Silvertel

Ag59800 Datasheet

High Efficiency SMT Class 8 Power-over-Ethernet Module

Features

- 95% efficient 100W DC/DC converter
- IEEE802.3bt class 8 PD (PoE++) for up to 89W output applications
- 12V and 24V variants available
- Low output ripple & noise
- Overload, short-circuit and thermal protection
- Adjustable output voltage
- Industrial temperature range
- Minimal external components required
- IEEE802.3bt compliant, compatible with IEEE802.3at and IEEE802.3af
- Compact Surface mount package size
  Ag59800-LPB:51mm x 30mm x 15mm
  Ag59800-ULP:70mm x 35mm x 11mm
- 1500Vdc isolation (input to output)
- Silvertel “design-in” assistance
- Designed and manufactured in the UK

Description

Ag59800 series Power-over-Ethernet (PoE++) modules are designed to extract power from a conventional twisted pair Category 5 Ethernet cable, conforming to the IEEE802.3 PoE standard, with full compatibility with the IEEE802.3bt, IEEE802.3at and IEEE802.3af amendments.

The Ag59800 is pre-configured as a Type 4 Class 8 device, requesting a minimum of 90W of power from the PSE, with nominal output voltages of 12V or 24V.

The high efficiency DC/DC converter can achieve up to 95% efficiency and operates over a wide input voltage range with a low ripple and low noise output. The DC/DC converter also has built-in output overload, output short-circuit and over-temperature protection and provides a 1500Vdc (input to output) isolation barrier, as required by the IEEE802.3 specification.

Table of Contents

Table of Figures

1 Product Overview

1.1 Form Factor Options

The Ag59800 is available in two electrically identical form factors, the Ag59800-LPB, which features gold block terminations for an SMT assembly process. The Ag59800-ULP is an ultra-low profile form factor featuring castellated terminations to allow for flexibility in mounting to accommodate application height restrictions.

1.2 Ag59800 Product Selector

Part Number[1]	Nominal Output Voltage	Output Power	Marking[2]	Package
Ag59812-LPB	12V	100W DC/DC Converter[3]	ab12c	SMT
Ag59812-ULP				SMT/THT
Ag59824-LPB	24V		ab24c	SMT
Ag59824-ULP				SMT/THT

Note 1: Complies with the European Directive 2011/65/EU for the Restriction of use of certain Hazardous Substances (RoHS) including Directive 2015/863 published in 2015, amending Annex II of Directive 2011/65/EU. Moisture Sensitive Level 1 and HBM 1.

Note 2: Located on the transformer.
The first letter, a, indicates the week as A-Z with uppercase being weeks 1-26, lower case weeks 27-52.
The second letter, b, indicates the year in uppercase A-Z starting from 2020.
The two digits are the nominal output voltage,
The final letter, c, is a Silvertel reference.

Note 3: Usable output power limited by PSE output power and transmission losses

Table 1: Ordering Information

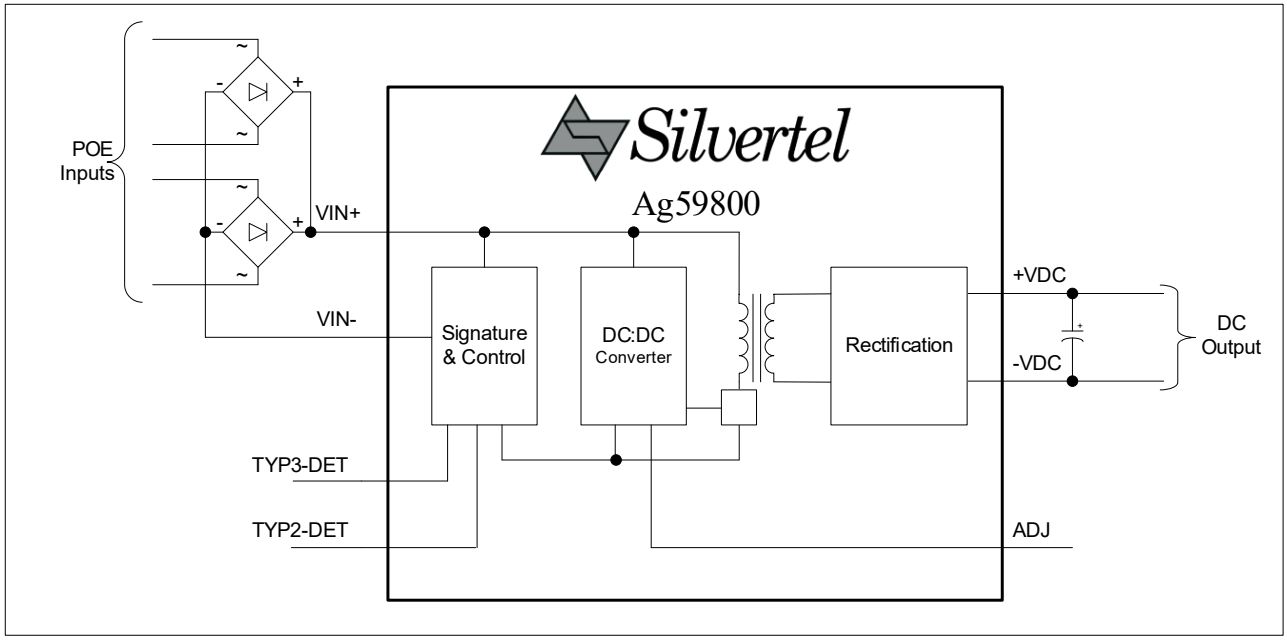


Figure 1: Block Diagram

1.3 Package Format

1.4 Ag59800-LPB

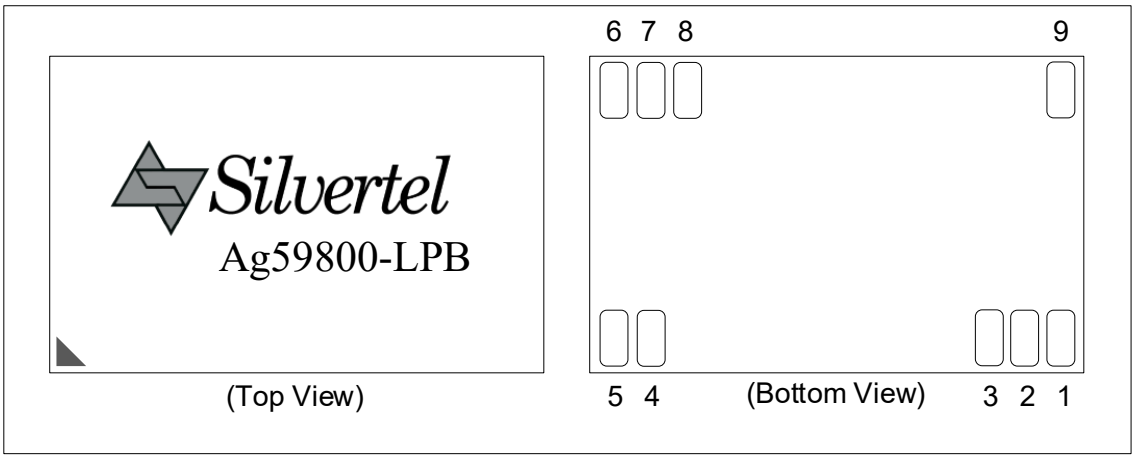


Figure 2: Ag59800-LPB Package Format

1.4.1 Pin Description

Pin #	Name	Description
1	V_{IN-}	**POE Direct Input -**. This pin connects to the negative (-) output of the POE input bridge rectifiers.
2	TYP3-DET	**Type 3 Detect Output.** This pin indicates if a IEEE802.3bt Type 3 or Type 4 PSE is supplying power to the Ag59800-LPB; see Section 2.3 for more details.
3	TYP2-DET	**Type 2 Detect Output.** This pin indicates if an IEEE802.3at PSE is supplying power to the Ag59800-LPB; see Section 2.3 for more details.
4	V_{OUT+}	**Positive DC Output.** This pin provides the positive regulated output from the Ag59800-LPB.
5		
6	V_{OUT-}	**Negative DC Output.** This pin provides the negative regulated output from the Ag59800-LPB.
7		
8	ADJ	**Output Adjust.** The output voltage can be adjusted from its nominal value, by connecting an external resistor from this pin to either the +VDC pin or the -VDC pin.
9	V_{IN+}	**POE Direct Input +**. This pin connects to the positive (+) output of the POE input bridge rectifiers.

Table 2: Pin Description

1.5 Ag59800-ULP

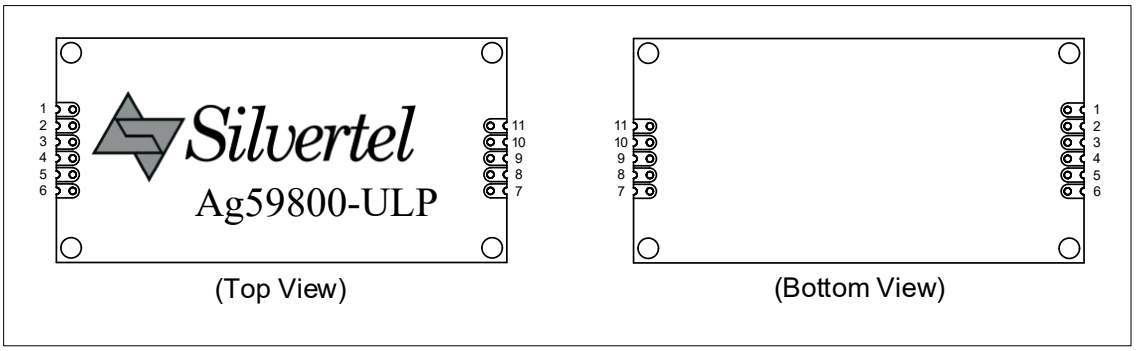


Figure 3: Ag59800-ULP Package Format

1.5.1 Pin Description

Pin #	Name	Description
1	V_{IN-}	**POE Direct Input -**. This pin connects to the negative (-) output of the POE input bridge rectifiers.
2		
3	TYP3-DET	**Type 3 Detect Output.** This pin indicates if a IEEE802.3bt Type 3 or Type 4 PSE is supplying power to the Ag59800-ULP; see Section 2.3 for more details.
4	TYP2-DET	**Type 2 Detect Output.** This pin indicates if an IEEE802.3at PSE is supplying power to the Ag59800-ULP; see Section 2.3 for more details.
5	V_{IN+}	**POE Direct Input +**. This pin connects to the positive (+) output of the POE input bridge rectifiers.
6		
7	V_{OUT+}	**Positive DC Output.** This pin provides the positive regulated output from the Ag59800-ULP.
8		
9	ADJ	**Output Adjust.** The output voltage can be adjusted from its nominal value, by connecting an external resistor from this pin to either the +VDC pin or the -VDC pin.
10	V_{OUT-}	**Negative DC Output.** This pin provides the negative regulated output from the Ag59800-ULP.
11		

Table 3: Pin Description

1.6 Typical Connections

The Ag59800 only requires a few external components - the bridge rectifiers on the V_{IN} input are to conform to the input polarity protection requirement. The output capacitor (C1) connected across the output is required for correct operation of the DC/DC converter. For optimal stability, this capacitor must be positioned as close to the output pins as possible.

The output capacitance can be a low-cost electrolytic capacitor as shown in Figure 4; it does not need to be a low ESR type for operation in temperatures down to 0°C. But if ambient temperatures \below 0°C are expected, a capacitor that retains a moderately low ESR and the minimum capacitance is essential for operation; Polymer Aluminium Solid Electrolytic Capacitors are ideal for below zero ambient temperature applications.

The output voltage can be adjusted by simply connecting a resistor between the ADJ pin and either the +VDC Pin or the –VDC pin, see section 3.2 Output Voltage Adjust Setting.

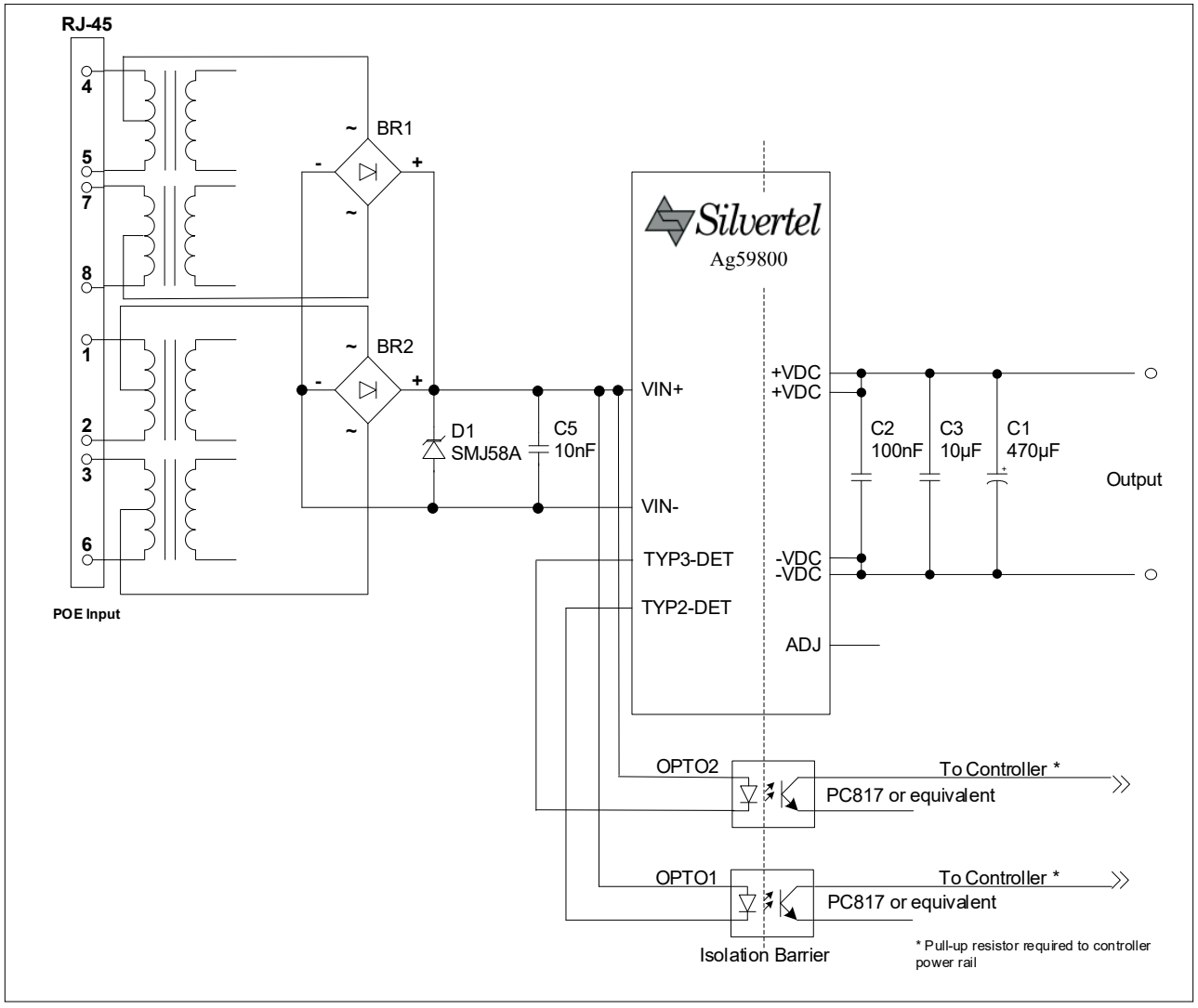


Figure 4: Typical System Diagram

2 Input

The Ag59800 has two input pins VIN+ and VIN-, these should be connected to the outputs of two external bridge rectifiers (see Figure 4: Typical System Diagram). This allows the Ag59800 to be compatible with Power Sourcing Equipment (PSE) that utilise any of the permissible power source polarity configurations.

The Ag59800 is designed to be powered by any compliant IEEE802.3 PSE, such as Silvertel's Ag6810.

2.1 PD Signature

The Ag59800 complies with the IEEE802.3 specifications and provides the required signature and control circuitry within. When the inputs are connected to a PSE, they will automatically present a Powered Device (PD) signature to the PSE (when requested). The PSE will then recognise that a valid PD is connected to that line and progress to the classification and powering stages.

2.2 Power Classification

The Ag59800 is a fixed Type 4 - Class 8 PD requesting 90W of power from a compliant IEEE802.3 Type 4 PSE by displaying the correct class pulse response shown in Table 4 below. If the Ag59800 is connected to a Type 1 or Type 2 PSE, the PSE will recognise the Class request as a valid request beyond maximum output and default to its highest output classification power level, and supply 15.4W for a type 1 PSE and 30W for a Type 2 PSE.

Requested Class	Class Pulse Count	*Pulse 1&2 Classification Current (mA)*	Pulse 3+ Classification Current (mA)	PSE Output Power (W)	Min. Available PD Power (W)	IEEE Spec. Amendment
0	1	*<5*	N/A	15.4	12.75	802.3af
1	1	*10*	N/A	4	3.84	
2	1	*20*	N/A	7	6.49	
3	1	*30*	N/A	15.4	12.75	
4	2 or 3	*40*	40	30	25.5	802.3at
5	4	*40*	<5	45	40	802.3bt
6	4	*40*	10	60	51	
7	5	*40*	20	75	62	
8	5	*40*	30	90	71.3	

Table 4: Classification Table

2.3 PSE Type Detection

The IEEE802.3 specification stipulates that if a device detects it is connected to a PSE that is not capable of providing the full requested power level, the device should remain in a reduced power mode and/or indicate to the user that the device is under powered. To complete the protocol (and conform to the IEEE802.3 specification) the controller should then confirm that it is a Type 4 PD over the Data Link Layer*.

To achieve this, the Ag59800 monitors the detection and classification sequence to determine the type of PSE that performed the signature and classification. The module then uses the two type detection output pins, TYP2-DET and TYP3-DET, to flag to either the application circuitry or the user the detected PSE type to either adjust the peak power draw of the application or to inform the user that the device is under powered and may power cycle.

When the PSE type has been detected, the relevant pins will pull low from Vin+; this can be used to drive an LED or an Optocoupler as shown in Figure 5.

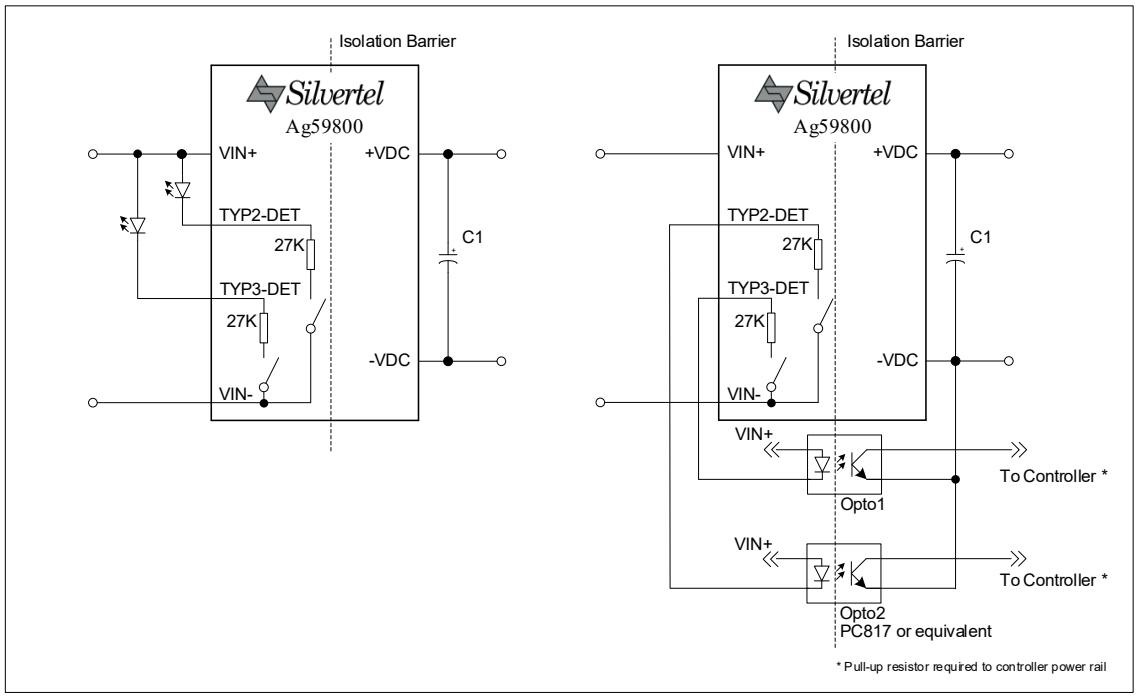


Figure 5: Physical Layer Detect Configuration.

Detected PSE Type	TYP2-DET output	TYP3-DET output
1	High	High
2	Low	High
3	High	Low
4	Low	Low

Table 5: Type Detect Output Table

* There are several PSEs (including Cisco) that will only deliver ≤15.4W until they receive confirmation over the Data Link Layer.

If the Ag59800 detects five or more Event Physical Layer classification, both switches will close and Opto1 and Opto2 will turn ON. The optocouplers will pass this signal across the isolation barrier and the output collector can be connected to a controller (with a pull-up resistor connected to the controller's power rail). When both Optocouplers are ON their collector (output) will be Logic 0, the controller will then know that the PSE is capable of delivering 90W.

If the Ag59800 detects a four Event Physical Layer classification, Opto1 will be ON and Opto2 will be OFF. The controller should then assume that the PSE is limited to only delivering up to 60W.

If the Ag59800 detects a Two Event Physical Layer classification, Opto2 will be ON and Opto1 will be OFF. The controller should then assume that the PSE is limited to only delivering up to 30W.

If the Ag59800 detects a Single Event Physical Layer classification, both Opto1 and Opto2 will be OFF and the output collectors will be Logic 1 (via pull-up resistor). The controller should then assume that the PSE is limited to only delivering up to 15.4W.

If the PSE does not support the Physical Layer classification, Opto1 and Opto2 will be OFF, even if it is supplying the full requested power level of the Ag59800.

The Ag59800 may operate with some PSEs that are not compliant to the IEEE802.3 specification.

3 Output

3.1 Maximum Output Power

A Type 4 (IEEE802.3bt) PSE supplying Class 8 power levels shall provide a minimum of 90W at its lowest voltage of 52V from its output, however with cable, connector and rectification losses, the available power and voltage at the input pins of the Ag59800 may be lower than this.

In a fully compliant IEEE802.3 system, the power available, measured at the input to the bridge rectifiers, may be as low as 71.3W, see "ANX-POE-Power" for more details. While the Ag59800 is capable of delivering an output power of 100W, it is recommended that any application where cabling and PSE cannot be specified, be designed for a maximum continuous output power of 67W from the Ag59800. In applications where cable length or category have additional constraints by the applications requirements or the PSE can be limited to a list of approved models, the available power budget may be higher.

3.2 Output Voltage Adjust Setting

The Ag59800 has an output voltage adjustment pin, ADJ, which can be used to either increase or decrease the output voltage of the module.

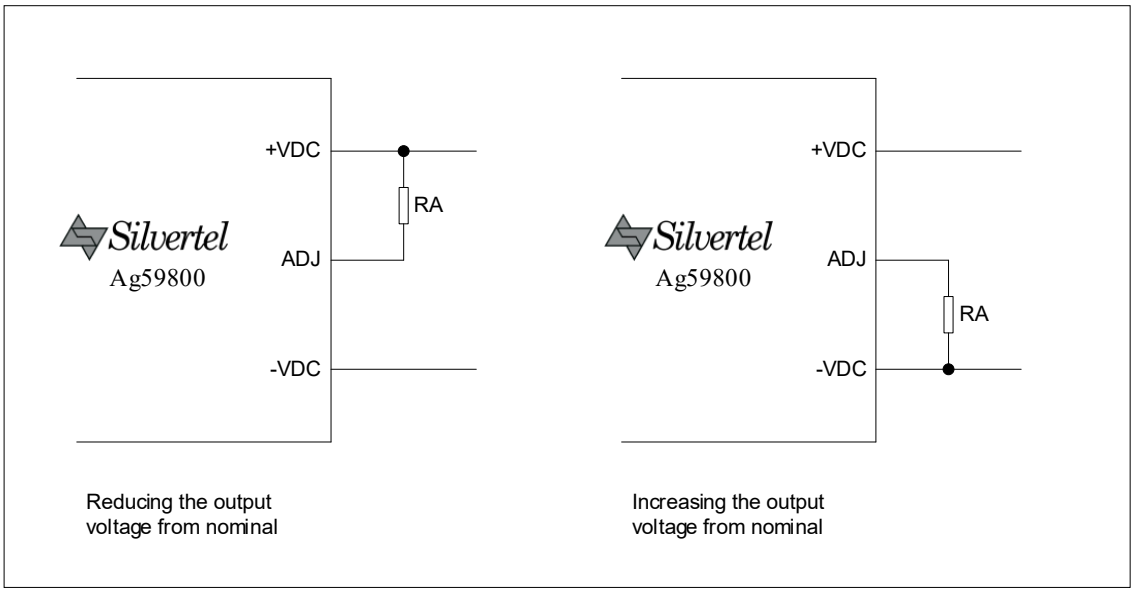


Figure 6: Output Voltage Adjustment

Reducing the output voltage, connect RA between ADJ and +VDC		
Value of RA	**Ag59812 output**	**Ag59824 output**
Open Circuit	12.0V	24.0V
0 Ohms	8.8V	18.9V
Increasing the output voltage, connect RA between ADJ and -VDC		
Value of RA	**Ag59812 output**	**Ag59824 output**
Open Circuit	12.0V	24.0V
0 Ohms	13.2V	25.0

Table 6: Output Voltage Adjustment Resistor Values

3.3 Output Filtering

The Ag59800 requires a bulk capacitance to be fitted on its output for stable operation, this is typically provided with a single electrolytic capacitor, this provides a high level of output regulation and low output ripple. Output ripple can be reduced further with the addition of ceramic capacitors across the output. The recommended output filtering is shown in Figure 7.

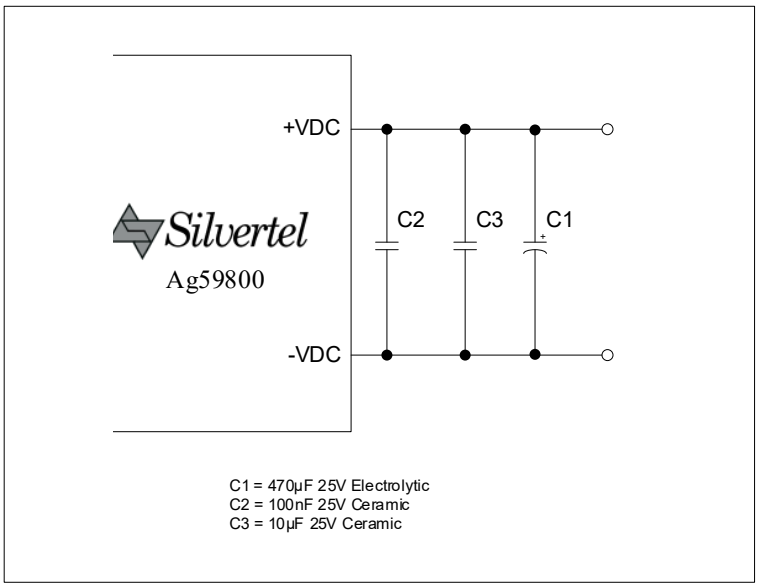


Figure 7: Output Filter

4 Efficiency

The Ag59800 has been designed as a high efficiency PoE++ solution. In order to preserve this efficiency in the end-to-end solution, it is recommended that the Ag59800 is paired with MOSFET rectification in order to eliminate the voltage drop incurred when using diode-based bridge rectification.

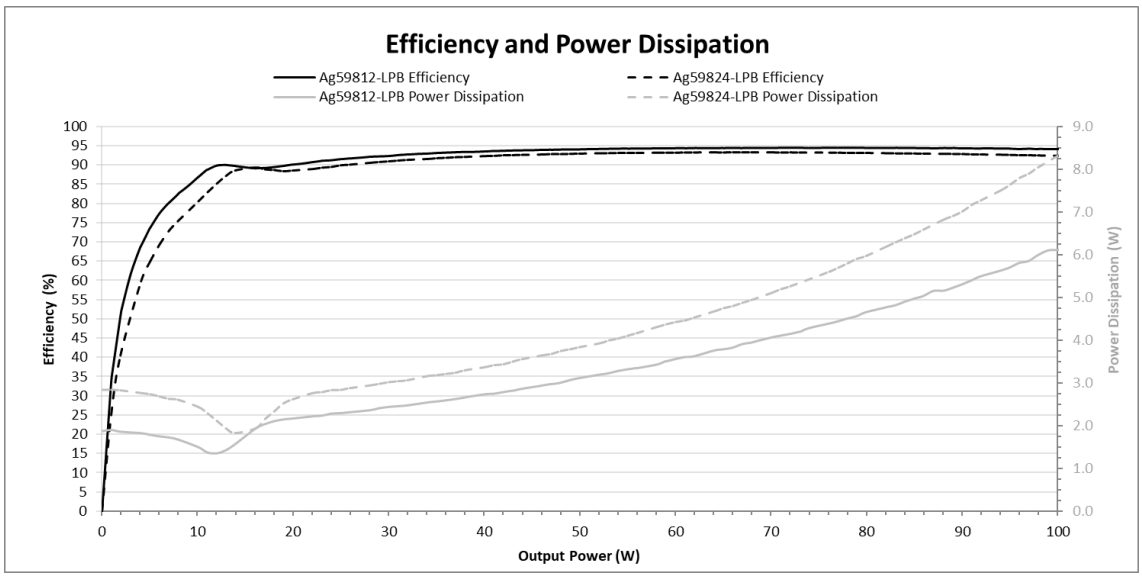


Figure 8: Efficiency

5 Operating Temperature Range

At the heart of the Ag59800 is a DC/DC converter, it will generate heat. While the product has been designed to be a high efficiency device, the small form factor requires that thermal management is taken into consideration at the design stage. The amount of heat generated by the module will depend on the load it is required to drive and the input voltage supplied by the PSE.

The Ag59800 can operate up to a maximum of 85˚C ambient, and a minimum of -40˚C ambient. When intended for used in ambient temperatures below 0°C it is recommended that an output capacitor that will retain the minimum output capacitance and ESR ratings for the Ag59800 at the lowest temperature in the intended operating range is used. A polymer aluminium electrolytic capacitor is ideal for this application, however a reputable brand rated to -55°C should suffice for most applications, please contact Silvertel if suggestions are required.

5.1 Thermal Considerations

Each application is different; therefore, it is impossible to give fixed and absolute thermal recommendations. Due to the compact design, while not required, it is recommended that a thermal interface material is used under the module to draw heat out and away from the module for continuous operation. It is recommended to make provision for heatsinking as follows.

5.1.1 Ag59800-LPB

The recommended method for drawing heat away from the Ag59800-LPB is by means of copper planes connected to the power pins of the Ag59800 along with a thermal gap filler gel fitted underneath the Ag59800-LPB, such as Parker Chomerics THERM-A-GAP GEL. This technique can be used to draw heat away from the DC/DC converter to dissipate over a larger surface area.

The copper planes should be on the outer layers of the PCB, best results are achieved with additional copper planes on internal layers of host PCB with multiple thermal via connections. An example of this is shown in Figure 9. It is also important that any enclosure has sufficient ventilation for the Ag59800.

It is recommended that the gap filler is applied to this region such that it encompasses both the components and PCB. The gap filler can be used in combination with thermal via arrays, to reduce the thermal resistance between the copper planes. Figure 10 shows the recommended application area for the gap filler to provide sufficient heat transfer from the module to the host PCB.

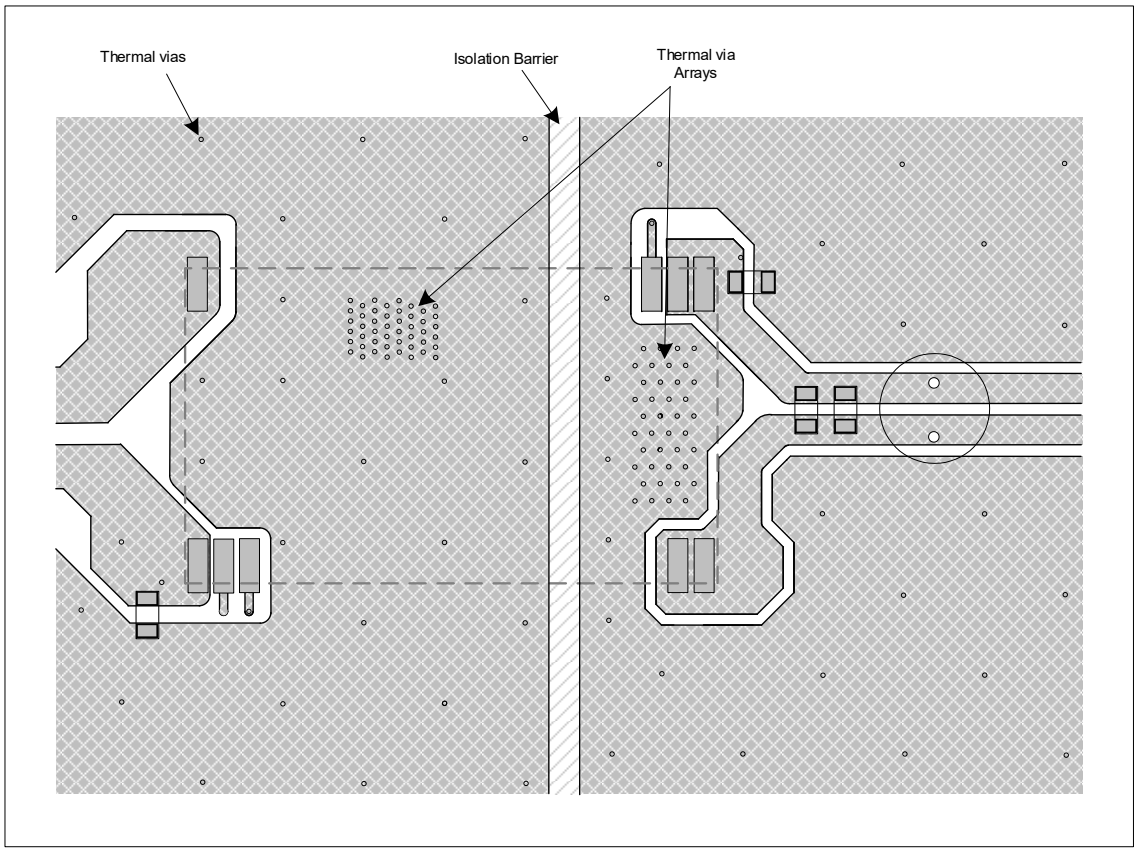
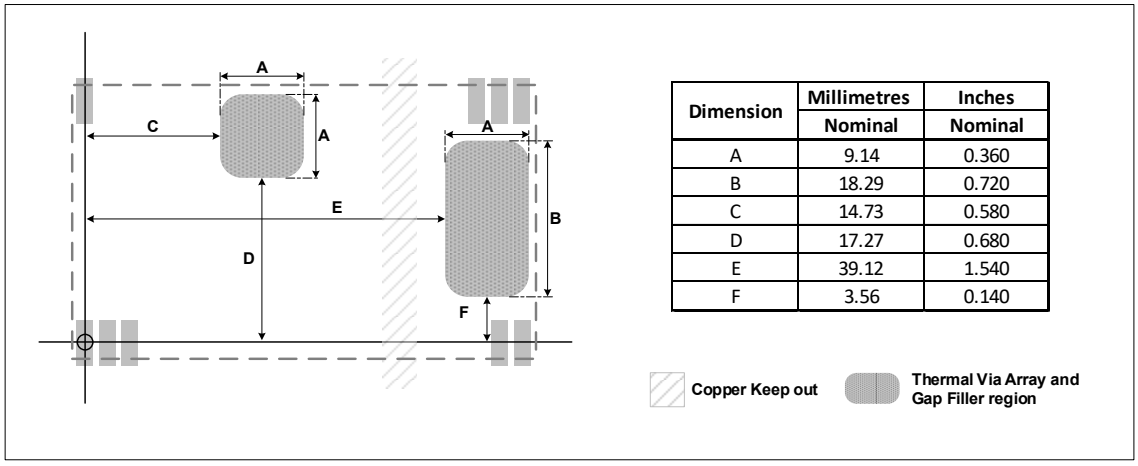


Figure 9: Thermal Relief



Dimension	Millimetres	Inches
	Nominal	Nominal
A	9.14	0.360
B	18.29	0.720
C	14.73	0.580
D	17.27	0.680
E	39.12	1.540
F	3.56	0.140

Figure 10: Thermal Interface Application Region

Heat dissipation can be improved further by thermally connecting to the enclosure of the application. The simplest method of performing this is to use a thermal gap pad located between the host PCB and the enclosure, situated over the area containing the thermal via arrays.

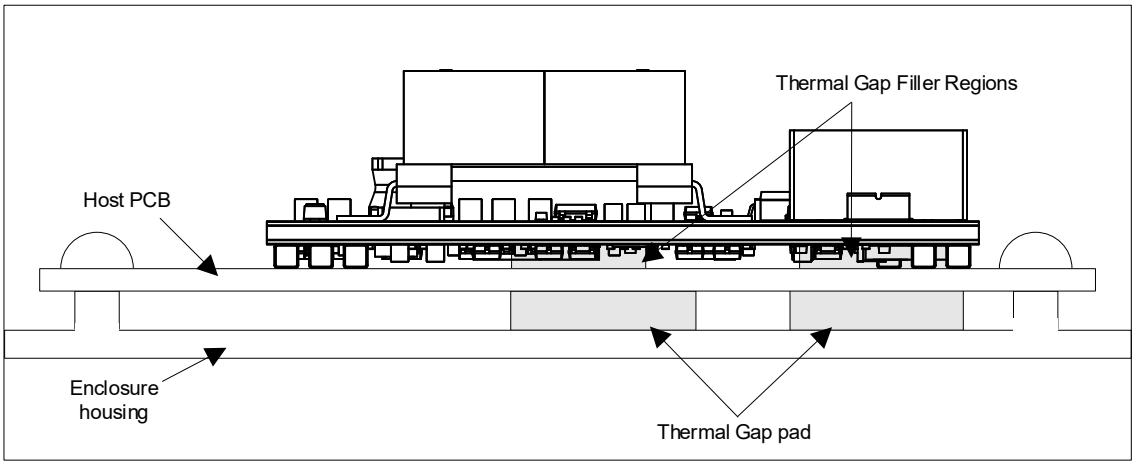


Figure 11: Additional Heatsinking

5.1.2 **Ag59800-ULP**

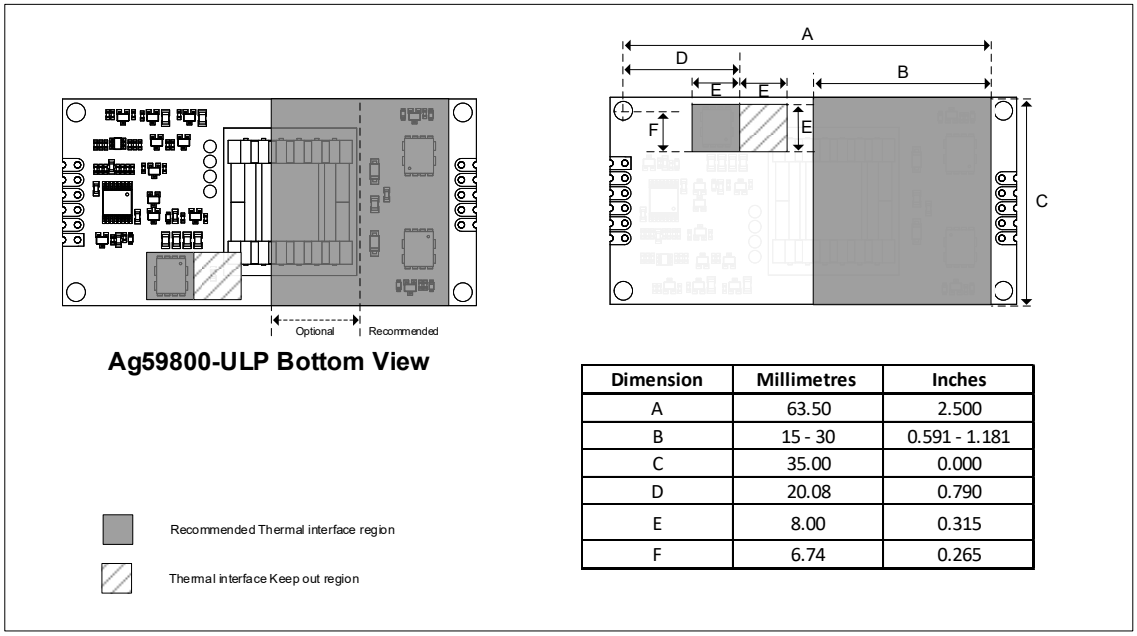
The Ag59800-ULP can be mounted to a host PCBA in a number of different configurations to allow for differing height constraints across applications. See Figure 13: Example Ag59800-ULP Mounting Configuration for examples.

The recommended method for drawing heat away from the Ag59800-ULP is by means of a thermal gap pad fitted underneath the module to the enclosure wall. This technique can be used to draw heat away from the DC/DC converter to dissipate over a larger surface area.

It is recommended that compressible gap pad is sized such that it spans from the enclosure wall to the Ag59800-ULP PCB, encompassing the components fully. The recommended gap pad size and location dimensions are detailed in Figure 12: Ag59800-ULP TIM dimensions. Thermal interface material can cover a larger proportion of the modules underside, but the temperature sensing region should be excluded from coverage to allow for proper operation of thermal protection circuitry.

It is recommended that the thickness of the gap pad, is kept to 3mm to or less to ensure thermal transfer through the material. The thickness of the gap pad should be sized to match or slightly exceed the distance between the modules PCB and the conducting surface.

If the enclosure wall is electrically conductive and is in close proximity to the Ag59800-ULP, it is recommended that an electrically isolating material is used on the enclosure wall where the primary side conductors are in close proximity to maintain the isolation requirements.



Dimension	Millimetres	Inches
A	63.50	2.500
B	15 - 30	0.591 - 1.181
C	35.00	0.000
D	20.08	0.790
E	8.00	0.315
F	6.74	0.265

Figure 12: Ag59800-ULP TIM dimensions

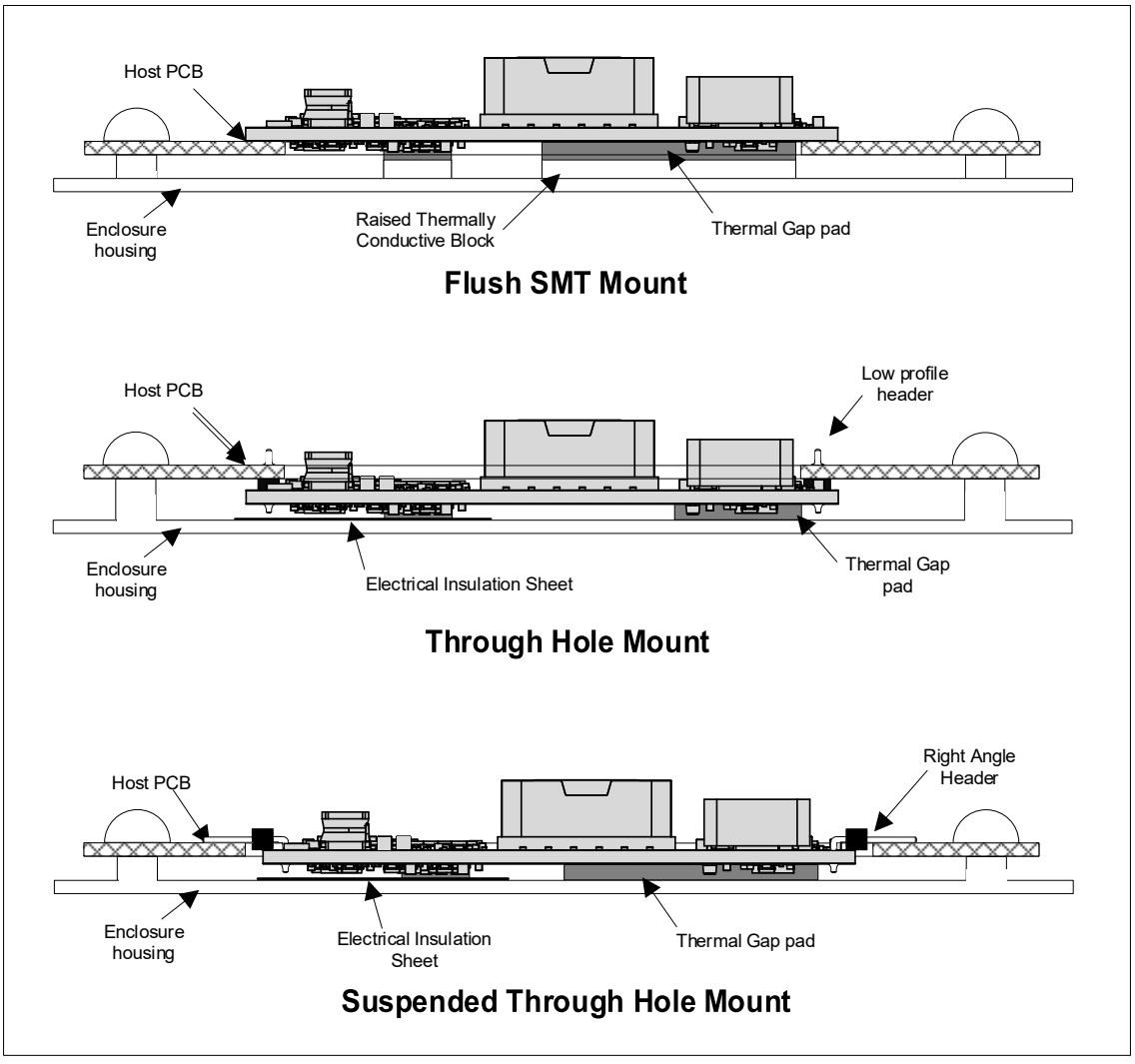


Figure 13: Example Ag59800-ULP Mounting Configuration

Protection

5.2 Input Protection

The Ag59800 will shut down the DC/DC converter if a voltage exceeding the maximum supply rating is detected.

The Ag59800 may be damaged by input voltage transients greater than 80V. While the module contains a TVS diode on board, removing the requirement for fitting external protection in the vast majority of applications. If additional protection from electrostatic discharge (ESD) or other high voltage transients is required, an additional over-voltage clamping device can be fitted across the VIN+ and VIN- input pins, see Figure 14 and Apps Note “ANX-POE-Protection” for more details.

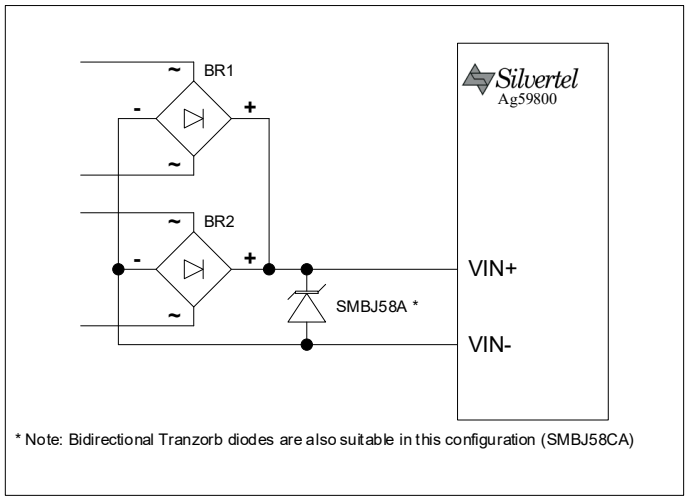


Figure 14: Input Protection

5.3 Output Back Feed Protection

If an external or auxiliary supply is to be used, it is essential that a blocking diode is present to prevent voltage injection on to the output circuitry of the module. This may cause damage to the module. The back feed protection is required even if the external voltage is present only while the module remains unpowered.

5.4 Output Short Circuit Protection

The Ag59800 has over-current protection to prevent the module from becoming damaged in the event of a short circuit event. If an over current event occurs the Ag59800 will disable the output, the Ag59800 will then test the current draw approximately every 2 seconds until the cause of the over current is removed, after which, the power will be restored to the output.

5.5 Thermal Protection

The Ag59800 contains built in thermal protection to prevent the module becoming damaged in the event that it is operated beyond its temperature specification. When the Ag59800 has detected it is over temperature, the output will be disabled until the module has cooled sufficiently.

6 Isolation

To meet the safety isolation requirements of the IEEE802.3 specification, a powered device must provide electrical isolation between all its accessible external connectors, including frame ground. In order to meet this requirement, the powered device should be subjected to and pass at least one of the following electrical strength tests of IEC 60950-1:2001 sub clause 6.2.1.

a) 1500V_{rms} at 50-60Hz for 60 seconds

b) 2250V_{dc} for 60 seconds or

c) 1500V_{dc} impulse test 10 times in either polarity.

To assist in this the Ag59800 has been designed to meet and pass the1500V_{dc} impulse test with no breakdown of insulation.

In order to maintain this isolation requirement, it is essential that that the isolation barrier is not breached, see ANX-POE-Isolation-Barrier for more details.

7 EMC

The Ag59800 has been designed to pass EN55032 Class B, however the Ag59800 will only be one component within the system so we would always advise that provisions are put in place in case further noise reductions are needed. From our experience we would recommend an inexpensive but effective solution to reduce emissions as shown in Figure 15, for more details please see ANX-POE-EMI-Considerations.

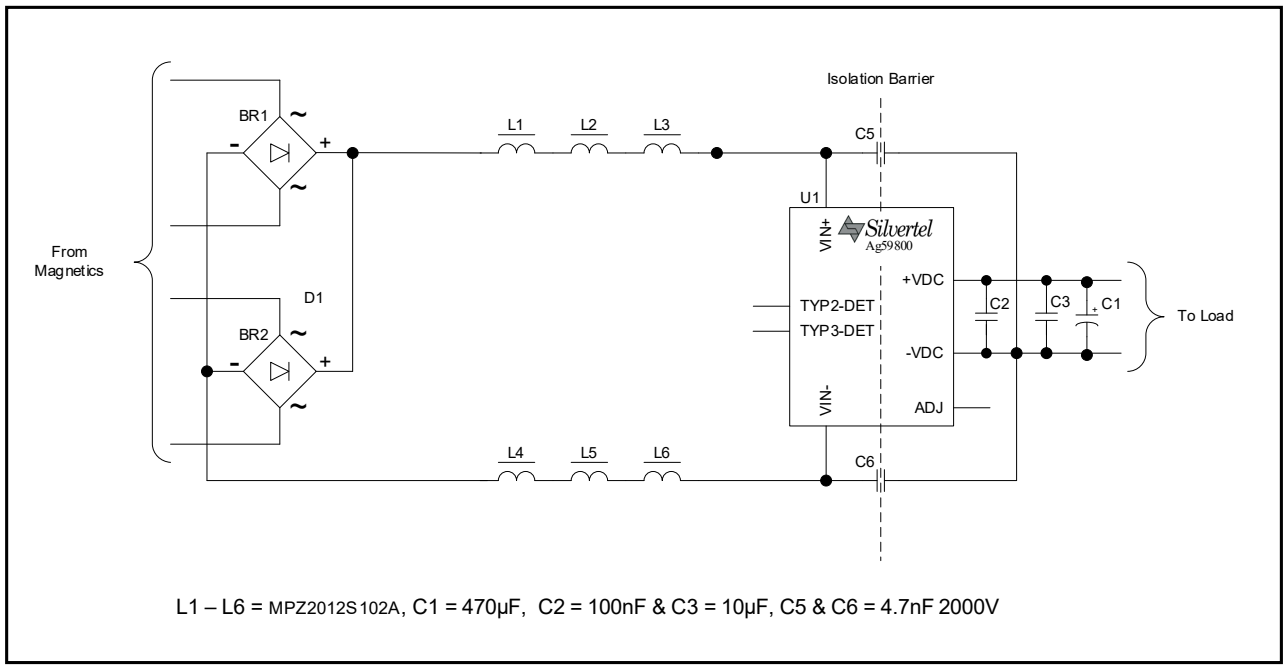


Figure 15: Typical Connection Diagram

8 Solderability

The Ag59800 has been designed with a fully automated assembly process in mind and is lead-free (Pb-free) and RoHS compliant and fully compatible with a Pb-free automated assembly process. The Ag59800 can still be mounted manually using soldering iron or hot air.

If the Ag59800 is to be put through a reflow process with topside of the module facing downwards, care should be taken to prevent components detaching from the module.

8.1 SMT Mounting

Both the Ag59800-LPB and the Ag59800-ULP can be SMT mounted. There are no specific requirements regarding stencil thickness or solder paste classification type. Solder mask defined (SMD) pads are preferred over non-solder mask defined (NSMD) pads, the land pattern dimensions are given in Figure 17.

Minimal thermal relief should be applied to the pads to allow for maximum thermal conductivity without hindering the reflow process, your Process Engineer should be able to provide suitable recommendations.

The Ag59800 requires no components of greater than Moisture Sensitivity level 1, as a result no special processes are required in the reflowing process of the Ag59800.

Note : Do not pass the Ag59800 through the reflow process mounted to the underside of the assembly due to the risk of components falling off the module.

8.1.1 Solder Profile

Below is a typical profile that can be used should the Ag59800 be SMT mounted, based on the J-STD-020 standard for Pb-Free applications. Exceeding these specifications may cause damage to the module. All production environments are different therefore please review these guidelines with the process engineer prior to use.

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Units
Zone Duration	42	42	42	42	42	Seconds
Top Heater	150	180	210	240	270	˚C
Bottom Heater	150	180	210	240	270	˚C
Typical Slope	2.1	1.2	1.1	0.9	0.8	˚C/Second
Airflow rate	40					M^3/Minute

Table 7: Solder Profile

	Min	Max	Units
Soak Time (s) 150-180˚C	30	90	Seconds
Time above (s) ≥217˚C	30	90	Seconds
Time within 5˚C of peak Temperature		30	Seconds
Target Peak Temperature (˚C)	230	245	˚C
ΔTemperature (˚C/s)	-6	3	˚C/Second

Table 8: Solder Parameters

8.2 Through Hole Mounting

The Ag59800-ULP can optionally be through hole mounted. The module is not provided with pin terminals fitted, this allows for the most suitable style and sizing of connector to be selected to meet the application design constraints.

9 Electrical Characteristics

9.1 Absolute Maximum Ratings

	Parameter	Symbol	Min	Max	Units
1	DC Supply Voltage	V_{CC}	-0.3	60	V
2	Storage Temperature	T_S	-40	+100	°C
3	Moisture Sensitivity Level	MSL	-	1	-

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

9.2 Recommended Operating Conditions

	Parameter		Symbol	Min	Typ	Max	Units
1	Input Supply Voltage		V_{IN}	41 [1]	54	57	V
2	Transient Supply Voltage[1]		V_{TRAN}	36			V
3	Input Under Voltage Lockout		V_{ULOCK}		37		V
4	Under Voltage Lockout Hysteresis		$V_{ULOCK-Hsy}$		2.5		V
5	Operating Temperature		T_{OP}	-40	25	85	Ta / °C
6	Output capacitance	Ag59812	C_{out}	470	1000	1500	µF
		Ag59824		330	470	680	

Note 1: With less than 50% load

9.3 DC Electrical Characteristics

	DC Characteristic		Sym	Min	Typ[1]	Max	Units	Comments
1	Nominal Output Voltage	Ag59812	$+V_{OUT}$	11.5	12	12.5	V	
		Ag59824		23.25	24	24.8		
2	Continuous Current output[2]	Ag59812	I_{LOAD}		8	8.4	A	
		Ag59824			4	4.2		
3	Line Regulation		V_{LINE1}		0.01		%	@ 50% load
4	Load Regulation		V_{LOAD1}		0.08		%	
5	Ripple and Noise[2]	Ag59812	V_{RN}		75		mV_{p-p}	At Full Load
		Ag59824			100			
6	Minimum Load		I_{MIN}	0			mA	
7	Short-Circuit Duration		T_{SC}			∞	sec	
8	Peak Efficiency[3]	Ag59812	EFF		95.0		%	
		Ag59824			93.8			
9	Isolation Voltage (I/O)		V_{ISO}			1500	V_{PK}	Impulse Test

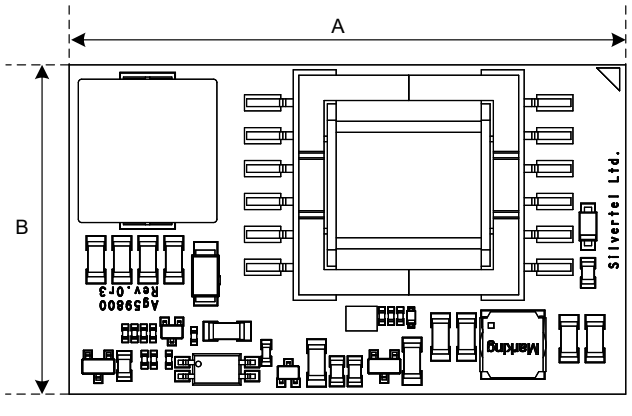
Note 1: Typical figures are at 25°C with a nominal output voltage with 57V supply with a 470µF output capacitor fitted and are for design aid only. Not Guaranteed.

Note 2: Measured with recommended output filter, see Section 3.3.

Note 3: Minimum 44Vin for maximum output at 25˚C. Maximum output power may be limited by PSE.

10 Package

10.1 Ag59800-LPB



Dimension	Millimetres		Inches	
	Nominal	Max	Nominal	Max
A	50.60	51.60	1.992	2.031
B	30.00	31.00	1.181	1.220
C	14.70	15.60	0.579	0.614
D	1.60	1.76	0.063	0.069
E	1.70	1.85	0.067	0.073
F	20.67	21.67	0.814	0.853
G	9.53	10.53	0.375	0.414
H	8.78	9.17	0.346	0.361
I	6.50	7.00	0.256	0.276
J	4.50	4.60	0.177	0.181
K	52.60	5.10	2.071	0.201
L	32.00	-	1.260	-
M	16.59	-	0.653	-

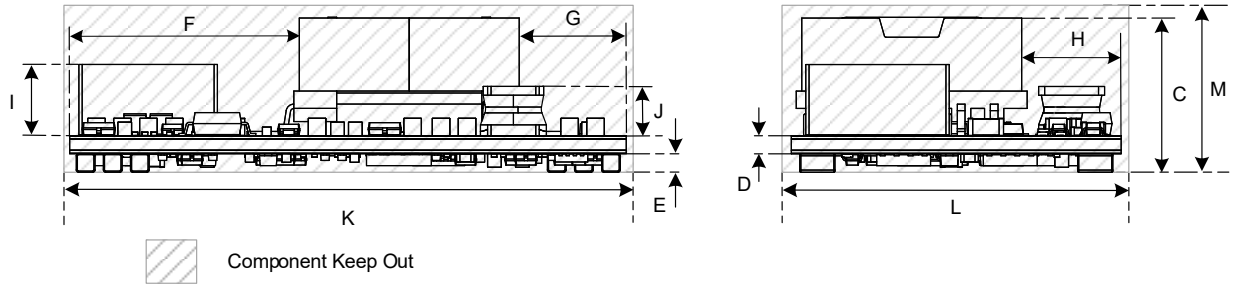
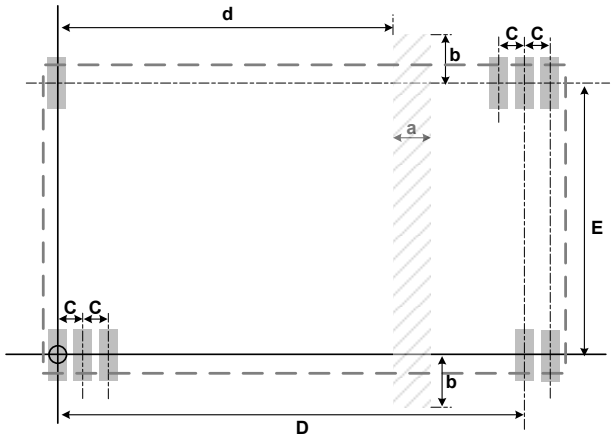


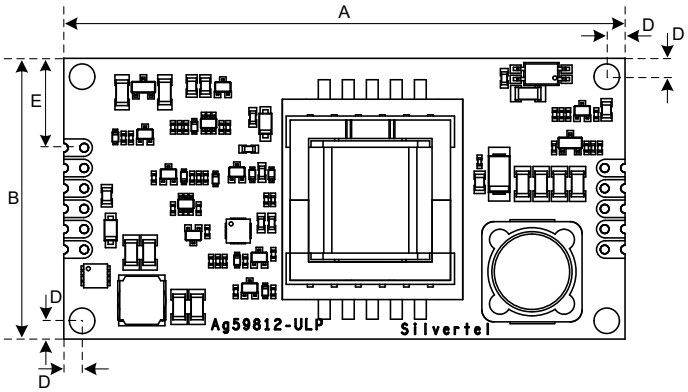
Figure 16: Package Dimensions



Dimension	Millimetres	Inches
A	5.00	0.197
B	1.83	0.072
C	2.46	0.097
D	45.31	1.784
E	26.57	1.046
a	3.00	0.118
b	> 4.712	> 0.186
d	33.17	1.306

Figure 17: Land Pattern

10.2 Ag59800-ULP



Dimension	Millimetres		Inches	
	Nominal	Max	Nominal	Max
A	70.00	71.00	2.756	2.795
B	35.05	36.05	1.380	1.419
C	1.60	1.76	0.063	0.069
D	2.29	2.79	0.090	0.110
E	11.15	11.65	0.439	0.459
F	9.60	10.26	0.378	0.404
G	1.10	1.30	0.043	0.051
H	27.51	28.24	1.083	1.112
I	20.50	21.23	0.807	0.836
J	6.63	7.34	0.261	0.289
K	5.77	7.29	0.227	0.287
L	7.61	8.37	0.299	0.329
M	7.45	8.22	0.293	0.323
N	1.68	2.44	0.066	0.096

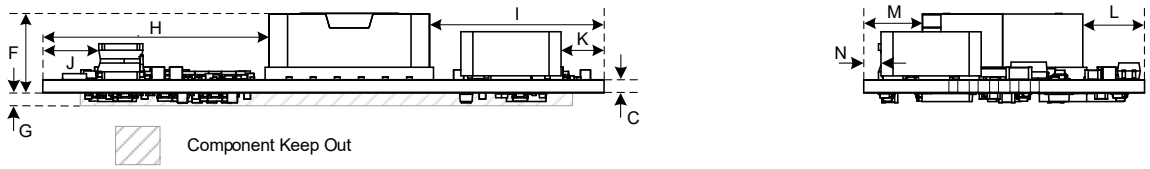
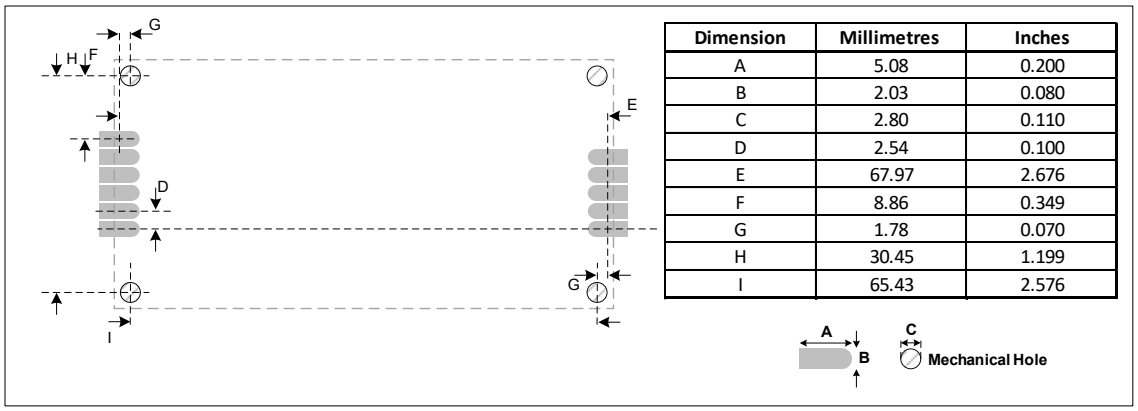
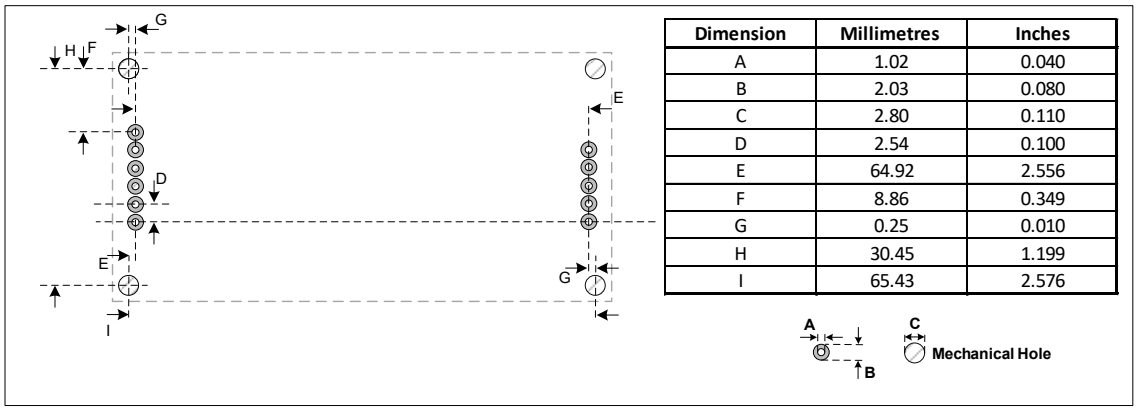


Figure 18: Package Dimensions



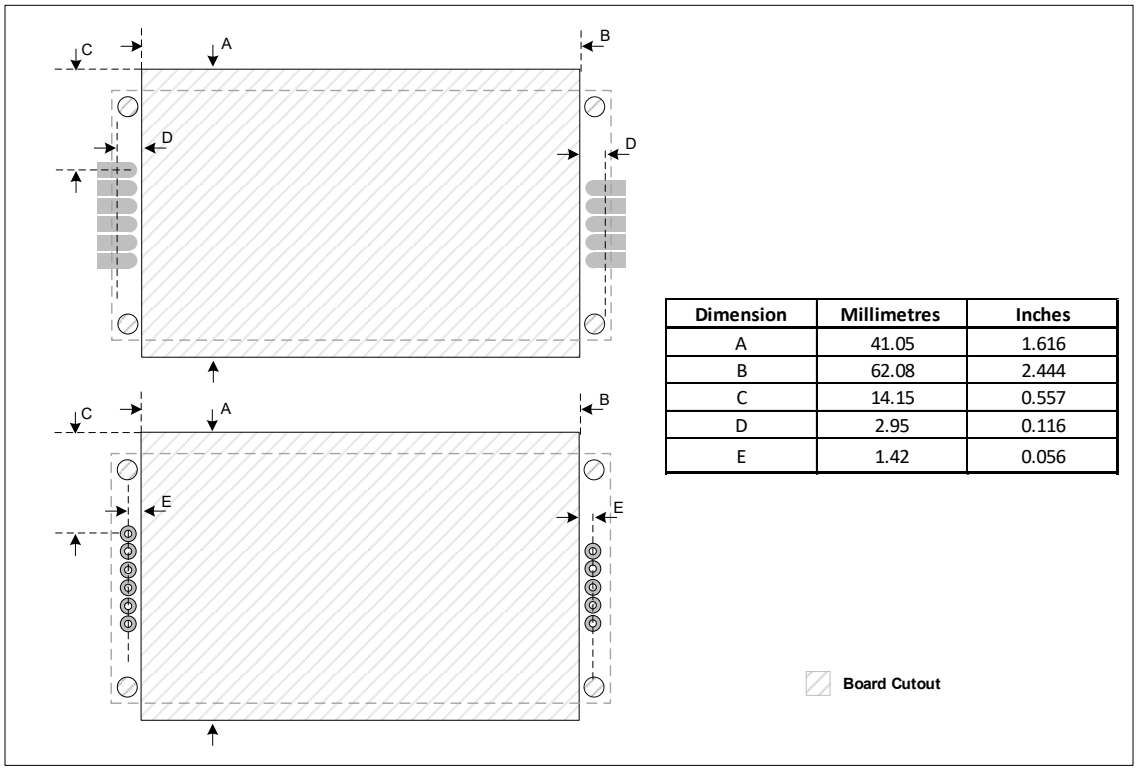
Dimension	Millimetres	Inches
A	5.08	0.200
B	2.03	0.080
C	2.80	0.110
D	2.54	0.100
E	67.97	2.676
F	8.86	0.349
G	1.78	0.070
H	30.45	1.199
I	65.43	2.576

Figure 19: SMT Land Pattern



Dimension	Millimetres	Inches
A	1.02	0.040
B	2.03	0.080
C	2.80	0.110
D	2.54	0.100
E	64.92	2.556
F	8.86	0.349
G	0.25	0.010
H	30.45	1.199
I	65.43	2.576

Figure 20: DIL Land Pattern



Dimension	Millimetres	Inches
A	41.05	1.616
B	62.08	2.444
C	14.15	0.557
D	2.95	0.116
E	1.42	0.056

Figure 21: PCBA Cutout

11 Packaging

The default packing for the Ag59800 series is supplied in trays of TBC.

12 Ordering Code