

Active Clamp Forward Current-Mode PWM Controller

Brief Description

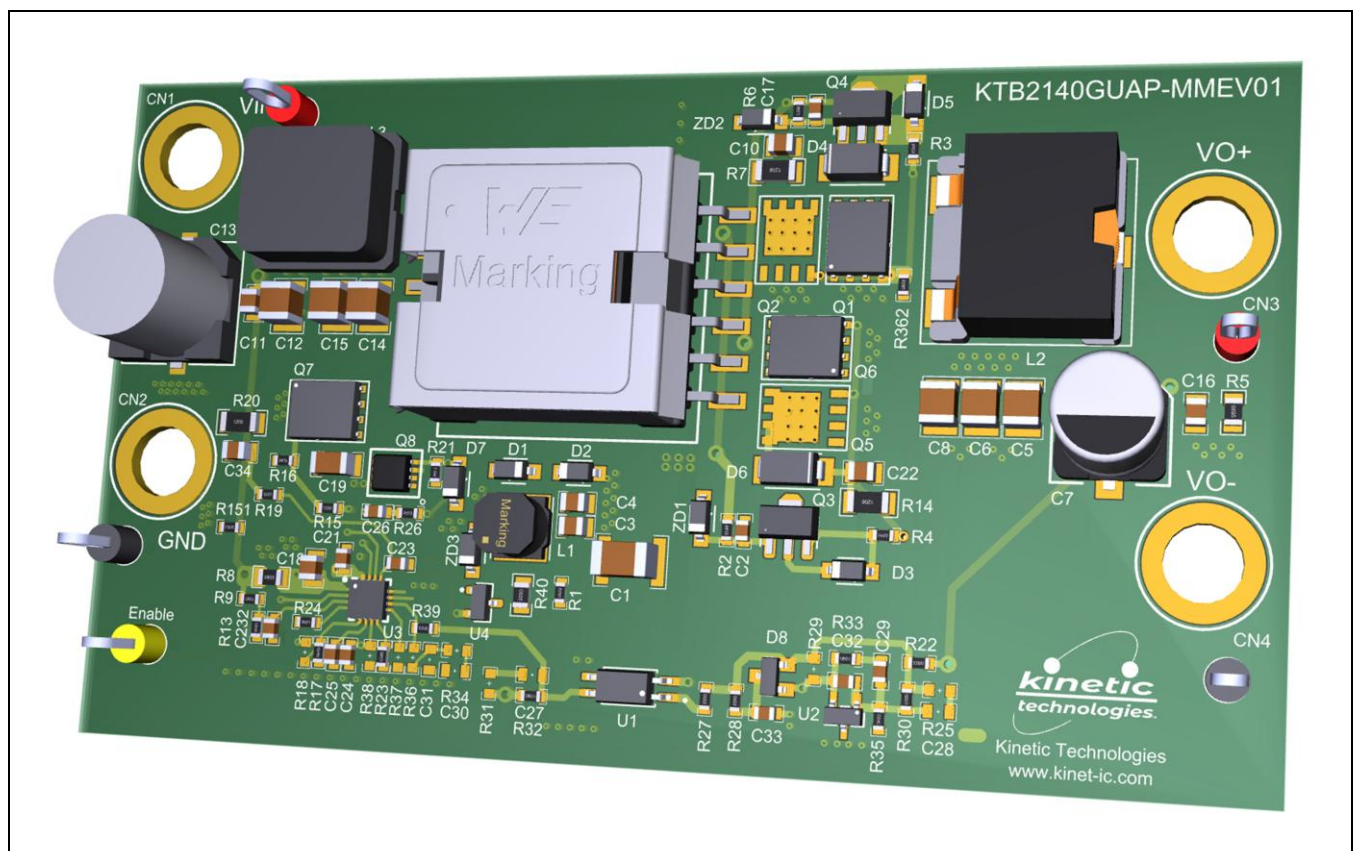
The KTB2140 Evaluation (EVAL) Kit is used to demonstrate and evaluate the KTB2140 functionality, performance, and PCB layout. This evaluation board utilizes 12V, 72W output with an active clamp forward topology.

The KTB2140 is a PWM controller that integrates all the circuitry required to design a smart and efficient converter for PoE and telecom mid-power applications. It features a programmable oscillator for the switching frequency, adjustable slope compensation, dual complementary low-side drivers with programmable dead time, programmable soft-start, and a programmable current sense blanking time. The KTB2140 is an active clamp current-mode DC-DC PWM controller that is optimized for Flyback and Forward topologies.

Ordering Information

Part Number	Description	IC Package
KTB2140GUAP-MMEV01	KTB2140GUAP-TB EVAL Kit, Active Clamp Forward, $V_{OUT} = 12V$	QFN33-16


3D CAD Image



EVAL Kit Physical Contents

Item #	Description	Quantity
1	KTB2140 Evaluation board fully assembled PCB	1
2	Anti-static bag	1
3	KTB2140 Quick Start Guide, printed 1 page (A4 or US Letter)	1
4	EVAL Kit box	1

QR Links for Documents

IC Datasheet	EVAL Kit Landing Page
 https://www.kinet-ic.com/ktb2140/	 https://www.kinet-ic.com/ktb2140guap-mmev01/

User-Supplied Equipment

Required Equipment

1. Power Sourcing Equipment Such a supply should provide 37V-57V up to 3A as needed for intended application.
2. Digital Multimeters, two required – used to measure input/output voltages and currents.
3. Load – any of the following may be used:
 - a. Electronic load capable of sinking 12V at 6A (72W)
 - b. Power Resistor - 2Ω / 72W or greater value is required
 - c. Actual system load that does not exceed 72W at 12V
4. Test leads:
 - a. One pair of banana-to-clip test leads to connect a voltmeter to the eval board VIN and GND
 - b. Two pairs of banana-jack test leads to connect VO+/VO- to an electronic load and voltmeter

Optional Equipment

1. Oscilloscope with 10x probes to monitor switching regulator waveforms

Recommended Operating Conditions

Parameter	Description	Value	Units
Input Voltage	Bench Supply applied to the VIN and GND Pins	37-57	V
Output Voltage	VO+ to VO-	12	V
Output Current	Max Load = 72W (12V @ 6A)	6	A

Quick Start Procedures

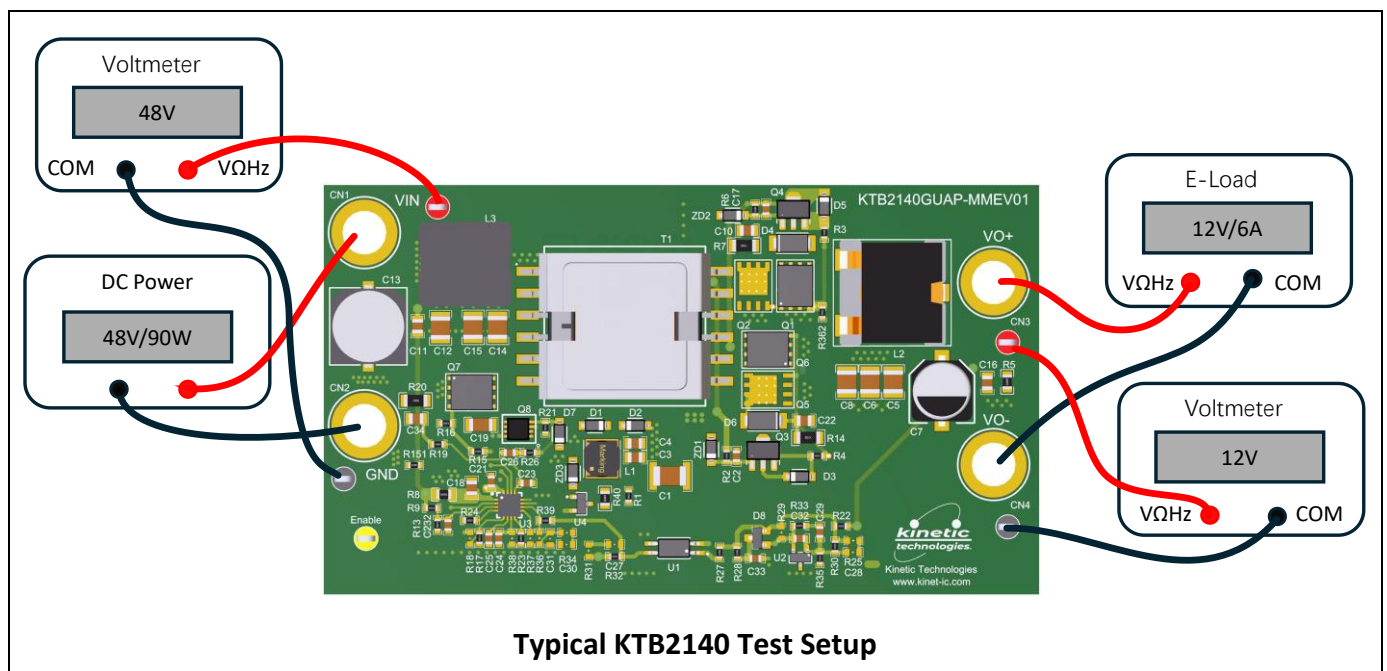
The output voltage of this board is set to 12V by the Kinetic Technologies KTB2140 controller. Below is the method to power KTB2140 evaluation board:

Method: Connect to VIN Power Supply

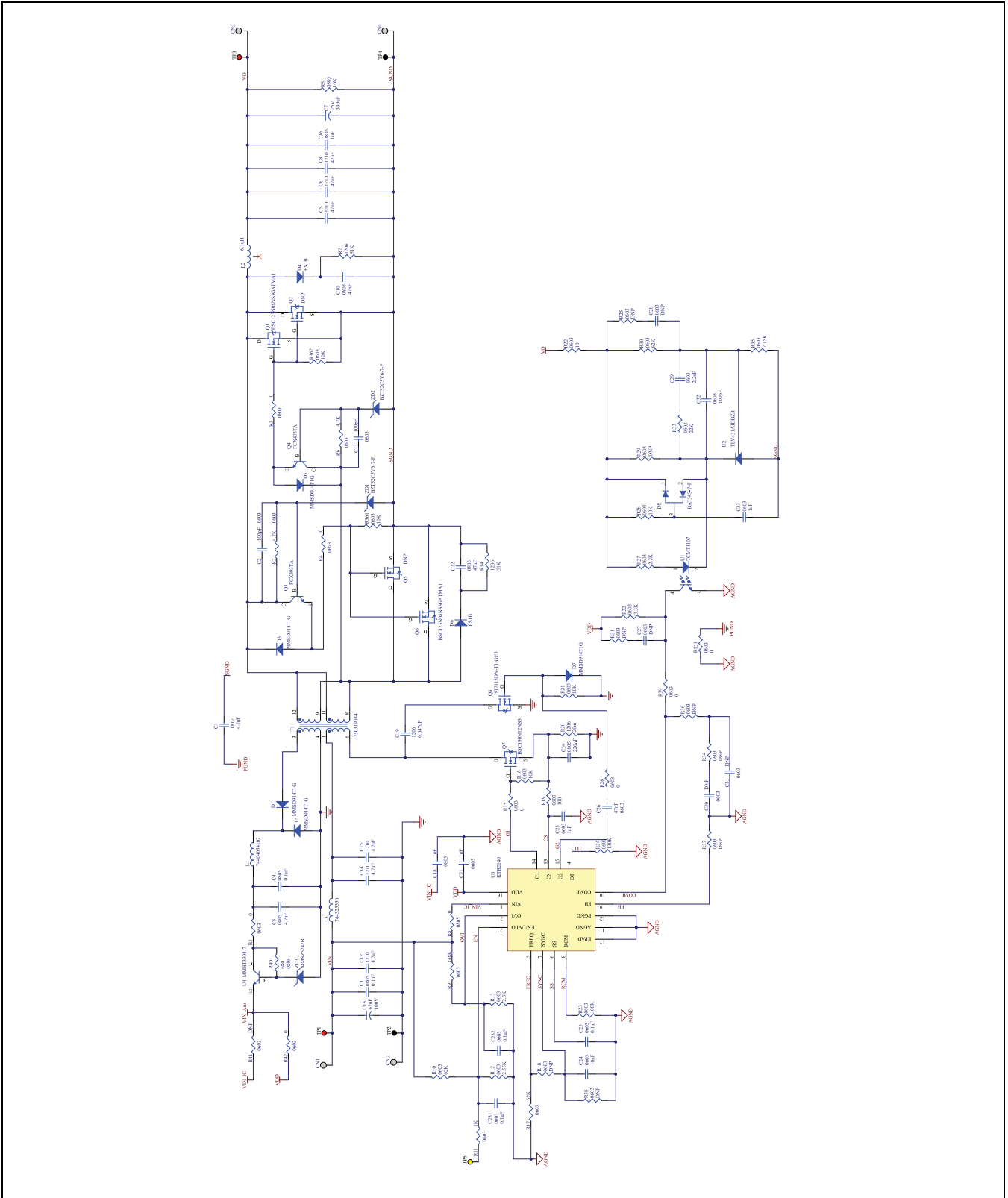
1. Connect one pair of power cables to the input connectors (VIN and GND) of EVAL Kit.
2. Before connecting the EVAL Kit to the bench power supply, turn on the supply and adjust the voltage as close to 0V as possible. Then disable the power supply output or turn the supply off. While disabled or off, connect the VIN / GND power cables' ends to the bench supply.
3. Connect a voltage meter to the VO+ and VO- output jacks.
4. Connect the load to the output VO+ and VO- output jacks.
5. Turn on the bench supply and very slowly ramp its voltage to an appropriate voltage, such as 48V (37V ~ 57V). While ramping bench supply slowly, use the bench supply's output current indication (or a digital multimeter) to monitor the bench supply current. If the current becomes high, reduce the bench supply voltage quickly to prevent damage. Then inspect the setup for any wiring errors.
6. Verify 12 Volts on the VO+ / VO- output jacks.

Typical Test Setup

The figure below shows a typical setup for KTB2140 EVB. Input voltage can be applied as described in the Connector Functionality table above.



Electrical Schematic



Bill of Materials

Designator	Description	Quantity	Value	Manufacturer	Manufacturer Part Number
C1	CAP CER 4.7nF 2KV 1812	1	4.7nF	Yageo	CC1812KKX7RDBB472
C2, C17	CAP CER 100pF 50V X7R 0603	2	100pF	Samsung	CL10C101JB8NNNC
C3	CAP CER 4.7μF 50V X7R 0805	1	4.7μF	Murata	GRM21BZ71H475KE15L
C4	CAP CER 0.1μF 50V X7R 0805	1	0.1μF	Samsung	CL21B104KBCNNNC
C5, C6, C8	CAP CER 47μF 16V X6S 1210	3	47μF	Murata	GRM32EC81C476KE15L
C7	CAP ALUM 330μF 20% 25V SMD	1	330μF	Nichicon	UWT1E331MNL1GS
C10, C22	CAP CER 47nF 100V X7R 0805	2	47nF	Yageo	CC0805KKX7R0BB473
C11	CAP CER 0.1μF 100V X7R 0805	1	0.1μF	Samsung	CL21B104KCFNNNE
C12, C14, C15	CAP CER 4.7μF 100V X7R 1210	3	4.7μF	Samsung	CL32B475KCVZW6E
C13	CAP ALUM 47μF 20% 100V SMD	1	47μF	Panasonic	EEE-FN2A470UL
C16	CAP CER 1μF 25V X7R 0805	1	1μF	Samsung	CL21B105KAFNNNE
C18	CAP CER 1μF 100V X7R 0805	1	1μF	Yageo	CC0805KKX7R0BB105
C19	CAP CER 0.047μF 250V X7R 1206	1	0.047μF	Murata	GRM31CR72E473KW03L
C21, C33	CAP CER 1μF 50V X7R 0603	2	1μF	YAGEO	CC0603KRX7R9BB105
C23	CAP CER 1nF 50V X7R 0603	1	1nF	Samsung	CL10B102KB8NNNC
C24	CAP CER 10nF 50V X7R 0603	1	10nF	Samsung	CL10B103KB8NNNC
C25, C231, C232	CAP CER 0.1μF 50V X7R 0603	3	0.1μF	Samsung	CL10B104KB8NNNC
C26	CAP 47nF 50V X7R 0603	1	47nF	Samsung	CL10B473KB8NNNC
C27, C28, C30, C31	CAP CER 0603 DNP	4	DNP		
C29	CAP CER 2.2nF 50V X7R 0603	1	2.2nF	Samsung	CL10B222KB8WPNC
C32	CAP CER 100PF 50V X7R 0603	1	100pF	Yageo	CC0603JRX7R9BB101
C34	CAP CER 220nF 50V X7R 0805	1	220nF	Samsung	CL21B224KBFNFNE
CN1, CN2, CN3, CN4	Banana Jack, 4mm, Socket, Solder Hole - Uninsulated	4		Cal Test Electronics	CT2220
D1, D2, D3, D5, D7	DIODE GEN PURP 100V 200MA SOD123	5		onsemi	MMSD914T1G
D4, D6	DIODE GEN PURP 100V 1A SMA	2		onsemi	ES1B
D8	DIODE ARRAY SCHOTTKY 30V SOT23-3	1		BAT54S-7-F	Diodes Inc.
L1	FIXED IND 1MH 200MA 6Ω SMD	1	1mH	Würth Elektronik	74404054102
L2	FIXED IND 6.1μH 11A 7.8 MΩ SMD	1	6.1μH	Sumida America Components Inc.	CDEP147NP-6R1MC-95
L3	FIXED IND 5.5μH 10A 10.3MΩ SMD	1	5.5μH	Würth Electronics	744325550
Q1, Q6	MOSFET N-CH 80V 11A/55A TDSON	2		Infineon	BSC123N08NS3GATMA1
Q2, Q5	MOSFET N-CH 80V 11A/55A TDSON DNP	2	DNP		
Q3, Q4	TRANS NPN 100V 1A SOT89-3	2		Diodes Incorporated	FCX493TA
Q7	MOSFET N-CH 120V 44A TDSON-8-EP(5x6)	1		Infineon	BSC190N12NS3 G
Q8	MOSFET P-CH 150V 8.9A PPAK1212-8	1		Vishay Siliconix	SI7115DN-T1-GE3
R1, R3, R4, R15, R26, R39, R42, R151	RES 0Ω JUMPER 1/10W 0603	8	0	Yageo	RC0603FR-070RL
R2, R6	RES 4.7KΩ 1% 1/10W 0603	2	4.7K	Yageo	RC0603FR-074K7L

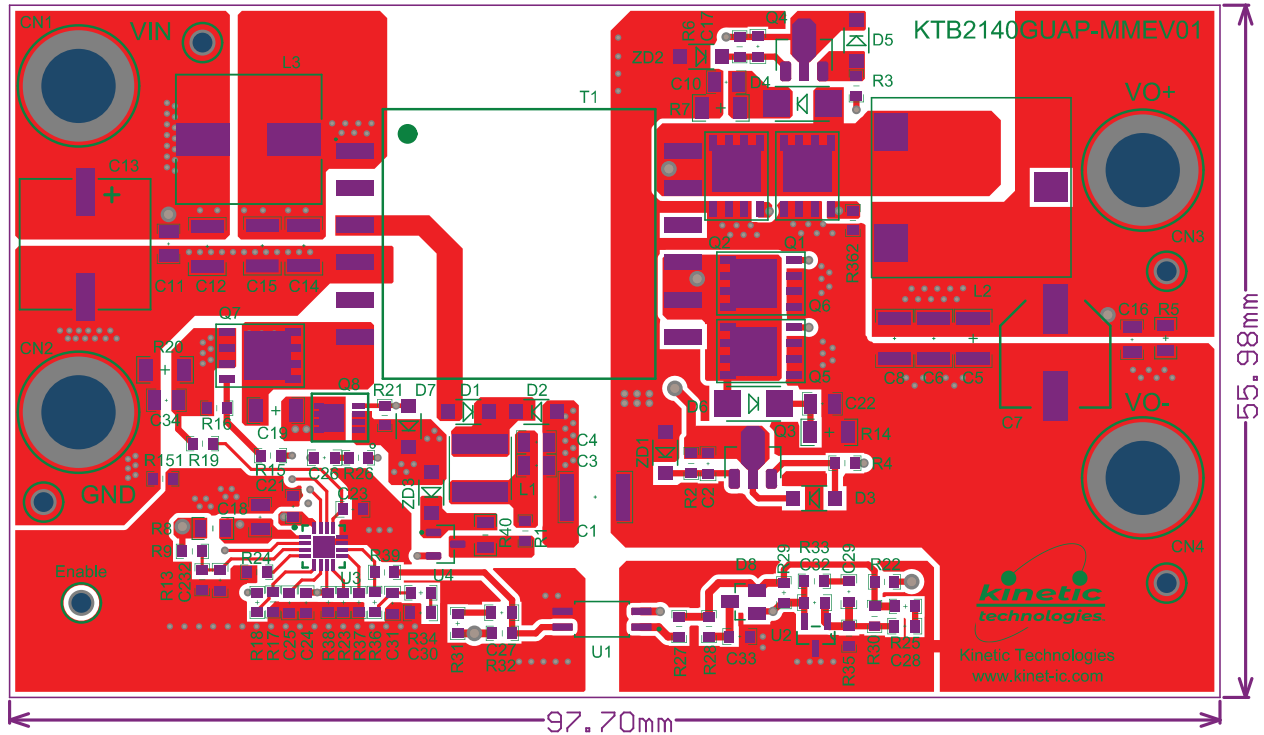
Designator	Description	Quantity	Value	Manufacturer	Manufacturer Part Number
R5	RES 10KΩ 1% 1/10W 0805	1	10K	Yageo	RC0805FR-0710KL
R7, R14	RES 51KΩ 1% 1/10W 1206	2	51K	Yageo	RC1206FR-0751KL
R8	RES 0Ω JUMPER 1/8W 0805	1	0	Yageo	RC0805FR-070RL
R9	RES 148KΩ 1% 1/10W 0603	1	148K	Yageo	RC0603FR-07147KL
R10, R17, R30	RES 62KΩ 1% 1/10W 0603	3	62K	Yageo	RC0603FR-07100RL
R11	RES 1KΩ 1% 1/10W 0603	1	1K	Yageo	RC0603FR-071KL
R12	RES 2.55KΩ 1% 1/10W 0603	1	2.55K	Yageo	RC0603FR-072K55L
R13	RES 2.3KΩ 1% 1/10W 0603	1	2.3K	Yageo	RC0603FR-072K32L
R16, R21, R28, R361, R362	RES 10KΩ 1% 1/10W 0603	5	10K	Yageo	RC0603FR-0710KL
R18, R25, R29, R31, R34, R36, R37, R38, R41	RES 0603 DNP	9	DNP		
R19	RES 100Ω 1% 1/10W 0603	1	100	Yageo	RC0603FR-07100RL
R20	RES 20mΩ 1% 1/10W 1206	1	20m	Yageo	RL1206FR-070R02L
R22	RES 10Ω 1% 1/10W 0603	1	10	Yageo	RC0603FR-0710RL
R23	RES 100K 1% 1/10W 0603	1	100K	Yageo	RC0603FR-07100KL
R24	RES 130KΩ 1% 1/10W 0603	1	130K	Yageo	RC0603FR-07130KL
R27	RES 2.2KΩ 1% 1/10W 0603	1	2.2K	Yageo	RC0603FR-102K2L
R32	RES 3.3KΩ 1% 1/10W 0603	1	3.3K	Yageo	RC0603FR-073K3L
R33	RES 22KΩ 1% 1/10W 0603	1	22K	Yageo	RC0603FR-0722KL
R35	RES 7.15KΩ 1% 1/10W 0603	1	7.15K	Yageo	RC0603FR-077K15L
R40	RES 680Ω 1% 1/10W 0805	1	680	Yageo	RC0805FR-07680RL
T1	WE-POE POWER-OVER-ETHERNET TRANS	1		Würth Elektronik	750319034
TP1, TP3	PC TEST POINT MULTIPURPOSE RED	2		Keystone	5010
TP2, TP4	PC TEST POINT MULTIPURPOSE BLACK	2		Keystone	5011
TP5	PC TEST POINT MULTIPURPOSE YELLOW	1		Keystone	5014
U1	Optoisolator Transistor Output 3750Vrms 1 Channel 4-SOP	1		Vishay Semiconductor	TCMT1107
U2	IC VREF SHUNT ADJ 1% SOT23-3	1		Texas Instruments	Texas Instruments
U3	ACTIVE CLAMP CURRENT-MODE PWM CONTROLLER	1		Kinetic Technologies	KTB2140GUAP-TB
U4	TRANS NPN 40V 0.2A SOT23-3	1		Diotec Semiconductor	MMBT3904-7
ZD1, ZD2	ZENERDIODE, SOD-123, 5.2V~6.0V,	2		DIODES	BZT52C5V6-7-F
ZD3	ZENERDIODE, SOD-123, 11.40V~12V,	1		Diotec Semiconductor	MMSZ5242B

Physical Access

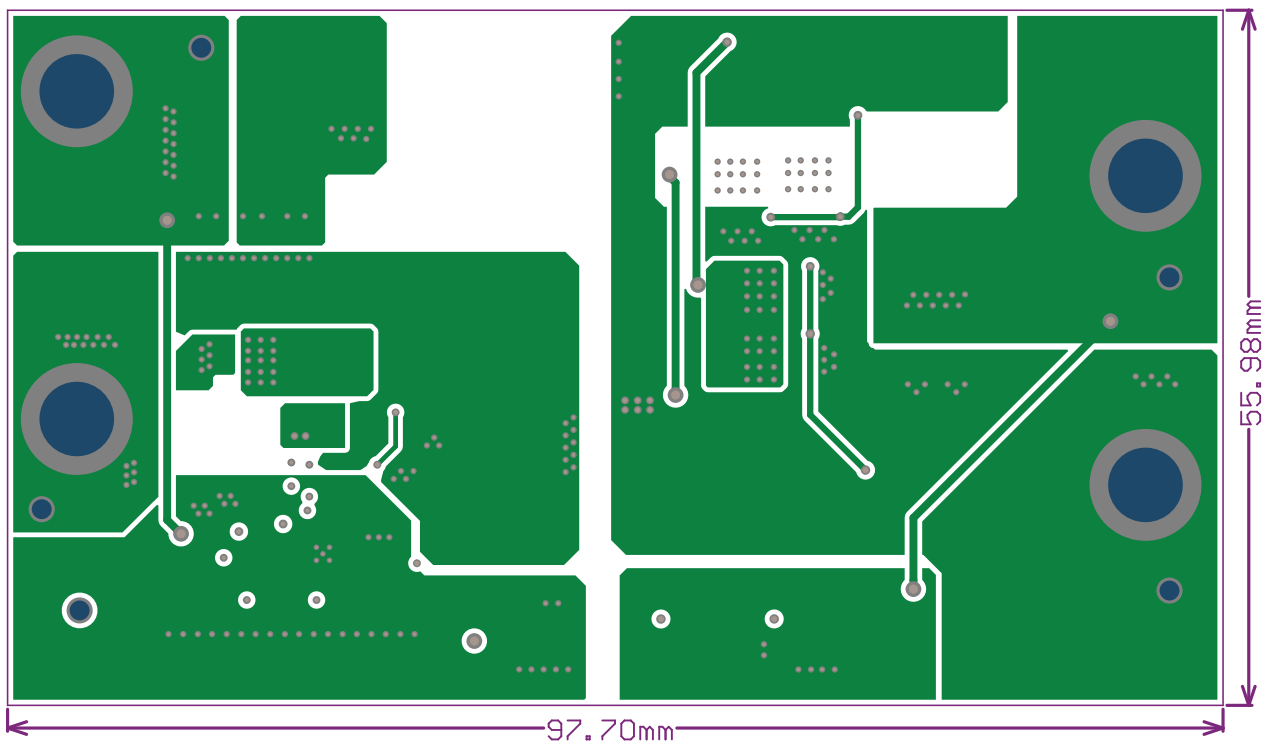
Connector	Description
VIN	Positive DC power supply input
GND	Negative DC power supply input
VO+	Positive output
VO-	Negative output

Printed Circuit Board (PCB)

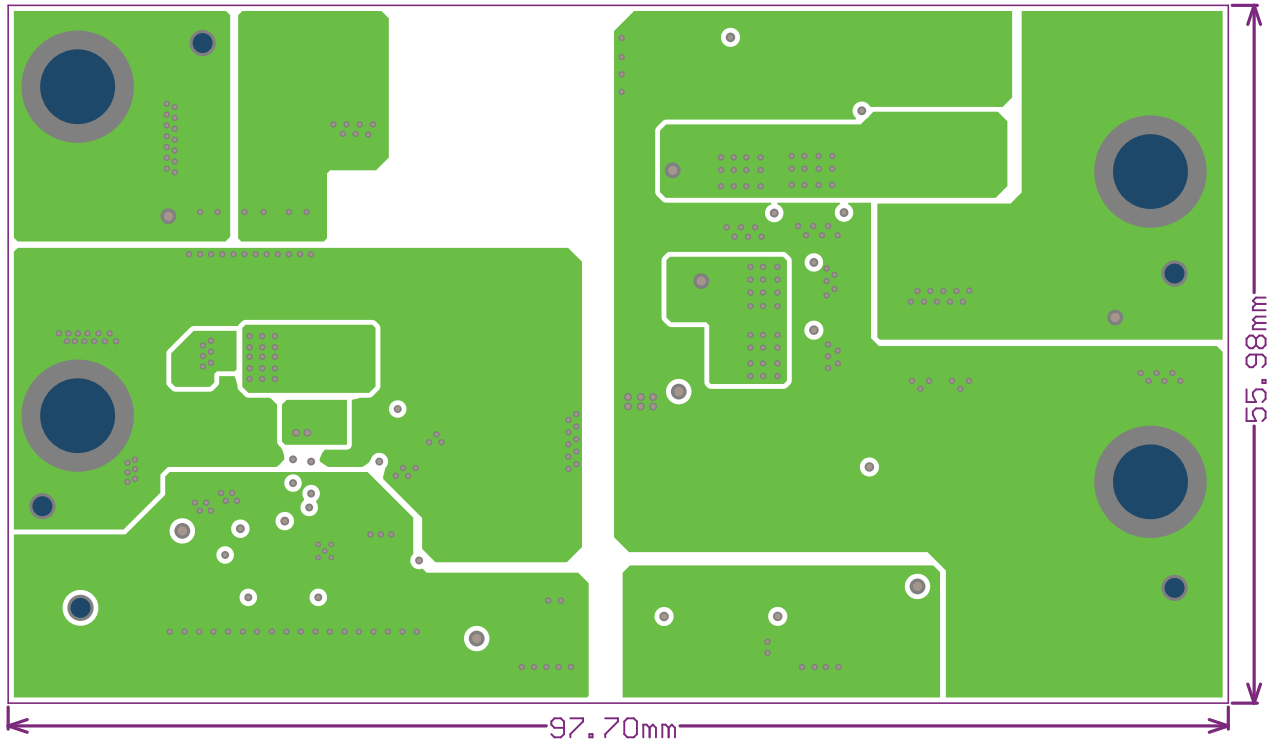
Top Side Layout/Routing



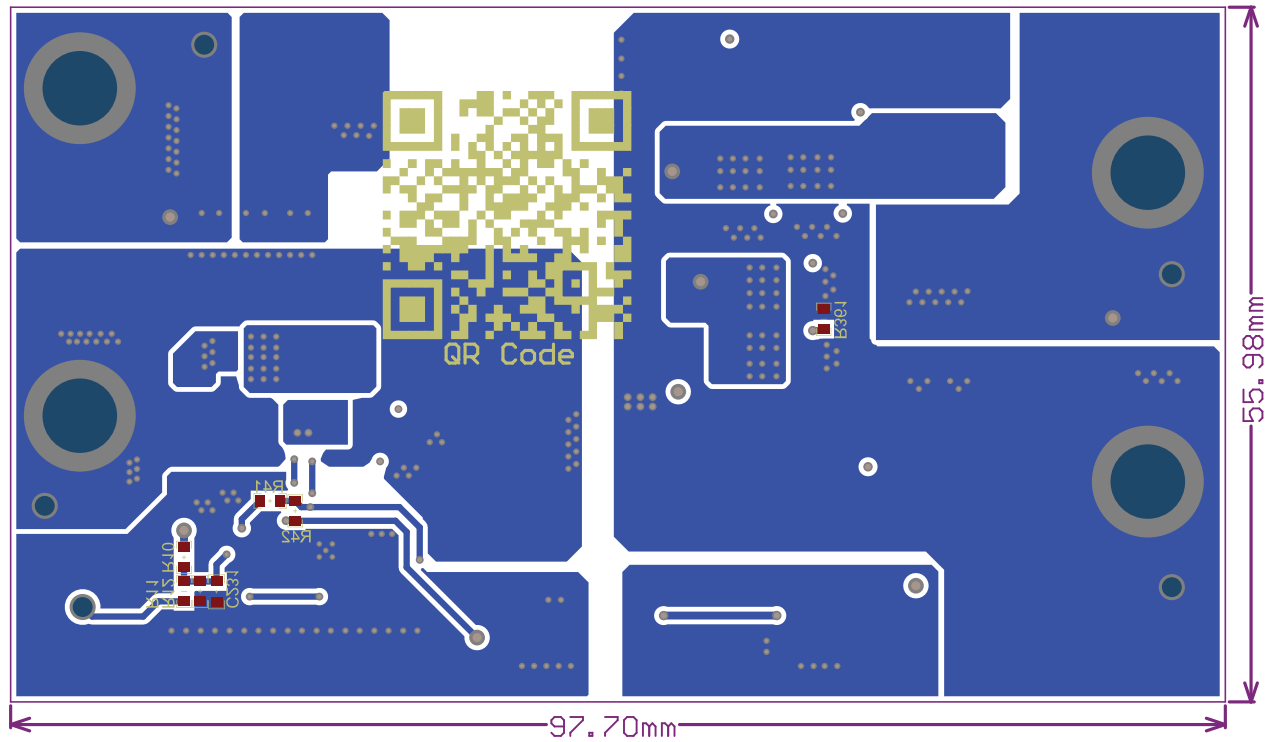
Layer Two Routing



Layer Three Routing



Bottom Layer Routing



Test Setup

1. The “Typical Test Setup Diagram” shows a typical setup for the KTB2140 EVAL board. Input voltage can be applied as described in the “Recommended Operating Conditions” Table
2. When a DC Power Supply is used to source power at the VIN and GND pins, the KTB2140 EVAL board will automatically start up and 12V may be observed on the output VO+/VO- pins
3. Digital multimeters may be used to monitor the input voltage level (VIN and GND test points) and output voltage levels at VO+/VO-
4. A load may be applied to the output at VO+/VO-. The load should not exceed 72W (6A at 12V)

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