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RFP for End to End Manufacturing and Delivery of Space Qualified HMC 40W, Triple Output DC-DC Converter

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1 Introduction

The URSC (U R Rao Satellite Centre) is a key unit of ISRO responsible for designing and developing communication, navigation, and remote sensing satellites for Indian space programme. URSC is currently seeking proposals from *Indian industries for manufacturing of space-qualified HMC technology based DC-DC converters*. It is intended that an *Indian industry* which is having manufacturing line of Thick Film Hybrid Microcircuits (HMC) in India and *having expertise in delivering space qualified DC-DC converter HMCs shall be considered for bid* to carry out the tasks described in this document.

2 Scope of the document

This document serves as an invitation for offers related to the **manufacturing** of **Hybrid Microcircuits (HMCs) converters**. The scope of work includes **procurement of EEE components, packages, raw materials, fabrication of DC-DC Converter HMCs, development and manufacturing of Functional & burn-in Jigs, testing, and screening of fabricated converters**.

The document is organized into **five (05) parts**:

1. **Scope and Description**: This section outlines the work scope, describes the tasks, specifies the mode of operation, and provides precautions to be followed during execution. It also outlines the responsibilities of both vendors and URSC.
2. **Activity, Responsibility Matrix and delivery schedule**: The second part includes matrices for activities and responsibilities, Screening tests, Destructive Physical Analysis (DPA)**,** and documentation requirements. The final section of this part includes URSC's requested tentative delivery schedule.
3. **Formats for Data Packs**: The third part presents the formats for the fabrication data pack and screening data pack.
4. **Bill of Materials and Engineering drawings:** The fourth part contains list of Bill of Material and Engineering documents required for manufacturing of 40W DC-DC converters.
5. **Details of Specification and quantity details of functional and burn-in jigs** to developed and manufactured

Additionally, the Process Identification Document may be periodically updated based on joint working experiences between URSC and the vendor(s) to ensure product quality.

PART I

3 Scope of Work:

The vendor is tasked with manufacturing of **40W Triple output DC-DC converter** HMCs and Testing Jigs based on the following categories:

1. **HMC Type:**
   - Works for a line Voltage range of 26V-42V with **Triple output**.
2. **Test Jigs**:
   - Functional Test Jig.
   - Burn-in Test Jig

These specified DC-DC types are intended for the powering of the **spacecraft subsystems**.

4 Work progression.

The work progression is depicted in the table below, along with the corresponding completion timeline.

Table 1. Manufacturing Work Progression

Receipt of Purchase Order	T0
Vendor Activity: Collection of Production Data on receipt of PO	T1=T0 + 60 weeks
Vendor Activity: Completion of procurement of raw materials, components and packages	
Vendor Activity: Submission of IGI reports of all procured items by vendor to URSC for clearance	
Vendor and URSC Activity: LAT test of packages by vendor and clearance by URSC	
Vendor Activity: Fabrication and delivery of Functional & Burn-in Jigs with datapack	
URSC Activity: IGI/LAT reports review, validation of jigs and clearance to vendor for usage of all procured components, packages, raw materials and Jigs	T2= T1 + 2 weeks
Vendor Activity: Collection of required jigs for testing & screening of HMCs	T3= T2 + 14 weeks
Vendor Activity: Fabrication of 1st batch HMCs, testing, screening and submission to URSC	
Vendor Activity: Fabrication of 2nd batch HMCs, testing, screening and submission to URSC	T4= T2 + 18 weeks
URSC Activity: Testing of 1st and 2nd batch HMCs at URSC and Clearance to vendor for fabrication of remaining HMCs	T5=T4 + 10weeks
Vendor Activity: Fabrication of 3rd batch HMCs, testing, screening and submission to URSC	T6= T5 + 8 weeks
Vendor Activity: Fabrication of 4th batch HMCs, testing, screening and submission to URSC	T7=T6 + 10 weeks
Vendor Activity: Fabrication of 5th batch HMCs, testing, screening and submission to URSC	T8=T7 +10 weeks

5 Statement of Work

The scope of work encompasses the procurement of EEE components, packages, and raw materials, followed by the fabrication of HMCs and test jigs, testing and screening of HMCs by the vendor. Detailed responsibilities, working methods, and test matrices have been provided to enable vendors to evaluate the scope of work and submit a commercial offer.

The vendor's responsibilities include the following tasks:

- **Procurement of EEE Components** as per procurement specification as provided in **Part V**, section 30.
- **Procurement of HMC Packages and raw materials** as per **Part IV, section 26**.
- **Fabrication of Functional and Burn-in Jigs** as per **Part V**, section 31.
- **Flight HMC realization** as per the **Process Identification Document** approved by URSC/ISRO.
- **Fabrication Data pack/Specification Control Sheets (SCS) as per section 23.**
- **Submission of HMC samples** for **testing the quality of manufactured converters.**
- **Screening of HMCs** as per Part II, Table 4.
- **Submission of Screening Data pack/SCS as per section 23 for acceptance of HMCs.**
- **Delivery of screened HMCs and fabricated test jigs as per section 21, table 8 & 9.**

It is essential that the vendor has the necessary facility to carry out all processes for fabrication of HMCs. Outsourcing of any fabrication process to a third party is not accepted however, vendor can subcontract fabrication of test jigs and partial screening tests such as environmental/ mechanical tests activities as detailed in ***section 17, table 3.***

5.1 Stages of procurement of EEE components and HMC packages

5.1.1 Procurement of components

a) Parts shall be procured from QML/QPL listed Original Component Manufacturers (OCM) or authorized distributors.

b) Vendor is responsible for the procurement of all EEE components in bare die form and passive components, referring to **Part-IV** for component details and **Part V, section 30** for procurement specifications of the same.

c) Procurement specification will contain Part details (part number, die diagram, etc.), Quality requirements, Wafer Lot acceptance test (WLAT)/Element evaluation requirement, documents to be delivered along with components and other requirements such as packing etc.

d) Post procurement, Vendor is required to perform Incoming goods inspection (IGI) as per approved Process Identification Document (PID), to ensure that the components received are of required quality with necessary certificates and data pack as specified in the procurement specification provided by URSC.

e) Vendor shall provide Procurement, Quality Conformance and all other technical details for every die listed in Bill of Materials (BOM) in the "Parts Approval Document" format attached as in **Part-III**. Approval shall be obtained from URSC before the start of fabrication.

f) Any deviation request from the suppliers during the component procurement or during incoming inspection has to be reported to URSC and obtain approval before the procurement/start of fabrication as the case may be.

g) The procured components shall be handled and stored as recommended in section 7.3. Storage conditions for components with respect to environment, humidity and particulate contamination shall be as per the URSC guidelines. All ESD guidelines must also be adhered to.

5.1.2 Procurement of HMC packages and RAW Materials

a) Vendor is responsible to procure all raw materials (substrates, printing inks, adhesives, wire/ribbons, packages, cleaning agents, gases, SIL clips, solders etc.) from the sources approved by URSC.

b) For adhesives, out gassing reports to be submitted to URSC to obtain approval for their usage.

c) Use shelf-life limited items before date of expiration specified by the manufacturer.

d) The raw materials and consumables used in the realization of HMC has to be as per the qualified materials listed in PID and relevant certificates corresponding to the lot used has to be filled during the assembly of the packages.

e) Perform Incoming goods inspection (IGI) for each material as per approved procedures by URSC and submit the recorded data.

f) The HMC packages shall be procured from qualified vendors. On receipt of packages, weight simulated packages are to be subjected for Lot Acceptance Tests (LAT) as per Section 20, Table 6. Certificate of Conformance (CoC) along with LAT fabrication / test data pack are to be submitted to ISRO for review and approval.

5.2 Stages of Manufacturing and delivery

The necessary details for manufacturing of Space Qualified HMCs, including package drawings, package outlines, marking details, component lists, materials, pin configurations, and approved layouts, are provided in **Part-IV**. The various stages involved in the manufacturing and delivery of Space Qualified HMC are explained in the following sections:

5.2.1 Applicable standards and process identification document (PID) for reference

a) *The standards/ specifications spelt out in MIL-PRF-38534 Standard will form the basis for execution of all tasks.*

b) *Vendor's PID (Process Identification document) approved by URSC shall form basis for all the activities to be performed by Vendor.* HMC fabrication process,

materials, operators, equipment, and practices as listed in the PID approved by URSC/ISRO has to be strictly followed during realization of this product.

c) *Incremental PID for the new processes, in case of need arises, are to be generated and submitted to URSC for review*. Necessary technical support/guidance will be provided by URSC to generate this part of PID.

d) The process steps as listed in approved PID and PID duly approved by URSC/ISRO (for new processes) is to be followed at every stage of product realization.

5.2.2 Fabrication

a) Fabricate Products as per Process Identification Document (PID) duly approved by URSC (no deviations from approved process are permitted).

b) Fabricate functional as well as burn-in jigs as per **Part V**, section 31.

c) Activities and URSC Inspection check points that are to be carried out during fabrication and post fabrication are as given in **Part-II, Table 3**.

d) Document all process details in Specification Control Sheet (SCS) formats as per section 23.

e) Perform inspection of Products on 100% basis at various stages of fabrication as per approved procedure and document along with SCS.

f) Precap Visual Inspection of fabricated HMCs at vendor's facility / URSC.

g) Submit SCS for review/ approval in the formats as per section 23 and obtain clearance for Screening.

5.2.3 Screening of HMCs

a) Vendor is responsible for carrying out Screening of HMCs as per the requirements spelt out in **Part-II, Table 4**.

b) Initiate Screening only after receiving clearance from URSC.

c) After completion of Screening, samples (as per the requirement provided by URSC) shall be subjected to DPA as per requirements given in Table-5.

d) Document all test results in the Screening Document formats and deliver them along with the products.

5.2.4 Data Pack

a) After completion of fabrication of functional as well as Burn-in Jigs, fabrication datapack shall be delivered along with Jigs to URSC for review and clearance of jigs for usage in testing of HMCs /verification/validation of jigs.

b) Specification Control Sheet (SCS) detailing the Parts, Materials and Processes used for realization of HMCs shall be submitted to URSC in formats (section 23) for each batch separately prior to initiation of Screening.

c) After completion of Screening, HMCs shall be delivered to URSC along with Screening data pack for each batch.

5.2.5 Rework Guidelines and History

Rework on any HMC should be done after confirmation from URSC based on the guidelines provided by URSC. All rework done on any HMC should be properly documented in SCS.

5.2.6 Non-Conformance Management

Any Non-conformance during realization/testing of product is to be presented to URSC before proceeding further with fabrication/testing. Corrective/preventive actions suggested by URSC are to be implemented.

6 Working Modality

Vendor shall identify one or more focal point/s for interaction with URSC for execution of tasks. The identified focal point should preferably be a senior person who will be able to provide any clarification and take decisions as required. URSC may identify one or more Contract Managers/ Focal Points for day-to-day interaction with the vendor and for execution of the tasks.

Responsibility of vendor focal point shall be as given below for various Tasks:

a. Collection of required design details of HMCs, design details of Test jigs, fabrication details and test procedures.
b. Submission of IGI reports, CoC, data pack, test reports and other details for the procured/realized items, to obtain approval from URSC for their flight usage to realize HMC converters.
c. Submission of fabrication data, SCS, Inspection reports, test results and applicable data for the activities as listed in *section 16* and *17* for the fabricated samples to URSC.
d. Delivery of HMC converters as per delivery schedule of section 21.1.
e. Delivery of Functional & Burn-jigs Test jigs along with all technical documents to URSC as per section 21.2.

7 Shipping and storage of semi- finished and finished products

7.1 Despatch of Products

Vendor shall supply semi-finished and finished Products in ESD safe containers (as applicable) along with data pack and shall take necessary steps for protection against moisture, contamination and use mechanical damage proof packing during transit.

a. Submission of samples of Products (100% of the batch) to URSC for precap inspection before sealing/encapsulation (will be returned to vendor) in desiccators.
b. Delivery of all fabricated and Screened HMCs along with the SCS and screening data for the complete batch.
c. Delivery of all fabricated functional and Burn-in Jigs along with all technical data on completion of Screening of final HMCs.

7.2 Acceptance of Products

a) Manufactured products will be accepted by URSC after
   - Review of fabrication/SCS/Screening data
   - External visual inspection
   - Verification of test results through electrical checks

b) Manufactured & delivered products shall have warranty period of one year from the date of acceptance by URSC.

7.3 Handling, Storage, Packing and ESD Protection

Guidelines given below shall be followed as a minimum during handling, storage, and packing.

a) Handle all materials with care while processing and safety precaution followed as per technical manuals/ data sheet supplied by the manufacturer/s.

b) Following precautions shall be taken to prevent failures due to Electro-static discharge (ESD):
   - Use of wrist straps while handling assembled substrates & devices and connecting wrist straps to thick grounding lines and proper anti-static mats.
   - Use of antistatic wrist strap, tablemats and ground mats during assembly inspection and testing of Products.
   - Use of antistatic gloves during sealing of Products and carrying sealed packages in antistatic boxes.
   - Use of Teflon tweezers and finger cots while handling metallised substrates.
   - Use of metallic trays covered with lids (glass) while transporting products from one work area to another during their assembly.

c) Precap HMCs/ Partially fabricated HMCs supplied to URSC shall be delivered in Nitrogen purged desiccators.

d) Use of proper test jig sockets to avoid damage to leads during all tests.

e) Caution shall be exercised to avoid damage to Products due to ESD/ EOS during all electrical tests.

f) Storage of all fabrication materials as per the instructions given in the technical manuals/ data sheet supplied by manufacturer/s.

g) Use of Nitrogen purged systems for storing the bare chip components.

h) Use of Nitrogen purged systems for storing half assembled products.

i) Storage of photo-sensitive films in dark room and limiting their exposure to yellow light while handling/using.

8 Responsibility Definition

The responsibilities of URSC and the vendor during various technical activities given below are to be read along with Table 2 & 3.

8.1 URSC will be responsible for the following:

a. Placing of Purchase orders along with providing HMC production details (approved Layout, Bill of Materials, etc.) and other fabrication details.
b. Review of CoC, datapack and other related documents received along with procured items (component, packages, raw materials and jigs) and providing clearance for flight HMCs fabrication.
c. Mandatory Inspection Checkpoints (QA activities) like Precap Visual Inspection, Fabrication data pack review, test results review and clearances as per Table-3.
d. *Providing specifications for fabrication and procedures for validation and verification of Functional and Burn-in jigs.*
e. *Providing Functional and Burn-in test procedures for HMCs.*
f. Audit the vendor facility and advice on improvements if necessary.

8.2 The vendor shall be responsible for the following:

a. Procurement of Components/ Raw Materials/ Packages (**5.1.1** & **5.1.2** as applicable) with details such as lot number, manufacturer etc.
b. Perform Incoming inspection for procured items (components, packages and raw materials) to ensure their quality with necessary certificates and data pack as specified in the procurement specification as per **Part V**, section 30.
c. Generate and submit incoming inspection, CoC, data pack and other documents for each items procured to URSC for clearance.
d. Perform Lot Acceptance Tests (LAT) for procured packages as per LAT plan given in per Section 20, Table 6. And submit CoC along with LAT fabrication / test data pack to URSC for review and lot clearance.
e. Fabrication of Functional and Burn-in jigs as per fabrication specifications of jigs in **Part V, section 31.** Delivery of jigs meeting delivery terms as per table 9 and collection of required jigs for testing & screening of HMCs.
f. Fabrication of HMCs as per approved PID.
g. Inform URSC about schedule for pre-cap inspection at least one week in advance (URSC may depute its representative for performing pre-cap, if required).
h. Submit SCS for review/ approval in formats as per section 23 and obtain clearance for Screening.
i. Screening of HMCs and Destructive Physical Analysis (DPA) on samples as per requirements of table 4 & 5.
j. Proper Storage and maintenance of jigs as per **section 7.3**.
k. Document all process details and test results in the specified formats and deliver them along with the products.

l. Packing of HMCs in ESD safe boxes as mentioned in **section 7** .

m. Transportation of HMCs and Test jigs along with all technical documents to URSC.

n. Vendor shall

- *Set up an internal system (through NC board) whereby all non-conformances noticed during execution of the tasks are properly recorded and reported within their own system as well as to URSC. The system will specifically address the procedures and responsibilities of personnel/ teams for disposal of 'minor' non-conformances. The failure analysis along with NC board recommendation to be provided to URSC for consideration*
- *Use all technical data supplied by URSC only for the intended purpose for which it is given. All Drawings, Documents and material of any kind passed on by URSC in connection with manufacturing work shall be held confidential by vendor or their Sub-Contractor/s, and shall remain the property of URSC. All Drawings, Documents and material of any kind passed on by URSC shall be duly returned on completion of manufacturing & delivery of HMC Converters. No hard copies or duplication of hard copies will be retained by the vendor. A Non-Disclosure Agreement (NDA) will be signed at the time of placement of purchase order.*
- *Participate in reviews related to failure of Products and carry out failure analysis based on deliberations and implement identified corrective actions.*
- *Submit all documents as 'hard copy' as well as the 'soft copy (scanned) in Compact Disc' along with the Products.*

9 Vendor Liability

Products that fail during tests whether performed either at vendor's place or elsewhere before acceptance shall be rejected. Products rejected by URSC shall be returned to the Vendor for rework/replacement. Failures of HMCs if traced due to the manufacturing process at any stage of fabrication, testing and screening, vendor is liable for manufacturing new product as the replacement of failed product. Similarly, any failures observed and reported in test jigs at any stage of fabrication and usage, is of the responsibility of vendor to correct or replace the test jig. Payment shall be made only for the accepted HMC products and Jigs. *Payment shall be made only for the accepted HMC products and Jigs.*

10 Status Reports and Plans

The vendor shall provide status report on various activities related to fabrication and testing of products and jigs. This report shall be submitted fortnightly. It shall also include the projections on activities planned and targeted during the following month.

11 Pre Bid Meet

Not Applicable.

12 Delivery Schedules

Vendors are required to provide clear delivery schedules for various tasks, considering the quantities to be delivered. The quotation should include the following details:

1. **Procurement Schedule**: This covers components, raw materials, and HMC packages as per Part IV and Part V, Section 30.
2. **Fabrication schedules of Test Jigs:** This covers fabrication, validation and verification and delivery of functional and burn-in jigs as per Section 21.2.
3. **Fabrication and Testing Schedule:** This includes components inspection, fabrication process, and final delivery.
4. **Batch Delivery Schedule:** Delivery schedule for fabrication and screening tests of HMCs shall be as per in Section 21.1.

13 Vendor selection criteria

The vendor must comply with URSC's technical and commercial requirements.
Also, Vendor must

- have complete thick film HMC manufacturing line in India certified for manufacturing space grade DC-DC converter HMCs for any aerospace agencies.
- provide thick film infrastructure facility details such as screen printer, screen preparation equipment, screen exposure unit, screen cleaning equipment, Thickness measurement unit, firing furnace (up to 1000°C), Microscope (magnification of about 250x to 400x), laser trimming system, Die bonders, Wire/ribbon bonders, Wire bond pull tester / Die shear tester , Reflow solder system, solder systems, laminar flow table of class 100, desiccators for storage of bare silicon chips/partially assemble hybrids, Deep freezer capable of storing adhesive materials at -40°C, Class 100 oven (+150°C), Hermetic sealing machines, Fine & Gross leak testing facilities, Marking machine, Test lab with power supplies, voltmeters, current meters, electronics loads, oscilloscopes and function generators.
- ensure manufacturing Lab environment (Temp: 22°C±3°C, Humidity: 50% ±5% RH, Cleanliness: Class 10000) with ESD safe operating and monitoring condition.
- submit supporting documentation for all above criteria along with the bid for evaluation.

14 Tender process

The tender process will be conducted in **two parts**: technical compliance and commercial terms. Vendors must demonstrate their technical capabilities related to the manufacturing space-grade converter HMCs as per criteria laid down in the section 13. In the second part, the price bid of the selected vendors who meet the specified criteria will be opened and ranked as L1, L2, L3 and so on based on their bids for each item. **Overall order for L1 quoted party only will be offered the purchase order. Part quote is not accepted.**

15 Limitation On Subcontracting

Subcontracting the services under this agreement like realization technology, process methods or product supply, in any form, partially or fully, to third party is strictly prohibited. However, in view of meeting delivery schedules, *vendor can subcontract followings:*

15.1 Fabrication of functional & burn-in jigs as per Part V, section 31.

15.2 Environmental and mechanical tests as listed in Screening matrix of Part II, Table 4.

PART II

16 Documentation required at various stages of fabrication, Screening and Testing

Table 2: Vendor Documentation list

Sl. No.	List of Document
To be provided along with each batch of Hybrid Microcircuits fabricated:	
1	Process and material details in URSC specified Formats (Section 22)
2	Magnetic Coil tuning and test results
3	Substrate Level electrical Test results
4	Pre-seal electrical measurement
5	Pre-seal inspection report
6	Failure report/ non-conformance report if any
7	Seal Leak Results (Fine & Gross)
8	Post seal electrical measurements
9	External visual inspection report
To be provided along with each batch of *Screened* Hybrid Microcircuits:	
10	External visual inspection report
11	Post Seal Leak results
12	Initial electrical measurements
13	Records of Screening – environmental & mechanical test results
14	Pre/Post Burn-in Electrical Measurement
15	Post ATC Electrical Measurement
16	Final Seal Leak test results
17	Final Electrical test results
18	Failure report / non-conformance report
19	Destructive Physical Analysis (DPA) Report
20	Final external visual inspection report
To be provided for Functional & Burn-in Test Jigs:	
21	Fabrication reports and user manuals along with test procedures

17 Progression of the Activity and Responsibility Matrix

Table 3: ACTIVITY AND RESPONSIBILITY MATRIX FOR FABRICATION AND TESTING OF PRODUCTS

SN.	ACTIVITY	PROCEDURE	DOCUMENTS	RESPONSIBILITY	REMARKS	Subcontract Permission
1	Submission of purchase order to vendor along with production document	Issue details with approval by URSC & DESIGNER and in the specified format	Production document	URSC		No
2	Procurement of components, packages & raw materials	Procurement referring to **Part-IV** for component details and **Part V** for procurement specifications	Procurement specification as provided by URSC shall contain Part details (part number, die diagram, etc.), Quality requirements	VENDOR / URSC		No
3	Perform Incoming inspection to ensure that the components received are of required quality and are received with necessary certificates and data pack as specified in the procurement specification.	Generate and submit incoming inspection reports for each items procured.		VENDOR		No
		Review and clearance of data pack of procured components and clearance for HMC fabrication		URSC		No

SN.	ACTIVITY	PROCEDURE	DOCUMENTS	RESPONSIBILITY	REMARKS	Subcontract Permission
4	Package LAT	Weight simulated packages to be subjected for Lot Acceptance Tests (LAT) as per per Section 20, Table 6. CoC along with LAT fabrication / test data pack are to be submitted to ISRO for review and lot clearance.	Packages shall be procured from qualified vendors	VENDOR / URSC		No
5	Fabrication and delivery of Functional and Burn-in jigs	As per fabrication Specifications of jigs in**, Part V**, section 31 and delivery as per section 21.2, table 9.		VENDOR		**YES** (As per point no. 15 with prior permission from URSC)
6	Substrate fabrication (print, fire, trim), coil tuning/testing and clearance for assembly	As per approved PID and clearance by URSC	SCS (process traveller format) and Inspection report	VENDOR	Inspection on 100% samples	No
7	Substrate level assembly (die attach, coil attach, wire bonding, substrate attach on substrate level jig, wire bonding as applicable) and clearance for testing	As per approved PID and clearance by URSC	SCS (process traveller format) and Inspection report	VENDOR	Inspection on 100% samples	No

SN.	ACTIVITY	PROCEDURE	DOCUMENTS	RESPONSIBILITY	REMARKS	Subcontract Permission
8	Substrate level testing and clearance for Packaging	As per specified test procedures/electrical specifications (Part IV, Section 29) and clearance by URSC	Test results and Inspection report	VENDOR		No
9	Package level assembly (substrate attach on Package and post pin wire bonding as applicable) and clearance for testing	As per approved PID and clearance by URSC	SCS (process traveller format) and Inspection report	VENDOR	Inspection on 100% samples	No
10	Pre seal electrical testing & precap inspection	As per specified test procedures/electrical specifications (Part IV, Section 29) and clearance by URSC	SCS including electrical test report	VENDOR		No
11	Pre cap visual inspection and clearance for go ahead for sealing/ encapsulation	As per approved PID	SCS (process traveller format)	VENDOR	Inspection on 100% samples	No
12	Sealing and post seal leak checks	As per approved PID	SCS (process traveller format)	VENDOR	100%	No
13	Post seal electrical test	As per specified test procedures/electrical specifications and clearance by URSC	SCS including electrical test report	VENDOR	100%	No

SN.	ACTIVITY	PROCEDURE	DOCUMENTS	RESPONSIBILITY	REMARKS	Subcontract Permission
14	Submit HMC fabrication data for review and clearance		SCS (process traveller format)	VENDOR		No
	Review of HMC fabrication data and clearance for go ahead for screening			URSC		No
15	Screening of DC-DC HMCs	As per approved PID		VENDOR	100%	**YES** (Partial screening tests – such as Environmental & Mechanical Test, As per point no. 15 with prior permission from URSC)
16	**Transportation of HMCs and Test jigs** along with all technical documents to URSC	Take all precautions during transportation as per section 7.3 for Handling, Storage, Packing and ESD Protection	SCS	VENDOR	100%	
17	Review all data and perform sample check for acceptance			URSC		

18 Screening Test Matrix

Table 4: SCREENING TEST MATRIX FOR DC-DC HYBRID MICROCIRCUITS

Test	**Test Conditions** **MIL-STD-883/ Test Method**
External Visual Inspection	TM 2009 (30X magnification)
Initial Electrical	As per specification (Part IV, Section 29)
Stabilization Bake	TM 1008, 72hrs at 125^0C
Temperature Cycling	TM1010 -55^0C to 125^0C , 10 cycles
Mechanical Shock	TM 2002, 700g half sine, 5 pulses Or 1000g SRS
PIND	TM 2020, Condition A
Pre Burn-In electrical measurements	As per specification (Part IV, Section 29)
Burn-in	TM 1015 @ 110^0C (Case Temperature) for 520hrs
Post Burn-in electrical	As per specification (Part IV, Section 29)
Active Temperature Cycling	-30^0C to $+85^0$C ,5 Cycles 2 short cycles – 2 hours 1 long cycle – 48 hours cold, 24 hours hot 2 short cycles – 2 hours
Electrical measurements	As per specification (Part IV, Section 29)
Seal Leak Test	TM 1014 Fine Leak Levels: 30psia 30hrs Limit: 5 x 10^{-8} atm cc/sec Gross Leak Levels: 30psia 24hrs No stream of bubbles
External Visual Inspection	TM 2009 (30X magnification)
Electrical measurements	As per specification (Part IV, Section 29)

19 DPA sequence for DC-DC converters

DPA Philosophy:

1. DPA shall be carried out on Screened HMC
2. DPA shall be carried out one HMC for every **25 nos.** from each manufacturing line

Table 5: Destructive Physical Analysis Sequence for Converters

SNo.	TEST	MIL-STD-883 TEST METHOD
1.	External visual examination	Method 2009
2.	Lead fatigue test	Method 2004
3.	External visual examination	Method 2009
4.	Seal leak Test* (a) Fine leak (b) Gross leak	Method 1014
5.	Internal visual examination	Method 2017
6.	Bond pull test	Method 2011
7.	Die shear test	Method 2019

* Bombing pressure:

As applicable based on screening matrix of Table 4.

20 Lot Acceptance Test of Packages

Table 6: Package LAT Matrix

SAMPLES	TEST	TEST CONDITIONS MIL-STD-883
06 weight simulated packages & 02 bare packages and lids	Dimension & external visual inspection	TM2016
	Seal leak test	TM1014 Fine leak condition: 30psia 30hrs Limit: 5 X10^{-8} atm cc/sec Gross leak condition: 30psia 24hrs Limit: No stream of bubbles
Group 1 : 3 packages	Liquid thermal Shock	TM1011 -55^{0}C to 125^{0}C 5mins - 10 sec - 5 mins, 10 cycles
	High temperature bake	TM1008, 1 hour at 150^{0}C
	Lead fatigue test	TM2004, 8 oz 45 ^{0}, 3 cycles
	Seal leak test	TM1014 Fine leak condition: 30psia 30hrs Limit: 5 X10^{-8} atm cc/sec Gross leak condition: 30psia 24hrs Limit: No stream of bubbles
	Moisture resistance test	TM1004 (No evidence of pits , discoloration, corrosion)
Group 2 : 3 packages	Temperature cycling	TM1010 Between -55^{0}C and 125^{0}C , 50 cycles
	Vibration test	TM2007 **Sine Vibration** (all three axis) 20 to 100 Hz : 20g (amplitude) Sweep rate : 2 oct/min. **Random Vibration** (all three axis) 20 to 70 Hz. $\Rightarrow$ +3dB/oct 70 to 700 Hz. $\Rightarrow$ 0.4g^2/Hz 700 to 2000 Hz. $\Rightarrow$ 6dB/oct g rms. : 21.4 Duration : 2 min/axis
	Seal Leak Test	TM1014 Fine leak condition: 30psia 30hrs Limit: 5 X10^{-8} atm cc/sec Gross leak condition: 30psia 24hrs Limit: No stream of bubbles
	Metal package isolation	TM1003, 600V DC, 100nA
	Solder ability test	TM-2003 Solder temperature +245^{0}C (±5^{0}C)
Group 3: **2 bare packages/ lids**	Salt atmosphere test	TM1009 (No evidence of discoloration, corrosion)

Note: If the package or manufacturer is new, substrate attachment and wire bonding verification shall be carried out.

21 Delivery of products and Payment terms

Total quantity to be manufactured is as per table below:

Table 7: Type of items

SN.	HMC- type	Description	Quantity
1	HD4042T-HF	42V, 40W Triple output converter	33
2	Functional Jig (FIJ)	Jigs for Functional Testing of HMCs	2
3	Burn-in Jigs (BIJ)	Jigs for Screening tests of HMCs	4

21.1 Delivery schedule and quantity of the converters need to be supplied:

L1 needs to supply 100% of HD4042T-HF as mentioned in Table 8.

Table 8: 40W Triple output converter through L1

<table>
<tr><th colspan="2">Activity Type</th><th>Timeline</th><th>Remarks</th></tr>
<tr><td colspan="2">Receipt of PO</td><td>T0</td><td></td></tr>
<tr><td colspan="2">Collection of Production Data on receipt of Purchase Order by vendor,</td><td rowspan="5">T1=T0 + 60 weeks</td><td></td></tr>
<tr><td colspan="2">Completion of procurement of raw materials, components and packages by Vendor,</td><td></td></tr>
<tr><td colspan="2">Submission of IGI reports of all procured items by vendor to URSC for clearance</td><td></td></tr>
<tr><td colspan="2">LAT test of packages by vendor and clearance by URSC</td><td></td></tr>
<tr><td colspan="2">Fabrication and delivery of
• Functional (2 nos.) &
• Burn-in Jigs (4 nos.) by vendor and validation by URSC</td><td>Collection of Jigs from URSC by vendor at the time of realization & testing of 1st batch of HMCs</td></tr>
<tr><td colspan="2">IGI/LAT reports review, validation of jigs and clearance to vendor for usage of all procured components, packages, raw materials and Jigs</td><td>T2=T1 + 2 weeks</td><td></td></tr>
<tr><td colspan="4">Fabrication of HMCs, testing, screening and submission to URSC</td></tr>
<tr><td>HMC P/N</td><td>Batch no.</td><td>Qty</td><td>Timeline</td><td></td></tr>
<tr><td rowspan="2">HD4042T-HF</td><td>1st batch</td><td>9 nos.</td><td>T3=T2+14 weeks</td><td rowspan="2">Delivery of HMCs in multiple lots is accepted upon clearance by URSC</td></tr>
<tr><td>2nd batch</td><td>6 nos.</td><td>T4=T2+ 18 weeks</td></tr>
<tr><td colspan="3">Testing of above HMCs at URSC and Clearance to vendor for fabrication of remaining HMC nos.</td><td>T5= T4+ 10 weeks</td><td></td></tr>
<tr><td rowspan="3">HD4042T-HF</td><td>3rd Batch</td><td>6 nos.</td><td>T6= T5+ 8 weeks</td><td></td></tr>
<tr><td>4th Batch</td><td>6 nos.</td><td>T7= T6+ 10 weeks</td><td></td></tr>
<tr><td>5th Batch (Final Batch)</td><td>6 nos.</td><td>T8= T7+ 10 weeks</td><td></td></tr>
<tr><td colspan="2">Total converters</td><td>33 nos.</td><td></td><td></td></tr>
</table>

21.2 Delivery schedule and quantity of the jigs need to be fabricated:

Vendor need to fabricate the jigs from total quantity as below:

Table 9: Test Jig Realization through vendor

Item Type	Qty	Realization schedule	Delivery terms
Functional Jig (FIJ)	2	T0 + 60 weeks	• Manufactured jigs by vendor will be delivered within realization schedule (T0 + 60 weeks) to URSC and clearance will be obtained from URSC for their usage. • Jigs will be collected back as FIM against bank guarantee at the time of realisation of HMC DC-DC Converters from 1st batch onwards as per table 8. • Bank Guarantee amount will be equal to the sum of PO value mentioned for item no. 2 (functional jigs) and 3 (Burn-in jigs). • Final Delivery of all Jigs to URSC in *working condition* on successful delivery of **Final batch** of HMCs as indicated in table 8.
Burn-in Jigs (BIJ)	4		

21.3 Payment Terms:

100% payment within 30 days of receipt and acceptance of items will be made on pro-rata basis.

PART III

22 PARTS APPROVAL DOCUMENT

	Ref :	
	DATE	**PAGE**

PARTS APPROVAL DOCUMENT

CONTRACT DETAILS:

VENDOR NAME:

CONTRACT NUMBER:

SUBSYSTEM/CARD:

_____

DIE DETAILS:

PART NUMBER:

PART DESCRIPTION:

MANUFACTURER:

LOT CODE:

QUALITY LEVEL:

PROCUREMENT SPEC(MIL/ESCC/NASA/OTHERS):

_____

_____ **DATAPACK DETAILS:**

SCREENING: LAT/QCI: RADIATION: DPA:

NON-CONFORMANCES:

_____

___ **QC DETAILS:**

SCREENING:

INCOMING INSPECTION:

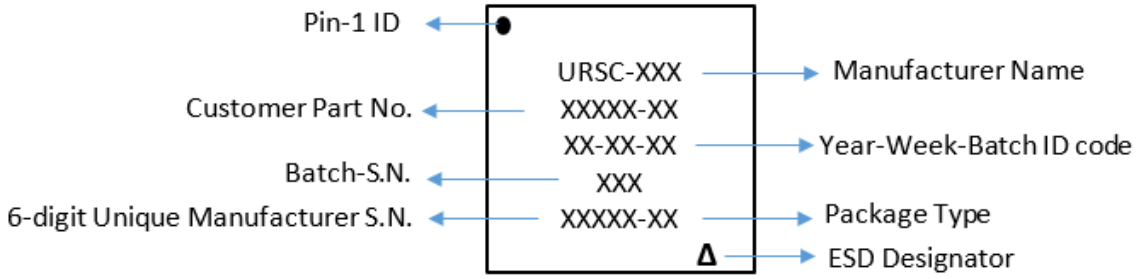
NON-CONFORMANCES:

PREPARED BY VENDOR		**APPROVED BY URSC**	
QC INSPECTOR		**NAME**	
DATE		**DATE**	
SIGNATURE		**SIGNATURE**	

23 Specification Control Sheet Format

23.1 Dispatch Summary

HMC Project		Customer Part/No	



Pin details					
Pin 01		Pin 02		Pin 03	
Pin 04		Pin 05		Pin 06	
-----		-----		-----	
Pin N-1		Pin N			

Work Order No/Date	
No. of HMCs and Dispatch Date	

Package Dimension [L x B x H]	
LID Dimension [L x B x T]	
Package Material	

HMC Batch details: Batch ID			
Batch-S.N.	6-Digit Unique S.N.	Batch-S.N.	6-Digit Unique S.N.

SCS clearance			
Checked by		Approved by	
Name		Name	
Sign and Date		Sign and Date	

23.2 Batch Yield Details-Summary

HMC Part No:		Batch No:	

Batch Quantity:

Process	Start Qty	Accepted Qty	Rejected Qty	Remarks (Attached NC)
Scribing				
Printing, settling, Drying & firing				
Fired substrate inspection				
Trimming				
Trimmed Substrate inspection				
Epoxy printing				
Die attach				
Substrate to package Attach				
Wire bonding Preparation				
Wire bonding				
Pre seal Electrical test				
Pre Cap internal visual inspection				
Customer Pre – cap Visual inspection				
Getter Gel application & Curing				
Vacuum baking, Sealing & Leak test				
Marking				
Post seal Electrical test				
External visual inspection				

Accepted PFT Sl Nos	
Used PFT SL Nos for FAB	

Verified by & Date			

23.3 Summary of Raw materials used for the fabrication of HMC

HMC Part No:		Batch Qty:	

CODE	Type of material & composition	Manufacturer	Part No.	Lot No / Batch No	ORG / RQ1 / RQ2 Expiry/Retest date	Used Date	IGA No
1	Alumina (96% Al_2O_3) substrates	Ceramtec / Coorstek	-				
2	D I water	Inhouse	-				
3	Photo Positive film	URSC	-				
4	Stainless steel mesh	HK WIRE Netting Ind / Paul GmbH & Co	250/280/325				
5	CDF Emulsion	Ulano Industries/Mc DERMID	CDF 3 /5 &5*				
6A	Ag Pd Conductor Paste	DuPont	7484 R				
6B	Gold (Au) Conductor paste	DuPont	5715 & 5771				
6B1	Solderable Gold Paste	DuPont	4597				
6C	Via Fill Gold Conductor Paste	DuPont	5727				
6D	Dielectric paste	DuPont	5704				
6E	Resistor paste 1 Ω/Sqm	DuPont	1703				
6E1	Resistor paste 10 Ω/Sqm	DuPont	1708H				
6E2	Resistor paste 100 Ω/Sqm	DuPont	1718H				
6E3	Resistor paste 1K Ω/Sqm	DuPont	1728				
6E4	Resistor paste 10K Ω/Sqm	DuPont	1738R				
6E5	Resistor paste 100K Ω/Sqm	DuPont	1748R				
6F	Over Glaze	DuPont	9137				
M7	Electronic Grade IPA	Merck/ RANKEM	-				
M8A	Conductive Silver epoxy	Ablestik (LOCTITE HENKEL) /EPOTEK	84 - 1LMI NB1/H20E				

CODE	Type of material & composition	Manufacturer	Part No.	Lot No / Batch No	ORG / RQ1 / RQ2 Expiry/Retest date	Used Date	IGA No
M8B	Non-Conductive epoxy	Ablestik (LOCTITE HENKEL) /EPOTEK	8700K/H74				
M9A & M9B	Bare Dies, Capacitors.	ISRO Supplied /procured	Refer components details enclosed				
M10A	Au/Ni plated KOVAR packages	HCC Aegis/EGIDE Other reputed manufacturer					
M10B	Au/Ni plated KOVAR LIDS	Hirel/EGIDE Other reputed manufacturer					
M11	Adhesive film for substrate to Package attach	Ablestik (LOCTITE HENKEL)	5020K/5025E				
M12 A,B,C &D	Au - Wire (0.7mil/1.0 mil /1.5 mil/2.0 mil)	HEREAUS/ Other reputed manufacturer					
M13A	Gold ribbon (12milX2mil)	HEREAUS/ Other reputed manufacturer					
M14A	Al wire(5 mil)	HEREAUS/ Other reputed manufacturer					
M15	Marking Ink	MARKEM/ Other reputed manufacturer	7261 Black				
M24	Getter Gel material	Dow corning / Other reputed manufacturer	SYLGARD 527				

23.4 Component Details

HMC Part No.		W.O. No.		Qty	

SL NO	Component (Dice/chip)	Die ID	Manufacturer	Lot no & Date code	Class K/H	LAT Cleared by at source/ISRO	LAT Status	Recd. date	Recd Qty.	Acc Qty.	Rej Qty.	Reason for rejection	Inspected by & date

Verified by & Date			

23.5 Thick Film Substrate Fabrication

23.5.1 Scribing setup details

HMC Part No.		**Batch No.**	
Equipment Make & Sl.No./Model No.		**Equipment Name & Asset No.**	

IGA ref no/ Manufacturer	Lot No./ Batch No.	Substrate thickness (25 mils)	Hole Dia 10 ± 2 mils	Measurement of scribe Depth 10 mils to 12.5 mils				Pulse spacing 5 -7 mils	Dimensions		Scribe line width 6 ± 2 mils.	No. of substrates scribed	Date & time started	Date & time Ended
				1	2	3	4		Actual	Measured				

IGA ref no/ Manufacturer	Lot No./ Batch No.	Substrate thickness (40 mils)	Hole Dia (10/28) ± 2 mils	Measurement of scribe Depth 16 mils to 20 mils				Pulse spacing 5 -7 mils	Dimensions		Scribe line width 6 ± 2 mils.	No. of substrates scribed	Date & time started	Date & time Ended
				1	2	3	4		Actual	Measured				

23.5.2 Scribing Machine Parameters

Equipment Make & Sl.No./Model No.		**Equipment Name & Asset No.**	

Process	Temp 22 ± 3°C	Humidity 55±5%RH	Power (100 W - 400W)	Table speed Inch/sec (0.03”-5”/sec)	Laser ON time (300-500 /6000 800 microsec)	Done on	Done by
Scribing							
Drilling/Machine							

23.5.3 Substrate Deburring

Qty Deburred	Done on	Done by

23.5.4 Substrate Cleaning

Equipment Make & Sl.No./Model No			Equipment Name & Asset No.			
Resistivity of DI water	Ultrasonic cleaning time	No. of substrates cleaned	Drying Time	Drying temperature	Performed by	Done on

23.5.5 Stress removal by firing

Furnace Parameter						
Equipment Make & Sl.No./Model No			Equipment Name & Asset No.			
Furnace Id (F2/F3)	Furnace Belt speed (3.8 /4 inch/min)	Total Cycle time (60min)	Dwell Time at 850°C (10 ± 1 min)	Qty	Done on	Done by

23.5.6 Substrate Batch yield data after scribing

Inspection Qty.	Accepted Qty.	Reason for rejection	Remarks	Signature

23.5.7 Screen preparation and tension measurement

Equipment Make & Sl.No./Model No					Equipment Name & Asset No.					
Screen for	IGA no of Mesh	Lot / Batch no	Frame size (In inches)	Mesh count	Screen tension in >15 N/Cm					Done by & Date
					1	2	3	4	5	
PTH printing										
AgPd Conductor printing										
Conductor printing (Au1 &Au2)										
Solderable Gold Conductor Printing (1 & 2)										
Dielectric printing (D1)										
Dielectric printing (D2)										
Conductor printing (Top-cond)										
Via fill Printing										
Resistor printing 1 Ω										
Resistor printing 10 Ω										
Resistor printing 100 Ω										
Resistor printing 1k Ω										
Resistor printing 10k Ω										
Resistor printing 100k Ω										
PTH printing										
AgPd Conductor printing										

23.6 Inspection under backlight using 10x magnification

Equipment Make & Sl.No./Model No				Equipment Name & Asset No.		
Screen for	**Design & Exposed dimension matching**	**Edge Definition**	**Air Bubbles**	**Physical Damage**	**Pin holes**	**Inspected by & Date**
PTH printing						
AgPd Conductor printing						
Conductor printing (Au1 &Au2)						
Solderable Gold Conductor Printing (1 & 2)						
Dielectric printing (D1)						
Dielectric printing (D2)						
Conductor printing (Top-cond)						
Via fill Printing						
Resistor printing 1 Ω						
Resistor printing 10 Ω						
Resistor printing 100 Ω						
Resistor printing 1k Ω						
Resistor printing 10k Ω						
Resistor printing 100k Ω						
Over Glaze printing						
Epoxy printing						

23.7 Thick Film Printing

23.7.1 Conductor Printing layer

23.7.1.1 Layer - I

Printing	Conductor	**Layer id**	Single Layer
Equipment Make & Sl.No./Model No		**Equipment Name & Asset No.**	

Manufacturer /Part No.	IGA Ref No./ Batch no	Shelf life / Expiry date			Printer ID No.	Drier ID No.	Furnace ID No.	Temp 22±3°C	Humidity 50±5% RH	Done by & date
		1st Qualified	1st Re-Qualified	2nd Re-Qualified						
Dupont / 5715/5771					MPM / TF – 100 2637 / 03		F2 – BTU / (VCD-01) F3- btu/tff142-126A4B			

Printer M/c Parameter				Drier parameter			Furnace parameter				
Sq. Speed (0.5-2.5 inch/ sec)	Sq. Pressure (10-15 lbs)	Snap off distance (25-75 mils	Down stop (10-15 mils)	Temp (150°C)	Time (15 / 20 min)	Dry Thickness (23 ± 3µ)	Furnace ID Belt speed (Inch/min) Total Cycle time (60 /30 min)		Peak tempr (850±3°C)	Dwell Time at 850°C (10±1min)	Fired Thickness (12 ± 2 µ)
							F2 3.8 / 6.65 60 /30	F3 4 / 5.5 60 / 30			

Inspection under backlight using 10x to 40x magnification (100%)

Edge Definition	Porosity	Peel-off	Voids, Scratch	Alignment	Open, shorts	Foreign Particles	Inspected Qty	Accepted Qty	Inspected by Date

23.7.1.2 Layer -II

Printing	Conductor	**Layer id**	Second Layer
Equipment Make & Sl.No./Model No		**Equipment Name & Asset No.**	

Manufacturer /Part No.	**IGA Ref No./ Batch no**	**Shelf life / Expiry date**			**Printer ID No.**	**Drier ID No.**	**Furnace ID No.**	**Temp 22±3°C**	**Humidity 50±5% RH**	**Done by & date**
Dupont / 5715/5771		**1st Qualified**	**1st Re-Qualified**	**2nd Re-Qualified**	**MPM / TF – 100 2637 / 03**		**F2 – BTU / (VCD-01) F3- btu/tff142-126A4B**			

Printer M/c Parameter				**Drier parameter**			**Furnace parameter**				
Sq. Speed (0.5-2.5 inch/ sec)	Sq. Pressure (10-15 lbs)	Snap off distance (25-75 mils	Down stop (10-15 mils)	Temp (150°C)	Time (15 **/ 20** min)	Dry Thickness (23 ± 3µ)	Furnace ID Belt speed (Inch/min) Total Cycle time (60 /30 min)		Peak tempr (850±3°C)	Dwell Time at 850°C (10±1min)	Fired Thickness (12 ± 2 µ)
							F2 3.8 / 6.65 60 /30	F3 4 / 5.5 60 / 30			

Inspection under backlight using 10x to 40x magnification (100%)

Edge Definition	**Porosity**	**Peel-off**	**Voids, Scratch**	**Alignment**	**Open, shorts**	**Foreign Particles**	**Inspected Qty**	**Accepted Qty**	**Inspected by Date**

23.7.2 Solderable Gold Conductor Printing

23.7.2.1 Layer-I

Printing	Gold	**Layer id**	Single Layer
Equipment Make & Sl.No./Model No		**Equipment Name & Asset No.**	

Manufacturer /Part No.	IGA Ref No./ Batch no	Shelf life / Expiry date			Printer ID No.	Drier ID No.	Furnace ID No.	Temp 22±3°C	Humidity 50±5% RH	Done by & date
		1st Qualified	1st Re-Qualified	2nd Re-Qualified						
Dupont / 4597					MPM / TF – 100 2637 / 03					

Printer M/c Parameter				Drier parameter			Furnace parameter				
Sq. Speed (1.5-2.5 inch/ sec)	Sq. Pressure (10-15 lbs)	Snap off distance (25-75 mils	Down stop (10-15 mils)	Temp (150°C)	Time (15 min)	Dry Thickness (23 ± 3µ)	Furnace ID Belt speed (Inch/min) Total Cycle time (60 /30 min)		Peak tempr (850±3°C)	Dwell Time at 850°C (10±1min)	Fired Thickness (12 ± 2 µ)
							F2 3.8 60	F3 4 60			

Inspection under backlight using 10x to 40x magnification (100%)

Edge Definition	Porosity	Peel-off	Voids, Scratch	Alignment	Open, shorts	Foreign Particles	Inspected Qty	Accepted Qty	Inspected by Date

23.7.2.2 Layer-II

Printing	Gold	**Layer id**	Second Layer
Equipment Make & Sl.No./Model No		**Equipment Name & Asset No.**	

Manufacturer /Part No.	**IGA Ref No./ Batch no**	**Shelf life / Expiry date**			**Printer ID No.**	**Drier ID No.**	**Furnace ID No.**	**Temp 22±3°C**	**Humidity 50±5% RH**	**Done by & date**
Dupont / 4597		**1st Qualified**	**1st Re-Qualified**	**2nd Re-Qualified**						

Printer M/c Parameter				**Drier parameter**			**Furnace parameter**				
Sq. Speed (1.5-2.5 inch/ sec)	Sq. Pressure (10-15 lbs)	Snap off distance (25-75 mils	Down stop (10-15 mils)	Temp (150°C)	Time (15 / **20** min)	Dry Thickness (23 ± 3µ)	Furnace ID Belt speed (Inch/min) Total Cycle time (60 /30 min)		Peak tempr (850±3°C)	Dwell Time at 850°C (10±1min)	Fired Thickness (18 ± 2 µ) for 2 layers
							F2 3.8 60	F3 4 60			

Inspection under backlight using 10x to 40x magnification (100%)

Edge Definition	**Porosity**	**Peel-off**	**Voids, Scratch**	**Alignment**	**Open, shorts**	**Foreign Particles**	**Inspected Qty**	**Accepted Qty**	**Inspected by Date**

23.7.3 Dielectric Printing

23.7.3.1 Layer-I

Printing	Dielectric	**Layer id**	Single Layer
Equipment Make & Sl.No./Model No		**Equipment Name & Asset No.**	

Manufacturer /Part No.	IGA Ref No./ Batch no	Shelf life / Expiry date			Printer ID No.	Drier ID No.	Furnace ID No.	Temp 22±3°C	Humidity 50±5% RH	Done by & date
Dupont / 5704		1st Qualified	1st Re-Qualified	2nd Re-Qualified						

Printer M/c Parameter				Drier parameter			Furnace parameter				
Sq. Speed (0.5-2.5 inch/ sec)	Sq. Pressure (10-15 lbs)	Snap off distance (25-75 mils	Down stop (10-15 mils)	Temp (150°C)	Time (15 min)	Dry Thickness (40 ± 5µ) for 1 layer	Furnace ID Belt speed (Inch/min) Total Cycle time (60 min)		Peak tempr (850±3°C)	Dwell Time at 850°C (10±1min)	Fired Thickness (22 ± 2 µ) for 1 layer
							F2 3.8 60	F3 4 60			

Inspection under backlight using 10x to 40x magnification (100%)

Edge Definition	Voids/ scratches	Alignment	Pin holes	Extension of dielectric on sides of conductor < 3mils	Foreign Particles	Inspected Qty	Accepted Qty	Inspected by Date

23.7.3.2 Layer-II

Printing	Dielectric	**Layer id**	Second Layer
Equipment Make & Sl.No./Model No		**Equipment Name & Asset No.**	

Manufacturer /Part No.	**IGA Ref No./ Batch no**	**Shelf life / Expiry date**			**Printer ID No.**	**Drier ID No.**	**Furnace ID No.**	**Temp 22±3°C**	**Humidity 50±5% RH**	**Done by & date**
Dupont / 5704		**1st Qualified**	**1st Re-Qualified**	**2nd Re-Qualified**						

Printer M/c Parameter				**Drier parameter**			**Furnace parameter**				
Sq. Speed (0.5-2.5 inch/ sec)	Sq. Pressure (10-15 lbs)	Snap off distance (25-75 mils	Down stop (10-15 mils)	Temp (150°C)	Time (15 min)	Dry Thickness (40 ± 5µ) for 1 layer	Furnace ID Belt speed (Inch/min) Total Cycle time (60 min)		Peak tempr (850±3°C)	Dwell Time at 850°C (10±1min)	Fired Thickness (40 ± 2 µ) for 2 layer
							F2 3.8 60	F3 4 60			

Inspection under backlight using 10x to 40x magnification (100%)

Edge Definition	**Voids/ scratches**	**Alignment**	**Pin holes**	**Extension of dielectric on sides of conductor < 3mils**	**Foreign Particles**	**Inspected Qty**	**Accepted Qty**	**Inspected by Date**

23.7.4 Via filling conductor printing

Printing	Via filling conductor	**Layer id**	
Equipment Make & Sl.No./Model No		**Equipment Name & Asset No.**	

Manufacturer /Part No.	IGA Ref No./ Batch no	Shelf life / Expiry date			Printer ID No.	Drier ID No.	Furnace ID No.	Temp 22±3°C	Humidity 50±5% RH	Done by & date
		1st Qualified	1st Re-Qualified	2nd Re-Qualified						
Dupont / 5727/5747										

Printer M/c Parameter				Drier parameter			Furnace parameter				
Sq. Speed (1.5-2.5 inch/ sec)	Sq. Pressure (10-15 lbs)	Snap off distance (25-75 mils	Down stop (10-15 mils)	Temp (150°C)	Time (15 min)	Thickness (Via fill >75% of via plug)	Furnace ID Belt speed (Inch/min) Total Cycle time (60 min)		Peak tempr (850±3°C)	Dwell Time at 850°C (10±1min)	Fired thickness (Via fill >75% of via plug)
							F2 3.8 60	F3 4 60			

Inspection under backlight using 10x to 40x magnification (100%)

Voids	Lifting	Peel-off	Blistering	Alignment	Via Flatness	Inspected Qty	Accepted Qty	Inspected by Date

23.7.5 Resistor Printing

Printing	Resistor Printing	**Layer id**	
Equipment Make & Sl.No./Model No		**Equipment Name & Asset No.**	

Manufacturer /Part No.	**IGA Ref No./ Batch no**	**Shelf life / Expiry date**			**Printer ID No.**	**Drier ID No.**	**Furnace ID No.**	**Temp 22±3°C**	**Humidity 50±5% RH**	**Done by & date**
Dupont / 17G series		**1st Qualified**	**1st Re-Qualified**	**2nd Re-Qualified**						

Printer M/c Parameter				**Drier parameter**			**Furnace parameter**				
Sq. Speed (1.5-2.5 inch/ sec)	Sq. Pressure (10-15 lbs)	Snap off distance (25-75 mils	Down stop (10-15 mils)	Temp (150°C)	Time (15 min)	Dry Thickness (26 ± 3 µ)	Furnace ID Belt speed (Inch/min) Total Cycle time (60 min)		Peak tempr (850±3°C)	Dwell Time at 850°C (10±1min)	Fired thickness (13 ±2 µ)
							F2 3.8 60	F3 4 60			

Inspection under backlight using 10x to 40x magnification (100%)

Alignment	Minimum overlap should be 4mils	Edge definition	Voids, Crack	Blisters	Increase or decrease in width	Inspected Qty	Accepted Qty	Done by & date

23.7.6 Over Glaze Printing

Printing	Over Glaze	**Layer id**	
Equipment Make & Sl.No./Model No		**Equipment Name & Asset No.**	

Manufacturer /Part No.	**IGA Ref No./ Batch no**	**Shelf life / Expiry date**			**Printer ID No.**	**Drier ID No.**	**Furnace ID No.**	**Temp 22±3°C**	**Humidity 50±5% RH**	**Done by & date**
Dupont / 9137		**1st Qualified**	**1st Re-Qualified**	**2nd Re-Qualified**						

Printer M/c Parameter				**Drier parameter**			**Furnace parameter**				
Sq. Speed (1.5-2.5 inch/ sec)	Sq. Pressure (10-15 lbs)	Snap off distance (25-75 mils	Down stop (10-15 mils)	Temp (150°C)	Time (15 min)	Dry Thickness (26 ± 3 µ)	Furnace ID Belt speed (Inch/min) Total Cycle time (60 min)		Peak tempr (850±3°C)/(500±5°C)	Dwell Time at 850°C/500°C (10±1min)	Fired thickness (12 ±2 µ)
							F2 3.8 60	F3 4 60			

Fired over glaze visual Inspection using 10x to 40x magnification (100%)

23.7.7 Pre-Trimmed resistor measurement

Pre-trimmed resistor value measurement substrate ID No: Dummy

Resistor ID	Resistor value minimum	Resistor value Typical	Resistor value maximum	Resistor value measured

Multimeter ID No.		**Cal due date**	
Equipment Make & Sl.No./Model No		**Equipment Name & Asset No.**	

Manufacturer /Part No.	IGA Ref No./ Batch no	Shelf life / Expiry date			Printer ID No.	Drier ID No.	Furnace ID No.	Temp 22±3°C	Humidity 50±5% RH	Done by & date
Dupont / 17G 17__		1st Qualified	1st Re-Qualified	2nd Re-Qualified						

Printer M/c Parameter				Drier parameter			Furnace parameter			
Sq. Speed (1.5-2.5 inch/ sec)	Sq. Pressure (10-15 lbs)	Snap off distance (25-75 mils	Down stop (10-15 mils)	Temp (150°C)	Time (15 min)	Dry Thickness (26 ± 3 µ)	Furnace ID Belt speed (Inch/min) Total Cycle time (60 min)	Peak tempr (850±3°C)/(500±5°C)	Dwell Time at 850°C/500°C (10±1min)	Fired thickness (12 ±2 µ)

23.8 Fired substrates visual inspection (QC check 100%)

REJECTION CRITERIA	No of inspected substrates	No of Accepted substrates	No of Rejected substrates	Remarks
Substrate Defects Crack, Chip In, Chip Out				
PTH Printing: Scratch, Lifting, Peeling, corrosion, Open, alignment, wall coverage & through hole continuity				
AgPd Conductor Printing Scratch, voids, lifting, pealing, corrosion, bridging, open, alignment, Porosity				
Solderable gold Conductor Printing Scratch, voids, lifting, pealing, corrosion, bridging, open, alignment, Porosity				
Conductor printing Scratch, voids, lifting, pealing, corrosion, bridging, open, alignment, Porosity				
Via Fill Conductor printing Voids, lifting, pealing, Blistering, alignment, Via flatness				
Dielectric printing Scratch, voids, pin holes, extension of dielectric on sides conductor (if < 3mil)				
Presence of foreign particles				
Miscellaneous observations				
Inspected by/Date				

23.9 Resistor trimming setup check

Date:

Wrist Strap availability [Yes/No]			
Equipment Make & Sl.No./Model No		**Equipment Name & Asset No.**	

ESD check (OK/ Not OK)	Temp 22±3 °C	Humidity 55±5 % RH	Trimmer	Laser Type	Laser power (3 – 4.5 Watts)	Q RATE (5004000)	BYTE SIZE (50-150)	Total QTY	Done by & date

23.9.1 Delta R Calculation

Resistor ID	Initial value (I)	Final value (F) after heating on hot plate at 300°C for 10 mins	ΔR =((F-I)/I)*100 R (≤0.5%)	Resistor ID

23.9.2 Trimming process capability measurement

	Sample 1		Sample 2		Sample 3		Sample 4	
Part no								
CLS 1 or 3								
Tolerance								
Nominal val								
Specification	USL	LSL	USL	LSL	USL	LSL	USL	LSL
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
Mean								
Sigma								
USL-mean								
LSL-mean								
3 σ								
CpK								
Done by								

23.9.3 Trimmed resistor value measurement

Substrate ID No			
Multimeter ID/S. No.		**Cal due date**	

Resistor ID	Tolerance	Resistor value Minimum	Resistor value Typical	Resistor value Maximum	Resistor value measured
Result	**Accept/Reject**		**Done by Date**		

23.9.4 Trimmed Substrate Visual inspection (100 %)

Equipment Make & Sl.No./Model No		Equipment Name & Asset No.	

REJECTION CRITERIA	No of inspected substrates	No of Accepted substrates	No of Rejected substrates	Remarks
Substrate Defects Crack, Chip In, Chip Out				
PTH Printing: Scratch, Lifting, Peeling, corrosion, Open, alignment, wall coverage & through hole continuity				
AgPd Conductor Printing Scratch, voids, lifting, pealing, corrosion, bridging, open, alignment, Porosity				
Solderable gold Conductor Printing Scratch, voids, lifting, pealing, corrosion, bridging, open, alignment, Porosity				
Conductor printing Scratch, voids, lifting, pealing, corrosion, bridging, open, alignment, Porosity				
Via Fill Conductor printing Voids, lifting, pealing, Blistering, alignment, Via flatness				
Dielectric printing Scratch, voids, pin holes, extension of dielectric on sides conductor (if < 3mil)				
Resistors printing Crack, void, Evidence of repair, dis-coloration, Increase/decrease in width, resistor overlap over the conductor (if <5 mils)				
Trimmed Resistors Kerf should be 5 mils away from conductor pad**,** Kerf width minimum 0.5 mil, Kerf should be clean, No occurrence of debris/micro cracks, 50% of resistor width should be left after trimming, Kerf Depth (5-8µ), Dis-colourization				
Presence of foreign particles				
Miscellaneous observations				
Inspected by/Date				

23.9.5 PFT Inspection prior to assembly

Equipment Make & Sl.No./Model No		Equipment Name & Asset No.	
HMC Part No		PFT Inspection Prior to Assembly	
Batch Qty			
Date of Inspection			

Sl.No.	Rejection Criteria	Substrate ID											
1	**Substrate Defects:** Crack, Chip In, Chip Out												
2	**Conductor Printing:** Scratch, voids, lifting, pealing, corrosion, bridging, open, alignment, Porosity												
3	**Dielectric Printing:** Scratch, voids, lint, cut, pinholes, Extension of dielectric on sides conductor (if <3 mils)												
4	**Resistors Printing:** Crack, void, evidence of repair, discoloration, Increase/decrease in width, resistor overlap over the conductor (if <5 mils)												
5	**Over Glaze Printing:** OG coverage on conductor pad, dust, lint												
6	Presence of foreign particle:												
7	Miscellaneous observations:												
Accept/ Reject													
Quality Inspector's Signature with Remarks (if any)													

23.10 Chip and Wire assembly

23.10.1 Die attachment

23.10.1.1 Substrate Cleaning

HMC Part No.			**Batch Qty**		
Temp (22±3 deg C):	**Humidity (50±5 %RH):**		**ESD Check: (pass /fail)**		
Equipment Make & Sl.No./Model No			**Equipment Name & Asset No.**		
IGI/ Batch/ Lot No. of Electronic Grade IPA	**Cleaning Time (<1 min)**	**N2 Blow 25 PSI 10Sec**	**ID Number of Substrates**	**Total No. of Substrates Cleaned**	**Performed by (Sign& Name) & Date**

23.10.1.2 Conductive Epoxy Printing at PFT Department

HMC Part No.					**Batch Qty**								
Temp (22±3 deg C):			**Humidity (50±5 %RH):**		**ESD Check: (pass /fail)**								
Equipment Make & Sl.No./Model No					**Equipment Name & Asset No.**								
Epoxy Part Number & Make	Epoxy LOT No.	Epoxy Expiry date: Shelf life	Epoxy Expiry date: Pot life	Sq. speed 1.5"-2.5"/sec	Epoxy stirring Time Approx - 30 Sec	Sq. Pressure 10-15 lbs	Snap off 25 - 75 mils	Down stop 10-15 mils	Wet Thickness 0.9-2.0 mils	Set up approval by Quality (Name &Sign)	ID Number of Substrates Printed	Total qty	Performed by (Sign& Name) & date

Note: Epoxy kneading to be performed before use % Die attachment must be completed within 24hrs of epoxy printing/dispensing

* Epoxy print thickness to be monitored for every 10 Substrates and recorded

23.10.1.3 Manual Conductive Epoxy Dispensing

HMC Part No.		**Batch Qty**	
Temp (22±3 deg C):	**Humidity (50±5 %RH):**	**ESD Check: (pass /fail)**	

Active Bare Dice & Passive Components/ Capacitors

Equipment Make & Sl.No./Model No			**Equipment Name & Asset No.**							
Epoxy dispensing Mode	Epoxy Part Number & Make	Epoxy Lot No.	Epoxy Expiry date		Nozzle Size	Air pressure	Set up approval By Quality (Name &Sign)	Sl.No. of substrates dispensed	Total qty	Performed by (Sign& Name) & date
			Shelf life	Pot life						

Note: If Epoxy printing process is not feasible, manual conductive epoxy dispensing process shall be carried out.

23.10.1.4 Non-Conductive Epoxy Dispensing-Passive Components/Capacitors

HMC Part No.		**Batch Qty**	
Temp (22±3 eg C):	**Humidity (50±5 %RH):**	**ESD Check: (pass /fail)**	

Equipment Make & Sl.No./Model No			**Equipment Name & Asset No.**							
Epoxy dispensing Mode	Epoxy Part Number & Make	Epoxy Lot No.	Epoxy Expiry date		Nozzle Size	Air pressure	Set up approval By Quality (Name &Sign)	Sl.No. of substrates dispensed	Total qty	Performed by (Sign& Name) & date
			Shelf life	Pot life						

23.10.2Die attach and curing

HMC Part No.		**Batch Qty**	
Temp (22±3 deg C):	**Humidity (50±5 %RH):**	**ESD Check: (pass /fail)**	
Equipment Make & Sl.No./Model No		**Equipment Name & Asset No.**	

Components Details	Sl.No. of Die attached Substrates	Total No of die attached Substrates	Curing Schedule			Set up approval By Quality (Name &Sign)	Performed by (Name & Sign) & date
			Curing Temp	Curing Time	Oven ID		

23.10.2.1.1 Pre-cure Die Attach Assembly Inspection

HMC Part No.		**Batch Qty**	
Temp (22±3 deg C):	**Humidity (50±5 %RH):**	**ESD Check: (pass /fail)**	
Equipment Make & Sl.No./Model No		**Equipment Name & Asset No.**	

Substrate ID	**Accept/ Reject Criteria**					
	Adhesive not visible on all 4 sides	Adhesive build up < 30% of components height	Adhesive material on top surface of die/Chip capacitor/ Die resistor	Spread of adhesive material on substrate	Die/Cap/Res Placement/ Orientation	Epoxy cracks/ Blow holes/ pin holes

Total Number of Substrates Inspected	
Number of Substrates Accepted	
Number of Substrates Rejected	
Inspected By production (Name & Sign) & Date	
Inspected by Quality (QC) (Name & Sign) & Date	

23.10.2.2 Non-Conductive Epoxy stacking/Build-up & curing-Passive components/capacitors

HMC Part No.				**Batch Qty**								
Temp (22±3 deg C):		**Humidity (50±5 %RH):**		**ESD Check: (pass /fail)**								
Equipment Make & Sl.No./Model No				**Equipment Name & Asset No.**								
Epoxy Part Number & Make	Epoxy dispensing Mode	Lot Number of Non Conductive Epoxy	Epoxy Expiry date		Nozzle Size	Air pressure	Serial No of Substrates completed	Curing Schedule			Set up approval By Quality (Sign & Name)	Performed by (Sign & Name) & date
			Shelf life	Pot life				Curing Temp	Curing Time	Oven ID		

23.10.2.3 Conductive Epoxy Build up & Curing

HMC Part No.				**Batch Qty**								
Temp (22±3 deg C):		**Humidity (50±5 %RH):**		**ESD Check: (pass /fail)**								
Equipment Make & Sl.No./Model No				**Equipment Name & Asset No.**								
Epoxy Part Number & Make	Epoxy dispensing Mode	Lot Number of Non Conductive Epoxy	Epoxy Expiry date		Nozzle Size	Air pressure	Serial No of Substrates completed	Curing Schedule			Set up approval By Quality (Sign & Name)	Performed by (Sign & Name) & date
			Shelf life	Pot life				Curing Temp	Curing Time	Oven ID		

23.10.2.4 Post-cure Die attach Assembly Inspection

HMC Part No.		**Batch Qty**	
Temp (22±3 deg C):	**Humidity (50±5 %RH):**	**ESD Check: (pass /fail)**	
Equipment Make & Sl.No./Model No		**Equipment Name & Asset No.**	

Substrate ID	**Accept/ Reject Criteria**					
	Adhesive not visible on all 4 sides	Adhesive build up < 30% of components height	Adhesive material on top surface of die/Chip capacitor/ Die resistor	Spread of adhesive material on substrate	Die/Cap/Res Placement/ Orientation	Epoxy cracks/ Blow holes/ pin holes

Total Number of Substrates Inspected	
Number of Substrates Accepted	
Number of Substrates Rejected	
Inspected By production (Name & Sign) & Date	
Inspected by Quality (QC) (Name & Sign) & Date	

23.10.3 Package Inspection (Before S/P attach, After S/P attach process)

Equipment Make & Sl.No./Model No		Equipment Name & Asset No.	
HMC Part No		Package Inspection	
Batch Qty			
Date of Inspection			

Sl.No.	Rejection Criteria	Package ID											
1	Evidence of any non-conformance with detail drawing i.e. No. of pins, Package size, Pin 1 identification & lead pitch.												
2	Package which exhibits peeling, flaking, pitting, blistering, delaminating, bumps, dents, discoloration & corrosion.												
3	Pits/bumps/Burrs, contamination, dents, nicks, embedded particle & non-uniformity on the seal periphery.												
4	Cracks, crazing, chip out, chip off, bubble, hole, red particles, gold particles, negative meniscus in glass to metal area.												
5	Gross leads bend, broken leads.												
6	Chip out, broken or cracks on the package body.												
7	Scratches that expose base metal due to damage.												
Quantity Received													
Quantity Accepted													
Quantity Rejected													
Inspection done by (Sign, Name & Date)													

23.10.3.1 Empty Package Ultrasonic cleaning

HMC Part No.				Batch Qty			
Temp (22±3 deg C):		Humidity (50±5 %RH):		ESD Check: (pass /fail)			
Equipment Make & Sl.No./Model No				Equipment Name & Asset No.			
Lot Number of Electronic grade IPA	Lot Number of Package	Ultrasonic Dipping Time (3-5 min)	N2 BLOW 25 psi 10 sec	No. of Packages Cleaned	Inspect at 40 X Magnification		Performed by (Sign & Name) & Date
					IN QTY	OUT QTY	

23.10.3.2 Inspection after Ultrasonic Cleaning

HMC Part No.			Batch Qty		
Temp (22±3 deg C):	Humidity (50±5 %RH):		ESD Check: (pass /fail)		
Equipment Make & Sl.No./Model No			Equipment Name & Asset No.		
Number of Packages Cleaned	Inspect at 40X Magnification	No of Packages Accepted	No of Packages Rejected	Remarks	Inspected By Quality (Sign & Name) & Date

After N2 blowing, packages are inspected under 40x microscope for visual criteria by quality personnel.

Remarks:

23.10.3.3 Substrate to Package attach assembly & curing – 5020K able film

Package Part Number & Make		**LAT Cleared (Yes/No)**	
Lot No. of Package		**LAT Report No & Date**	

Able film Part Number & Make	Lot Number of Able film	Able film Expiry Date	Pre-Cure Temp 100°C (2-5 Min)	Pre-Cure Temp 140°C (30-60 Sec)	Set up approval By Quality (Sign & Name)	Total S/P attached Details *	Curing Schedule			Performed by (Sign & Name)& Date
							Curing Time (90 min)	Curing Temp (150°C)	Curing Oven ID	

Equipment Make & Sl.No./Model No								**Equipment Name & Asset No.**												
Substrate ID No.																				
Package ID No.																				
Remarks:																				

23.10.3.4 Post cure package attach assembly inspection

Equipment Make & Sl.No./Model No		Equipment Name & Asset No.	

Package ID	Accept/Reject Criteria					
	Adhesive not visible on all 4 sides	Adhesive build up < 30% of Substrate height	Evidence of bubbles visible through naked eyes	Spread of adhesive material on posts	Substrate orientation >10 degrees	Foreign Particle presence on the Adhesive

Total Number of S/P Attached Packages Inspected	
Number of S/P Attached Packages Accepted	
Number of S/P Attached Packages Rejected	
Inspected By production (Sign & Name) & Date	
Inspected by Quality (QC) (Sign & Name) & Date	

23.10.3.5 Vapour degreasing before wire bonding

Equipment Make & Sl.No./Model No		Equipment Name & Asset No.	

Lot number of electronic grade IPA	Temperature of IPA (200 -250°C)	Vapour Degreasing time (30-60 Sec)	N2 Blow 25 psi, 10 sec	Number of Pkgs/Sub.	Performed by (Sign & Name) & Date

23.10.3.6 Vacuum Baking (Pre-Wire bonding)

Equipment Make & Sl.No./Model No		Equipment Name & Asset No.	

Number of Packages	Vacuum (0-100 m torr)	Temperature (145- 155°C)	Number of Intervals	Start		End		Duration (hours)	Performed by (Sign & Name) & Date
				Date	Time	Date	Time		

Intervals	Duration	Temperature	Function
1	20 min	150 ° C	Evacuation
2	45 min	150 ° C	N_2 purging
3	1 hr	150 ° C	Vacuum baking
4	20 min	25 ° C	Back filling

23.10.4 Wire bond Assembly

23.10.4.1 Plasma Cleaning (Pre-Wire bonding)

HMC Part No.		Batch Qty	
Temp (22±3 deg C):	Humidity (50±5 %RH):	ESD Check: (pass /fail)	

Argon cylinder Output Pressure (40-50psi)	Vacuum (1.0-1.6 torr)	Plasma power (0.3-0.4kw)	Plasma expose Time (4-6min)	Plasma Cleaned Quantity	Performed by (Sign & Name) & Date

23.10.4.2 Wire Bonding

Equipment Make & Sl.No./Model No		Equipment Name & Asset No.	

HMC Part number	Wire diameter	Au/Al	Make	IGI/ Lot No., of Au/Al wire	Number of Packages/Substrates Wire Bonded	Sl No. of the Packages/Sub Wire Bonded	Set up approval by Quality (Sign & Name)	Performed by (Sign & Name) & Date

23.10.4.3 Wire Bonding Parameters-Die/post pin to substrate/post to chassis

Temperature on the Packages (145 +/- 5 ° C)	Parameter setting					
	I – bond (Ball)			II –bond (Wedge)		
	Power	Force (gms)	Time (msec)	Power	Force (gms)	Time (msec)

23.10.4.4 Wire Bonding Parameters for K&S-3 – Wire bonder

HMC Part No.		Batch Qty	
Temp (22±3 deg C):	Humidity (50±5 %RH):	ESD Check: (pass /fail)	

Sl.No.	Wire bond parameters	0.7 mil	1mil	1.5 mil Die	1.5 mil Post	2 mil Die	2 mil Post	1.5 mil Post to chassis
1	**Ultrasonic power Ball**	2.0 to 2.3	1.5 to 1.7	1.8 to 2.0	1.8 to 2.2	1.9 to 2.0	3.1 to 3.5	1.8 to 2.2
2	**Ultrasonic power Wedge**	5 to 6.5	3.5 to 4	4.1 to 5	4.1 to 5	6.2 to 6.5	6.2 to 6.5	4.1 to 5
3	**Bond force-Ball**	27 to 32	31 to 34	55 to 65	45 to 51	87 to 90	70 to 75	45 to 51
4	**Bond force-wedge**	60 to 80	70 to 90	60 to 100	60 to 100	85 to 90	85 to 90	60 to 100
5	**Bond time-Ball**	30 to 40	49 to 55	35 to 45	50 to 55	67 to 70	50 to 55	50 to 55
6	**Bond time Wedge**	70 to 100	90 to 150	80 to 120	80 to 120	105 to 110	105 to 110	80 to 120

23.10.4.5 Wire Bonding Parameters for ASM Eagle-60

Sl.No.	Wire bond parameters	0.7 mil	1mil
1	**Ultrasonic power -- Ball**	28 to 32	60 to 65
2	**Ultrasonic power -- Wedge**	95 to 105	85 to 95
3	**Bond force-Ball**	15 to 20	15 to 20
4	**Bond force-wedge**	70 to 80	85 to 95
5	**Bond time-Ball**	8 to 12	10 to 15
6	**Bond time wedge**	40 to 50	60 to70

HMC Part No.		Batch Qty	
Temp (22±3 deg C):	Humidity (50±5 %RH):	ESD Check: (pass /fail)	

DPT Acceptable: 2.5 gms for 0.7 mil, 6.0 gms for 1 mil Au, 10 gms for 1.5 mil Au,15 gms for 2.0 mil Au wires

1st off/setup clearance (DPT acceptable: _____ gms)									
Pull tester ID	Time of calibration	Set up approval By Quality (Sign & Name)	Visual inspection result	DPT results					
				Ambient/ Post 300 deg	No of wire	Min strength	No of wire tested	No of wire failed	Failed bond strength

2nd off clearance (NDPT acceptable: _____gms)							
Pull tester ID	Time of calibration	Set up approval By Quality (Sign & Name)	Visual inspection result	NDPT results			
				ID of the Package/ Substrate	No of wire tested	No of wire Failed	Failed bond strength

23.10.4.6 Wire Bond Visual inspection

HMC Part No.		Batch Qty	
Temp (22±3 deg C):	Humidity (50±5 %RH):	ESD Check: (pass /fail)	

Equipment Make & Sl.No./Model No					Equipment Name & Asset No.					
Part No.	Wire Dia	Ball size (<3d or >5d)	Wire exit not within the periphery of the ball	Golf ball/ oblong ball	Wedge w(<1.5d / > 3d) & L(<1.5d / > 4d)	Excessive loop/ sag of wire	Nick/cuts/ crimps/ scoring/ Neck down of wire	Wire bonding not according to diagram	Tearing of the junction of wire bond, sharp bends/kinks in wire	Performed by (Sign & Name) & Date
QUALITY INSPECTION (QC) DONE BY & DATE										
REMARKS										
NDPT setting: 1.6 gms for 0.7 mil Au, 2.4 gms for 1 mil Au & 4.0 gms for 1.5 mil Au, 6.2 gms for 2.0 mil Au wires										

23.10.4.7 Wire Bond NDPT Results

Equipment Make & Sl.No./Model No		Equipment Name & Asset No.	

Production Run					Patrol Inspection Details (Die /Post to substrate/post to chassis)								
ID No of Packages /Substrate wire bonded	100% NDPT results				Pull Tester ID	Time of calibration	Set up approval By Quality (Sign & Name)	Visual inspection result	NDPT results				
	Number of wire tested	Number of wire failed	Failed bond strength	Performed by (Name & Sign)& Date					ID of Package/ Substrate	Number of wire tested	Number of wire failed	Failed bond strength	Performed by (Sign & Name)& Date
QUALITY INSPECTION (QC) DONE BY (Sign & Name) & DATE													

Note: 100% NDPT results of first & last HMCs of the batch will be attached along with DPT & NDPT results of setup clearance of HMCs.

23.10.4.8 Die Rework Details

HMC Part No.		Batch Qty	
Temp (22±3 deg C):	Humidity (50±5 %RH):	ESD Check: (pass /fail)	

Equipment Make & Sl.No./Model No		Equipment Name & Asset No.	

Package ID No.	Die replacement		Reason for rework	No of Dice reworked	Rework done as per drawing.	Rework done & verified by (Sign & Name) & Date	Inspected by QA (Sign & Name) & Date
	P/N	ID No.					

23.10.4.9 Wire Rework Details

Equipment Make & Sl.No./Model No		Equipment Name & Asset No.	

Pkg ID	No of re-bonds		Reason for Rework			NDPT Result	Visual inspection result	As per drawing rework, ok?	Done by (Sign & Name) & Date	Verified By QA (Sign & Name) & Date
	Dice to substrate	Post to substrate	Location/ ID of wire	Dice to substrate	Post to Substrate					

23.10.5 Pre-Seal Electrical Test Report

HMC Part No		Batch Qty	
Temp (22±3 Deg C):	Humidity (50±5 %RH):	ESD Check (Pass /Fail):	

Date		Manufacturer	
HMC Type		Date Code, Batch No.	
QTY Tested		QTY Accepted	

Sl.No. of Packages tested:

Result: _____

23.10.5.1 List of tests and measuring equipment:

Description	Make	Equipment ID	Cal Due on	Parameter	Selected Range
DC Power Supply1					
DC Power Supply2					
CRO					
Signal Generator					
Current/Multi-meter					
					Sign
Test performance by					
Approved By					

23.10.5.2 HMC Pre-Cap Visual Inspection List

Model		**Customer**	URSC	**Project**		**Batch Qty**	
Date		**Equipment Used**	Microscope	**Inspection by**			

Sl No	**Inspection Criteria**			**Specification**	**Pkg No**	**Pkg No**	**Pkg No**	**Pkg No**	**Pkg No**
	Subgroup		**Details**						
1	Substrate	1	Component to substrate edge separation	0.1mm					
		2	Functional metallization to substrate –edge separation Chipping	0.1mm					
		3		<0.05mm					
		4	Cracks/Holes	Nil					
		5	Discoloration	Nil					
		6	Miscellaneous observation	Nil					
2	Conductor Printing Quality	1	Scratches /Void reducing conductor width by more than 25%	Nil					
		2	Resistors overlap on metallization pad	>0.1mm					
		3	Metallization Bridging	Nil					
		4	Miscellaneous observation	Nil					
3	Dielectric/ Overglaze	1	Insulating dielectric layer spread beyond metallization (Either side)	No					
		2	Voids /Pinhole in insulating dielectric layer	No					
		3	Miscellaneous observation	Nil					
4	Resistors	1	Cracks/Voids/Scratches /Spreading/ mesh marks on resistor	Nil					
		2	Discoloration/stains in kerfs	Nil					
		3	Resistor width reduction less than 25% after trimming	Nil					
		4	Resistors overlap over the conductor 5 MIL	Nil					
		5	Miscellaneous observation	Nil					
		6	Chipping	Nil					
		7	Contamination on surface	Nil					
		8	Metallization discontinuities	Nil					
		9	Metallization Bridging	Nil					
		10	Miscellaneous observation	Nil					

Sl No	Inspection Criteria			Specification	Pkg No	Pkg No	Pkg No	Pkg No	Pkg No
	Subgroup		Details						
5	(a)Die	1	Cracks on Die/chip.	Nil					
		2	Chipping.	Nil					
		3	Contamination on surface.	Nil					
		4	Metallization Discontinuities.	Nil					
		5	Metallization bridging	Nil					
		6	Miscellaneous observation	Nil					
	(b)Die/Chip Attachment	1	Die orientation on mounting pad	As per layout <5deg.Misalignment					
		2	Conductive Die mounting	Visible on all sides, Good Wetting with die					
		3	Conductive Die mounting epoxy running onto bare substrate.	Nil					
		4	Conductive Die mounting epoxy build-up at die edges.	Upto20% of die height					
		5	Crack in epoxy greater than 10%of total periphery coverage at contact area.	Nil					
		6	Miscellaneous Observation						
	(C) Wire Bonding	1	Gold –wire ball bond, ball size.	2.0d<x<5.0d (d=diameter)					
		2	Wire exit from ball	From the centre of ball					
		3	Die to metallization interconnections	As per layout					
		4	Ball-bond alignment with pad Aligned with centre of bond pad	(covering not less than 75%of pad area whenever ball-bond and pad area are comparable)					
		5	Bond –wire to die clearance.	Twice wire dia (min)					
		6	Wedge-bond size.	1.5d<x<3.0d (d=diameter)					
		7	Metallization to point interconnections	As per layout					
		8	No of re-bonds	<10% of total bonds					
		9	NDPT of wires	100% required at specified NDPT value.					

Sl No	Inspection Criteria			Specification	Pkg No	Pkg No	Pkg No	Pkg No	Pkg No
	Subgroup		Details						
5	**D) Al 5 mil Wire bonding**	10	Ideal Bond impression						
		11	Heal Crack spikes in bond	Nil					
		12	Wire tears @ junction b/w ribbon loop & bond	Nil					
	E) Au 2X12 mil Ribbon wire bond	13	Bond which does not exhibit 100% bond impression	Nil					
		14	Bond tail longer than one ribbon width or 10.0mils whichever is lesser.	Nil					
		15	Miscellaneous Observation	Nil					
6	**Package Assembly**	1	Substrate orientation	Aligned with cavity, as per layout.					
		2	Substrate epoxy visible at periphery	All sides of periphery(preferred)					
		3	Cracks in epoxy greater than 10% of total periphery coverage at contact area.	Nil					
		4	Epoxy residues at sites other than specified.	Nil					
		5	Contamination in cavity.	Nil					
		6	Seal in periphery	Free from any Contamination					
		7	Cracks in glass to metal seal.	Radial &circumferential crack not allowed, and meniscus crack is acceptable.					
		8	Overall Package(body wall/bottom)/lead inspection	Discoloration& corrosion, Any burrs, peeling, flaking, pitting, blistering, delamination, bumps, dents, cracks					
		9	Overall cleanliness.	Free from Contamination					
		10	Miscellaneous Observation						
7	**Documentation**	1	Parts & Material Traceability.						
		2	Process traveller duly completed.						
		3	Process as per PID						
		4	Final in –house QC approval available.						
		5	QC comments/suggestions implemented.						
			ACCEPT / REJECT?						
Quality Inspector's Signature with remarks(if any):									

23.10.6 Cleaning Activities before loading the HMCs to Vacuum baking & Seam Sealing

23.10.6.1 Cleaning of loose particles/contamination from the surface of the HMCs

Customer Pre- cap clearance Status /Details	Is the loose particles /Contaminations are cleared from the HMCs using Clean wipe dipped in E.G.IPA??	Is the Package seal periphery is cleaned using clean wipe dipped in E.G.IPA??	Is the HMC/Circuit wire bonds are disturbed during the Cleaning Process?	Total Qty cleaned & cleared for further processes	Performed by (Sign & Name) & Date

23.10.6.2 Cleaning of Vacuum Baking Oven, Vacuum baking jigs and sealing enclosure

Is the vacuum Baking oven is thoroughly cleaned using Clean wipes and E.G.IPA ?	Is the vacuum Baking Jigs are cleaned using Clean wipes and E.G.IPA ?	Is the Seam sealing enclosure is cleaned using Vacuum cleaner, Clean wipes and E.G.IPA ?	Cleaning Performed by (Sign & Name) and date

23.10.6.3 QA Inspection before loading it into Vacuum baking process

HMC Part No.		**Batch Qty**	
Temp (22±3 deg C):	**Humidity (50±5 %RH):**	**ESD Check: (pass /fail)**	
Is all the HMCs are 100% Visually Inspected by Quality Department?	Quantity cleared after G0 – N0 G0 Electrical Testing	Total No of HMCs Accepted /Cleared for further Processes	Inspected by Quality (Sign & Name) and Date

23.10.6.4 Pre-Seal Vacuum Baking

Equipment Make & Sl.No./Model No		Equipment Name & Asset No.	

Vacuum Oven ID	Total number of Packages loaded	Vacuum (1-100Milli torr)	Temperature (145-155°C)	Number of intervals	Start		End		Duration (hours)	Performed by (Sign & Name) & Date
					Date	Time	Date	Time		

23.10.6.5 Vacuum baking sequence/intervals

Intervals	Duration	Temperature	Function
1	45 min	150 ° C	Evacuation
2	45 min	150 ° C	N_2 purging
3	72 hrs	150 ° C	Vacuum baking
4	45 min	25 ° C	Back filling

23.10.7 Package Sealing

Equipment Make & Sl.No./Model No		Equipment Name & Asset No.	
Dew Pont (-45°C to -65°C			

HMC Part No.		Batch Qty	
Temp (22±3 deg C):	Humidity (50±5 %RH):	ESD Check: (pass /fail)	

1ST WELD PARAMETER				2ND WELD PARAMETER			
PULSE - 1		PULSE - 2		PULSE - 1		PULSE - 2	
WELD CURRENT (0.1 – 2.40 kA)	PULSE DURATION (1 – 15m Sec)	WELD CURRENT (0.1 – 2.40 kA)	PULSE DURATION (1 – 15m Sec)	WELD CURRENT (0.1 – 2.40 kA)	PULSE DURATION (1 – 15m Sec)	WELD CURRENT (0.1 – 2.40 kA)	PULSE DURATION (1 – 15m Sec)

Weld Speed (0.01 - 1.5 Inch/Sec)	**Weld force** (250 - 2500 grams)	Length and Width (as per LID size)	**Track Specification** (Min 0.001 - 0.090 inch)	**Over Travel** (0.001 - 0.2 Inch)	**Electrode Details**

Serial Nos of the Seam sealed HMCs /Packages	Set up Approval by Quality (Name & Date)	Process Performed by (Name, Sign & Date)

Note: N2 purity should be 99.998% and helium purity (which is used as a tracer gas) should be 99.995% pure and should have the dew points better than -45°C

23.10.7.1 Visual Inspection after Seam Sealing (100%)

HMC Part No.		**Batch Qty**	
Temp (22±3 deg C):	**Humidity (50±5 %RH):**	**ESD Check: (pass /fail)**	

Equipment Make & Sl.No./Model No		**Equipment Name & Asset No.**	

HMC Pkg Sl No		VISUAL INSPECTION CRITERIA	ACCEPT	REJECT	OBSERVATION/ REMARKS
	Weld Stitch Marks related	Should be well etched			
		Dragging in weld Flow			
		Gold spot visibility			
		Cracks in stich area			
		Spark marks in Weld stitch			
		Line definition			
		Whitish appearance			
	Weld Flow related	Weld flow Separation/Gap (weld flow should be visible all along the Seal periphery)			
		Spikes in weld flow			
		Side wall coverage			
	General	Pits, bumps, burrs on the seal periphery			
		Dents/deep scratches on the package /LIDs			
		Visible evidence of corrosion, contamination, broken, grossly bent leads			
		Visible evidence of peeling of gold plating on the package and leads			
		Glass to metal seal problems like: Crazing of glass seal surface, Radial cracks ,Circumferential cracks, Cracks in the meniscus of glass seal surface, Voids, bubbles in the sealing glass			
Inspection done by Production (Name & sign) & Date **Inspection done by Quality (Name & Sign) & Date**					

23.10.8 Seal leak testing

HMC Part No		Batch Qty	
Temp (22±3 Deg C):	Humidity (50±5 %RH):	ESD Check (Pass /Fail):	

Helium bombing specification:	FC/Galden bombing specification:
30 hrs at 30psia for DC-DC	24 hrs at 30psia for DC-DC

23.10.8.1 Fine leak Test Report

Date		Package Size	
HMC Type		Date Code, Batch No	
Qty Tested		Qty Accepted	

Package Size	Pressure	Time

Helium Bombing Time In/Out Summary			
Date	Time In	Date	Time out
Helium Detection Summary			
Date	Time In	Date	Time out

Detection Equipment Used				
Description	Make	Model	Sl Number	Cal Due on

6-digit code	PACKAGE SL No.	LEAK RATE observed (atm cc / sec) of Helium (Acceptable leak rate: <5x 10^{-8} atm cc/sec)	RESULT

Test Performed By	Name	Sign
Approved By		

23.10.8.2 Gross Leak Test Report

Date		**Package Size**	
HMC Type		**Date Code, Batch No**	
Qty Tested		**Qty Accepted**	

Package Size	Pressure	Time
DC-DC Converter	30 psia	24 Hrs

FLUOROCARBON BOMBING TIME IN/OUT SUMMARY				
Fluoro carbon liquid used	**Date**	**Time in**	**Date**	**Time out**
GALDEN DET				

GROSS LEAK DETECTION SUMMARY					
Fluoro carbon liquid used	**FC liquid temp**	**Date**	**Time in**	**Date**	**Time out**
GALDEN DO_2	125°C				

Gross Leak Detection Equipment Used				
Description	**Make**	**Model**	**Sl Number**	**Cal Due on**

6 digit code	PACKAGE SL No.	RESULT

Test Performed By	**Name**	**Sign**
Approved By		

23.10.9 Package Marking

HMC Part No.		Batch Qty	
Temp (22±3 deg C):	Humidity (50±5 %RH):	ESD Check: (pass /fail)	

Equipment Make & Sl.No./Model No		Equipment Name & Asset No.	

Number of packages marked	Lot no of ink & Expiry date	Ink Part Number & Colour	Marking Monogram	Set up approval By Quality (Name &Sign)	Curing schedule			Performed by (Sign & Name) & Date
					Curing Time	Curing Temp	Oven ID	

23.10.9.1 Visual inspection of marking (100%) (IPI 9)

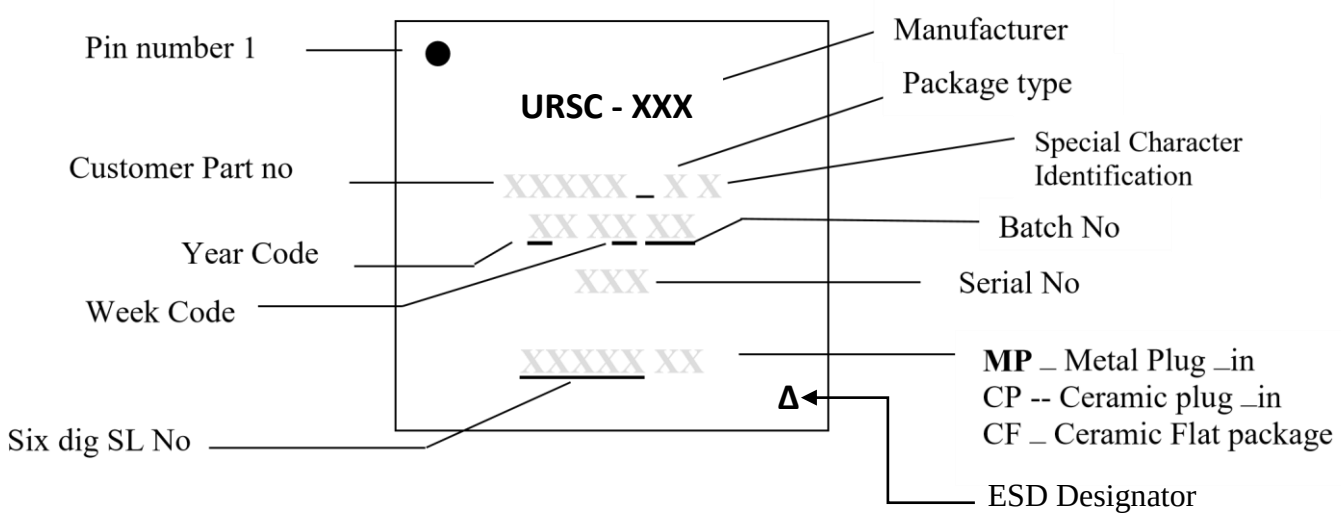
Equipment Make & Sl.No./Model No		Equipment Name & Asset No.	

Marking details as per Drawing specification	Type of ink used	Identification of Pin no. 1	Marking alignment	Foreign materials	Multiple impressions	Qty Inspected	Qty Rejected	Set up approval By Quality (Sign & Name)	Performed by (Sign & Name)& date

23.10.9.2 Marking Permanency Test

Wrist strap check Pass/Fail	Chemical & its IGA/Lot No	Process followed	Dip time in chemical	Rubbing by brush & No of cycles	No of Packages checked	Result	Performed by (Sign & Name) & Date

23.10.9.3 Marking Monogram



23.10.10 External Visual Inspection

HMC Type:		**Manufacturer:**		**Date:**	
Batch No./DC & Batch Qty:		**Qty Inspected:**		**Qty Accepted:**	

Ref Doc.: MIL-STD-883 METHOD 2009
Microscope ID No.:

Package Code No (6 Digits)	SL NO	Marking	Lead Inspection	Glass To Metal	Sealing periphery/ Weld Flow On Pkg wall	Pkg Braze area / Ceramic wall to seal ring Braze	Chip outs/ corrosion/ cleaning	Overall Lid & Package inspection	Residual spots	Lid Deflection	Result

	NAME	SIGN.
TEST DONE BY		
CHECKED BY		

23.11 Screening of Hybrid Microcircuits (Formats)

Table 1. List of Documents to be Submitted for each Batch of Screened Hybrids and applicable formats

Sl. No	Description	Format No.
1.	Screening Test Summary	HMC-S-SUM Rev 01
2.	Initial Electrical Test – Summary and Test report	HMC-S-01 Rev 00
3.	External Visual Inspection report	HMC-S-02 Rev 00
4.	Stabilization Bake – Test Report and monitoring chart	HMC-S-03 Rev 00
5.	Temperature Cycling – Test Report and Monitoring Chart	HMC-S-04 Rev 00
6.	Constant Acceleration or	HMC-S-05 Rev 00
	Mechanical Shock	HMC-S-06 Rev 00
7.	PIND	HMC-S-14 Rev 00
8.	Pre-Burn in Electrical Test-Summary and Test Report	HMC-S-01 Rev 00
9.	Burn in – Summary and Monitoring Chart	HMC-S-07 Rev 00
10.	Post Burn in Electrical Test-Summary and Test Report	HMC-S-01 Rev 00
11.	Active Thermal Cycling – Summary and monitoring Chart	HMC-S-08 Rev 00
12.	Post ATC Electrical Test-Summary and Test Report	HMC-S-01 Rev 00
13.	Seal Leak Test – Summary	HMC-S-09 Rev 00
	Fine Leak test Report	HMC-S-09A Rev 00
	Gross Leak Test Report	HMC-S-09B Rev 00
14.	External Visual Inspection Report	HMC-S-02-Rev 00
15.	Destructive Physical Analysis – Summary sheet	HMC-S-10 Rev 00
	External Visual Inspection	HMC-S-02 Rev 00
	Lead Fatigue Test	HMC-S-11 Rev 00
	External Visual Inspection	HMC-S-02 Rev 00
	Seal Leak Test – Summary	HMC-S-09 Rev 01
	Fine Leak test Report	HMC-S-09A Rev 00
	Gross Leak Test Report	HMC-S-09B Rev 00
	Destructive Physical Analysis-Summary	HMC-S-10 Rev 00
	Lead Fatigue Test	HMC-S-11 Rev 00
	Bond Pull Test	HMC-S-12 Rev 00
	Die Shear Test	HMC-S-13 Rev 00

23.11.1 Screening Test Summary (Format HMC-S_SUM Rev 01)

FORMAT HMC-S-SUM Rev 01 Page 1/1

Product Monogram Details

URSC Work Order Number		**Date**	

IDs of Products Tested

From (6 digits)	To (6 digits)	Except

SCREENING SEQUENCE (MIL-STD-883)			**Qty in**	**Qty failed**	**Qty out**
1	External Visual Inspection	Method 2009			
2	Initial Electrical Test	Per specified procedure			
3	Stabilization Bake	Method 1008			
4	Temperature Cycling	Method 1010			
5	Constant Acceleration (for HMCs)	Method 2001			
	Mechanical Shock (for DC/ DC)	Method 2002			
6	PIND	Method 2020			
7	Pre-Burn in Electrical Test	Per specified procedure			
8	Burn in	Method 1015			
9	Post Burn in Electrical Test	Per specified procedure			
10	ATC	Per specified procedure			
11	Seal Leak Test	Method 1014			
12	Final Electrical Test	Per specified procedure			
13	External Visual Inspection	Method 2009			

SCREENING TEST SUMMARY		
List Tests where failure observed	**ID (6 digits) of Products failed**	**NCR Reference**

	NAME	**SIGNATURE**	**DATE**
Prepared By			
Verified By			

23.11.2 Electrical Test (Format HMC-S-01 Rev 00)

FORMAT HMC-S-01 Rev 00 Page 1/1

Product Monogram Details

Vendor Ref No.		**Stage**	Initial/ Pre-Burn in/Post Burn-in/Post ATC/ Final/ Any Other
Test Procedure	URSC Specified Procedure		

Note – Post burn-in/ATC electrical tests should be performed within 72 hours of completion of burn-in/ATC

Equipment Used

Sl. No.	Equipment	Equipment ID	Calibration status

IDs of Products Tested

From (6 digits)	To (6 digits)	Quantity

Additional Information for Post Burn-in/Electrical Tests

	Date	Time
Completion of Burn in/ ATC		
Completion of electrical test		

Test Results

Quantity Passed	
Quantity Failed	
IDs OF Failed Products	
NC References	

	Name	Sign
Test Performed By		
Approved By		

23.11.3 External Visual Inspection-Summary (Format HMC-S-02 Rev 00)

FORMAT HMC-S-02 Rev 00-Page1/2

Product Monogram Details

Vendor Ref No.		**Stage**	Initial/ Final /Any Other

PARAMETERS TO BE CHECKED (at 30X magnification)

1. The Product is free from corrosion
2. The Product has no broken or loose leads
3. Marking is proper
4. There are no dent (@)/ chipouts (#) (applicable for metal (@)/ ceramic packages (#)
5. There are no cracks in glass to metal seal
6. Weld flow around seal periphery is uniform.

IDs of Products Tested

From (6 digits)	To (6 digits)	Quantity

Test Results

Quantity Passed	
Quantity Failed	
IDs OF Failed Products	

	Name	Sign
Test Performed By		
Approved By		

Note – While performing the initial external visual examination please confirm that Process specification control sheet for the Products is available. Look specifically for the following documents before starting the screening

- Pre-cap visual examination
- Pre-seal electrical test results
- Seal leak test results
- Post seal electrical test results
- External visual examination report

23.11.4 External Visual Inspection-Test Report (Format HMC-S-02 Rev 00)

FORMAT HMC-S-02 Rev 00-Page 2/2

Product Monogram Details

Vendor Ref No.		**Stage**	Initial/ Final /Any Other

IDs of Products Tested

From (6 digits)	To (6 digits)	Quantity

Package ID (6 digit)	Inspection Parameter						Remarks
	Corrosion and marking	Dents	Lead integrity	Glass To Metal seal	Sealing periphery	Weld Flow on Package Wall	

	Name	Sign
Test Performed By		
Approved By		

23.11.5 Stabilization Bake-Test Report (Format HMC-S-03 Rev 00)

FORMAT HMC-S-03 Rev 00-Page 1/2

Product Monogram Details

Vendor Ref No.	

Applicable Test Method	MIL STD 883 Method 1008 Temperature: 125°C Duration: 72 Hours

Note: Ensure that temperature does not exceed 125°C

Climatic Chamber Details	
Chamber Name	
Chamber ID	
Calibration Status	

	Date	**Time**
Test Start		
Test Completion		

DETAILS OF INTERRUPTIONS, if applicable

Interruption			**Reason for Interruption**
Date	**Time From**	**Time to**	

Note: If total duration of interruption exceeds 2 hours, the test completion should be suitably delayed complying with requirement of 72 hours baking.

IDs of Products Tested

From (6 digits)	**To (6 digits)**	**Quantity**

	Name	**Signature**	**Date**
Test Performed By			
Checked By			

23.11.6 Stabilization Bake-Monitoring Chart (Format HMC-S-03 Rev 00)

FORMAT HMC-S-03 Rev 00-Page 2/2

Product Monogram Details

Vendor Ref No.	

	Date	Time
Test Start		
Test Completion		

IDs of Products Tested

From (6 digits)	To (6 digits)	Quantity

Time	Temp	Monitored By	Time	Temp	Monitored By

Note – Temperature should be monitored at least once every 3 hours

	Name	Signature	Date
Checked By			

23.11.7 Thermal Cycling-Test Report (Format HMC-S-04 Rev 00)

FORMAT HMC-S-04 Rev 00-Page 1/2

Product Monogram Details

Vendor Ref No.	

Applicable Test Method	MIL STD 883 Method 1010 Temperature: +125°C, 10 minutes dwell : -55°C, 10 minutes dwell No. of Cycles: 10

Note: Ensure that temperature does not exceed 125°C

Climatic Chamber Details	
Chamber Name	
Chamber ID	
Calibration Status	

	Date	**Time**
Test Start		
Test Completion		

DETAILS OF INTERRUPTIONS, if applicable

Interruption			**Reason for Interruption**
Date	**Time From**	**Time to**	

Note: In case of interruption, the cycle in progress at the time of interruption should not be counted.

IDs of Products Tested

From (6 digits)	**To (6 digits)**	**Quantity**

	Name	**Signature**	**Date**
Test Performed By			
Checked By			

23.11.8 Thermal Cycling-Monitoring Chart (Format HMC-S-04 Rev 00)

FORMAT HMC-S-04 Rev 00-Page 2/2

Product Monogram Details

Vendor Ref No.	

	Date	**Time**
Test Start		
Test Completion		

Cycle No	**Hot Cycle**			**Cold cycle**		
	Temp	**Time in**	**Time out**	**Temp**	**Time in**	**Time out**

	Name	**Signature**	**Date**
Test Performed By			
Checked By			

23.11.9 Constant Acceleration (Format HMC-S-05 Rev 00)

(Not Applicable for DC-DC Converter HMCs)

FORMAT HMC-S-05 Rev 00-Page 1/1

Product Monogram Details

Vendor Ref No.	

Applicable Test Method	

TEST PROCEDURE:

ACCEPTANCE CRITERIA

FACILITY LOCATION

IDs of Products Tested

From (6 digits)	To (6 digits)	Quantity	IDs of failed Products

	Name	Signature	Date
Test Performed By			
Checked By			

23.11.10 Mechanical Shock (Format HMC-S-06 Rev 00)

FORMAT HMC-S-06 Rev 00-Page 1/1

Product Monogram Details

Vendor Ref No.	

Applicable Test Method	TM 2002, 700g half sine, 5 pulses Or 1000g SRS

Equipment Location: Calibration Status

ID of Product Tested

Product ID from (6 Digit)	Product ID to (6 digit)

Test Results

Quantity Passed	
Quantity Failed	
IDs OF Failed Products	

	Name	**Signature**	**Date**
Test Performed By			
Checked By			

23.11.11 PIND Test Report (Format HMC-S-14 Rev 00)

FORMAT HMC-S-14 Rev 00-Page 1/1

HMC Type		Batch No		Manufacturer		Date	

Method	MIL STD-883E, Method 2020, Condition A (20g peak @ 60Hz)

Equipment details		Calibration Status	

Start time		End Time	

Sl.No	HMC No.	No.of cycles					Result
		1	2	3	4	5	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Cycle No.	1	2	3	4	5
Qty Tested					
Qty Pass					
Qty Fail					
Qty cleared					

P: Pass, F: Fail

	ICG	SRG
Tested By		

23.11.12 Burn-In (Format HMC-S-07 Rev 00)

FORMAT HMC-S-07 Rev 00-Page 1/2

Product Monogram Details

Vendor Ref No.	

Applicable Test Procedure	Document will be supplied by URSC

Test Conditions	Temperature: 110°C, (measured at case using thermocouple for DC/DC, else chamber temperature) Duration: 520 Hours

Note: Ensure that temperature does not exceed 110°C (at case for DC-DC)

EQUIPMENT USED

Sl. No.	Equipment	Equipment ID	Calibration status

PARAMETERS (FROM TEST SET UP) TO BE LOGGED

Voltage		
Supply Voltage	Volts	Voltmeter ID No.
Vdd		
Vee		

Current		
Current consumed	mA	Current meter ID No.
Idd		
Iee		

Frequency		
Frequency port	Hz @ V	meter ID No.
Input		
Output		

BURN IN SUMMARY

	Start		Completion		Duration
	Date	Time	Date	Time out	
Test condition 1					
Test condition 2*					

* For types involving change over

FORMAT HMC-S-07 Rev 00-Page 2/2

Product Monogram Details

Vendor Ref No.	

IDs of Products Tested

From (6 digits)	To (6 digits)	Quantity

Test Results

Quantity Passed	
Quantity Failed	
IDs OF Failed Products	

	Name	Sign
Test Performed By		
Approved By		

Note – Detailed report and test monitor should accompany this table for each Product

23.11.13 Active Thermal Cycling (Format HMC-S-08 Rev 00)

FORMAT HMC-S-08 Rev 00-Page 1/1

Product Monogram Details

Vendor Ref No.	

Test Conditions	Between -30°C to +85°C, 5 Cycles in the sequence specified below 2 short cycles – 2 hours 1 long cycle – 48 hours cold, 24 hours hot 2 short cycles – 2 hours

Climatic Chamber Details	
Chamber Name	
Chamber ID	
Calibration Status	

IDs of Products Tested

From (6 digits)	To (6 digits)	Quantity

Test Results

Quantity Passed	
Quantity Failed	
IDs OF Failed Products	

	Name	Sign
Test Performed By		
Approved By		

Note – The list of parameters monitored should accompany this table for each Product type

23.11.14 Seal Leak Test -Test Summary (Format HMC-S-09 Rev 00)

FORMAT HMC-S-09 Rev 00-Page 1/3

Product Monogram Details

Vendor Ref No.	

Test Conditions	Fine Leak: 30psia 30hrs, Limit: 5 x 10^{-8} atm cc/sec
	Gross Leak: 30psia 30hrs, Acceptable leak rate: Free from stream of bubbles

IDs of Products Tested

From (6 digits)	To (6 digits)	Quantity

Test Results

Quantity Passed		
Quantity Failed	**Fine Leak**	
	Gross Leak	
IDs OF Failed Products		

	Name	Sign
Checked By		

23.11.15 Fine Leak Test -Test Report (Format HMC-S-09A Rev 00)

FORMAT HMC-S-09A Rev 00-Page 2/3

Product Monogram Details

Vendor Ref No.	

Equipment Location: Calibration Status

Detector Calibration	
Standard ID	
With Valve Closed	
With Valve Open	

Package Size	

Test Conditions	Bombing Pressure
	Test Duration

Helium Bombing Details			
Date	**Time In**	**Date**	**Time Out**

Helium Detection Details			
Date	**Time In**	**Date**	**Time Out**

Size of Test Batch (Qty)			
Sl.No	**Product ID**	**Leak Rate Observed**	**Remarks**

	Name	**Signature**	**Date**
Test Performed By			
Checked By			

23.11.16 Gross Leak -Test Report (Format HMC-S-09B Rev 00)

FORMAT HMC-S-09B Rev 00-Page 3/3

Product Monogram Details

Vendor Ref No.	

Equipment Location: Calibration Status

Package Size	

Test Conditions	Bombing Pressure
	Test Duration

Size of Test Batch (Qty)			
Sl.No	**Product ID**	**Observation**	**Remarks**

	Name	**Signature**	**Date**
Test Performed By			
Checked By			

Test Summary

Quantity Passed	
Quantity Failed	
IDs OF Failed Products	

	Name	**Sign**
Test Performed By		
Approved By		

23.11.17 Destructive Physical Analysis-Summary (Format HMC-S-10 Rev 00)

FORMAT HMC-S-10 Rev 00-Page 1/1

Product Monogram Details

Vendor Ref No.	

Test Standard	MIL-STD-883

ID of Product Tested	

Test Sequence			
Sl No	Test	Test Method	Performed (Yes/ No)
1	External visual examination	Method 2009	
2	Lead fatigue test	Method 2004	
3	Seal leak test – fine leak	Method 1014	
	Seal leak test – gross leak	Method 1014	
4	Internal visual examination	Method 2017	
5	Bond pull test	Method 2011	
6	Die shear test	Method 2019	

Enclose Attach all reports

	Name	**Signature**	**Date**
Test Performed By			
Checked By			

DISPOSITION

(Signature, Name & Date) _____

23.11.18 Lead Fatigue Test (Format HMC-S-11 Rev 00)

FORMAT HMC-S-11 Rev 00-Page 1/1

Product Monogram Details

Vendor Ref No.	

Applicable Test Procedure	MIL-STD 883 Method 2004

Test Specifications	8 oz (228 grams), +45°, 3 cycles

EQUIPMENT USED			
Sl. No.	**Equipment**	**Equipment ID**	**Calibration status**

Test Result				
Sl No	**Product ID (6 digit)**	**Pin nos. tested**	**Pins not meeting spec**	**Passed (Specify Yes/ No)**
1				
2				
3				
4				
5				
6				

Test Summary

Quantity Passed	
Quantity Failed	
IDs OF Failed Products	

	Name	**Sign**
Test Performed By		
Approved By		

23.11.19 Bond Pull Test (Format HMC-S-12 Rev 00)

FORMAT HMC-S-12 Rev 00-Page 1/1

Product Monogram Details

Vendor Ref No.	
Stage Test Performed	

Applicable Test Procedure	MIL-STD 883 Method 2011

ID OF PRODUCT TESTED

Observations

Sl.NO	MEASUREMENT	POST /PAD	POST/SUBST
1	Wire Bond Used	Gold	Gold
2	Diameter of the wire	1.0 Mil	1.5 Mil
3	Minimum Bond Strength Required (gmf)	2.5	4.0

OBSERVED BOND STRENGTH OF DIE TO SUBSTRATE BONDS			
4	Minimum Bond Strength Observed (gmf)		
5	Average Bond Strength Observed (gmf)		
6	Maximum Bond Strength Observed (gmf)		
7	Standard Deviation (gmf)		

OBSERVED BOND STRENGTH OF POST TO SUBSTRATE BONDS			
8	Minimum Bond Strength Observed (gmf)		
9	Average Bond Strength Observed (gmf)		
10	Maximum Bond Strength Observed (gmf)		
11	Standard Deviation (gmf)		

	Name	Sign
Test Performed By		
Checked By		

23.11.20 Die Shear test (Format HMC-S-13 Rev 00)

FORMAT HMC-S-13 Rev 00-Page 1/1

Product Monogram Details

Vendor Ref No.	
Stage Test Performed	

Applicable Test Procedure	MIL-STD 883 Method 2019

ID OF PRODUCT TESTED

DIE Shear Test Observations

Sl No	DIE TYPE	AREA	STRENGTH REQD (MIN) (Kgf)	STRENGH OBSERVED (Kgf)	REMARKS

RESULT OF DIE SHEAR TEST: PASS/ FAIL

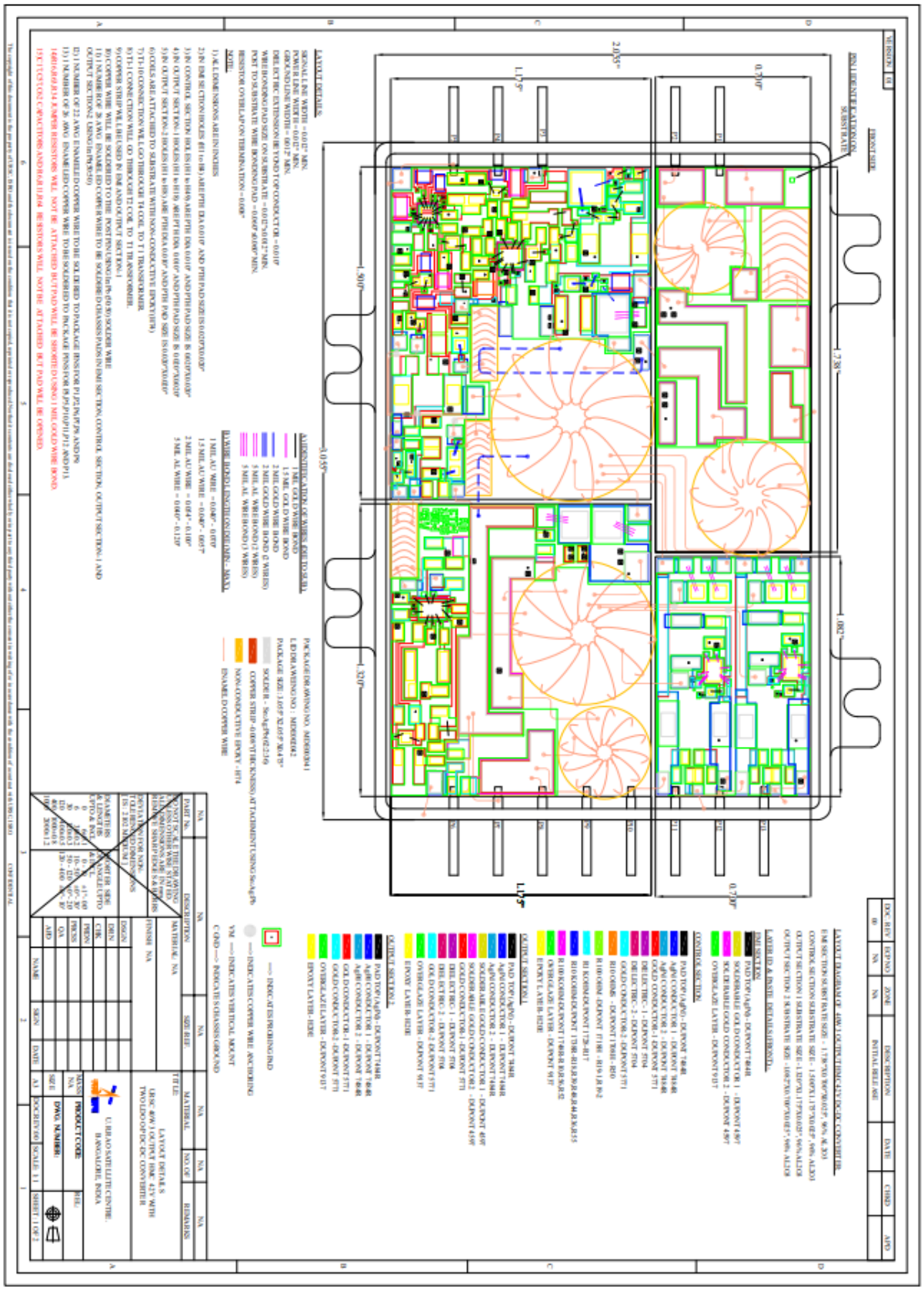
REMARKS: _____

	Name	Sign
Test Performed By		
Checked By		

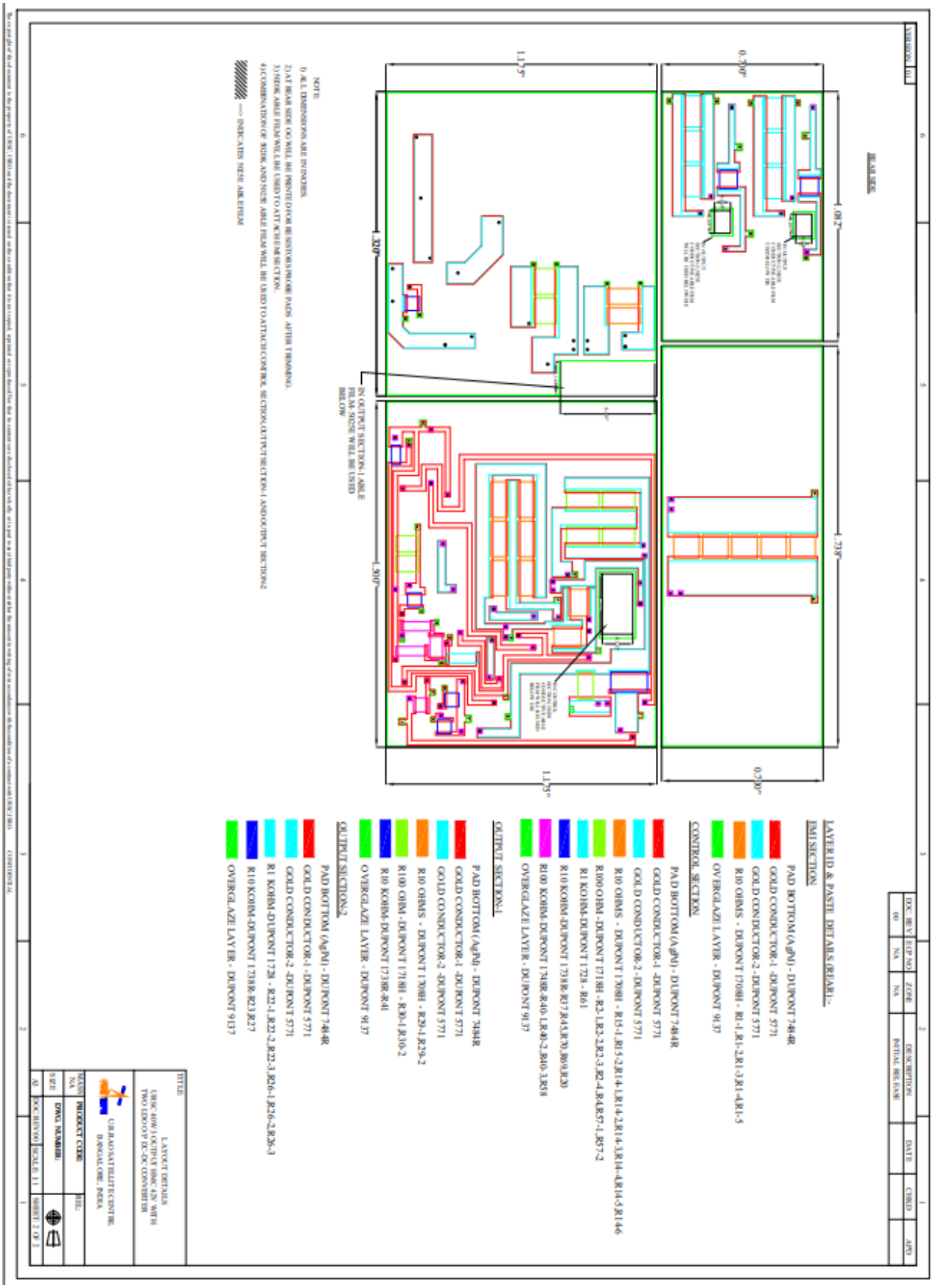
PART IV

24 HMC Layout

24.1 HD4042T-HF: Top Side



24.2 HD4042T-HF: Rear Side



25 Bill of Materials

25.1 BOM of HD4042T-HF: Semiconductors & Magnetics

BOM of 42V, 40W-Triple Output DC-DC Converter HMC (HD4042T-HF) Date - 20/06/2024 verified on 28/06/2024						
Sl No	**Manufacturing Part No**	**Part Description**	**Part Make (Manufacturer)**	**Type of Component**	**Type of Package**	**Qty (nos.)**
SEMICONDUCTOR						
1	BUY25CS12J01/CHIP L5490(P)	Die BUY25CS12J01,250V,12.4A	INFINEON	MOSFET	BARE DIE	1
2	JANKCB2N2907A	2N2907 -TRANSISTOR-BARE DIE	Fairchild Semiconductor/Microsemi/Sillicon supplies	TRANSISTORS	BARE DIE	1
3	JANKCA2N3019	BARE DIE 2N3019,80V,1A	VPT/Microsemi/Semicoa	TRANSISTORS	BARE DIE	1
4	JANK2N5666	2N5666 - TRANSISTOR-BARE DIE	Microsemi	TRANSISTORS	BARE DIE	1
5	JANKCC2N3700	Transistor bare die 2N3700	VPT/Allegro Microsystems	TRANSISTORS	BARE DIE	1
6	ISL78845ASRHVX	PWM bare die, ISL78845	Intersil Corp.	PWM CONTROLLER	BARE DIE	1
7	LM2941	Bare die,LM2941	NSC	LDO	BARE DIE	2
8	UC1901	Bare Die UC1901 Isola Feed Gen	Texas Instruments Inc.	AM MODULATOR	BARE DIE	1
9	LM139	IC-BARE DIE LM139A	National Semiconductor	COMPARATOR	BARE DIE	1
10	LM136-2.5	LM136A-2.5 ZENER	National Semiconductor	SHUNT REFERENCE	BARE DIE	2
11	JANKCE1N5806	Bare die 1N5806, 150V, 2.5A	Microsemi/Silicon supplies	DIODE	BARE DIE	5
12	SC105H100A/ SC125H100A	Bare die,100V,SC105H100A//SC125H100A	IR	DIODE	BARE DIE	2
13	JANKCE1N5811	Bare die,1N5811, 6A/150V	Microsemi/Silicon supplies	DIODE	BARE DIE	4
14	JANKCB1N6642	Bare die 1N6642,100V, 0.3A	Microsemi/Silicon supplies	DIODE	BARE DIE	8
15	JANKCA1N4626	Bare die,1N4626,500mW,5.6V	Microsemi/Sprgue	ZENER DIODE	BARE DIE	2
16	JANKCA1N965B	Bare die,1N965B,500mW,15V	Microsemi/Silicon supplies	ZENER DIODE	BARE DIE	1
17	JANKCA1N967B	Bare die,1N967B,500mW,18V	Microsemi/Silicon supplies	ZENER DIODE	BARE DIE	2
MAGNETICS						
1	YJ-40705-TC	Toriod core,YJ-40705-TC,AL:2088	Magnetics Inc.	INDUCTOR		1
2	55287-A2	55287A2 - TOROID	Magnetics Inc.	INDUCTOR		1
3	55051-A2	55051-A2,AL:27nH/T^A2 MAGNET	Magnetics Inc.	INDUCTOR		1
4	55027-M4	55027M4- TOROID	Magnetics Inc.	INDUCTOR		2
5	YR-41605-TC	YR-41605-TC TOROID	Magnetics Inc.	TRANSFORMER		1
6	YJ-40601-TC	TOROID CORE YJ-40601-TC	Magnetics Inc.	TRANSFORMER		3

25.2 BOM of HD4042T-HF: Resistors

BOM of 42V, 40W-Triple Output DC-DC Converter HMC (HD4042T-HF) Date - 20/06/2024 verified on 28/06/2024						
Sl No	**Manufacturing Part No**	**Part Description**	**Part Make (Manufacturer)**	**Type of Component**	**Type of Package**	**Qty (nos.)**
SMD RESISTOR						
1	RM1206	330Ω,0.25W,±1%,RM1206	Mini system Inc./ SOTA/VISHAY	SMD RESISTOR	1206	2
2	RM0505	33.2K,50mW,1%,RM0505		SMD RESISTOR	0505	1
3	RM0505	10 K,±1%, 50mW,RM0505		SMD RESISTOR	0505	2
4	RM0505	2.49K, 1%, 50mW,RM0505		SMD RESISTOR	0505	1
5	RM1206	1K,±1%,0.25W,100ppm/°C,RM1206		SMD RESISTOR	1206	3
6	RM1206	5.1K,0.25W,±1%,RM1206		SMD RESISTOR	1206	2
7	RM0505	2K,50mW,±1%,RM0505		SMD RESISTOR	0505	1
8	RM1206	6.81K,0.25W,±1%,RM1206		SMD RESISTOR	1206	1
9	RM1206	56K,0.25W,±1%,RM1206		SMD RESISTOR	1206	1
10	RM1206	10K,1/4W,±1%,RM1206		SMD RESISTOR	1206	1
11	RM0505	3.65K,±1% ,50mW,RM0505		SMD RESISTOR	0805	1
12	RM1206	28K,250mW,±1%,RM1206		SMD RESISTOR	1206	1

25.3 BOM of HD4042T-HF: Capacitors

BOM of 42V, 40W-Triple Output DC-DC Converter HMC (HD4042T-HF) Date - 20/06/2024 verified on 28/06/2024						
Sl No	**Manufacturing Part No**	**Part Description**	**Part Make (Manufacturer)**	**Type of Component**	**Type of Package**	**Qty (nos.)**
CAPACITORS						
1	LD20	10uF,100V,10%,2220	KEMET/Kyocera AVX/EXXELIA/Vitramon/Vishay/Avx Corporation	CAPACITOR	2220	8
2	LD14	100 KPF,200V,10%,2220		CAPACITOR	2220	2
3	CDR14	68PF,500V,10%,CDR13		CAPACITOR	CDR13	1
4	CWR29-H	10uF, 35V, ±10%,CWR29-H		CAPACITOR	CWR29-H	1
5	CWR29-H	15uF,25V, ±5%,CWR29-H		CAPACITOR	CWR29-H	1
6	LD20	4.7uF 100V X7R 10% 2220		CAPACITOR	LD20	1
7	CDR33	0.1uF, 50V, 10%, CDR33		CAPACITOR	CDR33	6
8	CDR34	56nF,100V,±10%,CDR34		CAPACITOR	CDR34	2
9	CDR01	1.2KPF,100V,10%,CDR01		CAPACITOR	CDR01	2
10	CDR31	100pF,100V,±10%,CDR31		CAPACITOR	CDR31	1
11	CDR31	100pF,100V,±1%,CDR31		CAPACITOR	CDR31	1
12	CDR31	470pF, 100V, ±1%, CDR31		CAPACITOR	CDR31	1
13	CDR31	4.7nF,100V,10%,0805		CAPACITOR	0805	8
14	CWR29	1uF,10V,5%, CWR29-A		CAPACITOR	CWR29-A	1
15	LD20	10uF, 50V, ±10%, LD20		CAPACITOR	LD20	2
16	CDR31	10nF,+/-10%,50V,PdAg,0805		CAPACITOR	CDR31	3
17	CDR31	8.2KPF,50V,10%,CDR31		CAPACITOR	CDR31	1
18	TESE336K035	33uF, 35V, 10%,TES-E		CAPACITOR	TES-E336K035	2
19	CWR29	0.47uF,20V,±5%,CWR29-A		CAPACITOR	CWR29-A	2
20	CDR31	680PF,100V,±10%,CDR31		CAPACITOR	CDR31	1
21	TESE157K016	150uF,16V,±10%TES-E		CAPACITOR	TBM-E	2
22	CWR29	0.22uF,35V,±10%,CWR29-A		CAPACITOR	CWR29-A	1
23	CWR29	0.22uF,35V,±5%,CWR29-A		CAPACITOR	CWR29-A	1
24	CDR31	270pF,100V,±1%, CDR31		CAPACITOR	CDR31	1
25	CDR31	1nF,100V,±10%,CDR31		CAPACITOR	CDR31	1
26	CDR31	220pF,100V,0805,±1%		CAPACITOR	CDR31	1

26 Package Procurement Specifications for HD4042T-HF

Specifications of HMC Power Package - CRS

Application: Metallic Packages with matched stepped Lids for High Reliability Space application.

1. **Package**
   a. Dimensional details as per drawings attached in **Annexure IV**.
   b. Material : CRS 1018/1008 as per AISI 1018/1008 (Single Piece Construction)
   c. Leads / Pins: Alloy 52 as per ASTM F30
   d. Eyelets : Glass (CORNING 7052/9010/9013 or Equivalent)
2. **Lids:** Matched stepped Lids for parallel Seam Sealing.
   a. Material: SS304/CRS 1018 as per AISI Standards (Single Piece Construction)
   b. Lid Dimension: Dimensional details as per drawings attached in **Annexure IV**.
3. **Plating for packages and Lids:**
   The plating finishes shall comply with the following:
   a) Gold plating (i.e. 99.9% purity) to MIL-DTL-45204D, Type III, Grade A (Electrolytic), 100µinches (2.54µm) minimum.
   b) Electrolytic Nickel (Ni) plating shall be as per AMS-QQ-N-290 REV C, CLASS 1, Dull Coating thickness 100µinches (2.54µm) to 180µinches (4.572 µm).
4. **Quality Requirements**
   1. Packages & Lids supplied shall conform to MIL-PRF-38534 requirements (Table C-VI of Appendix-C)
   2. Packages & Lids supplied shall meet the Quality Standards & Test levels as per Annexure-1.
5. **Reports to be supplied / Tests to be performed by the supplier:**
   a) Certificate of compliance signed by QA manager shall be enclosed with each shipment with the following information
      1) Package/lid type
      2) Suppliers name and Address
      3) Manufacturers name
      4) Package/lid quantity
      5) Purchase order number
      6) Applicable drawing number with revision No.
      7) Manufacturing lot no with date

8) Compliance Certificate to procurement specification requirement for both packages and lids as per MIL-PRF-38534H requirements (Table C-VI of Appendix-C).

b) 100% Visual inspection shall be carried out as per MIL guidelines.

c) Verification of Physical Dimension as per Method 2016, 3%, AQL of MIL-STD-883.

d) 100% Hermeticity checks to be conducted on bare packages as per MIL-STD-883 Method 1014 (A4). The measured leak rate shall be better than $1x10^{-8}$ atm cc/sec He.

e) Measurement of plating thickness of Gold and Nickel plating.

f) 100% Verification of Physical Dimension along with flatness and package serialization shall be carried out.

g) Test report / Certificate of Compliance for b, c, d, e & f should be provided.

6. PACKING AND MARKING:

a) Package and Lids shall be individually packed in suitable material into vacuum sealed packets and packing material shall not contain corrosive/out gassing elements.

b) Packing shall be such that it should be physically restrained from vibration and shock in order to avoid any kind of damage to Packages and Lids.

c) Containers shall be suitably packed for easy shipment, handling and storage without allowing damage to the parts.

d) Container shall be marked with part number, lot number and quantity of Packages or Lids in each shipping container.

e) Packing shall be such that no scratches should occur on Package and Lid during handling and transit.

7. TESTS TO BE PERFORMED AT CUSTOMER SITE:

The tests specified in ***Annexure-1*** shall be carried out at customer site and supplier need not perform these tests. However, the construction of the packages should be such that they meet the test levels provided in ***Annexure-1***.

On receipt of the Packages Customer will carry out visual inspection on 100% basis as per MIL-STD-883. However, Customer has every right to inspect with 40X or greater magnification for defect verification if any. Also Customer will carry out Lot Acceptance Tests (LAT) on eight packages/lids (randomly picked samples) as per Annexure-1. If Packages/Lids fail to meet the requirements & failure is attributed to package construction, then the whole lot shall be liable for rejection & free replacement.

8. OTHER REQUIREMENT:

1. Packages along with matching lid shall only be considered.
2. Point to point compliance matrix with respect to specifications of package & lid shall be provided.
3. Supplier shall obtain Drawing approval from vendor prior to fabrication.
4. Drawings of the Packages & Lids provided are final. However minor modifications shall be there at the time of ordering.
5. Package & lids shall be preferably of single Lot Code from latest manufactured Lot (6 months prior to Purchase order or later).
6. Drawing with all dimensional details and tolerance shall be supplied.

Annexure-I

TEST PLAN FOR PACKAGE LAT

SAMPLES	TEST	TEST CONDITIONS MIL-STD-883
06 weight simulated packages & 02 bare packages and lids	Dimension & external visual inspection	TM2016
	Seal leak test	TM1014 Fine leak condition: 30 psia for 30 hrs Limit: 5 x 10-8 atm cc/sec Gross leak condition: 30psia for 24hrs Limit: No stream of bubbles
Group 1: **3 packages**	Liquid thermal Shock	TM1011 -55ºC to 125ºC 5mins - 10 sec - 5 mins, 10 cycles
	High temperature bake	TM1008, 1 hour at 150ºC
	Lead fatigue test	TM2004, 8 oz 45 0, 3 cycles
	Seal leak test	TM1014 Fine leak condition: 30 psia for 30 hrs Limit: 5 x 10-8 atm cc/sec Gross leak condition: 30psia for 24hrs Limit: No stream of bubbles
	Moisture resistance test	TM1004 (No evidence of pits , discoloration, corrosion)
Group 2: **3 packages**	Temperature cycling	TM1010 Between -55ºC and 125ºC , 50 cycles
	Vibration test	**Refer Annexure II**
	Seal Leak Test	TM1014 Fine leak condition: 30 psia for 30 hrs Limit: 5 x 10-8 atm cc/sec Gross leak condition: 30 psia for 24 hrs Limit: No stream of bubbles
	Metal package isolation	TM1003, 600V DC, 100 nA
	Solder ability test	TM-2003 Solder temperature +245 ºC (±5 ºC)
Group 3: **2 bare packages/ lids**	Salt atmosphere test	TM1009 (No evidence of discoloration, corrosion)

Note: If the package or manufacturer is new, substrate attachment and wire bonding verification shall be carried out.

Annexure – II

Sine Vibration (all three axis)

20 to 100 Hz : 20g (amplitude)

Sweep rate : 2 oct/min.

Random Vibration (all three axis)

20 to 70 Hz. ⇒ +3dB/oct

70 to 700 Hz. ⇒ $0.4g^2/Hz$

700 to 2000 Hz. ⇒ 6dB/oct

g rms. : 21.4

Duration : 2 min/axis

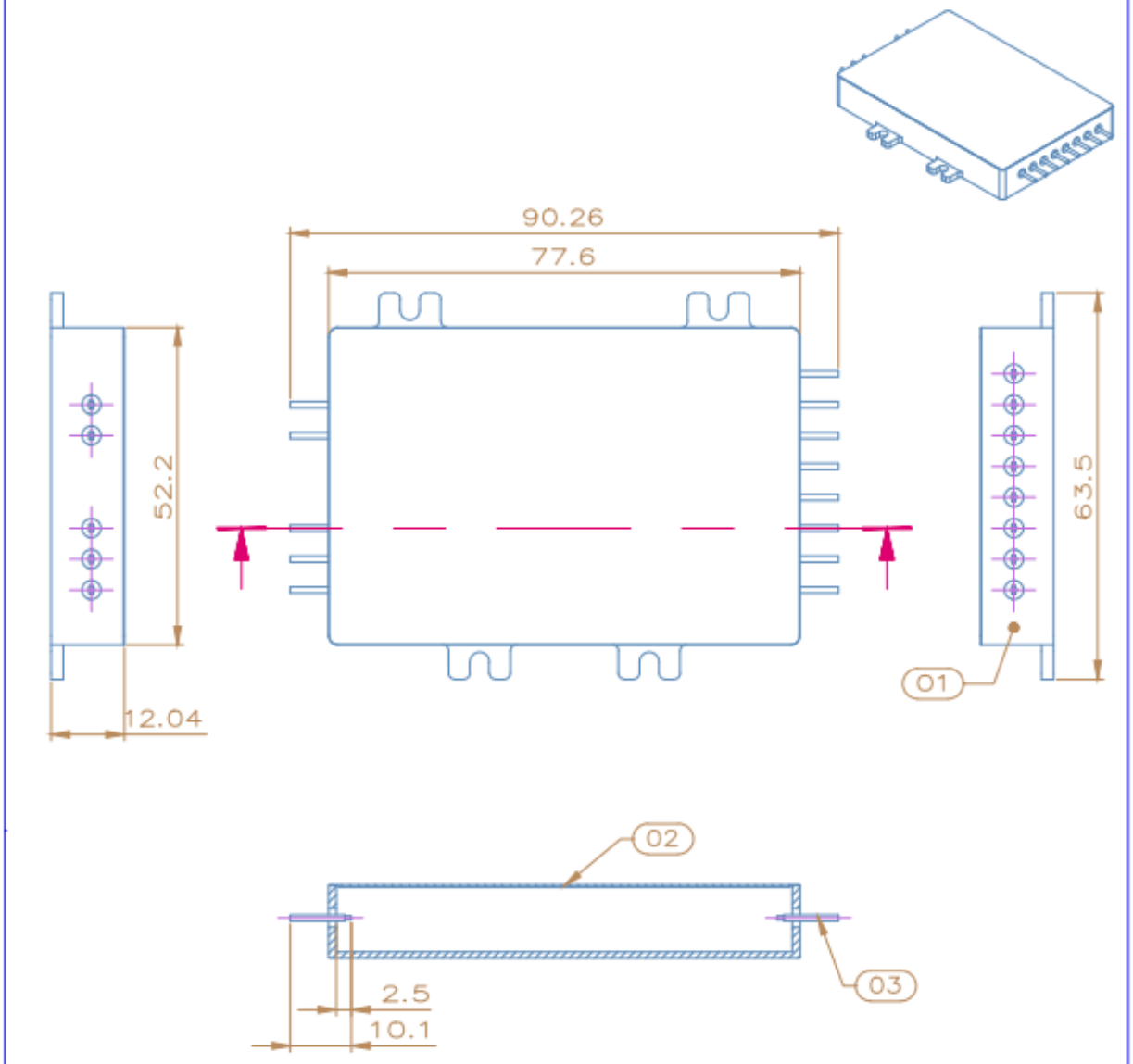
Annexure – III

SEAL LEAK TEST CONDITIONS

SN.	Package	Fine leak bombing test condition	Acceptable Fine leak rate	Gross leak bombing test condition
1	Package	30 psia for 30 hrs	5×10^{-8} atm cc/sec	30psia for 24hrs

Annexure-IV

REV NO	NOTES OF REVISION	ZONE
00	BASE LINE DRAWING	N/A



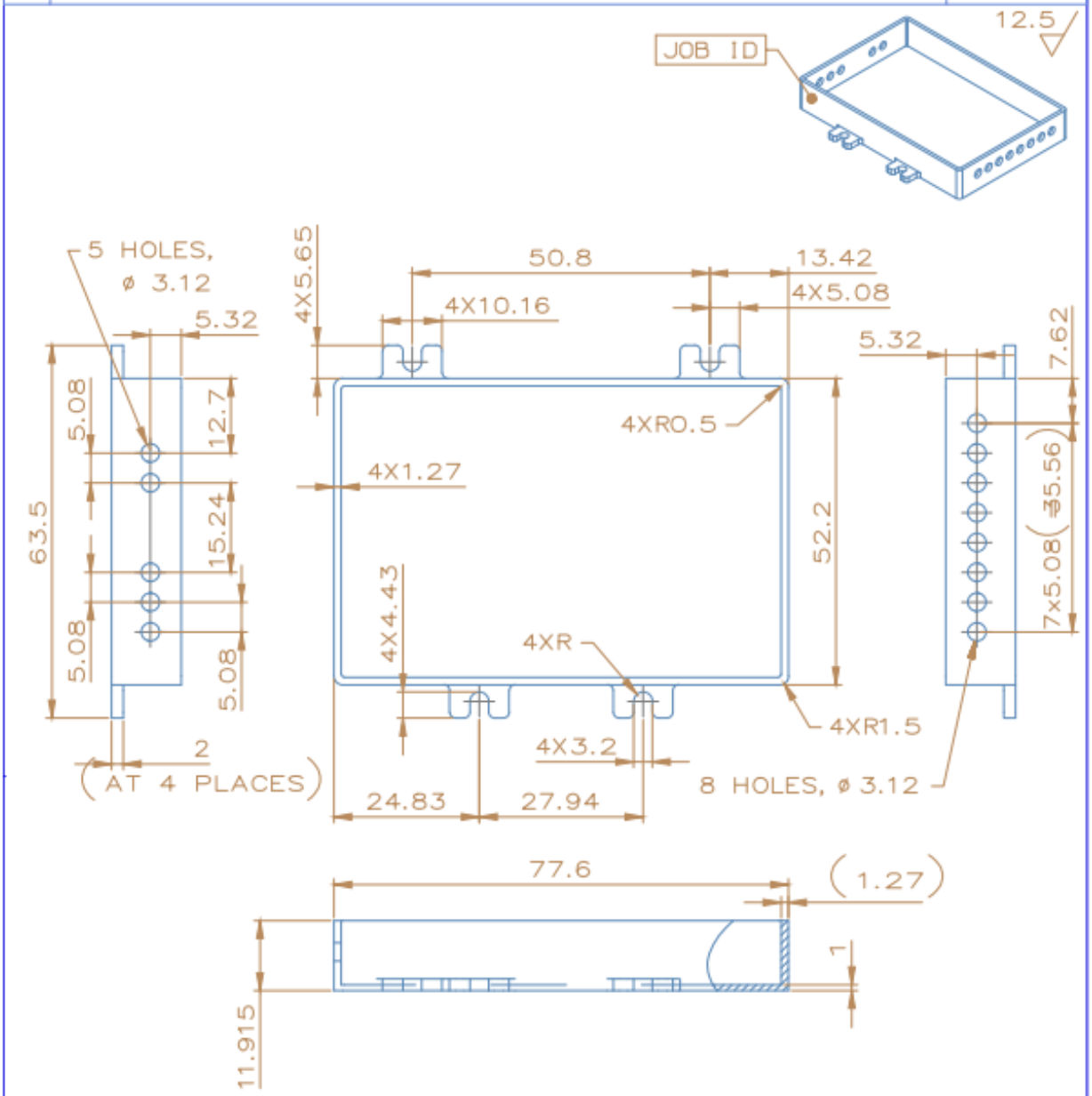
SL NO	DESCRIPTION	QTY.	MATL.	REMARKS
03	PIN	13	KOVAR	ISAC-DTDF-DTDP-38-00076/001
02	LID	1	KOVAR	ISAC-DTDF-DTDP-38-00072/001
01	FLAT PACK 13 PIN PACKAGE	1	CRS	ISAC-DTDF-DTDP-38-00071/001

*GENERAL TOLERANCE AS PER ISO 2768-m
(DIMENSIONS BELOW 0.5mm TO BE ACHIEVED BY BEST POSSIBLE METHOD)
*DO NOT SCALE THE DRAWING UNLESS OTHERWISE STATED.
*DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
*REMOVE SHARP EDGES.

TITLE: FLAT PACK 13 PIN PACKAGE ASSY

SCALE: 1:1

REV NO	NOTES OF REVISION	ZONE
00	BASE LINE DRAWING	N/A
01	MATERIAL CHANGED FROM SS304 TO CRS	N/A



NOTE:
1. ALL FILLET RADII ARE R1 UNLESS OTHERWISE SPECIFIED.

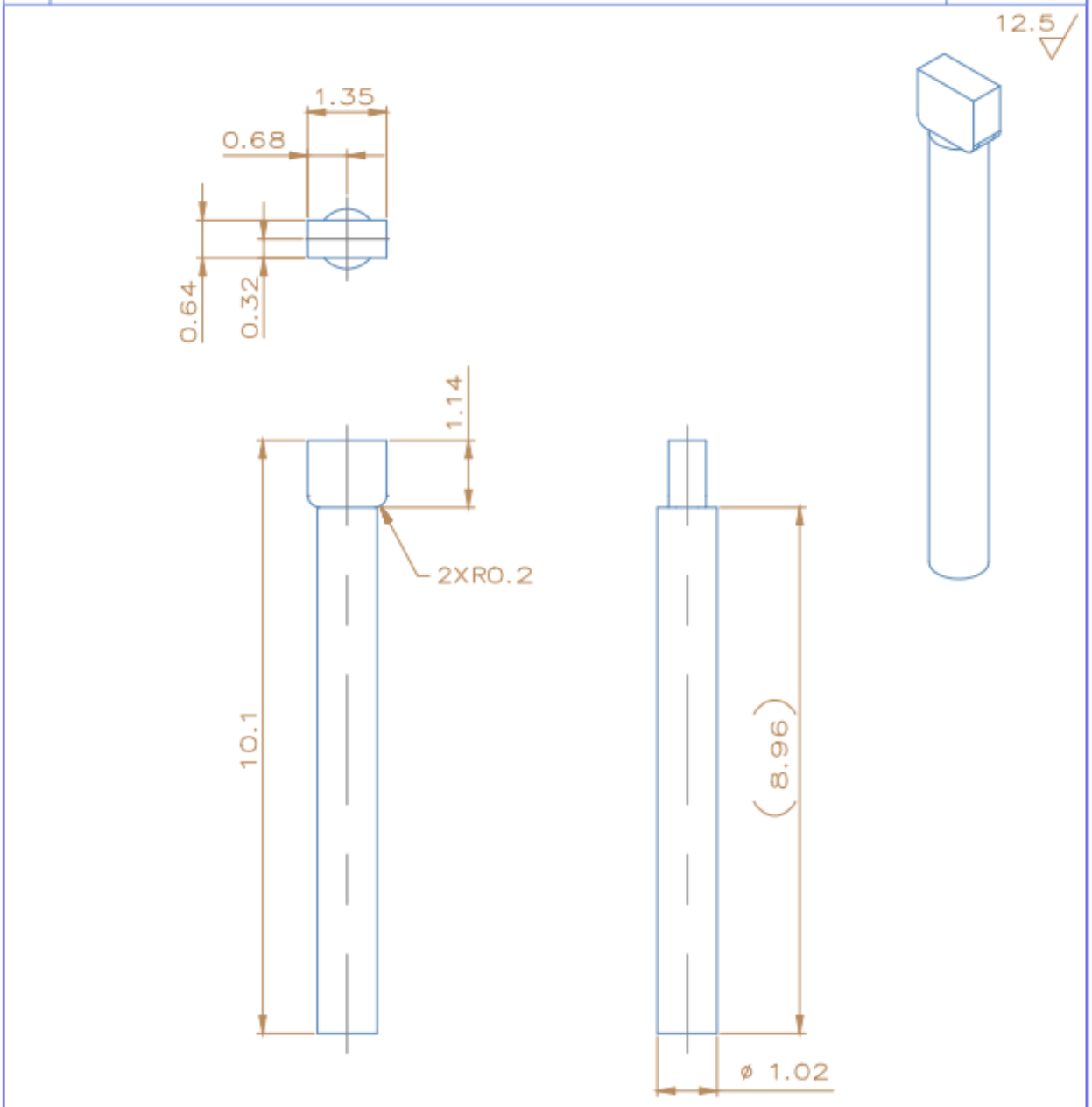
SL. NO	DESCRIPTION	QTY.	MATL.	MASS
1	FLAT PACK 13 PIN PACKAGE	1	CRS	61.00 gm

GENERAL TOLERANCE AS PER ISO 2768-mK
(DIMENSIONS BELOW 0.5mm TO BE ACHIEVED BY BEST POSSIBLE METHOD)
*DO NOT SCALE THE DRAWING UNLESS OTHERWISE STATED.
*DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
*REMOVE SHARP EDGES.

TITLE
FLAT PACK 13 PIN PACKAGE
(FLAT PACK 13 PIN PACKAGE ASSY)

SCALE
1:1

REV NO	NOTES OF REVISION	ZONE
00	BASE LINE DRAWING	N/A
01	MATERIAL CHANGED FROM SS304 TO KOVAR	N/A



NOTE:
1. JOB ID BY TAG.

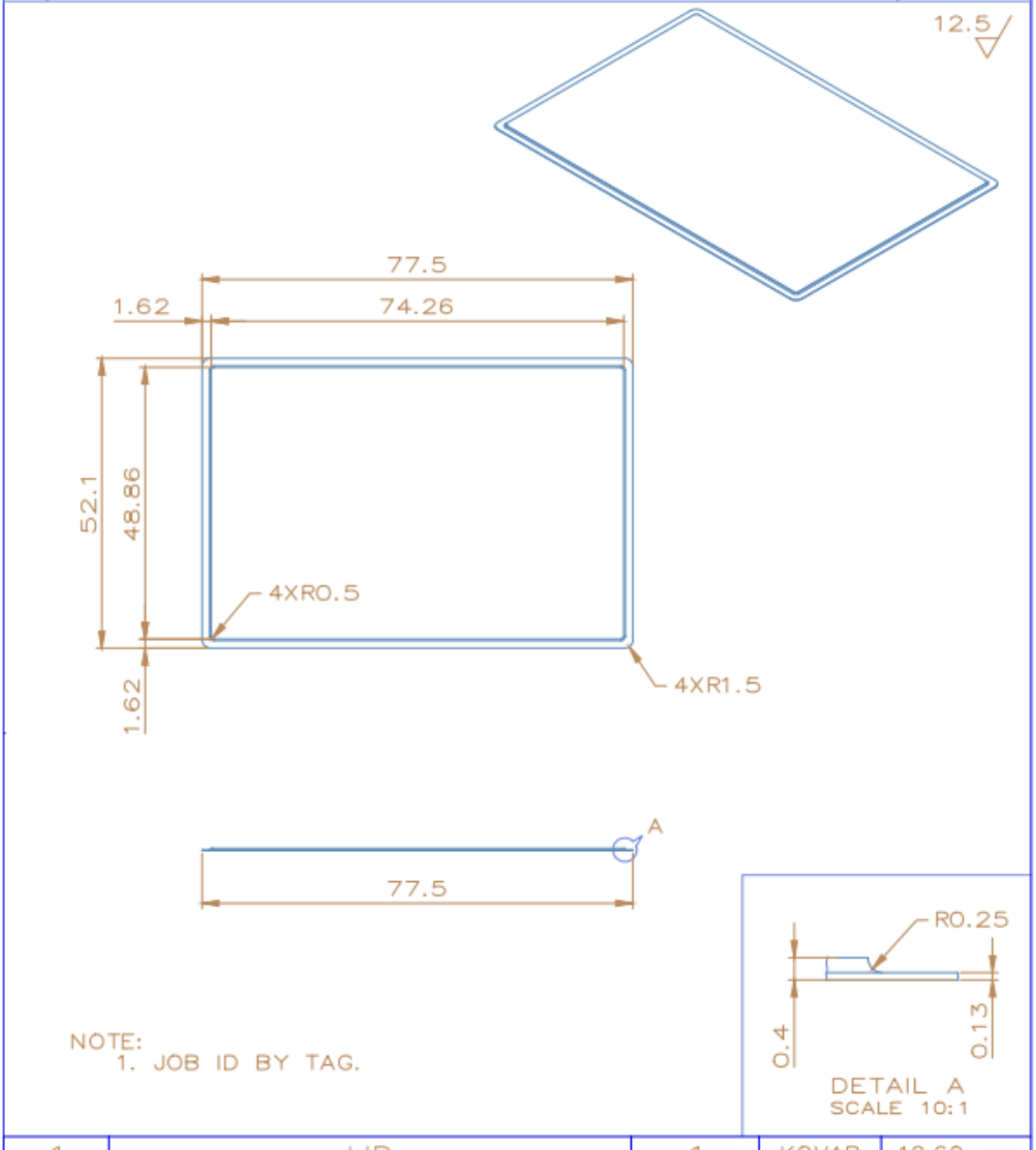
SL. NO	DESCRIPTION	QTY.	MATL.	MASS
1	PIN	1	KOVAR	0.06 gm

GENERAL TOLERANCE AS PER ISO 2768-mK
(DIMENSIONS BELOW 0.5mm TO BE ACHIEVED BY BEST POSSIBLE METHOD)
*DO NOT SCALE THE DRAWING UNLESS OTHERWISE STATED.
*DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
*REMOVE SHARP EDGES.

TITLE
PIN
(FLAT PACK 13 PIN PACKAGE ASSY)

SCALE
10:1

REV NO	NOTES OF REVISION	ZONE
00	BASE LINE DRAWING	N/A
01	MATERIAL CHANGED FROM SS304 TO KOVAR	N/A



NOTE:
1. JOB ID BY TAG.

SL. NO	DESCRIPTION	QTY.	MATL.	MASS
1	LID	1	KOVAR	12.60 gm

GENERAL TOLERANCE AS PER ISO 2768-mK
(DIMENSIONS BELOW 0.5mm TO BE ACHIEVED BY BEST POSSIBLE METHOD)
*DO NOT SCALE THE DRAWING UNLESS OTHERWISE STATED.
*DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
*REMOVE SHARP EDGES.

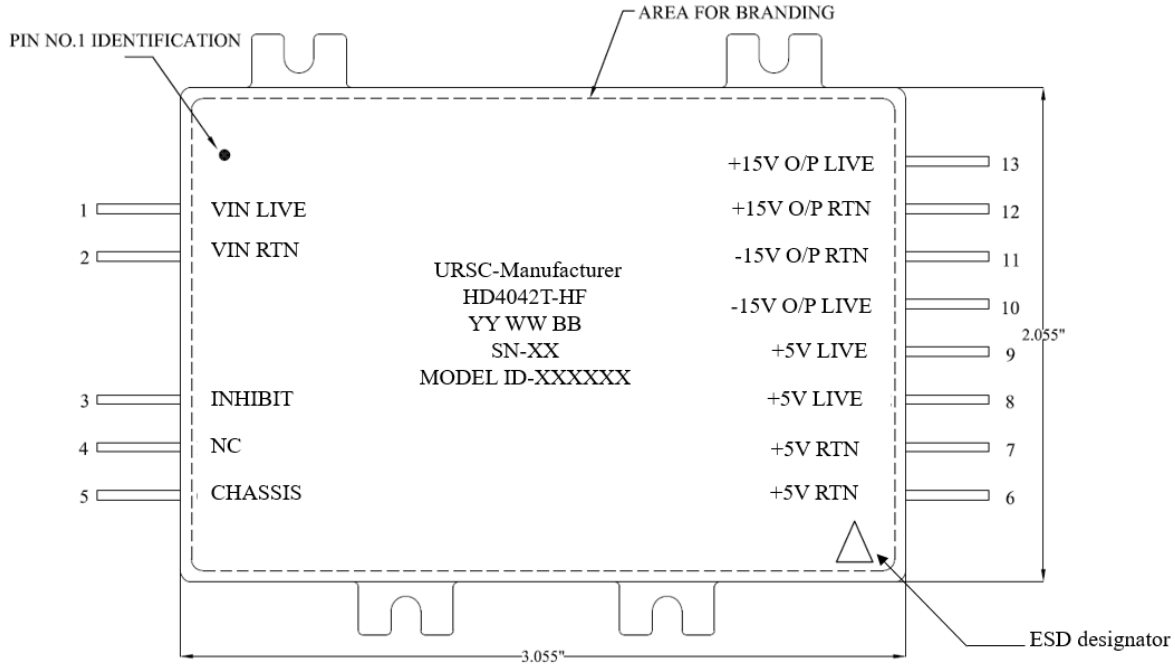
TITLE
LID
(FLAT PACK 13 PIN PACKAGE ASSY)

SCALE
1:1

27 HMC Package pin configuration for HD4042T-HF

PIN NO.	DESIGNATION
1	INPUT LIVE
2	INPUT RETURN
3	INHIBIT
4	NC
5	CHASSIS
6	+5V RETURN
7	+5V RETURN
8	+5V LIVE
9	+5V LIVE
10	-15V O/P LIVE
11	-15V O/P RTN
12	+15V O/P RTN
13	+15V O/P LIVE

28 Monogram marking details for HD4042T-HF



29 Test Specifications of HD4042T-HF

ABSOLUTE MAXIMUM RATINGS

Parameter	Absolute Maximum	Recommended operating range
Input Voltage Range	0-50V	26 to 43 V
Power rating	40W	40W
Operating Temperature Range	-40℃ to +110℃ in room condition (without de-rating). Burn-in carried out at 110℃). Note 1	-40℃ to + 65℃, in Vacuum Note 1 (with de-rating)
Storage Temperature Range	-55℃ to +125℃	-55℃ to +125℃

ELECTRICAL PERFORMANCE CHARACTERISTICS

Conditions: Case Temperature = -25ºC to +65ºC

Parameter (Unit)	Condition	LIMITS			UNITS
		Min	Nom	Max	
Input Voltage		26		43	**V**
Output Voltage Main Aux	Iout = 100% rated load Note 4	 4.95 +14.7 -14.7	 5.0 +15.0 -15.0	 5.05 +15.3 -15.3	**V**
Output Power (Po)	Vin = 26V,36V, 43V	8		40	**W**
Output Current, Iout (A) Main Aux	Vin = 26V,36V, 43V Note 2,3,4	 800 0 0		 4000 670 670	**mA**
Line Regulation, VR_{LINE} Main Aux	Vin = 26V,36V, 43V Iout = 20% and 100% rated, Note 4, 10		 ±1% ±2%		
Load Regulation, VR_{LOAD} Main Aux	Iout = 20% to100% rated load, for Vin = 26V, 36V, 43V Note 4,11		 ±1.5% ±2%		
Load Regulation, VR_{CROSS}	Vin = 26V, 36V, 43V Main o/p at 20%load and Aux o/ps are at 100% load Note 7		±1%		
Input Current	Inhibit Pin = 5V Iout = 0			10	**mA**
Output Ripple Main Aux	Note 8			 <50 <75	**mV**
Switching Frequency (kHz)	SYNC IN Pin Open Note 12	450		550	**kHz**
Efficiency (%)	Iout = 100% rated Note 4	70	72	74	**%**
Over Current Limit	Vin= 26V, 36V, 43V Note 9 On 5v Line	4.8A		5.4-6.5A	
	On ±15V line	1.2A		1.3-1.5A	
Under Voltage Lockout Turn ON Turn OFF		 23 22.5		 23.5 23	**V**

Parameter (Unit)	Condition	LIMITS			UNITS
		Min	Nom	Max	
Power Dissipation during Load Fault	Pout > 120%	1		3	**W**
Load transient Main Aux	20%-100% or 100%-20% loading Note 4	 -500 -100		 +500 +100	**mV (peak)**
Load transient recovery time Main Aux	20%-100% or 100%-20% loading Note 4,5			 500 100	**us**
Line Transient Main Aux	Vin= 26V to/from 43V Iout = 100% rated Note 4			 160 30	**mV (peak)**
Line transient recovery time Main Aux	Vin= 26V to/from 43V Iout = 100% rated Note 4,5			 500 50	**us**
Turn On Overshoot (V_{OS}) Main Aux	Iout = 20% rated load			 <600 50	**mV (peak)**
Turn On Delay Main and Aux	Iout = 20% rated load Note 6 Iout=100% rated load	 5 15		 10 30	**ms**
Isolation	Input to Output, any pin to case except CHAS GND pin	100			**MΩ**

MECHANICAL SPECIFICATIONS

Weight	116 g
Size	3.055” X 2.055 “ X 0.475 “

NOTES

1. Although operation between +65°C and +85°C is guaranteed, no parametric limits are specified. HMC DC/DC is subject to all standard screening tests including turn ON at -40^{O}C in vacuum.
2. Although operation with no load is permissible, light loading on the main (+5 volt) output may cause the output voltage of the auxiliary outputs (±15 volt) to drop out of regulation. It is therefore recommended that at least 800mA load current be drawn from the main (+5 volt) output. Loading less than 800mA results in 15 and -15 V lines output voltages drops below the specifications. Ripple voltage on 5V line goes above the specifications if the load current on 5V line is less than 400mA.
3. Although operation with no load is permissible, heavy loading on the main (+5 volt) output is limited to 4A to meet the derating of all components on auxiliary (±15 volt) outputs.
4. Unless otherwise specified, “Rated” load is 20W on the main (+5 volt) output and 10 watts each on the auxiliary (±15 volt) outputs.
5. Recovery time is measured from the initiation of the transient to where VOUT has returned to within ±1% of its steady state value.
6. Turn-on delay time from either a step application of input power or a logic high to a logic low transition on the inhibit input to the point where VOUT = 90% of nominal.
7. Aux outputs voltage is recorded while keeping Main o/p at 20% rated load and all Aux o/p at rated load.
8. Ripple measurement should be done with 0.1uF connected across a probe measuring tips with a shortest ground clip. It should be measured on monitoring line (noncurrent carrying line) tapped at HMC pin.
9. The over-current protection is Hic-cup mode. The converter will exhibit short ON times approximately 5-30ms depending on type of short and OFF times of approximately 300ms. The over-current is verified by keeping 2 outputs at 100% load and varying the 3rd output to >120% load.
10. Line regulation is calculated for each output as (V01- V02) x100/ ((V01+V02)/2)). Where V01 refers to the output voltage for min supply voltage (26V) and V02 refers to the output voltage for Max. Supply voltage (43) for all load conditions.
11. Load regulation is calculated for each output as (Vmin load-Vfull load) x100/ (Vfull load) where Vmin load is the output voltage for 20% load on all outputs and Vfull load refers to output voltage for 100% load on lines.

PART V

30 Procurement Specifications for Components & Raw Materials

Components	Types	Quality Requirements	
Chip Resistors	MSTF2SN Style	• Qualified to MIL-PRF-55342 with Group 'A' Test. • Class 'K' element evaluation as per MIL-PRF-38534 and Life test data. • Operating temp Range: -55℃ to +125℃.	
SMD Resistors	RM1206/RM0505 / RM0705/RM2010	• Qualified to MIL-PRF-55342 with Group 'A' Test. • Failure Rate: S (R level to be considered if no source available for S level) • Termination: Solderable/Epoxy (As per HMC layout)	
Capacitors	CDR Styles	• Qualified as per MIL-PRF-55681 with Group 'A' Test, • Operating temp Range: -55℃ to +125℃	• Style: CDR • Failure Rate: S • Termination: M
Capacitors	LD Series	• Qualified as per MIL-PRF-55681 with Group 'A' Test, • Operating temp Range: -55℃ to +125℃	• Style: MLCC, • Dieletric X7R • Solder termination (code ‘B’ 5% min lead)
Capacitors	Solid Tantalum	• Qualified to MIL-PRF-55365/11 with Group 'A', • Operating temp Range: -55℃ to +125℃	• Style: CWR 29 • Failure Rate: Weibull ‘C’ • Surge Current as per ‘C’ of MIL-PRF-55365
Magnetic Cores	Toroidal Cores	As per M/s Magnetics Catalogue.	

Detailed Specifications will be released as part of Purchase Order.

Components	Types	Quality Requirements
Thick Film Pastes	**Conductors** (Parts as per Layout)	• Screen Printable on 96% Alumina Substrate, Au/Al wire bondable conductor and dielectric Thick Film Compositions • Fired Thickness: 7 - 11(µm) • Viscosity (Pas), Brookfield 2xHA, utility cup and spindle, (SC4-14/6R),10rpm,25℃ ± 0.2℃: 350 - 500 • Shelf Life (Months): ≥ 6 Months
	Dielectrics (Parts as per Layout)	• Screen Printable on 96% Alumina Substrate for use in multilayer circuits as an insulator between conductor layers and on Au wire bondable Thick Film Compositions & fires to a pinhole-free smooth surface. • Fired Thickness: > 40 µm • Viscosity (Pas), Brookfield 2xHA, utility cup and spindle, (SC4-14/6R),10rpm,25℃ ± 0.2℃: 150 – 350 • Insulation resistance: $>10^{11}$ Ω at 100V DC • Shelf Life (Months): ≥ 6 Months
	Resistive Pastes (Parts as per Layout)	• Screen Printable on 96% Alumina Substrate, Au/Al wire bondable conductor • Composition: Bismuth Ruthenium Oxide (BIROX) • Temperature Coefficient of Resistance (TCR) ppm/℃: 0 ± 100 • Shelf Life (Months): ≥ 6 Months
Epoxies / Adhesives	Conductive / Non-conductive (Parts as per Layout)	• Epoxy Film for Substrate/die attach • Meets the requirements of MIL-STD-883, Method 5011.
Solders	InPb 50:50, Sn62	• Preforms and Wires as per Layout

Detailed Specifications will be released as part of Purchase Order.

Components	Types	Quality Requirements
Semiconductor Bare Dice	ICs	• Processed to QML'V' of MIL-PRF-38535. • Dice shall undergo dice evaluation in accordance with the requirements of Class 'K' of MIL-PRF-38534
	MOSFETS and Transistors	• Dice shall be as per or equivalent to MIL/ESCC specs, as applicable based on supply: • **MIL:** (i) Qualified to JANKC or Equivalent to JANKC of MIL-PRF-19500 (ii) Dice from each wafer lot shall be evaluated as per Table G-II of Appendix G of MIL-PRF-19500. • **ESCC:** (iii) Qualified to ESCC 5000 (iv) Wafer Lot Acceptance as per ESCC 5000 • MOSFET Dice shall be capable of withstanding TID of 100KRad(min), • SEE capability of MOSFET dice shall be > 35MeV-cm^2/mg
	Diodes	• Qualified to JANKC or Equivalent to JANKC of MIL-PRF-19500 • Dice from each wafer lot shall be evaluated as per Table G-II of Appendix G of MIL-PRF-19500.

Detailed Specifications will be released as part of Purchase Order.

31 Functional and Burn-in Test Jig Fabrication Specifications

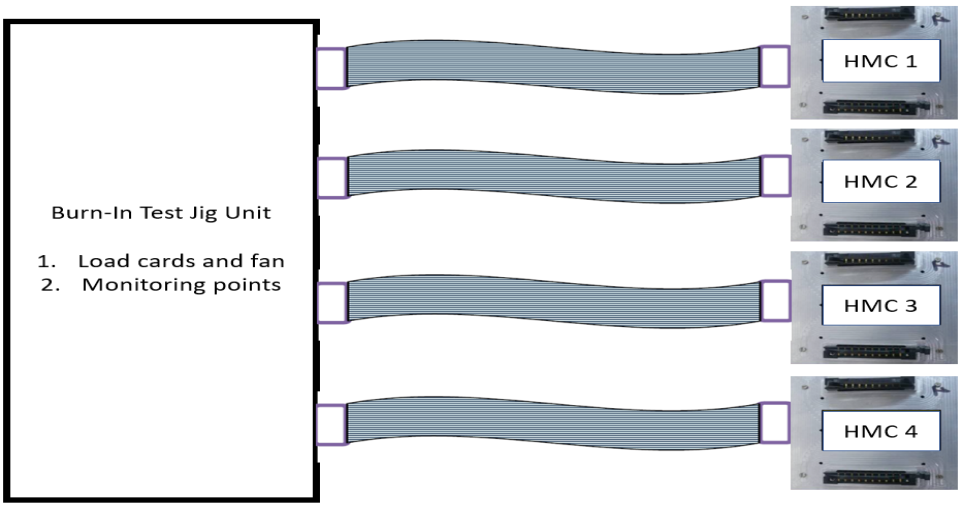
Specialized Functional and Burn–in jigs required for Screening of HMCs shall be realised / procured from ISRO approved vendors and evaluated prior to acceptance.

31.1 Functional Test Jig for 40W Triple Output DC DC Converter HMCs:

Functional Test Jig shall contain provision to test one HMC at a time. The test jig shall consist of socket assembly and test unit. Socket assembly shall consist of approved socket, supporting PCB, aluminium heat sink and D type connector for interfacing between HMC and test unit. The test jig shall cater to functional testing of HD4042T-HF.

31.2 Burn-In Test Jig for 40W Triple Output DC DC Converter HMCs

- Burn-in test jig should test four HMCs at a time. The test jig shall cater to Burn-In testing of HD4042T-HF.
- The jigs shall be used for conduct Burn in /ATC test for minimum of 4 HMCs at a time with external power supply. Dedicated test jigs shall be realised for Burn-in and ATC test.
- Test jig shall consist of Aluminum heat sink to mount HMC. Approved socket for I/O connections, polymide board and connector (Refer Images below). The required input signals are connected to corresponding inputs of the HMC through connector and PCB. During burn in test the load resistors are to be used and they shall be mounted on heat sink.



(a) Test jigs shall be realised as per guidelines "STATEMENT OF WORK TO FABRICATE FUNCTIONAL TEST/ BURN-IN TEST JIGS FOR TESTING HYBRID MICRO CIRCUITS & RC NETWORKS (DOC NO: INT: PMPD/SPES/HMC/GEN/13/REV-8)".

SOW40WJigRealisation.pdf

(b) Vendor shall generate detailed jig specification which shall include socket identification part number to suit to HMC package, mounting method with heat sink requirement, supporting PCB & connector for I/O connections from HMC to test jigs monitoring points, load resistors (if any), signal generation and harness details etc. which shall be approved by URSC prior to procurement.

(c) During phase of jig realization PCB layout design, Bill of materials used in realization of jigs, jig mechanical design & heat sink size shall be approved by URSC as specified in SOW document.

(d) One unit (Proto Test jig) shall be fabricated first and after evaluation and acceptance by URSC for the same, subsequent units shall be fabricated.

(e) Vendor shall plan to realize / procure jigs to meet the schedule as per RFP.

(f) The cost of these test jigs shall be separately billed and jigs shall be returned to URSC after the completion of all tests.