SGCircuits
PCB Group
for excellent customer solutions

Sunshine Global Circuits

Optical Module

Stock Code:300739

SGCircuits PCB Group
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CONTENT

Contents

Introduction

Frontier
Sales & Tech Support

Texas, USA
Chemnitz, Germany

Factory
Quick turn & Prototypes

Remscheid, Germany
Penang, Malaysia
Shenzhen, China

Factory
Mass Production & Automation

Jiujiang, China
Zhuhai, China (in progress)
Penang, Malaysia (in progress)

HSD | ATE | HDI | Heavy Copper

Automotive | Metal Core | Rigid-Flex | RF-Microwave

150w+ square meters
Annual Capacity

85% exported
International Market

2025	Establishment of business divisions for AI servers, PCB stator and PCB embedding
2024	Acquisition of Penang Bertam property for capacity expansion
2023	Capacity expansion of RF-microwave, heavy copper, and ATE product lines
2021	Expansion of global capacity and establishment of Advanced Technology Center
2019	Digital and intelligent transformation Expansion of rigid-flex PCB product line capacity
2018	IPO launch on the Shenzhen Stock Exchange
2015	Jiujiang awarded National High-Tech Enterprise title
2014	Jiujiang production launch
2013	Establishment of German sales subsidiary and acquisition of Germany factory
2011	Establishment of US sales office
2004	Accredited ISO/TS16949、ISO14001、ISO-9001 certification
2001	Founding of Sunshine Global Circuits

Customers

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EMS

flex, JABIL, PLEXUS, GPV, BMK, NEOTech, SIGMATRON INTERNATIONAL, VENTURE, zollner, creation TECHNOLOGIES, EmeraldEMS

Industrial Control

DAKTRONICS, MOTOROLA SOLUTIONS, Lenze, ABB, IPG PHOTONICS, Basler, Johnson Controls, Grayhill, Miller, BANNER, GENERAC, ELEMENT ENERGY

Medical

BECKMAN COULTER, Boston Scientific, ThermoFisher SCIENTIFIC, SIEMENS Healthcare, Dräger, stryker, BD

Power & Energy

GAÏA CONVERTER, EATON, lunar energy, Advanced Energy, LEACH INTERNATIONAL CORP, ANORD MARDIX, BCT 北京迪赛奇正科技有限公司, 爱科赛博 ACTIONPOWER

Telecom & Data Center

QUALCOMM, 中际旭创 ZHONGJI INNOLIGHT, ARRIS, FiberHome, Clear-Com AN HME COMPANY, Grass Valley WE LOVE LIVE, STARRY, COMTECH EF DATA

Transportation

HL Mando, ALSTOM, Faiveley TRANSPORT, CAT, NIO, JOHN DEERE, EBW Electronics, HANON SYSTEMS

Others

Infinitum, FLUKE, Genetec, AMX HARMAN, Meyer Sound, CRESTRON, qorvo, Extron, NXP, SoundOff Signal, PRODRIVE TECHNOLOGIES

Certifications

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ISO9001:2015 (Manufacturing)	IATF16949:2016 (Automotive)	ISO13485:2016 (Medical)	ISO45001:2018 (Healthy & safety)	ISO 14001:2015 ((Environment)	ISO 14067:2013 (Carbon Footprint)	QC080000:2017 (Hazardous Substance)	ISO27001:2022 (Information Safety)	AS9100D:2016 (Aerospace)	ISO50001:2018 (Energy)

Shenzhen

Reach RoHS UL CQC

Jiujiang

02

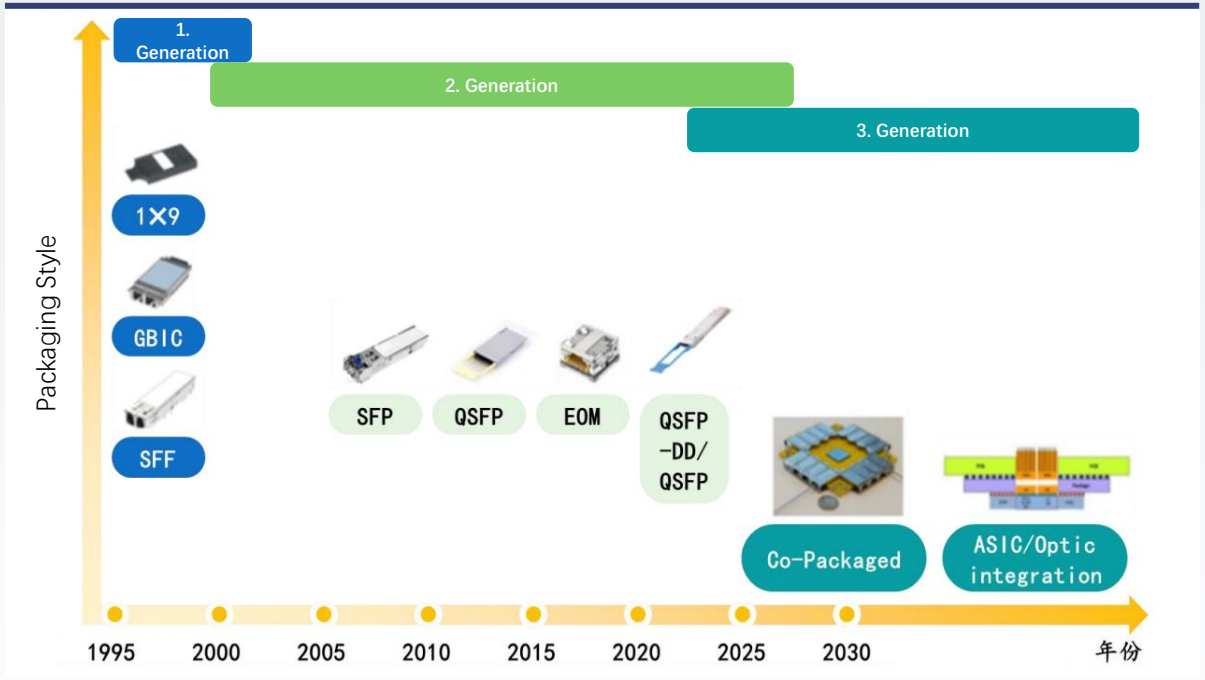
PCB Solutions

Leading with Innovation-Driven Expertise

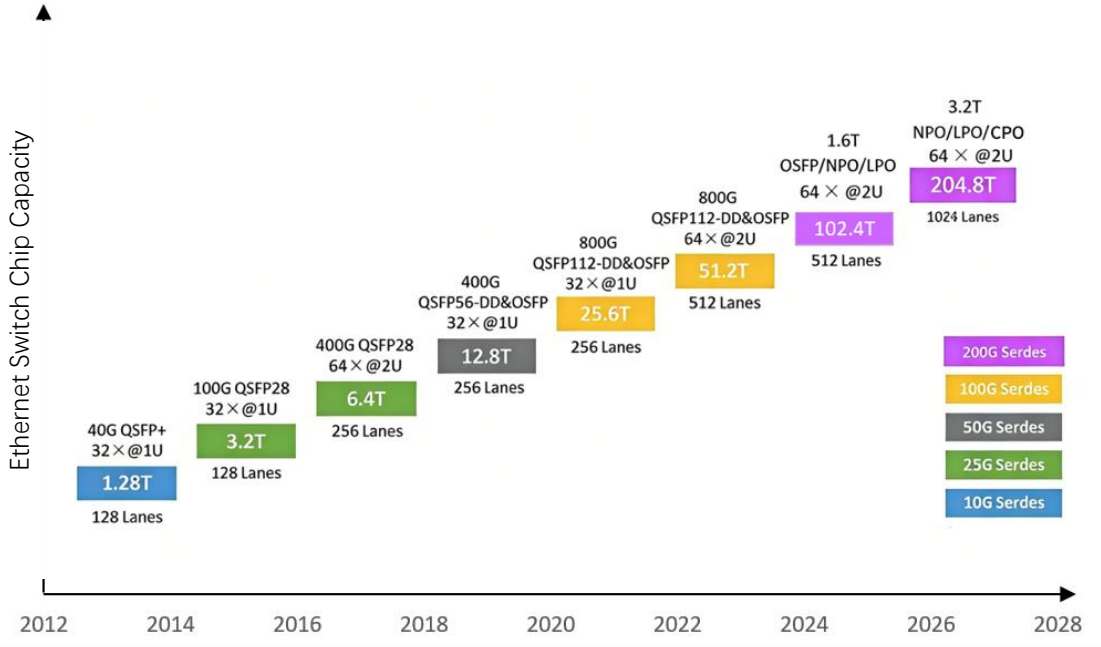
SGC leverages its technological expertise and industry experience to deliver advanced, professional solutions for diverse sectors.

1. Development of Optical Module Technology

Optical Module Technology Roadmap



Optical Module Rate Iteration Trend Chart



MSA (Multi-Source Agreement) Protocols: Always Evolving

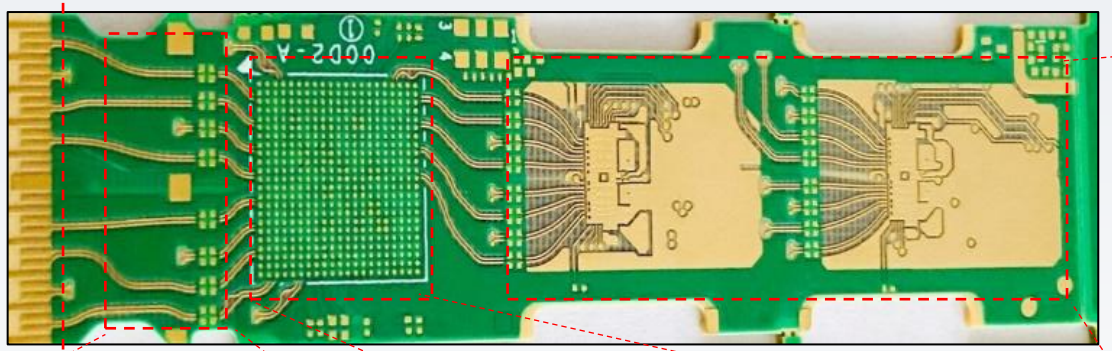
Driven by demand for higher speeds, MSA packaging protocols for traditional optical modules continuously evolve toward **higher data rates, greater density, lower power consumption**, and **longer transmission** distances.

CPO: High Promise, Early Stage

At 1.6T/3.2T+ speeds, Co-Packaged Optics (CPO) integrates the optical engine next to the switch chip — saving power and space for large-scale AI data centers. However, technical complexity, maintainability, and yield challenges mean CPO remains in early R&D.

Optical Module Technology Requirements

- Enables signal conversion and transmission between optical chips and electrical chips.
- Provides electrical connection interface between the optical module and network devices.



MSA Protocol

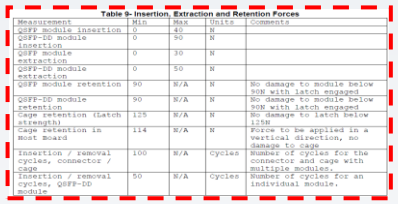


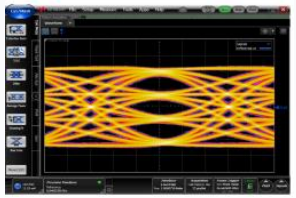
Table 9- Insertion, Extraction and Retention Forces

Measurement	Min	Max	Units	Comments
QSFP module insertion	0	40	N	
QSFP-DD module insertion	0	90	N	
QSFP module extraction	0	30	N	
QSFP-DD module extraction	0	50	N	
QSFP module retention	90	N/A	N	No damage to module below 90N with latch engaged
QSFP-DD module retention	90	N/A	N	No damage to module below 90N with latch engaged
Cage retention (Latch strength)	125	N/A	N	No damage to latch below 125N
Cage retention in host board	114	N/A	N	Force to be applied in a vertical direction, no damage to cage
Insertion / removal cycles, connector / cage	100	N/A	Cycles	Number of cycles for the connector and cage with multiple modules.
Insertion / removal cycles, QSFP-DD module	50	N/A	Cycles	Number of cycles for an individual module.

Pluggability Dimension

1. Strict appearance requirements
2. Full-board thick palladium ENEPIG and gold finger
3. Tight tolerance requirements (Gold fingers & board thickness)

PAM4 & QAM Modulation



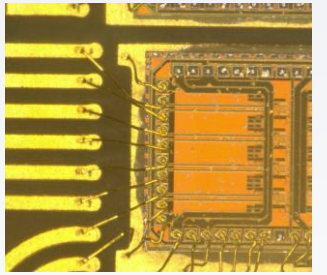
Low Transmission Loss

1. Single Channel 56-112G
2. M6/M7/M8 material
3. Very low loss

High Density Good Solderability

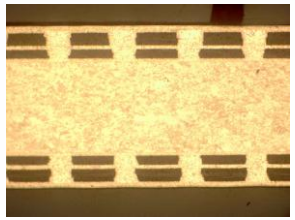
1. Very high density
2. As low as 30/30um Impedance Line
3. Anylayer & MSAP

Bare chip bonding



Bonding Reliability Chip Heat Dissipation

1. Embedded copper coin
2. Copper filling
3. 2.5/2.5mil Wire bonding



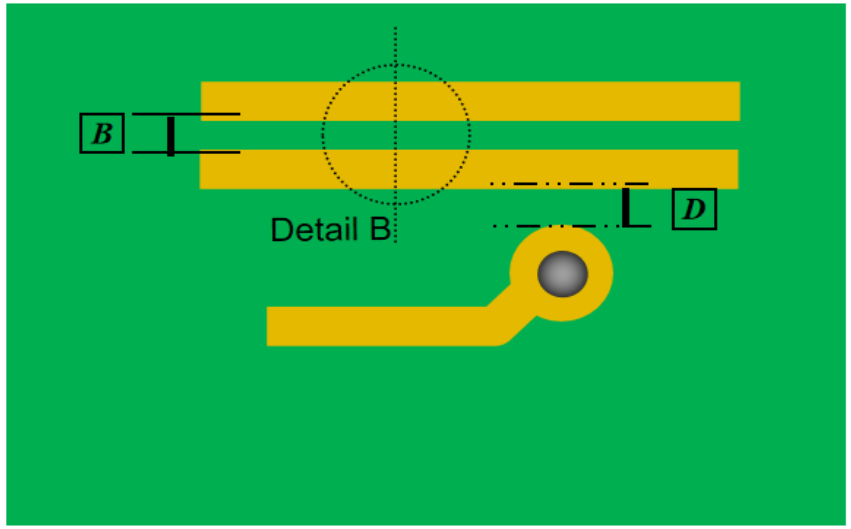
2. Optical Module Technology Requirements

Optical Module PCB Technology Roadmap						SGC Capability	
Transmission rate	≤100G	200G	400G	800G	1.6T	Tenting	mSAP
Trace W/S	4/4mil (100/100μm)	4/4mil (100/100μm)	3/3mil (75/75μm)	⩽2/2mil (50/50μm)	⩽1.5/1.5mil (40/40μm)	35/35μm	25/25μm
Bonding pad W/S	4/4mil (100/100μm)	4/4mil (100/100μm)	3/3mil (75/75μm)	2.5/2.5mil (60/60μm)	2/1.2mil (50/30μm)	60/60μm	50/30μm
BGA Pitch	0.5mm	0.5mm	0.4mm	⩽0.35mm	⩽0.3mm	0.4mm	0.15mm
Impedance tolerance	±10%	±10%	⩽10%	⩽8%	⩽7%	±8%	±5%
Laser size	⩾100μm	⩾100μm	100μm	75μm	50μm	⩾50μm	
Outline tolerance	±0.1mm	±0.1mm	±0.075mm	±0.05mm	±0.05mm	±0.05mm	
Gold finger to edge tolerance	±0.08mm	±0.075mm	±0.05mm	±0.05mm	±0.05mm	±0.05mm	
Layer	8-10L	10L	10-12L	10-14L	12-16L	2-16L	
Stack-up	2+N+2 Standard & BV	2+N+2 Standard & BV	Anylayer /3+N+3	Anylayer/ 3+N+3	Anylayer /4+N+4	Anylayer	
Materials	Low loss (M4) +FR4	Very low loss (M6)	Very low loss (M6)	Ultra low loss (M7)	Extremely low loss (M8)	Extremely low loss (M8)	
Surface treatment	ENEPIG/EPIG Gold Finger	ENEPIG/EPIG Gold Finger	ENEPIG/EPIG Gold Finger	ENEPIG/EPIG Gold Finger	ENEPIG/EPIG Gold Finger	ENEPIG/EPIG Gold Finger	

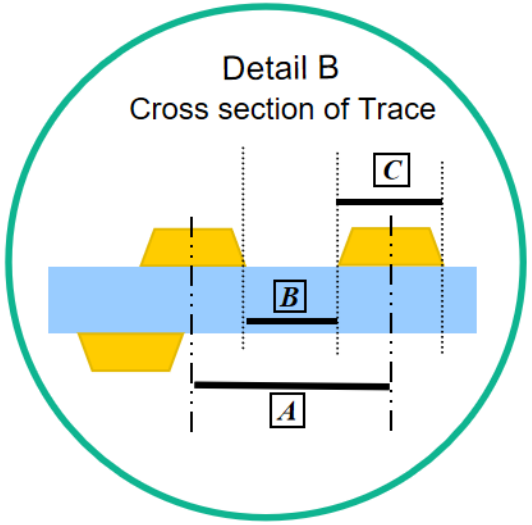
With the development of optical modules, higher requirements are placed on signal transmission and conduction design. Therefore, in order to adapt to the current changes, our company has configured a higher product line capability mSAP.

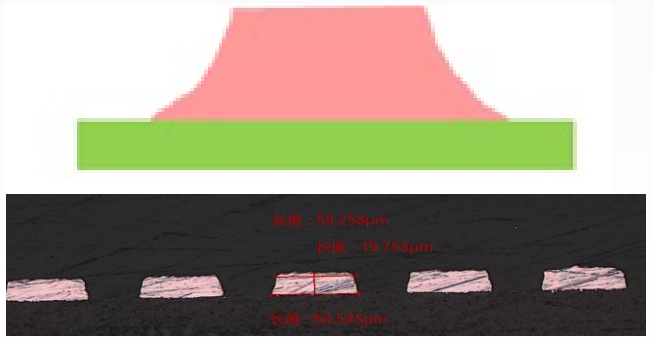
Optical Module Pattern Capability

➢ Circuitry Design

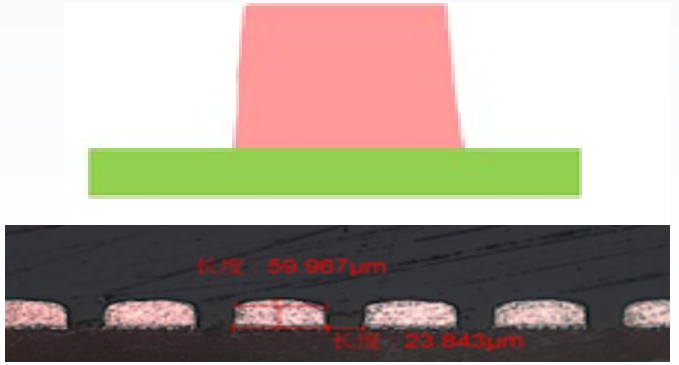


Craftsmanship	Tenting	MSAP
Finished copper thickness	18um(min)	18um(min)
Minimum pitch A	70	50
Minimum line spacing (Design) B	35	25
Minimum line width (bottom) C	35	25
Minimum ring to conductor D	30	25





Tenting



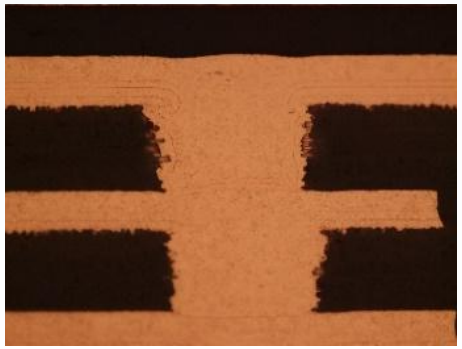
MSAP

Main Equipment Optical Module Equipment

➢ Mitsubishi Laser Drillier - GTW6P

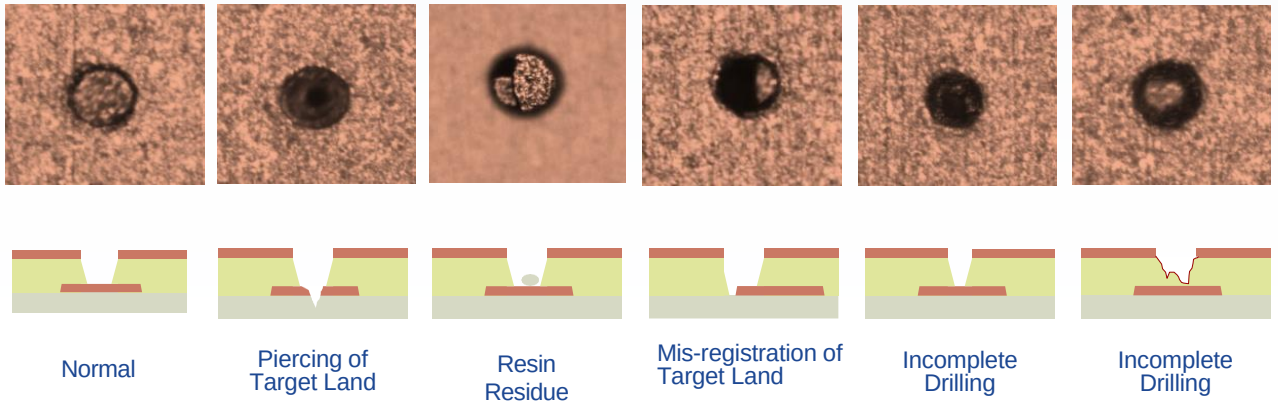
Mitsubishi - GTW6P

- Direct Copper Drilling with CO_2 Laser
- Laser pre-treatment: Brown Oxide
- Hole size: 50 - 100um



- Min laser drill: 50um

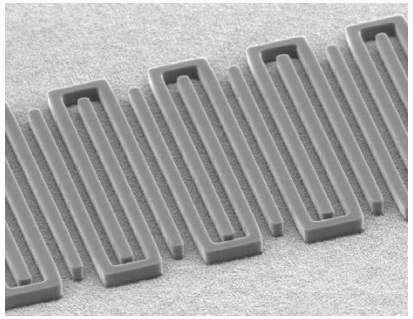
KLA Orbotech Ultra Dimension 700



Main Equipment of Optical Module

➢ KLA LDI Line Exposure Machine

KLA Nuvogo Fine 10 LDI system



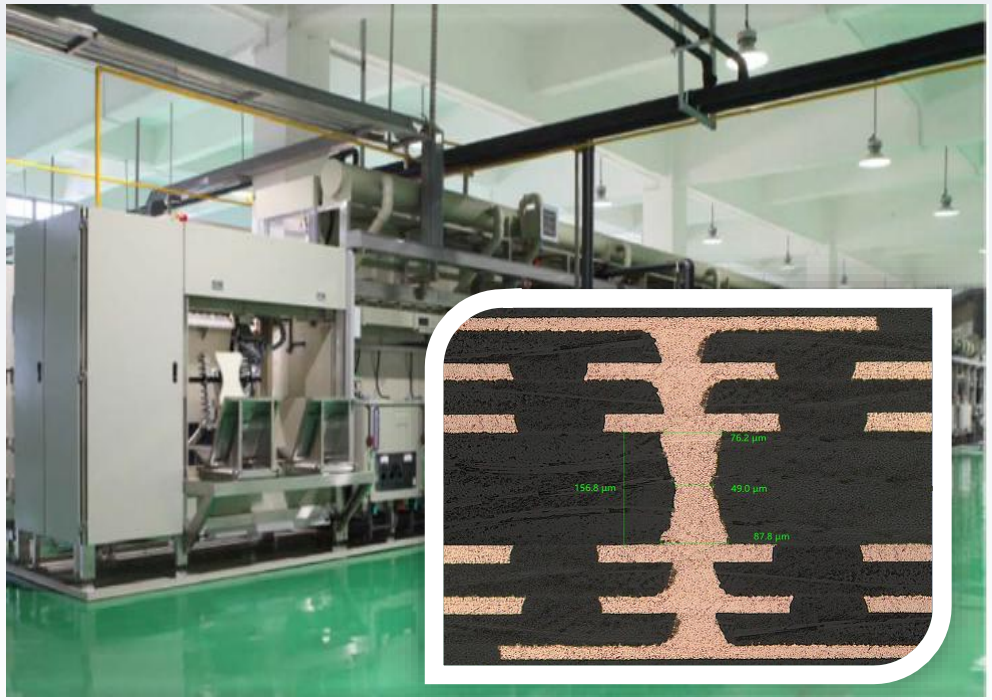
- Intelligent Expansion and Contraction Alignment Accuracy: ±15μm
- Exposure Resolution: Line Width/Space 10/15um

➢ Vertical Developing Line

- Development Capability Line Width/Spacing: 10/10μm
- Fully automatic non-contact vertical development
- Developing uniformity (COV) ≤ 3%.

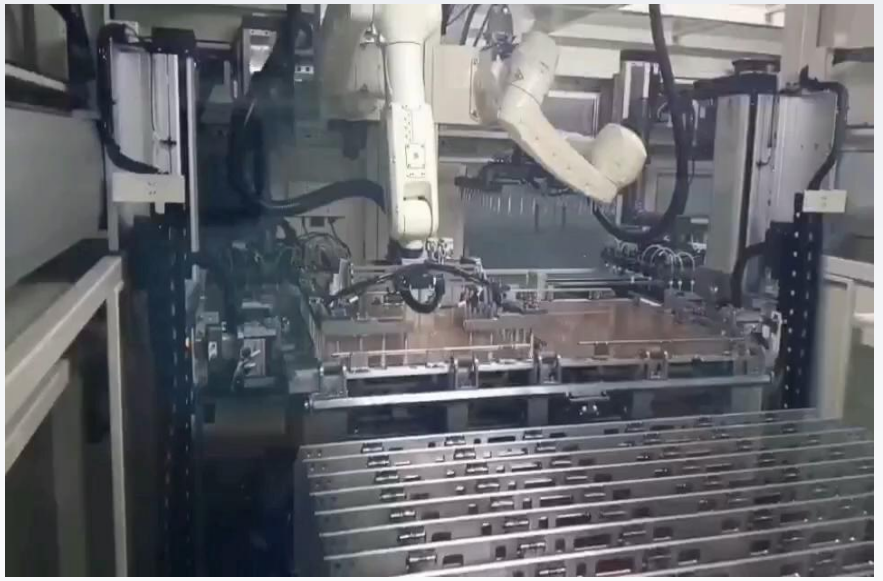
Main Equipment of Optical Module

➢ Vertical Micro-via Filling Line



- Double-sided and Top and Bottom Conductive Hanger
- Copper Plating Uniformity: ±2um (Copper Plating 25um)
- Filling Hole Depression/Protrusion: <10um/5um

➢ Automatic vertical plasma

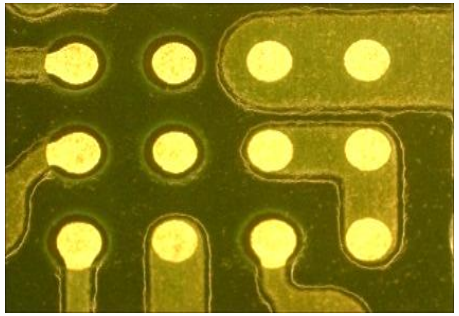


Fully automatic non-contact vertical plasma for board handling：

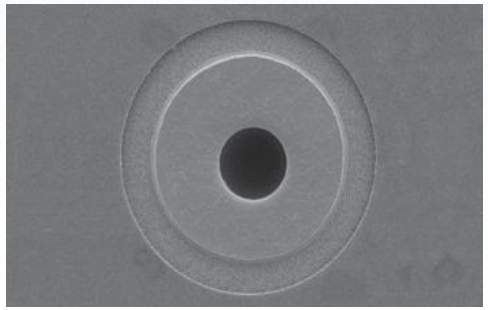
- Dry Desmear
- Laser Hole Bottom Cleaning
- Removal of Dry Film Residual between Fine Lines
- Surface Modification—Increasing Surface Tension, Enhancing Adhesion, Pre-treatment before Lamination
- Improve the Consistency of Solder Mask Color

Main Equipment of Optical Module

➢ Solder Mask DI Exposure Machine

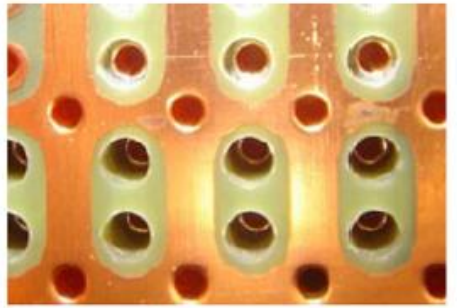


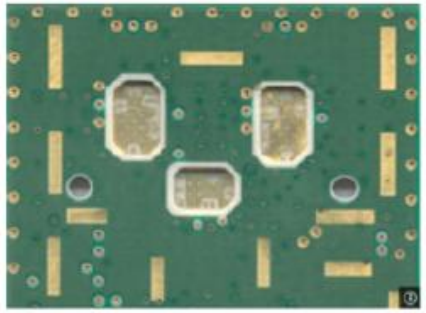
SMD PAD 60μm



Solder mask alignment tolerance ±15um

➢ Schmoll Drilling-Routing System





- CCD Accuracy ≤25um, Revolution 250krpm
- CCD Depth Controlled Drilling/Routing, Profiling, Back-drill

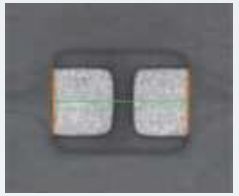
Main Equipment of Optical Module

➢ ATG A9 Plus Flying Probe Tester

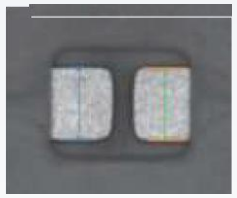
- Pad/Pitch: 25μm/ 50μm
- Testing Accuracy: ±3μm
- Continuity Test Resistance: 1Ω to 10KΩ
- Insulation Test Resistance: 5MΩ to 25MΩ (Field Method) / 5MΩ to 100GΩ (Ohmic Method)
- Test Voltage: 100mV to 1000V

➢ FAVI

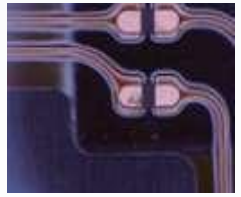
- Automatic Appearance Inspection
- Automatic Measurement of Outline Dimensions
- Measurement of All LED Pads
- Testing Accuracy: (3 + L(mm)/200) μm



PAD Position Measurement



PAD Size Measurement



Cosmetic Inspection

Main Equipment of Optical Module

➢ High-Speed Signal Integrity - SI Testing

Coverage test items:

- DK/DF test
- Impedance test
- Insertion loss test

Keysight
PNA-N5224B（43.5GHZ）

SPDR

SPDR：DK/DF Test equipment
Frequency：10G、15G

Delta L 3.0 measurement probe
Frequency : 20GHZ

Delta L 4.0 measurement probe
Frequency : 30+GHZ

Main Testing equipment for Optical Modules

➢ Thermal Analysis Techniques

- Measuring the properties of samples as they change with temperature or time under programmed temperature control.
- Used in the qualitative and quantitative characterization of the thermal, physical, mechanical properties and stability of materials.

Thermal Conductivity Meter

Thermal Gravimetric Analysis (TGA)

- Material Tg & Degree of Curing (DMA, TMA)
- CTE, Modulus of Material
- Rate of Moisture Absorption
- Decomposition Temperature
- Thermal Conductivity Coefficient

Dynamic Mechanical Analysis (DMA)

Thermal Mechanical Analysis (TMA)

Main Testing equipment for Optical Modules

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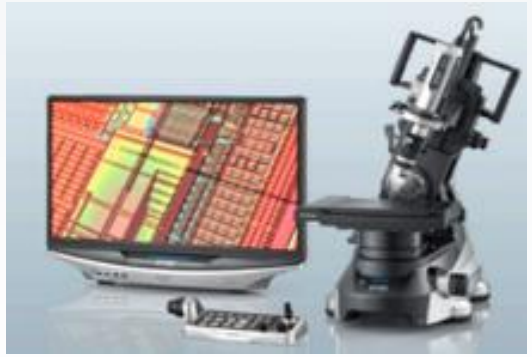
➢ Failure Analysis Techniques

SEM & EDS
- Ultra - high resolution
- Capable of observing secondary electron images and reflected electron images of the surface morphology of various solid samples
- Can simultaneously conduct qualitative, semi - quantitative, and quantitative analyses of elements at micro - area points, lines, and surfaces on the sample.
- Comprehensive analysis ability of morphology and chemical composition.
- Magnification: From 10 to 500,000 times

Thermal Emission Microscopy System
Locate the weak infrared energy emission caused by faults (short circuits and leakage currents)

White Light Interferometry
- Analyzes the interference fringes formed after light is reflected from two different surfaces.
- Nanometer - level high - precision surface profile measurement.

Scanning Acoustic Microscope
- Detect the internal areas and internal projections of an object
- Generate high resolution characteristic images.
- Non-destructive testing



Keyence Microscope
- Observation, photography and measurement.
- Subtle bumps and depressions are clearly presented
- Images are comparable to those of SEM.

Main Testing equipment for Optical Modules

➢ Accelerate Reliability Testing

- Strengthening the test conditions and ensuring failure mechanism remains unchanged, the tested products are made to fail at an accelerated rate.
- Acquisition of necessary information in a short period of time
- Evaluate the reliability or life index of the products under normal conditions.

- Temperature cycling and real-time resistance change monitoring
- CAF
- Highly Accelerated Aging Test
- IST
- Acidic Salt Spray, Neutral Salt Spray

Highly Accelerated Stress Test (HAST)

Thermal Shock Test Chamber

Constant Temperature and Humidity Test Chamber & Low Resistance System

Salt Spray Tester

Interconnect Stress Test (IST)

Product Showcase

➢ Optical Module -100G

Design Characteristic:

Layer count: 8L

Material: FR-408HR

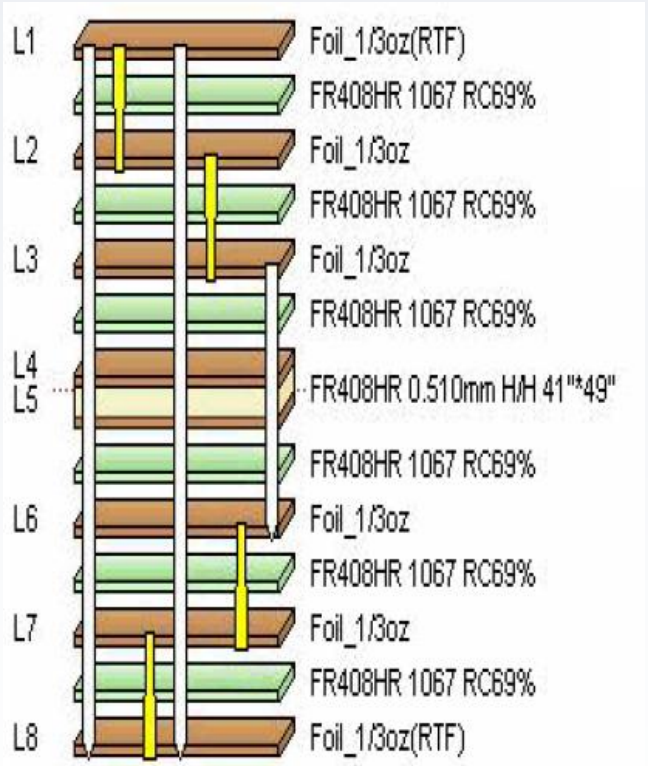
Board thickness: 1.0 mm

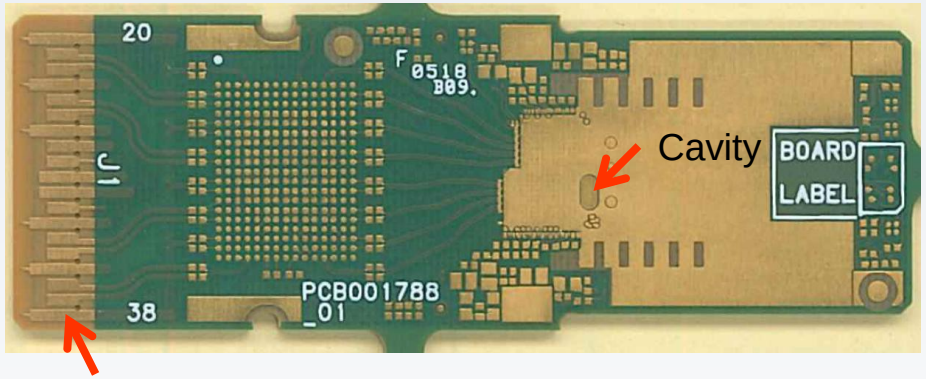
Line width/spacing: 100/100 μm

Minimum blind via: 0.1 mm

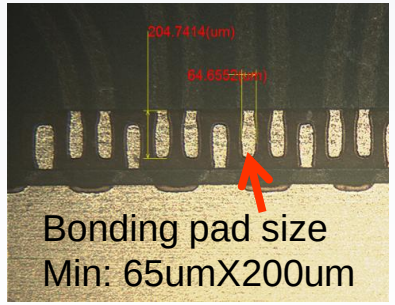
Special processes: POFV, Cavity groove

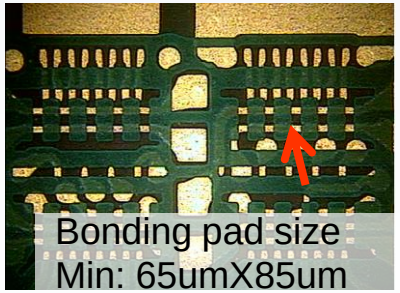
Surface treatment: Nickel-palladium-gold





Stepped Gold Finger





Product Showcase

➢ Optical Module – 400G

Design Characteristic:

Layer count: 12L

Material: TU-883-SP

Board thickness: 1.0 mm

Line width/spacing: 75/75 μm

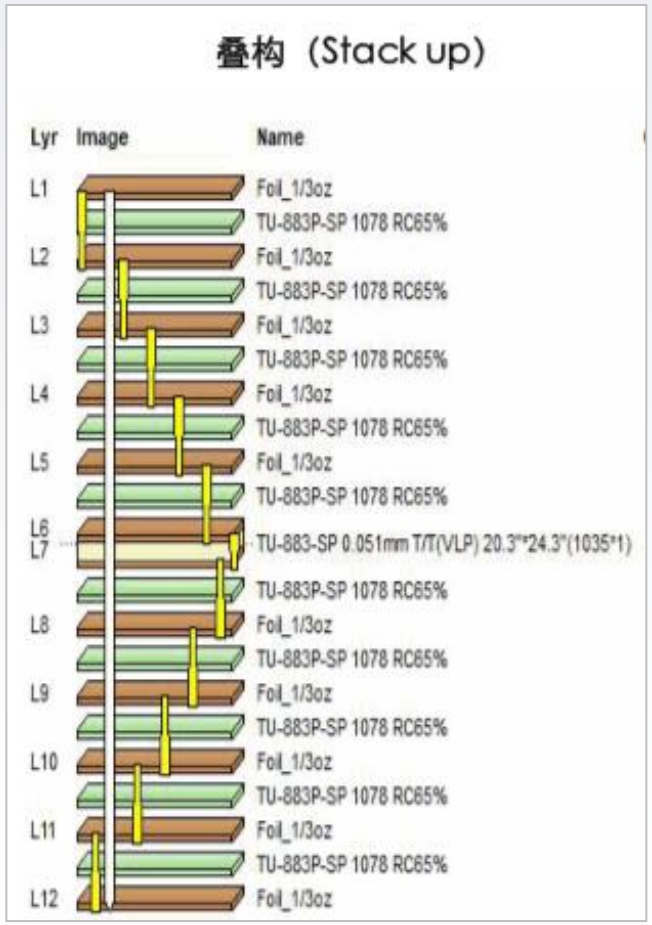
Bonding pad: 76/76 μm

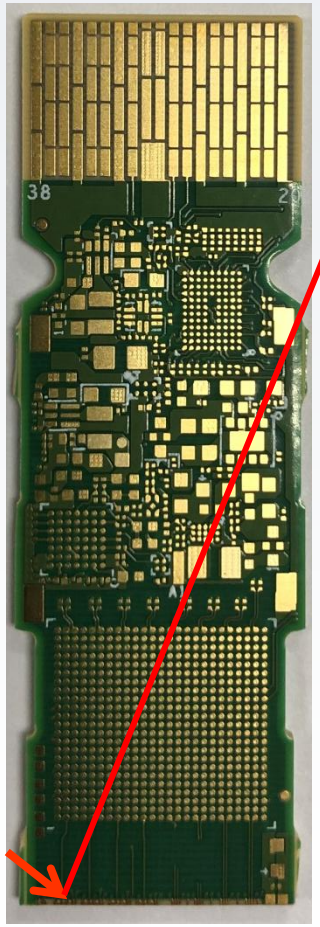
Pattern to edge tolerance: +/-1.5 mil

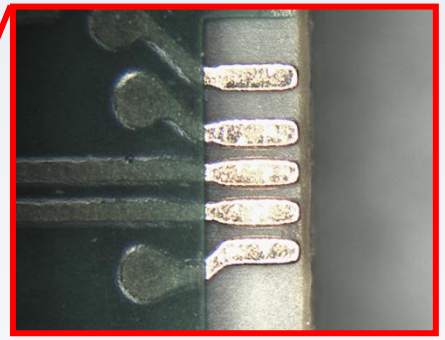
Minimum blind via: 0.1 mm

Special process: Segmented gold fingers

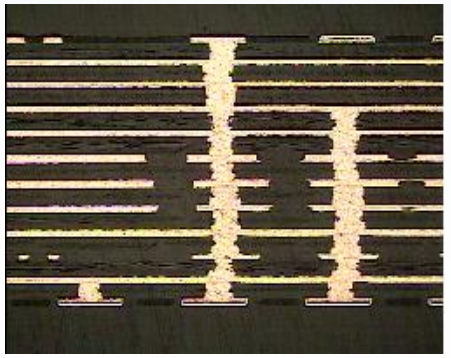
Surface treatment: Nickel-palladium-gold







Bonding Pad and Outline Tolerance: +/-1.5mil

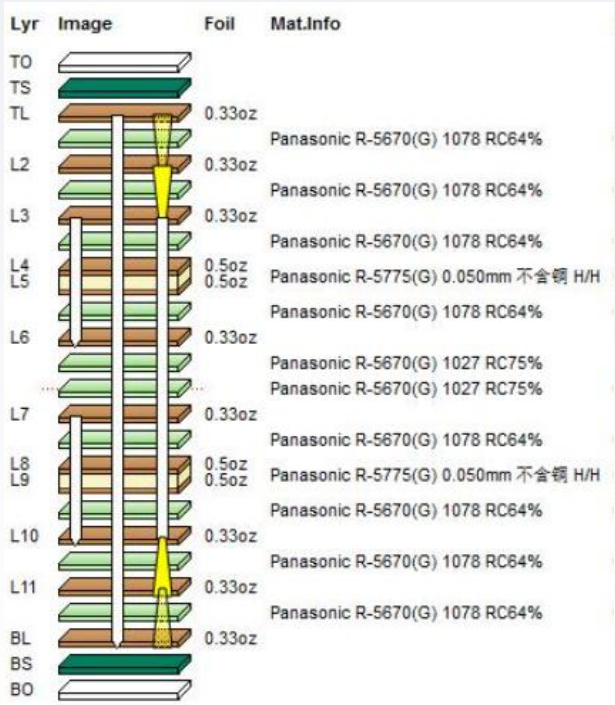


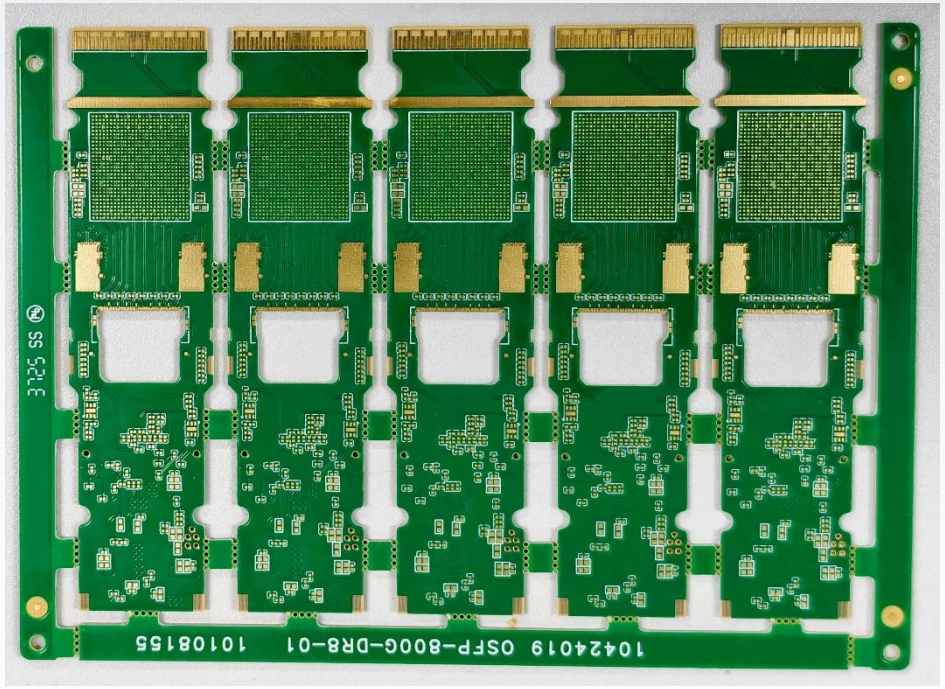
Product Showcase

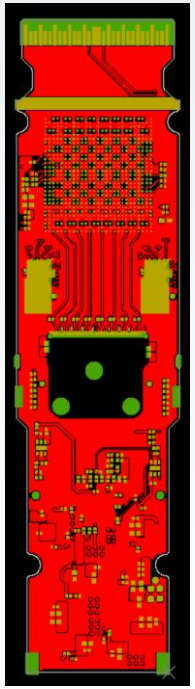
➢ Optical Module - 800G

Design Characteristic:

1. M6 Material, sequential lamination
2. 60/70um line width/space, 50±8% Impedance
3. ENEPIG Surface treatment
4. High Density BGA, 0.1mm stacked micro-via,







Product Showcase

➢ Optical Module - 800G

Design Characteristic：

Layer count: 12L

Material: M6 + IT-180

Board thickness: 1.0 mm

Trace width/spacing: 70/100 μm

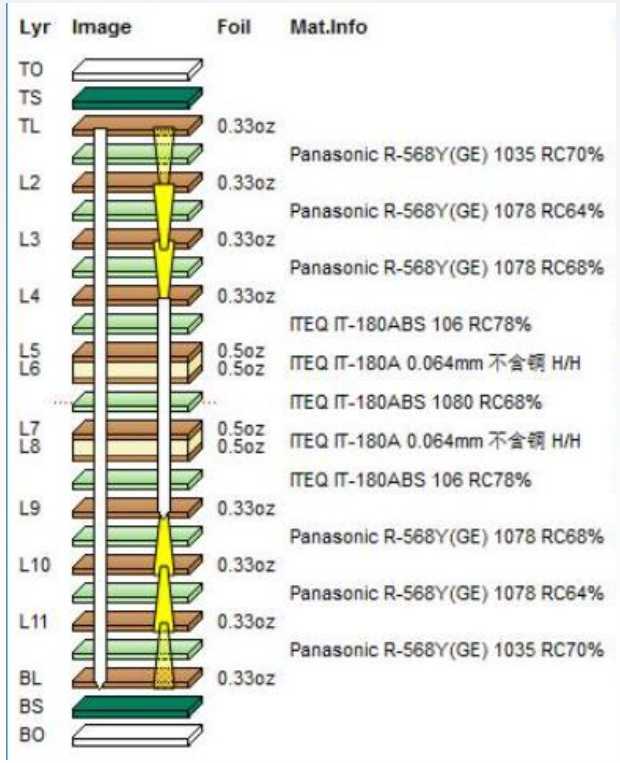
BGA Pitch: 0.4 mm

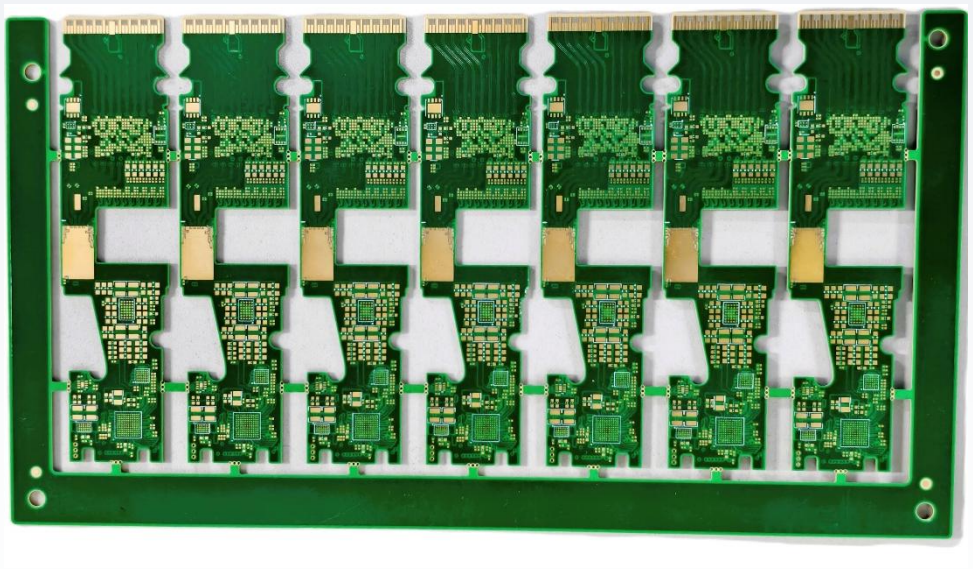
Impedance tolerance: ±8%

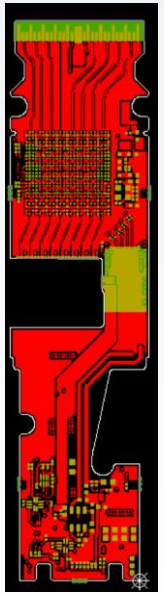
Minimum blind via: 0.08 mm

Blind via order: 3-level HDI

Surface finish: Nickel-palladium-gold



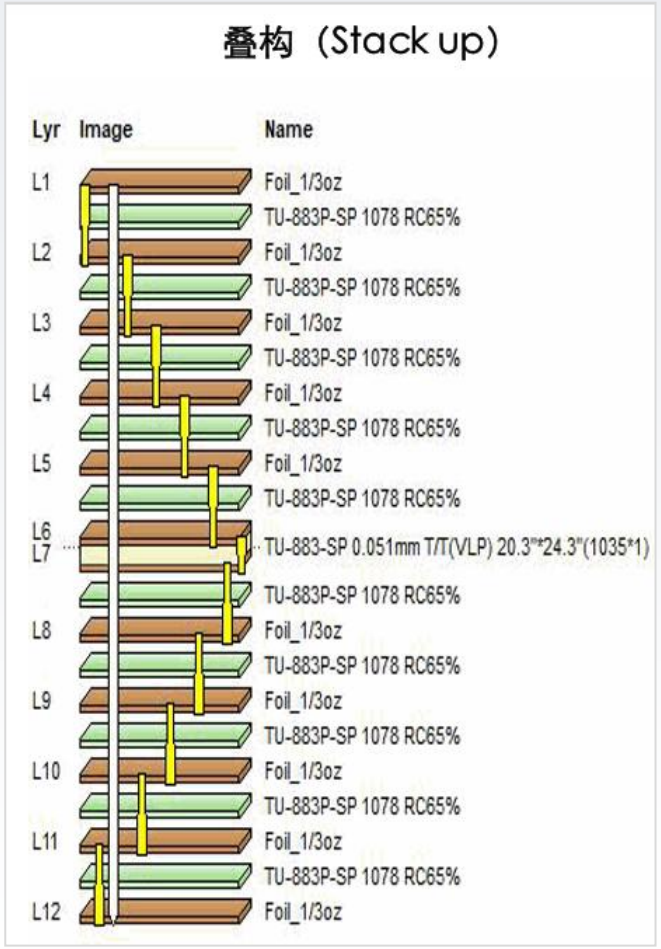


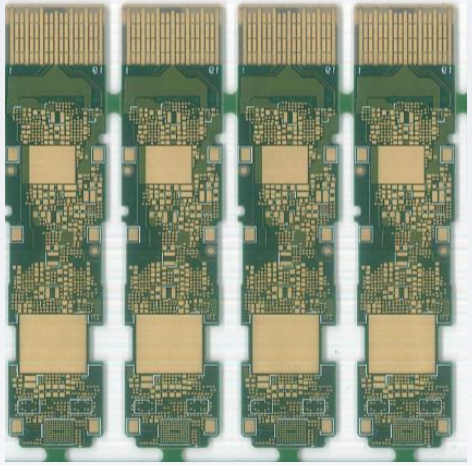


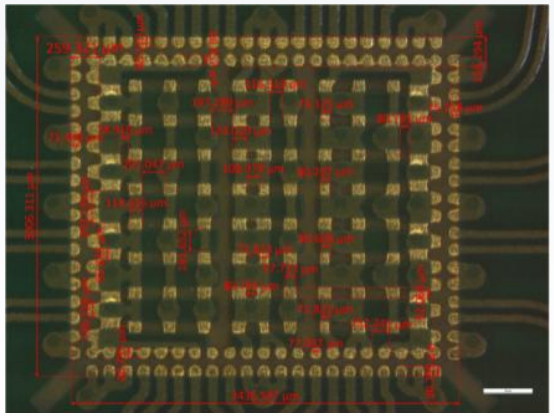
Product Showcase

➢ Optical Module - 800G

- Layer Count: 12L
- Material: TU-883-SP
- Board Thickness: 1.0 mm
- Trace Width/Spacing: 76/50 μm
- BGA Pitch: 0.15 mm
- Impedance Tolerance: ±8%
- Minimum Blind Via: 0.075 mm
- Blind Via Edge-to-Edge: 6 mil
- Blind Via Order: 5-level HDI
- Surface Finish: Nickel-Palladium-Gold







Flip Chip Pad

Product Showcase

➢ 1.6T Optical-Module Bit-Error-Rate Test Board

Design Characteristic：

Layers: 16L

Material: EM-892K

Board Thickness: 1.6 mm

Trace Width/Spacing: 34/50 μm

BGA Pitch: 0.15 mm

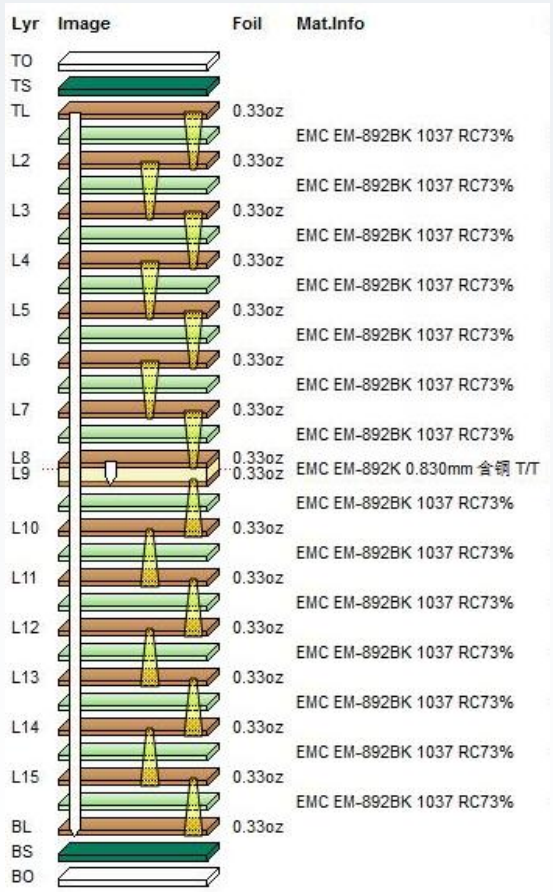
Impedance Tolerance: ±7%

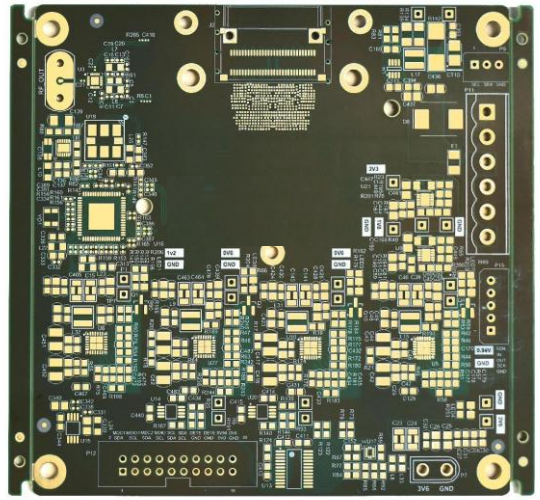
Minimum Blind Via: 0.075 mm

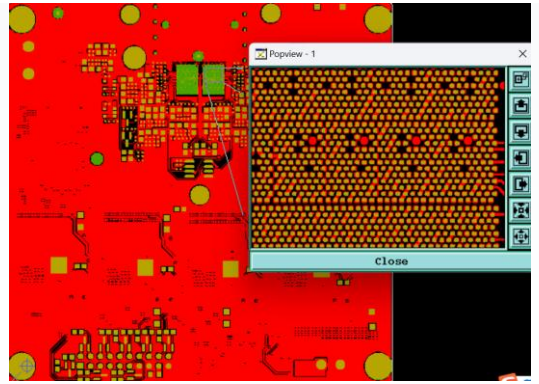
Blind Via Edge to Edge: 6 mil

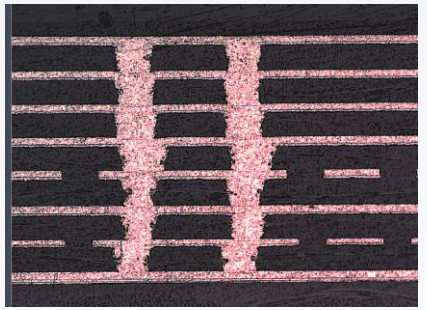
Blind Via Order: 7-level HDI

Surface Finish: Nickel-Palladium-Gold

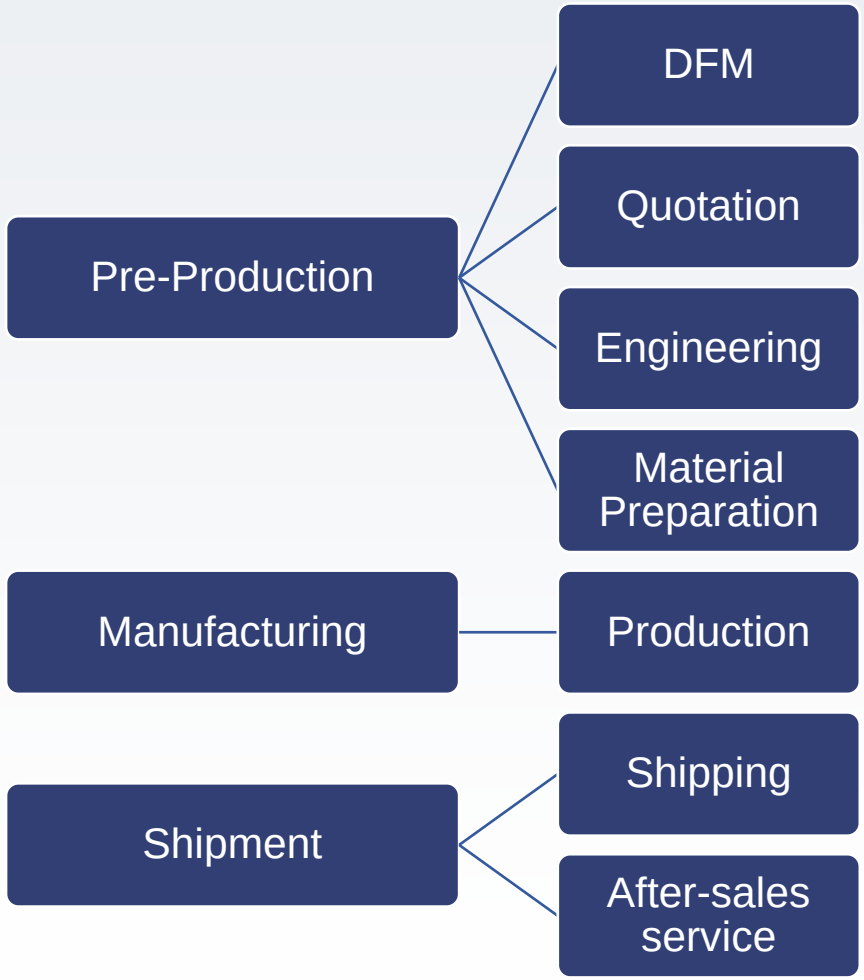








Delivery



Number of layers	Top Urgent (Day)	Urgent (Day)	Standard (Day)	
	≦3㎡	≦5㎡	≦5㎡	>5㎡
2L	8	12	16	20
4L(1+2+1)	8	12	16	20
6L(2+2+2)	12	18	24	30
8L(3+2+3)	16	24	32	40
10L(4+2+4)	20	30	40	50
12L(5+2+5)	24	26	48	60

Notes:

1. Above table is only the manufacturing time, excluding material preparation and EQ time
2. Lead time of special design or urgent delivery need to be evaluated.

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Thank You

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