



LOW NOISE TRAVELLING WAVE TUBE

Service Type CV8908

ABRIDGED DATA

Low noise travelling wave tube for use in the input stage of radar and other microwave receivers, and in i.f. amplifier service. The tube is contained in a metal canister and is fitted with coaxial input and output connectors. A separate focusing solenoid is required.

| | | |
|-----------------------------------|------------|-----|
| Frequency range | 2.7 to 3.2 | GHz |
| Saturation output power | 1.5 | mW |
| Noise factor | 4.0 | db |
| Low level gain | 24 | db |
| Recommended solenoid | N4041 | |



GENERAL

Electrical

| | | |
|---|---------------------------------|-------|
| Cathode | indirectly heated, oxide coated | |
| Heater voltage | 5.0 | V |
| Heater current | 0.3 | A |
| Heater starting current (peak) | 4.0 | A max |
| Cathode heating time (minimum) (see note 1) | 2.0 | min |

Mechanical

| | | |
|--|---|--|
| Overall length | 18.000 inches (457.2mm) max | |
| Canister diameter | 1.400 inches (35.56mm) max | |
| Net weight | 1.75 pounds (800g) approx | |
| R.F. connections | 50Ω coaxial plug connectors type 'N' U.S. military no. UG-1185/U | |
| Base | international octal | |
| Collector connection (earthed) | tag and screw to hole tapped 4BA | |
| Mounting position | any | |

MAXIMUM AND MINIMUM RATINGS (Absolute values) (see note 2)

No individual rating to be exceeded

| | Min | Max | |
|---|------|------|--------------|
| Collector voltage | 400 | 1100 | V |
| Collector current | — | 200 | μ A |
| Helix voltage | — | 500 | V |
| Helix current (see note 3) | — | 5.0 | μ A |
| Grid 4 voltage | — | 500 | V |
| Grid 3 voltage | — | 150 | V |
| Grid 1 and 2 voltage | — | 20 | V |
| Heater voltage | 4.75 | 5.25 | V |
| Magnetic field (see note 4) | 60 | — | mT |
| | 600 | — | gauss |
| Peak r.f. input power | — | 75 | W |
| Mean r.f. input power | — | 0.3 | W |
| Canister temperature (at hottest point) | — | 150 | $^{\circ}$ C |

TYPICAL OPERATION (at 2.9GHz)

Operational Conditions (see note 2)

| | | |
|---|------|---------|
| Heater voltage | 5.0 | V |
| Collector voltage (see note 5) | 800 | V |
| Collector current | 130 | μ A |
| Helix voltage (see notes 6 and 7) | 375 | V |
| Grid 4 voltage (see note 7) | 230 | V |
| Grid 3 voltage (see note 7) | 25 | V |
| Grid 1 and 2 voltage (see note 8) | 8.5 | V |
| Magnetic field (see notes 9 and 10) | 140 | mT |
| | 1400 | gauss |

Continued on page 3

Typical Performance

| | | |
|----------------------------|-------------|---------------|
| Helix current (see note 7) | 0.5 | μA |
| Grid 4 current | less than 1 | μA |
| Grid 3 current | less than 1 | μA |
| Grid 1 and 2 current | 50 | μA |
| Cold insertion loss | 70 | db |
| Gain | 24 | db |
| Noise factor (see note 7) | 4.0 | db |
| Output power (saturated) | 1.5 | mW |

RANGE OF CHARACTERISTICS FOR EQUIPMENT DESIGN (Over the frequency range 2.7 to 3.2GHz)



Recommended Applied Conditions (see note 2)

| | | |
|-------------------------------------|------------------------------|---------------|
| Heater voltage (see note 11) | 5.0 | V |
| Collector voltage (see note 5) | 800 | V |
| Collector current (see note 8) | 100 to 200 | μA |
| Helix voltage (see notes 6 and 7) | 350 to 400 | V |
| Grid 4 voltage (see note 7) | 150 to 400 | V |
| Grid 3 voltage (see note 7) | 0 to 50 | V |
| Grid 1 and 2 voltage (see note 8) | 0 to 20 | V |
| Magnetic field (see notes 9 and 10) | 140 ± 7 1400 ± 70 | mT gauss |

Range of Characteristics (with recommended applied conditions)

| | Min | Max | |
|------------------------------------|-----|-------|---------------|
| Heater current | 0.2 | 0.5 | A |
| Helix current | — | 5 | μA |
| Grid 4 current | — | 10 | μA |
| Grid 3 current | — | 10 | μA |
| Grid 1 and 2 current | — | 100 | μA |
| Gain | 21 | 27 | db |
| Noise factor | — | 4.5 | db |
| Output power (saturated) | 1.0 | — | mW |
| Tube input v.s.w.r. (see note 12) | — | 1.7:1 | |
| Tube output v.s.w.r. (see note 12) | — | 2.0:1 | |

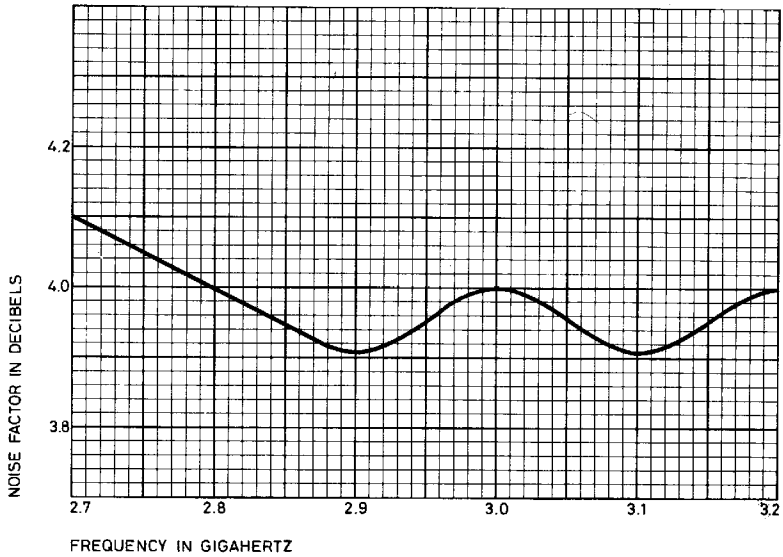
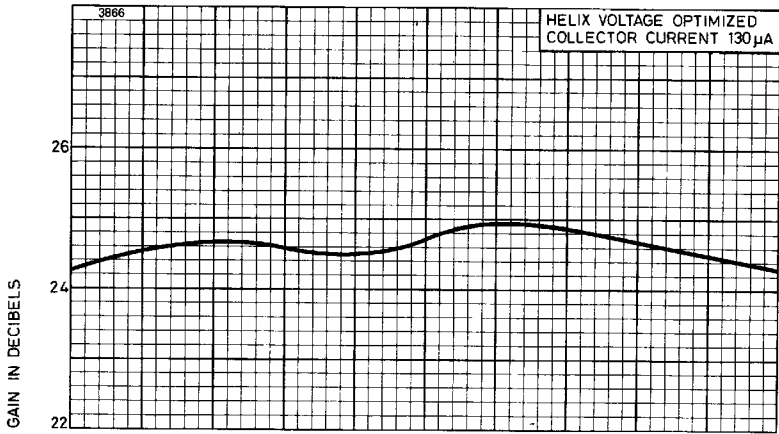
NOTES

1. The time between the application of full heater voltage and the application of h.t. voltages. In the event of a power supply failure of less than 10 seconds duration, all voltages may be re-applied simultaneously.
2. All voltages apart from the heater voltage are with respect to the cathode. It may sometimes be convenient to earth the collector and maintain the cathode at a negative potential.
3. During alignment in the magnetic focusing field this maximum value of helix current may be exceeded for short periods, but must never exceed $25\mu\text{A}$.
4. This minimum value of magnetic field strength will focus the electron beam but the optimum noise figure will not be obtained.
5. It is necessary to maintain the collector positive with respect to the helix. Fluctuations in collector voltage should be less than $\pm 10\%$.
6. The helix voltage should be set to the optimum value for the frequency of operation and stabilized to within $\pm 1\%$.
7. In order to operate the tube at the lowest noise factor it is necessary to adjust the electrode voltages as follows. After a cathode pre-heating time of at least 2 minutes, switch on the h.t. voltage with grid 1 and 2 voltage at zero and the other voltages at the values specified under Typical Operation on page 2. Slowly increase the grid 1 and 2 voltage, adjusting the centring of the tube in the magnetic field to obtain minimum helix current, until the specified collector current is reached. With a signal or noise input applied to the tube, adjust the helix voltage to give maximum output. This value of helix voltage simultaneously produces optimum gain and minimum noise factor. Next, with no input signal, vary grid 3 and grid 4 voltages alternately until the receiver output reaches a minimum. The voltages reached in this way are those which will operate the N1047M at the lowest noise factor for the particular frequency to which the equipment is tuned. For wide band operation these adjustments should be carried out at the centre frequency. If the focusing field changes, it will be necessary to repeat the adjustment above. Grid 3 and grid 4 voltages should be stabilized to within $\pm 5\%$.

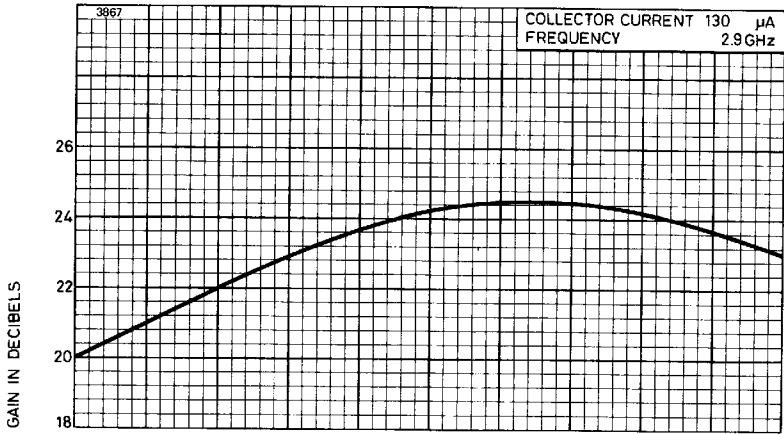
8. Grid 1 and 2 voltage is adjusted to give the correct collector current and should be stabilized to within $\pm 5\%$.
9. Care must be taken to avoid distortion of the magnetic field by metal parts in the vicinity of the tube. Unless otherwise specified, non-magnetic material should be used for such parts.
10. Provision must be made for aligning the tube in the solenoid. An adjustment of ± 0.100 inch (± 2.54 mm) about the axis should be sufficient. Care should be taken when winding the solenoid to ensure that the mechanical and magnetic axes are the same. The use of the EEV lightweight solenoid type N4041 is recommended.
11. Tolerance $\pm 5\%$.
12. The input and output matching transformers are contained within the canister of the tube. They are adjusted during manufacture for optimum performance over the frequency range and further adjustments are neither possible nor necessary.



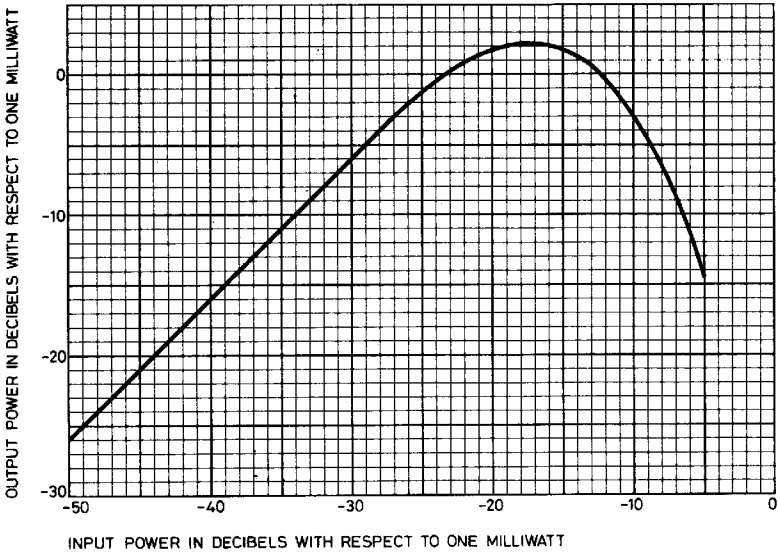
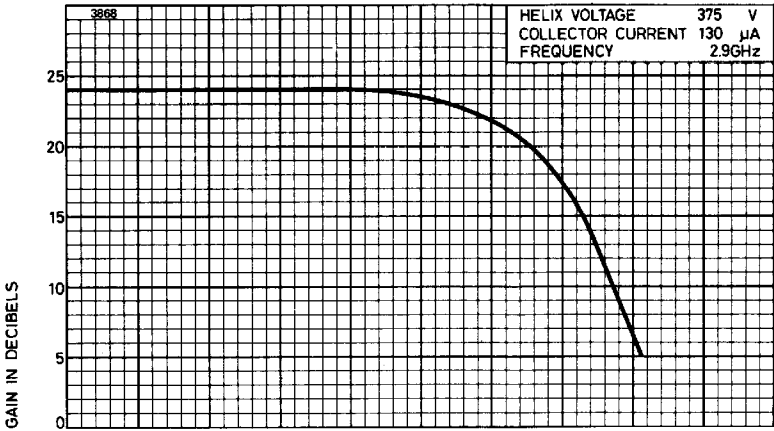
TYPICAL PERFORMANCE CHARACTERISTICS



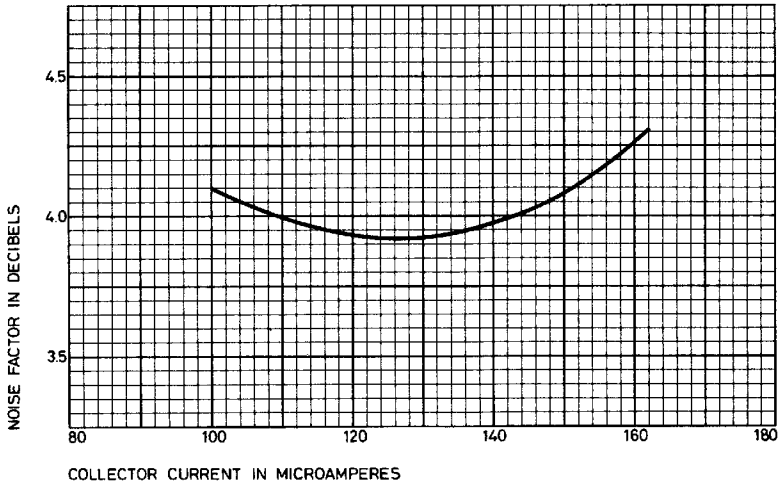
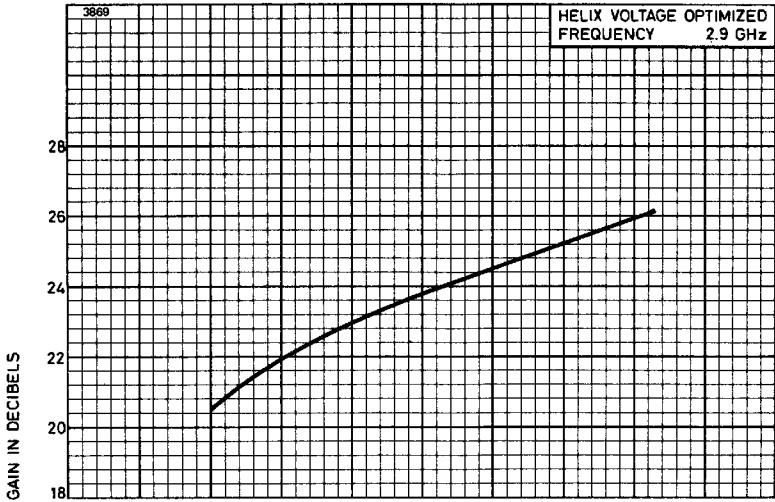
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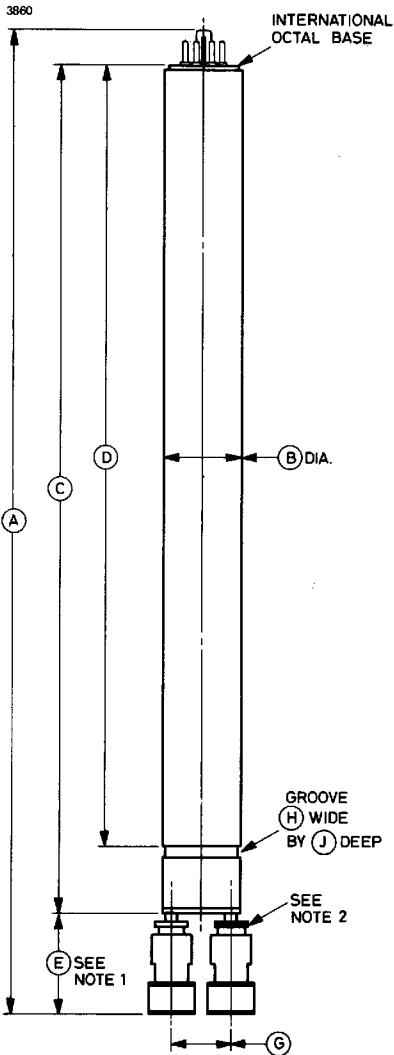
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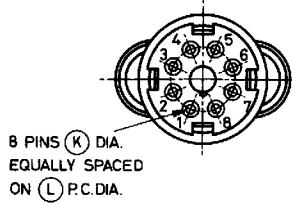
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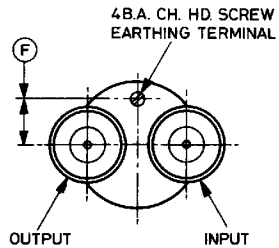
OUTLINE



Enlarged View on Base



Enlarged View on Connectors



Outline Dimensions (All dimensions without limits are nominal)

| Ref | Inches | Millimetres | Ref | Inches | Millimetres |
|-----|----------------|-------------|-----|---------------|---------------|
| A | 18.000 max | 457.2 max | G | 1.062 ± 0.020 | 26.97 ± 0.51 |
| B | 1.400 max | 35.56 max | H | 0.156 | 3.96 |
| C | 15.325 ± 0.050 | 389.3 ± 1.3 | J | 0.015 | 0.38 |
| D | 14.090 ± 0.050 | 357.9 ± 1.3 | K | 0.093 ± 0.003 | 2.362 ± 0.076 |
| E | 1.800 max | 45.72 max | L | 0.687 | 17.45 |
| F | 0.500 | 12.70 | | | |

Millimetre dimensions have been derived from inches



Connections

| Pin | Element |
|----------------|-----------------|
| 1 | Grid 1 and 2 |
| 2 | No connection |
| 3 | Helix |
| 4 | Grid 4 |
| 5 | Grid 3 |
| 6 | No connection |
| 7 | Heater |
| 8 | Heater, cathode |
| 4B.A. Screw | Collector |

Outline Notes

1. The two connectors will not necessarily be at the same level but both will be within the maximum dimension.
2. Coaxial plug connectors 50Ω type N. The input connector is indicated by a black band.