RCA
Solid State Division

RF Power Transistors

2N3478

JEDEC TO-72 H-1299

SILICON N-P-N EPITAXIAL PLANAR TRANSISTOR

For VHF/UHF Applications
in Industrial and Commercial Equipment

Features:

- high gain-bandwidth product – f_T = 900 MHz typ.
- low noise figure
  NF = 5 dB typ. at 470 MHz
  4.5 dB max. at 200 MHz
  2.5 dB typ. at 60 MHz
- high unneutralized power gain G_{pe} = 11.5 dB min. at 200 MHz
- hermetically sealed four-lead package
- all active elements insulated from case
- low collector-to-base feedback capacitance, C_{cb} 0.7 pF max.

RCA-2N3478 is an epitaxial planar transistor of the silicon n-p-n type with characteristics which make it extremely useful as a general purpose rf amplifier at frequencies up to 470 MHz. These characteristics include an exceptionally low noise figure at high frequencies, low leakage current, and a high gain-bandwidth product.

The 2N3478 utilizes a hermetically sealed four-lead package in which active elements of the transistor are insulated from the case. The case may be grounded by means of a fourth lead in applications requiring minimum feedback capacitance, shielding of the device, or both.

TERMINAL CONNECTIONS

Lead 1 – Emitter
Lead 2 – Base
Lead 3 – Collector
Lead 4 – Connected to case

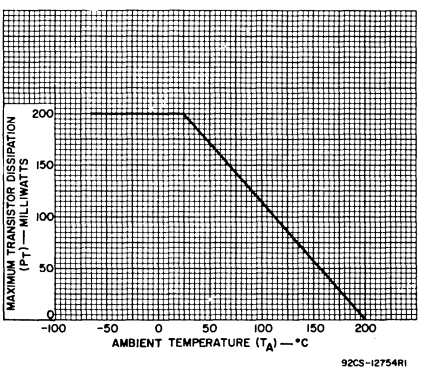


Fig. 1 - Rating chart for type 2N3478

Maximum Ratings, *Absolute-Maximum Values:*

Collector-to-Base Voltage, V_{CBO}	30 max.	V
Collector-to-Emitter Voltage, V_{CEO}	15 max.	V
Emitter-to-Base Voltage, V_{EBO}	2 max.	V
Collector Current, I_C	limited by dissipation	
Transistor Dissipation, PT:		
at ambient temperatures up to 25° C	200 max.	mW
at ambient temperatures above 25° C	See *Fig. 1*	
Temperature Range:		
Storage and Operating (Junction)	-65 to 200	°C
Lead Temperature (During Soldering):		
At distances not closer than 1/32" to seating surface for 10 seconds max.	265 max.	°C

ELECTRICAL CHARACTERISTICS, *At an Ambient Temperature, (T_A) of 25° C*

Characteristics	Symbols	TEST CONDITIONS			LIMITS			Units
		Frequency f	DC Collector-to-Emitter Voltage V_{CE}	DC Collector Current I_C	Type 2N3478			
		MHz	V	mA	Min.	Typ.	Max.	
Collector-Cutoff Current (V_{CB} = 1 V, I_E = 0)	I_{CBO}				–	–	0.02	μA
Collector-to-Base Breakdown Voltage (I_E = 0)	BV_{CBO}			0.001	30	–	–	V
Collector-to-Emitter Breakdown Voltage	BV_{CEO}			0.001	15	–	–	V
Emitter-to-Base Breakdown Voltage (I_E = –0.001 mA)	BV_{EBO}			0	2	–	–	V
Static Forward-Current Transfer Ratio	h_{FE}		8	2	25	–	150	
Magnitude of Small-Signal Forward-Current Transfer Ratio	h_{fe}[a]	100	8	2	7.5	9	16	
Collector-to-Base Feedback Capacitance (V_{CB} = 10 V, I_E = 0)	C_{cb}[b]	0.1 to 1			–	–	0.7	pF
Small-Signal, Common-Emitter Power Gain in Unneutralized Amplifier Circuit (See Fig.4)	G_{pe}[a]	200	8	2	11.5	–	17	dB
Small-Signal, Common-Emitter Power Gain in Neutralized Amplifier Circuit	G_{pe}[a, c]	470	6	1.5	–	12	–	dB
UHF Noise Figure	NF[a, c]	470	6	1.5	–	5	–	dB
VHF Noise Figure (See Fig.4)	NF[a] NF[a, d]	200 60	8 8	2 1	– –	 2.5	4.5 –	dB dB

[a] Fourth lead (case) grounded.

[b] C_{cb} is a three terminal measurement of the collector-to-base capacitance with the emitter and case connected to the guard terminal.

[c] Source Resistance, R_s = 50 ohms.

[d] Source Resistance, R_s = 400 ohms.

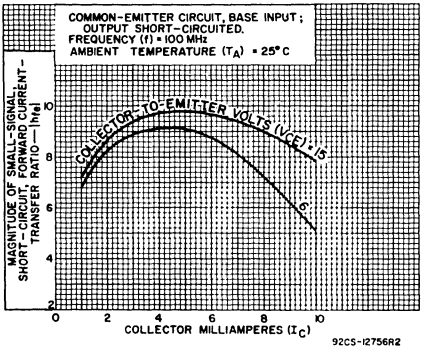


Fig. 2—Typical small-signal beta characteristics for type 2N3478

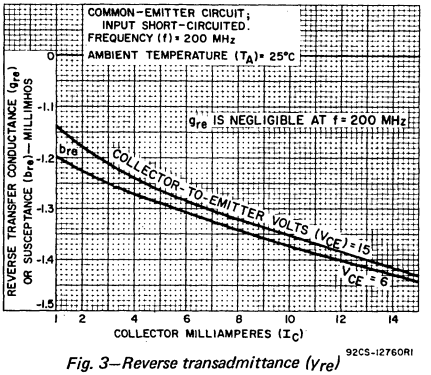
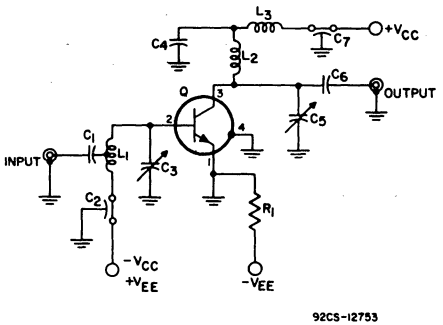


Fig. 3—Reverse transadmittance (y_{re})



C_1, C_4 = 510 pF
C_2, C_7 = 2300 pF
C_3, C_5 = 2-25 pF
C_6 = 10 pF
R_1 = 2000 ohms
Q = 2N3478
L_1 = ½ Turn #14 Formvar● center tapped
Length$_1$, ℓ_1 = 2 inches
L_2 = ½ Turn #14 Formvar●
Length$_2$, ℓ_2 = 1½ inches
L_3 = 1 μH RF choke
Source (Generator) Resistance R_g = 50 ohms
Load Resistance R_L = 50 ohms

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Fig. 4—200 MHz power gain and noise figure test circuit for type 2N3478

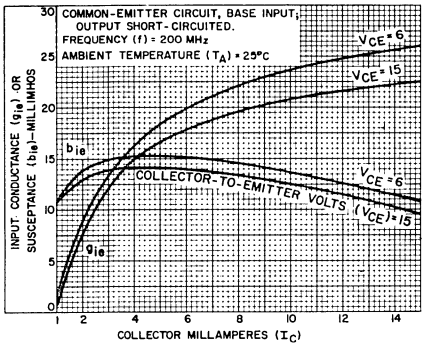


Fig. 5—Input admittance (y_{ie})

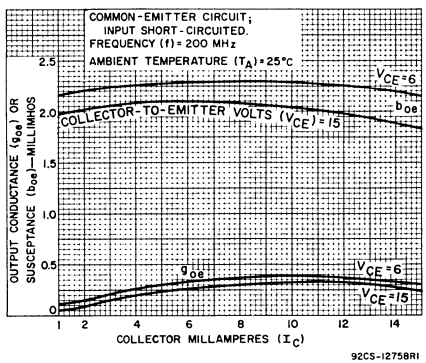


Fig. 6—Output admittance (y_{oe})

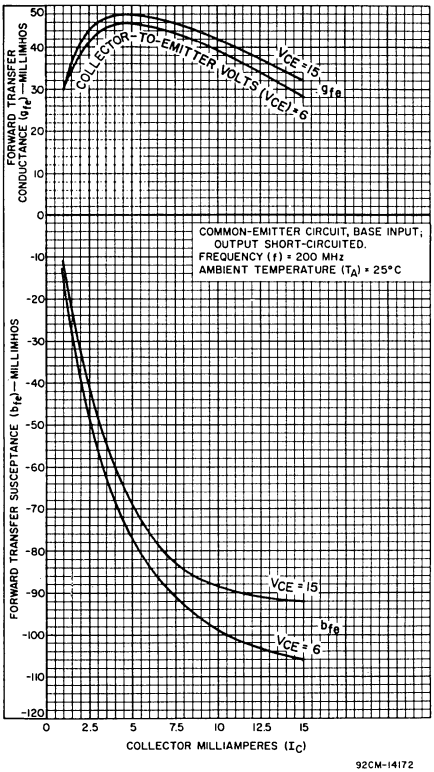
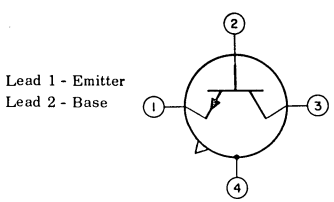


Fig. 7—Forward transadmittance (y_{fe})

TERMINAL DIAGRAM
Bottom View



Lead 1 - Emitter
Lead 2 - Base
Lead 3 - Collector
Lead 4 - Connected to Case