PD70201EVB25Fx

25 W Isolated Flyback Converter PD Evaluation Board

Introduction

Microchip's PD70201EVB25Fx Evaluation Board (see Figure 2) 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, class, and power supplying phases on the 2/4 pairs of the Cat5 cable. This document provides all the necessary steps and connection instructions required to install and operate this board. The board supports a 25 Watt, 5 V or 12 V output which differs by assembly version.

Figure 1. PD70201EVB25Fx Block Diagram

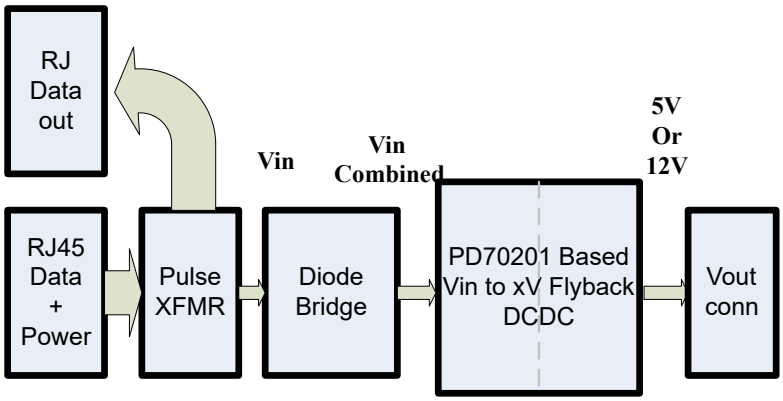
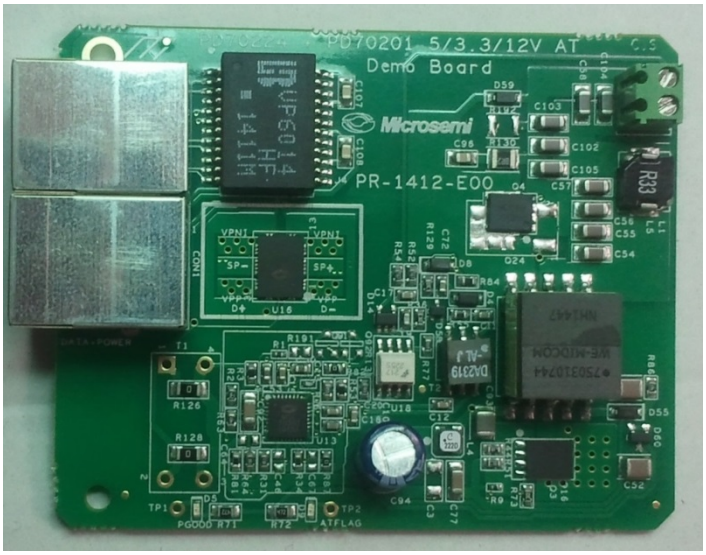


Figure 2. PD70201EVB25Fx Evaluation Board – General View



Microchip's PD70201ILQ device is part of a family of devices that are targeted for realizing the IEEE® 802.3at and IEEE 802.3af standard PD interface. The following table shows the PD interface family of devices.

Table 1. PoE PD Devices

P/N	Type	Package	IEEE 802.3af Support	IEEE 802.3at Support	HDBaseT Support	UPoE Support
PD70100	Front End	3x4 mm 12L DFN	x			
PD70101	Front End + PWM	5x5 mm 32L QFN	x			
PD70200	Front End	3x4 mm 12L DFN	x	x		
PD70201	Front End + PWM	5x5 mm 32L QFN	x	x		
PD70210	Front End	4x5 mm 16L DFN	x	x	x	x
PD70210A	Front End	4x5 mm 16L DFN	x	x	x	x
PD70210AL	Front End	5x7 mm 38L QFN	x	x	x	x
PD70211	Front End + PWM	6x6 mm 36L MLPQ	x	x	x	x
PD70224	Ideal Diode Bridge	7.5x10 mm 52L MLP	x	x	x	x

Table of Contents

1. Overview

1.1 Evaluation Boards Ordering Information

Microchip supplies the following list of evaluation boards.

Table 1-1. Microchip Evaluation Boards

Ordering Number	Description
PD70201EVB25F5	IEEE 802.3at Type 2 PD, based on PD70201 device, controls an isolated flyback converter, has a 5 V at 5 A output.
PD70201EVB25F12	IEEE 802.3at Type 2 PD based on PD70201 device, controls an isolated flyback converter, has a 12 V at 2.1 A output.

1.2 Evaluation Board Features

The following features are supported in the PD70201EVB25F5 and PD70201EVB25F12 evaluation boards.

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

1.3 Physical Characteristics

Table 1-2 lists the evaluation board's physical characteristics.

Table 1-2. Physical Characteristics

Parameter	Value
Mechanical dimensions (in mm)	81 x 65 x 15 (L x W x H)

2. Physical Description

2.1 Package Contents

Upon opening the evaluation board package, verify that the following part is included. If it is damaged, contact your local representative or Microchip's headquarters.

Package content for standard shipments is: PD70201EVB25Fx Evaluation Board.

2.2 Connectors

The following sections provide information regarding the unit’s connectors.

2.2.1 Connectors Table

The following table lists the evaluation board's connectors.

Table 2-1. Connectors List

#	Connector	Name	Description
1	CON1	RJ45 Connector	RJ45 port for Data and Power In for PSE connection
2	CON2	RJ45 Connectors	RJ45 port for Data Out for PD data connection
4	J1	Converter Output	Terminal blocks for connecting a load to output regulator

2.2.2 Connectors Detailed Explanation

The pin description in the following table refers to the connectors listed in Table 2-1.

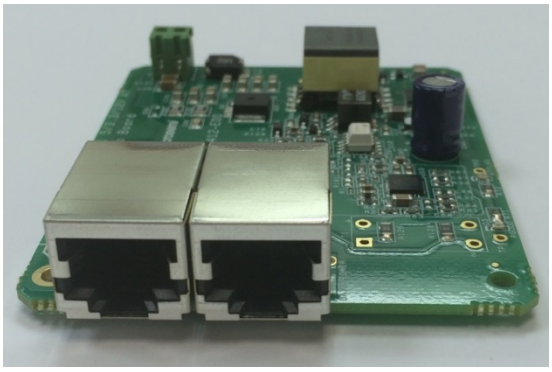
RJ45 Connectors

Figure 2-1 shows the two dedicated RJ45 connectors.

Table 2-2. RJ45 Connectors

Connector	Pin No	Signal Name	Description
CON2	1, 2, 3, 4, 5, 6, 7, and 8	Data Out	Data output to PD
CON1	1, 2	Data and Power In	Data and power input to a powered device
	3, 6	Data and Power In	Data and power input to a powered device
	4, 5	Data and Power In	Data and power input to a powered device
	7, 8	Data and Power In	Data and power input to a powered device

Figure 2-1. Front RJ45 and Wall Adapter Connectors



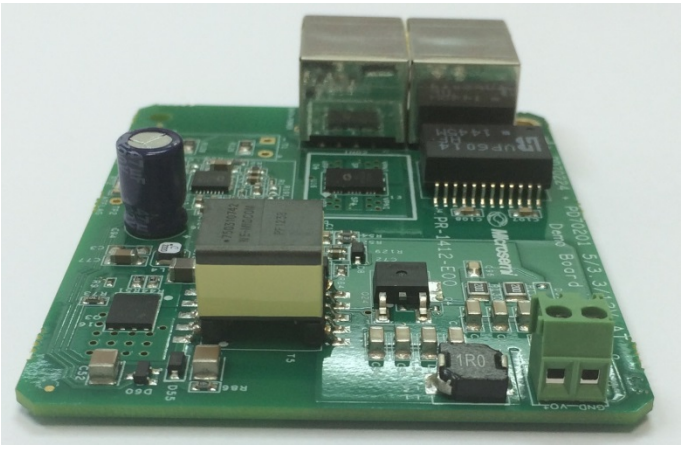
Vout Connectors

J1 is the DC/DC output connection used for connecting to an external load. See Figure 2-2.

Table 2-3. J1 Connector

Pin No.	Signal Name	Description
J1 (Left) – Pin 1	Vout	Positive DC/DC output voltage
J1 (Right) – Pin 2	Vout_Rtn	Return of DC/DC output voltage

Figure 2-2. Vout Connectors



2.3 Indications

The following section provide general information regarding unit indications.

LED Indication

Figure 2-3 shows the LEDs on the evaluation board.

- D5 is the Power_GOOD indication LED. A PD70201 device output signal indicating if the device isolation switch is in operation. The PWM converter should be turned on only after this signal is active.
- D9 is the AT flag indication LED. A PD70201 device output signal indicating that the device has detected two fingers class, thus PSE side is AT level capable. This signal is an indication to the PD environment that AT power level is supported.

Figure 2-3. LED Indications

3. Electrical Characteristics

The following table describes the PD70201EVB25Fx evaluation board's electrical characteristics:

Table 3-1. Electrical Characteristics

Parameter	Min	Max	Unit
Main DC supply–CON1, J2	42	57	V
Maximum available current	12 V/2.1 A		A
Maximum available current	5 V/5 A		A
Port isolation to chassis	-	1.5	kVrms

4. Installation

4.1 Preliminary Considerations and Safety Precautions

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

Note: In maximum power at the output, some of the devices may reach high temperatures (still less than 70 degrees). Pay attention while testing these devices.

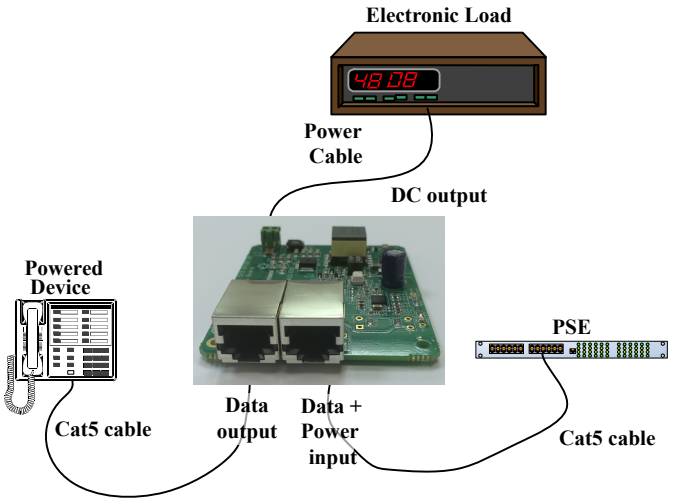
4.2 Initial Configuration

Note: Prior to starting any operation, verify that the evaluation board is setup as shown in Figure 4-1.

Follow the steps given below to verify the board set up:

1. Connect load to main board (J1).
2. Connect a Cat 5 cable from PSE to the evaluation board (CON1). Alternatively, connect a power cable from the power supply to the evaluation board (J2).
3. When there is a need to test the Ethernet data, connect Ethernet cable from the evaluation board (CON2) to PD Ethernet host.

Figure 4-1. Test Setup

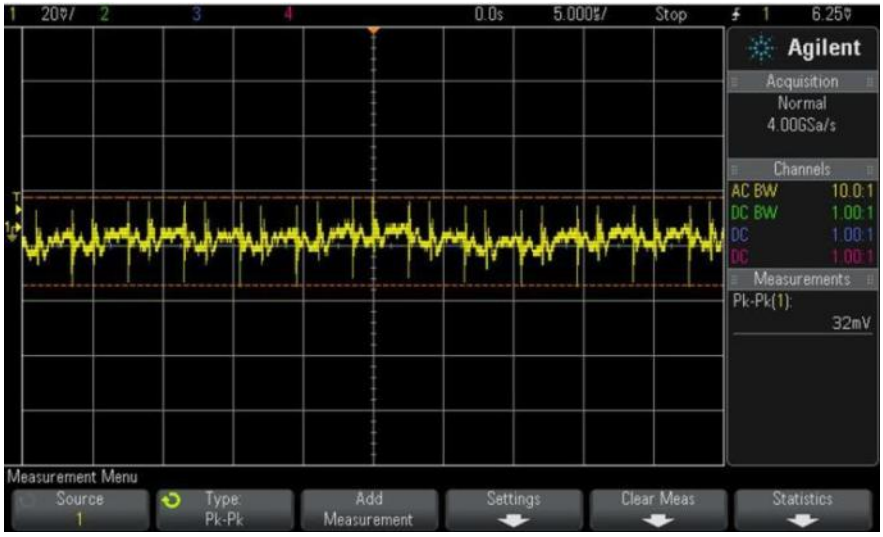


5. Board Test Waveforms

The following section shows the snapshots of the signals on 5 V and 12 V boards. Waveforms were dumped in Microchip's lab on a single board. Minor changes might be avoidances based on test setup and device variance.

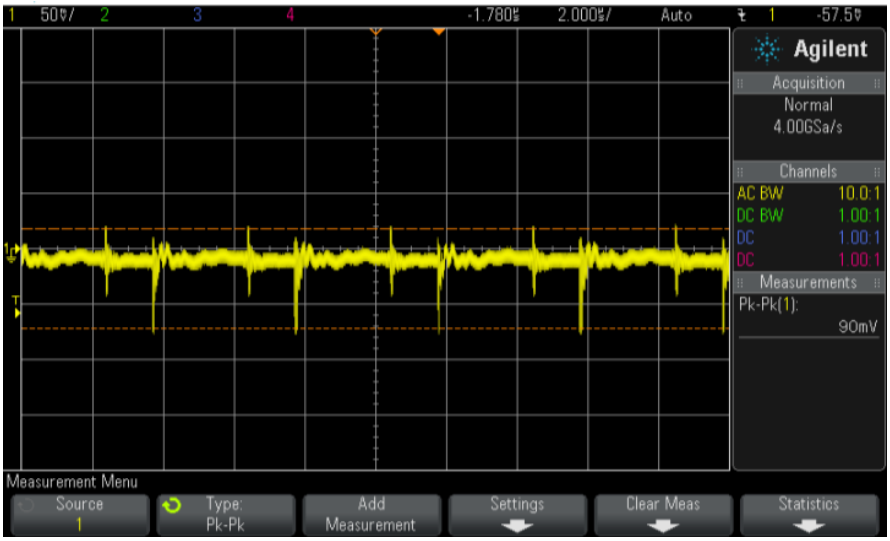
Output voltage ripple at full load: 32 mV peak to peak.

Figure 5-1. 12 V/25 W Flyback Output Voltage Ripple at Full Load



Output voltage ripple at full load: 90 mV peak to peak.

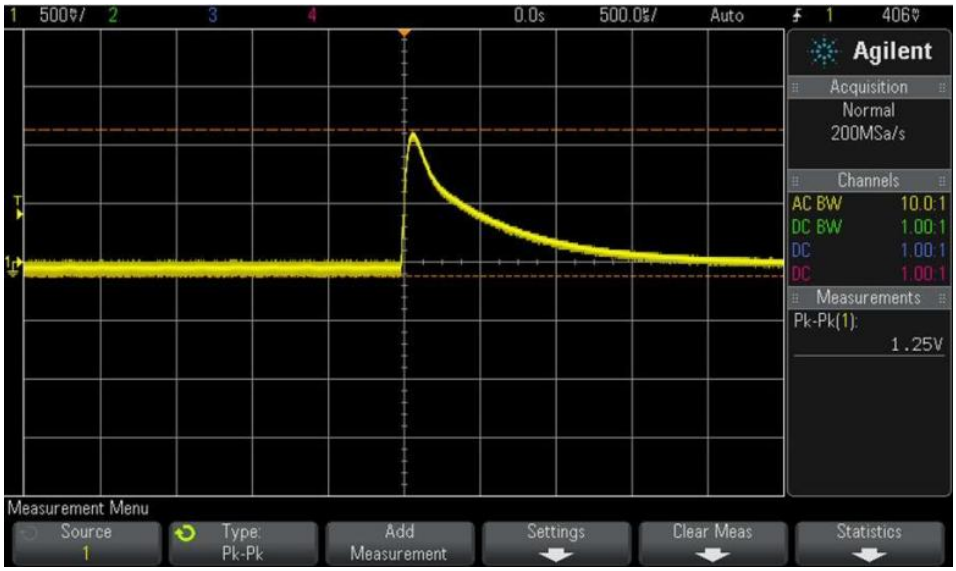
Figure 5-2. 5 V/25 W Flyback Output Voltage Ripple at Full Load



Output voltage at load switching from 90% to 20%:

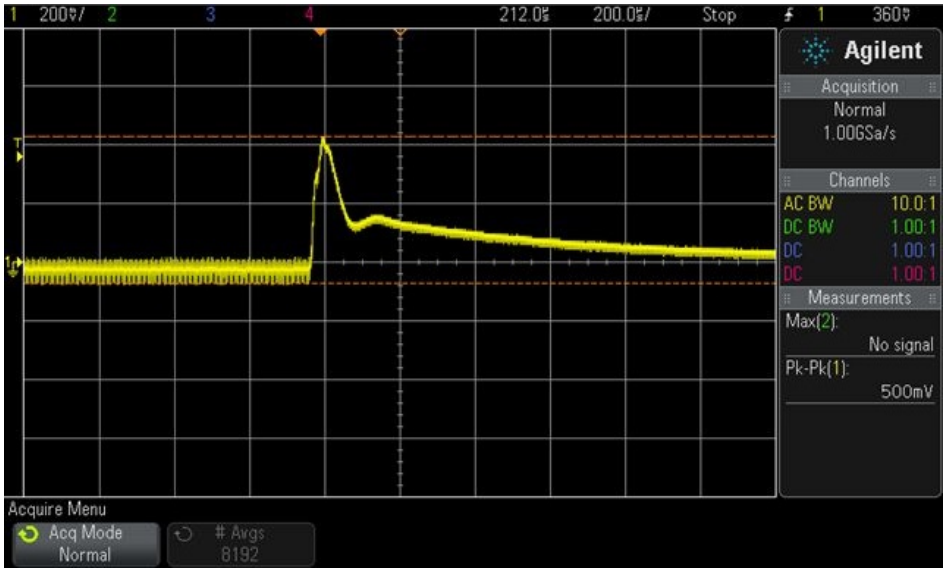
- 1.25 volt rise for 1.5 mSec

Figure 5-3. 12 V/25 W Flyback Output Voltage at Load Switching from 90% to 20%



- 0.5 volt rise for 0.3 mSec

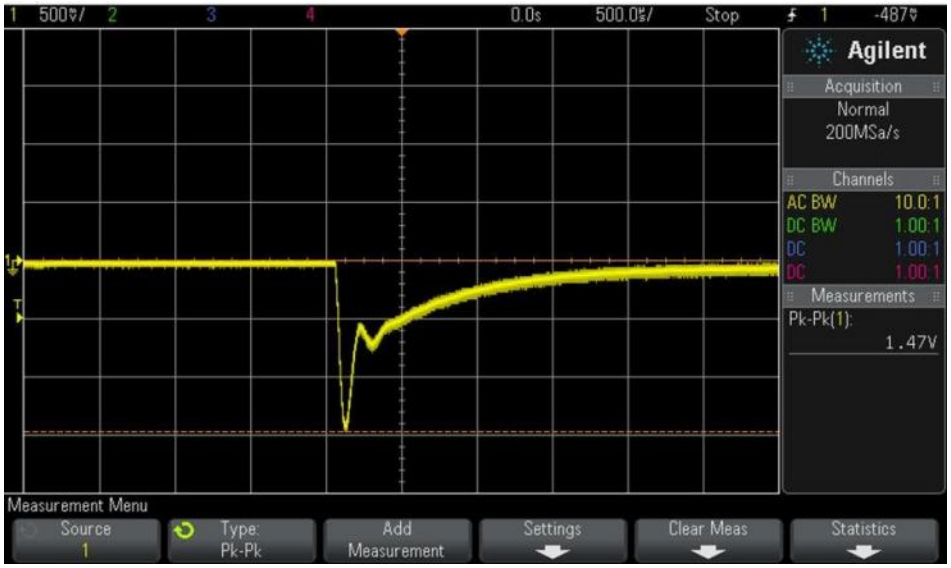
Figure 5-4. 5 V/25 W Flyback Output Voltage at Load Switching from 90% to 20%



Output voltage at load switching from 20% to 90%:

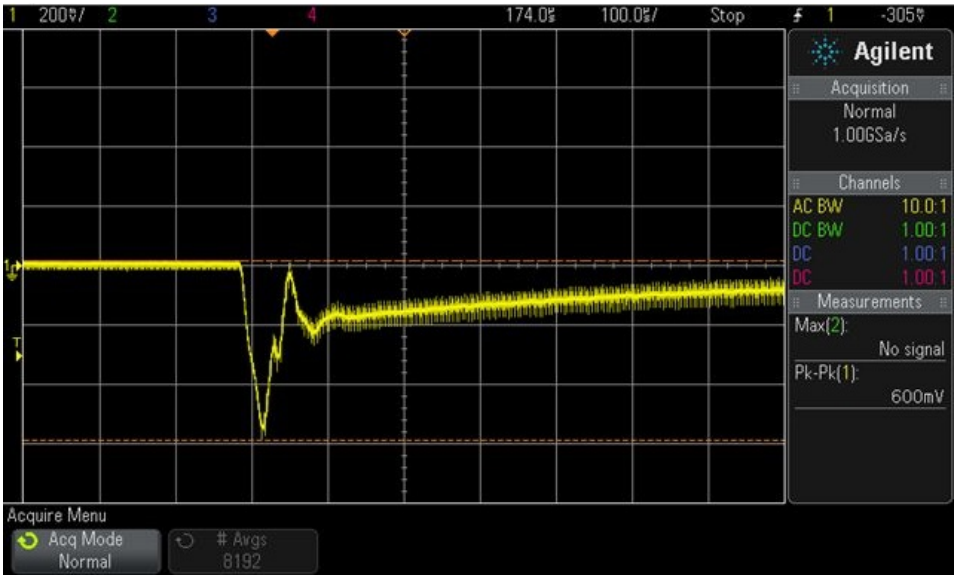
- 1.47 volt drop for 1.5 mSec

Figure 5-5. 12 V/25 W Flyback Output Voltage at Load Switching from 20% to 90%



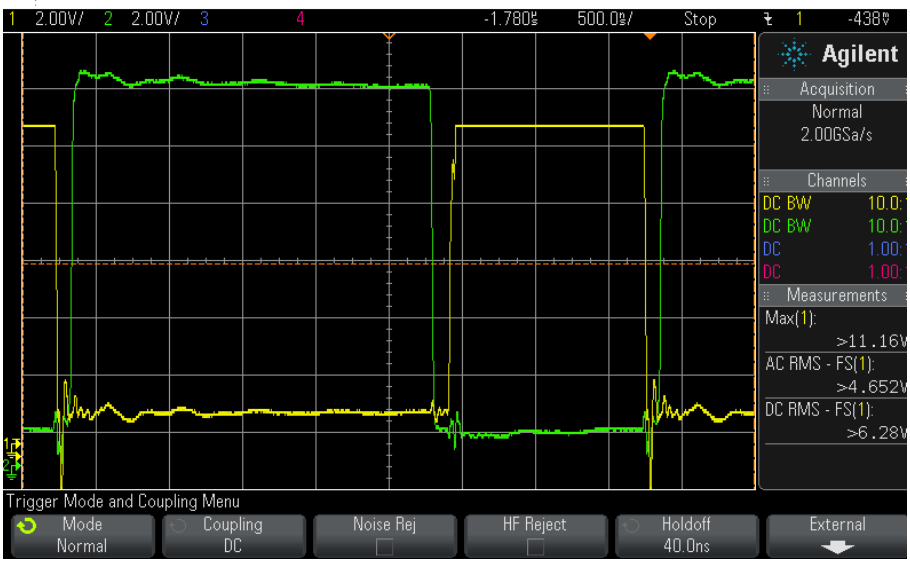
- 0.6 volt drop for 0.3 mSec

Figure 5-6. 5 V/25 W Flyback Output Voltage at Load Switching from 20% to 90%



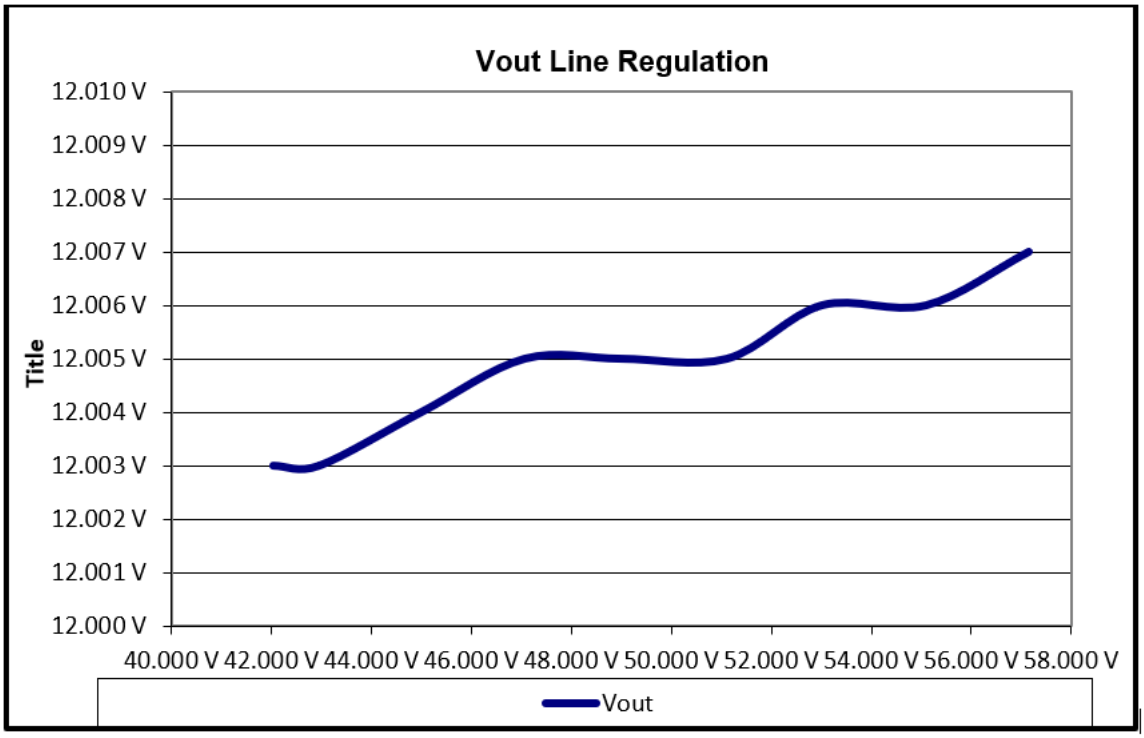
The following figure shows the primary FET switching signal and the secondary FET switching signal. Channel 1 is primary FET gate and channel 2 is secondary FET gate.

Figure 5-7. 12 V/25 W Flyback Primary and Secondary Fets Gate



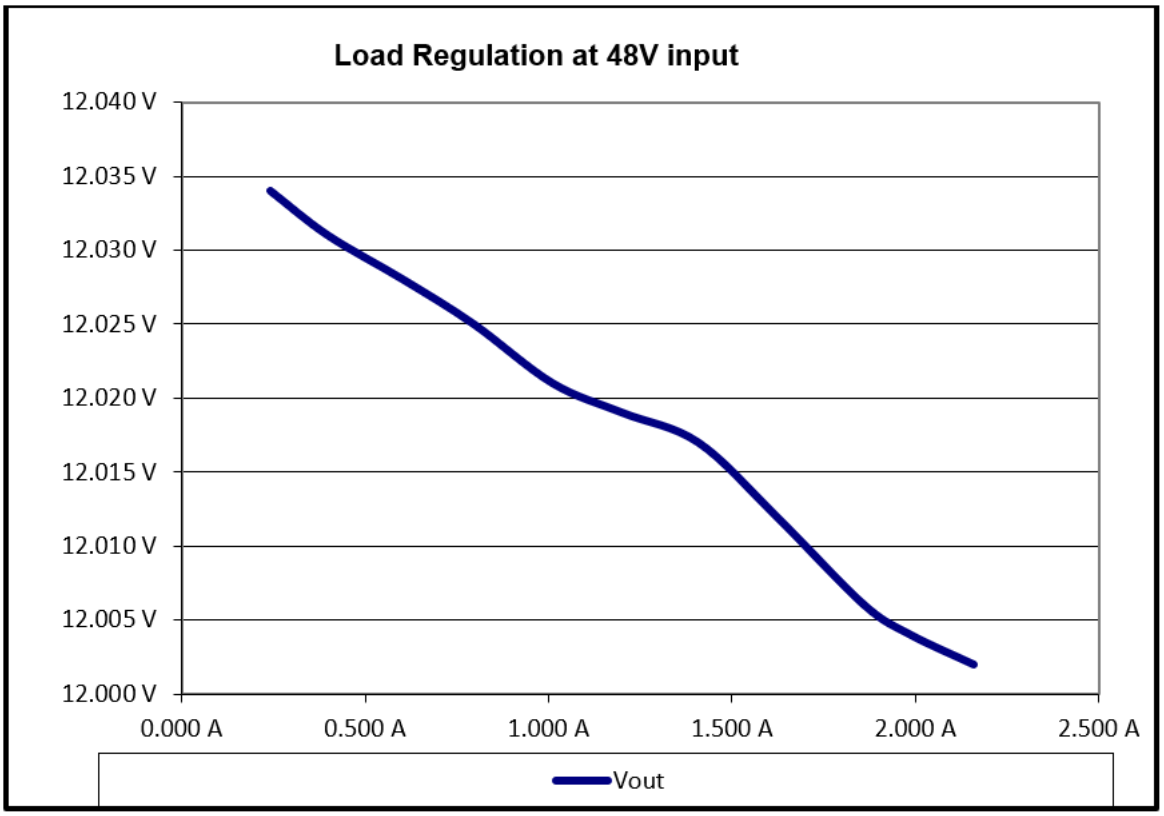
The following figure shows the PD70201EVB25F12 output voltage line regulation:

Figure 5-8. Output Voltage as a Function of Vin Voltage



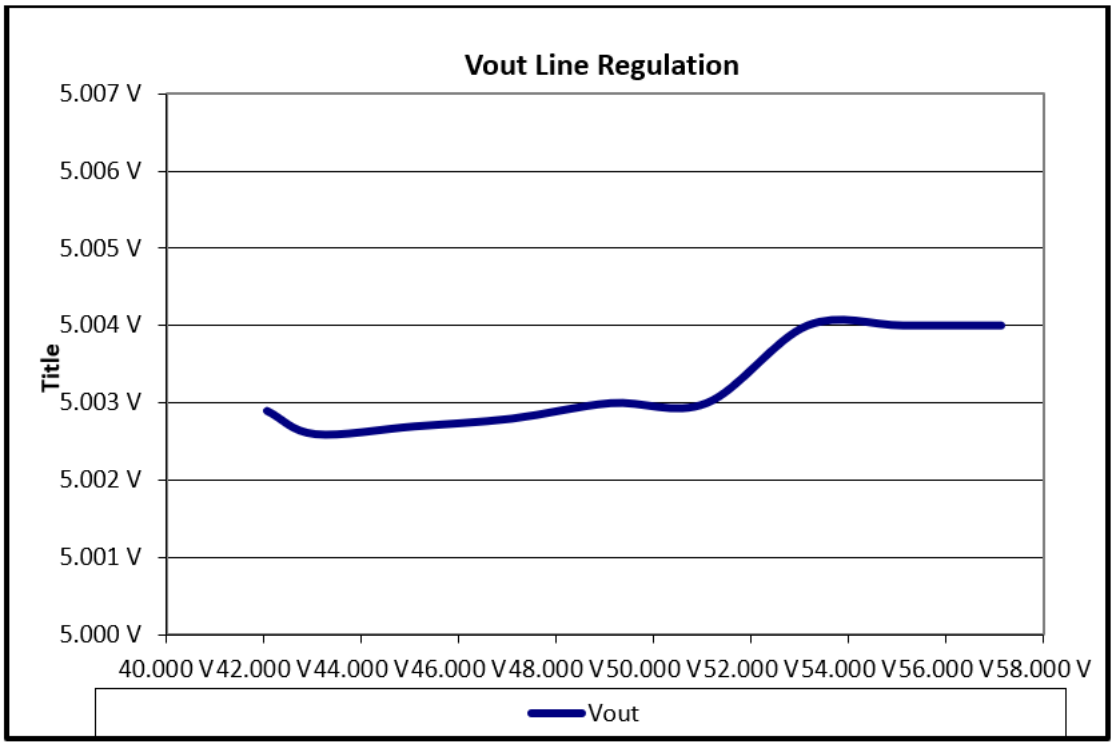
The following figure shows the PD70201EVB25F12 output voltage load regulation:

Figure 5-9. Output Voltage as a Function of the Load Current



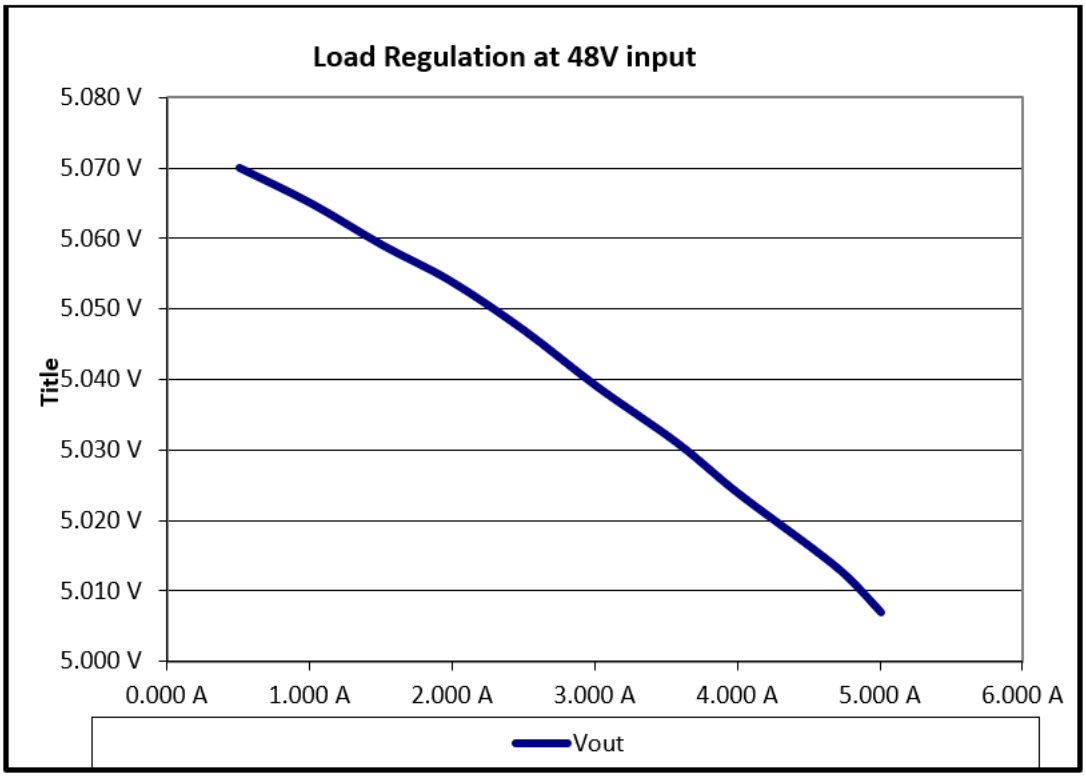
The following figure shows the PD70201EVB25F5 output voltage line regulation:

Figure 5-10. Output Voltage as a Function of Vin Voltage



The following figure shows the PD70201EVB25F5 output voltage load regulation:

Figure 5-11. Output Voltage as a Function of the Load Current



6. PD70201EVB25F12 Efficiency

This section describes typical EVB efficiency under various loads and PoE input voltage levels.

The information is presented by two modes:

- Total Eff – Efficiency measured between RJ45 input connector and output voltage connector. It does not include losses in the connectors.

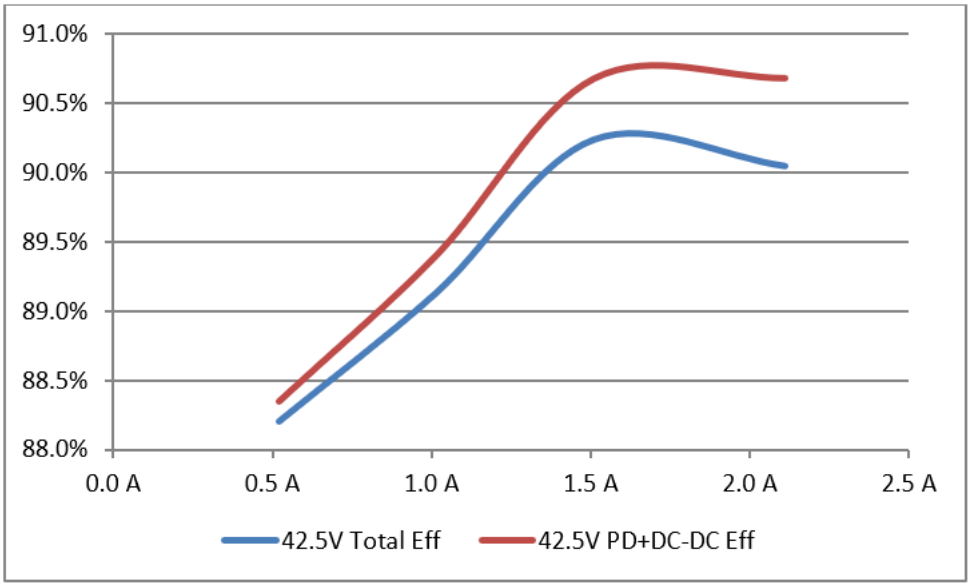
  $$TotalEff = \frac{Vout*Iout}{Vin*Iin}$$

- PD+DCDC Eff – Efficiency measured between diode bridge output and output voltage connector. It does not include the losses in the connectors, line transformer, and diode bridges.

  $$PD\_DCDCEff = \frac{Vout*Iout}{Vppout*Iin}$$

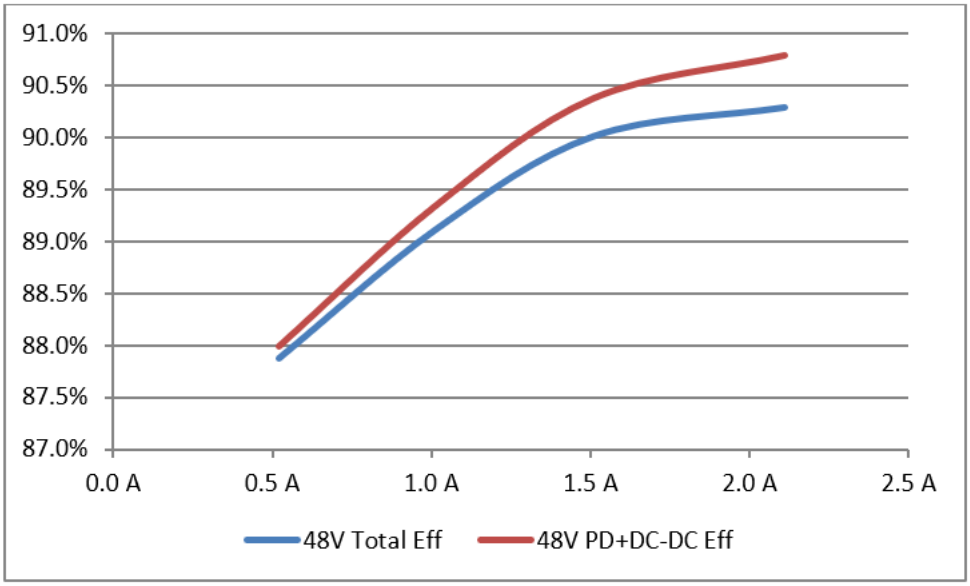
6.1 Efficiency for 42.5 V Input at the Input Connector

Figure 6-1. PD70201EVB25F12 Efficiency at 42.5 V



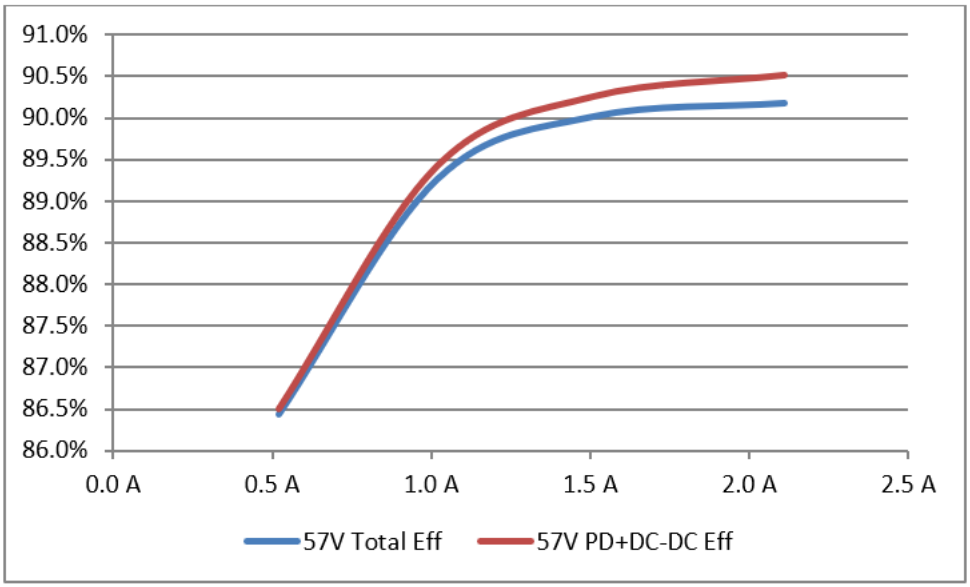
6.2 Efficiency for 48 V Input at the Input Connector

Figure 6-2. PD70201EVB25F12 Efficiency at 48 V



6.3 Efficiency for 57 V Input at the Input Connector

Figure 6-3. PD70201EVB25F12 Efficiency at 57 V



7. PD70201EVB25F5 Efficiency

This section describes typical EVB efficiency under various loads and PoE input voltage levels.

The information is presented by two modes:

- Total Eff – Efficiency measured between RJ45 input connector and output voltage connector. It does not include losses in the connectors.

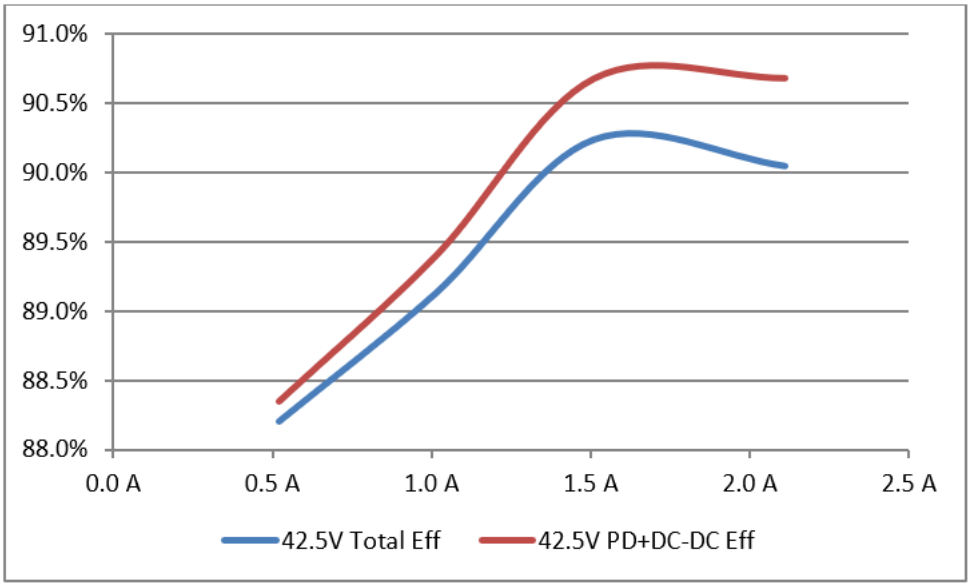
  $$TotalEff = \frac{Vout*Iout}{Vin*Iin}$$

- PD+DCDC Eff – Efficiency measured between diode bridge output and output voltage connector. It does not include the losses of the input connector, line transformer, and diode bridges.

  $$PD\_DCDCEff = \frac{Vout*Iout}{Vppout*Iin}$$

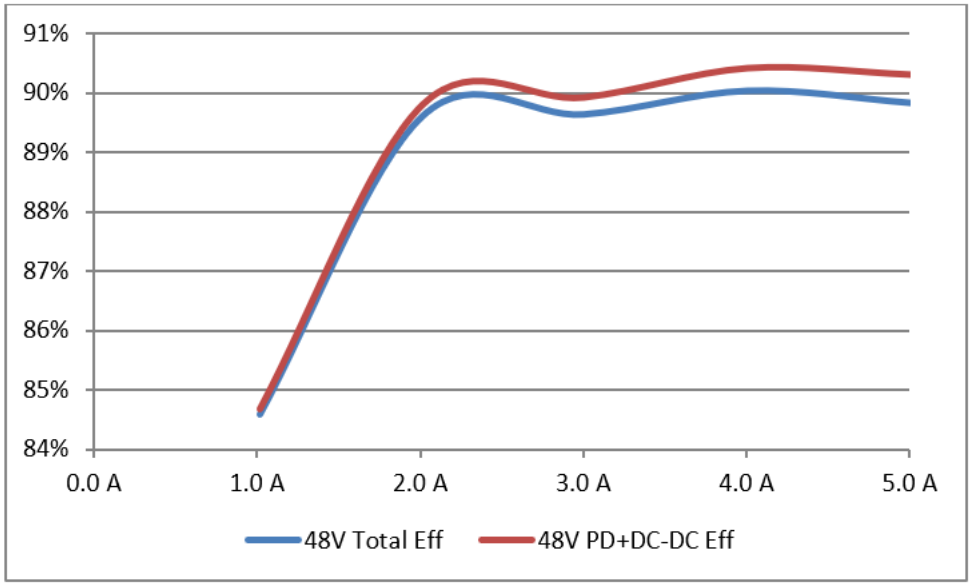
7.1 Efficiency for 42.5 V Input at the Input Connector

Figure 7-1. PD70201EVB25F5 Efficiency at 42.5 V



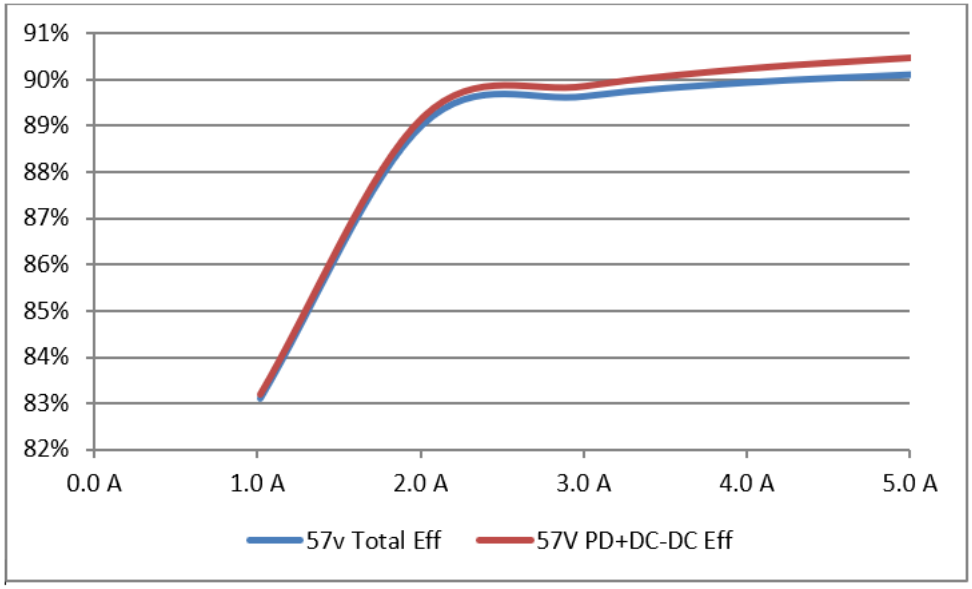
7.2 Efficiency for 48 V Input at the Input Connector

Figure 7-2. PD70201EVB25F5 Efficiency at 48 V



7.3 Efficiency for 57 V Input at the Input Connector

Figure 7-3. PD70201EVB25F5 Efficiency at 57 V



8. Schematics

Figure 8-1. Schematic of PD70201EVB25F5

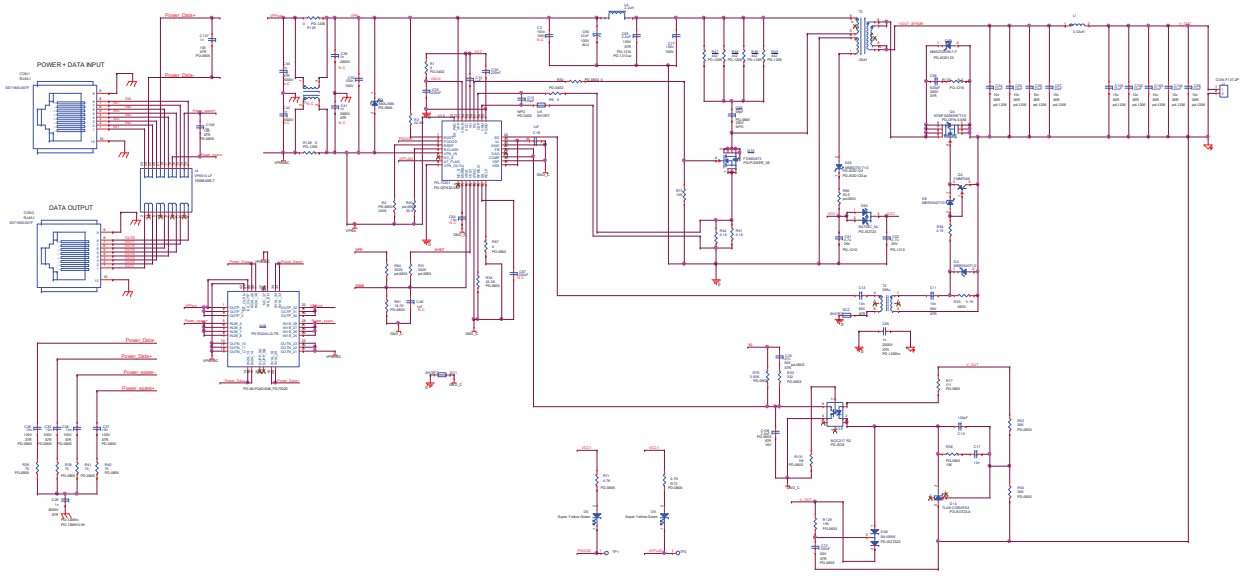
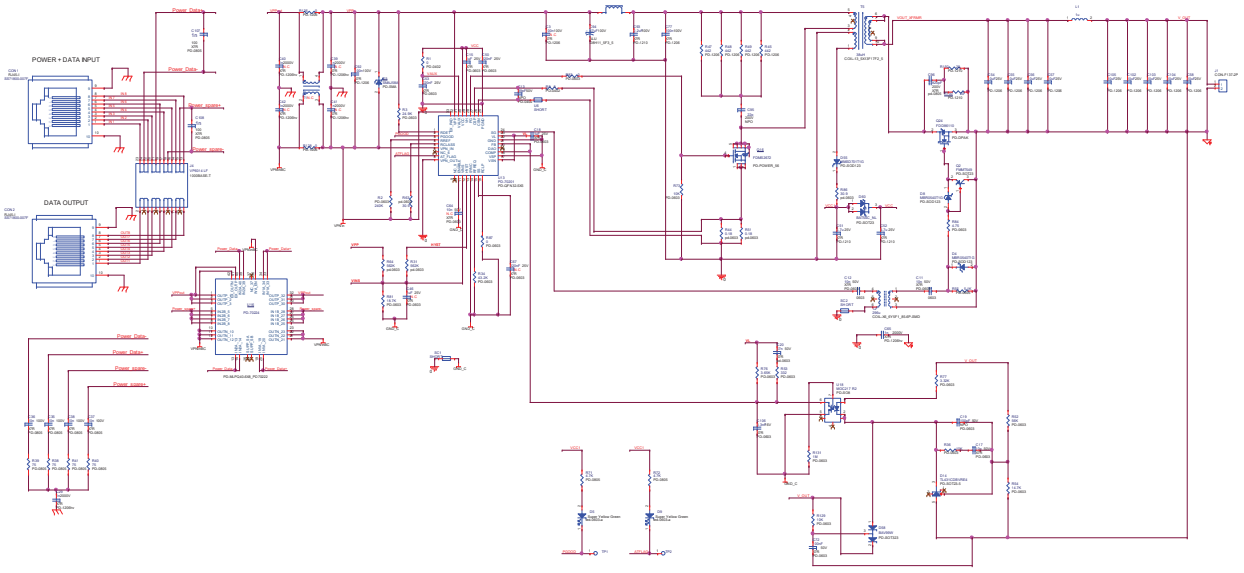


Figure 8-2. Schematic of PD70201EVB25F12



9. Bills of Materials

The following table specifies the parts of PD70201EVB25F5 devices.

Note: Parts may be replaced by approved equivalents.

Table 9-1. PD70201EVB25F5 Assembly

Item	Description	Qty	Ref Des	Mfr. Name	Mfr. Part Number
1	AT POE PD controller for IEEE 802.3 PD70201	1	U13	Microchip	PD70201ILQ-TR
2	IdealBridge™ Dual MOSFET-based Bridge Rectifier	1	U16	Microchip	PD70224ILQ-TR
3	CAP CRM 4.7n 100 V 10% 0805 SMT X7R	1	C95	Vishay	VJ0805A680KXCAT
4	Capacitor 820 pF 200 V 10% X7R 0805 SMT	1	C96	AVX	08052C821KAT2A
5	CAP CRM 10 nF 100 V 5% X7R 0805 SMT	4	C35-C38	AVX	08051C103JAT2A
6	CAP CRM 22 µF 10 V 20% X5R 1206 SMT	9	C54-C58, C102-C105	AVX	1206ZD226MAT2A
7	CAP CRM 1 nF/2000 V 10%++X7R 1206 SMT	2	C29, C65	AVX	1206GC102KAT1A
8	CAP CRM 100 nF 100 V 10% X7R 1206 SMT	2	C77, C92	AVX	12061C104KAT2A
9	CAP CER 39PF 50 V 5% C0G 0402	1	C13	AVX	04025A390JAT2A
10	Capacitor, X7R, 4.7 µF, 25 V, 10% 1210	2	C51, C52	Murata	GRM32DR71E475KA61L
11	CAP CER 2.2 uF 100 V 10% X7R 1210 SMT	1	C93	CAPAX	1210X225K101SNT
12	CAP COG 100 pF 50 V 5% 0603	1	C19	AVX	06035A101JAT2A
13	Capacitor, X7R, 3.3 nF, 16 V, 10% 0603	1	C106	Murata	GRM188R71H332KA01
14	CAP CRM 100 nF 50 V 10% X7R 0603	1	C72	Meritek	MA0603XR104K500
15	CAP 220 nF 25 V X7R 10% 0603	2	C50, C53	Murata	GRM188R71E224KA88D
16	Capacitor, X7R, 47 nF, 50 V, 10% 0603	1	C20	AVX	06035C473KAT2A
17	Capacitor, X7R, 1 µF, 25 V, 10% 0603	2	C15, C18	Murata	GRM188R71E105KA12D
18	CAP CRM 10 nF 50 V 10% X7R 0603 SMT	3	C11, C12, C17	EPCOS	B37931-K5103-K60
19	CAP ALU 47 µF 100 V 20% 8X11.5 105C P=3.5 mm T/H	1	C94	Nichicon	UVY2A470MPD1CA
20	CON RJ45 SINGLE 8 POS. SHILDED	2	CON1, CON2	Bel Stewart	SS71800-007F
21	Terminal block 2 Pole interlocking 3.5 mm pitch	1	J1	DECA	MB332-350M02
22	Diode Dual BAT54C	1	D60	Diodes Inc.	BAT54C
23	Diode, Dual Switching BAV99W SOT323	1	D58	Diodes Inc.	BAV99W-7-F

.....continued

Item	Description	Qty	Ref Des	Mfr. Name	Mfr. Part Number
24	DIODE Zener 28 V SMT	1	D59	Diodes Inc.	MMSZ5255B-7-F
25	DIODE SCHOTTKY 70 V 0.2 A, 225 W, SOD123	1	D55	ON Semiconductor	MMSD701T1G
26	DIODE SCHOTTKY 40 V 500 mA SOD123 REC. SMT	2	D4, D8	ON Semiconductor	MBR0540T1G
27	IC Prog Shunt Ref 2.5 V 2% SOT23-5 SMT	1	D14	TI	TL431CDBVRE4
28	IC, N-CH POWER MOSFET 150 V 4.1 A SO8	1	Q16	Fairchild	FDMS86242
29	1000 BASE T SINGLE PORT MAGNETICS SMT	1	J4	BOTHHAND	VP6014 HF
30	Power Inductors 2.2 µHy 1.5 A 110 mΩ SMT Shielded	1	L4	Coilcraft	LPS3015-222MR
31	Power Inductor 0.33 µH 20 A Shielded SMT	1	L1	Bourns	SRP7030-R33M
32	Transformer, Gate driver SMT 269 µH 0.795 DCR	1	T2	Coilcraft	DA2319-AL
33	TRANS FLYBACK POE+ 38UH SMD PRI RES0.082 Ω	1	T5	WURTH ELEKTRONIK	750310744
	alternate			Tesla Magnetics	TX4014
34	LED SuperYelGrn 100-130o 20-40mcd h=1 0603 SMD	2	D5, D9	Everlight	19-21-SYGCS530E3TR8
35	IC OPTOISOLATOR MOC217	1	U18	Fairchild	MOC217R2-M
36	RES 75R 125 mW 1% 0805 SMT	4	R38-R41	Bourns	CR0805-FX-75R0-E
37	Resistor, 0 Ω, 5%, 1/16 W 0402	2	R1, R9	ASJ	CR10-000ZK
38	RES 0R 250 mW 5% 1206 SMT JUMPER<0.05R	2	R126, R128	Samsung	RC3216J000CS
39	RES TK FLM 4.7k 0805 SMT	2	R71, R72	Bourns	
40	RES TCK FLM 40.2K 250 mW 1% 1206 SMT	4	R45, R47-R49	Rohm	MCR18EZPF4022
41	RES 8.2 OHM 1/2 W 5% 1210 SMT	1	R130	KOA	RK73B2ETTD8R2J
42	RES TCK FLM 0R 62.5 mW 5% 0603 SMT	2	R82, R87	ASJ	CR16-000ZL
43	RES TCK FLM 24.9K 62.5 mW 1% 0603 SMT	1	R3	ASJ	CR16-2492FL
44	RES 43.2K 100 mW 0603 SMT 1%	1	R34	ASJ	CR16-4322FL
45	Resistor, 18.7K, 1%, 1/16 W 0603	1	R81	ASJ	CR16-1872FL
46	Resistor, 30.9R 1%, 1/10 W 0603	2	R63,R86	KOA	RK73H1JTTD30R9F
47	RES TCK FLM 5.1K 62.5 mW 1% 0603 SMT	1	R55	ASJ	CR16-5101FL

.....continued					
Item	**Description**	**Qty**	**Ref Des**	**Mfr. Name**	**Mfr. Part Number**
48	RES 562K, 1%, 1/16 W, 0603	2	R31, R64	ASJ	CR16-5623FL
49	RES 3.65K 0.1 W 1% 0603 SMT MTL FLM	1	R76	ASJ	CR16-3651-FL
50	Resistor, 240K, 1%, 1/10 W 0603	1	R2	KOA	RK73H1JTTD2403F
51	Resistor, SMT 56K, 1%, 1/10 W 0603	2	R52, R54	KOA	RK73H1JTTD5602F
52	RES TCK FLM 0.18R 0.1 W 1% 0603 SMT	2	R44, R51	Bourns	CRL0603-FW-R180ELF
53	RES 4.75R 0.1W 1% 0603 SMT MTL FLM	1	R84	Samsung	RC1608F4R75CS
54	RES 332R 62.5 mW 1% 0603 SMT MTL FLM	1	R53	ASJ	CR16-3320FL
55	RES 511R 100 mW 1% 0603 SMT MTL FLM 100 ppm	1	R77	Panasonic	ERJ3EKF5110V
56	RES 10K 62.5 mW 1% 0603 SMT MTL FLM	3	R36, R73, R129	ASJ	CR16-1002FL
57	RES 1M 62.5 mW 1% 0603 SMT MTL FLM	1	R131	ASJ	CR16-1004-FL
58	TRN PNP -30V -1A SOT23	1	Q2	Fairchild	FMMT549
59	N-CH POWER MOSFET with Schottky diode 30 V 4 mΩ	1	Q4	On Semi	NTMFS4983NFT1G

The following table specifies the parts of PD70201EVB25F12 devices.

Note: Parts may be replaced by approved equivalents.

Table 9-2. PD70201EVB25F12 Assembly

Item	Description	Qty	Ref Des	Mfr. Name	Mfr. Part Number
1	AT POE PD controller for IEEE 802.3 PD70201	1	U13	Microchip	PD70201ILQ-TR
2	IdealBridge™ Dual MOSFET-based Bridge Rectifier	1	U16	Microchip	PD70224ILQ-TR
3	Capacitor 820 pF 200 V 10% X7R 0805 SMT	1	C96	AVX	08052C821KAT2A
4	CAP CRM 22 pF 200 V 10% NPO 0805 SMT	1	C95	Vishay	VJ0805A220KXCAT
5	CAP CRM 10 nF 100 V 5% X7R 0805 SMT	4	C35-C38	AVX	08051C103JAT2A
6	Capacitor, X5R, 10 µF, 25 V, 10% 1206	9	C54-C58, C102-C105	Murata	GRM31CR61E106KA12L
7	CAP CRM 1 nF/2000 V 10%++X7R 1206 SMT	2	C29, C65	AVX	1206GC102KAT1A
8	CAP CRM 100 nF 100 V 10% X7R 1206 SMT	2	C77, C92	AVX	12061C104KAT2A

.....continued

Item	Description	Qty	Ref Des	Mfr. Name	Mfr. Part Number
9	CAP CER 39PF 50 V 5% C0G 0402	1	C13	AVX	04025A390JAT2A
10	Capacitor, X7R, 4.7 µF, 25 V, 10% 1210	2	C51, C52	Murata	GRM32DR71E475KA61L
11	CAP CER 2.2 µF 100 V 10% X7R 1210 SMT	1	C93	CAPAX	1210X225K101SNT
12	CAP COG 100 pF 50 V 5% 0603	1	C19	AVX	06035A101JAT2A
13	Capacitor, X7R, 3.3 nF, 16 V, 10% 0603	1	C106	Murata	GRM188R71H332KA01
14	CAP CRM 100 nF 50 V 10% X7R 0603	1	C72	Meritek	MA0603XR104K500
15	CAP 220 nF 25 V X7R 10% 0603	2	C50, C53	Murata	GRM188R71E224KA88D
16	Capacitor, X7R, 47 nF, 50 V, 10% 0603	1	C20	AVX	06035C473KAT2A
17	Capacitor, X7R, 1 µF, 25 V, 10% 0603	2	C15, C18	Murata	GRM188R71E105KA12D
18	CAP CRM 10 nF 50 V 10% X7R 0603 SMT	3	C11, C12, C17	EPCOS	B37931-K5103-K60
19	CAP ALU 47 µF 100 V 20% 8X11.5 105C P=3.5 mm T/H	1	C94	Nichicon	UVY2A470MPD1CA
20	CON RJ45 SINGLE 8 POS. SHILDED after vibration	2	CON1, CON2	Bel Stewart	SS71800-007F
21	Terminal block 2 Pole interlocking 3.5 mm pitch	1	J1	DECA	MB332-350M02
22	DIODE TVS 58 V 40 A SRG 400WPK SMA SMT	1	D3	Diodes Inc.	SMAJ58A
23	Diode, Dual Switching BAV99W SOT323	1	D58	Diodes Inc.	BAV99W-7-F
24	DIODE SCHOTTKY 70 V 0.2 A, 225 W, SOD123	1	D55	ON Semiconductor	MMSD701T1G
25	DIODE SCHOTTKY 40 V 500 mA SOD123 SMT	2	D4, D8	ON Semiconductor	MBR0540T1G
26	IC Prog Shunt Ref 2.5 V 2% SOT23-5 SMT	1	D14	TI	TL431CDBVRE4
27	IC, N-CH POWER MOSFET 150 V 4.1 A SO8	1	Q16	Fairchild	FDMS86242
28	1000 BASET SINGLE PORT MAGNETICS SMT	1	J4	BOTHHAND	VP6014 HF
29	Power Inductors 2.2 µHy 1.5 A 110 mΩ SMT Shielded	1	L4	Coilcraft	LPS3015-222MR
30	INDUCTOR SHIELDED PWR 1UH IRMS=11A SMT	1	L1	Bourns	SRP7030-1R0M
31	Transformer, Gate driver SMT 269 µH 0.795 DCR	1	T2	Coilcraft	DA2319-AL
32	TRANS FLYBACK POE+ 38UH SMD	1	T5	WURTH ELEKTRONIK	750310742
33	LED SuperYelGrn 100-130o 20-40mcd h=1 0603 SMD	2	D5, D9	Everlight	19-21-SYGCS530E3TR8

.....continued

Item	Description	Qty	Ref Des	Mfr. Name	Mfr. Part Number
34	IC OPTOISOLATOR MOC217	1	U18	Fairchild	MOC217R2-M
35	PCB Mrk 3.3/5/12V/25 W Flyback EVB Drilling Card	1		IQE	PR-1412-D00-IQ
36	RES 75R 125 mW 1% 0805 SMT	4	R38-R41	Bourns	CR0805-FX-75R0-E
37	Resistor, 0 Ω, 5%, 1/16 W 0402	2	R1, R9	ASJ	CR10-000ZK
38	RES 0R 250 mW 5% 1206 SMT JUMPER<0.05R	2	R126, R128	Samsung	RC3216J000CS
39	RES 442R 250 mW 1% 1206 SMT	4	R45, R47-R49	Panasonic	ERJ8ENF4420V
40	RES TK FLM 4.7k 0805	2	R71, R72	Bourns	
41	RES 20 Ω 1/2 W 5% 1210 SMT	2	R130, R192	KOA	RK73B2ETTD200J
42	RES TCK FLM 0R 62.5 mW 5% 0603 SMT	2	R82, R87	ASJ	CR16-000ZL
43	RES TCK FLM 24.9K 62.5 mW 1% 0603 SMT	1	R3	ASJ	CR16-2492FL
44	RES TCK FLM 14.7K 62.5 mW 1% 0603 SMT	1	R54	ASJ	CR16-1472FL
45	RES 43.2K 100 mW 0603 SMT 1%	1	R34	ASJ	CR16-4322FL
46	Resistor, 18.7K, 1%, 1/16 W 0603	1	R81	ASJ	CR16-1872FL
47	Resistor, 3.32K, 1%, 1/16 W 0603	1	R77	ASJ	CR16-3321FL
48	Resistor, 30.9R 1%, 1/10 W 0603	2	R63, R86	KOA	RK73H1JTTD30R9F
49	RES TCK FLM 5.1K 62.5 mW 1% 0603 SMT	1	R55	ASJ	CR16-5101FL
50	RES 562K, 1%, 1/16 W, 0603	2	R31, R64	ASJ	CR16-5623FL
51	RES 3.65K 0.1 W 1% 0603 SMT MTL FLM	1	R76	ASJ	CR16-3651-FL
52	Resistor, 240K, 1%, 1/10 W 0603	1	R2	KOA	RK73H1JTTD2403F
53	Resistor, SMT 56K, 1%, 1/10 W 0603	1	R52	KOA	RK73H1JTTD5602F
54	RES TCK FLM 0.18R 0.1 W 1% 0603 SMT	2	R44, R51	Bourns	CRL0603-FW-R180ELF
55	RES 4.75R 0.1 W 1% 0603 SMT MTL FLM	1	R84	Samsung	RC1608F4R75CS
56	RES 332R 62.5 mW 1% 0603 SMT MTL FLM	1	R53	ASJ	CR16-3320FL
57	RES 10K 62.5 mW 1% 0603 SMT MTL FLM	3	R36, R73, R129	ASJ	CR16-1002FL
58	RES 1M 62.5 mW 1% 0603 SMT MTL FLM	1	R131	ASJ	CR16-1004-FL
59	TRN PNP -30 V -1 A SOT23	1	Q2	Fairchild	FMMT549

.....continued

Item	Description	Qty	Ref Des	Mfr. Name	Mfr. Part Number
60	N-CH MOSFET 100 V 50 A 10.2 mΩ TO-252 DPAK SMT	1	Q24	Fairchild	FDD86110

10. Board Layout

This section describes the layout of the evaluation board.

The board is a two layer board. The layers are 2 Oz layers. The following figures show the two copper layers and the silk of the board for tracking devices placements.

Figure 10-1. Top Silk

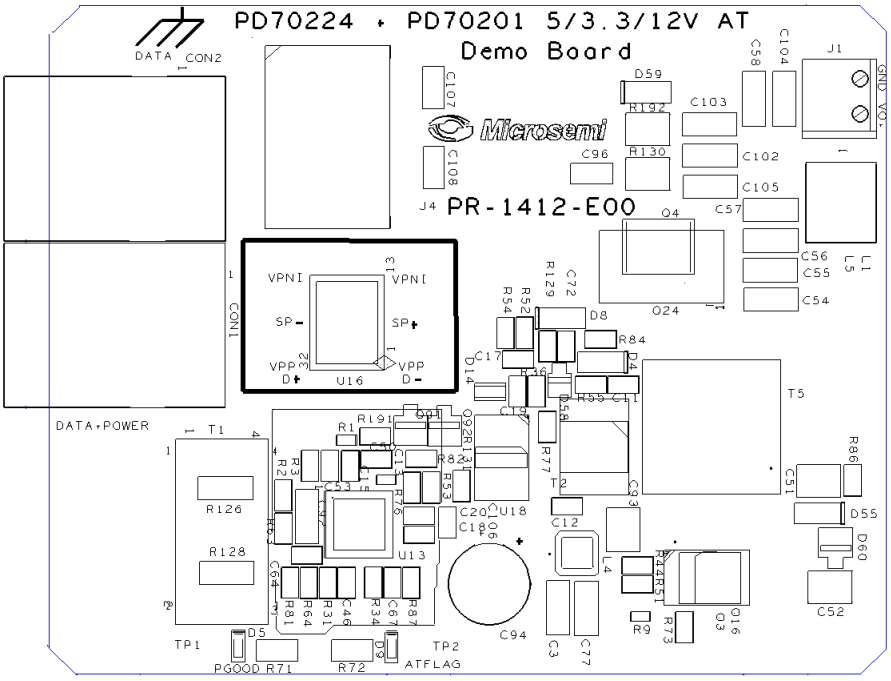


Figure 10-2. Top Layer

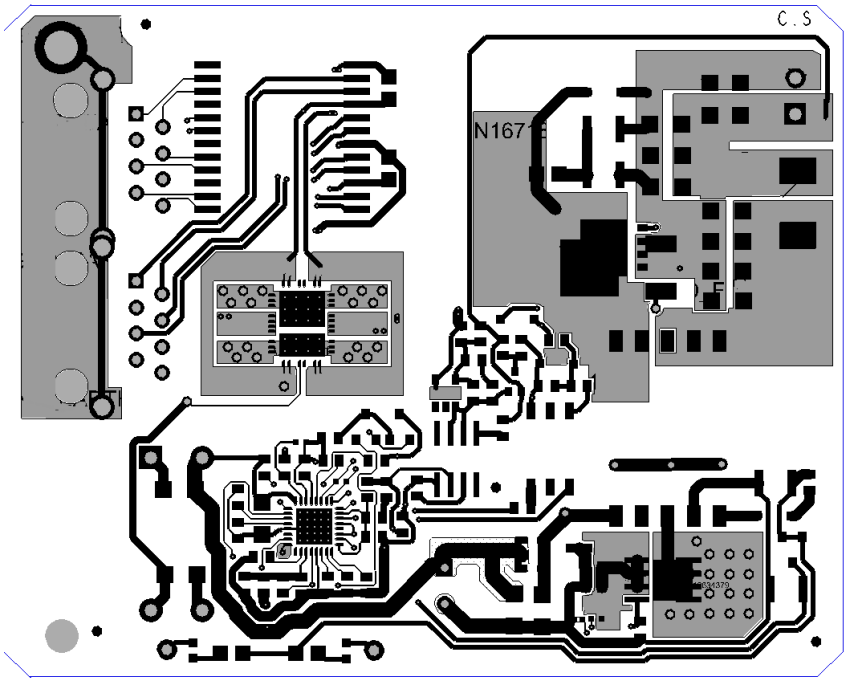


Figure 10-3. Bottom Layer

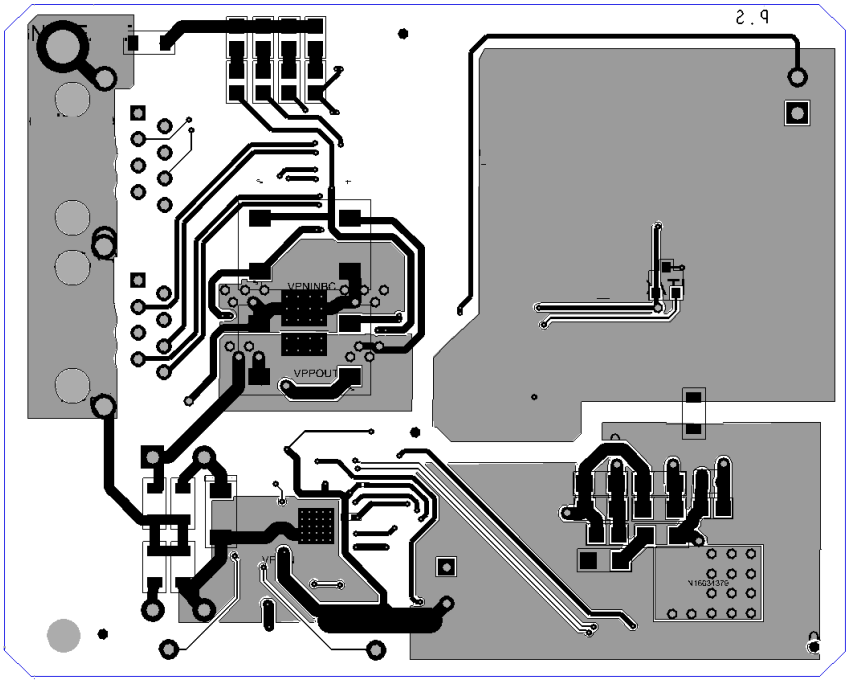
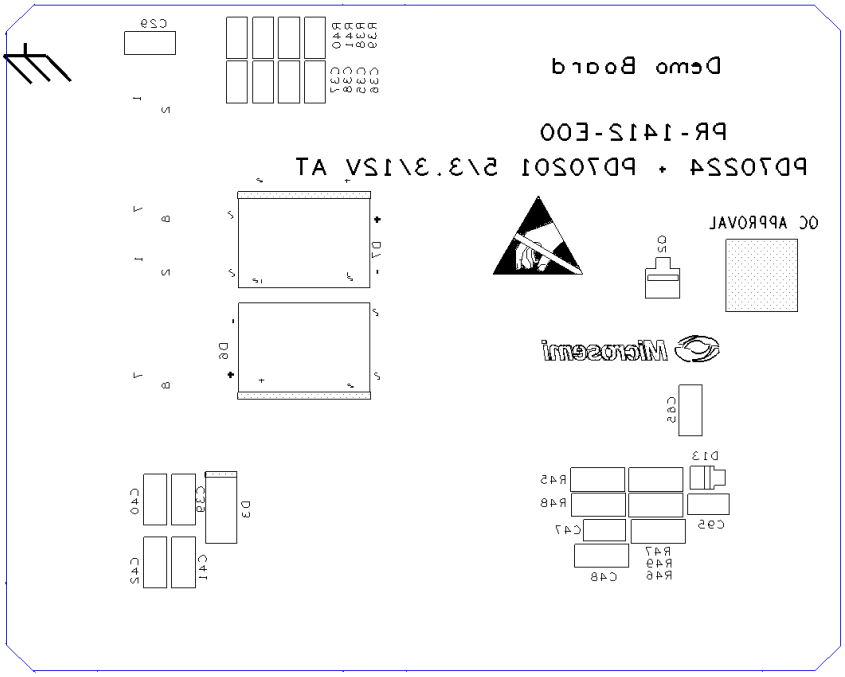


Figure 10-4. Bottom Silk



11. Reference Documents

- *PD70201 Datasheet (catalog number DS_PD70101A_70201)*
- *AN3471 Designing Power Device Using PD702x1 and PD701x1 ICs*
- *AN3551 PD70101A PD70201 PD Device Layout Guidelines*
- *AN3410 Design for PD System Surge Immunity PD701xx PD702xx*

12. Revision History

Revision	Date	Description
A	08/2020	The following is a summary of changes in revision A of this document. • The document was migrated to Microchip template. • The document number assigned as "DS00003603A".
3.3	04/2016	Updated BOM and table with product offering.
3.2	07/2016	Updated BOM.
3.1	04/2016	Deleted duplicate schematic.
3.0	01/2016	Removed aux connector J2, updated board revision, and schematics.
2.1	01/2016	Update board revision.
2.0	12/2012	Update signal waveforms, efficiency information, and board gerbers.
0.1	04/2012	Initial release.

The Microchip Website

Microchip provides online support via our website at www.microchip.com/. This website is used to make files and information easily available to customers. Some of the content available includes:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip design partner program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

Product Change Notification Service

Microchip's product change notification service helps keep customers current on Microchip products. Subscribers will receive email notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, go to www.microchip.com/pcn and follow the registration instructions.

Customer Support

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Embedded Solutions Engineer (ESE)
- Technical Support

Customers should contact their distributor, representative or ESE for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in this document.

Technical support is available through the website at: www.microchip.com/support

Microchip Devices Code Protection Feature

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

Legal Notice

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with

your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Trademarks

The Microchip name and logo, the Microchip logo, Adaptec, AnyRate, AVR, AVR logo, AVR Freaks, BesTime, BitCloud, chipKIT, chipKIT logo, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, HELDO, IGLOO, JukeBlox, KeeLoq, Kleer, LANCheck, LinkMD, maXStylus, maXTouch, MediaLB, megaAVR, Microsemi, Microsemi logo, MOST, MOST logo, MPLAB, OptoLyzer, PackeTime, PIC, picoPower, PICSTART, PIC32 logo, PolarFire, Prochip Designer, QTouch, SAM-BA, SenGenuity, SpyNIC, SST, SST Logo, SuperFlash, Symmetricom, SyncServer, Tachyon, TempTrackr, TimeSource, tinyAVR, UNI/O, Vectron, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

APT, ClockWorks, The Embedded Control Solutions Company, EtherSynch, FlashTec, Hyper Speed Control, HyperLight Load, IntelliMOS, Libero, motorBench, mTouch, Powermite 3, Precision Edge, ProASIC, ProASIC Plus, ProASIC Plus logo, Quiet-Wire, SmartFusion, SyncWorld, Temux, TimeCesium, TimeHub, TimePictra, TimeProvider, Vite, WinPath, and ZL are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, BlueSky, BodyCom, CodeGuard, CryptoAuthentication, CryptoAutomotive, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, EtherGREEN, In-Circuit Serial Programming, ICSP, INICnet, Inter-Chip Connectivity, JitterBlocker, KleerNet, KleerNet logo, memBrain, Mindi, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, PowerSmart, PureSilicon, QMatrix, REAL ICE, Ripple Blocker, SAM-ICE, Serial Quad I/O, SMART-I.S., SQI, SuperSwitcher, SuperSwitcher II, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

The Adaptec logo, Frequency on Demand, Silicon Storage Technology, and Symmcom are registered trademarks of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

ISBN: 978-1-5224-6531-7

Quality Management System

For information regarding Microchip's Quality Management Systems, please visit www.microchip.com/quality.

Worldwide Sales and Service

AMERICAS	ASIA/PACIFIC	ASIA/PACIFIC	EUROPE
Corporate Office 2355 West Chandler Blvd. Chandler, AZ 85224-6199 Tel: 480-792-7200 Fax: 480-792-7277 Technical Support: www.microchip.com/support Web Address: www.microchip.com **Atlanta** Duluth, GA Tel: 678-957-9614 Fax: 678-957-1455 **Austin, TX** Tel: 512-257-3370 **Boston** Westborough, MA Tel: 774-760-0087 Fax: 774-760-0088 **Chicago** Itasca, IL Tel: 630-285-0071 Fax: 630-285-0075 **Dallas** Addison, TX Tel: 972-818-7423 Fax: 972-818-2924 **Detroit** Novi, MI Tel: 248-848-4000 **Houston, TX** Tel: 281-894-5983 **Indianapolis** Noblesville, IN Tel: 317-773-8323 Fax: 317-773-5453 Tel: 317-536-2380 **Los Angeles** Mission Viejo, CA Tel: 949-462-9523 Fax: 949-462-9608 Tel: 951-273-7800 **Raleigh, NC** Tel: 919-844-7510 **New York, NY** Tel: 631-435-6000 **San Jose, CA** Tel: 408-735-9110 Tel: 408-436-4270 **Canada - Toronto** Tel: 905-695-1980 Fax: 905-695-2078	**Australia - Sydney** Tel: 61-2-9868-6733 **China - Beijing** Tel: 86-10-8569-7000 **China - Chengdu** Tel: 86-28-8665-5511 **China - Chongqing** Tel: 86-23-8980-9588 **China - Dongguan** Tel: 86-769-8702-9880 **China - Guangzhou** Tel: 86-20-8755-8029 **China - Hangzhou** Tel: 86-571-8792-8115 **China - Hong Kong SAR** Tel: 852-2943-5100 **China - Nanjing** Tel: 86-25-8473-2460 **China - Qingdao** Tel: 86-532-8502-7355 **China - Shanghai** Tel: 86-21-3326-8000 **China - Shenyang** Tel: 86-24-2334-2829 **China - Shenzhen** Tel: 86-755-8864-2200 **China - Suzhou** Tel: 86-186-6233-1526 **China - Wuhan** Tel: 86-27-5980-5300 **China - Xian** Tel: 86-29-8833-7252 **China - Xiamen** Tel: 86-592-2388138 **China - Zhuhai** Tel: 86-756-3210040	**India - Bangalore** Tel: 91-80-3090-4444 **India - New Delhi** Tel: 91-11-4160-8631 **India - Pune** Tel: 91-20-4121-0141 **Japan - Osaka** Tel: 81-6-6152-7160 **Japan - Tokyo** Tel: 81-3-6880- 3770 **Korea - Daegu** Tel: 82-53-744-4301 **Korea - Seoul** Tel: 82-2-554-7200 **Malaysia - Kuala Lumpur** Tel: 60-3-7651-7906 **Malaysia - Penang** Tel: 60-4-227-8870 **Philippines - Manila** Tel: 63-2-634-9065 **Singapore** Tel: 65-6334-8870 **Taiwan - Hsin Chu** Tel: 886-3-577-8366 **Taiwan - Kaohsiung** Tel: 886-7-213-7830 **Taiwan - Taipei** Tel: 886-2-2508-8600 **Thailand - Bangkok** Tel: 66-2-694-1351 **Vietnam - Ho Chi Minh** Tel: 84-28-5448-2100	**Austria - Wels** Tel: 43-7242-2244-39 Fax: 43-7242-2244-393 **Denmark - Copenhagen** Tel: 45-4485-5910 Fax: 45-4485-2829 **Finland - Espoo** Tel: 358-9-4520-820 **France - Paris** Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79 **Germany - Garching** Tel: 49-8931-9700 **Germany - Haan** Tel: 49-2129-3766400 **Germany - Heilbronn** Tel: 49-7131-72400 **Germany - Karlsruhe** Tel: 49-721-625370 **Germany - Munich** Tel: 49-89-627-144-0 Fax: 49-89-627-144-44 **Germany - Rosenheim** Tel: 49-8031-354-560 **Israel - Ra'anana** Tel: 972-9-744-7705 **Italy - Milan** Tel: 39-0331-742611 Fax: 39-0331-466781 **Italy - Padova** Tel: 39-049-7625286 **Netherlands - Drunen** Tel: 31-416-690399 Fax: 31-416-690340 **Norway - Trondheim** Tel: 47-72884388 **Poland - Warsaw** Tel: 48-22-3325737 **Romania - Bucharest** Tel: 40-21-407-87-50 **Spain - Madrid** Tel: 34-91-708-08-90 Fax: 34-91-708-08-91 **Sweden - Gothenberg** Tel: 46-31-704-60-40 **Sweden - Stockholm** Tel: 46-8-5090-4654 **UK - Wokingham** Tel: 44-118-921-5800 Fax: 44-118-921-5820