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Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

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Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China





22V, 15A Synchronous Step Down COT Power Module

December 2014

Rev. 1A

GENERAL DESCRIPTION

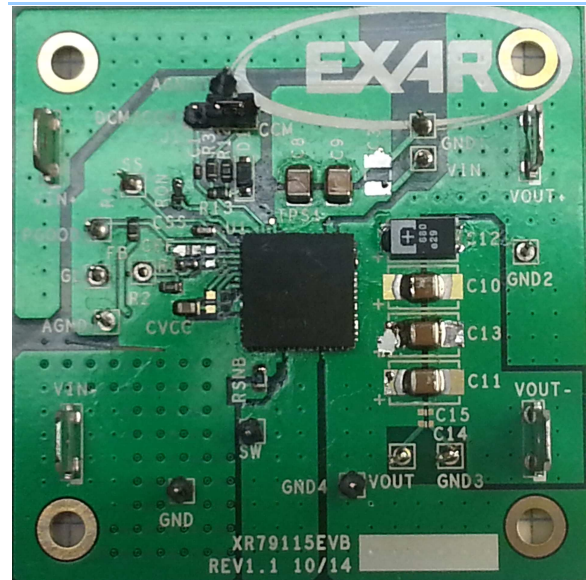
The XR79115 is a 15A synchronous step-down Power Module for point-of load supplies. A wide 5V to 22V input voltage range allows for single supply operation from industry standard 5V, 12V, and 19.6V rails.

With a proprietary emulated current mode Constant On-Time (COT) control scheme, the XR79115 provides extremely fast line and load transient response using ceramic output capacitors. It requires no loop compensation hence simplifying circuit implementation and reducing overall component count. The control loop also provides 0.35% 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. With a 96% peak efficiency and 90% for loads as low as 100mA, the XR79115 is suitable for applications where low power losses are important.

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

The XR79115 is available in a RoHS compliant, green/halogen free space-saving 68-pin 12x12x4mm QFN package. With integrated controller, drivers, bootstrap diode and capacitor, MOSFETs, inductor, CIN and COUT, this solution allows the smallest possible 15A POL design.

EVALUATION BOARD MANUAL



FEATURES

- Controller, drivers, bootstrap diode and capacitor, MOSFETs, Inductor, CIN and COUT integrated in one package
- 15A Step Down Module
 - Wide 5V to 22V Input Voltage Range
 - $\geq 0.6V$ Adjustable Output Voltage
- Proprietary Constant On-Time Control
 - No Loop Compensation Required
 - Ceramic Output Cap. Stable operation
 - Programmable 200ns-2 μ s On-Time
 - Constant 400kHz-600kHz freq.
 - Selectable CCM or CCM/DCM Operation
- 68-pin 12x12x4mm QFN package

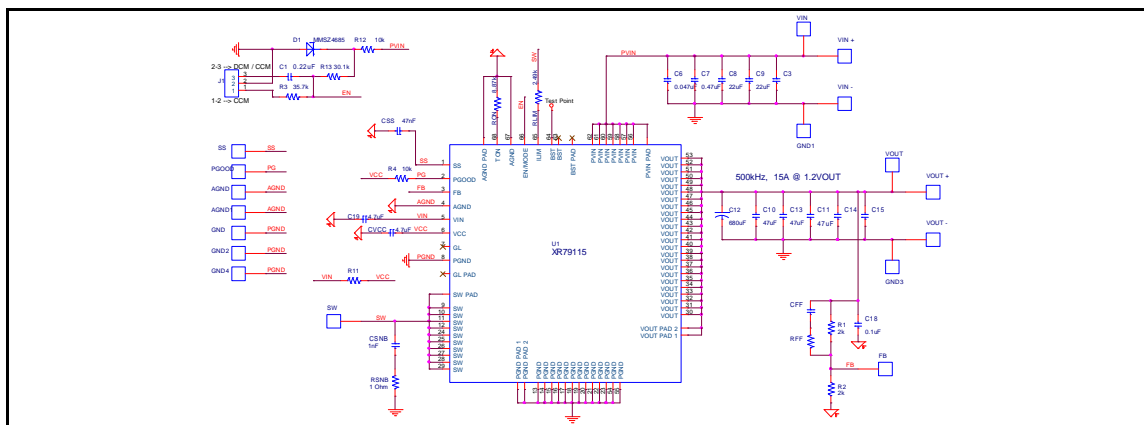


Fig. 1: XR79115 Evaluation Board Schematics



22V, 15A Synchronous Step Down COT Power Module

PIN ASSIGNMENT

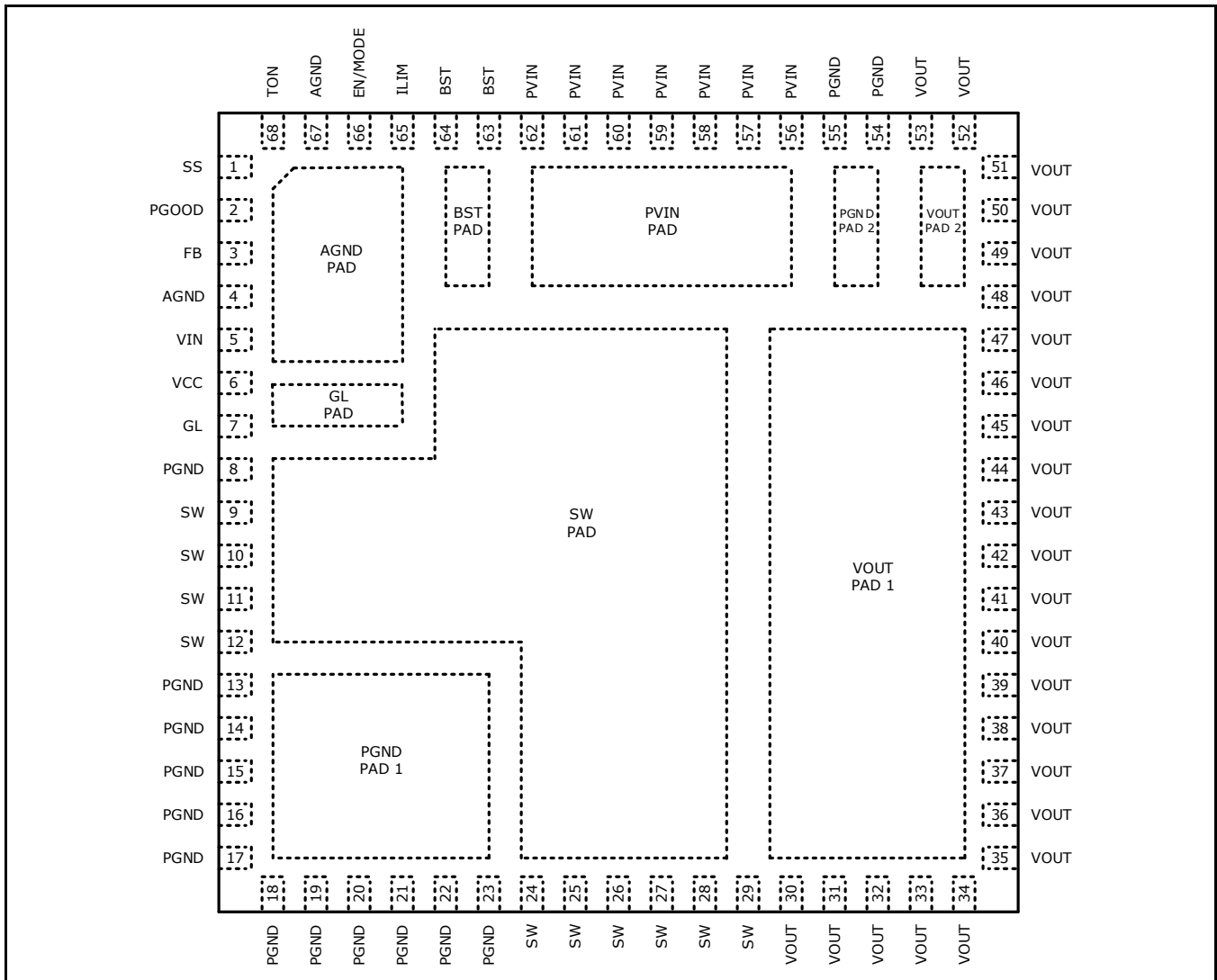


Fig. 2: XR79115 Pin Assignment

**22V, 15A Synchronous Step Down COT Power Module****PIN DESCRIPTION**

Pin No.	Pin Name	Type	Description
1	SS	A	Soft-start pin. Connect an external capacitor between SS and AGND to program the soft-start rate based on the 10uA internal source current.
2	PGOOD	OD, O	Power-good output. This open-drain output is pulled low when V _{OUT} is outside the regulation.
3	FB	A	Feedback input to feedback comparator. Connect with a set of resistors to V _{OUT} and AGND in order to program V _{OUT} .
4, 67, AGND Pad	AGND	A	Analog ground. Control circuitry of the IC is referenced to this pin.
5	VIN	PWR	IC supply input. Provides power to internal LDO.
6	VCC	PWR	The output of LDO. Bypass with a 4.7uF capacitor to AGND. For operation from a 5V _{IN} rail, VCC should be tied to VIN.
7, GL pad	GL	O	Driver output for Low-side N-channel synchronous MOSFET. It is internally connected to the gate of the FET. Leave this pin floating.
8	PGND	PWR	Controller low-side driver ground. Connect with a short trace to closest PGND pins or PGND pad.
13-23, 54, 55, PGND pads	PGND	PWR	Ground of the power stage. Should be connected to the system's power ground plane.
9-12, 24- 29, SW Pad	SW	PWR	Switching node. It is internally connected. Use thermal vias and/or sufficient PCB land area in order to heatsink the low-side FET and the inductor.
30-53, VOUT pads	VOUT	PWR	Output of the power stage. Place the output filter capacitors as close as possible to these pins.
56-62, PVIN Pad	PVIN	PWR	Power stage input voltage. Place the input filter capacitors as close as possible to these pins.
63, 64, BST Pad	BST	A	Controller high-side driver supply pin. It is internally connected to SW via a 0.1uF bootstrap capacitor. Leave these pins floating.
65	ILIM	A	Over-current protection programming. Connect with a short trace to SW pins.
66	EN/MODE	I	Precision enable pin. Pulling this pin above 1.9V will turn the IC on and it will operate in Forced CCM. If the voltage is raised above 3.0V, then the IC will operate in DCM or CCM depending on load.
68	TON	A	Constant on-time programming pin. Connect with a resistor to AGND.

Type: A = Analog, I = Input, O = Output, I/O = Input/Output, PWR = Power, OD = Open-Drain

ORDERING INFORMATION

Refer to XR79115 datasheet and/or www.exar.com for exact and up to date ordering information.

**22V, 15A Synchronous Step Down COT Power Module**

USING THE EVALUATION BOARD**POWERING UP**

Connect the VIN+/VIN- with short/thick leads to power supply. Use test pins VIN and GND1 to monitor VIN+ and VIN- respectively. Connect VOUT+/VOUT- with short/thick leads to an electronic load. Use test pins VOUT and GND3 to monitor VOUT+ and VOUT- respectively. Apply 12V using the power supply. The XR79115EVB should power up and regulate the output at 1.2V. Input voltage range is from 5V to 22V. Maximum rated current for XR79115 is 15A.

JUMPER J1

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

If the Jumper is set to DCM/CCM position the Module will operate in DCM at light load. Transition from DCM to CCM is at approximately 5A.

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 R11 with a 0 Ω resistor. This enhances the operation of the drivers at $V_{IN}<5V$. Please remember to remove R11 for operation at higher V_{IN} .

PROGRAMMING THE OUTPUT VOLTAGE

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

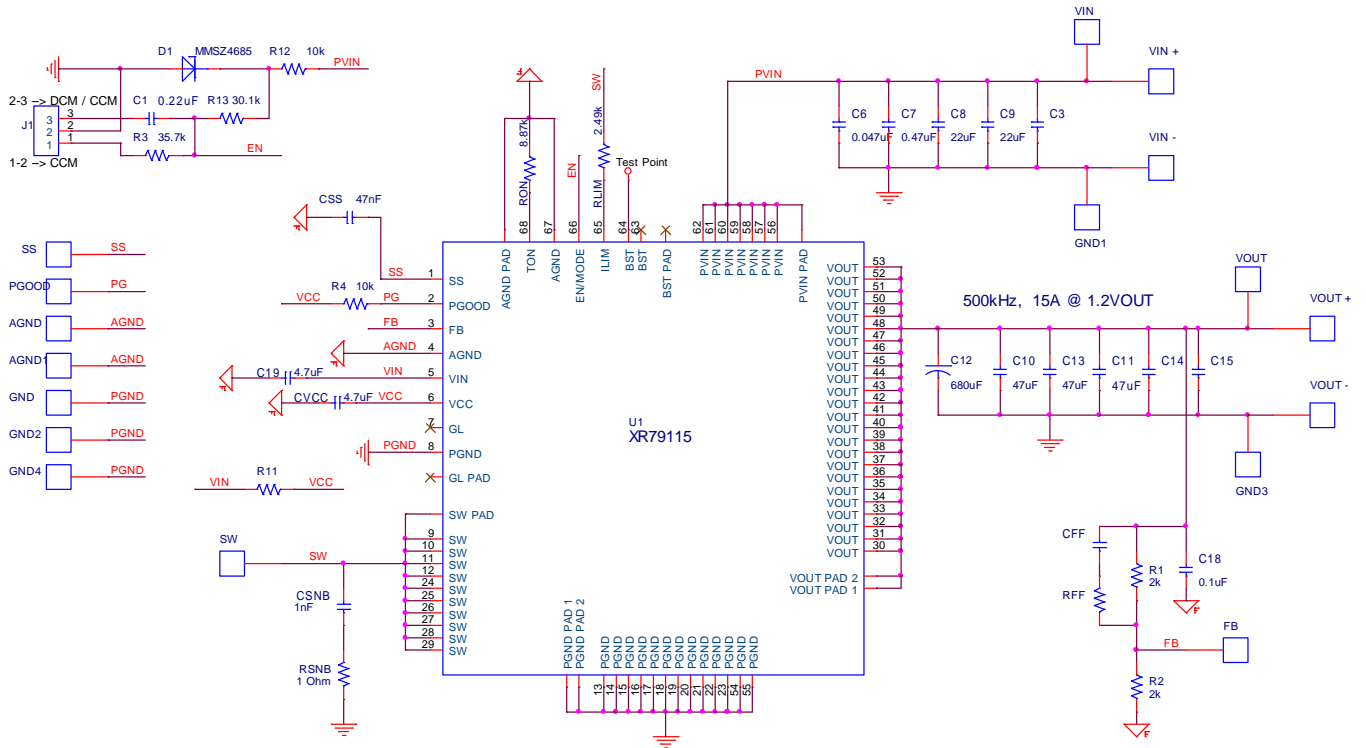
$$R1 = R2 \times \left(\frac{V_{OUT}}{0.6} - 1 \right)$$

Note that capacitor C12 has a voltage rating of 2.5V. Remove C12 when programming $V_{OUT}>2.5V$.



22V, 15A Synchronous Step Down COT Power Module

EVALUATION BOARD SCHEMATICS





22V, 15A Synchronous Step Down COT Power Module

XR79115EVB BILL OF MATERIAL

Reference Designator	Qty.	Manufacturer	Manufacturer Part Number	Size	Component
PCB	1	Exar	XR79115		XR79115 Evaluation kit
U1	1	Exar	XR79115	12x12x4mm QFN	Synchronous Step Down COT Power Module
D1	1	ON SEMI	MMSZ4685T1G	SOD-123	Diode Zener 3.6V, 500MW,
C1	1	MURATA	GRM155R71C224KA12D	0402	CERAMIC CAP., 0.22uF, 16V, X7R, 10%
C8,C9	2	MURATA	GRM32ER71E226KE15L	1210	CERAMIC CAP. 22uF, 25V, X7R, 10%
C19, CVCC	2	MURATA	GRM21BR71C475KA73L	0805	CERAMIC CAP , 4.7uF, 16V, X7R, 10%
C6	1	MURATA	GRM155R71E473KA88D	0402	CERAMIC CAP., 0.047uF, 25V, X7R, 10%
C7	1	MURATA	GRM188R71E474KA12D	0603	CERAMIC AP. , 0.47uF, 25V, X7R, 10%
C12	1	PANASONIC	2R5TPE680MCL	2917	CAP. POSCAP, 680 uF,2.5 V, 10mOhm, 20%
C10,C11,C13	3	MURATA	GRM32ER71A476KE15L	1210	CERAMIC CER, 47uF, 10V, X7R, 10%
C18	1	MURATA	GRM188R71H104KA93D	0603	CERAMIC CAP. 0.1uF, 50V,X7R,10%
CSNB	1	MURATA	GRM188R71H102KA01D	0603	CERAMIC CAP. 1.0 nF, 50V,X7R,10%
CSS	1	MURATA	GRM188R71H473KA61D	0603	CERAMIC CAP. 0.047uF, 50V,X7R,10%
C18	1	MURATA	GRM188R71H104KA93D	0603	CERAMIC CAP., 0.1uF, 50V, 10%, X7R
R4,R12	2	PANASONIC	ERJ-3EKF1002V	0603	Resistor 10.0K Ohm, 1/10W, 1%
R13	1	PANASONIC	ERJ-3EKF3012V	0603	Resistor 30.1K Ohm, 1/10W,1%,SMD
R3	1	PANASONIC	ERJ-3EKF3572V	0603	Resistor 35.7K Ohm, 1/10W, 1%, SMD
R1,R2	2	PANASONIC	ERA-3YEB202V	0603	Resistor 2.0K Ohm, 1/10W, 0.1%, SMD
RLIM	1	PANASONIC	ERJ-3EKF2491V	0603	Resistor 2.49K Ohm, 1/10W,1%, SMD
RON	1	PANASONIC	ERJ-3EKF8871V	0603	Resistor 8.87K Ohm, 1/10W,1%, SMD
RSNB		PANASONIC	ERJ-6RQF1R0V	0603	Resistor 1.0 Ohm,1/8W,1%,SMD
J1	1	Würth Elektronik	61300311121		3-PIN CONNECTOR
VIN+, VOUT+, VIN-,VOUT-	4	Würth Elektronik	7471287		CONNECTOR BLADE TERMINAL
AGND1,SS,PGOOD,FB,AGND,GND,SW,GND1,VIN,GND2,VOUT,GND3,GND4, GL	14	Würth Elektronik	61300111121		SINGLE Test Point Post



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EVALUATION BOARD LAYOUT

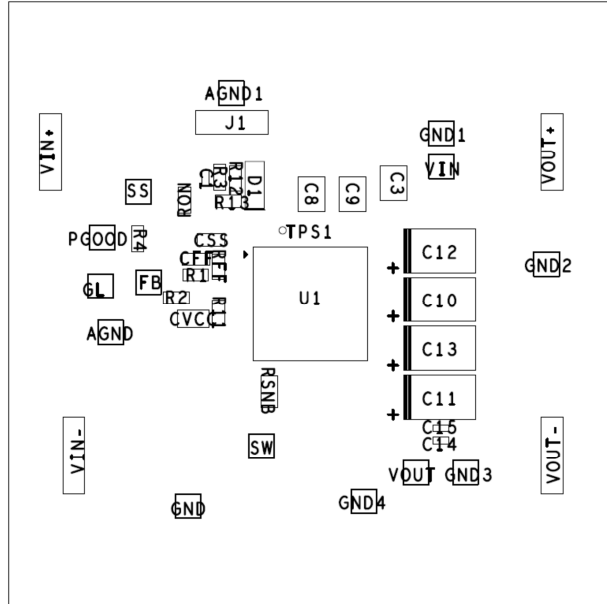


Fig. 3: Assembly Top

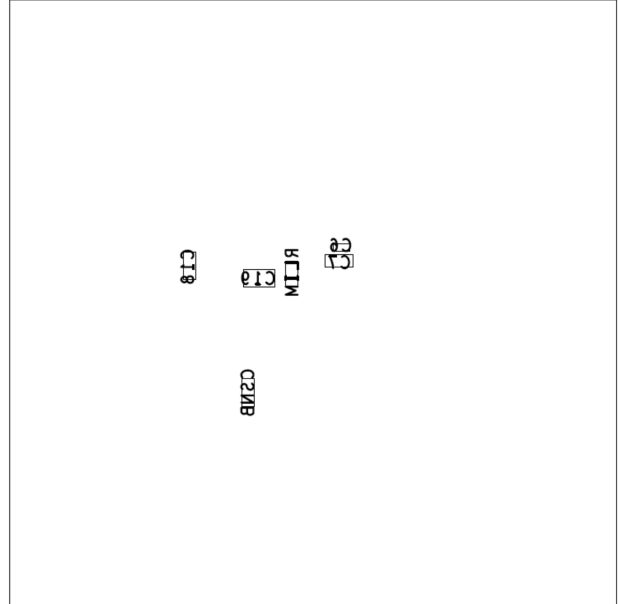


Fig. 4: Assembly Bottom

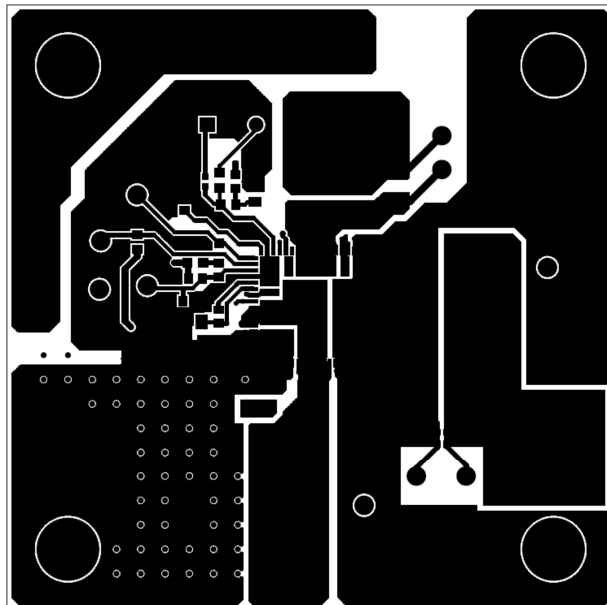


Fig. 5: Top

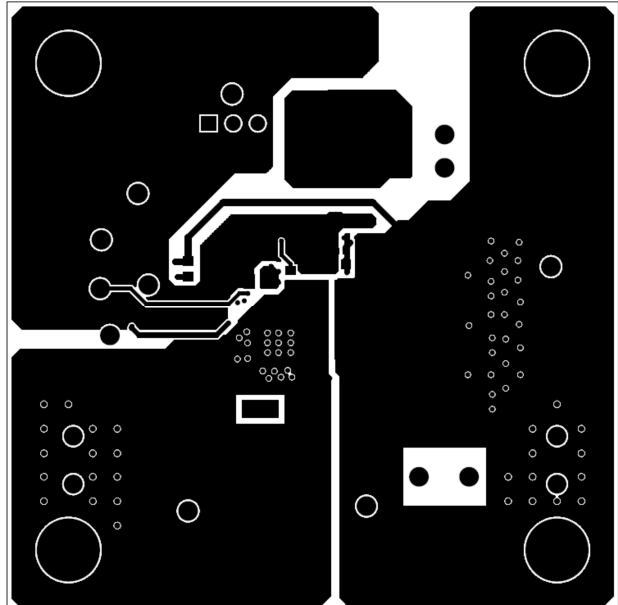


Fig. 6: Bottom



22V, 15A Synchronous Step Down COT Power Module

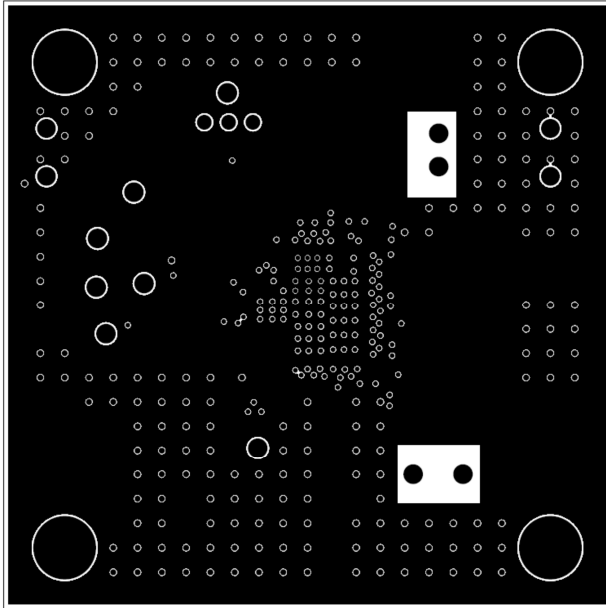


Fig. 7: Layer 2, GND 1

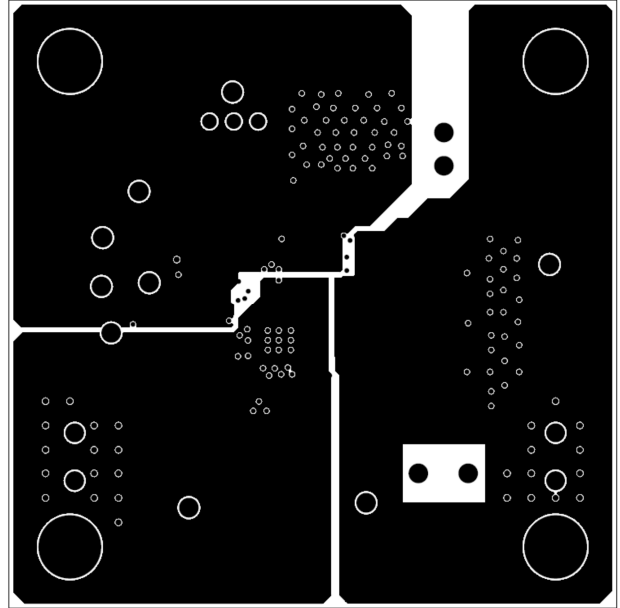


Fig. 8: Layer 3, VCC1

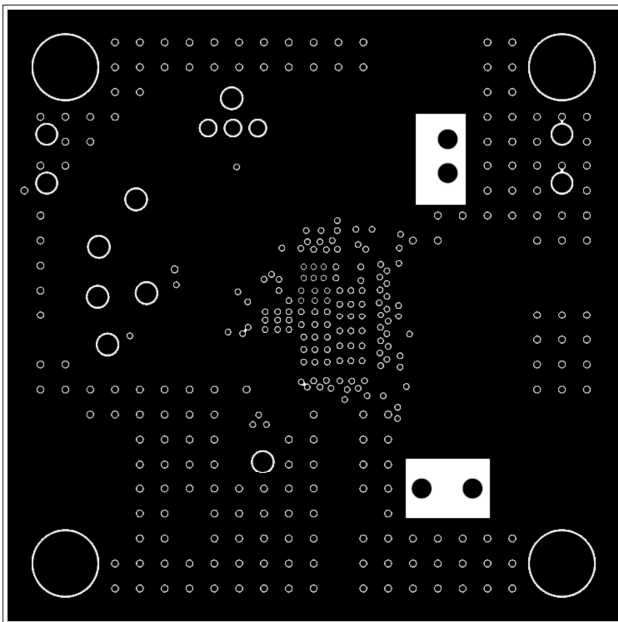


Fig. 9: Layer 4, GND 2

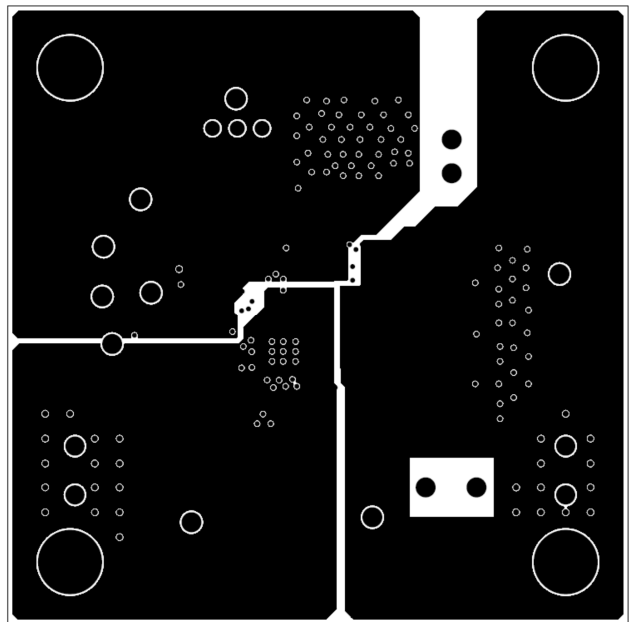


Fig. 10: Layer 5, VCC2



22V, 15A Synchronous Step Down COT Power Module

DOCUMENT REVISION HISTORY

Revision	Date	Description
1A	12/12/14	Initial release of document

BOARD REVISION HISTORY

Board Revision	Date	Description
REV 1.1	12/12/14	Initial release of evaluation board

FOR FURTHER ASSISTANCE

Email:

customersupport@exar.com

powertechsupport@exar.com

Exar Technical Documentation:

<http://www.exar.com/TechDoc/>



EXAR CORPORATION

HEADQUARTERS AND SALES OFFICES

48720 Kato Road

Fremont, CA 94538 – USA

Tel.: +1 (510) 668-7000

Fax: +1 (510) 668-7030

www.exar.com

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