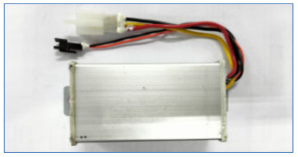
INTRODUCTION



Project Name:

SP9-GGE295 DC-DC Converter 12V-10A & 5V-1A

Objective- To Development Electronics part (DC Power Supply) for E Vehicle .

Scope- DC DC Converter is converter which converter High DC voltage to Low voltage with below Spec.

Input Rating - 35-90V DC, Output Rating 12V-10A and 5V 1A DC , Enclosure- IP 65.

Hardware side - Designing part of this Converter using one of the SMPS topology based.

Software side- No any scope of work.

Mechanical Side- To develop IP 65 Enclosure in aluminum casing

Measurement Goals - SV: ±20% , PDD: 0.10±0.02 , PPDD : 0.20±0.02

Link to Project Data : HTTP://192.168.100.9:8080/SVN/DC_DC_Converter/SP9_GGE295

Team Size: 10 Nos. Effort Size: 156 hrs. Time Line : 19-7-2022 to 20-8-2022

Actual Scheduled Start to Finish Date: 19-7-2022 to 31-8-2022

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Requirement Development

- Initial Requirement received from Sr. management in form of VOC and one nos. sample product.
  VOC Format link as GGE295_Voice of Customer-Idea Vetting
- Requirement capture form sample product testing result and making functional specification & requirement traceability table .
  GGE295_Requirement Capture & Elicitation
  GGE295_FUNSPC
  GGE295_REQTRT

VOC
Product Power Ratings-120W
Input Parameters-Battery Voltage= 60 V
Output Parameters-12V 10A and 5V 1A for Mobile Charging

- Effort Estimation give us the estimated effort size 157.13 person hrs. . GGE295_ESTFNL

Project Planning in Einframe - Project Plan Link-
HTTP://gil.einframe.com/rptprojectoverview.aspx

Sr. No	Need Statement	Elaboration
1	Input source (Li-ion battery)	48/60/72V
2	Converter type (conman ground)	Non isolated
3	Input voltage range (40 to 84V)	35V to 90V DC
4	Output Voltage 12 VDC	12 +/- 0.5V DC
5	Output Current 10A	10A +/- 0.5 A DC
6	Output Voltage 5 VDC	5 +/- 0.5V DC
7	Output Current 1 A	1A +/- 0.5 A DC
8	Efficiency (> 88%)	>88% at working range
9	Over current Protection (>10A) at 12 V output	Output voltage start to reduce
10	short circuit protection at 12 V output	output voltage reduces to zero
11	Over current Protection (>1A) at 5 V output	Output voltage start to reduce
12	short circuit protection at 5 V output	output voltage reduces to zero
13	Enclosure Type aluminium IP 65	IP 65
14	Output cable for 12V	150 mm with 3 pin Connector
15	Output cable for 5V	150 mm with 2 pin Connector

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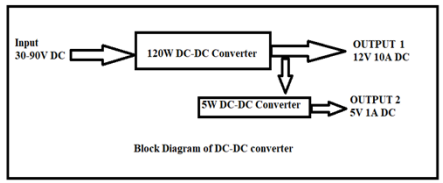
Design and Implementation

To build a technical solution for meet the requirement hardware design , mechanical design and interface & integration design is done and respectively document developed.
Design document as listed below.
GGE295_HDWDSN- Hardware design document is electrical requirement technical solution that is all hardware modules .
GGE295_MCHDSN- Mechanical design document is mechanical requirement technical solution ,that is enclosure and external part.
GGE295_INTDSN- This design document is interface and integration of all modules with to each other and build complete product as per requirement.

GGE295_HDWDSN



Block Diagram of DC-DC converter

Hardware Modules-120W DC-DC Converter 12V-10A

- Description
- Topology selection
- Logical Flow
- External Interfaces (if any)
- Internal Dependencies
- Critical Design Consideration
- Design Alternative Consideration
- Development & Execution Environment
- Safety Consideration
- Component Selection and Details
- Prototyping and its results
- Schematic and Layout considerations
- Failure modes and Mitigation steps
- Reuse Components

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Key Modules-
First- 120W DC-DC converter : Input 30-90V Dc and output 12V -10A DC.
Second- 5W DC-DC converter :Input 12V DC and output 5V -1A DC.

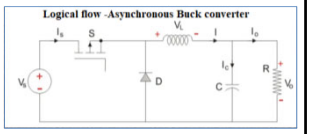
Criteria for design decisions-
Input Voltage =35-90VDC
Output Voltage = 12VDC
Output Current =10ADC
Efficiency=>85%
Isolation - NON- isolated
Input voltage > output voltage so applicable topology is buck and Fly back converter
Non isolated SMPS topology decided -Buck converter

Topology type Selection-
1. Synchronous Buck converter (comparatively high cost / high complex/ new part involvement)
2.Asynchronous Buck converter (low cost /low complex/ less new part involvement)

Design Alternative Consideration -Synchronous type buck converter ,but cost will be differ and higher side.

Reuse Components
PWM IC 3845 50% max Duty Cycle , Capacitor 100V 220uF , Capacitor 1000uH 25V, Mosfet IR4110 100V 120A , Diode FERD20H100ST 100V 20 A

Logical flow -Asynchronous Buck converter



Interface item consideration - 3 pin cable for input battery and output connection.

Design Document Review - Review using review check list

Outcomes
- Modules Schematics and its prototype result
- Layout consideration
- First Draft BOM (passive and active part)
- Basic design of enclosure

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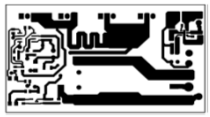
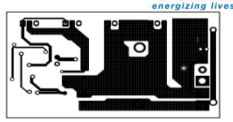
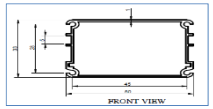
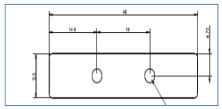
Interface document

- Interface for input and output 12V10A 3 pin cable on PCB Board
- Interface of 5V USB Supply cable on PCB Board
- PCB and enclosure interface .
- Thermal interface between Mosfet and enclosure using thermal pad
- Outer assembly(Grove met ,side plate ,gasket) interface for IP enclosure.
- Packaging related interface .



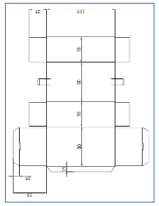


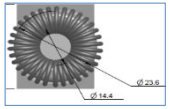


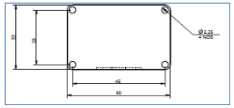


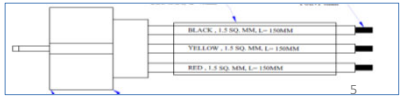
Implementation Outcomes

- Schematic No-G0449P1157 Rev. 1.0
- PCB Layout-G0449P1157 Rev. 1.0
- Enclosure Drawing-HW_2856
- Mounting Plate Drawing-HW_2859
- Packaging Box Drawing-HW_2875
- Inductor drawing -HW_2883
- Side plate Drawing-HW_2896
- 3 Pin Harness Drawing-HW_2857
- 2pin USB Drawing-HW_2858
- Thermal Pad Drawing-HW_2874









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Hardware module test Report-REPORT_HWTCAS

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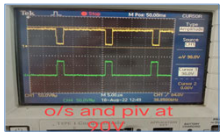
HWD_3.1_C	Voltage stress at Power device



System test Case and Ids

- UVLO and Start Up Test- VAL_1
- Voltage Regulation Test- VAL_2
- Efficiency Test - VAL_3
- Output Ripple Test- VAL_4
- Overload and short circuit test- VAL_5
- Heat Run Test- VAL_6

At 100% Load				
Input V	Input C	Output V	Output C	Efficiency
40	2.9	11.96	9.43	97.22655172
50	2.4	11.96	9.43	93.98566667
60	2	11.96	9.43	93.98566667
70	1.7	11.96	9.43	94.77546218
80	1.5	11.96	9.43	93.98566667
90	1.4	11.96	9.43	89.51015873

Test Case ID	Test Case Description	Inputs	Tools Required	Testing Steps	Expected Result	Actual Result	Pass/Fail
VAL_1	UVLO and Start Up Test	30V to 90V	Multimeter, Power Supply	1. Power supply Dc supply connected to modules 2.Increses voltage from 0 to 40 Volt 3.check output voltage ,measure low cut recovery and low cut voltage at no load and at 10A resistive load (1.2 OHM)	Low cut recovery voltage -30V+/-5V Low cut voltage -20 v+/- 5V	No load Low Cut Voltage=29V o/p=10.5 No Load Low Cut Recovery=29.5 o/p=10.7 10A load Low Cut Voltage=24.7 o/p=10.5	Pass

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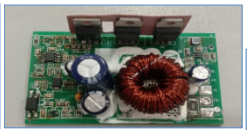
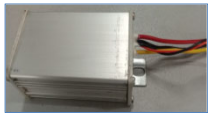
Hardware Module test Case and Ids

- UVLO and Start Up Test- HWD_3.1_A
- Voltage Regulation Test- HWD_3.1.B
- Voltage stress at Power device- HWD_3.1_C
- Efficiency Test - HWD_3.1_D
- Output Ripple Test- HWD_3.1_E
- Overload and short circuit test- HWD_3.1_F
- Heat Run Test- HWD_3.1_G





Integration document and Integration IDs

- Side Plate HW_2896 and Rubber grove-met Integration -INT_1
- harness HW_2857 and Harness HW_2858 integration INT_2
- PCB assembly integration INT_3
- Thermal Pad and Mosfet integration INT_4
- PCB assembly in enclosure integration INT_5
- Side cover on enclosure integration INT_6

Test Case ID	Test Case Description	Sub-Module Name	Tools Required	Testing Steps	Expected Result	Actual Result	PCB Number	Pass/Fail	Remarks
HWD_3.1_A	UVLO and Start Up Test	NA	Multimeter, Power Supply	1. Power supply Dc supply connected to modules 2.Increses voltage from 0 to 40 Volt 3.check output voltage ,measure low cut	Low cut recovery voltage -30V+/-5V Low cut voltage -20 v+/- 5V	No load Low Cut Voltage=29V o/p=10.5 No Load Low Cut Recovery=29.5 o/p=10.7 10A load Low Cut Voltage=24.7 o/p=10.5	G0449P1157 Rev1.0	Pass	

Test Case ID	Test Case Description	Inputs	Tools Required	Testing Steps	Expected Result	Actual Result	Pass/Fail	Remarks
INT_1	Integrated side cover and grove-met	Side Plate HW_2896 Rubber grove-met	By Hand	Rubber grove-met push into the side cover hole by fingers	Rubbergrovemet must properly fixed	Fitment Ok	Pass	
INT_2	Integrated cover, grove met , Harness HW_2857 and Harness HW_2858	Step 1 outcome Harness HW_2857 Harness HW_2858	By Hand	Insert the each wire into the rubber grove met up to sleeve	Wire insertion shoud properly .	Wire intert properly .	Pass	

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Closure

GGE295_CLOSRE.DOCX

Project Closure Report

Date	7-9-2022
Project Code	GGE295 DC-DC Converter 12V-10A & 5V-1A
Project Manager	Sobhag Prajapat
Configuration Administrator	Jalaj Mathur
Audit Date	8-Sep-22
Participants	Sobhag Prajapat ,Jalaj Mathur

Sr. No	Checkpoint	Location/Link	Remarks (PM/CA)	Remarks (Project Close Audit)
1	Technical data package-			
	Requirement Documents (Customer requirements, Functional specifications, Requirement Traceability Table)	http://192.168.100.9:8080/svn/DC_DC_Converter/SP9_GGE295/Requirment/	OK	Looks Ok, direct link will be better. (Will be checked separately)
	Planning Data (Project Plan, Risk Plan, Estimates, Schedule)	http://192.168.100.9:8080/svn/DC_DC_Converter/SP9_GGE295/Plan/	OK	Looks Ok, direct link will be better. (Will be checked separately)
	Source Codes, Schematics, BOMs, Mechanical drawings, PCB layouts	http://192.168.100.9:8080/svn/DC_DC_Converter/SP9_GGE295/Hardware%20Doc/	OK	Looks Ok, direct link will be better. (Will be checked separately)
	Design Documents	http://192.168.100.9:8080/svn/DC_DC_Converter/SP9_GGE2	OK	Looks Ok, direct link will be better. (Will be checked

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