

**PD70201EVB-25F-D-5**

**User Guide**

**25W Isolated Flyback Converter Evaluation Board**

October 2019



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# 1 Revision History

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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 October 2019. It was the first publication of this document.

## 2 Product Overview

This document provides the description and operating procedures for Microsemi's reduced size 5V 25W board PD70201EVB-25F-D-5. This board type is used for evaluating the performance of the PD70201 device, which contains both the standard 802.3af PD application interface, and a PWM controller.

Microsemi's PD70201 device is part of a family of devices that support the IEEE 802.3af, 802.3at and HDBT standards PD interface.

The PD interface includes the following family of devices.

**Table 1 • PD Family of Devices**

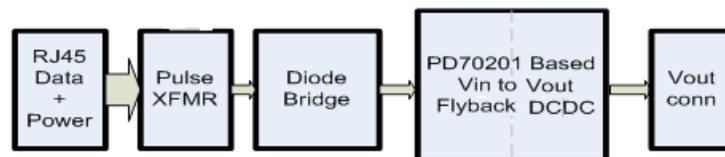
Device type	Power Capability	Integrates PWM Controller	WA Priority
PD70100	IEEE 802.3at Type 1 (IEEE 802.3 af level)	No	No
PD70101	IEEE 802.3at Type 1 (IEEE 802.3 af level)	Yes	No
PD70200	IEEE 802.3at Type 2	No	No
PD70201	IEEE 802.3at Type 2	Yes	No
PD70210	IEEE 802.3at Type 2	No	No
PD70210A	IEEE 802.3at 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-25F-D-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 Powering 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 voltages.

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

**Figure 1 • PD70201EVB-25F-D-5 Block Diagram**

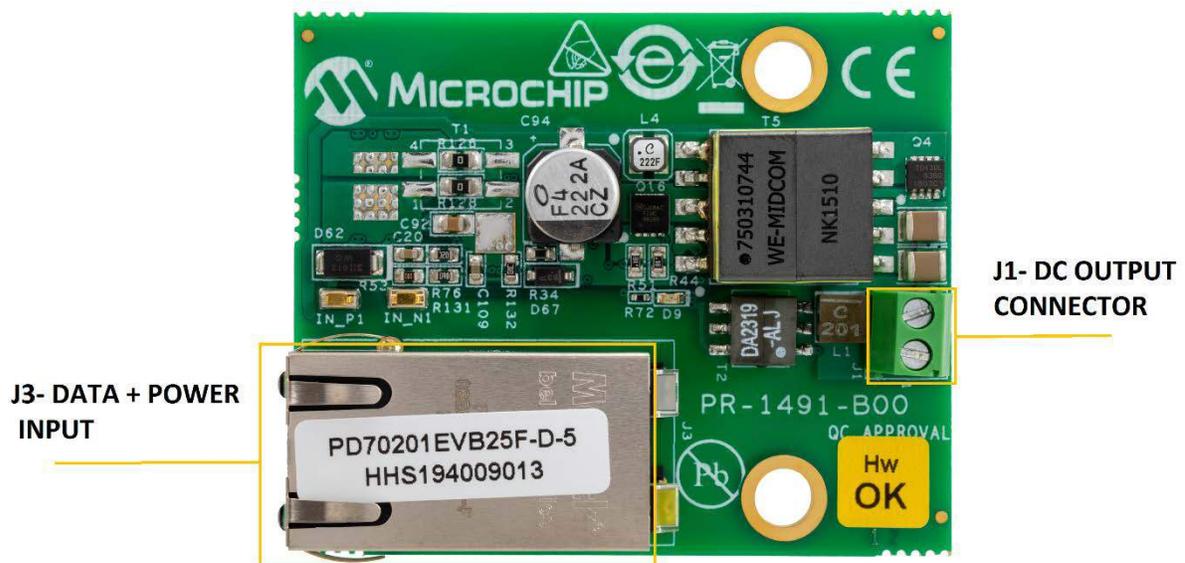


The board can be powered either by a PSE or a lab supply through RJ45 connector- see [electrical characteristics \(page 7\)](#) for the input voltage range. The external load is connected to evaluation board using output connector (J1) - refer to [evaluation board picture \(page 5\)](#) for the location of input and output connectors.

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-25F-D-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	J3	RJ45 Connector	RJ45 port for Data and Power Input for PSE connection
2	J1	Output connector	Terminal blocks for connecting a load to output regulator

### 2.2.1 RJ45 Connectors

The pinout of RJ45 input connector for power and data is described in the following table.

**Table 3 • RJ45 Input Connector (J3)**

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

- Manufacturer: Bel Stewart
- Manufacturer part number: 08261X1TGH-F or equivalent

### 2.2.2 Output Connector

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

**Table 4 • J1 Connector**

Pin No.	Signal Name	Description
Pin 1	VOUT	Positive DC/DC output voltage
Pin 2	VOUT_RTN	Return of DC/DC output voltage

- Manufacturer: Kaifeng Electronic
- Manufacturer part number: KF350V-02P-14

## 2.3 Physical Characteristics

The maximum mechanical dimensions of the board are 25.4mm x 21mm x 17mm (L x W x H).

## 2.4 Electrical Characteristics

Following are electrical characteristics of the evaluation board.

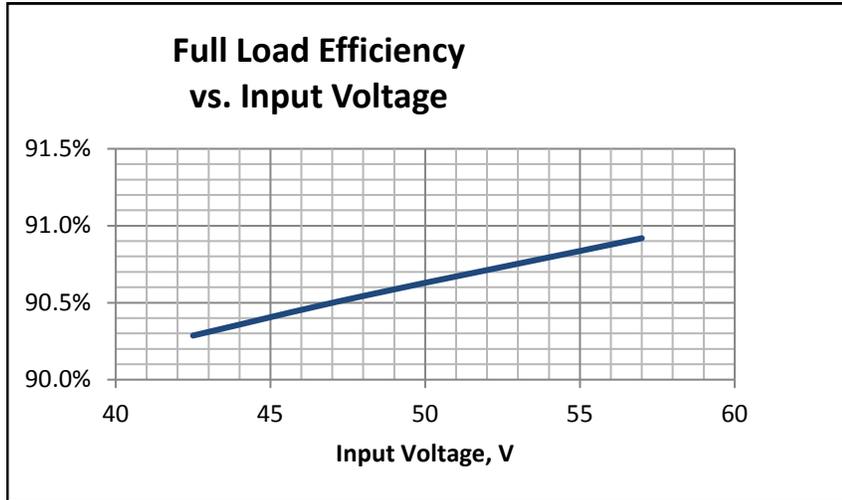
**Table 5 • Electrical Characteristics**

	Min	Max	Unit
Input – Con J3	36	57	V
Output voltage	4.8	5.25	V
Maximum Output Current	--	5	A
Port Isolation to Chassis	--	1.5	kVrms
Ambient temperature	-40	+50	°C

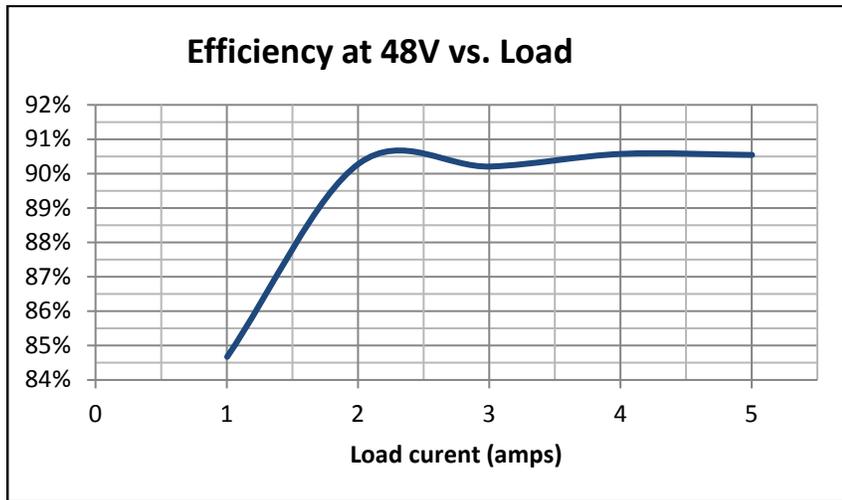
Note: to operate evaluation board from +50 °C to +70 °C an external heatsink (not supplied) has to be attached to the board via a thermally conductive conformal insulator (such as Bergquist GAP PAD p/n TGP 800VOS) by using two mounting holes on the board.

## 2.5 Typical Performance

### 2.5.1 Efficiency at full load (5A)

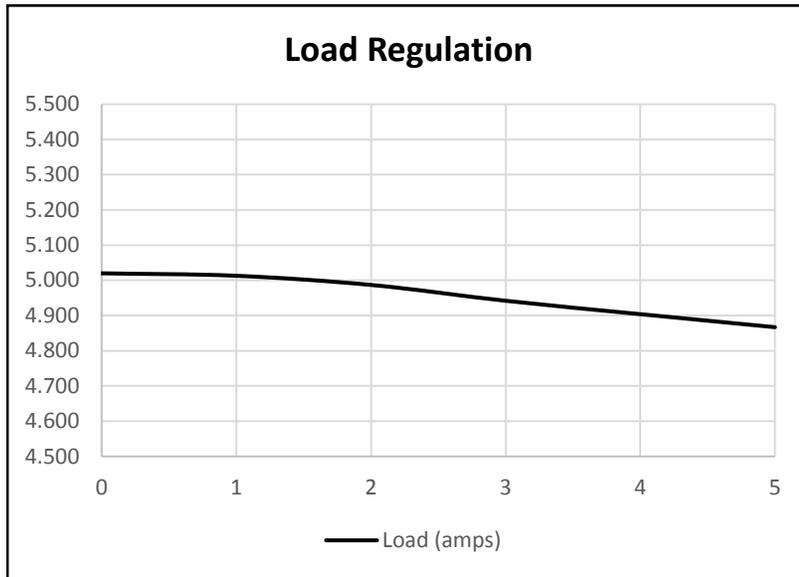


### 2.5.2 Efficiency vs load at 48V input



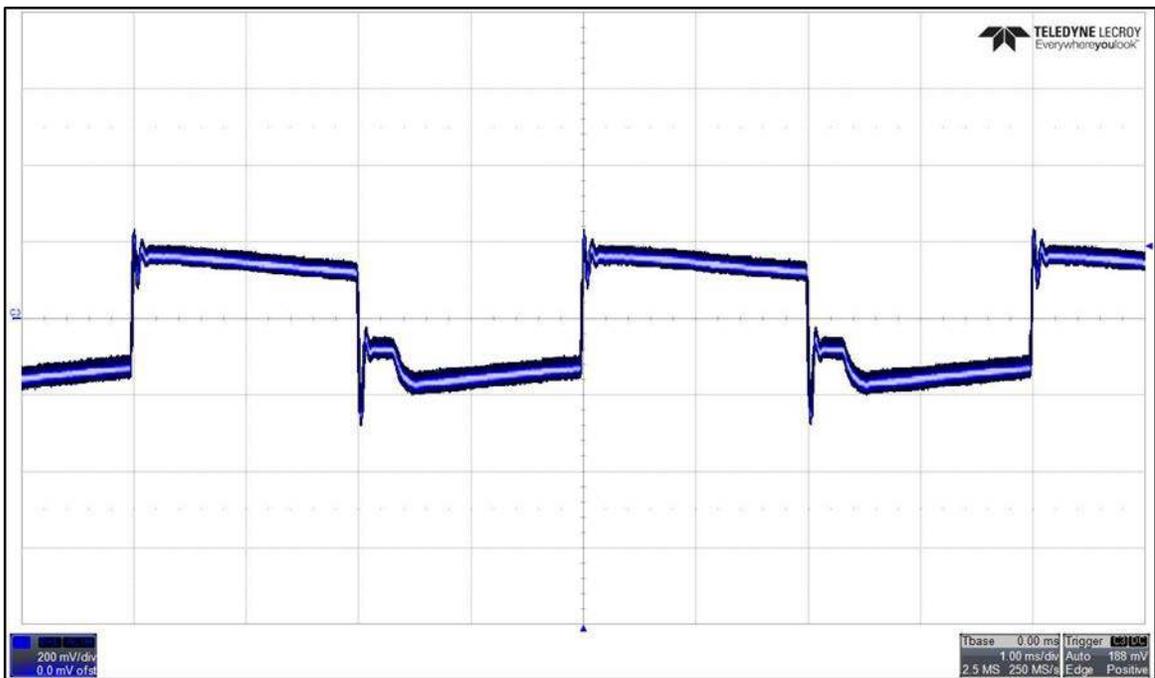
### 2.5.3 Load Regulation

Output voltage vs. load current



### 2.5.4 Step load response

Output voltage response to continuous load transients from 2A to 5A



## 3 Installation

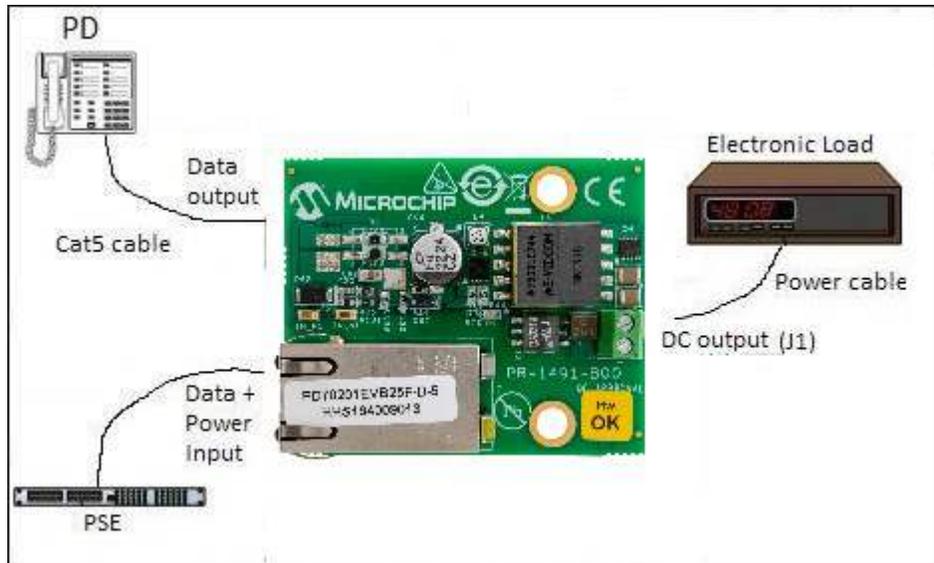
Ensure that the board's power source is turned OFF before all peripheral devices are connected.

### 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.

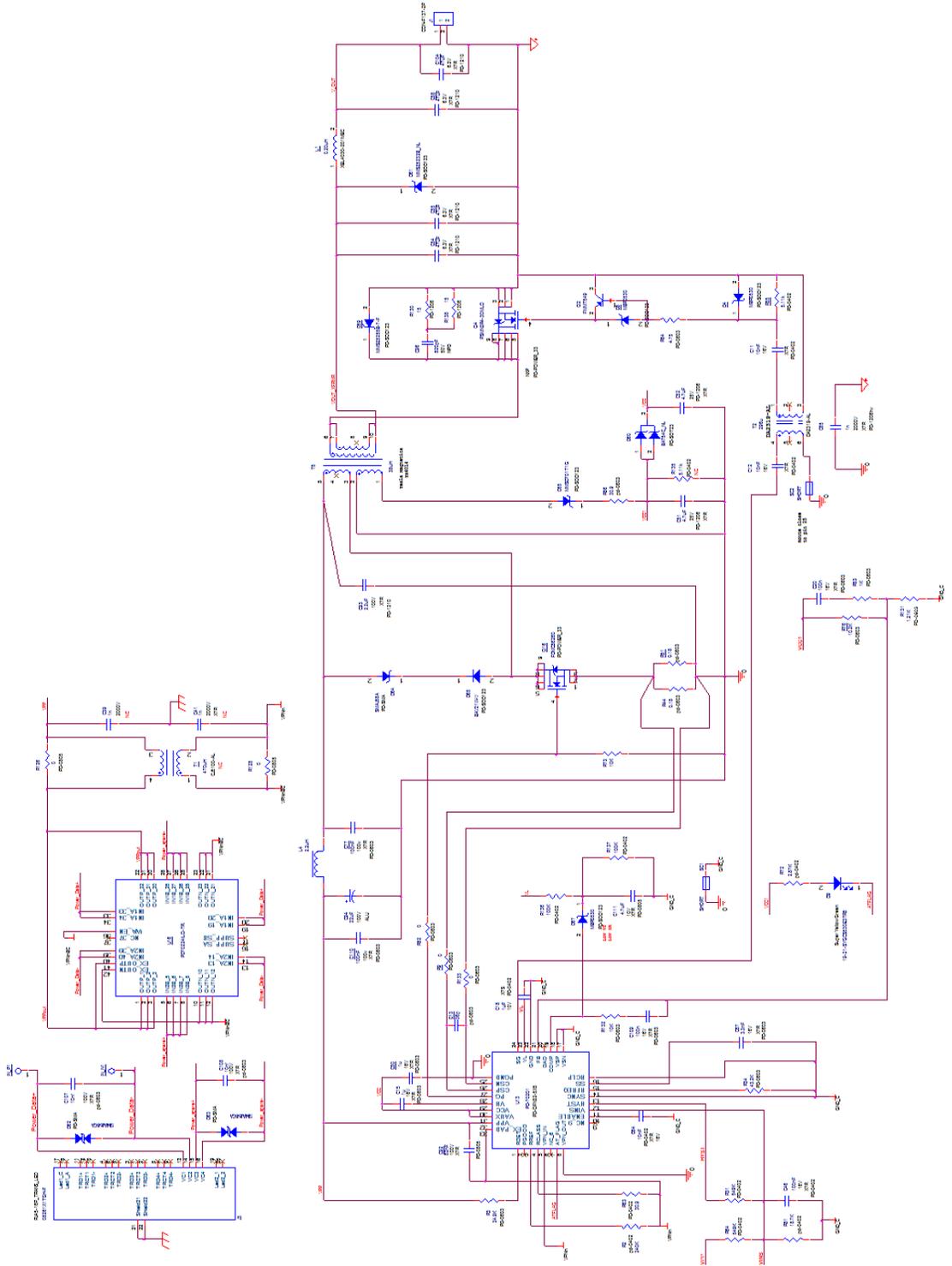
- Connect load to the board (using J1).
- Connect a Cat5 cable from PSE or a DC power supply to evaluation board using input connector J3.

Figure 3 • Test Setup



# 4 Schematic

Figure 4 • Schematic



## 5 Bill of Materials

Table 8 • Bill of materials

Item	QTY	Reference	VALUE	DESCRIPTION	Mfr Part Number	Mfr Name	NOTES
1	3	C11	10nF	CAP CRM 10nF 50v 10%X7R 0603 SMT	CL05B103KB5NNNC	Samsung	
		C12	10nF	CAP CRM 10nF 50v 10%X7R 0603 SMT	CL05B103KB5NNNC	Samsung	
		C64	10nF	CAP CRM 10nF 50v 10%X7R 0603 SMT	CL05B103KB5NNNC	Samsung	
2	1	C13	36p	CAP CER 36PF 50V COG 0603	C1608COG1H360J	TDK	
3	2	C15	1u	Capacitor, X7R, 1uF, 25V, 10% 0603	GRM188R71C105KA12D	Murata	
		C50	1u	Capacitor, X7R, 1uF, 25V, 10% 0603	GRM188R71C105KA12D	Murata	
4	1	C18	1uF	Capacitor, X7R, 1uF, 25V, 10% 0603	C1005X7S1A105K050BC	TDK	
5	1	C20	100n	CAP CER 0.1UF 16V X7R 0603	GRM188R71C104KA01D	Murata	
6	2	C39	1n	CAP CRM 1nF/2000V 10%+X7R 1206 SMT	1206GC102KAT1A	AVX	N.C
		C41	1n	CAP CRM 1nF/2000V 10%+X7R 1206 SMT	1206GC102KAT1A	AVX	N.C
7	1	C46	100nF	Capacitor, X7R, 1uF, 25V, 10% 0603	CL05B104KO5NNNC	Samsung	
8	2	C51	4.7uF	Capacitor, X7R, 4.7uF, 25V, 10% 1210	GRM31CR71E475KA88L	Murata	
		C52	4.7uF	Capacitor, X7R, 4.7uF, 25V, 10% 1210	GRM31CR71E475KA88L	Murata	
9	4	C54	47uF	CAP CER 47UF 6.3V X7R 1210	JMK325B7476MMHPR	Taiyo Yuden	
		C55	47uF	CAP CER 47UF 6.3V X7R 1210	JMK325B7476MMHPR	Taiyo Yuden	
		C58	47uF	CAP CER 47UF 6.3V X7R 1210	JMK325B7476MMHPR	Taiyo Yuden	
		C104	47uF	CAP CER 47UF 6.3V X7R 1210	JMK325B7476MMHPR	Taiyo Yuden	
10	1	C65	1n	CAP CRM 1nF/2000V 10%+X7R 1206 SMT	1206B102K202CT	Walsin	
11	1	C67	3.3nF	CAP 470NF 10V X7R 10% 0603	ECJ1VB1C332K	Panasonic	
12	2	C77	100nF	CAP CRM 100nF 100V 10% <sup>+</sup> X7R 1206 SMT	GRM188R72A104KA35D	Murata	
		C110	100nF	CAP CRM 100nF 100V 10% <sup>+</sup> X7R 1206 SMT	GRM188R72A104KA35D	Murata	
13	1	C92	82nF	CAP CRM 100nF 100V 10%X7R 1206 SMT	C0805C823K1RACTU	Kemet	
14	1	C93	2.2uF	CAP CER 2.2uF 100V 10% X7R 1210 SMT	C3225X7R2A225K	TDK	
15	1	C94	22uF	CAP ALUM 22UF 20% 100V SMD	UCZ2A220MCL6GS	Nichicon	
16	1	C96	820pF	CAP CER 820PF 50V COG 0603	C1608COG1H821J	TDK	
17	2	C107	10nf	CAP CER 10000PF 100V X7R 0603	06031C103KAT2A	AVX	
		C108	10nf	CAP CER 10000PF 100V X7R 0603	06031C103KAT2A	AVX	
18	1	C109	100n	CAP CER 100nF 16V 10% X7R 0603	VJ0603Y104KXJT	Vishay	
19	1	C111	4.7uF	Capacitor, X7R, 1uF, 25V, 10% 0603	CL21B475KPFNFNE	Samsung	
20	3	D4	MBR0530	DIODE SCHOTTKY 30V 500MA SOD123 MBR0530	MBR0530	Fairchild	
		D8	MBR0530	DIODE SCHOTTKY 30V 500MA SOD123 MBR0530	MBR0530	Fairchild	
		D67	MBR0530	DIODE SCHOTTKY 30V 500MA SOD123 MBR0530	MBR0530	Fairchild	
21	1	D9	LED yellow	LED Super Yel Grn 100-130o 20-40mcd h=1 0603 SMD	19-21-SYGCSS30E3TR8	Everlight	
22	1	D55	MMSD701T1G	DIODE SCHOTTKY 70V 0.2A,225 W, SOD123	MMSD701T1G	ON Semiconductor	
23	1	D59	MMSZ5255B-7-F	Diode Zener, 28V 500mW 5% SOD123	MMSZ5255B-7-F	Diodes Inc.	
24	1	D60	BAT54C_NL	Diode Schottky Dual 30V CC SOT23 BAT54C	BAT54C_NL	Fairchild	

25	1	D61	MMSZ5232B_NL	Diode, Zener, 500mW, 5.6V, 5% SOD 123 MMSZ5232	MMSZ5232B_NL	Fairchild	
26	2	D62	SMAJ58CA	TVS DIODE 58VWM 93.6VC SMA	SMAJ58CA	Diodes Inc.	
		D63	SMAJ58CA	TVS DIODE 58VWM 93.6VC SMA	SMAJ58CA	Diodes Inc.	
27	1	D64	SMAJ58A	DIODE TVS 58V 40A SRG400WPK SMA SMT	SMAJ58A	STMicroelectronics	
28	1	D65	BAV21W-V	DIODE SWITCH 200V 100MW SOD123 - BAV21W	BAV21W-V	Vishay	
30	2	IN_P1	HK-2-G-S05	TEST POINT TIN PLATED HEAD 1.7mm H-3mm L-3.2mm	HK-2-G-S05	MAC-8	
		IN_N1	HK-2-G-S05	TEST POINT TIN PLATED HEAD 1.7mm H-3mm L-3.2mm	HK-2-G-S05	MAC-8	
31	1	J1	PD-CON2	Terminal block 2 Pole interlocking 3.5mm pitch	KF350V-02P-14	Kaifeng Electronic	
32	1	J3	08261X1TGH-F	CONN MAGJACK 1PORT 1000 BASE-T	08261X1TGH-F	Bel Stewart	
33	1	L1	0.20uH	Fixed Inductors 0.20uH 20% 2.4mOhms 4X4m	XEL4030-201MEC	Coilcraft	
34	1	L4	2.2uH	Power Inductors 2.2uHy 1.5A 110mOhmSMT Shielded	LPS3015-222ML	Coilcraft	
35	1	Q2	FMMT549	TRN PNP -30V -1A SOT23	FMMT549	Fairchild	
36	1	Q4	PSMN2R4-30MLD	MOSFET N-CH 30V 4.2mOhm power33 SMT	PSMN2R4-30MLD	NXP	
37	1	Q16	FDMC86260	MOSFET N-ch 150V, 34 mohm Power33 SMT	FDMC86260	Fairchild	
38	1	R2	240K	RES 240K 125mW 5%0402 SMT MTL FLM	ERJ2GEJ244X	Panasonic	
39	1	R3	24.9K	RES TCK FLM 24.9K 62.5mW 1%0603 SMT	RC1608F2492CS	Samsung	
40	3	R9	0	RES TCK FLM 0R 62.5mW 5% 0603 SMT	MCR03EZPJ000	Rohm	
		R82	0	RES TCK FLM 0R 62.5mW 5% 0603 SMT	MCR03EZPJ000	Rohm	
		R133	0	RES TCK FLM 0R 62.5mW 5% 0603 SMT	MCR03EZPJ000	Rohm	
41	2	R31	549K	Resistor, 549K, 1%, 1/16W 0402	MCR01MZPF5493	Rohm	
		R64	549K	Resistor, 549K, 1%, 1/16W 0402	MCR01MZPF5493	Rohm	
42	1	R34	43.2K	RES 43.2K 100mW 0603SMT 1%	ERJ3EKF4322V	Panasonic	
43	2	R44	0.18	RES TCK FLM 0.18R 0.1W 1% 0603 SMT	ERJ3RSFR18V	Panasonic	
		R51	0.18	RES TCK FLM 0.18R 0.1W 1% 0603 SMT	ERJ3RSFR18V	Panasonic	
44	1	R53	1K	RES 1K 62.5mW 1%0603 SMT MTL FLM	ERJ3EKF1001V	Panasonic	
45	1	R55	5.11k	RES SMT5.11K 1% 1/16w 0402	CR10-5111FK	ASJ	
46	1	R63	30.9	Resistor 30.9Ohm 1% 1/16W 0402 SMD	RC0402FR-0730R9L	Yageo	
47	1	R72	2.87K	RES FLM 2.87K 1% 62.5mW 0402 SMT	CRCW04022K87FKED	Vishay	
48	2	R73	10K	RES 10K 62.5mW 1%0603 SMT MTL FLM	MCR03EZPFX1002	Rohm	
		R132	10K	RES 10K 62.5mW 1%0603 SMT MTL FLM	MCR03EZPFX1002	Rohm	
49	1	R76	10.2K	RES 10.2K 62.5mW 1%0603 SMT MTL FLM	RC1608F1022CS	Samsung	
50	1	R81	18.7K	Resistor, 18.7K, 1%, 1/16W 0402	ERJ-2RKF1872X	Panasonic	
51	1	R84	4.75	RES 4.75R 0.1W 1%0603 SMT MTL FLM	CRCW06034R75FKEA	Vishay	
52	1	R86	30.9	Resistor, 30.9R 1%, 1/10W 0603	ERJ3EKF30R9V	Panasonic	
53	2	R126	0	RES TCK FLM 0R 125mW 5% 0805 SMT	RC2012J0000CS	Samsung	
		R128	0	RES TCK FLM 0R 125mW 5% 0805 SMT	RC2012J0000CS	Samsung	
54	2	R130	15	Resistor, 15 Ohm 250mW 1% 1206	WR12X15R0FTL	Walsin	
		R138	15	Resistor, 15 Ohm 250mW 1% 1206	WR12X15R0FTL	Walsin	
55	1	R131	1.21K	RES 1.21K 62.5mW 1%0603 SMT MTL FLM	RC0603FR-071K21L	Yageo	
56	1	R135	5.11k	RES SMT5.11K 1% 1/16w 0402	CR10-5111FK	ASJ	N.C
57	2	R136	100K	Resistor, SMT 100K, 1%, 1/16W 0402	ERJ-2RKF1003X	Panasonic	
58		R137	100K	Resistor, SMT 100K, 1%, 1/16W 0402	ERJ-2RKF1003X	Panasonic	
59	1	T1	470uH	Inductor 0.47mH 0.85A 9.4x6mm SMT	CJ5100-AL	Coilcraft	N.C
60	1	T2	296u	Transformer, Gate driver SMT 269uH, DCR 0.795	DA2319-AL	Coilcraft	
61	1	T5	38uH	TRANS FLYBACK POE+ 38UH SMD PRI RES0.082	TX4014	Tesla Magnetics	

				ohm			
62	1	U13	PD70201	AT POE PD controller for IEEE 802.3 PD70201	PD70201ILQ-TR	Microsemi	
63	1	U16	PD70224	Ideal Diode Bridge dual 6x8 SMT PD70224	PD70224ILQ-TR	Microsemi	

Notes: Third party components can be replaced by approved equivalents.  
N.C= not installed (optional)

## 6 Board Layout

This section provides the layout of the evaluation board. The board is a four-layer board with 2 Oz copper. The following figures represent the silk of the board for tracking devices placements.

Figure 5 • Top Silk

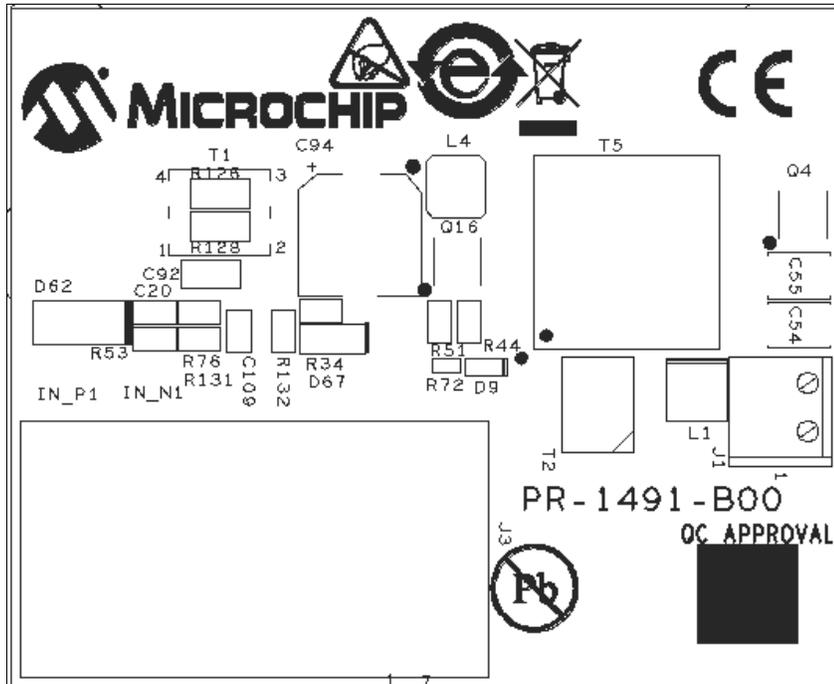
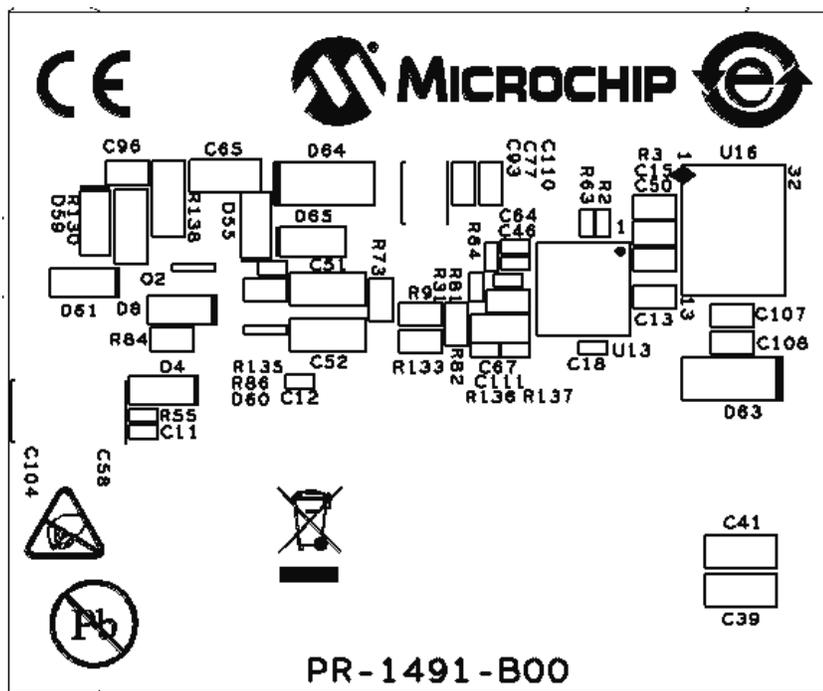


Figure 6 • Bottom Silk



## 7 Evaluation board ordering information

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**Table 9 • Evaluation Board Ordering Information**

Ordering Number	Description
PD70201EVB-25F-D-5	IEEE802.3AT Type 2 PD based on PD70201 device with a 5V 5A output.

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