

KTA1142 (Forward Topology)

IEEE® 802.3af/at/bt PoE PD with Integrated
Active Clamp Forward/Flyback DC-DC Controller

Brief Description

The KTA1142 Evaluation (EVAL) Kit is designed to demonstrate and evaluate the performance and capabilities of Kinetic Technologies' KTA1142 for PoE (Power over Ethernet) applications. This evaluation board specifically delivers 72W at 12V output with an active clamp forward topology, having power and signal I/O connections with an array of test points for signal observation. Additionally, this EVAL Kit includes other Kinetic Technologies products. The KTA1170 is a single chip dual MOSFET bridge rectifier designed for customers who want an integrated solution with 1.5-2% better power conversion efficiency at higher loads. The KTS1900 is an ideal diode and load switch controller with reverse input protection. Each of these devices can also be tested and evaluated for their functionality, performance, and PCB layout.

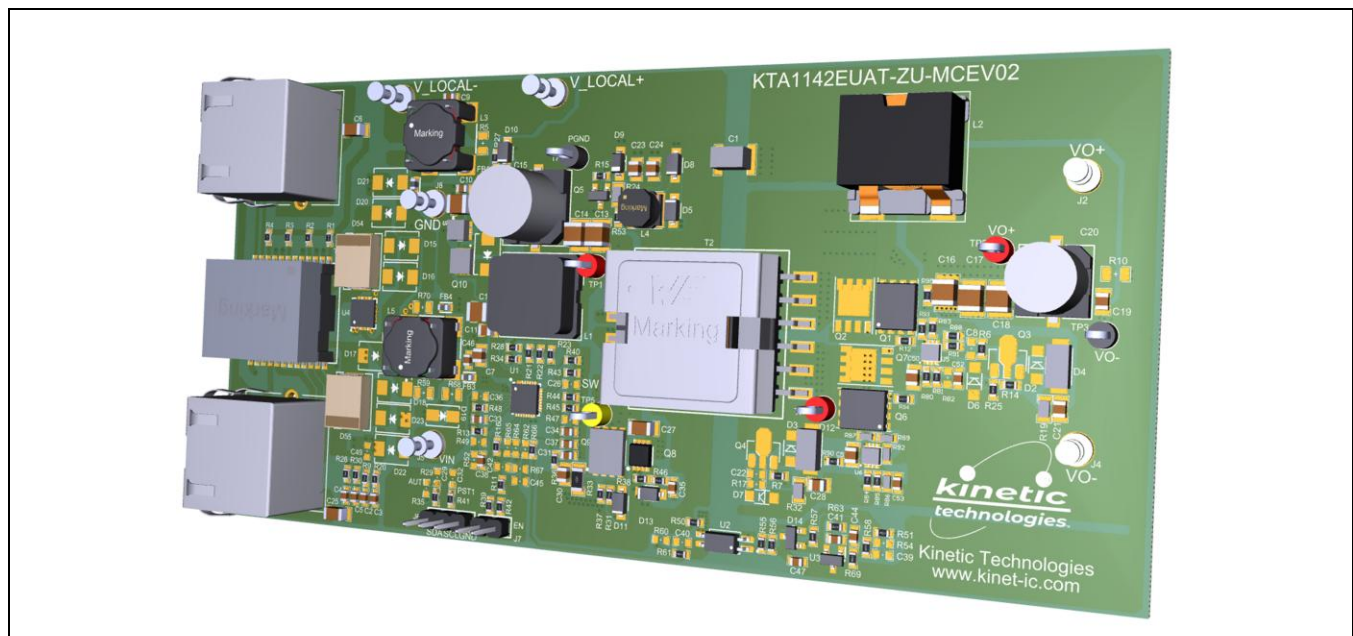
The KTA1142 device is an IEEE® 802.3af/at/bt compliant PD (Powered Device) interface controller optimized for isolated and non-isolated converter topologies. KTA1142 also includes an active clamp current-mode DC-DC PWM controller that is optimized for both Flyback and Forward topologies.

Please note that there is an alternative KTA1142 kit created for the evaluation of a 12V, 51W output with an active clamp flyback topology. Contact a Kinetic Technologies sales representative for further details.

Ordering Information

Part Number	Description	IC Package
KTA1142EUAT-ZU-MCEV02	KTA1142 EVAL Kit – 12V, 72W Output w/ active clamp forward topology. Includes KTA1170 and KTS1900.	WQFN44-32 (4mm x 4mm)

3D CAD Image



KTA1142 (Forward Topology)

EVAL Kit Physical Contents

Item #	Description	Quantity
1	KTA1142 (forward topology) Evaluation board fully assembled PCB	1
2	Anti-static bag	1
3	KTA1142 (forward topology) 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/kta1142/	 https://www.kinet-ic.com/kta1142euat-zu-mcev02/
KTA1170 Integrated Dual MOSFET Bridge Rectifier	
https://www.kinet-ic.com/kta1170/	https://www.kinet-ic.com/kta1170gvae-mmev01/
KTS1900 Ideal Diode and Load Switch Controller with Reverse Input Protection	
https://www.kinet-ic.com/kts1900/	https://www.kinet-ic.com/kts1900qgxaa-zr-mmev01/

User-Supplied Equipment

Required Equipment

- Power Sourcing Equipment (PSE), PoE power injector or PoE powered network switch that can source 48V at 90W or greater.
 - Alternatively, a bench Power Supply may be substituted for a PoE power injector, but this will bypass the KTA1142 functionality. Such a supply should provide 37V-57V up to 3A as needed for intended application.
- CAT-5, CAT-5e or CAT-6 RJ45 M/M ethernet cable, 1m length or shorter.
- Digital Multimeters, two required – used to measure input/output voltages and currents.
- Load – any of the following may be used:
 - Electronic load capable of sinking 6A at 12V (72W)
 - Power Resistor - 2Ω / 72W or greater value is required
 - Actual system load that does not exceed 72W at 12V
- Test leads:
 - One pair of banana-to-clip test leads connecting a voltmeter to the eval board VIN and GND
 - Two pairs of banana-jack test leads connecting VO+/VO- to an electronic load and volt meter

Optional Equipment

- Oscilloscope with 10x probes to monitor switching regulator waveforms

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Recommended Operating Conditions

Parameter	Description	Value	Units
Input Voltage	PoE PSE/Injector to the RJ1 RJ45 connector	48	V
	Bench Supply applied to the V_Local+ and V_Local- Pins	37-57	V
Output Voltage	VO+ to VO-	12	V
Output Current	Max Load = 72W (6A @ 12V)	6	A

Quick Start Procedures

The output voltage of this board is set to 12V by the Kinetic Technologies KTA1142 controller. There are two methods to power KTA1142 (forward topology) evaluation board:

Method 1: Connect to PSE

1. Connect a voltage meter between the VIN and GND test points to monitor the input supply voltage.
2. Connect a voltage meter to the VO+ and VO- output jacks to monitor the regulated output voltage.
3. Connect the load to the output VO+ and VO- output jacks.
4. Connect the RJ45 ethernet cable from the PSE into the evaluation board ethernet Jack RJ1. The board will automatically start up.

Method 2: Connect to Local Power Supply

1. Connect one pair of power cables to the Test pins (V_Local+ and V_Local-) 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 V_Local + / V_Local - 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.

General Configuration

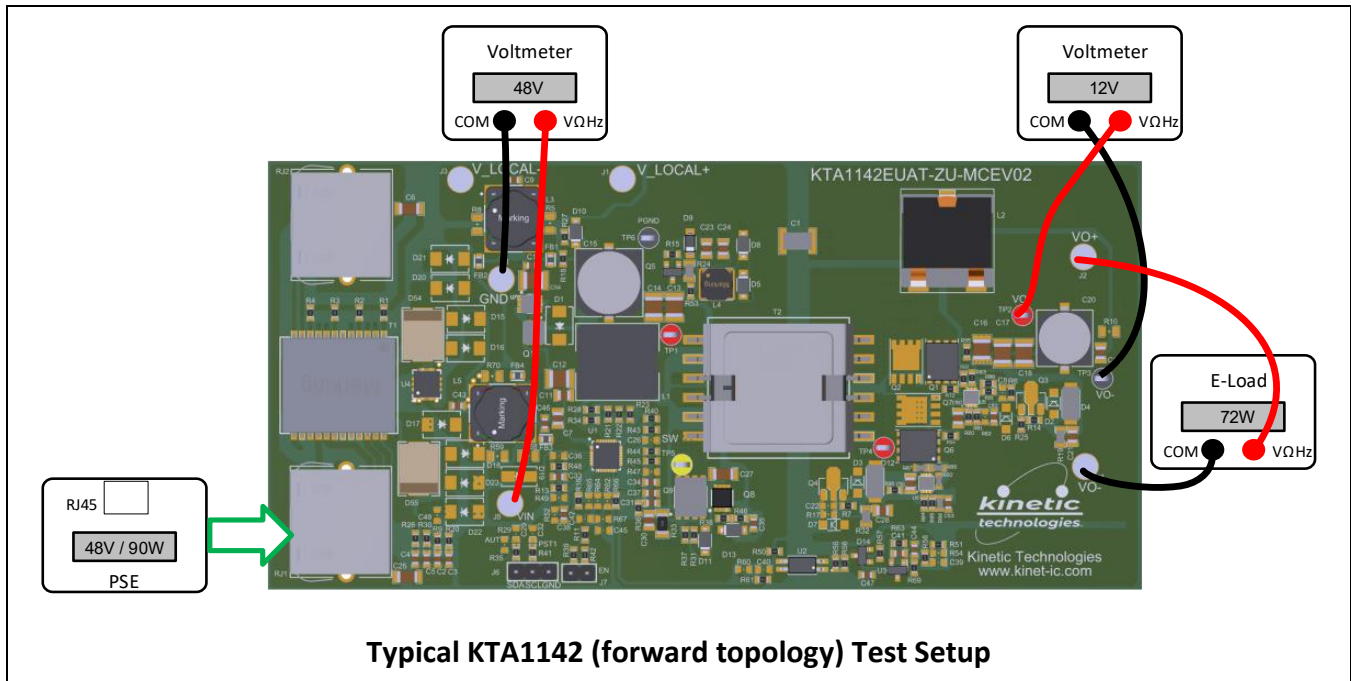
Connector Functionality

Connector	Description
RJ1	Ethernet power input connector (RJ45 connector)
RJ2	Ethernet data port connector (RJ45 connector)
VO-, VO+	VOOUT (output) to system DC power
V_Local-	Negative of local power supply input
V_Local+	Positive of local power supply input (37V ~ 57V)

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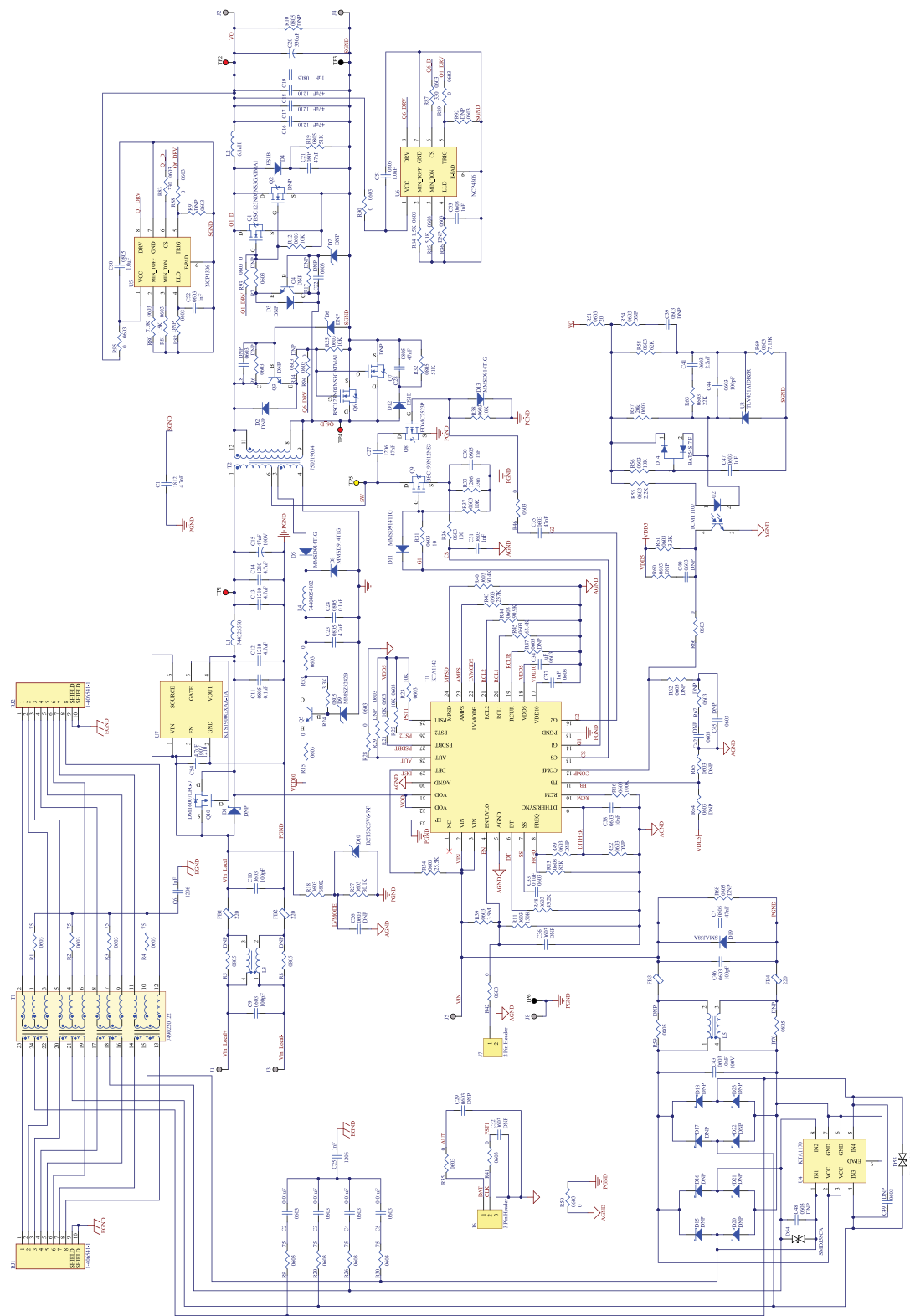
Typical Test Setup

The figure below shows a typical setup for KTA1142 (forward topology) EVB. Input voltage can be applied as described in the Connector Functionality table above.



KTA1142 (Forward Topology)

Electrical Schematic



KTA1142 (Forward Topology)

Bill of Materials

Designator	Description	Quantity	Value	Manufacturer	Manufacturer Part Number
C1	CAP CER 4700pF 2KV X7R 1812	1	4.7nF	Yageo	CC1812KKX7RDBB472
C2, C3, C4, C5	CAP CER 0.01μF 100V X7R 0603	4	0.01μF	Samsung	CL10B103KC8NNNC
C6, C25	CAP CER 1000pF 2KV X7R 1206	2	1nF	Yageo	CC1206KKX7RDBB102
C7, C21, C28	CAP CER 0.047μF 100V X7R 0805	3	47nF	Murata Electronics	GRM21BR72A473KA01L
C8, C22	CAP CER 22pF 100V C0G/NPO 0603	0	DNP	Yageo	CC0603JRNPO0BN220
C9, C10, C46	CAP CER 100pF 100V X7R 0603	3	100pF	Yageo	CC0603KRX7R0BB101
C11	CAP CER 0.1μF 100V X7R 0805	1	0.1μF	Yageo	CC0805KKX7R0BB104
C12, C13, C14	CAP CER 4.7μF 100V X7S 1210	3	4.7μF	Samsung, Murata	CL32Y475KCIVPNE
C15	CAP ALUM 47μF 20% 100V SMD	1	47μF	Nichicon	UUR2A470MNL1GS
C16, C17, C18	CAP CER 47μF 25V X5R 1210	3	47μF	KYOCERA AVX	KGM32LR51E476MU
C19	CAP CER 1.0μF 25V X7R 0805	1	1μF	Samsung	CL21B105KAFNNNE
C20	CAP ALUM 330μF 20% 25V SMD	1	330μF	Nichicon	UUD1E331MNL1GS
C23	CAP CER 4.7μF 25V X7R 0805	1	4.7μF	Samsung	CL21B475KAFNNNE
C24	CAP CER 0.1μF 50V X7R 0805	1	0.1μF	Samsung	CL21B104KBCNNNC
C26, C29, C32, C36, C39, C40, C42, C45	CAP 0603	0	DNP		
C27	CAP CER 0.047μF 250V X7R 1206	1	47nF	Murata	GRM31CR72E473KW03L
C30	CAP CER 1000pF 100V X7R 0805	1	1nF	Samsung	CL21B102KCANNNC
C31, C52, C53	CAP CER 1000pF 50V X7R 0603	3	1nF	Samsung	CL10B102KB8NNNC
C33	CAP CER 0.1μF 50V X7R 0603	1	0.1μF	Samsung	CL10B104KB8NNNC
C34, C37	CAP CER 1μF 16V X7R 0603	2	1μF	Samsung	CL10B105KO8NNNC
C35	CAP CER 0.047μF 50V X7R 0603	1	47nF	Samsung	CL10B473KB8NNNC
C38	CAP CER 0.01μF 50V X7R 0603	1	10nF	Samsung	CL10B103KB8NNNC
C41	CAP CER 2200pF 50V X7R 0603	1	2.2nF	Samsung	CL10B222KB8NNNC
C43	CAP CER 10000pF 100V X7R 0603	1	10nF	Murata Electronics	GCM188R72A103KA37D
C44	CAP CER 100pF 50V C0G/NPO 0603	1	100pF	Samsung	CL10C101JB8NNNC
C47	CAP CER 1μF 50V X5R 0603	1	1μF	Yageo	CC0603KRX7R9BB105
C48, C49	CAP CER 10000pF 100V X7R 0603	0	DNP	Murata Electronics	GCM188R72A103KA37D
C50, C51	CAP CER 1μF 100V X7R 0805	2	1.0μF	KYOCERA AVX	08051C105K4Z2A
C54	CAP CER 4.7μF 100V X7R 1210	1	4.7μF	Samsung	CL32B475KCVZNWE
D2, D3	DIODE GEN PURP 100V 200MA SOD123	0	DNP	ON Semiconductor	MMSD914T1G
D4, D12	DIODE SUPERFAST SMA 100V 15NS	2		ON Semiconductor	ES1B
D5, D8, D11, D13	DIODE GEN PURP 100V 200MA SOD123	4		ON Semiconductor	MMSD914T1G
D6	ZENERDIODE, SOD-123, 11.40V~12V	0	DNP	Diotec Semiconductor	MMSZ5242B
D7	ZENERDIODE, SOD-123, 11.40V~12V	0	DNP	Diotec Semiconductor	MMSZ5242B
D9	ZENERDIODE, SOD-123, 11.40V~12V	1		Diodes Incorporated	MMSZ5242B
D10	DIODE ZENER 5.6V 500MW SOD123	1		Diodes Incorporated	BZT52C5V6-7-F
D14	DIODE ARRAY SCHOTTKY 30V SOT23-3	1		BAT54S-7-F	Diodes Incorporated

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Designator	Description	Quantity	Value	Manufacturer	Manufacturer Part Number
D1, D15, D16, D17, D18, D20, D21, D22, D23	DIODE SCHOTTKY 100V 2A SMB	0	DNP	Diodes Incorporated	B2100-13-F
D19	TVS DIODE 58VWM 93.6VC DO214AC	1		Littelfuse Inc.	SMAJ58A
D54, D55	TVS DIODE 58VWM 93.6VC DO214AB	2		Littelfuse Inc.	SMDJ58CA
FB1, FB2, FB3, FB4	FERRITE BEAD 220Ω 0603 1LN	4	220	Murata Electronics	BLM18EG221SN1D
J1, J2, J3, J4, J5, J8	TERM TURRET SINGLE L=7.14MM TIN	6		Keystone Electronics	1514-2
J6	CONN HEADER VERT 3POS 2.54MM	1		Sullins	PREC003SAAN-RC
J7	CONN HEADER VERT 2POS 2.54MM	1		Sullins Connector Solutions	PREC002SAAN-RC
L1	FIXED IND 5.5μH 10A 10.3MΩ SMD	1	5.5μH	Würth Electronics	744325550
L2	FIXED IND 6.1μH 11A 7.8 MΩ SMD	1	6.1μH	Sumida	CDEP147NP-6R1MC-95
L3, L5	WE-SL5 SMT Common Mode Line Filter, 250μH, 2A, 0.035Ω	2		Würth Elektronik	744272251
L4	FIXED IND 1MH 200MA 6Ω SMD	1	1mH	Würth Elektronik	74404054102
Q1, Q6	MOSFET N-CH 80V 11A/55A TDSO	1		Infineon	BSC123N08NS3GATMA1
Q2, Q7	MOSFET N-CH 80V 11A/55A TDSO	0	DNP	Infineon	BSC123N08NS3GATMA1
Q3, Q4	TRANS NPN 100V 1A SOT89-3	0	DNP	Diodes Incorporated	FCX493TA
Q5	TRANS NPN 40V 0.2A SOT23-3	1		Diode Semiconductor	MMBT3904-7
Q8	MOSFET P-CH 150V 8.9A PPAK1212-8	1	FDMC2523P	Vishay Siliconix	SI7115DN-T1-GE3
Q9	MOSFET N-CH 150V 9.6A/35A 8PQFN	1		ON Semiconductor	190N12NS
Q10	MOSFET N-CH 60V 15A PWRDI3333	1		Diodes Incorporated	DMT6007LFG-7
R1, R2, R3, R4, R9, R20, R26, R30	RES 75Ω 1% 1/10W 0603	8	75	Yageo	RC0603FR-0775RL
R5, R8, R10, R59, R68, R70	RES 0805	0	DNP		
R6, R17	RES 4.7KΩ 1% 1/10W 0603	0	DNP	Yageo	RC0603FR-074K7L
R7, R14	RES 4.7Ω 1% 1/10W 0603	0	DNP	Yageo	RC0603FR-074R7L
R11	RES 150KΩ 1% 1/10W 0603	1	150K	Yageo	RC0603FR-13150KL
R12, R21, R22, R23, R25, R37, R38, R56	RES 10KΩ 1% 1/10W 0603	8	10K	Yageo	RC0603FR-0710KL
R13	RES 82KΩ 1% 1/10W 0603	1	82K	Yageo	RC0603FR-0782KL
R15, R28, R35, R41, R42, R46, R50, R53, R66, R88, R89, R90, R93, R94, R95	RES 0Ω JUMPER 1/10W 0603	15	0	Yageo	RC0603FR-070RL
R16	RES 100KΩ 1% 1/10W 0603	1	100K	Yageo	RC0603FR-07100KL
R18	RES 680KΩ 1% 1/10W 0603	1	680K	Yageo	RC0603FR-07680KL
R19, R32	RES 51KΩ 1% 1/8W 0805	2	51K	Yageo	RMCF0805FT51K0
R24	RES 3.3KΩ 1% 1/8W 0805	1	3.3K	Yageo	RC0805FR-073K3L
R27	RES 30.1KΩ 1% 1/10W 0603	1	30.1K	Yageo	RC0603FR-0730K1L
R29, R47, R49, R52, R54, R60, R62, R64, R65, R67	RES 0603	0	DNP		

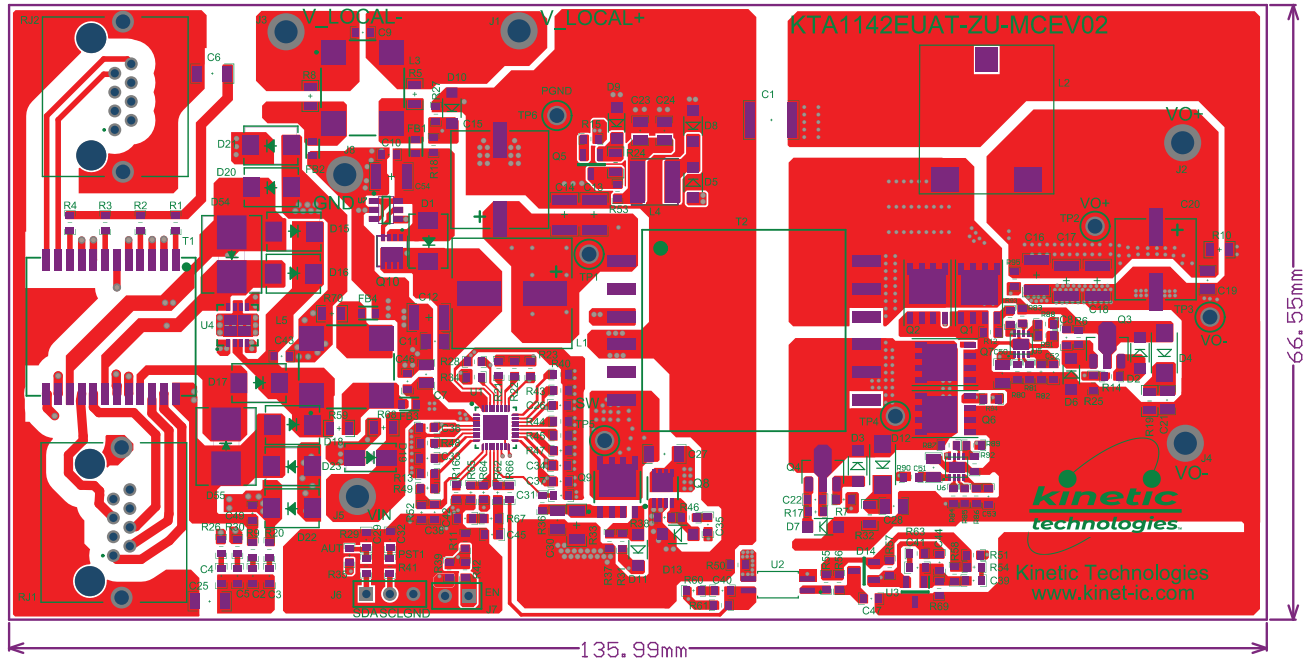
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Designator	Description	Quantity	Value	Manufacturer	Manufacturer Part Number
R31	RES 10Ω 1% 1/10W 0603	1	10	Yageo	RC0603FR-0710RL
R33	RES 33mΩ 1% 1/10W 1206	1	33m	Yageo	RL1206FR-070R033L
R34	RES 25.5KΩ 1% 1/10W 0603	1	25.5K	Yageo	RC0603FR-0725K5L
R36	RES 100Ω 1% 1/10W 0603	1	100	Yageo	RC0603FR-07100RL
R39	RES 3.9MΩ 1% 1/10W 0603	1	3.9M	Yageo	RC0603FR-073M9L
R40	RES 60.4KΩ 1% 1/10W 0603	1	60.4K	Yageo	RC0603FR-0760K4L
R43	RES 237KΩ 1% 1/10W 0603	1	237K	Yageo	RC0603FR-07237KL
R44	RES 90.9KΩ 1% 1/10W 0603	1	90.9K	Yageo	RC0603FR-0790K9L
R45	RES 63.4KΩ 1% 1/10W 0603	1	63.4K	Yageo	RC0603FR-0763K4L
R48	RES 43.2KΩ 1% 1/10W 0603	1	43.2K	Yageo	RC0603FR-0743K2L
R51	RES 20Ω 1% 1/10W 0603	1	20	Yageo	RC0603FR-0720RL
R55	RES SMD 2.2KΩ 1% 1/10W 0603	1	2.2K	Yageo	AF0603FR-072K2L
R57	RES 20KΩ 0.1% 1/10W 0603	1	20k	YAGEO	RC0603JR-0720KL
R58	RES 62KΩ 1% 1/10W 0603	1	62K	Yageo	RC0603FR-0762KL
R61	RES 3.3KΩ 1% 1/10W 0603	1	3.3K	Yageo	RC0603FR-073K3L
R63	RES 22KΩ 1% 1/10W 0603	1	22K	Yageo	RC0603FR-0722KL
R69	RES 7.15KΩ 1% 1/10W 0603	1	7.15K	Stackpole Electronics Inc	RMCF0603FT7K15
R80	RES 7.5KΩ 1% 1/10W 0603	1	7.5K	Yageo	RC0603FR-077K5L
R81, R84	RES SMD 1.5KΩ 1% 1/10W 0603	2	1.5K	Yageo	AC0603FR-071K5L
R82, R86, R91, R92	RES 10KΩ 1% 1/10W 0603	0	DNP	Yageo	RC0603FR-0710KL
R83, R87	RES 330Ω 1% 1/10W 0603	2	330	Yageo	RC0603FR-07330RL
R85	RES 5.1KΩ 1% 1/10W 0603	1	5.1K	Yageo	RC0603FR-075K1L
RJ1, RJ2	Mod Jack; Right Angle; 8 Position; Cat 5; Shielded; Inverted; Panel & PCB Ground	2		TE Connectivity	1-406541-1
T1	WE-LAN LAN Transformer, SMT, 1000 Base-T, 1 port	1		Würth Elektronik	7490220122
T2	WE-POE POWER-OVER-ETHERNET TRANS	1		Würth Elektronik	750319034
TP1, TP2, TP4	PC TEST POINT MULTIPURPOSE RED	3		Keystone	5010
TP3, TP6	PC TEST POINT MULTIPURPOSE BLACK	2		Keystone	5011
TP5	PC TEST POINT MULTIPURPOSE YELLOW	1		Keystone	5014
U1	IEEE 802.3bt-Compliant, PoE Powered Device With DC-DC Controller	1		Kinetic Technologies	KTA1142
U2	Optoisolator Transistor Output 3750Vrms 1 Channel 4-SOP	1		Vishay Semiconductor	TCMT1107
U3	IC VREF SHUNT ADJ 1% SOT23-3	1		Texas Instruments	Texas Instruments
U4	Integrated Dual MOSFET Bridge Rectifier	1		Kinetic Technologies	KTA1170
U5, U6	Power Supply Controller Secondary-Side Controller, Synchronous Rectifier 8-DFN (2x2.2)	2		ON Semiconductor	NCP4306AAZZAMN1TBG
U7	Ideal Diode and Load Switch Controller with Reverse Input Protection	1		Kinetic Technologies	KTS1900GXAA-TA

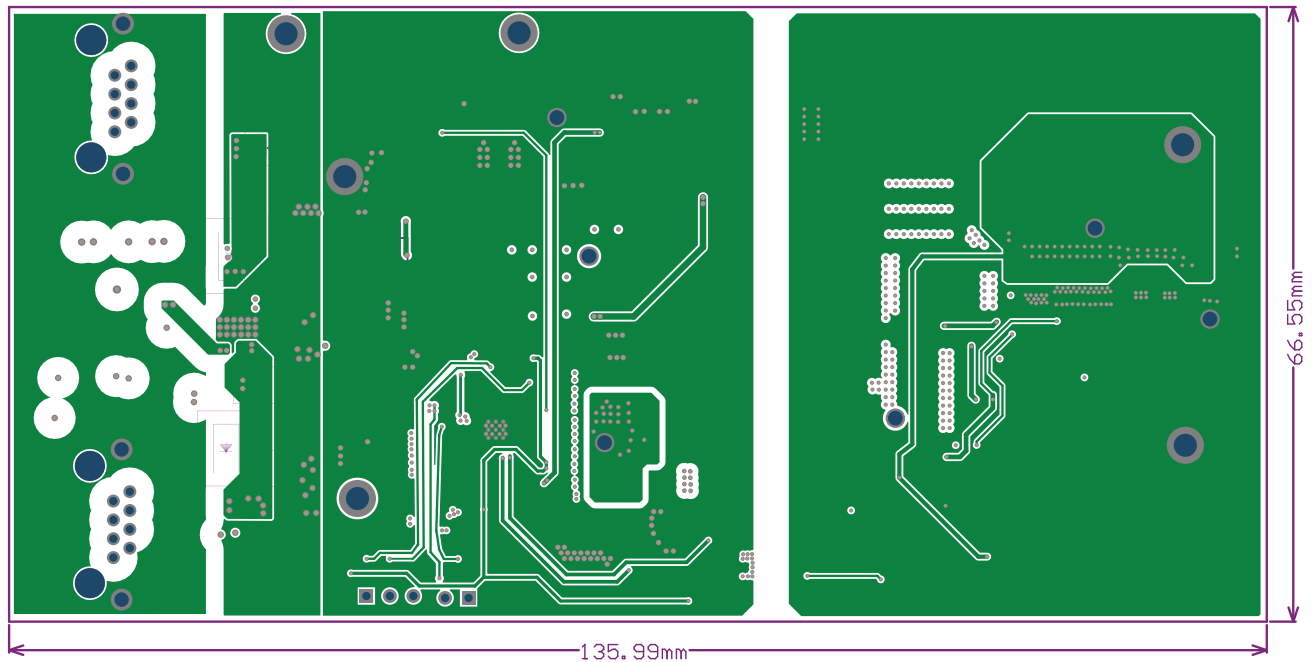
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Printed Circuit Board (PCB)

Top Side Layout/Routing

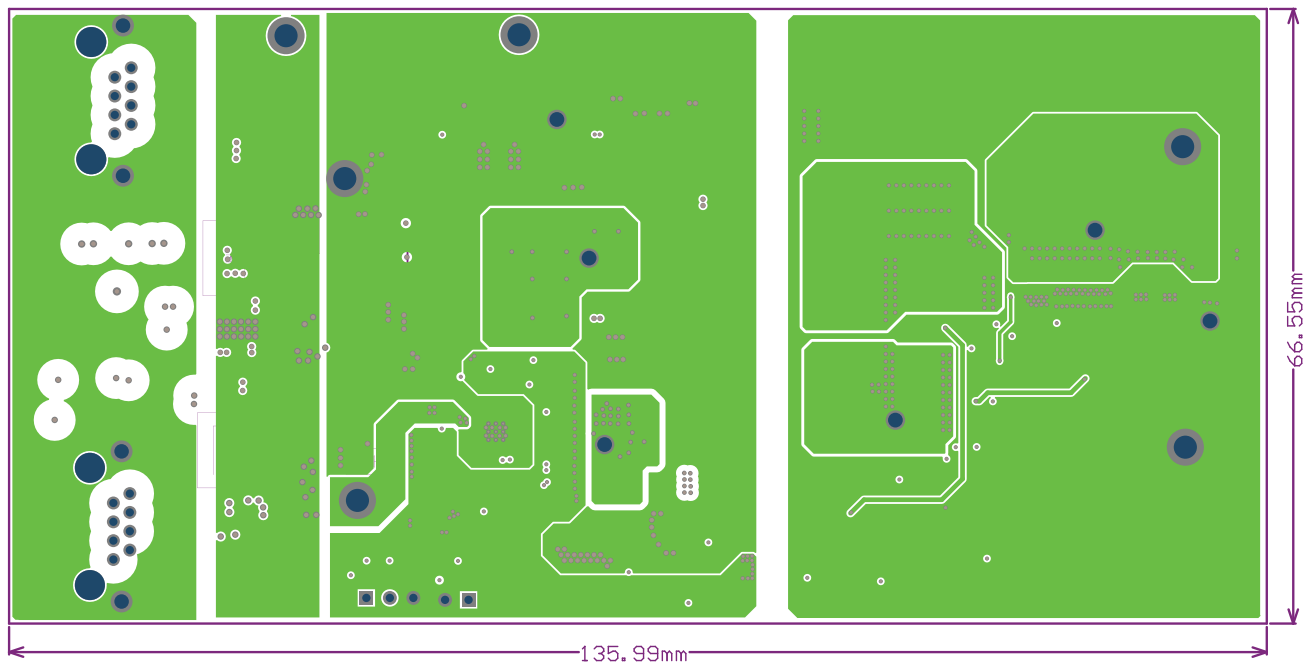


Layer Two Routing

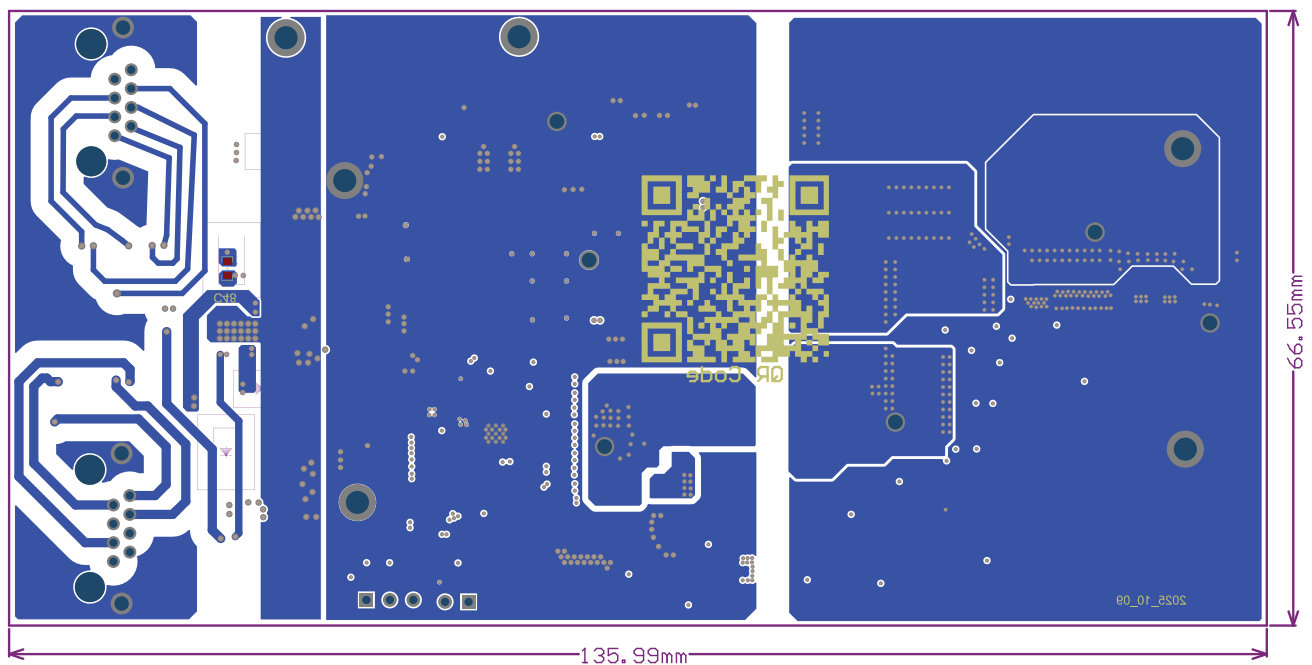


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Layer Three Routing



Bottom Layer Routing



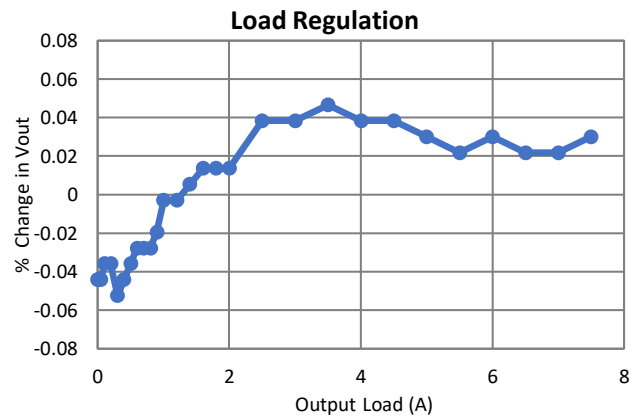
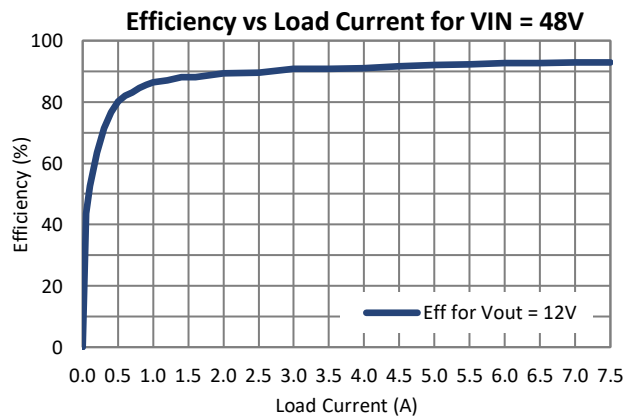
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Test Setup

1. The “Typical Test Setup Diagram” shows a typical setup for the KTA1142 (forward topology) EVAL board. Input voltage can be applied as described in the “Recommended Operating Conditions” Table
2. When a PSE PoE injector or PoE capable switch is used to source power, the KTA1142 (forward topology) EVAL board will automatically start up and 12V may be observed on the output VO+/VO- pins
3. If an external bench power supply is used to source power to the V_Local+ and V_Local- input pins, the KTA1142 PD functionality will be bypassed. However, when power is applied to this input, the KTA1142 active clamp forward controller will regulate the EVAL board output to 12V.
4. Digital multimeters may be used to monitor the input voltage level (VIN and GND test points) and output voltage levels at VO+/VO-
5. A load may be applied to the output at VO+/VO-. The load should not exceed 6A at 12V (72W) output.

Test Results

When testing the KTA1142EUAT-ZU-MCEV02 evaluation boards by using an Agilent 6644 DC power supply, the resulting efficiency and load regulation curves are shown below. Data measured on KTA1142 (Forward) evaluation boards identified as KTA1142EUAT-ZU-MCEV02 and powered using an IEEE802.3 compliant PSE power source should provide similar results.



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