USB Type-C 28V EPR Port Protector for CC and SBU Pins

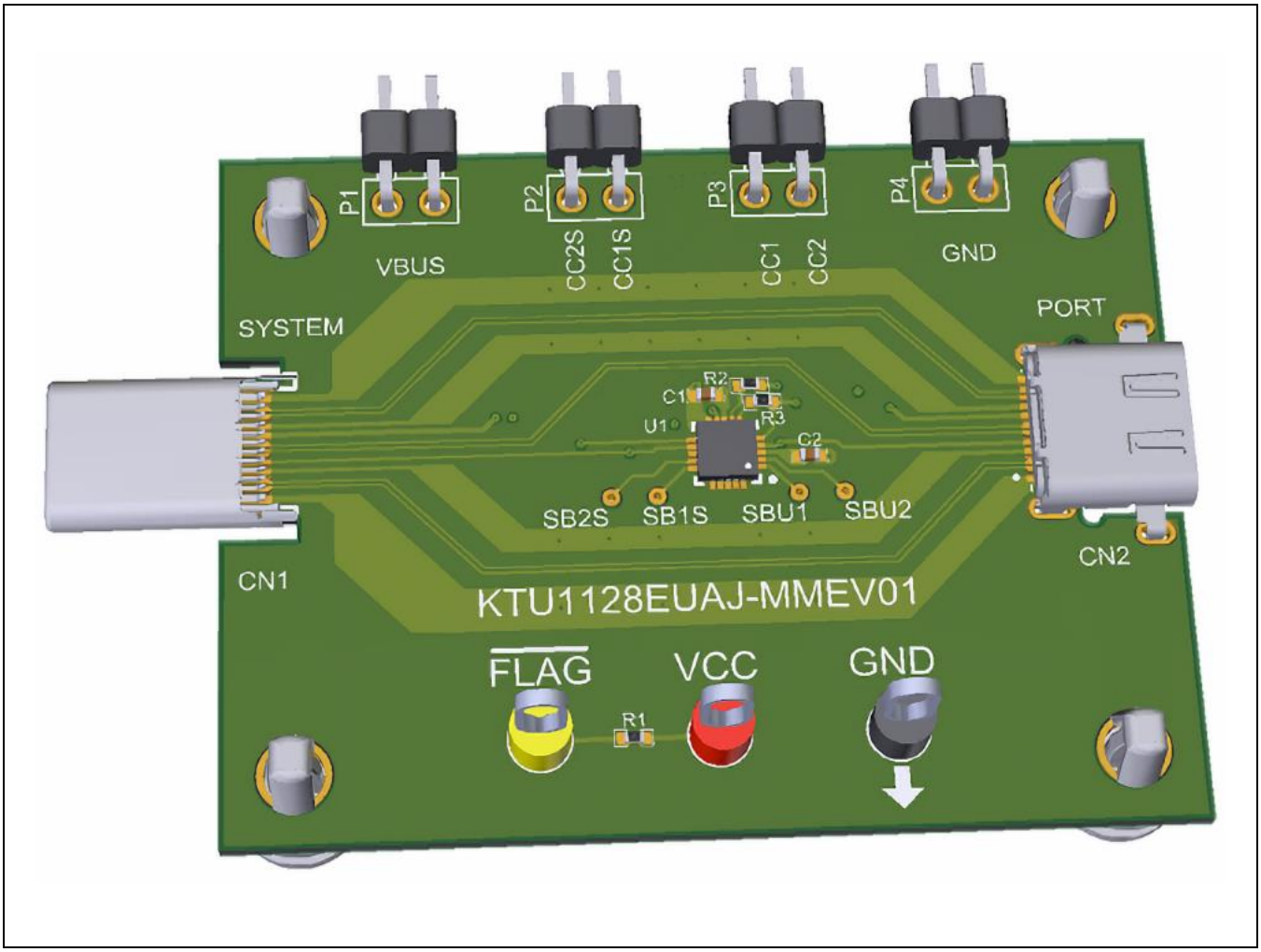
Brief Description

The KTU1128 Evaluation (EVAL) Kit is used to demonstrate and evaluate the KTU1128 functionality, performance, and PCB layout. The kit includes a fully assembled and tested PCB with the KTU1128 IC installed and a printed copy of the Quick Start Guide (also contained within this document). The WQFN33-20 package version of the KTU1128 IC is mounted on the PCB. In addition to test-points, the PCB includes Type-C port pass-through connectivity.

Ordering Information

Part Number	Description	IC Package
KTU1128EUAJ-MMEV01	KTU1128 EVAL Kit	WQFN33-20

3D CAD Image



EVAL Kit Physical Contents

Item #	Description	Quantity
1	KTU1128 EVAL fully assembled PCB	1
2	Anti-static bag	1
3	Quick Start Guide, printed (A4 or US Letter)	1
4	EVAL Kit box	1

QR Links for Documents

IC Landing Page	EVAL Kit Landing Page
https://www.kinet-ic.com/KTU1128/	https://www.kinet-ic.com/KTU1128euaj-mmev01

User-Supplied Equipment

Required Equipment

1. Bench Power Supply for VCC: 3.0V with 0.5A current limit.
2. Digital Current Meter for VCC: set range for 0.001mA or 0.0001mA resolution.
3. Bench Power Supply for CC1: adjustable 0 to 9V with 0.5A current limit.
4. Digital Current Meter for CC1: set range for 0.001mA or 0.0001mA resolution.
5. Digital Voltmeter for CC1S: set range for 0.001V or 0.0001V resolution.
6. Test Leads:
    a. VCC/GND Input Power: 1x (red) banana-to-banana & pair (red/black) banana-to-clip
    b. CC1/GND Input Voltage/Current: 1x (red) banana-to-banana & pair (red/black) banana-to-clip
    c. CC1S/GND Output Voltage: pair (red/black) banana-to-clip

Optional Equipment

1. Load: either an eLoad, power resistors, or an actual system load.
2. Oscilloscope: for dynamic testing of voltages (and currents with a current probe, if available).
3. Function Generator – for dynamic testing of on/off & fault response, debounce, and recovery times.

Recommended Operating Conditions

Symbol	Description	Value	Units
VCC	Supply Withstand Voltage	-0.3 to 6	V
	Supply Operating Voltage	2.5 to 5.5	V
V_{IO}	CC1, CC2, RPD_G1, RPD_G2, SBU1, SBU2 Withstand Voltage	-0.3 to 32	V
	CC1S, CC2S, SB1S, SB2S Withstand Voltage	-0.3 to 8	
	$\overline{FLAG}$ Withstand Voltage	-0.3 to 6	
	CC1, CC2, CC1S, CC2S, RPD_G1, RPD_G2 Operating Voltage	-0.3 to 5.5	
	SBU1, SBU2, SB1S, SB2S Operating Voltage	-0.3 to 4.5	
	$\overline{FLAG}$ Operating Voltage	-0.3 to 5.5	
I_{IO}	CC Switch Continuous Current	0 to 1.25	A
	CC Switch Peak Current (2.5ms)	2	
	SBU Switch Continuous Current	0.1	

Jumper Descriptions

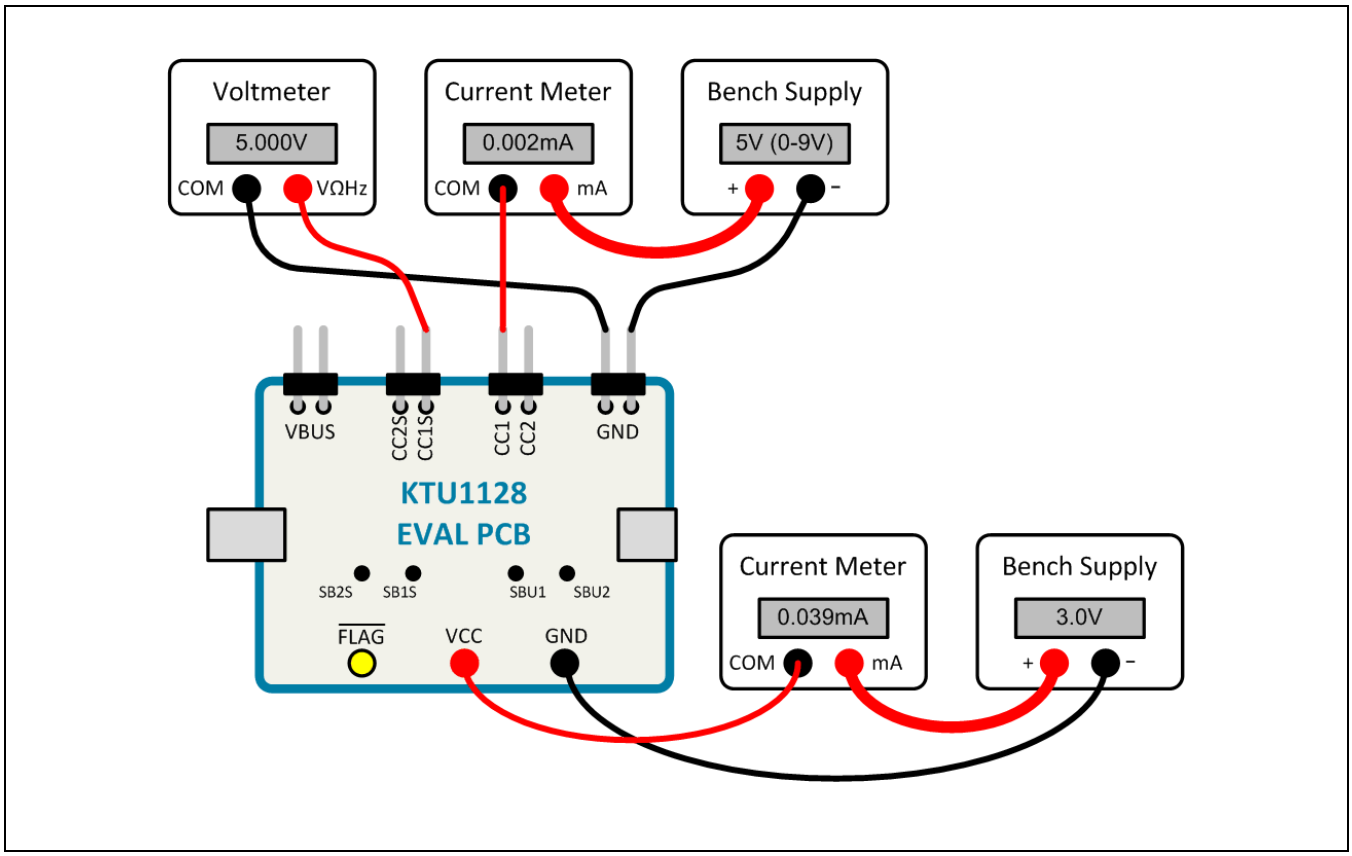
Designator	Name	Description	Default
P1	VBUS	VBUS Connection Test Point	DNP
P2	CC1S, CC2S	System-Side CC/VCON Connection Test Points (do not place jumper)	DNP
P3	CC1, CC2	Port-Side CC/VCON Connection Test Points (do not place jumper)	DNP
P4	GND	Ground Connection Test Point	DNP

Do not place jumpers on P1 through P4 along the upper edge of the EVAL PCB. These are connection test points, as per the EVAL PCB silkscreen labels.

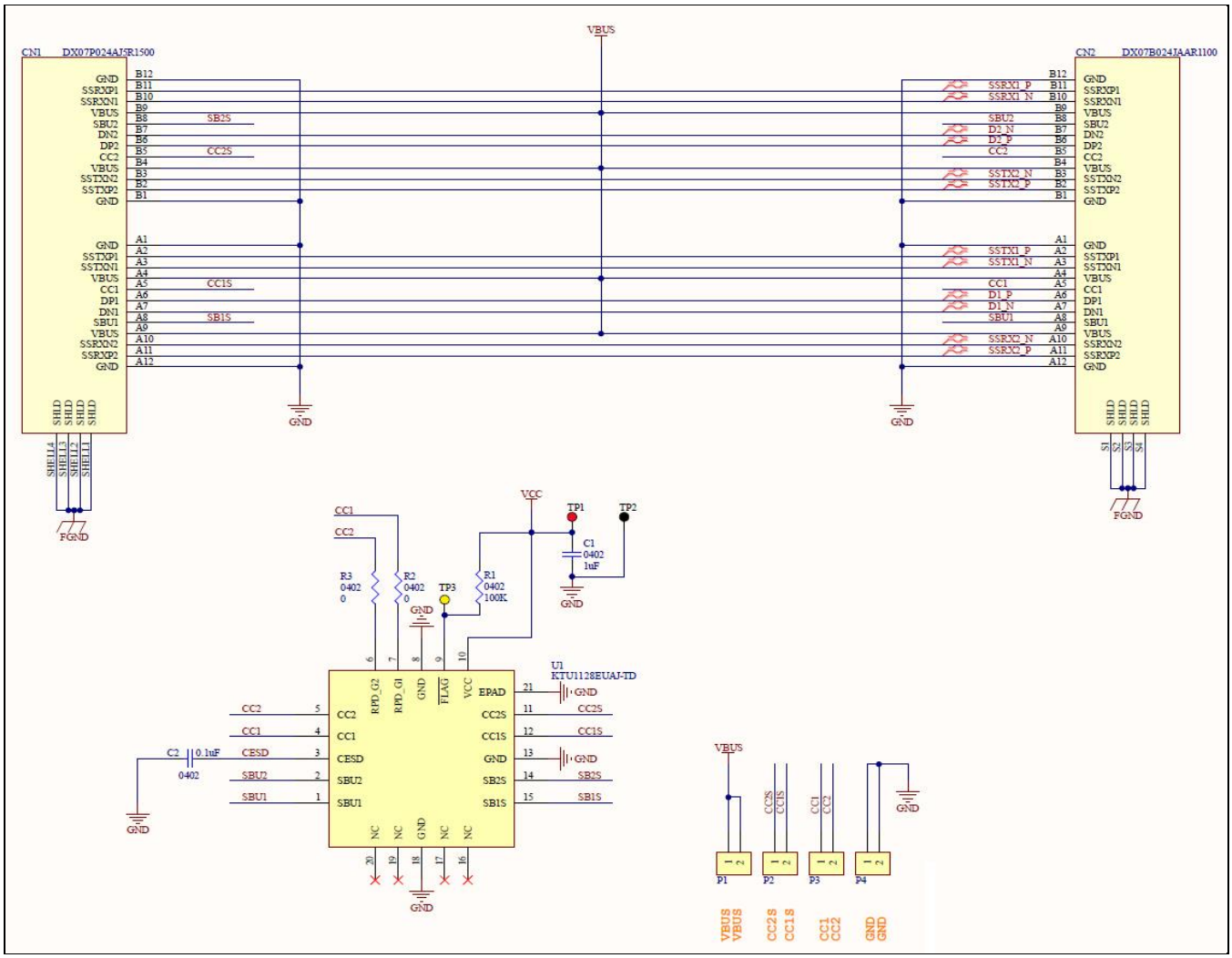
Quick Start Procedures

1. Before connecting the EVAL Kit to the Bench Power Supplies, turn on the supplies and adjust their voltages as close to 0V as possible. Also set both current limits to 0.5A.
2. Using the Test Leads, wire up the two Bench Supplies, two Current Meters, and one Voltage Meter as indicated in the *Typical Test Setup Diagram* section of this document.
3. Start slowly ramping the VCC Bench Supply to V_{CC} = 3.0V while monitoring the VCC Current Meter. If the current becomes high, quickly reduce the voltage to prevent damage. Then inspect the setup for any wiring errors.
4. Test the No-Load Supply Current at V_{CC} = 3.0V. It should measure about 0.040mA.
5. Keep VCC at 3.0V. Start slowly ramping the CC1 Bench Supply to V_{CC1} = V_{CC1S} = 5.0V while monitoring the CC1 Current Meter. If the current becomes high, quickly reduce the voltage to prevent damage. Then inspect the setup for any wiring errors. Observe the CC1 Switch is ON by checking that the CC1S voltage is 5.0V.
6. Adjust the CC1 Bench Supply to V_{CC1} > 6V. Observe the CC1 Switch turns OFF due to OVP fault by checking that the CC1S voltage falls to 0V.
7. Adjust the CC1 Bench Supply to V_{CC1} = 2.6V. Observe the CC1 Switch is ON after OVP Recovery by checking that the CC1S voltage is also 2.6V.
8. Keep CC1 at 2.6V. Adjust the VCC Bench Supply as close to 0V as possible. Observe the CC1 Switch is OFF due to VCC in UVLO by checking that the CC1S voltage falls to 0V.
9. Check the CC1 Dead Battery Pull-Down Current. With CC1 voltage between 2.5V and 2.7V, the CC1 input current is 0.41mA minimum, 0.51mA typical, and 0.66mA maximum.

Typical Test Setup Diagram



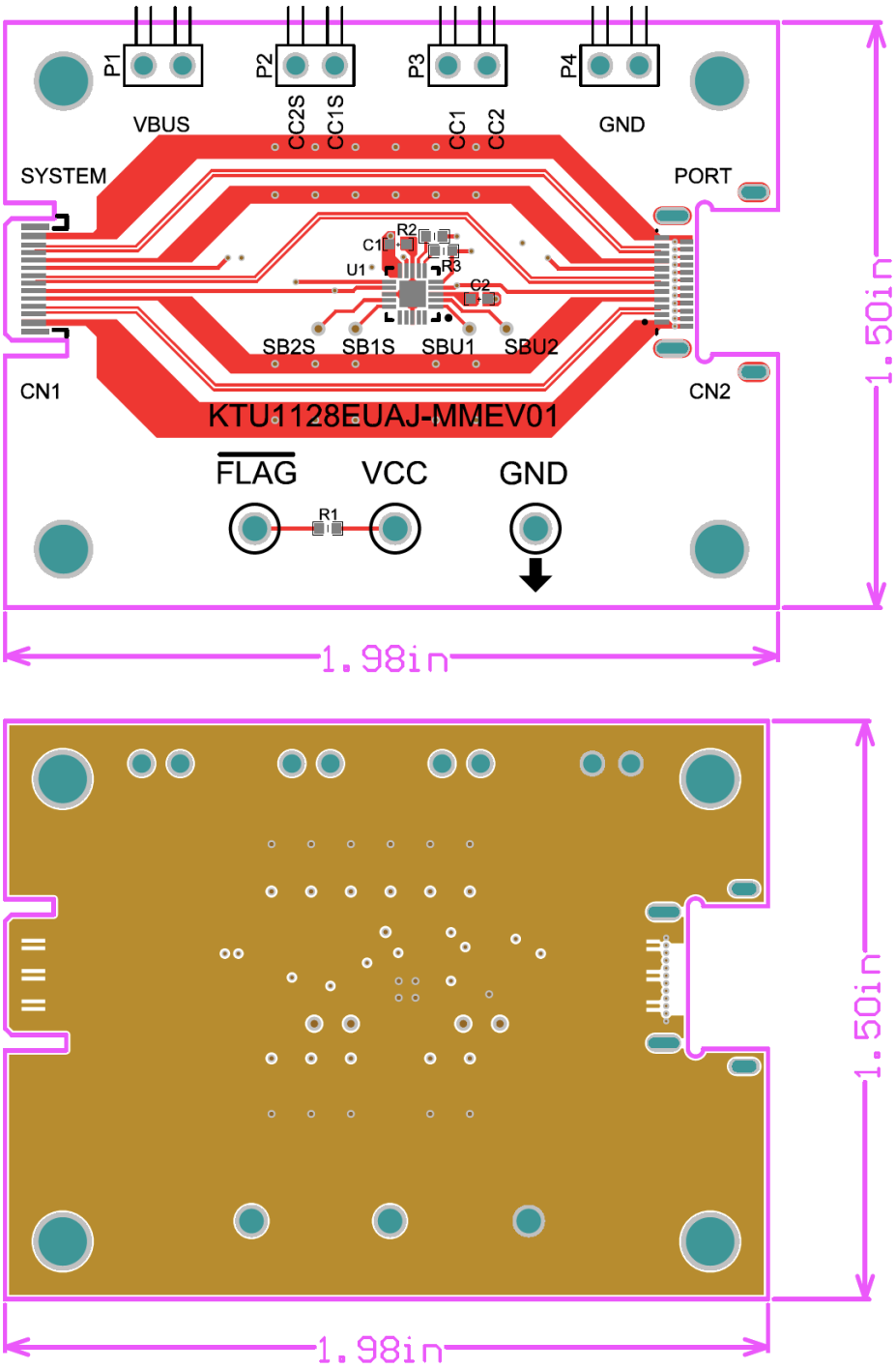
Electrical Schematic



Bill of Materials (BOM)

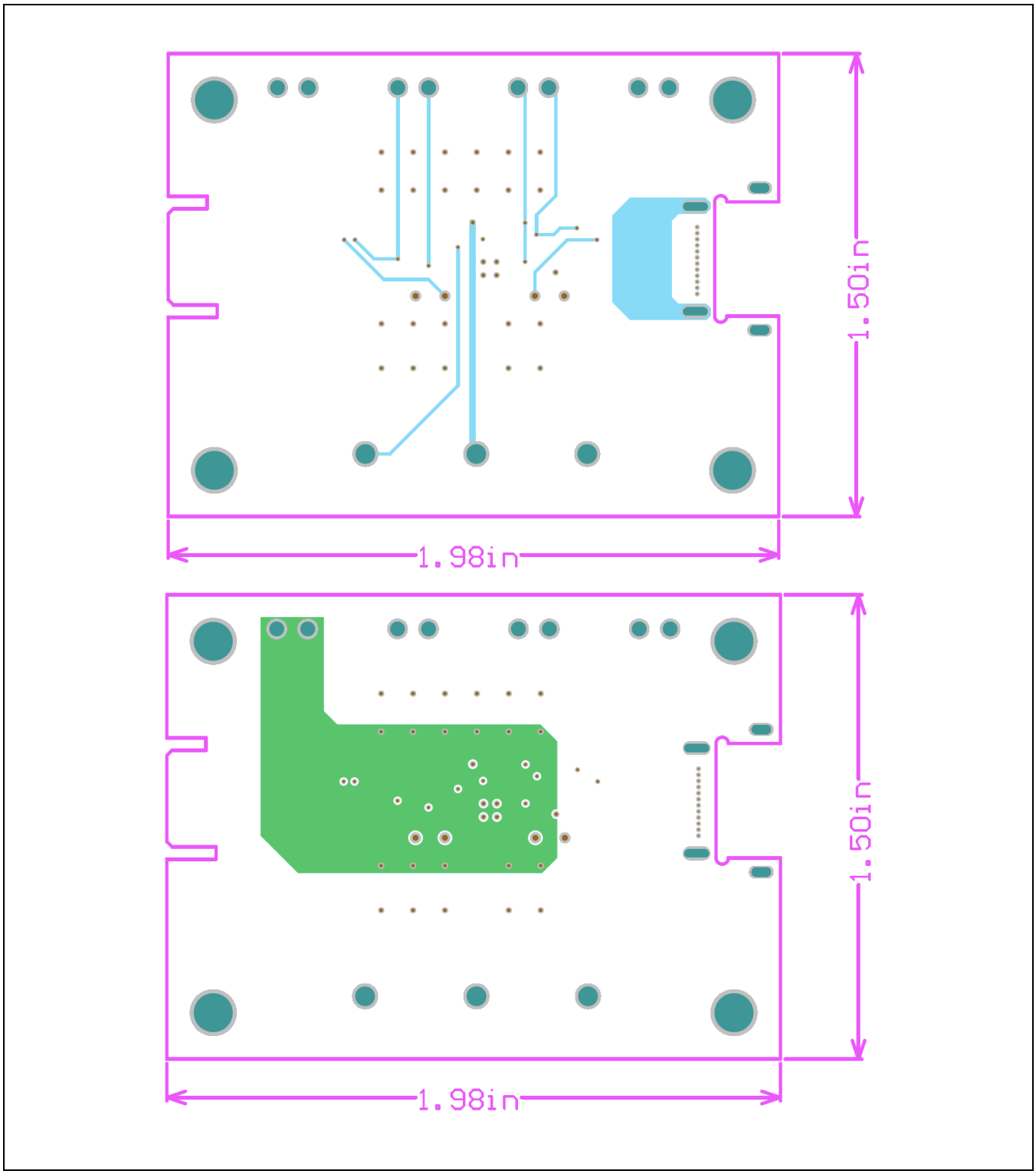
Item #	Quantity	Designator	Description	Package	Value	Manufacturer	Manufacturer Part Number	Digikey Part Number	Mouser Part Number
1	1	C1	CAP CER 1.0uF 35V X5R 0402	0402	1uF	Samsung	CL05A105KL5NRNC	1276-6796-1-ND	187-CL05A105KL5NRNC
2	1	C2	CAP CER 0.1uF 50V X7R 0402	0402	0.1uF	Samsung	CL05B104KB54PNC	1276-CL05B104KB54PNCCT-ND	187-CL05B104KB54PNC
3	1	CN1	CONN PLUG USB3.1 TYPEC BRD EDGE	SMD		JAE Electronics	DX07P024AJ5R1500	670-3064-1-ND	656-DX07P024AJ5R1500
4	1	CN2	CONN RCPT USB4 TYPC 24P BRD EDGE	SMD		JAE ELectronics	DX07B024JAAR1100	670-DX07B024JAAR1100CT-ND	656-DX07B024JAAR1100
5	4	H1, H2, H3, H4	BRD SPT SNAP LOCK REST MNT 4MM			Essentra Components	PSD-4M-19	PSD-4M-19-ND	144-PSD-4M-19
6	4	P1, P2, P3, P4	CONN HEADER R/A 2POS 2.54MM	TH		Sullins Connector Solutions	PRPC002SBBN-M71RC	S1121EC-02-ND	
7	1	R1	RES 100K OHM 1% 1/16W 0402	0402	100K	Yageo	RC0402FR-07100KL	311-100KLRCT-ND	603-RC0402FR-07100KL
8	2	R2, R3	RES 0 OHM 1% 1/16W 0402	0402	0	Yageo	RC0402FR-070RL	311-0.0LRCT-ND	603-RC0402FR-070RL
9	1	TP1	PC TEST POINT MULTIPURPOSE RED	TH		Keystone	5010	36-5010-ND	534-5010
10	1	TP2	PC TEST POINT MULTIPURPOSE BLACK	TH		Keystone	5011	36-5011-ND	534-5011
11	1	TP3	PC TEST POINT MULTIPURPOSE YELLOW	TH		Keystone	5014	36-5014-ND	534-5014
12	1	U1	USB Type-C 28V EPR Port Protector for CC and SBU Pins	TQFN33-20		Kinetic Technologies	KTU1128EUAJ-TD		389-KTU1128EUAJ-TD

Printed Circuit Board (PCB)



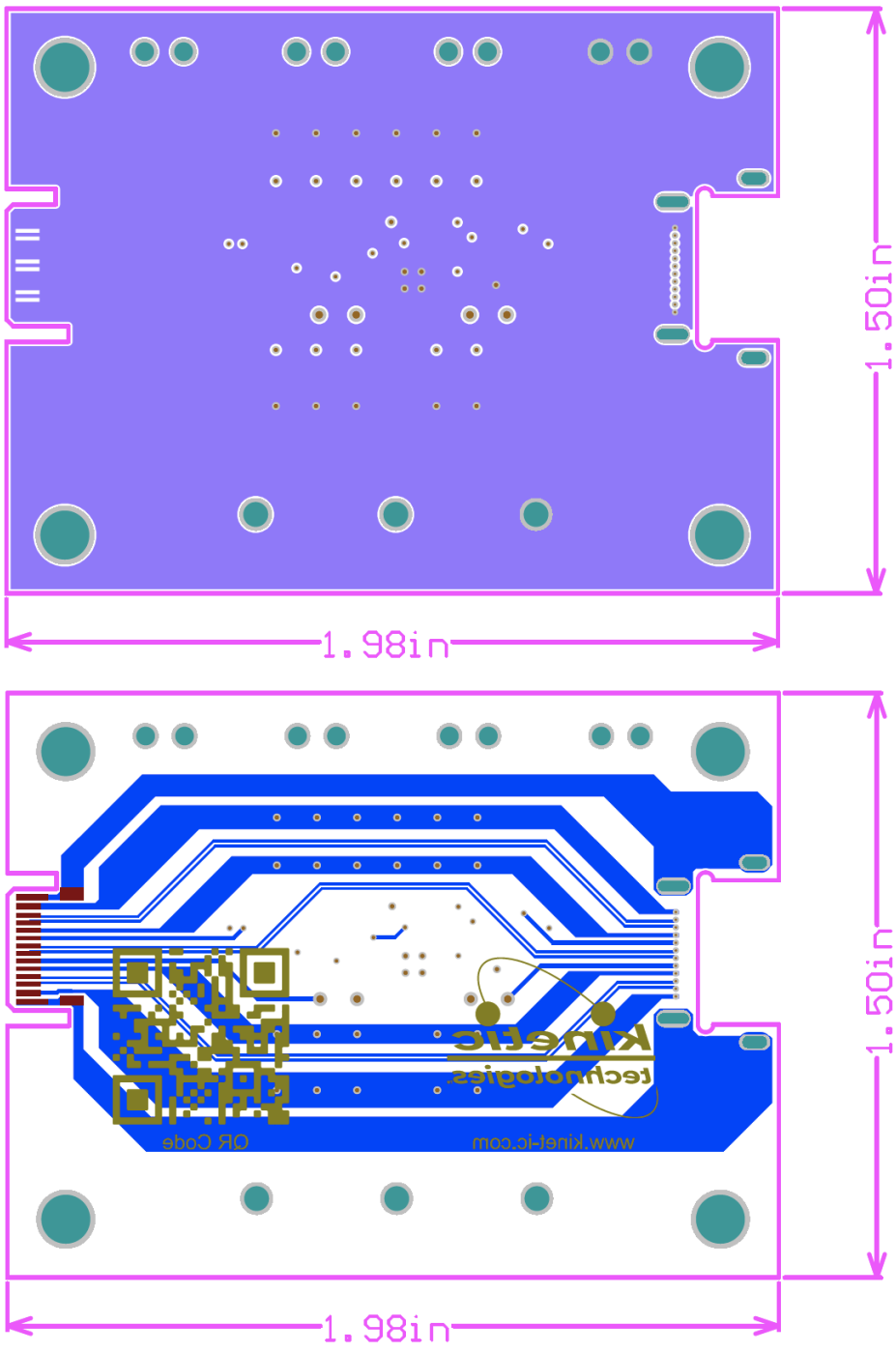
(continued next page)

Printed Circuit Board (PCB)



(continued next page)

Printed Circuit Board (PCB) (Continued)



Additional Test Procedures

1. Testing the CC2, SBU1, and SBU2 Channels: similar to testing the CC1 channel in the *Quick Start Procedures* section, test the other channels for switch turn on/off and OVP. Test the dead battery pull-down function on CC2. The SBU1/2 OVP threshold of 4.8V typical is lower than for CC1/2, so test that the switches are on at 4V and off at 5V. The test points for SBU1, SBU2, SB1S, and SB2S are small, exposed vias within the PCB trace to maximize the SBU signal-path bandwidth; therefore, testing SBU functionality is slightly more difficult than for the CC channels. As a tip, typical through-hole resistor leads usually fit nicely into these vias, providing easy attachment of clip test leads. Alternatively, obtain appropriate USB type-C breakout boards than can be easily connected to the EVAL PCB.
2. Testing On-Resistance (R_{ON}): add an appropriate load to either CC or SBU channel and connect a voltmeter across the channel to measure voltage drop. Calculate $R_{ON} = V_{DROP}/I_{LOAD}$. For appropriate loading range, see the *Recommended Operating Conditions* section.
3. Testing OVP Response Time (t_{OVP}): use a function generator square-wave at 100ms period and 50%duty-cycle with programmable V_{HIGH} = 7V and V_{LOW} = 4V to transition the port-side input (either CC1, CC2, SBU1, or SBU2) from below to above the OVP threshold. To program the correct output voltage levels, either put the function generator in "HighZ" output-load mode, or use 50Ω termination, or set V_{HIGH} = 3.5V and V_{LOW} = 2V if using "50Ω" output-load mode without 50Ω termination. The function generator output cannot support significant load current regardless of mode; however, it isn't necessary to apply any load at the switch output for this test. Use an oscilloscope to capture the input and output waveforms for the channel being tested. Trigger on the input rising edge at 5.8V trigger-level for the CC channels and 4.8V trigger-level for the SBU channels. Set the time-scale to 20ns/division to measure t_{OVP}. To ease measurement, position and scale the input and output waveforms to overlap each other. To check the OVP falling debounce time, simply trigger on the falling edge and adjust the time-scale to 200µs/division. Also, it is interesting to lower the V_{HIGH} level just above and just below the OVP threshold to observe the response. However, when doing so, it is important to lower the oscilloscope's trigger-threshold, as well. If obtaining a stable trigger is difficult, enable the high-frequency rejection in the trigger menu, but usually, the DC-coupled option makes it easier to measure the delay.
4. FLAG Logic Output Testing: while testing OVP Response Time, connect a third oscilloscope probe to the $\overline{FLAG}$ test point on the EVAL PCB. For the response time, use 20ns/division. For the recovery time, use 1ms/division.
5. In-System Pass-Through Testing: the EVAL PCB includes male and female USB type-C connectors. It may be connected in series with a USB type-C cable between any two systems with USB type-C ports. Do not forget to provide supply power to the KTU1128 at the VCC and GND test points. The KTU1128 protects the CC1/2 and SBU1/2 channels. The VBUS, D+/-, and TX/RX channels are pass-through on the EVAL PCB. Keep in mind that the EVAL PCB and connectors add capacitance and resistance to all channels, which are additive to that contained within the two systems. This may slightly diminish the TX/RX, SBU1/2, and D+/- bandwidths. However, when integrating the KTU1128 into a system (in place of a competing protection solution), this is less of a concern.
6. Surge and ESD Testing: special surge and/or ESD test equipment is required. Training and prior experience is recommended before undertaking these tests.

Disabling the Dead Battery Pull-Down Function

The KTU1128 includes optional dead battery 5.1kΩ pull-down circuits when VCC is below UVLO or above OVP thresholds. As configured, the EVAL PCB enables this feature. To disable, remove R2 and R3.

Troubleshooting

Symptom	Root Cause	Solution
The CC and SBU switches do not turn on. $\overline{FLT}$ is low.	The KTU1128 is not powered at VCC. $\overline{FLT}$ has no pull-up voltage.	Connect a valid VCC voltage supply from VCC to GND.
The CC and SBU switches do not turn on. $\overline{FLT}$ is low.	OVP is triggered at CC1, CC2, SBU1, or SBU2 pins.	Check the voltages at CC1, CC2, SBU1, and SBU2. Make sure all of them are below their respective OVP thresholds of 5.8V typical for CC1/2 and 4.8V typical for SBU1/2.

Important Notices

Legal notice

Kinetic Technologies assumes no responsibility or liability for information contained in this document. Kinetic Technologies reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or services without notice. The information contained herein is believed to be accurate and reliable at the time of printing.

Reference design policy

This document is provided as a design reference and Kinetic Technologies assumes no responsibility or liability for the information contained in this document. Kinetic Technologies reserves the right to make corrections, modifications, enhancements, improvements, and other changes to this reference design documentation without notice.

Reference designs are created using Kinetic Technologies' published specifications as well as the published specifications of other device manufacturers. This information may not be current at the time the reference design is built. Kinetic Technologies and/or its licensors do not warrant the accuracy or completeness of the specifications, or any information contained therein.

Kinetic Technologies does not warrant that the designs are production worthy. Customer should completely validate and test the design implementation to confirm the system functionality for the end use application.

Kinetic Technologies provides its customers with limited product warranties, according to the standard Kinetic Technologies terms and conditions.

For the most current product information visit us at www.kinet-ic.com

Life support policy

LIFE SUPPORT: KINETIC TECHNOLOGIES' PRODUCTS ARE NOT DESIGNED, INTENDED, OR AUTHORIZED FOR USE AS COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS. NO WARRANTY, EXPRESS OR IMPLIED, IS MADE FOR THIS USE. AUTHORIZATION FOR SUCH USE SHALL NOT BE GIVEN BY KINETIC TECHNOLOGIES, AND THE PRODUCTS SHALL NOT BE USED IN SUCH DEVICES OR SYSTEMS, EXCEPT UPON THE WRITTEN APPROVAL OF THE PRESIDENT OF KINETIC TECHNOLOGIES FOLLOWING A DETERMINATION BY KINETIC TECHNOLOGIES THAT SUCH USE IS FEASIBLE. SUCH APPROVAL MAY BE WITHHELD FOR ANY OR NO REASON.

“Life support devices or systems” are devices or systems which (1) are intended for surgical implant into the human body, (2) support or sustain human life, or (3) monitor critical bodily functions including, but not limited to, cardiac, respirator, and neurological functions, and whose failure to perform can be reasonably expected to result in a significant bodily injury to the user. A “critical component” is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

SUBSTANCE COMPLIANCE

Kinetic Technologies IC products are compliant with RoHS, formally known as Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. However, this evaluation kit does not fall within the scope of the EU directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE, or UL, and may not meet the requirements of these or related directives. To the best of our knowledge the information is true and correct as of the date of the original publication of the information. Kinetic Technologies bears no responsibility to update such statement.

X-ON Electronics

Largest Supplier of Electrical and Electronic Components

Click to view similar products for Other Development Tools ***category:***

Click to view products by Kinetic Technologies ***manufacturer:***

Other Similar products are found below :

BK0004 BK0012 THS6002EVM MIKROE-5539 410-320 TS9001DB TS9002DB TS9004DB BK0009 TSX00003 410-330 SABMB16 4537 5637 5649 DK-M3F-1.8-TRK-1.5-S DK-M3-FS-1.8-1.5-M12/16 DK-M3-LS-1.8-6 RS-485EVALBOARD2 RS-485EVALBOARD4 240-000 240-123 240-125 410-062 410-125 410-163 410-378 540-033 GAMECONTROLLERTOBO1 KTU1128EUAJ-MMEV01 XRA1405IG24-0B-EB BK0010 EFIELDEV MIKROE-3319 MIKROE-3357 MIKROE-4039 MIKROE-1370 MIKROE-1899 MIKROE-1901 MIKROE-1917 MIKROE-3116 MIKROE-5079 MIKROE-6000 MIKROE-957 NVT4558-4858-EVB OM13543 P3S0210BQ-ARD BB-GEVK STR-LOGIC-GATES-EVK GRV-EPIC-LC2