

# FINE-LINE CIRCUITS LIMITED

(TECHNICAL)

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# COMPANY PROFILE



## Who we are?

**Fine-Line Circuits Limited** is a Space accredited ( ISRO- Space Application Qualified) publicly traded company located at Mumbai, India with a sales office in San Jose, USA manufacturing & exporting all types of Printed Circuit Boards(PCBs) of world class quality.

## What we do?

- All Types of PCBs
- In Small to Medium Volumes
- Delivered Rapidly
- For High Reliability Applications

# OUR CORE COMPETENCY

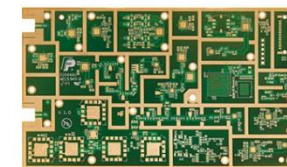
We specialize in the production (including Duroids Series) of Space Grade RF Microwaves/High Frequency PCBs using a variety of Low Loss/High Performance laminates especially from Rogers, Nelco, Taconic & Panasonic substrates with Electrolytic Bondable Gold finish with full integrity of the RF path.



We are the only approved PCB Supplier for India's foremost Space Agency - ISRO (Indian Space Research Organization) for their RT Duroid PCBs which go into their Satellite Communication Systems.





Our capability to build RF Microwave PCBs is also with a special surface finish - **Electrolytic Bondable Gold Direct on Copper with gold thickness is of 1 to 4 microns and without Nickel barrier**. This ensures the lowest signal losses & high signal performance as the skin depth is optimized & as Nickel is absent there are no signal losses & further it will give gold wire bondability.



# CERTIFICATE & APPROVALS

## ISRO Space Application Centre Approval Certificate (Flight Hardware)

<p>अंतरिक्ष उपयोग केंद्र अंतरिक्ष विभाग भारत सरकार अहमदाबाद - 380015 गुजरात, भारत</p>	<p>अर्हता प्रमाणपत्र / Certificate of Qualification</p>	<p>Space Applications Centre Department of Space Government of India Ahmedabad - 380015 Gujarat, India</p>												
<p>जारी करने की तिथि: सितम्बर 09, 2016 प्रमाणपत्र सं.: एसएजी/सेक/सर्टिफिकेट/2016/02</p>	<p>ISSUE DATE: September 09, 2016 CERTIFICATE No.: SAC/SRG/CERT/2016/02</p>													
<p><b>This is to certify that</b> <b>M/s. Fine Line Circuits Limited</b></p>														
<p>145, SDF V, Seepz, Andheri (East), Mumbai - 400096, India has been Qualified by Space Applications Centre for the fabrication of gold Plated PTH PCB using Soft RF Substrates for Flight Hardware Realization. Details of Qualified Process are as under,</p>														
<table border="1"> <thead> <tr> <th>Sr. No.</th> <th>Laminate Type</th> <th>Capabilities</th> <th>Processing Type</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>RT/D-6002 with and without Cu-Back</td> <td>Line Width/Spacing: 5mil PTH/Via : 0.3mm, without Cu-Back &amp; 0.5mm, with Cu-back</td> <td>Pattern Formation: Subtractive Processing PTH/Via : Electroless Copper</td> </tr> <tr> <td>2</td> <td>RT/D- 6010 with and without Cu-Back</td> <td>Gold Finish : 2 to 4 μm</td> <td>Gold Deposition : Electrodeposited</td> </tr> </tbody> </table>	Sr. No.	Laminate Type	Capabilities	Processing Type	1	RT/D-6002 with and without Cu-Back	Line Width/Spacing: 5mil PTH/Via : 0.3mm, without Cu-Back & 0.5mm, with Cu-back	Pattern Formation: Subtractive Processing PTH/Via : Electroless Copper	2	RT/D- 6010 with and without Cu-Back	Gold Finish : 2 to 4 μm	Gold Deposition : Electrodeposited		
Sr. No.	Laminate Type	Capabilities	Processing Type											
1	RT/D-6002 with and without Cu-Back	Line Width/Spacing: 5mil PTH/Via : 0.3mm, without Cu-Back & 0.5mm, with Cu-back	Pattern Formation: Subtractive Processing PTH/Via : Electroless Copper											
2	RT/D- 6010 with and without Cu-Back	Gold Finish : 2 to 4 μm	Gold Deposition : Electrodeposited											
<p>यह प्रमाणपत्र अगस्त 31, 2018 तक वैध है   This Certificate is valid up to August 31, 2018.</p>														
<p>संदर्भ दस्तावेज / Reference Documents</p> <ul style="list-style-type: none"> <li>परीक्षण रिपोर्ट सं. SAC/SRA/GEN/QTR/05, 2016 / Qualification Test Report No. SAC/SRA/GEN/QTR/05, 2016</li> <li>प्रक्रिया पहचान दस्तावेज आइडी: Fineline/D/PID-02, संशोधन: 01/00, दिनांक 22 मार्च 2016 / Process Identification Document ID: Fineline/D/PID-02 Revision: 01/00 dated 22 March 2016.</li> </ul>														
<p> (के. बी. व्यास) (K. B. Vyas) ग्रुप प्रधान, एसएजी/सेक Group Head, SRG/SAC</p>	<p> (ए. के. लाल) (A. K. Lal) ग्रुप निदेशक, एसएजी/सेक Group Director, SRG/SAC</p>	<p> (तपन मिश्रा) (Tapan Misra) निदेशक, सेक Director, SAC</p>												



# CERTIFICATE & APPROVALS

## ISRO Space Application Centre Approval Certificate

अंतरिक्ष उपयोग केंद्र  
अंतरिक्ष विभाग  
भारत सरकार  
अहमदाबाद - 380015  
गुजरात, भारत



अर्हता प्रमाणपत्र / Certificate of Qualification

Space Applications Centre  
Department of Space  
Government of India  
Ahmedabad - 380015  
Gujarat, India

जारी करने की तिथि: फरवरी १६, २०१७  
प्रमाणपत्र सं.: सेक/एसआरजी/सर्टिफिकेट/२०१७/०२  
जारी कर्ता: पीएमक्यूडी-ई/एसआरजी/सेक

ISSUE DATE: February 16, 2017  
CERTIFICATE No.: SAC/SRG/CERT/2017/02  
ISSUED BY: PMQD-E/SRG/SAC

**This is to certify that**  
**M/s. Fine Line Circuits Limited**

145, SDF V, Seepz, Andheri (East), Mumbai - 400096, India has been Qualified by Space Applications Centre for the fabrication of Rigid-Multilayer Board in accordance with ISRO-PAX-304, Issue-2, for Flight Hardware Realization. Details of Qualified Process are as under,

Sr. No.	Process Type	Capabilities
1	14-layer, FR-4 (HR-370) laminate, HASL finish	Line/Gap: 6 mil, Basic Cu: 1/2-Oz on Outer layers & 1-Oz on other layers PTH/Via: 0.4mm, Max. Aspect Ratio (PCB Thickness/Drill Dia) of 5.3 PTH/Via Filling: Nil

यह प्रमाणपत्र फरवरी १६, २०२० तक वैध है | This Certificate is valid up to February 15, 2020.

संदर्भ दस्तावेज़ / Reference Documents

- परीक्षण रिपोर्ट सं.: SAC/SRA/GEN/QTR/18, 2015 / Qualification Test Report No. SAC/SRA/GEN/QTR/18, 2015.
- प्रक्रिया पहचान दस्तावेज़ सं.: Fineline/D/PID-01, संशोधन: 01/00, दिनांक 25 नवम्बर 2015 / Process Identification Document ID: Fineline/D/PID-01 Revision: 01/00 dated 25 November 2015.



(र. क. हेगडे)  
(R. K. Hegde)

प्रधान, पीएमक्यूडी-ई/एसआरजी  
Head, PMQD-E/SRG



(के. बी. व्यास)  
(K. B. Vyas)

ग्रुप प्रधान, एसआरजी/सेक  
Group Head, SRG/SAC



(ए. के. लाल)  
(A. K. Lal)

ग्रुप निदेशक, एसआरजी/सेक  
Group Director, SRG/SAC



(तपन मिश्रा)  
(Tapan Misra)  
निदेशक, सेक  
Director, SAC

## Why We Recommend Bondable Gold Direct on Copper for RF/High Frequency Boards?

- Broadly to achieve optimal signal performance in the RF Microwave applications your design will require a good surface finish which minimize the signal loss & a good base laminate with the appropriate dielectric constant & dissipation factor.
- The surface finishes contributes in a major way to signal performances. It's contribution weightage is about 75% & the low loss base laminate contributes about 25 % .
- Hence the Electrolytic Bondable Gold Direct on Copper without the Nickel barrier will achieve a much superior signal performance level especially at the high frequencies.

## Benefits Of Bondable Gold Direct On Copper

### ❖ Superior Wire Bondability

- Our gold process is Electrolytic (and not Electroless) making it free from any impurities which are generally present in the Electroless process
- We use Pure Soft Gold (99.99% purity) (not hard gold) making it much superior for Gold Wire Bonding.
- Our gold plating capability includes providing a very controlling gold thickness for all types of copper densities & even for unbalanced copper.
- Controlling the gold over hang over copper to be less than 12 micron (Complying to the Space Grade requirements).
- Our Soft Gold meets the requirements of MIL-DTL-45204 and ASTM B 488, Type 3, Code A with a hardness range of 90 Knoop maximum.

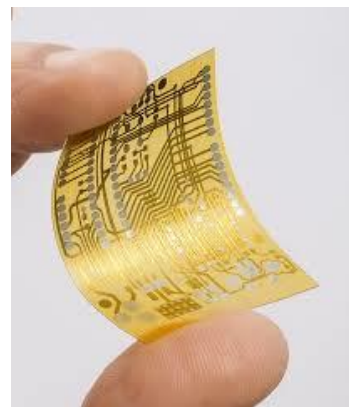




## Benefits Of Bondable Gold Direct On Copper

### ❖ Optimised Skin effect Performance Gold Plating

- Gold has excellent conductivity and when it is thick gold on copper without the nickel barrier it will avoid the nickel related signal losses resulting in a much superior signal performance.
- At higher frequency the skin effect comes into play & here the gold being thick enables adequate conductive layer thereby achieving perfect signal performance at higher frequencies.



# OUR RF Microwave CAPABILITIES

Base Material (With & Without Copper Backup)	Surface Finish (on all Base Materials)	Designs
ROGERS 5880, 5880LZ, 5870	<u>Special Finish</u> Electrolytic Bondable Gold Direct on Copper (1 $\mu\text{m}$ to 4 $\mu\text{m}$ ) ENEPIG	Edge Plating & Castellations
ROGERS 6002, 6006, 6010		Blind Vias
ROGERS 4003, 4350, 4835		Buried Vias
ROGERS 3003, 3010, 3035		Cavity Designs
TC350, AD350A		Metal backed PCBs
TMM10i, TMM4	<u>Conventional Finish</u> HASL, Lead-Free HAL, Immersion Silver, Immersion Tin, ENIG	Hybrid Multilayer & Teflon Multilayer
CoolSpan Teca		Positive Etch Back
NELCO ALL TYPES		Pre-bonded & Post bonded
TACONIC ALL TYPES		Control Depth milling & Back Drilling
PANASONIC ALL TYPES		Positive etch-back (3-point connection) Cavity constructions heavy copper Selective copper electroplating especially beneficial for filters.

# TOTAL CAPABILITIES

- 1 to 24 Layer Printed Circuit Boards Rigid, R/Flex, Backplanes, RF Microwave Frequency Board.
- Controlled Impedance BGA Blind/Buried Via PCBs.
- Line/Space-4mil/0.1mm, SMD Pads -10mil/0.25mm & Hole Size-8mil/0.20mm.
- Stringent intricacies covering tight SM dams, Aspect ratios of 12:1, Annular rings, Tight Isolations.
- Specials: via hole filling, edge plating, thick copper, press fit holes, heat sinks, buried resistors.



Production  
ability\_RF PCB Bo



Production  
ability\_Flex PCB Bo



Production  
ability\_Rigid PCB B



Production  
ability\_Rigid-Flex I

[For Technology Roadmap Click here](#)

## What's special about Fine-Line ?

### ❖ Via Integrity: Plasma and Sodium Treatment

- Further processing 5880 material with PTH not only requires Plasma activation but also Sodium treatment (this is strongly recommended by Rogers Corp.), as If sodium treatment is not done then the hole / via reliability is suspect and can fail in the field.
- We are the only company in India that does Sodium treatment for ensuring perfect hole quality resulting in perfect via integrity.

### ❖ Superior Electrical Performance exact to the design & dimensional compliance

- In RF microwave boards or boards using low loss substrates, the dimensional compliance to the requirements is AN ABSOLUTE MUST to achieve the best performance of your end application.
- Our quote includes routing the pcbs and retaining them with a small slug and supplying you in panels which saves effort, time and costs.

## What's special about Fine-Line ?

### ❖ RF Path Integrity:

- We take extreme care in building the boards and all our equipments and processes are geared up to build this without dents, scratches and voids.
- Due to our very trained and tight Quality Control ensure you get the pcbs with a fully compliant RF path and we will ensure full integrity of the RF path.

### ❖ Wide Capability Of Manufacturing:

- We can manufacture with reliability and consistency PCB designs with edge plating & with blind vias, buried vias and having cavity designs as per the specification from the customers.
- We are also Space qualified vendor for RF PCBs and maintain the line width to very tight tolerances, ensures that you get a RF Microwave pcbs with full integrity of the RF path ensuring performance to your application to its desired level.



## Our Manufacturing Best Practices

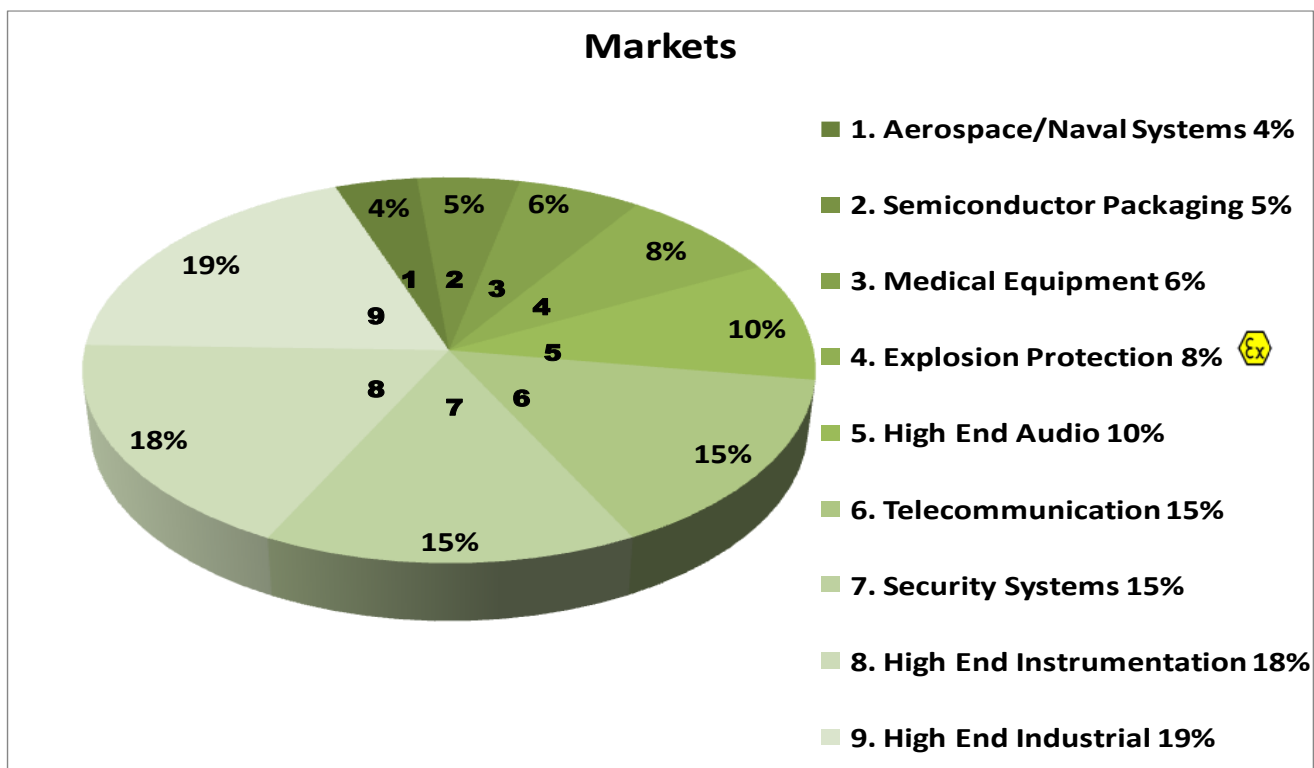
- All processes are in-house & no subcontracting of any process.
- All processes are compliant to Class III IPC Standards, AS/EN 9100 and TS16949.
- All employees are trained for “Intrinsic Safety” requirements of customers.
- No compromise in material sourcing (laminates from Rogers, Nelco, Panasonic, Nanya etc).
- Intense & Collaborative DFM process enabling smooth fabrication.
- No deviation done to design without customer’s written approval.
- Continuous technology upgradation with avg. equipment age < than 5 years.
- Continuous focus on “Flow” with Lean Manufacturing & 5S ( Sort, Set in Order, Shine, Standardize & Sustain) implementation.
- Continuous focus on Cycle Time Reduction.
- Continuous focus on Environment with high “Green” awareness & Zero Discharge.

# CERTIFICATIONS

- ISRO Certificate Number# (SAC/SRG/CERT/2016/02) & (SAC/SRG/CERT/2017/02).  
(Indian Space Research Org: Space Application Centre.)
- Medical ISO 13485:2012 + ISO 9001:2008  
URS/UKAS Certificate Number# 70330/A/0001/UK/En.
- TS 16949 & AS/EN 9100 & IPC Class III Compliant.
- UL # E146621 A
- A Lieferant Certifications / A-Supplier Certifications from many German & USA customers.

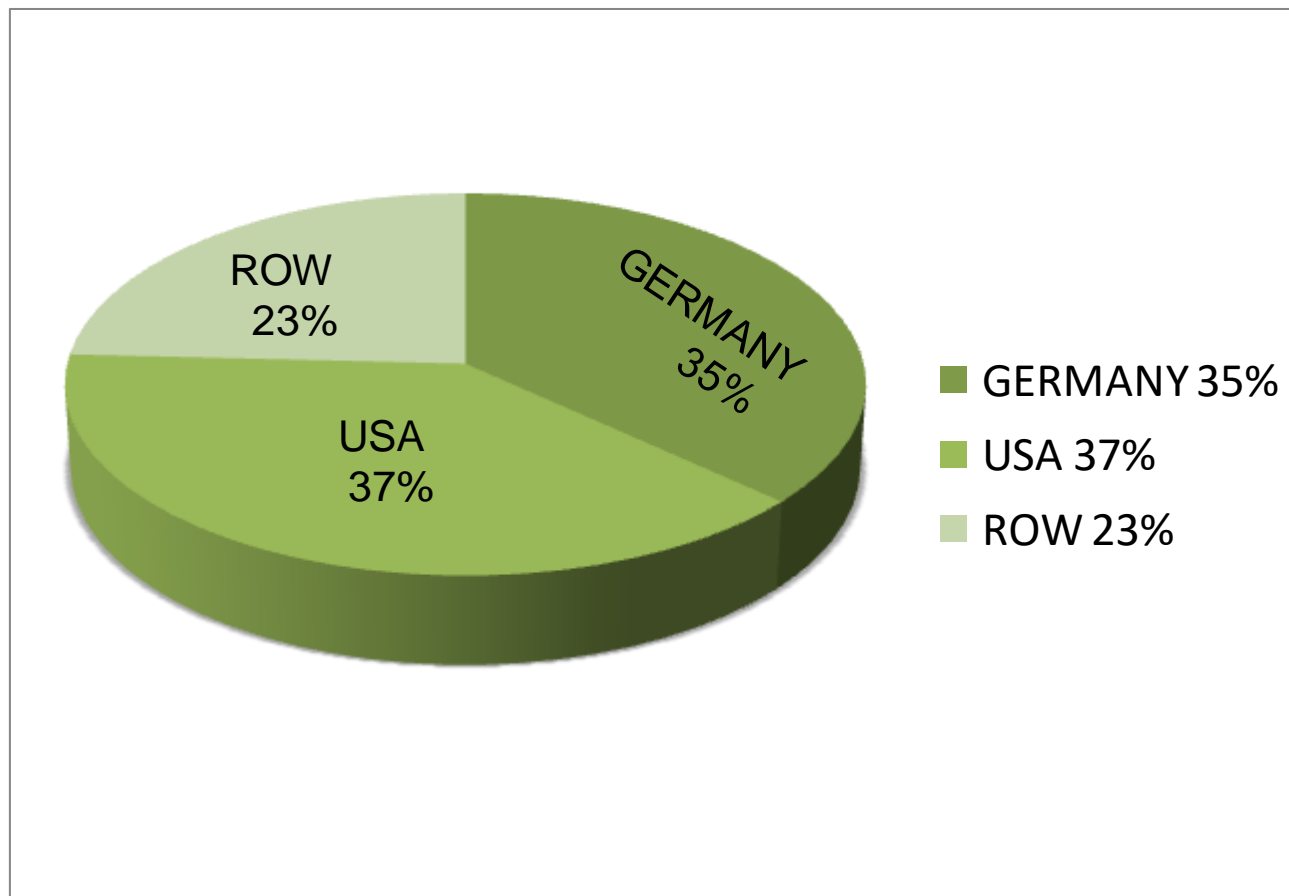
# OUR SERVICES & MARKET COVERAGE

- Production Volume of all types of 1 - 24 layers PCBs delivered in 10 - 20 days.
- Prototypes / Quick Turns docked at your door in 5-7 days



## OUR GLOBAL REACH..

100% Exports to USA, EU & FAR EAST



## OUR ESTEEMED CUSTOMERS



ERZIA

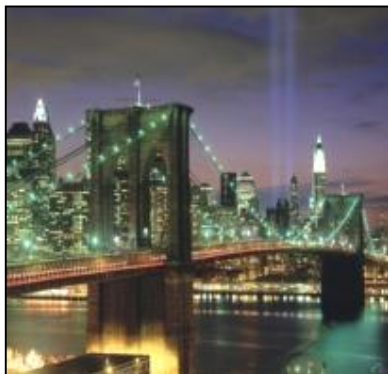


# OUR CONTACT

## HEADQUARTERS



## EU REPRESENTATION



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**THANK YOU**