22V, 20A Synchronous Step Down COT Power Module

May 2015 Rev. 1A

GENERAL DESCRIPTION

The XR79120 is a 20A synchronous step-down Power Module for point-of load supplies. 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 XR79120 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 0.12% load and 0.17% 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 93% peak efficiency and 84% for loads as low as 100mA, the XR79120 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 XR79120 is available in a RoHS compliant, green/halogen free space-saving 74-pin 12x14x4mm QFN package. With integrated controller, drivers, bootstrap diode and capacitor, MOSFETs, inductor, CIN and COUT, this solution allows the smallest possible 20A POL design.

EVALUATION BOARD MANUAL

FEATURES

- Controller, drivers, bootstrap diode and capacitor, MOSFETs, Inductor, CIN and COUT integrated in one package
- 20A Step Down Module
  - Wide 4.5V to 22V Input Voltage Range
  - ≥0.6V Adjustable Output Voltage
- Proprietary Constant On-Time Control
  - No Loop Compensation Required
  - Ceramic Output Cap. Stable operation
  - Programmable 200ns-2µs On-Time
  - Constant 400kHz-600kHz freq.
  - Selectable CCM or CCM/DCM Operation
- 74-pin 12x14x4mm QFN package

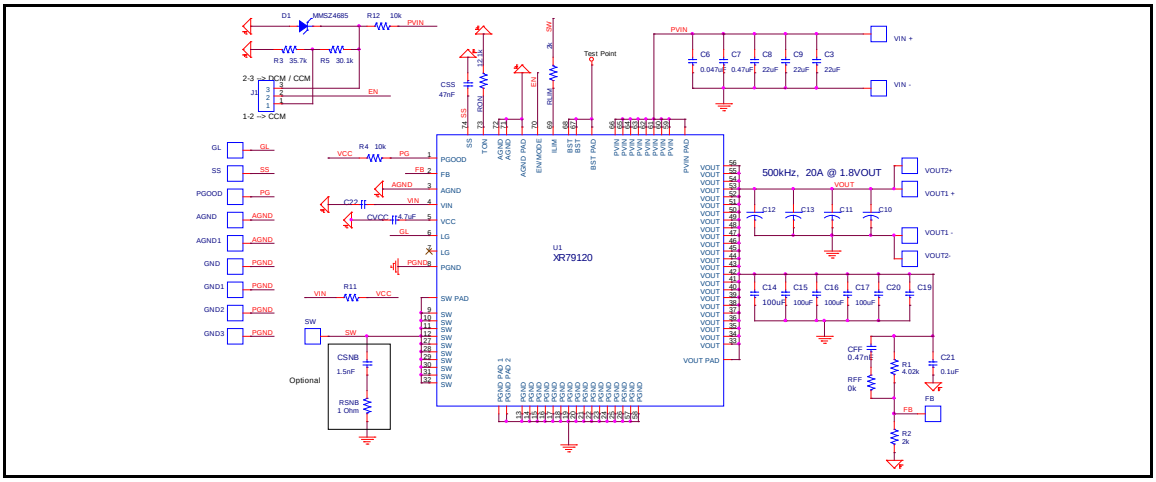


Fig. 1: XR79120 Evaluation Board Schematics

PIN ASSIGNMENT

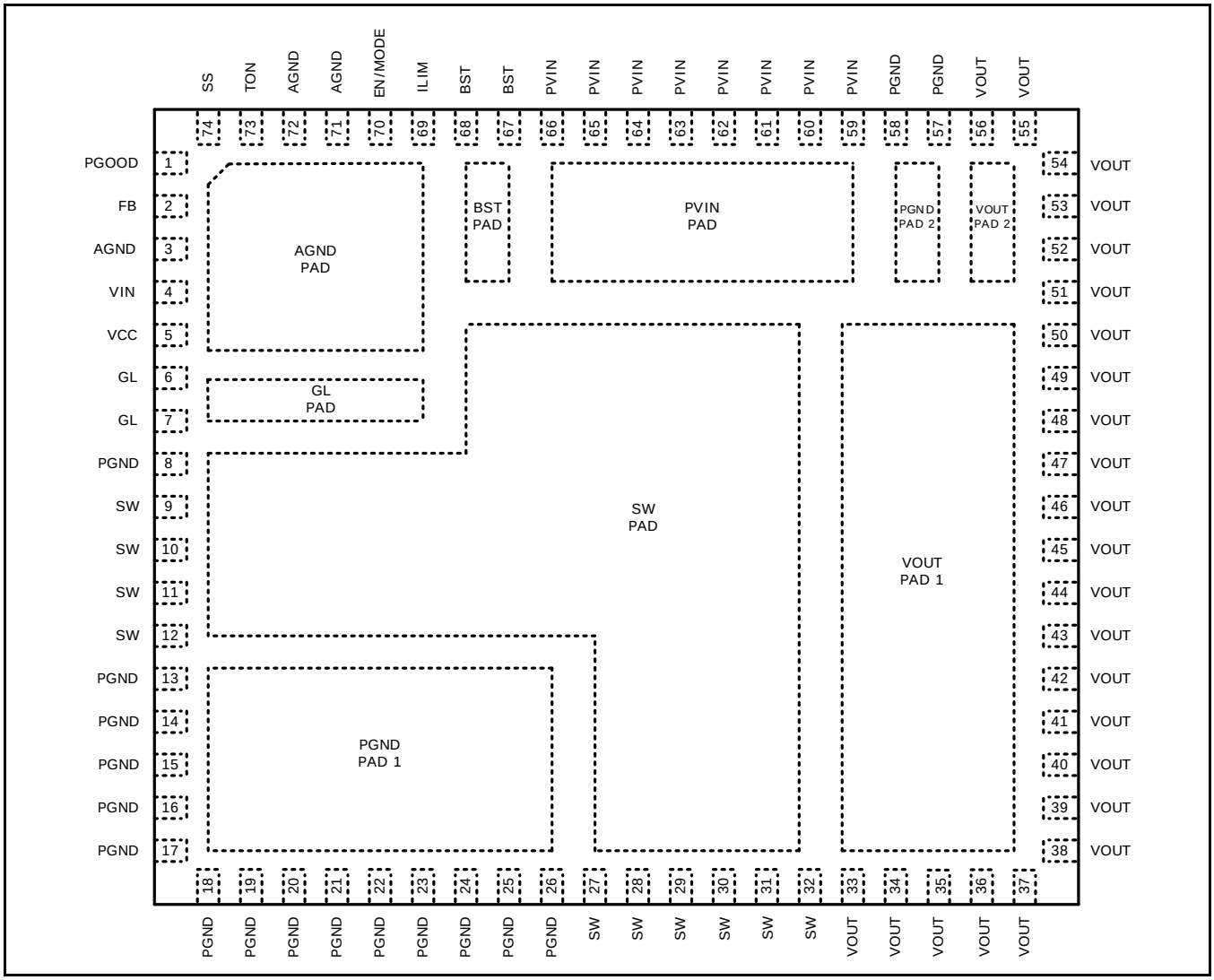


Fig. 2: XR79120 Pin Assignment

PIN DESCRIPTION

Pin No.	Pin Name	Type	Description
1	PGOOD	OD, O	Power-good output. This open-drain output is pulled low when V_{OUT} is outside regulation.
2	FB	A	Feedback input to feedback comparator. Connect with a set of resistors to VOUT and AGND in order to program VOUT.
3, 71, 72, AGND Pad	AGND	A	Analog ground. Control circuitry of the IC is referenced to this pin. Should be connected to PVIN at a single point.
4	VIN	PWR	Controller supply input. Provides power to internal LDO.
5	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.
6, 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.
13-26, 57, 58, PGND pads	PGND	PWR	Ground of the power stage. Should be connected to the system's power ground plane.
9-12, 27-32, 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.
33-56, VOUT pads	VOUT	PWR	Output of the power stage. Place the output filter capacitors as close as possible to these pins.
59-66, PVIN pad	PVIN	PWR	Power stage input voltage. Place the input filter capacitors as close as possible to these pins.
67, 68, 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.
69	ILIM	A	Over-current protection programming. Connect with a short trace to SW pins.
70	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.
73	TON	A	Constant on-time programming pin. Connect with a resistor to AGND.
74	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.

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

ORDERING INFORMATION

Refer to XR79120 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 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 XR79120EVB should power up and regulate the output at 1.8V. Input voltage range is from 4.5V to 22V. Maximum rated current for XR79120 is 20A.

JUMPER J1

If the jumper is set to CCM position (left side) the Module will operate in “forced CCM”.

If the Jumper is set to DCM/CCM position (right side) 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 0Ω resistor. This enhances the operation of the drivers at V_{IN}<5V. Please remember to remove R11 for operation at higher V_{IN}.

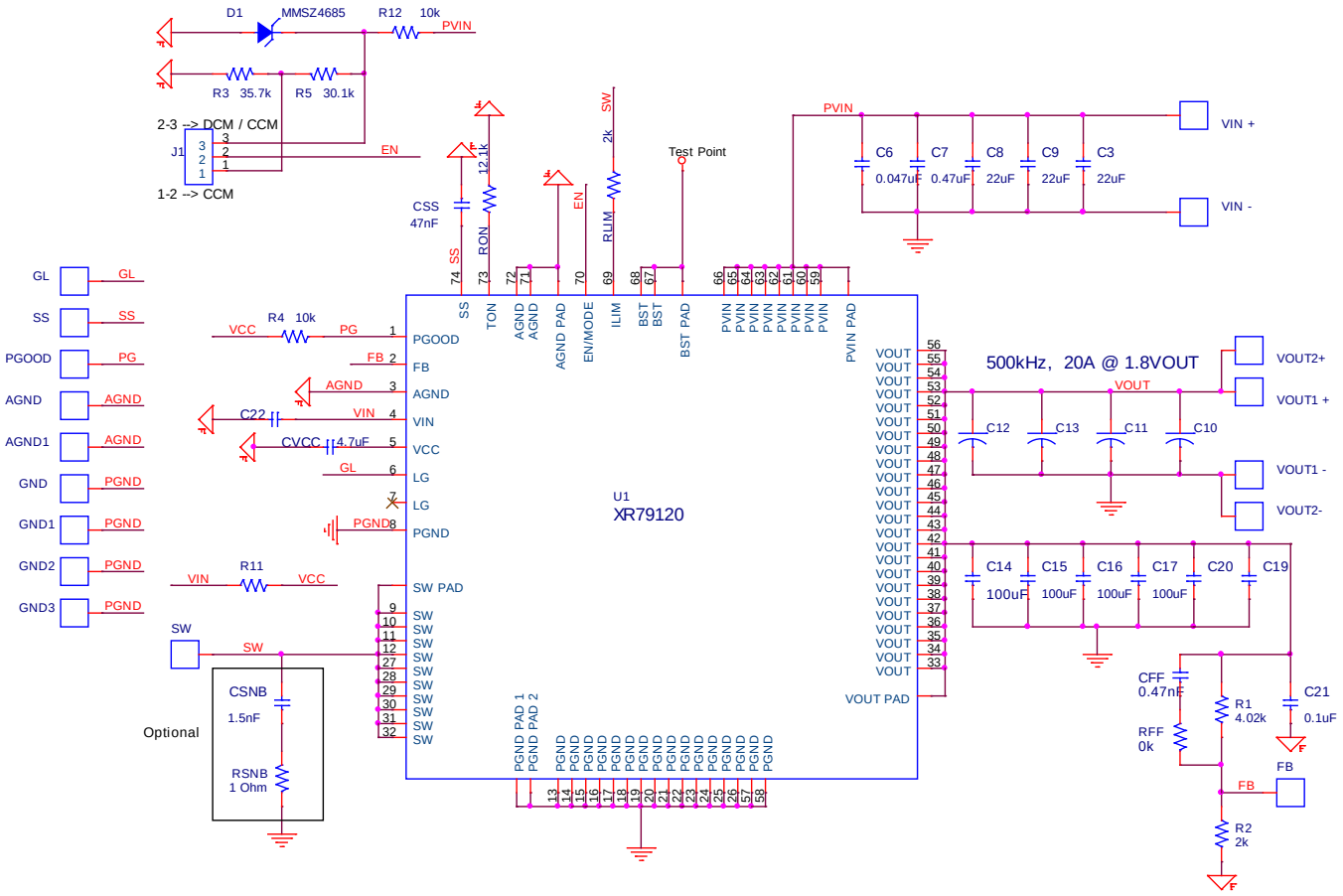
PROGRAMMING THE OUTPUT VOLTAGE

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

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

Where R2 has a nominal value of 2kΩ.

EVALUATION BOARD SCHEMATICS



XR79120EVB BILL OF MATERIAL

Reference Designator	Qty.	Manufacturer	Manufacturer Part Number	Size	Component
PCB	1	Exar	XR79120		XR79120 Evaluation kit
U1	1	Exar	XR79120	12x14x4mm	20A Power Module
D1	1	ON SEMI	MMSZ4685T1G	SOD-123	Diode Zener 3.6V, 500MW,
C3,C8,C9	3	MURATA	GRM32ER71E226KE15L	1210	CERAMIC CAP. 22uF, 25V, X7R, 10%
CVCC	1	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%
CFF	1	MURATA	GRM188R71H471KA01D	0603	CERAMIC CAP ., 470pF, 50V, X7R, 10%
CSNB	1	MURATA	GRM188R71H152KA01D	0603	CERAMIC CAP., 1.5nF, 50V, X7R, 10%
CSS	1	MURATA	GRM188R71H473KA61D	0603	CERAMIC CAP. 0.047uF, 50V,X7R,10%
C14,C15,C16,C17	4	MURATA	GRM32ER60J107ME20L	1210	CERAMIC CAP. 100uF, 6.3V, 20%, X5R
C21	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%
R5	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
RFF	1	PANASONIC	ERJ-3GEY0R00V	0603	Resistor Jumper, 0 Ohm, 1/10W
R1	1	PANASONIC	ERJ-3EKF4021V	0603	Resistor 4.02K Ohm, 1/10W, 1%, SMD
RLIM	1	PANASONIC	ERJ-3EKF2001V	0603	Resistor 2.0K Ohm, 1/10W, 1%, SMD
R2	1	PANASONIC	ERA-3YEB202V	0603	Resistor 2.0K Ohm, 1/10W, 0.1%, SMD
RON	1	PANASONIC	ERJ-3EKF1212V	0603	Resisrtor 12.1K Ohm, 1/10W,1%, SMD
RSNB	1	PANASONIC	ERJ-6RQF1R0V	0805	Resistor 1.0 Ohm,1/8W,1%,SMD
J1	1	Wurth Elektronik	61300311121		3-PIN CONNECTOR
VIN+, VOUT+, VIN-,VOUT-	4	Wurth Elektronik	7471287		CONNECTOR BLADE TERMINAL
AGND,PGOOD,AGND1,GND,SW,GND1,VIN,GND2,VOUT, GND3,GND4, GL	12	Wurth Elektronik	61300111121		SINGLE Test Point Post

EVALUATION BOARD LAYOUT

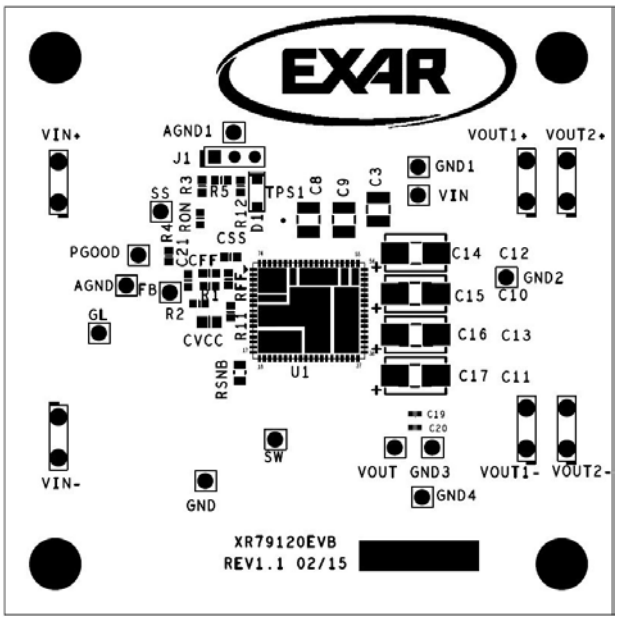


Fig. 3: Assembly Top

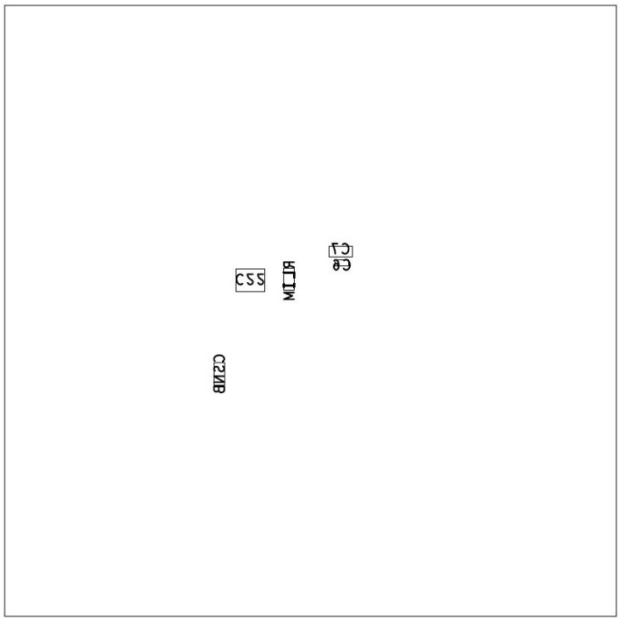


Fig. 4: Assembly Bottom

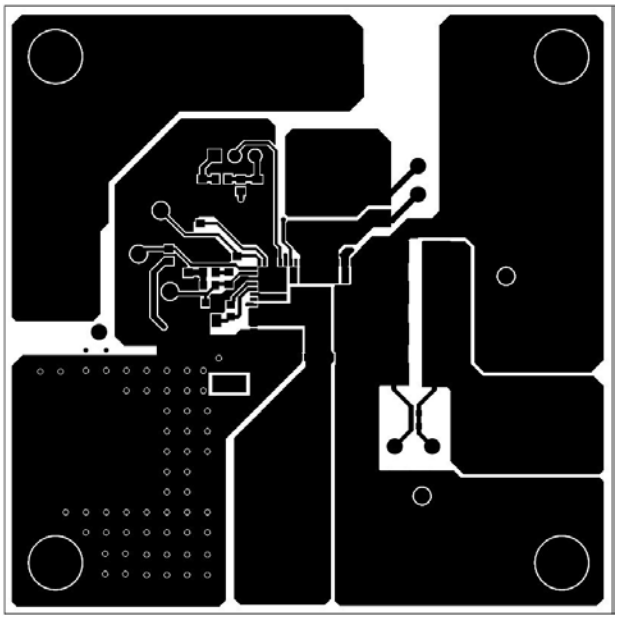


Fig. 5: Top

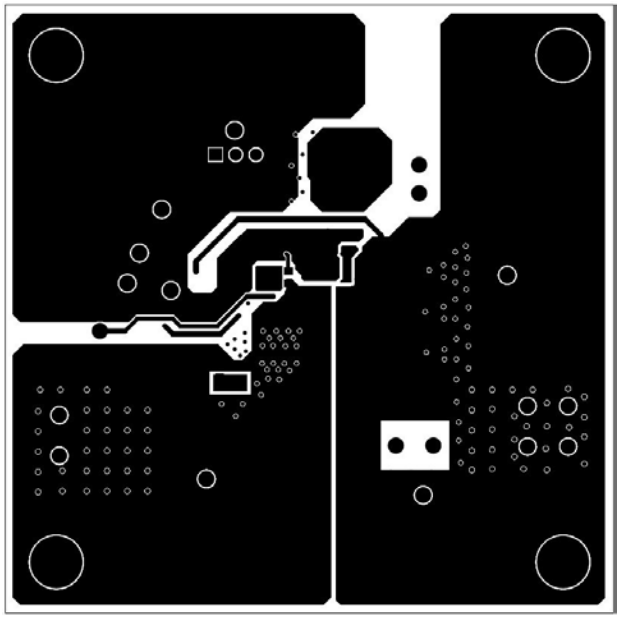


Fig. 6: Bottom

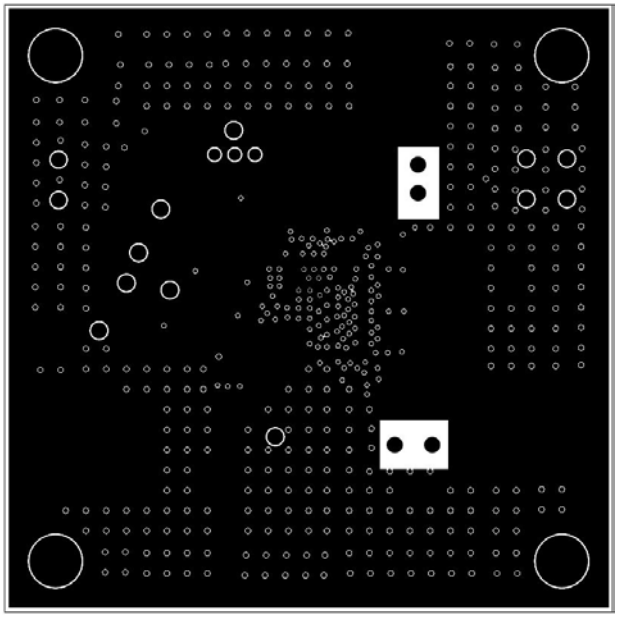


Fig. 7: Layer 2, GND 1

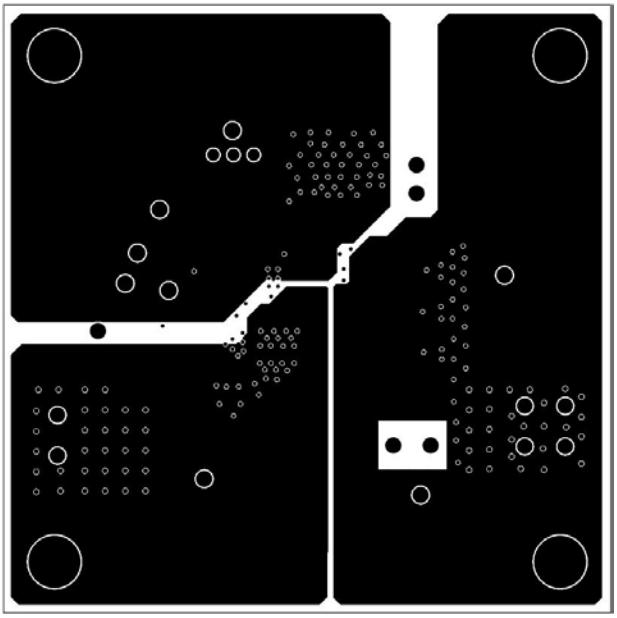


Fig. 8: Layer 3, VCC1

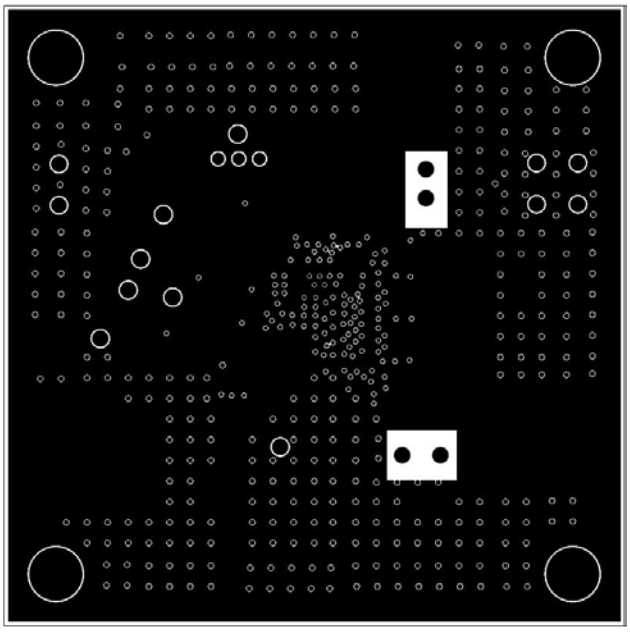


Fig. 9: Layer 4, GND 2

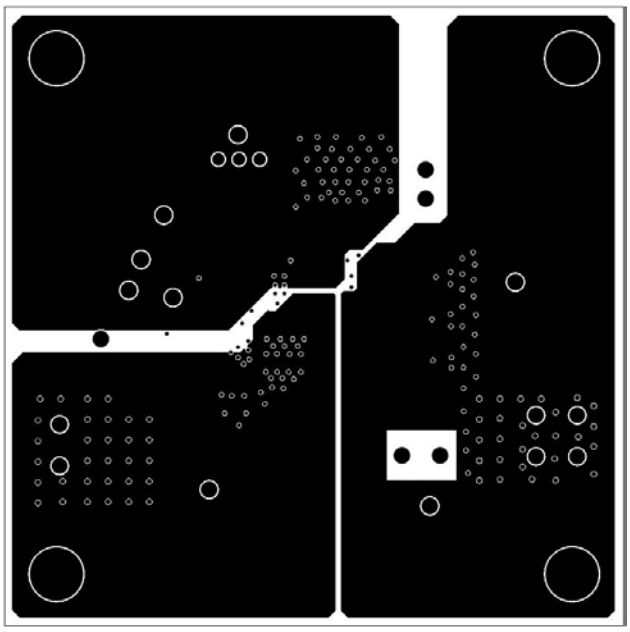


Fig. 10: Layer 5, VCC2

DOCUMENT REVISION HISTORY

Revision	Date	Description
1A	2/15	Initial release of document

BOARD REVISION HISTORY

Board Revision	Date	Description
REV 1.1	2/15	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

NOTICE