



Doc No:- TF32PASF_TO_02_25



Packaging and Systems Facility- PASF
CeNSE-IISc

Third Floor- TF32

Packaging and Design Services-
Technical Orientation

Issue 1Rev 0

12/12/2025



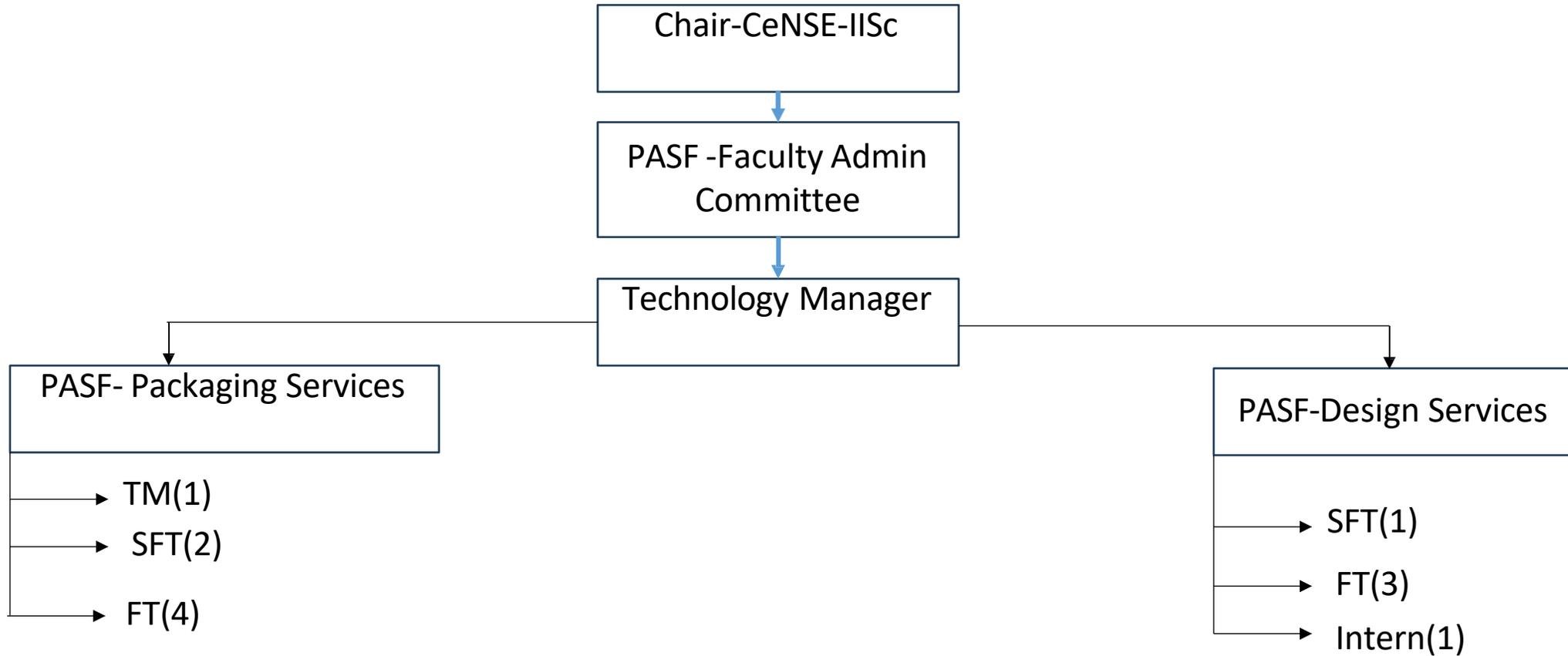
Agenda



1. PASF Overview-Organisation Chart, TF32 Layout
2. Why PASF??
3. PASF-Design Services Overview
4. PASF-Design Services Flow & Tools
5. PASF Design Services Hardware Design and Product Overview
6. PASF- Packaging Facility Key Equipments & Tools
7. PASF Services High Lights
8. Question & Answers.



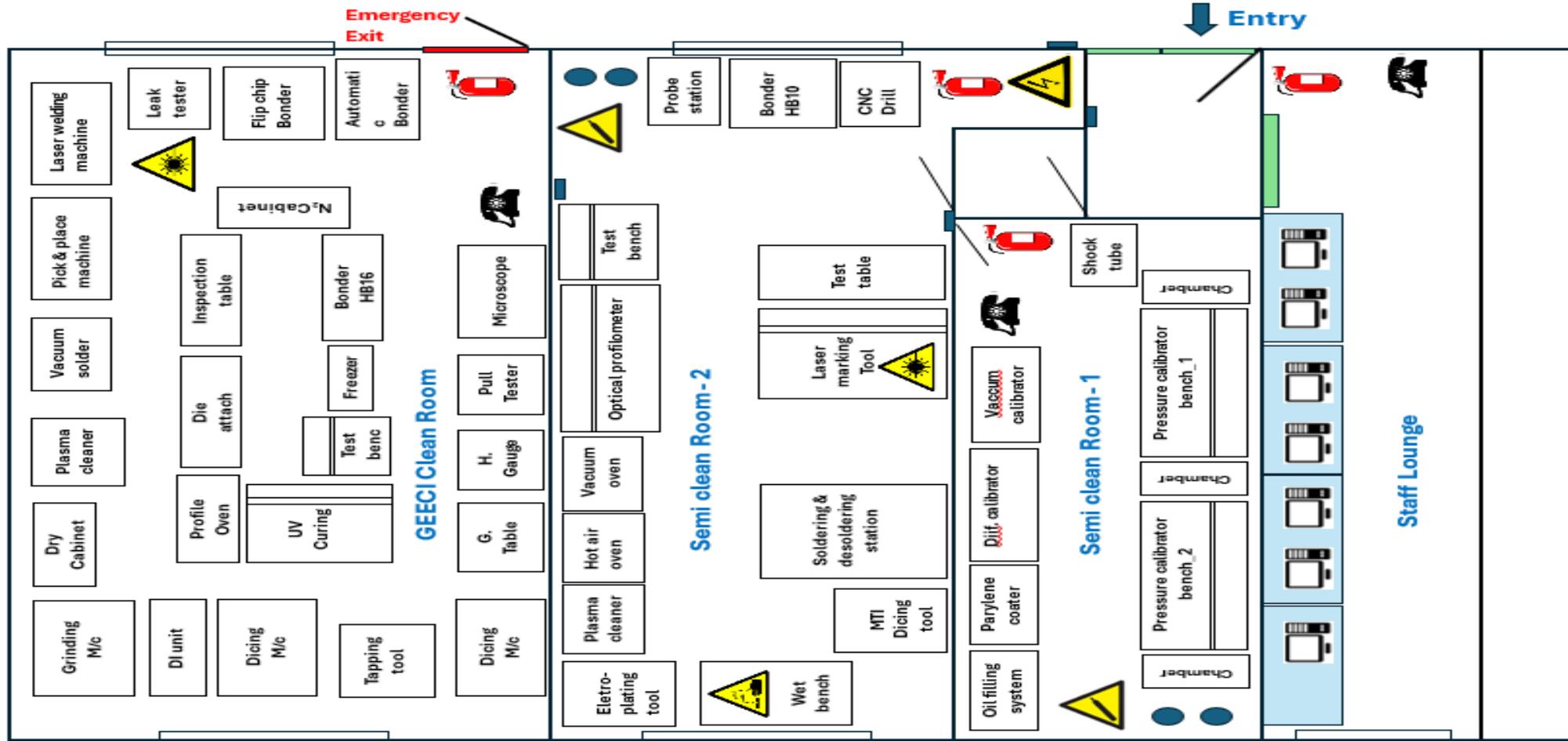
1.0 Organisation Chart of PASF



13 Staff

TM-Technology Manager
SFT-Senior Facility Technologist
FT- Facility Technologist
ET- Equipment Technologist
PA- Project Associate

1.1) PASF-TF32 Layout



Clean Room Class10K –
Restricted Entry

Semiclean Room2

Semiclean Room1
Testing Area

Seating-Design
Services-TF36
Seating- Packaging
Services-TF34



1.2) PASF Overview



- ❖ Packaging and Systems Facility at CeNSE-IISc is a National Facility of 3500 SFT at Third Floor- TF32, TF33, TF34.
- ❖ Facility has 2 Semiclean Rooms 1&2, Clean Room 10K and Staff Seating area for Design Services and Packaging Staff.
- ❖ ~25 Key Equipments in TF 32 Such as Automatic Dicing Saw, Wirebonding, Wafer Grinding, Die Bonder, Flip Chip Bonder etc etc.
- ❖ Design Services Embedded Hardware/Firmware/Mech Design
- ❖ Testing Equipments for Sensors such as Thermal Chamber, Calibrators, Lab Power Supplies, Digital Storage Oscilloscopes.
- ❖ Current Staff Strength of 20 for Design, Development and Facility Operations.
- ❖ Facility Supports Students (CeNSE/IISc/External Academic/Industry) with above activities

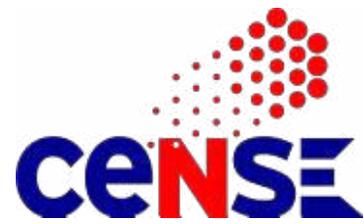
2.0 Why & What is PASF



- ❖ NNFC –CeNSE IISc has MEMS or Nano Fabrication Facility
- ❖ Once Wafer is Fabricated, Characterised.... Need to be Packaged.
- ❖ Packaging involves Wafer Dicing, Die Packaging, Substrate Design.
- ❖ Only a Die Designed and Fabricated means ????
- ❖ Need interface Electronics to interpret what a Die does
- ❖ System Design- Simple to complex Electronics, Mech Housing Design and Prototype Development and Testing
- ❖ TOT- For Mass Production after User/Customer Acceptance



2)Packaging and Systems Facility (PASF) at Centre for Nanosciences- IISc



The Vision and Charter of PASF is to bring NanoTechnology to Life by offering Products , Solutions , Services from the Research efforts at CeNSE IISc & to meet societal needs

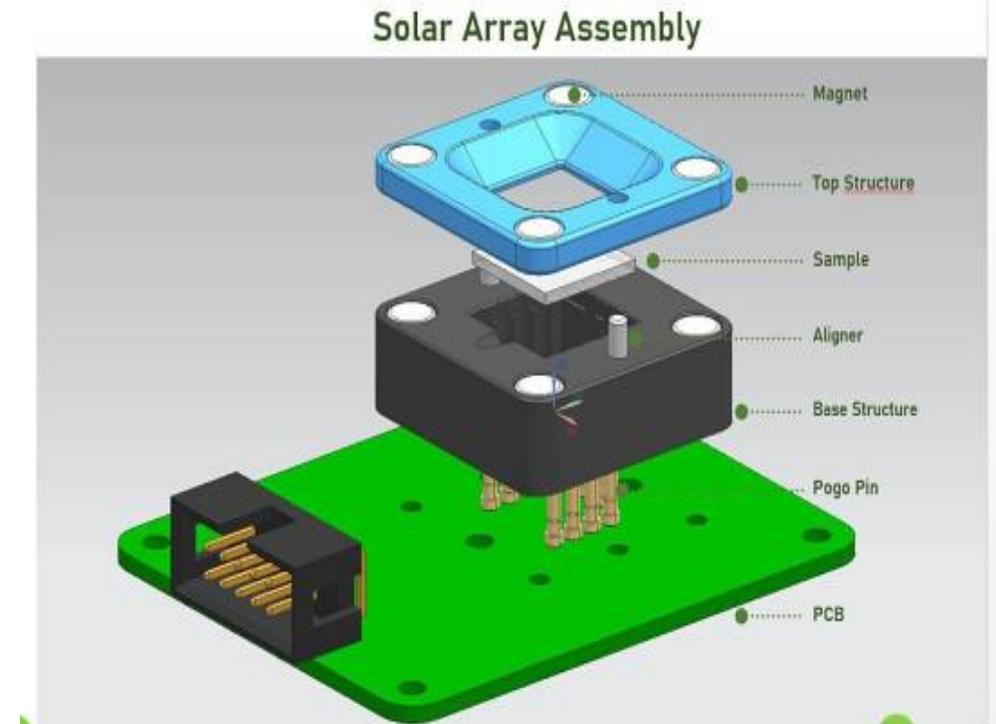
Solutions and Services Offered

- I. Analog and Digital Board Hardware Design.
- II. Firmware and Customised Software Development.
- III. Mechanical Housing Design and Modelling
- IV. 3D Printing
- V. Prototype Development and Transfer to Mass Production
- VI. Support TBI (Technology Business Incubation) & Startup's
- VII. Packaging of Microelectronics such as Wafer Dicing, Wirebonding, Laser Welding, Flip Chip Bonding.
- VIII. Design and Development of New Products based on Nanotechnology Research at CeNSE- IISc such as Gas Sensors, Pressure Sensors etc..
- IX. **Provide Advanced Packaging Solutions with Focus on Research and Development.**



3)PASF-Design Services Overview

- ❖ **Electronics & Embedded Hardware Design, PCB Assembly**
 - Simple 2 Layer PCB Design to Complex 6 Layer Designs with >1000 Components and based on STM32, Arduino Nano and Other Platforms.
 - Precision Analog Sensor Interfacing Circuits, Prototype & POC development, TOT of Sensors to Final Product.
- ❖ **Embedded Firmware Development, Testing and Debug**
 - PASF is able to optimize resources such as timing, power for the above embedded hardware through Firmware Development.
 - Standard Interfaces like SPI, I2C, USB, ADC, DAC and Interrupt Management to avoid deadlocks.
- ❖ **Mechanical Modelling and Prototype Enclosure Design**
 - 3d Modelling and Design of Enclosures for Prototype and POC
 - 3d Printing of the above of various types of Material
 - Advanced Packaging such as Flip Chip and Die Bonding



Key Summary:-

Customised Design and development of Prototype hardware solutions and TOT for Mass Transfer.



4)PASF-Design Services Flow

1. Customer/User Specs
2. PASF Feasibility Study
3. Techno commercial Proposal (Time and Cost)
4. Revise 3) if needed and approval from 1)
5. Prototype Design (Hardware Design, Firmware Development, Mechanical Design)
6. Prototype Realisation:- Procurement of PCB/Components and Assembly
7. Testing and Debugging
8. Submission to User/Customer with Documentation.
9. Modifications (if needed).
10. Technology Transfer (TOT) if needed.

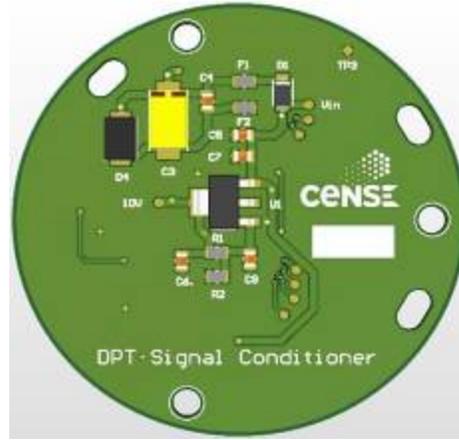
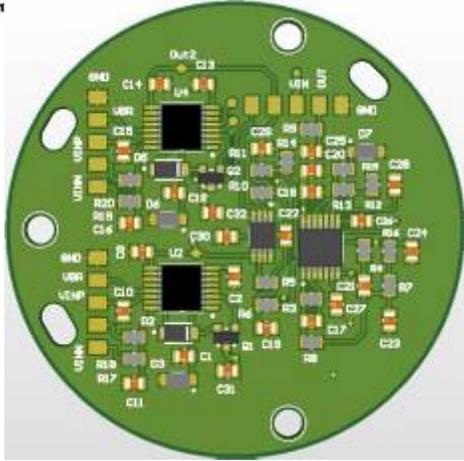


4a)PASF-Design Services Tools



1. Hardware Design & PCB Layout :- Altium
2. Firmware Design and Development:- STM 32, Arduino Nano, Mega,Duo, ESP 32 Wireless Platform
3. Lab View Software for User Interface
4. Mechanical Design:- Solid works
5. 3D Printing:- Bambu Carbon Fiber Multi Color Printer.

5) Hardware Design Services – Few Snap Shots



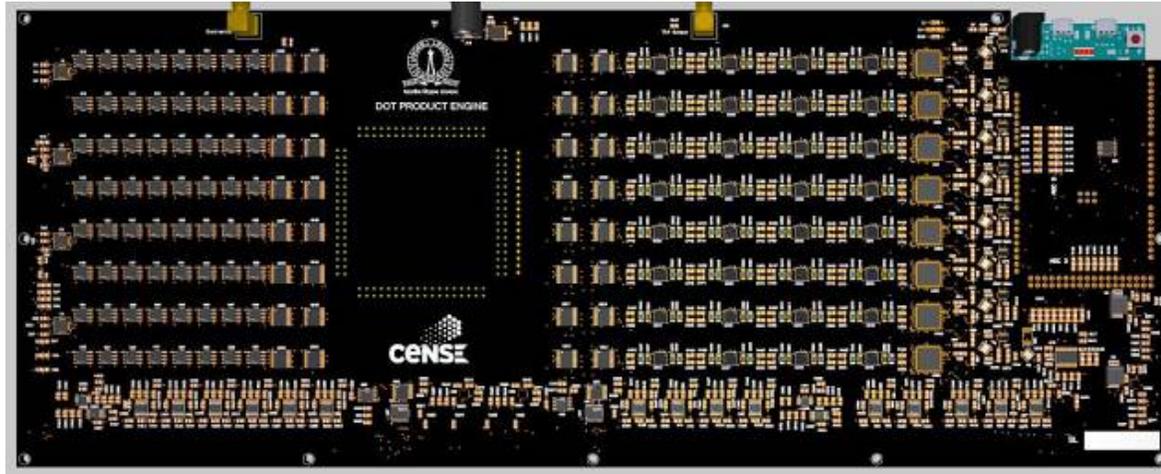
Sensor Signal Conditioner PCB



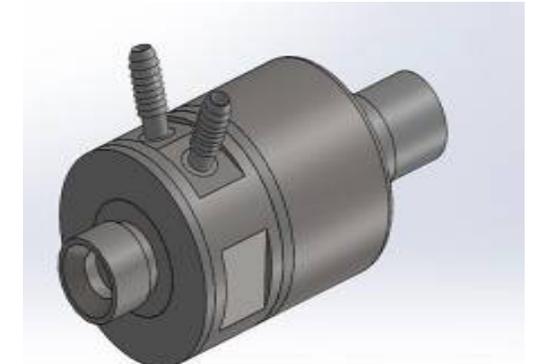
AQM Unit



64 Array Gas Sensor Package

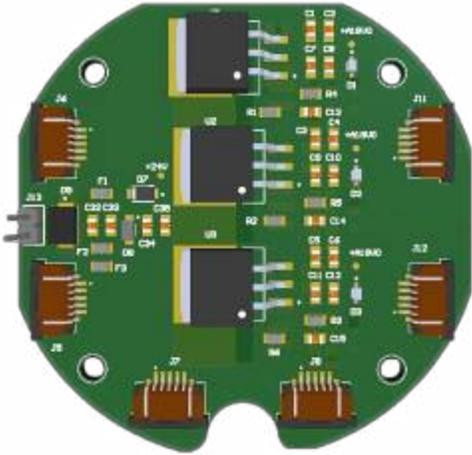


6 Layer Sensor Interface Board with 3900 Components – Design and PCB Assembly

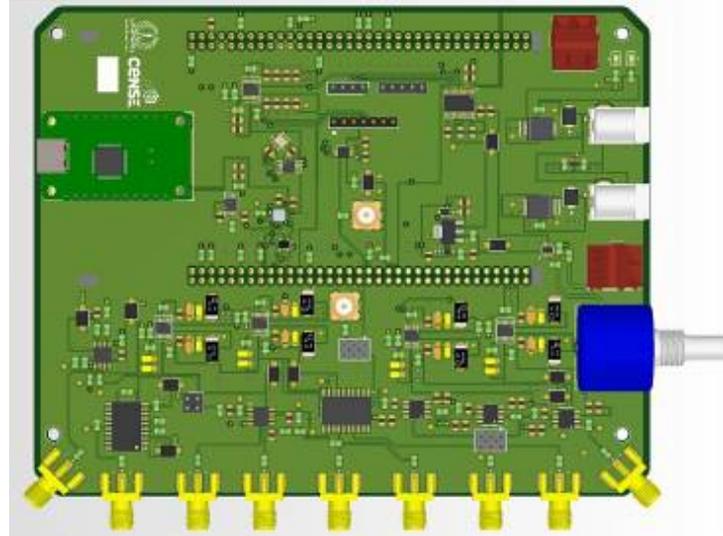


3 in 1 Sensor Package- Modelled and 3d Printed

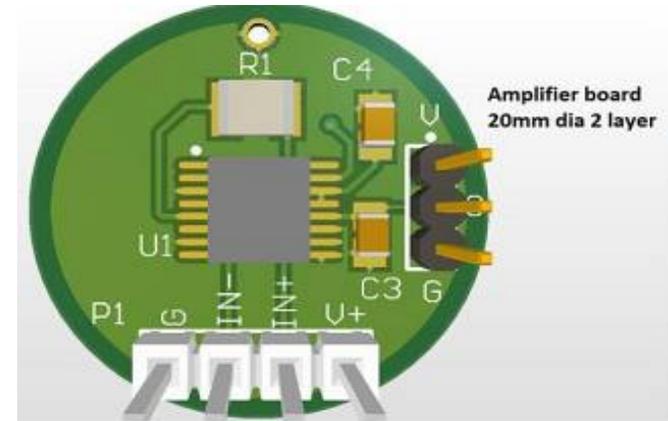
5a) Hardware Design Services – Few Snap Shots



**Pressure and Temp
Sensor for GTRE-V2.0**

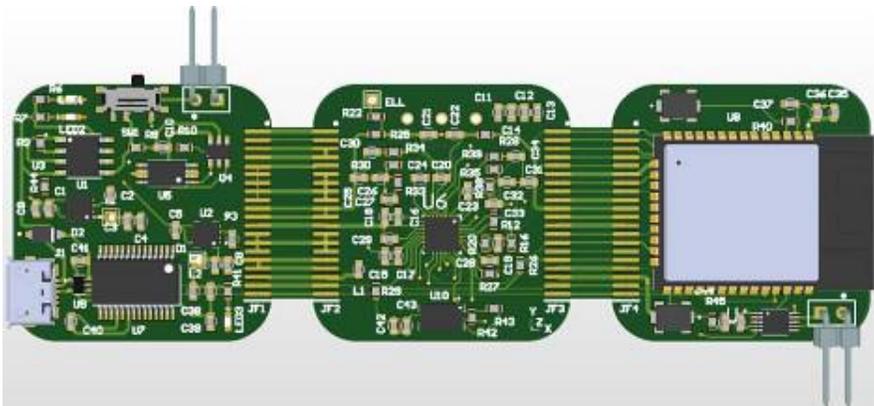


SQUID- Interface Electronics-IIT Delhi

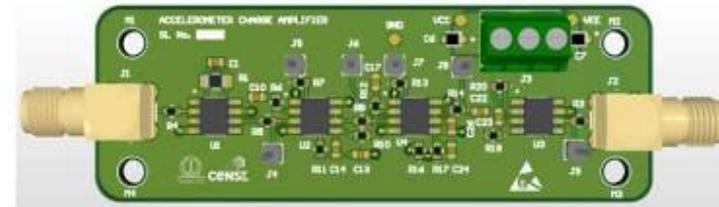


**Pressure Sensor
Amplifier Board**

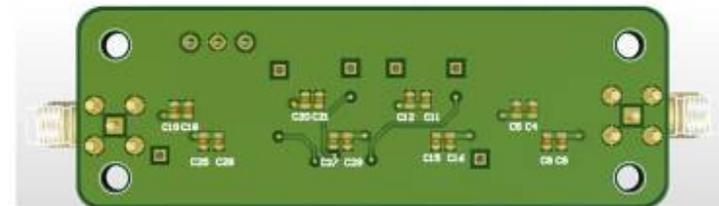
Amplifier board
20mm dia 2 layer



ECG Flex PCB



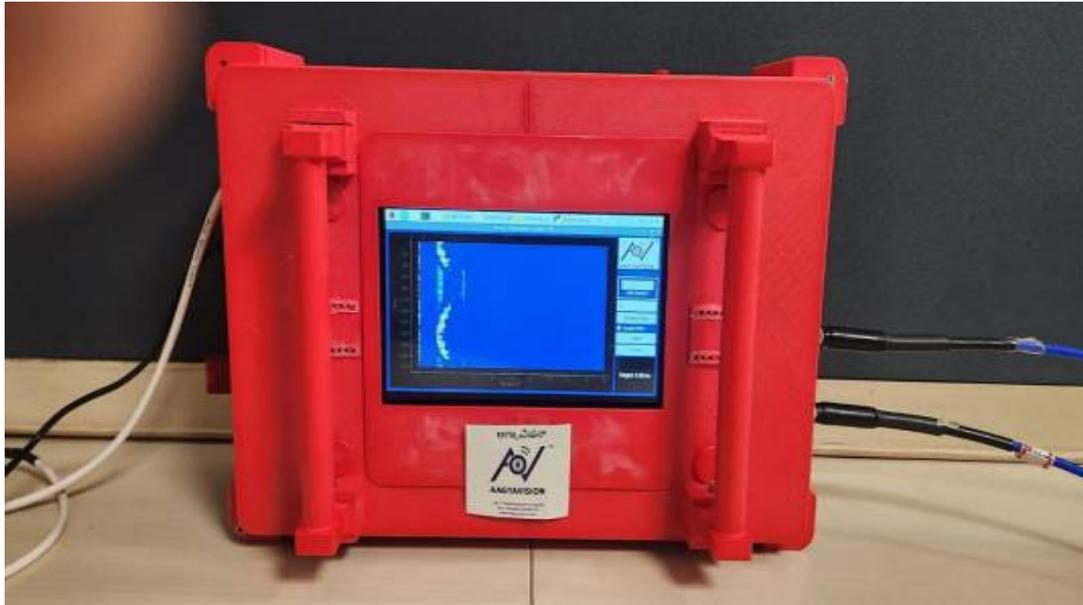
Accelerometer PCB



5b) Design Services-Prototypes

CeNSE-IISc and AAGYAVISION Private Limited (IISc faculty ECE founded startup) have jointly designed and developed a 3D Printed Housing for Prototype V1.0 for a handheld radar system.

The 3D-printed design measures 350 × 240 × 70 mm (L × W × H) and encloses the radar system, except the antenna and is fully functional as shown below.



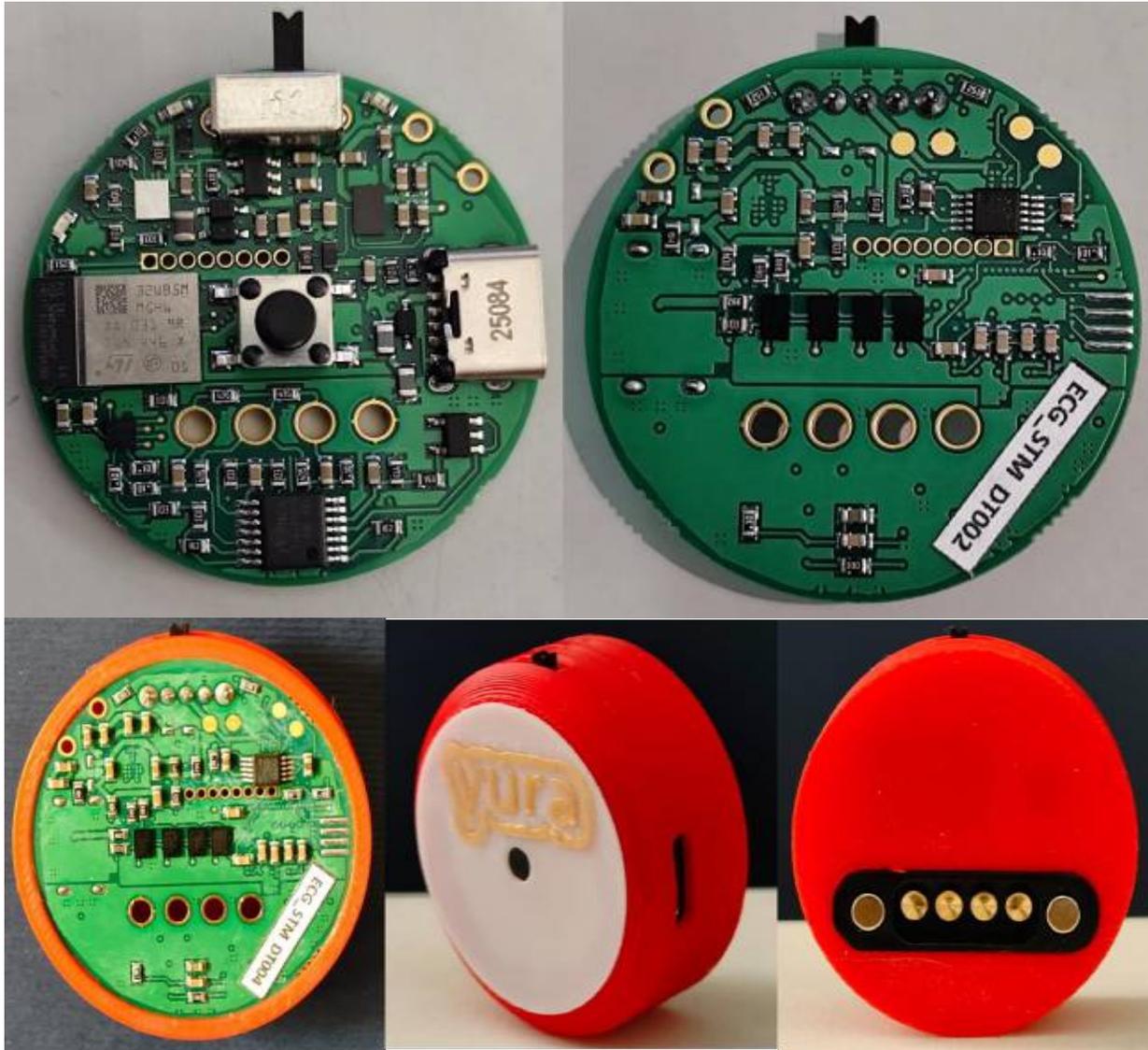
Handheld Radar Prototype Enclosure

Plating Driver V3.0 :- Agnit Start Up

The Plating Driver is designed for electroplating, capable of generating both positive and negative current pulses. It allows precise control over the pulse width (duty cycle) and enables current adjustment from 0 to 100mA with 0.1mA resolution. Frequency Range from D.C to 1Khz. The Plating Driver precisely modulates these pulses to optimize the plating process, enabling better control over the thickness and smoothness of the electroplated layers. This flexibility ensures optimal plating quality by improving uniformity and reducing defects, making it ideal for high-precision electroplating applications.



5c) ECG Designs



WLCSP (HDI) Board
7 BGA chips with Board Diameter of 3.5cm

Flex- PCB Design

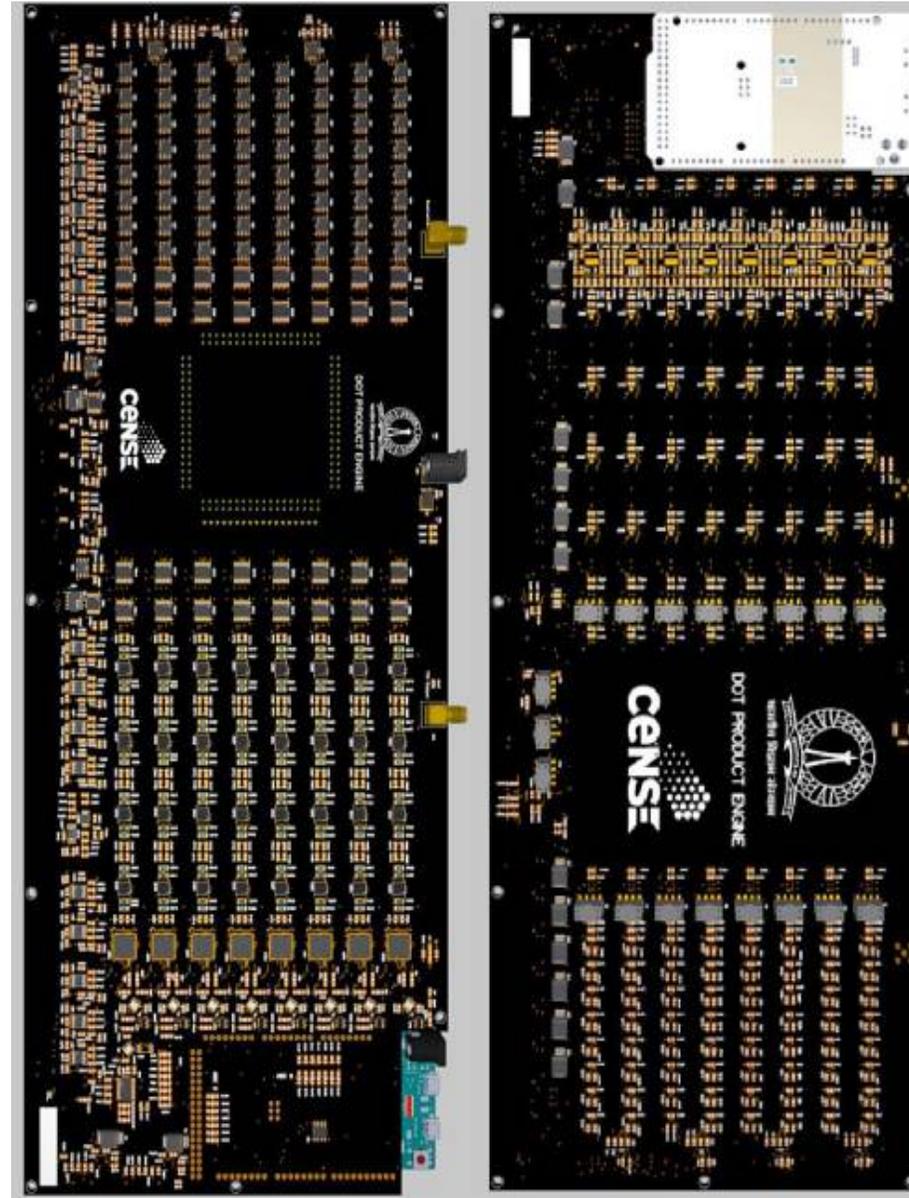


5d) Complicated Board Design & Assembly

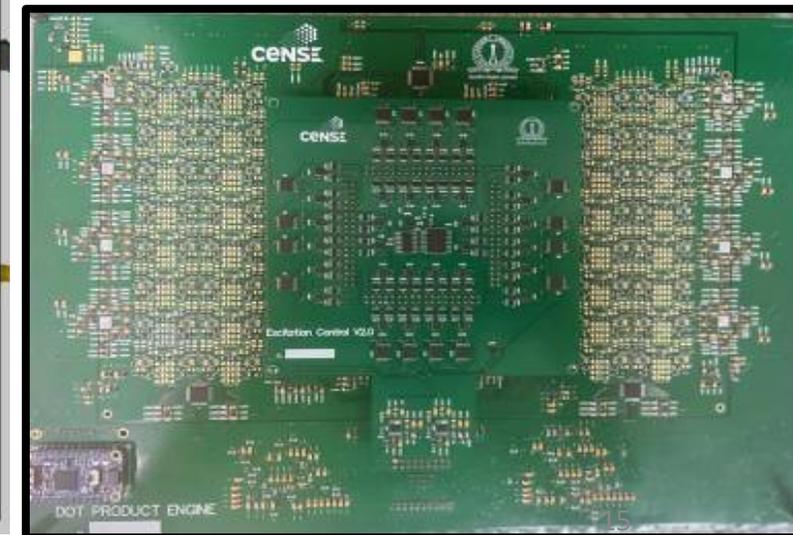
MEM Array Parallel Mother Board_V1.0

MEM Array Parallel Mother Board V2.0 Top

Process	Soldering
Solder paste (Using HOT plate) Temperature	Alloy Sn63/pb37. 200°C
Total assembled PCB: V1.0 & V2.0	4Numbers. 15days.
Passive component	12000 Numbers
Packages	0402,0603,0805, 1206
Total Active component	800 Numbers (opamp,16bit DAC,Analog Switch ICs, Precision Amplifiers, STM, LDO,ADC,TI,



MEM Array Parallel Mother Board V2.0 Bottom



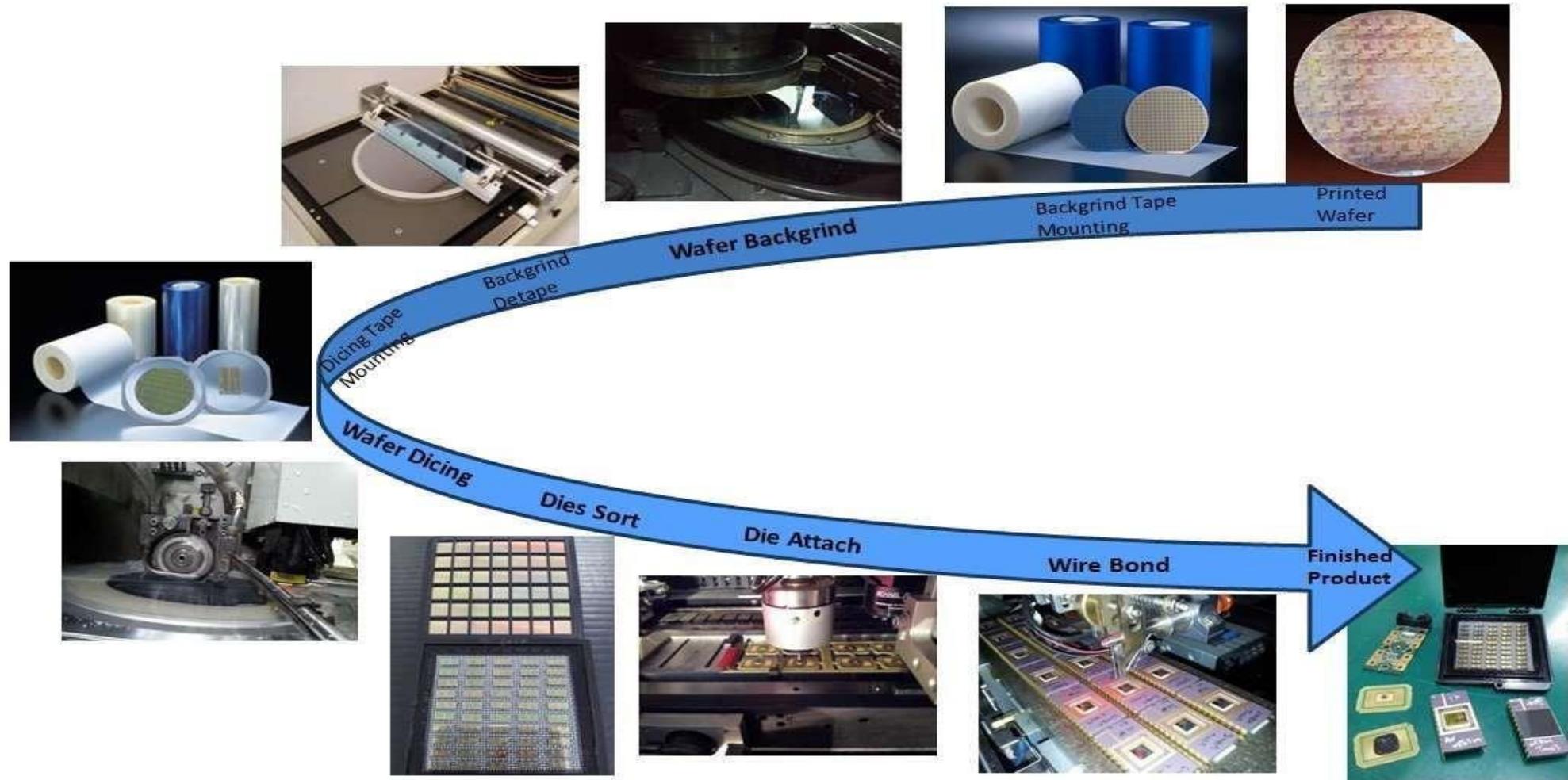


6) PASF Key Equipments & Design Services List



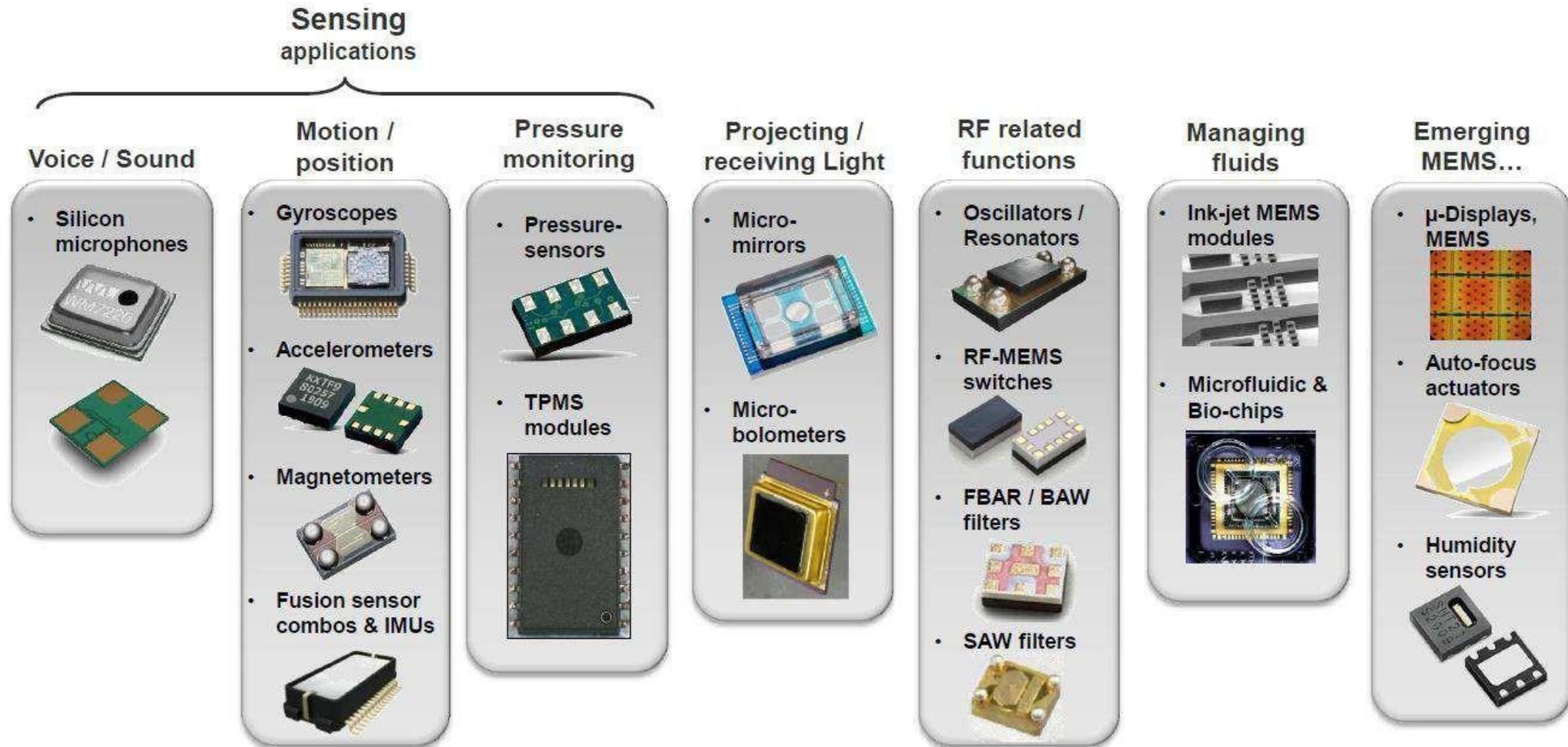
Equipment Bays	Tool name	Tool Name in FOM	Tool Number	Tool category
Semiclean Room1-TF32	Climate Chamber Votsch -1	Climate Chamber Votsch -1	PASF002	Electrical
	Environmental Chamber ATT	Environmental Chamber ATT	PASF018	Electrical
	Hydraulic Dead Weight Tester	Hydraulic Dead Weight Tester	PASF021_TS20	Electromechanical
	Parylene C Deposition System	Parylene C Deposition System	PASF004	Vaccum Type
	Pneumatic Pressure controller 200bar	Pneumatic Pressure controller 200bar	PASF017	Electromechanical
	Pneumatic Pressure controller 20bar	Pneumatic Pressure controller 20bar	PASF011	Electromechanical
	Votsch Climate chamber-2	Votsch Climate chamber-2	PASF003	Electrical
	Pressure cycling Tester	Pressure cycling Tester	PASF027	Electromechanical
Semiclean Room2-TF32	Fibre Laser Marking Tool	Fibre Laser Marking Tool	PASF009	Electrical
	High power Plasma Cleaner	High power Plasma Cleaner	PASF015	Electrical
	Hot Air oven	Hot Air oven	PASF013	Electrical
	Hydraulic Pressure Calibrator	Hydraulic Pressure Calibrator	PASF012	Electromechanical
	Manual DC Probe Station	Manual DC Probe Station	PASF007	Electrical
	MTI Preciison CNC Manual Dicing Tool	MTI Preciison CNC Manual Dicing Tool	PASF001	Electromechanical
	REMI Centrifuge PASF016	REMI Centrifuge PASF016	PASF016	Electrical
	Semi automatic wire bonder HB16	Semi automatic wire bonder HB16	PASF005	Electrical
	Soldering and Desoldering station	Soldering and Desoldering station	PASF020	Electrical
Clean Room-TF32	Automatic Dicing Saw	Automatic Dicing Saw	PASF010	Electromechanical
	Wire bonder HB10	Wire bonder HB10	PASF0025	Electrical
Systems Engg Facility-TF33	Design Services1- PCB Design and Development	Altium	PASF022-DS-01	Electrical/PCB Design
	Design Service3 -Embedded Firmware	STM Cube MX, Arduino	PASF022-DS-02	Electrical/Coding and Debug
	Design Services 2- PCB Design and Development	Altium	PASF022-DS-03	Electrical/PCB Design
	Design Services6-Mech Design & Development	Solid Works	PASF022-DS-06	Mechanical/CAD

6) Typical semiconductor manufacturing process



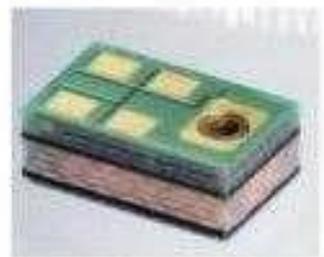
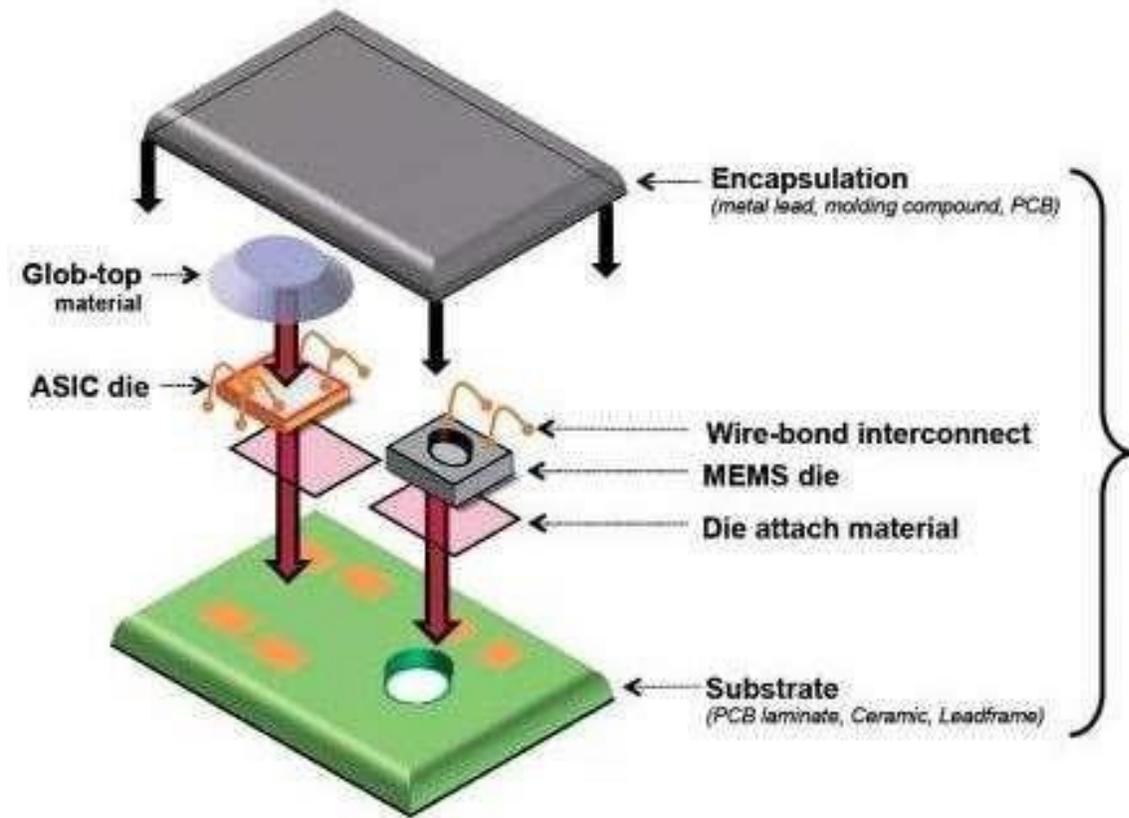
6a) Why do you need Silicon Packaging?

To fulfill end-application requirements such as mechanical protection, electrical interconnection, thermal management and hermeticity



Process for Packaging

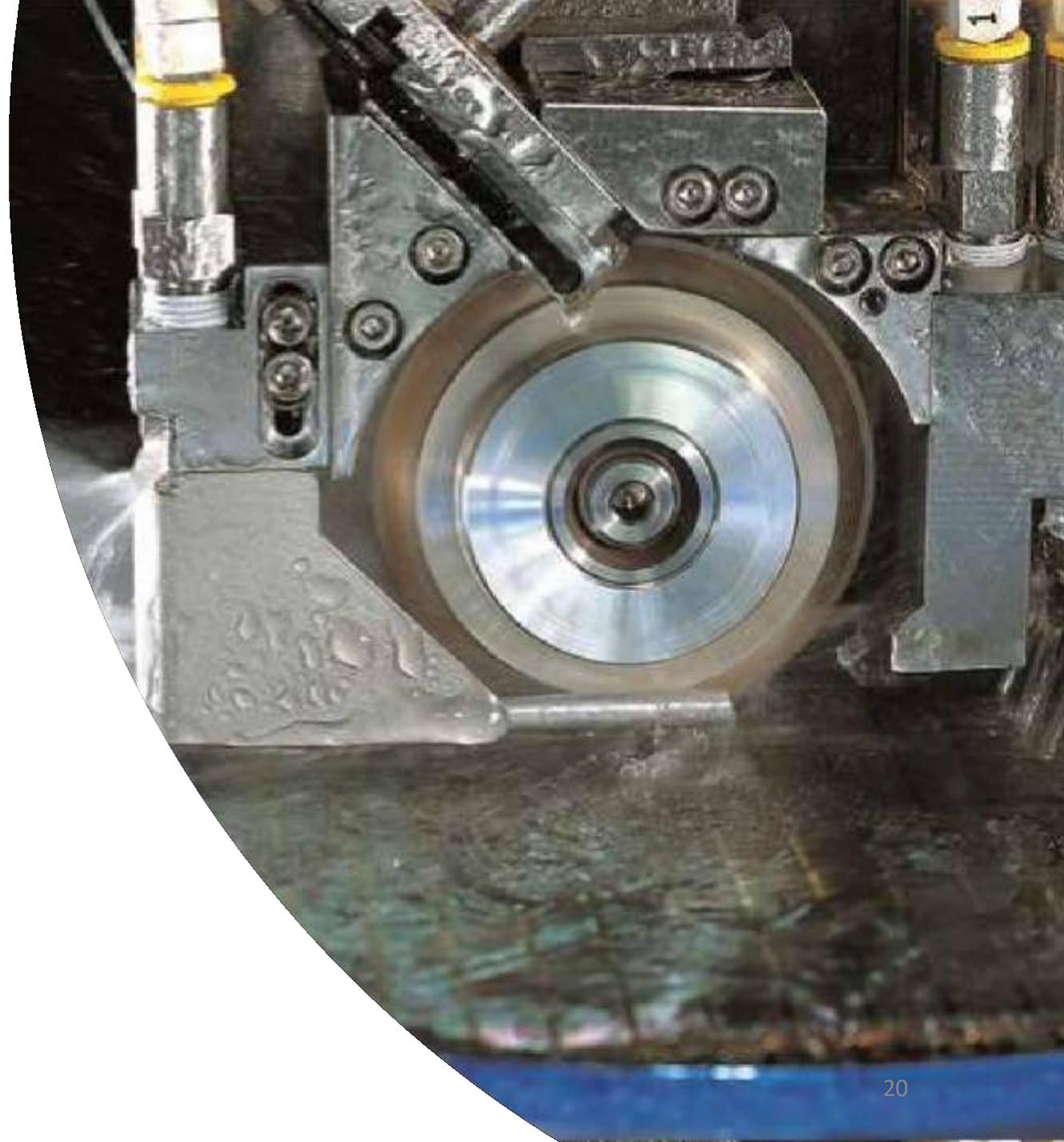
- Silicon wafer visual inspection
- Wafer Dicing
- Dies sorting
- Dies attachment
- Plasma cleaning
- Wirebonding
- Encapsulation



MEMS microphone module
(Source: Knowlins Acoustics)

Wafer dicing

wafer dicing is the process by which die are separated from a wafer of semiconductor following the processing of the wafer. The dicing process can involve scribing and breaking, mechanical sawing (normally with a machine called a *dicing saw*) or laser cutting. All methods are typically automated to ensure precision and accuracy. Following the dicing process the individual silicon chips are encapsulated into chip carriers.

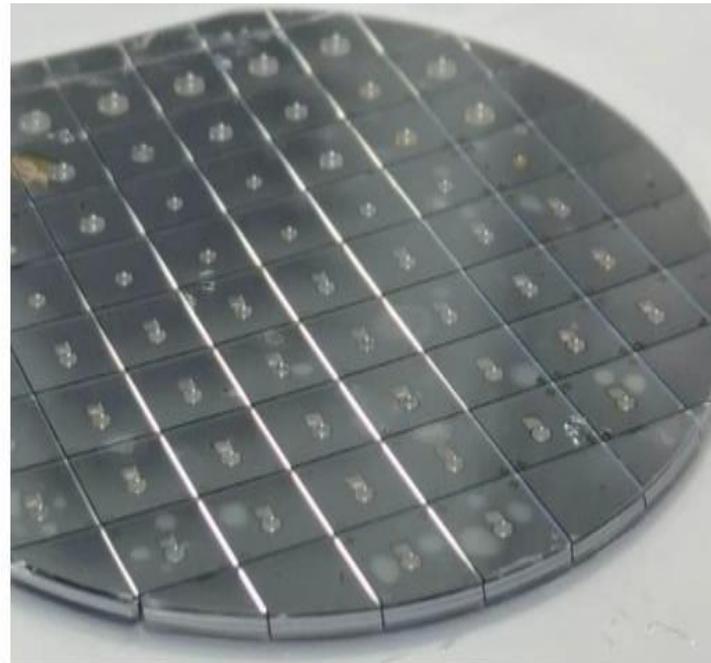


6b) PASF-Key Equipments & Tools:- Dicing M/C



Dicing Machine 2- 8" Wafer

- I. Si, SOI, LiNbO₃, LiTaO₃, ITO, STO, LNO, GaN
 - II. On Si, Glass wafer, Bonded Wafer,
 - III. Niobium on Si.
 - IV. Ceramic substrates, AuSn
 - V. Quartz, SiC, Sapphire, GaN on SiC
- Saw street: 500 μ m
 - Device dimension: 2mm x 2mm
 - Wafer Thickness: 1mm (max)



2mm stack Glass Si Glass Dicing



ITO 10 micron step cut Dicing

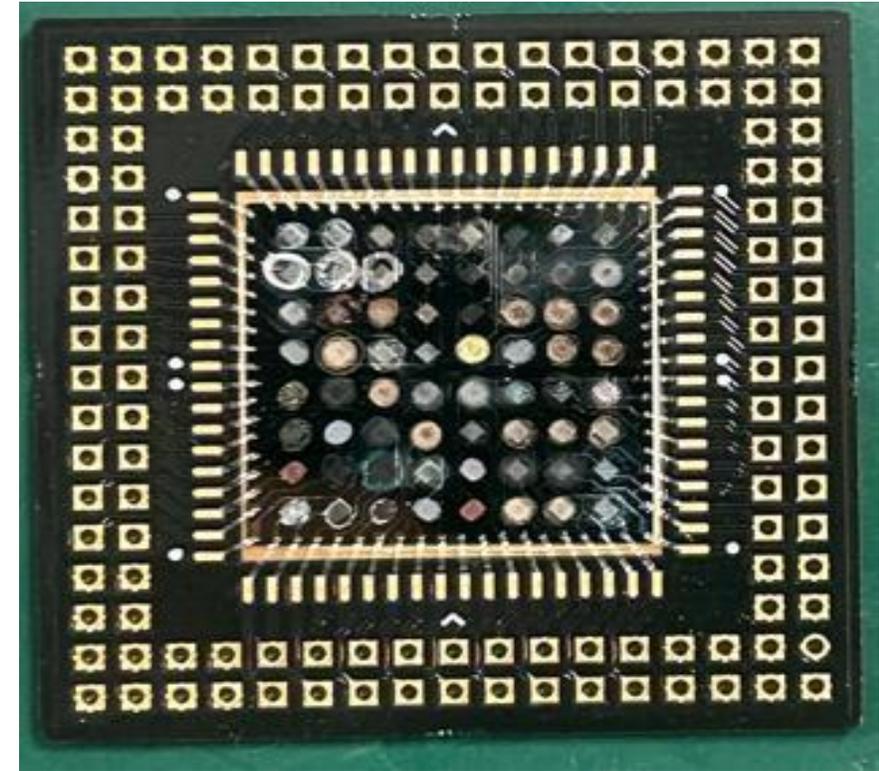
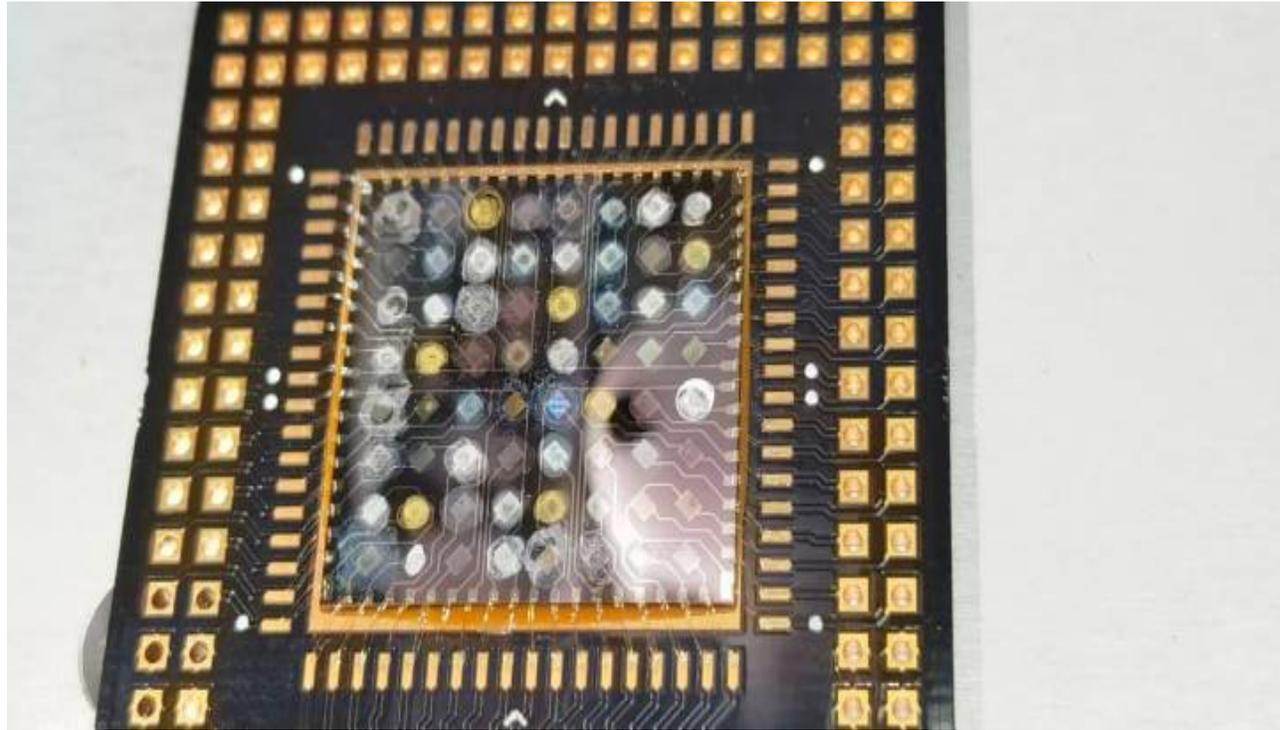
6c)PASF- Key Equipments & Tools-Wire Bonder



Semi Automatic Wire Bonders
Ball and Wedge Au & Al

- Semi Automatic Wire Bonder HB10 & HB16.
- Supports ball-wedge, wedge-wedge, and ball-bump bonding without the need to change the bond head—only tool tips are swapped.
- Compatible with gold, aluminium, with diameters ranging from 25 μm to 33 μm and ribbons up to 25 $\mu\text{m} \times 250 \mu\text{m}$.
- Accommodates substrates up to 50 mm \times 50 mm.
- Device Requirements: Pad size (100 $\mu\text{m} \times 100\mu\text{m}$) , Pad Pitch : 200 μm , Metallization thickness: seed layer - >10nm, Metal layer: >100nm
- Pad Metallisation: Ti/Pt , Cr/Au, PCB with ENIG finish, Chip carrier, Lead frame and To package

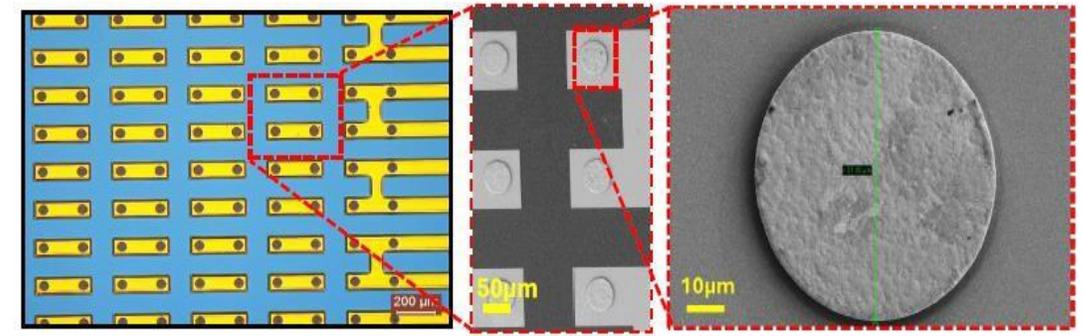
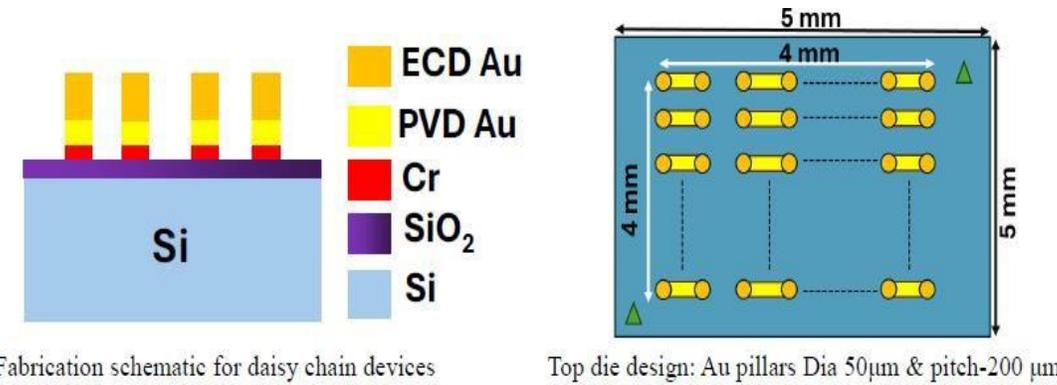
6d)PASF- Key Equipments -Wire Bonding examples



- ❖ 64 Pads
- ❖ Pad Size 200x300u
- ❖ Pitch 300u
- ❖ Ti/Pt- 10/100nm
- ❖ Au & Al both ball and wedge



Flip Chip Bonder- Thermocompression Fine pitch Bonding & other applications



Fabricated bottom die with daisy chains. Inset shows the SEM images

Au-Au Bonding Pillars with 50u Diameter and Pitch 200u

6f) PASF- Key Equipments & Tools others



Temperature Chamber - 70°C to 180°C Reliability Testing

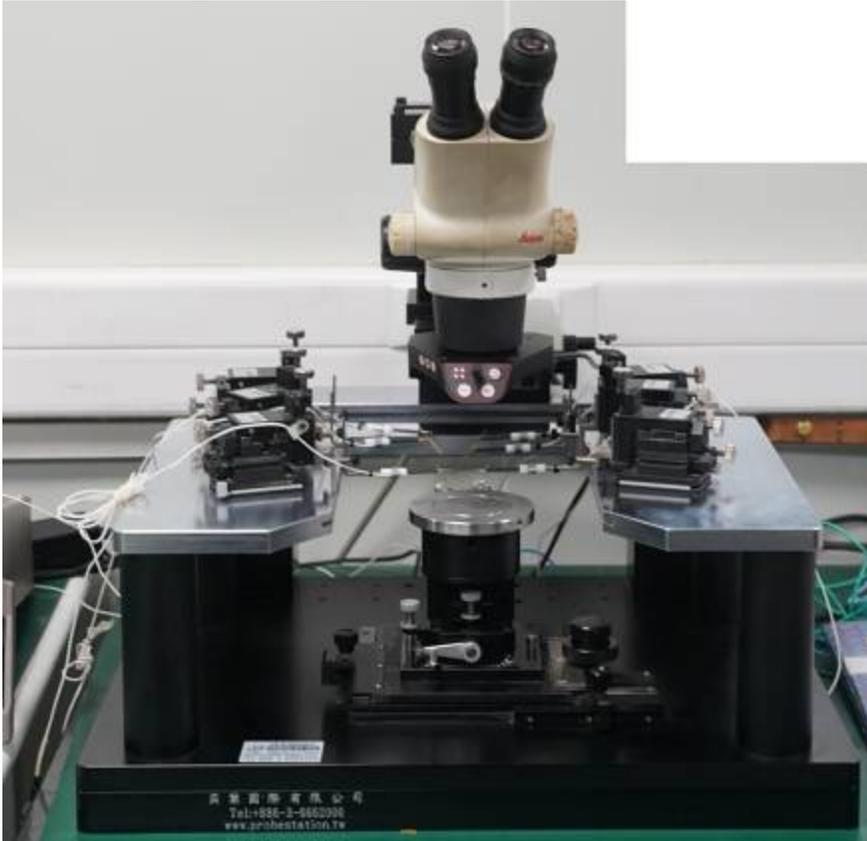


Parylene C Deposition System- Fine Coating for dielectric absorption, moisture protection



Helium Leak Detector
5X10⁻¹² bar- Fine Leak

6g)PASF- Key Equipments & Tools-Others



DC Probe Station- Electrical
Characterisation



Laser Welding Machine-
S.S/Kovar-50mm Dia & 0.3 mm
SS/0.7mm Depth

6h) PASF- Key Equipments & Tools



Sand Blasting System-
Surface Modification



Plasma Cleaner-
Contamination removal and
Surface Treatment



Centrifuge- Material
Separation



7) PASF Services Offered

1. Design Services 1 :- Embedded Hardware/Analog.
2. Design Services 2:- Embedded Firmware/Software.
3. Design Services 3:- Mechanical Design and Modelling
4. 3d Printing of Packages/Housings for Prototypes
5. Packaging Services of Semiconductors:- Wafer Dicing to Packaging (Die Attach & Wire Bonding).
6. Pressure Sensors complete Wafer to Product including reliability Testing.
7. Prototype feasibility to Technology Transfer with ISO9001 Standards Documentation.
8. For Details on PASF Capabilities:- Refer to below link

<https://sysefandpackagingfacility.cense.iisc.ac.in/pasf-services/capabilities/>



8) PASF Questions and Answers



PASF Website:- <https://sysefandpackagingfacility.cense.iisc.ac.in/get-access/>

Share your Experience

1)Click [Feedback Form](#)

1a)Select **General Feedback** for Overall feedback for the facility

1b)Select **MNCF, NNFC, PASF** for the Tool/Equipment specific feedback

For FOM & Other issues log into below 2)

2)[PASF Compliant Register](#)

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<https://sysefandpackagingfacility.cense.iisc.ac.in/>

