COMPANY OVERVIEW

• Provider of technically demanding RF/microwave, electromagnetic, power, and security solutions for defense, aerospace and commercial industries
• Founded in 1981; Listed on NASDAQ June 2011 with a new company vision
  – Today, one of the largest non-Prime provider of RF/Microwave and microelectronics
• 1,975 employees worldwide
• 3,000+ customers worldwide
• Revenue breakdown
  – ~75% Domestic / 25% International
  – ~60% Defense & Government / 40% Commercial
**OUR FOOTPRINT**

- **Design & Manufacturing**  
- **Design Center**  
- **Manufacturing Center**  
- **Sales Office**

<table>
<thead>
<tr>
<th>Europe</th>
<th>North America</th>
<th>Asia</th>
</tr>
</thead>
</table>

- **Europe**
  - Design & Manufacturing facilities

- **North America**
  - Design & Manufacturing facilities

- **Asia**
  - Design & Manufacturing facilities

### Key Facts

- **12 Trusted facilities worldwide (US, UK, Canada)**
- **Technology focused:** Nearly 20% of our employees are engineers and skilled design professionals
- **International manufacturing locations are API companies - not subcontractors; same equipment and processes as U.S.**
30 YEARS OF DESIGN AND MANUFACTURING EXPERIENCE

• Over 600 Microwave employees
• Access to lower cost manufacturing (RF facilities in Mexico and China)
• State College, PA facility - 275,000 sq. ft.

A | Columbia, MD
   Acquired July 2002 (FSY)

B | Delmar, DE
   Acquired February 2004 (Salisbury Engineering)

C | Palm Bay, FL
   Acquired October 2004 (Q-bit)

D | Philadelphia, PA
   Acquired February 2005 (Amplifonix)

E | State College, PA
   Acquired January 2007 (EMF Systems)

F | Marlborough, MA
   Acquired September 2008 (Satcon-Film MicroElectronics)
   Acquired December 2009 (Micro Networks)

G | Nashua, NH
   Acquired June 2010 (Sage Electronics)
API Technologies 45,000 ft2 facility to support the combined manufacturing and engineering operations of our Worcester and Marlborough facilities, located in the Marlborough, Massachusetts Technology Park. The facility is AS9100 registered and fully certified to MIL-PRF-38534 Class H and Class K standards.

API is a designer and manufacturer of RF/microwave and hybrid components, microwave, MMW, and microelectronic assemblies for defense, space systems, satellite, high-rel commercial, communications, avionics and ruggedized industrial applications.

API Benefits
- 30,000 square feet of Class 100,000 Clean Room
- Prototypes, Production and Qualification
- Reduce Size/Lower Weight
- Improve Performance and Reliability
- Full Temperature Testing
- Environmental Stress Screening
- MIL-PRF-38534 Class H / K
Only 19 facilities worldwide have MIL-PRF-38534 Class K (Space) certification. Two of them are ours.

### Deep Space
- Galileo
- Cassini
- USERS
- Mars Phoenix
- OCO
- LCROSS
- Mars Satellite Lab
- ISS Kibo EF

### Scientific Missions
- SAOCOM
- Hershel Plank
- Grail
- EnMap
- AMS-02
- Lisa Pathfinder
- Meteosat
- Juno

### Communications
- Sirius Radio
- DirectTV
- Olympus
- Optus 10
- Amazonas 3
- GPS-2F
- Thor 7
- MUOS
- Inmarsat
- Intelsat
- Hot Bird

### Launch & Reentry
- Curiosity
- Taurus
- Minuteman
- HII
COMPLETE SOLUTION PROVIDER

Technologies
- Mixed Signal & Power
- RF, Microwave & MMW
- Optoelectronics
- Space
- Thin Film / SAW Wafer
- Power Conversion / Regulation

Markets
- Defense (MIL-PRF-38534 Class H)
- Space (MIL-PRF-38534 Class K)
- Avionics
- Hi-Rel Commercial
- Ruggedized Industrial
- Secure Communications

Capabilities
- Advanced Engineering
- High Density Manufacturing
- DC-50 GHz
- High Reliability
- Class K Certified Facility
- Thin Film / SAW Wafer Fab
THIN FILM & SAW FAB

Capabilities

- Laser Cutting
- Metal Deposition
- Photo Lithography
- Auto Step Reticle Stepper
- Precision Photo Resist
- Automated Developer Application
- Ion Etching
- Pack
- Auto Probe & Trim
- Auto Wafer Dicing
- Active or Passive Laser Trim
API Technologies’ engineers are experts in the field of metallization. With over 40 years of manufacturing experience, we are the leaders in substrate metallization and process development. API routinely handles a number of various substrate materials, including: Silicon, Alumina, BeO, AlN, Ferrite, Quartz, Glass, Sapphire, Fused Silica, and various Titanates.
NiChrome/Tantalum Nitride Resistors
Our internal thin film manufacturing operation has the capability to deposit either NiChrome or Tantalum Nitride resistors on all popular substrates with most conductor metals, barrier metals and base metals. Specific core competencies include:

- Tolerances to $\pm 0.0001"$
- Resistor tolerance to 0.1% absolute, 0.01% matching
- Metallized vias and wraparounds
- Copper filled vias
- Gold filled vias
- Polyimide, Silox and Silicon Nitride dielectrics
- Dielectric bridges
- Gold/Tin selective deposition
- Fine lines and spaces 0.0006"/0.0006" (10μm)
Metal schemes including Gold, Copper, Nickel, Nichrome and Tantalum Nitride lines/spaces to ± 0.0003".

BeO, Alumina, Aluminum Nitride, Silicon and Ferrites are just some of the substrate materials available.

Few companies have the capability to provide edge and via wrap-around services as we do. Selective 360° deposition allows for Gold to be deposited with a thickness of 100-400 micro inches.

Gold plated or metallized vias for improved ground plane connection or heat dissipation.
We offer both filled vias or plated through holes, part of the benefits of the API Technologies Advantage. Our in-house laser drilling capabilities allow you, the customer, to eliminate epoxy bonding in the assembly process for improved grounding and thermal conductivity.

Plated Through Vias
Whether drilling on Alumina, Aluminum Nitride, BeO, Silica or Quartz, using our advanced laser drilling method ensures enhanced mounting convenience without the need for awkward bonding techniques.
COPPER FILLED VIAS

- Copper filled vias provide a cost efficient solution to rising costs as the price of gold has risen more than 300% over the last decade.

- Copper technology offers increased thermal and electrical conductivity over gold.

- Copper filled vias are the preferred technology available for commercial packaging, hybrid manufacturers, and microelectronics providers in need of a high reliability and high conductivity substrate.
FILLED VIAS vs. PLATED THROUGH HOLES

- Filled vias provide higher conductivity and better thermal conductivity for RF/Microwave than plated through holes, and are preferable for high power applications.

- Filled vias and plated through holes both provide electrical connections to the ground plane in thin film substrates (also on PWBs/PCBs and thick film). Also, it provides interconnects for thin film substrates with patterns on both sides of the substrates.
Polyimide can be customized to meet a variety of shapes and dimensions, thereby providing versatility and flexibility with your design requests.

Adding a second layer of Polyimide helps protect the delicate bridge from structural damage during the assembly process.

Another example of adding value through innovation is found while utilizing Polyimide for bridges and dams. The advantage of poly bridges over traditional air bridges is that non-conductive polyimide adds a level of support preventing the bridge from collapsing onto the circuit below. We have taken that process one step further by adding a second layer of polyimide on top of the bridge, complementing the foundation of structural integrity added to the bridge process by the base Polyimide layer.

Polyimide, which when added traditionally allows for repeatable coupler lines and spaces as small as 0.0006".
With over 4 decades of sputtering experience, we are the premier choice for thin film metallization solutions. Besides standard metals like Gold, Nickel and Titanium Tungsten, we are also specialists in a number of exotic metals including:

- Platinum
- Chromium
- Palladium
- Aluminum
- Silver
- Copper
Sputtering Equipment
- KDF954
- KDF943
- MRC954
- Load lock systems
- 12” x 12” pallette size

Multiple sputtering systems with multiple targets
Improved lead times with reduced target changes

Process
- Alkaline cleaning with DI water rinse
- 12” x 10” sweet spot
Photolithography and Etching

- Positive Resist
- Wet etching available for Au, TiW, Ta, NiCr, Ni, Cu, Ti, SiO2
- Minimum Geometrical Etching
  - Conductors: 0.6 mils (0.1 tolerance)
  - Resistors: 0.2 mils (0.04)
Design Guide

*Thin Film Metallized Substrates*

This useful layout guide, with its accompanying metals and their functions outline, should help serve as a resource for both the CAD specialists, as well as the engineer involved in the design of the substrate or PC board. Helpful resistor values along with material types and their range of functions is included and is another example of why API Technologies leads the industry in both innovation AND customer service.

### Sample Resistor Layout Guide

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value Inches (µm)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistor Style</td>
<td>Type-1 0.002 x 0.002 (50 x 50)</td>
<td>Resistor inboard of conductor</td>
</tr>
<tr>
<td>Min Resistor Dim.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min. Probe Pad Dim.</td>
<td>0.003 x 0.003 (75 x 75)</td>
<td>Perpendicular to current flow</td>
</tr>
<tr>
<td>Conductor/Resistor Overlap</td>
<td>0.0005 (12.5) per side min. 0.002 (50) per end</td>
<td>Parallel to current flow</td>
</tr>
</tbody>
</table>

### Metals and their Functions

<table>
<thead>
<tr>
<th>Material Function</th>
<th>Material Type</th>
<th>Range of Functions</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistors</td>
<td>Tantalum-Nitride (TaN)</td>
<td>10 – 150 Ω/square (Min)</td>
<td>Best for non-hermetic environment</td>
</tr>
<tr>
<td></td>
<td>Nickel-Chromium (NiCr)</td>
<td>20 – 350 Ω/square (Min)</td>
<td>Low TCR</td>
</tr>
<tr>
<td></td>
<td>Chromium-Silicon (CrSi)</td>
<td>500 – 1500 Ω/square</td>
<td>Small package hi-value resistors</td>
</tr>
<tr>
<td>Adhesion</td>
<td>Titanium - Tungsten (TiW)</td>
<td>250 – 750 Angstroms</td>
<td>Ideal for high temperatures</td>
</tr>
<tr>
<td></td>
<td>Chromium (Cr)</td>
<td>250 – 750 Angstroms</td>
<td>Low temperature limitation</td>
</tr>
<tr>
<td>Barriers</td>
<td>Nickel (Ni) - Sputtered</td>
<td>750 – 20000 Angstroms</td>
<td>Standard barrier</td>
</tr>
<tr>
<td></td>
<td>Nickel (Ni) - Plated</td>
<td>40 – 100µ in. (1 – 2.5 µm)</td>
<td>High conductivity barrier</td>
</tr>
<tr>
<td>Conductors</td>
<td>Copper (Cu)</td>
<td>30 – 500µ in.</td>
<td>High power/solderable</td>
</tr>
<tr>
<td></td>
<td>Gold (Au)</td>
<td>10 – 200µ in. (0.25 – 5 µm)</td>
<td>Tight tolerance</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fine line features available</td>
</tr>
</tbody>
</table>
Thin Film Chip Resistors

API Technologies offers a variety of thin film chip resistors as standard products. These chip resistors provide variations in substrate, resistor material, temperature coefficient of resistance, resistance and tolerance. Resistor families are available with multi-tap options, front and back contact options, applications for wire bond or soldering and resistor matching.
ADVANCED THIN FILM TECHNOLOGIES

20x20 Silicon Chip Resistors

**Electrical Specifications**

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<tr>
<th>Parameter</th>
<th>Limit</th>
<th>Test conditions</th>
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<tbody>
<tr>
<td>Power Rating</td>
<td>100 mW</td>
<td>(derated at 70°C to 0 mW @ 150°C)</td>
</tr>
<tr>
<td>Life</td>
<td>± 0.2% max</td>
<td>1000 hours @ 125°C</td>
</tr>
<tr>
<td>Noise</td>
<td>-35 dB typ</td>
<td>MIL-STD-202 Method 308</td>
</tr>
<tr>
<td>High Temp Exposure</td>
<td>± 0.2% max</td>
<td>100 hours at 150°C</td>
</tr>
<tr>
<td>TCR (68AL, 68BCN)</td>
<td>0 ± 50 ppm/°C</td>
<td>-55°C to 125°C</td>
</tr>
<tr>
<td>TCR (68ALT, 68BCR)</td>
<td>-100 ± 50 ppm/°C</td>
<td>-55°C to 125°C</td>
</tr>
<tr>
<td>Operating voltage</td>
<td>100 VDC max</td>
<td>MIL-STD-202 Method 106</td>
</tr>
<tr>
<td>Moisture resistance</td>
<td>± 0.5% max</td>
<td>MIL-STD-202 Method 107</td>
</tr>
<tr>
<td>Thermal shock</td>
<td>± 0.5% max</td>
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30x30 Silicon Chip Resistors

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Values and Tolerances Schematic
API Technologies knows that critical attention to artwork dimensions and tolerances is of paramount importance during a design packet transfer. To assist with this critical step in the design process, we provide an illustration as seen here, which includes suggested values and tolerances that should be followed in order to facilitate a complete and comprehensive design packet.
QUALITY AND RELIABILITY – Marlborough Facility

• AS9100:2009 Certified - DNV

• MIL-PRF-38534 Certified and Qualified - DLA Land and Maritime
  o MIL-PRF-38534, Class K and H Certified Hybrid Microcircuits
  o MIL-PRF-38534, QML-38534 Qualified Processes and Materials
  o MIL-PRF-38534, Thin Film Chip Resistor & Substrate Fab
  o MIL-STD-883 Test Methods - DLA Lab Suitability

• Other Specifications Guidelines
  o J-STD-001
  o IPC-A-610

• Quality Assurance Programs
  o Calibration Recall System for Test and Measurement Equipment
  o ESD Program
  o Failure Analysis and Corrective Action System
  o AS9100 and MIL-PRF-38534 Internal Audit Program
  o Operator Training and Recertification Program
MIL-PRF-38534
HYBRID MICROCIRCUIT CERTIFICATION
FOR
CLASSES K and H
IS HEREBY AWARDED TO

SPECTRUM MICROWAVE
400 Nickerson Road
Marlborough, MA 01752

THIS CERTIFICATION IS VALID UNTIL TERMINATED BY WRITTEN NOTIFICATION FROM DLA LAND AND MARITIME. REFERENCE DLA LAND AND MARITIME LETTER VQ(VQH-12-024040) FOR DETAILS PERTAINING TO THIS CERTIFICATION.

SAMUEL E. MERRITT
Director, Operations Support Directorate
DLA Land and Maritime
DNV Business Assurance
Management System Certificate

Certificate No. 137259-2013-AQ-USA-ANAB

This is to certify that

API Technologies Corp.- Spectrum Microwave

at

400 Nickerson Road, Suite #1, Marlborough, MA 01752 USA

has been found to conform to the Management System Standard:
We incorporate the latest design software in all our processes and procedures.

**Design Tools:**
- Ansoft Designer
- Agilent Eagleware Genesys
- Orcad
- Cadence Allegro
- SolidWorks
- AutoCAD
- P-Spice
- Sonnet Pro EM Simulator
DESIGN & DEVELOPMENT PROCESS

1. Specification & Development
2. Simulation & Design
3. Testing
4. Prototyping
5. Manufacturing
6. Logistics
Thin Film - Points of Contact

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