User's Manual

ISL91211BII-EV1Z

User's Manual: Evaluation Board

Core Power Solutions

ISL91211BII-EV1Z

Evaluation Board

The ISL91211BII-EV1Z platform allows quick evaluation of the high performance features of the ISL91211B multi-output PMIC, which has four controllers capable of configuring its power stages for 1+1+1+1 channel outputs. Each channel can deliver up to 5A continuous output current per phase. The ISL91211B uses the Renesas proprietary R5 modulator technology to maintain accurate voltage regulation, while providing excellent efficiency and transient response. It also supports the standard I^{2}C and SPI communication protocols, ideal for systems using a single-cell battery.

Key Features

- Small, compact design
- Supports both I^{2}C and SPI bus communication protocols
- Adjustable V_{OUT} and independent DVS control for all four channels
- Real-time fault protection and monitor (OC, UV, OV, OT)
- Six layer board design optimized for thermal performance and efficiency
- Connectors, test points, and jumpers for easy measurements
- Built-in load transient circuits for each output channel

Specifications

The board is designed to operate at the following conditions:

- Input voltage rating from 2.5V to 5.5V
- Programmable output voltage range of 0.3V to 2V
  Note: An output range of 2V can be supported ONLY by factory OTP when requesting samples, not available with standard ISL91211B.
- 1+1+1+1 configuration with 5A maximum load current/phase
- 4MHz switching frequency
- Default DVS slew rate of 3mV/µs
- Power-up sequence: VOUT1→VOUT2→VOUT3→VOUT4, 1ms delay between each rail
- Power-down sequence: VOUT1-4 power down at the same time
- Operating temperature range: -40°C to +85°C
- VOUT1, 2, 3, and 4 = 0.9V

Ordering Information

Part Number	Description
ISL91211BII-EV1Z	ISL91211BII-EV1Z evaluation board

Related Literature

For a full list of related documents, visit our website:
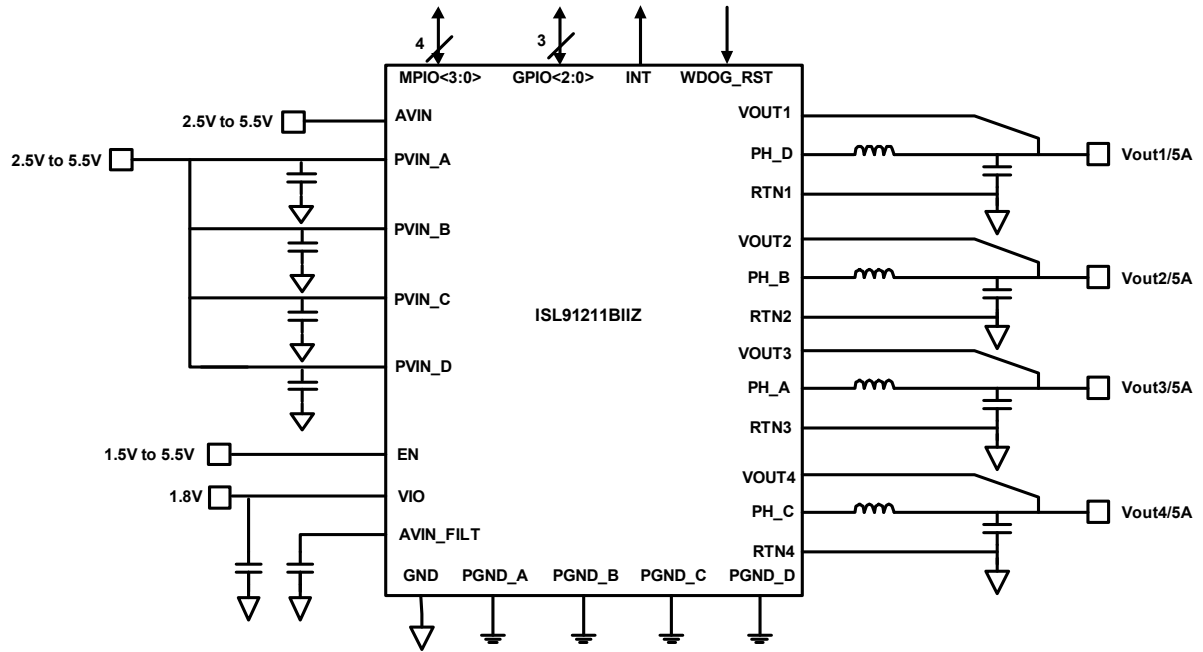
- ISL91211B device page

Figure 1. ISL91211B 1+1+1+1+ Block Diagram

1. Overview

1.1 Contents

• ISL91211BII-EV1Z evaluation board

• Evaluation software

• Renesas mini USB I^{2}C dongle with USB cable (ISLUSBMINIEVAL1Z)

• All applicable documentation

1.2 Recommended Equipment

• 0V to 10V power supply with at least 5A current sourcing capability (VIN SUPPLY BIAS)

• 0V to 10V power supply with at least 1A current sourcing capability (VCC_6V SUPPLY BIAS)

• Electronic loads capable of sinking current up to 5A

• Digital multimeter

• 500MHz quad-trace oscilloscope

• Dual-edge slew rate controllable signal generator

• Differential probe (for load transient current measurement)

2.   Functional Description

The ISL91211BII-EV1Z evaluation board provides a simple platform to demonstrate the feature-rich ISL91211B PMIC. It has a 0.9V output (default) on each of its output channels after start-up and each output voltage can be programmed by I^2C/SPI. The evaluation board has been functionally optimized for best performance, working harmoniously with the factory default tuning on the ISL91211B. The input power and load connections are provided through multi-pin connectors for high current operations.

The ISL91211BII-EV1Z evaluation board is shown in Figure 11 on page 12. Table 1 lists the key test points and jumpers on the evaluation board. The internal registers of the ISL91211B can be accessed by the I^2C/SPI through the on-board header J24 (SPI) and J42 (I^2C).

Table 1.   Description of Important Test Points and Jumpers

Test Point(s)	Description
J6(+), J7(-)	Header for connecting V_{IN} supply
J35(+), J65(-)	Buck1 Header for connecting external load
J37(+), J58(-)	Buck2 Header for connecting external load
J57(+), J36(-)	Buck3 Header for connecting external load
J64(+), J38(-)	Buck4 Header for connecting external load
J3	V_{IN} Kelvin connection for efficiency measurements
J15	Buck1 V_{OUT} Kelvin connection for efficiency measurements
J18	Buck2 V_{OUT} Kelvin connection for efficiency measurements
J56	Buck3 V_{OUT} Kelvin connection for efficiency measurements
J63	Buck4 V_{OUT} Kelvin connection for efficiency measurements
TP1	VCC_6V SUPPLY for VIO LDO and load transient circuits
J60	Buck1 driver input for load transient circuit
J61	Buck2 driver input for load transient circuit
J62	Buck3 driver input for load transient circuit
J66	Buck4 driver input for load transient circuit
J52	Load transient current sense, 1A/10mV
J55	Load transient current sense, 1A/10mV
J59	Load transient current sense, 1A/10mV
J67	Load transient current sense, 1A/10mV
J24	Header for connecting to SPI interface
J42	Header for connecting to I^2C interface
SW1	Enable/disable IC

The evaluation software Graphical User Interface (GUI) window for ISL91211B is shown in Figure 8 on page 10. The schematic of the ISL91211BII-EV1Z evaluation board is shown in Figure 13 on page 13. The PCB layout images for all layers are shown in Figures 17 through 24. The bill of materials of the ISL91211BII-EV1Z is shown in "ISL91211BII-EV1Z Bill of Materials" on page 17.

2.1   Operating Range

The V_{IN} range of the boards is 2.5V to 5.5V. The adjustable V_{OUT} range for the ISL91211BII-EV1Z is 0.3V to 2.0V. The I_{OUT} range of the boards is 0A to 5A per phase. The operating ambient temperature range is -40°C to +85°C.

2.2   Quick Start Guide

For the ISL91211BII-EV1Z evaluation board, the default output voltage is set at 0.9V for all four outputs. No jumper configurations are needed to power up the part into its default state. All the settings and features are instead loaded through the one-time programmable memory inside the IC, when minimum bias conditions are met. The following Setup Guide describes how to power-up the board for proper operation.

2.2.1   Setup Guide

1. Place scope probes on the V_{OUT} test point and other test points of interest.

2. Connect a power supply to J6 and J7 (VIN Supply), with voltage setting between 2.5V and 5.5V, this biases the PVIN and AVIN pins of the IC, but no start-up sequence has initiated and quiescent current should be less than 1mA.

3. Connect a second power supply to TP1 (VCC_6V), with voltage set to 6V. This biases the VIO and Chip Enable pin as well as the on-board load transient circuits. The ISL91211B boots up its internal reference, loads the default register settings, and then initiates a power-on sequence by toggling SW1 to the ENABLE position. All four outputs should turn on in the Pulse Skipping mode if there are no external loads present, and V_{OUT} should default to 0.9V.

4. During the start-up sequence, all four outputs should turn on sequentially, from Buck1 to Buck2 to Buck3 and then Buck4. Buck1 turns on with a 1.4ms delay from the Chip Enable pin going high, while the other Buck regulators turns on 1ms apart.

5. To initiate a shutdown sequence, toggle SW1 to the DISABLE position, and the ISL91211B turns off all the buck regulators at the same time.

2.2.2   I^{2}C and SPI Communication

The ISL91211B supports I^{2}C communication by default, a USB to I^{2}C communication dongle (ISLUSBMINIEVAL1Z) is included with each ISL91211BII-EV1Z purchase, and the GUI supports this tool across all operating systems.

1. To communicate with the ISL91211B through I^{2}C, connect the Renesas USB to I^{2}C dongle to J42. Make sure R93 is present on the board, as it provides the pull-up from SPI_SS to 1.8V VIO supply.

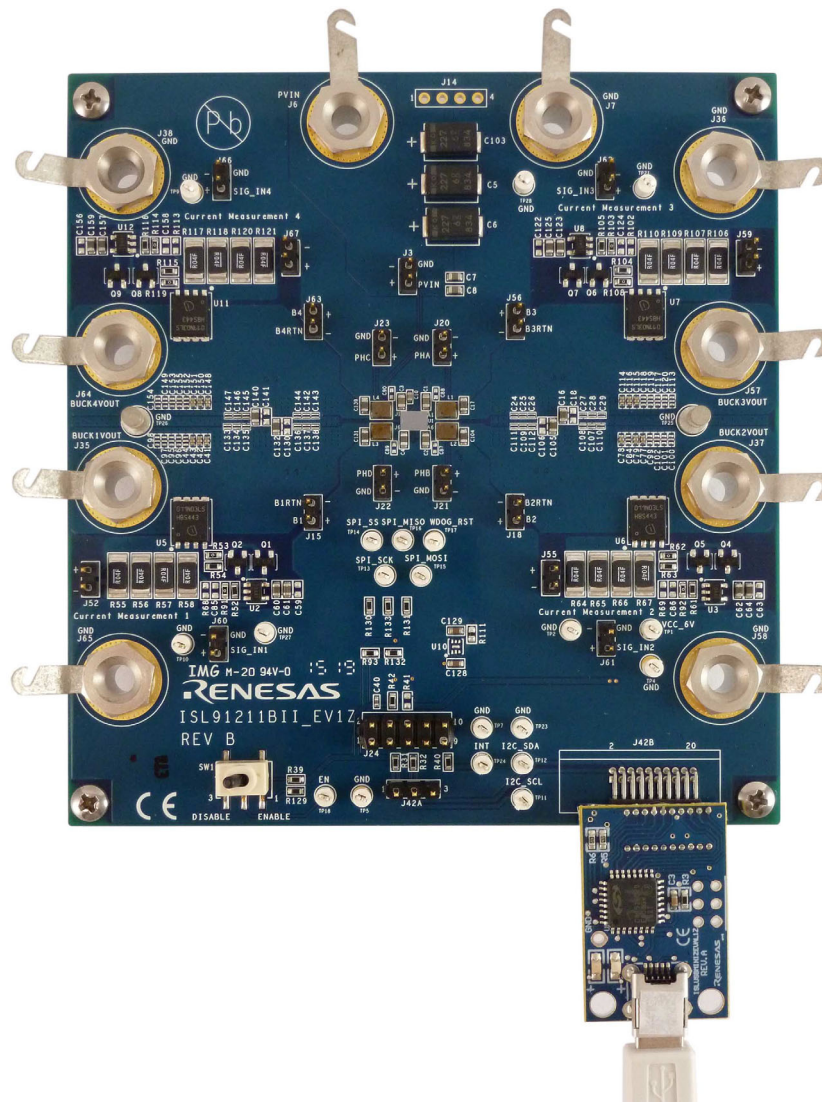**Note:** For the SPI communication option using the Renesas Graphical User Interface (GUI), contact Renesas support.

Figure 2. Communication Dongle Connection

2.2.3   Efficiency Measurement

1. Connect a power supply at J6 (VIN supply), with a voltage setting between 2.5 and 5.5V. Its current limit should be set high enough to support the maximum load current with additional head room. If the power supply supports remote sense lines, use a Kelvin connection on J3. Otherwise, connect a multimeter at J3.

2. Apply 6V to TP1 (VCC_6V) to initiate the start-up sequence and all four outputs turn on. To get an accurate single channel measurement, disable the other three outputs using the Renesas GUI.

3. Turn on the electronic load at VOUTx. The connection should be made at J35 (VOUT1), J37 (VOUT2), J57 (VOUT3), or J64 (VOUT4). Make sure the load current does not exceed 5A per phase, and the correct wire gauge is used when attaching the electronic load.

4. Measure the output voltage with a multimeter. The voltage should regulate within datasheet spec limits.

5. To determine efficiency, measure input and output voltages at the Kelvin sense test points (S+ and S-), which are located at J3 (VIN SENSE) and J15 (BUCK1 SENSE), J18 (BUCK2 SENSE), J56 (BUCK3 SENSE), or J63 (BUCK4 SENSE) headers. Measure the input and output currents from the VIN power supply and the electronic load. Calculate efficiency based on these measurements. For detailed setup information, see .

2.2.4   Load Transient Measurement

1. Go through the setup procedure. The ISL91211BII-EV1Z should already be powered up with 2.5V to 5.5V at J6 (VIN supply) and 6V at TP1 (VCC_6V).

2. Connect a slew rate controllable signal generator to transient load circuit input, J60 (TRANSIENT 1 PULSE GEN), J61 (TRANSIENT 2 PULSE GEN), J62 (TRANSIENT 3 PULSE GEN), or J63 (TRANSIENT 4 PULSE GEN).

3. Program the signal generator to pulse mode, set the frequency to 100Hz, ON duration to 200µs, and signal amplitude from 0V to 2V. The load transient circuit starts to turn on when the input is ~2.6V. When in doubt, always connect the signal generator output to an oscilloscope set to 1MΩ termination. The slew rate of the pulse, both rising and falling, should be conservatively slow, for example, 1µs.

4. Connect a differential probe to monitor load current across the sense resistors J52 (ISENSE1), J55 (ISENSE2), J59 (ISENSE3), or J67 (ISENSE4). The load current can be accurately converted to a voltage at 1A/10mV. Make sure the vertical scale of the oscilloscope is set properly to display the full amplitude of the load profile.

5. Connect a second differential probe at the VOUT sense points connected to the VOUT decoupling capacitors, J15 (BUCK1 SENSE), J18 (BUCK2 SENSE), J56 (BUCK3 SENSE), or J63 (BUCK4 SENSE).

6. Set the oscilloscope to measure the rise and fall times and maximum level of the load current. Slowly increase the signal generator amplitude and slew rate until desired load profile is a achieved. For detailed setup information, see Figure 12 on page 12.
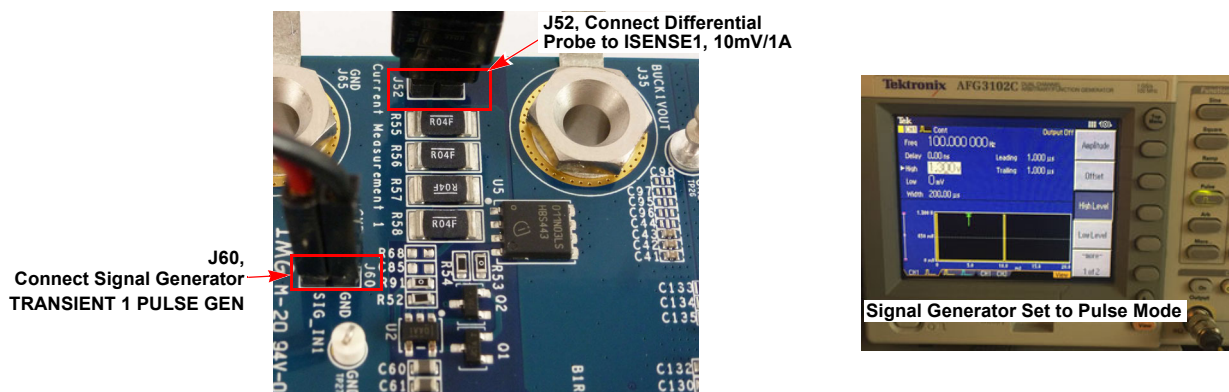

Figure 3. Buck1 Transient Load Connection Example

2.3   Evaluation Software Installation and Use

1. Extract the package and run **Autorun.exe**. Follow the instructions to install the Multiphase PMIC I^{2}C Control Tool software.

2. Attach the USB- I^{2}C interface (ISLUSBMINIEVAL1Z) dongle to the computer using the supplied USB cable.

3. Attach the USB-I^{2}C interface dongle to J42 on the ISL91211BII-EV1Z evaluation board. Follow the instructions in "Setup Guide" on page 6, connect the power supplies, DC load, and other test equipment to the ISL91211BII-EV1Z evaluation board and then apply power.

4. Start the Multiphase PMIC I^{2}C Control Tool software. Select **Start > Programs > Renesas > Multiphase PMIC I2C Control Tool.**

5. Select **ISL91211** from the **Select Product** drop down menu. Click the **Connect** button on the GUI to establish connection between GUI and the dongle. The LED on the dongle lights up. If a connection is not detected, the software shows a red X next to **I2C Communication**. Press **Reset** to reconnect dongle.
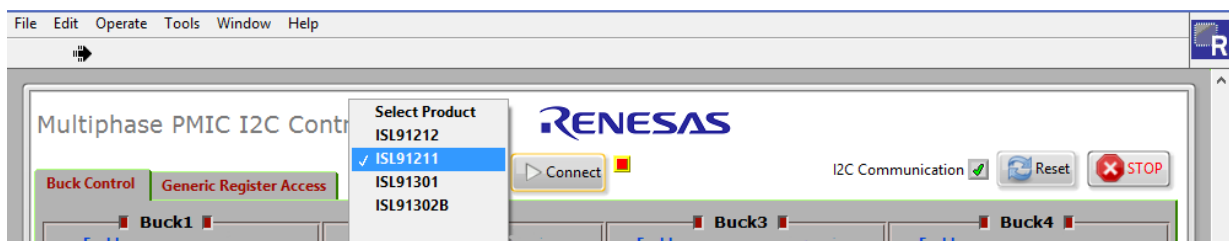

Figure 4. Product Selection Menu and I^{2}C Communication OK Indicator

6. After the evaluation software establishes a connection to the USB- I^{2}C interface dongle, the software loads a blank start-up script by default and reads all the pertinent register values to show on screen.

7. You should see Buck1 enabled, and the default DVS0 values should be 0.9V. If no fault conditions occurred during the board power-up, all the fault indicators (UV, OV, and OC) should be clear rather than red.

8. To change the output voltage, enter the desired value in voltages in the DVS0 control. There are also four default DVS values that are loaded as part of the ISL91211B one-time programmable memory space. You can go to any of them and activate a DVS command by clicking on the **DVS pointer**.
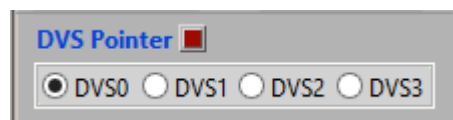

Figure 5. DVS Pointer Selection

9. Changing the **Max Voltage** control changes the internal feedback divider between ratios of 1x, 0.8x, and 0.6x. This changes the maximum output voltage the ISL91211B can support, with the maximum being 2V.
   Note: The smallest DVS resolution the IC and the software can support is no less than the maximum voltage divided by 1023.

10. After the evaluation software is up and running without hiccup, it polls all the registers at 2s intervals by default. You can disable this feature by clearing the **Continuous Read** option.
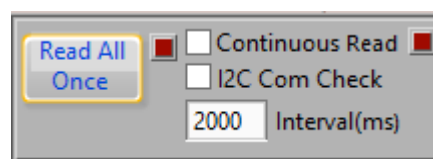

Figure 6. Continuous Read and Manual Read All Options

11. The fault indicators self-clear when the software reads the register through Continuous Read or the fault is removed. Three additional replica fault indicators (UV, OV, and OC) latch the faults so they clear only after you click **Push to Clear** in the event of a spurious fault condition.

Figure 7. Fault Indicators

Note: The default switching frequency of the ISL91211B is set to 4MHz and slew rates for both DVS and power-up/down are set to 3mV/µs. These settings, along with many other features are programmable only through OTP request or a Start-up Script and are not supported by evaluation software. For more information, contact Renesas support.

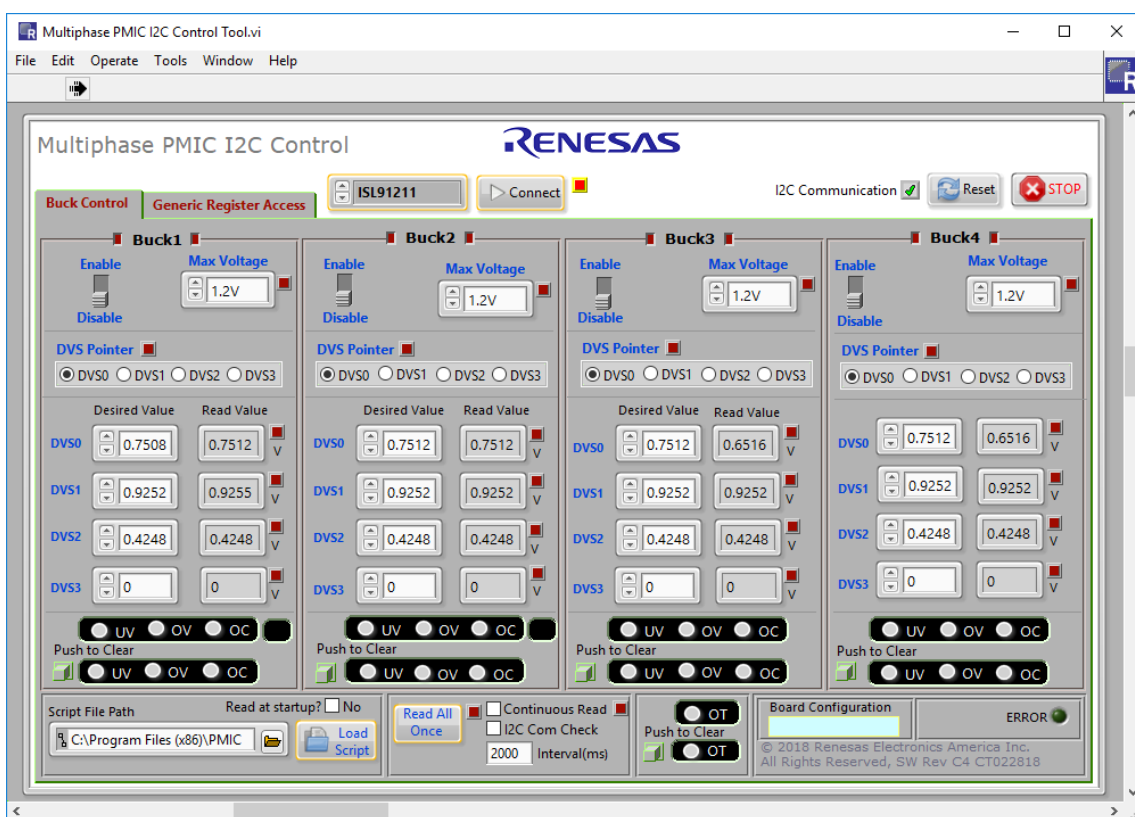**Figure 8. ISL91211B Evaluation Software Window**

3.   PCB Layout Guidelines

The ISL91211BII-EV1Z Board is a 6-layer FR4 board. The main components are the ISL91211B, its passive filter components, test points, and connectors. A 220nH inductor is located close to each phase node of the ISL91211B, and 2x22µF in addition to 3x4.3µF low ESR capacitors are used for each single phase outputs. PVIN is distributed using a power plane on an inner layer with a 10µF capacitor placed in close proximity to the PVIN and PGND balls of the power stage. In addition, there is a 10µF AVIN filter capacitor placed next to the ISL91211B referenced to a quiet ground plane.

The PCB layout is a very critical design step in making sure the designed converter works under optimum conditions. For the ISL91211B, the power loop is composed of the inductor, output capacitors, phase node, and PGND pins. It is necessary to keep this loop as short as possible and the connecting traces among them should be direct, short, and wide. The phase nodes of the ISL91211B are very noisy, so keep remote sense signals away from traces coming out of the phase nodes, and do not route them under the inductor in an adjacent layer. Place the input capacitor as close as possible to the PVIN and PGND pins. Also, there should be a large unbroken ground plane that should connect all the decoupling capacitors together.

The heat of the ISL91211B is mainly dissipated through the GND and PHASE plane vias under the IC. To maximize thermal performance, use as much copper area as possible connecting to these vias. In addition, a solid ground plane is helpful for better EMI performance.

3.1   Key Layout Strategies

• Place input capacitors as close as possible to their respective PVIN and PGND pins to minimize parasitic loop inductance.

• Route phase nodes with short, wide traces and avoid any sensitive nodes.

• Route the remote sense lines directly to the load using small, low inductance capacitors at the load for bypassing.

• Output capacitors should be close to the inductors and have a low impedance path to the PGND pins.

• Keep digital and phase nodes from intersecting AVIN_FILT, VOUT, and RTN lines.

• Create a PGND plane on the second layer of the PCB below the power components and bumps carrying high switching currents.
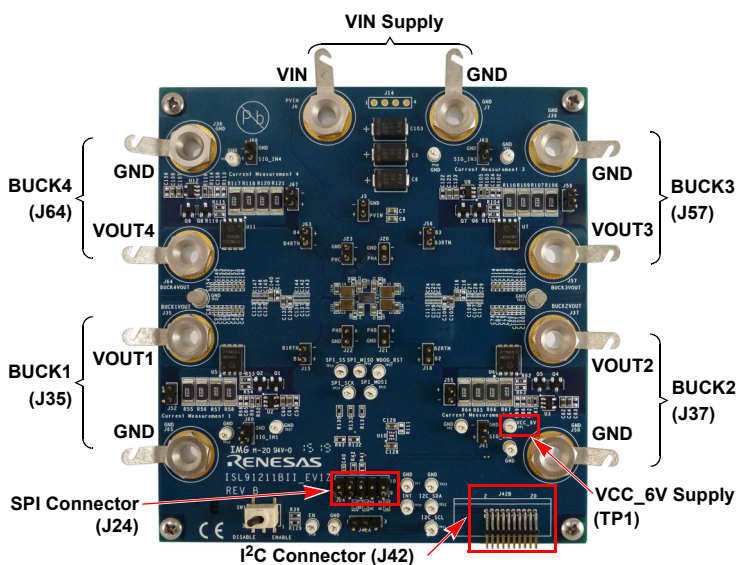
3.2   ISL91211BII-EV1Z Evaluation Board
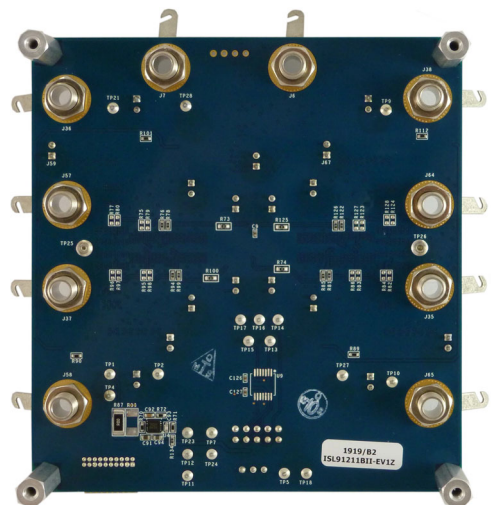

Figure 9. ISL91211BII-EV1Z Top View

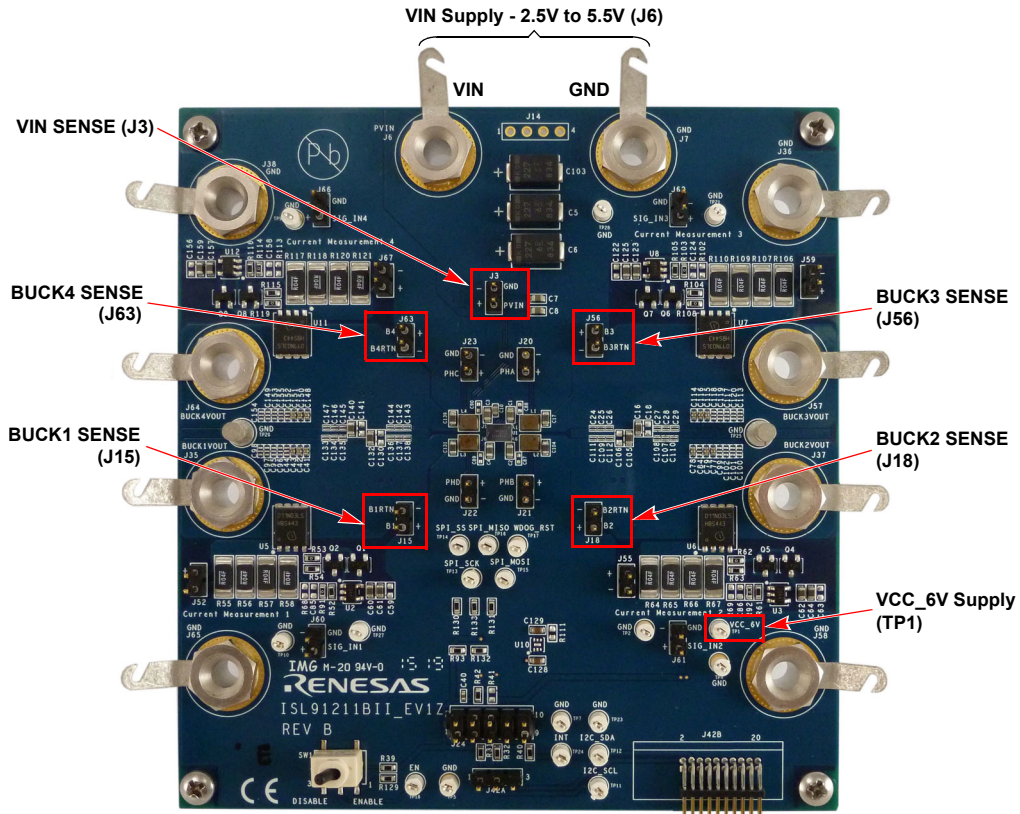
Figure 10. ISL91211BII-EV1Z Bottom View

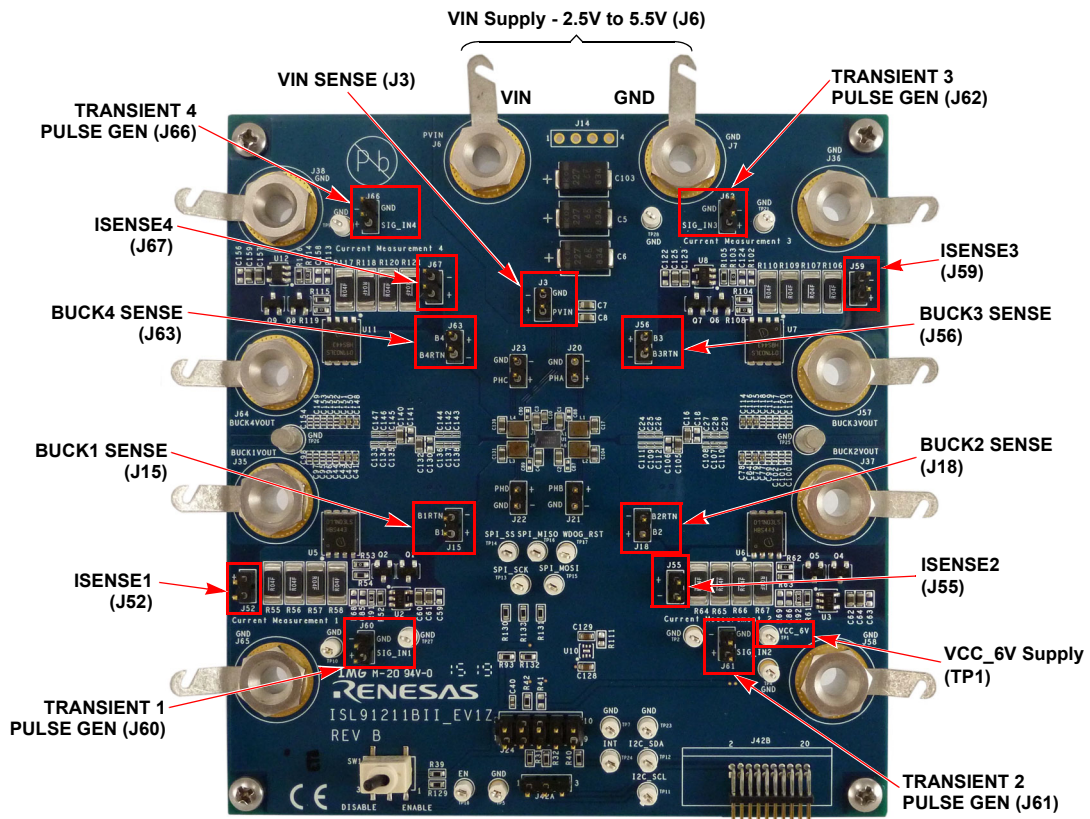**Figure 11. ISL91211BII-EV1Z Efficiency Measurement Connections**

Figure 12. ISL91211BII-EV1Z Load Transient Measurement Connections
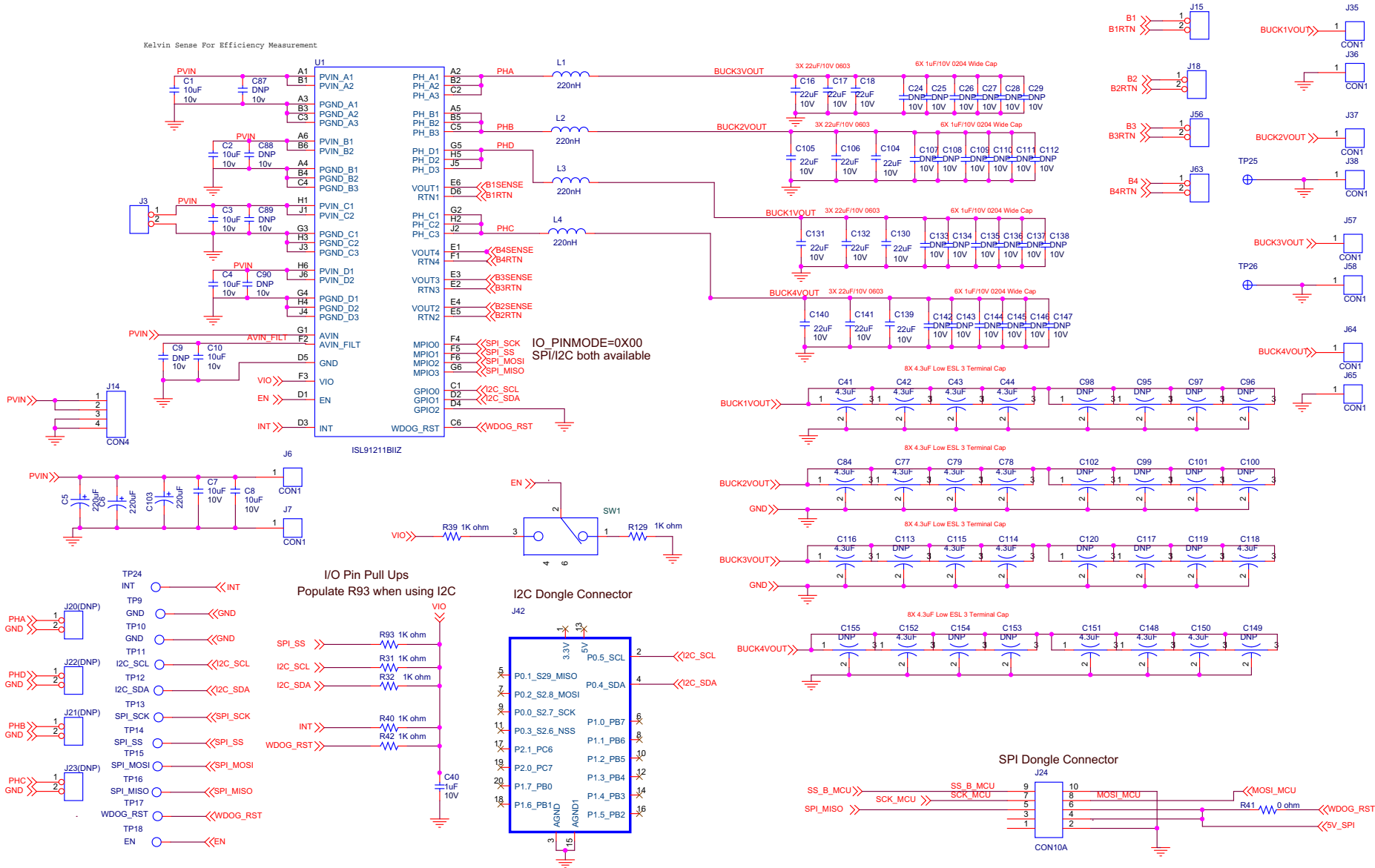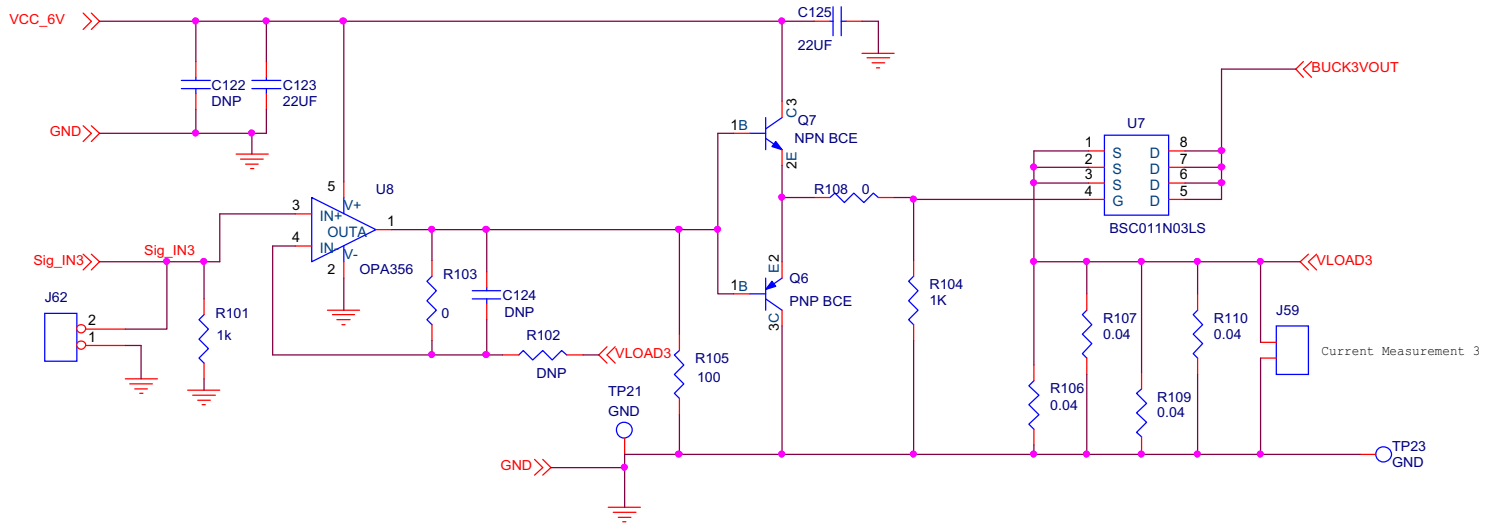
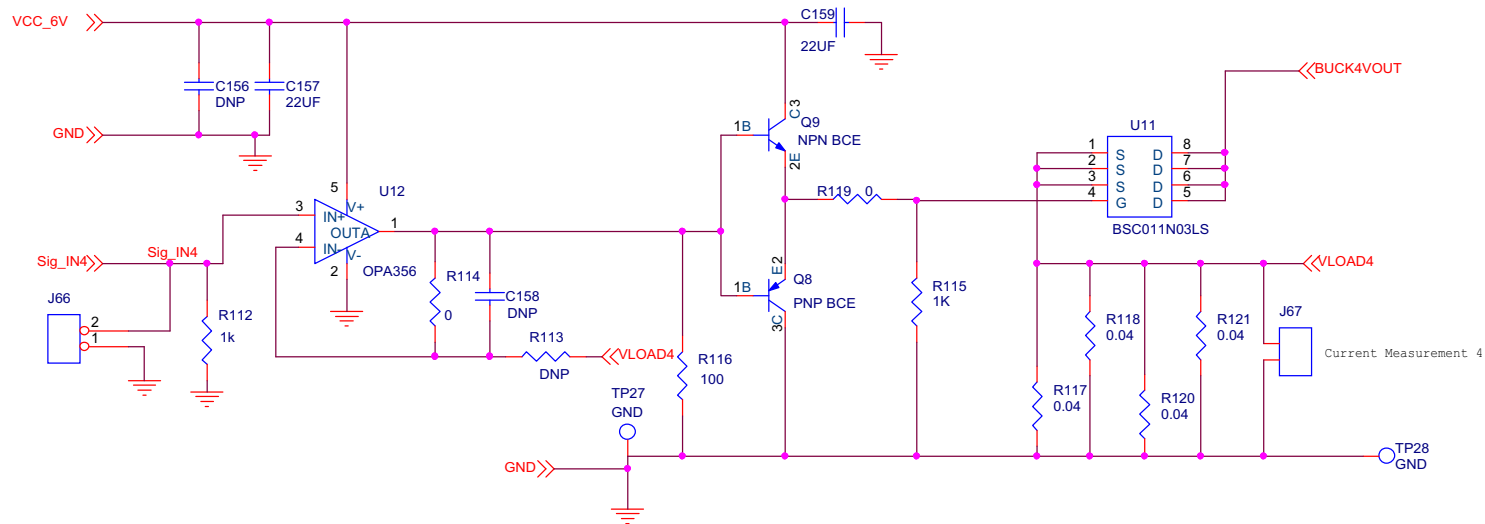## 3.3 ISL91211BII-EV1Z PCB Schematics

Figure 13. ISL91211BII-EV1Z
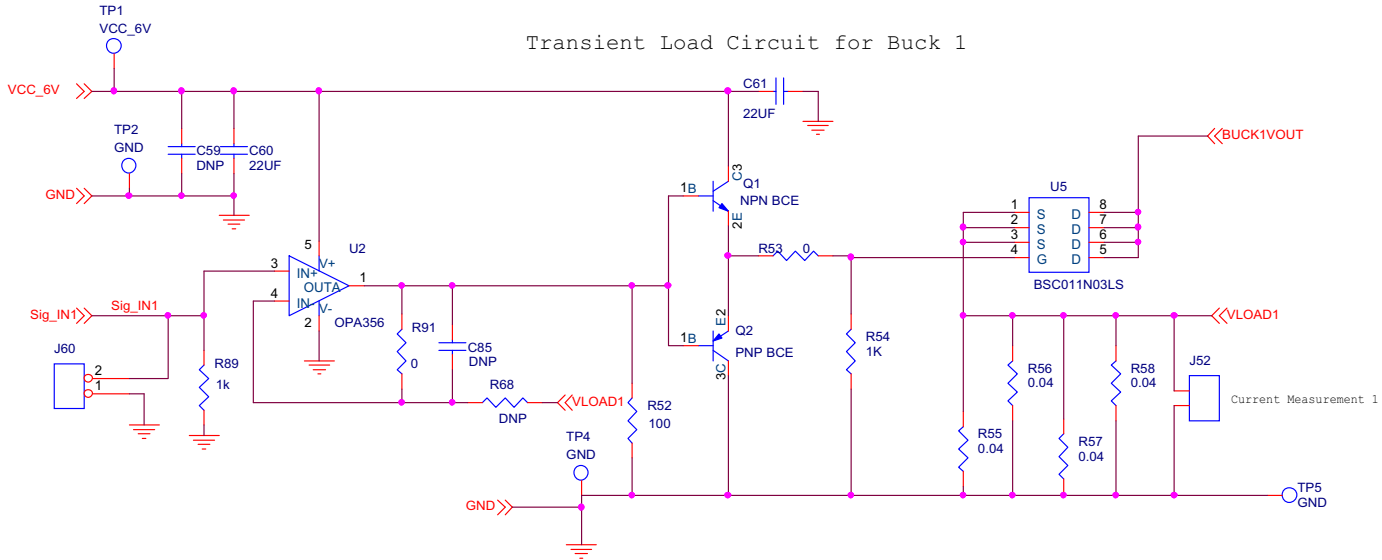
Transient Load Circuit for Buck 3

Set signal generator minimum amplitude at J62 = 1V+, current measurement at J59 is 10mV/1A

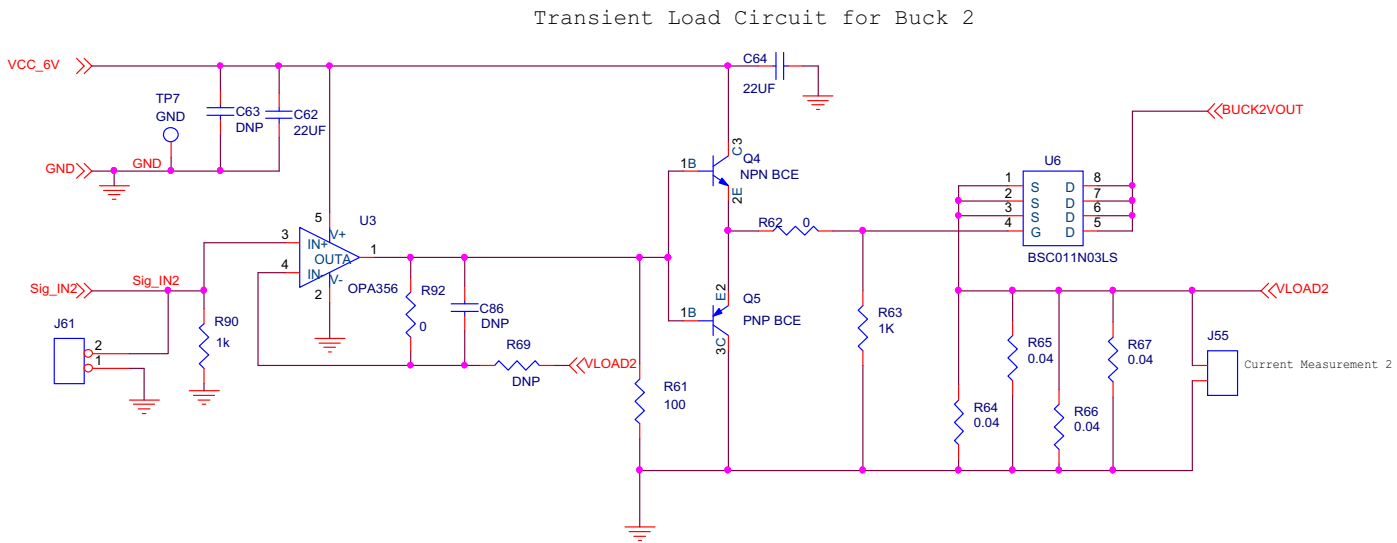Transient Load Circuit for Buck 4

Set signal generator minimum amplitude at J66 = 1V+, current measurement at J67 is 10mV/1A

**Figure 14. Transient Load Circuits for Buck3 and Buck4**

RENESAS

Transient Load Circuit for Buck 1

TP1
VCC_6V

VCC_6V

C61
22UF

BUCK1VOUT

TP2
GND

C59
DNP

C60
22UF

GND

Q1
NPN BCE
1B
2E
C3

U5
1 S   D 8
2 S   D 7
3 S   D 6
4 G   D 5
BSC011N03LS

R53
0

5
3 IN+ V+
OUTA
4 IN- V-
2
U2
OPA356
1

Sig_IN1

Sig_IN1

J60
2
1

R89
1k

R91
0

C85
DNP

R68
DNP

VLOAD1

Q2
PNP BCE
1B
E2
3C

R52
100

R54
1K

R56
0.04

R58
0.04

J52

Current Measurement 1

VLOAD1

R55
0.04

R57
0.04

TP5
GND

TP4
GND

GND

Set signal generator minimum amplitude at J60 = 1V+, current measurement at J52 is 10mV/1A

Transient Load Circuit for Buck 2

VCC_6V

C64
22UF

BUCK2VOUT

TP7
GND

C63
DNP

C62
22UF

GND

GND

Q4
NPN BCE
1B
2E
C3

U6
1 S   D 8
2 S   D 7
3 S   D 6
4 G   D 5
BSC011N03LS

R62
0

5
3 IN+ V+
OUTA
4 IN- V-
2
U3
OPA356
1

Sig_IN2

Sig_IN2

J61
2
1

R90
1k

R92
0

C86
DNP

R69
DNP

VLOAD2

Q5
PNP BCE
1B
E2
3C

R61
100

R63
1K

R65
0.04

R67
0.04

J55

Current Measurement 2

VLOAD2

R64
0.04

R66
0.04

Set signal generator minimum amplitude at J61 = 1V+, current measurement at J55 is 10mV/1A

Figure 15. Transient Load Circuits for Buck1 and Buck2
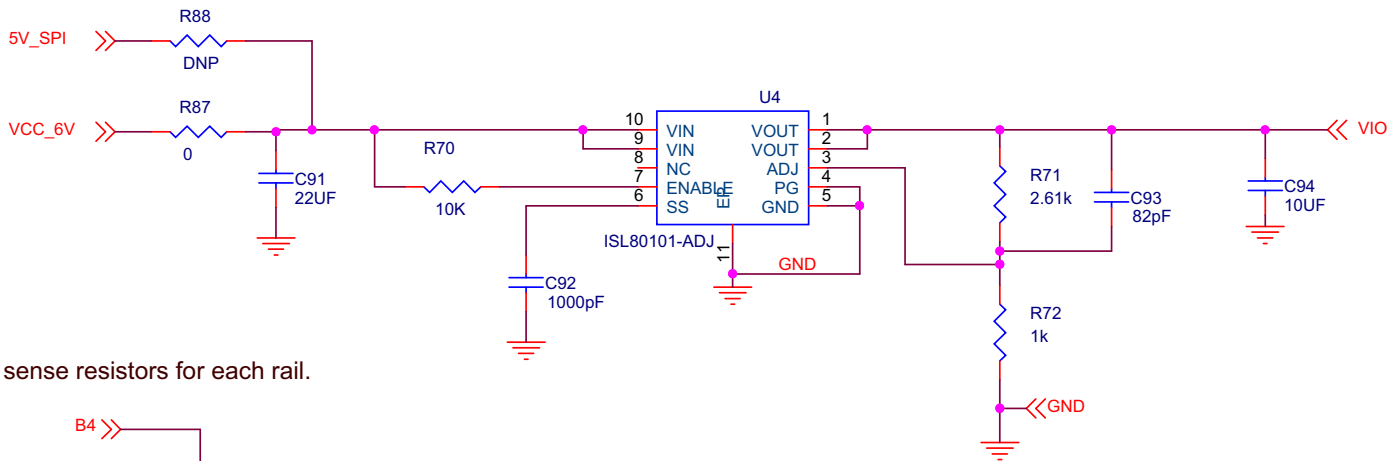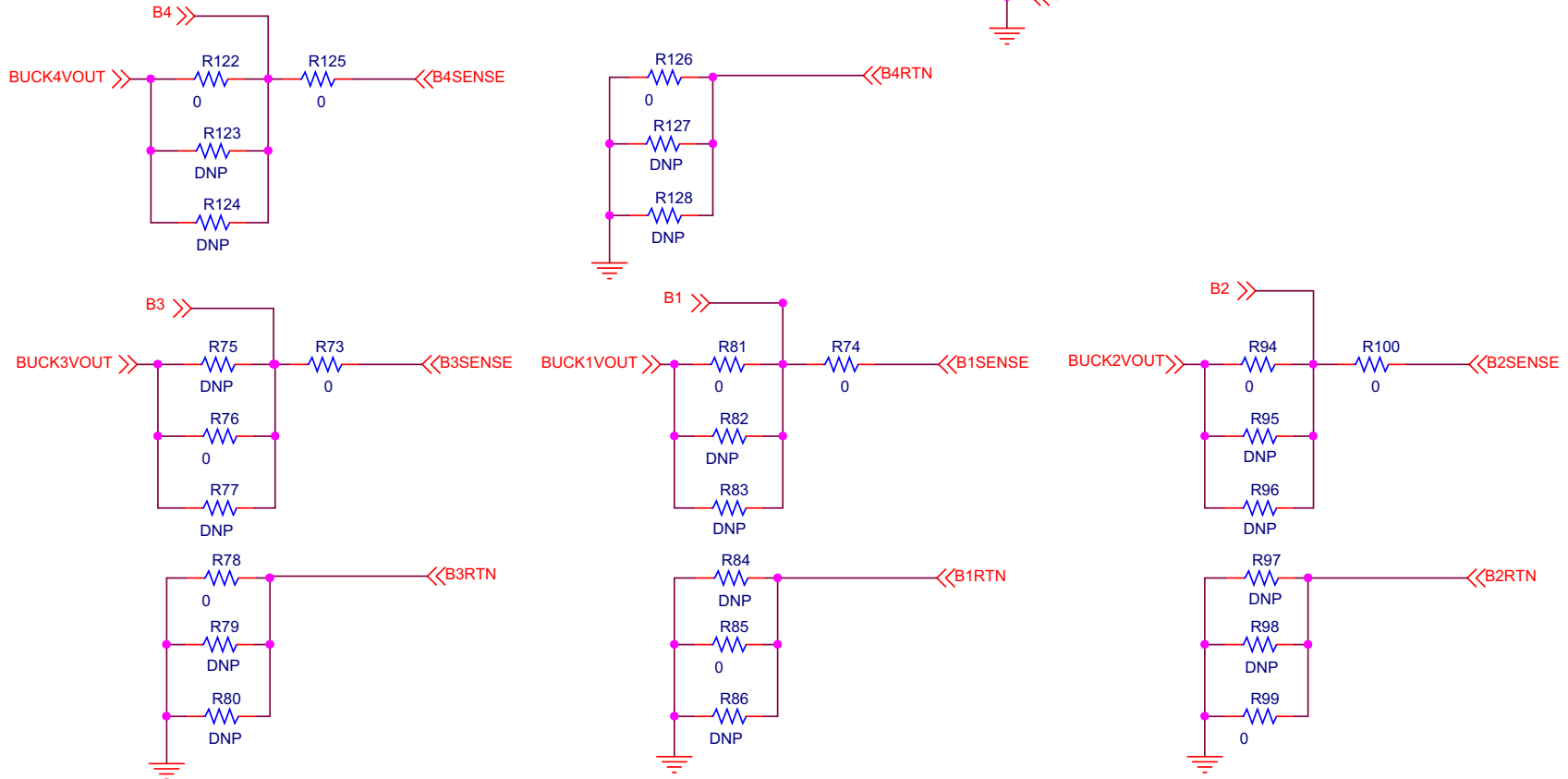
Ouput sense resistors for each rail.

Figure 16. VIO Regulator and Feedback Resistors

3.4 ISL91211BII-EV1Z Bill of Materials

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part Number
1		PWB-PCB, ISL91211BII-EV1Z, REVB, ROHS	Imagineering Inc	ISL91211BII-EV1ZREVBPCB
3	C9, C126, C127	CAP, SMD, 0402, 0.1µF, 10V, 10%, X5R, ROHS	Murata	GRM155R61A104KA01D
1	C40	CAP, SMD, 0402, 1.0µF, 10V, 10%, X5R, ROHS	Murata	GRM155R61A105KE15D
1	C10	CAP, SMD, 0402, 10µF, 10V, 20%, X5R, ROHS	Samsung	CL05A106MP5NUNC
0	C87, C88, C89, C90	CAP, SMD, 0402, DNP-PLACE HOLDER, ROHS		
1	C92	CAP, SMD, 0603, 1000pF, 100V, 10%, X7R, ROHS	Venkel	C0603X7R101-102KNE
2	C128, C129	CAP, SMD, 0603, 10µF, 16V, 10%, X5R, ROHS	Murata	GRM188R61C106KAALD
17	C16, C17, C60, C61, C62, C64, C91, C104, C105, C123, C125, C131, C139, C157, C159, C132, C140	CAP, SMD, 0603, 22µF, 10V, 20%, X5R, ROHS	TDK	C1608X5R1A226M
0	C18, C59, C63, C85, C86, C106, C122, C124, C130, C141, C156, C158	CAP, SMD, 0603, DNP-PLACE HOLDER, ROHS		
7	C1, C2, C3, C4, C7, C8, C94	CAP-AEC-Q200, SMD, 0603, 10µF, 10V, 20%, X5R, ROHS	Taiyo Yuden	LMK107BBJ106MAHT
12	C41, C42, C43, C77, C78, C79, C114, C115, C116, C148, C150, C151	CAP-AEC-Q200, SMD, 0402, 4.3µF, 2.5V, 20%, ROHS	Murata	NFM15PC435R0E3D
1	C93	CAP-AUTO, SMD, 0603, 82pF, 250V, 5%, C0G/NP0, ROHS	Taiyo Yuden	QVS107CG820JCHT
3	C5, C6, C103	CAP-TANT, SMD, 7.3x4.3, 220µF, 6.3V, 20%, 40mΩ, ROHS	Kemet	T520D227M006ATE040
4	L1, L2, L3, L4	COIL-PWR CHOKE INDUCTOR, SMD, 2.5x2mm, 0.22µH, 20%, 6.3A, ROHS	Cyntec Co., Ltd.	HMLB25201T-R22MSR-01
10	J6, J7, J35, J36, J37, J38, J57, J58, J64, J65	CONN-JACK, BANANA-SS-SDRLESS, VERTICAL, 0.40Length, ROHS	Johnson Components	108-0740-102
2	TP25, TP26	CONN-TURRET, TERMINAL POST, TH, ROHS	Keystone	1514-2
20	TP1, TP2, TP4, TP5, TP7, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18, TP21, TP23, TP24, TP27, TP28	CONN-MINI TEST POINT, VERTICAL, WHITE, ROHS	Keystone	5002
1	J24	CONN-HEADER, 2x5, BRKAWY-2x36, 2.54mm, ROHS	Berg/FCI	67996-272HLF
1	J42A	CONN-HEADER, 1x3, BREAKAWY 1x36, 2.54mm, ROHS	Berg/FCI	68000-236HLF
17	J3, J15, J18, J20, J21, J22, J23, J52, J55, J56, J59, J60, J61, J62, J63, J66, J67	CONN-HEADER, 1x2, RETENTIVE, 2.54mm, 0.230x0.120, ROHS"	Berg/FCI	69190-202HLF
1	J42B	CONN-HEADER, TH, 2x10, 1.27mmPITCH, R/A, ROHS	Harwin Inc	M50-3901042
1	U4	IC-ADJ.V, 1A LDO REGULATOR, 10P, DFN, 3x3, ROHS	Renesas	ISL80101IRAJZ
1	U1	IC-4-PHASE, 4-OUTPUT PMIC, 54P, WLCSP, ROHS	Renesas	ISL91211BIIZ
4	U2, U3, U8, U12	IC-OP-AMP, R/R OUTPUT, SMD, 5P, SOT23-5, 200MHz, ROHS	Texas Instruments	OPA356AIDBVR

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part Number
4	U5, U6, U7, U11	TRANSIST-MOS, N-CHANNEL, 30V, 100A, SMD, 8P, PG-TDSON-8, ROHS	Infineon Technology	BSC011N03LS
4	Q1, Q4, Q7, Q9	TRANSISTOR-NPN, SMD, SOT-23, 40V, 200mA, 350mW, ROHS	Fairchild	MMBT3904
4	Q2, Q5, Q6, Q8	TRANSISTOR-PNP, SMD, SOT-23, 40V, 200mA, 350mW, ROHS	Fairchild	MMBT3906
1	R111	RES-AEC-Q200, SMD, 0402, 10k, 1/10W, 1%, TF, ROHS	Panasonic	ERJ-2RKF1002X
4	R52, R61, R116, R105	RES-AEC-Q200, SMD, 0603, 100Ω, 1/10W, 1%, TF, ROHS	Panasonic	ERJ-3EKF1000V
16	R31, R32, R39, R40, R42, R54, R63, R72, R89, R90, R93, R101, R104, R112, R115, R129	RES-AEC-Q200, SMD, 0603, 1k, 1/10W, 1%, TF, ROHS	Panasonic	ERJ-3EKF1001V
5	R130, R131, R132, R133, R70	RES-AEC-Q200, SMD, 0603, 10k, 1/10W, 1%, TF, ROHS	Panasonic	ERJ-3EKF1002V
1	R71	RES-AEC-Q200, SMD, 0603, 2.61k, 1/10W, 1%, TF, ROHS	Panasonic	ERJ-3EKF2611V
21	R53, R62, R73, R74, R76, R78, R81, R85, R91, R92, R94, R99, R100, R103, R108, R114, R119, R122, R125, R126, R134	RES-AEC-Q200, SMD, 0603, 0Ω, 1/10W, TF, ROHS	Panasonic	ERJ-3GEY0R00V
0	R41, R68, R69, R75, R77, R79, R80, R82, R83, R84, R86, R95, R96, R97, R98, R102, R113, R123, R124, R127, R128	RES, SMD, 0603, DNP-PLACE HOLDER, ROHS		
1	R87	RES-AEC-Q200, SMD, 2010, 0Ω, 3/4W, TF, ROHS	Stackpole	RMCF2010ZT0R00
0	R88	RES, SMD, 2010, DNP, DNP, DNP, TF, ROHS		
16	R55, R56, R57, R58, R64, R65, R66, R67, R106, R107, R109, R110, R117, R118, R120, R121	RES-AEC-Q200, SMD, 2010, 0.04Ω, 1W, 1%, CURR.SENSE, ROHS	Vishay/dale	WSL2010R0400FEA18
1	SW1	SWITCH-TOGGLE, SMD, 6PIN, SPDT, 2POS, ON-NONE-ON, ROHS	ITT Industries/ C&K Division	GT11MSCBE
4	Four corners	SCREW, 4-40x1/4in, PHILLIPS, PANHEAD, STAINLESS, ROHS	Building Fasteners	PMSSS 440 0025 PH
4	Four corners	STANDOFF, 4-40x3/4in, F/F, HEX, ALUMINUM, 0.25 OD, ROHS	Keystone	2204
0	J14	DO NOT POPULATE OR PURCHASE		
0	U10 (ISL9008AIENZ-T)	DO NOT POPULATE OR PURCHASE		
0	U9 (MAX3023EUD+	DO NOT POPULATE OR PURCHASE		
0	C24, C25, C26, C27, C28, C29, C107, C108, C44, C84, C95, C96, C97, C98, C99, C100, C101, C102, C113, C117, C118, C119, C120, C109, C110, C111, C112, C133, C134, C135, C136, C137, C138, C142, C143, C144, C145, C149, C152, C153, C154, C155, C146, C147	DO NOT POPULATE OR PURCHASE		

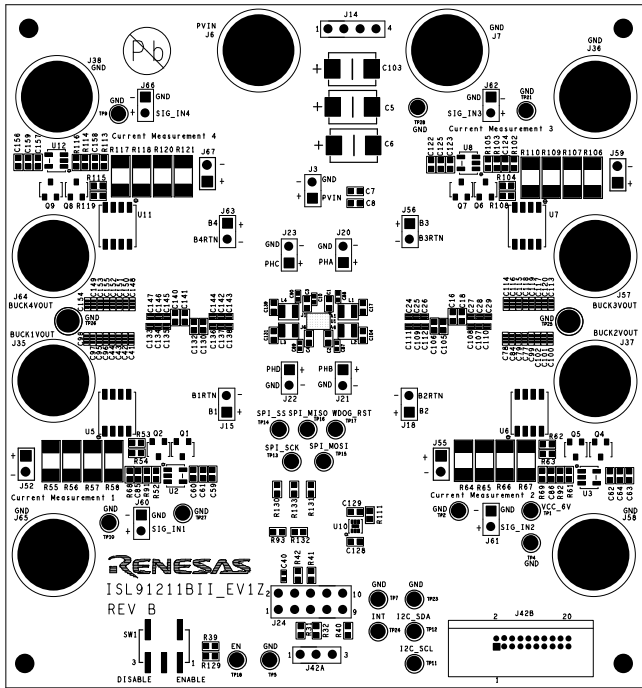## 3.5   ISL91211BII-EV1Z PCB Layout

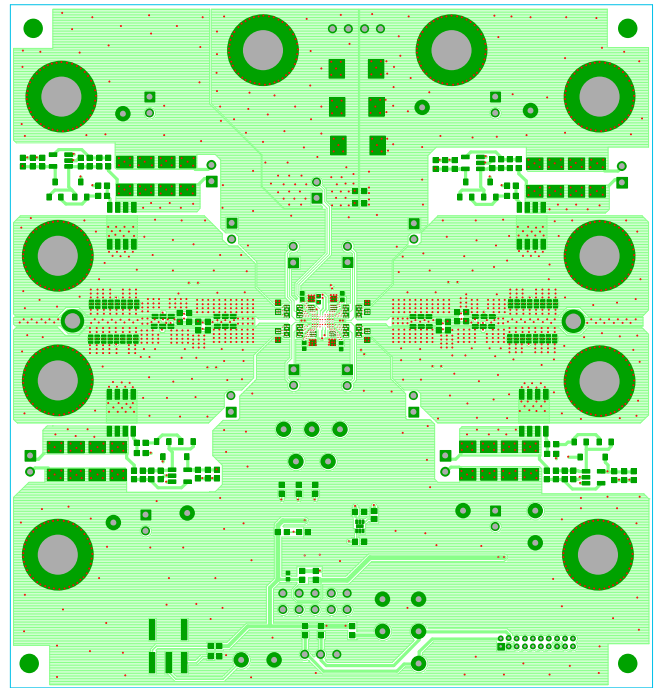
Figure 17. Top Silkscreen Layer
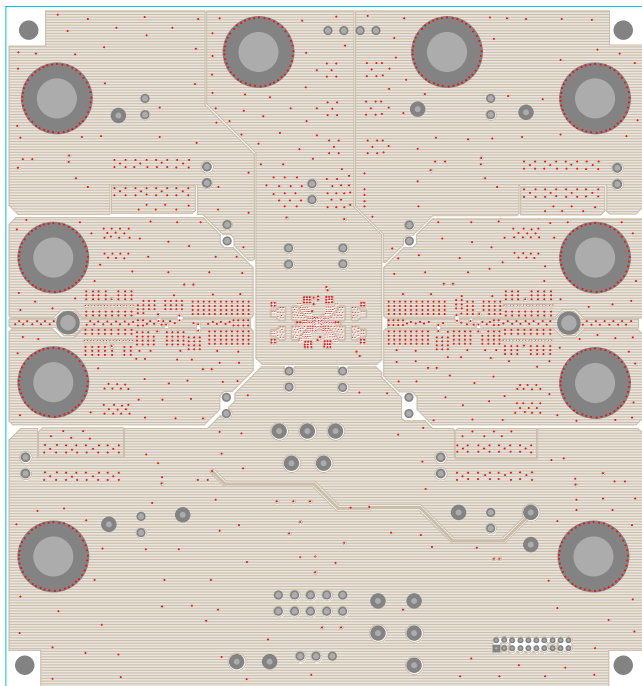

Figure 18. Top Layer

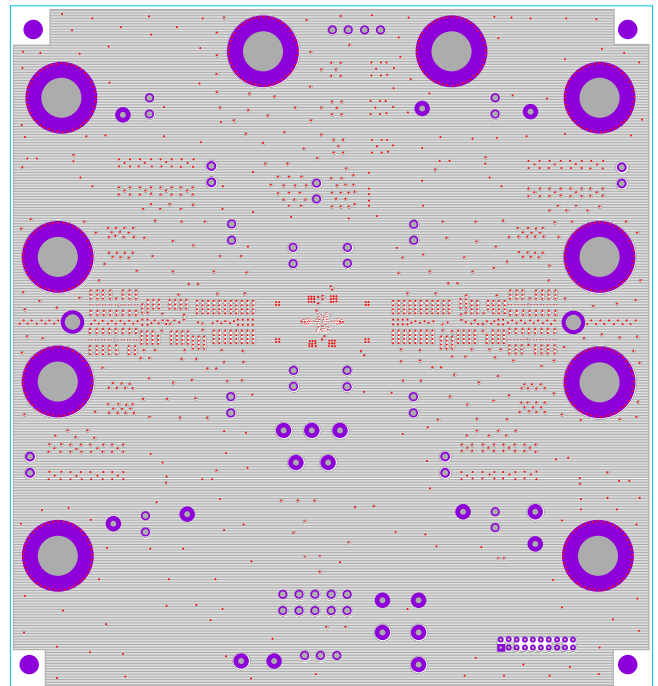Figure 19. Layer 2 (PVIN Plane)
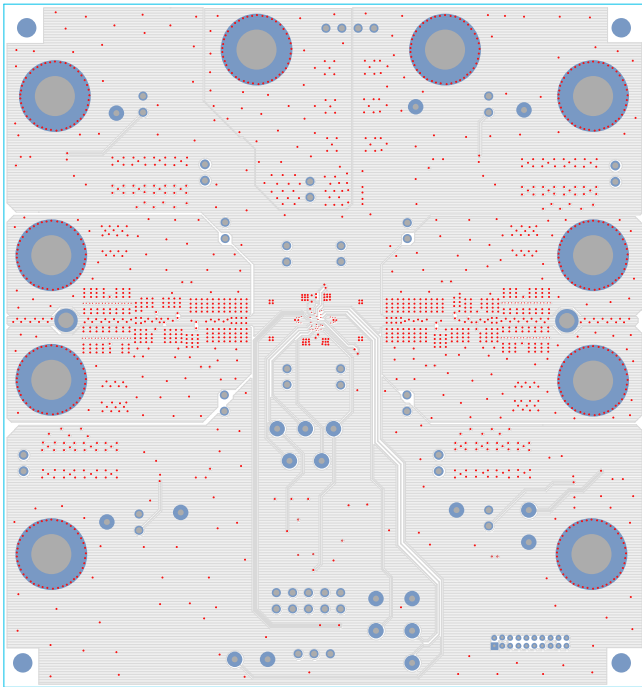

Figure 20. Layer 3 (GND Plane)

Figure 21. Layer 4 (IO Communications)
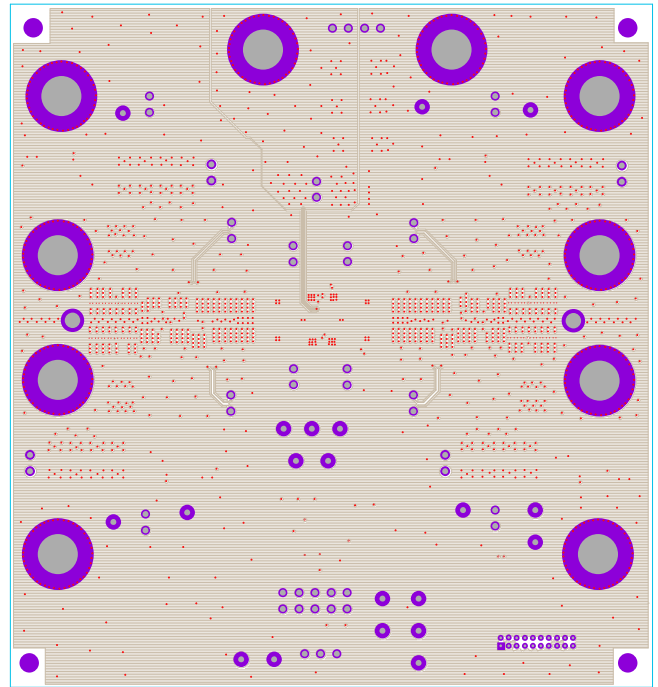

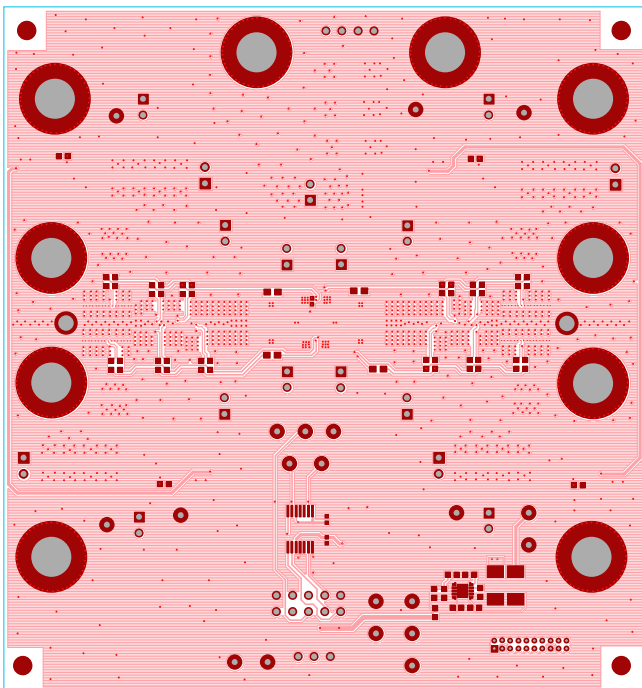Figure 22. Layer 5 (GND Plane)

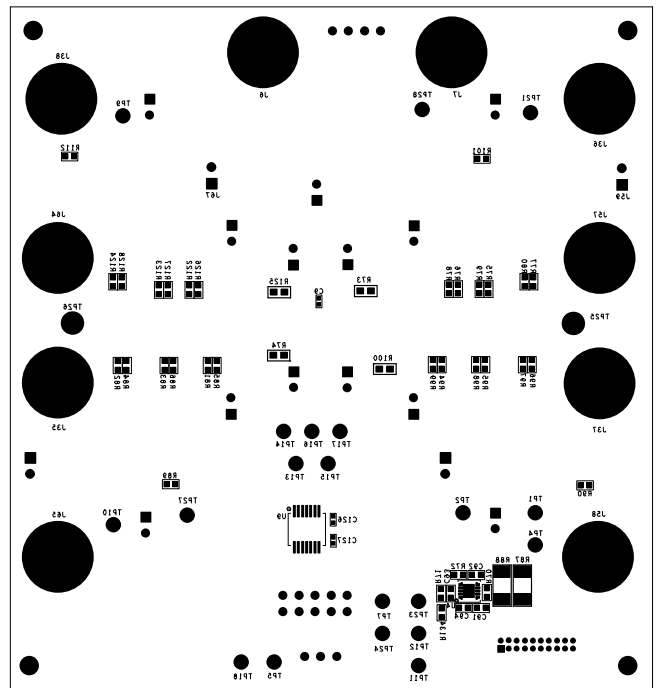Figure 23. Bottom Layer (Remote Sense Lines)

Figure 24. Bottom Silk Screen Layer

4. Typical Performance Curves
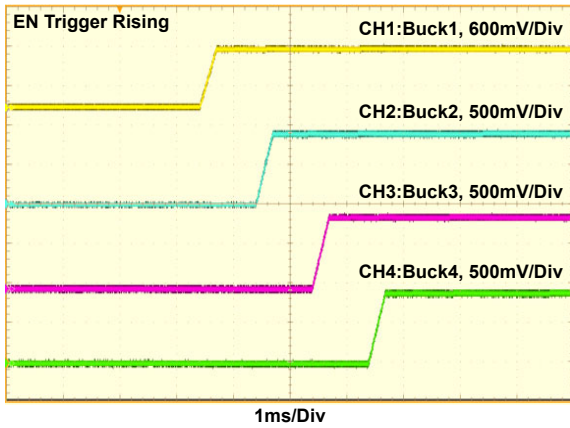

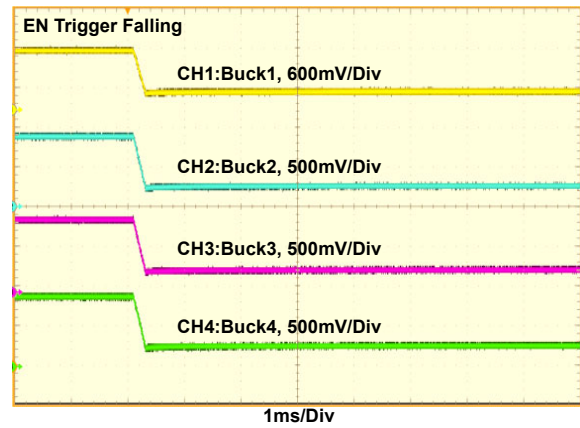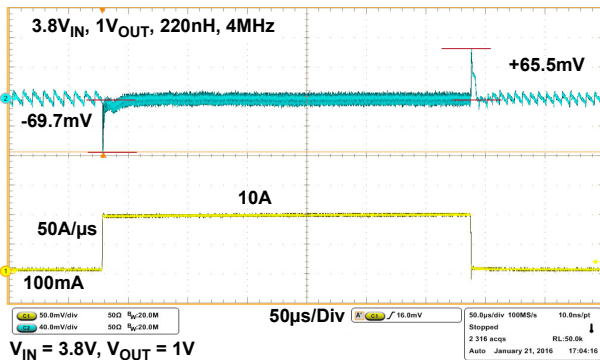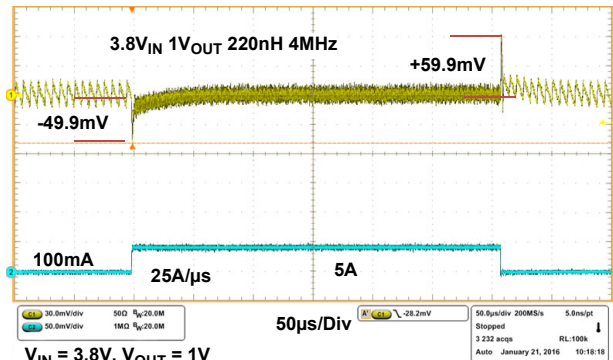**Figure 25. Startup by EN, VOUT1, 2, 3, 4 = 0.9V**

Figure 26. Shutdown by EN, VOUT1, 2, 3, 4 = 0.9V

V_{IN} = 3.8V, V_{OUT} = 1V
Load Step Slew Rate: 50A/µs, 0.1A to 10A
220nH Inductor (Cyntec)
3x22µF Capacitor (0603 6.3V Murata)
6x4.7µF Capacitor (0603 10V)

Figure 27. Dual-Phase Load Transient (10A/200ns)

V_{IN} = 3.8V, V_{OUT} = 1V
Load Step Slew Rate: 25A/µs, 0.1A to 5A
220nH Inductor (Cyntec)
1x22µF Capacitor (0603 6.3V Murata)
6x4.3µF Capacitor (Low ESL)

Figure 28. Single-Phase Transient (5A/200ns)

5.   Revision History

Rev.	Date	Description
2.00	Sep.25.19	Added Revision History Updated to new template. Page 1, Specifications - updated bullets: from: • DVS slew rate of 2.5mV/µs to: • Default DVS slew rate of 3mV/µs. from: • Power-up sequence: SW1→SW2→SW3→SW4, 1ms delay between each rail to: • Power-up sequence: VOUT1→VOUT2→VOUT3→VOUT4, 1ms delay between each rail from: • Power-down sequence: SW1-4 power down at the same time to: • Power-down sequence: VOUT1-4 power down at the same time Updated VIN supply to 2.5V to 5.5V Updated Figure 1. Updated Table 1 Removed Note from Operating Range section. Setup Guide step 2 updated from: Connect a power supply to J6 to: Connect a power supply to J6 and J7. Updated Note in I^{2}C and SPI Communications section. Updated Evaluation Software Installation and User section. Updated board photos, schematics, PCB layouts.

Notice

1. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation or any other use of the circuits, software, and information in the design of your product or system. Renesas Electronics disclaims any and all liability for any losses and damages incurred by you or third parties arising from the use of these circuits, software, or information.

2. Renesas Electronics hereby expressly disclaims any warranties against and liability for infringement or any other claims involving patents, copyrights, or other intellectual property rights of third parties, by or arising from the use of Renesas Electronics products or technical information described in this document, including but not limited to, the product data, drawings, charts, programs, algorithms, and application examples.

3. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.

4. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.

5. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.

    "Standard":   Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; industrial robots; etc.

    "High Quality": Transportation equipment (automobiles, trains, ships, etc.); traffic control (traffic lights); large-scale communication equipment; key financial terminal systems; safety control equipment; etc.

    Unless expressly designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not intended or authorized for use in products or systems that may pose a direct threat to human life or bodily injury (artificial life support devices or systems; surgical implantations; etc.), or may cause serious property damage (space system; undersea repeaters; nuclear power control systems; aircraft control systems; key plant systems; military equipment; etc.). Renesas Electronics disclaims any and all liability for any damages or losses incurred by you or any third parties arising from the use of any Renesas Electronics product that is inconsistent with any Renesas Electronics data sheet, user's manual or other Renesas Electronics document.

6. When using Renesas Electronics products, refer to the latest product information (data sheets, user's manuals, application notes, "General Notes for Handling and Using Semiconductor Devices" in the reliability handbook, etc.), and ensure that usage conditions are within the ranges specified by Renesas Electronics with respect to maximum ratings, operating power supply voltage range, heat dissipation characteristics, installation, etc. Renesas Electronics disclaims any and all liability for any malfunctions, failure or accident arising out of the use of Renesas Electronics products outside of such specified ranges.

7. Although Renesas Electronics endeavors to improve the quality and reliability of Renesas Electronics products, semiconductor products have specific characteristics, such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Unless designated as a high reliability product or a product for harsh environments in a Renesas Electronics data sheet or other Renesas Electronics document, Renesas Electronics products are not subject to radiation resistance design. You are responsible for implementing safety measures to guard against the possibility of bodily injury, injury or damage caused by fire, and/or danger to the public in the event of a failure or malfunction of Renesas Electronics products, such as safety design for hardware and software, including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult and impractical, you are responsible for evaluating the safety of the final products or systems manufactured by you.

8. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. You are responsible for carefully and sufficiently investigating applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive, and using Renesas Electronics products in compliance with all these applicable laws and regulations. Renesas Electronics disclaims any and all liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.

9. Renesas Electronics products and technologies shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations. You shall comply with any applicable export control laws and regulations promulgated and administered by the governments of any countries asserting jurisdiction over the parties or transactions.

10. It is the responsibility of the buyer or distributor of Renesas Electronics products, or any other party who distributes, disposes of, or otherwise sells or transfers the product to a third party, to notify such third party in advance of the contents and conditions set forth in this document.

11. This document shall not be reprinted, reproduced or duplicated in any form, in whole or in part, without prior written consent of Renesas Electronics.

12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products.

(Note1) "Renesas Electronics" as used in this document means Renesas Electronics Corporation and also includes its directly or indirectly controlled subsidiaries.

(Note2) "Renesas Electronics product(s)" means any product developed or manufactured by or for Renesas Electronics.

(Rev.4.0-1 November 2017)

ISL91211BII-EV1Z