

## 5A<sub>RMS</sub> VBUS Current-Sink Protection Load Switch

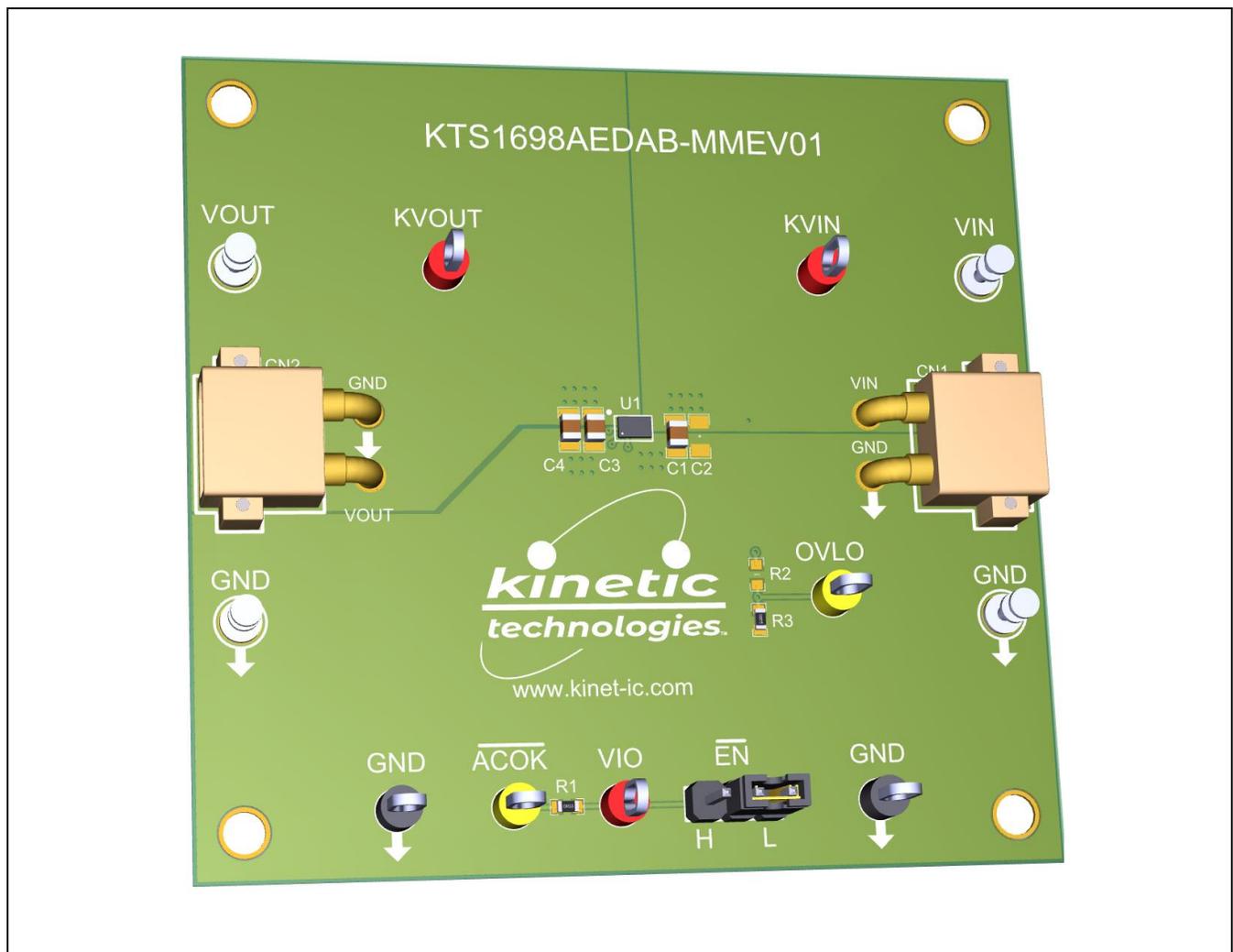
### Brief Description

The KTS1698A Evaluation (EVAL) Kit is used to demonstrate and evaluate the KTS1698A functionality, performance, and PCB layout. The kit includes a fully assembled and tested PCB with the KTS1698A IC installed, two pairs of high-current XT30-to-Banana power cables, and a printed copy of the Quick Start Guide (also contained within this document). The KTS1698A has  $\overline{EN}$  active-low input logic with internal 1M $\Omega$  pull-down.

### Ordering Information

Part Number	Description	IC Package
KTS1698AEDAB-MMEV01	KTS1698A EVAL Kit	WLCSP-15

### 3D CAD Image



### EVAL Kit Physical Contents

Item #	Description	Quantity
1	KTS1698A EVAL fully assembled PCB	1
2	XT30-to-Banana power cables, red/black pair	2 pairs
3	Anti-static bag	1
4	Quick Start Guide, printed 1 page (A4 or US Letter)	1
5	EVAL Kit box	1

### QR Links for Documents

IC Landing Page	EVAL Kit Landing Page
 <a href="https://www.kinet-ic.com/KTS1698/">https://www.kinet-ic.com/KTS1698/</a>	 <a href="https://www.kinet-ic.com/kts1698aeoab-mmww01">https://www.kinet-ic.com/kts1698aeoab-mmww01</a>

### User-Supplied Equipment

#### Required Equipment

1. Bench Power Supply for VIN – 5V/9V/15V/20V and 0.5A/1.5A/3A/5A, as needed for the intended application. For testing over-voltage protection and withstand voltage, a 29V adjustable bench power supply is preferred.
2. Digital Multimeter – one or more, used to measure input/output voltages and currents.

#### Optional Equipment

1. Bench Power Supply for VIO – 1.5V to 5V, low current. Needed for shutdown mode ( $\overline{EN} = H$ ) and fault monitoring ( $\overline{ACOK}$  pull-up voltage).
2. Oscilloscope – for dynamic testing of voltages (and currents with a current probe, if available).
3. Load – either an eLoad, power resistors, or an actual system load.
4. Additional Digital Multimeters

### Recommended Operating Conditions

Symbol	Description	Value	Units
VIN	Absolute Input Withstand Voltage	-0.3 to 29	V
	Input Operating Voltage	3 to 23	V
VIO	VIO Operating Voltage	1.5 to 5.5	V
I <sub>OUT</sub>	Output Load Current	0 to 5	A

### Jumper Descriptions

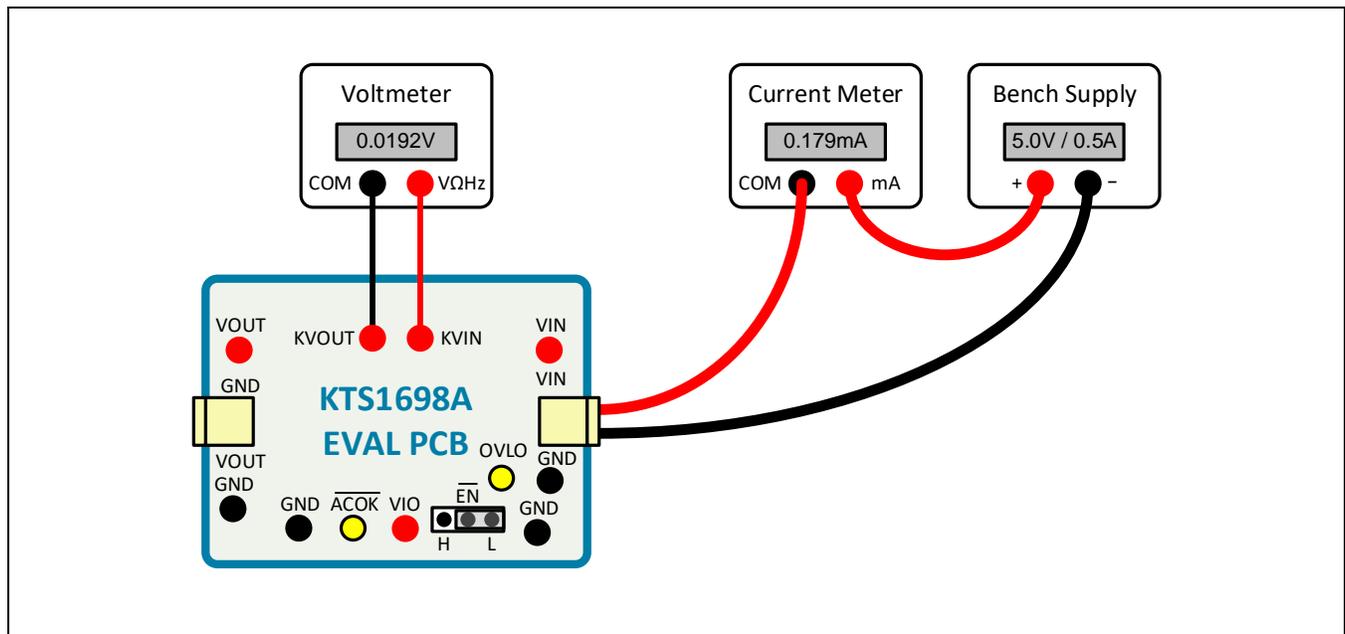
Designator	Name	Description	Default
P1	$\overline{EN}$	Active-Low Enable Input H: Shutdown Mode – switch disabled (A-Version) L: Enable Mode – normal switch operation (A-Version)	L

### Quick Start Procedures

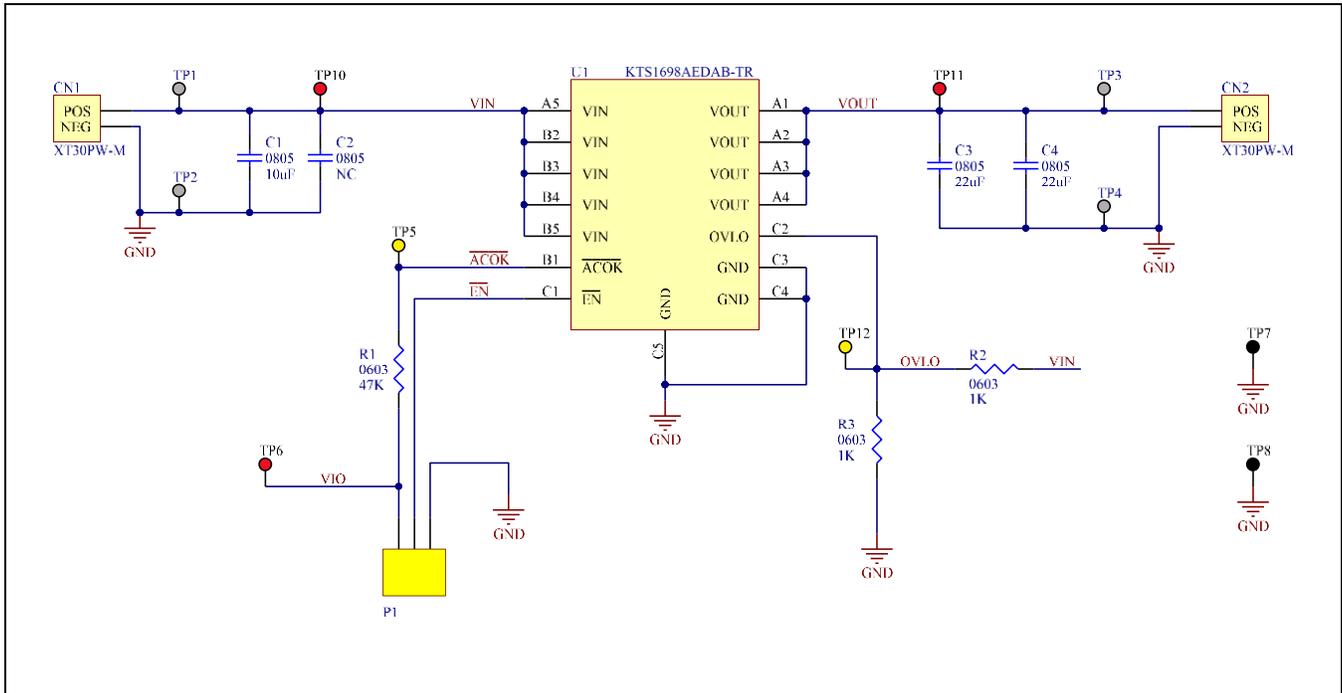
1. Set Jumpers to default:  $\overline{EN} = L$
2. Connect one pair of XT30-to-Banana power cables to the XT30 connector at VIN and GND (right edge of EVAL Kit).
3. Before connecting the EVAL Kit to the VIN bench supply, turn on the supply and adjust the voltage as close to 0V as possible. Then turn off the supply. While off, connect the banana ends of the XT30-to-Banana power cables to the VIN bench supply.
4. Turn on the VIN bench supply and very slowly ramp its voltage to an appropriate voltage, such as 5, 9, 12, 15, or 20V. While ramping VIN slowly, use the bench supply's output current indication (or a digital multimeter) to monitor the VIN current. If the current becomes high, reduce the VIN voltage quickly to prevent damage. Then inspect the setup for any wiring errors.
5. With valid VIN voltage, use a digital multimeter to check the output voltage between the KVOUT and GND terminals on the EVAL Kit. It should be nearly the same as the input voltage.
6. Use a digital multimeter to check the "ideal diode" droop regulation voltage between the KVIN and KVOUT terminals on the EVAL Kit. At no-load and light-load conditions (<50mA), it should be close to 20mV.
7. Use a digital multimeter to check the no-load supply current at VIN. Consult the KTS1698 datasheet for the expected current range at the VIN voltage condition in use. For conditions of VIN = 5.0V,  $\overline{EN} = L$ , and no-load, it should be close to 170 $\mu$ A.

### Typical Test Setup Diagram

As an example, use the following test setup to measure items 6 and 7 in the Quick Start Procedures.



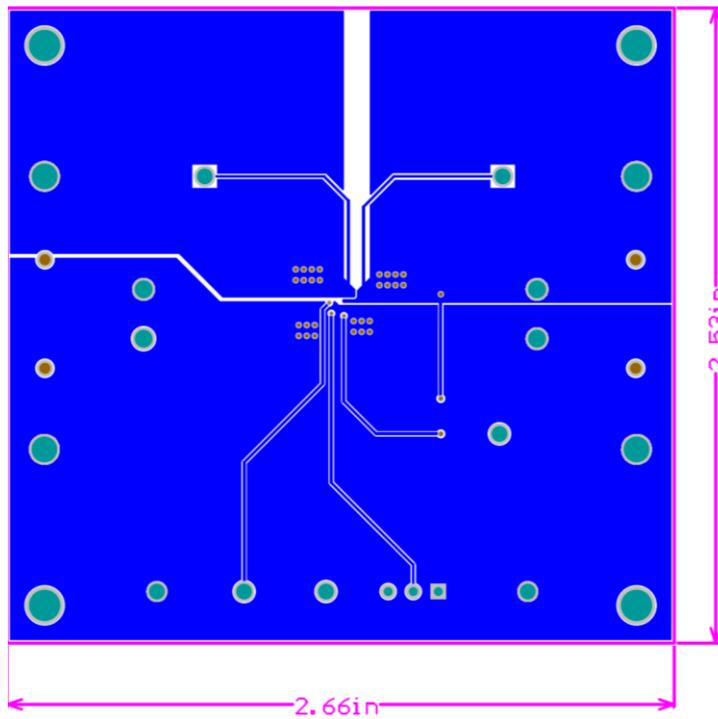
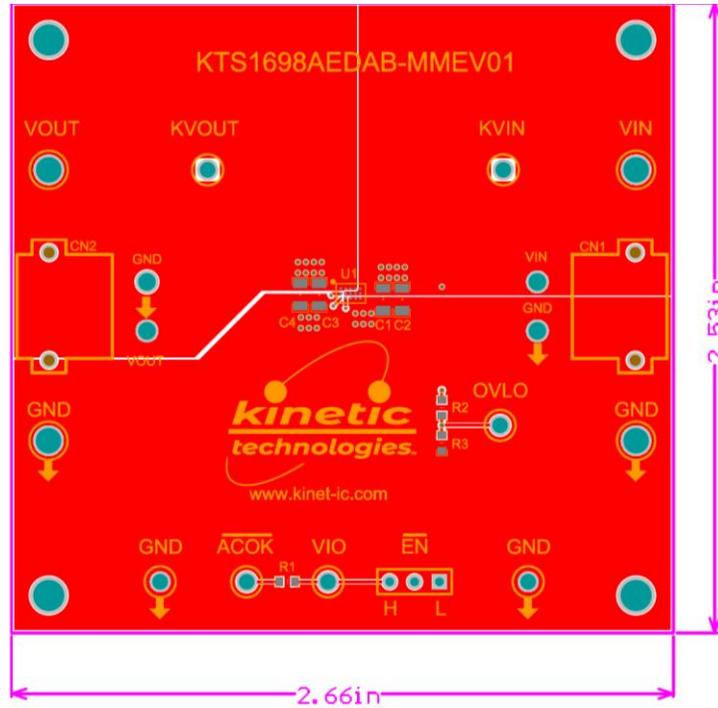
### Electrical Schematic



### Bill of Materials (BOM)

Item #	Quantity	Designator	Description	Value	Package	Manufacturer	Manufacturer Part Number	Digikey Part Number	Mouser Part Number
1	1	C1	CAP CER 10uF 50V XSR 0805	10uF	0805	Murata	GRM21BR61H106KE43L	490-18663-1-ND	81-GRM21BR61H106KE3L
2	1	C2	CAP 0805	NC	0805				
3	2	C3, C4	CAP CER 22uF 25V XSR 0805	22uF	0805	Murata	GRM21BR61E226ME44L	490-10749-1-ND	81-GRM21BR61E226ME4L
4	2	CN1, CN2	30A Right Angle Through Hole Power Connectors			AMASS	XT30PW-M		
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	1	P1	Header with jumper connects pin 1 to pin 2		TH	Sullins	PREC003SAAN-RC	S1012C-03-ND	
7	1	R1	RES 47K OHM 1% 1/10W 0603	47K	0603	Yageo	RC0603FR-0747KL	311-47.0KHRCT-ND	603-RC0603FR-0747KL
8	1	R2	RES 0603	NL	0603				
9	1	R3	RES 1K 1% 1/10W 0603	1K	0603	Yageo	RC0603FR-071KL	311-1.00KHRCT-ND	603-RC0603FR-071KL
10	4	TP1, TP2, TP3, TP4	TERM TURRET SINGLE L=5.56MM TIN		TH	Keystone	1502-2	36-1502-2-ND	534-1502-2
11	2	TP5, TP12	PC TEST POINT MULTIPURPOSE YELLOW		TH	Keystone	5014	36-5014-ND	534-5014
12	3	TP6, TP10, TP11	PC TEST POINT MULTIPURPOSE RED		TH	Keystone	5010	36-5010-ND	534-5010
13	2	TP7, TP8	PC TEST POINT MULTIPURPOSE BLACK		TH	Keystone	5011	36-5011-ND	534-5011
14	1	U1	5ARMS VBUS Current-Sink Protection Load Switch		WLCSP-15	Kinetic Technologies	KTS1698AEDAB-TA		389-KTS1698AEDAB-TA

**Printed Circuit Board (PCB)**



## Additional Test Procedures

1. Logic Pins Testing:
  - a. Before connecting the EVAL Kit to the VIO bench supply, turn on the supply and adjust the voltage as close to 0V as possible. Then turn off the supply. While off, connect the VIO bench supply to VIO and GND terminals on the EVAL Kit (with user-supplied banana-to-clip leads).
  - b. Turn on the VIO bench supply and very slowly ramp its voltage to an appropriate voltage, such as 1.8, 3.3, or 5V. While ramping VIO slowly, use the bench supply's output current indication (or a digital multimeter) to monitor the VIO current. If the current becomes high, reduce the VIO voltage quickly to prevent damage. Then inspect the setup for any wiring errors.
  - c. With valid VIO and VIN voltages, check the  $\overline{EN}$  and  $\overline{ACOK}$  functionality. Check the shutdown supply current at VIN with  $\overline{EN} = H$ . With  $\overline{EN} = L$ , check the  $\overline{ACOK}$  flag pulls high to VIO when  $VIN < 2.5V$  and when  $VIN > 24V$ .
2. Testing with Load:
  - a. Use the second XT30-to-Banana power cable pair to apply loads from VOUT to GND.
  - b. Under heavy-load conditions, use caution. The KTS1698A IC may become hot; avoid skin contact. The voltage between the KVIN and KVOUT terminals at 3A load condition should be close to 75mV due to on-resistance of the switch.
  - c. Use multimeters and an oscilloscope to make DC and transient measurements as desired.

## Setting OVLO

By default, the EVAL Kit uses the internal 23V setting for the Over-Voltage Protection (OVP) threshold. The OVLO pin and associated resistive voltage divider (R2, R3) are used to externally set the over-voltage threshold in the range of 4V to 23V. As shipped, R2 is not populated and R3 is populated with a 1k $\Omega$  pull-down so that OVLO is 0V and the KTS1698A uses the internal 23V setting.

To set a different OVP threshold using the OVLO pin, populate R2. See the KTS1698 datasheet to calculate the necessary value of resistance.

## Adding Additional Input Capacitance

The CIN input capacitance of the EVAL Kit is 10 $\mu$ F by design. 10 $\mu$ F is the maximum allowed by USB standards on the VBUS pin of the USB connector. However, for non-standard applications, the C2 footprint (not populated) is available to add additional input capacitance.

## Evaluating Other ICs

This EVAL Kit may optionally be used to evaluate the similar KTS1698B, KTS1677A and KTS1677B VBUS current-sink protection load switches. Before ordering samples of these devices, please confirm capability to reflow and exchange WLCSP devices.

## Troubleshooting

Symptom	Root Cause	Solution
$\overline{ACOK}$ does not go high during faults.	VIO supply is off or not connected.	Connect and enable a VIO pull-up supply. $\overline{ACOK}$ has an Absolute Maximum Rating of 6V.
$\overline{EN} = H$ does not disable the switch.	VIO supply is off or not connected.	Connect and enable a VIO pull-up supply. Optionally, remove the jumper on P1 and connect $\overline{EN}$ (at pin 2 of P1) to VIN with a clip-to-clip lead. $\overline{EN}$ has an Absolute Maximum Rating of 29V.

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