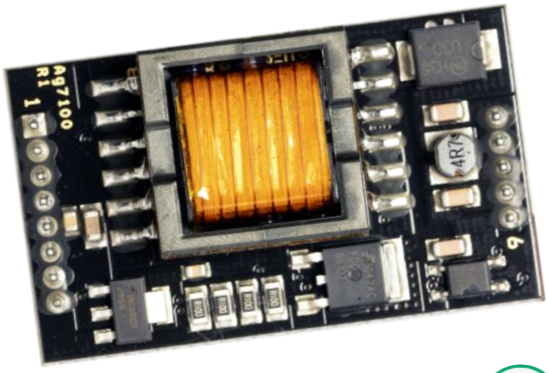
Silvertel

Ag7100

40W Boost Converter Module



Features

- 40W Output
- Input voltage range 12V to 27V
- Adjustable Output of 48V to 57V
- High efficiency (>90%)
- Small footprint
- Suitable for IEEE802.3 Type 1 (af) and Type 2 (at) compliant PSEs
- Low cost
- Minimal external components required
- Short-circuit and Thermal protection
- 1500V isolation (input to output)
- Silvertel “design-in” assistance

Description

The Ag7100 module is a low noise DC/DC boost converter, designed to generate the higher voltages required for an IEEE802.3 compliant PSE application. This module provides exceptional efficiency (>90%) while providing full compatibility with the IEEE 802.3 power and isolation requirements.

The Ag7100 accepts a wide DC voltage input range, from 12V to 27V. and provides a regulated adjustable output, of between 48V and 57V, the voltage required to power one of Silvertel’s PSE modules (or compatible PSE circuit)

Ag7100 provides an ideal solution for powering the Silvertel Ag6120 PSE module from a battery, 12V PSU or other commonly available power supply. Its low cost, small footprint, high efficiency, and in-built isolation make it an extremely versatile DC-DC boost converter for a wide range of potential applications.

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1 Product Overview

1.1 Ag7100 Product Selector

Part Number[1]	Output Voltage	Maximum Output Power	Date code[2] and Volage Marking
Ag7100	48V to 57V	40 Watts	WWYY A

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: Date code format: “WW” = Week Number, “YY” = Year.

Table 1: Ordering Information

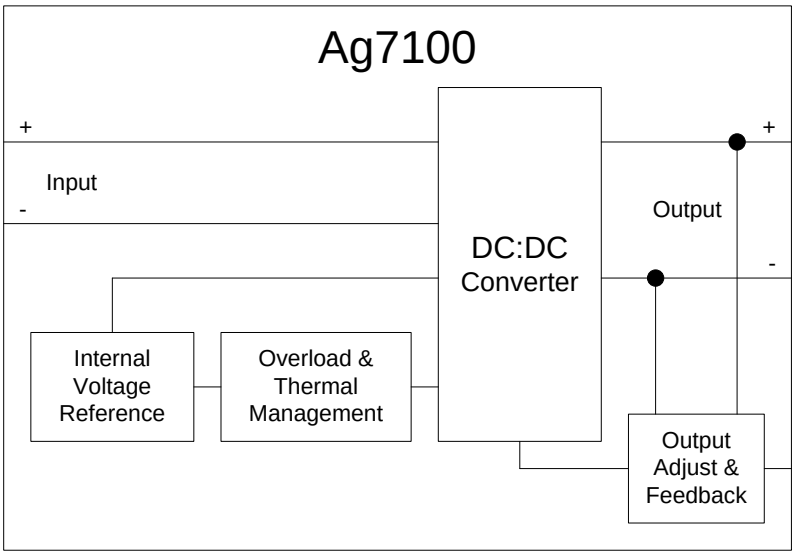


Figure 1: Block Diagram

2 Pin Description

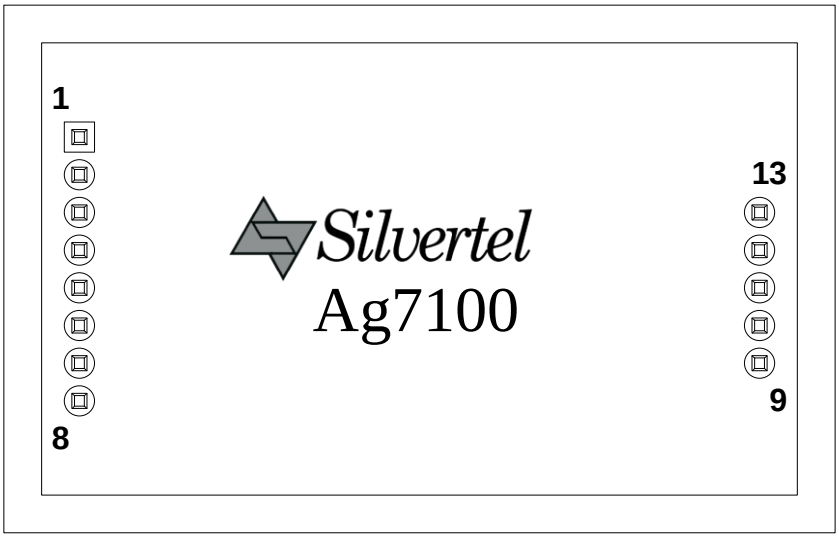


Figure 2: Ag7100 Package Format

2.1 Ag7100

Pin #	Name	Description
1	VIN+	Direct Input +. These pins connect to the positive (+) output of the power supply.
2		
3	IC	Internal Connection. Do not connect to these pins.
4		
5		
6		
7	VIN-	Direct Input -. These pins connect to the negative (-) output of the power supply.
8		
9	+VDC	DC Output. These pins provide the regulated output from the DC/DC converter.
10		
11	ADJ	Output Adjust. The output voltage can be adjusted down from its nominal value of 57V. This can be done by connecting an external resistor from this pin to the +VDC pins.
12	-VDC	DC Return. These pins are the return path for the +VDC output.
13		

Table 2: Pin Description

3 Functional Description

3.1 Input

The Ag7100 has a wide input voltage range of 12Vdc to 27Vdc; as shown in Figure 3.

The 470µF 35V electrolytic capacitor connected across the Ag7100 input is required to reduce the ripple from the supply. This value can be adjusted, depending on the quality of the power supply being used. For operation below -20˚C it is recommended that additional ceramic capacitance is fitted to the input and the output of the module to maintain stability. The recommended values for these capacitors are 22µF to the input and 2.2µF to the output.

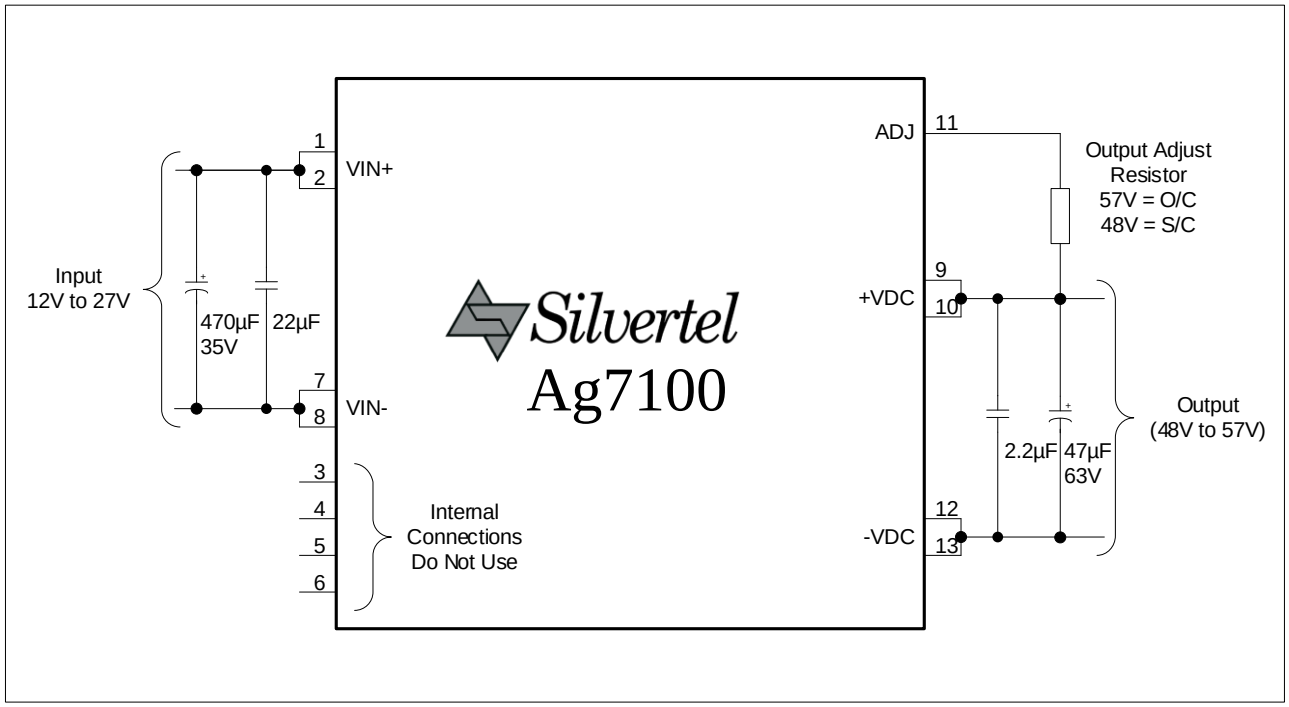


Figure 3: Typical System Diagram

3.2 DC/DC Converter

The Ag7100 DC/DC converter provides a regulated output that has built-in over-temperature and output-short-circuit protection.

3.3 Output

The Ag7100 output must have an external 47µF 63V electrolytic capacitor fitted. This capacitor must be fitted as close as possible to the output pins. It functions as part of the output filter and is required to reduce the DC/DC converter switching noise and output ripple.

To reduce the output ripple and noise further, we would recommend using a low ESR electrolytic capacitor. If ambient temperatures below 0°C are expected, a capacitor that retains a moderately low ESR and the minimum capacitance is essential for operation.

3.4 Output Adjustment

The Ag7100 has a nominal output voltage of 57V. This can be adjusted down to a minimum of 48V, by fitting a resistor between the ADJ and +VDC pins, as shown in Figure 4.

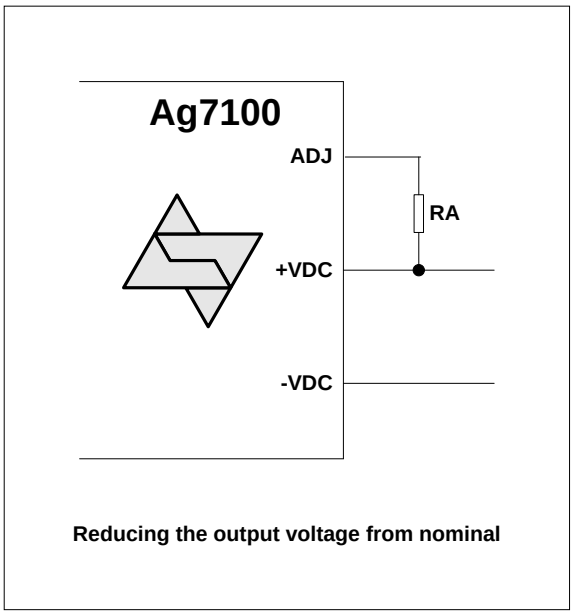


Figure 4: Output Adjustment

Reducing the output voltage, connect R between ADJ and +VDC	
Value of RA	**Ag7100 Output**
Open Circuit	57V
0 Ohms	48V

Table 3: Output Adjustment Resistor (R) Value

Note: For resistor calculation to set the output voltage to a value between 48V and 57V please Contact Silvertel.

3.5 Isolation

To meet the safety isolation requirements of Power over Ethernet (PoE); the Ag7100 has been designed to meet the 1500Vdc impulse test*. It is also important that the tracks on either side of the isolation barrier also have at least a 3mm clearance, see Figure 7 in Section 6 for more information.

*Note: The impulse test is defined in the IEEE802.3 specification section 33.4.1 option c:

4 Efficiency

The Ag7100 has been designed to be a high efficiency DC/DC converter in order to maintain end-to-end system efficiency and reduce heat output.

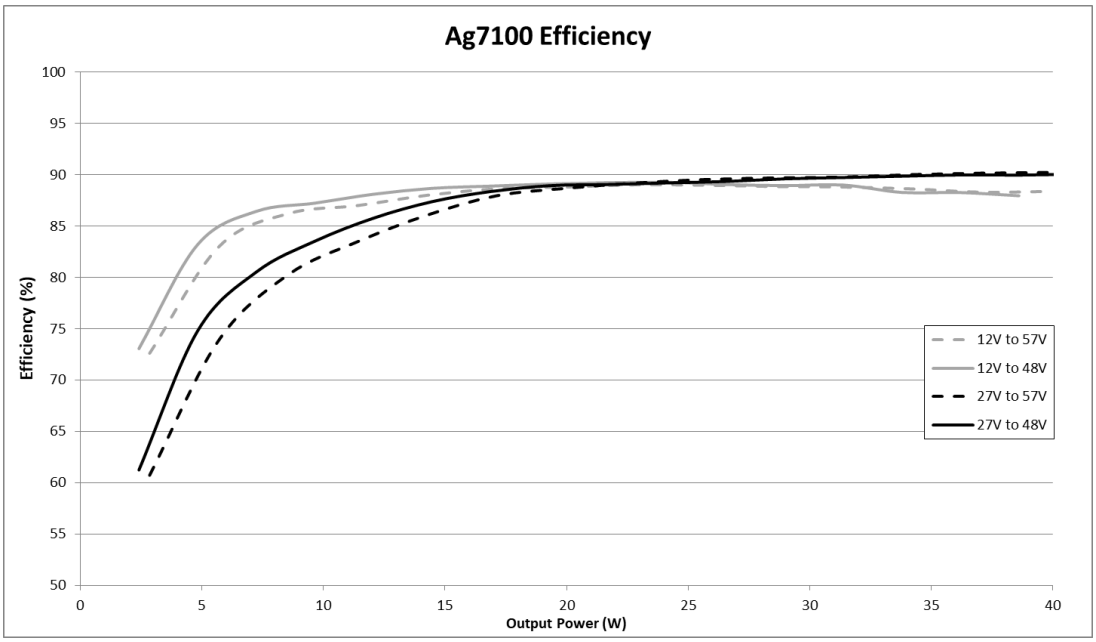


Figure 5: Ag7100 Efficiency

5 Typical Connections

The Ag7100 requires minimal external components as shown in Figure 6.

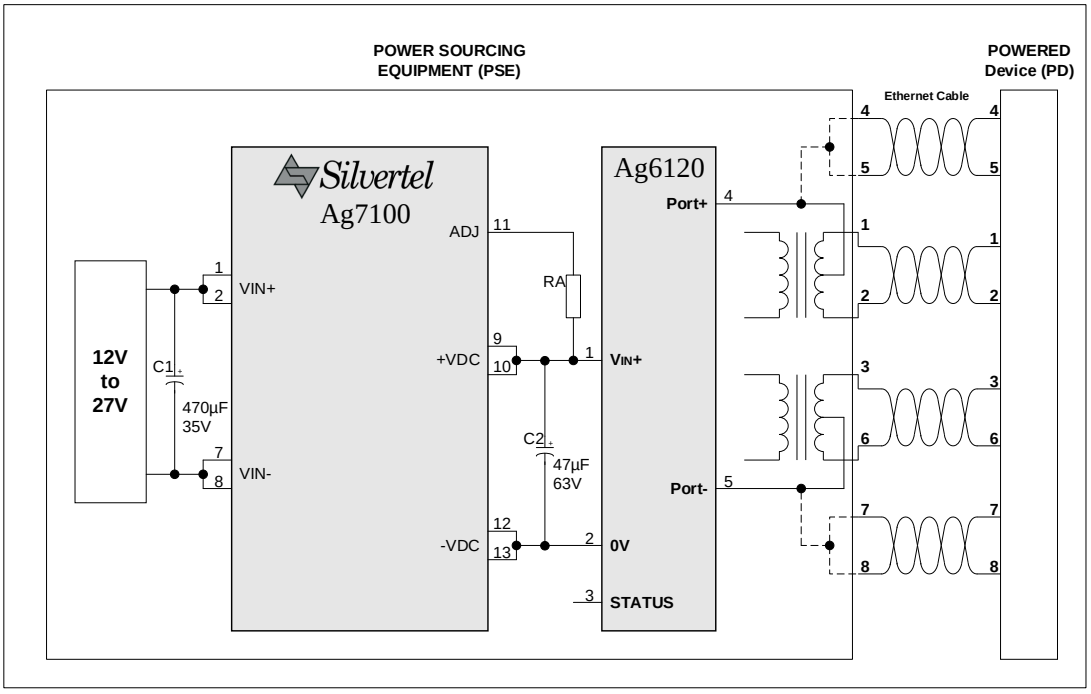


Figure 6: Typical Connection Diagram

The output adjust resistor (RA) is optional, it is provided to give greater flexibility to the Ag7100. Further information on using this pin can be found in Section 3.4.

6 Layout Consideration

Figure 7 shows our suggested board layout for the Ag7100, with reference to the typical connection diagram shown in Figure 6.

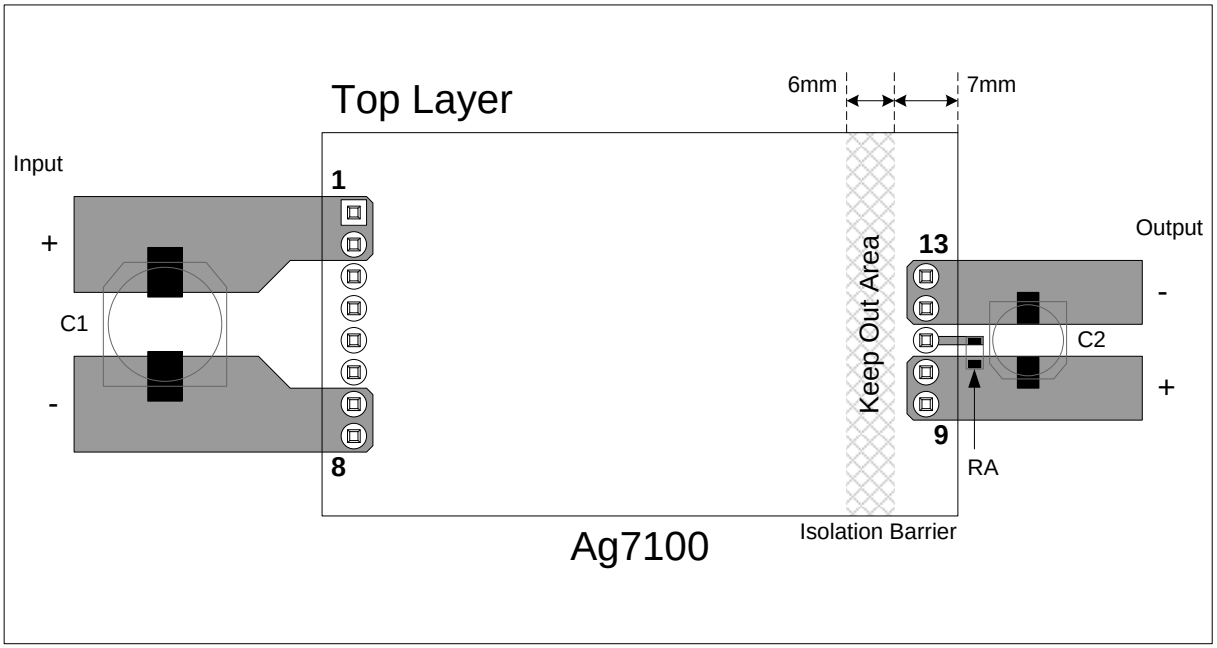


Figure 7: Layout Consideration

It is important that tracks (on the top layer) and through-hole vias are not placed in the "Keep Out Area" shown in Figure 7. This area is required to maintain the integrity of the isolation barrier, described in Section 3.5.

7 Operating Temperature Range

Because the Ag7100 is a power component, it will generate heat; so it is important that this be taken into consideration at the design stage.

The heart of the Ag7100 is a DC/DC converter, which like any other power supply will generate heat. The amount of heat generated by the module will depend on the load it is required to drive and the input voltage supplied.

The Ag7100 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 sufficient output capacitance and ESR ratings at the lowest temperature in the intended operating range is used. A reputable brand rated to -55˚C should suffice, please contact Silvertel if suggestions are required.

The below results were performed in an environment chamber - Temperature Applied Sciences ECO MT135 Environmental Chamber, without any heat-sinking. The performance of the Ag7100 can be improved by forcing the airflow directly over the part or by using thermal relief pads to draw heat away from the module.

The Ag7100 does have thermal protection; but it is important that the maximum operating temperature is never exceeded.

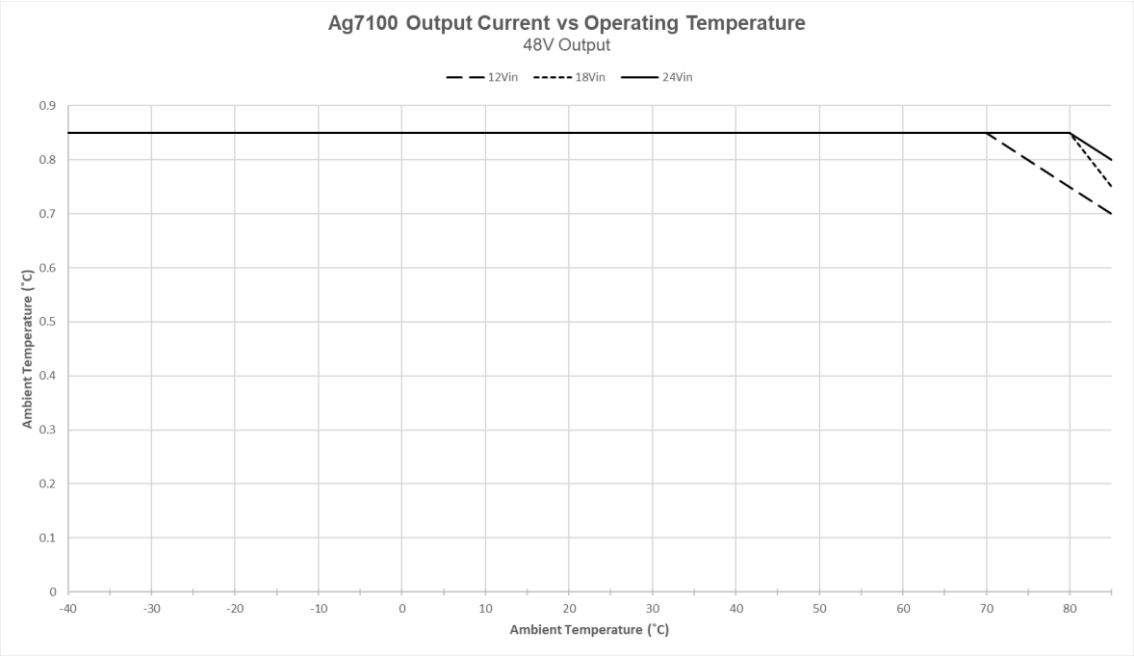


Figure 8: 48V Output Operating Profile

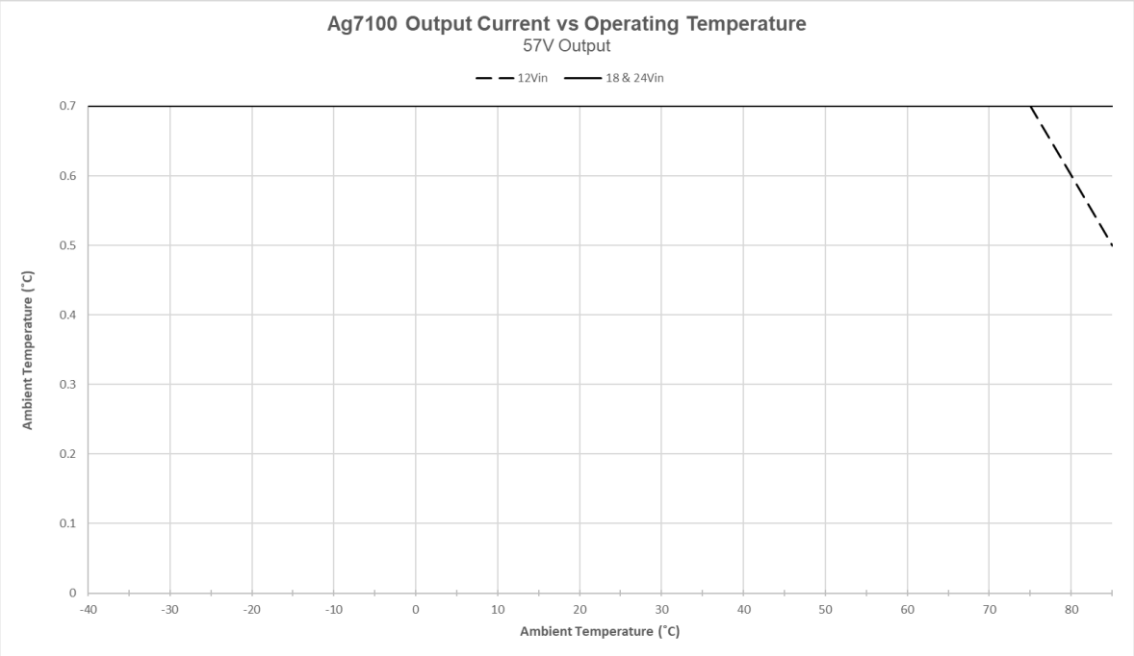


Figure 9: 57V Output Operating Profile

7.1 Thermal Layout

One simple technique that can be used to draw heat away from the module is to add power planes to the input and output pins.

The Ag7100 has been designed with thermal relief pads under D2 and Q3. The use of thermal pad material placed between the module and the power planes helps remove heat from the Ag7100, see Figure 10 for an example of this.

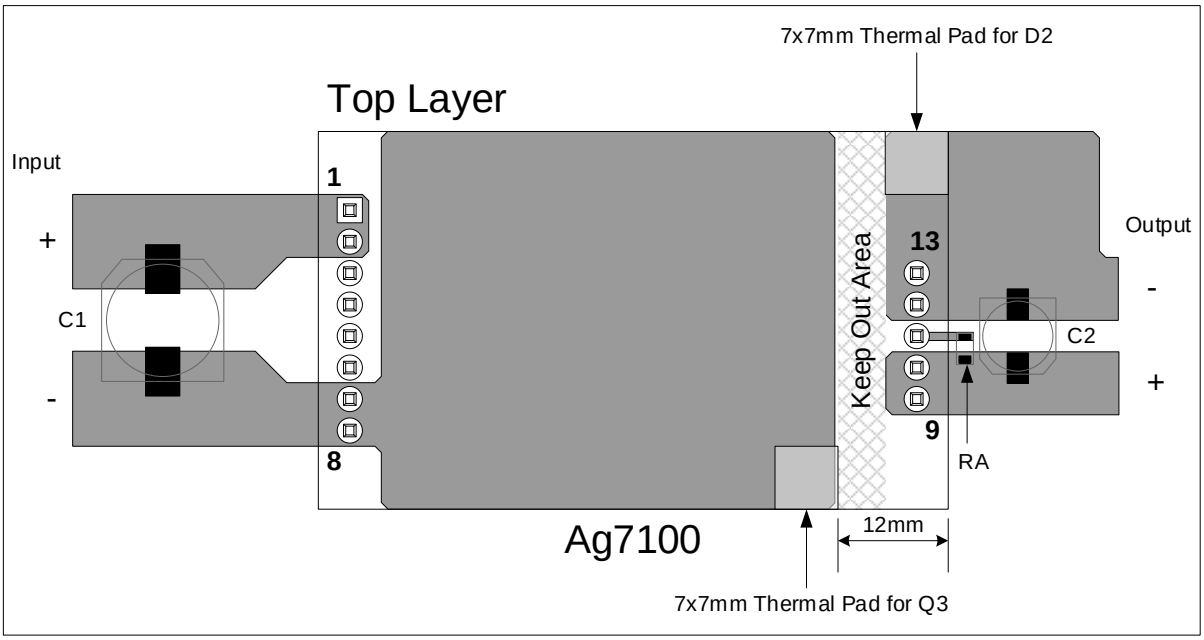


Figure 10: Ag7100 Thermal Relief Power Planes

Due to its small size, it is important that as much heat is drawn away from the module as possible. It is also important that any enclosure used has sufficient ventilation for the Ag7100 and a direct airflow if possible. But because each application is different, it is impossible to give fixed and absolute thermal recommendations.

8 Protection

8.1 Output Protection

The Ag7100 output must be protected from over-voltages exceeding the 80V maximum rated surge voltage. An inexpensive but effective solution can be achieved by connecting a Tranzorb diode across the output; see Figure 11.

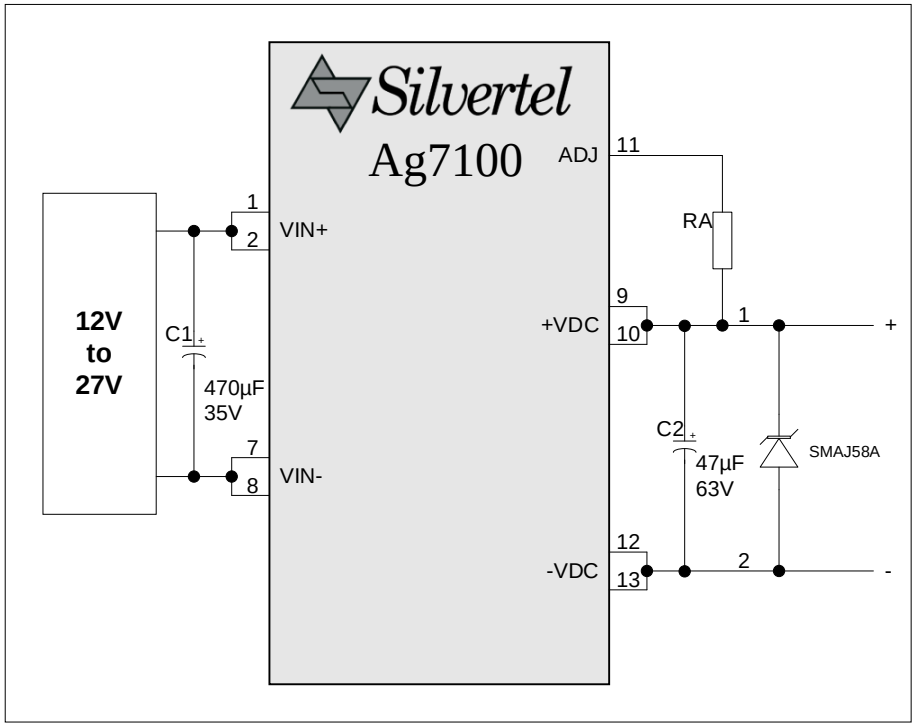


Figure 11: Ag7100 Output Protection

8.2 Thermal Protection

The Ag7100 has built-in thermal protection as standard.

When the thermal protection is tripped, the dc/dc converter will shut down for ~3 seconds. After this duration the dc/dc converter will turn back on and the temperature retested. If the temperature is still too high, it will repeat this process until the temperature falls to within the modules operating parameter.

9 EMC

The Ag7100 is designed to meet EN55022 Class B (pre-compliance test results are available from Silvertel).

However, because the Ag7100 will only be one component within your system, it is impossible to say whether the final product will pass EMC testing, without the need for additional filtering.

10 Electrical Characteristics

10.1 Absolute Maximum Ratings[1]

	Parameter	Symbol	Min	Max	Units
1	DC Supply Voltage	V_{CC}	11	30	V
2	Surge Voltage at Output (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.

10.2 Recommended Operating Conditions

	Parameter	Symbol	Min	Typ	Max	Units
1	Input Supply Voltage[1]	V_{IN}	12	24	27	V
2	Operating Temperature[1]	T_{OP}	-40	25	85	Ta / °C

Note 1: See Section 7.

10.3 DC Electrical Characteristics

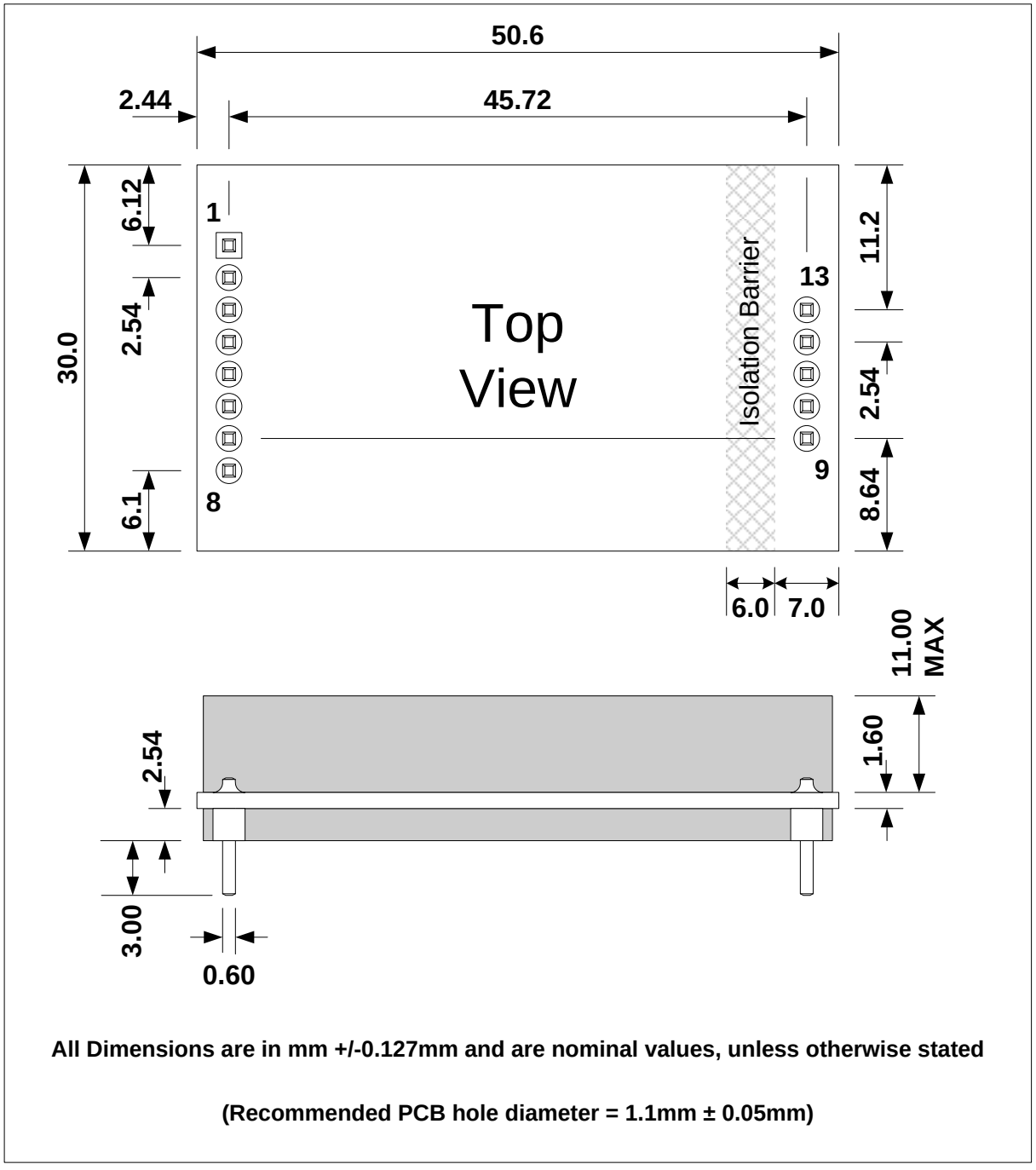
	DC Characteristic	Sym	Min	Typ[1]	Max	Units	Test Comments
1	Nominal Output Voltage	+VDC	55.6	57.0	58.4	V	
2	Peak Output Current[2]	I_{LOAD}			0.7 0.85	A A	@ 57V @ 48V
3	Line Regulation	V_{LINE}		0.035		%	
4	Load Regulation - Min to Max	V_{LOAD}		0.02		%	
5	Output Ripple and Noise[3]	V_{RN}		500		mVp-p	
6	Minimum Load	I_{MIN}	0			mA	
7	Short-Circuit Duration	T_{SC}			∞	sec	
8	Peak Efficiency	EFF		90.0		%	
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 = 57V and are for design aid only. Not Guaranteed.

2: See Section 7

3: Measurements made on a Grundig SO50 with a 200MHz (x10) probe.

11 Package



All Dimensions are in mm +/-0.127mm and are nominal values, unless otherwise stated

(Recommended PCB hole diameter = 1.1mm ± 0.05mm)