



**PD70201EVB47F**  
**Evaluation Board User Guide**  
Revision 0.2

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# 1 About this Guide

This user guide provides both description and operation procedures for Microsemi's PD70201EVB47F board.

This board type is used for evaluating the performance of PD70201 device.

The PD70201ILQ device is supporting both the standard 802.3at PD application interface and a PWM controller that is used for the PD operational voltages DC/DC.

The board is supporting a 47Watt 12V output.

## 1.1 Audience

This user guide is intended for qualified personnel, meaning operators and technicians who have a background in basic concepts of electronics.

## 1.2 Organization

This guide is divided into several sections as follows:

|             |                                                                                                                                                 |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| • Chapter 1 | <b>About this Guide:</b> Describes the objectives, audience, and organization.                                                                  |
| • Chapter 2 | <b>Introduction:</b> Provides an overview about evaluation board's main functions, features, physical characteristics and ordering information. |
| • Chapter 3 | <b>Physical Description:</b> Provides explanation related to the physical description (switches, jumpers, connectors).                          |
| • Chapter 4 | <b>Electrical Characteristics:</b> Provides electrical characteristics of the evaluation board.                                                 |
| • Chapter 5 | <b>Installation:</b> Provides description of the installation process.                                                                          |
| • Chapter 6 | <b>Schematic:</b> Provides board schematic diagram                                                                                              |
| • Chapter 7 | <b>List of Materials:</b> Provides board's list of materials.                                                                                   |

## 1.3 Reference Documents

PD70201 datasheet, catalogue number DS\_PD70101\_70201

## 2 Introduction

Microsemi's PD70201ILQ device is part of a family of devices which are targeted for realizing the 802.3at standard PD interface.

The PD interface family of devices includes the following:

| Device type | Power capability                             | Integrates PWM controller |
|-------------|----------------------------------------------|---------------------------|
| PD70100/A   | IEEE 802.3at Type 1<br>(IEEE 802.3 af level) | No                        |
| PD70101/A   | IEEE 802.3at Type 1<br>(IEEE 802.3 af level) | Yes                       |
| PD70200     | IEEE 802.3at Type 2                          | No                        |
| PD70201     | IEEE 802.3at Type 2                          | Yes                       |

Microsemi's PD70201EVB47F Evaluation Board (see Figure 2) provides designers with an environment needed to evaluate the performance and implementation of PD applications based on PD70201 device.

The board is using a single PD device PD70201ILQ to support the detection, Class and Power supplying phases on the 4 Pairs of the Cat5 cable. PD70201ILQ supports the current of the 4 Pairs, which is twice the level of a standard IEEE802.3AT Type 2 interfaces.

All necessary steps and connection instructions required to install and operate this board are provided within this document.

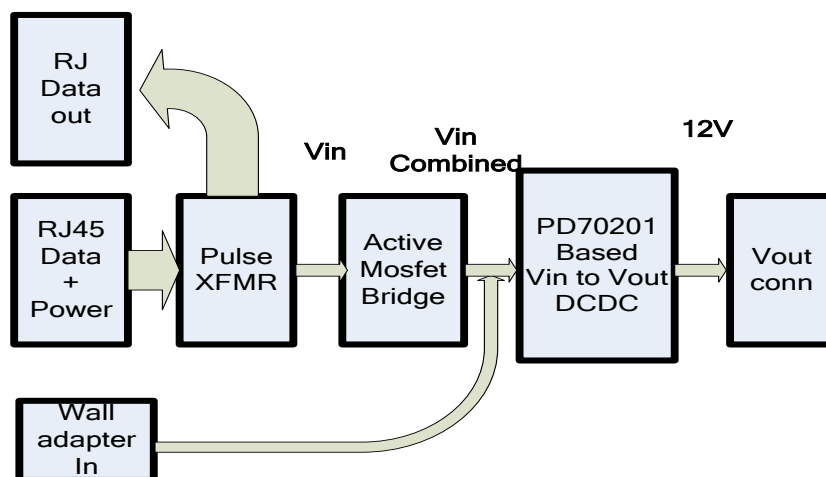


Figure 1: PD70201EVB47F Block Diagram

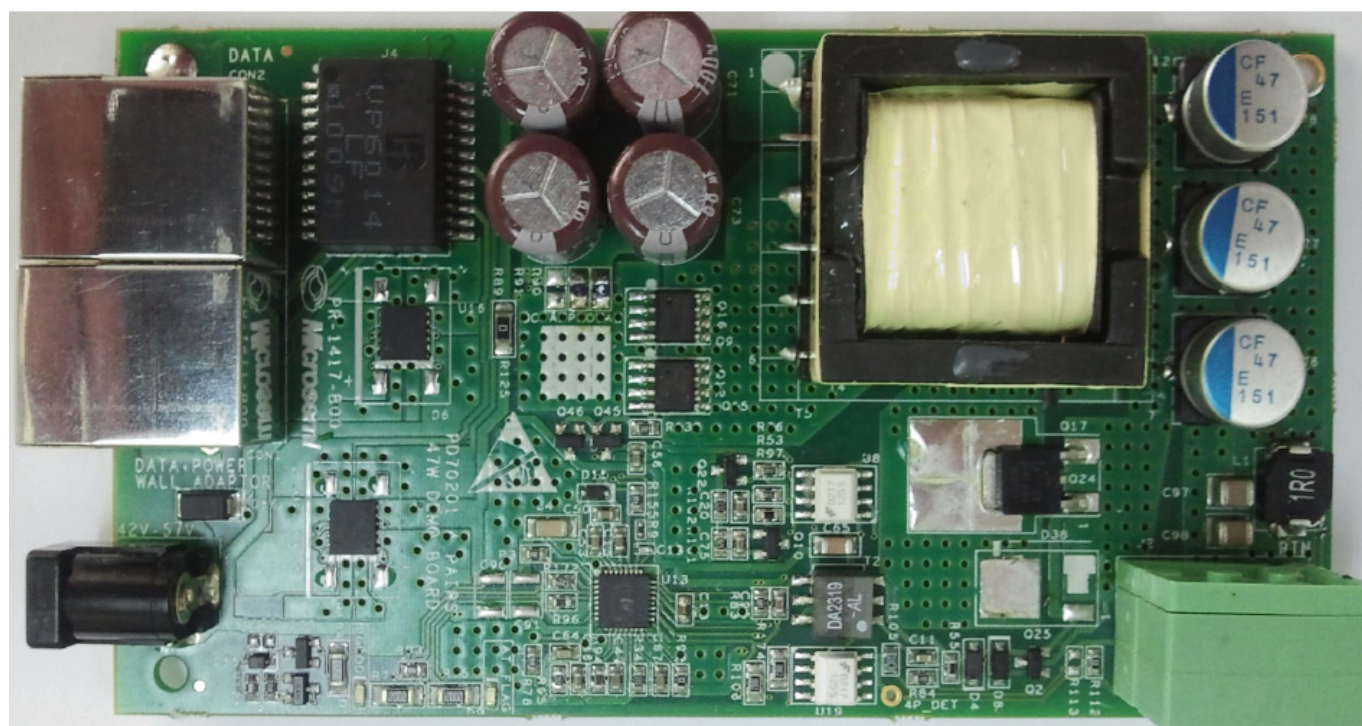


Figure 2: PD70201EVB47F Evaluation Board – General View

## Evaluation Boards Ordering Information

Microsemi’s supplies the following Evaluation Boards as shown below:

| Ordering Number | Description                                                                                                                     |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------|
| PD70201EVB47F   | IEEE802.3 Type 1 PD based on PD70201 device controlling an <b>isolated flyback converter</b> , having a <b>12V 4Amp</b> output. |

### 2.1 Evaluation Board Features

- Designed to support Data and Spare current by a single PD70201 device
- Power is supplied through the 4-pairs of the Cat5 cable.
- Two RJ45 connectors (Data and Power In, Data Out)
- Wall adapter – DC in connector
- 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° to +70°C
- RoHS compliant

### 2.2 Evaluation Board Interfaces and Connections

Board has several interfaces:

- **RJ45 Interface:** Running from PSE side to PD (powered device)(CON1)
- **RJ45 Interface:** Running from Evaluation Board to evaluated PD (CON2)

- **V<sub>in</sub> Connectors:** DC in, alternative wall adapter connection (J3)
- **Output Voltage Connector:** output voltage connection (J2)
- **LEDs Indication:** Power good LED indication (D5)
- **LEDs Indication:** AT flag LED indication (D9)

## 2.3 Physical Characteristics

Table 1 lists evaluation board's physical characteristics.

**Table 1: Physical Characteristics**

| Parameter                   | Value                        |
|-----------------------------|------------------------------|
| Mechanical dimensions in mm | 122 x 65 x 25 mm (L x W x H) |

### 3 Physical Description

#### 3.1 Package Contents

Upon opening the Evaluation Board package, verify the following part is included. If it seems damaged, contact local representative or Microsemi's headquarters.

Package content for standard shipments is:

- PD70201EVB47F Evaluation Board

#### 3.2 Connectors

The following sections provide both general and detailed information regarding unit's connectors.

##### 3.2.1 Connectors Table

Table 2 lists the Evaluation Board's connectors.

**Table 2: 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                                                                              |
| 3 | J3        | Optional Wall Adapter | Optional DC in connection for powering the board instead of CON1.<br>Insertion of wall adapter connector disconnects CON1. |
| 4 | J2        | Converter Output      | terminal blocks for connecting a load to output regulator                                                                  |

##### 3.2.2 Connectors Detailed Explanation

(The numbering is in reference to the numbers listed in Table 2.)

###### 1. RJ45 Connectors

There are two dedicated RJ45 connectors, See Figure 3.

**Table 3: RJ45 Connectors**

| CON2 Pin No            | Signal Name       | Description                                                            |
|------------------------|-------------------|------------------------------------------------------------------------|
| 1, 2, 3, 4, 5, 6, 7, 8 | Data Out          | Data output to PD                                                      |
| CON1 Pin No            | Signal Name       | Description                                                            |
| 1, 2                   | Data and Power In | Data and power input to powered device (PoE Master Negative data port) |
| 3, 6                   | Data and Power In | Data and power input to powered device (PoE Master Positive data port) |
| 4, 5                   | Data and Power In | Data and power input to powered device (PoE Master Negative data port) |
| 7, 8                   | Data and Power In | Data and power input to powered device (PoE Master Positive data port) |

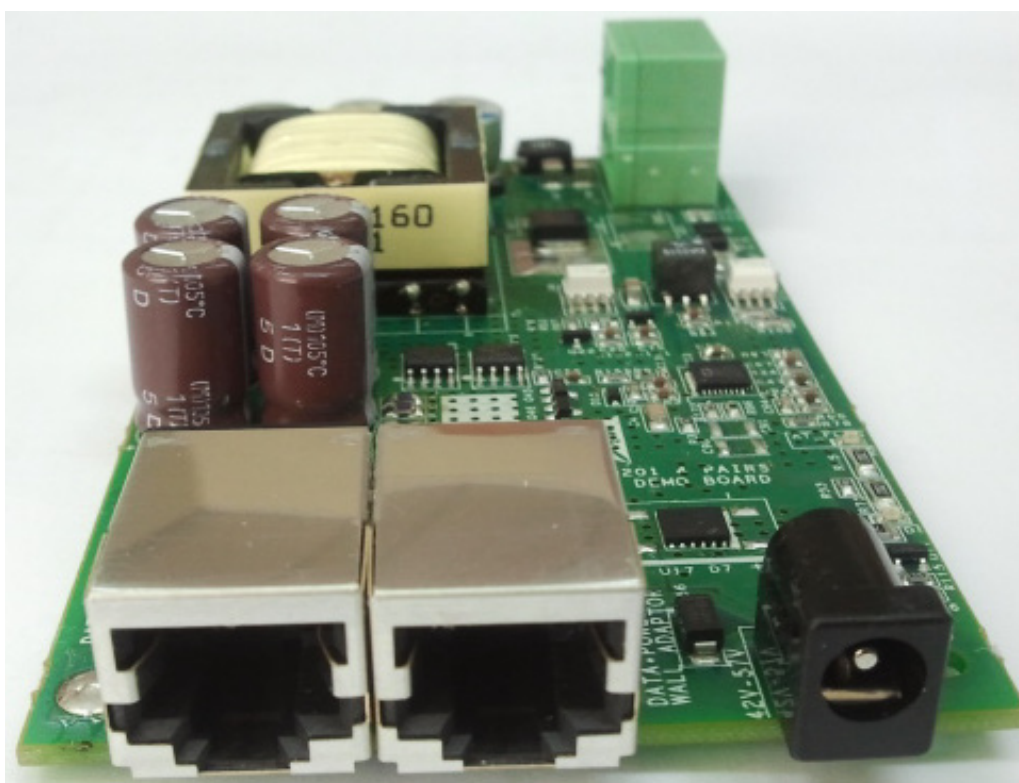


Figure 3: Front RJ45 and Wall Adapter Connectors

## 2. $V_{in}$ Connectors (J3)

DC in connection can be used to power Evaluation Board instead of RJ45 PSE connection

$42V > V_{in} > 57VDC$ .

Table 4:  $V_{in}$  Connectors

| Pin No.       | Signal Name           | Description            |
|---------------|-----------------------|------------------------|
| External ring | $V_{main} (V_{in} -)$ | Negative input voltage |
| Internal pin  | $V_{main} (V_{in} +)$ | Positive input voltage |

- Manufacturer: **TAI CHUNG ELECTRONIC COMPONENT PARTS CO., LTD.**
- Manufacture part number: **TC18-013-02**

### 3. V<sub>out</sub> Connectors

See Figure 4.

J2 – DCDC output connection, used for connecting to external load.

Table 5: J1 Connectors

| Pin No.              | Signal Name | Description                   |
|----------------------|-------------|-------------------------------|
| J2 (Left)-<br>Pin 1  | Vout        | Positive DCDC output voltage  |
| J2 (Right)-<br>Pin 2 | Vout_Rtn    | Return of DCDC output voltage |



Figure 4: V<sub>out</sub> Connectors



### 3.3 Indications

The following sections provide general information regarding unit's indications.

#### 1. LED Indication

See Figure 5.

D5 is the Power\_GOOD indication LED, a PD70201 device output signal indicating device's isolation switch is operated. 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 device's 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.

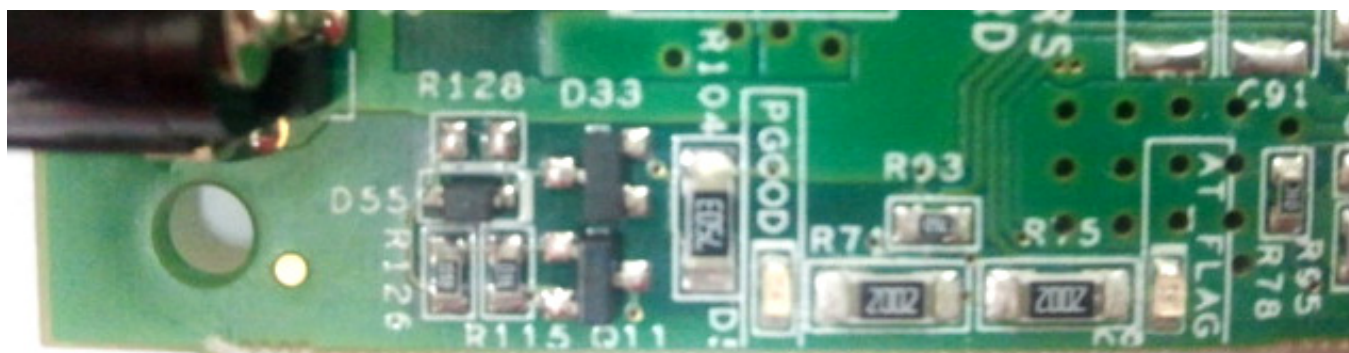


Figure 5: Power\_Good LED Indication D5

#### 2. 4P powering Circuitry

See Figure 7.

This circuit intends to indicate to the PD application when the power is supplied on the 4 pairs of Cat5E cable. For IEEE802.3 AT Type 2 compliant interface, each of the 2 pairs can support current up to 600 mA. Thus for supporting the 47 Watt application of the existing board, the current should be supplied by the 4 pairs. The 47 Watt at the DCDC output is maintained only if all of the 4 Pairs are active and powering the PD.

The 4 Pairs active detection is done by the circuit in Figure Figure 6: 4P\_DET indication.

When power is supplied on Data pairs (pins 1,2 and 3,6) D31 is conducting on one of its Diode instances, thus asserting Low D33-Pin1.

When power is supplied on Spare pairs (pins 4,5 and 7,8) D32 is conducting on one of its Diode instances, thus asserting Low D33-Pin2.

If the power is supplied both on Data and Spare (thus 4 pairs are supplying Power), D33 is not conducting so Q11 has Low on its Gate and thus U19 LED is not lit and there is High on 4P\_DET TP.

If the power is supplied on one of the paths, Data or Spare (thus 2 pairs are supplying Power), D33 is conducting so Q11 has a voltage on its Gate which operates Q11 and thus U19 LED is lit and there is Low on 4P\_DET TP.

In Figure 7 you can see the location of 4P\_DET TP, Near the J1 output connector. You can use the floating GND named also SLEEPGND or the Vout\_RTN signal as the return path for this indication.

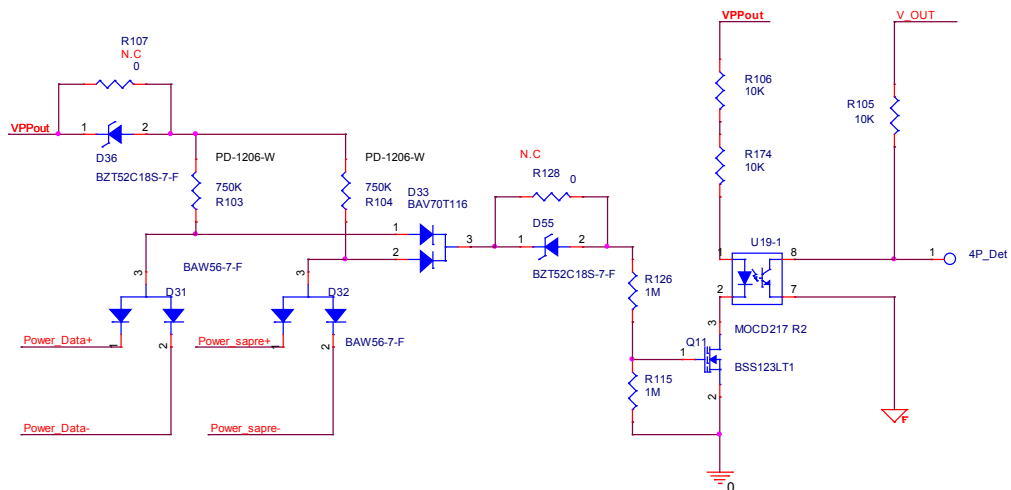


Figure 6: 4P\_DET indication Circuit

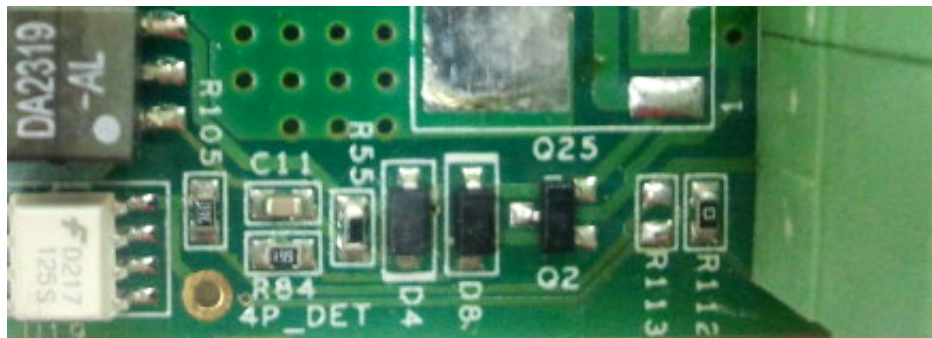


Figure 7: 4P\_DET indication Test Point

### 3.4 Active bridge MOSFET for Diode bridge circuitry

For the PD side 47 watt application, the diode bridge power drop becomes significantly high due to the high current through it.

In this application we are using Fairchild's Active Bridge MOSFET which comprises 4 FET package instead of each discrete diode bridge.

Traditional Diode bridge D6 and D7 are not assembled.

Fairchild's FDMQ8203 application power dissipation is lower than the discrete Diode Bridge.

You can see below the Diode bridge stage. The circuit comprising U16 and its peripheral replaces the D6 device.

The circuit comprising U17 and its peripheral replaces the D7 device.

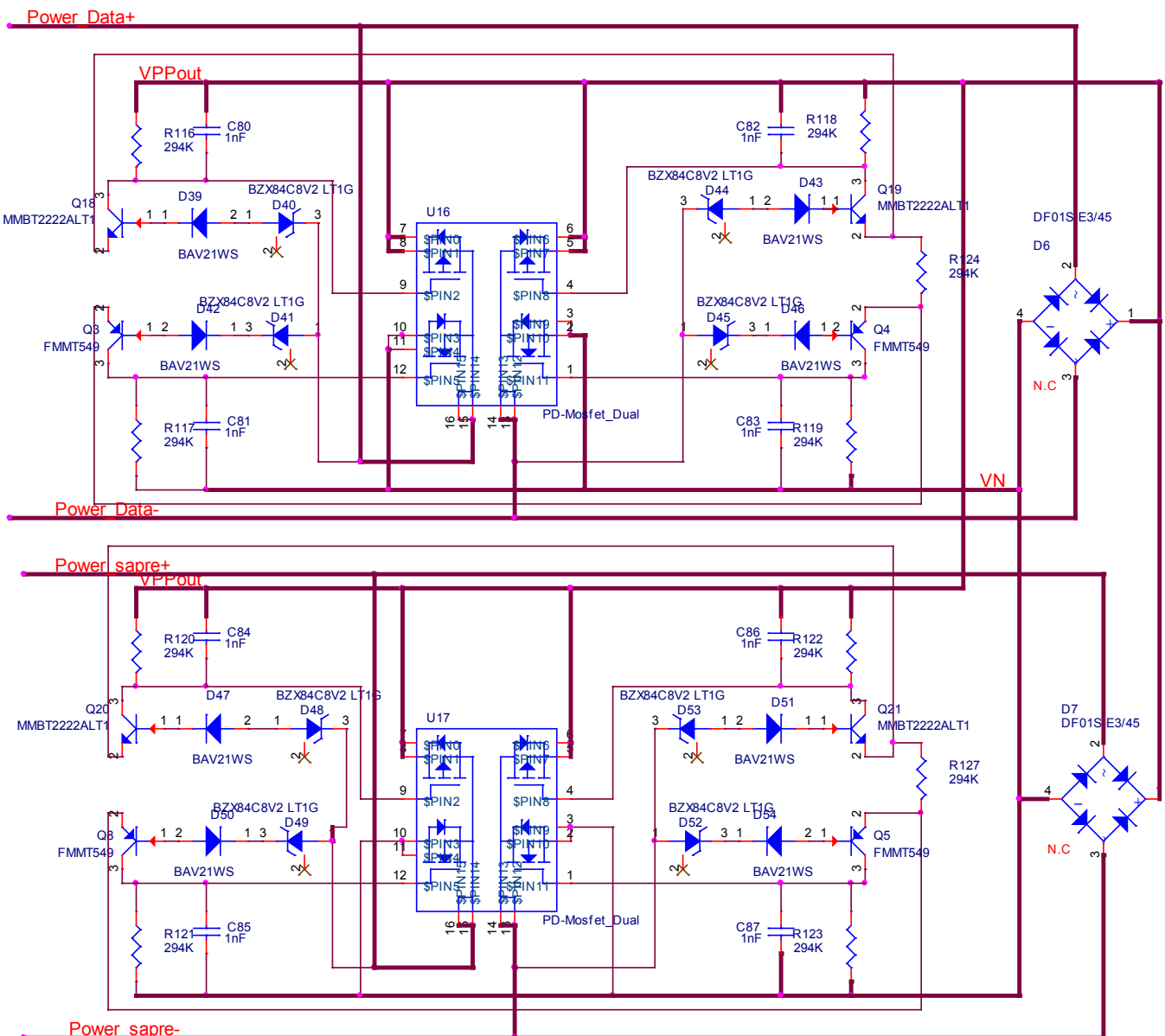


Figure 8: Diode bridge circuitry

## 4 Electrical Characteristics

Evaluation board's electrical characteristics are described below:

**Table 6: Electrical Characteristics**

| Parameter                 | Symbol | Min. | Max. | Units |
|---------------------------|--------|------|------|-------|
| Main DC Supply – Con1, J3 |        | 44   | 57   | V     |
| Port Isolation to Chassis |        | -    | 1.5  | kVrms |

## 5 Installation

This chapter describes the steps required to install and operate Evaluation Board with any PoE application.

|                                          |  |   |     |       |
|------------------------------------------|--|---|-----|-------|
| All Communication's Isolation to Chassis |  | - | 1.5 | kVrms |
|------------------------------------------|--|---|-----|-------|

### 5.1 Preliminary Considerations and Safety Precautions

- Verify board's power supply is turned on before peripheral devices are turned on.

### 5.2 Initial Configuration

**Note:** It is important to verify Evaluation Board is setup as shown in Figure 9 prior to starting any operation.

- Connect load to main board (J1).
- Connect a power cable from power supply to Evaluation Board (CON1).
- Connect Ethernet Cable from Evaluation Board (CON2) to PD Ethernet Host.

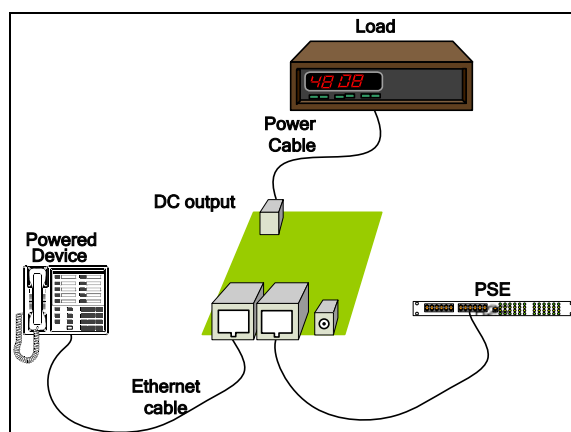
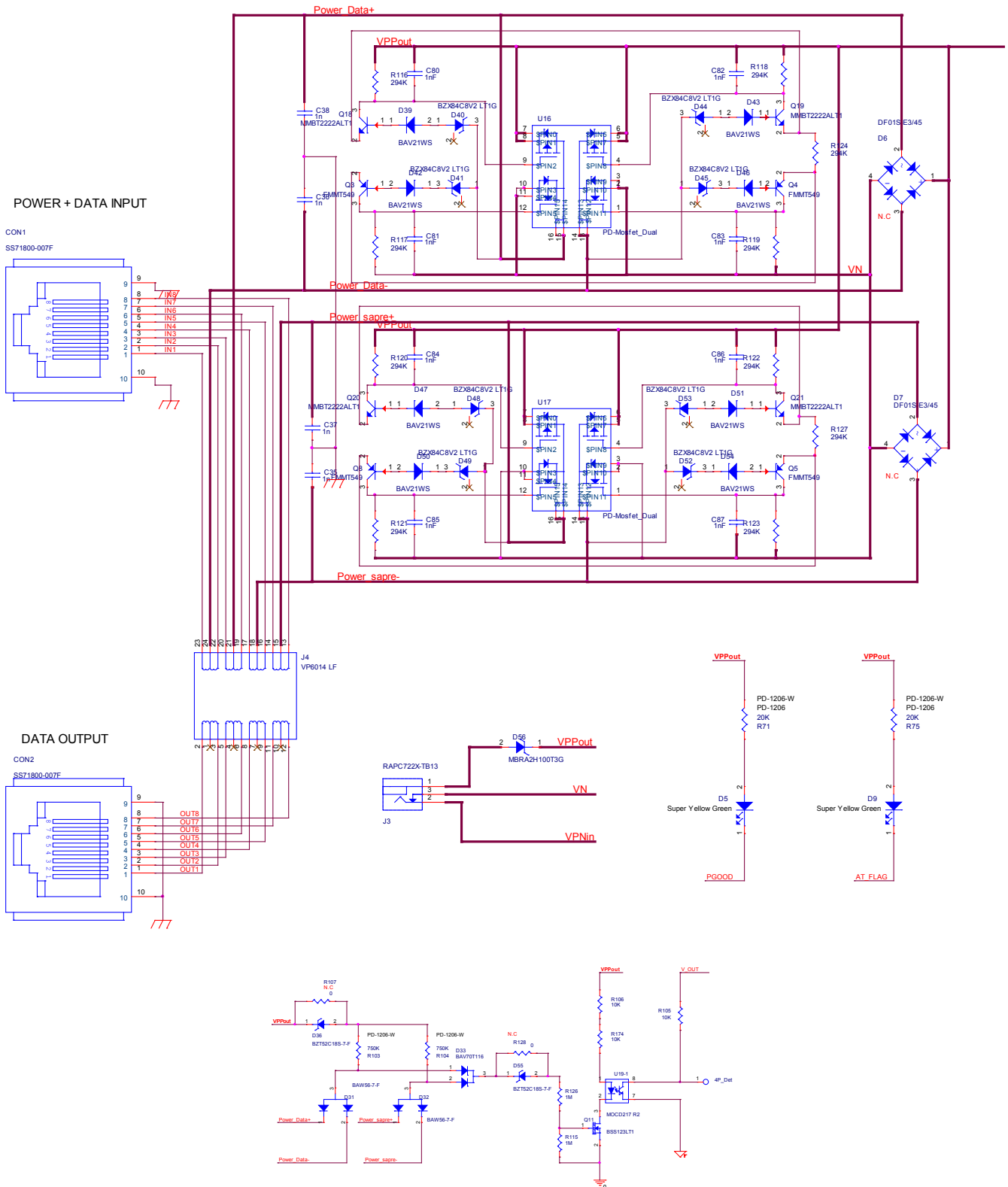


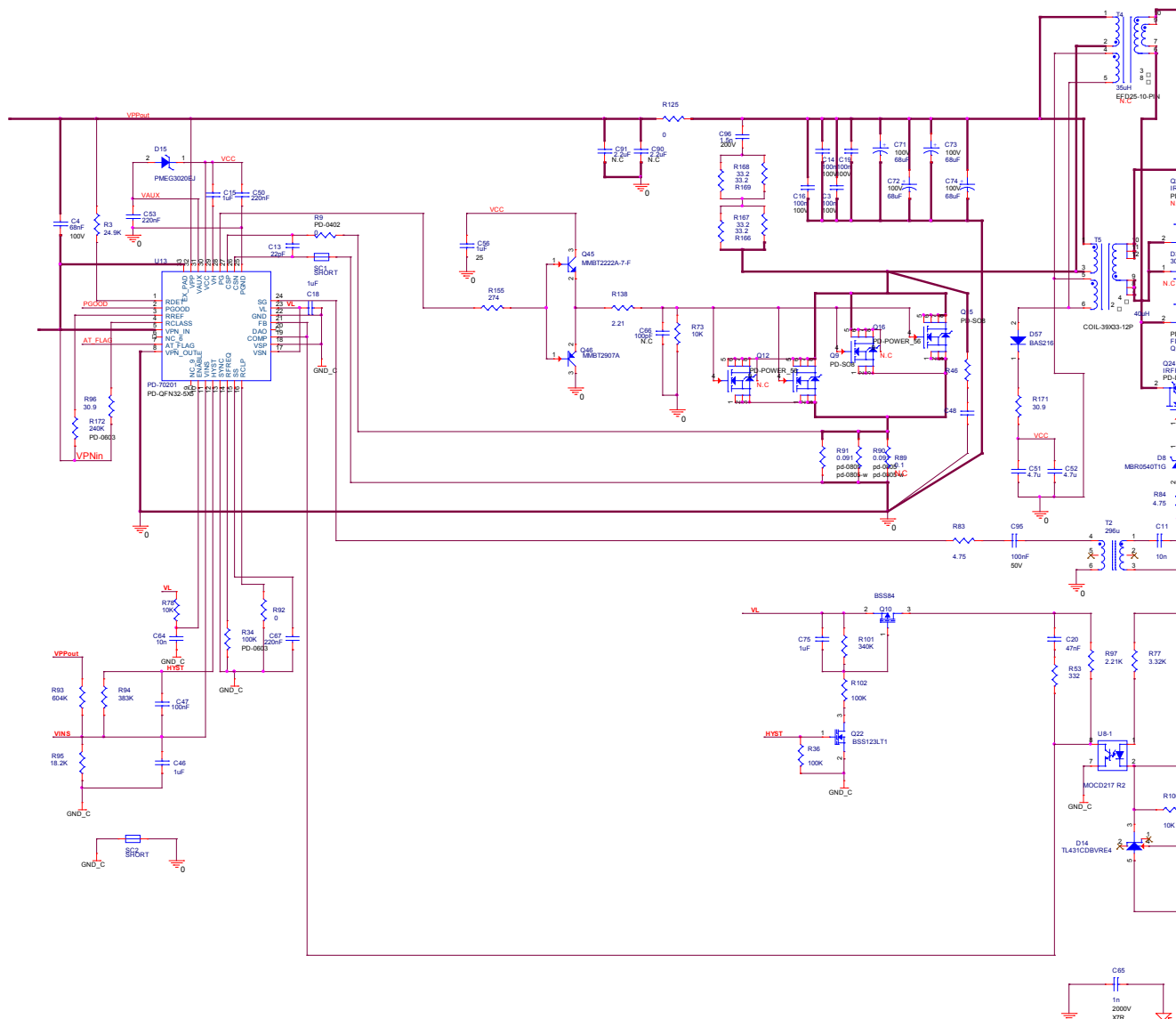
Figure 9: Test Setup

## 6 Schematic





# PD70201EVB47F Evalu



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## 7 List of Materials-

| Item | Item Description                                         | Qty | Ref Des                         | Manufacturer               | Manufacture P/N    |
|------|----------------------------------------------------------|-----|---------------------------------|----------------------------|--------------------|
| 1    | CAP CRM 68nF 100V 10% X7R 1206 SMT                       | 1   | C4                              | AVX                        | 12061C683KAT2A     |
| 2    | CAP CRM 1nF/2000V 10%+X7R 1206 SMT                       | 5   | C35-C38,C65                     | AVX                        | 1206GC102KAT1A     |
| 3    | CAP CRM 1.5nF 200V 10% X7R 1206 SMT                      | 1   | C96                             | AVX                        | 12062C152KAT2A     |
| 4    | CAP CRM 100nF 100V 10% X7R 1206 SMT                      | 4   | C3,C14,C16,C19                  | AVX                        | 12061C104KAT2A     |
| 5    | CAP CER 22pF 50V 5% NPO 0402 SMT                         | 1   | C13                             | Kemet                      | C0402C220J5GAC     |
| 6    | Capacitor, X7R, 4.7uF, 25V, 10% 1210                     | 2   | C51,C52                         | Murata                     | GRM32DR71E475KA61L |
| 7    | CAP CRM 22uF 25V 20% 1210 X7R SMT                        | 2   | C97,C98                         | Murata                     | GRM32ER71E226ME15L |
| 8    | CAP COG 100pF 50V 5% 0603                                | 1   | C70                             | AVX                        | 06035A101JAT2A     |
| 9    | Cap 1nF 100V 10% X7R 0603 SMT                            | 8   | C80-C87                         | Hitano                     | 0603B102K101NT     |
| 10   | Capacitor, X7R, 47nF, 16V, 10%                           | 1   | C20                             | Murata                     | GRM188R71C473KA01  |
| 11   | CAP CRM 100nF 50v 10% X7R 0603                           | 1   | C95                             | Murata                     | GRM188R71H104KA01  |
| 12   | CAP 220NF 25V X7R 10% 0603                               | 3   | C50,C53,C67                     | Murata                     | GRM188R71E224KA88D |
| 13   | Capacitor,X7R, 1uF, 25V, 10% 0603                        | 5   | C15,C18,C46,C56,C75             | Murata                     | GRM188R71E105KA12D |
| 14   | Capacitor, X7R, 100nF,100v, 10% 0603                     | 1   | C47                             | Murata                     | GRM188R72A104KA35D |
| 15   | CAP CRM 10nF 50v 10% X7R 0603 SMT                        | 3   | C11,C17,C64                     | Murata                     | GRM188R71H103KA01  |
| 16   | CAP ALU 47uF 25V 10X10mm ESR=45 Irms=2400 mA SMT         | 3   | C76-C78                         | Nichicon                   | PCF1E470MCL1GS     |
| 17   | CAP ALU 68uF 100V 20% 10x16 IR=600mA 4000 Hr P=5         | 4   | C71-C74                         | Nippon Chemi-Con           | EKZE101ELL680MJ16S |
| 18   | CON RJ45 SINGLE 8 POS. SHILDED after vibration           | 2   | CON1,CON2                       | Bel Stewart                | SS71800-007F       |
| 19   | CON DC POWER JACK RA 2.0X6.3 T/H                         | 1   | J3                              | Shogyo International Corp. | MJ-179P            |
| 20   | Terminal block 2 pole interlocking 5mm pitch PB C insert | 1   | J2                              | DINKLE                     | DT-123RA-02P       |
| 21   | Diode Dual C.A 70v 200mA 225mW SOT23 BAW 56              | 2   | D31,D32                         | Diodes Inc.                | BAW56-7-F          |
| 22   | DIO 200V 250mA SOD323 SMT trr=50nSEC SWI                 | 8   | D39,D42,D43,D46,D47,D50,D51,D54 | Diodes Inc.                | BAV21WS-7-F        |
| 23   | DIO DUAL 70V 150mA SOT-23 SMT                            | 1   | D33                             | Diodes Inc.                | BAV70-7-F          |
| 24   | DIO 85V 250mA HIGH SPE. SOD110 SMT                       | 1   | D57                             | Philips                    | BAS216             |
| 25   | DIO SCHOTTKY 100V 2A SMA SMT                             | 1   | D56                             | ON Semiconductor           | MBRA2H100T3G       |
| 26   | DIO SCHOTTKY 30V 2A SOD323F SMT                          | 1   | D15                             | NXP                        | PMEG3020EJ         |
| 27   | DIO SCHOTTKY 40V 500mA SOD123 REC. SMT                   | 2   | D4,D8                           | ON Semiconductor           | MBR0540T1G         |
| 28   | DIO 8.2V 225mW 5% Ir=5uA SOT23 SMT ZENER                 | 8   | D40,D41,D44,D45,D48,D49,D52,D53 | ON Semiconductor           | BZX84C8V2 LT1G     |
| 29   | Diode Zener, 18V 200mW SOD323                            | 2   | D36,D55                         | Diodes Inc.                | BZT52C18S-7-F      |
| 30   | IC Prog Shunt Ref 2.5V 2% SOT23-5 SMT                    | 1   | D14                             | Philips                    | TL431CD5           |





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| Item | Item Description                                           | Qty | Ref Des           | Manufacturer                 | Manufacture P\N     |
|------|------------------------------------------------------------|-----|-------------------|------------------------------|---------------------|
| 31   | 1000 BASE T SINGLE PORT VOICE OVER IP MAGNETICS MODULE SMT | 1   | J4                | BOTHHAND                     | VP6014 HF           |
| 32   | AT POE PD controller for IEEE 802.3 PD70201                | 1   | U13               |                              |                     |
| 33   | INDUCTOR SHIELDED PWR 1UH IRMS=11A SMT                     | 1   | L1                | Bourns                       | SRP7030-1R0M        |
| 34   | Flyback Transform 40uH 15% 0.3uH to1.2uH T.H               | 1   | T5                | ICE Components Asia Co. Ltd. | TX11160             |
| 35   | Transformer, Gate driver SMT 269uH 0.795 DCR               | 1   | T2                | Coilcraft                    | DA2319-AL           |
| 36   | LED SuperYelGrn 100-130o 20-40mcd h=1 0603 SMD             | 2   | D5,D9             | Everlight                    | 19-21-SYGC5530E3TR8 |
| 37   | IC OPTOISOLATOR MOCD217 DUALCHANNEL SMT                    | 2   | U8,U19            | Fairchild                    | MOCD217R2-M         |
| 38   | PCB Mrkt EVB 70201 Combo 4p AT Flyback Drilling            | 1   | PCB               | PCB Technologies             | PR-1417-B00-PT      |
| 39   | Res Current Sense 0.091ohm 0805 1/4W 100PPM SMT            | 2   | R90,R91           | KOA                          | UR732ATTD91L0F      |
| 40   | RES 10K 125mW 1% 0805 SMT Thick Film                       | 2   | R106,R174         | KOA                          | RK73H2ATTD1002F     |
| 41   | Resistor, 0 Ohm, 5%, 1/16W 0402                            | 1   | R9                | ASJ                          | CR10-000ZK          |
| 42   | RES 0R 250mW 5% 1206 SMT JUMPER<0.05R                      | 1   | R125              | Samsung                      | RC3216J000CS        |
| 43   | RES 33.2R 250mW 1% 1206 SMT MTL FLM                        | 4   | R166-R169         | Bourns                       | CR1206-FX-33R2-ELF  |
| 44   | RES TK FLM 20K 250mW 1% 1206                               | 2   | R71,R75           | Bourns                       | CR1206-FX-2002-ELF  |
| 45   | RES 750K 250mW 1% 1206                                     | 2   | R103,R104         | Samsung                      | RC3216F7503CS       |
| 46   | RES TCK FLM 0R 62.5mW 5% 0603 SMT                          | 2   | R92,R112          | ASJ                          | CR16-000ZL          |
| 47   | RES TCK FLM 24.9K 62.5mW 1% 0603 SMT                       | 1   | R3                | ASJ                          | CR16-2492FL         |
| 48   | RES 383K 100mW 1% 0603SMT MTL FLM                          | 1   | R94               | ASJ                          | CR16-3833FL         |
| 49   | Resistor, 3.32K, 1%, 1/16W 0603                            | 1   | R77               | ASJ                          | CR16-3321FL         |
| 50   | Resistor, 13K, 1%, 1/16W 0603                              | 1   | R99               | ASJ                          | CR16-1302FL         |
| 51   | Resistor, 30.9R 1%, 1/10W 0603                             | 2   | R96,R171          | KOA                          | RK73H1JTDD30R9F     |
| 52   | Resistor, 294K, 1%, 1/16W 0603                             | 10  | R116-R124,R127    | ASJ                          | CR16-2943FL         |
| 53   | Resistor, 2.21K, 1%, 1/16W 0603                            | 1   | R97               | ASJ                          | CR16-2211FL         |
| 54   | RES TCK FLM 5.1K 62.5mW 1% 0603 SMT                        | 1   | R55               | ASJ                          | CR16-5101FL         |
| 55   | RES 604K, 1%, 1/16W, 0603                                  | 1   | R93               | ASJ                          | CR16-6043FL         |
| 56   | Resistor, 240K, 1%, 1/10W 0603                             | 1   | R172              | KOA                          | RK73H1JTDD2403F     |
| 57   | RES 2.21R 62.5mW 1% 0603 SMT MTL FLM                       | 1   | R138              | ASJ                          | CR16-2R21FL         |
| 58   | RES 4.75R 0.1W 1% 0603 SMT MTL FLM                         | 2   | R83,R84           | Samsung                      | RC1608F4R75CS       |
| 59   | RES TCK FLM 274R 62.5mW 1% 0603 SMT                        | 1   | R155              | Bourns                       | CR-0603-FX-2740ELF  |
| 60   | RES 332R 62.5mW 1% 0603 SMT MTL FLM                        | 1   | R53               | ASJ                          | CR16-3320FL         |
| 61   | RES 10K 62.5mW 1% 0603 SMT MTL FLM                         | 4   | R73,R78,R100,R105 | ASJ                          | CR16-1002FL         |
| 62   | RES 18.2K 62.5mW 1% 0603 SMT MTL FLM                       | 1   | R95               | Rohm                         | MCR03EZHF1822       |
| 63   | RES 51.1K 62.5mW 1% 0603 SMT MTL FLM                       | 1   | R98               | ASJ                          | CR16-5112FL         |
| 64   | RES 100K 62.5mW 1% 0603 SMT MTL FLM                        | 3   | R34,R36,R102      | ASJ                          | CR16-1003FL         |
| 65   | RES TN FLM 340K 1% 62.5mW 0603 SMT                         | 1   | R101              | ASJ                          | CR16-3403FL         |
| 66   | RES 1M 62.5mW 1% 0603 SMT MTL FLM                          | 2   | R115,R126         | ASJ                          | CR16-1004-FL        |
| 67   | TRN PNP -30V -1A SOT23                                     | 5   | Q2-Q5,Q8          | Fairchild                    | FMMT549             |



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| Item | Item Description                                 | Qty | Ref Des     | Manufacturer | Manufacture P\N |
|------|--------------------------------------------------|-----|-------------|--------------|-----------------|
| 68   | TRN NPN 40V 600mA SOT23 300mW 250MHZ<br>MMBT2222 | 5   | Q18-Q21,Q45 | Diodes Inc.  | MMBT2222A-7-F   |
| 69   | TRN PNP 60V 600mA SOT23 SMT 250mW                | 1   | Q46         | Fairchild    | KST2907AMTF_NL  |
| 70   | FET PCH -50V -0.13A 10R ENH MODE SOT-23          | 1   | Q10         | Fairchild    | BSS84           |
| 71   | FET NCH 100V 0.15A 6R Logic Level SOT23          | 2   | Q11,Q22     | Diodes Inc.  | BSS123-7-F      |
| 72   | IC Dual N/P CH power mosfet 100v 6A SMT          | 2   | U16,U17     | Fairchild    | FDMQ8203        |
| 73   | N-CH POWER MOSFET DPAK 60V 43A 18mOhm            | 1   | Q24         | I.R.         | IRFR3806PBF     |
| 74   | MOSFET N-CH 200V 3.9A 8-SOIC SMT                 | 2   | Q9,Q15      | Fairchild    | FDS2672         |



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### Revision History

| Revision Level / Date | Para. Affected/Page | Description                    |
|-----------------------|---------------------|--------------------------------|
| 0.1 / 11-Dec-11       |                     | Initial revision               |
| 0.2 / 18-Mar-11       |                     | Update Revision B of the board |
|                       |                     |                                |

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