Load Switch with OVP and Reverse Polarity Protection

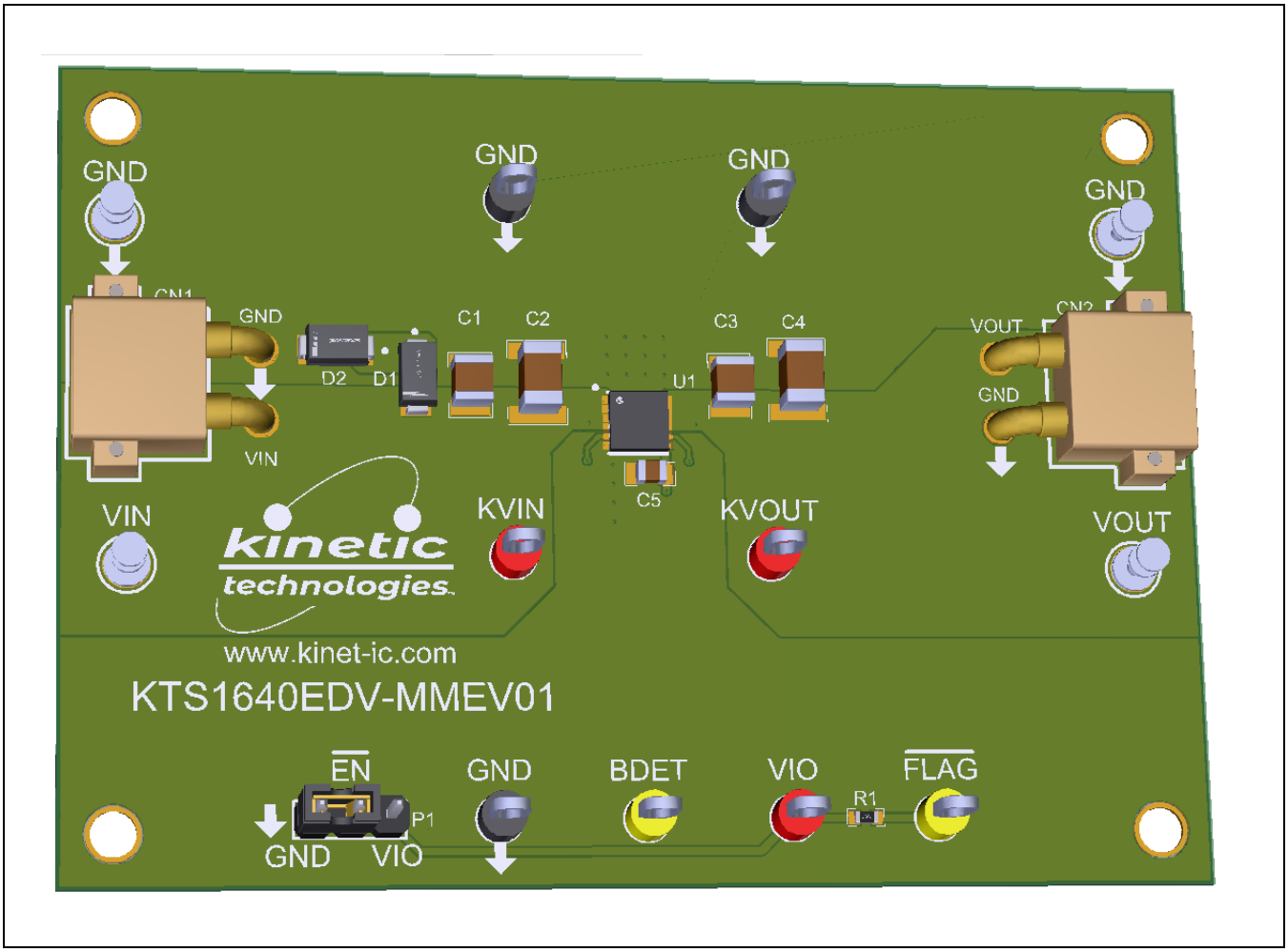
Brief Description

The KTS1640 Evaluation (EVAL) Kit is used to demonstrate and evaluate the KTS1640 functionality, performance, and PCB layout. The kit includes a fully assembled and tested PCB with the KTS1640 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).

Ordering Information

Part Number	Description	IC Package
KTS1640EDV-MMEV01	KTS1640 EVAL Kit	TDFN44-12

3D CAD Image



EVAL Kit Physical Contents

Item #	Description	Quantity
1	KTS1640 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
https://www.kinet-ic.com/KTS1640/	https://www.kinet-ic.com/ kts1640edv-mmev01/

User-Supplied Equipment

Required Equipment

1. Bench Power Supply for VIN – 14V/30V and 0.5A/6A, as needed for the intended application. For testing over-voltage protection and withstand voltage, a 30V or 40V 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 ($\overline{EN}$ = VIO = High) and fault monitoring ($\overline{FLAG}$ 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	Input Withstand Voltage Input Operating Voltage	-28 to 40 6 to OVP (27V typ)	V V
VIO	VIO Operating Voltage	1.5 to 5.5	V
I_{OUT}	Output Load Current	0 to 6	A
I_{BDET}	BDET Output Current	0 to 100	mA

Jumper Descriptions

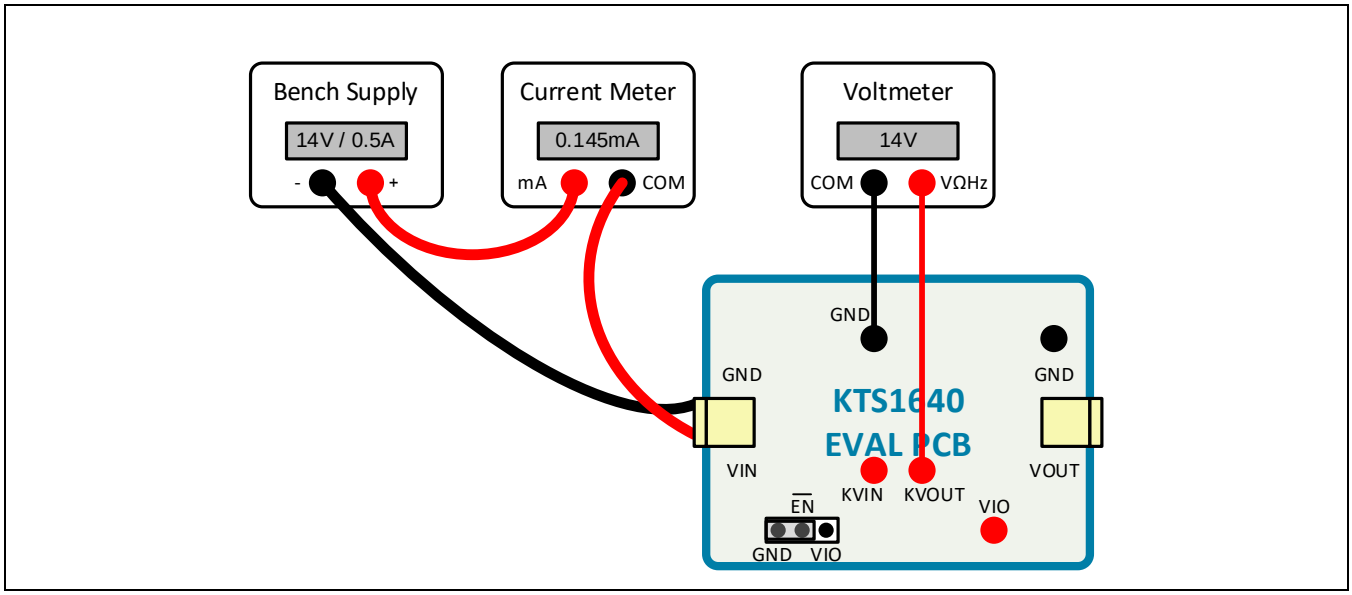
Designator	Name	Description	Default
P1	$\overline{EN}$	Active-Low Enable Input VIO (High): Shutdown Mode – switch disabled GND (Low): Enable Mode – normal switch operation	GND

Quick Start Procedures

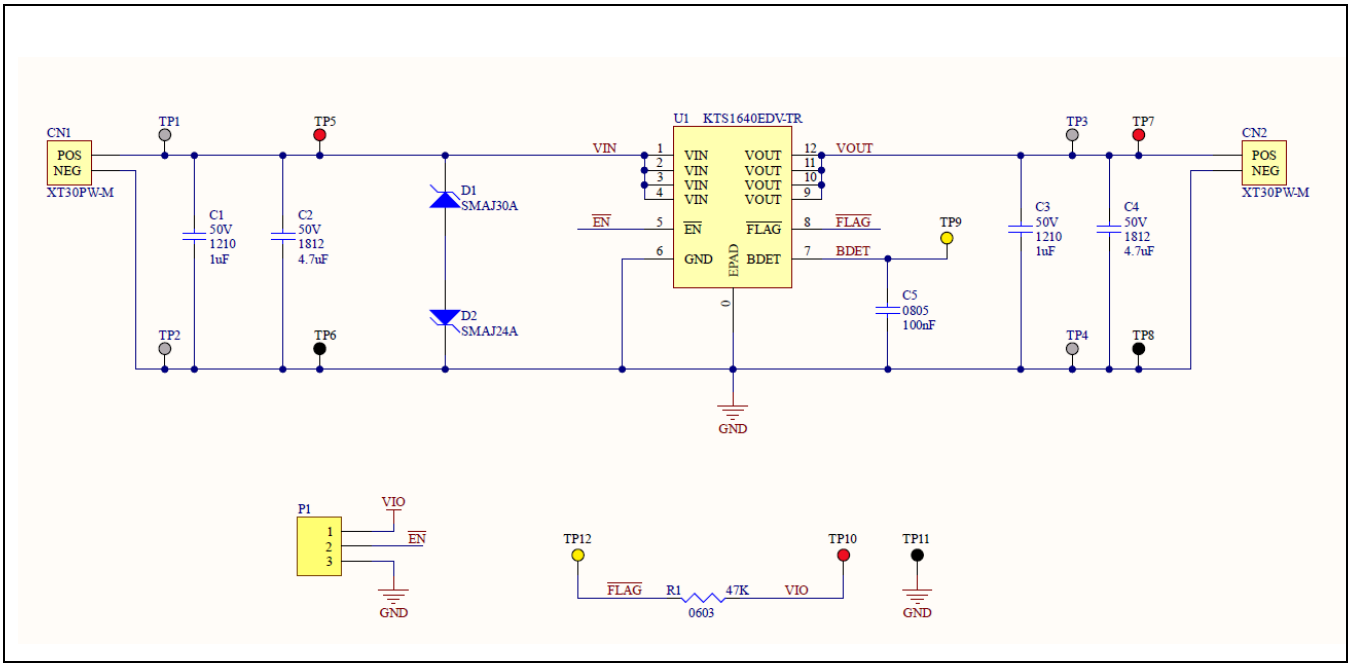
1. Set Jumpers to default: $\overline{EN}$ = GND
2. Connect one pair of XT30-to-Banana power cables to the XT30 connector at VIN and GND (left edge of EVAL Kit).
3. Before connecting the EVAL Kit to the VIN bench supply, turn on the supply and adjust the voltage as close to 0V as possible. Then turn 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 14V. 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 no-load supply current at VIN. Consult the KTS1640 datasheet for the expected current range at the VIN voltage condition in use. For conditions of VIN = 14V, $\overline{EN}$ = GND, and no-load, it should be close to 145µA.

Typical Test Setup Diagram

As an example, use the following test setup to measure items 5 and 6 in the Quick Start Procedures.



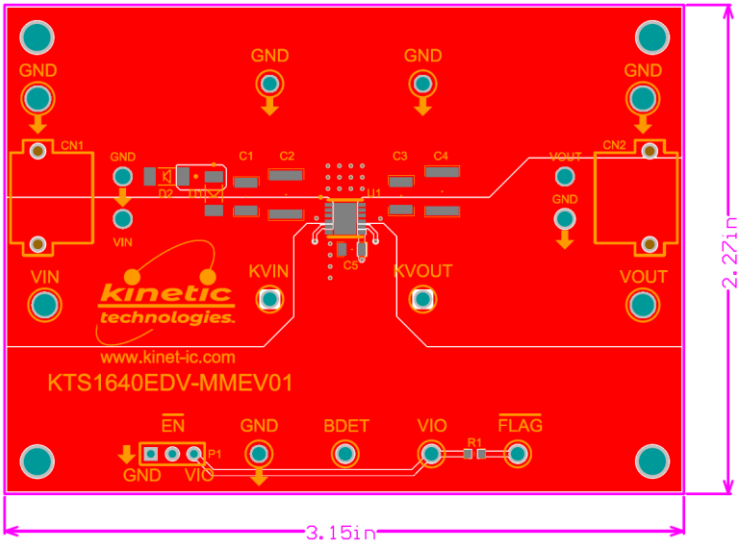
Electrical Schematic

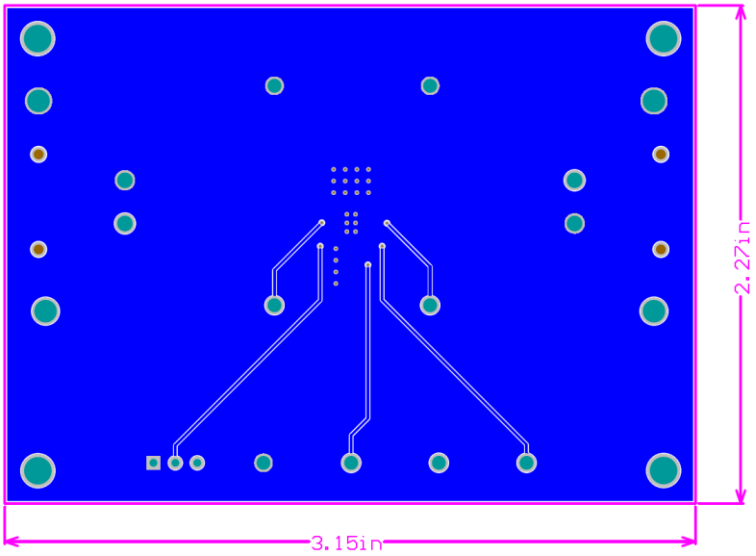


Bill of Materials (BOM)

Quantity	Designator	Description	Value	Package	Manufacturer	Manufacturer Part Number	Digikey Part Number	Mouser Part Number
2	C1, C3	CAP 1UF 50V X7R 1210	1uF	1210	KEMET	C1210C105K5RAC7800	399-C1210C105K5RAC7800CT-ND	N/A
2	C2, C4	CAP 4.7UF 50V X7R 1812	4.7uF	1812	TDK	CGA8M3X7R1H475KT0Y0N	445-7906-1-ND	N/A
1	C5	CAP 0.1UF 50V X7R 0805	100nF	0805	Yageo	CC0805KRX7R9BB104	311-1140-1-ND	603-CC805KRX7R9BB104
2	CN1, CN2	30A Right Angle Through Hole Power Connectors			AMASS	XT30PW-M		
1	D1	TVS DIODE 30V 48.4V SMA		DO-214AC	Littelfuse Inc.	SMAJ30A	SMAJ30ALFCT-ND	576-SMAJ30A
1	D2	TVS DIODE 24VWM 38.9VC		DO-214AC	Littelfuse Inc.	SMAJ24A	SMAJ24ALFCT-ND	576-SMAJ24A
1	P1	3 Pin Header		Through Hole	Sullins Connector Solutions	PREC003SAAN-RC	S1012EC-03-ND	
1	R1	RES 47K 1% 1/10W 0603	47K	0603	Yageo	RC0603FR-0747KL	311-47.0KHRCT-ND	603-RC0603FR-0747KL
4	TP1, TP2, TP3, TP4	TERM TURRET SINGLE L=5.56MM TIN		1POS	Keystone	1502-2	36-1502-2-ND	534-1502-2
2	TP5, TP7	PC TEST POINT MULTIPURPOSE RED		Through Hole	Keystone	5010	36-5010-ND	534-5010
2	TP6, TP8	PC TEST POINT MULTIPURPOSE BLACK		Through Hole	Keystone	5011	36-5011-ND	534-5011
2	TP9, TP12	PC TEST POINT MULTIPURPOSE YELLOW		Through Hole	Keystone	5014	36-5014-ND	534-5014
1	TP10	PC TEST POINT MULTIPURPOSE RED		Through Hole	Keystone	5010	36-5010-ND	534-5010
1	TP11	PC TEST POINT MULTIPURPOSE BLACK		Through Hole	Keystone	5011	36-5011-ND	534-5011
1	U1	Load Switch with OVP and Reverse Polarity Protection		TDFN	KInetic Technologies	KTS1640EDV-TR		389-KTS1640EDV-TR

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 at 3V and VIN voltage at 14V, check the $\overline{EN}$ and $\overline{FLAG}$ functionality.
    d. Check the shutdown supply current at VIN with $\overline{EN}$ = VIO. The supply current should be a few µA only. $\overline{FLAG}$ fault pin voltage should be close to VIO voltage.
    e. With $\overline{EN}$ = GND, check the $\overline{FLAG}$ fault pulls low to GND when VIN < 5.3V (UVLO) and when VIN > 27.8V (OVLO).
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 KTS1640 IC may become hot; avoid skin contact.
    c. Use multimeters and an oscilloscope to make DC and transient measurements as desired.

Troubleshooting

Symptom	Root Cause	Solution
$\overline{FLAG}$ does not go low during faults.	VIO supply is off or not connected.	Connect and enable a VIO pull-up supply. $\overline{FLAG}$ has an Absolute Maximum Rating of 7V.
$\overline{EN}$ = VIO does not disable the switch.	VIO supply is off or not connected.	Connect and enable a VIO pull-up supply. $\overline{EN}$ has an Absolute Maximum Rating of 7V

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