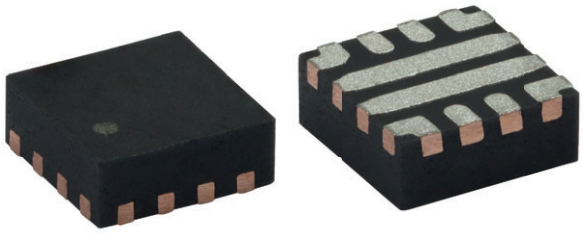
Evaluation Board User's Manual
SiP32435, SiP32436, SiP32437



DESCRIPTION

This reference board allows the user to evaluate the SiP32435A/B, SiP32436A/B, and SiP32437A/B single channel eFuses.

The SiP32435A/B, SiP32436A/B, and SiP32437A/B integrate multiple control and protection features with 9.2 mΩ FET, which provide increased controllability and reliability with simplified designs and minimal external components. They protect both power sources and downstream circuitry connected to the switch from overloads, short circuits, voltage surges, and excessive inrush currents.

FEATURES

- 2.7 V to 23 V typical operating voltage range
- Active current clamping or circuit breaker options with programmable current limit
- Programmable transient blanking timer for load current between ILIM and 2 x ILIM
- Programmable soft start output voltage slew rate and auto retry time
- Programmable overvoltage clamp with pin-selectable threshold (SiP32436A/B) or programmable overvoltage lockout with voltage divider (SiP32435A/B or SiP32437A/B)
- Fixed 24 V overvoltage protection at V_{IN}
- Fault indicator (SiP32435A/B) or Power good with settable threshold (SiP32436A/B or SiP32437A/B)
- TVS diode protects voltage spike from input
- Schottky diode protects negative spike generated from OCP
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

APPLICATIONS

- Server, computer, and add-in cards
- Networking and data storage
- Medical, healthcare, and patient monitoring devices
- Pad, table, and eBook

TABLE 1: EVALUATION BOARD ORDERING INFORMATION

PART NUMBER	EN / UVLO SET (kΩ)	OVP SET (kΩ)	OCP	FAULT OUTPUT	FAULT RESPONSE
SiP32435AEVB	604 / 80.6	665 / 63.4	Active current clamping	/FLT	Latch
SiP32435BEVB	604 / 80.6				Auto-retry
SiP32436AEVB	604 / 80.6	Selectable 3.8 V, 5.8 V, 14.2 V		PGD	Latch
SiP32436BEVB	604 / 80.6				Auto-retry
SiP32437AEVB	604 / 80.6	665 / 63.4	Circuit breaker		Latch
SiP32437BEVB	604 / 80.6				Auto-retry

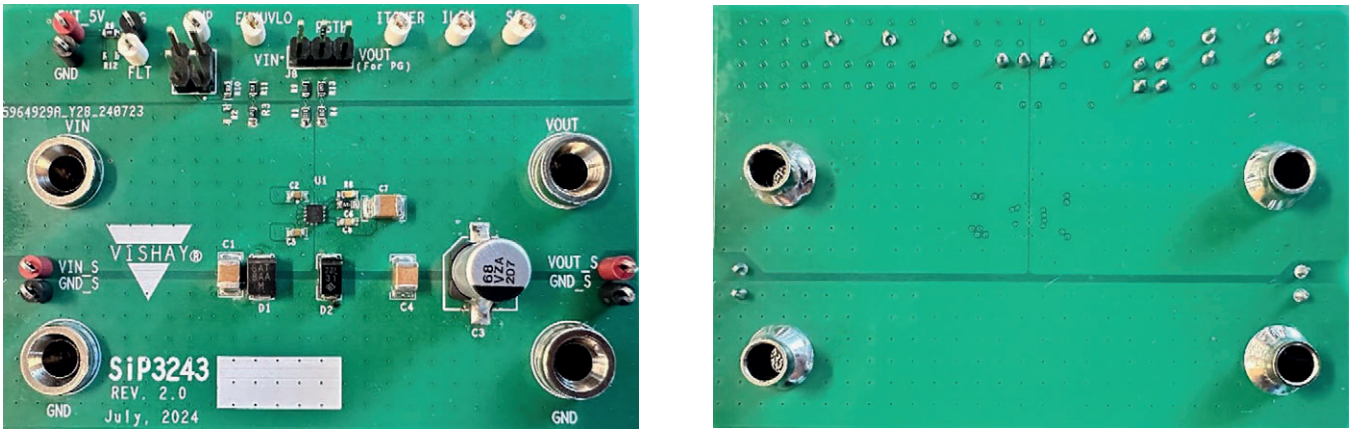


Fig. 1 - SiP3243xxEVB Evaluation Board Rev. 2.0

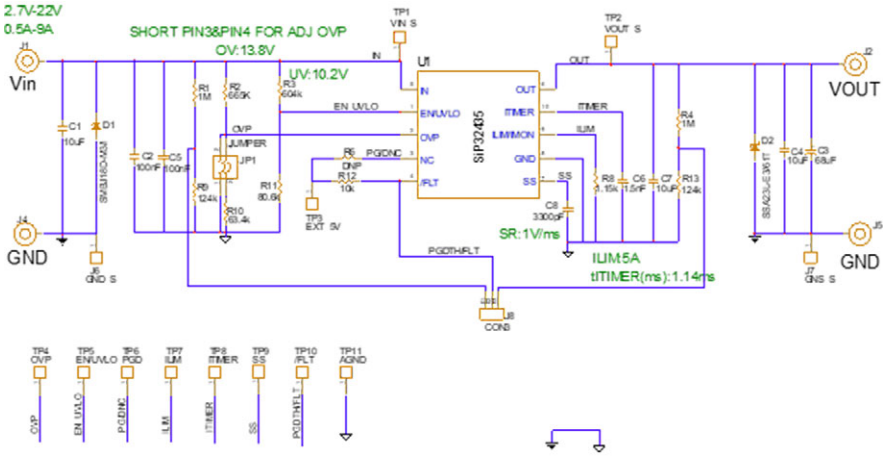


Fig. 2 - SiP3243xxEVB Evaluation Board Rev. 2.0

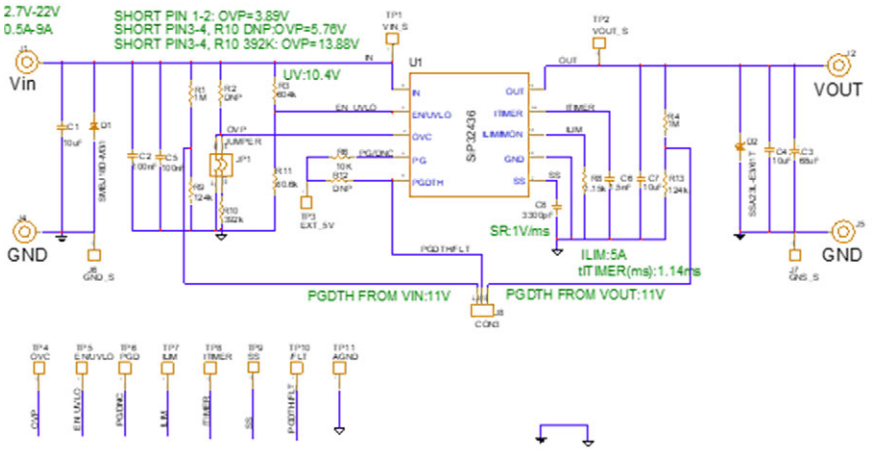


Fig. 3 - SiP3243xxEVB Evaluation Board Rev. 2.0

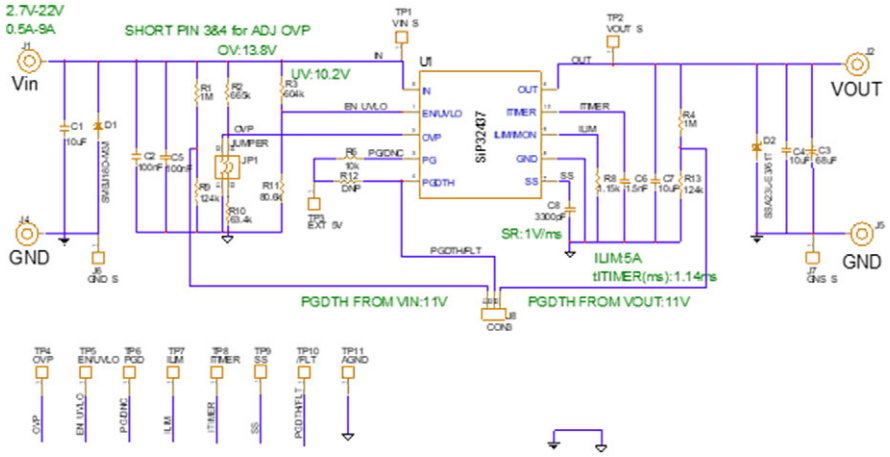


Fig. 4 - SiP3243xxEVB Evaluation Board Rev. 2.0

SIP3243XXEVB PHYSICAL ACCESS

Table 2 lists the SiP3243XXEBV eFuse evaluation board's switch on/off control, power input and output connectors. Table 3 lists the test points. Table 4 describes jumpers and the functions to be set.

TABLE 2: INPUT AND OUTPUT CONNECTOR DESCRIPTION

REFERENCE DESIGNATOR	NAME	DESCRIPTION
J1	VIN	Power input connector
J2	VOUT	Power output connector
J4, J5	PGND	Ground connection for the power input and power output
TP3	EXT_5V	Connect to external 5 V supply for PG or /FLT open drain pull up
TP5	EN / UVLO	Enable, active high / under voltage lock out input. Voltage divider resistors are 665 kΩ and 63.4 kΩ

TABLE 3: TEST POINTS DESCRIPTION

REFERENCE DESIGNATOR	NAME	DESCRIPTION
TP1	VIN_S	Power input voltage sense probe point
TP2	VOUT_S	Power output voltage sense probe point
TP4	OVC / OVP	Over voltage clamping or protection probe point
TP6	PGD	Power good indicator, active high, pull up to external 5 V supply through a 10 kΩ resistor
TP7	ILIM	Current monitoring probe point
TP8	ITIMER	Over current blanking interval probe point
TP9	SS	Soft start ramping voltage probe point
TP10	/FLT	Fault indicator, active low, pull up to external 5 V supply through a 10 kΩ resistor
TP11	AGND	IC Analog ground probe point

TABLE 4: JUMPER DESCRIPTION AND DEFAULT SETTINGS

REFERENCE DESIGNATOR	NAME	DESCRIPTION
JP1	OVP / OVC	SIP32435: Jump short PIN3,4, R2 and R10 to set OVP SIP32436: Remove R2, and choose one of the option, - OVC = 3.8 V Jump short PIN1 and PIN2 on JP1 - OVC = 5.8 V Remove any jumper on JP1 - OVC = 14.2 V Jump short PIN 3 and PIN 4 SiP32437: Jump short PIN3,4, R2 and R10 to set OVP
J8	PGDTH	Jumper to set PGDTH from power input or power output

SOFT POWER UP WITH PROGRAMMABLE SLEW RATE

The capacitor connected between SS and GND, C8, determines the device's soft start slew rate. The output slew rate control circuit regulates the VOUT to 9 x of voltage on SS pin.

The soft start slew rate can be determined by inrush current limit, load capacitance and operating voltage, the proper soft start time can be given by

$$\text{Slew Rate} = \frac{VOUT}{tss} = \frac{INRUSH}{COUT} \quad (1)$$

The soft start capacitor can be calculated by the selected slew rate,

$$\text{Slew Rate} = \frac{VOUT}{tss} = \frac{ISS}{CSS} \times 9 \quad (2)$$

Test point TP5 is directly connected to the EN pin for the enable function of the device. A user defined under voltage protection is implemented by a voltage divider R3 and R11.

To perform the soft start test, connect VIN to a 12V power supply, enable the device with 5V step signal. Figure 5 shows an example of soft startup waveform captured on SiP32436A evaluation board.

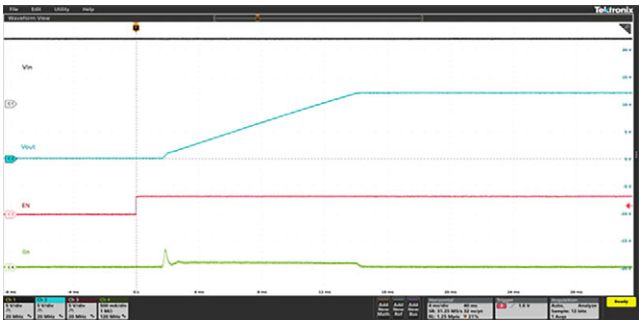


Fig. 5 - SiP32436AEVB Soft Start Waveform

ACTIVE CURRENT CLAMPLING - SIP32435X AND SIP32436X

SiP32435x and SiP32436x will actively regulate the output current if the output overcurrent condition persists after the user defined fault blanking time iTimer.

The over current limit (ILIM) can be set by resistor (RILIM) R8.

$$R_{ILIM} = \frac{600\ mV}{GIMON \times ILIM} \quad (3)$$

GIMON is the switch current sense gain on the ILIM/IMON pin of 105.5 µA/A.

The over current blacking time can be programmed by the capacitor CITIMER, C6

$$T_{ITimer} = \frac{IITIMER}{CITIMER \times \Delta VITIMER} \quad (4)$$

To evaluate SiP32435A/B and SiP32436A/B active current clamping feature, simply increase the load current, the part will enter active clamping mode. When load current increase above the current clamping limit and persist longer than blanking time set by C6, SiP32435x and SiP32436x will clamp the switch current. The clamping current level is set by R8.

Figure 6 shows an example of active current clamping behavior by SiP32436A.

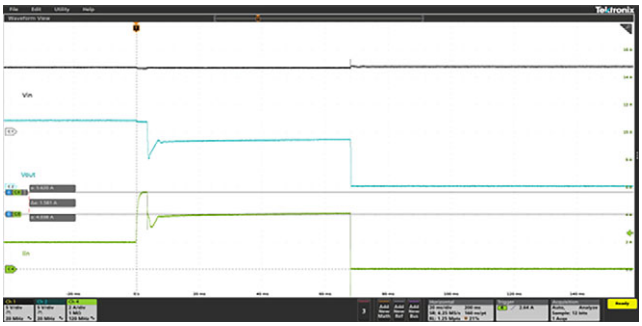


Fig. 6 - SiP32436A Active Current Clamping Waveform

CIRCUIT BREAKER - SIP32437A/B

The SiP32437A/B will turn off the switch if the output overcurrent condition persists after the under-defined blanking time. In the event the load current reaches the short circuit protection threshold (2 x ILIM), the switch will be turned off immediately.

The overcurrent limit set resistor and overcurrent blanking time capacitor shares the same calculation with SiP32435A/B and SiP32436A/B as presented in the previous section.

To evaluate the circuit breaker function, simply increase the load current above the current limit threshold. The part will shut down if the load current persists after the blanking time.

Figure7 shows an example of circuit breaker behavior by SiP32437A.

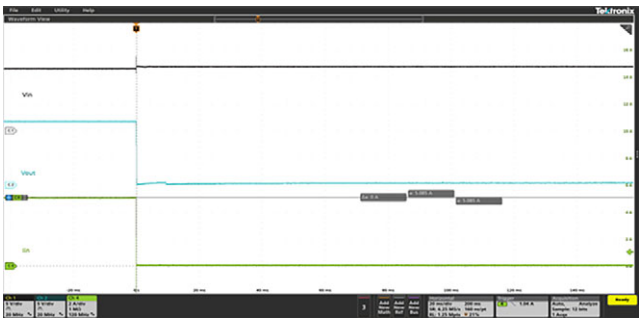


Fig. 7 - SiP32437A Circuit Breaker Waveform

STARTUP INTO SHORT

GIMON is the switch current sense gain on the ILIM/IMON pin is 208 µA/A during startup. Short the VOUT to ground and then startup by enabling the part, the part will clamp the current to half of the level during normal operation.

Figure 8 shows an example of a startup waveform when output is short to ground.

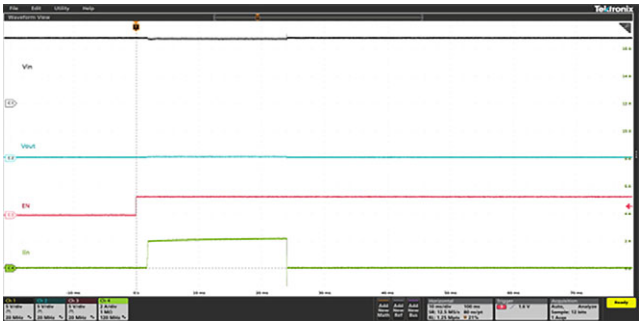


Fig. 8 - SiP32436A Startup into Short

OVERVOLTAGE PROTECTION

The SiP32435A/B and SiP32437A/B VIN OVLO threshold are set by resistor divider R2 an R10. The part will have 1µs response time to shut down the device. SiP32436A/B features overvoltage clamping on three user-selected voltage levels, i.e. floating, ground and ground through 392 kΩ resistor. The response time is 5 µs.

Figure 7 shows an example of the overvoltage lockout waveform of SiP32437A. Figure 8 shows an example of overvoltage clamping waveform of SiP32436A.

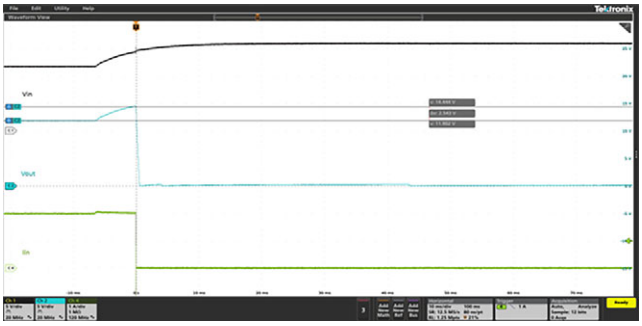


Fig. 9 - Overvoltage Lockout Waveform of SiP32437A

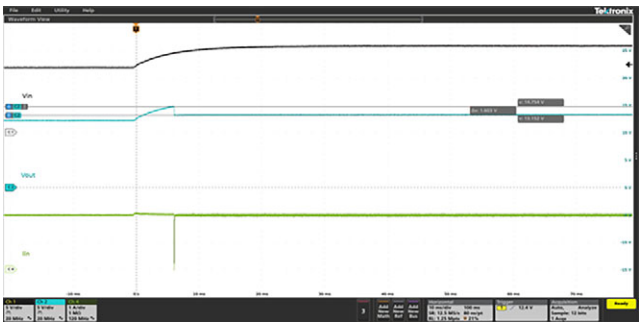


Fig. 10 - Overvoltage Clamping Waveform of SiP32436A

PCB LAYOUTS

Figure 8 to Figure 11 show component placement and PCB layout.

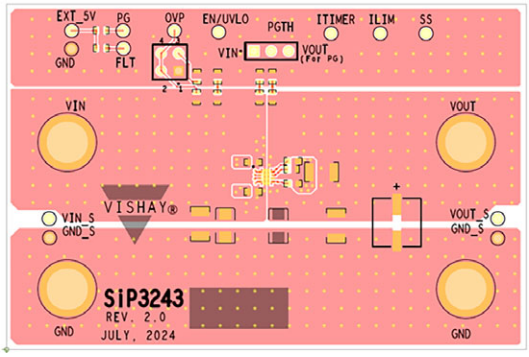


Fig. 11 - SiP3243xx EVB Board Top Layer

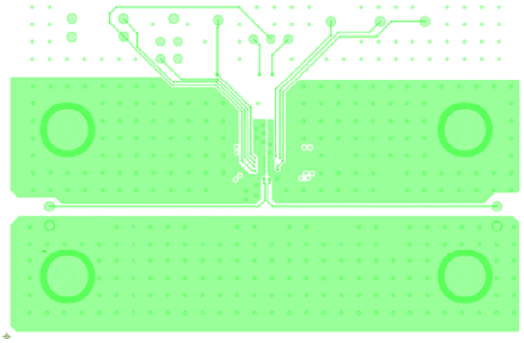


Fig. 12 - SiP3243xx EVB Board Bottom Layer

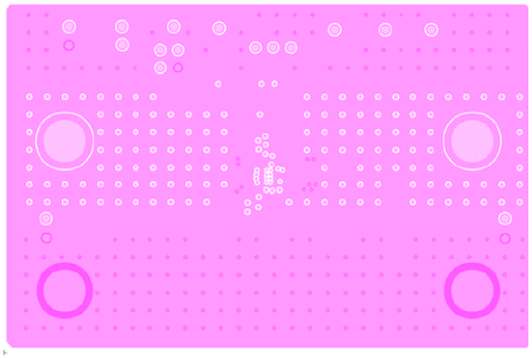


Fig. 13 - SiP3243xx EVB Board Inner layer 1

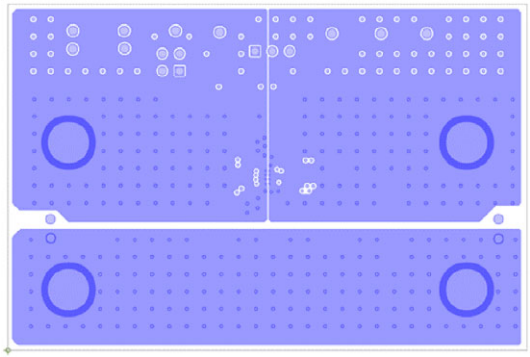


Fig. 14 - SiP3243xx EVB Board Inner layer 2

BILL OF MATERIAL REPORT, SIP32435A/B				
REFERENCE DESIGNATOR	**QUANTITY**	**DESCRIPTION**	**PART NUMBER**	**MANUFACTURER**
C3	1	CAP ALUM HYBRID 68µF 20% 35V SMD	EEH-ZA1V680XP	Panasonic Electronic Components
J1, J2, J4, J5	4	BANANA JACK SOLDER	575-4	Keystone Electronics
C2, C5	2	CAP CER 0.1µF 50V X7R 0603	CC0603KRX7R9BB104	YAGEO
C6	1	CAP CER 1500pF 50V X7R 0603	0603B152K500CT	Walsin Technology Corporation
C8	1	CAP CER 3300pF 50V X7R 0603	CL10B332KB8NNNC	Samsung Electromechanics
C1, C4, C7	3	CAP CER 10µF 25V X5R 1210	TMK325BJ106KN-T	Tayio Yuden
D1	1	TVS	SMBJ18D-M3/I	Vishay
D2	1	Schottky Diode	SSA23L-E3/61T	Vishay
R1, R4	2	1MΩ	0603WAF1004T5E	Royalohm
R2	1	665kΩ	RC0603FR-07665KL	
R6	1	DNP		
R3	1	604kΩ	0603WAF6043T5E	Royalohm
R12	1	10kΩ	0603WAF1002T5E	Royalohm
R8	1	1.15kΩ	0603WAF1151T5E	Royalohm
R9, R13	2	124kΩ	0603WAF1243T5E	Royalohm
R10	1	392kΩ	0603WAF3923T5E	Royalohm
R11	1	80.6kΩ	0603WAF8062T5E	Royalohm
JP1	1	CONN HEADER VERT 4POS 2.54MM	TSW-102-07-G-D	Samtec Inc.
J8	1	CONN HEADER VERT 3POS 2.54MM	TSW-103-14-F-S	Samtec Inc.
J6, J7, TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11	13	PC TEST POINT MINIATURE WHITE	5002	Keystone Electronics
U1	1	eFuse	SiP32435A/B	Vishay

BILL OF MATERIAL REPORT, SIP32436A/B				
REFERENCE DESIGNATOR	**QUANTITY**	**DESCRIPTION**	**PART NUMBER**	**MANUFACTURER**
C3	1	CAP ALUM HYBRID 68µF 20% 35V SMD	EEH-ZA1V680XP	Panasonic Electronic Components
J1, J2, J4, J5	4	BANANA JACK SOLDER	575-4	Keystone Electronics
C2, C5	2	CAP CER 0.1µF 50V X7R 0603	CC0603KRX7R9BB104	YAGEO
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C8	1	CAP CER 3300pF 50V X7R 0603	CL10B332KB8NNNC	Samsung Electro-Mechanics
C1, C4, C7	3	CAP CER 10µF 25V X5R 1210	TMK325BJ106KN-T	Taiyo Yuden
D1	1	TVS	SMBJ18D-M3/I	Vishay
D2	1	Schottky Diode	SSA23L-E3/61T	Vishay
R1, R4	2	1MΩ	0603WAF1004T5E	Royalohm
R2, R12	2	DNP		
R3	1	604kΩ	0603WAF6043T5E	Royalohm
R6	1	10kΩ	0603WAF1002T5E	Royalohm
R8	1	1.15kΩ	0603WAF1151T5E	Royalohm
R9, R13	2	124kΩ	0603WAF1243T5E	Royalohm
R10	1	392kΩ	0603WAF3923T5E	Royalohm
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JP1	1	CONN HEADER VERT 4POS 2.54MM	TSW-102-07-G-D	Samtec Inc.
J8	1	CONN HEADER VERT 3POS 2.54MM	TSW-103-14-F-S	Samtec Inc.
J6, J7, TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11	13	PC TEST POINT MINIATURE WHITE	5002	Keystone Electronics
U1	1	efuse	SiP32436A/B	Vishay

BILL OF MATERIAL REPORT, SIP32437A/B				
REFERENCE DESIGNATOR	**QUANTITY**	**DESCRIPTION**	**PART NUMBER**	**MANUFACTURER**
C3	1	CAP ALUM HYBRID 68µF 20% 35V SMD	EEH-ZA1V680XP	Panasonic Electronic Components
J1, J2, J4, J5	4	BANANA JACK SOLDER	575-4	Keystone Electronics
C2, C5	2	CAP CER 0.1µF 50V X7R 0603	CC0603KRX7R9BB104	YAGEO
C6	1	CAP CER 1500pF 50V X7R 0603	0603B152K500CT	Walsin Technology Corporation
C8	1	CAP CER 3300pF 50V X7R 0603	CL10B332KB8NNNC	Samsung Electro-Mechanics
C1, C4, C7	3	CAP CER 10µF 25V X5R 1210	TMK325BJ106KN-T	Taiyo Yuden
D1	1	TVS	SMBJ18D-M3/I	Vishay
D2	1	Schottky Diode	SSA23L-E3/61T	Vishay
R1, R4	2	1MΩ	0603WAF1004T5E	Royalohm
R2, R12		DNP		
R3	1	604kΩ	0603WAF6043T5E	Royalohm
R6	1	10KΩ	0603WAF1002T5E	Royalohm
R8	1	1.15kΩ	0603WAF1151T5E	Royalohm
R9, R13	2	124kΩ	0603WAF1243T5E	Royalohm
R10	1	392kΩ	0603WAF3923T5E	Royalohm
R11	1	80.6kΩ	0603WAF8062T5E	Royalohm
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J6, J7, TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11	13	PC TEST POINT MINIATURE WHITE	5002	Keystone Electronics
U1	1	eFuse	SiP32437A/B	Vishay

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