EV46B51A

LAN8720A PHY-PoE Daughter Board User Guide

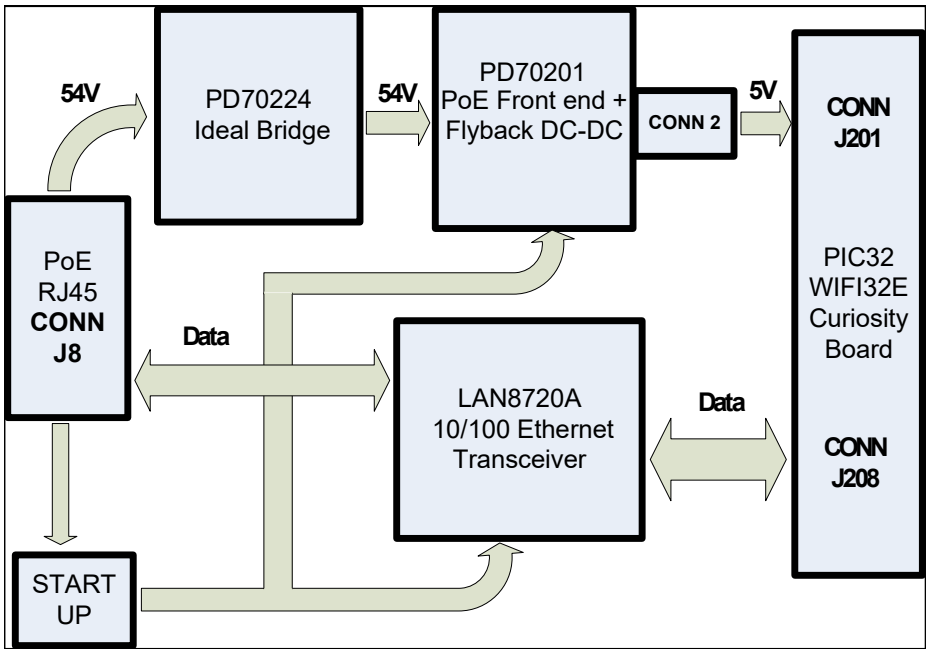
Introduction

This document provides the description and operational procedures for Microchip's EV46B51A LAN8720A PHY-PoE Daughter Board. This board is used to power PIC32 WFI32E Curiosity Board (EV12F11A) through Power over Ethernet (PoE) instead of USB while facilitating the data transfer between the PIC32 WFI32E Curiosity Board and the Personal Computer (PC).

Microchip's EV46B51A LAN8720A PHY-PoE Daughter Board comprises two main sections. The first is an IEEE® 802.3at Type 2 compliant PoE Powered Devices (PD) based on the PD70201 PoE Controller. The PD uses a flyback DC-DC topology that delivers 5V and up to 3A current for use in demanding high-power end applications through PIC32 WFI32E Curiosity Board. The second section is the data transfer based on a high-performance 10/100 Ethernet Transceiver LAN8720A PHY compliant with IEEE 802.3/802.3u (Fast Ethernet) and ISO 802-3/IEEE 902.3 (10BASE-T). This allows a fast and easy data transfer between the PC and PIC32 WFI32E Curiosity Board enabling various IoT applications.

The following figure shows the block diagram of the EV46B51A Evaluation Board.

Figure 1. EV46B51A Block Diagram



The board can be powered through the RJ45 input connector from an IEEE 802.3at Type 2 PoE Power Sourcing Equipment (PSE) or PoE Midspan. The load is PIC32 WFI32E Curiosity Board. The EV46B51A LAN8720A PHY-PoE Daughter Board is connected to the load through the dedicated socket J208 of the PIC32 WFI32E Curiosity Board, and two power cables from the 2-pin connector J2 of the EV46B51A LAN8720A PHY-PoE Daughter Board to the 2-pin connector J201 of PIC32 WFI32E Curiosity Board.

The following figures show the top and bottom views of the EV46B51A Evaluation Board.

Figure 2. EV46B51A Evaluation Board—Top View

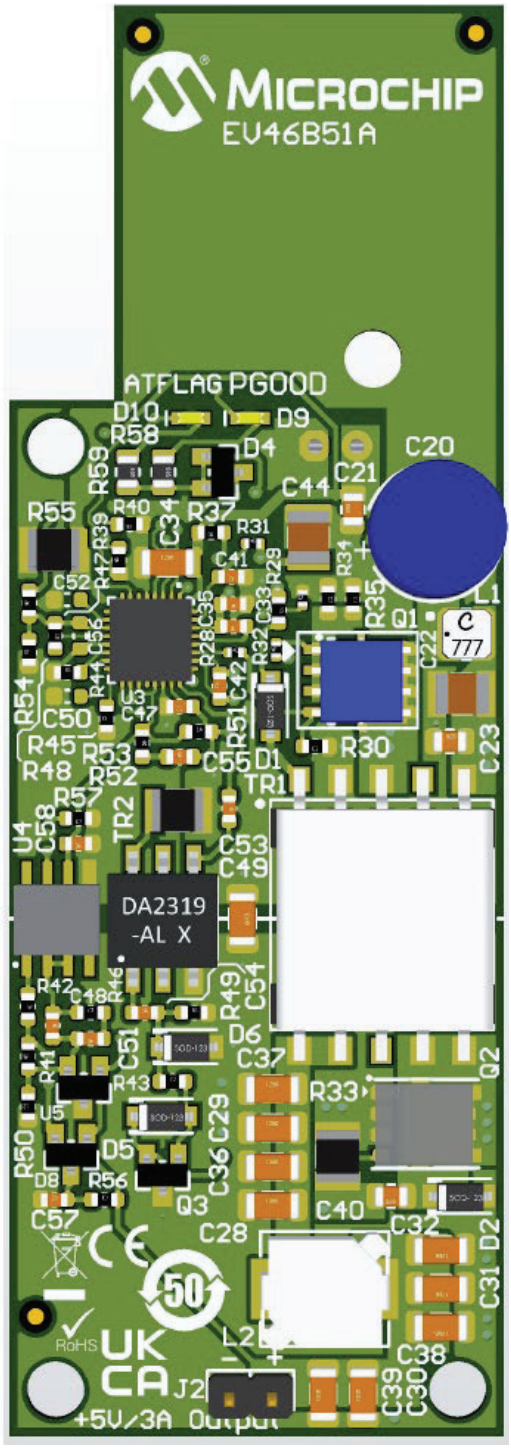


Figure 3. EV46B51A Evaluation Board—Bottom View

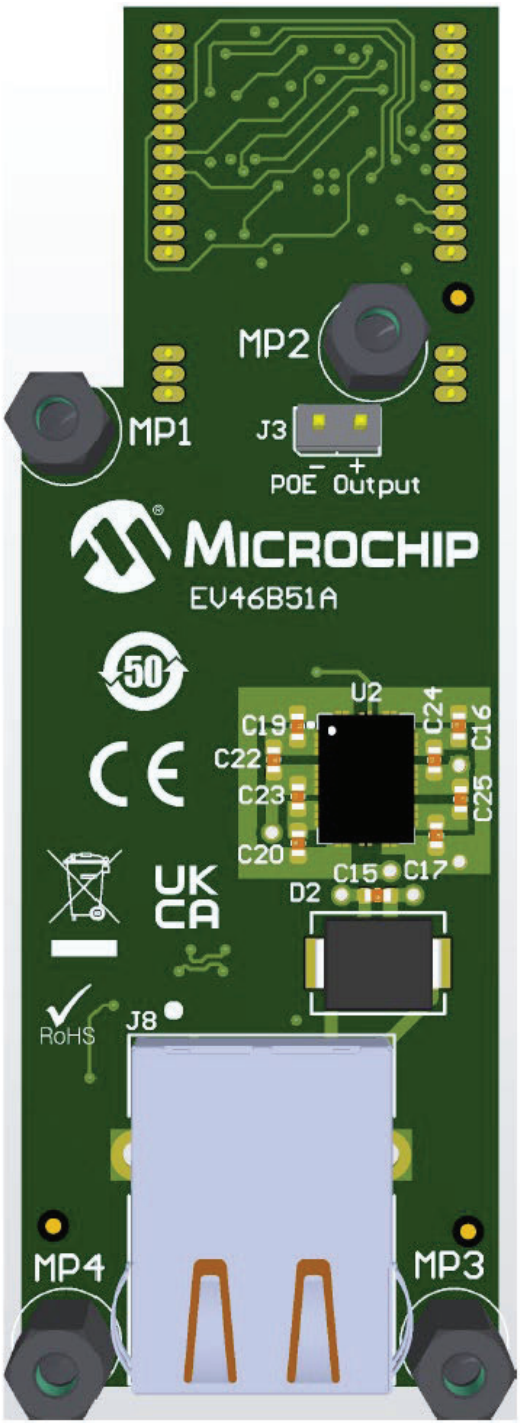


Table of Contents

1. Product Overview

This section provides the product overview of the EV46B51A Evaluation Board.

1.1 Features

The following are key features of the EV46B51A Evaluation Board.

- High performance 10/100 Ethernet Transceiver
- Compliant with IEEE 802.3at (30W PoE)
- Compliant with IEEE 802.3/802.3u (Fast Ethernet)
- Compliant with ISO 802-3/IEEE 902.3 (10BASE-T)
- Comprehensive flexPWR® Technology
  - Variable I/O Voltage Capability
  - Low-power and standby modes of operation to minimize power consumption
- Flexible Power Management Architecture
- IEEE 802.3at Type 2 Compliant PoE
- +5V/3A Power Output
- Flyback Topology
- Output Voltage Connector
- On-board Output Power Good LED Indicators
- On board AT Detected LED Indicator
- -40 ℃ to 50 ℃ Operating Temperature
- RoHS Compliant

1.2 Connectors

The following table lists the EV46B51A Evaluation Board connectors.

Table 1-1. Connector Details

#	Connector	Name	Description
1	J8	Input connector	RJ45 for connecting PoE PSE.
2	J4	Input/Output connector	12-pin terminal connector for connecting PIC32 WIFI32E Curiosity Board.
3	J5	Input/Output connector	12-pin terminal connector for connecting PIC32 WIFI32E Curiosity Board.
4	J6	—	Earth Ground.
5	J7	—	Earth Ground.
6	J2	Output connector	2-pin terminal connector for connecting PIC32 WIFI32E Curiosity Board.
7	J3	—	2-pin terminal connector: Connecting the two boards of EV46B51A LAN8720A PHY-PoE Daughter Board together.
8	J1	—	2-pin terminal connector: Connecting the two boards of EV46B51A LAN8720A PHY-PoE Daughter Board together.

1.2.1 Input Connector

This section lists the pinout details, manufacturer, and manufacturer part number of the J8 input connector.

Table 1-2. J8 Connector

Pin Number	Signal Name	Description
Pin 0	EGND	Earth Ground
Pin 1	TXP	Transmit positive line
Pin 2	VDDA	+3.3V Analog Port power
Pin 3	TXN	Transmit negative line
Pin 4	RXP	Receive positive line
Pin 5	RXN	Receive negative line
Pin 7	Power_Data+	Positive data line
Pin 8	Power_Data-	Negative data line
Pin 9	Power_Spare+	Positive power line
Pin 10	Power_Spare-	Negative power line
Pin 11	—	Green LED Anode
Pin 12	—	Green LED Cathode
Pin 13	—	Yellow LED Anode
Pin 14	—	Yellow LED Cathode

Manufacturer	Part Number
Pulse	JKM-0201NL

1.2.2 Output Connector

This section lists the pinout details, manufacturer, and manufacturer part number of the J2 output connector.

Table 1-3. J2 Connector

Pin Number	Signal Name	Description
Pin 1	GND	Return of 5V output.
Pin 2	V_OUT	Positive DC/DC output voltage 5V.

Manufacturer	Part Number
Wurth Electronics	61300211121

1.2.3 Other Connectors

This section lists the pinout details, manufacturer, and manufacturer part number of the J4, J5, J3, and J1 output connectors.

Table 1-4. J4 Connector

Pin Number	Signal Name	Description
Pin 1	TX_EN	Transmit Enable
Pin 2	TXD0	Transmit Data 0
Pin 3	TXD1	Transmit Data 1
Pin 4	N.C.	No connect
Pin 5	N.C.	No connect
Pin 6	GND	Ground
Pin 7	XTAL1	External Crystal Input
Pin 8	CLK_IN	External Clock Input
Pin 9	GND	Ground
Pin 10	3.3V	3.3V Supply
Pin 11	N.C.	No connect
Pin 12	N.C.	No connect

Manufacturer	Part Number
Samtec	TMS-112-02-G-S

Table 1-5. J5 Connector

Pin Number	Signal Name	Description
Pin 1	N.C.	No connect
Pin 2	N.C.	No connect
Pin 3	RXD1	Receive Data 1
Pin 4	RXD0	Receive Data 0
Pin 5	RX_ER	Receive Error
Pin 6	CRS_DV	Carrier Sense/Receive Data Valid
Pin 7	MDC	SMI Clock
Pin 8	MDIO	SMI Data Input/Output
Pin 9	nINT	Interrupt Output
Pin 10	nRST	External Reset
Pin 11	N.C.	No connect
Pin 12	N.C.	No connect

Manufacturer	Part Number
Samtec	TMS-112-02-G-S

Table 1-6. J3 Connector

Pin Number	Signal Name	Description
Pin 1	VPNin	Input PoE Power Negative Line
Pin 2	VPP	Input PoE Power Positive Line

Manufacturer	part number
Samtec	ZW-01-12-T-D-460-285

Table 1-7. J1 Connector

Pin Number	Signal Name	Description
Pin 1	VPNin	Input PoE Power Negative Line
Pin 2	VPP	Input PoE Power Positive Line

Manufacturer	Part Number
Sullins	PPTC021LFBN-RC

1.3 Electrical Characteristics

The following table lists the electrical characteristics of the EV46B51A Evaluation Board.

Table 1-8. Electrical Characteristics

Parameter	Minimum Value	Maximum Value	Unit
Input at RJ45 connector J8	42	57	V
Output voltage at J2	4.8	5.25	V
Maximum output current at J2	—	3	A
Port J2 isolation to input	1500	—	V_{RMS}
Ambient temperature	0	70	°C

2. Installation

This section describes the installation procedure for the EV46B51A Evaluation Board.

Important: Ensure that the power source of the board is turned OFF before connecting the peripheral devices.

2.1 Initial Configuration

Perform the following steps for initial configuration:

1. Set the J202 connector of the PIC32 WFI32E Curiosity Board with the jumper on pins 1 and 2.
2. Connect the EV46B51A LAN8720A PHY-PoE Daughter Board into the dedicated socket J208 of the PIC32 WFI32E Curiosity Board.
3. Connect the power cables (provided with the kit) between connector J2 of the EV46B51A LAN8720A PHY-PoE Daughter Board and the J201 of PIC32 WFI32E Curiosity Board.
4. Connect an IEEE 802.3at Type 2 PoE compliant PoE equipment (PSE or Midspan) to the J8 RJ45 input connector on the EV46B51A LAN8720A PHY-PoE Daughter Board.

3. Schematics

The following figures show the schematic diagrams of the EV46B51A Evaluation Board.

Figure 3-1. EV46B51A Evaluation Board Schematic—Top Board

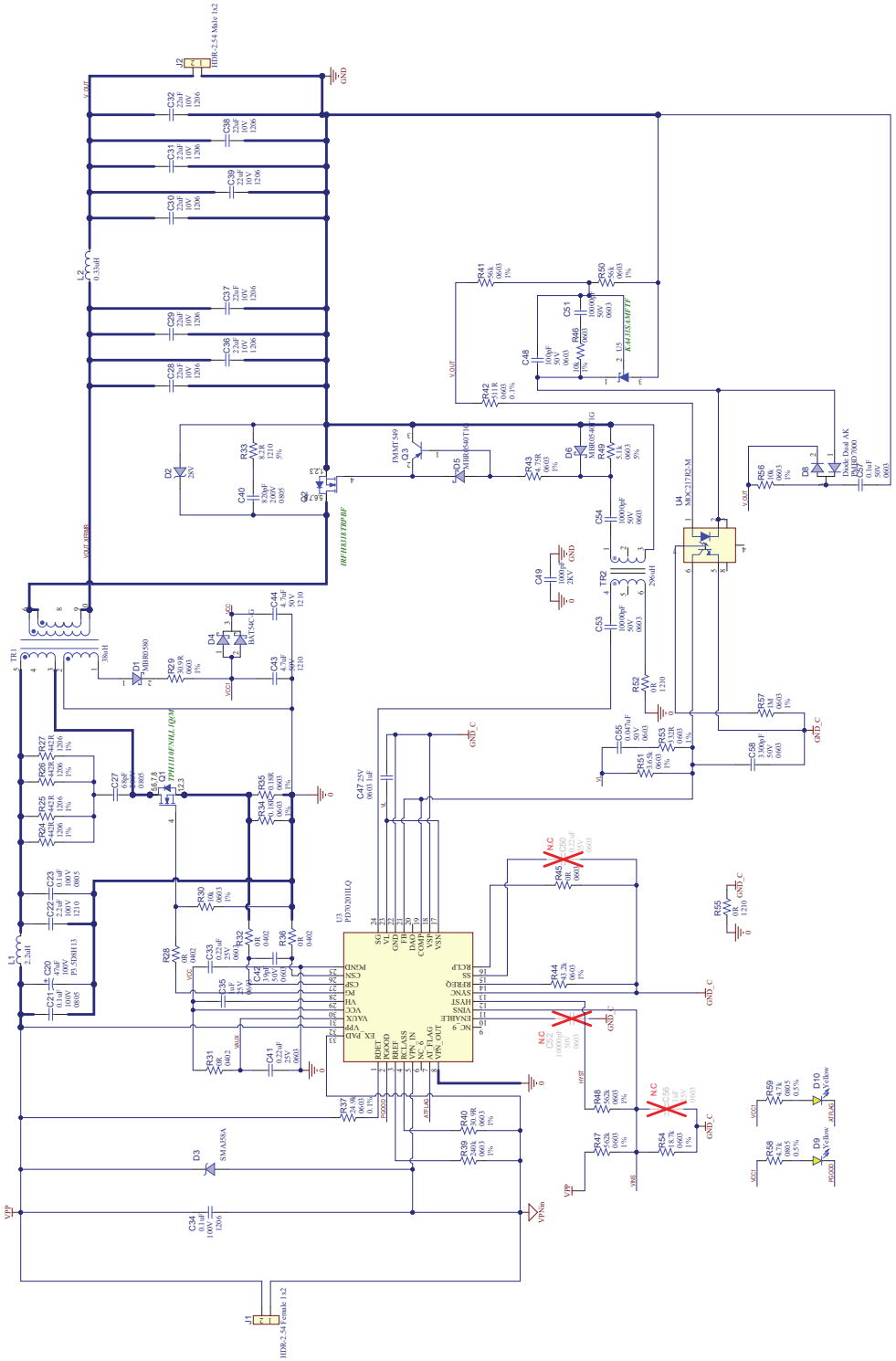
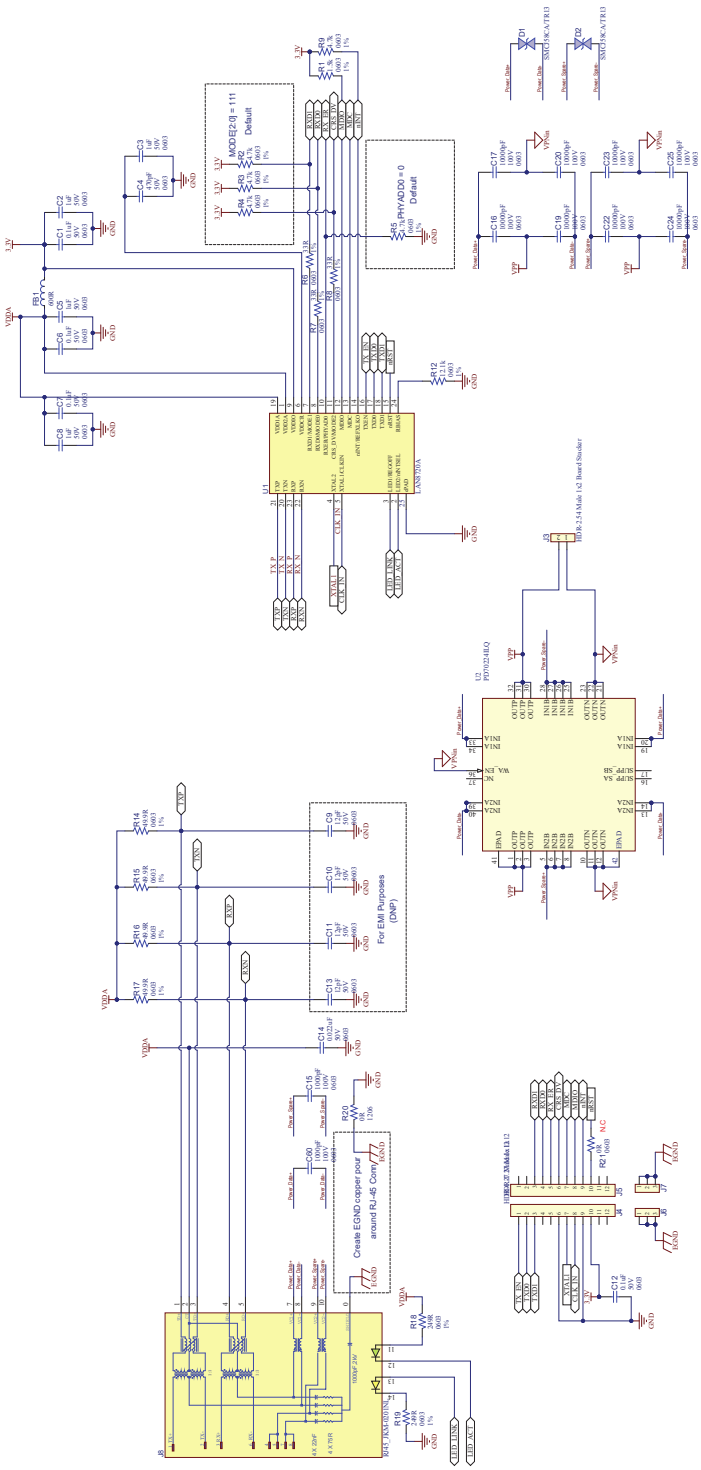


Figure 3-2. EV46B51A Evaluation Board Schematic—Bottom Board



4. Bill of Materials

The following table lists the bill of materials of the EV46B51A Evaluation Board.

Table 4-1. Bill of Materials

Item	Quantity	Designator	Description	Manufacturer	Manufacturer Part Number
1	1	C20	CAP ALU 47uF 100V 20% RAD P3.5D8H13	Nichicon	UVK2A470MPD1TD
2	2	C21, C23	CAP CER 0.1uF 100V 10% X7R SMD 0805	Kyocera AVX	08051C104K4T2A
3	1	C22	CAP CER 2.2uF 100V 10% X7R SMD 1210	Samsung	CL32B225KCJSNNE
4	1	C27	CAP CER 68pF 200V 5% NP0 SMD 0805	Kyocera AVX	08052A680JAT2A\4K
5	9	C28, C29, C30, C31, C32, C36, C37, C38, C39	CAP CER 22uF 10V 10% X7R SMD 1206	Samsung	CL31B226KPHNNNE
6	2	C33, C41	CAP CER 0.22uF 25V 10% X7R SMD 0603 AEC-Q200	Murata	GCM188R71E224KA55D
7	1	C34	CAP CER 0.1uF 100V 10% X7R SMD 1206 AEC-Q200	TDK	CGA5L2X7R2A104K160AE
8	2	C35, C47	CAP CER 1uF 25V 10% X7R SMD 0603	Yageo	CC0603KRX7R8BB105
9	1	C40	CAP CER 820pF 200V 10% X7R SMD 0805	Kyocera AVX	08052C821KAT2A
10	1	C42	CAP CER 39pF 50V 5% C0G SMD 0603	Murata	GRM1885C1H390JA01D
11	2	C43, C44	CAP CER 4.7uF 50V 10% X7R SMD 1210	Murata	GRM32ER71H475KA88L
12	1	C48	CAP CER 100pF 50V 1% C0G/NP0 SMD 0603	Kyocera AVX	06035A101FAT2A
13	1	C49	CAP CER 1000pF 2KV 10% X7R SMD 1206	Johanson	202R18W102KV4E
14	1	C51	CAP CER 10000pF 50V 10% X7R SMD 0603	KEMET	C0603C103K5RACTU
15	2	C53, C54	CAP CER 10nF 50V 10% X7R SMD 0603 AEC-Q200	Kyocera AVX	06035C103K4T2A
16	1	C55	CAP CER 0.047uF 50V 10% X7R SMD 0603	Samsung	CL10B473KB8NNNC
17	1	C57	CAP CER 0.1uF 50V 10% X7R SMD 0603	Yageo	CC0603KRX7R9BB104
18	1	C58	CAP CER 3300pF 50V 10% X7R SMD 0603	Wurth Electronics	885012206086
19	1	D1	DIO SCTKY MBR0580S1-7 800mV 500mA 80V SMD SOD-123	MCC	MBR0580-TP
20	1	D2	DIO ZENER MMSZ5255B 28V 500mW SMD SOD-123	Diodes	MMSZ5255B-7-F
21	1	D3	DIO TVS SMAJ58A 58V 400W DO-214AC_SMA	Littelfuse	SMAJ58A
22	1	D4	DIO SCTKYARR BAT54C-G 520mV 200mA 30V SMD SOT-23-3	Comchip	BAT54C-G
23	2	D5, D6	DIO SCTKY MBR0540T1G 510mV 500mA 40V SMD SOD-123	ON Semiconductor	MBR0540T1G
24	1	D8	DIO RECT ARRAY PMBD7000 1.25V 215mA 100V SMD SOT-23-3	Nexperia	PMBD7000,235
25	1	D9, D10	DIO LED YELLOW 2.1V 20mA 8mcd Clear SMD 0603	Kingbright	APT1608YC
26	1	J1	CON HDR-2.54 Female 1x2 Tin TH VERT	Sullins	PPTC021LFBN-RC
27	1	J2	CON HDR-2.54 Male 1x2 Gold 5.84MH TH VERT	Wurth Electronics	61300211121

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Item	Quantity	Designator	Description	Manufacturer	Manufacturer Part Number
28	1	L1	INDUCTOR 2.2uH 1.1A 20% SMD L3.05W3.05H1.5	Coilcraft	LPS3015-222MRC
29	1	L2	FIXED IND 0.33uH 20A 3.9mOHM SMD 7.8mmx7mm	Bourns	SRP7030-R33M
30	1	Q1	TRANS FET N-CH TPH1110FNH 250V 15A 57W 2-5Q1S SMD	Toshiba	TPH1110FNHL1Q(M
31	1	Q2	TRANS FET N-CH IRFH8318TRPBF 30V 27A 3.6W 0.0031R PQFN-8	Infineon	IRFH8318TRPBF
32	1	Q3	TRANS BJT PNP FMMT549 30V 1A 500mW SOT-23-3	ON Semiconductor / Fairchild	FMMT549
33	4	R24, R25, R26, R27	RES TKF 442R 1% 1/4W SMD 1206 AEC-Q200	Panasonic	ERJ-8ENF4420V
34	4	R28, R31, R32, R36	RES TKF 0R 1/16W SMD 0402	Stackpole Electronics	RMCF0402ZT0R00
35	2	R29, R40	RES TKF 30.9R 1% 1/10W SMD 0603	Panasonic	ERJ-3EKF30R9V
36	2	R30, R46	RES TKF 10k 1% 1/10W SMD 0603	Stackpole Electronics	RMCF0603FT10K0
37	1	R33	RES TKF 8.2R 5% 1/2W SMD 1210 AEC-Q200	Panasonic	ERJ-P14J8R2U
38	2	R34, R35	RES TKF 0.18R 1% 1/10W 0603	Panasonic	ERJ-3RSFR18V
39	1	R37	RES TF 24.9k 0.1% 1/10W SMD 0603	Panasonic	ERA-3AEB2492V
40	1	R39	RES TKF 240k 1% 1/10W SMD 0603	Panasonic	ERJ-3EKF2403V
41	2	R41, R50	RES TKF 56k 1% 1/10W SMD 0603	Stackpole Electronics	RMCF0603FT56K0
42	1	R42	RES TF 511R 0.1% 1/10W SMD 0603	Yageo	RT0603BRD07511RL
43	1	R43	RES TKF 4.75R 1% 1/10W SMD 0603	Yageo	RC0603FR-074R75L
44	1	R44	RES TKF 43.2k 1% 1/10W SMD 0603	Panasonic	ERJ-3EKF4322V
45	1	R45	RES TKF 0R 1/10W SMD 0603	Panasonic	ERJ-3GEY0R00V
46	2	R47, R48	RES TKF 562k 1% 1/10W SMD 0603	Stackpole Electronics	RMCF0603FT562K
47	1	R49	RES TKF 5.1k 5% 1/10W SMD 0603	Panasonic	ERJ-3GEYJ512V
48	1	R51	RES TKF 3.65k 1% 1/10W SMD 0603	Yageo	RC0603FR-073K65L
49	2	R52, R55	RES TKF 0R 1/2W SMD 1210 AEC-Q200	Vishay Dale	CRCW12100000Z0EA
50	1	R53	RES TKF 332R 1% 1/10W SMD 0603 AEC-Q200	Stackpole Electronics	RMCF0603FT332R
51	1	R54	RES TKF 18.7k 1% 1/10W SMD 0603	Yageo	RC0603FR-0718K7L
52	1	R56	RES TKF 10k 1% 1/10W SMD 0603 AEC-Q200	Panasonic	ERJ-3EKF1002V
53	1	R57	RES TKF 1M 1% 1/10W SMD 0603	Yageo	RC0603FR-071ML
54	2	R58, R59	RES MF 4.7k 0.5% 1/10W SMD 0805	Susumu	RR1220P-472-D
55	1	TR1	TRANS POWER PoE Transformer 5:1:2.5 SMD	Wurth Electronics	750310744
56	1	TR2	Transformer 296uH 795/655mR SMD L6.6W5H5.4	Coilcraft	DA2319-AL

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Item	Quantity	Designator	Description	Manufacturer	Manufacturer Part Number
57	1	U4	IC ISOLATOR MOC217R2-M Phototransistor Output Optocoupler SOIC-8	ON Semiconductor	MOC217R2M
58	1	U5	IC POWER KA431 Shunt Voltage Reference SOT-23-3	ON Semiconductor / Fairchild	KA431SAMFTF
59	4	C1, C6, C7, C12	CAP CER 0.1uF 50V 10% X7R SMD 0603	Kyocera AVX	06035C104KAT2A
60	4	C2, C3, C5, C8	CAP CER 1uF 50V 10% X5R SMD 0603	Taiyo Yuden	UMK107BJ105KA-T
61	1	C4	CAP CER 470PF 50V C0G/NP0 0603	Yageo	CC0603FRNPO9BN471
62	4	C9, C10, C11, C13	CAP CER 12pF 50V 5% NP0 SMD 0603	Yageo	CC0603JRNPO9BN120
63	1	C14	CAP CER 0.022uF 50V 10% X7R SMD 0603	Samsung	CL10B223KB8NNNC
64	2	C15, C60	CAP CER 1000pF 100V 5% NP0 SMD 0603	Walsin Technologies	0603N102J101CT
65	8	C16, C17, C19, C20, C22, C23, C24, C25	CAP CER 10000pF 100V 10% X7R SMD 0603	TDK	C1608X7R2A103K080AA
66	2	D1, D2	DIO TVS BI-DIR SMCJ58CA/TR13 93.6V 16.1A SMD DO-214AB_SMC	Yageo	SMCJ58CA/TR13
67	1	FB1	FERRITE 600R 100MHz 1A SMD 0805	Bourns	MH2029-601Y
68	1	J3	CON HDR-2.54 Male 1x2 Gold 7.239MH Board Stacker TH VERT 11.684mm	Samtec	ZW-01-12-T-D-460-285
69	2	J4, J5	CON HDR-1.27 Male 1X12 Gold 2.54MH TH VERT	Samtec	TMS-112-02-G-S
70	2	J6, J7	CON HDR-1.27 Male 1X3 TH VERT	Samtec	TMS-103-02-L-S
71	1	J8	CON MODULAR JACK RJ45 TH R/A JKM-0201NL	Pulse	JKM-0201NL
72	4	MP1, MP2, MP3, MP4	MECH HW STEEL SPACER STUD WE 971220321 M3x22mm	Wurth Electronics	971220321
73	1	R1	RES TKF 1.5k 1% 1/10W SMD 0603	Stackpole Electronics	RMCF0603FT1K50
74	5	R2, R3, R4, R5, R9	RES TKF 4.7k 1% 1/10W SMD 0603 AEC-Q200	Panasonic	ERJ-3EKF4701V
75	3	R6, R7, R8	RES TKF 33R 1% 1/10W SMD 0603 AEC-Q200	TE Connectivity	CRGCQ0603F33R
76	1	R12	RES TKF 12.1k 1% 1/10W SMD 0603	Panasonic	ERJ-3EKF1212V
77	4	R14, R15, R16, R17	RES TKF 49.9R 1% 1/4W SMD 0603	Vishay Dale	CRCW060349R9FKEAHP
78	2	R18, R19	RES TKF 249R 1% 1/10W SMD 0603	Yageo	RC0603FR-07249RL
79	1	R20	RES TKF 0R SMD 1206 AEC-Q200	Vishay	CRCW12060000Z0EA
80	1	U1	MCHP TRANSCEIVER LAN8720A VFQFN-24_4X4_EP2.5X2.5	Microchip	LAN8720A-CP-ABC
81	1	U2	MCHP INTFC PoE DUAL-MOSFET BRIDGE RECTIFIER PD70224ILQ QFN-40	Microsemi	PD70224ILQ-TR

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Item	Quantity	Designator	Description	Manufacturer	Manufacturer Part Number
82	4	NUT1, NUT2, NUT3, NUT4	MECH HW NUT M3x2.4mm HEX Zinc	Bossard	1874659
83	4	SCR1, SCR2, SCR3, SCR4	MECH HW SCREW M3x6mm CheeseHead Phillips Zinc	Bossard	1154249

5. Board Layout

This section provides the board layout diagrams of the EV46B51A Evaluation Board. This evaluation board consists of two boards, the top and bottom boards. The top board is a two-layer with 1 Oz copper Printed Circuit Board (PCB), and the bottom is a four-layer with 1 Oz copper PCB.

The following figures show the silk of the boards for tracking the device placements.

Figure 5-1. Top Board—Top Silk

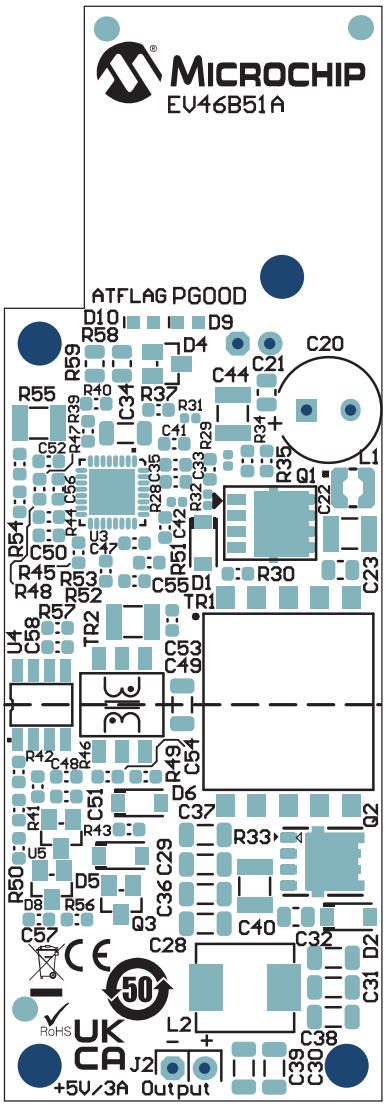


Figure 5-2. Top Board—Bottom Silk

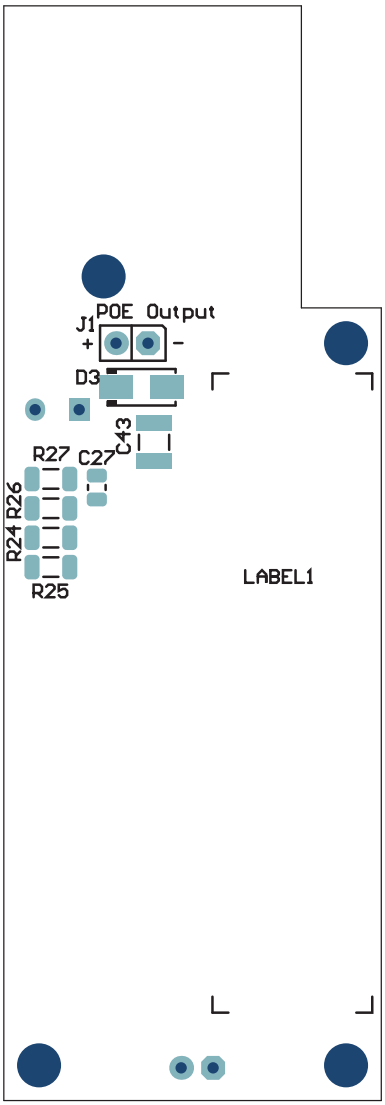


Figure 5-3. Top Board—Top Copper

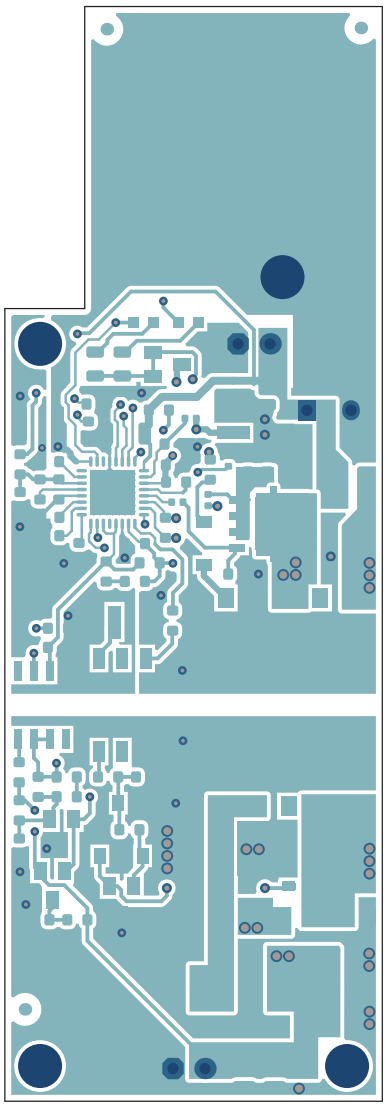


Figure 5-4. Top Board—Bottom Copper

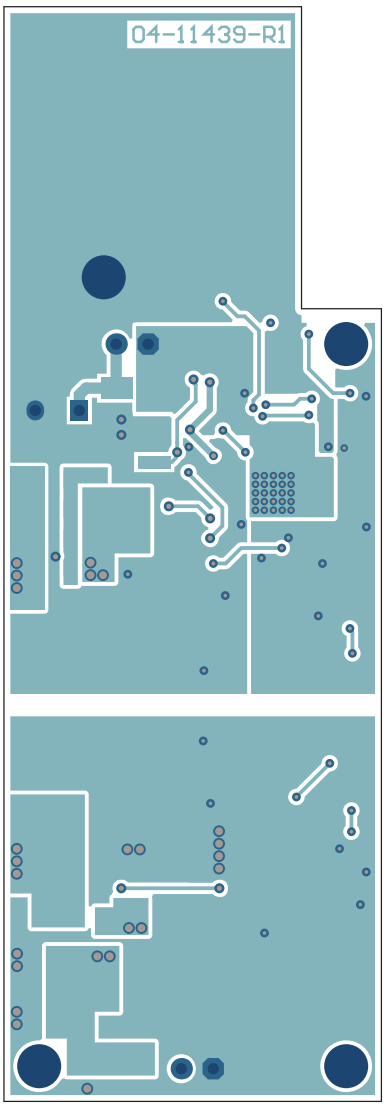


Figure 5-5. Bottom Board—Top Silk

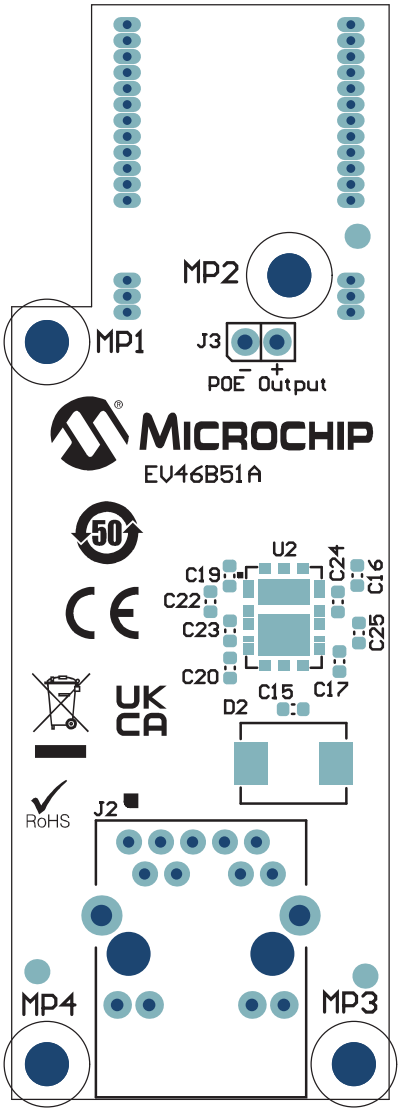


Figure 5-6. Bottom Board—Bottom Silk

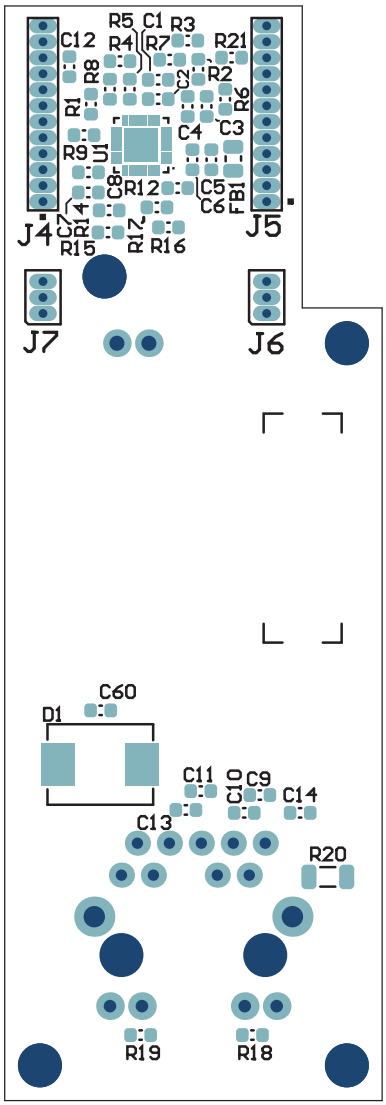


Figure 5-7. Bottom Board—Top Copper

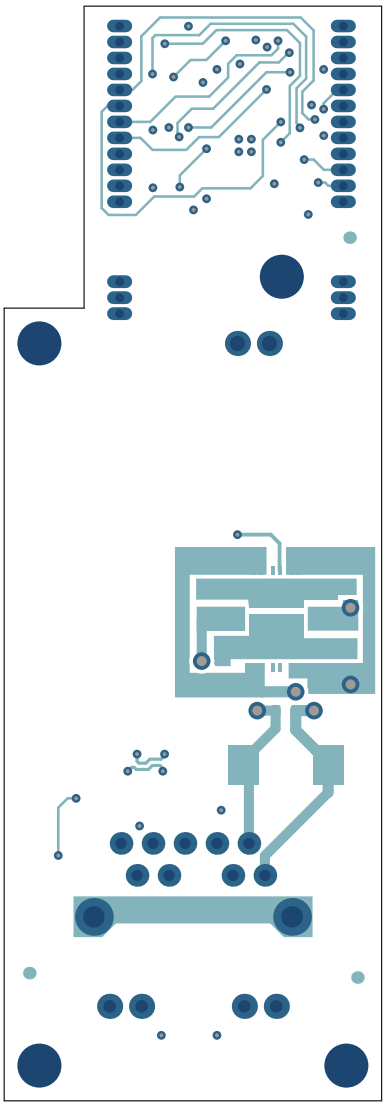


Figure 5-8. Bottom Board—Middle Layer 1 Copper

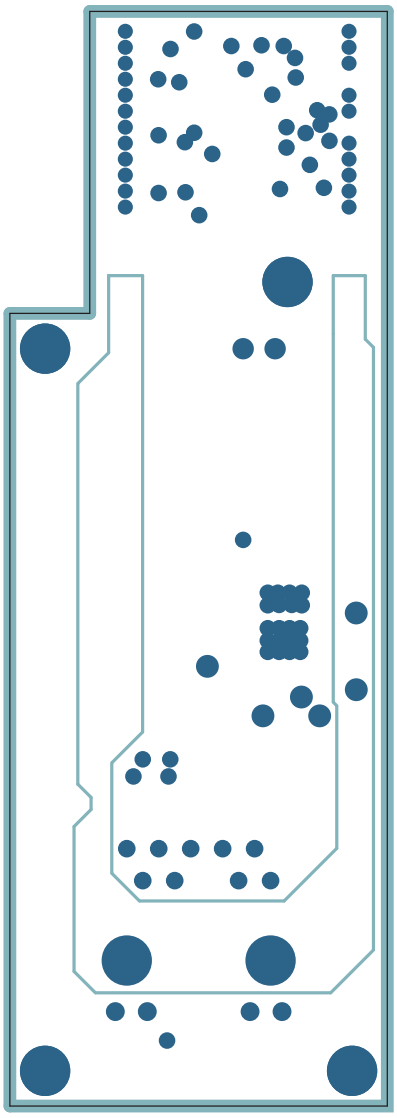


Figure 5-9. Bottom Board—Middle Layer 2 Copper

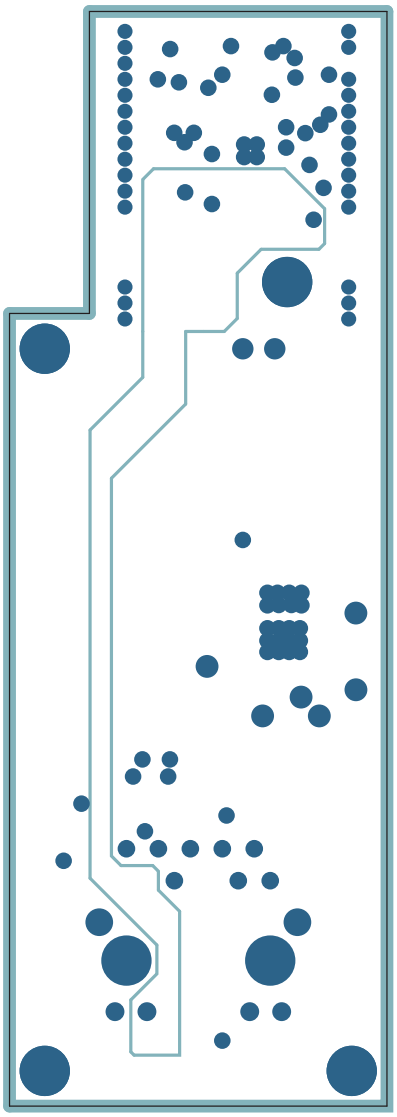
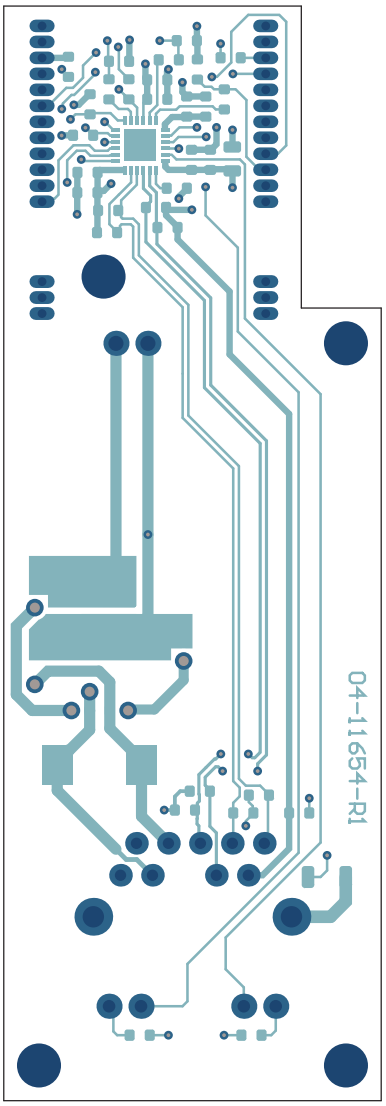


Figure 5-10. Bottom Board—Bottom Copper



6. Ordering Information

The following table lists the ordering information for the EV46B51A Evaluation Board.

Table 6-1. Ordering Information

Ordering Number	Description
EV46B51A	LAN8720A PHY-PoE Daughter Board.

7. Revision History

Revision	Date	Description
A	09/2022	Initial Revision.

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ISBN: 978-1-6683-1222-3

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