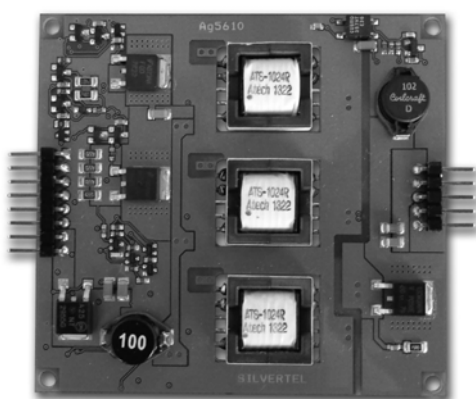




Ag5610

Power-Over-HDBaseT (PoH) Module



1 Features

- PoH, Cisco ® UPOE, IEEE802.3at and IEEE802.3af compliant
- Maximum 100 Watt output power
- High efficiency DC/DC converter
- Wide adjustable output voltage range
- 1500Vdc isolation (input to output)
- Input voltage range 52V to 57V
- Low output ripple and noise
- Minimal (low cost) external components required
- Overload, thermal and short-circuit protection
- Can be used with Silvertel Ag6600 100W PSE
- No minimum load required
- Silvertel "design-in" assistance

2 Description

The Ag5610 is a Twin High Power over HDBaseT (PoH) module that can deliver up to 100 Watts of output power. Suitable for applications such as Monitors, TV's and LED Displays.

The Ag5610 has been designed to extract power from Power Sourcing Equipment (PSE) over a conventional twisted pair Category 5 or 6 Ethernet cable. The module's input conforms to the PoH, IEEE802.3af and IEEE803.2at standards for signature recognition.

The high efficiency DC/DC converter operates over a wide input voltage range and provides a regulated low ripple and low noise output. The DC/DC converter also has built-in overload, thermal and short-circuit output protection.

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3 Ag5610 Product Selector

| Part Number† | Nominal Output Voltage | Maximum Output Power * |
|--------------|------------------------|------------------------|
| Ag5610 | 24V | 100 |

*At 25°C with heatsink
† The Ag5610 fully meets the requirements of the RoHS directive 2002/95/EC on the restriction of hazardous substances in electronic equipment.

Table 1: Ordering Information

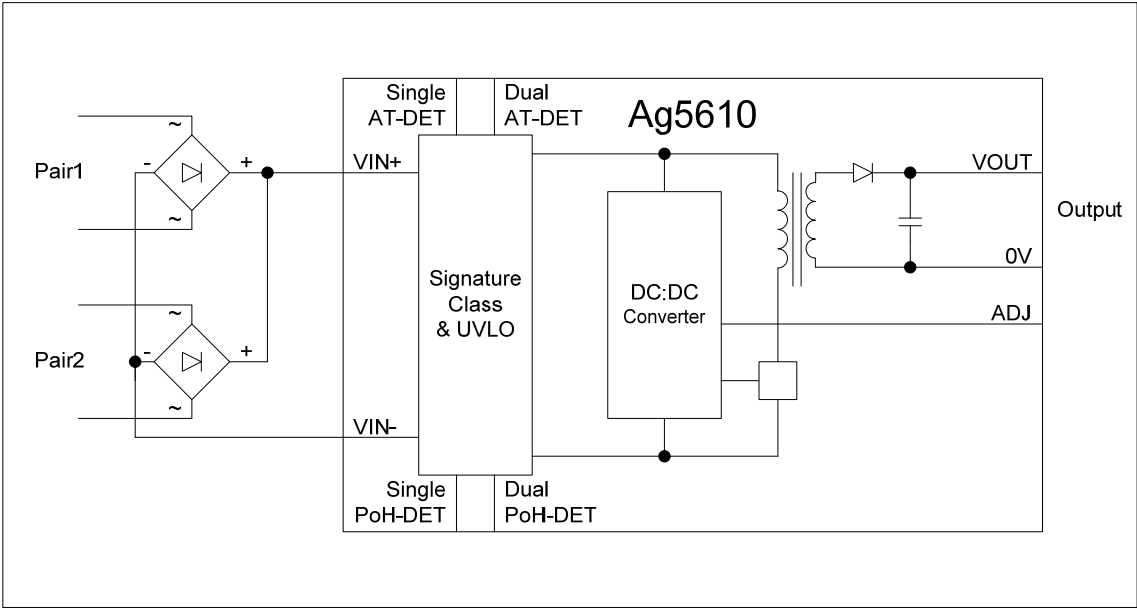


Figure 1: Block Diagram

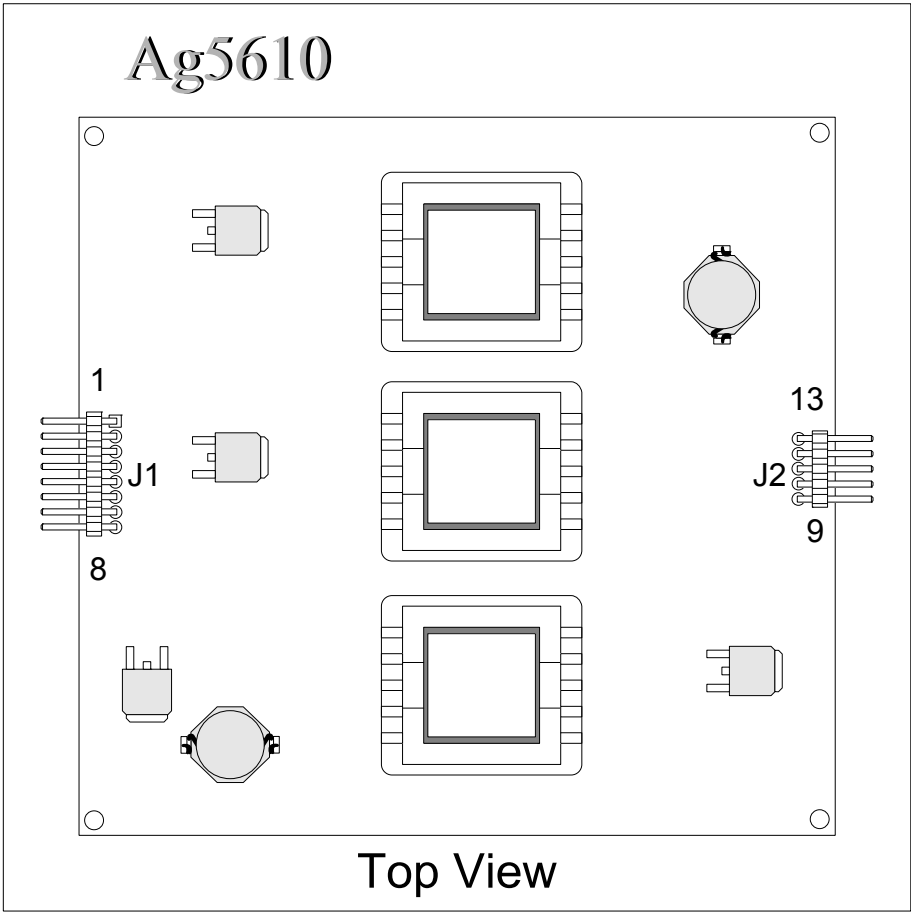


Figure 2: Ag5610 DIL Package Format (Top View)

4 Pin Description

| Pin # | Name | Description |
|-------|----------|---|
| J1 | | |
| 1 | VIN- | Direct Input -. This pin connects to the negative (-) output of the input bridge rectifiers. |
| 2 | | |
| 3 | PoH-DET2 | Dual PoH Detect Output. This pin indicates if a PoH PSE is supplying power to both inputs; see Section 5.4 for more details. |
| 4 | PoH-DET1 | Single PoH Detect Output. This pin indicates if a PoH PSE is supplying power to one input; see Section 5.4 for more details. |
| 5 | AT-DET2 | Dual AT Detect Output. This pin indicates if an IEEE802.3at PSE is supplying power to both inputs; see Section 5.4 for more details. |
| 6 | AT-DET1 | Single AT Detect Output. This pin indicates if an IEEE802.3at PSE is supplying power to one input; see Section 5.4 for more details. |
| 7 | VIN+ | Direct Input +. This pin connects to the positive (+) output of the input bridge rectifiers. |
| 8 | | |
| J2 | | |
| 9 | VOUT | DC Output. This pin provides the main regulated output from the DC/DC converter. |
| 10 | | |
| 11 | ADJ | Output Adjust. The output voltage can be adjusted from its nominal value, by connecting an external resistor from this pin to either the VOUT pin or the 0V pin. |
| 12 | 0V | Ground. The ground return for the VOUT output. |
| 13 | | |

5 Functional Description

5.1 Inputs

The Ag5610 has input pins VIN+ and VIN-, these must be connected to external bridge rectifiers to ensure the input is polarity protected, see Figure 3: Typical System Diagram.

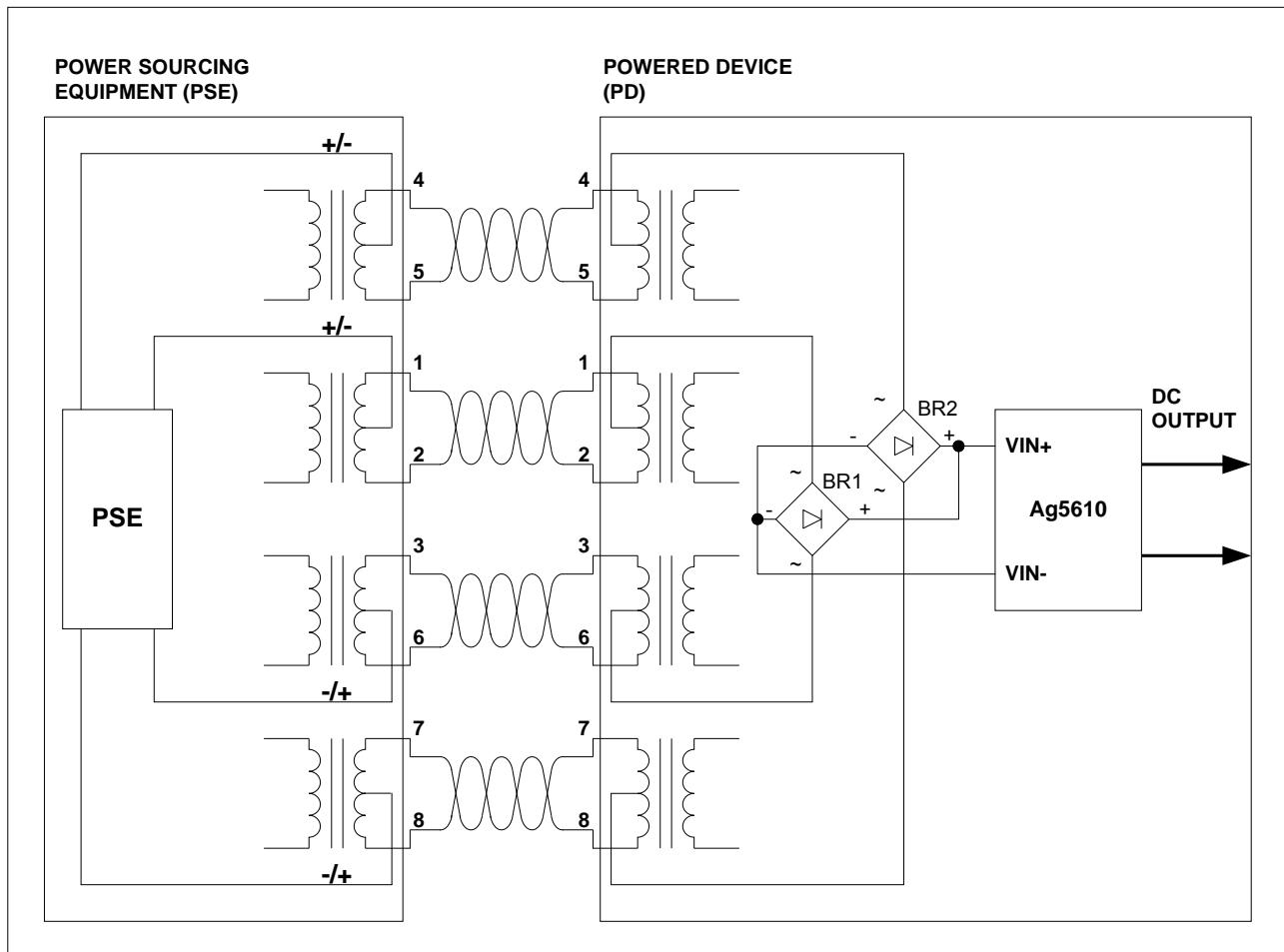


Figure 3: Typical System Diagram

5.2 PD Signature

The input Signature complies with IEEE802.3af, IEEE802.3at and HDBaseT specifications. When the input is connected to a Power Sourcing Equipment (PSE) via a Cat 5e or Cat 6 cable, it will automatically present a Powered Device (PD) signature to the PSE (when requested). The equipment will then recognise that a PD is connected to that port and supply power.

5.3 Power Classification

The Ag5610 classification is fixed at Class 4, this means that an IEEE802.3at Type 1 or an IEEE802.3af PSE will default to Class 0. For HDBaseT PSE and IEEE802.3at Type 2 PSE the Ag5610 will be recognised as Class 4.

5.4 PSE Type Detection

The Ag5610 has four output pins which are used to identify the Type of PSE connected to its input.

Each output pin can be connected directly to an opto-coupler, so that the output can cross the isolation barrier, as shown in Figure 4.

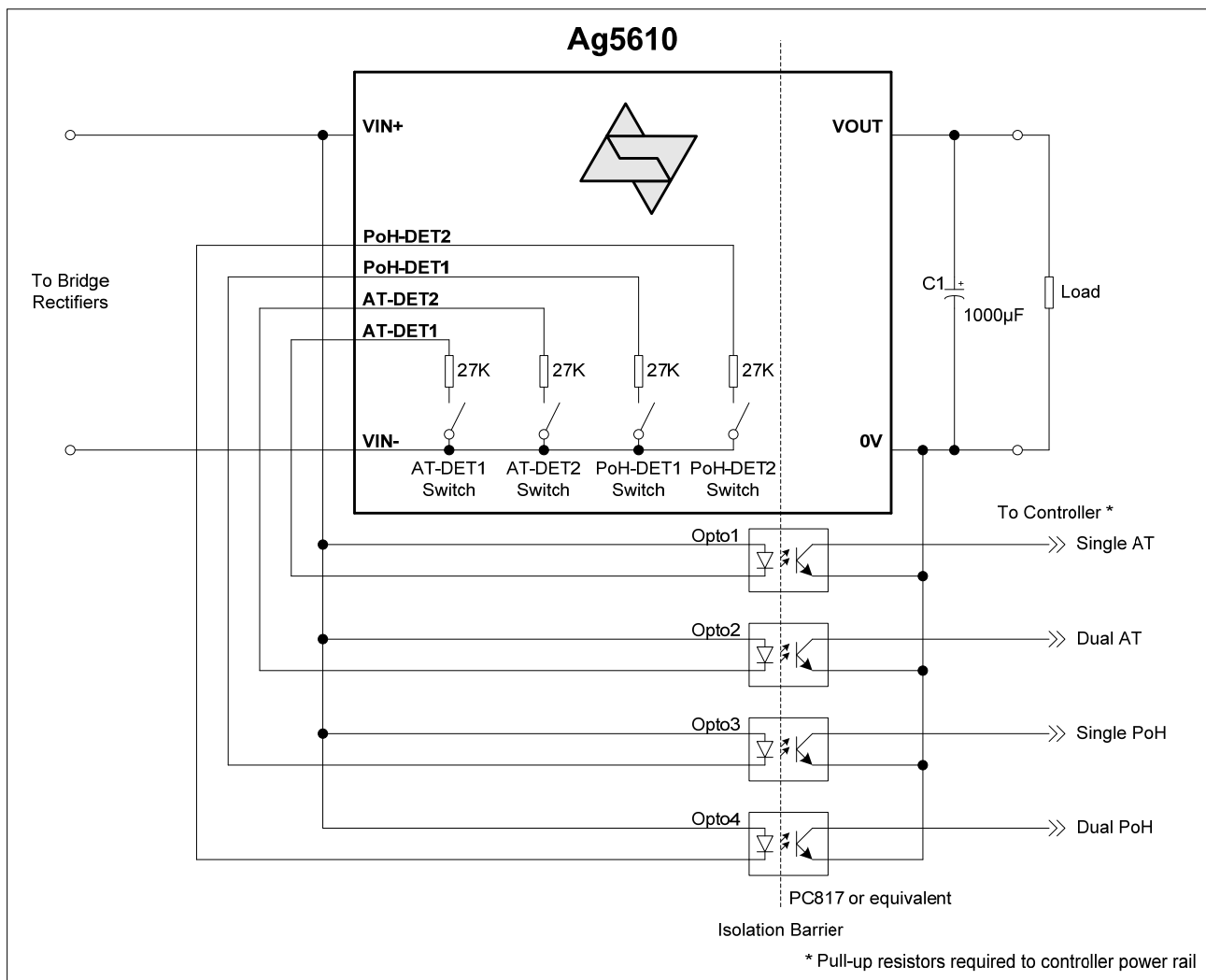


Figure 4: Physical Layer Detect Configuration

If an IEEE802.3af PSE is connected, the Ag5610 will power up but none of the detect outputs will be active.

If a standard IEEE802.3at PSE is connected, the AT-DET1 pin will be active and Opto1 will turn ON.

If a dual IEEE802.3at PSE is connected, the AT-DET2 pin will be active and Opto2 will turn ON.

If a standard PoH PSE is connected, the PoH-DET2 pin will be active and Opto4 will turn ON.

If one of the PoH inputs is not connected (or a proprietary single output PoH PSE is connected), the PoH-DET1 pin will be active and Opto3 will turn ON.

It is important to remember that Ag5610's output is limited to the capability of the PSE.

5.5 Isolation

To meet the safety isolation requirements of IEEE802.3at Section 33.4.1, a PD must pass the electrical strength test of IEC 60950-1:2001 sub clause 6.2.1. This calls for either a) 1500Vac test or b) 2250Vdc test or c) 1500Vdc impulse test. The Ag5610 has been designed to meet c) 1500Vdc impulse test (only).

5.6 DC/DC Converter

The Ag5610's DC/DC converter provides a regulated low ripple and low noise output that has built-in over-load and short-circuit output protection.

5.7 Output Adjustment

The Ag5610 has an ADJ pin, which allows the output voltage to be increased or decreased from its nominal value.

Figure 5: Output Adjustment Figure 5 shows how the ADJ pin is connected: -

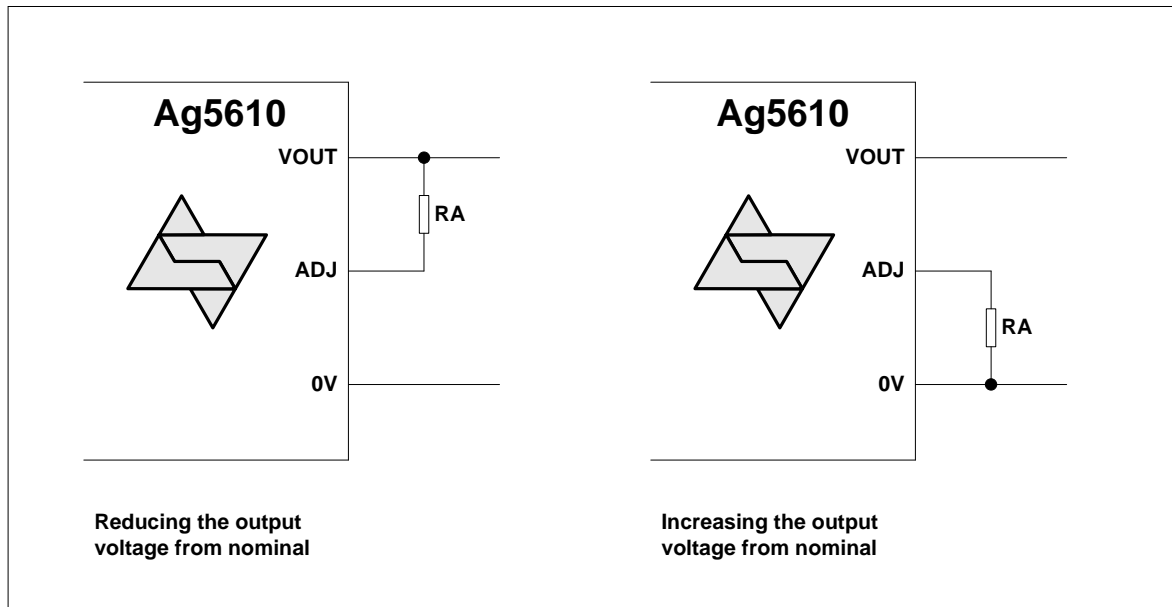


Figure 5: Output Adjustment

| Reducing the output voltage, connect RA between ADJ and VOUT | |
|--|-------|
| Value of RA | VOUT |
| Open Circuit | 24V |
| 36K | 17.5V |
| | |
| Increasing the output voltage, connect RA between ADJ and 0V | |
| Value of RA | VOUT |
| Open Circuit | 24V |
| 0R | 30.8V |

Table 2: Output Adjustment Resistor (R) Value

5.8 Output Power

The Ag5610 is capable of delivering a maximum output power of 85W continuous / 100W peak; however this is limited by the available input power to the module.

When calculating the output power, the following factors must be taken into account: -

1. Ag5610 efficiency
2. PSE output power
3. Cable and connector losses
4. Input bridge rectifier losses

5.9 Typical Connections

Figure 6 shows the typical configuration of the Ag5610. A minimum of 1000 μ F must be connected across the output for output stability and positioned as close to the pins as possible. This capacitor is also needed for step load change performance and can be a standard low cost electrolytic. It does not need to be a low ESR type, unless the ambient temperature can be $\leq 0^{\circ}\text{C}$.

Note: When connecting to an IEEE802.3af PSE, too much capacitance can cause the PSE to shut-down as it may not be able to handle the in-rush current.

The Output Adjust input is optional and is provided to give great flexibility to the Ag5610. Further information on using this input can be found in Section 5.7 Output Adjustment.

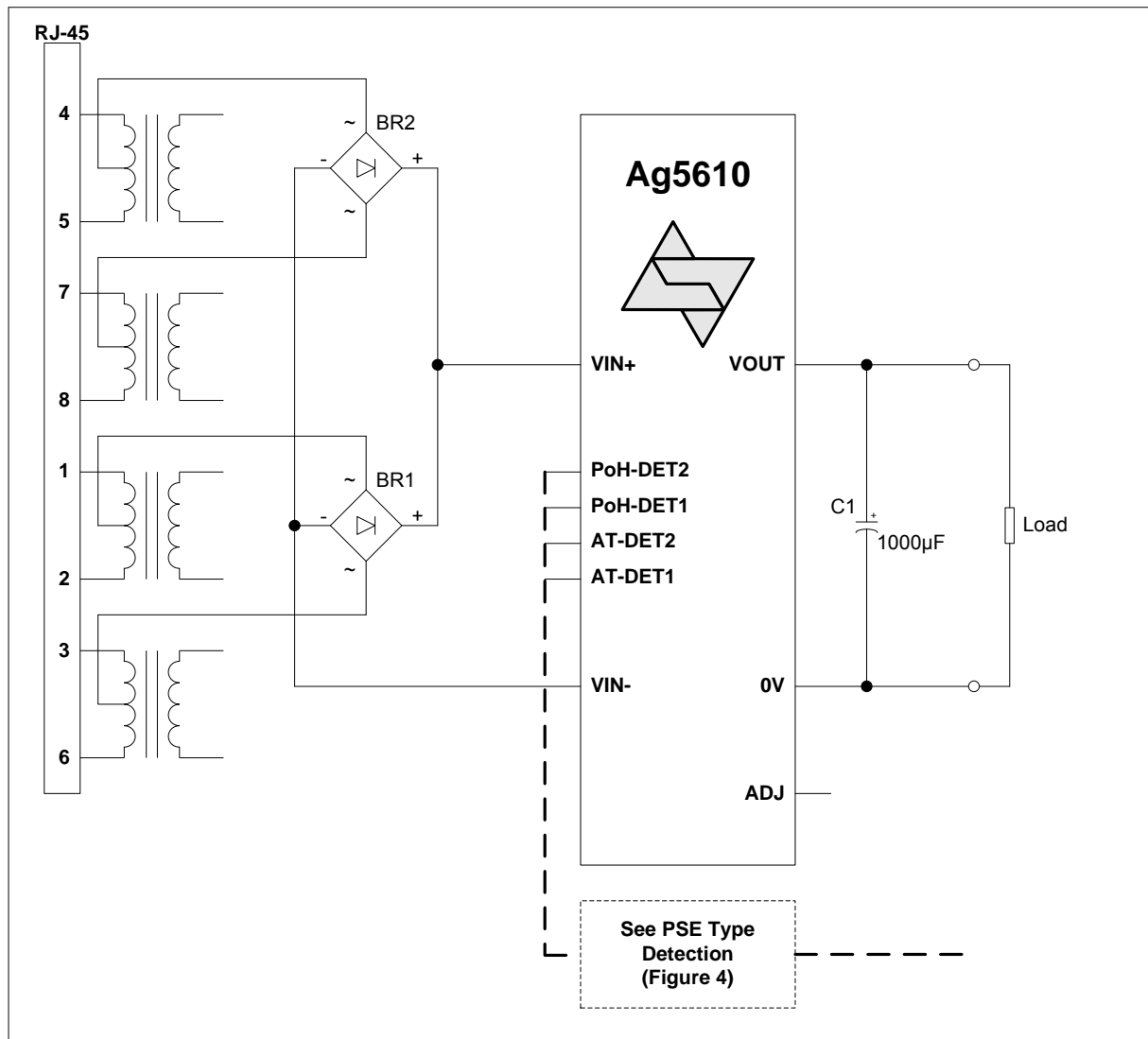


Figure 6: Typical Connection Diagram

6 Operating Temperature Range

It is important to remember that Ag5610 is a power supply, and as such careful consideration should be taken over the mechanical design of the host product, with provision for heat sinking and/or forced air cooling.

At full power the Ag5610 will generate approximately 11W of heat. The device has been designed to be used with a heat-sink plate, or thermally connected to the chassis of the host equipment and / or cooled with forced air.

Below is a suggested mounting method for the Ag5610.

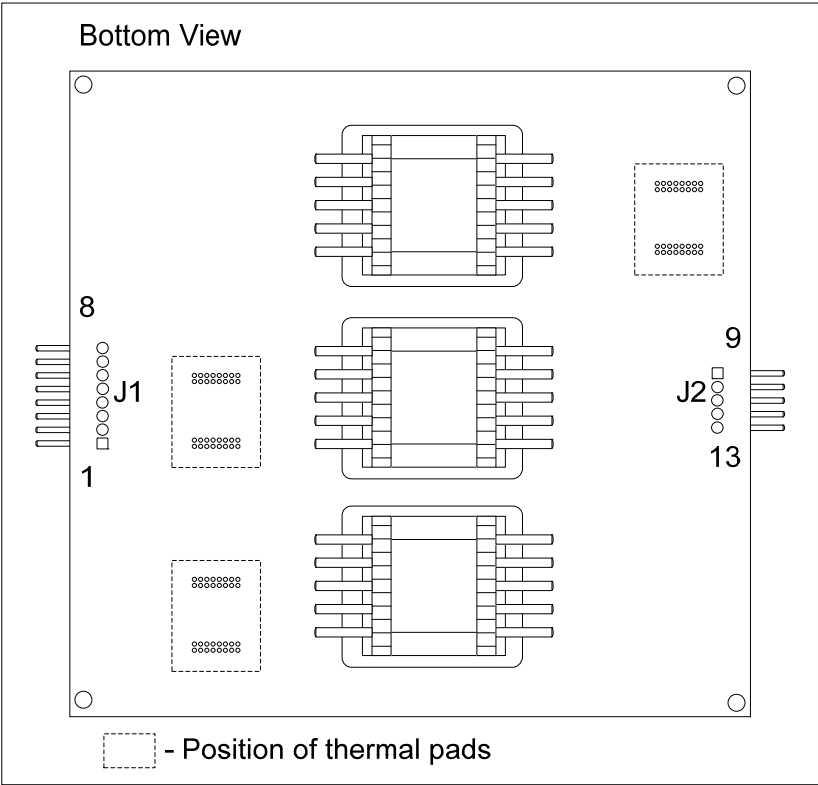


Figure 7: Module Position of Heat Pads (bottom view)

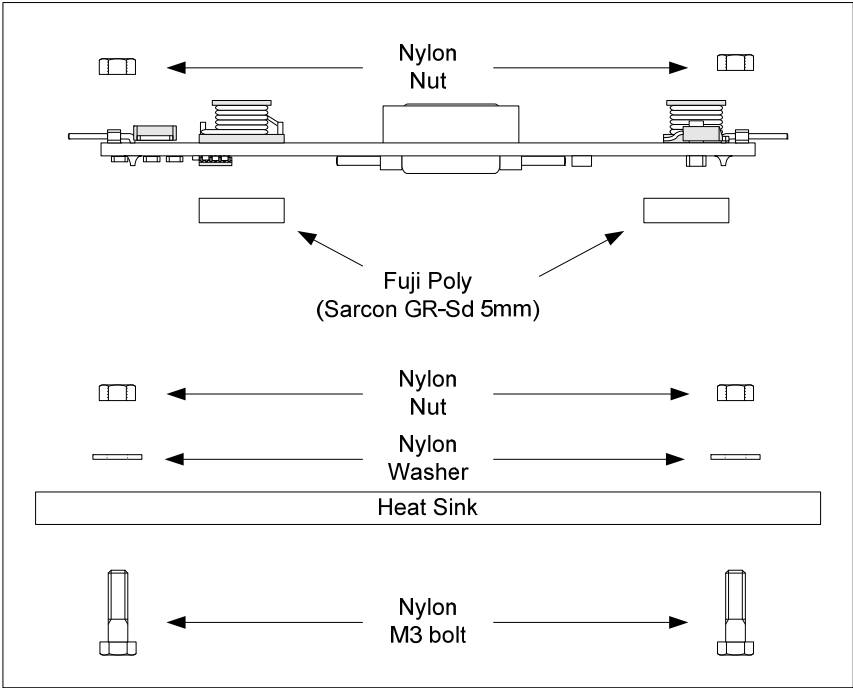


Figure 8: Suggested Heat Sink Assembly

The output stage of the Ag5610 has a built-in thermal protection circuit, to prevent the module from being damaged if operated beyond its power / temperature specification.

Because each application is different it is impossible to give fixed and absolute thermal recommendations. However it is important that any enclosure used has sufficient ventilation for the Ag5610 and a direct airflow if possible.

The results shown in Figure 9 were measured inside an Associated Environmental System SD-302 chamber. The solid line shows the performance with a heat sink fitted. The dotted line shows how the thermal performance can be extended by directly blowing air over the module with a fan. In this example an EMBPAPST – RLF35-8/14N was used.

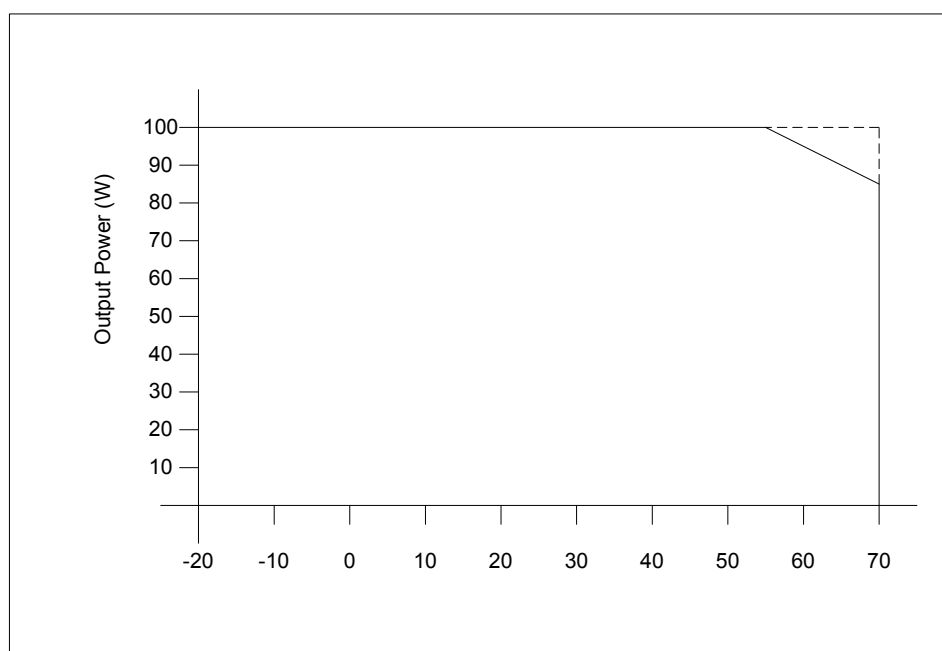


Figure 9: Ag5610 Operating Profile with Heatsink

7 Protection

The Ag5610 must be protected from over-voltages exceeding the 80V maximum rated surge input voltage. An inexpensive but effective solution can be achieved by connecting Transorb diodes across each of the inputs; see Apps Note “ANX-POE-Protection”.

8 Electrical Characteristics

8.1 Absolute Maximum Ratings¹

| | Parameter | Symbol | Min | Max | Units |
|---|---------------------------------|--------------------|------|------|-------|
| 1 | DC Supply Voltage | V _{CC} | -0.3 | 60 | V |
| 2 | DC Supply Voltage Surge for 1ms | V _{SURGE} | -0.6 | 80 | V |
| 3 | Storage Temperature | T _S | -40 | +100 | °C |

Note 1: Exceeding the above ratings may cause permanent damage to the product. Functional operation under these conditions is not implied. Maximum ratings assume free airflow.

8.2 Recommended Operating Conditions

| | Parameter | Symbol | Min | Typ | Max | Units |
|---|------------------------------------|-------------------|-----|-----|-----|---------|
| 1 | Input Supply Voltage ¹ | V _{IN} | 36 | | 57 | V |
| 2 | Under Voltage Lockout | V _{LOCK} | 30 | | 36 | V |
| 3 | Operating Temperature ² | T _{OP} | -20 | 25 | 70 | Ta / °C |

Note 1: With minimum load

2: See Section Operating Temperature Range

8.3 DC Electrical Characteristics

| | DC Characteristic | Sym | Min | Typ ¹ | Max | Units | Test Comments |
|----|---|---------------------|------|------------------|------|-----------------|-------------------------|
| 1 | Input Voltage Range at Full Load | V _{INFL} | 52 | 56 | 57 | V | |
| 2 | Nominal Output Voltage | +VDC | 22.8 | 24 | 25.2 | V | |
| 3 | Voltage Adjust Range | V _{ADJMIN} | | 17.5 | | V | See Output Adjustment |
| | | V _{ADJMAX} | | 30.8 | | V | See Output Adjustment |
| 4 | Output Current ² (V _{IN} = 56V) | I _{OUT} | | | 4.17 | A | |
| 5 | Line Regulation | V _{LINE} | | 0.06 | | % | @ 50% Load |
| 6 | Load Regulation | V _{LOAD} | | 0.1 | | % | |
| 7 | Output Ripple and Noise | V _{RN} | | 120 | | mVp-p | @ Max load ³ |
| 8 | Minimum Load ⁴ | R _{LOAD} | 0 | | | mA | |
| 9 | Short-Circuit Duration | T _{SC} | | | ∞ | sec | |
| 10 | Efficiency | EFF | | 87.7 | | % | 50% Load |
| 11 | Isolation Voltage (I/O) | V _{ISO} | | | 1500 | V _{PK} | Impulse Test |

Note 1: Typical figures are at 25°C with a nominal 56V supply, parallel output configuration (unless otherwise stated) and are for design aid only. Not Guaranteed

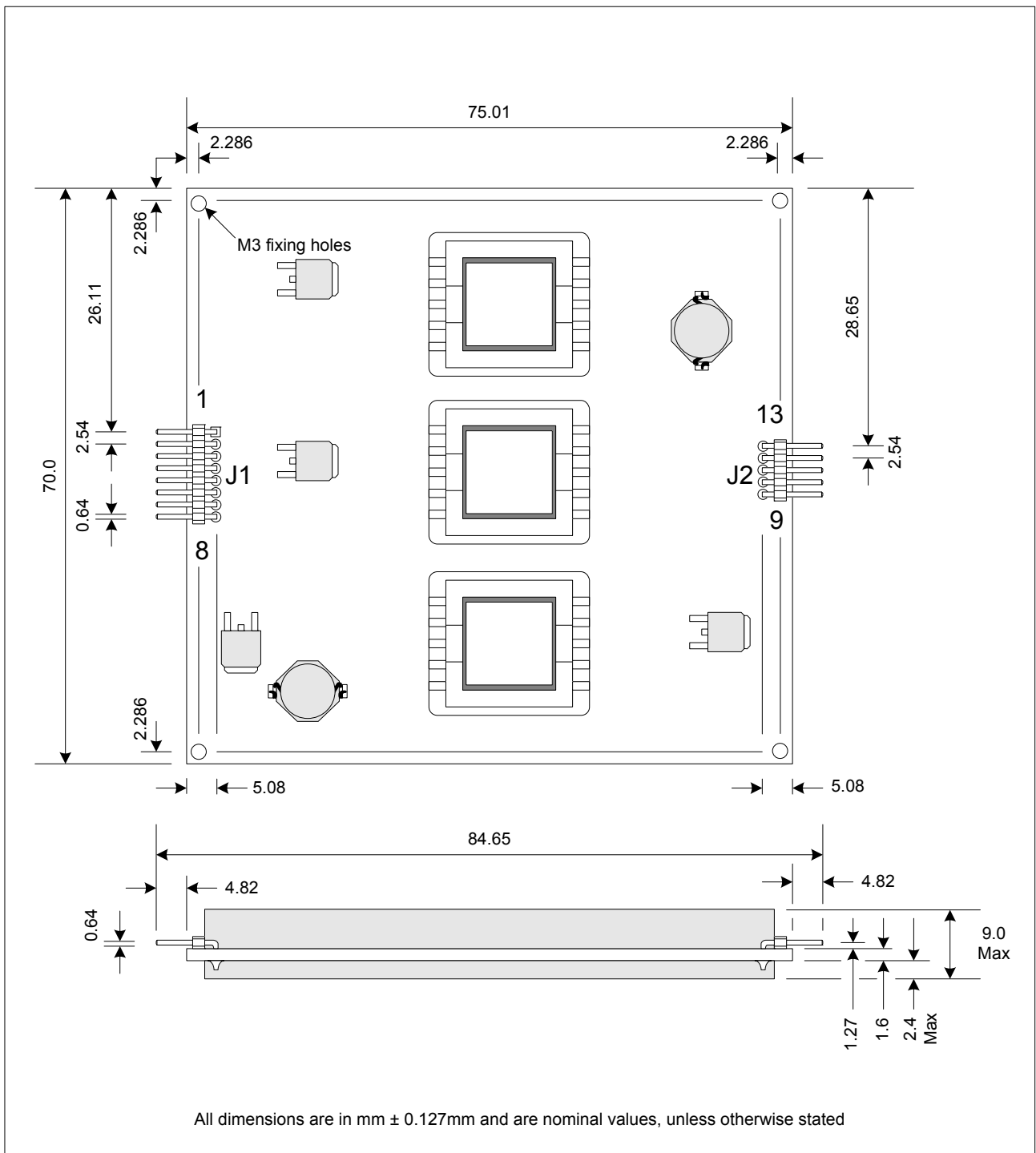
2: The output will be limited by the available power from the PSE.

3: The output ripple and noise can be reduced with an external filter, see application note.

4: The Ag5610 has been designed to work normally when no load is connected.

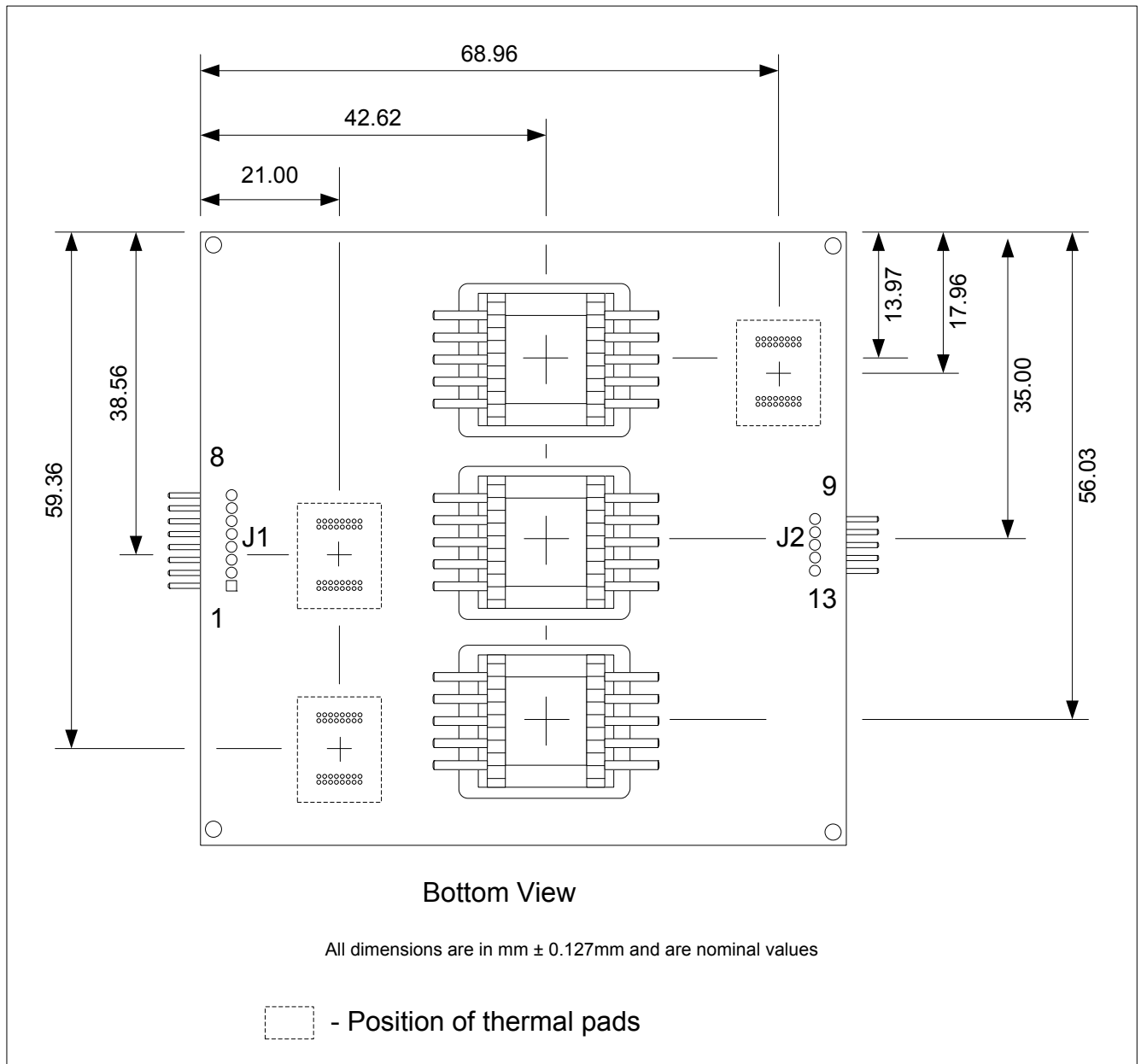
9 Package

9.1 Ag5610 Dimensions



9.2 Ag5610 Transformer and Thermal Pad Centres

The drawing below shows the centres of the transformer and thermal relief pads.



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