# **INTRODUCTION (GGE295)**

#### Genus energizing lives

#### **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

1

# 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 REQUIREMENT CAP
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

2

# **Design and Implementation**



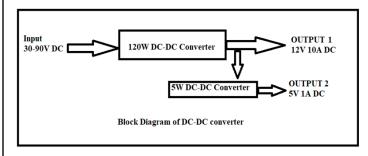
To build a technical solution for meet the requirement hardware design, mechanical design and interface & integration design is done and respectively document developed.

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



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

3

#### **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-

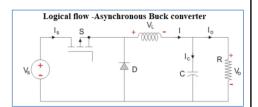
- 1. Synchronous Buck converter (comparatively high cost / high complex/ new part involvement)
- 2.Asynchronous Buck converter (low cost /low complex/ less new part involvement)

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





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

Design Document Review - Review using review check list

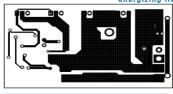
### Outcomes

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

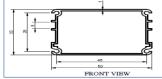
1

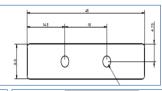
#### Interface document

- 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.



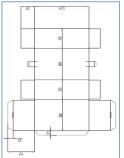
Genus

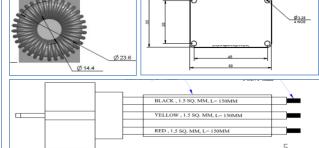




#### Implementation Outcomes

- 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





## Hardware Module test Case and Ids

UVLO and Start Up Test-HWD 3.1 A HWD 3.1.B Voltage Regulation Test-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







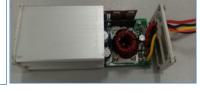
#### Integration document and Integration IDs

- Side Plate HW\_2896 and Rubber grove-met Integration -INT\_1
- harness HW\_2857 and Harness HW\_2858 integration INT\_2 INT 3
- PCB assembly integration

Thermal Pad and Mosfet integration INT 4

PCB assembly in enclosure integration INT\_5 INT\_6

Side cover on enclosure integration





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	INA	Multimeter, Power Supply	2 Increses voltage from 0 to 40 Volt	30V+/-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	

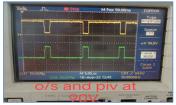
Test Case ID	Test Case Description	Inputs	Tools Required	Testing Steps	Expected Result	Actual Result	Pass/Fail	Remarks
INT 4	Integrated side cover and	Side Plate HW_2896	By Hand	Rubber grove-met push into the	Rubbergrovemet must	Fitment Ok	D	
INT_1	grove-met	Rubber grove-met	by nano	side cover hole by fingers	properly fixed	ritment Ok	Pass	
	Integrated cover, grove met,	Step 1 outcome		Insert the each wire into the rubber	Wind in continuo de cont			
INT_2	Harness HW_2857 and	Harness HW_2857	By Hand		0.0000000000000000000000000000000000000	Wire intert properly.	Pass	
	Harness HW_2858	Harness HW_2858		grove met up to sleeve	properly .			6

# Hardware module test Report-REPORT\_HWTCAS



HWD\_3.1\_ Voltage stress at Power device





System test Case and Ids	
<ul> <li>UVLO and Start Up Test-</li> </ul>	VAL_1
<ul> <li>Voltage Regulation Test-</li> </ul>	VAL_2
Efficiency Test -	VAL_3
<ul> <li>Output Ripple Test-</li> </ul>	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 Cas	e II ▼	Test Case Description	Inputs •	Tools Required •	Testing Steps ▼	Expected Result	Actual Result	Pass/Fail 🔻
					Power supply Dc supply connected to		No load Low Cut	
					modules 2.Increses voltage from 0 to 40 Volt	Low cut recovery voltage -30V+/-5V	Voltage=29V o/p=10.5 No Load Low Cut	
VAL_1		UVLO and Start Up Test		Multimeter Power Supply		Low cut voltage -20 v+/- 5V	Recovery=29.5 o/p=10.7	Pass
					recovery and low cut voltage at no load and at		10A load Low Cut	
			30V to 90V		10A resistive load (1.2 OHM)		Voltage=24.7 o/p=10.5	

7

# Closure

GGE295\_CLOSRE.DOCX

# Gënus energizing lives

# 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_GGE2 95/Requirment/	ок	Looks <u>Ok</u> , 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 GGE2 95/Plan/	ок	Looks <u>Ok</u> , 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 GGE2 95/Hardware%20Doc/	ОК	Looks <u>Ok</u> , 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

8