

IEEE 802.3at PoE PD with Integrated DC-DC Controller

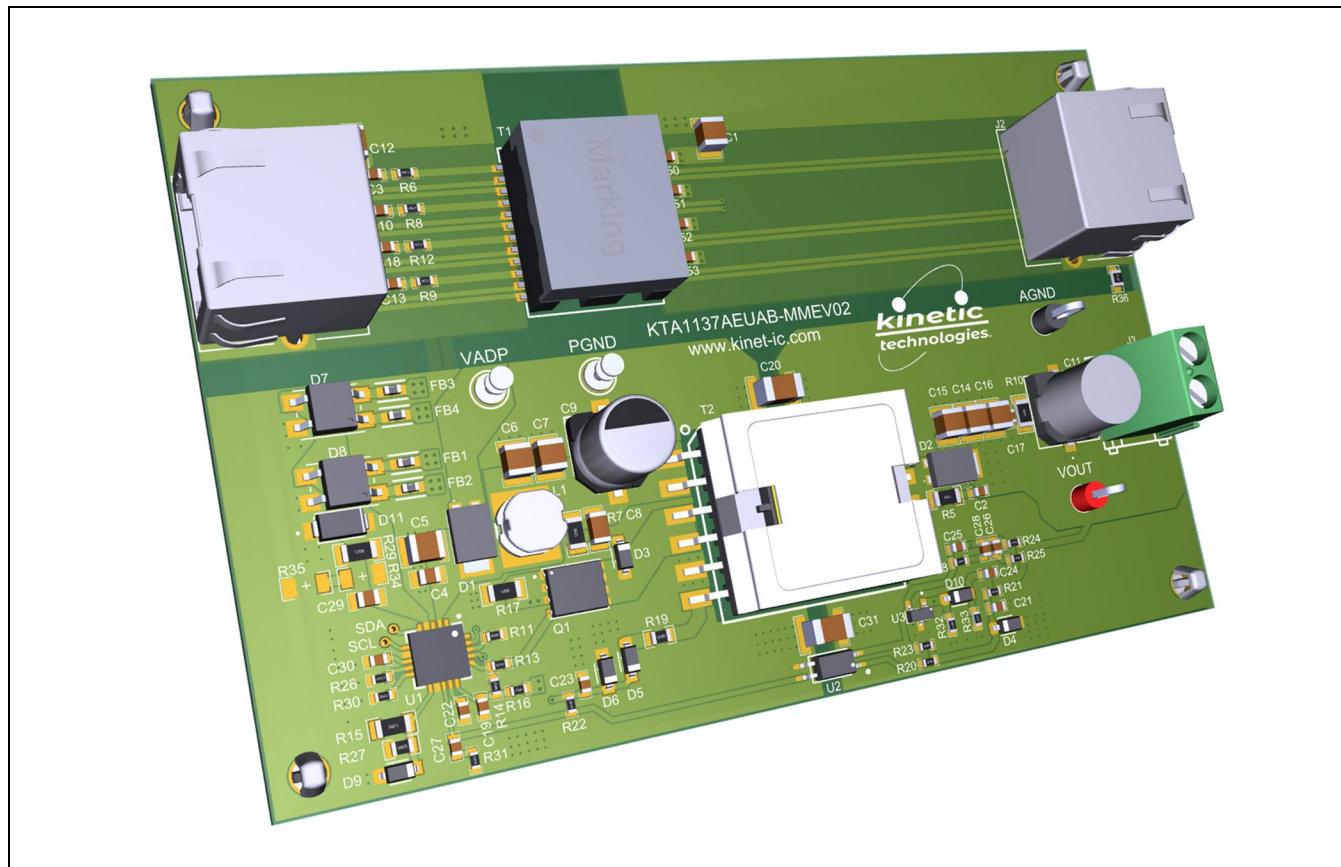
### Brief Description

The KTA1137A Evaluation (EVAL) Kit is used to demonstrate and evaluate the KTA1137A functionality, performance, and PCB layout. The kit includes a fully assembled and tested PCB with the KTA1137A IC installed, and a printed copy of the Quick Start Guide. The KTA1137A device is an IEEE 802.3af/at compliant combination powered device (PD) controller and power supply controller optimized for isolated and non-isolated converter topologies. This KTA1137A EVAL board provides power and signal I/O connections and an array of test points for signal observation. A non-synchronous 12V, 25W flyback topology design is featured, but synchronous rectified designs are also possible using synchronous winding of the transformer.

### Ordering Information

Part Number	Description	IC Package
KTA1137AEUAB-MMEV02	KTA1137A EVAL Kit – Version 2	QFN55-20



### 3D CAD Image



### EVAL Kit Physical Contents

Item #	Description	Quantity
1	KTA1137A Evaluation board fully assembled PCB	1
2	Anti-static bag	1
3	KTA1137A 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
 <a href="https://www.kinet-ic.com/kta1137a">https://www.kinet-ic.com/kta1137a</a>	 <a href="https://www.kinet-ic.com/kta1137aeuab-mmev02">https://www.kinet-ic.com/kta1137aeuab-mmev02</a>

### User-Supplied Equipment

- Power Sourcing Equipment (PSE) or Bench Power Supply for  $V_{IN} = 37V-57V$  and 1A as needed for intended application.
- Digital Multimeter – used to measure input/output voltages and currents.
- Load – either power resistors, an E-Load, or an actual system load.

### Recommended Operating Conditions

Parameter	Condition	Min	Typ	Max	Units
<b>Power Interface</b>					
Input voltage	Applied to power pins of connectors RJ1 or J1	0		57	V
Operation voltage	After start-up with 37V or above	34		57	V
Input UVLO	Rising input voltage		34		V
	Falling input voltage		30		V
Detection voltage	At device terminals	2.7		13	V
Classification voltage	At device terminals	11		24	V
Classification current	$R_{CLASS} = 63.4k\Omega$	36		44	mA
Inrush current-limit		100		400	mA
Operation current-limit			1200		mA
<b>DC/DC Converter</b>					
Output voltage	$34 \leq V_{IN} \leq 57V, I_{LOAD} \leq I_{LOAD (MAX)}$				V
Output current	$34 \leq V_{IN} \leq 57V$		2.1		A
Output ripple voltage (peak to peak)	$V_{IN} = 48V, I_{LOAD} = 2.1A$		50		mV
Efficiency (end to end)	$V_{IN} = 48V, I_{LOAD} = 2.1A$		86.61		%
Switching frequency		110		130	kHz

### Quick Start Procedures

The output voltage of this board is set to 12V. There are two methods to start KTA1137AEUAB-MMEV02:

#### Method 1: Connect to PSE

1. Connect a voltage meter to the output VOUT and AGND test pins, it should measure the output voltage.
2. Connect the load to the output VOUT and AGND test pins.
3. Connect the cable coming from the PSE into the Ethernet Jack J1. The board will automatically startup.

#### Method 2: Connect to Local Power Supply

1. Connect one pair of power cables to the connector of EVAL Kit at VADP (9.5V ~ 57V) and PGND.
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 turn off the supply. While off, connect the power cables ends to the bench supply.
3. Connect a voltage meter to the output VOUT and AGND test pins, it should measure the output voltage.
4. Connect the load to the output VOUT and AGND test pins.
5. Turn on the VIN bench supply and very slowly ramp its voltage to an appropriate voltage, such as 48V. 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.

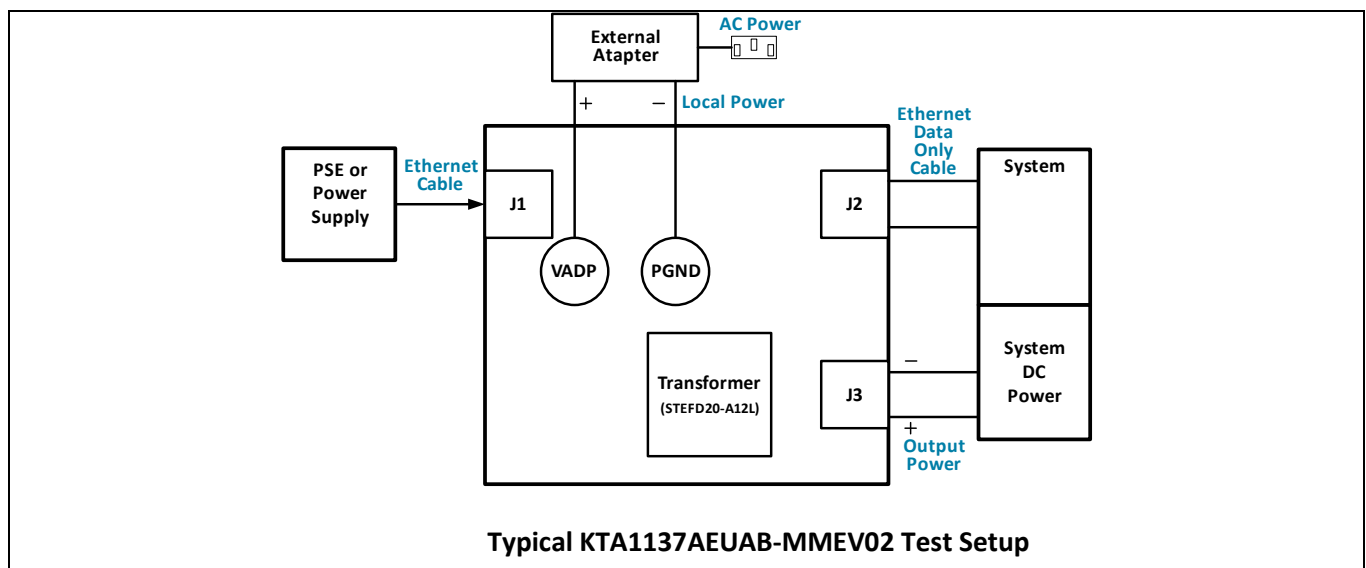
### General Configuration

#### Connector Functionality

Connector	Description
J1	Ethernet power input connector (RJ45 style connector)
J2	Ethernet data port connector (RJ45 style connector)
J3	VOUT (output) to system DC power
PGND	Adapter ground
VADP	External adaptor input (9.5V ~ 57V)

### Typical Test Setup

The figure below shows a typical setup for KTA1137A EVB. Input voltage can be applied as described in the Connector Functionality table above.

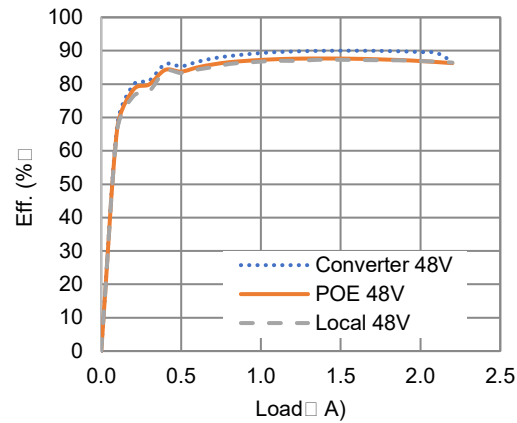


## Typical Performance Data

### 12V Output DC/DC Efficiency

The Figure below illustrates three different 48VDC input efficiency plots:

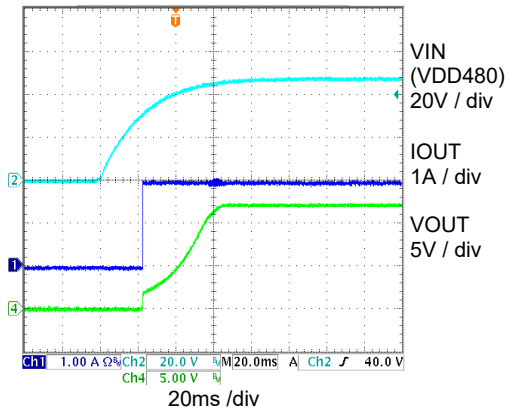
1. POE, 48V from RJ1
2. Converter only 48V
3. Adaptor 48V from J1



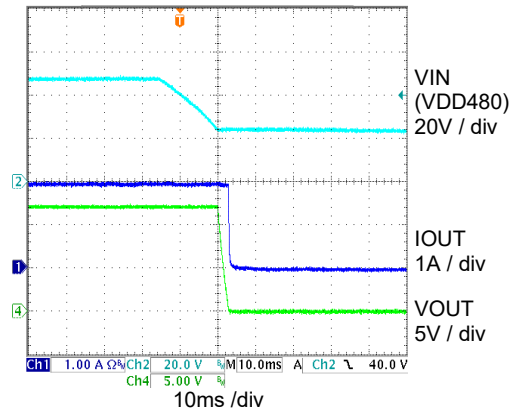
### KTA1137A EVB Efficiency with 12V Output

### Operational Waveforms

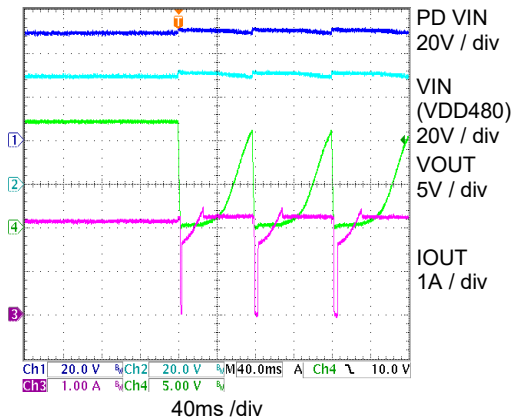
**Power Up**



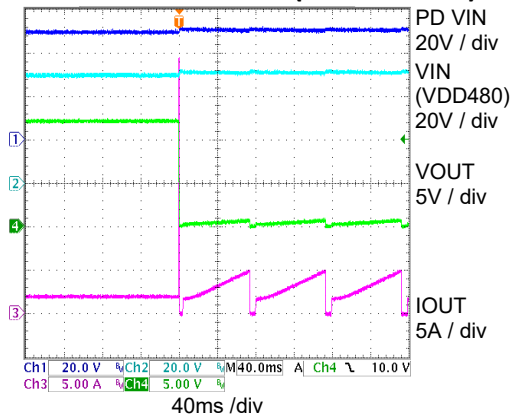
**Power-down**



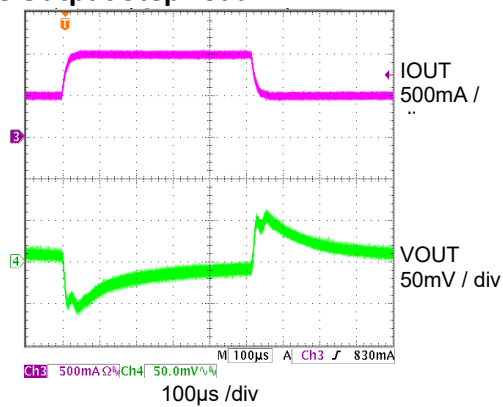
**Over Current Protection (Overload)**



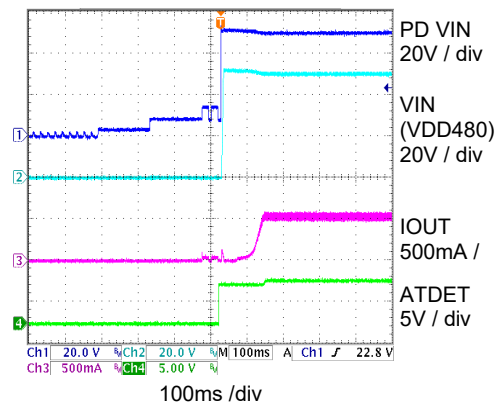
**Over Current Protection (Short Circuit)**



**DC-DC Output Step Load**



**AT Detection**





### Bill of Materials (BOM)

Designator	Description	Value	Package	Manufacturer	Manufacturer Part Number
C1	CAP CER 1000pF 2KV X7R 1210	1nF	1210	Johanson Dielectrics Inc.	202S41W102KV4E
C2	CAP CER 1000pF 100V X7R 0603	1000pF	0603	Samsung	CL10B102KC8NNNC
C3, C10, C13, C18	CAP CER 10nF 100V X7R 0603	10nF	0603	Samsung	CL10B103KC8NNNC
C4	CAP CER 0.1µF 100V X7R 0805	0.1µF	0805	Yageo	CC0805KKX7R0BB104
C5, C6, C7	CAP CER 4.7µF 100V X7S 1210	4.7µF	1210	Taiyo Yuden	HMK325C7475KN-TE
C8	CAP CER 0.022µF 100V X7R 1206	22nF	1206	Yageo	CC0805KRX7R0BB223
C9	CAP ALUM 47µF 20% 63V SMD	47µF	SMD	Panasonic	EEE-HA1J470UP
C11	CAP ALUM 330µF 20% 25V SMD	330µF	SMD	Wurth Electronics	865060453008
C12	CAP CER 1000pF 2KV X7R 1206	1nF	1206	Yageo	CC1206KKX7RDBB102
C14, C15, C16	CAP CER 47µF 16V X5R 1210	47µF	1210	Murata	GRM32ER61C476KE15L
C17, C50, C51, C52, C53	CAP CER 0.1µF 16V X7R 0603	0.1µF	0603	Samsung	CL10B104K08NNNC
C19, C25	CAP CER 100pF 50V C0G/NP0 0603	100pF	0603	Samsung	CL10C101JB8NNNC
C20, C31	CAP CER 4700pF 2KV X7R 1812	4.7nF	1812	Yageo	CC1812KXK7RDBB472
C21	CAP CER 10µF 16V X5R 0603	10µF	0603	Murata	GRM188R61C106MA73D
C22, C23, C30	CAP CER 1µF 16V X5R 0603	1µF	0603	Samsung	CL10A105K08NNNC
C24	CAP CER 0.22µF 25V X7R 0603	0.22µF	0603	Samsung	CL10B224KA8NNNC
C26, C27	CAP 0603	DNP	0603		
C28	CAP CER 0.01µF 50V X7R 0603	10nF	0603	Samsung	CL10B103KB8NNNC
C29	CAP CER 0.068µF 100V X7R 0805	0.068µF	0805	Yageo	CC0805KKX7R0BB683
D1, D2	DIODE SCHOTTKY 100V 10A TO277B			LITTELFUSE	DST10100S-A
D3	DIODE GEN PURP 200V 200MA SOD123		SOD123	SMC Diode Solutions	BAV21W
D4, D6, D9	DIODE ZENER 5.6V 500MW SOD123		SOD123	Diodes Inc	BZT52C5V6-7-F
D5, D10	DIODE ZENER 27V 500MW SOD123		SOD123	onsemi	MMSD4148T1G
D7, D8	BRIDGE RECT 1PHASE 100V 2A MBS-2		TO-269AA	Comchip Technology	CDBHM2100L-HF
D11	TVS DIODE 58VWM 93.6VC DO214AC		DO-214AC	Littelfuse Inc.	SMAJ58A
FB1, FB2, FB3, FB4	FERRITE BEAD 220Ω 0603 1LN	220	0603	Murata Electronics	BLM18EG221SN1D
H1, H2, H3, H4	BRD SPT SNAP LOCK REST MNT 4MM			Essentra Components	PSD-4M-19
J1, J2	CONN MOD JACK 8P8C R/A SHIELDED		None	TE Connectivity	1-406541-1
J3	TERM BLK 2P SIDE ENT 5.08MM PCB			TE Connectivity	282837-2
L1	FIXED IND 6.8µH 2.8A 47.3MΩ SM	6.8µH	SMD	Bourns Electronics	SRN6045-6R8Y
Q1	MOSFET N-CH 150V 4.4A 8PQFN		PQFN-8	ON Semiconductor	FDMS86252L
R5	RES SMD 4.7Ω 1% 1/4W 1206	4.7	1206	Yageo	RC1206FR-074R7L
R6, R8, R9, R12	RES SMD 75Ω 1% 1/10W 0603	75	0603	Yageo	RC0603FR-0775RL
R7	RES SMD 24.9KΩ 1% 1/4W 1206	24.9K	1206	Yageo	RC1206FR-0724K9L
R10	RES 1206	DNP	1206		
R11	RES SMD 143K 1% 1/10W 0603	143K	0603	Yageo	RC0603FR-07143KL
R13	RES SMD 10Ω 1% 1/10W 0603	10	0603	Yageo	RC0603FR-0710RL
R14	RES SMD 30K 1% 1/10W 0603	30.1K	0603	Yageo	RC0603FR-0730K1L
R15	RES SMD 2.74k 1% 1/4W 1206	2.74K	1206	Yageo	RC1206FR-072K74L



# EVAL Kit Manual

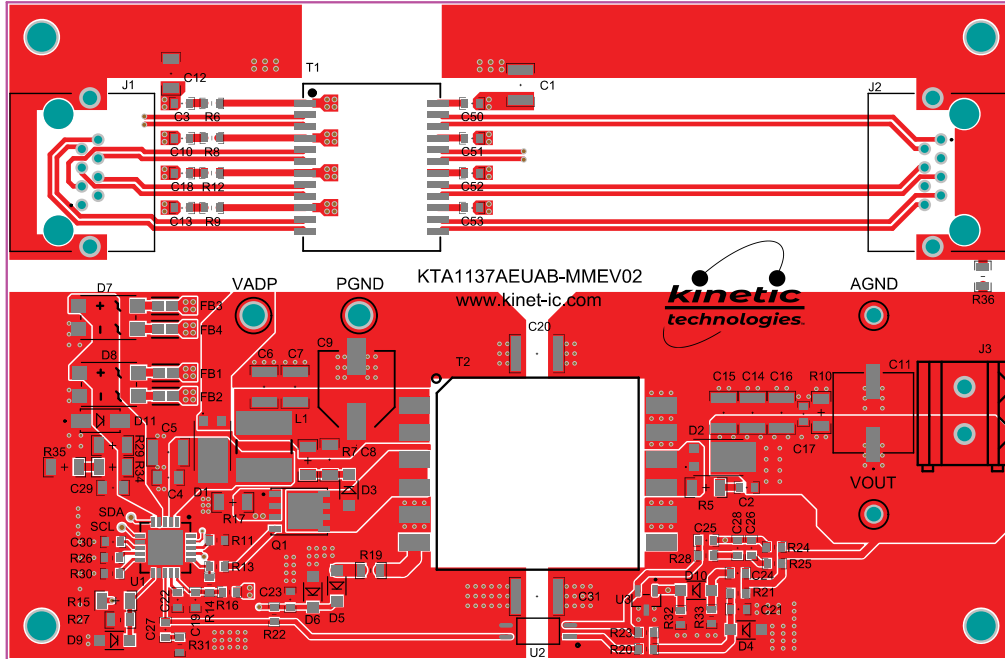
## KTA1137A

Designator	Description	Value	Package	Manufacturer	Manufacturer Part Number
R16, R20	RES SMD 1K 1% 1/10W 0603	1K	0603	Yageo	RC0603FR-071KL
R17	RES SMD 100mΩ 1% 1/4W 1206	0.1	1206	Yageo	RL1206FR-070R1L
R19	RES SMD 22.1Ω 1% 1/10W 0805	22.1	0805	Yageo	RC0805FR-0722R1L
R21	RES SMD 499 Ω 1% 1/10W 0603	499	0603	Yageo	RC0603FR-07499RL
R22	RES SMD 10K 1% 1/10W 0603	10K	0603	Yageo	RC0603FR-0710KL
R23	RES SMD 3.24K 1% 1/10W 0603	3.24K	0603	Yageo	RC0603FR-073K24L
R24	RES SMD 39.2K 1% 1/10W 0603	39.2K	0603	Yageo	RC0603FR-0739K2L
R25, R26, R31	RES 0603	DNP	0603		
R27	RES SMD 4.02K 1% 1/10W 0805	4.02K	0805	Yageo	RC0805FR-074K02L
R28	RES SMD 30.1K 1% 1/10W 0603	30.1K	0603	Yageo	RC0603FR-0730K1L
R29	RES SMD 25.5K 1% 1/4W 1206	25.5K	1206	Yageo	RC1206FR-0725K5L
R30	RES SMD 63.4K 1% 1/10W 1206	63.4K	0603	Yageo	RC0603FR-0763K4L
R32	RES SMD 10.2K 1% 1/10W 0603	10.2K	0603	Yageo	RC0603FR-0710K2L
R33	RES SMD 10.7K 1% 1/10W 0603	10.7K	0603	Yageo	RC0603FR-0710K7L
R34	RES SMD 11K 1% 1/4W 1206	11K	1206	Yageo	RC1206FR-0711KL
R35	RES SMD 15K 1% 1/4W 1206	15K	1206	Yageo	RC1206FR-0715KL
R36	RES SMD 10Ω 1% 1/10W 0805	10	0805	Yageo	RC0805FR-0710RL
T1	WE-LAN LAN Transformer, SMT, 1000 Base-T, 1 port			Wurth Elektronik	7490220122
T2	Power Transformer			SamWha	STEFD20-A12L
TP1, TP2	TERM TURRET SINGLE L=5.56MM TIN		TH	Keystone	1502-2
TP3	PC TEST POINT MULTIPURPOSE RED		TH	Keystone	5010
TP4	PC TEST POINT MULTIPURPOSE BLACK		TH	Keystone	5011
U1	IEEE 802.3at PoE PD with Integrated DC-DC Controller		QFN55-20	Kinetic Technologies	
U2	OPTOISO 3.75KV TRANSISTOR 4SMD		4-SOIC	ON Semiconductor / Fairchild	HMHA2801A
U3	IC VREF SHUNT ADJ 0.5% SOT23-3		SOT-23-3	Texas Instruments	TL432BIDBZR

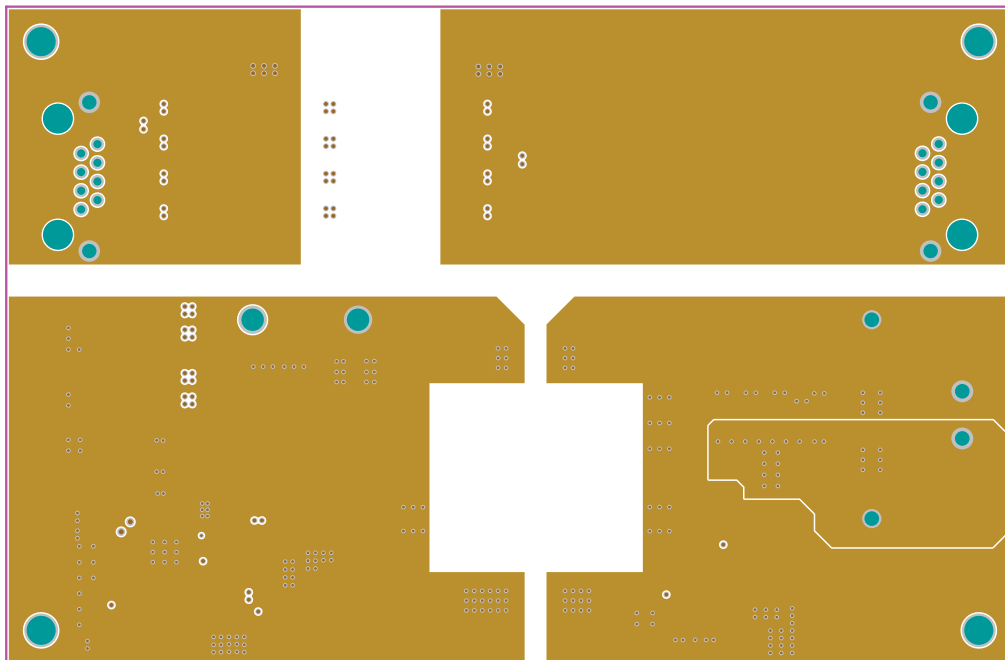


## Printed Circuit Board (PCB)

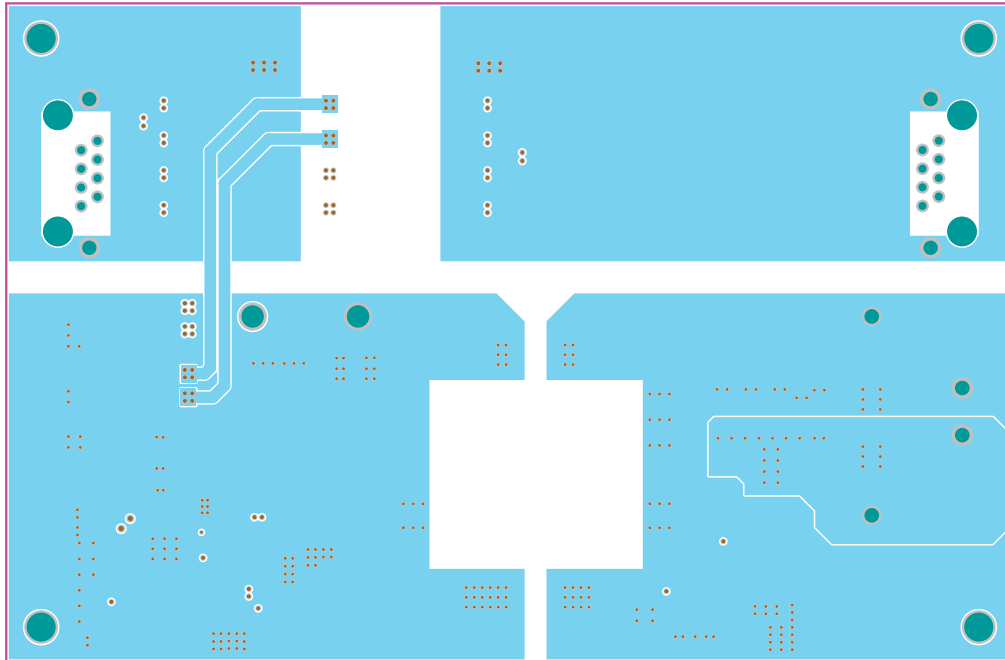
Top Side Layout/Routing



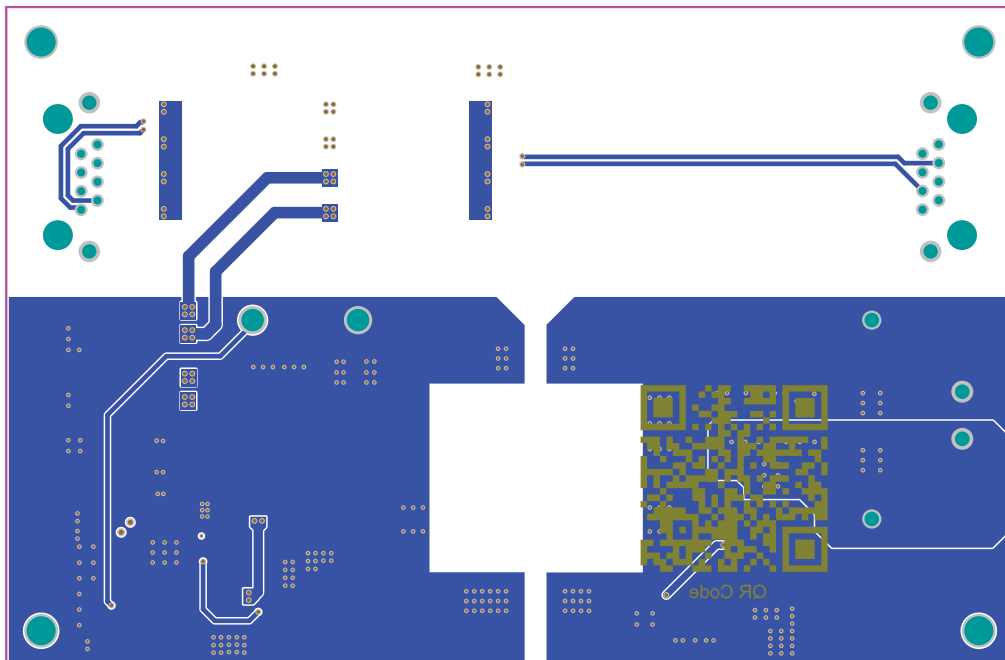
Layer Two Routing



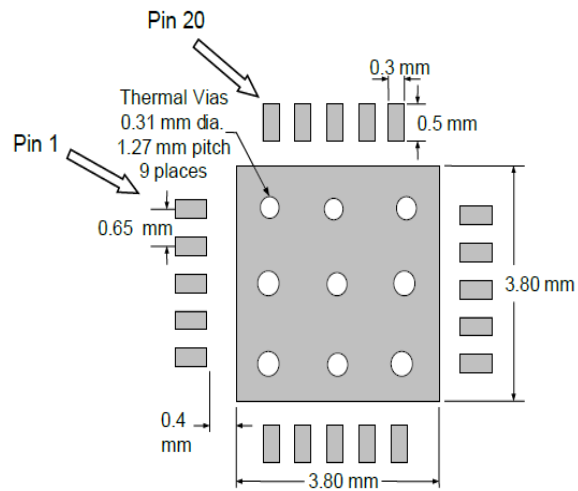
Layer Three Routing



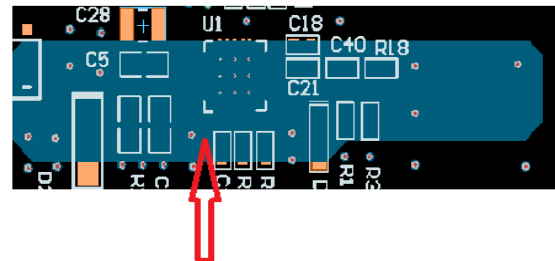
Bottom Layer Routing



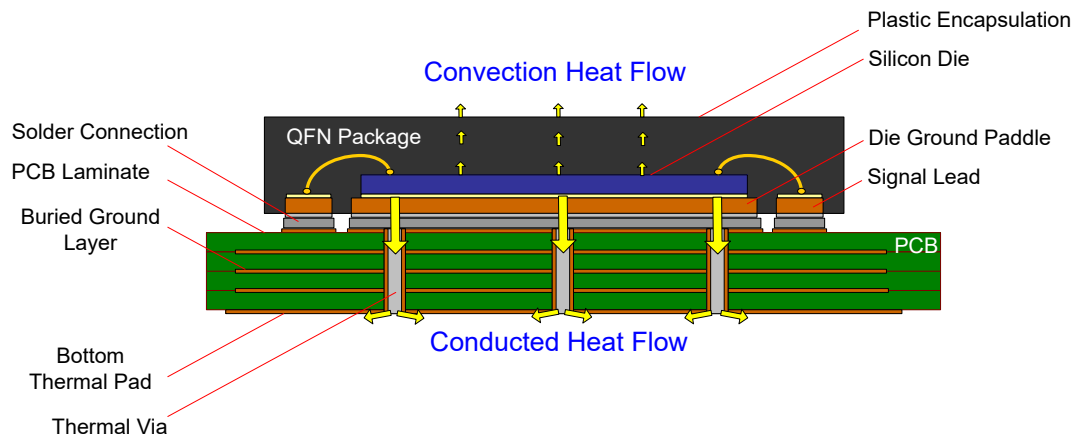
## Layout Guidelines



**KTA1137A Footprint (Top View)**

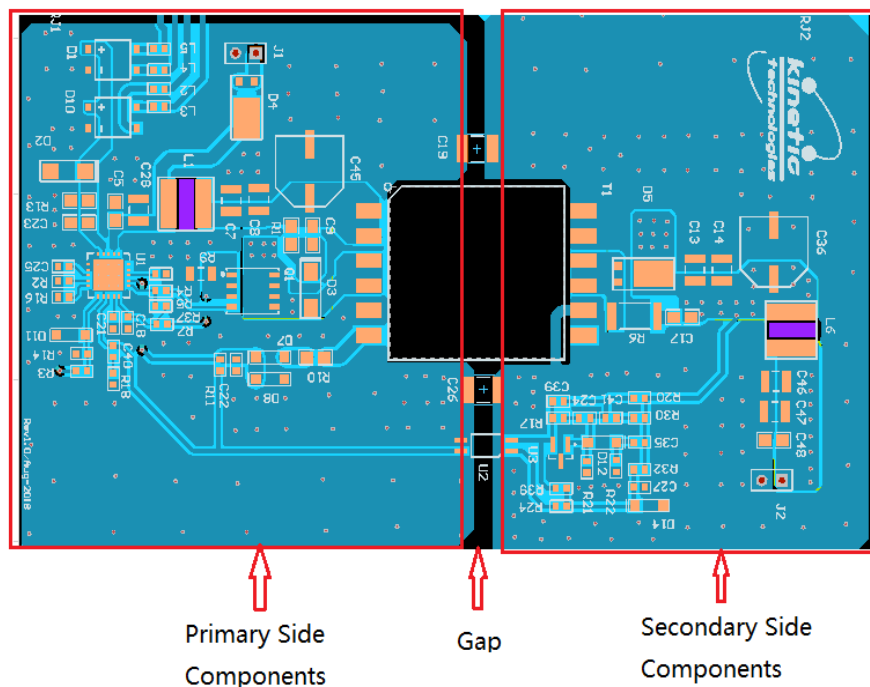


**Bottom Solder Mask**



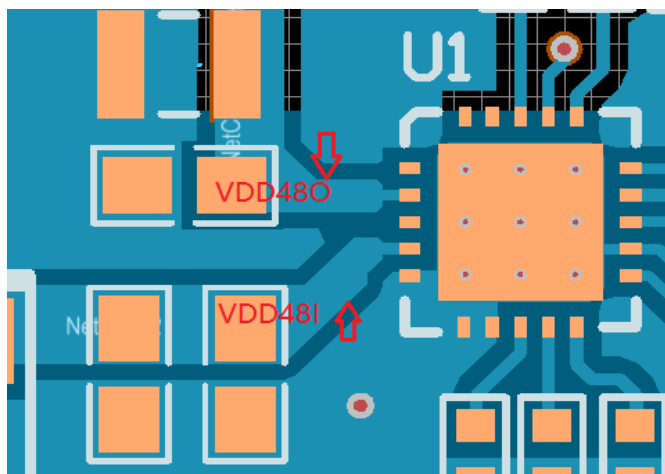
**KTA1137A PCB Footprint and Conducted Heat Flow**

The PCB layout is divided into primary (input) side and secondary (output) side components and typically separated by an isolation barrier. The primary components should be grouped together, and the secondary components should be grouped together. T1, U2, C20 and C31 are the only components bridging the isolation barrier between the primary and secondary circuitry. Primary and secondary traces, planes and other conductive items should be separated by a gap specified by the safety agency requirements appropriate for the insulation classification required by the application. The minimum spacing (creepage distance) for up to 63V input and Basic insulation is 1.25mm (IEC60950-1 Edition 2.2 2013-05). It is best practice to create a defined gap under T1, U2, C20 and C31 between primary side and secondary side as shown below.



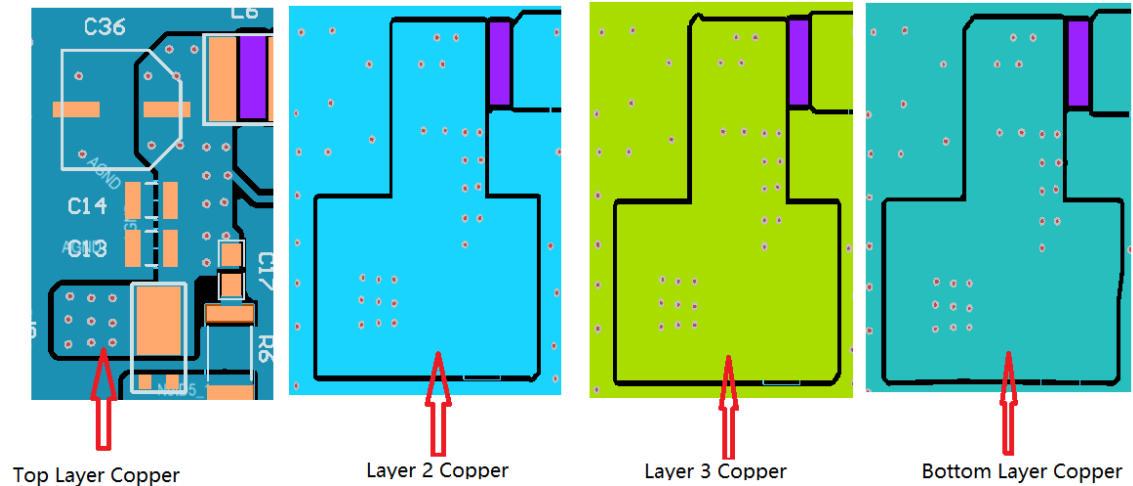
### Primary Side and Secondary Side Components Placement

Please note: There should be no crossover between VDD48I and VDD48O.



VDD48I and VDD48O Route

Large copper fills and traces should be used on SMT power -dissipating devices, and wide traces or overlay copper fills should be used in the power path, such as D1, D2, D4, D5, L1, Q1, T2 and U1.

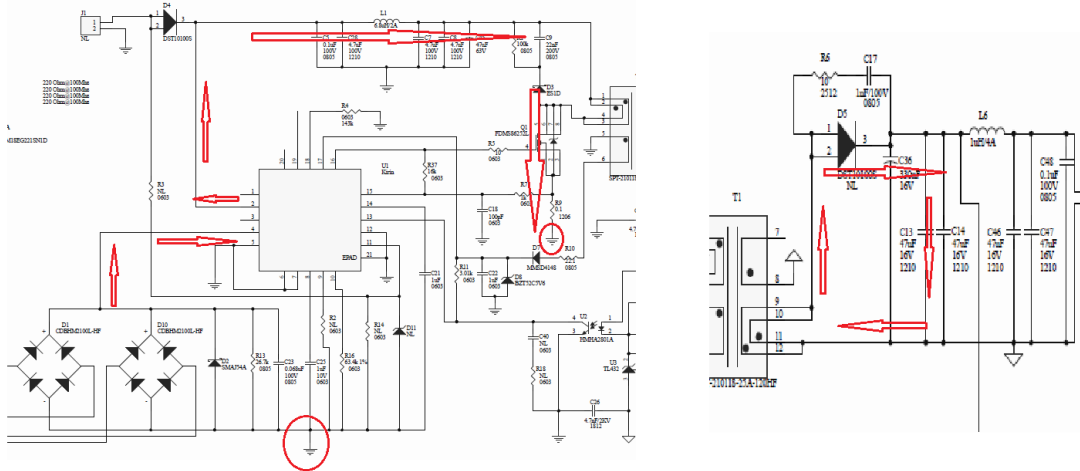


### Power-dissipating Device Route

- Parts placement should prioritize a minimize trace length with point-to-point connections, i.e. no branch connections.
- High current circuitry should have priority over low power connections. Return paths should be paired with the corresponding source either with a dedicated return path or a ground plane.
- To minimize crosstalk there should not be any crossover of signals from one part of the flow to another.
- Spacing consistent with safety standards such as IEC60950 must be observed between the 48V input rails, primary side signals, and between the input and isolated output.
- Where possible, use vertical pairing of signal and return paths.
- Keep high-current and high-voltage switching nodes away from low-level circuits.
- Pay special attention to spacing between the high-voltage sections of the converter and all other circuitry.

### EMI Containment

- Use compact loops for high frequency and/or high current circuit paths (power loops and gate drives).



#### Two Compact Power Loops

- Use minimal, yet thermally adequate, copper areas for heat sinking of components tied to switching nodes (minimize exposed radiating surfaces).
- Use copper ground planes and top layer floods (surround circuitry with ground floods).
- Use 4-layer PCB if economically feasible.
- Minimize or shield the amount of copper area associated with input traces (to minimize radiated pickup).
- Hide copper associated with switching nodes under shielded magnetics where possible.
- Heat sink the “quiet side” of components instead of the “switching side” where possible (like the output side of inductor).
- Use Bob Smith terminations, Bob Smith EFT capacitor, and Bob Smith plane (add reference).
- Use Bob Smith plane as ground shield on input side of PCB (creating a phantom or lateral earth ground).
- Use LC filter at DC/DC input.
- Dampen high frequency ringing on all switching nodes (allow for possible resistor-capacitor or resistor-capacitor diode snubbers).
- Control rise times with gate drive resistors and possible snubbers
- Observe the polarity dot on inductors (embed noisy end)
- Use of ferrite on input (allow for possible use of ferrite beads)
- Maintain segregation between input-related circuitry and power circuitry
- A common-mode input inductor may be required.
- Possible use of integrated RJ45-45 jacks (Magjack, for example)
- End-product enclose considerations(shielding)

## Important Notices

### Legal notice

Copyright © Kinetic Technologies. Other names, brands and trademarks are the property of others.

Kinetic Technologies assumes no responsibility or liability for information contained in this document. Kinetic Technologies reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or services without notice. The information contained herein is believed to be accurate and reliable at the time of printing.

### Reference design policy

This document is provided as a design reference and Kinetic Technologies assumes no responsibility or liability for the information contained in this document. Kinetic Technologies reserves the right to make corrections, modifications, enhancements, improvements, and other changes to this reference design documentation without notice.

Reference designs are created using Kinetic Technologies' published specifications as well as the published specifications of other device manufacturers. This information may not be current at the time the reference design is built. Kinetic Technologies and/or its licensors do not warrant the accuracy or completeness of the specifications or any information contained therein.

Kinetic Technologies does not warrant that the designs are production worthy. Customer should completely validate and test the design implementation to confirm the system functionality for the end use application.

Kinetic Technologies provides its customers with limited product warranties, according to the standard Kinetic Technologies terms and conditions.

For the most current product information visit us at [www.kinet-ic.com](http://www.kinet-ic.com)

### Life support policy

LIFE SUPPORT: KINETIC TECHNOLOGIES' PRODUCTS ARE NOT DESIGNED, INTENDED, OR AUTHORIZED FOR USE AS COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS. NO WARRANTY, EXPRESS OR IMPLIED, IS MADE FOR THIS USE. AUTHORIZATION FOR SUCH USE SHALL NOT BE GIVEN BY KINETIC TECHNOLOGIES, AND THE PRODUCTS SHALL NOT BE USED IN SUCH DEVICES OR SYSTEMS, EXCEPT UPON THE WRITTEN APPROVAL OF THE PRESIDENT OF KINETIC TECHNOLOGIES FOLLOWING A DETERMINATION BY KINETIC TECHNOLOGIES THAT SUCH USE IS FEASIBLE. SUCH APPROVAL MAY BE WITHHELD FOR ANY OR NO REASON.

“Life support devices or systems” are devices or systems which (1) are intended for surgical implant into the human body, (2) support or sustain human life, or (3) monitor critical bodily functions including, but not limited to, cardiac, respirator, and neurological functions, and whose failure to perform can be reasonably expected to result in a significant bodily injury to the user. A “critical component” is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

### SUBSTANCE COMPLIANCE

Kinetic Technologies IC products are compliant with RoHS, formally known as Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. However, this evaluation kit does not fall within the scope of the EU directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and may not meet the requirements of these or related directives. To the best of our knowledge the information is true and correct as of the date of the original publication of the information. Kinetic Technologies bears no responsibility to update such statement.

## X-ON Electronics

Largest Supplier of Electrical and Electronic Components

*Click to view similar products for* [Power Management IC Development Tools](#) *category:*

*Click to view products by* [Kinetic Technologies](#) *manufacturer:*

Other Similar products are found below :

[EVB-EP5348UI](#) [BQ25010EVM](#) [ISL80019AEVAL1Z](#) [ISLUSBI2CKIT1Z](#) [ISL8002AEVAL1Z](#) [ISL91108IIA-EVZ](#) [MAX8556EVKIT](#)  
[MAX15005AEVKIT+](#) [ISL28022EVKIT1Z](#) [STEVAL-ISA008V1](#) [DRI0043](#) [KITPF8100FRDMEVM](#) [EVB-EN6337QA](#)  
[SAMPLEBOXILD8150TOBO1](#) [MAX18066EVKIT#](#) [AP62300WU-EVM](#) [KITA2GTC387MOTORCTRTOBO1](#) [AEK-MOT-TK200G1](#)  
[EVLONE65W](#) [STEVAL-ILH006V1](#) [STEVAL-IPE008V2](#) [STEVAL-IPP001V2](#) [STEVAL-ISA013V1](#) [STEVAL-ISA067V1](#) [STEVAL-](#)  
[ISQ002V1](#) [TPS2306EVM-001](#) [TPS2330EVM-185](#) [TPS40001EVM-001](#) [SECO-HVDCDC1362-15W-GEVB](#) [BTS7030-2EPA](#)  
[LT8638SJV#WPBF](#) [LTC3308AIV#WTRPBF](#) [TLT807B0EPV](#) [BTS71033-6ESA](#) [EV13N91A](#) [EASYPIC V8 OVER USB-C](#) [EV55W64A](#)  
[CLICKER 4 FOR STM32F4](#) [EASYMX PRO V7A FOR STM32](#) [CLICKER 4 FOR PIC18F](#) [Si8285\\_86v2-KIT](#) [PAC52700EVK1](#) [NCP-](#)  
[NCV51752D2PAK3LGEVB](#) [ISL81807EVAL1Z](#) [AP33772S-EVB](#) [EVALM7HVIGBTFCINV4TOBO1](#) [903-0300-000](#) [902-0173-000](#) [903-](#)  
[0301-000](#) [ROA1286023/1](#)