Procurement specifications for HMC DC-DC converters

1. Major Specifications for – Procurement of Rad Hard components, fabrication and Screening of of Rad Hard HMC DC-DC Converters

1.1 Major Specifications for – Procurement of Rad Hard components, fabrication and Screening of of Rad Hard HMC DC-DC Converter Type-1D1(28V)

Table 1.1 Specification for Type 1D1(28V)	
Specification	**Value**
Input Voltage Range	24V to 45V DC
No. of DC Output Voltages	1
Output Voltage	10.1 ±0.1 V
Output current	0.6 A(max), 0.5A (nom)
Line regulation	±0.25%
Load Regulation	±0.5%
Ripple	Max 50 mVpp at full load
Spike	100mVpp
Insulation @50V	>1000 MΩ
Efficiency at rated load	>60%
Over Current Limit	>110% Max Load
Substrate Details	No Of Layers: 2 Substrate:1 – 1” x 0.987” x 0.025” Substrate:2 – 0.17” x 0.358” x 0.025”
HMC Size including pins and flange	1.57" x 1.12" x 0.39”
Package material	Kovar
Fabrication Details	As per document DCDC_Converter_1D1_28V_FabricationDetails
Screening Details	As per Screening Test Matrix-LEOS DC-DC Document

1.2 Major Specifications for – Procurement of Rad Hard components, fabrication and Screening of of Rad Hard HMC DC-DC Converter Type-1D1 (70V)

Table 1.2 Specification for Type 1D1(70V)	
Specification	**Value**
Input Voltage Range	45V to 75V DC
No. of DC Output Voltages	1
Output Voltage	10.1 ±0.1 V
Output current	0.6 A (max), 0.5A (nom)
Line regulation	±0.25%
Load Regulation	±0.5%
Ripple	50 mVpp
Spike	100mVpp
Insulation @50V	>1000 MΩ
Efficiency at rated load	>55%
Over Current Limit	>110% Max Load
Substrate Details	No Of Layers: 2 Substrate:1 – 1” x 0.987” x 0.025” Substrate:2 – 0.17” x 0.358” x 0.025”
HMC Size including pins and flange	1.57" x 1.12" x 0.39”
Package material	Kovar
Fabrication Details	As per Document DCDC_Converter_1D1_70V_FabricationDetails
Screening Details	As per Screening Test Matrix-LEOS DC-DC Document

1.3 Major Specifications for – Procurement of Rad Hard components, fabrication and Screening of of Rad Hard HMC DC-DC Converter Type-1A(28V)

Table 1.3 Specification for Type 1A(28V)	
Specification	**Value**
Input Voltage Range	24V to 45V DC
No. of DC Output Voltages	2
Main Output Voltage	5.1V ±0.2V
Main Output current	1.2A (max), 1A (nom)
Aux Output Voltage	5.1V ±0.2V
Aux Output current	0.3A(max), 0.25A (nom)
Line regulation	<= ±0.25%
Load Regulation	±0.5%
Ripple	30 mVpp(Main), 30 mVpp(Aux)
Spike	100mVpp(Main), 50mVpp(Aux)
Insulation @50V	>1000 MΩ
Efficiency at rated load	>58%
Over Current Limit	>110% Max Load
Substrate Details	No Of Layers: 2 Substrate:1 – 1.26” x 1.03” x 0.025” Substrate:2 – 0.18” x 0.36” x 0.025”
HMC Size including pins and flange	2” x 1.18” x 0.43”
Package material	Kovar
Fabrication Details	As per Document DCDC_Converter_1A_28V_FabricationDetails
Screening Details	As per Screening Test Matrix-LEOS DC-DC Document

2. General terms:

2.1 Partial supply is allowed and payment shall be done on pro rata basis.

2.2 The design of the converter is proprietary of IISU & should not be reproduced/ duplicated/ hardware realized and supplied, in part/ full to any other party without prior written permission from LEOS.

2.3 The vendor should have been qualified by ISRO for fabrication and testing of HMC DCDC Converters. Documentary evidence has to be provided.

2.4 The vendor should have HMC DC-DC Converters fabrication line certification as per ISRO-PAS-206 by ISRO QC/QA. Documentary evidence has to be provided.

2.5 ISRO certified facility validation certificate should be produced by the vendor at the time of quotation.

2.6 Vendor should have completed the process qualification to fabricate the HMC DC-DC converters for all points as per Section 3 and Table 3 of HMC_DCDC_Technical_Annexure.

2.7 Vendor should have completed the process qualification to fabricate the HMC DC-DC converters for all points as per Section 4 and Table 4 of HMC_DCDC_Technical_Annexure.

2.8 Vendor should have completed the process qualification to fabricate the HMC DC-DC converters for all points as per Section 5 and Table 5 of HMC_DCDC_Technical_Annexure.

2.9 Documentary proof should provided for section 2.6,2.7 and 2.8.

2.10 The vendor should have Flight (radhard) fabrication experience and should have completed Proto/ CTQ of any ISRO designed HMC DC-DC Converters. Documentary evidence has to be provided.

2.11 Final schematic, approved HMC layout, test specification and screening procedure document will be supplied by LEOS at the time of order placement.

2.12 Post-delivery, if the HMCs are failed during testing, HMCs shall undergo failure analysis as per LEOS norms. If any abnormalities found inside due to vendor defects, HMCs shall be sent to vendor for replacement/ rework at no additional cost.

2.13 If any HMCs found, not as per the required specification at any stage, i.e. (manufacturing defect/material defect/unsuitable for the operation) and it shall be replaced by the vendor at free of cost.

2.14 The HMCs shall be accepted after thorough incoming inspection and clearance.

2.15 The HMCs shall be delivered in anti-static containers along with test data and reports in safe & secure manner.

2.16 Each HMCs shall confirm the specifications strictly, deviations, if any, shall be intimated to LEOS and final decision of acceptance/ rejection will rest with LEOS.

2.17 The acceptance of the HMCs is purely under the discretion of LEOS, clearance by LEOS QC & QA on satisfactory test results and data pack verification.

2.18 Burn in jig and other test equipment cost shall be borne by the party and its details will be shared at the time of order placement.

2.19 Vendor shall refer, IISU screening procedure document for burn-in test, constant acceleration/ mechanical shock (HMC DC-DC screening) test levels.

2.20 The stand-alone electrical test specifications of HMCs shall be taken from IISU screening procedure document.

2.21 No rework is allowed for HMCs, due to unavoidable circumstances if any rework is required, shall be informed and get prior approval from LEOS.

2.22 Vendor shall submit post seal electrical test results, leak test report and P/N marking details to LEOS QA for verification and screening clearance.

2.23 Any deviation in fabrication process/ testing methods/ electrical tests results shall be intimated to LEOS and clearance shall be obtained.

2.24 The HMCs shall be sealed after getting the precap inspection clearance by LEOS QC & sealing clearance by LEOS QA.

2.25 100% precap inspection by LEOS QC and process traveler auditing by LEOS QA is mandatory.

2.26 The readiness of pre-cap visual Inspection to be intimated to LEOS in advance to enable pre-cap visual inspection and QA auditing of process traveler & preseal test results prior to sealing.

2.27 The vendor shall facilitate Pre-Seal inspection of each HMCs by LEOS QC and carry out suggested corrections if any, at no additional cost.

2.28 The vendor shall provide facility and support for Substrate level, package level testing of the HMC with LEOS participation when necessary without any additional cost.

2.29 The DIE & chip component devices shall meet the requirements of class K of MIL-PRF- 38534 when assembled and tested.

2.30 The Vendor shall submit the post laser trimmed substrate level resistance values to LEOSQA for verification (post substrate fabrication).

2.31 The fabrication & screening of the HMCs shall be carried out in ISRO certified facility in accordance with ISRO-PAS-206 and corresponding certificates shall be attached along with quote.

2.32 The die/components shall be from single wafer lot/ lot code/ date code less than five years preferably (from the date of shipment). Any deviation from this shall get approval from LEOS before procurement.

2.33 If any quality deviation observed in vendor procured substrates by LEOS vendor, the substrate lot shall be rejected for usage and cost of fresh substrate procurement shall be borne by vendor.

2.34 If any failures/ faulty/ insufficient test results in the procured space grade components, substrates and raw materials, shall be intimated to LEOS QA and designer immediately. The generated action shall be closed before starting the fabrication.

2.35 If quality deviation found by LEOS vendor on vendor procured component lot and rejected for usage, cost of fresh component procurement shall be borne by vendor.

2.36 The dice wafer lot number and waffle pack are to be retained for records at vendor site and shall be sent to LEOS after the completion of fabrication.

2.37 DIE & chip component devices shall undergo visual inspection at vendor site on 100% basis to condition A of test method 2010 of MIL-STD-883.

2.38 The vendor shall submit the datapack/ test reports, CoC of components, substrate and raw material to LEOS QA/QC for verification, before starting the fabrication of HMCs.

2.39 If vendor faces any technical issues/ delay/ any other issues during the procurement of components, raw materials and substrates, shall be informed to LEOS and get it ratified in real time.

2.40 The vendor shall procure the space grade components, raw materials and substrates from ISRO preferred manufacturer through reliable distributors.

2.41 Vendor should procure HMC packages from the approved vendors Technotron, AMETEK Aegis, EGIDE, HCC Aegis or any other vendor meeting LEOS qualification requirements with prior approval from LEOS before procurement.

2.42 HMC Lids have to be procured from the approved vendors Hi-Rel, AMETEK Aegis, EGIDE or any other vendor meeting LEOS qualification requirements with prior approval from LEOS before procurement.

2.43 Vendor should quote for all 3 types of converters. Partial quotations will not be considered.

2.44 Vendor has to provide warranty for 12 months period. If any manufacturing defect is seen during warranty period, same has to be rectified and delta testing has to be carried out as per ISRO QA guidelines without additional cost. Acceptance of the rectified parts will be based on specification compliance. In case of non-compliance HMCs have to be replaced with new one at free of cost.

2.45 Vendor has to provide all the deliverables as per section 6 meeting LEOS requirements.

2.46 After the receipt of PO, vendor has to follow the delivery schedule strictly and deliver the converters as per Section 7.

2.47 Vendor should provide the documents as listed in section 8.

3. **The vendor should have completed the following process qualification to fabricate the specified HMC DC-DC Converters:**

Process Qualification: - Fabrication of Thick Film Substrates (P- Print , D- Dry, F -Fire)

Table 3 Fabrication of Thick Film Substrates (P- Print , D- Dry, F -Fire)		
S. No.	**Process**	**Materials/ equivalent materials**
3.1	Blank Substrate with via drilled as per design	Alumina 96% , 25 mil, Kyocera
3.2	Via Back Side - PDF	DP4597
3.3	Via Front Side- PDF	DP4597
3.4	Solder able gold conductor Two Layers PDF	DP4597
3.5	Gold Conductor back -PDF	DP5771
3.6	Gold Conductor front-PDF	DP5771
3.7	Pad top-PTH Via Hole	Dupont 7484R
3.8	Resistor 10 ohm -PD	DP1709
3.9	Resistor 100 ohm -PD	DP1719/21
3.10	Resistor 1K ohm -PD	DP1729/31
3.11	Resistor 3K ohm -PD	Dupont 1728/1738R (blend resistor)
3.12	Resistor 10K ohm PD	DP1739
3.13	Resistor 100K ohm-PD	DP1749
3.14	Firing of Substrate at 850'C	-
3.15	Laser Trimming of resistors	-
3.16	Laser Scribing of Substrate	-
3.17	Screen Printing Non Cond. epoxy -Back side	H74

4. **The vendor should have completed the following process qualification to fabricate the specified HMC DC-DC Converters:**
   Process Qualification: Soldering of Capacitors and magnetic components

Table 4 Soldering of Capacitors and magnetic components		
4.1	Cleaning of PFTS	Cleaning in boiling IPA
4.2	Solder paste Stencil Printing	Sn63
4.3	Non Conductive Epoxy below Chip Capacitors	H74- Epotek
4.4	Capacitor Placement	Under Microscope
4.5	Reflow Soldering	230°C peak temp
4.6	Cleaning	3 tray cleaning and boiling IPA
4.7	E Core Transformer Fixing	DC93500 and conductive able film 5025E
4.8	2 E Core attachment with airgap	H74 epoxy
4.9	Coil attachment VM & HM	H74 epoxy
4.10	Hand soldering of Magnetics and I/O Cu Wires	under microscope
4.11	Cleaning	tray cleaning and boiling IPA

5. The vendor should have completed the following process qualification to fabricate the specified HMC DC-DC Converters:

Process Qualification: Die Attach and Wire Bonding

Table 5 Die Attach and Wire Bonding		
5.1	Conductive Epoxy Dotting	H20 E
5.2	Over glaze layer printing	Dupont 9137
5.3	Die attach	Under microscope
5.4	Curing	At 150 °C 30 mins in Oven
5.5	Gold Wire Bonding	Thermo sonic Wire Bonders
5.6	1mil Gold wire	Active component to 5771 pad
5.7	1.5mil Gold wire	Active component to 5771 pad
5.8	5mil Al wire	Active component to 5771 pad
5.9	10 mil Ribbon	Active component to 5771 pad
5.10	Bond Pull testing	Semiautomatic Bond pull
5.11	Pre electrical Visual QC	Under Microscope
5.12	Substrate level Electrical Testing	On Test Jig
5.13	Substrate Assembly in Package	Able film 5020K, Able film 5025 E
5.14	Soldering of cu wire to post	Sn96Ag4
5.15	Electrical Testing	On Test Jig
5.16	Epoxy Fillet to Inductor	Under Microscope
5.17	Precap Visual Inspection	As per check list
5.18	Vacuum Baking	150 deg C. 72hr 1x 10^{-3} Torr
5.19	Seam Sealing	With parallel seam sealer
5.20	Leak Testing fine & Gross	Leak 5 X 10^{-8} atm cc/sec
5.21	Marking	Markem 7224
5.22	External Visual Inspection	Under Microscope
5.23	Final Electrical Test	As per Specifications
5.24	Daughter substrate attachment	Able film 5025E
5.25	Cutting of Substrates edges with smooth (45 deg) corner	Alumina 96% , 25 mil, Kyocera
5.26	U cut in the main substrate	
5.27	Center portion cut in the main substrate	

6. Deliverables to LEOS:

6.1 Fabrication & Screening datapack of HMC DC-DCs (Both Hard & Soft Copy)

6.1.1 Fabrication datapack:

1. Batch yield details
2. Summary of Raw materials
3. Component details as per BOM
4. Substrate fabrication details
    a. Printing of Conductors,
    b. Printing of dielectric layers
    c. Printing of resistors
    d. Batch firing,
    e. Over glaze printing
    f. Resistor trimming
    g. Epoxy printing
    h. Inspection
5. Components Soldering, Die assembly and wire bonding:
    a. Capacitor assembly
    b. Transformer and inductor assembly
    c. Cu wire soldering
    d. Die assembly and inspection
6. Wire bonding and inspection
7. Package assembly details:
8. Package inspection
9. Substrate to package assembly and inspection
10. Input/ output Cu wire soldering
11. Preseal electrical test*
12. Precap visual inspection (QC) and sealing clearance (QA)
13. Clearance report
14. Seam sealing and leak test details
15. Vacuum backing
16. Seam sealing

17. Visual inspection
18. Fine and Gross leak test
19. Package marking
20. Post seal electrical test*
21. Visual inspection and screening clearance report

6.1.2 Screening datapack:

a. Batch yield details
b. Electrical test equipment's
c. Initial electrical test*
d. Stabilization bake test
e. Go-no-go test
f. Temperature cycling test
g. Go-no-go test
h. Mechanical shock test
i. Go-no-go test
j. PIND test
k. Pre burn-in electrical test*
l. Burn-in test setup approval
m. Burn-in monitoring sheet
n. Burn-in temperature log
o. Post burn-in electrical test*
p. Active thermal cycling (ATC) test setup approval
q. ATC monitoring sheet
r. Post ATC Electrical test*
s. Fine leak and gross leak test
t. Final electrical test*

***Electrical test:** Isolation, Insulation, Load regulation, Line regulation, Cross regulation (if applicable), Efficiency, Ripple and spike.

***Go-no-go test:** Isolation and no load test at nominal voltage.

6.2 Sealed HMC DC-DCs after screening in anti-static containers

7 Delivery terms for fabrication and screening:

T0	Receipt of PO	
T1	All Risk Insurance Policy submission by vendor	
T2	Components procurement specification submission	**T1 + 1 week**
T3	Components procurement clearance from LEOS	**T2 + 1 week**
T4	Component procurement completion by vendor	**T3 + 36weeks**
T5	Fabrication clearance from LEOS for 1st batch of 24nos	**T4 + 1 week**
T6	1st batch of 24 HMCs submission for LEOS precap	**T5 + 12 weeks**
T7	Precap and sealing clearance from LEOS	**T6 + 3 weeks**
T8	S-level screening and delivery of 1st batch of 24 HMCs	**T7 + 8 weeks**
T9	Fabrication clearance from LEOS for 2nd batch of 40 HMC DC-DCs	**T7 + 1 week**
T10	2nd batch of 40 HMC DC-DCs submission for LEOS precap	**T9 + 12 weeks**
T11	Precap and sealing clearance from LEOS	**T10 + 3 weeks**
T12	S-level screening and delivery of 2nd batch of 40 HMCs	**T11 + 8 weeks**
T13	Fabrication clearance from LEOS for 3rd batch of 36 HMC DC-DCs	**T11 + 1 week**
T14	3rd batch of 36 HMC DC-DCs submission for LEOS precap	**T13 + 12 weeks**
T15	Precap and sealing clearance from LEOS	**T14 + 3 weeks**
T16	S-level screening and delivery of last batch of 41 HMCs	**T15 + 8 weeks**

8 Documents Solicited from Vendor

8.1 Radhard HMC DC-DC converters fabrication line certification as per ISRO-PAS-206 by ISRO QC/QA

8.2 Latest purchase orders received from ISRO center's on Procurement/fabrication & screening of Radhard HMC DC-DC Converters.

8.3 Vendor HMC fabrication & screening facility audit & approved report by ISRO (Audit within two years).

8.4 Budgetary quote with delivery schedule for procurement of radhard components, fabrication and screening of radhard HMC DC-DC converters.

8.5 Heritage in fabrication & screening of ISRO designed HMC DC-DC Converters.

8.6 Compliance statement for technical, general specifications and supply conditions.