

PD70201EVB-U-25F-5
User Guide
Isolated Flyback Converter Evaluation Board

April 2018



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1 Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

1.1 Revision 1.0

Revision 1.0 was published in April 2018. It was the first publication of this document.

2 Product Overview

This document provides the description and operating procedures for Microsemi's PD70201EVB-U-25F-5 board. This board type is used for evaluating the performance of the PD70201 device in both standard IEEE802.3at and non-standard applications with input 17-54 V_{DC}. The board is a 25 W PD consisting of isolated DC-DC converter to step down voltage to 5 V. The AUX input gets priority in supplying the load, when it is connected to the application and the PD inputs act as backup power if the AUX is disconnected.

Microsemi's PD70201ILQ device is part of a family of devices that support the IEEE 802.3at standard PD interface, and a PWM controller that is used for PD operational voltages DC/DC.

The PD interface includes the following family of devices.

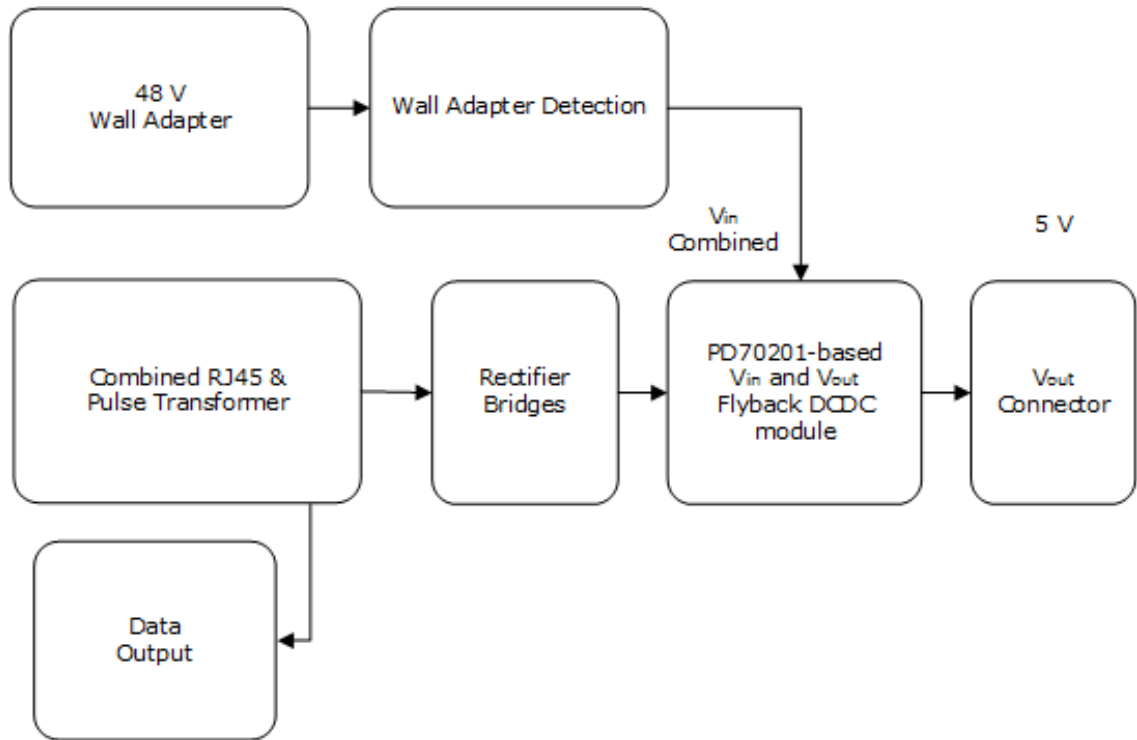
Table 1 • PD Family of Devices

Device type	Power Capability	Integrates PWM Controller	WA_EN support
PD70100	IEEE 802.3at Type 1 (IEEE 802.3 af level)	No	No
PD70101	IEEE 802.3at Type 1 (IEEE 802.3 af level)	Yes	No
PD70200	IEEE 802.3at Type 2	No	No
PD70201	IEEE 802.3at Type 2	Yes	No
PD70210	IEEE 802.3at Type 2	No	No
PD70210A	IEEE 802.3at Type 2	No	Yes
PD70211	IEEE 802.3at Type 2, HDBT	Yes	Yes
PD70224	IEEE 802.3at Type 2, HDBT	No	Yes

Microsemi's PD70201EVB-U-25F-5 Evaluation Board provides designers with the environment needed for evaluating the performance and implementation of PD applications based on the PD70201 device.

The board uses a single PD device (PD70201ILQ) to support the Detection, Classification, and Power Supplying phases on the 2/4 pairs of the Cat5 cable. PD70201ILQ supports a standard IEEE802.3at Type 2 interface as well as wide range non-standard input voltage.

This document provides all necessary procedures and instructions to install and operate this board.

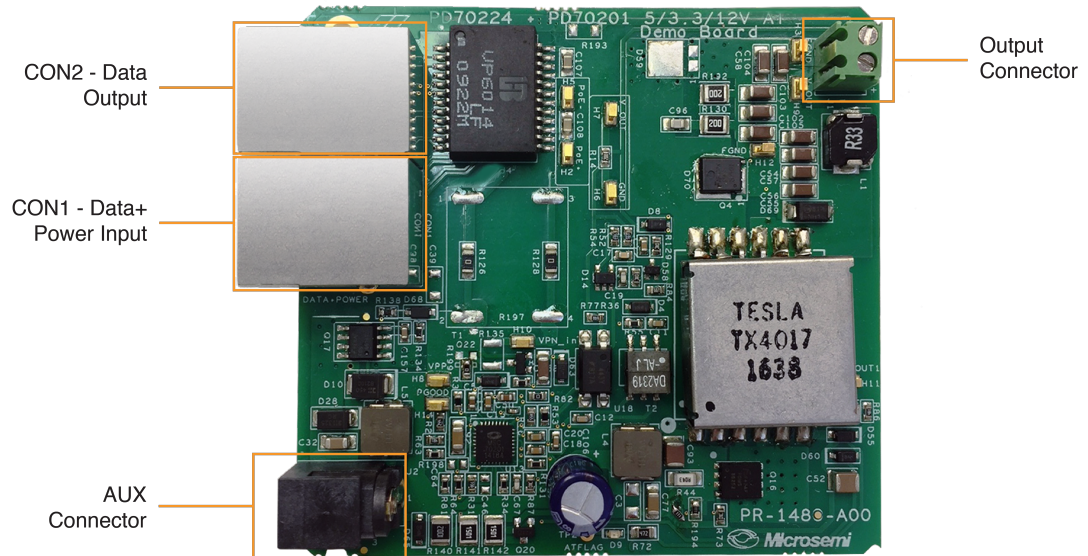
Figure 1 • PD70201EVB-U-25F-5 Block Diagram


The board can be powered either by a PSE through CON1 or by an auxiliary connector (AUX connector), see [electrical characteristics \(see page 6\)](#) for the input voltage range. The external load is connected to evaluation board using output connector (J1)(refer to [evaluation board \(see page 4\)](#) for the output connector). The evaluation board can be powered by connecting an external AC adaptor to the AUX connector (J2) (refer to [evaluation board \(see page 4\)](#) for the AUX connector).

D9 is the AT flag indication LED, a PD70201 device output signal indicating that the device has detected two fingers class, so the PSE side is AT level capable. This signal in the PD environment indicates that AT power level is supported.

The following image shows a top view of the evaluation board.

Figure 2 • PD70201EVB-U-25F-5 Evaluation Board – General View



2.1 Evaluation Board Features

- Designed to support data and spare current by a single PD70201 device
- Two RJ45 connectors (Data and Power Input, Data Output)
- Output voltage connector
- On board AT detected LED indicator
- Pulse transformer for routing the data to PD application to enable full PD evaluation
- Wide input voltage range
- Evaluation Board working temperature: 0°C to 70°C
- RoHS compliant

2.2 Evaluation Board Connectors

The evaluation board connectors are listed in the following table.

Table 2 • Connector Details

#	Connector	Name	Description
1	CON1	RJ45 Connector	RJ45 port for Data and Power Input for PSE connection
2	CON2	RJ45 Connectors	RJ45 port for Data Output for PD data connection
3	J1	Output connector	Terminal blocks for connecting a load to output regulator
4	J2	AUX connector	Auxiliary input connection to power the EVB using AC adaptor, see the Electrical Characteristics section for operating voltage ranges.

2.2.1 RJ45 Connectors

There are two dedicated RJ45 connectors (refer to [evaluation board \(see page 4\)](#) for the RJ45 connectors), one input connector (CON1) for power and data and one output connector (CON2) for data. The pin connections of the input and output connectors are described in the following table.

Table 3 • RJ45 Input Connector (CON1)

CON1 Pin No	Alternative A (MDI-X)	Alternative A (MDI)	Alternative B (MDI-X/MDI)
1	DATA - Vport_Neg	DATA - Vport_Pos	
2	DATA - Vport_Neg	DATA - Vport_Pos	
3	DATA - Vport_Pos	DATA - Vport_Neg	
4			SPARE - Vport_Pos
5			SPARE - Vport_Pos
6	DATA - Vport_Pos	DATA - Vport_Neg	
7			SPARE - Vport_Neg
8			SPARE - Vport_Neg

Table 4 • RJ45 Output Connector (CON2)

CON2 Pin No	Signal Name	Description
1, 2, 3, 4, 5, 6, 7, 8	Data Out	Data output to PD

- Manufacturer: Bel Stewart
- Manufacturer part number: SS71800-007F or equivalent

2.2.2 Output Connector

An external load is connected to the evaluation board using the output connector (J1). The pin connections of the output connector is described in the following table.

Table 5 • J1 Connector

Pin No.	Signal Name	Description
Pin 1	V _{OUT}	Positive DC/DC output voltage
Pin 2	V _{OUT_RTN}	Return of DC/DC output voltage

- Manufacturer: DECA
- Manufacturer part number: MB332-350M02

2.2.3 AUX Connector

The evaluation board can be powered by an external AC adaptor using the auxiliary connector (J2). The pin connections of AUX Connector are described in the following table.

Table 6 • J2 Connector

Pin No.	Signal Name	Description
Pin 1	V _{IN_RTN}	Return of AUX connector
Pin 2 & 3	V _{IN}	Positive of AUX connector

- Manufacturer: Switchcraft
- Manufacturer part number: RAPC712X

The polarity of the AUX connector is shown in the following illustration.

Figure 3 • AUX Connector Cable Polarity



2.3 Physical Characteristics

The mechanical dimensions of the board are 81 mm x 65 mm x 15 mm (L x W x H).

2.4 Electrical Characteristics

Following are electrical characteristics of the evaluation board.

Table 7 • Electrical Characteristics

Parameter	Min	Max	Unit
Main DC Supply – Con1, J2	17	57	V
Output voltage	4.8	5.25	V
Maximum Output Current	--	5	A
Port Isolation to Chassis	--	1.5	kVrms

3 Installation

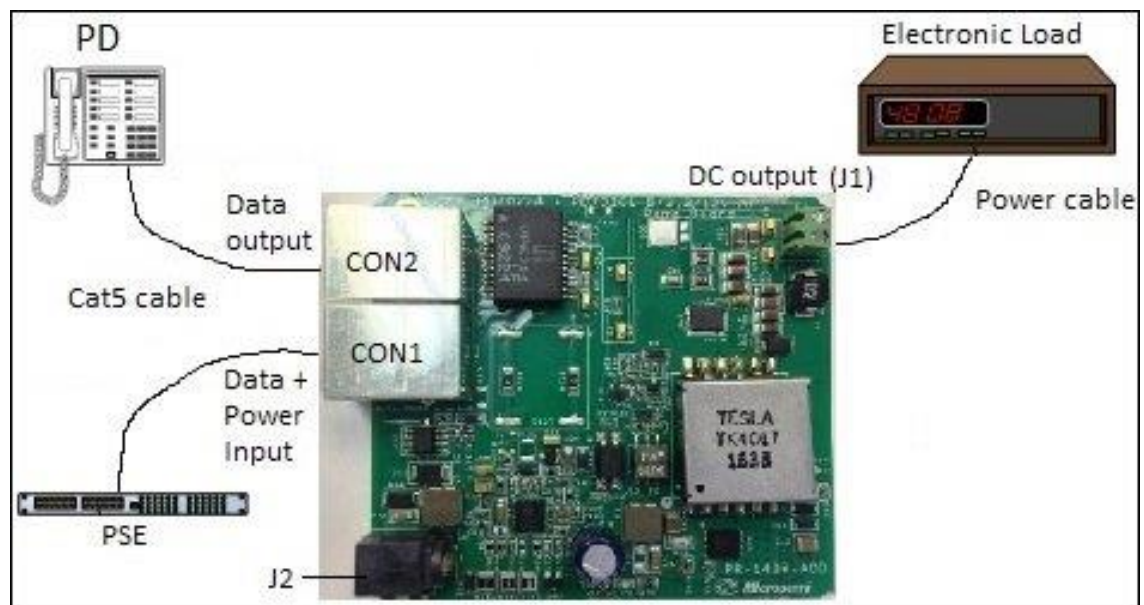
Ensure board's power supply is turned OFF before all peripheral devices are connected.

3.1 Initial Configuration

Note: Prior to starting any operation, it is important to verify that the evaluation board is setup as shown in the following figure.

- Connect load to the main board (using J1).
- Connect a Cat5 cable from PSE to evaluation board (using CON1). Alternatively, connect a power cable from the power supply to evaluation board (using J2).
- To test the Ethernet data, connect Ethernet cable from evaluation board (using CON2) to the PD Ethernet Host.

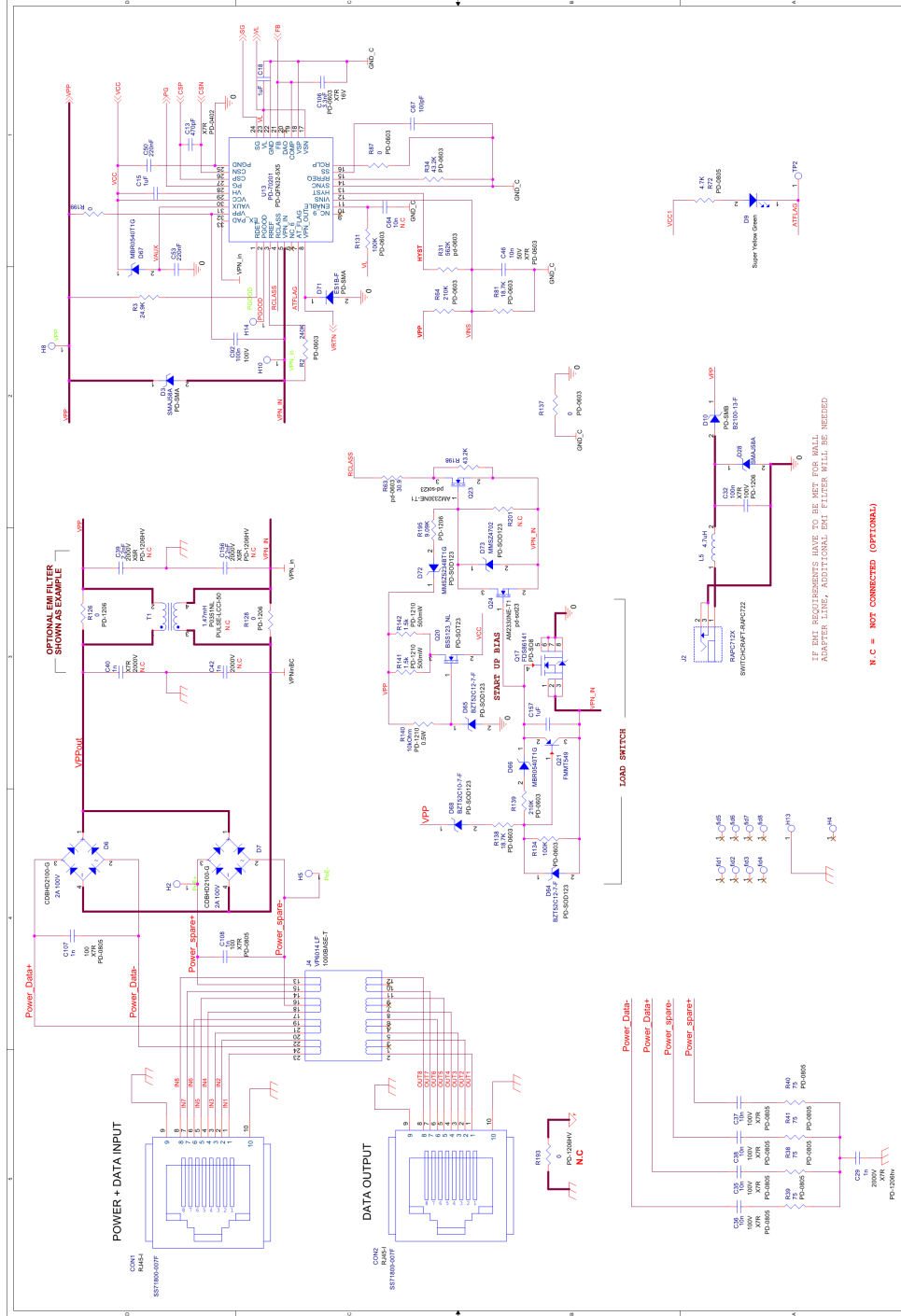
Figure 4 • Test Setup



4 PD70201EVB-U-25F-5 Schematics

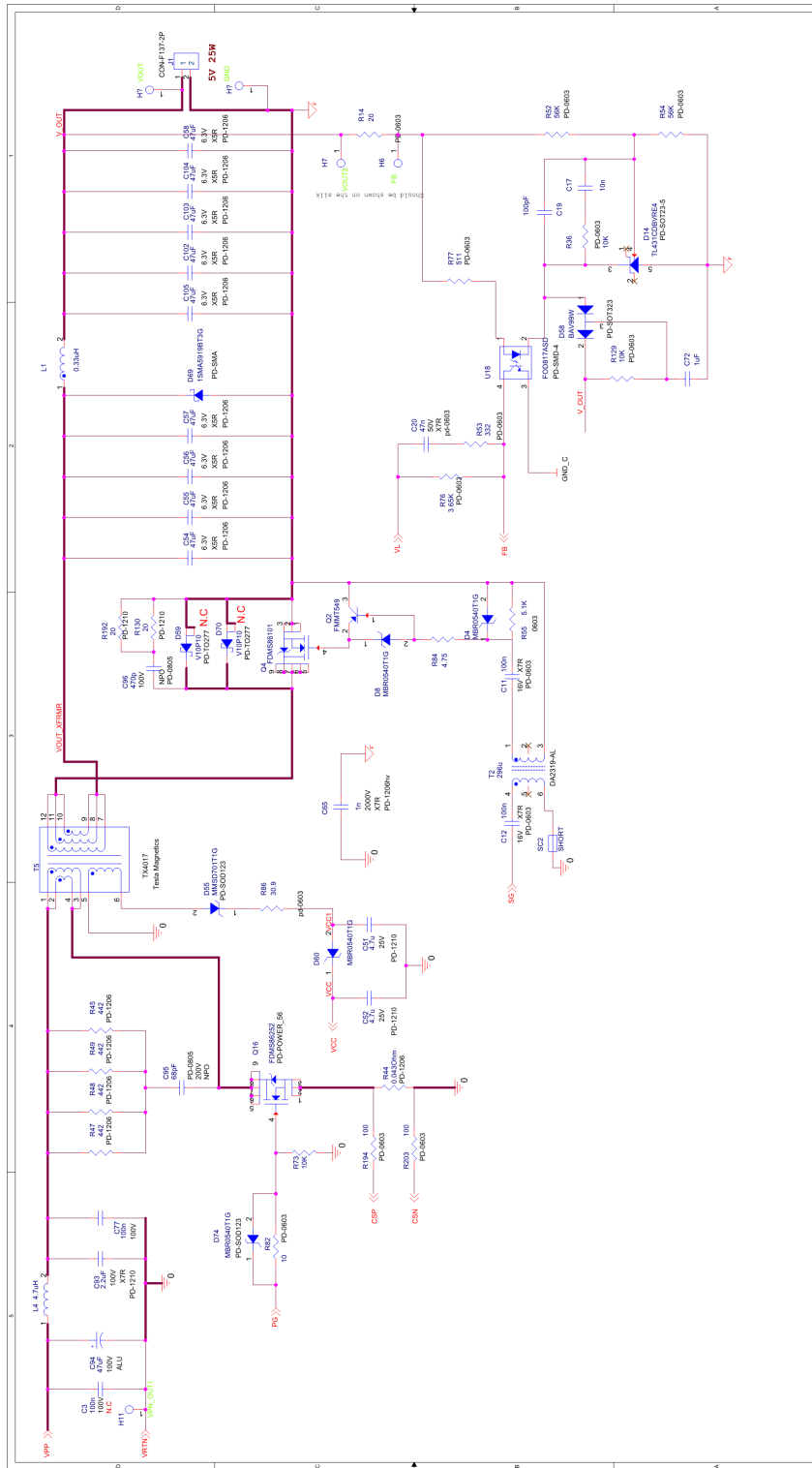
The following image shows the front-end section, EMI, and PD70201 circuitry.

Figure 5 • Front-end and PD70201 Circuitry



The following image shows the power section of flyback converter.

Figure 6 • Flyback Converter Power Section



5 PD70201EVB25FX Bill of Materials

Table 8 • PD70201EVB25F5 Assembly

Item	Description	Quantity	Reference Designation	Manufacturer Name	Manufacturer Part Number
1	CON RJ45 SINGLE 8 POS. SHILDED after vibration	2	CON1, CON2	Bel Stewart	SS71800-007F
2	CAP CER 100nF 100V 10% X7R 1206 SMT	4	C3, 32, C77, C92	AVX	12061C104KAT2A
3	CAP CER 100nF 16V 10% X7R 0603 SMT	2	C11, C12	Taiyo Yuden	EMK107B7104KA-T
4	CAP CER 470pF 50V X7R 0402	1	C13	Yageo	CC0402KRX7R9BB471
5	CAP CER X7R 1uF 25V 10% 0603	4	C15, C18, C72, C157	Murata	GRM188R71E105KA12D
6	CAP CER 10nF 50v 10% X7R 0603 SMT	3	C17, C46, C64	Rohm	MCH185CN103KK
7	CAP C0G 100pF 50V 5% 0603	2	C19, C67	TDK	C1608C0G1H101J
8	CAP CER 0.047UF 50V X7R 0603	1	C20	Samsung	CL10B473KB8NNNC
9	CAP CER 1nF/2000V 10% X7R 1206 SMT	4	C29, C40, C42, C65	AVX	1206GC102KAT1A
10	CAP CER 10000PF 100V X7R 0805	4	C35, C36, C37, C38	Kemet	C0805C103J1RAC
11	CAP CER 2.2nF 2000V X7R 1206	2	C39, C156	Walsin	1206B222K202CT
12	CAP 220NF 25V X7R 10% 0603	2	C50, C53	TDK	C1608X7R1E224K
13	CAP X5R 4.7uF 25V 10% 1210	2	C51, C52	Taiyo Yuden	TMK325BJ475KN-T
14	CAP CER 47UF 6.3V X5R 1206	9	C54, C55, C56, C57, C58, C102, C103, C104, C105	AVX	12066D476MAT2A
15	CAP CER 2.2UF 100V X7R 1210	1	C93	TDK	C3225X7R2A225K
16	CAP ALU 47uF 100V 20% 8X11.5 105C P=3.5mm T /H	1	C94	Rubycon	100PX47M EFC T7 8X11.5
17	CAP CER 68pF 200V 10% NPO 0805	1	C95	AVX	08052A680KAT2A
18	CAP CER 470pF 100V 2% NPO 0805 SMT	1	C96	Walsin	0805N471G101LT
19	CAP CER X7R 3.3nF 16V 10% 0603	1	C106	TDK	C1608X7R1C332K
20	CAP CER 1000PF 100V X7R 0805	2	C107, C108	TDK	C2012X7R2A102K

Item	Description	Quantity	Reference Designation	Manufacturer Name	Manufacturer Part Number
21	DIO TVS 58V 40A SRG400WPK SMA SMT	2	D3, D28	Vishay	SMAJ58A
22	DIO SCHOTTKY 40V 500mA SOD123 REC SMT	6	D4, D8, D60, D66, D67, D74	ON Semiconductor	MBR0540T1G
23	Schottky bridge rectifier 100V 2A TO-269AA	2	D6, D7	Comchip	CDBHD2100-G
24	LED SuperYelGrn 100- 130o 20-40mcd h=1 0603 SMD	1	D9	Everlight	19-21-SYGCS530E3TR8
25	DIODE SCHOTTKY 100V 2A SMB	1	D10	Diodes Inc.	B2100-13-F
26	IC Prog Shunt Ref 2.5V 2% SOT23-5 SMT	1	D14	Texas Instruments	TL431CDBVRE4
27	DIODE SCHOTTKY 70V 0.2 A, 225 mW, SOD123	1	D55	ON Semiconductor	MMSD701T1G
28	Diode, Dual Switching SOT323	1	D58	NXP	BAV99W
29	Diode Schottky 10A/100V Vf= 0.574V TO-277A SMT	2	D59, D70	Vishay	V10P10
30	Diode Zener 12V 500MW SOD123 SMT	2	D64, D65	Diodes Inc.	BZT52C12-7-F
31	Diode Zener 10V 500MW SOD123 SMT	1	D68	Diodes Inc.	BZT52C10-7-F
32	Diode Zener 5.6V 1.5W SMA case 403D	1	D69	ON- Semiconductor	1SMA5919BT3G
33	Diode 100V 1A SuperFastRec. trr=25nS SMA	1	D71	Diodes Inc.	ES1B-F
34	Diode Zener 500mW 6.2V 5% SOD123	1	D72	ON Semiconductor	MMSZ5234BT1G
35	Diode Zener 15V 500MW SOD123	1	D73	ON Semiconductor	MMSZ4702
36	TEST POINT TIN PLATEDHEAD 1.7mm H- 3mm L-3.2mm	10	H2, H3, H5, H6, H7, H8, H9, H10, H11, H14	MAC-8	HK-2-G
37	Terminal block 2 Pole interlocking 3.5mm pitch	1	J1	DECA	MB332-350M02
38	DC Power Jack 16V 5A TH Pin dia 2.5mm	1	J2	Switchcraft	RAPC712X
39	1000 BASE -T SINGLE PORT VOICE OVER IP MAGNETICS MODULE SMT	1	J4	BOTHHAND	VP6014 LF
40	Power Inductor 0.33uH 20A Shilded SMT	1	L1	Bourns	SRP7030-R33M
41	FIXED IND 4.7uH 5.5A 40m Ohm SMD	2	L4, L5	Vishay	IHLP2525CZER4R7M01
42	TRN PNP -30V -1A SOT23	2	Q2, Q21	Fairchild	FMMT549

Item	Description	Quantity	Reference Designation	Manufacturer Name	Manufacturer Part Number
43	MOSFET N-CH 100V 8mOhm 60A POWER56 SMT	1	Q4	Fairchild	FDMS86101
44	N-CH POWER MOSFET 150v 16A POWER56	1	Q16	Fairchild	FDMS86252
45	MOSFET N-CH 100V 7A 8- SOIC SMT	1	Q17	Fairchild	FDS86141
46	FET NCH 100V 0.17A 6RLogic Level SOT23	1	Q20	Fairchild	BSS123_NL
47	N channel MOSFET 30V Rds=44mOhm SOT23	2	Q23, Q24	Analog Power	AM2330NE-T1
48	RES 240K Ohm 1%, 1/10W 0603	1	R2	KOA	RK73H1JTTD2403F
49	RES 24.9K Ohm 1%, 1 /10W 0603 SMT	1	R3	Samsung	RC1608F2492CS
50	RES 20 Ohm 5%, 1/10W 0603	1	R14	Rohm	MCR03EZPJ200
51	RES 562K Ohm 1% 1/10W 0603	1	R31	Samsung	RC1608F5623CS
52	RES 43.2K Ohm 1% 100mW 0603 SMT	2	R34, R198	Panasonic	ERJ3EKF4322V
53	RES 10K Ohm 1% 1/10W 0603 SMT	3	R36, R73, R129	Yageo	RC0603FRF-0710KL
54	RES 75 Ohm 1% 125mW 0805 SMT	4	R38, R39, R40, R41	Bourns	CR0805-FX-75R0-E
55	RES 0.043 Ohm 1% 1/2W 1206 SMD	1	R44	Rohm	UCR18EVHFSR043
56	RES 442 Ohm 1% 250mW 1206 SMT	4	R45, R47, R48, R49	Stackpole Electronics Inc	RMCF1206FT442R
57	RES 56K Ohm 1% 1/10W 0603	2	R52, R54	Panasonic	ERJ3EKF5602V
58	RES 332 Ohm 1% 1/10W 0603 SMT	1	R53	Yageo	RC0603FR-07332R
59	RES 5.1K Ohm 1% 1/10W 0603 SMT	1	R55	Vishay	CRCW06035K10FKEA
60	RES 30.9 Ohm 1% 1/10W 0603	2	R63, R86	Panasonic	ERJ3EKF30R9V
61	RES 210K Ohm 1%, 1/10W 0603	2	R64, R139	Vishay	CRCW0603210KFKEA
62	RES 4.7K Ohm 5% 125mW 0805 SMT	1	R72	Bourns	CR0805-JW-472ELF
63	RES 3.65K Ohm 1% 0.1W 0603 SMT	1	R76	Panasonic	ERJ3EKF3651V
64	RES 511 Ohm 1% 100mW 0603 SMT	1	R77	Panasonic	ERJ3EKF5110V
65	RES 18.7K Ohm 1% 1/10W 0603	2	R81, R138	ASJ	CR16-1872FL

Item	Description	Quantity	Reference Designation	Manufacturer Name	Manufacturer Part Number
66	RES 10 Ohm 5% 1/10W 0603	1	R82	Rohm	MCR03EZPJ100
67	RES 4.75 Ohm 1% 0.1W 0603 SMT	1	R84	Vishay	CRCW06034R75FKEA
68	RES 0 Ohm 5% 250mW 1206 SMT JUMPER<0.05R	2	R126, R128	Samsung	RC3216J000CS
69	RES 20 Ohm 5% 1/2W 1210 SMT	2	R130, R192	KOA	RK73B2ETTD200J
70	RES 100K Ohm 1% 1/10W 0603 SMT	2	R131, R134	Samsung	RC1608F1003CS
71	RES 0 Ohm 5% 1/10W 0603 SMT	4	R87, R137, R193, R199	Rohm	MCR03EZPJ000
72	RES 10K Ohm 1% 1/2W 1210 SMT	1	R140	Yageo	RC1210FR-0710KL
73	RES 1.5K Ohm 1% 1/2W 1210 SMD	2	R141, R142	Vishay	CRCW12101K50FKEA
74	RES 100 Ohm 5% 1/10W 0603	2	R194, R203	Samsung	RC1608J101CS
75	RES 9.09K Ohm 1% 250mW 1206 SMT	1	R195	Samsung	RC3216F9091CS
76	RES 301K Ohm 1% 0.1W 0603 SMT	1	R201	Rohm	MCR03EZPFX3013
77	Inductor common mode 1.47mH 2.8A SMD	1	T1	Pulse	P0351NL
78	Transformer Gate driver SMT 296uH 0.795Ohm DCR	1	T2	Coilcraft	DA2319-AL
79	Transformer Flyback 16-57V EFD20 5V 25W	1	T5	Tesla Magnetics	TX4017
80	AT POE PD controller for IEEE 802.3 PD70201	1	U13	Microsemi	PD-70201
81	OPTOISOLATOR 5KV TRANSISTOR 4 SMD	1	U18	Fairchild	FOD817ASD

6 Board Layout

This section provides the layout of the evaluation board. The board is a two-layer board. The layers are two Oz layers. The following figures represent the two copper layers and the silk of the board for tracking devices placements.

Figure 7 • Top Silk

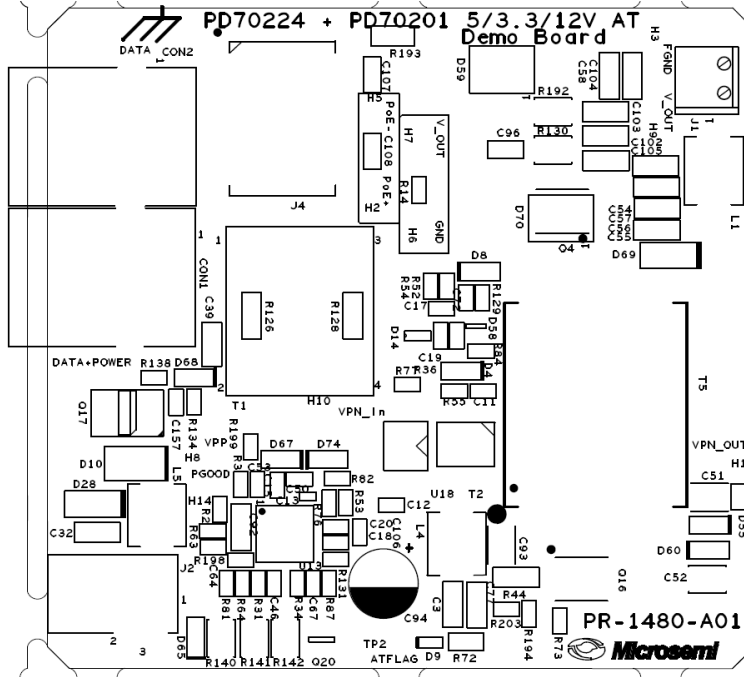


Figure 8 • Bottom Silk

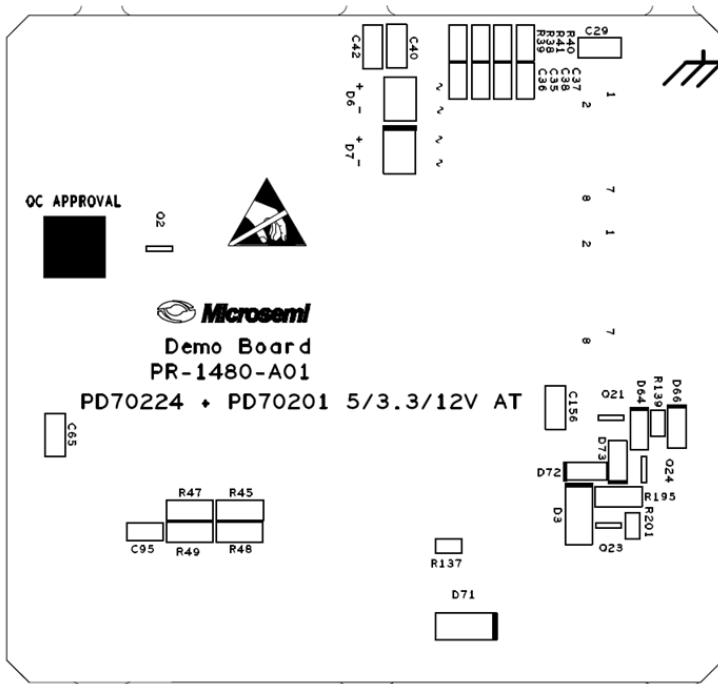


Figure 9 • Top Layer

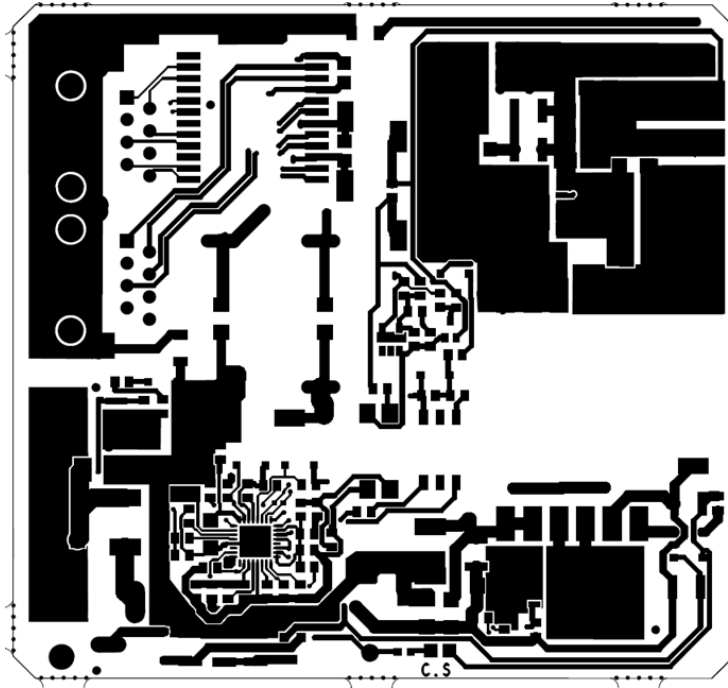
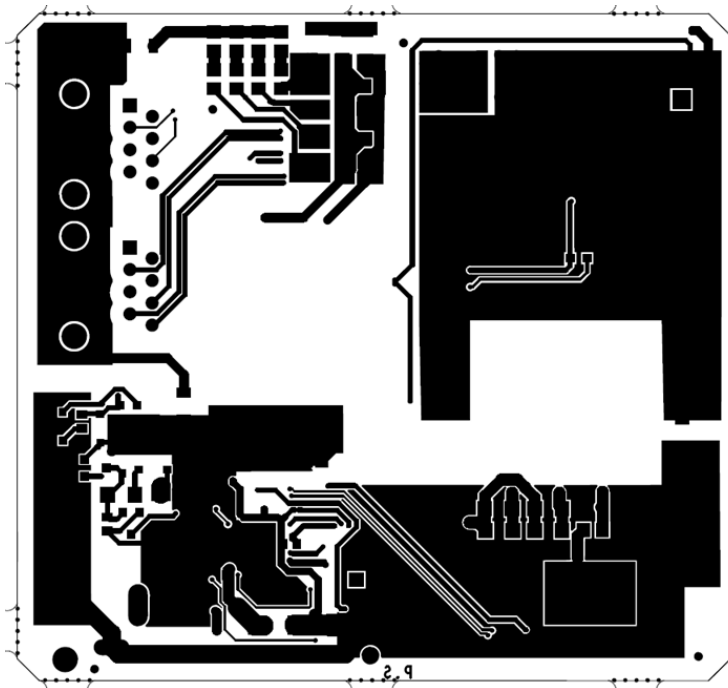


Figure 10 • Bottom Layer



7 Evaluation board Ordering information

Table 9 • Evaluation Board Ordering Information

Ordering Number	Description
PD70201EVB-U-25F-5	IEEE802.3AT Type 2 PD, wide input voltage range, based on PD70201 device, controls an isolated flyback converter, has a 5 V 5 Amp output.

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