



A New Direction in Mixed-Signal

August 2014

XR76108 and XR76112

8A and 12A Synchronous Step Down COT Regulator

Rev. 2.0.0

GENERAL DESCRIPTION

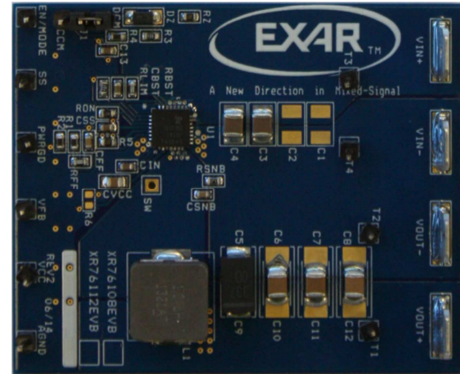
The XR76108 and XR76112 are synchronous step-down regulators combining the controller, drivers, bootstrap diode and MOSFETs in a single package for point-of-load supplies. The XR76108 has a load current rating of 8A and the XR76112 has a load current rating of 12A. A wide 4.5V to 22V input voltage range allows for single supply operation from industry standard 5V, 12V and 19.6V rails.

With a proprietary emulated current mode Constant On-Time (COT) control scheme, the XR76108 and XR76112 provide extremely fast line and load transient response using ceramic output capacitors. They require no loop compensation, simplifying circuit implementation and reducing overall component count. The control loop also provides 0.25% load and 0.1% line regulation and maintains constant operating frequency. A selectable power saving mode, allows the user to operate in discontinuous mode (DCM) at light current loads thereby significantly increasing the converter efficiency.

A host of protection features, including over-current, over-temperature, short-circuit and UVLO, help achieve safe operation under abnormal operating conditions.

The XR76108/12 are available in a RoHS-compliant, green/halogen-free space-saving QFN 5x5mm package.

EVALUATION BOARD MANUAL



FEATURES

- 8A and 12A Step Down Regulators
 - 4.5V to 5.5V Low V_{IN} Operation
 - 4.5V to 22V Wide Single Input Voltage
 - $\geq 0.6V$ Adjustable Output Voltage
- Controller, drivers, bootstrap diode and MOSFETs integrated in one package
- Proprietary Constant On-Time Control
 - No Loop Compensation Required
 - Ceramic Output Cap. Stable operation
 - Programmable 200ns-2 μ s On-Time
 - Quasi Constant 200kHz-800kHz Freq
 - Selectable CCM or CCM/DCM Operation

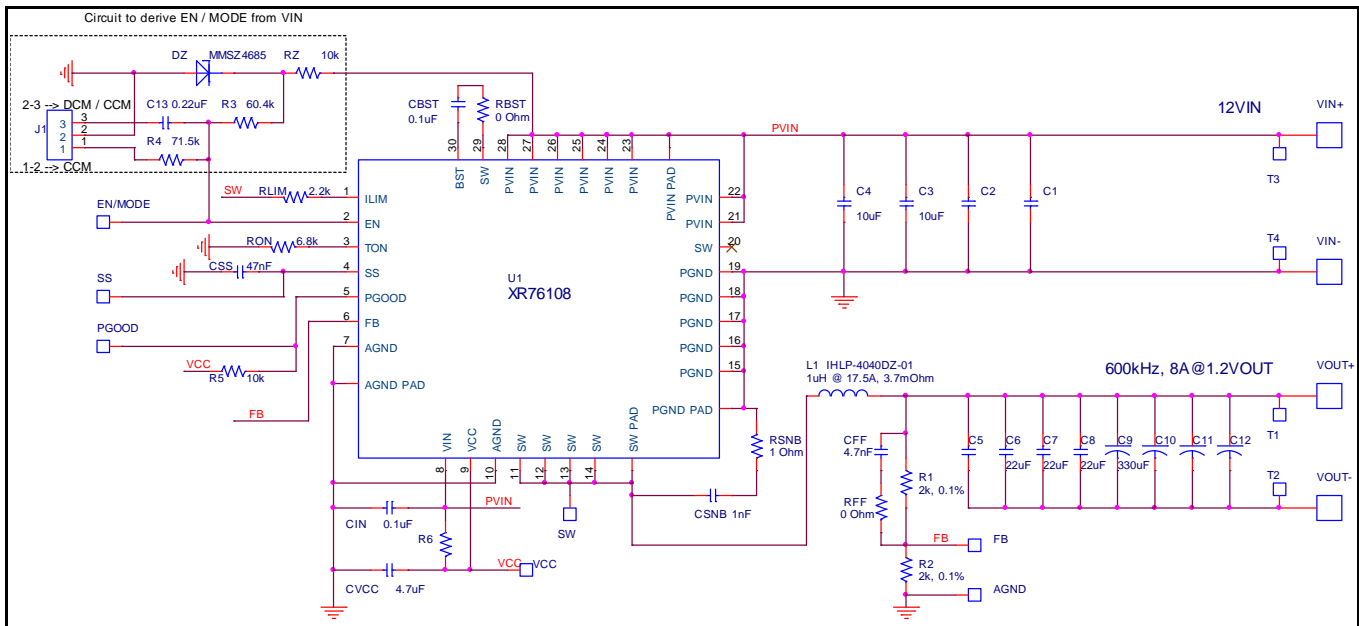


Fig. 1: XR76108 Evaluation Board Schematics

PIN ASSIGNMENT

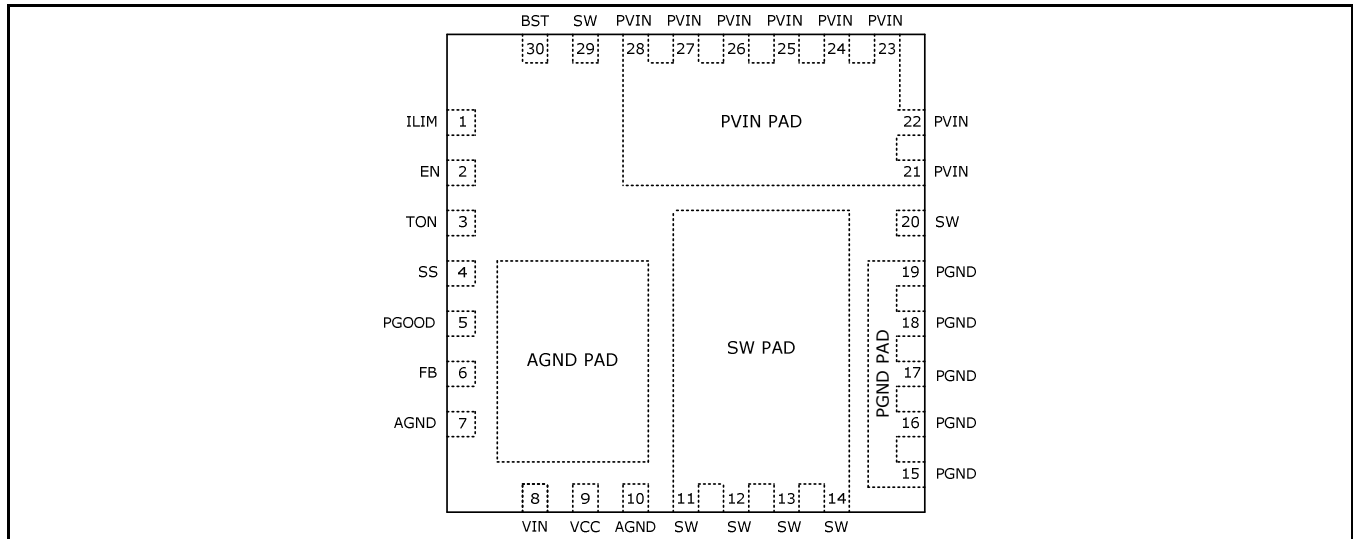


Fig. 2: XR76108 and XR76112 Pin Assignment

PIN DESCRIPTION

Name	Pin Number	Description
ILIM	1	Over-current protection programming. Connect with a resistor to SW.
EN/MODE	2	Precision enable pin. Pulling this pin above 1.9V will turn the regulator on and it will operate in CCM. If the voltage is raised above 3.0V then the regulator will operate in DCM/CCM depending on load.
TON	3	Constant on-time programming pin. Connect with a resistor to AGND.
SS	4	Soft-Start pin. Connect an external capacitor between SS and AGND to program the soft-start rate based on the 10uA internal source current.
PGOOD	5	Power-good output. This open-drain output is pulled low when V_{OUT} is outside the regulation.
FB	6	Feedback input to feedback comparator. Connect with a set of resistors to V_{OUT} and AGND in order to program V_{OUT} .
AGND	7, 10, AGND Pad	Signal ground for control circuitry. Connect AGND Pad with a short trace to pins 7 and 10.
VIN	8	Supply input for the regulator's LDO. Normally it is connected to PVIN.
VCC	9	The output of regulator's LDO. For operation using a 5V rail, VCC should be shorted to VIN.
SW	11-14, 20, 29, SW Pad	Switch node. Drain of the low-side N-channel MOSFET. Source of the high-side MOSFET is wire-bonded to the SW Pad. Pins 20 and 29 are internally connected to SW pad.
PGND	15-19, PGND Pad	Ground of the power stage. Should be connected to the system's power ground plane. Source of the low-side MOSFET is wire-bonded to PGND Pad.
PVIN	21-28, PVIN Pad	Input voltage for power stage. Drain of the high-side N-channel MOSFET.
BST	30	High-side driver supply pin. Connect the bootstrap capacitor between BST and pin 29.

ORDERING INFORMATION

Refer to XR76108 and XR76112's datasheet and/or www.exar.com for exact and up to date ordering information.

USING THE EVALUATION BOARD

POWERING UP

Connect the VIN+/VIN- with short/thick leads to power supply. Use test pins T3 and T4 to monitor VIN+ and VIN- respectively. Connect VOUT+/VOUT- with short/thick leads to an electronic load. Use test pins T1 and T2 to monitor VOUT+ and VOUT- respectively. Apply 12V using the power supply. The XR761XXEVB should power up and regulate the output at 1.2V. Input voltage range is from 5V to 22V. Maximum rated current for XR76108 and XR76112 is 8A and 12A respectively.

JUMPER J1

If the jumper is set to CCM position the regulator will operate in "forced CCM".

If the Jumper is set to DCM position the regulator will operate in DCM at light load. Transition from DCM to CCM is at approximately 1.5A.

USING EXTERNAL "EN/MODE" SIGNAL

Remove the jumper from the 3-pin connector and resistor R3. Use an auxiliary supply to apply voltage to "EN/MODE" pin. For

$2V \leq V_{EN} \leq 2.8V$ the regulator will operate in FORCED CCM. For $3.1V \leq V_{EN} \leq 5.5V$ the regulator will operate in DCM/CCM depending on load current. Note that for DCM/CCM operation the signal has to be sequenced with respect to V_{OUT} as explained in the datasheet.

OPERATION FROM A 5V RAIL ($V_{IN}=4.5V-5.5V$)

For operation from a 5V rail it is recommended to tie output of the LDO to V_{IN} by populating R6 with a 0Ω resistor. This enhances the operation of the drivers at $V_{IN} < 5V$. Please remember to remove R6 for operation at higher V_{IN} .

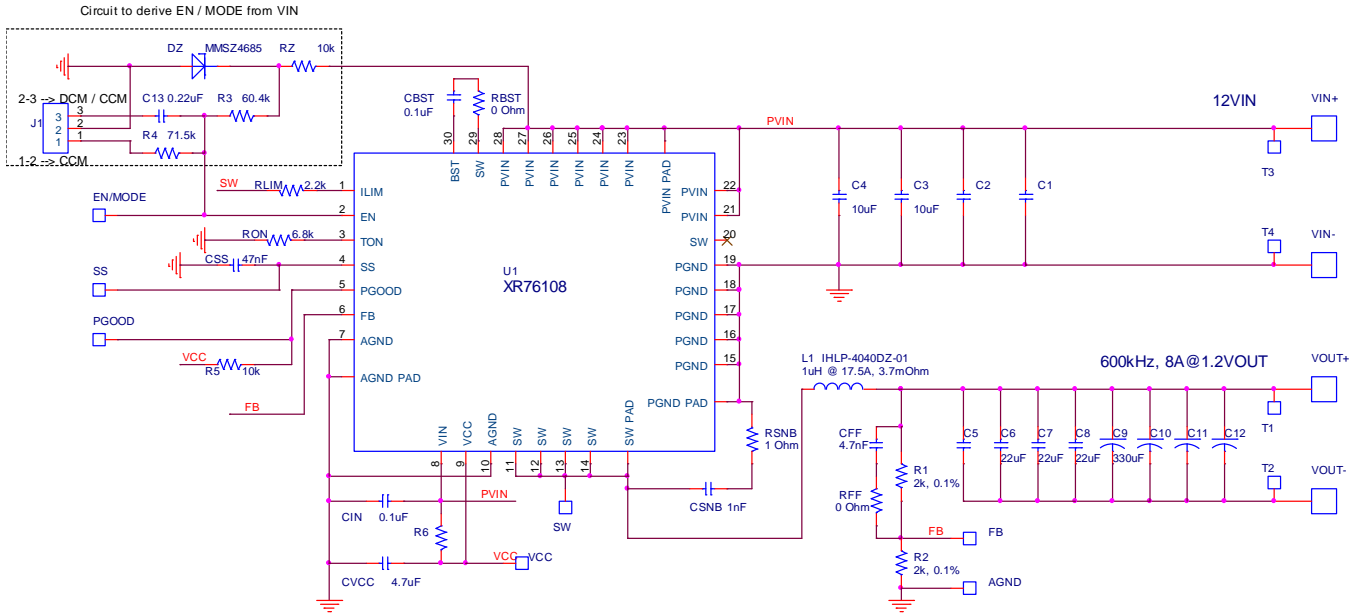
PROGRAMMING THE OUTPUT VOLTAGE

V_{OUT} can be programmed by changing R1 according to:

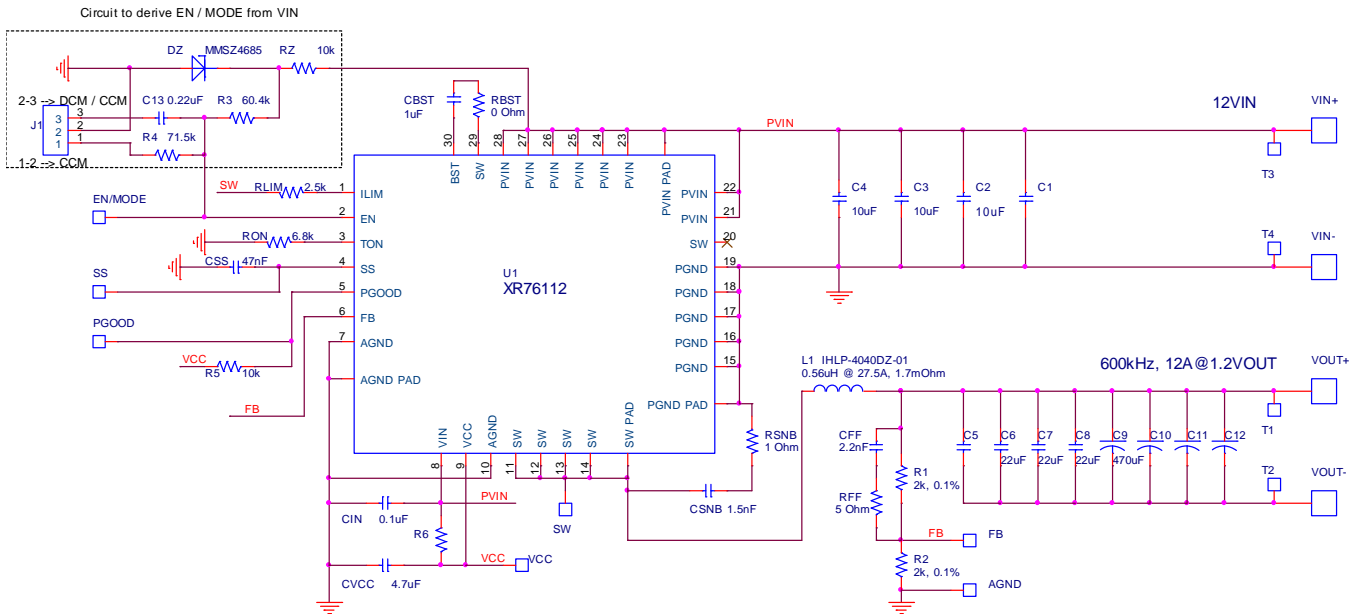
$$R1 = R2 \times \left(\frac{V_{OUT}}{0.6} - 1 \right)$$

Note that capacitor C9 has a voltage rating of 2V. Remove C9 when programming $V_{OUT} > 1.8V$.

EVALUATION BOARD SCHEMATICS



XR76108 EVB schematic



XR76112 EVB schematic

XR76108 BILL OF MATERIAL

Reference Designator	Qty.	Manufacturer	Manufacturer Part Number	Size	Component
PCB	1	Exar	XR76108EVB		XR76108 Evaluation kit
U1	1	Exar	XR76108	QFN 5x5mm	Constant On-Time Power Blox
L1	1	VISHAY	IHLP4040DZER1R0M01	10.3x10.9mm	Power Inductor, 1uH, 17.5A
DZ	1	On Semi	MMSZ4685T1G	SOD-123	3.6Volt Zener
C9	1	Murata	ECASD60D337M007K00	7343	Cap. Alum. Polymer 330uF, 2V, 20%
C3,C4	2	Murata	GRM32ER7YA106KA12L	1210	Cap. Cer. 10uF, 35V, 10%, X7R
C6, C7, C8	3	Murata	GRM32ER71C226KE18L	1210	Cap. Cer. 22uF, 16V, 10%, X7R
CVCC	1	Murata	GRM21BR71C475KA73L	0805	Cap. Cer. 4.7, 16V, 10%, X7R
CSS	1	Murata	GRM188R71C473KA01D	0603	Cap. Cer. 47nF, 50V, 10%, X7R
C13	1	Murata	GRM188R71E224KA88D	0603	Cap. Cer. 0.22uF, 25V, 10%, X7R
CBST, CIN	2	Murata	GRM188R71H104KA93D	0603	Cap. Cer. 0.1 uF, 50V, 10%, X7R
Csnb	1	Murata	GRM188R71H102KA01D	0603	Cap.. Cer. 1nF, 50v, 10%, X7R
CFF	1	Murata	GRM188R71H472KA01D	0603	Cap. Cer. 4700pF, 50V, 10%, X7R
R1, R2	2	PANASONIC	ERA-3AEB202V	0603	Resistor 2K Ohm, 0.1%, SMD
RZ, R5	2	PANASONIC	ERJ-3EKF1002	0603	Resistor 10K Ohm, 1%, SMD
RLIM	1	PANASONIC	ERJ-3EKF2201V	0603	Resistor 2.2K Ohm, 1%, SMD
RON	1	PANASONIC	ERJ-3EKF6801V	0603	Resistor 6.8K Ohm, 1%, SMD
Rsnb	1	PANASONIC	ERJ-3RQF1R0V	0603	Resistor 1 Ω , 1%, SMD
R3	1	PANASONIC	ERJ-3EKF6042V	0603	Resistor 60.4K Ohm, 1%, SMD
R4	1	PANASONIC	ERJ-3EKF7152V	0603	Resistor 71.5K Ohm, 1%, SMD
RBST,RFF	2	PANASONIC	ERJ-3GEY0R00V	0603	Resistor 0 Ω , 5%, SMD
J1	1	Wurth Elektronik	61300311121	0.1x0.1in	Conn.Header 1x3
VIN+, VIN-, VOUT+, VOUT-	4	Wurth Elektronik	7471287	0.32X0.10in	Mounting Tabs
T1, T2, T3, T4, EN/MODE, SS, PWRGD, VCC, AGND	9	Wurth Elektronik	61300111121	0.1x0.1in	SINGLE Test Point Post

XR76112 BILL OF MATERIAL

Reference Designator	Qty.	Manufacturer	Manufacturer Part Number	Size	Component
PCB	1	Exar	XR76112EVB		XR76112 Evaluation kit
U1	1	Exar	XR76112EL-F	QFN 5x5mm	Constant On-Time Power Blox
L1	1	VISHAY	IHLP4040DZERR56M01	10.3x10.9mm	Power Inductor, 0.56uH, 27A
DZ	1	On Semi	MMSZ4685T1G	SOD-123	3.6Volt Zener
C9	1	Murata	ECASD60D477M006K00	7343	Cap. Alum. Polymer 470uF, 2V, 20%
C2,C3,C4,	3	Murata	GRM32ER7YA106KA12L	1210	Cap. Cer. 10uF, 35V, 10%, X7R
C6, C7, C8	3	Murata	GRM32ER71C226KE18L	1210	Cap. Cer. 22uF, 16V, 10%, X7R
CVCC	1	Murata	GRM21BR71C475KA73L	0805	Cap. Cer. 4.7, 16V, 10%, X7R
CSS	1	Murata	GRM188R71C473KA01D	0603	Cap. Cer. 47nF, 50V, 10%, X7R
CBST	1	Murata	GRM188R71C105KA12D	0603	Cap. Cer. 1uF, 16V, 10%, X7R
CIN	1	Murata	GRM188R71H104KA93D	0603	Cap. Cer. 0.1 uF, 50V, 10%, X7R
C13	1	Murata	GRM188R71E224KA88D	0603	Cap. Cer 0.22uF, 25V, 10%, X7R
Csnb	1	Murata	GRM188R71H152KA01D	0603	Cap.. Cer. 1.5nF, 50v, 10%, X7R
CFF	1	Murata	GRM188R71H222KA01D	0603	Cap. Cer. 2200pF, 50V, 10%, X7R
R1, R2	2	Panasonic	ERA-3AEB202V	0603	Resistor 2K Ohm, 0.1%, SMD
RZ, R5	2	Panasonic	ERJ-3EKF1002V	0603	Resistor 10K Ohm, 1%, SMD
RLIM	1	Panasonic	ERJ-3EKF2491V	0603	Resistor 2.49K Ohm, 1%, SMD
RON	1	Panasonic	ERJ-3EKF6801V	0603	Resistor 6.8K Ohm, 1%, SMD
Rsnb	1	Panasonic	ERJ-3RQF1R0V	0603	Resistor 1Ω, 1%, SMD
R4	1	Panasonic	ERJ-3EKF7152V	0603	Resistor 71.6K Ohm, 1%, SMD
R3	1	Panasonic	ERJ-3EKF6042V	0603	Resistor 60.4K Ohm, 1%, SMD
RFF	1	Panasonic	ERJ-3GEYJ5R1V	0603	Resistor 5.1 Ohm, 5%, SMD
RBST	1	Panasonic	ERJ-3GEY0R00V	0603	Resistor 0Ω, Jumper, SMD
J1	1	Würth Elektronik	61300311121	0.1x0.1in	Conn.Header 1x3
VIN+, VIN-, VOUT+, VOUT-	4	Würth Elektronik	7471287	0.32X0.10in	Mounting Tabs
T1, T2, T3, T4, EN/MODE, SS, PWRGD, VCC, AGND	9	Würth Elektronik	61300111121	0.1x0.1in	SINGLE Test Point Post

EVALUATION BOARD LAYOUT

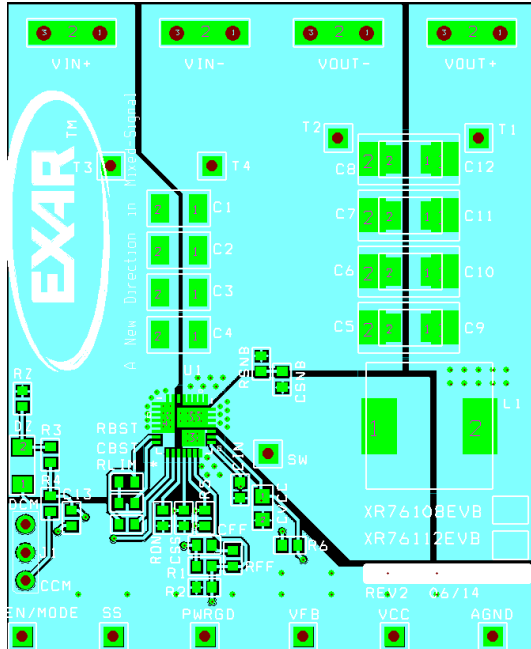


Fig. 3: Component Placement – Top Side

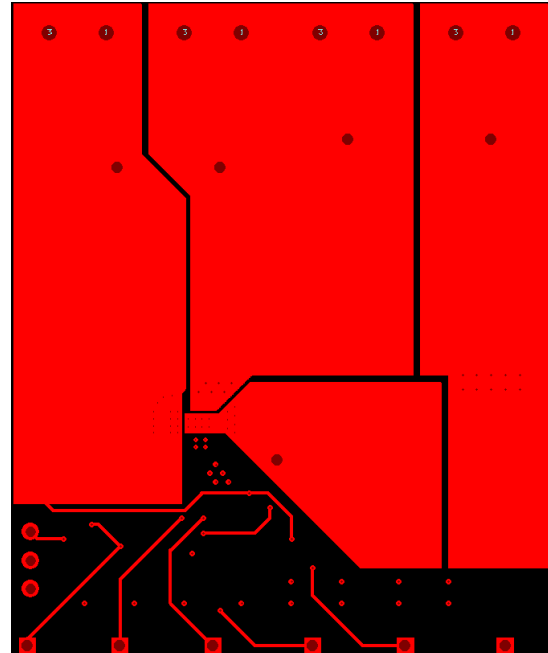


Fig. 4: Bottom Side

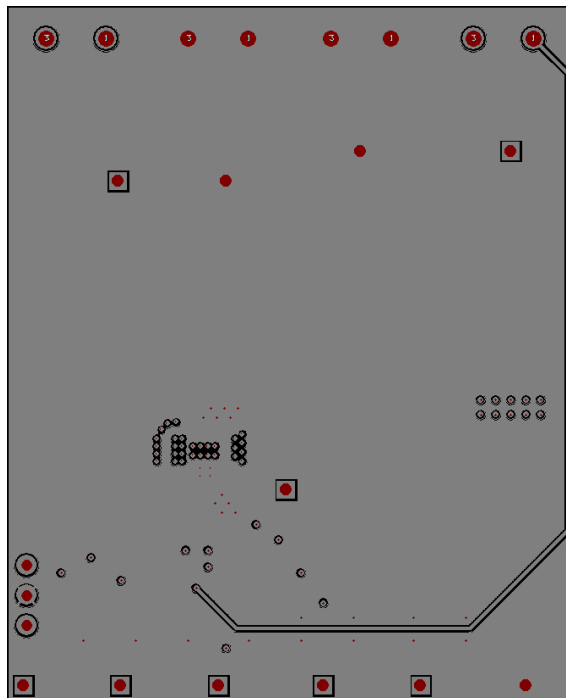


Fig. 5: Layer 2

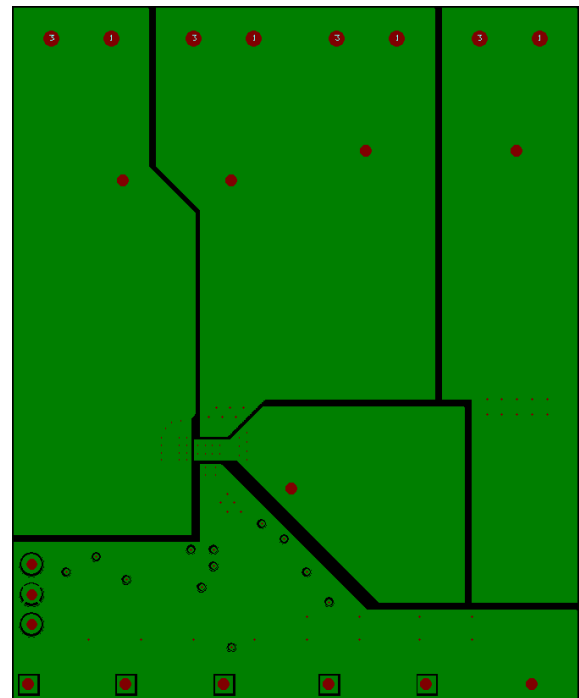


Fig. 6: Layer 3



DOCUMENT REVISION HISTORY

Revision	Date	Description
1.0.0	3/20/14	Initial release of document
2.0.0	8/15/14	Updated EVB picture, circuit schematics, BOM and layout. Added to "Using the Evaluation Board".

BOARD REVISION HISTORY

Board Revision	Date	Description
146-6712-1	3/20/14	Initial release of evaluation board
REV2	6/14	EVB modified to allow CCM or CCM/DCM mode of operation

FOR FURTHER ASSISTANCE

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