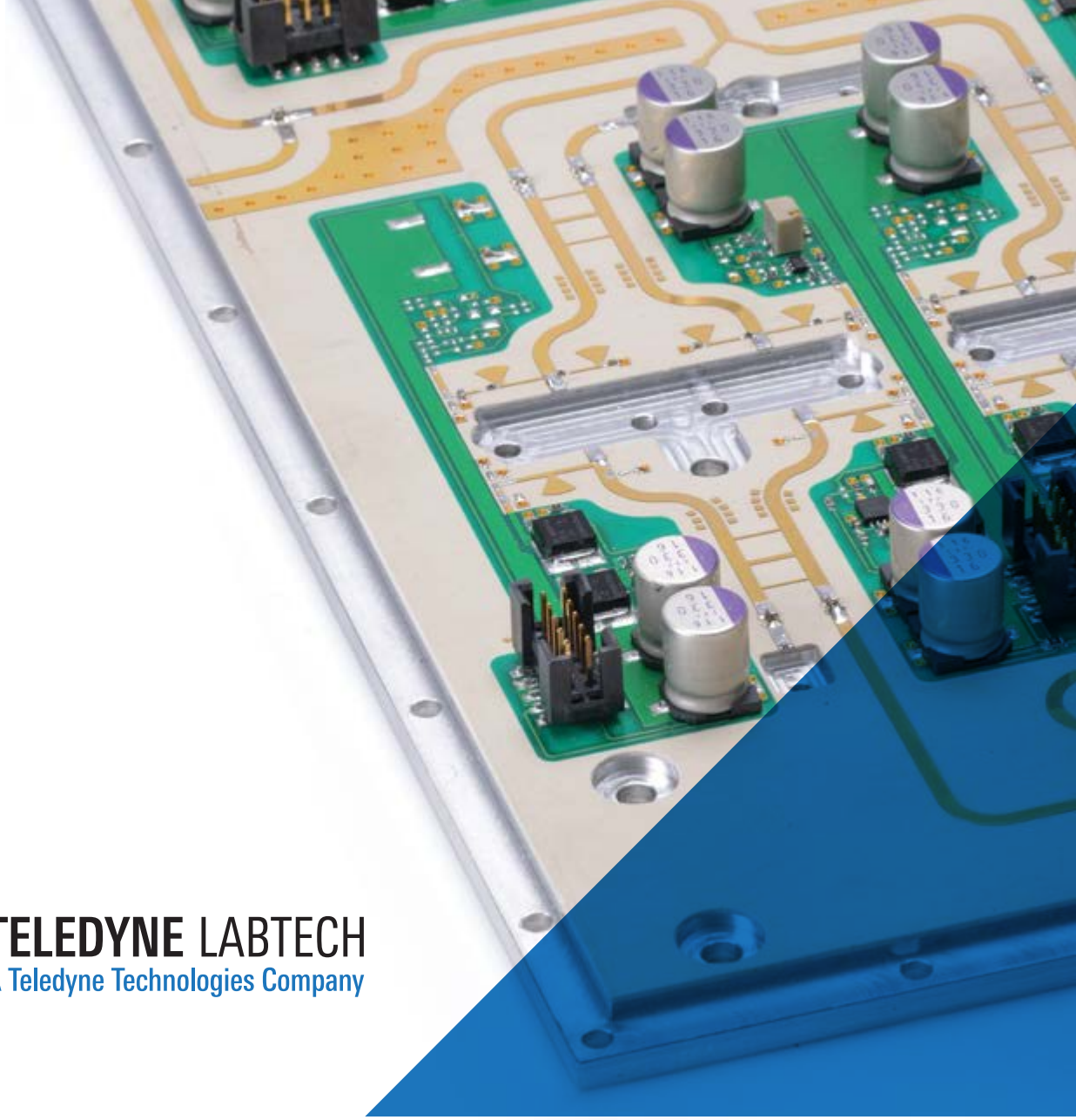
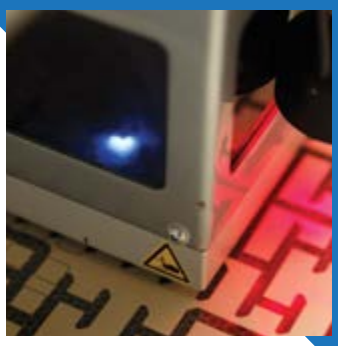


TELEDYNE LABTECH
A Teledyne Technologies Company

RF/Microwave PCB Manufacturing Capability

Offering RF & Microwave Value-Added Services for Demanding Applications



RF/Microwave PCB Manufacturing Capability

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Introduction

Teledyne Labtech is one of the world's leading manufacturers of complex, demanding RF/Microwave PCB printed circuit boards with an established pedigree, which spans more than 30 years. Providing specialist solutions for Military and challenging Commercial markets, Teledyne Labtech offers a wide range of complementary RF/Microwave PCB capabilities. Through comprehensive technical support, our ability to meet prototype-to-volume production requirements, along with state-of-the-art testing facilities, means we've set new standards in the development, manufacturing and testing of RF/Microwave PCB's for demanding and critical applications.

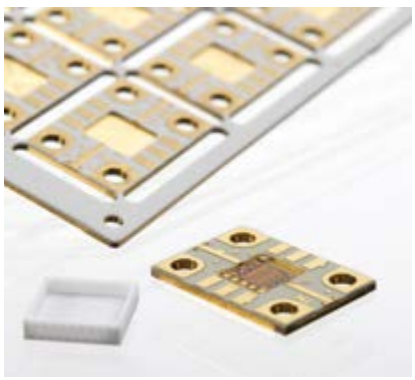
- Dedicated RF/Microwave PCB manufacturer
- Wire bondable surface finishes
- Embedded component capability
- Bonded Wave guide structures & components
- Large format capability
- Laser drilling, profiling and ablation to sub-layers
- Heavy metal machining capability
- Assembly and microwave testing to 40 GHz

Metal-backed RF/ Microwave PCB's

- Pre-bonded laminates
- Post bonding of finished RF/ Microwave PCB's to discrete carriers
- Conductive and non-conductive adhesives
- Plated thru hole capability to metal backing
- Aluminium, brass & copper
- Copper-invar-copper, copper moly copper and other exotic metal backings

Precision single sided and double sided RF/ Microwave PCB's

- Thin dielectrics
- MMIC Packages
- High tolerance capability



Multilayer RF/ Microwave PCB's

- PTFE, LCP and mixed Dielectric constructions including flexible substrates
- Blind, buried and sequential vias
- Metal core and metal backed structures
- Coins and copper filled vias for thermal management
- Ohmega Ply & Ticer Foil – planar resistor technology
- Embedded components
- Vacuum Press and Autoclave bonding capability
- Fusion bonding for PTFE and LCP substrates

Materials

Teledyne Labtech has extensive experience using the full range of RF/Microwave PCB materials. These materials can be combined with multi-functional epoxy or high temperature laminates to construct multi-layer structures. Teledyne Labtech has full capability to process metal backed laminates and where these are not available from the supplier can be constructed in-house.

Microwave materials used	Typical Dk's
• Random glass	2.33
• LCP	2.90
• Thermoset	3.50
• Woven glass & ceramic fillers	6.00
• PTFE with ceramic fillers	10.20

Data submittal
Email: labtechsales@teledyne.com
Note, Zip files will need to be posted onto Teledyne Liquid files

FTP: http://transfereast.teledyne.com

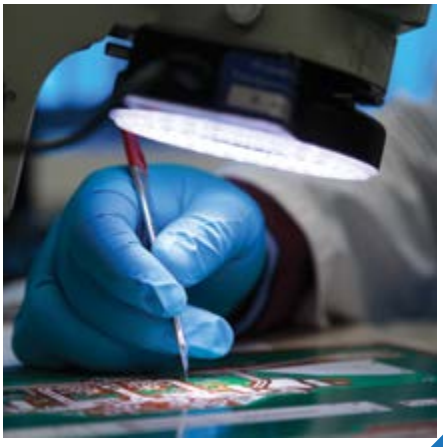
Data formats
RF/Microwave PCB design
- ODB++
- Extended Gerber (RS-274x)
- Autocad DWG/DXF

Mechanical design
- STP files
- Autocad DWG/DXF

Board Dimensions

Maximum standard panel	457mm x 610mm	18″ x 24″
Large format capability	100mm x 1800mm	4″ x 70″
Bonded Antenna structures	Up to 500mm x 1800mm	20″ x 70″
Minimum laminate thickness	0.025mm	0.001″
Maximum Board thickness	8mm	0.315″

Board thickness above 8mm can be manufactured although certain processes are not compatible with boards above this thickness.



Circuit Feature Capability

Imaging

Base foil thickness

	1/4oz 9 micron	1/2oz 18 micron	1oz 35 micron	2oz 70 micron
Minimum Track	50µm* 0.002″	75µm 0.003″	125µm 0.005″	150µm 0.006″
Minimum Gap	50µm* 0.002″	75µm 0.003″	125µm 0.005″	150µm 0.006″
Etch Tolerance Print & Etch	+/10µm 0.0004″	+/10µm 0.0004″	+/25µm 0.001″	+/40µm 0.0016″

* Print & etch only, minimum 65µm 0.0025″ for pattern plate process.

Values quoted are best possible without major yield impact. Wherever possible tolerances should be relaxed and minimum features should only be used where necessary, not globally.

Pad – drilled hole registration

Standard	+/−50µm	+/–0.002″
Technical	+/−25µm	+/–0.001″

Minimum designed annular ring to avoid drill breakout (Outer Layers)

Standard	100µm	0.004″
Technical	50µm	0.002″

Where required it is possible to plate hole barrels only to avoid pad build up on surface. This is not possible on holes below 0.30mm (0.012″) drilled diameter.

Image registration side-side

Standard	+/−45µm	+/–0.0018″
Technical	+/−25µm	+/–0.001″

PTFE laminates can stretch or shrink during the process cycle.

Laser Capability

Positional Accuracy		
Feature – feature	+/−25µm	+/–0.001″

Laser Via

Thru

Standard	200µm	0.008″
Technical	50µm	0.002″

Blind

Standard	200µm	0.008″
Technical	100µm	0.004″

Maximum 1:1 aspect ratio on blind hole processing.

Hole – Hole Spacing		
Minimum	0.05mm	0.002″

Profiling		
Internal radii	10µm	0.0004″
Dimensional Tolerance	+/−25µm	+/–0.001″
Alignment to circuit image	+/−25µm	+/–0.001″

Ablation

Dimensional Tolerance

X & Y axis	+/−25µm	+/–0.001″
Z axis	+/−10µm	+/–0.001″

Laser ablation can be controlled to ablate material and thus expose buried circuit features, the minimum base copper on these should be 18 micron 1/2oz.

Mechanical Drilling

Maximum Aspect ratio

(Board Thickness : Hole Diameter)

Standard	10:1
Technical	11:1
Metal Backed	10:1
Blind Holes	1:1

Aspect ratios in excess of the above could cause plating deposition issues. Note, limitations on drill sizes may impact the above ratios

Minimum drill diameter

Softboard & Multilayer

Standard	0.20mm	0.008″
Technical	0.10mm	0.004″

Metal backed

Standard	0.50mm	0.002″
Technical	0.30mm	0.012″

Hole – Hole Spacing		
Minimum	0.20mm	0.008″

Z axis control		
Standard	+/–0.50mm	+/–0.002″
Technical	+/–0.025mm	+/–0.001″

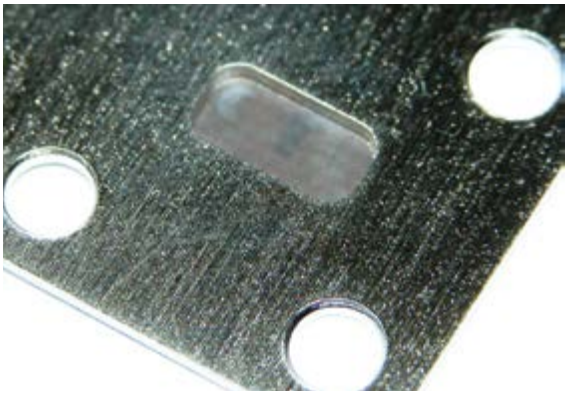
Hole size Tolerance

Plated

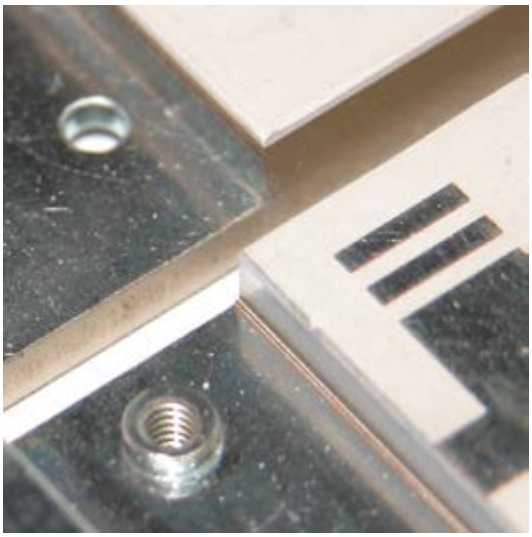
Standard	+/–0.10mm	+/- 0.004″
Technical	+/–0.05mm	+/- 0.002″

Non-plated

Standard	+/–0.05mm	+/- 0.002″
Technical	+/–0.02mm	+/- 0.0008″



Mechanical Machining



Profile feature tolerance

Standard	+/–0.050mm	+/–0.002″
Technical	+/–0.030mm	+/–0.0012″

Minimum Internal radii

Metal Backed

Standard	1.000mm	0.040″
Technical	0.500mm	0.020″

Soft-board/Multilayer

Standard	0.500mm	0.020″
Technical	0.200mm	0.008″

Where required by the use of tool overshoot in corners a pocket without radii in corners can be achieved. Note, minimum radii will be dependent upon material thickness

Alignment to circuit image

Standard	+/–0.50mm	+/–0.002″
Technical	+/–0.25mm	+/–0.001″

“Z” axis depth control

Standard	+/–0.05mm	+/–0.002″
Technical	+/–0.25mm	+/–0.001″

Critical waveguide features designed on thin dielectrics can be formed using a combination of mechanical and chemical processing techniques.

Solder Mask etc.

Solder mask

Type:	Peters SD2467SG DG
Thickness:	20 – 70µm/0.0008″ – 0.0028″
Colour:	Green (Red or blue also available)
Hardness:	6 H

Circuit feature – mask clearance on design

Standard	0.100mm	0.004″
Technical	0.075mm	0.003″

Minimum solder mask web (Isolation)

Standard	0.150mm	0.006″
Technical	0.100mm	0.004″

Solder resist dams (Line thickness)

Standard	0.200mm	0.008″
Technical	0.100mm	0.004″

Due to the nature of some PTFE laminates it is not possible to achieve fine solder-mask features when positioned over bare laminate.

Notation

Type:	Peters SD2513UV
Thickness:	10 – 20µm/0.0004″ – 0.0008″
Colour:	White, yellow & black (Others also available)
Hardness:	4 H

Minimum character size

Standard	1.500mm	0.060″
Technical	1.000mm	0.040″

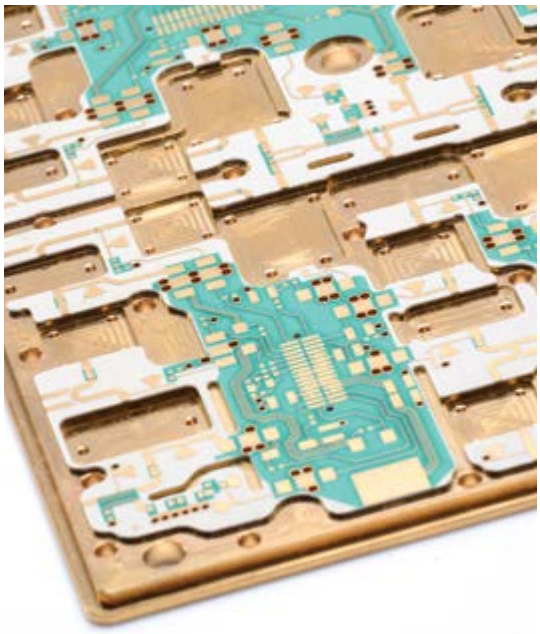
Minimum line thickness

Standard	0.254mm	0.010″
Technical	0.150mm	0.006″

Peelable solder masks (Temporary)

Type:	Elektra EM55
Minimum thickness:	0.200mm 0.008″
Colour:	Green/Red

Type:	Peters DD 2954
Minimum thickness:	0.300mm 0.012″
Colour:	Blue



Surface Finishes

Profile feature tolerance

Tin/Lead (60/40 ratio) (As plated or brushed)	Min thickness 2.00um
Bright acid Tin	Min thickness 2.00µm
Tin (as plated or brushed)	Min thickness 2.00µm
Immersion Tin	0.10µm
Electroless Tin	0.50 – 1.5 µm
Electroless Nickel/Immersion Gold	Ni 3.50 – 8.00µm Au 0.05 – 0.15µm
Electroless Nickel/Immersion Gold (Higher build Gold for wire bonding)	Ni 3.50 – 8.00µm Au 0.10 – 0.20µm
Electroless Nickel/Palladium/Gold (Universal plating for wire bonding)	Ni 3.50 – 8.00µm Pd 0.20 – 0.50µm Au 0.05 – 0.15µm
Electrolytic pure soft Gold plating (Suitable for wire bonding)	Au 0.50 – 5.00µm
Optional Nickel under-layer	Ni 1.00 – 10.00µm

Alternative finishes are available through our network of fully approved sub-contractors.

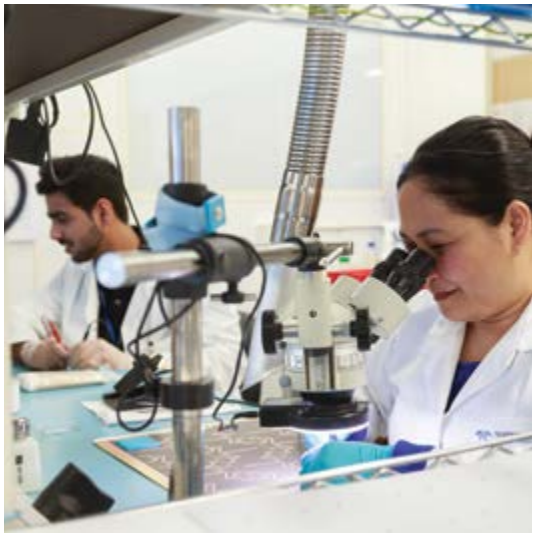
Planar resistor technology

Ohmega-Ply clad laminates or foils

Ticer Foil

25, 50 & 100 ohm/square material

10% capability tolerance



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