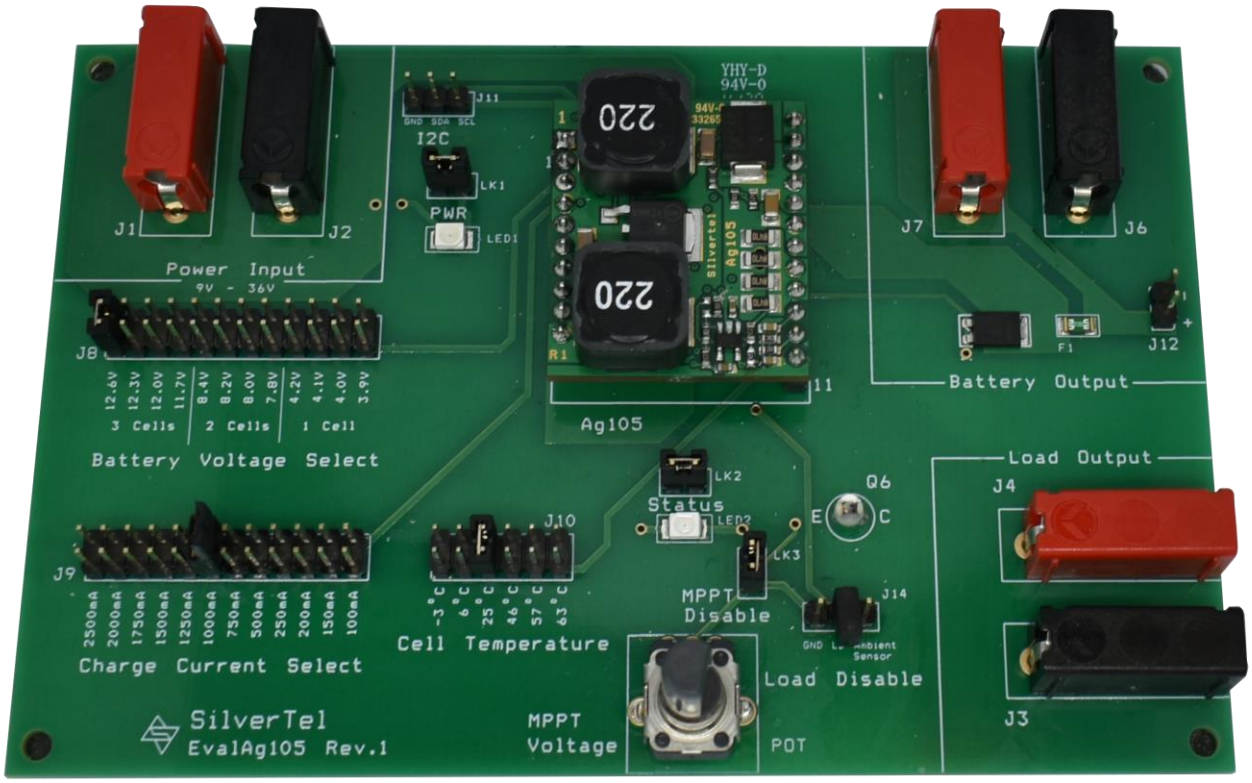

EvalAg105
Evaluation Kit
User Manual

Version 1.0 – ~January 2021

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- EvalAg105 Evaluation Board
- Ag105 Lithium-ion Charge controller with Solar MPPT

2 Introduction

This manual is intended to be a guide to using the “EvalAg105 Evaluation Board” fitted with Silvertel’s Ag105 module. This board has been designed to assist with evaluating the Ag105’s function for a potential application;

3 Board Layout

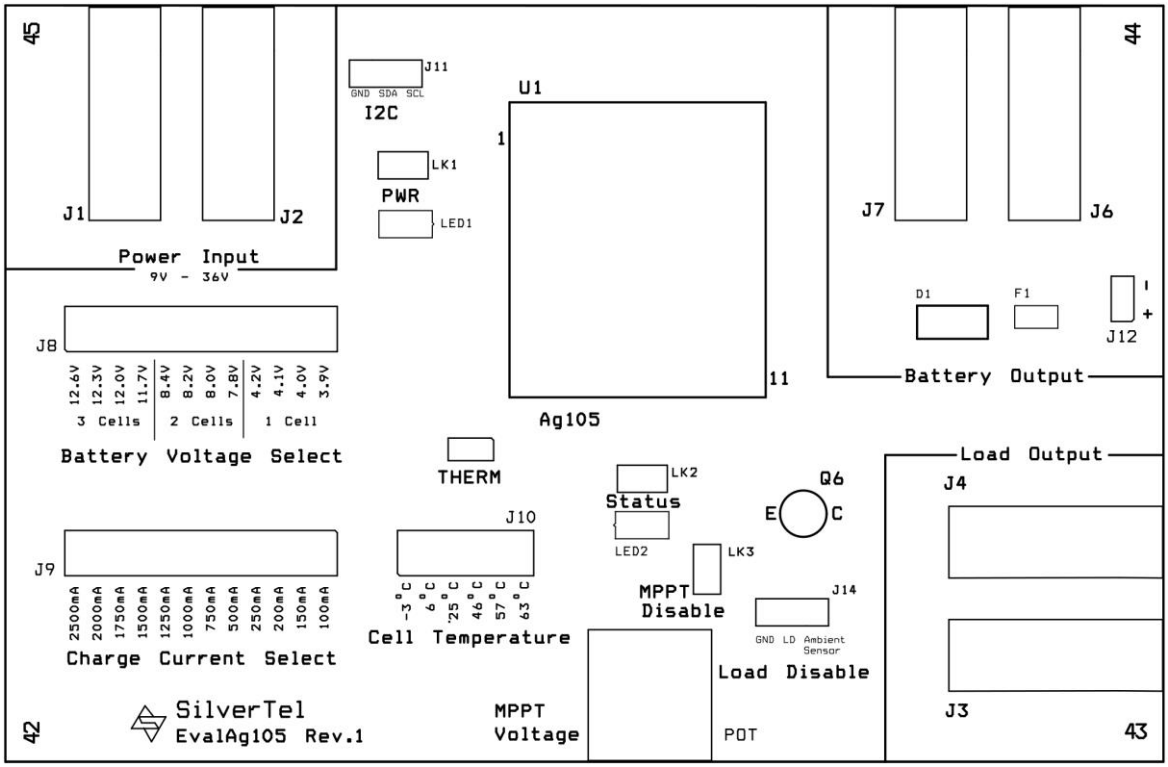


Figure 1: EvalAgSil Board Layout

3.1 Link Settings

LK1 – Input Power LED Enable

LK2 – Status LED Enable

LK3 – MPPT Disable

J8 – Battery Voltage Select

J9 – Charge Current Select

J10 – Battery Temperature Select

J14 – Load Disable Select

3.2 Input Output Connections

J1 & J2 – Input Power

J3 & J4 – Load Output

J6, J7 & J12 – Battery Output

J11 – I^2C connector

THERM – Thermistor

4 Input

The supply to the EvalAg105 should be connected to J1 and J2 via banana connector. For ease of identification the positive input is the Red connector, J1. With the negative being a Black connector J2. The voltage input range for the Ag105 is 11-36V_{dc} this can be supplied by a fixed DC supply, such as a bench power supply, or a variable DC source, such as a 21V solar panel.

5 Operation

5.1 Battery Voltage Select

The Ag105 has the ability to charge at 12 different voltage settings, allowing for 1, 2 or 3 cells in series, with 4 separate voltage-per-cell options. The EvalAg105 has the facility to set any of these modes by adding a jumper link to the corresponding pins on header J8.

If no jumper link is present, the Ag105 will revert to the default voltage charge profile, which is the 4.2V single cell setting.

5.2 Charge Current Select

The Ag105 has 12 options for the charge current that will be supplied to the battery while the module is in constant current mode. The range of this setting is from 100mA to 2.5A, and can be set by connecting a jumper link to the corresponding pins on header J9.

If no jumper link is present the Ag105 will revert to the default current charge profile, which is the 1000mA setting.

5.3 Maximum Power Point Tracking (MPPT)

The Ag105 features MPPT for use with renewable energy generation sources, such as a solar panel. When this feature is enabled the Ag105 will monitor the input voltage and adjust the charge profile in order to maximise the energy harvested from the generation source to charge the battery.

When enabled the Ag105 will monitor the input supply in relation to the set MPPT voltage, if the charging load would cause the input supply to drop below the MPPT Voltage, the Ag105 will reduce the charge power in order to maintain the input supply.

If the input voltage is below the set MPPT Voltage the EvalAg105 will not charge the battery connected to the battery output.

5.3.1 MPPT Disable

If MPPT is not required, a jumper link can be placed across LK3. This will pull the MPPTD pin LOW disabling the MPPT feature. If the MPPT feature is disabled, the EvalAg105 will charge the connected battery when supplied with between 11-36V_{dc}.

5.3.2 MPPT Voltage

When enabled, the MPPT voltage setting can be set by using the single turn 50kΩ potentiometer fitted to the EvalAg105. This setting has a range of 11-33V with a resistance range of 0Ω-31KΩ. A resistance above approximately 41 KΩ the default setting of 18V will be set.

Turning fully anti-clockwise will set the MPPT voltage to the lowest setting: 11V, while turning the Potentiometer fully clockwise will result in the MPPT voltage being set to the default setting of 18V

5.4 Load Disable

By default the Ag105 is to presents the battery potential across the load output connection when the Ag105 is not actively charging. In order to prevent increased charge cycles it is recommended that this is prevented by actively controlling the LD pin.

By setting the jumper link on J14 to the right setting “Ambient Sensor” allows the photo transistor, Q6, to be connected, resulting in the battery potential only being present on the load output when the ambient light drops below the threshold of the fitted phototransistor.

Additionally this pin can be connected either directly to ground, or external circuitry can be connected between the middle pin “LD” and the leftmost pin “GND” using a 2 pin 0.1” pitch connector.

5.5 Cell Temperature

In order to simulate battery packs at various temperatures a jumper link can be placed on J10 for the desired temperature setting. Six options have been fitted to the EvalAg105 simulate the different regions on the JEITA temperature profile. See the Ag105 datasheet for more details.

5.5.1 External thermistor

If an external 10k thermistor with beta value of 3435k is to be used it can be connected to either the THERM header or any of the lower pins on the J10 header and ground, via J2 or J3 or any other available ground connection.

5.6 I^2C

The Ag105 contains an I^2C interface in order to allow for the control and monitoring of the charge controller. This can be done by connecting a three pin connector to J11. The Pin arrangement is as below:

Ground **-** *Serial Data Analogue* **-** *Serial Clock*

For more details of the I^2C interface, see the Ag105 Datasheet.

5.7 **LED Output**

There are two LEDs fitted to the EvalAg105 board, each of these can be disabled by removing the associated link jumper.

Name	Location	Enable Link	Description
PWR	LED1	LK1	Illuminates when input voltage is present
Status	LED2	LK2	Indicates the current status of the Ag105

5.7.1 **Status Output**

The below table shows the different mode conditions of the Ag105 indicated by the Status LED.

Mode	Status Mode	STAT Output
0	Charging	Steady State 'Logic 1'
1	Fully Charged	50% 'Logic 1', period:2s
2	Disconnected Battery Error	1 Pulse
3	Battery Temperature Error	2 Pulses
4	OC/Regulation Error	3 Pulses
5	Timeout Error	4 Pulses
6	Major Battery Fault	5 Pulses
7	Input Voltage Removed	Steady State 'Logic 0'

All pulses are 200ms 'Logic 1' followed by a 200ms 'logic 0'.
With a period, dependant on the configuration and error state, of ≥1.2 seconds between sets of pulses.

6 Output

6.1 Battery Output

The chosen battery can be connected to the Battery Output section of the EvalAg105 via the 2 pin 0.1” pitch connector plugged into J12 or via banana connectors inserted into the red J7 (positive) connector and the black J6 (Negative) connector.

6.2 Load Output

The chosen load can be connected to the Load Output Section of the EvalAg105 using banana connectors to the black J3 (negative) connector and the red J4 (positive) connector.

7 Protection

The Ag105 is designed to be operated with protected cells, in addition to this the EvalAg105 features basic reverse polarity protection to protect the module from damage if a battery is connected with the wrong polarity. If such an event does occur, there is a current path through D1 and F1. The Fuse fitted to the EvalAg105 is an 8A slow blow.

8 Test Setup

8.1 Basic Test Setup

Figure 2 shows the basic set up using the EvalAg105 evaluation board powered by a solar panel to charge a battery pack that will power an LED light when the Ambient light reduces below the threshold of the photodiode fitted to the EvalAg105 board.

In this setup MPPT will be enabled and configured to the power output of the chosen solar panel

The equipment required: -

- EvalAg105.
- Battery Pack
- 10-20W Solar Panel
- LED Light

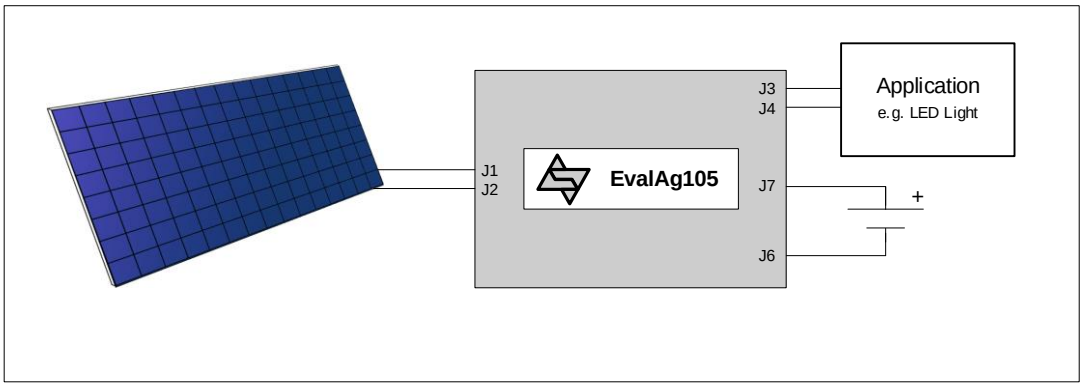


Figure 2 Basic Test Setup

8.2 **Advanced Test Setup**

Figure 3 shows a more advanced set up using the EvalAg105 evaluation board powered via PoE to act as battery backup for an IP camera. The load output will be disabled when the PoE voltage is present. If the PoE supply drops out, the battery connected to the EvalAg105 will automatically be connected to the application circuit, a bulk storage capacitor may be required on the input of the application in order to maintain power during the switchover.

The equipment required: -

- EvalAg105.
- Battery Pack
- EvalAgSil fitted with a 12V class 4 Silvertel module such as Ag5300 or Ag5412.
- Type 2 or greater PSE
- Schottky diode D1 e.g. MBR340, MOSFET Q1 e.g. 2N7000, 2x 10kΩ resistors

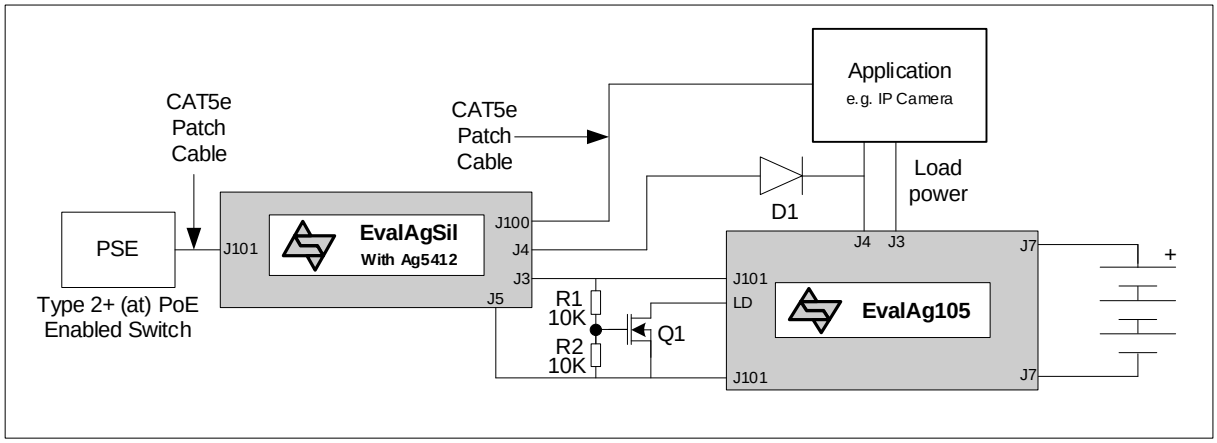
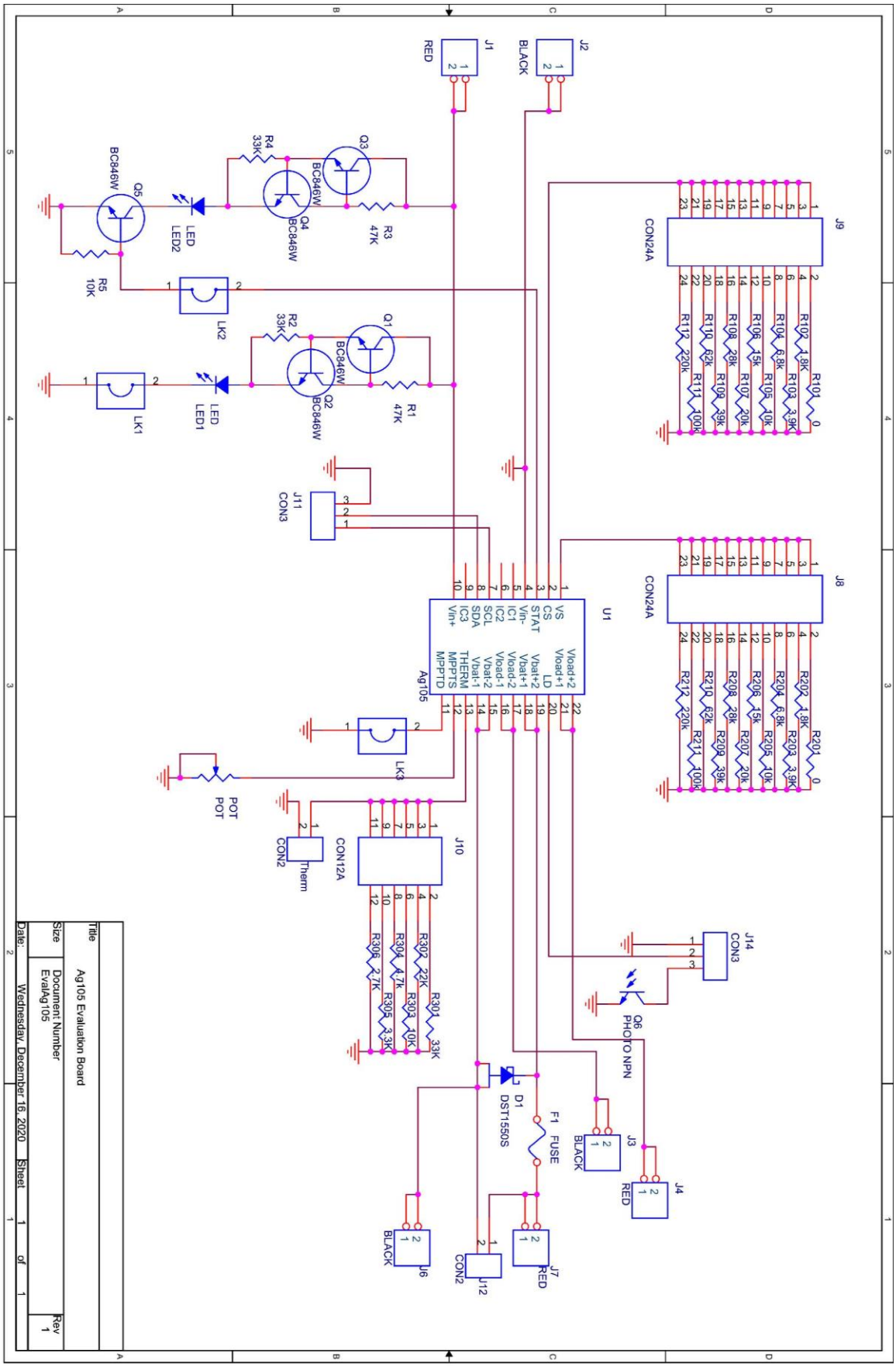


Figure 3 Advanced Test Setup

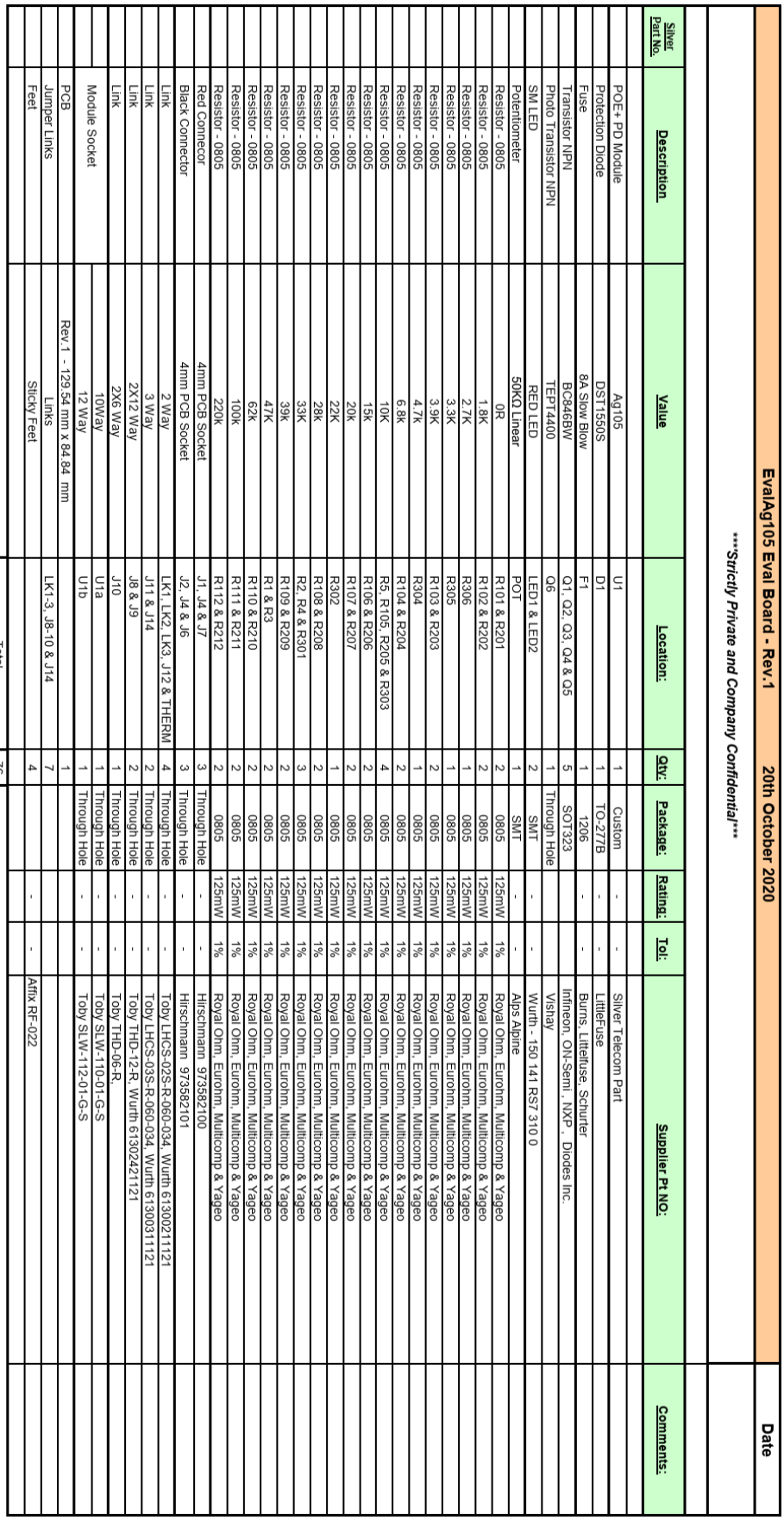
9 Additional information

Full operating conditions and features of the Silvertel module set can be found in the relevant product datasheet, available from www.silvertel.com.

10 Schematic



11 Bill of Materials



EvalAg105 Eval Board - Rev.1 — **20th October 2020**

Strictly Private and Company Confidential

Silver Part No.	Description	Value	Location:	Qty:	Package:	Rating:	Tol:	Supplier Pt NO:	Comments:
	POE+ PD Module	Ag105	U1	1	Custom	-	-	Silver Telecom Part	
	Protection Diode	DST1550S	D1	1	TO-277B	-	-	LittleFuse	
	Fuse	8A Slow Blow	F1	1	1206	-	-	Burns, Littelfuse, Schurter	
	Transistor NPN	BC846BW	Q1, Q2, Q3, Q4 & Q5	5	SOT323			Infineon, ON-Semi, NXP, Diodes Inc.	
	Photo Transistor NPN	TEPT4400	Q6	1	Through Hole			Vishay	
	SM LED	RED LED	LED1 & LED2	2	SMT	-	-	Wurth - 150 141 RS7 310 0	
	Potentiometer	50KΩ Linear	POT	1	SMT	-	-	Alps Alpine	
	Resistor - 0805	0R	R101 & R201	2	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	1.8K	R102 & R202	2	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	2.7K	R306	1	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	3.3K	R305	1	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	3.9K	R103 & R203	2	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	4.7K	R304	1	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	6.8K	R104 & R204	2	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	10K	R5, R105, R205 & R303	4	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	15k	R106 & R206	2	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	20K	R107 & R207	2	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	22K	R302	1	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	28K	R108 & R208	2	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	33K	R2, R4 & R301	3	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	39k	R109 & R209	2	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	47K	R1 & R3	2	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	62k	R110 & R210	2	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	100k	R111 & R211	2	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Resistor - 0805	220k	R112 & R212	2	0805	125mW	1%	Royal Ohm, Eurohm, Multicomp & Yageo	
	Red Connecor	4mm PCB Socket	J1, J4 & J7	3	Through Hole	-	-	Hirschmann 973582100	
	Black Connector	4mm PCB Socket	J2, J4 & J6	3	Through Hole	-	-	Hirschmann 973582101	
	Link	2 Way	LK1, LK2, LK3, J12 & THERM	4	Through Hole	-	-	Toby LHCS-02S-R-060-034, Wurth 61300211121	
	Link	3 Way	J11 & J14	2	Through Hole	-	-	Toby LHCS-03S-R-060-034, Wurth 61300311121	
	Link	2X12 Way	J8 & J9	2	Through Hole	-	-	Toby THD-12-R, Wurth 61302421121	
	Link	2X6 Way	J10	1	Through Hole	-	-	Toby THD-06-R,	
		10Way	U1a	1	Through Hole	-	-	Toby SLW-110-01-G-S	
	Module Socket	12 Way	U1b	1	Through Hole	-	-	Toby SLW-112-01-G-S	
	PCB	Rev.1 - 129.54 mm x 84.84 mm		1					
	Jumper Links	Links	LK1-3, J8-10 & J14	7					
	Feet	Sticky Feet		4		-	-	Affix RF-022	
			Total	76					

Date	