MPT, Inc.
The Right Solution With A Lower Risk At The Right Time.

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About MPT

- Incorporated 2003, Focused solely on DoD and Government Products and Services
- Commercial engineering design services division: RLS Design
- 15 Employees
- HUBZone Certified January 2015
- Small Minority, Disadvantaged, Native American Owned Business
- Core Capabilities
  - Phased Array components and sub-systems for communication and radar from 500MHz to 40GHz.

Products and Services

- SiGe, GaAs and GaN MMIC Development
  - SiGe Integrated Circuits For Phased Arrays, Digital Receivers, and Communication Systems
- Antennas
  - Conformal, printed circuit, linear, dual, and circular polarization,
  - Narrow or broad band-multi octave
- T/R modules and Sub Arrays
  - S-band to Ka-Band, beam forming networks
- Low Cost Digital Receivers/Exciters
  - Single, Dual, Triple Channel. Stand Alone, Rack Mount, W/ ADC & FPGA

Sample of Recent Contracts

- Naval Surface Warfare Center
  - Contract # N00167-11-P-0382
- Naval Sea Systems Command
  - Contract # N00024-13-C-4524
- US Army Redstone Arsenal
  - Contract # W31P4Q-12-C-0011
  - Contract # W31P4Q-13-C-0021
- US Army Aviation Applied Technology
  - Contract # W911W6-14-C-0014
- Various sub contracts with DoD prime contractors
All Our SiGe/GaN/GaAs Designers Have Developed Multiple Chip Sets For T/R Modules & Radar

- Rick Sturdivant, MSEE (CEO): Has developed MMIC low noise amplifiers, phase shifters, variable gain amplifiers, multipliers (2X and 3X), and distributed amplifiers.
- XX, MSEE, MBA (Director): Has developed over 46 different MMIC and RFIC MMICs. His expertise is in High Power Amplifiers, Drivers, Distributed Amplifiers in GaAs, multifunction integrated circuits (full T/R) in SiGe, and limiters and high power amplifiers in GaN.
- XX, MSEE (Senior Staff Engineer): Has developed highly integrated MMICs for full transmit receive functions, fully integrated receivers and exciters, modulator drivers, distributed amplifiers, and amplifiers/switches for cellular phones.
- XX, MSEE (Senior Staff Engineer): Has developed MMICs in GaAs and SiGe all for applications in phased array radar and for receiver/exciters. Includes low noise amplifiers, down/up converters, driver amplifiers, phase shifters and variable gain amplifiers.
- XX, MSEE (Staff Engineer): Has developed MMICs in GaAs. Highly experienced in high power amplifier and driver amplifier development as well as electromagnetic simulations and design.
- XX, PhD EE(Staff Engineer): Has 11 years designing SiGe and Si-CMOS for wireless and radar applications.
- Plus network of proven consultants
Services Highlight: SiGe, GaAs, and GaN Integrated Circuit Development

● Service Description
  – Provide Three ways our customers win
    – The Right Solution: Technologies include SiGe, GaAs, and GaN
    – Lower Risk: Experienced Team with a track record of success in our markets
    – The Right Time: Fewer design cycles delivered on schedule
  – Have access to TowerJazz Semi, Cree Semi, Qorvo (Triquint Semi)

● Target Markets
  – DoD, Prime Contractors

● Example Programs
  – US Navy contract ($984K) to develop a GaN MMICs
  – Developing SiGe integrated circuit on US Army contract
  – Developing SiGe chip for digital radio

● Have increased our software suite to accommodate more designers
Examples Of T/R Module Common Leg Circuit (CLC) MMICs

- CLC is the heart of a T/R module chip set.
- Is actually a complete T/R module (low power)

**Common Leg (CLC) MMIC**
- Freq: 7-11 GHz
- Phase Control: 6 Bits
- Amplitude Control: 5 Bits
- Gain: 12dB
- Conventional Face Up

**Common Leg (CLC) MMIC**
- Freq: 7-11 GHz
- Phase Control: 6 Bits
- Amplitude Control: 5 Bits
- Gain: 17dB
- Conventional Face Up

**Common Leg (CLC) MMIC**
- Freq: 7-11 GHz
- Phase Control: 6 Bits
- Amplitude Control: 5 Bits
- Gain: 17dB
- Flip Chip
High Power Amplifier MMICs

- High power amplifiers are used to increase the radar transmit signal just before it reaches the circulator and antenna.

**High Power Amplifier MMICs**

- **HPA MMIC – GaAs PHEMT**
  - Freq: 8-10 GHz
  - Output Power: 6W
  - Gain: 24dB
  - Flip Chip

- **HPA MMIC – GaAs PHEMT**
  - Freq: 8-11 GHz
  - Output Power: 8W
  - Gain: 22dB
  - Conventional Face Up

- **HPA MMIC – GaAs PHEMT**
  - Freq: 8-11 GHz
  - Output Power: 8W
  - Gain: 22dB
  - Flip Chip
Distributed Amplifier MMICs

- Distributed Amplifiers (DAs) have extremely wide bandwidth, flat gain, and excellent phase linearity.
- Used extensively in high data rate telecommunications equipment such as optical telecom modulator drivers.
Other Modules and MMICs

The team has developed MMICs and modules from 1 to 40GHz. This is a small sample of a few of the products.

- **Frequency Doubler**
  - Input Freq: 12GHz
  - Output Freq: 24GHz
  - Conversion Loss: 8dB

- **Frequency Tripler**
  - Input Freq: 4GHz
  - Output Freq: 12GHz
  - Conversion Loss: 12dB

- **Frequency Tripler**
  - Input Freq: 11GHz
  - Output Freq: 33GHz
  - Conversion Loss: 15dB
RLS Design Team Has Developed Several T/R Modules That Have Transitioned Into Production

- Transmit/Receiver (T/R) modules are combined to form Active Electronically Scanned Arrays (AESAs).

  - **T/R Module**
    - Freq: X-Band
    - Output Power: >3W
    - LTCC, LNA, HPA, Drivers, Phase, Amplitude Control

  - **Tile Array Module**
    - Freq: X-Band
    - Output Power: >5W
    - Mixed Ceramics, LNA, HPA, Drivers, Phase, Amplitude Control

Phased Array
Product Highlight: Ka-Band Phased Array System

- **Product Description**
  - High performance Ka-band radar for general radar use
  - Additional Uses: millimeter-wave communication systems

- **Status**
  - Funding: 100% funded by US Army (Current Funding: $1.15M + $2.85M. Future: $10-12M)
  - Product demo 2016.

Part of Program Is Development of A Thermal Solution
Product Highlight: Receive Only Array For Mobile DirecTV Reception Developed For An Automotive Customer

- Frequency Range: 11.7-12.2 GHz
- Passive Gain: 26dB, RX Noise: 0.8dB max
- RX Gain: 60dB gain.
- G/T>12dB
- Size: 10.375” Diameter, 0.7” Thick
- Polarization: Linear
- # of Elements: 292 Elements
- Weight: <1.5 lbs
- Cool: Air cooled
- Survivability: 20 year life spec
- Cost: $900 moderate/high volume (10K units per year)

DC: 5V at 3Amax

Includes:
- Phase Shifters
- 2 Phase Locked Loop Sources
- Superheterodyne Down Converter
- Image Rejection Filter
- Beam Steering Computer
- Shift Registers
- IF Amplifier Chain
Software Tools

- NI AWR
  - Microwave Office
  - Analog Office
- Cadence
- Keysight (Agilent)
- Tower Jazz Library
- Ongoing Training
Manufacturing Is Fully Qualified Through Our Production Partners

- Our products are fabricated in fully qualified production lines
  - ISO9001
  - MIL-PRF-38534 (class H & K)
  - MIL-STD-883
  - ITAR Registered
  - IPC-A-610 Class I, II, & III

Ceramic Substrates: LTCC, HTCC, Thick Film

Automatic Pick and Place

Automatic Wire Bonding
Conclusions

- Our customers benefit from our products and services in at microwave and millimeter-wave frequencies.
  - SiGe, GaAs and GaN integrated circuit development
  - Transmit/Receive (T/R) module development
  - Phased arrays and antennas
- As a HUBZone Small Business MPT is a great partner on SBIRs

MPT can help YOUR company deliver more MMIC and module products in 2015.
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