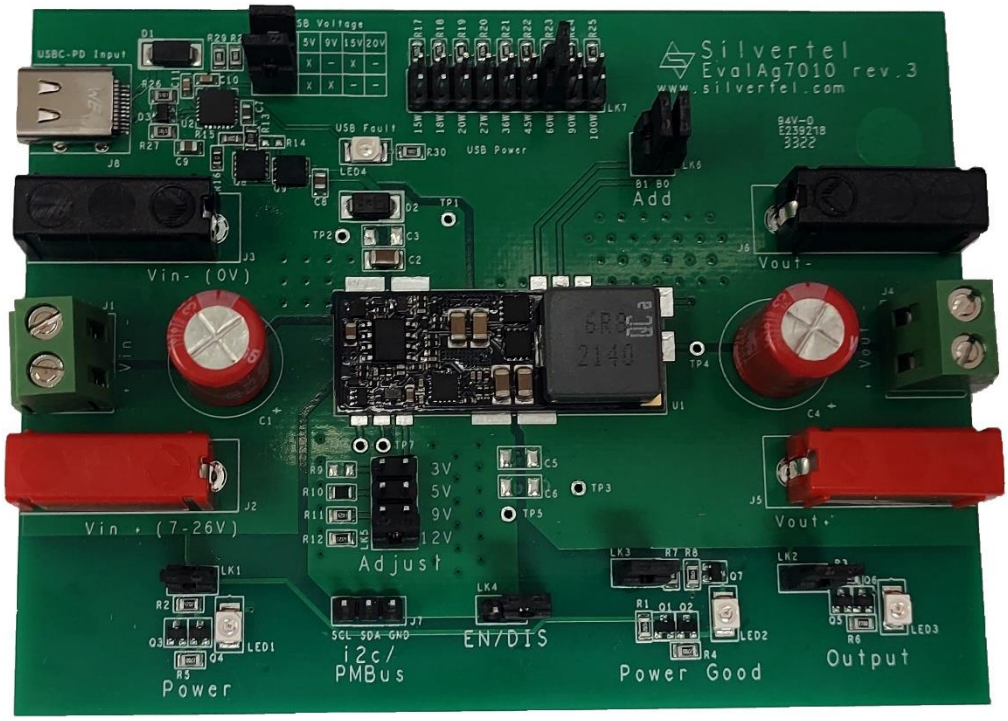
Silvertel

Evaluation Board User Manual



EvalAg7010
Evaluation Board
User Manual

Version 2.0 – September 2022

© Silver Telecom 2022

Table of Contents

1 Kit Contents 3
2 Additional Components 3
3 Board Layout 3
3.1 Link Settings 3
3.2 Input Output Connections 3
4 Introduction 4
5 Input 4
5.1 Supply 4
5.2 Output Voltage Adjust 4
5.3 EN/DIS 4
6 I^2C 5
6.1 I^2C Address 5
7 USB 5
7.1 USB Voltage Request Select 5
7.2 USB Power Level Request Select 5
7.3 USB LED 5
7.4 Data 6
8 Output 6
8.1 PWR good LED 6
9 Test Setup 6
10 Additional information 6
11 Schematic 7
12 Bill of Materials 8

Table of Figures

Figure 1: EvalAg7010 Board Layout 3
Figure 2: Basic Test Setup 6

© Silver Telecom 2022

1 Kit Contents

- EvalAg7010 Evaluation Board
- Ag7010 Soldered to Evaluation Board

2 Additional Components

- I²C controller
- USB-C Source

3 Board Layout

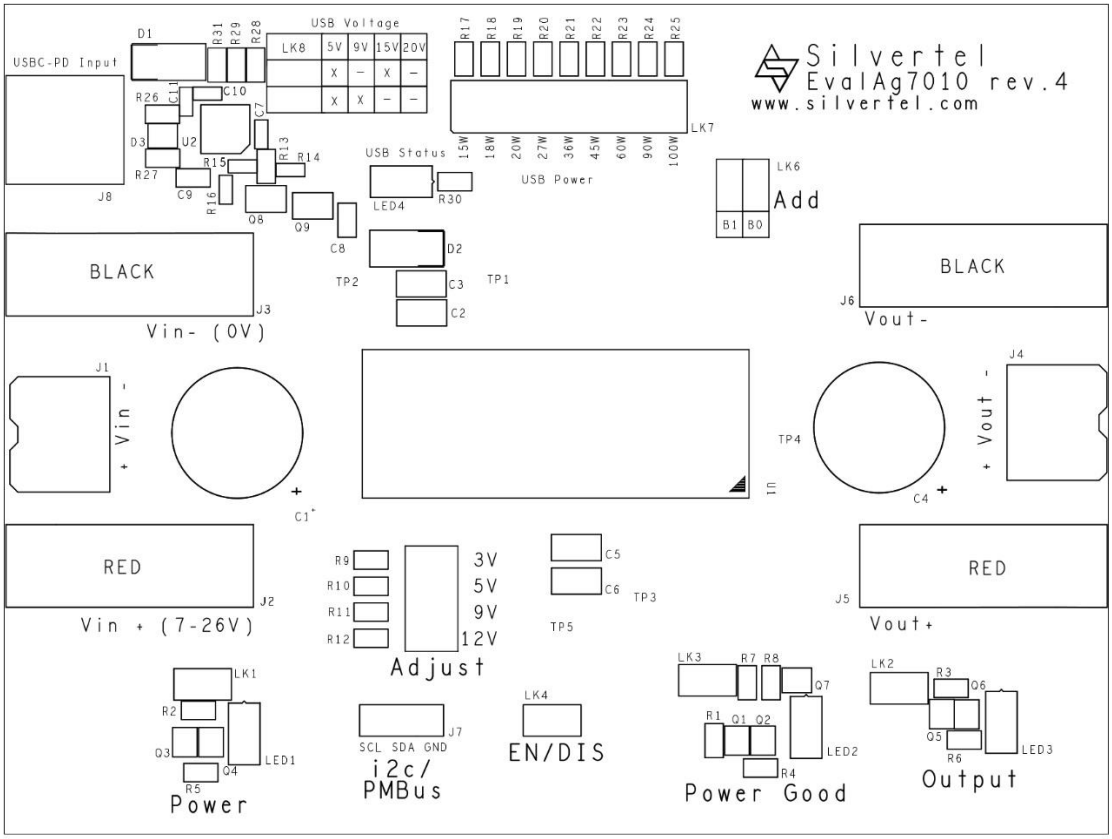


Figure 1: EvalAg7010 Board Layout

3.1 Link Settings

LK1 – Input Power LED Enable

LK2 – Output Power LED Enable

LK3 – PWR good LED Enable

LK4 – CONTROL Set

LK5 – Output voltage Select

LK6 – I²C Address Set

LK7 – USB Power Request Set

LK8 – USB Voltage Request Set

3.2 Input Output Connections

J1 – Input Power DC jack

J2 & J3 – Input Power Banana Connectors

J4 – Load Output Dc Jack

J5 & J6 – Load Output Banana Connectors

J7 – I²C Interface

J8 – USB-C Connector

© Silver Telecom 2022

4 Introduction

This Manual is a guide to using the EvalAg7010 revision 3 or greater evaluation board fitted with a Silvertel Ag7010 High Efficiency Buck Converter module for use in a wide variety of point of load (PoL) and DC-DC converter applications, including USB Power Delivery (USB-PD), Apple Lightning and Intel Thunderbolt enabled devices

5 Input

5.1 Supply

The EvalAg7010 evaluation board can be powered using a DC Power supply connected to either J2 and J3 via banana connectors, J1 with bare wire or J8 via USB-C.

This supply should deliver between 8-24V, a lower voltage will not cause damage to the module. The DCDC converter will be enabled when its supply exceeds the configured VIN_ON setting, by default this is 6.75V.

The Ag7010 can output up to 10A of continuous output current for a maximum power output of 120W.

At this output current the Ag7010 will dissipate up to 5.1W. Any power source should be suitably rated for the desired output power, the power dissipation of the Ag7010 and any transmission power losses.

5.2 Output Voltage Adjust

The output voltage of the Ag7010 module can be adjusted by changing the location of the jumper LK5. There are four jumper locations on LK5 that can be used to set the Ag7010 to one of the pre-configured the output voltage of 3V, 5V, 9V, or 12V.

To set the output voltage to a custom value, fit a resistor to location R9 to overriding the 3V output setting with the custom voltage output, please refer to the Ag7010 datasheet for details on resistor value calculation.

With no jumper present on LK5, the module will default to 3V output.

5.3 EN/DIS

The Ag7010 DCDC converter can be enabled or disabled by pulling the CONTROL pin LOW, which can be performed by connecting a jumper link to LK4, EN/DIS.

The default action is a jumper link placed on LK4 will disable the output. This pin function can be inverted or negated using the PMBus configuration.

© Silver Telecom 2022

6 I²C

The Ag7010's I²C interface supports PMBus commands and is designed to the PMBus rev 1.3 specification.

This allows for the configuration, control, and monitoring of the DC/DC converter by a system controller. For the full command list of the I²C interface, see the Ag7010 Datasheet

The Pin arrangement for the I2C interface on J7 is as below:

Serial Clock - Serial Data Analogue – Ground

6.1 I²C Address

Up to four Ag7010 modules can operate on the same I²C bus by configuring them to operate on different addresses. Bits 0 and 1 of the I²C address can be pulled LOW from their default HIGH state by connecting one or two jumpers vertically to LK6. Bit 0 is set by the right column of LK6, bit 1 is set by the left column of LK6.

7 USB

The EvalAg7010 rev 3 is fitted with a Diodes Inc AP33771 USB PD Sink Controller, this controller performs the role of requesting voltage and power levels from a USB-PD source.

The AP33771 uses resistor links to configure the voltage and power level request, as opposed to the AP33772, which is configured via I²C.

7.1 USB Voltage Request Select

The requested voltage from the USB-PD source is set using two jumper links on LK8. With both links present 20V will be requested from the source. With only the lower link present 15V will be requested.

If neither jumper link is present, the USB volage will be 5V, with this voltage the I²C interface on the Ag7010 will be active, but the voltage will be too low for the DCDC converter to be enabled.

7.2 USB Power Level Request Select

The power level requested from the USB-PD source is set by placing a jumper link on the appropriate setting on LK7. If the USB-PD source device has a power contract that allows this power level at the requested voltage, power will be supplied, otherwise a mismatch will be flagged.

7.3 USB LED

The EvalAg7010 features an LED to indicate the status of the power request from the USB connection. The behaviour of the LED will be as per the Table 1 when connected to a USB-PD source.

LED action	Status
Full Light	powered with <500mA draw
4-sec Breathing	Powered and Drawing Currernt
Flashing - 2 second period	Voltage or Power request Mismatch
Flashing - 0.6 second period	Over Voltage Protection

Table 1: USB LED States

© Silver Telecom 2022

7.4 Data

The EvalAg7010 contains a USB-PD sink controller negotiating power delivery from a USB PSE for the purpose of evaluating the module for USB powered applications. There is no data Throughput for the USB-C connection.

8 Output

The Ag7010 will output 3V-12.7V and can deliver a continuous output current of 10A, for up to 120W of continuous power, the peak output power may be reduced as a result of the power source or operating conditions the module is operating in.

8.1 PWR good LED

The power good LED will illuminate when the output voltage has reached a regulated output.

9 Test Setup

Figure 2 shows a typical test set up using the EvalAg7010 evaluation board.

The equipment required: -

- Up to 130W USB-PD source or 24V bench power supply
- Application Device
- USB-C cable

Optional equipment: -

- Data source e.g. PC

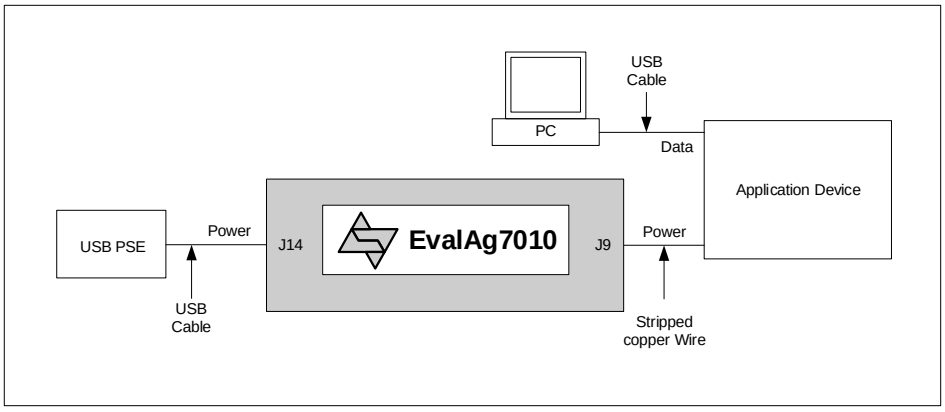


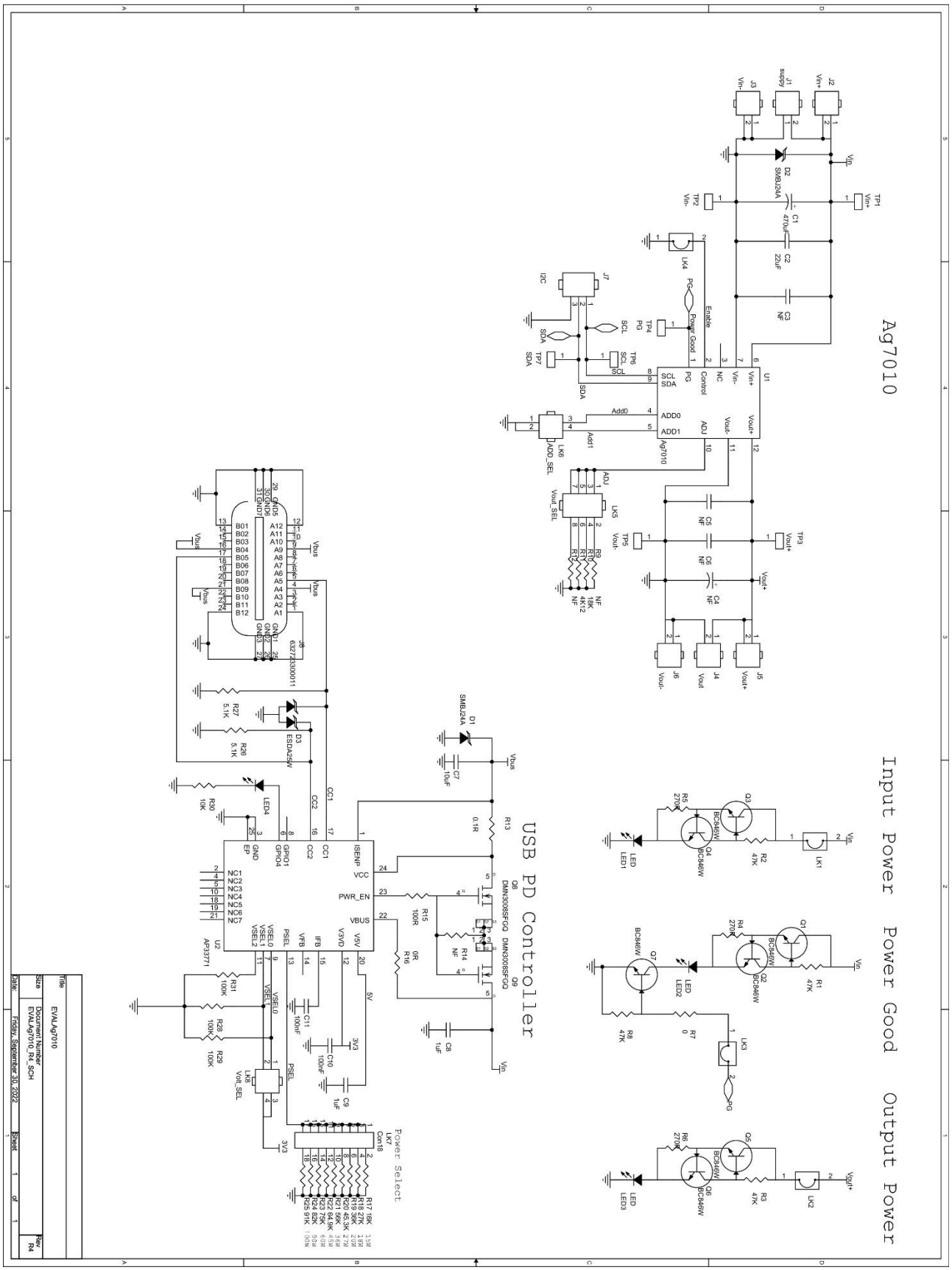
Figure 2: Basic Test Setup

10 Additional information

Full operating conditions and feature set can be found in the Ag7010 product datasheet, available from www.silvertel.com.

© Silver Telecom 2022

11 Schematic



© Silver Telecom 2022

12 Bill of Materials

EvalAg7010 Eval Board - Rev.4 — **Date: 30th September, 2022**

Silver Part No.	Description	Value	Location:	Qty:	Package:	Rating:	Tol:	Supplier Pt NO:	Comments:
	PD Module	Ag7010	U1	1	Custom	-	-	Silver Telecom Part	
	USB PD Sink Controller	AP33771	U2	1	W-QFN4040-24	-	-	Diodes Inc.	
	Transistor NPN 60v Single	BC846BW	Q1-Q7	7	SOT323	-	-	Infineon or NXP Only	
	MOSFET N Channel	DMN3008SFG	Q8,Q9	2	Powerdi3333-8	-	-	Diodes Inc.	
	Protection Diode	SMAJ24A	D1, D2	2	SMA	-	-	Wurth- 824500241,Vishay, ST Micro, Diodes Inc	
	Protection Diode	ESDA25W	D3	1	SOT323	-	-	ST Micro	
	SM LED	RED LED	LED1-LED4	4	SMT	-	-	Wurth - 150 141 RS7 310 0	
	Capacitor Electolytic	470uF	C1	1	Through Hole	35V	20%	Panasonic, Samsung, NIC, TDK, Kemet, AVX, Wurth:860020575014	Pitch: 5mm
	Capacitor Electolytic	NF	C4	0	Through Hole	35V	20%	-	Pitch: 5mm
	Ceramic multi-layer	22uF	C2	1	1206	35V	20%	Samsung, NIC, TDK, Murata, Kemet, AVX, Wurth	
	Ceramic multi-layer	NF	C3, C5, C6	0	1206	35V		-	
	Ceramic multi-layer	1uF	C8, C9	2	0805	25V	20%	Samsung, NIC, TDK, Murata, Kemet, AVX, Wurth:885012107015	
	Ceramic multi-layer	10uF	C7	1	0603	25V	20%	Samsung, NIC, TDK, Murata, Kemet, AVX, Wurth: 885012106031	
	Ceramic multi-layer	100nF	C10, C11	2	0603	25V	20%	Samsung, NIC, TDK, Murata, Kemet, AVX, Wurth: 885012206120	
	Resistor - 0805	47K	R1,R2,R3,R8	4	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	270R	R4,R5,R6	3	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	0R	R7	1	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	NF	R9, R12	0	0805	125mW	1%	-	
	Resistor - 0805	19K1	R10	1	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	6K2	R11	1	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	4K12	R12	1	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	0R01	R13	1	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	16K	R17	1	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	27K	R18	1	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	36K	R19	1	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	45K3	R20	1	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	56K	R21	1	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	64K9	R22	1	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	75K	R23	1	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	82K	R24	1	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	95K3	R25	1	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	5K1	R26, R27	2	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	100K	R28, R29, R31	2	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0805	10K	R30	1	0805	125mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0603	NF	R14	0	0603	100mW	1%	-	
	Resistor - 0603	100R	R15	1	0603	100mW	1%	Royal Ohm, Eurohm & Yageo	
	Resistor - 0603	0R	R16	1	0603	100mW	1%	Royal Ohm, Eurohm & Yageo	
	Red Connecor	4mm PCB Socket	J2, J5	2	Through Hole	-	-	Hirschmann 973582101	
	Black Connector	4mm PCB Socket	J3, J6	2	Through Hole	-	-	Hirschmann 973582100	
	DC Power Connector	2 Way Screw Terminal	J1, J4	2	Through Hole	-	-	Multicomp, Amphenol, Wurth 691216510002S	
	USB-C Connector	632723300011	J8	1	Through Hole	-	-	Wurth - 691216510002S	
	Link	3 Way	J7	1	Through Hole	-	-	Valcon LHCS-03S-R-060-034, Wurth 613003111121	
	Link	2 Way	LK1-4	4	Through Hole	-	-	Valcon LHCS-02S-R-060-034, Wurth 613002111121	
	Link	9x2 Way	LK7	1	Through Hole	-	-	Valcon THD-09-R	
	Link	4x2 Way	LK5	1	Through Hole	-	-	Valcon THD-04-R	
	Link	2x2 Way	LK6, LK8	2	Through Hole	-	-	Valcon THD-02-R	
	Test point	1 Way	TP1-7	0	Through Hole	-	-	Valcon, Multicomp, Keystone	
	PCB	Rev.3 - 104.14mm x 71.12mm		0		-	-		
	Jumper Links	Links	LK1 - LK8	10		-	-		
	Feet	Sticky Feet	-	4	-	-	-	Affix RF-022, SJ-5003	
			Total	83					

© Silver Telecom 2022