Marconi

COAXIAL NOISE DIODE TUNGSTEN FILAMENT

CV2341

ISSUE 2

A coaxial noise diode of 70Ω characteristic impedance suitable for use at frequencies up to 2500Mc/s with correction as specified and at currents up to 200 mA.

FILAMENT

*V_f (range)	0–4·7	V
I_f (at V_f=4·7)	3·8 (approx)	A

*The value of the saturated anode current is regulated by variation of the filament voltage.

An anode current of the order of 1mA is obtained at V_f=2V (approx).

MAXIMUM RATINGS (Absolute)

I_a	200	mA
V_a	400	V
p_a (convection cooled)	10	W
p_a (forced-air cooled)	40	W
V_f	5	V

CHARACTERISTICS

Characteristic impedance (Z_o)	70 (approx)	Ω
V_a	200	V
I_a (saturated)	23 (approx)	mA
V_f	3·5	V
I_f	3·2 (approx)	A

CAPACITANCE (Measured on a cold valve)

c_{a-f} 4·8 pF (approx)

TYPICAL OPERATION

V_a	180	V
V_f (range)	0–4·7 (approx)	V
I_a (saturated)	0–180	mA
Noise factor measurement (range) (uncorrected)	0–24	dB

When measuring the noise factor of an amplifier, using the technique of setting the value of I_a (saturated) to double the noise output power from the amplifier, the range of noise factor that can be measured is as shown.

Due to transit time effects, the noise factor given by the use of the formula:

$$\text{Noise factor} = 10 \log_{10} (20\, I_a\, Z_o)\ \text{dB}$$

where I_a = diode anode current in amperes
and $Z_o = 70\Omega$

will be greater than the true value. The correction will depend upon frequency and diode anode voltage. These corrections, which can only be calculated approximately, are shown in fig. 5. Better corrections can be obtained by comparison with other white noise generators. Fig. 6 shows the corrections obtained by comparison with a helically coupled argon discharge noise source and it is recommended that these corrections should normally be applied. In all cases the correction in decibels must be deducted from the noise factor obtained from the above formula.

The noise diode must be operated in a coaxial circuit as described overleaf and must be matched in this circuit into the amplifier under test with a VSWR better than 1·1:1.

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INSTALLATION AND CIRCUIT DETAILS

For use as a u.h.f. noise source, it is recommended that the valve be operated in a circuit similar to the one shown in figs. 2 and 3.

This circuit provides d.c. isolation for the applied anode voltage V_a, r.f. isolation for the applied filament power and the correct resistive termination to the line.

Isolation of V_a is obtained by separating the coaxial circuit into three parts A, B and C, (as shown in fig. 2) along the axis and joining the parts A to B and B to C with flanges separated by mica plates approximately 0·010in. thick, each forming a capacitor of at least 150pF with 500V insulation. V_a is applied to section B and thence via very flexible connectors to the valve anode.

Isolation of the heater supply is by chokes made by close-winding a length of 24 s.w.g. enamelled copper wire on a ⅛in. dia. ceramic rod, the wire length being $\lambda/3$, where λ is the wavelength of the centre frequency required. These chokes feed the filament power via the inner conductors of the line through sections A and C and so to the two filament pins. Care must be taken to use very flexible finger connectors to these pins to prevent strain on the seals.

The correct resistive termination to the line is obtained by using a special resistor (Welwyn Electrical Laboratories Ltd., Type UD3611-71 Ω) which forms part of the inner conductor in section A.

Noise output power is taken from the line at the end of section C which can be fitted with a suitable 70 Ω coaxial connector.

The circuit should have a VSWR of less than 1·2:1 looking into section C, at the centre frequency chosen for the chokes and with the valve switched on.

The flexible connections to the anode and filament should extend round the complete circumference of the contacting surfaces and maintain the characteristic impedance of the coaxial line in these regions.

The temperature of the hottest part of the valve must not exceed 140°C. Forced-air cooling is not normally required for a p_a up to 10W. For a p_a greater than 10W, an air-flow of at least 2·5 cubic feet per minute is required, directed at right angles to the valve axis.

The valve may be mounted in any position.

Provision of circuit information in this publication does not imply a right to use any invention which may be involved and which is the subject of patents by whomsoever owned.

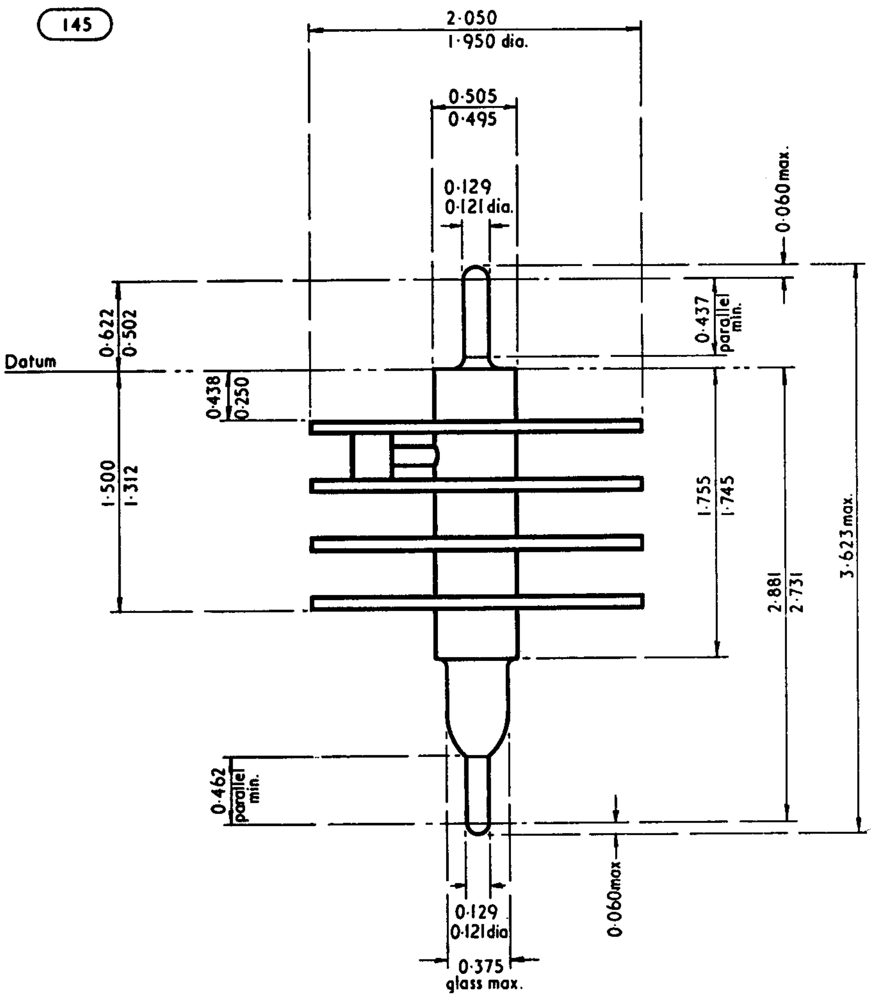

Fig. 1. Dimensions in inches.

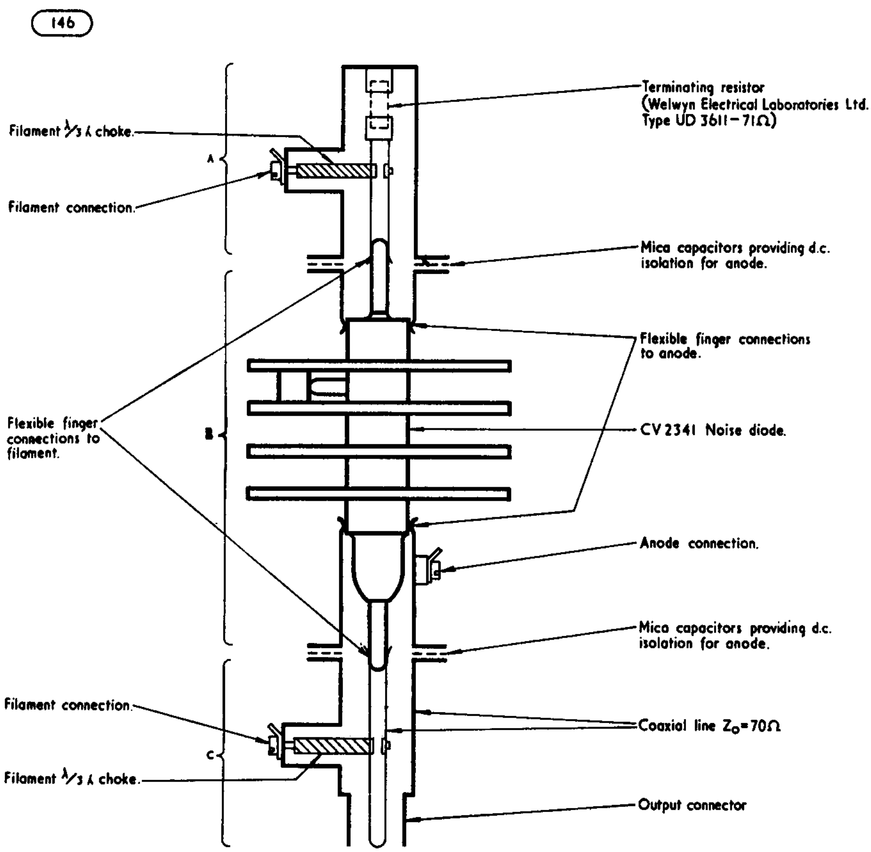

Fig. 2. Diagramatic section through coaxial noise diode circuit.

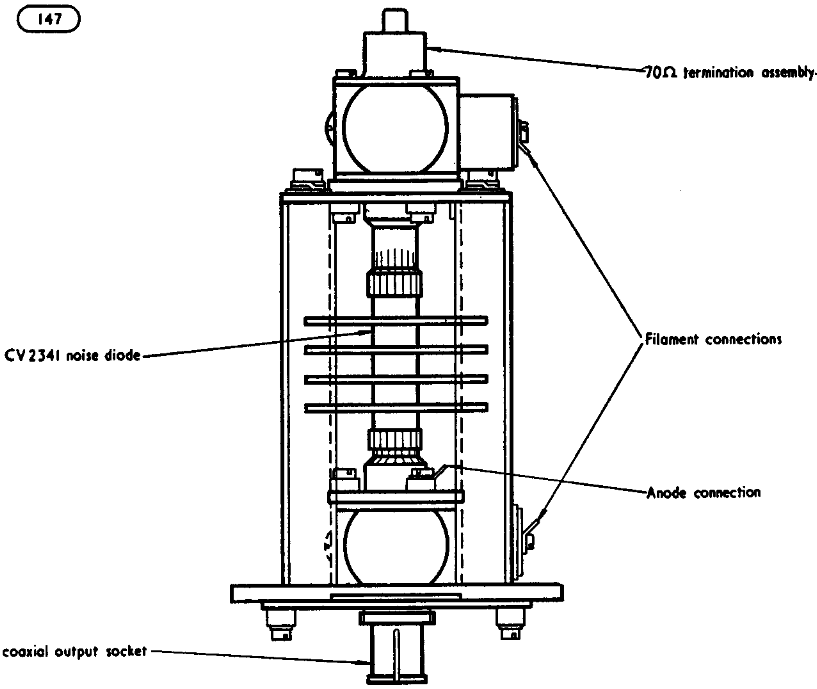

Fig. 3. External view of a typical circuit.

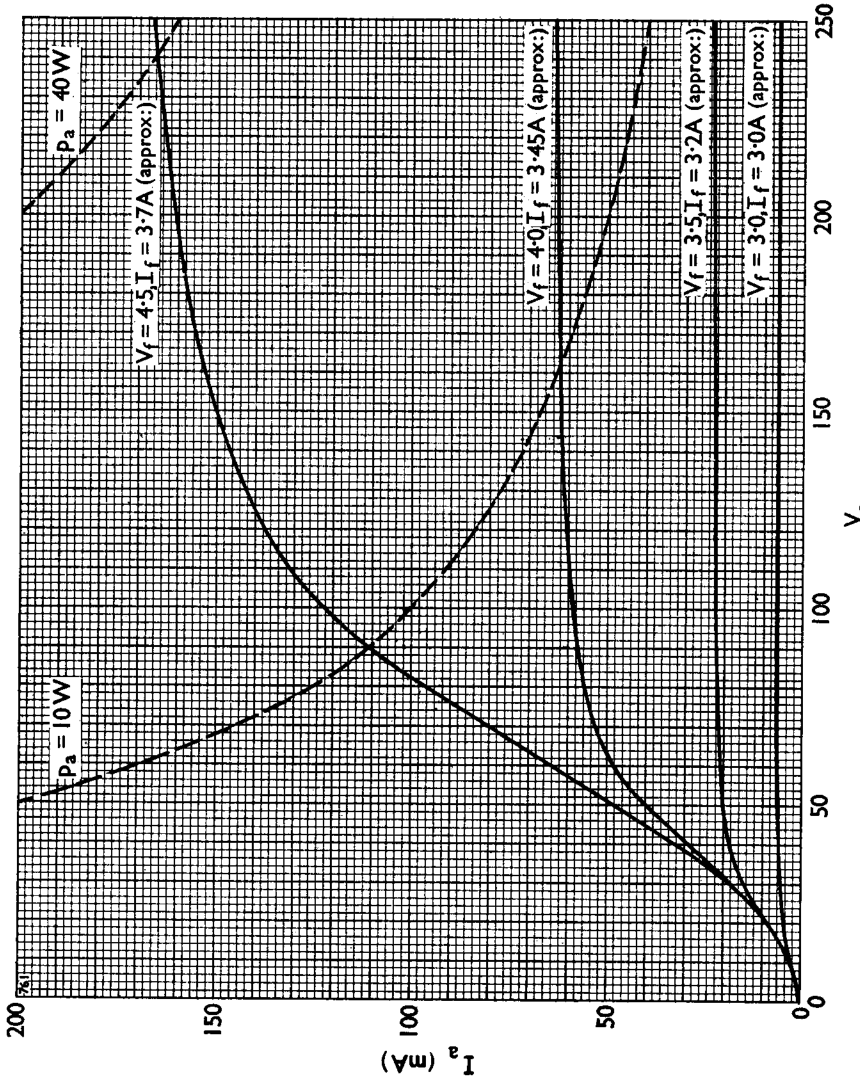
P_a = 40W
P_a = 10W
V_f = 4·5, I_f = 3·7A (approx:)
V_f = 4·0, I_f = 3·45A (approx:)
V_f = 3·5, I_f = 3·2A (approx:)
V_f = 3·0, I_f = 3·0A (approx:)
I_a (mA)
V_a
0
50
100
150
200
250

Fig. 4.

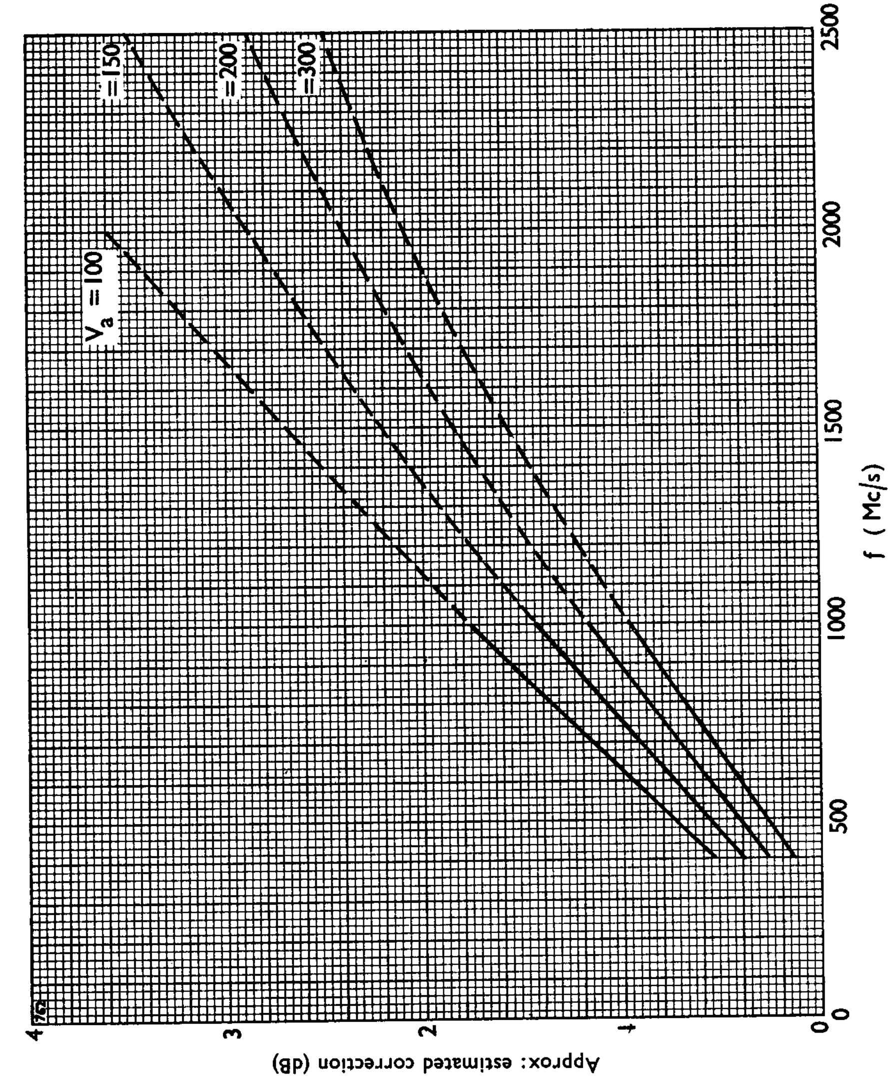

Fig. 5. Calculated corrections to noise factor measurements for frequency and anode voltage.

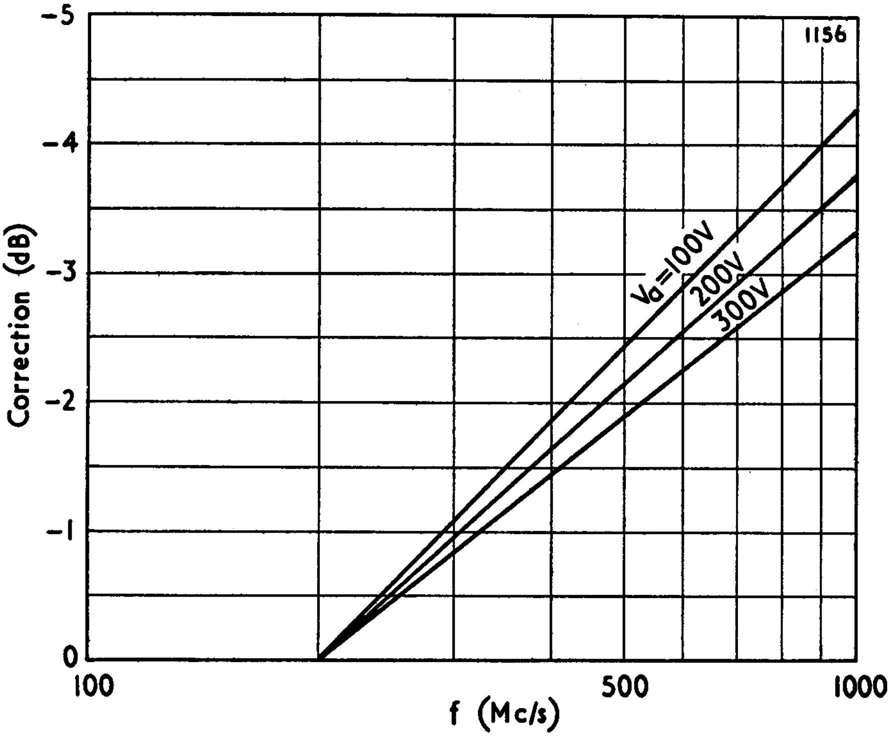

Fig. 6. Correction to be applied to noise factor measurements obtained from the CV2341 in recommended circuit based on gas-discharge noise source as reference, applying no coupling correction to gas-discharge source.

V_a = diode anode voltage

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