# IEEE 802.3at PoE PD with Integrated DC-DC Controller

## 1. General Description

The User's Guide describes the design and operation of the KTA1137A EVB-001 evaluation board. The KTA1137A is an IEEE 802.3af/at compliant combination powered device (PD) controller and power supply controller optimized for isolated and non-isolated converter topologies. The KTA1137A EVB-001 demonstrates a 12V, 25W flyback converter for PD applications. The KTA1137A is a pin compatible with the discontinued AS1138 and may be substituted with minimal effort.

## 2. Ordering Information

| Part Number | Description | IC Package |
|---|---|---|
| KTA1137AEUAB-EV1 | KTA1137A EVAL Kit | QFN55-20 |

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## 3. Description

KTA1137A EVB-001 allows reference circuity evaluation of the KTA1137A. It 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 the KTA1137A.

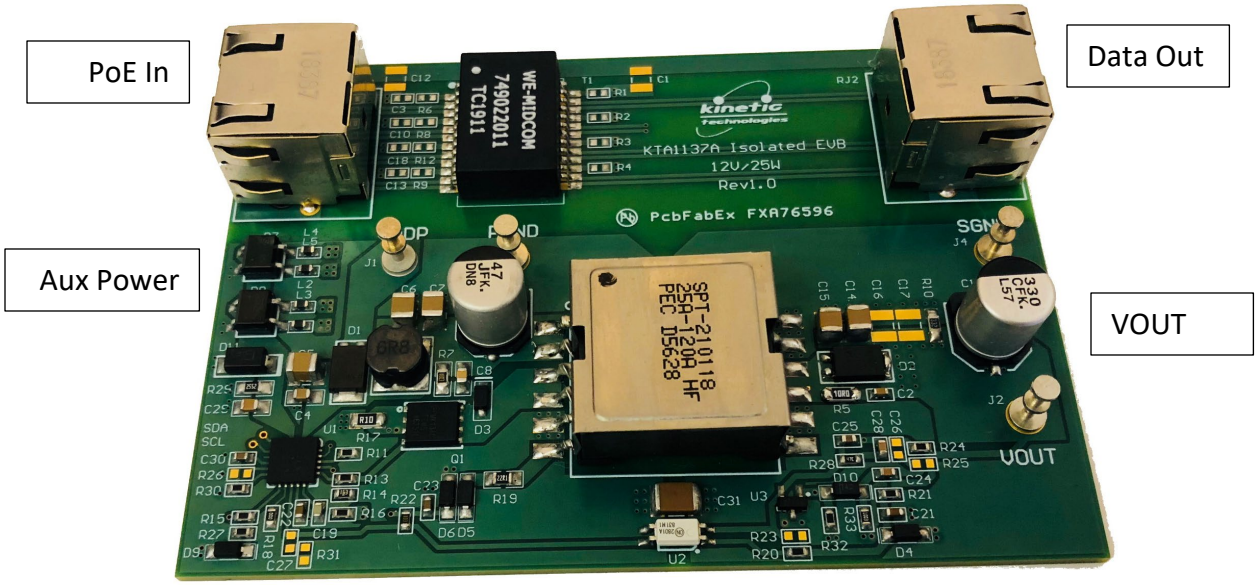



**Figure 1. KTA1137A EVB-001**

### 3.1 Features

- 25W output
- Operates from either POE or external AC power adaptor(48V)
- Isolated 12V output voltage

### 3.2 Applications

- Voice over Internet Protocol---IP telephones
- Wireless LAN---Wireless Access Points
- Security---Wired IP cameras

## 4. Electrical Specifications

**Table 1. KTA1137A EVB-001 Electrical and Performance Specifications**

| Parameter | Condition | | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Power Interface** | | | | | | |
| Input voltage | Applied to the power pins of connectors RJ1 or J1 | | 0 | | 57 | V |
| Operation voltage | After start-up | | 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 | $R_{CLASS}$ = 63.4kΩ | | 36 | | 44 | mA |
| Inrush current-limit | | | 100 | | 400 | mA |
| Operation current-limit | | | | 1200 | | mA |
| **DC/DC Converter** | | | | | | |
| Output voltage | $34 \leq V_{IN} \leq 57V$, $I_{LOAD} \leqq I_{LOAD}$ (max) | 12V output | | | | V |
| Output current | $34 \leq V_{IN} \leq 57V$ | 12V output | | 2.1 | | A |
| Output ripple voltage, peak to peak | $V_{IN}$ = 48V, $I_{LOAD}$ = 2.1A | 12V output | | 50 | | mV |
| Efficiency, end to end | $V_{IN}$ = 48V, $I_{LOAD}$ = 2.1A | 12V output | | 86.61 | | % |
| Switching Frequency | | | 110 | | 130 | kHz |

## 5. Schematic

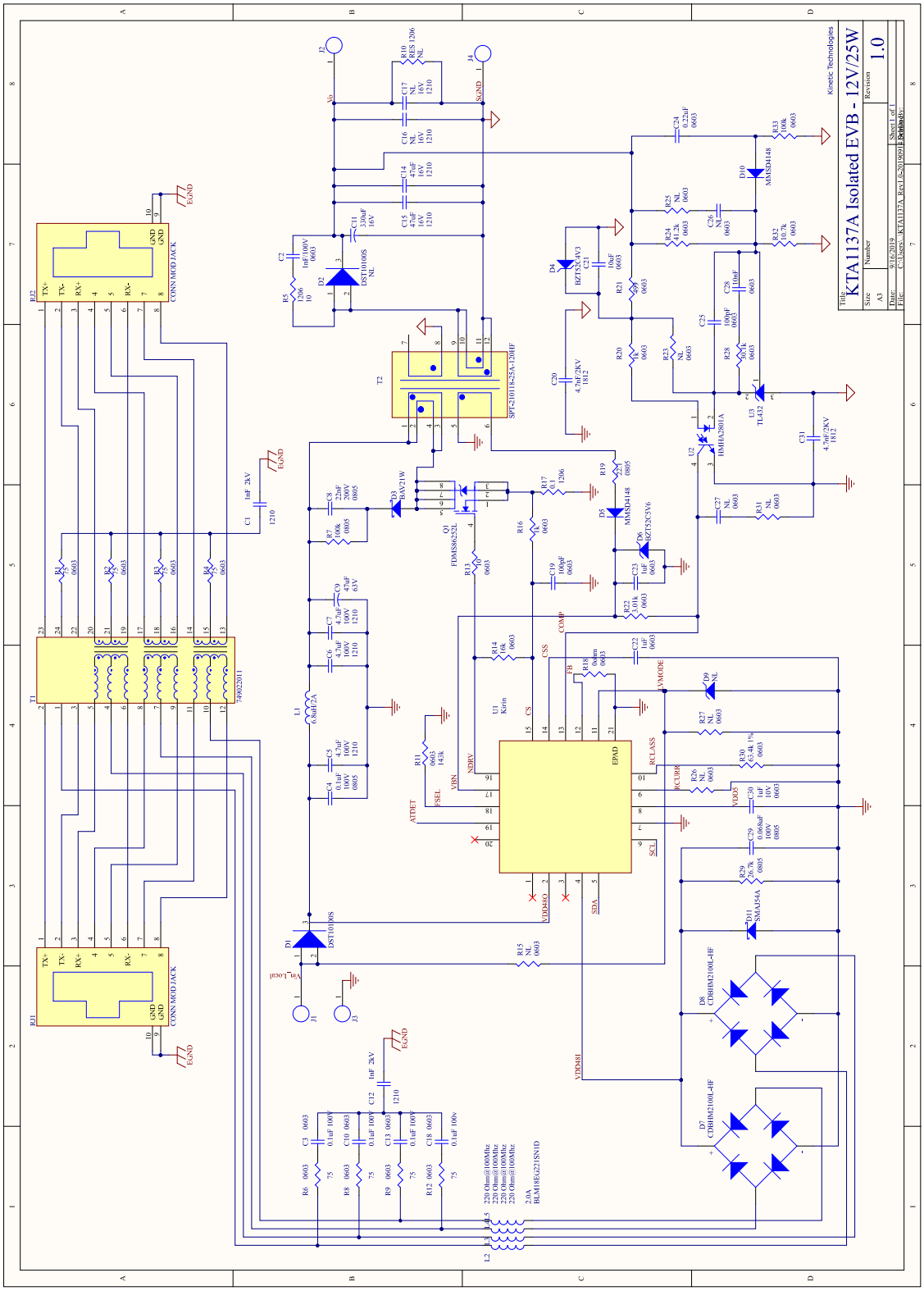



**Figure 2. KTA1137A EVB-001 Schematic**

# 6. General Configuration and Description

## 6.1 Physical Access

Table 2 lists the KTA1137A EVB-001 connectors functionality.

**Table 2. Connectors Functionality**

| Connector | Description |
|---|---|
| J1 | External adaptor input. |
| J2 | Output voltage connector |
| RJ1 | Ethernet power input connector (RJ45 Style Connector). |
| RJ2 | Ethernet data port connector. |

# 7. Test Setup

Figure 3 shows a typical setup for KTA1137A EVB-001. Input voltage can be applied as described in Table 2.

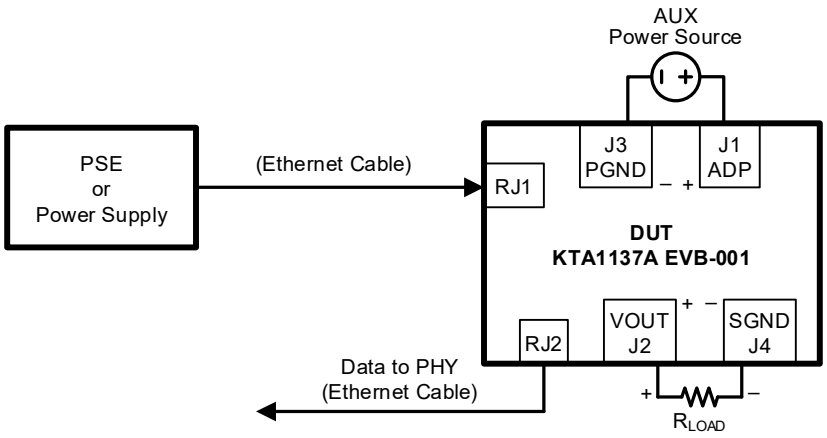



**Figure 3. Typical KTA1137A EVB-001 Test Setup**

# 8. KTA1137A EVB-001 Typical Performance Data

## 8.1 12V DC/DC Efficiency

Figure 4 illustrates three different 48VDC input efficiency plots:

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

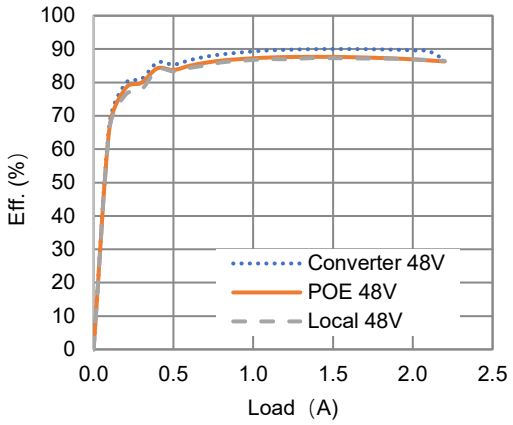



**Figure 4. KTA1137A EVB-001 Efficiency with 12V Output**

## 8.2 Operational Waveform

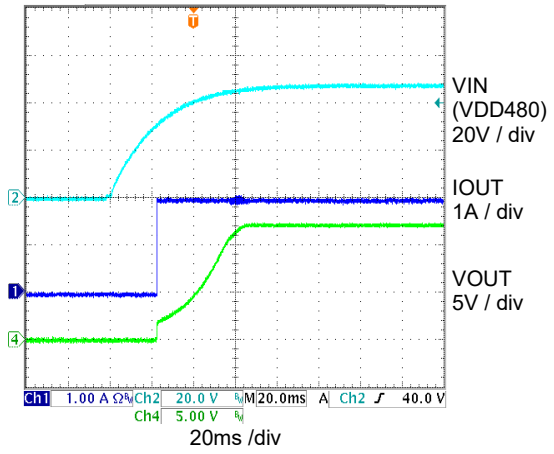



**Figure 5. Power-up**

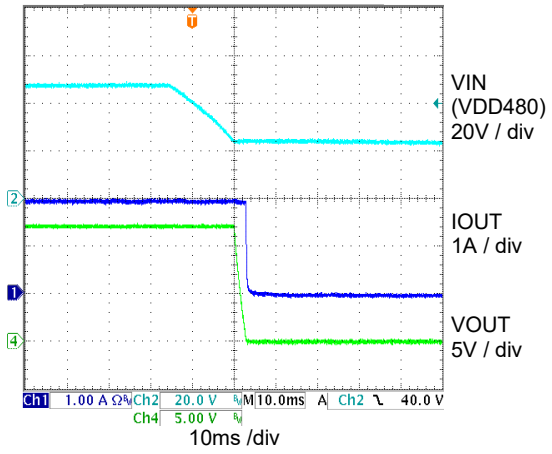



**Figure 6. Power-down**

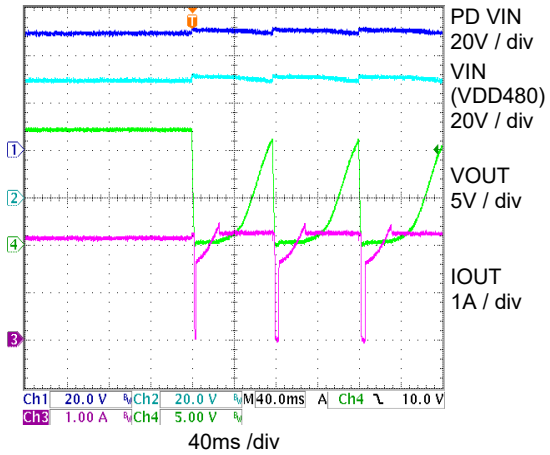



**Figure 7. Over Current Protection (Overload)**

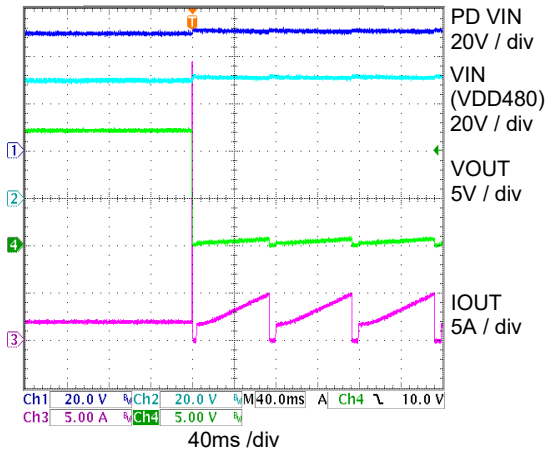



**Figure 8. Over Current Protection (Short Circuit)**

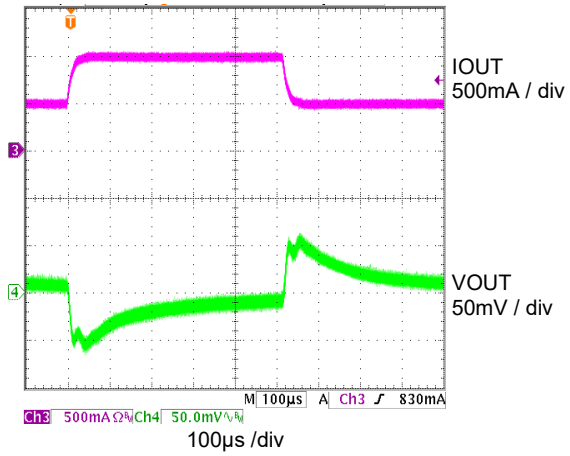



**Figure 9. DC-DC Output Step Load**

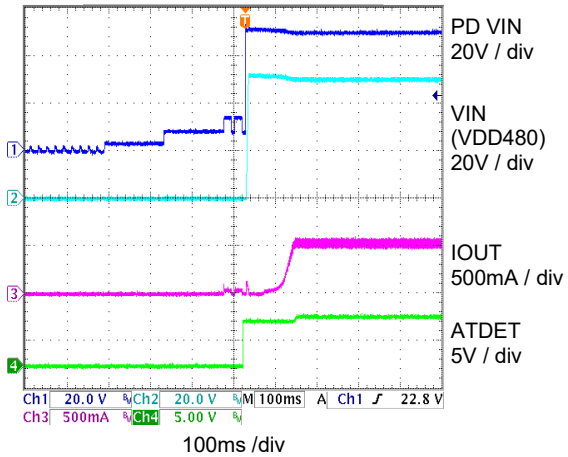



**Figure 10. AT Detection**

# 9. EVB Assembly Drawings and Layout Guidelines

## 9.1 PCB Drawings

The following figure show component placement and layout.

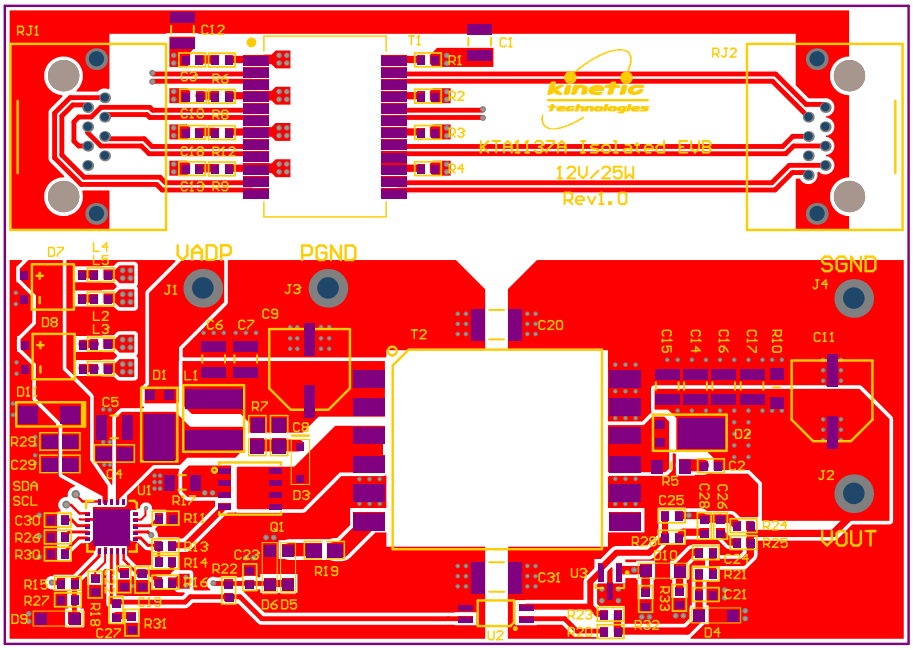



**Figure 11. Top Side Layout/Routing**

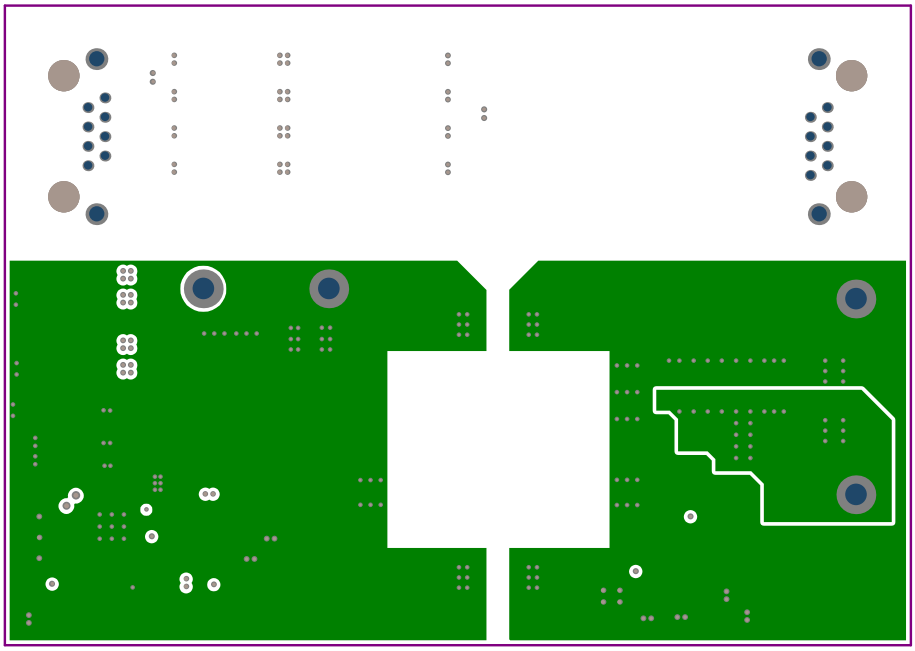


**Figure 12. Layer Two Routing**

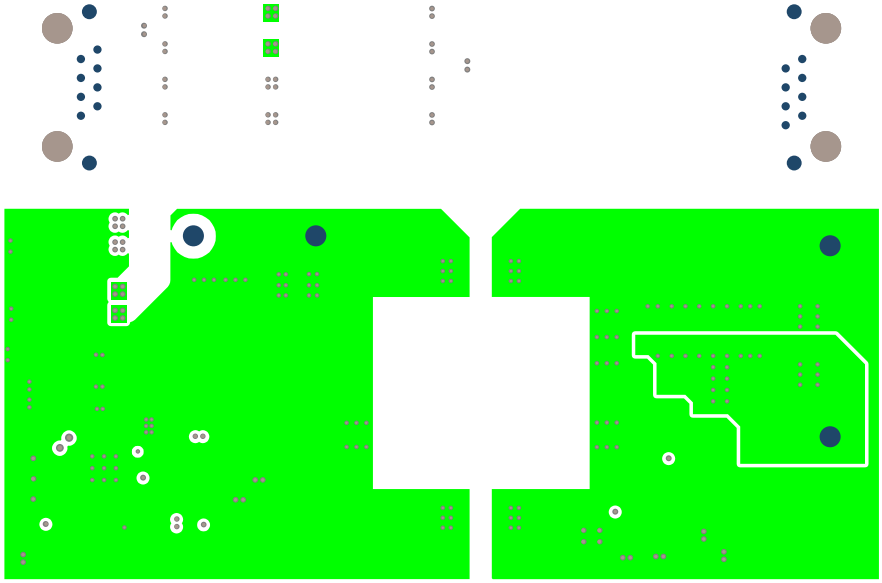


**Figure 13. Layer Three Routing**

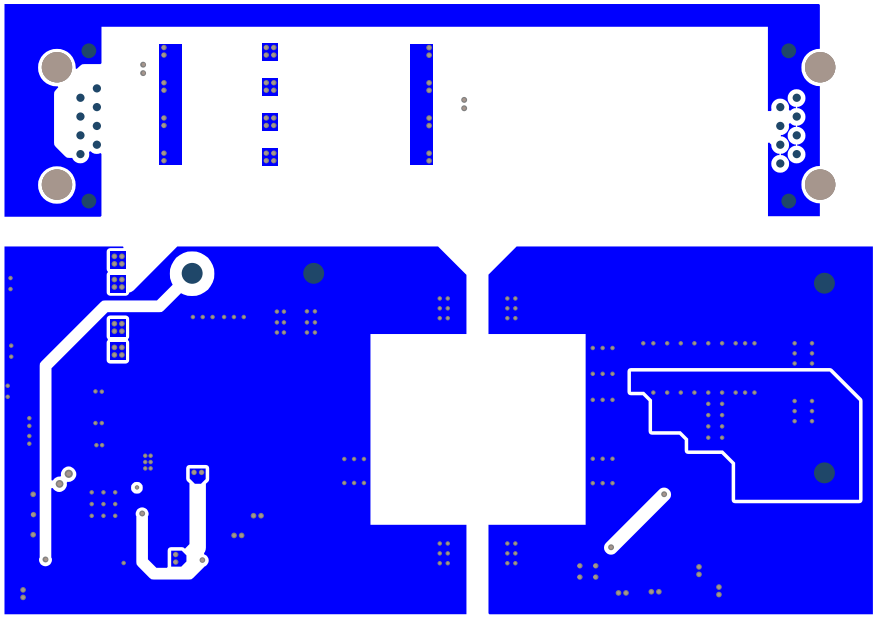
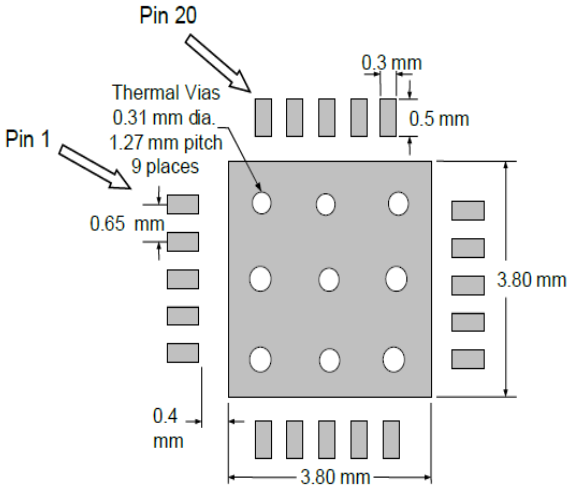


**Figure 14. Bottom Layer Routing**

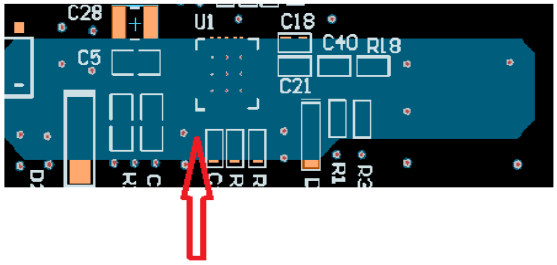
## 9.2 Layout Guidelines

The layout of the POE front end and DC/DC converter should follow power and EMI/ESD best practice guideline *Addressing EMC Preemptively in Ethernet Connected Devices*, https://www.kinet-ic.com/support-training/training/. Recommendations include:

- KTA1137A PCB Footprint must be designed according to datasheet requirement.




**KTA1137A Footprint (Top View)**




**Bottom Solder Mask**

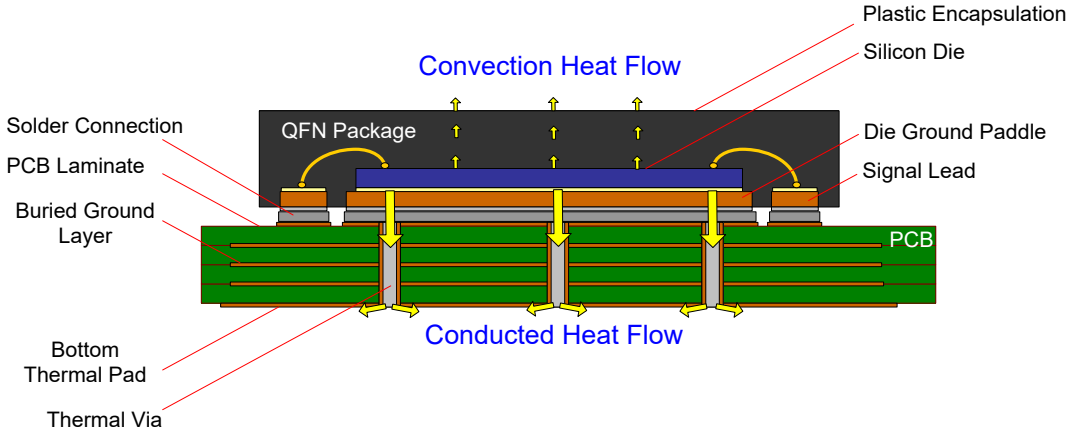



**Figure 15. KTA1137A PCB Footprint and Ground Route**

- 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, C19 and C26 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, C19 and C26 between primary side and secondary side as shown below.

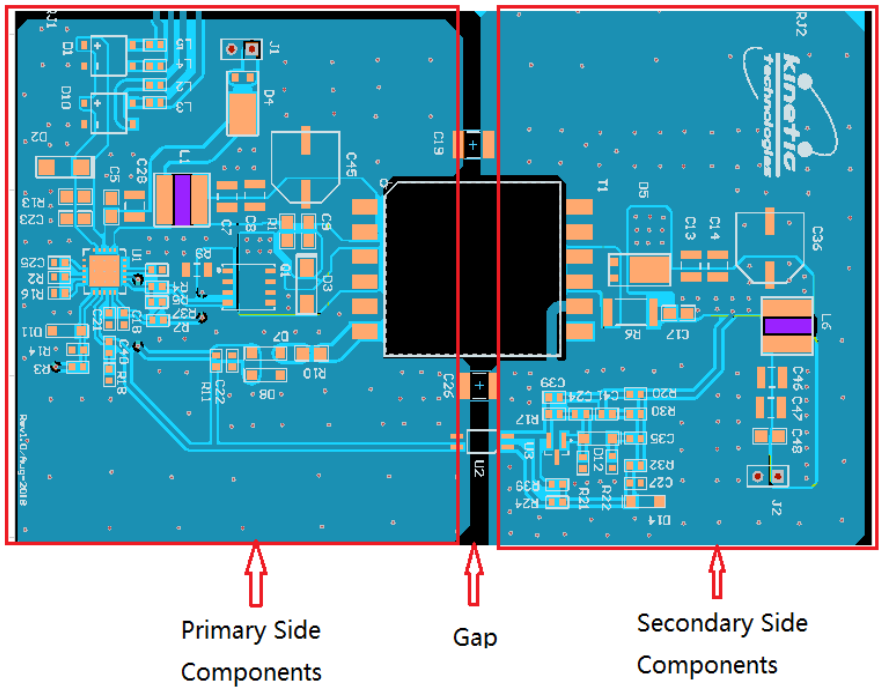



**Figure 16. Primary Side and Secondary Side Components Placement**

- There should be not crossover between VDD48I and VDD48O.

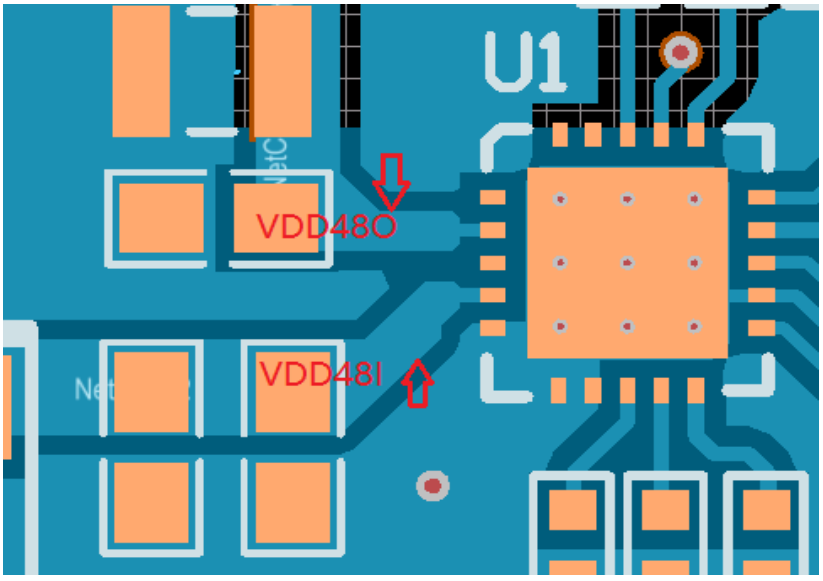



**Figure 17. VDD48I and VDD48O Route**

- 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, D10, D4, U1, Q1, L1and T1, D5, L6.

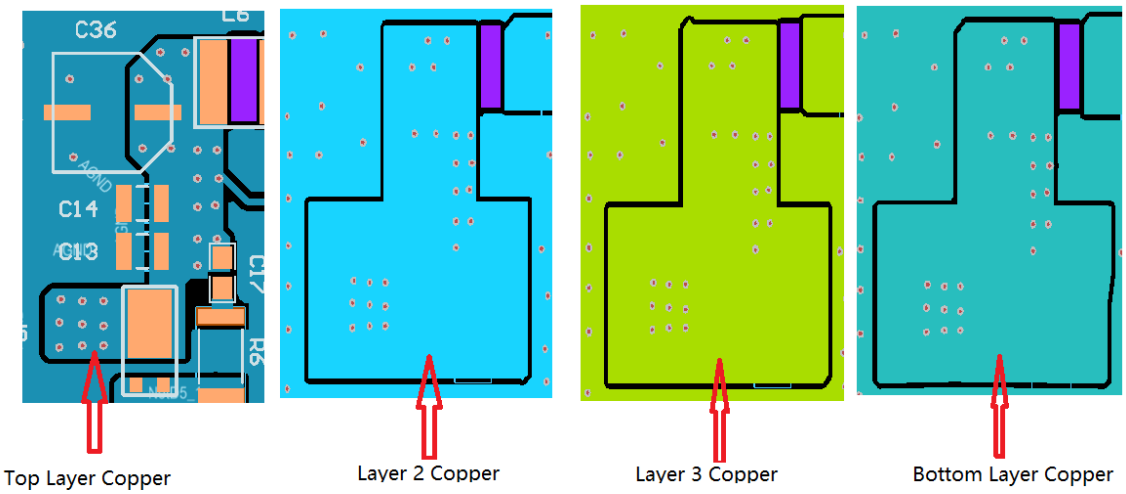



**Figure 18. Power-dissipating Device Route**

- 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.

## 9.3 EMI Containment

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

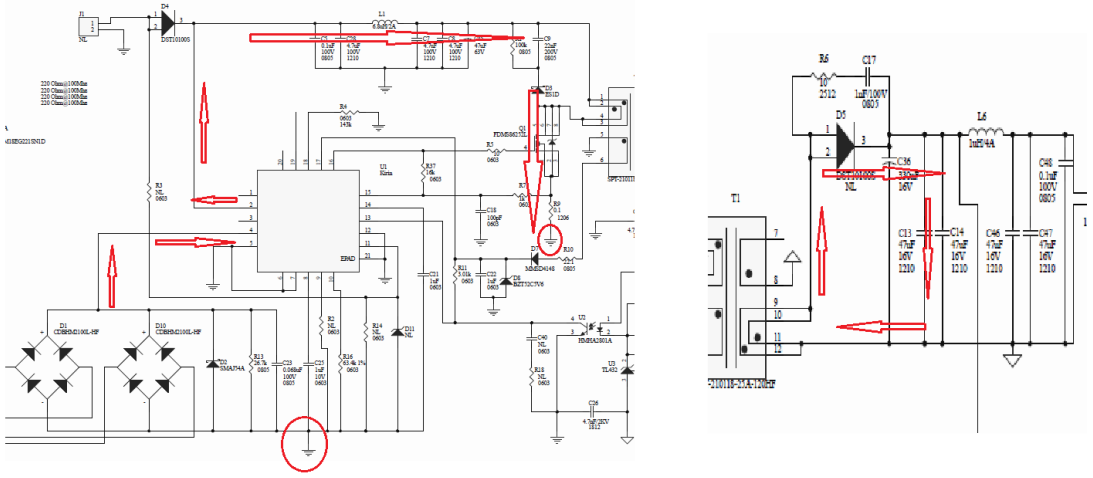


**Figure 19. Two Compact Power Loops**

- 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 circuity and power circuity
- A common-mode input inductor may be required.
- Possible use of integrated RJ45-45 jacks (Magjack, for example)
- End-product enclose considerations(shielding)

## 10. Bill of Materials

**Table 3. KTA1137A EVB-001 Bill of Materials**

| Designator | Description | Manufacturer | Manufacturer P/N | Digikey P/N |
|---|---|---|---|---|
| C1, C2, C3, C4 | Capacitor, Ceramic, 25V, 0.10µF, X7R, ±10%, 0603 | STD | STD | STD |
| C5, C48 | Capacitor, Ceramic, 100V, 0.10µF, X7R, ±10%, 0805 | STD | STD | STD |
| C7, C8, C28 | Capacitor, Ceramic, 100V, 4.7µF, X7S, ±10%,1210 | STD | STD | STD |
| C9 | Capacitor, Ceramic, 200V, 22nF, X7R, ±10%, X7R 0805 | STD | STD | STD |
| C13, C14, C46, C47 | Capacitor, Ceramic,16V, 47µF, X5R, ±10%,1210 | STD | STD | STD |
| C17 | Capacitor, Ceramic, 100V, 1nF, X7R, ±10%, 0805 | STD | STD | STD |
| C18 | Capacitor, Ceramic, 50V, 100pF, X7R, ±10%, 0603 | STD | STD | STD |
| C19, C26 | Capacitor, Ceramic, 2kV, 4.7nF, X7R, ±10%, 1812 | STD | STD | STD |
| C21, C22, C25 | Capacitor, Ceramic, 10V, 1µF, X7R, ±10%, X7R, 0603 | STD | STD | STD |
| C23 | Capacitor, Ceramic, 100V, 68nF, X7R, ±10%, 0805 | STD | STD | STD |
| C24 | Capacitor, Ceramic, 50V, 10nF, X7R, ±10%, 0603 | STD | STD | STD |
| C27 | Capacitor, Ceramic, 10V, 10µF, X7R, ±20%, 0603 | STD | STD | STD |
| C35 | Capacitor, Ceramic, 10V, 0.22µF, X7R, ±10%, 0603 | STD | STD | STD |
| C45 | Capacitor, Aluminum, 63V, 47µF, ±20%, 8*10.5mm | Panasonic | EEEFK1J470P | PCE3789CT-ND |
| C36 | Capacitor, Aluminum, 16V, 330µF, ±20% 8*10.5mm | Panasonic | EEEFK1C331P | PCE3789CT-ND |
| C39 | Capacitor, Ceramic ,50V, 100pF, X7R, ±10%, 0603 | STD | STD | STD |
| C40, C41 | Capacitor, Ceramic, 0603, NL | STD | STD | STD |
| D1, D10 | Schottky Bridge Rectifier, 100V, 2A, MBS2 | Comchip | CDBHM2100L-HF | 641-1432-1-ND |
| D2 | Diode, TVS, Uni, 54 V, 400W, SMA | Littlefuse | SMAJ54A | SMAJ54ALFCT-ND |
| D3 | Diode, Ultrafast, 200 V, 1A, SMA | ON Semiconductor | ES1D | ES1DFSCT-ND |
| D4, D5 | Diode, Schottky, 100V, 10A, TO277A | Littelfuse Inc. | DST10100S | F7418DKR-ND |
| D7, D12 | Diode, Switching, 100V, 0.2A, SOD123 | ON Semiconductor | MMSD4148T1G | MMSD4148T1GOSCT-ND |
| D8, D11 | Diode, Zener, 5.6V, 500mW, SOD123 | Diodes Inc | BZT52C5V6-7-F | BZT52C5V6-FDIDKR-ND |
| D14 | Diode, Zener, 4.3V, 500mW SOD123 | Diodes Inc | BZT52C4V3-7-F | BZT52C4V3-FDICT-ND |
| J1 | TERM BLK 2P SIDE ENT 2.54mm PCB | TE Connectivity AMP Connectors | 282834-2 | A98333-ND |
| J2 | TERM BLK 2P SIDE ENT 2.54mm PCB | TE Connectivity AMP Connectors | 282834-2 | A98333-ND |
| L1 | Fixed, IND, 6.8µH, 2.8A, 47.3mΩ | Bourns Inc. | SRN6045-6R8Y | SRN6045-6R8YTR-ND |

| Designator | Description | Manufacturer | Manufacturer P/N | Digikey P/N |
|---|---|---|---|---|
| L2, L3, L4, L5 | 220Ω Impedance Ferrite Bead 0603 SM 2A | Murata | BLM18EG221SN1D | 490-3992-1-ND |
| L6 | Fixed, IND, 1µH, 4A, 49mΩ, SMD | Wruth | 7447730 | 732-1249-1-ND |
| Q1 | MOSFET N-CH 150V 8-MLP | ON Semiconductor | FDMS86252L | FDMS86252LCT-ND |
| R1 | Resistor, Chip, 100kΩ, 1/10W, 5%, 0805 | STD | STD | STD |
| R3 | Resistor, Chip, 1/10W, 1%, 0603, 20kΩ | STD | STD | STD |
| R2, R18, R30, R37, R39 | Resistor, Chip, 1/10W, 1%, 0603, NL | STD | STD | STD |
| R4 | Resistor, Chip, 143kΩ, 1/16W, 1%, 0603 | STD | STD | STD |
| R5 | Resistor, Chip, 10Ω, 1/16W, 1%, 0603 | STD | STD | STD |
| R6 | Resistor, Chip, 10Ω, 1W, 5%, 2512 | Yageo | RC2512JK-0710RL | YAG3395CT-ND |
| R7, R24 | Resistor, Chip, 1kΩ, 1/16W, 1%, 0603 | STD | STD | STD |
| R9 | Resistor, Chip, 0.1Ω, 1/4W, 5%, 1206 | Panasonic | ERJ-8RSJR10V | P.10PCT-ND |
| R10 | Resistor, Chip, 22.1Ω, 1/10W, 5%, 0805 | STD | STD | STD |
| R11 | Resistor, Chip, 10kΩ, 1/16W, 1%, 0603 | STD | STD | STD |
| R13 | Resistor, Chip, 25.5kΩ, 1/10W, 1%, 0805 | STD | STD | STD |
| R14 | Resistor, Chip, 4.02kΩ, 1/16W, 1%, 0603 | STD | STD | STD |
| R16 | Resistor, Chip, 63.4kΩ, 1/16W, 1%, 0603 | STD | STD | STD |
| R17 | Resistor, Chip, 30.1kΩ, 1/16W, 1%, 0603 | STD | STD | STD |
| R20 | Resistor, Chip, 41.2kΩ, 1/16W, 1%, 0603 | STD | STD | STD |
| R21 | Resistor, Chip, 10.7kΩ, 1/16W, 1%, 0603 | STD | STD | STD |
| R22 | Resistor, Chip, 100kΩ, 1/16W, 1%, 0603 | STD | STD | STD |
| R32 | Resistor, Chip, 499Ω, 1/16W, 1%, 0603 | STD | STD | STD |
| RJ1 | 1 Port RJ45 Magjack Connector Through Hole (PoE+) | Bell Fuse | 0838-1X1T-W7 | 0838-1X1T-W7-ND |
| RJ2 | CONN MOD JACK 8P8C R/A UNSHLD | TE Connectivity AMP Connectors | 5520252-4 | A31408-ND |
| T1 | EFD20 | PEC | SPT-210118 25A-120HF | |
| U1 | IEEE 802.3af/at PoE PD with Flyback DC-DC Controller, 20QFN | Kinetic Technologies | KTA1137A | |
| U2 | OPTOISO 3.75kV TRANS 4-MINI-FLAT | ON Semiconductor | HMHA2801A | HMHA2801A-ND |
| U3 | IC, Shunt Regulator, 36V, 100mA, 1% | Texas Instruments | TL432AQDBZR | 296-17340-1-ND |

# 11. Appendix 1 – Representative Sifos Results

## 11.1 ALT A MDI

| PDA-600 TEST REPORT | | | Coverage: | ALT A | MDI | Type-1 | Software Version: | 1.10 | Sifos® Technologies |
|---|---|---|---|---|---|---|---|---|---|
| November 26, 2019 | 10:19 AM | | | ALT B | MDI-X | Type-2 PHY | PDA Firmware: | 1.07 | |
| Product Tested: | Cycles: | | Color Key: | | | Type-2 LLDP | Report Ver: | 1.6 | |
| Kinetic_KTA1137A_EVB | 1 | | PASS | FAIL | WARN | INFO | Serial Number | 602A0004 | |

| Detection & Classification | PSE Emulation: | | Pairs: | A | Polarity: | MDI | Det_Cycles: | 3 |
|---|---|---|---|---|---|---|---|---|
| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
| Rdet | 25.33 | kohm | 25.33 | 25.33 | 25.33 | 23.70 | 26.30 | P |
| Rdet_final | 25.29 | kohm | 25.29 | 25.29 | 25.29 | 23.70 | 26.30 | P |
| Rdet_unpwr | >99.00 | kohm | 99.00 | 99.00 | 99.00 | <12.00 | >45.00 | P |
| Cdet | 0.07 | uF | 0.07 | 0.07 | 0.07 | 0.05 | 0.12 | P |
| Cdet_final | 0.07 | uF | 0.07 | 0.07 | 0.07 | 0.05 | 0.12 | P |
| 1 Event Classification | | | | | | | | |
| Iclass | 40.3 | mA | 40.3 | 40.3 | 40.3 | 36.0 | 44.0 | P |
| ClassNum | 4 | | 4 | 4 | - | 0 | 4 | P |
| Tclass | 0.0005 | sec | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0050 | P |
| ClassStability | 1 | | | | | 1 | 1 | P |
| 2 Event Classification | | | | | | | | |
| Iclass_event1 | 40.3 | mA | 40.3 | 40.3 | 40.3 | 36.0 | 44.0 | P |
| Iclass_event2 | 40.4 | mA | 40.4 | 40.4 | 40.4 | 36.0 | 44.0 | P |
| MarkI | 2.30 | mA | 2.30 | 2.30 | 2.30 | 0.25 | 4.00 | P |
| ClassNum2 | 4 | | 4 | 4 | - | 0 | 4 | P |
| Tclass_event1 | 0.0005 | sec | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0050 | P |
| Tclass_event2 | 0.0005 | sec | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0050 | P |
| ClassStability_event1 | 1 | | | | | 1 | 1 | P |
| ClassStability_event2 | 1 | | | | | 1 | 1 | P |

| Power-Up / Down | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
| InrushI_1 | -1.0 | mA | -1.0 | -1.0 | -1.0 | 0.0 | 400.0 | NA |
| InrushI_2 | 367.6 | mA | 367.6 | 367.6 | 367.6 | 0.0 | 400.0 | P |
| Pmax_Tdelay | 1.9 | W | 1.9 | 1.9 | 1.9 | 0.0 | 14.4 | P |
| Inrush_delayed | 0 | | 0 | 0 | - | 0 | 0 | P |
| Von | 37.5 | VDC | 37.5 | 37.5 | 37.5 | 30.0 | 42.0 | P |
| Voff | 31.8 | VDC | 31.8 | 31.8 | 31.8 | 30.0 | 37.0 | P |
| Vhyst | 5.7 | VDC | 5.7 | 5.7 | 5.7 | 4.0 | 12.0 | P |
| BackfeedV | 0.0 | VDC | 0.0 | 0.0 | 0.0 | 0.0 | 2.8 | P |
| ClassRecover | 0 | | 0 | 0 | - | 0 | 0 | P |
| SigRecoverTime | 0.0 | sec | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 | P |

| MDI Powered Type-1 | PSE Emulation: | | On Time: | 10 sec | Off Time: | 10 sec | Vport: | -1.0 |
|---|---|---|---|---|---|---|---|---|
| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |

| MDI Powered Type-2 PHY | PSE Emulation: | | On Time: | 10 sec | Off Time: | 10 sec | Vport: | 54.0 |
|---|---|---|---|---|---|---|---|---|
| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
| MinI_2 | 12.3 | mA | 12.3 | 12.3 | 12.3 | 0.0 | 524.2 | P |
| MaxI_2 | 15.6 | mA | 15.6 | 15.6 | 15.6 | 10.0 | 524.2 | P |
| Vport_2 | 54.0 | VDC | 54.0 | 54.0 | 54.0 | 42.5 | 57.0 | INFO |
| Ppeak_2 | 0.84 | W | 0.84 | 0.84 | 0.84 | 0.0 | 28.3 | P |
| Pavg_2 | 0.70 | W | 0.70 | 0.70 | 0.70 | 0.0 | 25.5 | P |
| MPSViolation_2 | 0 | | 0 | 0 | - | 0 | 0 | P |
| TcutWindowViolation_2 | 0 | | 0 | 0 | - | 0 | 0 | P |
| DutyCycleViolation_2 | 0 | | 0 | 0 | - | 0 | 0 | P |

| MDI Powered Type-2 LLDP | PSE Emulation: | | On Time: | -1 sec | Off Time: | 10 sec | Vport: | -1.0 |
|---|---|---|---|---|---|---|---|---|
| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |

## 11.2 ALT B MDI

**PDA-600 TEST REPORT**
November 26, 2019 10:19 AM

| Product Tested: | Cycles: |
|---|---|
| Kinetic_KTA1137A_EVB | 1 |

| Coverage: | ALT A | MDI | Type-1 |
|---|---|---|---|
| | ALT B | MDI-X | Type-2 PHY |
| Color Key: | | | Type-2 LLDP |
| PASS | FAIL | WARN | INFO |

Software Version: 1.10
PDA Firmware: 1.07
Report Ver: 1.6
Serial Number 602A0004

Sifos® Technologies

| Detection & Classification | PSE Emulation: | Pairs: | B | Polarity: | MDI | Det_Cycles: | 3 |
|---|---|---|---|---|---|---|---|

| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
|---|---|---|---|---|---|---|---|---|
| Rdet | 25.43 | kohm | 25.43 | 25.43 | 25.43 | 23.70 | 26.30 | P |
| Rdet_final | 25.43 | kohm | 25.43 | 25.43 | 25.43 | 23.70 | 26.30 | P |
| Rdet_unpwr | >99.00 | kohm | 99.00 | 99.00 | 99.00 | <12.00 | >45.00 | P |
| Cdet | 0.07 | uF | 0.07 | 0.07 | 0.07 | 0.05 | 0.12 | P |
| Cdet_final | 0.07 | uF | 0.07 | 0.07 | 0.07 | 0.05 | 0.12 | P |
| 1 Event Classification | | | | | | | | |
| Iclass | 40.6 | mA | 40.6 | 40.6 | 40.6 | 36.0 | 44.0 | P |
| ClassNum | 4 | | 4 | 4 | - | 0 | 4 | P |
| Tclass | 0.0005 | sec | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0050 | P |
| ClassStability | 1 | | | | | 1 | 1 | P |
| 2 Event Classification | | | | | | | | |
| Iclass_event1 | 40.6 | mA | 40.6 | 40.6 | 40.6 | 36.0 | 44.0 | P |
| Iclass_event2 | 40.6 | mA | 40.6 | 40.6 | 40.6 | 36.0 | 44.0 | P |
| MarkI | 2.40 | mA | 2.40 | 2.40 | 2.40 | 0.25 | 4.00 | P |
| ClassNum2 | 4 | | 4 | 4 | - | 0 | 4 | P |
| Tclass_event1 | 0.0005 | sec | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0050 | P |
| Tclass_event2 | 0.0005 | sec | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0050 | P |
| ClassStability_event1 | 1 | | | | | 1 | 1 | P |
| ClassStability_event2 | 1 | | | | | 1 | 1 | P |

| Power-Up / Down | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
| InrushI_1 | -1.0 | mA | -1.0 | -1.0 | -1.0 | 0.0 | 400.0 | NA |
| InrushI_2 | 367.9 | mA | 367.9 | 367.9 | 367.9 | 0.0 | 400.0 | P |
| Pmax_Tdelay | 1.9 | W | 1.9 | 1.9 | 1.9 | 0.0 | 14.4 | P |
| Inrush_delayed | 0 | | 0 | 0 | - | 0 | 0 | P |
| Von | 37.5 | VDC | 37.5 | 37.5 | 37.5 | 30.0 | 42.0 | P |
| Voff | 31.9 | VDC | 31.9 | 31.9 | 31.9 | 30.0 | 37.0 | P |
| Vhyst | 5.6 | VDC | 5.6 | 5.6 | 5.6 | 3.9 | 12.0 | P |
| BackfeedV | 0.0 | VDC | 0.0 | 0.0 | 0.0 | 0.0 | 2.8 | P |
| ClassRecover | 0 | | 0 | 0 | - | 0 | 0 | P |
| SigRecoverTime | 0.0 | sec | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 | P |

| MDI Powered Type-1 | PSE Emulation: | On Time: | 10 sec | Off Time: | 10 sec | Vport: | -1.0 |
|---|---|---|---|---|---|---|---|

| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
|---|---|---|---|---|---|---|---|---|

| MDI Powered Type-2 PHY | PSE Emulation: | On Time: | 10 sec | Off Time: | 10 sec | Vport: | 54.0 |
|---|---|---|---|---|---|---|---|

| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
|---|---|---|---|---|---|---|---|---|
| MinI_2 | 12.4 | mA | 12.4 | 12.4 | 12.4 | 0.0 | 524.2 | P |
| MaxI_2 | 16.6 | mA | 16.6 | 16.6 | 16.6 | 10.0 | 524.2 | P |
| Vport_2 | 54.0 | VDC | 54.0 | 54.0 | 54.0 | 42.5 | 57.0 | INFO |
| Ppeak_2 | 0.90 | W | 0.90 | 0.90 | 0.90 | 0.0 | 28.3 | P |
| Pavg_2 | 0.70 | W | 0.70 | 0.70 | 0.70 | 0.0 | 25.5 | P |
| MPSViolation_2 | 0 | | 0 | 0 | - | 0 | 0 | P |
| TcutWindowViolation_2 | 0 | | 0 | 0 | - | 0 | 0 | P |
| DutyCycleViolation_2 | 0 | | 0 | 0 | - | 0 | 0 | P |

| MDI Powered Type-2 LLDP | PSE Emulation: | On Time: | -1 sec | Off Time: | 10 sec | Vport: | -1.0 |
|---|---|---|---|---|---|---|---|

| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
|---|---|---|---|---|---|---|---|---|

## 11.3 ALT A MDI-X

**PDA-600 TEST REPORT**
November 26, 2019 10:19 AM

Product Tested: Kinetic_KTA1137A_EVB
Cycles: 1

Coverage: ALT A / ALT B — MDI / MDI-X — Type-1 / Type-2 PHY / Type-2 LLDP
Color Key: PASS | FAIL | WARN | INFO

Software Version: 1.10
PDA Firmware: 1.07
Report Ver: 1.6
Serial Number 602A0004

Sifos® Technologies

**Detection & Classification** — *PSE Emulation*: Pairs: A — Polarity: MDI-X — Det_Cycles: 3

| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
|---|---|---|---|---|---|---|---|---|
| Rdet | 25.29 | kohm | 25.29 | 25.29 | 25.29 | 23.70 | 26.30 | P |
| Rdet_final | 25.36 | kohm | 25.36 | 25.36 | 25.36 | 23.70 | 26.30 | P |
| Rdet_unpwr | >99.00 | kohm | 99.00 | 99.00 | 99.00 | <12.00 | >45.00 | P |
| Cdet | 0.07 | uF | 0.07 | 0.07 | 0.07 | 0.05 | 0.12 | P |
| Cdet_final | 0.07 | uF | 0.07 | 0.07 | 0.07 | 0.05 | 0.12 | P |
| 1 Event Classification | | | | | | | | |
| Iclass | 40.4 | mA | 40.4 | 40.4 | 40.4 | 36.0 | 44.0 | P |
| ClassNum | 4 | | 4 | 4 | - | 0 | 4 | P |
| Tclass | 0.0005 | sec | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0050 | P |
| ClassStability | 1 | | | | | 1 | 1 | P |
| 2 Event Classification | | | | | | | | |
| Iclass_event1 | 40.4 | mA | 40.4 | 40.4 | 40.4 | 36.0 | 44.0 | P |
| Iclass_event2 | 40.3 | mA | 40.3 | 40.3 | 40.3 | 36.0 | 44.0 | P |
| MarkI | 2.30 | mA | 2.30 | 2.30 | 2.30 | 0.25 | 4.00 | P |
| ClassNum2 | 4 | | 4 | 4 | - | 0 | 4 | P |
| Tclass_event1 | 0.0005 | sec | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0050 | P |
| Tclass_event2 | 0.0005 | sec | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0050 | P |
| ClassStability_event1 | 1 | | | | | 1 | 1 | P |
| ClassStability_event2 | 1 | | | | | 1 | 1 | P |

**Power-Up / Down**

| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
|---|---|---|---|---|---|---|---|---|
| InrushI_1 | -1.0 | mA | -1.0 | -1.0 | -1.0 | 0.0 | 400.0 | NA |
| InrushI_2 | 366.8 | mA | 366.8 | 366.8 | 366.8 | 0.0 | 400.0 | P |
| Pmax_Tdelay | 1.9 | W | 1.9 | 1.9 | 1.9 | 0.0 | 14.4 | P |
| Inrush_delayed | 0 | | 0 | 0 | - | 0 | 0 | P |
| Von | 37.6 | VDC | 37.6 | 37.6 | 37.6 | 30.0 | 42.0 | P |
| Voff | 31.8 | VDC | 31.8 | 31.8 | 31.8 | 30.0 | 37.0 | P |
| Vhyst | 5.7 | VDC | 5.7 | 5.7 | 5.7 | 3.9 | 12.0 | P |
| BackfeedV | 0.0 | VDC | 0.0 | 0.0 | 0.0 | 0.0 | 2.8 | P |
| ClassRecover | 0 | | 0 | 0 | - | 0 | 0 | P |
| SigRecoverTime | 0.0 | sec | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 | P |

**MDI Powered Type-1** — *PSE Emulation*: On Time: 10 sec — Off Time: 10 sec — Vport: -1.0

| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
|---|---|---|---|---|---|---|---|---|

**MDI Powered Type-2 PHY** — *PSE Emulation*: On Time: 10 sec — Off Time: 10 sec — Vport: 54.0

| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
|---|---|---|---|---|---|---|---|---|
| MinI_2 | 12.4 | mA | 12.4 | 12.4 | 12.4 | 0.0 | 523.2 | P |
| MaxI_2 | 14.6 | mA | 14.6 | 14.6 | 14.6 | 10.0 | 523.2 | P |
| Vport_2 | 54.1 | VDC | 54.1 | 54.1 | 54.1 | 42.5 | 57.0 | INFO |
| Ppeak_2 | 0.79 | W | 0.79 | 0.79 | 0.79 | 0.0 | 28.3 | P |
| Pavg_2 | 0.70 | W | 0.70 | 0.70 | 0.70 | 0.0 | 25.5 | P |
| MPSViolation_2 | 0 | | 0 | 0 | - | 0 | 0 | P |
| TcutWindowViolation_2 | 0 | | 0 | 0 | - | 0 | 0 | P |
| DutyCycleViolation_2 | 0 | | 0 | 0 | - | 0 | 0 | P |

**MDI Powered Type-2 LLDP** — *PSE Emulation*: On Time: -1 sec — Off Time: 10 sec — Vport: -1.0

| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
|---|---|---|---|---|---|---|---|---|

## 11.4 ALT B MDI-X

**PDA-600 TEST REPORT**
November 26, 2019 10:19 AM

Product Tested: Kinetic_KTA1137A_EVB
Cycles: 1

*Coverage:* ALT A / ALT B | MDI / MDI-X | Type-1 / Type-2 PHY / Type-2 LLDP
*Color Key:* PASS | FAIL | WARN | INFO

*Software Version:* 1.10
*PDA Firmware:* 1.07
*Report Ver:* 1.6
*Serial Number* 602A0004

Sifos® Technologies

**Detection & Classification** — *PSE Emulation*: Pairs: **B** Polarity: **MDI-X** Det_Cycles: **3**

| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
|---|---|---|---|---|---|---|---|---|
| Rdet | 25.36 | kohm | 25.36 | 25.36 | 25.36 | 23.70 | 26.30 | P |
| Rdet_final | 25.43 | kohm | 25.43 | 25.43 | 25.43 | 23.70 | 26.30 | P |
| Rdet_unpwr | >99.00 | kohm | 99.00 | 99.00 | 99.00 | <12.00 | >45.00 | P |
| Cdet | 0.07 | uF | 0.07 | 0.07 | 0.07 | 0.05 | 0.12 | P |
| Cdet_final | 0.07 | uF | 0.07 | 0.07 | 0.07 | 0.05 | 0.12 | P |
| 1 Event Classification | | | | | | | | |
| Iclass | 40.6 | mA | 40.6 | 40.6 | 40.6 | 36.0 | 44.0 | P |
| ClassNum | 4 | | 4 | 4 | - | 0 | 4 | P |
| Tclass | 0.0005 | sec | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0050 | P |
| ClassStability | 1 | | | | | 1 | 1 | P |
| 2 Event Classification | | | | | | | | |
| Iclass_event1 | 40.6 | mA | 40.6 | 40.6 | 40.6 | 36.0 | 44.0 | P |
| Iclass_event2 | 40.6 | mA | 40.6 | 40.6 | 40.6 | 36.0 | 44.0 | P |
| MarkI | 2.40 | mA | 2.40 | 2.40 | 2.40 | 0.25 | 4.00 | P |
| ClassNum2 | 4 | | 4 | 4 | - | 0 | 4 | P |
| Tclass_event1 | 0.0005 | sec | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0050 | P |
| Tclass_event2 | 0.0005 | sec | 0.0005 | 0.0005 | 0.0005 | 0.0005 | 0.0050 | P |
| ClassStability_event1 | 1 | | | | | 1 | 1 | P |
| ClassStability_event2 | 1 | | | | | 1 | 1 | P |

**Power-Up / Down**

| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
|---|---|---|---|---|---|---|---|---|
| InrushI_1 | -1.0 | mA | -1.0 | -1.0 | -1.0 | 0.0 | 400.0 | NA |
| InrushI_2 | 368.0 | mA | 368.0 | 368.0 | 368.0 | 0.0 | 400.0 | P |
| Pmax_Tdelay | 1.9 | W | 1.9 | 1.9 | 1.9 | 0.0 | 14.4 | P |
| Inrush_delayed | 0 | | 0 | 0 | - | 0 | 0 | P |
| Von | 37.7 | VDC | 37.7 | 37.7 | 37.7 | 30.0 | 42.0 | P |
| Voff | 31.9 | VDC | 31.9 | 31.9 | 31.9 | 30.0 | 37.0 | P |
| Vhyst | 5.8 | VDC | 5.8 | 5.8 | 5.8 | 3.9 | 12.0 | P |
| BackfeedV | 0.0 | VDC | 0.0 | 0.0 | 0.0 | 0.0 | 2.8 | P |
| ClassRecover | 0 | | 0 | 0 | - | 0 | 0 | P |
| SigRecoverTime | 0.0 | sec | 0.0 | 0.0 | 0.0 | 0.0 | 30.0 | P |

**MDI Powered Type-1** — *PSE Emulation*: On Time: **10 sec** Off Time: **10 sec** Vport: **-1.0**

| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
|---|---|---|---|---|---|---|---|---|

**MDI Powered Type-2 PHY** — *PSE Emulation*: On Time: **10 sec** Off Time: **10 sec** Vport: **54.0**

| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
|---|---|---|---|---|---|---|---|---|
| MinI_2 | 12.3 | mA | 12.3 | 12.3 | 12.3 | 0.0 | 524.1 | P |
| MaxI_2 | 17.3 | mA | 17.3 | 17.3 | 17.3 | 10.0 | 524.1 | P |
| Vport_2 | 54.0 | VDC | 54.0 | 54.0 | 54.0 | 42.5 | 57.0 | INFO |
| Ppeak_2 | 0.93 | W | 0.93 | 0.93 | 0.93 | 0.0 | 28.3 | P |
| Pavg_2 | 0.70 | W | 0.70 | 0.70 | 0.70 | 0.0 | 25.5 | P |
| MPSViolation_2 | 0 | | 0 | 0 | - | 0 | 0 | P |
| TcutWindowViolation_2 | 0 | | 0 | 0 | - | 0 | 0 | P |
| DutyCycleViolation_2 | 0 | | 0 | 0 | - | 0 | 0 | P |

**MDI Powered Type-2 LLDP** — *PSE Emulation*: On Time: **-1 sec** Off Time: **10 sec** Vport: **-1.0**

| Parameter | Cycle: 1 | Units | Min. | Max. | Average | Low Lim. | High Lim. | P/F |
|---|---|---|---|---|---|---|---|---|

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