0.01 1	- -	- -	0.01 1	µA µA
Collector-to-Base Breakdown Voltage	BV_{CBO}	25				0	0.001		30	-	-	30	-	-	V
Collector-to-Emitter Sustaining Voltage	$BV_{CEO}(sus)$	25					3	0	15	-	-	15	-	-	V
Emitter-to-Base Breakdown Voltage	BV_{EBO}	25				0.01	0		3	-	-	3	-	-	V
Collector-to-Emitter Saturation Voltage	$V_{CE}(sat)$	25					10	1	-	-	0.4	-	-	0.4	V
Base-to-Emitter Saturation Voltage	$V_{BE}(sat)$	25					10	1	-	-	1	-	-	1	V
Static Forward Current-Transfer Ratio	h_{FE}	25			1		3		20	-	-	20	-	150	
Small-Signal Forward Current-Transfer Ratio[a]	h_{fe}	25	100 100 1 kHz		10 6 6		4 5 2		6 - -	- - -	- - -	- 8.5 40	- - -	- 15 200	
Common-Base Output Capacitance[b]	C_{ob}	25	0.1 to 1	10 0		0 0			- -	- -	1.7 3	- -	- -	- -	pF pF
Collector-to-Base Feedback Capacitance[b]	C_{cb}	25	0.1 to 1	10		0			-	-	-	-	-	1	pF
Common-Base Input Capacitance[c] (V_{EB} = 0.5V)	C_{ib}	25	0.1 to 1				0		-	-	2	-	1.4	-	pF
Collector-to-Base Time Constant[a]	$r_b'C_c$	25	40 31.9	6 6			2 5		- -	15 -	- -	- 4	- -	- 15	ps ps
Small-Signal Power Gain in Neutralized Common-Emitter Amplifier Circuit[a] (See Fig.2 & Fig.3)	G_{pe}	25	200		12 6		6 5		15 -	21 -	- -	- 17	- -	- 24	dB dB
Small-Signal Power Gain in Unneutralized Common-Emitter Amplifier Circuit[a] (See Fig.4)	G_{pe}	25	200		10		5		-	13	-	-	-	-	dB
Power Output in Common-Emitter Oscillator Circuit[c] (See Fig.5)	P_o	25	≥ 500	10		12			30	-	-	20	-	-	mW
Noise Figure[a] (See Fig.2)	NF	25	200		6		1.5		-	-	-	-	-	4.5	dB
Noise Figure[a,d]	NF	25	60		6		1		-	-	6	-	-	3	dB

[a] Lead No.4 (case) grounded.

[b] Three-terminal measurement of the collector-to-base capacitance with the case and emitter leads connected to the guard terminal.

[c] Lead No.4 (case) floating.

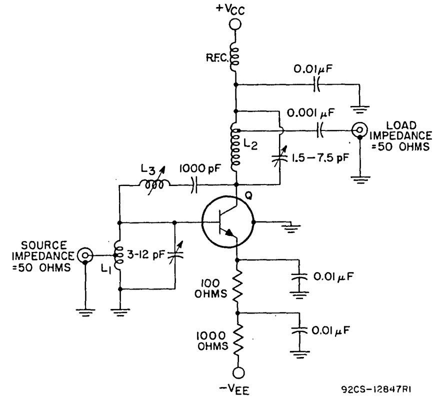
[d] Generator Resistance (R_g) = 400 ohms.



NOTE: (Neutralization Procedure): (a) Connect a 50-Ω rf voltmeter to the output of a 200-MHz signal generator (R_g = 50 Ω), and adjust the generator output to 5 mV. (b) Connect the generator to the input and the rf voltmeter to the output of the amplifier, as shown above. (c) Apply V_{EE} and V_{CC}, and adjust the generator output to provide an amplifier output of 5 mV. (d) Tune C_2, C_6, and C_7 for maximum amplifier output, readjusting the generator output, as required, to maintain an output of 5 mV from the amplifier. (e) Interchange the connections to the signal generator and the rf voltmeter. (f) With sufficient signal applied to the output terminals of the amplifier, adjust C_N for a minimum indication at the amplifier input. (g) Repeat steps (a), (b), (c), and (d) to determine if retuning is necessary.

Q = Type 2N3600

Fig.2 - Neutralized amplifier circuit used to measure power gain and noise figure at 200 MHz for type 2N3600.



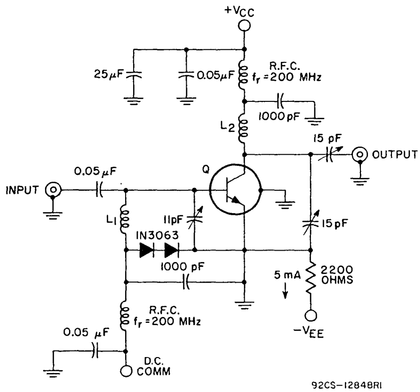
L_1 - 3.5 turns No.16 tinned copper wire; 5/16 " dia.; 7/16 " long; turns ratio ≃ 4:2

L_2 - 8 turns No.16 tinned copper wire; 1/8 " dia.; 7/8 " long; turns ratio ≃ 8:1

L_3 - MILLER #4303 (0.4 - 0.65 μH) or equivalent

Q = Type 2N918

Fig.3 - Neutralized amplifier circuit used to measure power gain at 200 MHz for type 2N918.

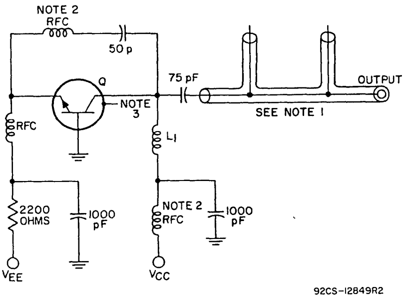


L_1 - 1 loop #12 AWG wire; I_D = 13/16 "

L_2 - 1/2 loop #12 AWG wire; I_D = 1-3/16 "

Q = 2N918

Fig.4 - Circuit used to measure 200-MHz unneutralized power gain for type 2N918.



Note 1 - Coaxial-Line output network consisting of:

2 General Radio Type 874 TEE or equivalent

1 General Radio Type 874-D20 Adjustable Stub or equivalent

1 General Radio Type 874-LA Adjustable Line or equivalent

1 General Radio Type 874-WN3 Short-circuit termination or equivalent

Note 2 - RFC = 0.2 μH Ohmite #2-460 or equivalent

Note 3 - Lead Number 4 (case) floating

L_1 - 2 turns #16AWG wire, 3/8 inch OD, 1-1/4 inch long

Q = 2N918 or 2N3600

Fig.5 - Circuit used to measure 500-MHz oscillator power output for types 2N918 and 2N3600.

TWO-PORT ADMITTANCE (y) PARAMETERS AS FUNCTIONS OF COLLECTOR CURRENT (I_C) FOR RCA TYPES 2N918 AND 2N3600

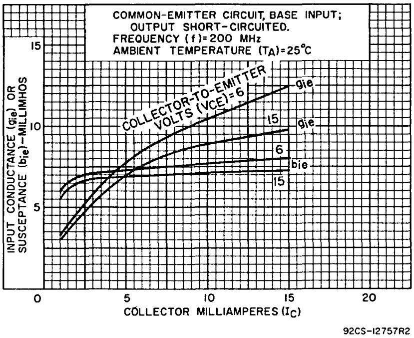


Fig.6 - Input admittance (y_{ie}).

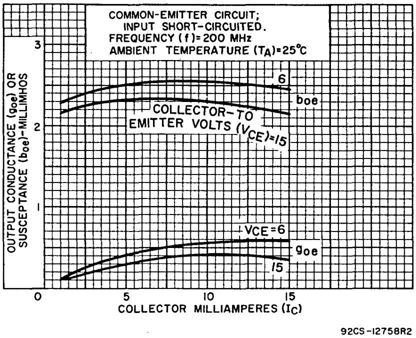


Fig.7 - Output admittance (y_{oe}).

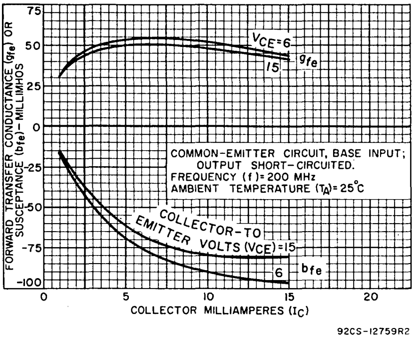


Fig.8 - Forward transadmittance (y_{fe}).

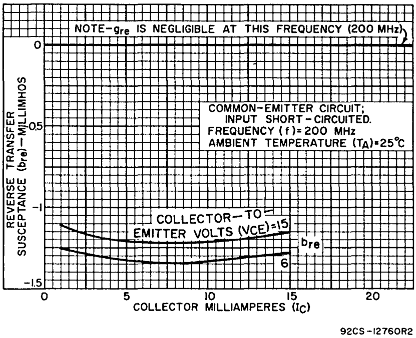


Fig.9 - Reverse transadmittance (y_{re}).

TERMINAL CONNECTIONS

LEAD 1 - EMITTER

LEAD 2 - BASE

LEAD 3 - COLLECTOR

LEAD 4 - CONNECTED TO CASE