



Ag7300

High Power Boost Converter Module



Features

- >91% efficient DC/DC converter
- 48V-57V output voltage
- 120W output power
- 1500V isolation for IEEE802.3 PoE applications
- Wide input voltage range 18V-36V
- Overload & short-circuit protection
- Thermal Protection
- Industrial temperature range
- Minimal external components required
- Low profile SMT package size – 40mm (L) x 35mm (W) x 17mm (H)
- Silvertel “design-in” assistance



Description

The Ag7300 is a high power DC/DC boost converter, designed to generate the higher voltages while providing the isolation required for an IEEE802.3 compliant PSE application. For use in single IEEE802.3bt (PoE++) applications, multiple IEEE802.3af/at (PoE/PoE+) applications or power distribution applications

The Ag7300 accepts a wide DC voltage input range, from 18V to 36V. and provides a regulated adjustable output, of between 48V to 57V, while achieving greater than 91% efficiency. The DC/DC converter also has built-in output overload, output short-circuit and over-temperature protection.

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1 Product Overview

1.1 Ag7300 Product Selector

Part Number ¹	Nominal Output Voltage	Output Current	Marking ²
Ag7300	55.5V	2.2A Continuous	abc

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 Sensitivity Level 1 and HBM 1.

Note 2: 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 final letter, c, is a Silvertel reference.

Table 1: Ordering Information

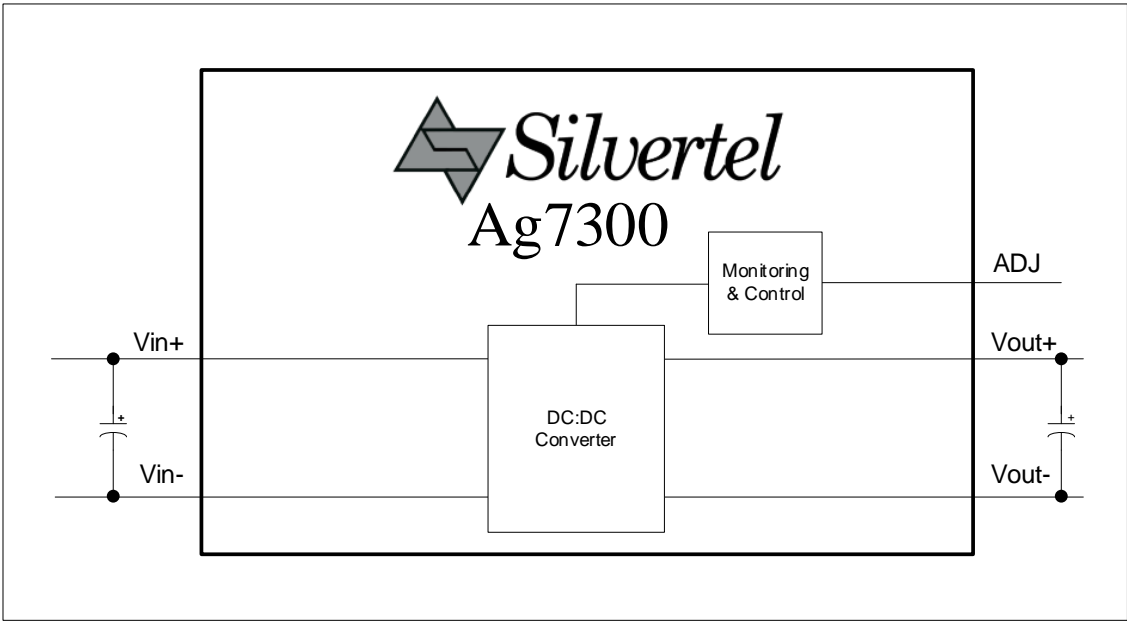


Figure 1: Block Diagram

1.2 Package Format



Figure 2: Ag7300 Package Format

1.3 Pin Description

Pin #	Name	Description
1	Vin-	Low Supply. This pin connects to the reference of the positive supply
2		
3	Vin+	High Supply. This pin connects to the positive (+) supply
4		
5	Vout-	Negative DC Output. This pin provides the negative regulated output from the Ag7300.
6	ADJ	Output Adjust. The output voltage can be adjusted from its nominal value, by connecting an external resistor from this pin to either pin 5 or 7.
7	Vout+	Positive DC Output. This pin provides the positive regulated output from the Ag7300.

Table 2: Pin Description

2 Functional Description

2.1 Typical Connections

The Ag7300 requires only a few external components for operation. The 470 μ F capacitor (C1) connected across the input is required for correct operation of the DC/DC converter. This capacitor must be positioned as close to the input pins as possible for optimal stability. This can be a low-cost electrolytic capacitor for operation in temperatures down to 0°C as shown in Figure 3. 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 this application.

The output voltage can be adjusted by simply connecting a resistor, R1, between the ADJ pin and either the Vout– or Vout+ pins, see section 2.3.2 for more details.

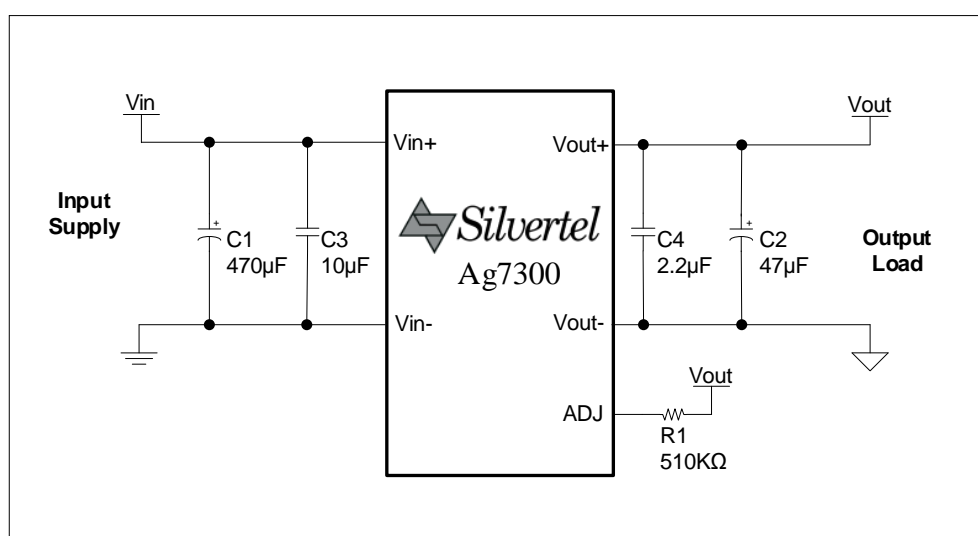


Figure 3: Typical System Diagram

2.2 Input

The Ag7300 has four input pins VIN+ and VIN-, these pins should be connected to an 18V-36V supply (see Figure 3: Typical System Diagram). For stability it is recommended that an 470 μ F electrolytic and a 10 μ F ceramic capacitor be fitted across these pins.

2.3 Output

2.3.1 Maximum output power

Whilst the Ag7300 can deliver a continuous output current of 2.2A, for up to 120W of continuous power, the peak output power may be reduced as a result of the operating conditions the module is operating in.

2.3.1 Output Filtering

The Ag7300 only requires an electrolytic capacitor on its output for stable operation, However, greater ripple reduction can be achieved with just a few additional components, using Output filter B resulted in the output ripple being reduced to 50mVpk-pk.

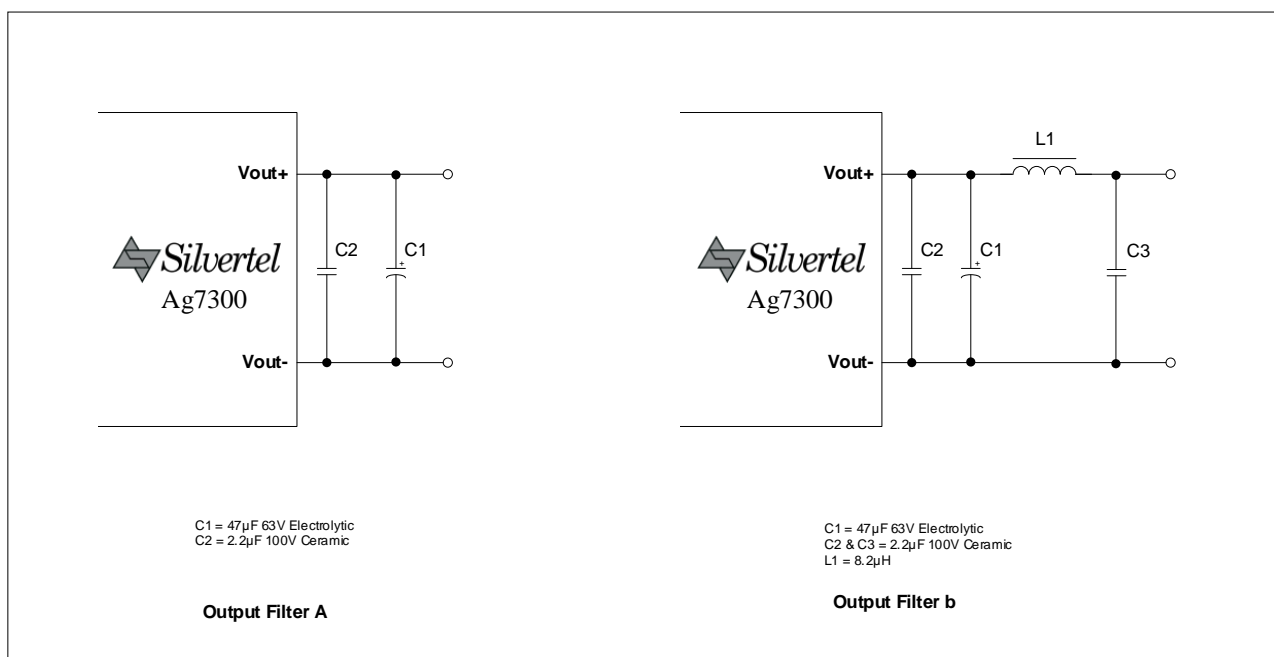


Figure 4: Output Filter

2.3.2 Output Voltage Adjust Setting

The Ag7300 has a nominal output of 55.5V, but with use of the output voltage adjustment pin, ADJ, this can be increased to a maximum of 57V or decreased to 48V at the output of the Ag7300.

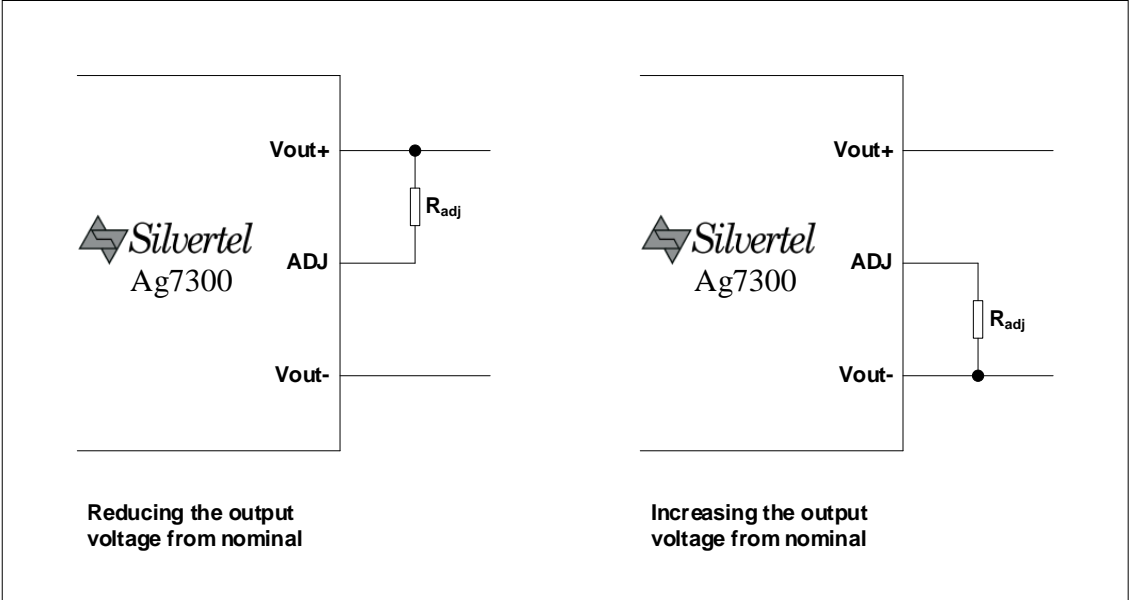


Figure 5: Output Voltage Adjustment

Reducing the output voltage, connect RA between ADJ and Vout+	
Value of R_{adj}	Ag7300 output
Open Circuit	55.5V
510K Ohms	48V ¹
Increasing the output voltage, connect RA between ADJ and Vout-	
Value of R_{adj}	Ag7300 output
Open Circuit	55.5V
0 Ohms	58V

Table 3: Output Voltage Adjustment Resistor Values

Note 1: It is important that the minimum output adjust is not taken below this level. Setting the output voltage below this level may result in the module being permanently damaged.

3 Efficiency

The Ag7300 has been designed as a high efficiency DC/DC solution,

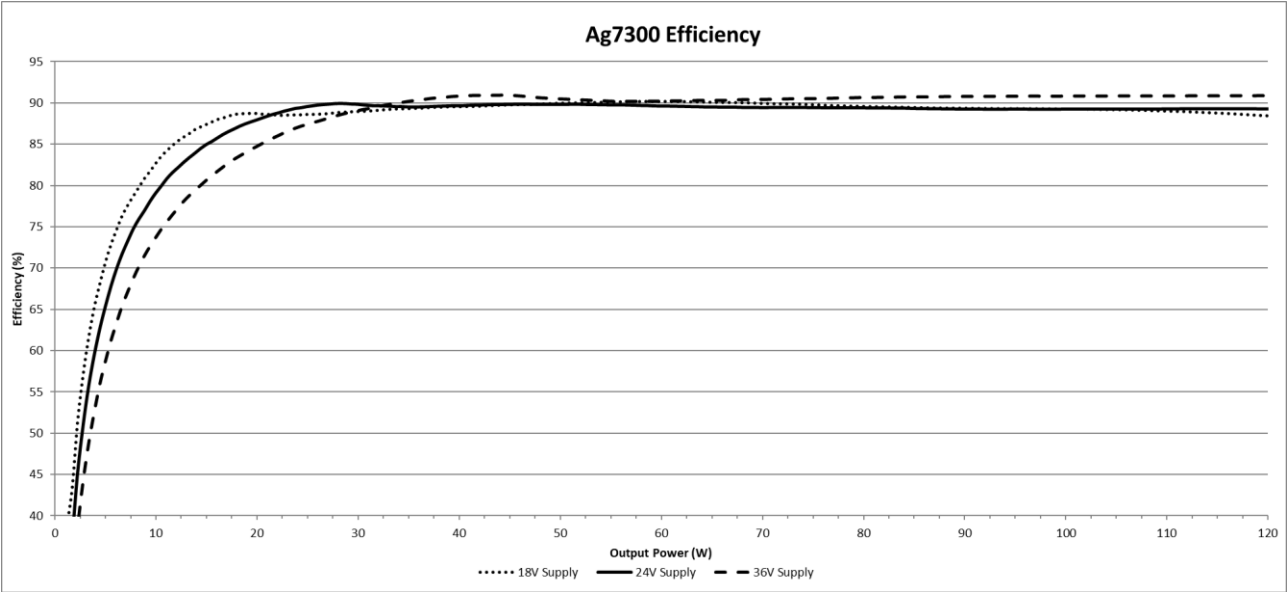


Figure 6: Ag7300 Efficiency

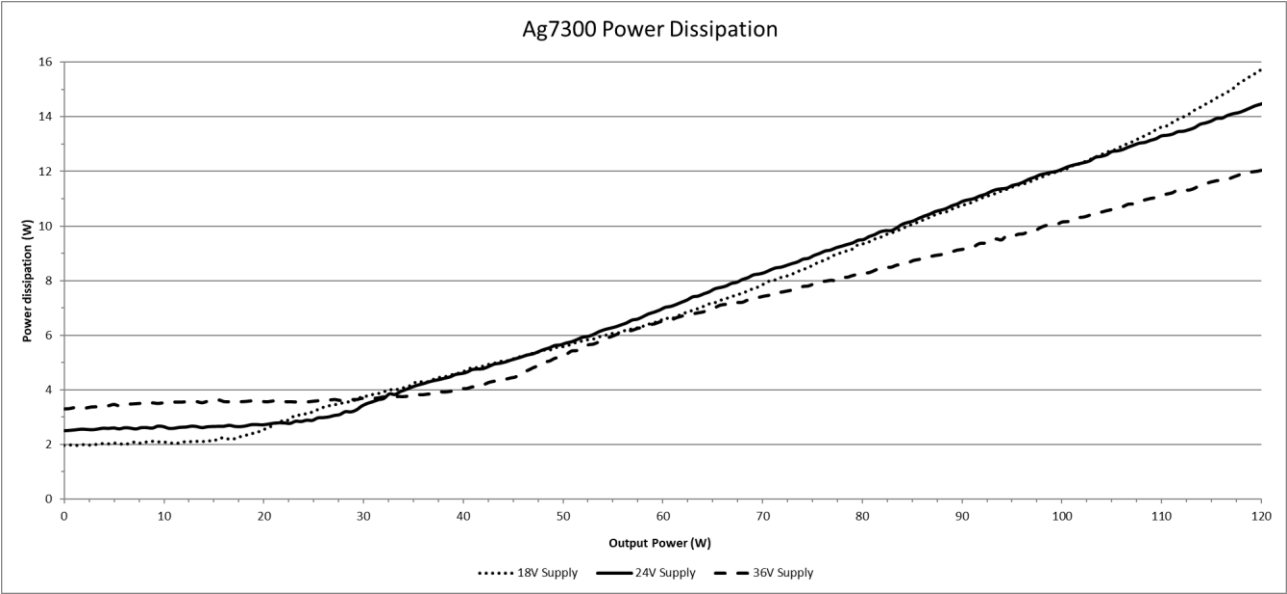


Figure 7: Ag7300 Power Dissipation

4 Operating Temperature Range

The Ag7300 is a DC/DC converter. Whilst it has been designed to be efficient, it is still a power device and thus will generate heat, so it is important that this 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.

The Ag7300 can operate up to a maximum of 85°C ambient, and a minimum of -40°C ambient. When intended for use in ambient temperatures below 0°C it is recommended that an input capacitor that will retain capacitance and ESR ratings at the lowest temperature in the intended operating range is used. A reputable brand capacitor rated to -55°C should suffice for most applications, please contact Silvertel if suggestions are required.

The graph below shows the continuous load capabilities of the module across environmental temperatures, for a range of common input output configurations. These results have been recorded in a Temperature Applied Sciences ECO MT135 Environmental chamber (with circulating air) with forced airflow across the module at a rate of 0.5m/s mounted as per Figure 11 to a 1.5mm thick steel sheet measuring 16cm x 18cm. Under these conditions the Ag7300 is capable of sourcing its full output power for any given input and output voltage across an operating temperature range of -40°C to +65°C. Operation in a sealed enclosure or with limited airflow will result in further de-rating of the operating temperature profile.

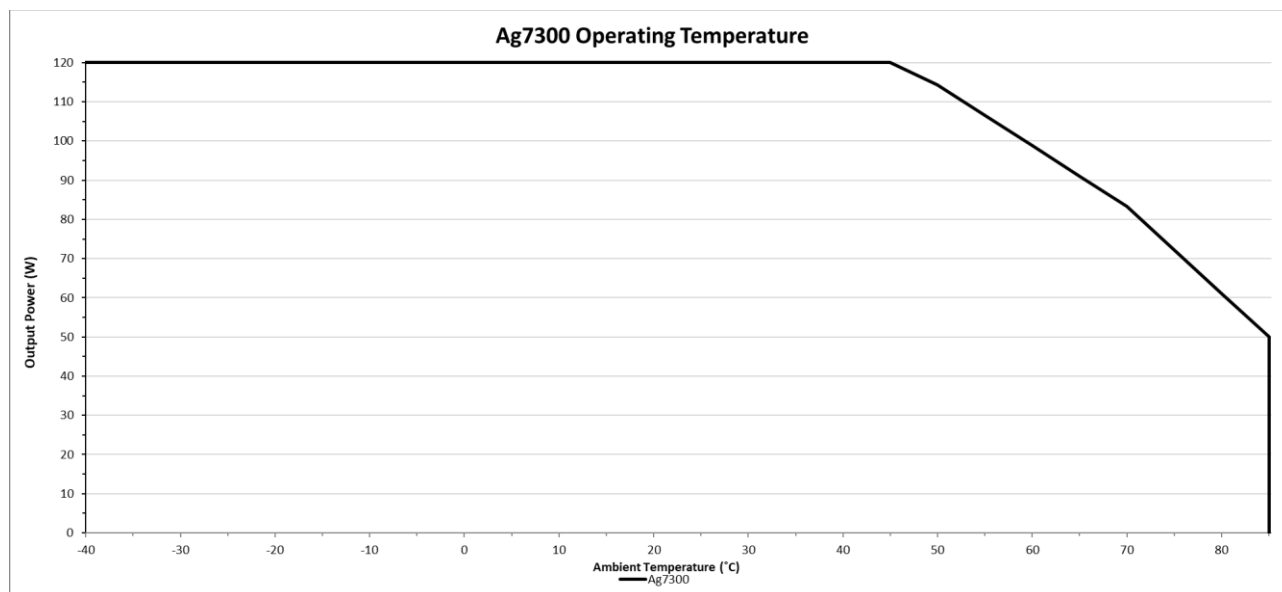


Figure 8: Ag7300 operating temperature profile

4.1 Thermal Considerations

Each application is different; therefore, it is impossible to give fixed and absolute thermal recommendations. Due to the small size and power output of this module, it is important that heat is drawn out and away. Despite its high efficiency, at full load the Ag7300 can dissipate up to 16W, it is also important that any enclosure has sufficient ventilation to remove this energy from the application.

One simple method for drawing some of the heat away from the Ag7300 is by means of a thermal gap filling material, such as Parker Chomerics THERM-A-GAP GEL, in combination with power planes connected to the power pads of the module Vin+, Vin-, Vout+, and Vout-. These power planes must be on the outer layers of the PCB and the best results are achieved by having power planes on both sides of the main board with regular via connections to thermally bond the planes. An example of the topside layout is shown in Figure 9.

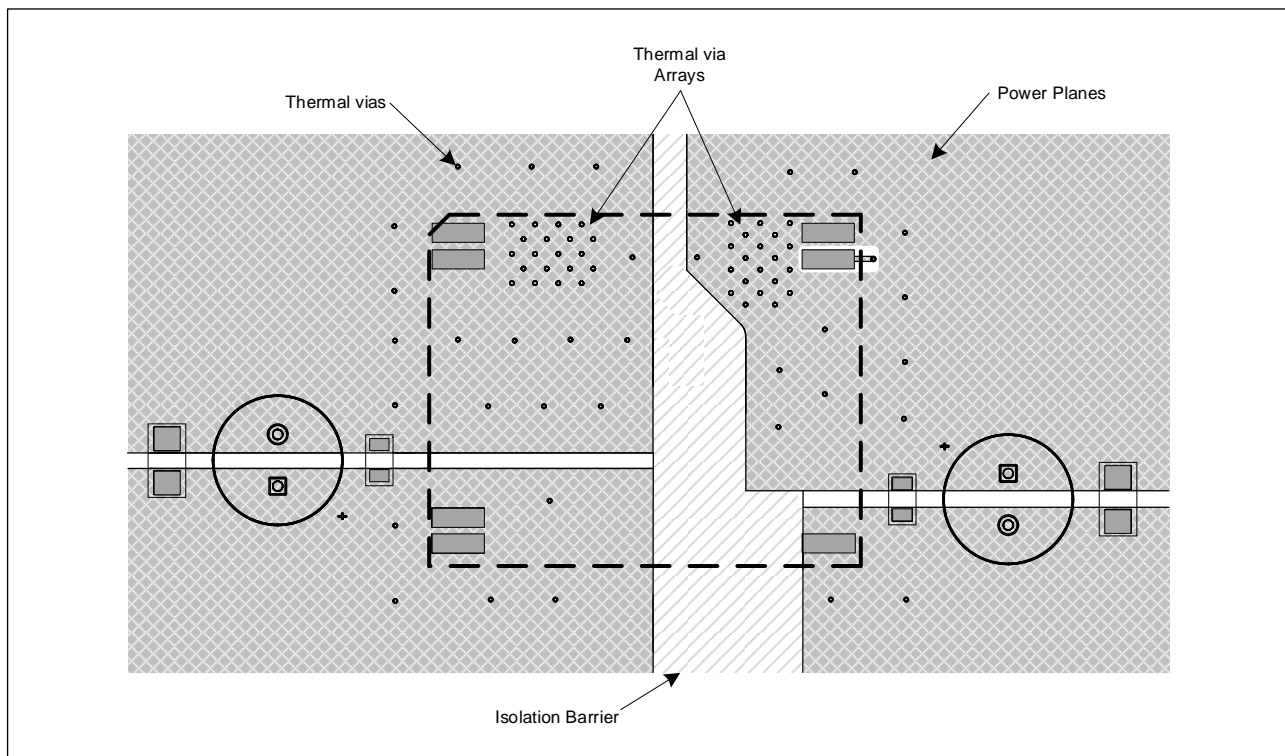


Figure 9: Thermal Relief

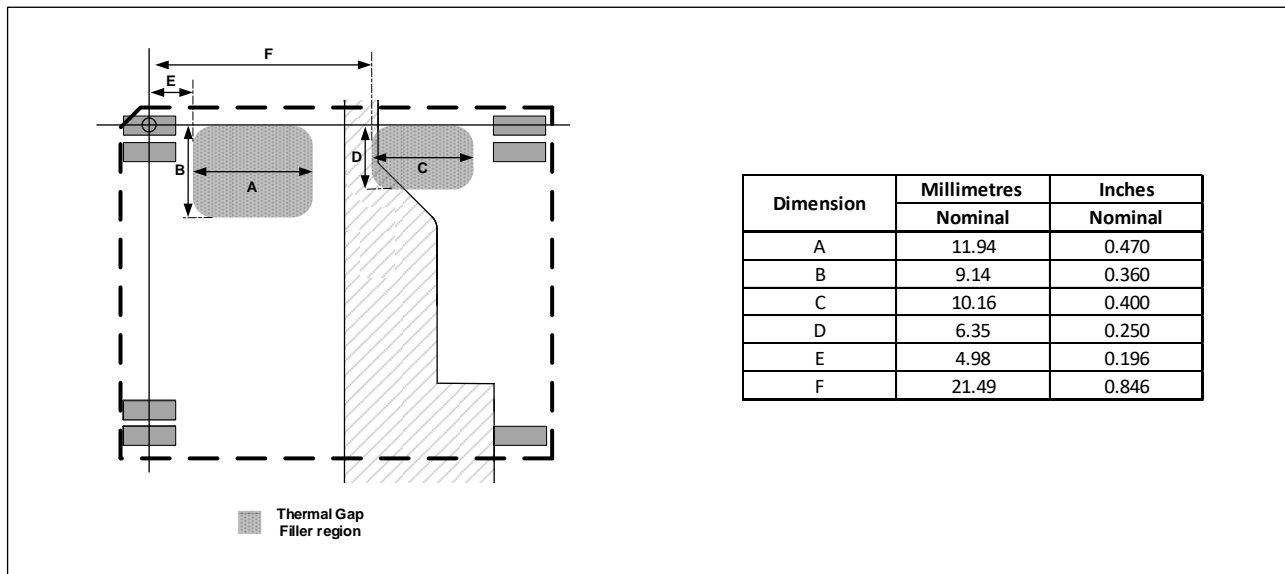


Figure 10: Thermal Interface Application Region

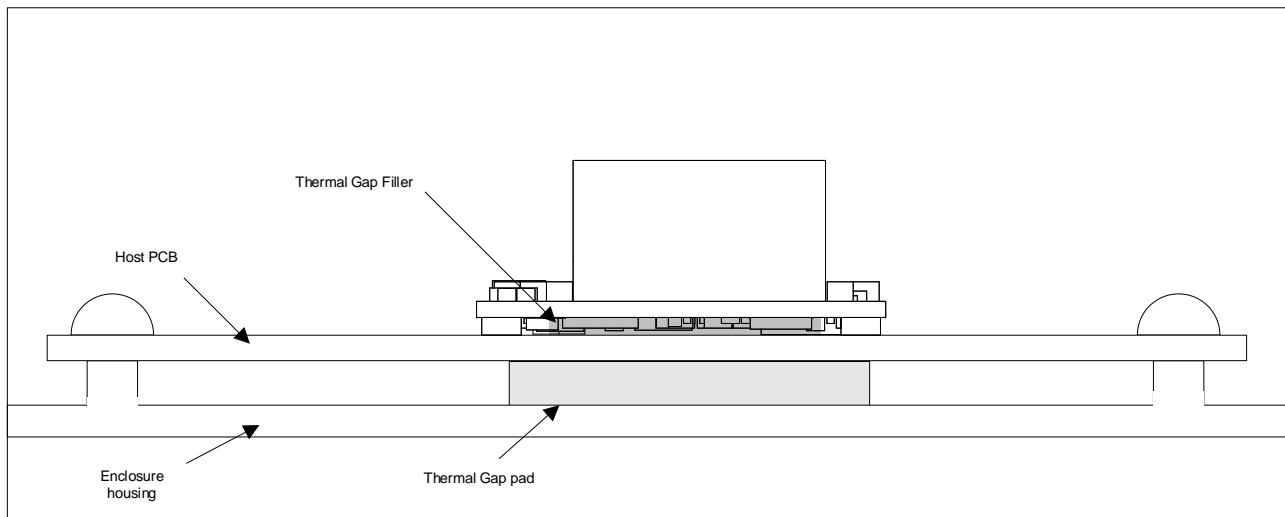


Figure 11: Additional Heatsinking

5 EMC

The Ag7300 has been designed to pass EN55032 Class B, however the Ag7300 will only be a single component within the system, depending on the application, filtering of the emissions passing through the Ag7300 may be required.

6 Protection

6.1 Input Protection

The Ag7300 does not feature input protection and may be damaged if input voltages exceed 40V. Over voltage protection such as a TVS diode can be fitted across the VIN+ and VIN- input pins, providing protection from electrostatic discharge (ESD) or other high voltage transients. One example of this is the SMAJ36A.

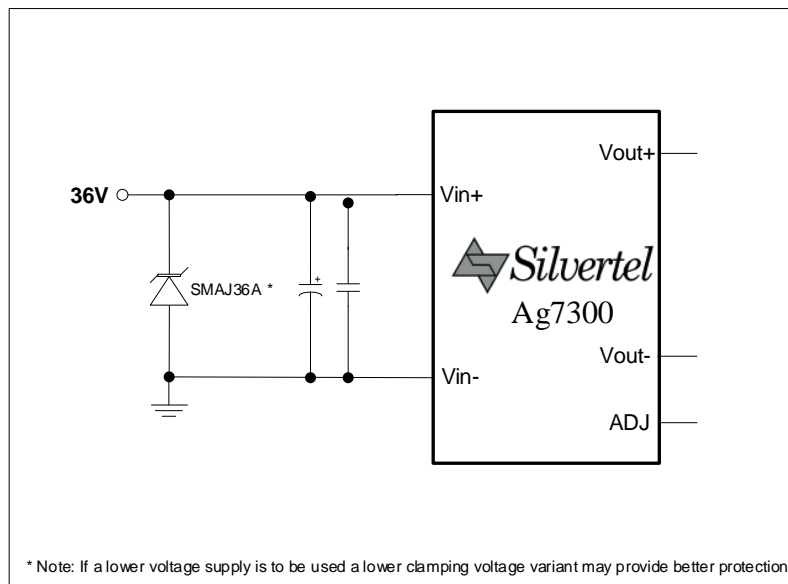


Figure 12: Input Protection

6.2 Output Back Feed Protection

If an external or auxiliary supply is to be used, gating circuitry should present to prevent voltage injection on to the output circuitry of the module to avoid damage to the module.

6.3 Output Short Circuit Protection

The Ag7300 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 Ag7300 will disable the output, the Ag7300 will then periodically attempt restart approximately every 2 seconds until the cause of the over current is removed, after which, the power will be restored to the output.

6.4 Thermal Protection

The Ag7300 contains built-in thermal protection to prevent the module becoming damaged in the event that the module is operated beyond its temperature specification. When the Ag7300 has detected it is over temperature, the output will be disabled until the module has cooled sufficiently.

7 Solderability

The Ag7300 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 Ag7300 can still be mounted manually using soldering iron or hot air.

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 14.

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 Ag7300 requires no components of greater than Moisture Sensitivity level 1, as a result no special processes are required in the reflowing process of the Ag7300.

Note : Do not pass the Ag7300 through the reflow process mounted to the underside of the assembly due to the risk of components falling off the module.

7.1 Solder Profile

Below is a typical profile that the Ag7300 should be 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 4: Solder Profile

	Min	Max	Units
Soak Time (s) 150-180°C	30	90	Seconds
Time above (s) ≥220°C	30	90	Seconds
Peak Temperature (°C)	230	255	°C
ΔTemperature (°C/s)	-3	3	°C/Second

Table 5: Solder Parameters

8 Electrical Characteristics

8.1 Absolute Maximum Ratings

	Parameter	Symbol	Min	Max	Units
1	DC Supply Voltage	V_{CC}	-0.3	40	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.

8.2 Recommended Operating Conditions

	Parameter	Symbol	Min	Typ	Max	Units
1	Input Supply Voltage	V_{IN}	18		36	V
2	Operating Temperature	T_{OP}	-40	25	85	T_a / °C
3	Input capacitance	C_{in}	220	470		μF
4	Output capacitance	C_{in}	22	47		μF

8.3 DC Electrical Characteristics

	DC Characteristic	Sym	Min	Typ ¹	Max	Units	Comments
1	Nominal Output Voltage	V_{OUT}		55.5 ²		V	
2	Continuous Current output ³	I_{LOAD}	-	-	2.2	A	
3	Line Regulation	V_{LINE}	-	-	0.15	%	
4	Load Regulation	V_{LOAD}	-	-	0.15	%	
5	Ripple and Noise ⁴	V_{RN}	-	370	-	mV _{p-p}	
6	Minimum Load	I_{MIN}	0	-	-	mA	
7	Short-Circuit Duration	TSC	-	-	∞	sec	
8	Peak Efficiency	EFF	-	91	-	%	@ 15Vin

Note 1: Typical figures are at 25°C with a nominal output voltage and are for design aid only. Not Guaranteed.

Note 2: With ADJ pin Open circuit.

Note 3: Maximum output Current may be limited as a result of input supply.

Note 4: Measured at full load using Output Filter A and 20Mhz Bandwidth.

9 Package and Footprint

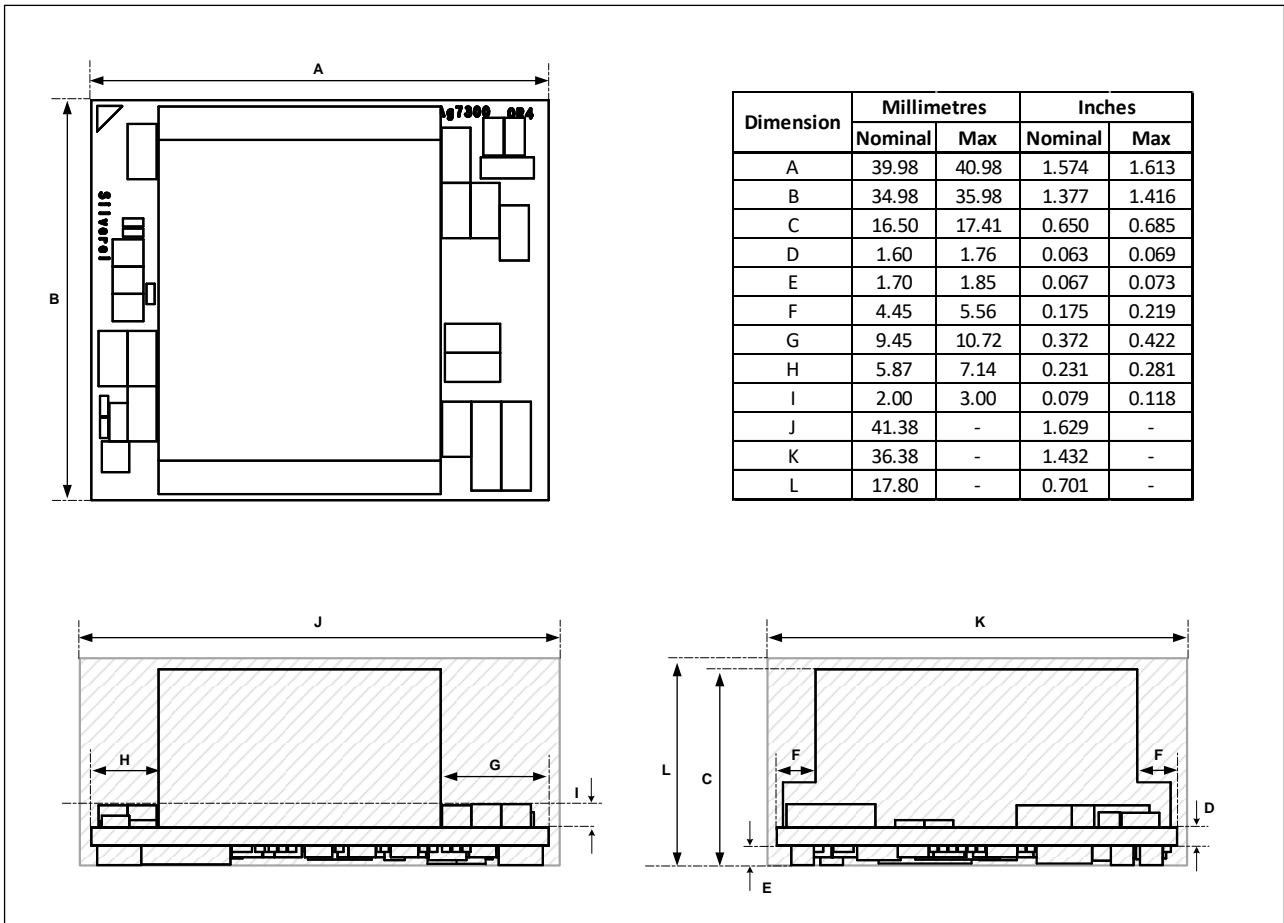


Figure 13: Package Dimensions

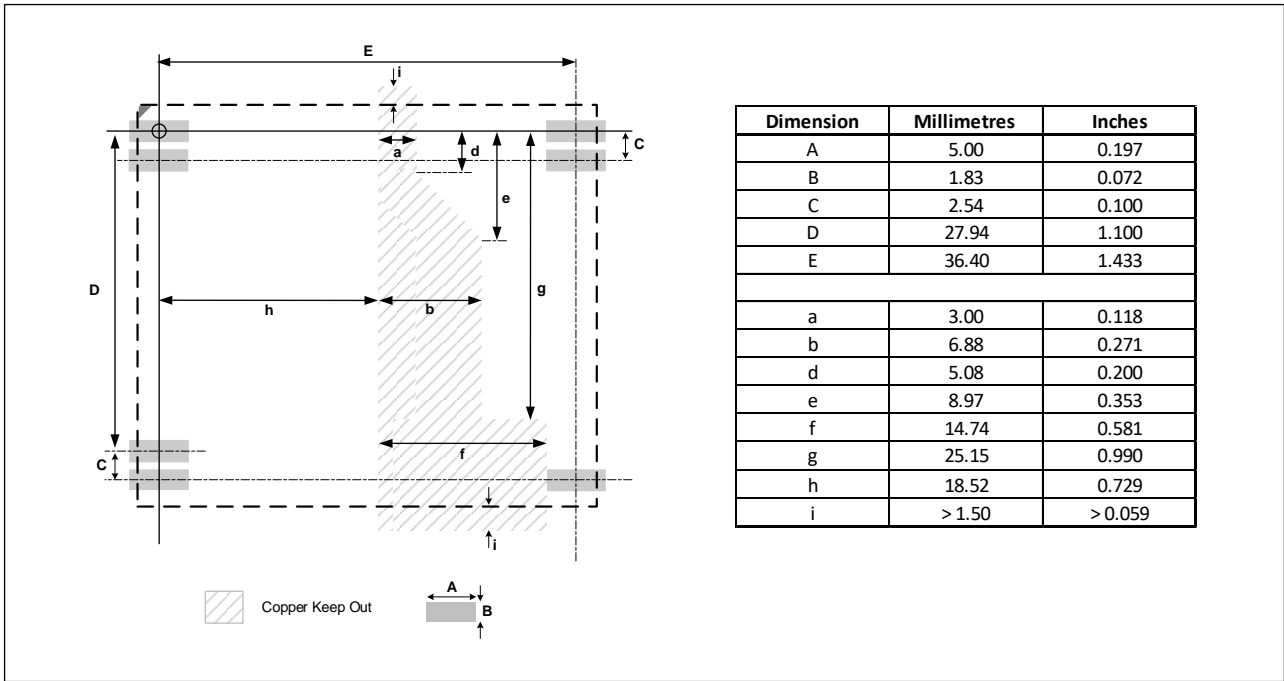
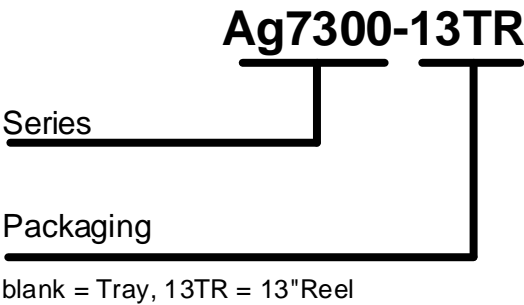


Figure 14: Land Pattern

10 Ordering Code



11 Packaging

The default packing for the Ag7300 series is supplied in trays of 36, additionally there is the option for the Ag7300 to be packaged in quantities of 75 on a 13-inch reel.

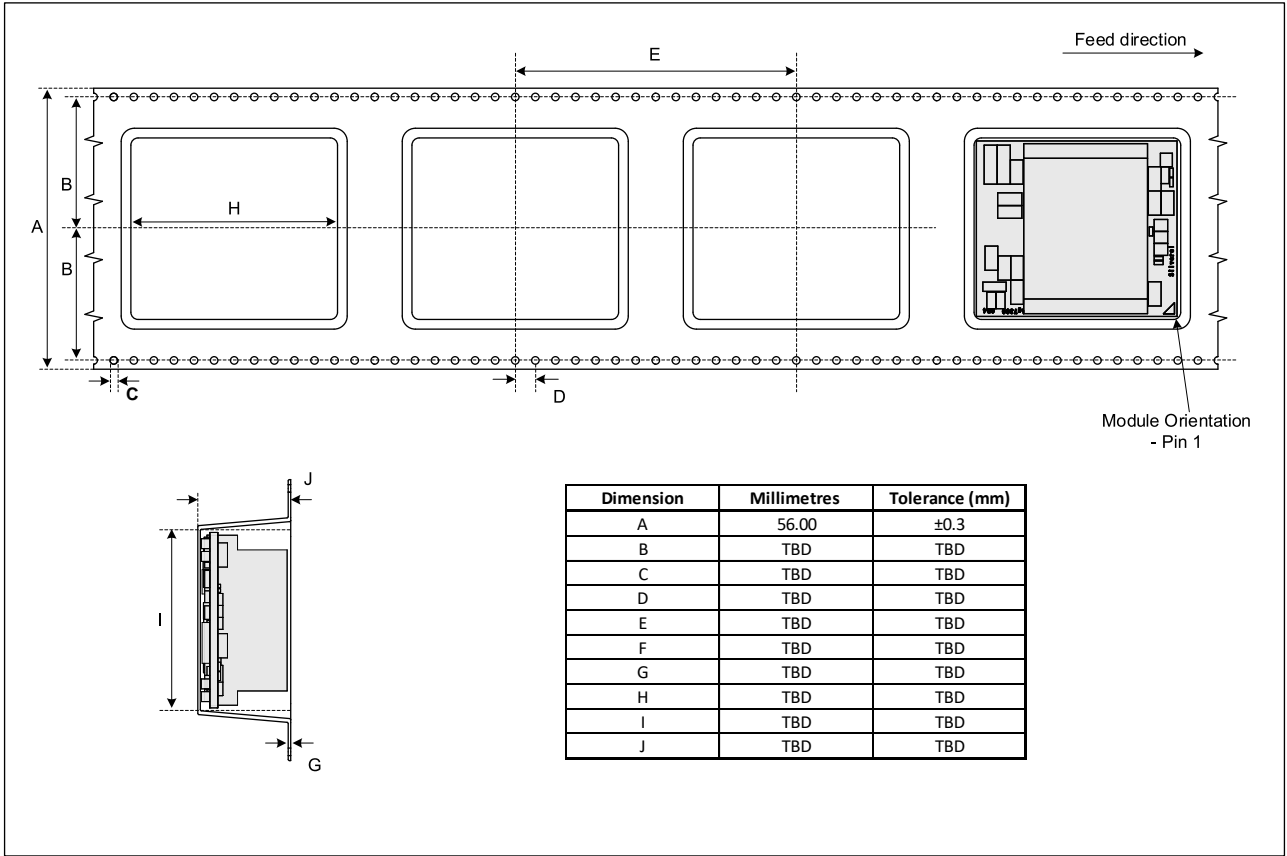


Figure 15: Tape Dimensions

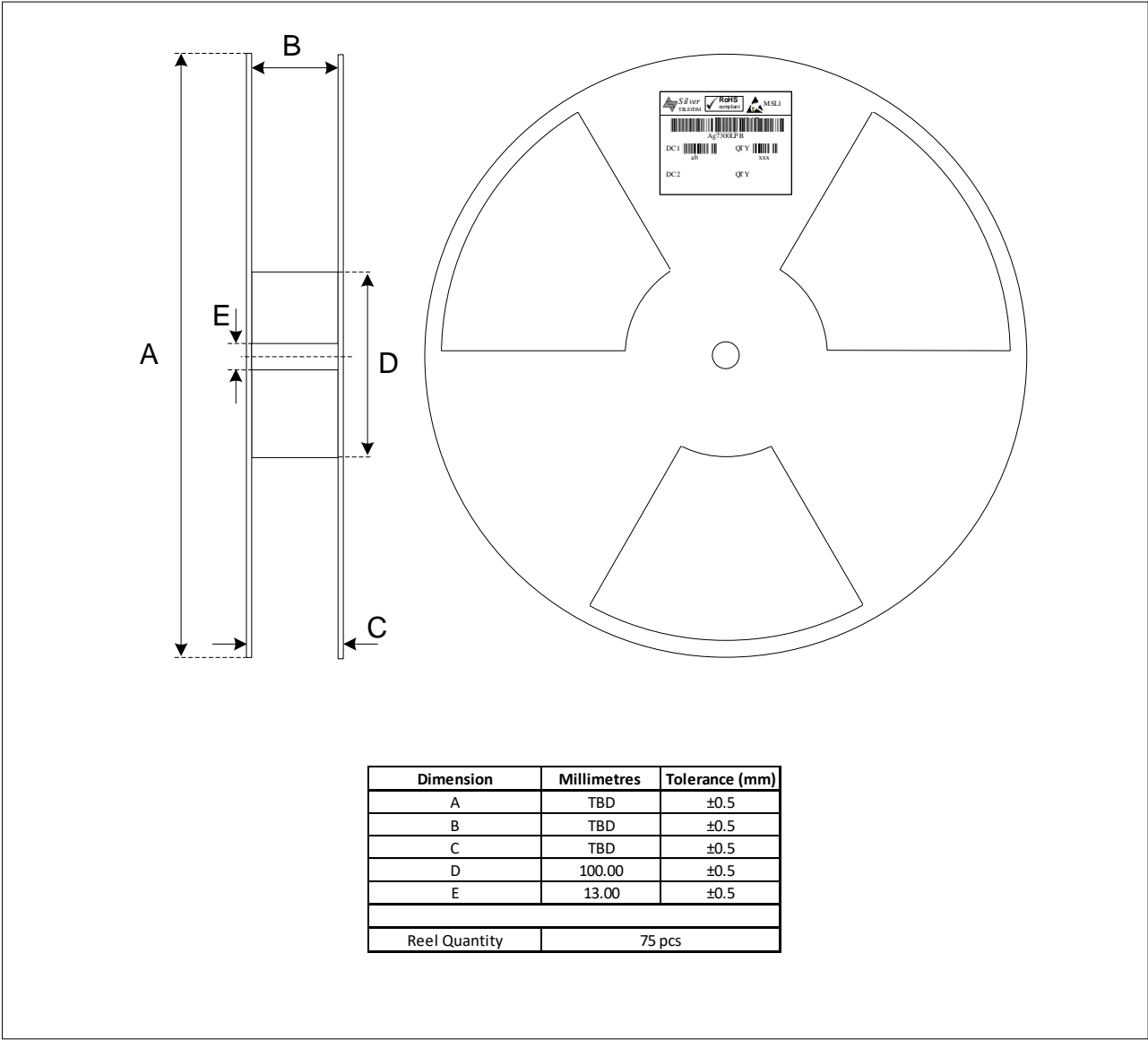


Figure 16: Reel Dimensions

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