

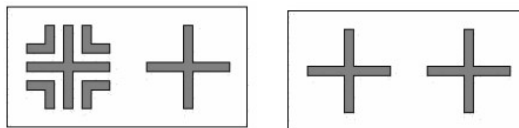
Packaging and System Facility (PASF)

Packaging and Design Services Capabilities

1. Wafer Dicing

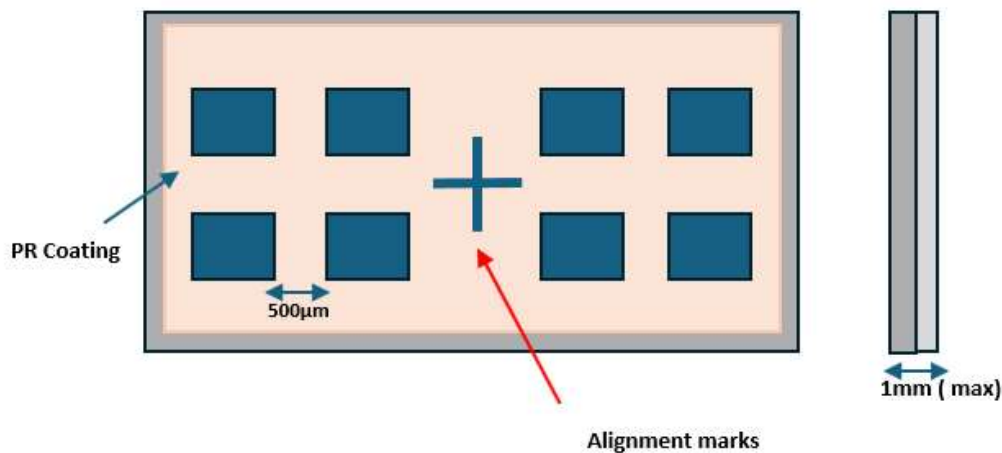
1.1 Automatic Dicing Saw

- i. Wafer/sample size can handle from 2 cm to 6-inch wafers.
- ii. Capable of performing both full cuts and half cuts.
- iii. Sample types: silicon wafers, ITO, STO, LNO, glass wafers and bonded wafers (Si on Si and glass on Si).
- iv. Maximum wafer/sample thickness: 1 mm.
- v. Minimum dicing sample size: 2 mm × 2 mm.
- vi. Minimum saw street between devices: 500 μm (no metallization on saw street).
- vii. Device placement on the wafer/sample must follow a uniform index.
- viii. Wafer/samples with released structures are not acceptable.
- ix. Alignment marks are mandatory on the wafer/sample.



- x. The dicing side of the sample must be coated with PR (photoresist) material (maximum 1 μm thick).

Figure1 : Wafer Profile for Automatic Dicing



1.2 MTI Precision CNC Dicing machine

- i. Wafer/sample size can range from 2 cm to 3-inch wafers.
- ii. Allowed only fresh/unprocessed wafers.
- iii. Wafer/sample types: silicon wafers, glass wafers, ceramics and sapphires.
- iv. Maximum wafer/sample thickness: 3 mm.
- v. Minimum dicing sample size: 2 mm × 2 mm.
- vi. Minimum cut line width between devices: 500 μm (without metallization).
- vii. Device placement on the wafer/sample must follow a uniform index
- viii. Samples with released structures are not acceptable. (Patterned wafers are not allowed)
- ix. Alignment marks are not a mandatory on the dicing sample.
- x. The dicing side of the sample must be coated with PR (photoresist) material (maximum 1 μm thick).

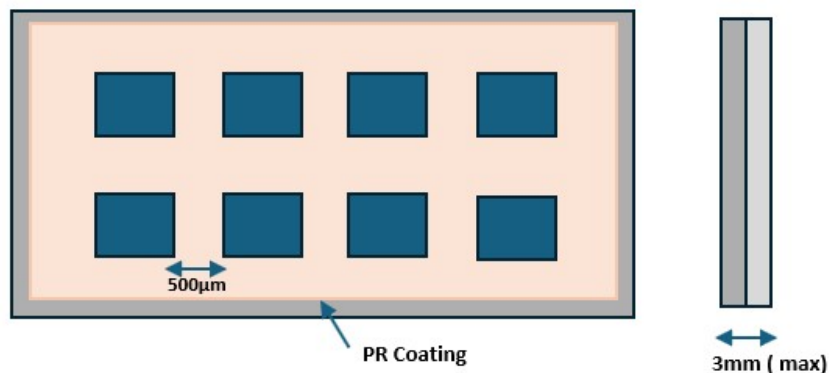


Figure 2: Wafer Profile for Manual Dicing

2. Wire bonding

2.1 Die attachment

- i. User should provide the package (PCB with ENIG/ENPIG finish, Chip carrier, TO)
- ii. Epoxy available: (Curing Temperature as per data sheet)
 - H70E: Thermally conductive
 - H20E: Thermally and electrically conductive
 - H70E2: Thermally conductive
- iii. Process type - manual

2.2 Wire bonder

- i. Diced devices are recommended, or devices that can fit within the package dimensions.
- ii. Bonding Type & Material:
 - Wedge bonding: 25 μm Au wire, 33 μm Al wire
 - Ball bonding: 25 μm Au wire
- iii. Minimum Bond Pad Dimension: 100 μm $\times$ 100 μm
- iv. Minimum Bond Pad Pitch: 200 μm
- v. Device Metallization: Al, Cr/Au, Ti/Pt or Ti/Au (seed layer thickness > 10 nm and metallization > 100 nm)
- vi. Bond pad surface must be free from contamination, photoresist (PR) and oxide layers.

3. Parylene Deposition

- i. Substrates allowed ranging from small samples up to 4-inch wafers.
- ii. Samples: silicon wafers, glass, ceramics, metals, MEMS devices, electronic components, medical implants, polymers, plastics, and optical parts.
- iii. Parylene Type: Parylene C, Parylene N
- iv. Capable of depositing thickness: 500nm to 5 μm .
- v. Provides uniform coatings on substrates of various shapes and sizes, including non-flat samples, facilitated by a rotating sample holder.
- vi. Deposition pressure approximately 15mTorr, enabling the formation of high-quality conformal coatings.

4. Hot air Oven

- i. Samples allowed for baking/curing: Silicon, glassware, metal tools, electronic components, polymers, powders, and small mechanical parts.
- ii. Internal Dimension: 30cm $\times$ 30cm $\times$ 30cm
- iii. Temperature range: 150°C to 180°C
- iv. Temperature uniformity: $\pm 3^\circ\text{C}$
- v. Ramp Rate: 3°C /min

5. Vacuum Oven

- i. Samples allowed for baking/curing: Silicon, glassware, metal tools, electronic components, polymers, powders, and small mechanical parts.
- ii. Internal Dimension: 35cm × 35cm × 35cm
- iii. Vacuum Range: 5mTorr
- iv. Temperature range: 25°C to 250°C
- v. Temperature uniformity: $\pm 3^\circ\text{C}$
- vi. Ramp Rate: $2^\circ\text{C}/\text{min}$

6. High Power Plasma Cleaner

- i. Samples allowed for surface cleaning /Bonding: silicon wafers, glass, metals, polymers, ceramics, MEMS devices, and PDMS
- ii. Sample size: < 65 mm
- iii. Adjustable RF power: Low (8W), Medium (14W), High (40W)
- iv. Vacuum range: 5mTorr
- v. Gas exposure: N_2 , Ar, O_2
- vi. Gas Flow meter range: 50 mL/min
- vii. Samples with greasy residues, oily films, unbaked resists or uncured polymers are not allowed
- viii. Two slots for gas flow meters.

7. DC Probe station

- i. Samples allowed with metal layer: Silicon wafers, Glass and MEMS devices
- ii. Sample size: < 50 mm
- iii. Probing Pad size: 100 μm
- iv. Microscope Magnification: 10x – 50x
- v. Micro Positioners: 6 units with magnet on/off bases
- vi. Measurement Capabilities: Resistance, Inductance, Capacitance
- vii. Probe tip size: 50 μm

8. Ultra Probe sonication

- i. Samples allowed for dispersion: RGO, CNT, Graphene, Nanoparticles
- ii. Frequency Range: Typically, 20–40 kHz
- iii. Probe Tip size: 0.3mm and 18mm
- iv. Power Output: Ranges from 50 W to 500 W RMS
- v. Mode of operation: Continuous /Pulse Mode
- vi. Probe/Tip Material: Titanium due to its durability and chemical resistance
- vii. Tab/PC operation.

9. Centrifuge system

- i. Samples allowed for separation and concentration of nanoparticles, carbon nanotubes (CNTs), graphene.
- ii. Maximum Speed: 10,000 RPM
- iii. Speed Accuracy: ± 100 RPM
- iv. Maximum Tube Size: 100 mL
- v. No. of. tube slot: 8 no's

10. Chemical Wet bench

- i. Samples allowed for cleaning: Silicon, glass, PCB, Metal components
- ii. Allowed process chemicals: IPA and Acetone
- iii. Support for sample dehydration and preheating processes.
- iv. Ultrasonic bath cleaning for effective removal of contaminants.
- v. Equipped with exhaust ventilation, chemical-resistant surfaces and splash guards for safe operation.
- vi. Equipped with DI water, N₂ gas and CDA lines for sample cleaning.

11. Fibre laser marking tool

- i. Materials allowed: Metals, Silicon wafers, Plastic, PCB
- ii. Process: Metal shadow mask, Text engraving, Pattern transfer and QR code.
- iii. Laser type: Fibre Laser (20W), 1064 nm, class 1 safety ring
- iv. Marking Area: 100 × 100 mm
- v. Minimum line width: 0.05mm
- vi. Marking Depth: ≤ 0.3 mm
- vii. Supported File Formats: DXF, BMP, JPG, DWG and EZD.

12. Helium leak tester

- i. Minimum Detectable Leak Rate: Helium (vacuum mode): $< 5 \times 10^{-12}$ mbar-l/s
- ii. Test method: Spray Method
- iii. Measurement Range: 1×10^{-12} to 1×10^{-1} mbar-l/s
- iv. Helium Pumping Speed (vacuum mode): 2.5 l/s
- v. Flange Type: DN 25 ISO-KF
- vi. Suitable Materials for Leak Testing: Metals: Stainless steel, aluminium, copper, titanium

13. Pneumatic Pressure Calibrator/controller

- i. Pressure range: up to 75 bar
- ii. Mode of calibration: Relative, Absolute
- iii. Accuracy: $\pm 0.015\%$ of reading
- iv. Required test port end fitting (Male): $\frac{1}{4}$ " BSP, M10X1, M14 x1.5
- v. Test Medium - N_2 gas

14. Hydraulic Pressure Calibrator

- i. Pressure range: 1 to 1000 bar
- ii. Mode of calibration: Relative/Gauge
- iii. Accuracy: $\pm 0.015\%$ of reading
- iv. Required test port end fitting (Male): $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{1}{2}$ NPT or BSP
- v. Test Medium – Hydraulic oil

15. Pressure Cycle Tester

- i. Pressure range: up to 10 bar
- ii. Mode of calibration: Relative, Absolute
- iii. Test Medium: Compressed Air, N_2 gas
- iv. Required test port end fitting (Male): $\frac{1}{4}$ " BSP, M10X, M14 x1.5
- v. Programmable total cycles: up to 10,000
- vi. Adjustable pressure hold time

16. Dynamic Pressure test (Shock Tube)

- i. Shock wave pressure: 1 to 10 bar
- ii. Test method: Diaphragm rupture method, Solenoid valve control method
- iii. Test medium: Compressed Air, N₂ gas
- iv. Required test port end fitting (Male): ¼" BSP, M10X1, M14 x1.5

17. Climatic Test Chamber

- i. Temperature Range: -60°C to +170°C
- ii. Humidity Range: 10% to 90% RH (at +10°C to +95°C)
- iii. Internal Dimensions: 548 × 460 × 447 mm
- iv. Cooling Rate: 2.8°C/min (from +170°C to -60°C)
- v. Heating Rate: 3.2°C/min (from -60°C to +160°C)
- vi. Temperature Fluctuation: ±1°C
- vii. Relative Humidity Fluctuation: ±3%
- viii. Programmable test profiles for automated sequences
- ix. Fed through access port (Dia 50mm) for taking electrical connection

18. Soldering and Desoldering workstation

- i. Process type: Manual hand soldering and desoldering
- ii. PCB: Rigid, Flex
- iii. PCB board dimensions: 80 mm x 80mm
- iv. Small PCBs are preferred in panel
- v. Component Type: SMD (0603 ,0805,1206), QFN, SSOP, SOIC
- vi. Support only for proto unit test and development units.
- vii. A stencil is recommended for panels or larger PCBs

19. FDM _ 3D printing

- i. Print Filament Material: PLA, ABS
- ii. Build part dimension: 180mm x 180mm x 180mm
- iii. Layer resolution: 0.16mm to 0.4mm
- iv. Required file format: STL file

20. High Resolution 3D Printer:-

Powered by BMF's Projection Micro Stereolithography (PμSL) technology, the microArch S240 delivers 10μm micro-precision across a build volume of 100 × 100 × 75mm — the largest in BMF's lineup. Engineered for industrial production environments, the S240 combines high-viscosity material compatibility, a 10× faster roller-based recoating system, and support for composite polymers and ceramics to produce intricate, exact, and replicable micro-scale parts at the throughput that production demands.

PARAMETER	SPECIFICATION
Printer Model	BMF microArch® S240A
Printing Technology	Projection Micro Stereolithography (PμSL)
XY Resolution (2D Lateral Resolution)	10 μm
Layer Thickness	10–40 μm
Minimum Feature Size	50 μm
Maximum Build Area (Stitch Mode)	100 × 100 mm
Maximum Build Height	75 mm
Stitching Accuracy	< 10 μm
Printing Material	HTL-Y-20 Photopolymer Resin
Light Source	UV Digital Light Projection (DLP) (<i>PμSL process</i>)
Calibration System	Optical calibration and stitching calibration
Monitoring System	Software-based print process monitoring
Cleaning Method	Isopropanol (IPA)
Measurement Equipment	Optical Microscope (SEM may be required for fine features)

Resins used:

HTL

HT-200 (High Temperature Resin)

Clear Resin (90% transparent)

21. Embedded Design Services

- **Hardware design:**

Project architecture design, schematic design (Analog, digital, mixed signals, power management), component selection, Custom board design, PCB layout-multi layer, multi-board design, impedance matching, differential pair analysis, and prototyping.

- **Firmware development:**

Low-level software development for microcontroller (STM32, Analog devices, TI, ATmega) systems (Single, dual-core, multi-controller designs). Device drivers – SPI, I2C, UART, RS232, RS485, RTOS.

- **Software development:**

Embedded software development using Python, Visual Code Studio, and front-end development.

- **System integration:**

Seamless hardware, firmware, software, and mechanical components integration.

- **Testing and validation:**

Rigorous testing procedures to ensure product quality and reliability. Active and passive burn-in testing, temperature cycling, and humidity testing.