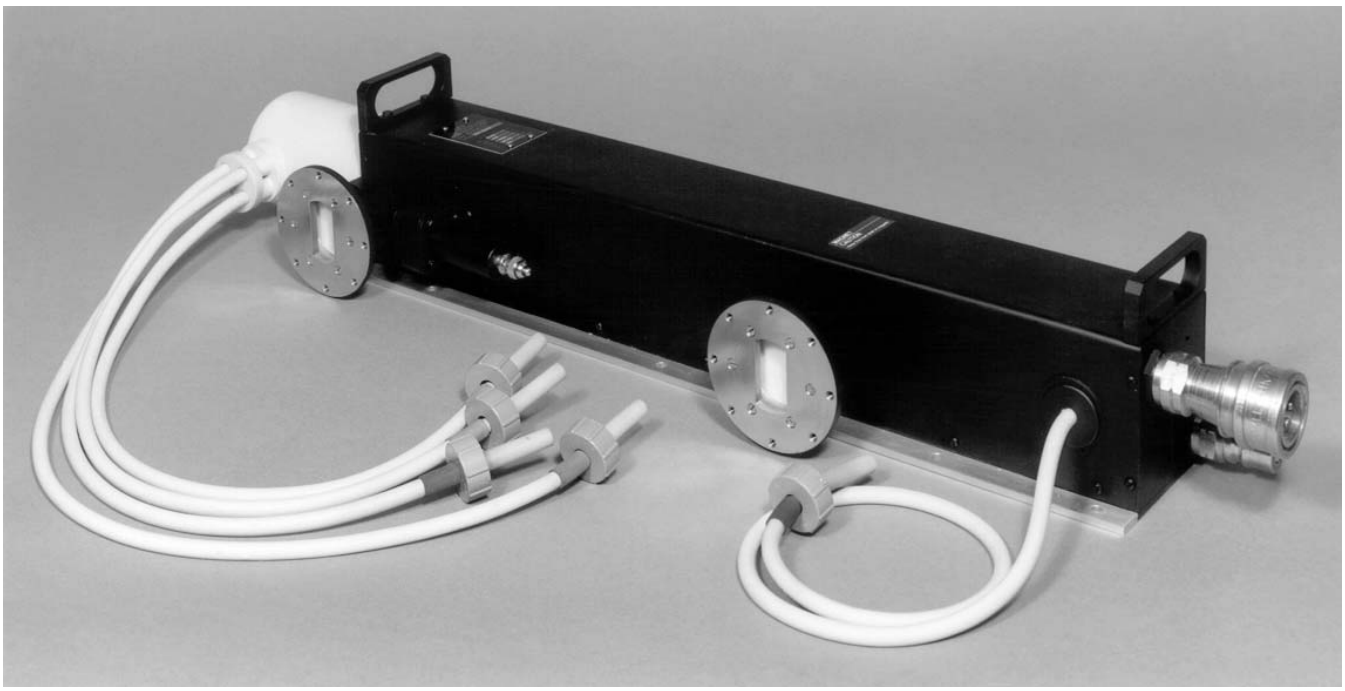
e2v technologies

# N10524
# C-band Pulsed Travelling Wave Tube



## ABRIDGED DATA

Pulsed power amplifier travelling wave tube, coupled cavity type, with integral periodic permanent magnet focusing. The tube is shadow-grid modulated. It is intended for radar applications and is of rugged construction for use in mobile military environments.

The tube may be mounted and operated in either a vertical or horizontal plane using the integral baseplate and requires a single liquid coolant supply. The collector voltage can be depressed for maximum efficiency.

| | | |
|---|---|---|
| Frequency range | 5.4 to 5.9 | GHz |
| Peak output power | 50 | kW min |
| Gain | 50 | dB min |
| Duty cycle | 0.023 | max |

## GENERAL

### Electrical

| | | |
|---|---|---|
| Cathode | indirectly heated | |
| Heater voltage (see notes 1 and 2) | 9.5 | V |
| Heater current | 5.5 | A |
| Cathode pre-heating time | 10 | minutes |
| Ion pump voltage (see note 3) | 3.0 | kV |

### Mechanical

| | | |
|---|---|---|
| Overall dimensions | see outline | |
| RF connections | UG-419/U with M5 tapped holes at input and output | |
| Mounting position | any | |
| Net weight | 20 | kg approx |

### Cooling

Demineralised water or 40/60 water/glycol mixture.

| | | |
|---|---|---|
| Flow rate | 13 | l./min min |
| Pressure drop at 13 l./min | 241 | kPa max |
| Resistivity | not less than 1 MΩ cm | |

### Magnetic Fields

No magnetic materials or energised magnets may be placed within 75 mm of any part of the tube.

## MAXIMUM AND MINIMUM RATINGS
## (Absolute values)

| | Min | Max | |
|---|---|---|---|
| Heater voltage (rms) | 8.0 | 12 | V |
| Heater current | – | 15 | A |
| Cathode to body voltage | −35 | 0 | kV |
| Cathode current | – | 12 | A |
| Collector to cathode voltage | 17 | 35 | kV |
| Body current (peak) | – | 3.0 | A |
| Grid to cathode bias voltage | −1200 | −400 | V |
| Grid to cathode pulse voltage | 0 | 900 | V |
| Duty cycle (beam) | – | 0.024 | |
| Pulse duration (beam) | – | 22 | µs |
| RF input power | – | 2.0 | W |
| VSWR (load) (see notes 4 and 5) | – | 6.0:1 | |
| VSWR (source) (see notes 4 and 5) | – | 2.0:1 | |
| Coolant temperature (input) | – | 60 | °C |
| Coolant flow, 40/60 water/glycol | 13 | – | l./min |
| Coolant pressure | – | 1034 | kPa |

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## TYPICAL OPERATION

| | | |
|---|---|---|
| Frequency range | 5.4 to 5.9 | GHz |
| Cathode to body voltage | −31 | kV |
| Collector to body voltage | −11 | kV |
| Grid to cathode pulse voltage | 475 | V |
| Grid to cathode bias voltage | −500 | V |
| Cathode current (peak) | 9.0 | A |
| Body current (peak) | 2.0 | A |
| Grid current (peak) | 1.0 | mA |
| RF duty cycle | 0.023 | |
| RF pulse duration | 20 | μs |
| RF output power (peak) | 55 | kW |
| RF input power | 0.4 | W |
| Phase sensitivity to cathode voltage | 100 | °/kV |
| Grid capacitance | 50 | pF |
| Load VSWR | 1.25:1 | |
| Source VSWR | 1.3:1 | |

## NOTES

1. Each tube is marked with the recommended values of heater voltage, grid bias, peak grid pulse voltage and RF drive power.
2. The heater is suitable for operation from DC up to a frequency of 25 kHz, using a rectangular waveform. When operated from a DC supply, the cathode must be connected to the positive side of the heater supply.
3. The ion pump voltage of 3 kV must be applied whenever the tube is operating. During switch-on, the ion pump may draw 1 mA surge current and under this condition the voltage may fall to 1.5 kV. An interlock should be provided to prevent application of cathode and grid pulse voltages if the ion pump current exceeds 20 μA.
4. The tube will be damaged if it is operated with open-circuit or short-circuit conditions at either the input or output RF connectors.
5. The maximum VSWR over the band 5.2 to 6.8 GHz shall be the limit set by straight lines drawn through the following points:

| VSWR | Frequency (GHz) |
|---|---|
| 3.0:1 | 5.2 |
| 1.25:1 | 5.4 |
| 1.25:1 | 5.9 |
| 2.0:1 | 6.3 |
| 3.0:1 | 6.8 |

## SWITCH-ON PROCEDURE

a) Apply ion pump voltage.
b) Apply coolant flow at the specified rate.
c) After 10 minutes cathode pre-heating, apply the cathode and collector voltages marked on the tube.
d) Apply the grid pulse voltage marked on the tube.
e) Apply the RF drive voltage marked on the tube.

## SWITCH-OFF PROCEDURE

a) Switch off the RF drive and the grid pulse voltages.
b) Switch off the cathode and collector voltages.
c) Switch off the heater voltage.
d) Turn off the coolant flow.
e) Switch off the ion pump voltage.

## LONG-TERM STORAGE

The vacuum in the tube should be maintained during storage by operating the ion pump and heater at least once a year. The ion pump voltage only is applied first, and when the ion pump current is less than 5 μA heater voltage is applied, and operated until the ion pump current is again less 5 μA. The maximum ion pump current must be limited to 200 μA by heater voltage control.

## PROTECTIVE CIRCUITS

The tube can be permanently damaged by excessive current caused by power supply faults, operating errors, internal or waveguide arcs and the following protective circuits are recommended.

i) The maximum energy that can be dissipated in a tube arc is 55 J. A series resistor should be incorporated such that:

$$CV^2/2R \leqslant 1$$

ii) A spark gap should be connected between the grid and cathode of the tube, to break down within 1 μs at 1 kV. Connections to the grid should be as short as possible.

### Outline Dimensions

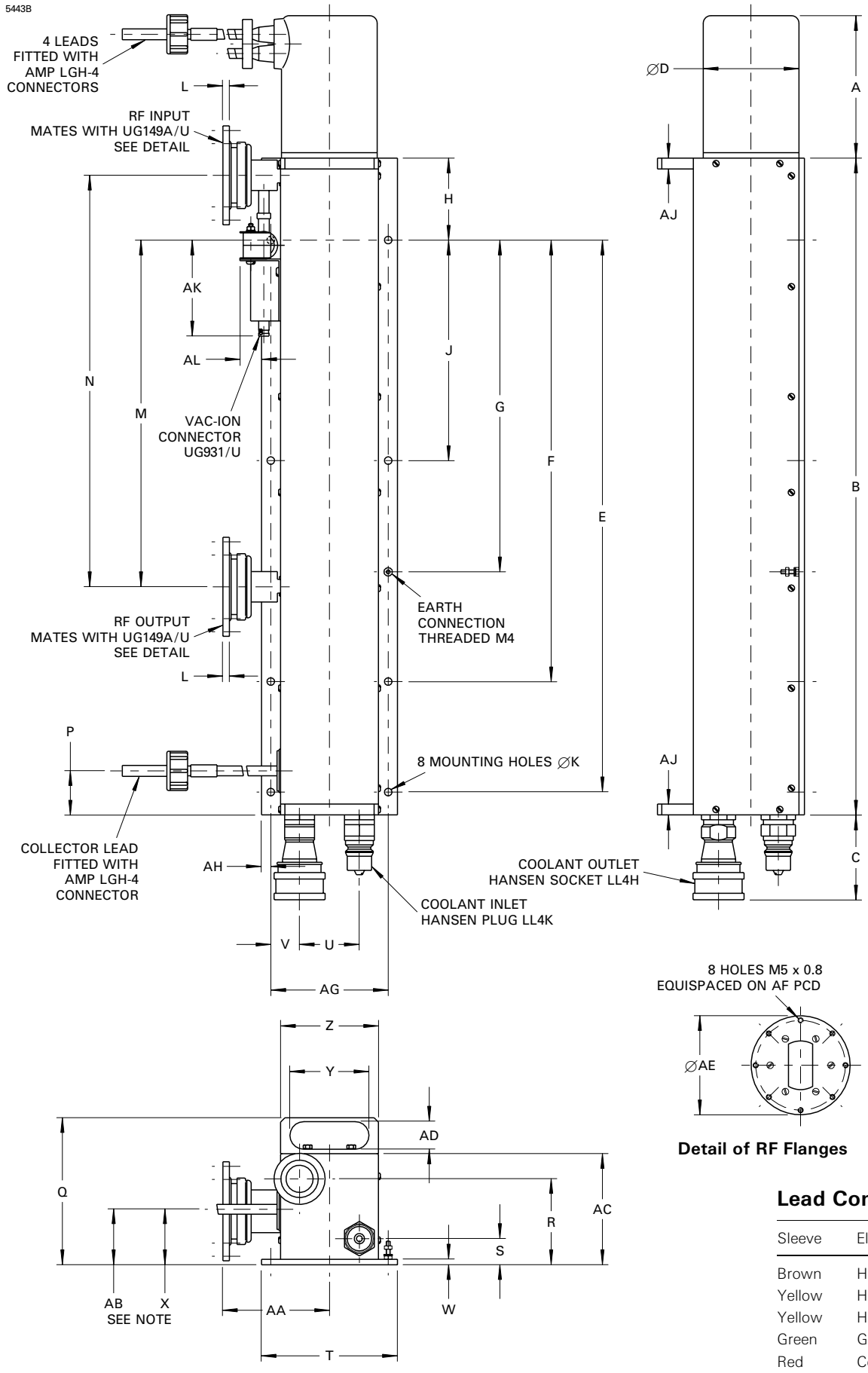
| Ref | Millimetres |
|---|---|
| A | 133.0 max |
| B | 604.35 max |
| C | 90.0 max |
| D | 91.0 max |
| E | 508.00 ± 0.25 |
| F | 406.40 ± 0.25 |
| G | 305.0 ± 10.0 |
| H | 75.35 ± 0.50 |
| J | 203.20 ± 0.25 |
| K | 7.00 ± 0.25 |
| L | 6.0 min |
| M | 321.0 ± 1.5 |
| N | 379.65 ± 3.00 |
| P | 40.5 ± 2.5 |
| Q | 137.85 max |
| R | 78.2 ± 2.5 |
| S | 25.9 ± 1.5 |
| T | 127.0 max |
| U | 54.5 ± 2.5 |
| V | 26.5 ± 1.0 |
| W | 4.8 ± 1.5 |
| X | 51.0 ± 2.5 |
| Y | 72.4 |
| Z | 90.0 |
| AA | 100.0 ± 1.0 |
| AB | 48.8 ± 1.0 |
| AC | 103.5 max |
| AD | 25.4 |
| AE | 92.0 |
| AF | 82.55 ± 0.10 |
| AG | 108.00 ± 0.25 |
| AH | 9.0 ± 0.5 |
| AJ | 9.6 max |
| AK | 115.0 max |
| AL | 22.0 max |

### Outline Note

Dimension X is taken from the centre line of the collector lead. Dimension AB is taken from the centre line of the RF flanges.

## OUTLINE

**(All dimensions without limits are nominal)**







**Detail of RF Flanges**

### Lead Connections

| Sleeve | Element |
|---|---|
| Brown | Heater |
| Yellow | Heater, cathode |
| Yellow | Heater, cathode |
| Green | Grid |
| Red | Collector |

## HEALTH AND SAFETY HAZARDS

e2v technologies electronic devices are safe to handle and operate provided that the relevant precautions stated herein are observed. e2v technologies does not accept responsibility for damage or injury resulting from the use of electronic devices it produces. Equipment manufacturers and users must ensure that adequate precautions are taken. Appropriate warning labels and notices must be provided on equipments incorporating e2v technologies devices and in operating manuals.

### High Voltage

Equipment must be designed so that personnel cannot come into contact with high voltage circuits. All high voltage circuits and terminals must be enclosed and fail-safe interlock switches must be fitted to disconnect the primary power supply and discharge all high voltage capacitors and other stored charges before allowing access. Interlock switches must not be bypassed to allow operation with access doors open.

### RF Radiation

All RF connectors must be correctly fitted before operation so that no leakage of RF energy can occur, and the RF output must be correctly terminated.

### X-Ray Radiation

The operating voltage of this tube results in the emission of X-rays. The maximum penetrating ability of the X-rays may correspond to a voltage approximately twice the applied voltage. Shielding is required.

### Beryllium Oxide Ceramics

This assembly contains beryllium oxide ceramic parts, which are not accessible unless the metal casing of a tube is damaged or removed. ***Beryllium oxide dust or fumes are highly toxic if inhaled, or if particles enter a cut or abrasion.*** Consult e2v technologies regarding the disposal of damaged or life-expired tubes.