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Our technical pedigree allows us to develop the most challenging and complex integrated, multi-function assemblies for multiple markets and applications.

FEATURED PRODUCT ►
Phase Matrix worked closely with its customer to develop a C band radar altimeter transceiver assembly to provide accurate above-ground-level information for small aircraft. The rugged assembly exemplifies our outstanding capabilities in meeting challenging customer specifications.

Features and Functions:
• Airborne application for radar altimeter
• Environmental screening for airborne application
• Exceptional phase noise, linearity, and receiver sensitivity allows increase in dynamic range of detectable signal
• Designed to operate in a temperature range between -40 and +85 degrees Celsius

We Make:
• Filters and diplexers
• Oscillators
• High-speed clocks
• Frequency multipliers
• Frequency synthesizers
• Transceivers and converters
• Integrated microwave assemblies

Phase Matrix, Inc.
A National Instruments Company

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TRANSCEIVER ASSEMBLIES

Our transceiver assembly capabilities cover point-to-point and point-to-multipoint communication systems to frequency modulated continuous wave (FMCW) radar applications. Our transceiver designs are fully integrated assemblies that incorporate microwave and millimeter wave circuits featuring thin film and softboard technology. Phase Matrix’s ability to integrate complex circuitry is partly achieved by using advanced modeling and simulation technology, which allows us to include LNAs, VCOs, mixers, isolators, and filters as part of a complete solution to application challenges.

Industries We Serve

Phase Matrix serves many industries and has participated in advancing RF and microwave technology in both military and commercial applications. One example is our fast-switching, fast-settling, spurious-free wideband multi-oscillator assemblies that provide a key function in a major U.S. military program.

Another example of our advancement of technology is a recent broadband diplexed downconverter designed for a major T&M instrument manufacturer. The downconverter enabled the successful acquisitioning and displaying of live signals at 100 GHz bandwidth. Presently, no other diplexers are known to operate at 100 GHz.

For another customer, we designed a point-to-point transceiver for a C-band radar altimeter used in small aircraft. The transceiver consists of low-noise amplifiers, voltage-controlled oscillators, mixers, isolators, and filters integrated into a rugged package to meet avionics industry standards.

Also, Phase Matrix supplies the communications industry with numerous oscillator components and assemblies. For example, communication-equipment designers use our oscillators (designed per their specifications) in phase-locked loops for frequency synthesis as well as in voltage-controllable frequency for function generators.
Today’s rapid technological advances demand physical size reduction and increased functionality from components and circuit designs. Phase Matrix applies break-through design techniques in its utilization of hybrid thin film and softboard technology to meet the form, fit, and function constraints of the most current and advanced RF and microwave applications.

Phase Matrix has extensive experience in designing and delivering highly complex, multi-function integrated microwave assemblies that operate at high frequencies up to 67 GHz.

The Phase Matrix team has produced a broad range of oscillator-based components including direct replacements for Avantek and Hewlett Packard signal sources, oscillators, and oscillator sub-assemblies. Our team is especially adept at leveraging its robust and flexible designs to meet unique customer requirements. The team consists of experts in the field of microwave and millimeter-wave technology, many with master’s and doctorate degrees.

We use the latest CAD and simulation tools and continually evaluate new technologies and processes to deliver the best available technology in our products. We invest heavily in research and development of advanced technologies with the goal of surpassing the requirements of next-generation telecommunication, instrumentation, electronic-warfare, and avionic systems.

**FEATURED PRODUCT ►**

Phase Matrix designs and manufactures single and multi-channel frequency converters and partners with customers to optimize time-to-market, performance, and costs. The example product on this page is a dual-channel, DC to 65 GHz downconverter assembly, which is used in a real-time bandwidth oscilloscope.

Features and functions of this product are summarized below.

- Input frequency range: DC to 65 GHz
- Input power range: -1 dBm to -18 dBm
- LO frequency: 67.5 GHz
- IF frequency: 2.5 GHz to 32.5 GHz
- Programmable gain: 17 dB
- S/N ratio: 39 dB
- IM products: < -40 dBc
- Image rejection: 40 dB
- Control interface: I2C
Phase Matrix’s design and manufacturing facility is located in the heart of California’s resource-rich Silicon Valley. Our 50,000 square-foot building includes an R&D lab, clean rooms, and test stations. Our ATE capabilities enable us to produce components and sub-assemblies in high volume. Furthermore, we assertively engage in continuous process improvement by reviewing and optimizing our processes for time, material, and cost while unwaveringly maintaining a high-quality product.

Each employee at Phase Matrix is committed to ensuring that we meet our customer’s expectations. Our benchmark for quality has allowed us to operate as a world-class manufacturer of advanced microwave and millimeter-wave products.
CUSTOM COMPONENTS
Phase Matrix’s broad array of standard oscillator-based components include narrow and broadband voltage-controlled oscillators (VCOs), fixed-tuned oscillators (FTOs), phase-locked oscillators (PLOs), digitally tuned oscillators (DTOs), high-speed clocks, and frequency multipliers. Our components are available in frequencies up to 67 GHz; furthermore, we readily utilize our advanced product capabilities to customize our standard components to meet our customers’ form, fit, and function needs.

VOLTAGE-CONTROLLED OSCILLATORS
Our narrow and broadband VCOs and FTOs employ high-performance silicon bi-polar junction transistors (Si BJTs) to achieve very low phase noise. The use of hyper-abrupt silicon varactor diodes enables tuning capability, and GaAs MMIC buffer amplifiers provide the necessary power output and load isolation of the oscillators. Our VCOs are used in multiple applications across a variety of industries including avionics, instrumentation, and telecommunications.

PHASE-LOCKED OSCILLATORS
Phase Matrix’s PLOs use high-performance Si BJTs and highly stable oven-controlled crystal oscillators, phase-lock loops, and sampling mixers to deliver a low phase-noise performance (see graph). Many of our PLOs are designed for rugged applications such as electronic warfare.

FEATURED PRODUCT
Our integration capabilities enable us to include additional functionality into our oscillator assemblies to deliver multi-function units to customers whose systems have tight constraints. A prime example of a custom oscillator assembly is our 9 to 15 GHz DTO.

9 to 15 GHz DTO Integrated Features and Functions:
- Multiple wideband signal sources combined using Wilkinson power combiners.
- A GaAs MMIC amplifier provides the necessary output power and load isolation.
- TTL control
- EEPROMs yield high accuracy, high resolution, and high linearity.
- DAC, decoder, detectors, and dual comparators on board.
- Proprietary design techniques achieve fast-switching and fast-settling times as well as low spurious performance.
- Hermetically sealed for an operating temperature range between -40 and +85 degrees Celsius.

9 to 15 GHz DTO Specifications:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency range</td>
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Phase Matrix, Inc.®
A National Instruments Company
Oscillators Assemblies

Phase Matrix’s oscillator assemblies represent state-of-the-art signal sources with customized features and functionality. Features include improved phase noise, reduced spurious, faster settling times, widened bandwidth, higher power, and higher tuning-port bandwidth. Summarized below are some common “add-on” features. Maximum frequency of Phase Matrix oscillator assembly designs is 67 GHz.

- DC voltage conditioning for bias and control
- Filters and switches for suppression of harmonics and sub-harmonics
- Differential outputs
- Amplifiers and frequency multipliers
- Digital tuning and controls
- Multi-frequencies and multiple outputs
- Power detectors

Contiguous Diplexers

Diplexers are common building blocks within communication systems and military sub-systems. Phase Matrix’s superior, high-frequency (up to 67 GHz) diplexers provide high selectivity, high channel-to-channel isolation, and extremely low insertion loss.

Frequency Multipliers

Phase Matrix’s custom, high-performance frequency-multiplier modules use state-of-the-art MMICs, discrete devices, and filters to achieve the desired multiplication ratio, power output, and spurious performance. We design custom narrowband and wideband multipliers up to 67 GHz.
INTEGRATED ASSEMBLIES
Phase Matrix’s integrated microwave assemblies employ the most advanced technology available to achieve high operating frequencies of up to 67 GHz and are capable of a multitude of functions for numerous applications across a diverse range of industries. Our deep commitment to extensive R&D brings emerging (proprietary) technology from concept to utilization, which enables Phase Matrix to deliver highly complex assemblies per customer requirements and industry demands.

Our team of experts builds strong relationships with customers to leverage knowledge of thin-film hybrid circuits, MMICs, discrete components, waveguides, and softboard technologies to meet and exceed customer expectations.

SYNTHESIZER MODULES
Phase Matrix developed a revolutionary phase-refining technology called QuickSyn® technology that enables the production of synthesizers capable of fast-switching speeds as well as low phase noise and low spurious performance. These microwave frequency synthesizers are available at low cost and are housed in a compact package. In addition, to our proprietary QuickSyn® synthesizer technology, Phase Matrix utilizes a variety of synthesizer technologies including YIG-, VCO-, and DDS-based solutions.
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CONVERTER ASSEMBLIES
Phase Matrix designs highly-integrated frequency up and downconverters that operate up to 67 GHz. Our frequency converters are used in a variety of applications such as satellite communications, telecommunications, electronic warfare, and instrumentation.

Typical Functions:
- Microcontrollers (analog-to-digital converters, digital-to-analog converters, complex logic devices)
- Synthesized LOs
- LO multipliers
- LNAs
- Output power control
- High linearity
- Digitally controlled attenuation
- Automatic gain control
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DESIGN & PRODUCTION

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