MPMs (MICROWAVE POWER MODULES)

...the power in microwaves!

www.tmd.co.uk
www.tmdus.com
MPMs (MICROWAVE POWER MODULES) FOR RADAR, EW AND COMMUNICATIONS/DATALINKS APPLICATIONS

Expertise in both TWT and solid state technology means whatever your needs, we’ve got them covered.

TMD began developing TWT based MPMs around 15 years ago. Since then we have produced a wide variety of bespoke products. Most recently we have added solid state MPMs to the range, which offer technical advantages for particular specifications and applications.

Each of our TWT based units comprises compact power supply and mini TWT, combined into an ultra-compact, lightweight “drop in” amplifier block. This simplifies system design and installation, increases reliability and minimises safety hazards. The units also feature high electrical efficiency and excellent thermal management. Performance is factory set, removing the need for any user adjustments in the field, and if necessary permitting easy field replacement of the complete unit. The product range covers S to Ka band, and includes CW, pulsed and CW/pulsed units.

Our solid state units incorporate the latest advances in 0.25 µm GaN MMIC technology and low loss power combiners; optimised for EW applications.

Pictured left: Our latest development in solid state microwave technology; the PTS6900 SSPA.

Pictured right: Our ultra-compact and lightweight TWT microwave power module; the PTXM1000.
Pocket-sized Power aptly describes TMD’s MPMs, our newest and most advanced range of rugged amplifiers.

The table on page 8 shows a selection of generic products, but don’t worry if you can’t see exactly what you are looking for – bespoke solutions are available and our Business Development Team is always eager to discuss the ways in which TMD can contribute to new technology areas.

Brand New Product Developments
The recently developed PTXM range of TWT based MPMs has an exceptionally low weight and small size - typically 1.7 kg and 190 x 120 x 30 mm, which has been achieved with no reduction in RF power or reliability. This high power-to-volume feature is the result of superior packaging techniques to efficiently use all available space. These MPMs are particularly suitable for airborne applications or for other situations where space and weight are critical.

Another very important development is our new range of solid state MPMs especially optimised for EW/ECM applications. These units utilise the latest advances in 0.25 µm GaN MMIC Technology and feature a very fast mute time of 1 µs.

More details of both these new developments are given in the following pages.

For full details of all TMD’s products and capabilities, please go to www.tmd.co.uk www.tmdus.com

After sales support
At TMD relationships with our customers do not end when an order is placed. We pride ourselves in our after sales support, through delivery, set up and user testing. We also offer a comprehensive repairs service - contact us at wecare@tmd.co.uk for an evaluation.

DID YOU KNOW?
Bespoke products are what TMD does best. This product summary brochure provides a brief insight into just a few of our product ranges. If you don’t see exactly what you are looking for, let us know and we’ll be happy to work towards a collaborative bespoke solution.
PTXM ULTRA-COMPACT MODULAR MPMs

The result of many years’ experience in the design and manufacture of high frequency, high power TWT based MPMs, the state of the art PTXM Series from TMD offers possibly the highest power density on the market.

By incorporating mini TWTs and employing extremely efficient packaging these ultra-compact units, weighing typically only 1.7 kg, are ideal for airborne radar, EW and communications applications - particularly in UAVs, where low volume and weight are critical considerations. Moreover, the exceptionally low weight and small size (190 x 120 x 30 mm typically) has been achieved with no reduction in RF power or reliability. This high power-to-volume feature is the result of employing superior packaging techniques to efficiently use all available space.

Fully integrated and modular design
Because of TMD’s cost effective fully integrated, modular concept the PTXM units are easier to manufacture and test - offering higher performance, superb reliability, rapid installation, and proven value.

Each PTXM unit integrates a mini TWT and an optimised high density switched mode power supply to produce a single ‘drop in’ microwave amplifier block. Included are a solid state pre-amplifier and/or lineariser, depending on model or application. Moreover, the system designer’s task is made easier by the integration of the TWT and its high voltage power supply – eliminating the TWT interconnect along with associated reliability and safety issues. This integration also allows reduction in system size, simplifying installation.

All units feature excellent thermal management and high electrical efficiency, with minimum cooling required over a wide operating temperature range - significantly contributing to the exceptional reliability.

No user adjustments required
To optimise TWT performance the MPM adjustments are set at the factory. This not only eliminates the need for user adjustment, but also makes any field replacements easier and quicker.

The system designer’s task is made easier by the integration of the TWT and its high voltage power supply - eliminating the TWT interconnect along with associated reliability and safety issues.
To sum up...

The aerospace and defence market continues to demand higher frequency and power at the lowest possible weight and volume. In high power, or high frequency applications, tube based solutions still have the advantage. TMD continues to invest in engineering development to remain at the forefront of this technology.

Pictured below:
The PTXM1000 ultra compact and lightweight MPM featuring a Ku band (13.75 GHz to 14.5 GHz) TWT capable of providing 110 W across the band.

The versatile configuration of the MPMs means that a range of different TWTs can be incorporated, allowing the customer to specify frequency and peak power. The range also covers models with a number of input power supply options including 28 V DC, 270 V DC, or 115 V AC.

A control interface provides remote operation and status monitoring, enabling diagnostic outputs for BIT purposes. This allows the operator to identify and monitor operational conditions quickly and efficiently.

Withstanding the harshest conditions
A fully encapsulated high voltage section allows the PTXM units to operate in the harshest of environments - at high altitudes and humidity, and surviving high levels of vibration and shock. Again, making this product highly suitable for airborne applications.

For full details of all TMD’s products and capabilities, please go to www.tmd.co.uk or email us at wecare@tmd.co.uk
KA BAND MPM TECHNOLOGY

In recent years TMD’s MPM product development has focused on the requirements of EW/ECM systems. In particular, the emerging threats posed by higher frequency radar systems has made it necessary for EW/ECM counter measures to operate in Ka band - and at high power levels.

TMD’s flagship product to address this requirement is the PTX8807, which combines a mini-helix Travelling Wave Tube (TWT) with a matched high density switch mode power supply, to produce a single “drop-in” microwave amplifier unit. The mechanical outline is 450 x 224 x 55 mm and the weight 8.5 kg.

As with all our products, the ability to customise to particular situations is an important part of the design philosophy. The following graph show the frequency/power performance for three different options.

The PTX8807 can be configured to incorporate a variety of TWT models, allowing the user to specify different duty, frequency and peak power parameters. In addition to very small size and light weight, the unit features excellent thermal management. High electrical efficiency results in minimum cooling requirements and provides high reliability service over a wide temperature range.
The PTS6900 MPM is a good example of TMD’s growing solid state design and manufacturing expertise. Employing the latest advances in 0.25 µm GaN MMIC technology and low loss combiners, this compact, low weight unit covers the 2 to 6 GHz frequency band at 150 W RF output power. It has a gain of 55 db adjustable from 50 to 60 dB, which aids system integration. The PTS6900 is a fully integrated solution optimised for fast integration into EW systems; both airborne and ground based, but is also suitable for other high power microwave applications where volume and weight are critical requirements.

Key markets include: airborne EW/ECM, vehicle based EW applications (including Counter IED) and other applications (including EMC Testing etc) both broad and narrow band in the 2 to 6 GHz range.

The inherent high reliability of the PTS6900 offers a predicted MTBF of over 30,000 hours for an airborne uninhabited fighter environment, at the maximum allowable baseplate temperature. Moreover, the module will survive an infinite output load VSWR at the full rated RF output power, reducing the likelihood of accidental damage.

Also, the new MPM is entirely ITAR free. Since most similar competitor-manufactured units are from the USA, this gives non-US users the significant benefit of an alternative European ITAR-free source.

Fast RF mute capability
As well as providing an instant start up, the PTS6900 allows the RF output to be muted in less than 1 µs - making it ideal for deception jamming EW applications.

In addition, harmonic performance is -20 dBC typical, which is much improved over a Helix TWT solution.

Built-in testing
A comprehensive built-in test capability includes monitoring of the internal DC to DC converters and module baseplate over-temperature. An RF sample output is included to aid testing and integration of the module without the need for an additional output test coupler.

Mechanical
The PTS6900 is very compact measuring just 325 x 200 x 50 mm at 4.5 kg making it suitable for airborne applications.

Prime Power
The PTS6900 operates from a power supply of + 28 V DC (optional + 270 V DC) as a standard primary source, with a typical input power requirement of 900 W. Efficiency is typically 17% from either +28 V or +270 V prime power input to RF output.

Environmental
The PTS6900 has a military airborne environmental specification which includes the ability to operate in a high humidity environment. Provided that the baseplate hot-spot temperature of +71 °C is not exceeded the module will operate reliably in high ambient temperatures. It offers good gain flatness without the need to incorporate a gain equaliser and is internally temperature compensated to maintain its performance across the whole operating temperature range. The PTS6900 can be supplied with a heatsink, but is not offered as standard so that customers have the option of using their own cooling fixture. To ensure full compliance with the EMC requirements of MIL-STD-461G an internal filter is incorporated on the power supply input, making the use of an external filter unnecessary.
MICROWAVE POWER MODULES (MPMs)

Please note - This table lists just a few of our generic product types. Many other variants are available, so if you don’t see exactly what you are looking for, let us know and we’d be happy to work towards a collaborative bespoke solution.

Performance values stated in the table are typical - please send us an email to wecare@tmd.co.uk for more information.

<table>
<thead>
<tr>
<th>Type</th>
<th>Number</th>
<th>Frequency</th>
<th>Output Power W (RF)</th>
<th>Duty Cycle %</th>
<th>Pulse Length us</th>
<th>Prime Power</th>
<th>Tube/Gun Type</th>
<th>Cooling</th>
<th>Size LxWxH mm</th>
<th>Weight kg</th>
<th>App-</th>
<th>Special Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid State MPMs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTS6900</td>
<td>2.0-6.0</td>
<td>150</td>
<td>CW Only</td>
<td>-</td>
<td>28 VDC</td>
<td>-</td>
<td>-</td>
<td>325 x 200 x 50</td>
<td>4.5</td>
<td>EW</td>
<td></td>
<td>GaN MMIC. Accepts Mil-STD PSU input</td>
</tr>
<tr>
<td>PTS9734</td>
<td>2.0-6.0</td>
<td>150</td>
<td>CW Only</td>
<td>-</td>
<td>270 VDC</td>
<td>-</td>
<td>-</td>
<td>325 x 200 x 50</td>
<td>4.5</td>
<td>EW</td>
<td></td>
<td>GaN MMIC. Accepts Mil-STD PSU input</td>
</tr>
<tr>
<td>PTS9663</td>
<td>2.0-6.0</td>
<td>180</td>
<td>CW Only</td>
<td>-</td>
<td>28 VDC</td>
<td>-</td>
<td>-</td>
<td>350 x 240 x 48</td>
<td>8.0</td>
<td>EW</td>
<td></td>
<td>GaN MMIC. Accepts Mil-STD PSU input</td>
</tr>
<tr>
<td>PTS9800</td>
<td>6.0-18.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td>80 x 30 x 9.7</td>
<td>0.05</td>
<td>-</td>
<td></td>
<td>Gain equaliser for broadband TWT amplifiers</td>
</tr>
<tr>
<td>TWT MPMs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTX1052</td>
<td>6.0-18.0</td>
<td>100</td>
<td>CW/Pulsed</td>
<td>-</td>
<td>270 VDC</td>
<td>Cond'n</td>
<td>202.5 x 120 x 35</td>
<td>1.95</td>
<td>EW,R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTX9754</td>
<td>6.0-18.0</td>
<td>100</td>
<td>CW/Pulsed</td>
<td>-</td>
<td>28 VDC</td>
<td>Cond'n</td>
<td>203.2 x 196.85 x 35</td>
<td>2.6</td>
<td>EW,R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTX1059</td>
<td>6.0-18.0</td>
<td>125</td>
<td>CW/Pulsed</td>
<td>-</td>
<td>270 VDC</td>
<td>Cond'n</td>
<td>254 x 135 x 45.5</td>
<td>2.4</td>
<td>EW,R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTX1069</td>
<td>6.0-18.0</td>
<td>140</td>
<td>CW/Pulsed</td>
<td>-</td>
<td>270 VDC</td>
<td>Cond'n</td>
<td>254 x 135 x 45.5</td>
<td>2.4</td>
<td>EW,R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTX1110</td>
<td>6.0-18.0</td>
<td>200</td>
<td>CW/Pulsed</td>
<td>-</td>
<td>270 VDC</td>
<td>Cond'n</td>
<td>330 x 200 x 55</td>
<td>6</td>
<td>EW,R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTX1057</td>
<td>7.5-18.0</td>
<td>140</td>
<td>CW/Pulsed</td>
<td>-</td>
<td>270 VDC</td>
<td>Cond'n</td>
<td>254 x 135 x 45.5</td>
<td>2.4</td>
<td>EW,R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTX1056</td>
<td>8.5-15.0</td>
<td>125</td>
<td>CW/Pulsed</td>
<td>-</td>
<td>270 VDC</td>
<td>Cond'n</td>
<td>202.5 x 120 x 35</td>
<td>1.95</td>
<td>EW,R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTX8430</td>
<td>9.0-10.0</td>
<td>1000</td>
<td>5</td>
<td>100</td>
<td>28 VDC</td>
<td>Grid TWT</td>
<td>Cond'n</td>
<td>300 x 160 x 50</td>
<td>3.8</td>
<td>R</td>
<td></td>
<td>High Efficiency</td>
</tr>
<tr>
<td>PTX8501</td>
<td>9.0-10.0</td>
<td>1000</td>
<td>10</td>
<td>100</td>
<td>28 VDC</td>
<td>Grid TWT</td>
<td>Cond'n</td>
<td>300 x 160 x 50</td>
<td>4.2</td>
<td>R</td>
<td></td>
<td>High Efficiency</td>
</tr>
<tr>
<td>PTX8511</td>
<td>9.0-10.0</td>
<td>2000</td>
<td>5</td>
<td>50</td>
<td>28 VDC</td>
<td>Grid TWT</td>
<td>Cond'n</td>
<td>350 x 160 x 50</td>
<td>4.5</td>
<td>R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTX8400</td>
<td>9.2-9.5</td>
<td>1000</td>
<td>5</td>
<td>100</td>
<td>25 VDC</td>
<td>Grid TWT</td>
<td>Cond'n</td>
<td>300 x 160 x 50</td>
<td>3.8</td>
<td>R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTX1000</td>
<td>13.75-14.5</td>
<td>110</td>
<td>53</td>
<td>270 VDC</td>
<td>CW TWT</td>
<td>Cond'n</td>
<td>190 x 120 x 30</td>
<td>1.7</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTX1058</td>
<td>14.4-14.8</td>
<td>110</td>
<td>53</td>
<td>270 VDC</td>
<td>CW TWT</td>
<td>Cond'n</td>
<td>202.5 x 120 x 35</td>
<td>1.95</td>
<td>C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PTX8621</td>
<td>15.5-17.5</td>
<td>600</td>
<td>60</td>
<td>7</td>
<td>28 VDC</td>
<td>Grid TWT</td>
<td>Cond'n</td>
<td>305 x 250 x 80</td>
<td>10</td>
<td>R</td>
<td></td>
<td>Forward/Reverse Power Protection</td>
</tr>
<tr>
<td>PTX8807</td>
<td>26.5-40</td>
<td>200</td>
<td>CW/Pulsed</td>
<td>-</td>
<td>270 VDC</td>
<td>Grid TWT</td>
<td>Cond'n</td>
<td>450 x 224 x 55</td>
<td>8.5</td>
<td>EW, R</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EW = Electronic Warfare; R = Radar; C = Communications; FE = Focus Electrode

* wider bandwidth performance available

Power converters and control boxes are also available. Please contact TMD for more details.

EVD6894 Issue 13 (December 2019)