POWER

LGA80D

Evaluation Test Board
Digital DC-DC Converter

Contents

Descriptions

LGA80D-EVAL-KIT gives you the ability to connect the demonstration board to a USB socket on a PC, with the PMBus interface, dongle and cable provided in the kit to control and monitor the LGA80D units as they would be used in an application.

This document is a reference guide for the evaluation test board of the compatible series power supply. It is for evaluation purposes only. The evaluation board provides output terminals, test points to power signals, control signals and communication interface via I^{2}C bus. Refer to the technical reference note of the power supply for more information about the specifications and the signal definitions.

ARTESYN
EMBEDDED TECHNOLOGIES

Overview

The key components and connection locations are shown in the picture of the evaluation board below.
Note that the LGA80D shown at the 'top' of this picture is the one that is configured as the single output unit, and the 'bottom' converter is configured as a dual output module.
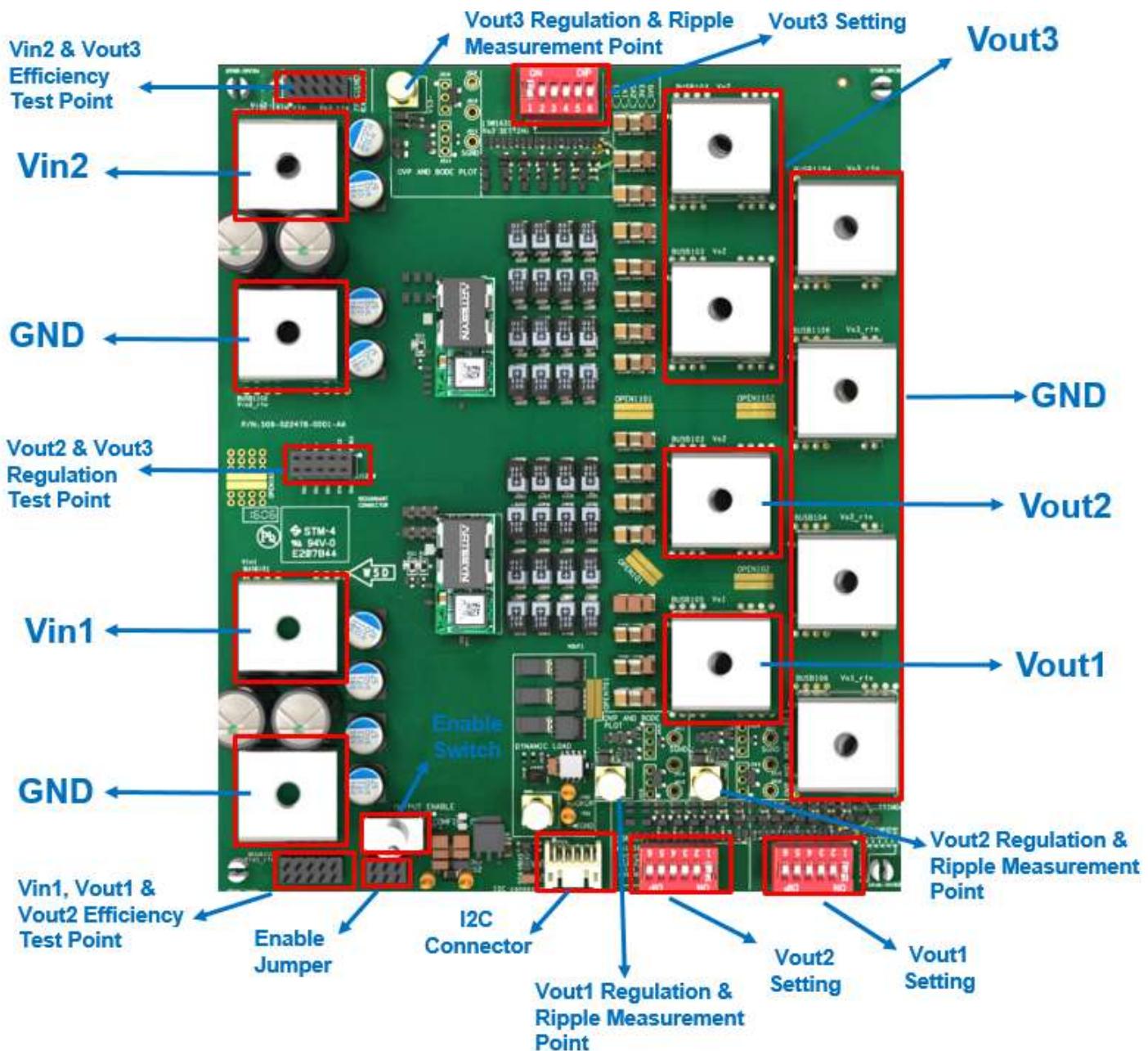

Figure 1. Evaluation Test Board for LGA80D
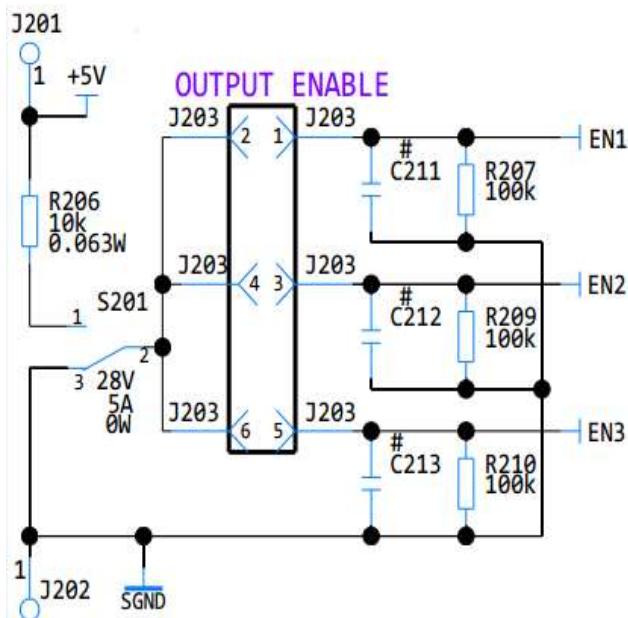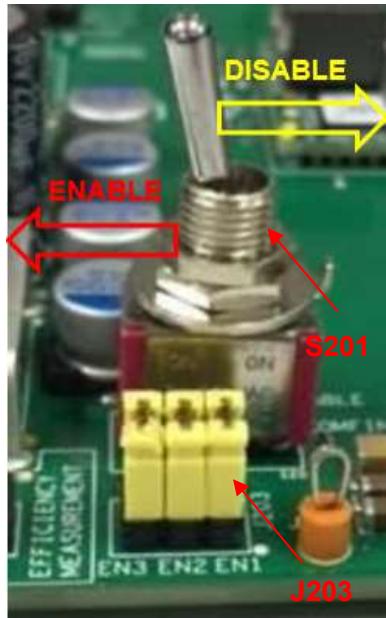
Pin Assignment

| Item	Pin Number	Designation	Functions
Test Point	BUSB101	V_{IN1}	Input terminal
	BUSB102	V_{IN1_rtn}	Input return terminal
	BUSB1101	V_{IN2}	Input terminal
	BUSB1102	V_{IN2_rtn}	Input return terminal
	BUSB103	V_{O2}	Output terminal
	BUSB104	V_{O2_rtn}	Output return terminal
	BUSB105	V_{O1}	Output terminal
	BUSB106	V_{O1_rtn}	Output return terminal
	BUSB1103	V_{O3}	Output terminal
	BUSB1104	V_{O3_rtn}	Output return terminal
	BUSB1105	V_{O3}	Output terminal
	BUSB1106	V_{O3_rtn}	Output return terminal
	J205	V_{IN1} , V_{O1} & V_{O2}	Efficiency test point
	J1205	V_{IN2} & V_{O3}	Efficiency test point
	J1206	V_{O2} & V_{O3}	Regulation test point
	J303	V_{O2}	Regulation and Ripple measurement point
	J403	V_{O1}	Regulation and Ripple measurement point
	J1403	V_{O3}	Regulation and Ripple measurement point
Jumper	J203	Enable Jumper	Output Enable
Switch	S201	Enable Switch	Output Enable
	SW601	V_{O1}	V_{O1} setting
	SW631	V_{O2}	V_{O2} setting
	SW1601	V_{O3}	V_{O3} setting
Connector	J204	I²C Connector	I2C Communication

**LGA80D Output Enable Connection (S201, J203)**

Notes: S201 and J201 work with each other. S201 is used to enable / disable the output of LGA80D (2 modules, 3 outputs), if EN1 of J201 is connected, the Vout1 will be enabled /disabled, if EN1, EN2 & EN3 are connected, Vout1, Vout2 & Vout3 will be all enabled /disabled.

LGA80D I2C Connection (J204)
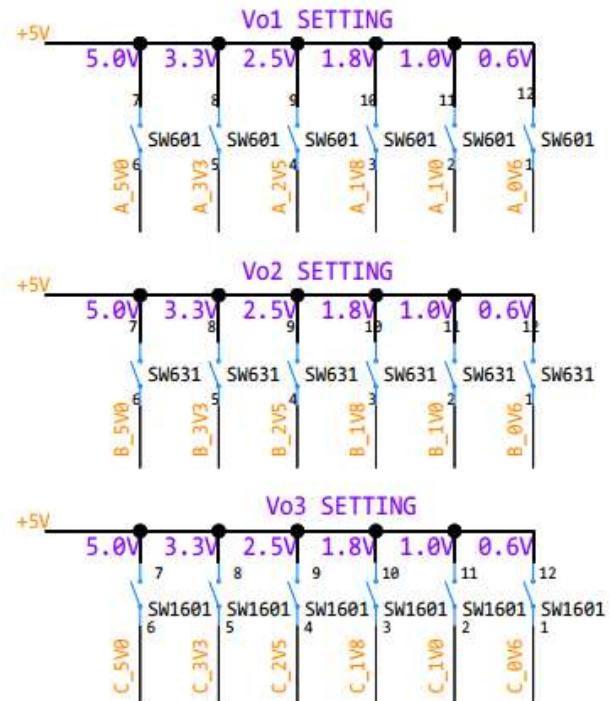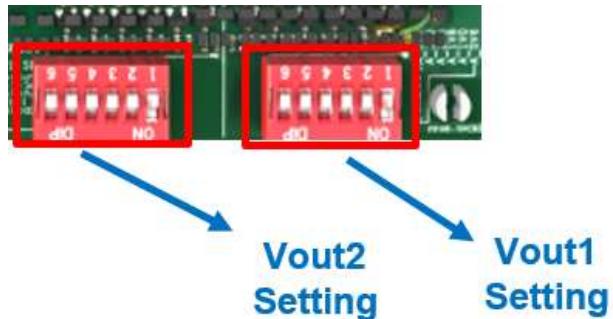
Pin Number	Designation	Pin Number	Designation
1	VBUS	6	NC
2	SDA	7	NC
3	SGND	8	NC
4	SCL	9	NC
5	NC	10	NC

Artesyn Embedded Technologies
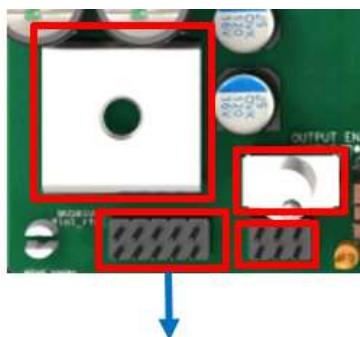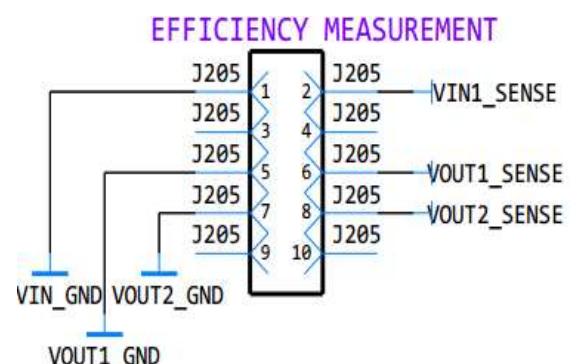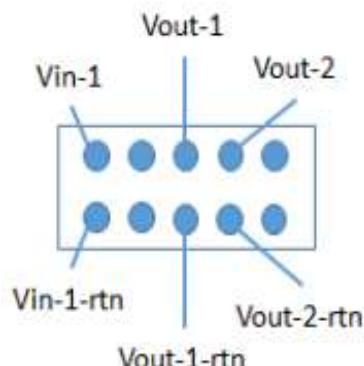
LGA80D Voltage Setting (SW601, SW631, SW1601)

LGA80D Efficiency Test Point (J205, J1205)
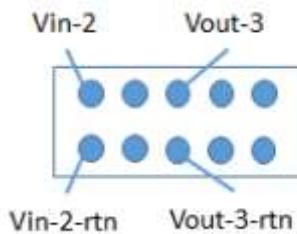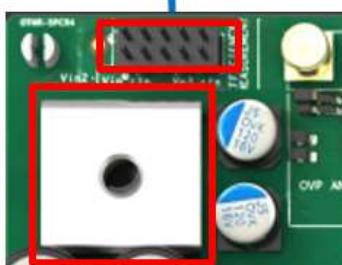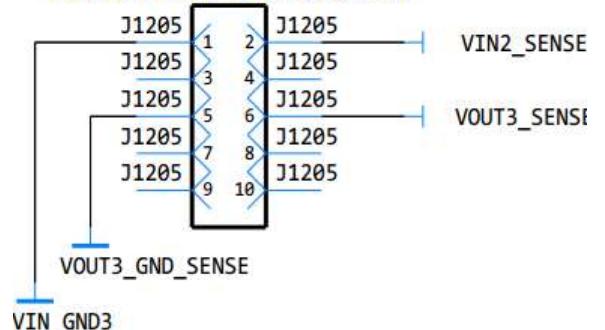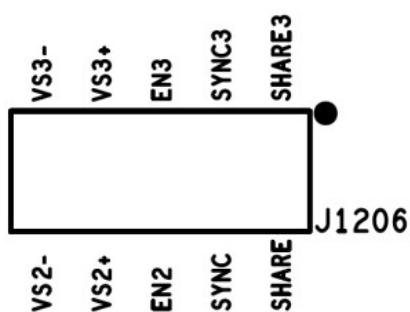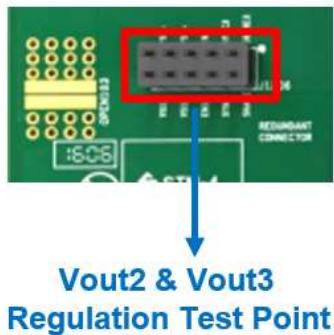
Vin2 & Vout3 Efficiency Test Point
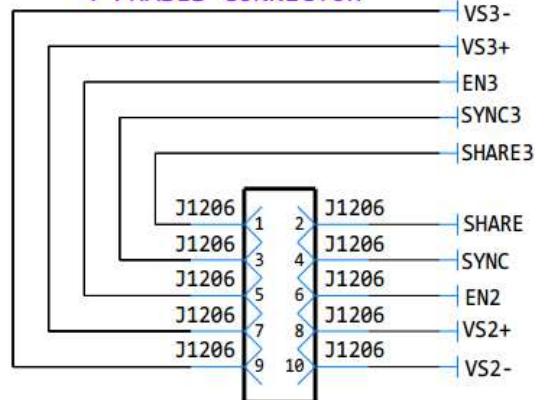
EFFICIENCY MEASUREMENT

5. LGA80D Regulation Test Point (J1206)

Vout2 & Vout3 Regulation Test Point

4 PHASES CONNECTOR

Test Setup

Hardware Test Setup

The LGA80D can be connected with the E-load via the Vout and Return terminals, and communicates with LGA80D GUI through the I^{2}C connector J204.
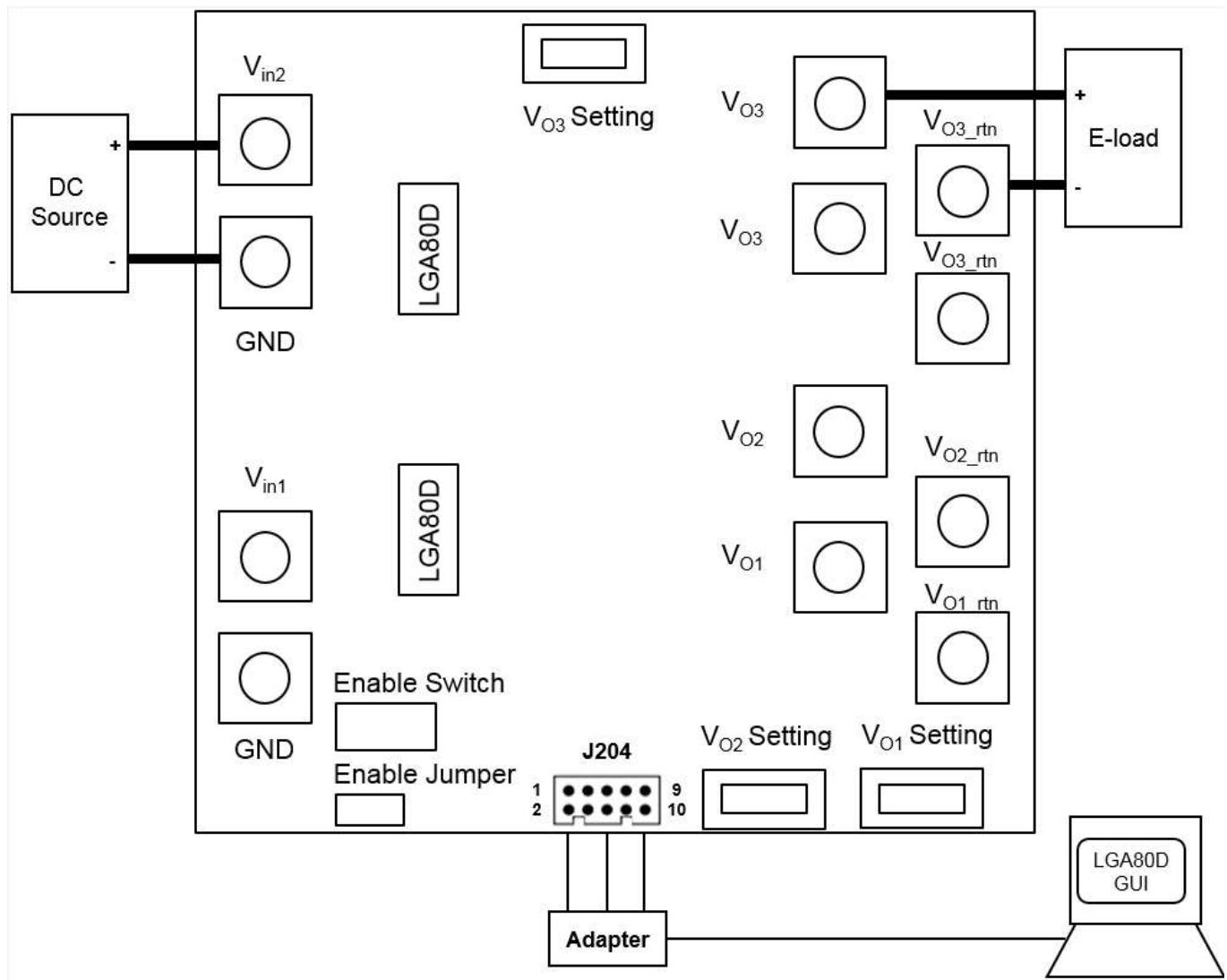
Figure 2. Hardware Interface Setup

Assumption: The user has made the power connections to and from the evaluation card. These will not be described further.

Software Test Setup

The LGA80D has an evaluation software, LGA80D GUI, designed to make the unit accessible to the user. It is intended to control and monitor the LGA80D units as they would be used in an application.

Computer   USB I²C Adapter (73-769-00x)   Evaluation Test Board   LGA80D
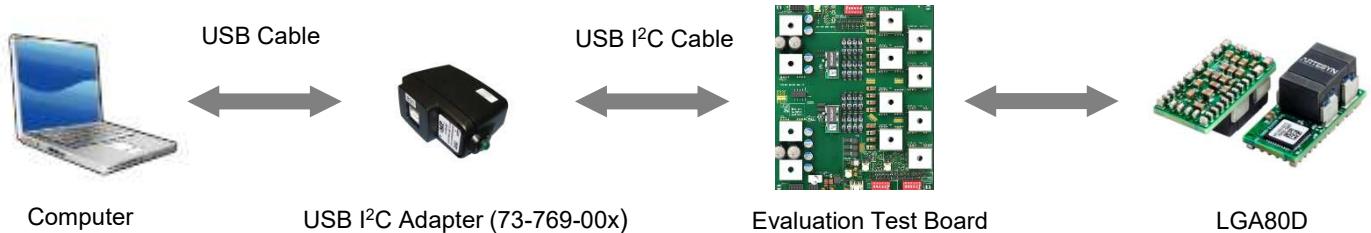
Figure 3. Software Interface Setup

The LGA80D GUI must be installed on a PC before using of all of the functions of this program. Please refer to the Figure 4.
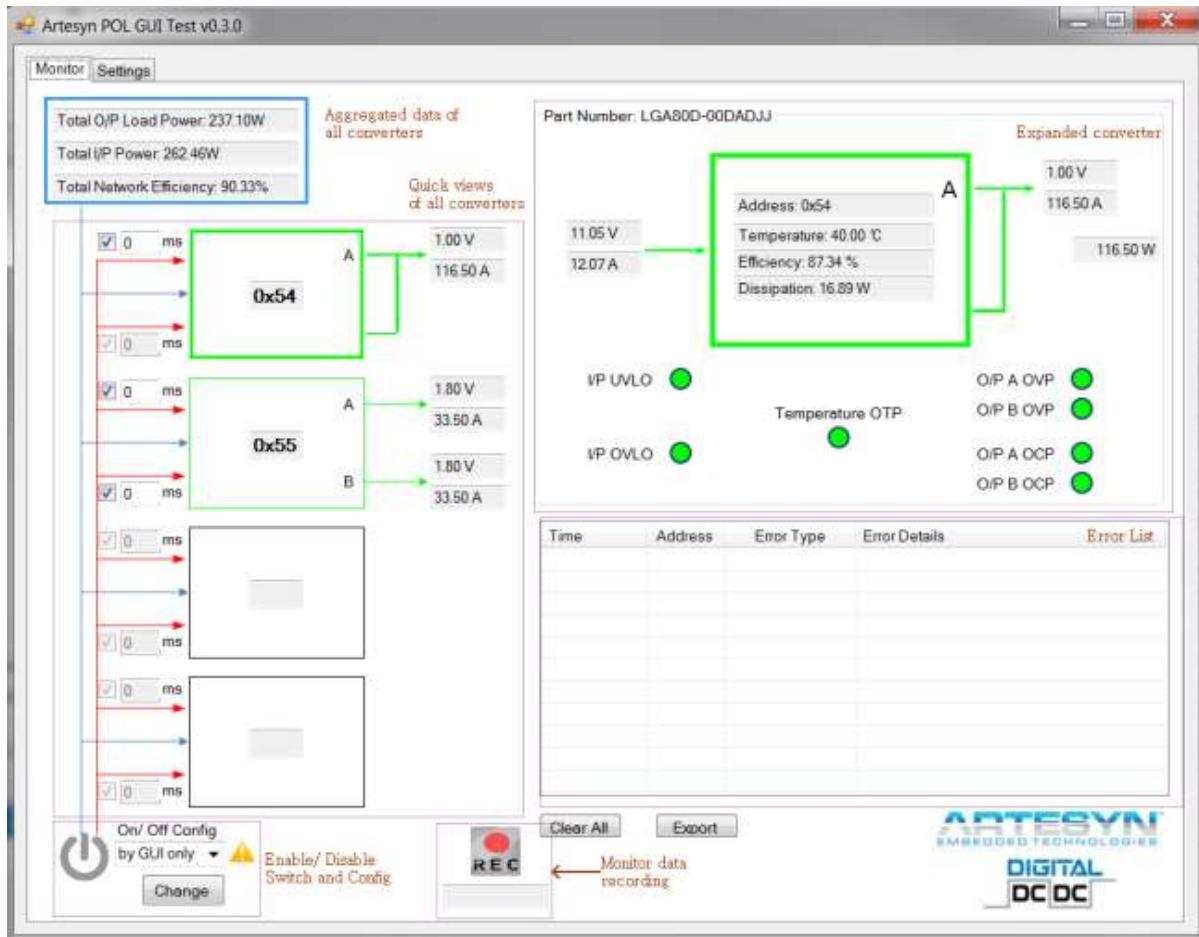
Figure 4. Universal PMBus™ GUI

Hardware Test Setup

The setup example is shown in figure 5. It contains the input cord, LGA80D, evaluation test board, USB to I^{2}C adapter and computer. The adapter is required to connect the unit to the computer. The Artesyn USB-to-I^{2}C interface adapter P/N is 73-769-001 or 73-769-002.
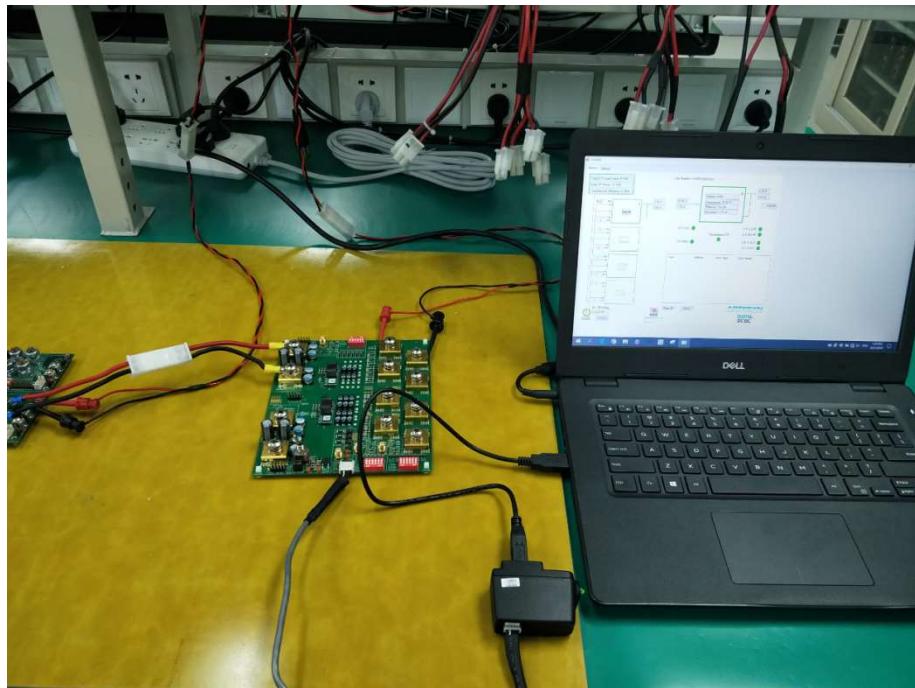
Figure 5. Setup Example
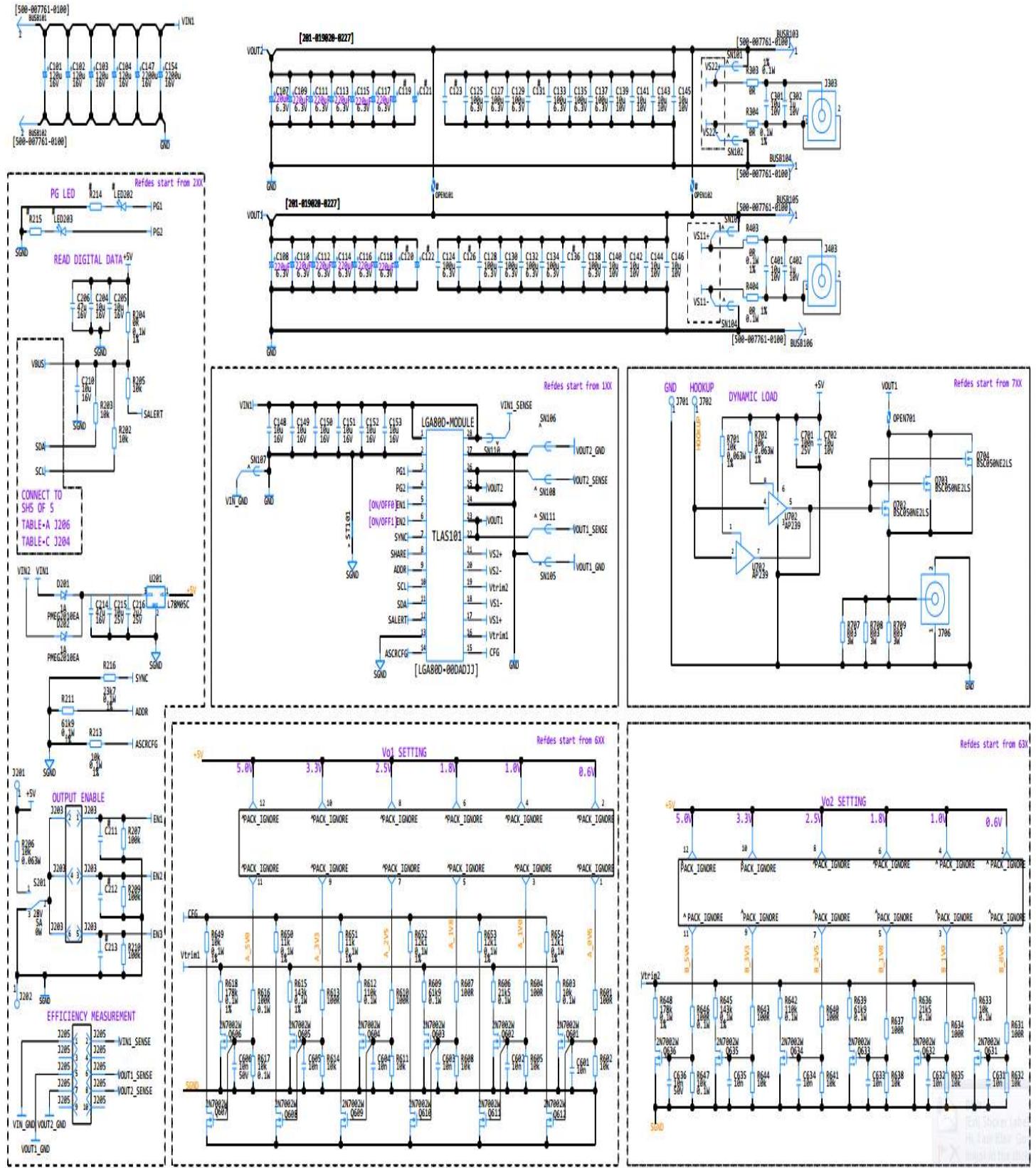
Supported Models

Part Number	Description
LGA80D-00DADJJ	Dual O/P Non-isolated 80 A Digital DC/DC Converter

Schematic

Schematic

Schematic

CIRCUIT-A

Refdes start from 31X

Refdes start from 41X

VS2+ VS2- VS22- VS22+

VS1+ VS1- VS11- VS11+

OVP AND BODE PLOT

OVP AND BODE PLOT

J314
1
J314
2
J314
3

R313
49R9
0.1W

J414
1
J414
2
J414
3

R413
49R9
0.1W

R311

R411

0R
0.125W
1%

0R
0.125W
1%

BODE PLOT REF TEST POINT
BODE PLOT CIRCUIT

J319 ^ 1

J419 ^ 1

J316
3
J316
2
J316
1

R316
49R9
0.25W

J416
3
J416
2
J416
1

R416
49R9
0.25W

R312

R412

0R
0.125W
1%

0R
0.125W
1%

J310 ^ 1

J410 ^ 1

BODE PLOT TEST POINT

BODE PLOT TEST POINT

J311 ^ 1

J411 ^ 1

BODE PLOT GND

SGND

SGND

CIRCUIT-B

VS3+ VS3- VS33-   VS33+

Refdes start from 51X

OVP AND BODE PLOT

J514
1
J514
2
J514
3

R513
49R9
0.1W

R511

0R
0.125W
1%

BODE PLOT REF TEST POINT

J519 ^ 1

BODE PLOT CIRCUIT

J516
3
J516
2
J516
1

R516
49R9
0.25W

R512

0R
0.125W
1%

J510 ^ 1

BODE PLOT TEST POINT

J511 ^ 1

BODE PLOT GND

SGND

CIRCUIT-C

R301
VS2+ _____ VS22+
0R
0.125W
1%
R302
VS2- _____ VS22-
# #
R305 R405   0R
0.125W
1%
R401
VS1+ _____ VS11+
0R
0.125W
1%
R402
VS1- _____ VS11-
VBUS   0R
0.125W
1%
#
R208 Vbus

J204
J204   1 2   J204 ___ SDA
J204   3 4   J204 ___ SCL
SGND NC J204 5 6 J204 NC
NC J204 7 8 J204 NC
NC J204 910 J204 NC

+5V   Vo1 SETTING
5.0V 3.3V 2.5V 1.8V 1.0V 0.6V
 7   8   9   10   11   12
SW601 SW601 SW601 SW601 SW601 SW601
A_5V0 A_3V3 A_2V5 A_1V8 A_1V0 A_0V6

+5V   Vo1 SETTING
5.0V 3.3V 2.5V 1.8V 1.0V 0.6V
 12   10   8   6   4   2
J601
 11   9   7   5   3   1
A_5V0 A_3V3 A_2V5 A_1V8 A_1V0 A_0V6

+5V   Vo2 SETTING
5.0V 3.3V 2.5V 1.8V 1.0V 0.6V
 7   8   9   10   11   12
SW631 SW631 SW631 SW631 SW631 SW631
B_5V0 B_3V3 B_2V5 B_1V8 B_1V0 B_0V6

+5V   Vo3 SETTING
5.0V 3.3V 2.5V 1.8V 1.0V 0.6V
 7   8   9   10   11   12
SW1601 SW1601 SW1601 SW1601 SW1601 SW1601
 6   5   4   3   2   1
C_5V0 C_3V3 C_2V5 C_1V8 C_1V0 C_0V6

J206 6
      5 SDA
J206
      4 SCL
J206
      3
J206 2
      1 SGND
J206

+5V   Vo1 SETTING
5.0V 3.3V 2.5V 1.8V 1.0V 0.6V
 12   10   8   6   4   2
J601
 11   9   7   5   3   1
A_5V0 A_3V3 A_2V5 A_1V8 A_1V0 A_0V6

+5V   Vo2 SETTING
5.0V 3.3V 2.5V 1.8V 1.0V 0.6V
 12   10   8   6   4   2
J631
 11   9   7   5   3   1
B_5V0 B_3V3 B_2V5 B_1V8 B_1V0 B_0V6

+5V   Vo3 SETTING
5.0V 3.3V 2.5V 1.8V 1.0V 0.6V
J1631 12   10   8   6   4   2
 11   9   7   5   3   1
C_5V0 C_3V3 C_2V5 C_1V8 C_1V0 C_0V6

LGA80D Test Board BOM

Item	Qty	Manufacture P/N	Description	Manufacture	Reference	Part
1	1	LGA80D-EVAL-KIT	ARTESYN LGA80D Test Board (PCB), 8 layers	Advanced Circuits	8 Layers_PCB	ARTESYN LGA80D
2	3	F800102	CONN,HDR,FEM, STRAIGHT,2,2.54 mm,3A,GOLD,2.54 MM MINI JUMPER	LANDWIN	OTHR1 OTHR2 OTHR3	F800102
3	4	ETS-3(V0)-1	MECH. OTHR PUR,OTHR, MOUNTING, PLASTIC CONICAL ANCHORS,N66,V0	KANG YANG	OTHR-SPCR1 OTHR-SPCR2 OTHR-SPCR3 OTHR-SPCR4	ETS-3(V0)-1
4	12	EME-SW-0616	FSTNR,MTL MET,SEMS,SST, OTHER,PAN HEAD,CROSS RECESS (PHILLIPS),M6 X 1,12mm,PLAIN & SPRING	VICTOR METAL PRODUCTS (HK) COMPANY LIMITED	SCRW1 SCRW2 SCRW3 SCRW4 SCRW5 SCRW6 SCRW7 SCRW8 SCRW9 SCRW10 SCRW11 SCRW12	EME-SW-0616
5	4	ZLH 10X20_EFC	CAP,ELECT,LIMPD, 1500μF,16VDC,20%, -20%,10 X 20	RUBYCON	C147 C154 C1147 C1154	35ZLH560MEFC 10X20
6	3	NDS-06V	SWI,MECH,SLD, SLIDE,SPST,25mA, 999W,999V,24VDC	DIPTRONICS MANUFACTURING	SW601 SW631 SW1601	NDS-06V
7	1	T801x-SEC	SWI,MECH,TOG, TOGGLE,SPDT,5A, 0W,125V,0VDC	SALECOM	S201	T801x-SEC
8	1	2052P1000T-01	CONN,HDR,M, RIGHT-ANGLE, 10,2mm,3A,SOLDER TAIL,TIN,N/A	LANDWIN	J204	2052P1000T-01
9	1	7313P06011-6	CONN,HDR,M, STRAIGHT,6, 2.54mm,3A,SOLDER TAIL,GOLD,PIN HEADER	LANDWIN	J203	7313P06011-6

Item	Qty	Manufacture P/N	Description	Manufacture	Reference	Part
10	1	GPHA201-0502A001B1BA	CONN,HDR,M,STRAIGHT,10,2,2.54mm,SOLDER TAIL,GOLD,DUAL ROW PIN HEADER	GREENCONN ELECTRONIC TECHNOLOGY (SUZHOU) CO., LTD.	J205 J1205 J1206	GPHA201-0502A001B1BA
11	4	5013	CONN,OTHR,MALE,STRAIGHT,1,0mm,TIN,ORANGE TEST POINT	KEYSTONE ELECTRONICS CORP.	J201 J202 J701 J702	5013
12	12	500-007761-TABD	MECH,FAB MET,BUSBAR,CU,STMP,BUSBAR TEST-JIG OUTPUT	ARTESYN	BUSB101 BUSB102 BUSB103 BUSB104 BUSB105 BUSB106 BUSB1101 BUSB1102 BUSB1103 BUSB1104 BUSB1105 BUSB1106	500-007761-TABD
13	1	AP239TR	IC,ANALOG,DRVR,SOIC8	STMICROELECTRONICS	U702	AP239TR
14	1	LF33ABDT-TR	IC,VREG,LDO-FXD,LF33AB,3.3V,1%,1A,125°C,TO252 (DPAK)	STMICROELECTRONICS ASIA	U201	LF33ABDT-TR
15	3	BSC009NE2LS	XSTR,FET,NLVMOS,25V,0.9mΩ,100A,BSC009NE2,PG-TDSON-8	INFINEON	Q702 Q703 Q704	BSC009NE2LS
16	18	2N7002KW	XSTR,FET,NLVMOS,60V,1.6Ω,0.31A,2N7002W,SOT323 (SC-70)	ON SEMICONDUCTOR	Q601 Q602 Q603 Q604 Q605 Q606 Q607 Q608 Q609 Q610 Q611 Q612 Q631 Q632 Q634 Q635 Q636 Q1631	2N7002KW

Artesyn Embedded Technologies

Item	Qty	Manufacture P/N	Description	Manufacture	Reference	Part
16	11	2N7002KW	XSTR,FET, NLVMOS,60V,1.6Ω, 0.31A,2N7002W, SOT323 (SC-70)	ON SEMICONDUCTOR	Q1632 Q1633 Q1634 Q1635 Q1636 Q1637 Q1638 Q1639 Q1640 Q1641 Q1642	2N7002KW
17	18	0603B821K500CT	CAP,CER,X7R,10nF ,50VDC,10%, -10%,0603	WALSIN	C601 C602 C603 C604 C605 C606 C631 C632 C633 C634 C635 C636 C1631 C1632 C1633 C1634 C1635 C1636	0603B821K500CT
18	18	CL32X107MQVNN NE	CAP,CER,X6S,100 µF,6.3VDC,20%, -20%,1210	SAMSUNG ELECTRO-MECHANICS	C124 C125 C127 C128 C129 C130 C132 C133 C134 C135 C137 C138 C1123 C1125 C1127 C1128 C1129 C1130	CL32X107MQVNN NE
19	3	CL21B105KAFNFN E	CAP,CER,X7R,10µF ,10VDC,10%, -10%,0805	SAMSUNG ELECTRO-MECHANICS	C301 C401 C1401	CL21B105KAFNFN E
20	4	CC1206KKX7R8BB 475	CAP,CER,X7R,2.2 µF,25VDC,10%, -10%,1206	YAGEO	C204 C205 C210 C216	CC1206KKX7R8BB 475
21	3	CC0603KRX7R8BB 563	CAP,CER,X5R,1µF, 10VDC,±15%,10%, -10%,0603	YAGEO	C302 C402 C1402	CC0603KRX7R8B B563
22	1	CC0402KRX7R9BB 332	CAP,CER,X7R, 100nF,25VDC,10%, -10%,0402	YAGEO	C701	CC0402KRX7R9B B332
23	1	TMK316AB7106KL-T	CAP,CER,X7R, 10µF,25VDC,10%, -10%,1206	TAIYO YUDEN	C215	TMK316AB7106KL -T

Item	Qty	Manufacture P/N	Description	Manufacture	Reference	Part
24	2	C1210C476M4PACTU	CAP,CER,X5R,47µF,16VDC,20%,-20%,1210	KEMET	C206 C214	C1210C476M4PACTU
25	8	APXS160ARA121MH70G	CAP,ELECT,POLY,120µF,16VDC,20%,-20%,8 X 6.7	NIPPON CHEMI-CON	C101 C102 C103 C104 C1101 C1102 C1103 C1104	APXS160ARA121MH70G
26	17	C1206C222K1RACTU	CAP,CER,X7R,10µF,10VDC,10%,-10%,1206	KEMET	C139 C140 C141 C142 C143 C144 C145 C146 C702 C1139 C1140 C1141 C1142 C1143 C1144 C1145 C1146	C1206C222K1RACTU
27	12	CL21B105KAFNFNE	CAP,CER,X7R,10µF,16VDC,10%,-10%,0805	SAMSUNG ELECTRO-MECHANICS	C148 C149 C150 C151 C152 C153 C1148 C1149 C1150 C1151 C1152 C1153	CL21B105KAFNFNE
28	18	6TPF220M5L	CAP,OTHR,SPCLP OLY,220µF,6.3VDC,20%,-20%,TANTALUM	PANASONIC	C107 C108 C109 C110 C111 C112 C113 C114 C115 C116 C117 C118 C1107 C1110 C1111 C1114 C1115 C1118	6TPF220M5L
29	4	0402WGF1803TCE	RES,DIS,TKF,10KΩ,0.063W,1%,100ppm [TC],0402	ROYAL	R202 R203 R205 R206	0402WGF1803TCE
30	3	0402WGF1803TCE	RES,DIS,TKF,100 KΩ,0.063W,1%,100ppm [TC],0402	ROYAL	R207 R209 R210	0402WGF1803TCE
31	6	0603WAF2700T5E	RES,DIS,TKF,0Ω,0.1W,5%,100ppm [TC],0603	ROYALOHM	R204 R303 R304 R403 R404 R1201	0603WA

Item	Qty	Manufacture P/N	Description	Manufacture	Reference	Part
31	4	0603WAF2700T5E	RES,DIS,TKF,0Ω, 0.1W,5%, 100ppm [TC],0603	ROYALOHM	R1202 R1203 R1403 R1404	0603WAF2700T5E
32	18	0603SAF6491T5E	RES,DIS,TKF,100Ω, 0.1W,1%,200ppm [TC],0603	ROYALOHM	R601 R604 R607 R610 R613 R616 R631 R634 R637 R640 R643 R646 R1631 R1634 R1637 R1640 R1643 R1646	0603SAF6491T5E
33	23	0603WAF2700T5E	RES,DIS,TKF,10KΩ, 0.1W,1%,100ppm [TC],0603	ROYALOHM	R213 R602 R603 R605 R608 R611 R614 R617 R632 R633 R635 R638 R641 R644 R647 R1213 R1632 R1633 R1635 R1638 R1641 R1644 R1647	0603WAF2700T5E
34	6	0603SAF6491T5E	RES,DIS,TKF,12.1K Ω,0.1W,1%,100ppm [TC],0603	ROYALOHM	R649 R650 R651 R652 R653 R654	0603SAF6491T5E
35	3	0603WAF2700T5E	RES,DIS,TKF,110K Ω,0.1W,1%,100ppm [TC],0603	ROYALOHM	R612 R642 R1642	0603WAF2700T5E
36		RC0603FR-071R1L	RES,DIS,TKF,143K Ω,0.1W,1%,100ppm [TC],0603	YAGEO	R615 R645 R1645	RC0603FR-071R1L
37	3	0603WAF2700T5E	RES,DIS,TKF,178 KΩ,0.1W,1%,100 ppm [TC],0603	ROYALOHM	R618 R648 R1648	0603WA
38	3	RM06FTN1002	RES,DIS,TKF,21.5 KΩ,0.1W,1%,100 ppm [TC],0603	TA-I	R606 R636 R1636	RM06FTN1002
39	2	RC0603FR-071R1L	RES,DIS,TKF,23.7 KΩ,0.1W,1%,100 ppm [TC],0603	YAGEO	R216 R1214	RC0603FR-071R1L

Item	Qty	Manufacture P/N	Description	Manufacture	Reference	Part
40	1	WR06W1R00FTL	RES,DIS,TKF,56.2KΩ,0.1W,1%,100ppm [TC],0603	WALSIN	R1211	WR06W1R00FTL
41	4	0603SAF6491T5E	RES,DIS,TKF,61.9KΩ,0.1W,1%,100ppm [TC],0603	ROYALOHM	R211 R609 R639 R1639	0603SAF6491T5E
42	6	RC0603FR-071R1L	RES,DIS,TKF,68.1KΩ,0.1W,1%,100ppm [TC],0603	YAGEO	R1649 R1650 R1651 R1652 R1653 R1654	RC0603FR-071R1L
43	6	RM10FTN1000	RES,DIS,TKF,0Ω,0.125W,1%,100ppm [TC],0805	TA-I	R301 R302 R401 R402 R1401 R1402	RM10FTN1000
44	2	RK73H1ERTTP100F	RES,DIS,TKFS,10KΩ,0.063W,1%,200ppm [TC],0402	KOA	R701 R702	RK73H1ERTTP100F
45	3	RLP25FECR100	RES,DIS,PWR MTL STRP,30mΩ,3W,1%,75ppm [TC]	TA-I	R707 R708 R709	RLP25FECR100
46	2	CSD95490Q5MC	IC,ANLG,DRVR,125°C,CSD95490Q5MC,DFN22	TEXAS INSTRUMENTS	U1 U2	CSD95490Q5MC
47	1	ZL8802ALAFT	IC,DGTL,CNTLR,125°C,ZL8802,QFN44	INTERSIL	U3	ZL8802ALAFT
48	2	CL05B152KB5NFNC	CAP,CER,X7R,5.6nF,50VDC,10%,-10%,0402	SAMSUNG ELECTRO-MECHANICS	C7 C27	CL05B152KB5NFNC
49	1	CL05B152KB5NFNC	CAP,CER,X7R,470pF,50VDC,10%,-10%,0402	SAMSUNG ELECTRO-MECHANICS	C37	CL05B152KB5NFNC
50	3	CC0603KRX7R8BB563	CAP,CER,X7R,1µF,16VDC,10%,-10%,0603	YAGEO	C9 C29 C39	CC 0603 X7R
51	14	CL21B105KAFNFNE	CAP,CER,X7R,10µF,16VDC,20%,-20%,0805	SAMSUNG ELECTRO-MECHANICS	C1 C2 C3 C4 C5 C6 C21 C22 C23 C24 C25 C26 C32 C34	CL21B105KAFNFNE

Item	Qty	Manufacture P/N	Description	Manufacture	Reference	Part
52	2	CL05B152KB5NFNC	CAP,CER,X7R,1µF,6.3VDC,10%,-10%,0402	SAMSUNG ELECTRO-MECHANICS	C30 C38	CL05B152KB5NFNC
53	2	0805B102K102CT	CAP,CER,X7R,10µF,6.3VDC,10%,-10%,0805	WALSIN	C31 C33	0805B102K102CT
54	2	GRM0335C1E680JA01D	CAP,CER,C0G/NP0,68pF,25VDC,5%,-5%,0201	MURATA	C35 C36	GRM0335C1E680JA01D
55	2	EMK063C7104KPQF	CAP,CER,X7S,100nF,16VDC,10%,-10%,0201	TAIYO YUDEN	C8 C28	EMK063C7104KPQF
56	1	RM04FTN5R10	RES,DIS,TKF,1KΩ,0.063W,1%,100ppm[TC],0402	TA-I	R33	RM04FTN5R10
57	3	0402WGF1803TCE	RES,DIS,TKF,10KΩ,0.063W,1%,100ppm[TC],0402	ROYAL	R37 R39 R40	0402WGF1803TCE
58	2	RC0402FR-0749K9L	RES,DIS,TKF,100KΩ,0.063W,1%,100ppm[TC],0402	YAGEO	R3 R23	RC0402FR-0749K9L
59	1	RM04FTN5R10	RES,DIS,TKF,3.48KΩ,0.063W,1%,100ppm[TC],0402	TA-I	R32	RM04FTN5R10
60	1	0402WGF1803TCE	RES,DIS,TKF,38.3KΩ,0.063W,1%,100ppm[TC],0402	ROYAL	R36	0402WGF1803TCE
61	4	RC0402FR-0749K9L	RES,DIS,TKF,47Ω,0.063W,1%,100ppm[TC],0402	YAGEO	R31 R38 R41 R42	RC0402
62	2	RT0402BRD073K9L	RES,DIS,TNF,1.05KΩ,0.063W,0.1%,25ppm[TC],0402	YAGEO USA (HK) LTD	R2 R22	RT0402
63	2	RT0402BRD073K9L	RES,DIS,TNF,221Ω,0.063W,0.1%,25ppm[TC],0402	YAGEO USA (HK) LTD	R1 R21	RT0402
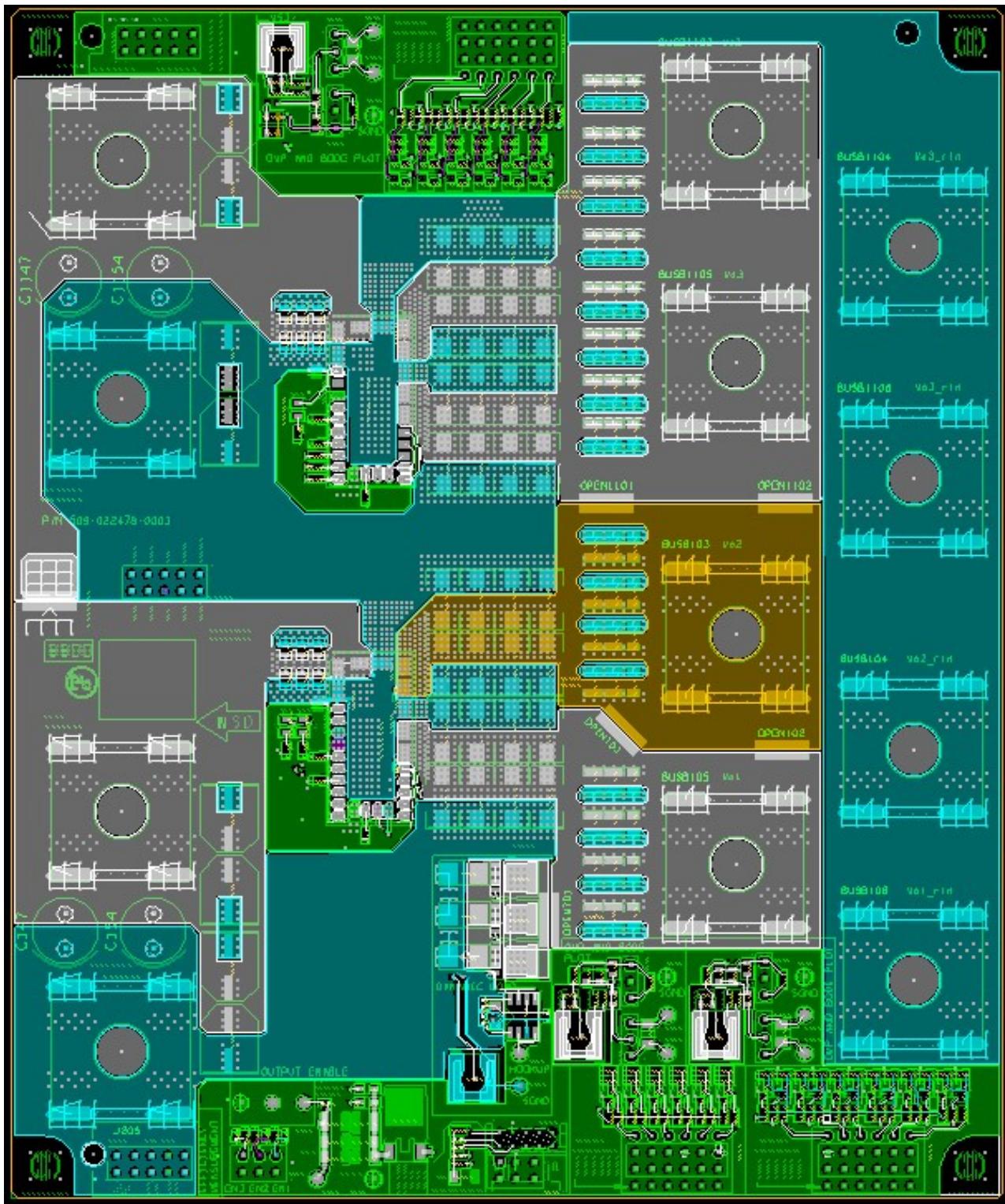
Item	Qty	Manufacture P/N	Description	Manufacture	Reference		Part
64	2	RMCS0402FT100K-AS	RES,DIS,TKFS,1.4KΩ, 0.063W,1%,200ppm [TC],0402	STACKPOLE ELECTRONICS	R5	R25	RMCS0402FT100K-AS
65	2	SG73S1ETTP4R70F	RES,DIS,TKF,4.7Ω, 0.125W,1%,200ppm [TC],0402	KOA	R7	R27	SG73S1ETTP4R70F
66	2	RK73H1HTTC3320F	RES,DIS,TKF,10KΩ, 0.05W,1%,200ppm [TC],0201	KOA SPEER ELECTRONICS	R4	R24	RK73H1HTTC3320F
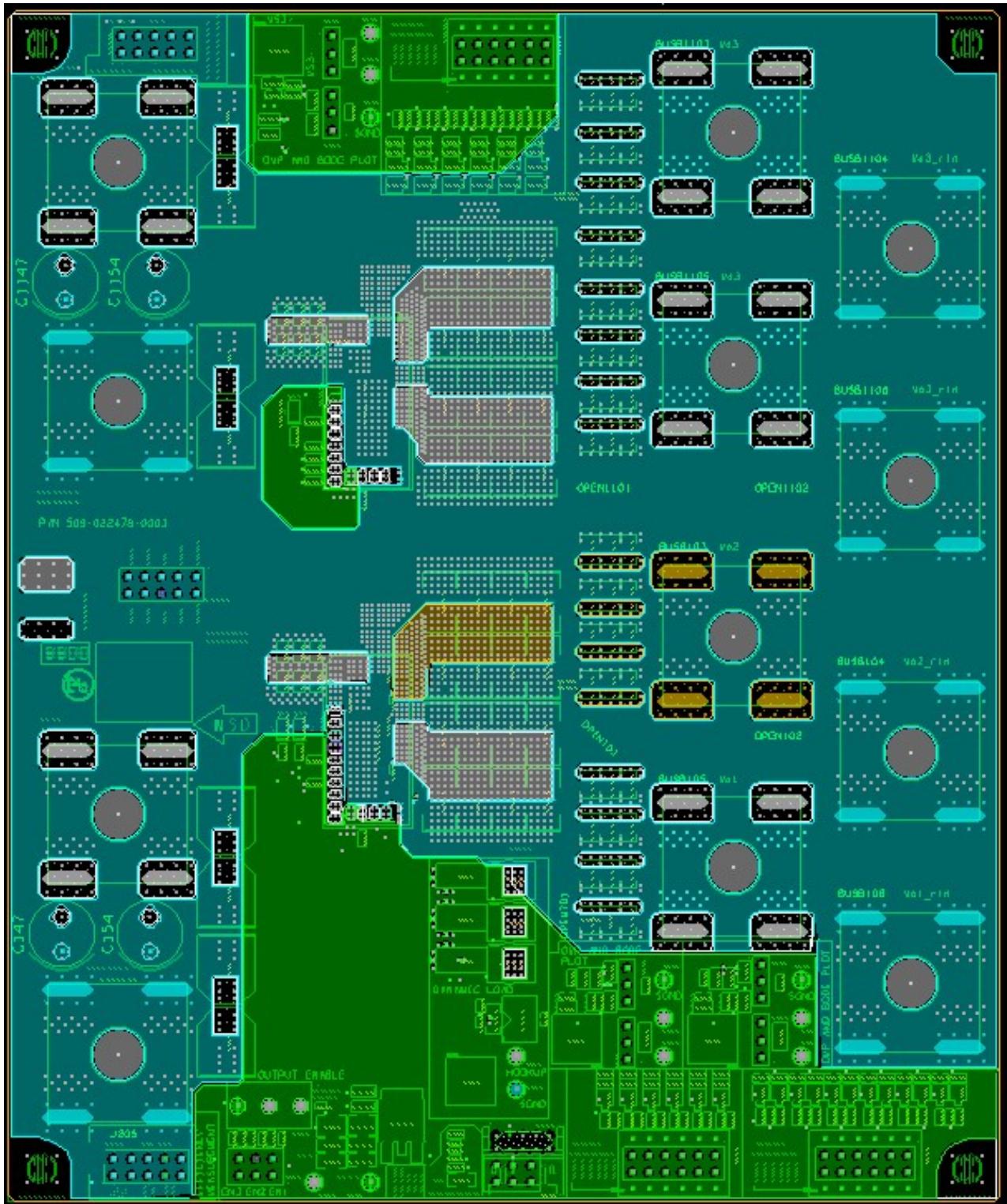
PCB Layout

Top copper
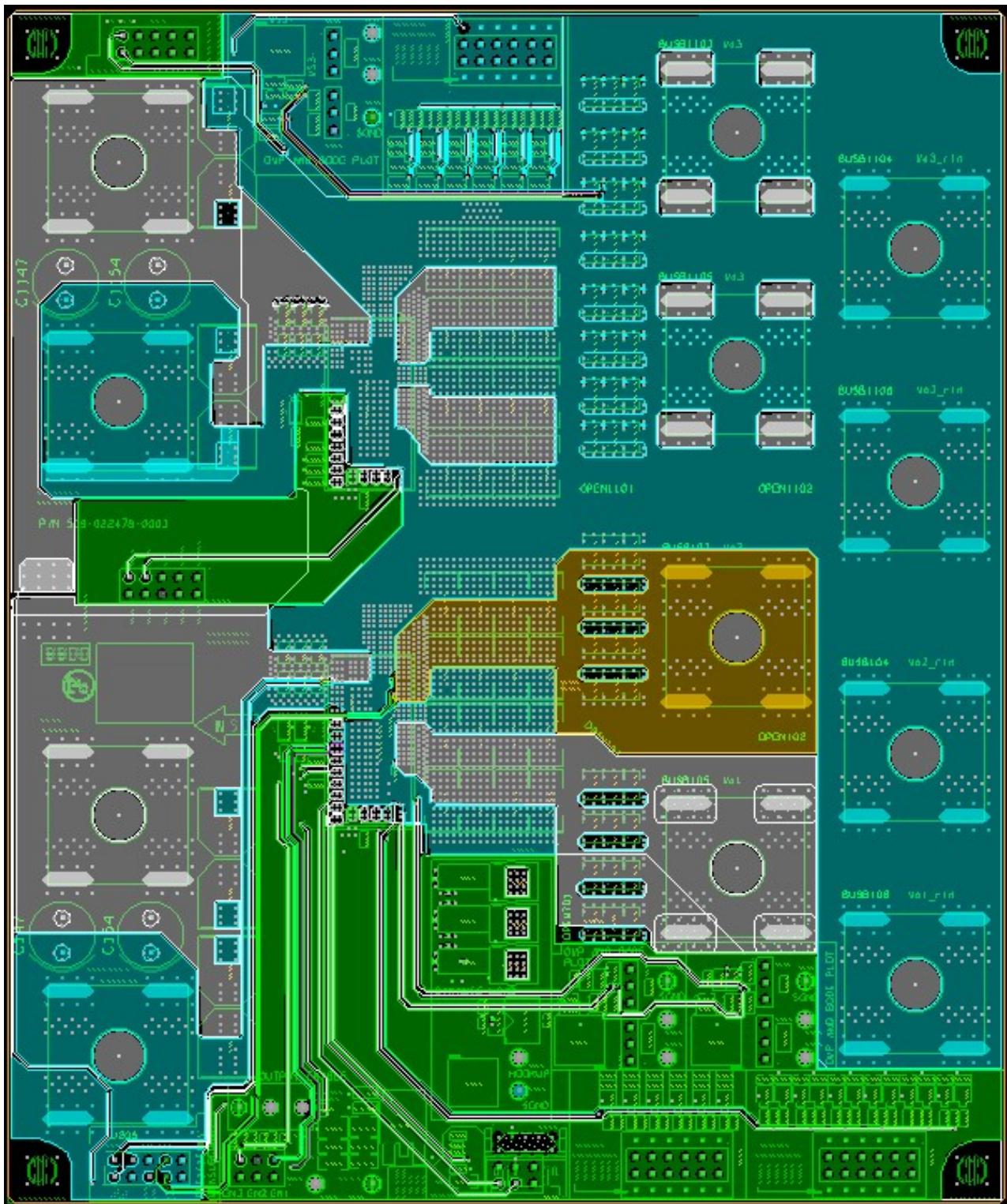
PCB Layout

Layer 2 copper

PCB Layout

Layer 3 copper
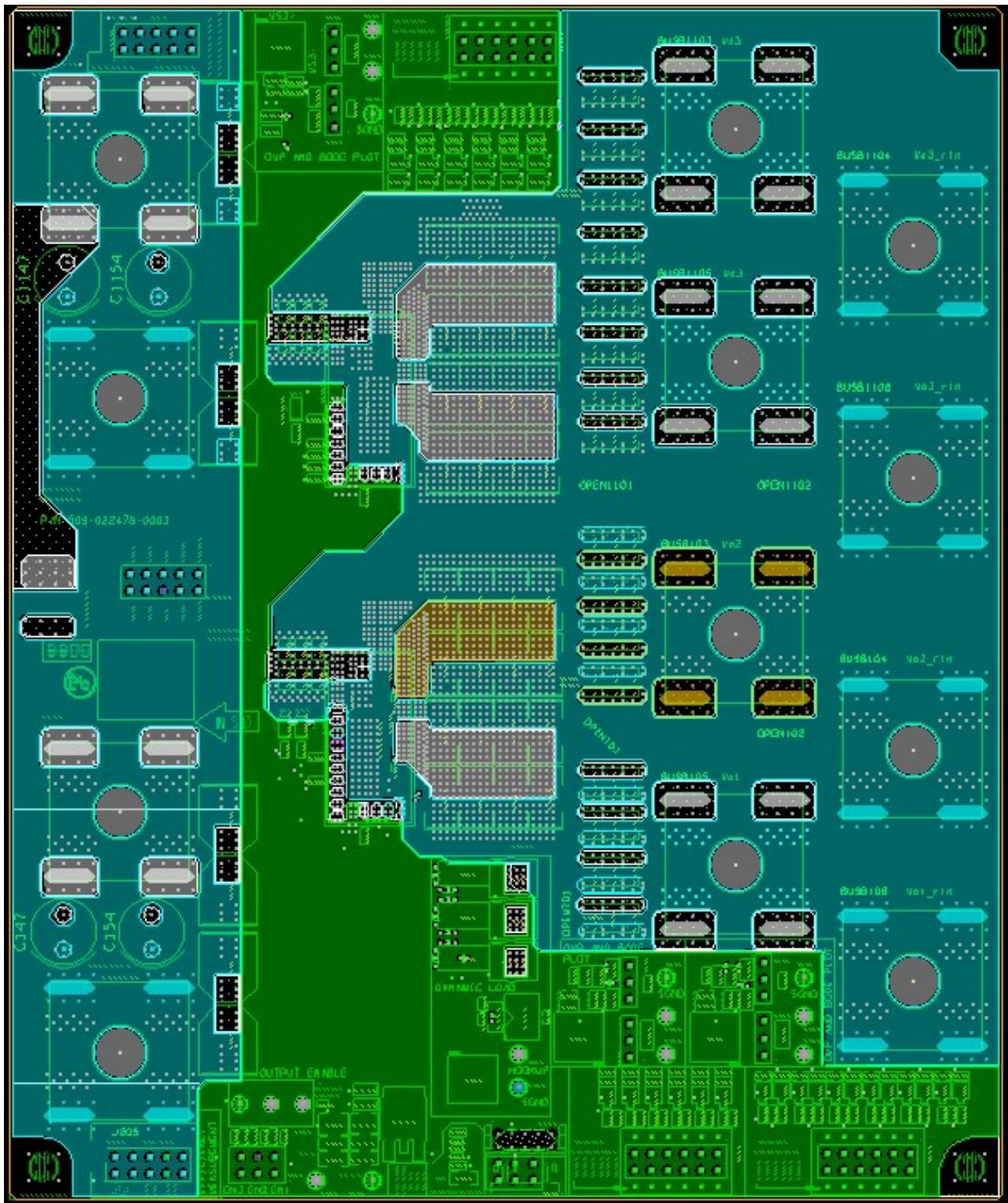
PCB Layout

Layer 4 copper
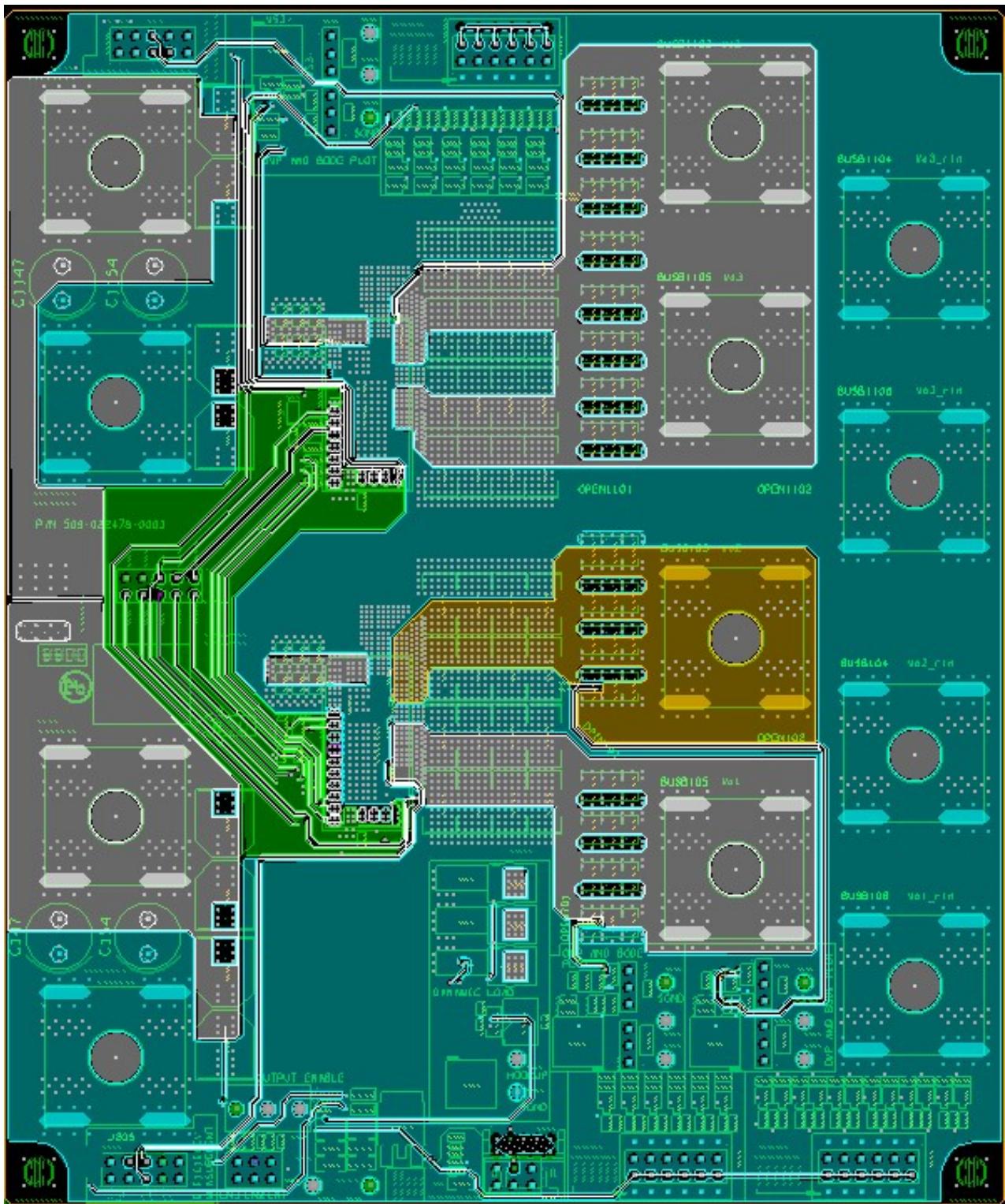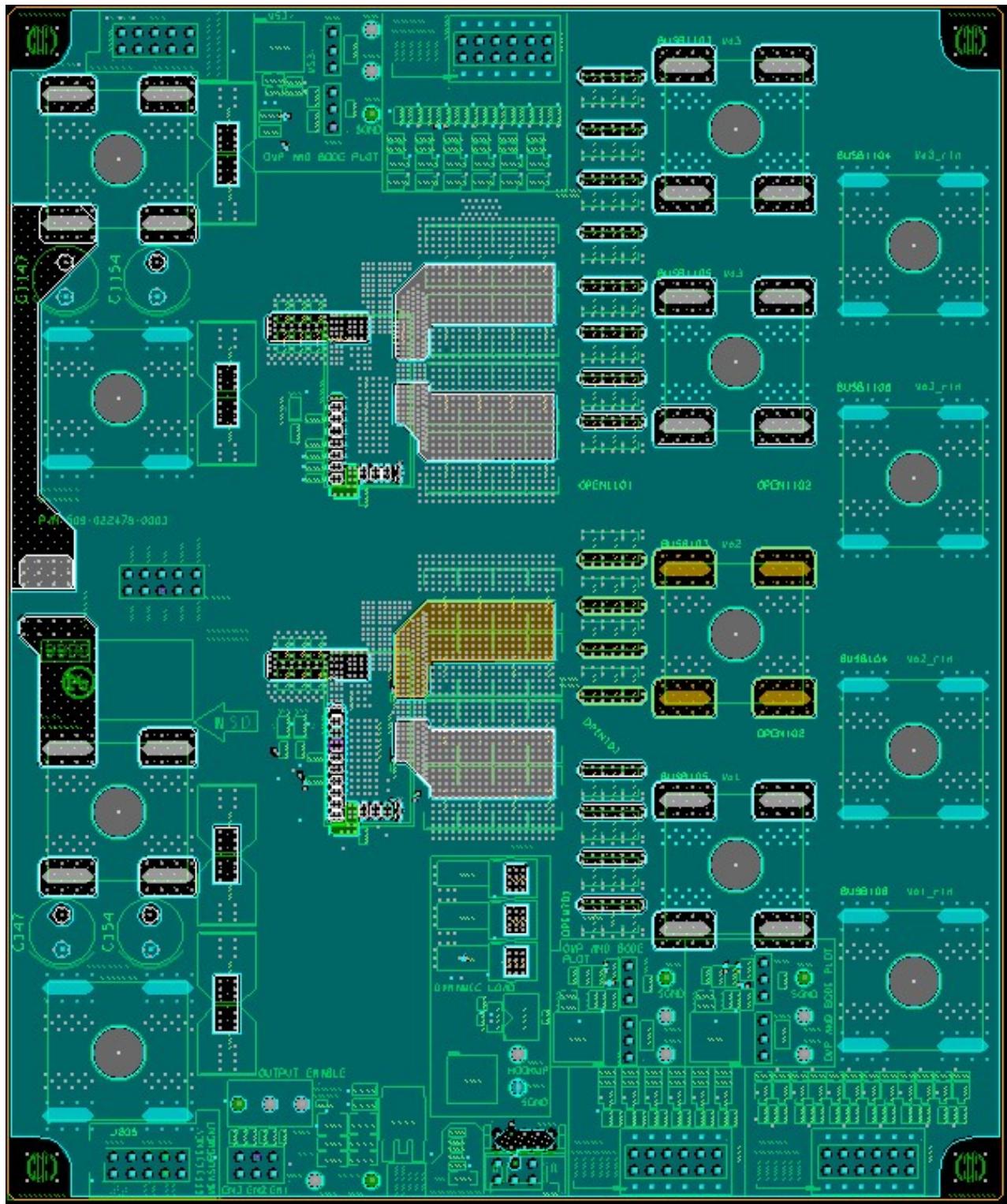
PCB Layout

Layer 5 copper
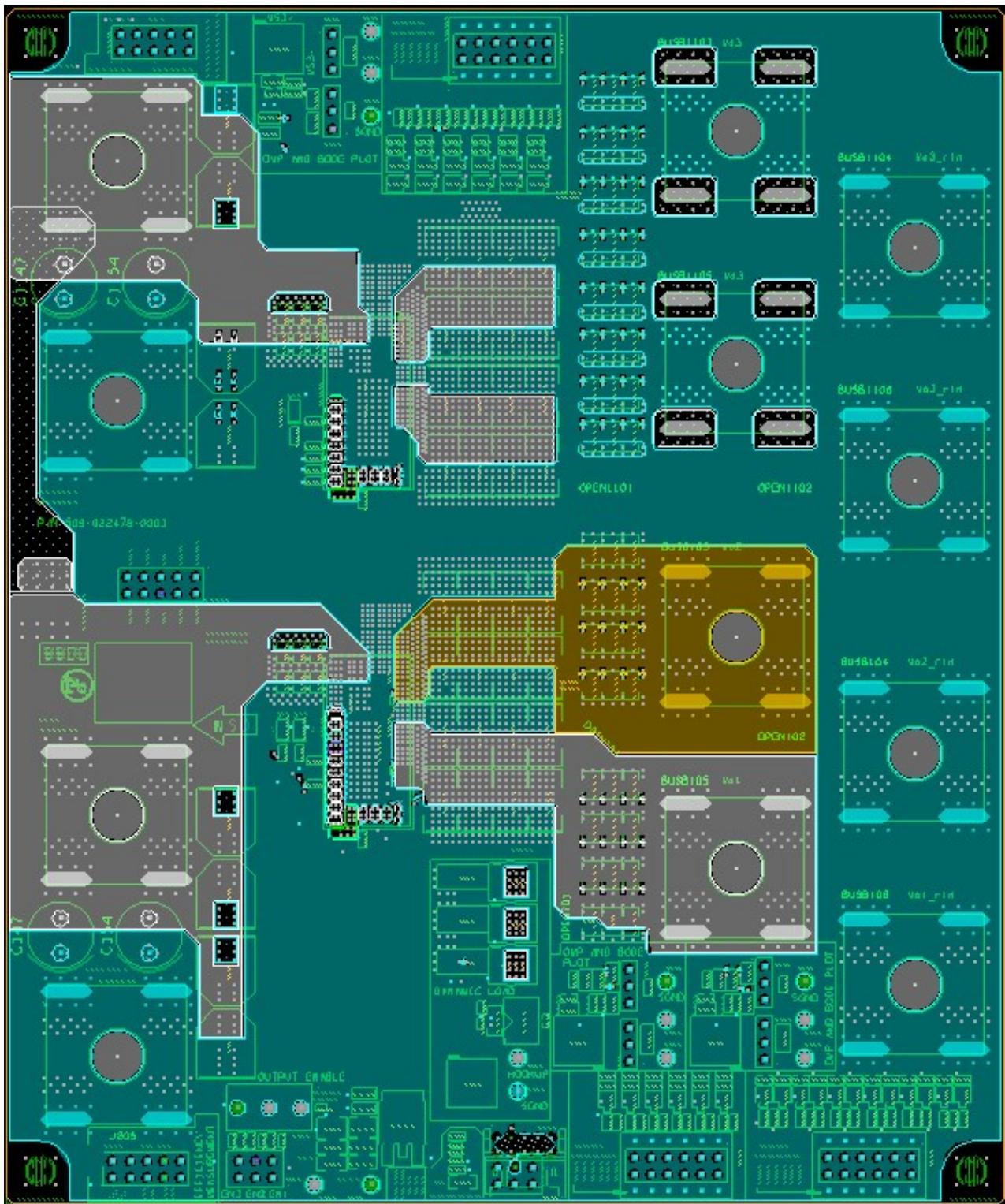
PCB Layout

Layer 6 copper

PCB Layout

Layer 7 copper
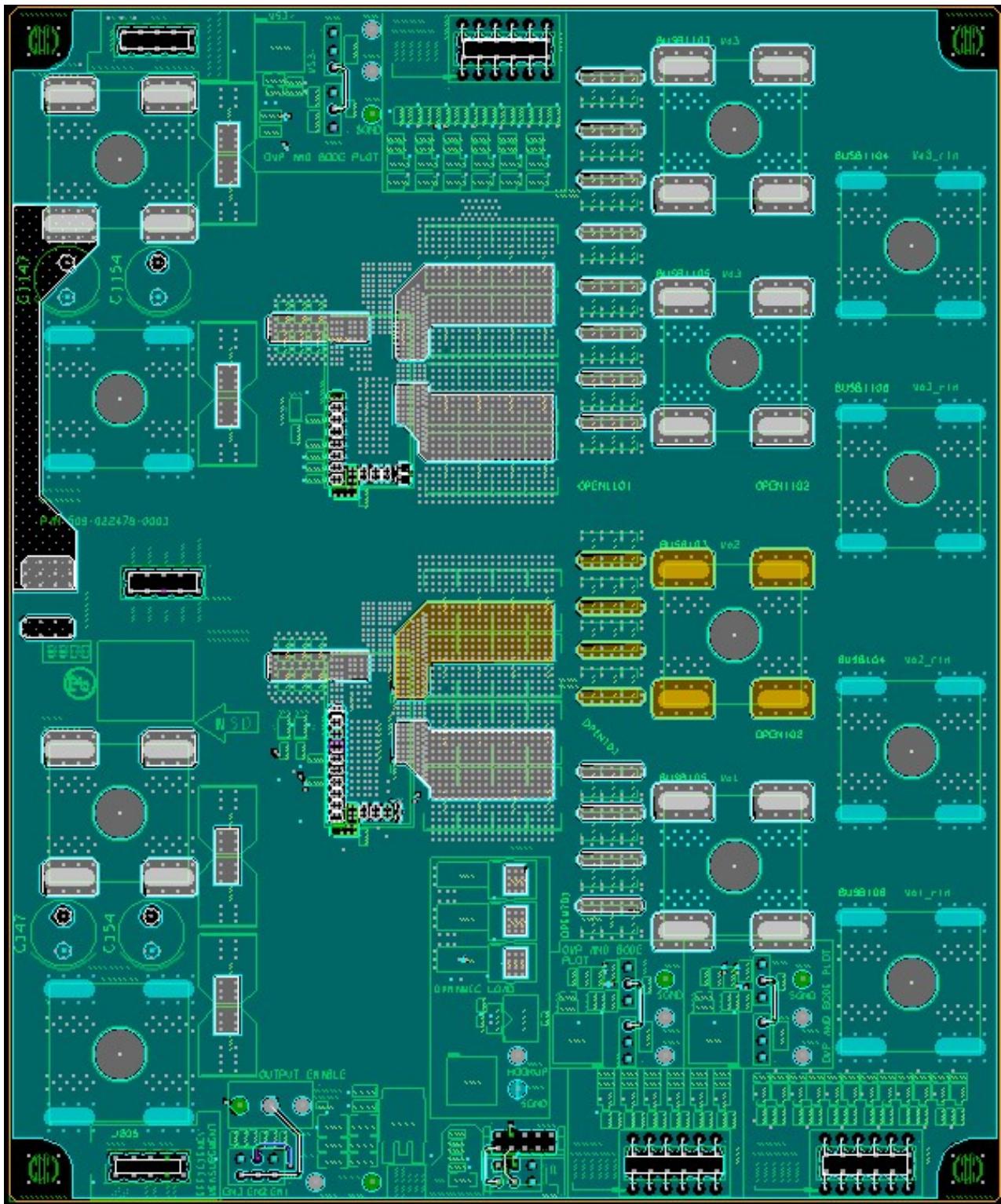
PCB Layout

Bottom copper

Record of Revision and Changes

Issue	Date	Description	Originators
1.0	11.06.2019	First Issue	J. Ma

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