



# Tubes

product  
summary

**TMD**

*...the power in microwaves!*

# Microwave Tubes

## For Radar, Scientific and Missile Seeker Applications

At TMD we understand microwave tubes. We've been immersed in their funny little ways for a very long time and are not easily put off by a difficult specification, an unusual application or an integration challenge.

Our tube engineering "DNA" extends back over 60 years, to EMI Electronics' high power klystron developments during WWII. Since then TMD has been instrumental in many of the industry's major TWT, magnetron and klystron developments.

During the 1970s and 1980s, the company was funded by UK MoD, ESA and US DoD to investigate the fundamental chemical and physical properties of impregnated tungsten dispenser cathodes, with the aim of extending the life of microwave tubes.

As a result, TMD is a recognised European Centre of Excellence for dispenser cathode and electron gun gun technology, producing some tubes with lives of more than 90,000 hours. Making our own cathodes helps us to achieve optimal performance and minimises reliance on ITAR controlled parts.

Most recently, we have focussed our tube developments on coupled cavity TWTs for ATC radar, and ring loop TWTs for seeker applications; in particular, rugged, fast

warm, high duty Ku band ring loop TWTs. This work has culminated in the PT6789 super-tube described in the following pages.

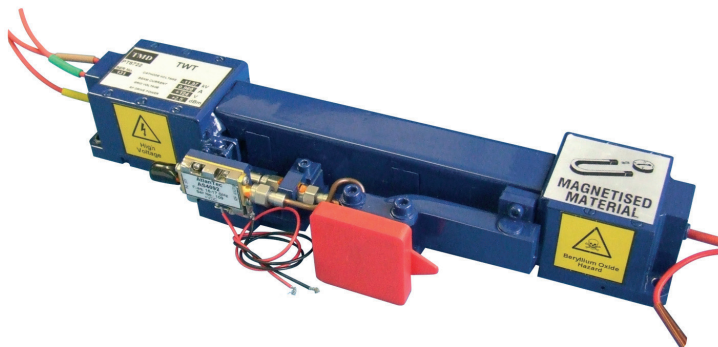
The following table shows a selection of generic products in this range – but don't worry if you can't see exactly what you are looking for – bespoke solutions are available, although the impossible may take a little longer! Our Business Development Team is always eager to discuss the ways in which TMD can contribute to new technology areas.

For more details of TMD's products and capabilities, please go to [www.tmd.co.uk](http://www.tmd.co.uk), or request a copy of our capability brochure.

We also offer a comprehensive repairs service for our microwave products; contact us at [wecare@tmd.co.uk](mailto:wecare@tmd.co.uk) for an evaluation.

We provide after sales support wherever you are in the world.

**TMD is approved to the rigorous Quality Standard BS EN ISO9001:2008 – quality is at the heart of everything we do.**



## Pulsed Travelling Wave Tubes

TMD manufactures three main types of TWT - ring loop, ring bar and coupled cavity. Applications include naval surveillance radar, air traffic control radar and airborne radar. Our TWTs are often combined with our own switched mode power supplies to produce TWTAs used in a variety of markets, both military and commercial, and in particular as part of radar transmitter subsystems.

The coupled cavity TWTs we produce for the Watchman air traffic control radar are providing up to 90,000 hours of service. This reliability is largely a consequence of our expertise in dispenser cathode technology. Latest TWT developments include rugged Ku band ring loop tubes for very demanding airborne environments.

| Part  | Type                  | Freq Range | Peak Power | Duty Cycle   | Gain (Min) | Pulse Length | Structure Voltage | Peak Beam Current | Collector Volts (Wrt. Cathode)        | Focussing | Weight  |
|---|-----------------------|------------|------------|--------------|------------|--------------|-------------------|-------------------|---------------------------------------|-----------|---------|
|   |                       | GHz        | kW         | (max)        | dB         | us           | kV                | A                 | kV                                    |           | kg      |
| PT6019  | ring bar              | 1.2-1.4    | 150        | 0.035        | 45         | 100          | 40                | 14                | UD                                    | IS        | 110     |
| PT6049  | ring bar              | 1.2-1.4    | 170        | 0.05         | 45         | 100          | 43                | 14                | 36                                    | IS        | 115     |
| PT6055  | coupled cavity        | 2.75-3.05  | 50         | 0.023        | 50         | 30           | 33                | 9                 | 22                                    | PPM       | 41      |
| PT6062  | ring loop             | 8.5-9.5    | 8          | 0.02         | 60         | 10           | 14.5              | 3                 | 9.5                                   | PPM       | 2.5     |
| PT6067  | ring loop             | 8.7-9.2    | 8          | 0.002        | 60         | 30           | 14.5              | 2.7               | 11                                    | PPM       | 2.5     |
| PT6088  | ring loop             | 8.9-9.4    | 8          | 0.02         | 60         | 30           | 14.5              | 2.7               | 11                                    | PPM       | 2.5     |
| PT6074  | ring loop             | 9.0-9.5    | 5.3        | 0.03         | 60         | 40           | 13.5              | 2                 | 10                                    | PPM       | 2.5     |
| PT7105  | ring loop             | 9.0-9.5    | 8          | 0.02         | 60         | 10           | 14.5              | 2.7               | 11                                    | PPM       | 2.5     |
| PT6156  | ring loop             | 9.0-10.0   | 9          | 0.035        | 60         | 40           | 14.5              | 2.5               | 11.5/9.5 dual stage                   | PPM       | 2.5     |
| PT6073  | ring loop             | 9.2-9.4    | 8.5        | 0.02         | 60         | 20           | 14.5              | 2.7               | 11                                    | PPM       | 2.5     |
| PT6744  | ring loop             | 9.2-9.5    | 1          | 0.1          | 40         | 80           | 6.5               | 1.0               | 4/1.5                                 | PPM       | 0.65    |
| PT6226  | ring loop             | 9.2-10.0   | 4          | 0.04         | 45         | 30           | 13.0              | 2.0               | 9.1                                   | PPM       | 2.0     |
| PT6109  | ring loop             | 9.5-10.0   | 8          | 0.02         | 60         | 30           | 14.5              | 2.7               | 10                                    | PPM       | 2.5     |
| In the Ku band range, the main generic types are listed below. However additional custom designs are available in the range 200-1000 W peak power and up to 400 W mean power, up to 1 GHz bandwidth-anywhere between 13 and 18 GHz. In addition many of the variants are fast-warm - < 3 seconds (FW) |                       |            |            |              |            |              |                   |                   |                                       |           |         |
| PT6713  | ring loop             | 14.5-17.0  | 2          | 0.02         | 63         | 40           | 11-15             | 1                 | 8.5                                   | PPM       | 1       |
| PT6715  | ring loop             | 16.0-17.0  | 2          | 0.02         | 63         | 40           | 11.5              | 1                 | 8                                     | PPM       | 1       |
| PT6745 <sup>FW</sup>  | ring loop             | 16.0-18.0  | 0.4        | 0.33         | 35/55*     | 20           | 8                 | 0.35              | 4/5 dual stage                        | PPM       | 1.5/2.0 |
| PT6738 <sup>FW</sup>  | ring loop (dual mode) | 16-18      | 3.5<br>0.8 | 0.02<br>0.08 | 60*        | 40           | 12.5<br>11.5      | 1.6<br>0.65       | 8/4.5/2.5<br>7.5/4.5/2.5 triple stage | PPM       | 1.5     |
| PT6789 <sup>FW</sup>  | ring loop             | 17.0-18.0  | 0.8-1.0    | 0.33         | 35/55*     | 40           | 11                | 0.55              | 5/6 dual stage                        | PPM       | 1.5/2.0 |

**Notes** PPM – Periodic Permanent Magnet IS – Integral solenoid UD – Undepressed \* with saturating amplifier

## Broadband Klystrons

Our klystron technology leads the world in terms of performance and reliability. We were responsible for much of the important development work on multi-cavity klystrons and resonant coupled cavity output in the 1960s, which enabled increased efficiency and wider bandwidths to be achieved. Markets are wide ranging and include military airborne radar, CW tubes for Satcom and high power linear accelerators for scientific research and medical applications.

TMD makes the world's only electro-statically focused klystron (ESFK), developed during the 1960s, which is at the heart of the Rapier Short Range Air Defence System (SHORADS). Current developments include new BBK's (broad band klystrons) for airborne radar and very high power tubes for particle accelerators.

| Part   | Type   | Freq      | Peak Power | Duty Cycle | Gain (Min) | Pulse Length | Peak Beam Volts | Peak Beam Current | Mod  | Focussing | Weight |
|--------|--------|-----------|------------|------------|------------|--------------|-----------------|-------------------|------|-----------|--------|
|        |        | GHz       | kW         | (max)      | dB         | us           | kV              | A                 |      |           | kg     |
| PT6014 | pulsed | 3.09-3.25 | 2          | 0.11       | 43.5       | 8.5          | 12.5            | 2.5               | MA   | ES        | 13.7   |
| PT6015 | pulsed | 3.25-3.40 | 2          | 0.11       | 43.5       | 8.5          | 12.5            | 2.5               | MA   | ES        | 13.7   |
| PT6203 | pulsed | 9.5-10.0  | 50         | 0.03       | 40         | 100          | 29.5            | 8.25              | G/MA | PPM       | 5      |

**Notes** S – Solenoid, ES – Electro-static, CA – cathode, G – grid, MA – modulating anode, PPM – Periodic Permanent Magnet

## Magnetrons

TMD manufactures a wide variety of magnetrons with conventional and coaxial structures; fixed frequency or tunable, using dither or shutter tuning mechanisms. The latter, which achieves especially high agility rates, is unique to TMD and was developed during the 1970s and 1980s as part of many refinements to magnetron design, including work on improved frequency stability, reduced spectral noise and increased life.

Our magnetrons have proven their worth in many applications, including arduous helicopter environments for search and rescue radar and in fixed wing aircraft for terrain-following radars. An evaluation and repair service is provided for the many mature platforms still requiring support.

| Part   | Type  | Freq Range | Peak Power | Tuning Range | Duty Cycle | Peak Anode Volts | Peak Anode Current | Agility Rate | Tuning Mechanism | Weight |
|--------|-------|------------|------------|--------------|------------|------------------|--------------------|--------------|------------------|--------|
|        |       | GHz        | kW         | MHz          | (max)      | kV               | A                  | Hz           |                  | kg     |
| PT6250 | fixed | 16.0-17.0  | 29-60      | -            | 0.00126    | 11               | 8.5                | -            | -                | 2.5    |
| PT6240 | agile | 16.0-17.0  | 35         | 230          | 0.0012     | 13.5             | 9                  | 100          | Dither           | 2.2    |
| PT5065 | fixed | 16.0-17.0  | 50         | -            | 0.0015     | 13               | 13                 | -            | -                | 1.3    |
| PT5064 | agile | 16.0-17.0  | 70         | 200          | 0.0012     | 14               | 15                 | 133          | Dither           | 3.2    |

## Under development

Various Ka band ring loop TWTs

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