Load Switch with OVP and Reverse Polarity Protection

Brief Description

The KTS1642AQ Evaluation (EVAL) Kit is used to demonstrate and evaluate the KTS1642AQ functionality, performance, and PCB layout. The kit includes a fully assembled and tested PCB with the KTS1642AQ IC installed, and a printed copy of the Quick Start Guide (also contained within this document).

Ordering Information

Part Number	Description	IC Package
KTS1642AQGDV-MMEV01	KTS1642AQ EVAL Kit	TDFN44-12

3D CAD Image

EVAL Kit Physical Contents

Item #	Description	Quantity
1	KTS1642AQ EVAL fully assembled PCB	1
2	Anti-static bag	1
3	Quick Start Guide, printed 1 page (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/kts1642aq/	https://www.kinet-ic.com/kts1642aqgdv-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. Bench Power Supply for VIO – 1.5V to 5V, low current. Needed for enable mode (EN = VIO = High) and fault monitoring ($\overline{FLAG}$ pull-up voltage).
3. Digital Multimeter – one or more, used to measure input/output voltages and currents.

Optional Equipment

1. Oscilloscope – for dynamic testing of voltages (and currents with a current probe, if available).
2. Load – either an eLoad, power resistors, or an actual system load.
3. Additional Digital Multimeters

Recommended Operating Conditions

Symbol	Description	Value	Units
VIN	Input Withstand Voltage Input Operating Voltage	-28 to 40 4 to OVP (20.3 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 500	mA

Jumper Descriptions

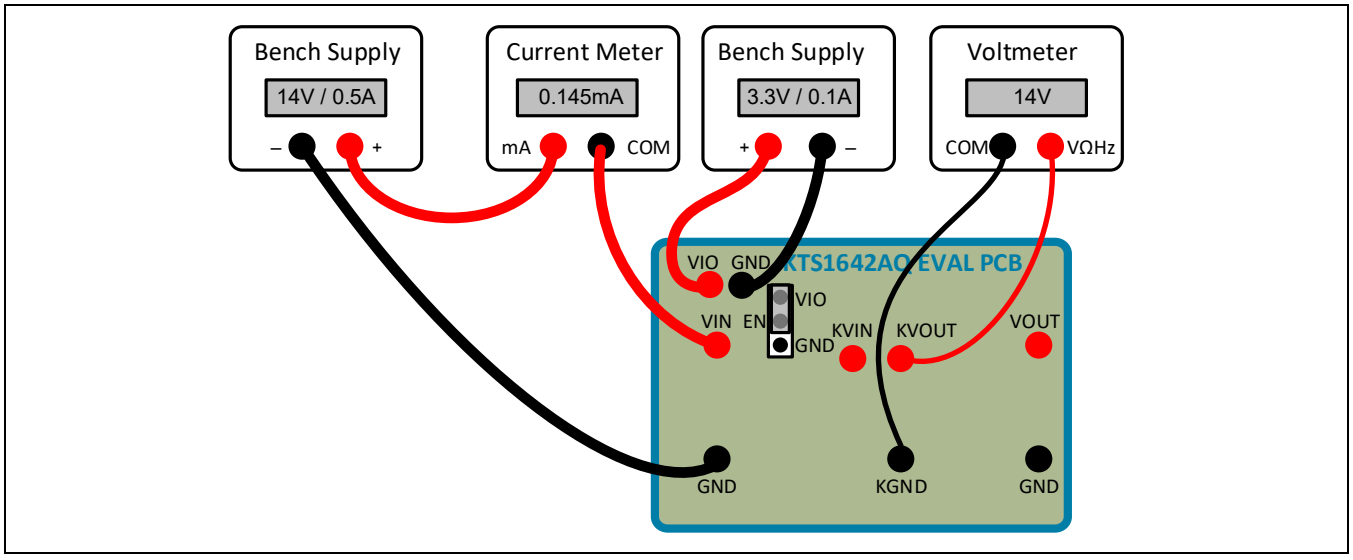
Designator	Name	Description	Default
P1	EN	Active-High Enable Input VIO (High): Enable Mode – normal switch operation GND (Low): Enable Shutdown Mode – switch disabled	VIO

Quick Start Procedures

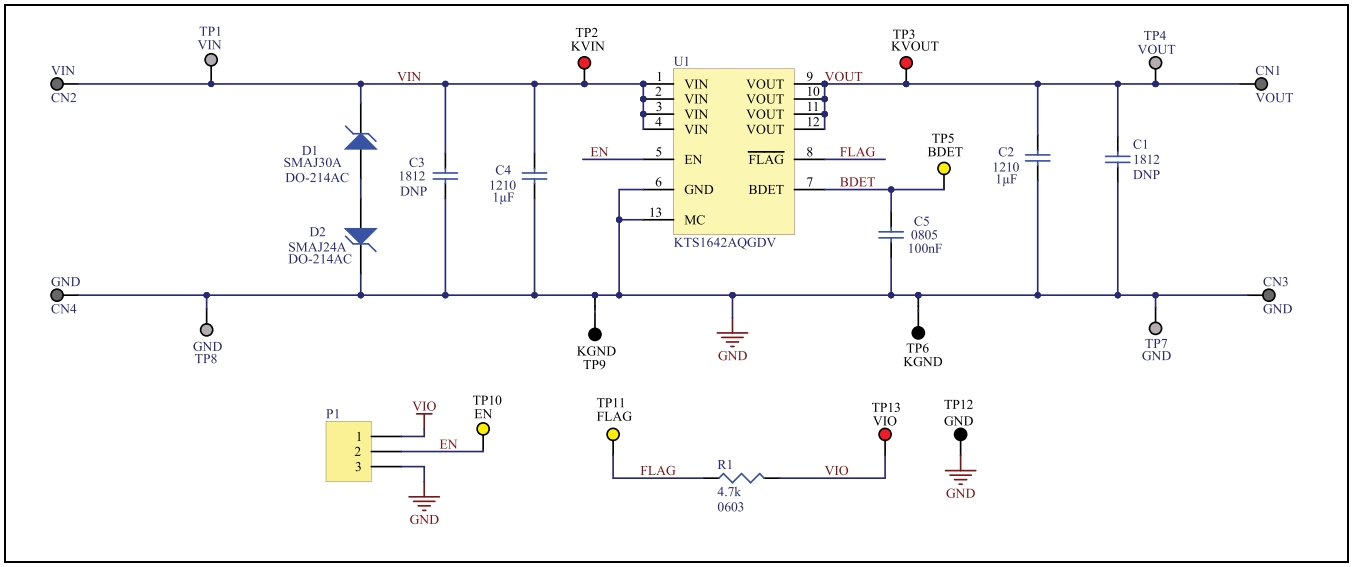
1. Set Jumper to default: EN = VIO (High)
2. Connect one pair of Banana-to-Banana power cables to the connectors at VIN and GND (left edge of EVAL Kit).
3. Before connecting the EVAL Kit to the VIN bench supply, turn on the supply and adjust the voltage as close to 0V as possible. Then turn off the supply. While off, connect the Banana-to-Banana power cables to the VIN bench supply.
4. Connect a pair of banana-to-clip test leads from VIO power supply to EVAL board VIO testpoint and GND. Turn on the VIO power supply to 3.3V.
5. 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.
6. 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.
7. Use a digital multimeter to check the no-load supply current at VIN. Consult the KTS1642AQ datasheet for the expected current range at the VIN voltage condition in use. For conditions of VIN = 14V, EN = VIO, 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.



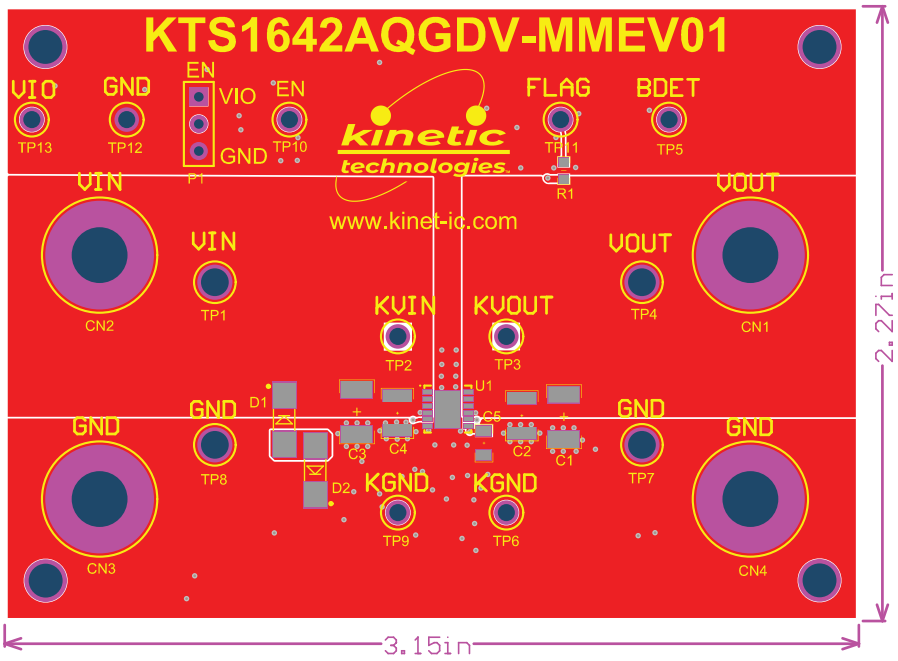
Electrical Schematic

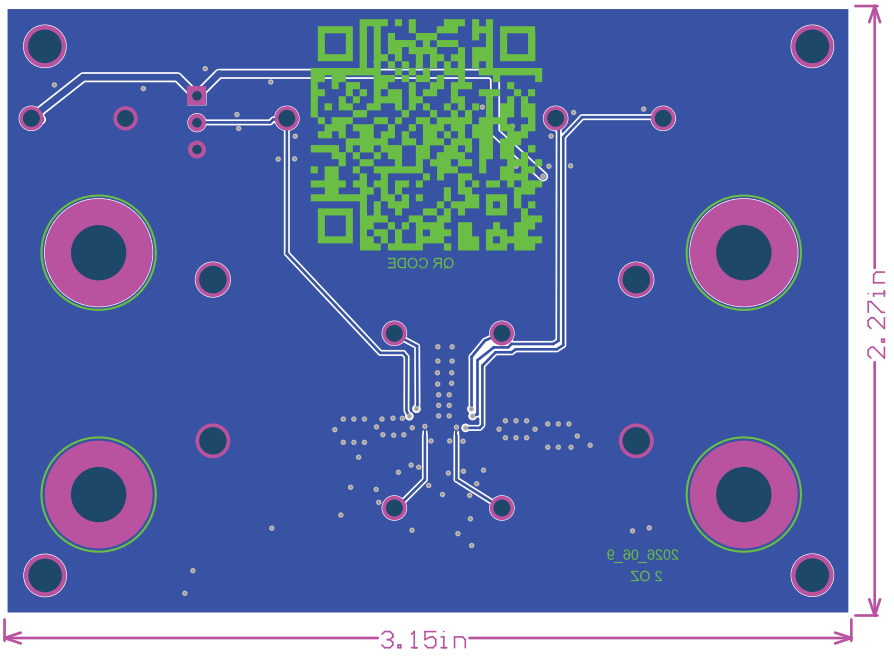


Bill of Materials (BOM)

Designator	Description	Quantity	Value	Manufacturer	Manufacturer Part Number
C1, C3	Cap 1812 DNP	0	DNP		
C2, C4	CAP CER 1µF 50V X7R 1210	2	1µF	Samsung Electro-Mechanics	CL32B105KBHNNNE
C5	CAP CER 0.1µF 50V X7R 0805	1	100nF	Samsung Electro-Mechanics	CL21B104KBCNNNC
CN1, CN2, CN3, CN4	CONN BANANA JACK SOLDER	4		Keystone Electronics	575-4
D1	TVS DIODE 30VWM 48.4VC DO214AC	1		Littelfuse Inc.	SMAJ30A
D2	TVS DIODE 24VWM 38.9VC DO-214AC	1		Littelfuse Inc.	SMAJ24A
H1, H2, H3, H4	BRD SPT SNAP LOCK REST MNT 14MM	4		Essentra	PSD-14M-19
P1	3 Pin Header with jumper connecting pin 1 to pin 2	1		Sullins Connector Solutions	PREC003SAAN-RC
R1	RES 4.7KΩ 1% 1/10W 0603	1	4.7k	Yageo Group	RC0603FR-074K7L
TP1, TP4, TP7, TP8	TERM TURRET SINGLE L = 5.56MM TIN	4		Keystone	1502-2
TP2, TP3, TP13	PC TEST POINT MULTIPURPOSE RED	3		Keystone	5010
TP5, TP10, TP11	PC TEST POINT MULTIPURPOSE YELLOW	3		Keystone	5014
TP6, TP9, TP12	PC TEST POINT MULTIPURPOSE BLACK	3		Keystone	5011
U1	Automotive Load Switch with OVP and RB Protection TDFN44-12	1		Kinetic Technologies	KTS1642AQGDV

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 EN and $\overline{\text{FLAG}}$ functionality.
    d. Check the shutdown supply current at VIN with EN = GND. The supply current should be a few µA only. $\overline{\text{FLAG}}$ fault pin voltage should be close to VIO voltage.
    e. With EN = VIO, check the $\overline{\text{FLAG}}$ fault pulls low to GND when VIN < 2.9V (UVLO) and when VIN > 21.1V (OVLO).
2. Testing with Load:
    a. Use a Banana-to-Banana power cable pair to apply loads from VOUT to GND.
    b. Under heavy-load conditions, use caution. The KTS1642AQ 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
$\overline{\text{FLAG}}$ does not go high during normal operation.	VIO supply is off or not connected.	Connect and enable a VIO pull-up supply. $\overline{\text{FLAG}}$ has an Absolute Maximum Rating of 7V.
EN = VIO does not enable the switch.	VIO supply is off or not connected.	Connect and enable a VIO pull-up supply. EN has an Absolute Maximum Rating of 7V.

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