SPECIFICATION TO SUPPLY 200MM WAFER WITH PASSIVE INTERCONNECT NETWORK

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Glossary

ADR: European agreement on the international carriage of dangerous goods by road
BHT: High technology building
BSDI: Industrial waste record
BT: Transport office
CACES: Safe operating proficiency certificate
Spec.: Specifications
CEA: Commissariat à l'Energie Atomique et aux énergies alternatives (CEA - French Alternative Energies and Atomic Energy Commission)
CEA Grenoble: CEA office in Grenoble
CI: Site manager
CRCV: Radiological testing of vehicle loads
CS: Security correspondent (information protection)
CSP: Clean room consumables
CT: Technical correspondent for the contract
DATI: Alarm device for lone workers
DIA: Internal purchase request
DIB: Ordinary industrial waste
DOPT: Département Optronique et PhoTonique (part of LETI)
DPEI: Département Projet, Exploitation et Ingénierie
DPFT: Département des PlateFormesTechnologiques (part of LETI)
ELPS: Local first aid teams
PPE: Personal Protective Equipment
FDS: Safety datasheets
FEFO: First Expired, First Out
FIFO: First In, First Out
FLS: Local Safety Unit
CAPM: Computer Aided Production Management
HCT: Collective Working Hours (from 7:55 AM to 4:35 PM)
HNO: Non-Working Hours (from 8:30 PM to 6:00 AM)
HO: Working Hours (from 6:00 AM to 8:30 PM)
ISI: Site safety engineer
LBB: End-to-End Link
LPE: Company access pass
LETI: Laboratoire d'Electronique et de Technologie de l'Information
MINATEC: Innovation campus for MIcro and NAnoTEChnologies
PC 41: Control station for building 41
PP: Prevention plan
PPS: Simplified prevention plan
PQP: Special quality plan
RDO: Order distribution network
SFETN: Service Facilities Exploitation et Travaux Neufs (part of DPFT)
SMA: Purchasing Service



If this symbol appears in the margin of the document, close attention will be paid to the point(s) in question during the analysis of the proposals and throughout the service.

1 PURPOSE

These Specifications define the procurement conditions for 200mm wafers with RF interconnect network for CEA Grenoble under a contract based on order forms.

200mm wafers with passive Cu based interconnect network are hereafter referred to as the "Supply wafer".

These Specifications define the characteristics of the needed base interconnect wafers provided by a foundry (i.e the Supplier), for CEA- project related to optical communication and display. The wafers supplies are destinated to be used for 3D assembly with a GaN optical integrated circuit process, and must enable the usage of up to 4 level metal layers (Back-end-of-line, BEOL) without active device (Front End of Line, FEOL). GaN Optical integrated circuits (OIC) are fabricated at CEA.

The objective of the final product serves two domains

- The demonstration of LETI GaN technology in the field of optical communication, including emitting device and receiving device
- The demonstration of LETI GaN technology in the field of display

2 APPLICABLE DOCUMENTATION

2.1 *General*

The detailed list of documents included in this chapter is not exhaustive, and is intended to identify the main documents applicable to the services described in these Specifications. CEA Grenoble will update the list as often as necessary in compliance with security rules, changes to regulations and the supplier's recommendations as part of the monitoring of technological and regulatory developments.

2.2 *Reference documents*

The administrative order for the site, CEA safety instructions and circulars apply on the CEA Grenoble site, particularly the following texts:

- General purchasing conditions;
- Internal rules at CEA Grenoble.

These documents can be viewed on-site or forwarded on request. The supplier must inform CEA Grenoble of all changes to regulations in the fields covered by these Specifications and any inherent effects on the contract.

3 TECHNICAL SPECIFICATIONS

CEA's basic requisites in terms of 200mm Cu based interconnect network are the following.

3.1 *PROCESS DESIGN KIT (PDK)*

The supplier must supply to the CEA LETI the process design kit enabling design of interconnect network. It includes full access to targeted technology description, including:

- Design Rules Manual with all design rules and process options
- BEOL Stack description, including Metal and dielectric property (resistivity, permittivity)
- Technology files for EDA tools (Cadence Virtuoso and Calibre Design Rev, and Klayout)
- Design Rules Checks technological file for Siemens Calibre mm DRC
- Dummies Generation technological file for Siemens Calibre mm DRC

3.2 *BASE WAFER SUBSTRATE*

The interconnect network must be built above low resistivity 200mm Si wafer in 100 crystal orientation, should be isolated from the surface of the substrate.

3.3 *TECHNOLOGY NODES*

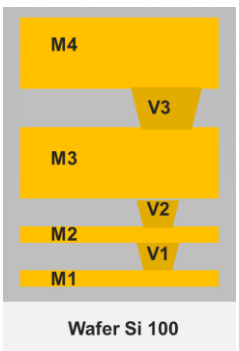
Although the present document specifies only metal interconnect layers, the technology with which the interconnect layers must be fabricated should be at least 130nm node, or more advanced nodes (65nm, 45nm etc).

3.4 *PROCESS MATURITY*

The wafer must be fabricated using a highly reproducible process over TRL8 in the scale of Technology Readiness Level, which correspond to a complete and qualified system.

3.5 *TECHNOLOGY LAYER STACK*

In order to meet RF requirements, the metal stack should at least be composed of the layers mentioned in the following table. Alternatively, the metal stack should be made with only 2 or 3 metal layers.

Layer (1)	type	
M1	Thin metal routing	
V1	Via from M1 to M2	
M2	Thin metal routing	
V2	Via from M2 to M3	
M3	Thick metal routing	
V3	Via from M3 to M4	
M4	Thick metal routing	

(1) The layer names are purely generic names and are not related to any known technological stack

The proposed technology must full fill the following specification:

- The two first metal (M1,M2) should be thin metal layer (< 0.5µm) and the two last metal (M3,M4) should be thick metal layer (> 3µm). If the proposed stack is 2 metal layers only, the first metal layer should be

a thin layer and the second a thick layer with specifications thickness defined above. If the proposed stack metal is 3 layers only, the first metal layer should be a thin layer and the second and third should be thick layer with specifications thickness defined above.

- Metal layer material should be Cu
- The dielectric must be inorganic preferably a silicon oxide. The **total dielectric thickness between M2 and M4 should be at least 4µm** with a dielectric permittivity around 4.

The last material must be an inorganic dielectric layer that is fully encapsulating the last metal layer.

The alignment of the supplier's proposal with the specifications of this stack is mandatory for the offer to be considered a valid candidate.

3.6 ***DESIGN RULE COMPATIBILITY***

The general rules must respect the following:

- grid <= 0.01µm
- metal routing at 0°, 90° or 45° or 135°

In order to be compatible with the design of GaN OIC, the following design rules must be respected:

- The minimum thin metal layer (M1, M2) feature size (space and width) must be below 0.5µm
- The maximum thin metal layer (M1, M2) width must be over 10µm
- The minimum thick metal layer (M3, M4) feature size (space and width) must be below 2µm
- The maximum thick metal width (M3, M4) must be over 12µm

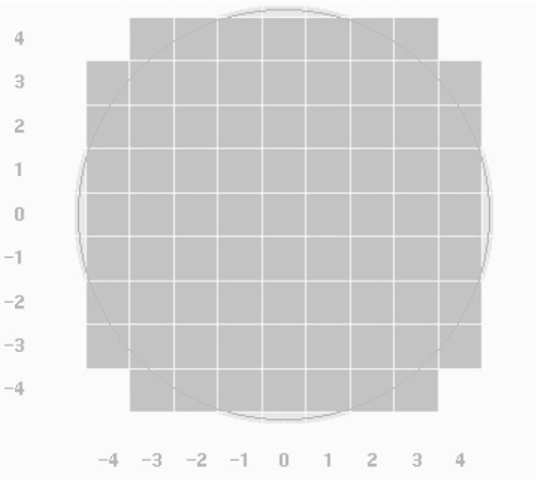
Appreciation of the compatibility with the CEA GaN OIC will be let at the judgement of CEA technical experts at the reception of the offer.

3.7 ***PERIPHERY AND FIELD SIZE***

The CEA design field will be surrounded by an inner periphery ring of 150µm. CEA will have in the last metal layer alignment marks and SPM structure in the periphery area. Those structures may require no-dummies area and may not be fully compliant with design rules, but exceptions will be waived. Positions of supplier alignment marks with respect to these marks will be discussed to fulfil minimum distance in between alignment marks to avoid interferences.

The supplier proposal **must be compatible with a circuit of size 20880µm x 20880µm,** and **a pitch of 21000 µm in x and y**. (Note: the supplier outer foundry periphery should be 60µm or less).

Additionally, The CEA-circuit is drawn with a wafer-map shift of zero as represented in the following figure. Thus it is mandatory that the supplier accept compatibility with a wafer-map shift of zero.



3.8 *WAFER TEST*

Since the required wafer does not include Front-End devices, such as mosfet, diode, etc**, the electrical test of the supplied wafer is not mandatory.**

The supplied wafers must be processed in accordance to supplier internal quality procedure, and be in the specification range given by the Design Rules Manual of the Supplier.

3.9 *Part Identification and traceability*

Each wafer shall be identified with a unique code allowing a full traceability.

4 NUMBER OF BATCHES AND MASKSET NECESSARY

The present document specifies the supply of one batch of 25 wafers, including the maskset supply for the 4 metal levels and 3 via levels.

Core request	1 full maskset 1 batch of 25 wafers

5 DELIVERABLE

The CEA will transfer the maskset design to the Supplier (GDS or Oasis) in accordance with Supplier internal rules.

The Supplier shall issue a report detailing all database verification checks performed on the maskset design. The report shall be provided after delivery of the maskset design **no later than 1 month**. In the event of any non-conformity, the CEA may either correct the maskset design or discuss a case-by-case waiver with the Supplier.

After joint CEA/supplier approval of the final maskset design, the final masks database should be sent to CEA for formal approval before maskset manufacturing by the Supplier. At this time customer service should issue the expected delivery date.

Only wafers fulfilling the technology specifications will be delivered and charged. In case of a few wafers are missing (up to 5 out of 25 wafers) no restart of the missing wafers is requested.

The expected delay to receive the fabricated wafers is expected to be no more than **4 months (preferably less) after CEA final maskset database approval**.

6 WAFER ACCEPTANCE

The supplier will issue a certificate attesting the manufacturing in accordance with its process specifications and DRM.

CEA will perform acceptance inspections on the received wafers:

- CEA will visually inspect each wafer and verify its conformity with the Supplier's specifications, as defined in the Design Rules Manual or other document provided by the Supplier (called the Supplier Specifications).
- CEA may perform additional physical or electrical characterizations to verify conformity with the Supplier's specifications.

- CEA shall notify the Supplier of any non-conformity identified with respect to the requirements of the Design Rules Manual. CEA may reject a wafer if major discrepancies are identified, following discussion with the Supplier regarding each detected non-conformity.

7 OPERATING PROCEDURES

7.1 *Technological environment*

LETI carries out R&D in micro and nanotechnologies. It can boast its own clean rooms rated between ISO3 and ISO8 (as per standard ISO 14644-1), laboratories and related areas (basements, production units, corridors, tertiary premises) for this purpose. Clean rooms are used at all times thanks to alternating user shifts.

7.2 *Contributors and their respective roles*

7.2.1 CEA Grenoble

- CEA monitors technical aspects of services. The Technical Correspondent is designated for this purpose.
- The Purchasing Service of CEA Grenoble monitors commercial aspects of the services provided by the supplier.
- The Environmental Health and Safety Unit is the priority contact for all safety aspects (e.g.: Safety datasheet, PPE, etc.).
- The Quality Unit monitors quality aspects of the services and supplier documents. The Quality Unit is in charge of monitoring anomalies, programming audits and the associated improvement actions.
-

7.2.2 Supplier

The supplier will provide the services defined in the above Specifications.

7.3 *Relations with CEA Grenoble*

The supplier will designate a priority correspondent, who will report directly to Technical Correspondent for the monitoring of technical aspects.

The supplier will provide CEA with an e-mail address and a telephone number for the purpose of sending delivery requests for Supplies.

The supplier must immediately report any type of anomaly, incident or accident which occurs during the services to the Technical Correspondent.

7.4 *Compliance at receipt*

The Supplies are considered conform with reference to the wafer acceptance specifications mentioned in § 6 and with following items:

- the Supplies correspond to the CEA's delivery request (reference and quantity),
- the Supplies are in good condition. The CEA will indicate its reservations in writing in all other cases,

In the event of non-conform Supplies, the CEA will inform the supplier in view of analysis and corrective actions.

7.5 *Delivery conditions*

The supplier will specify in its offer the preferred transport conditions by CEA or at its charge.

8 INFORMATION AND CONSULTANCY - OBLIGATION TO PROVIDE INFORMATION

The supplier will provide feedback and expertise, and ensure technological and regulatory monitoring to the benefit of CEA Grenoble.

Any element that doesn't allow the supplier to correctly perform the services described in this supply specifications must be the subject of an alert to the Technical Correspondent.

The supplier must ensure to notify the CEA of any changes relating to the Supplies: the technical characteristics, the container, packaging… at least 2 months prior to the date of effect of the modification.

If part of the Supplies is withdrawn from sale, the supplier will provide the CEA with at least 6 months' notice of withdrawal and propose an alternative product to the CEA, if applicable.

9 GENERIC RESOURCES

In case the transport is taken in charge by the supplier, CEA will not provide the supplier with any specific resources at delivery. The supplier must dispose of packaging in a manner which allows the CEA to easily collect it using conventional equipment.

10 SUSTAINABLE DEVELOPMENT

CEA Grenoble works to improve its environmental performances as part of the "Sustainable Development" policy and encourages its suppliers to accompany this approach.

The supplier will share its sustainable development strategy and its proposals for specific improvements to the service covered by these Specifications in its proposal.

11 EXECUTION CHECKS - SERVICE INSPECTION

The service inspection is based on the objective criteria defined for each task. The data required to calculate the indicators is saved by the service Supplier.

Task	Indicator	Target	Method used to calculate the indicator
Lead Time	Deadlines indicated in the contract	0 late deliveries	Period between the delivery request dispatch date and the delivery date
Conformity	Defined in § 6	5 non conformities max (cf § 5)	Number of non-conformities