Ag7300

Thermal considerations

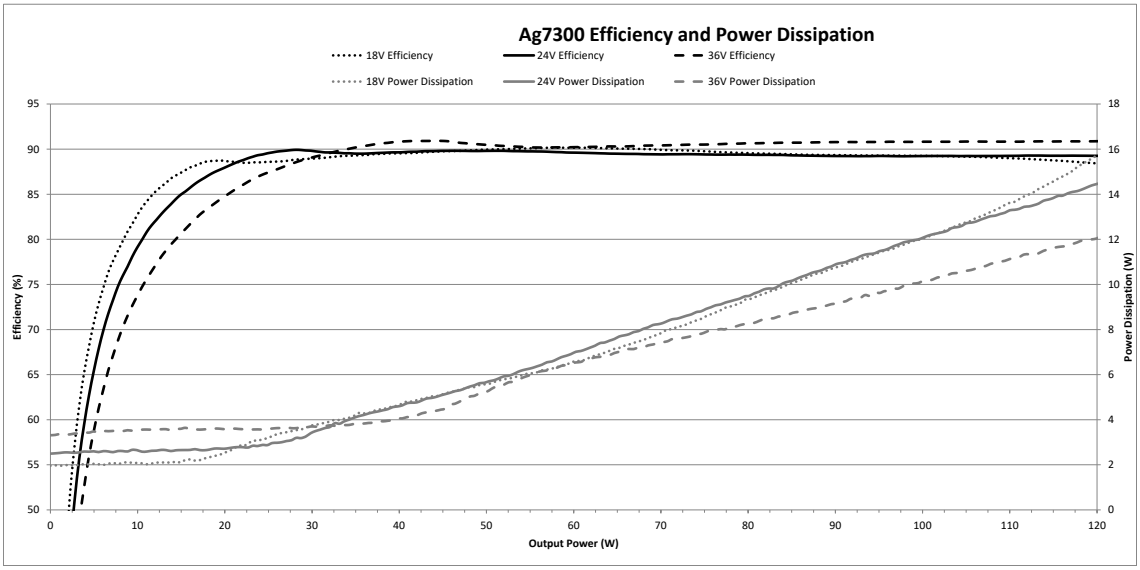
Version 1.1

The following document details the thermal performance of the Ag7300 series for use with designing thermal management when integrating into an application.

The Ag7300 module is a compact power converter that will generate heat in the small footprint. The amount of heat generated by the module will depend on the load it is required to drive and the supply voltage. To ensure continuous operation at maximum power, it is important that any enclosure used to house the application should have sufficient heatsinking, ventilation, and airflow over the Ag7300 to dissipate the highest average power demand of the Ag7300 as well as the power dissipation of the application circuitry to limit the temperature elevation inside the enclosure.

The Ag7300 series is capable of sourcing up to 120W of power to an application, however it should be noted that the module may shut down as a result of the thermal protection if the heat generated is not removed from the device.

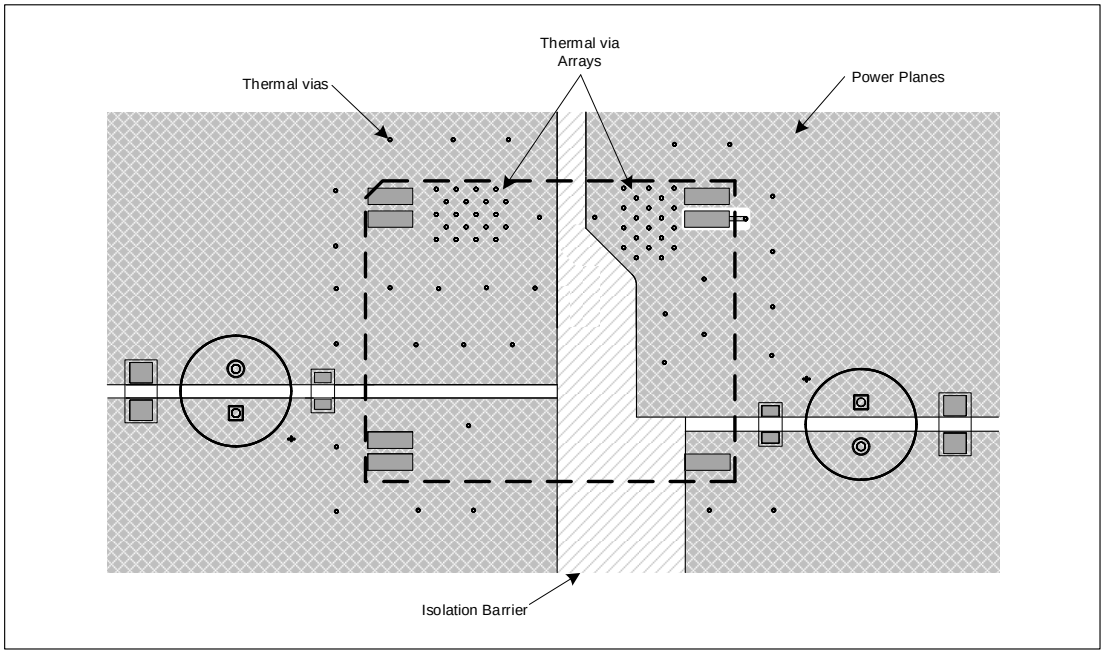
While the module can achieve efficiencies of up to 91% it should be noted that at full load the power dissipation in the module will be 12W-16W.



Ag7300 Efficiency and Power Dissipation

It is always preferential to have enough air movement in a system to remove any static pockets of elevated temperature air surrounding the components on the module. Using the combination of thermal planes, vias, and thermal interface material under the module to draw heat away from the highest power dissipating components and spread the energy over a larger surface area will greatly assist the thermal management of the module.

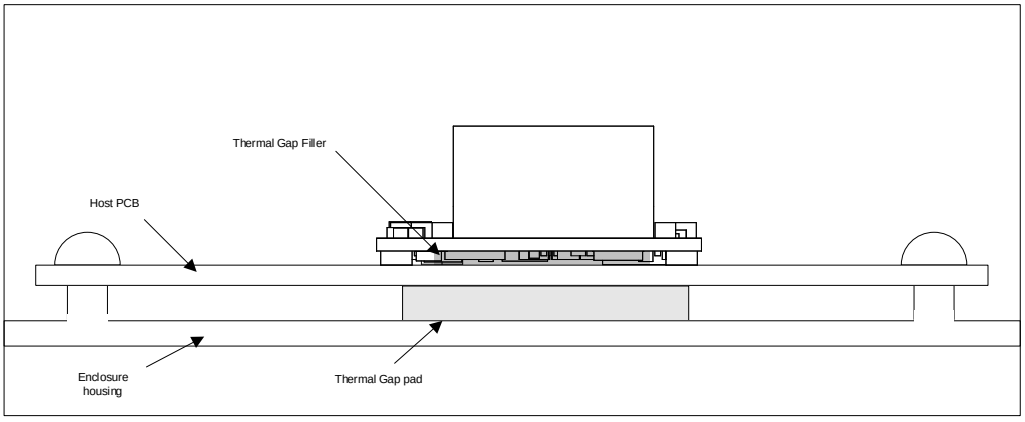
An example layout of the thermal planes and vias is shown below. Arrays of thermal vias are used below the location of the highest power dissipating components to more effectively spread the thermal energy between the layers of the application PCB. The Thermal interface material will have the most effect in this region.



Ag7300 suggested Thermal plane layout

The thermal management of the application can be further improved by heatsinking the application PCB to the enclosure walls by use of a gap pad. This allows the thermal energy of the application PCB to be dissipated to the air surrounding the enclosure rather than the elevated ambient temperature inside the enclosure.

For optimal affect, gap pads should be placed such that they provide the greatest reduction in thermal resistance from the highest power dissipating components to the enclosure wall, in the case of the Ag7300, this would be covering the thermal via arrays as shown below.



Ag7300 Enclosure Heatsinking

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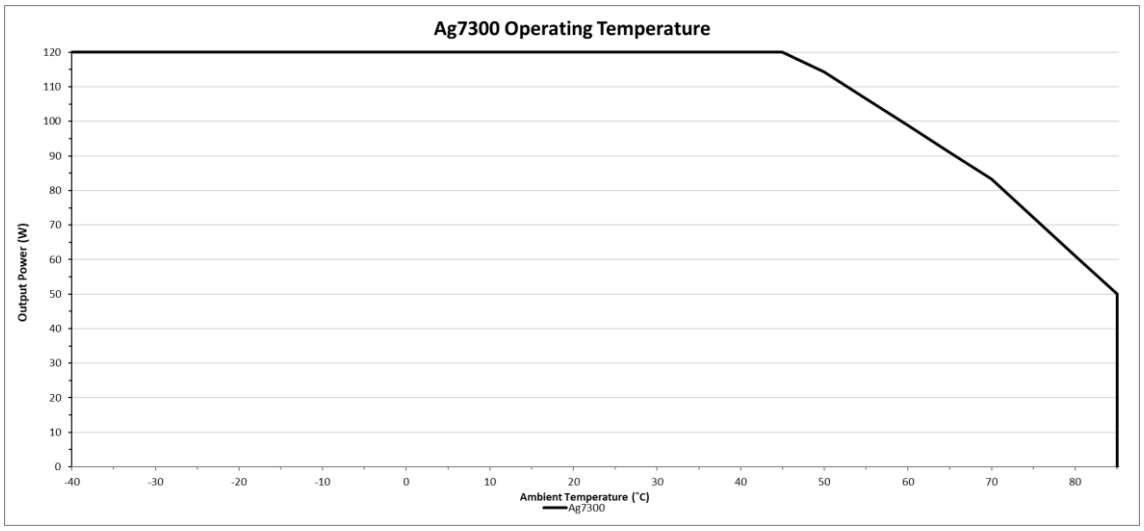
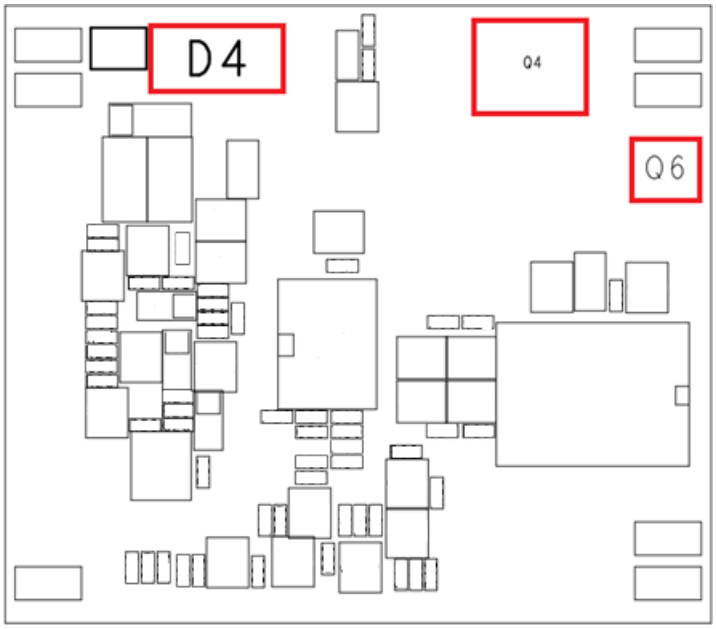
The following tests show typical component temperatures while operating in ambient temperatures between -40˚C and 85˚C. These tests were performed in a Temperature Applied Sciences Ltd ECO MT135 Environmental chamber with circulating air at a rate of approximately 0.5m/s over the Ag7300 module while mounted onto an EvalAg7300 evaluation board with Parker Chomerics THERM-A-GAP GEL 37 applied under the module, as per the datasheet application region diagram, and a thermal Gap Pad to a 1.5mm thick steel sheet measuring 16cm x 18cm.



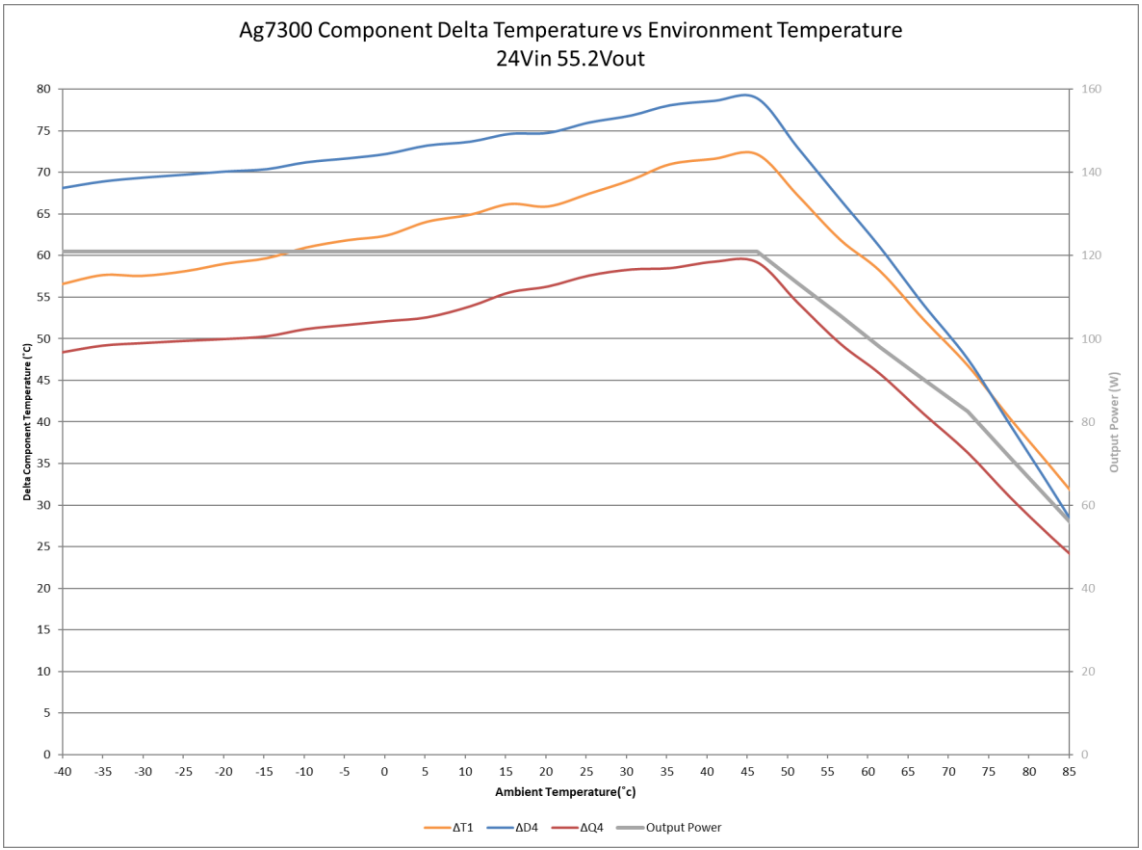
Ag7300 operating temperature profile

Highlighted below are the hottest components on the underside of the Ag7300 module.



Ag7300 Hottest Components

Below shows the temperature of the components relative to the ambient temperature of the chamber for the module outputting its nominal output voltage with a 24V supply at an output power shown in the grey line.

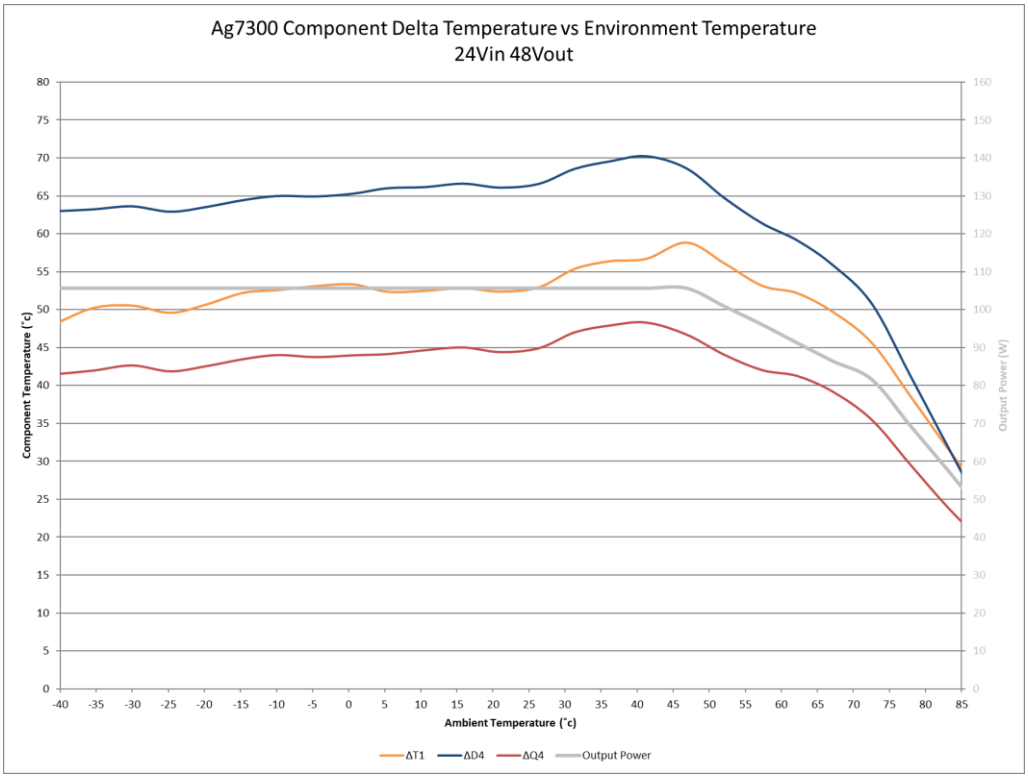


Ag7300 delta component temperature

Ambient Temperature (˚c)	T1 Temperature (˚c)	D4 Temperature (˚c)	Q4 Temperature (˚c)	Supply Voltage (V)	Supply Current (A)	Output Voltage (V)	Output Current (A)
-40.00	16.00	27.58	7.83	24.01	5.59	55.15	2.20
-35.00	22.61	33.86	14.14	24.00	5.59	55.17	2.20
-30.00	27.43	39.24	19.36	24.01	5.58	55.20	2.20
-25.00	33.48	45.09	25.11	24.00	5.58	55.22	2.20
-20.00	39.31	50.39	30.26	24.00	5.58	55.24	2.20
-15.00	45.03	55.74	35.65	24.00	5.58	55.26	2.20
-10.00	51.19	61.44	41.40	23.99	5.57	55.27	2.20
-5.00	57.31	67.15	47.13	24.00	5.57	55.28	2.20
0.00	62.73	72.54	52.43	24.00	5.57	55.28	2.20
5.00	69.35	78.52	57.87	23.99	5.57	55.29	2.20
10.00	75.54	84.33	64.53	23.99	5.57	55.30	2.20
15.00	81.72	90.16	71.11	23.99	5.58	55.30	2.20
20.00	86.21	95.07	76.61	23.99	5.58	55.24	2.20
25.00	92.83	101.39	83.00	23.99	5.58	55.24	2.20
30.00	99.72	107.49	88.97	23.99	5.58	55.23	2.20
35.00	106.40	113.50	93.92	24.00	5.58	55.23	2.20
40.00	112.53	119.52	100.18	24.00	5.59	55.23	2.20
45.00	118.39	125.15	105.43	24.01	5.59	55.23	2.20
50.00	118.52	124.27	105.64	24.01	5.23	55.24	2.06
55.00	118.48	123.31	106.00	24.00	4.87	55.24	1.92
60.00	119.65	122.51	107.30	24.01	4.51	55.25	1.78
65.00	119.24	121.01	107.93	23.99	4.15	55.27	1.64
70.00	119.21	119.98	108.73	24.00	3.79	55.27	1.50
75.00	118.10	117.35	108.63	24.00	3.29	55.27	1.30
80.00	117.32	114.70	108.98	24.00	2.78	55.26	1.10
85.00	116.41	111.72	109.69	24.00	2.28	55.28	0.90

Ag7300 component temperature with nominal output voltage

Below shows the temperature of the components relative to the ambient temperature of the chamber for the module outputting 48V with a 24V supply at an output power shown in the grey line.



Ag7300 delta component temperature

Ambient Temperature (˚c)	T1 Temperature (˚c)	D4 Temperature (˚c)	Q4 Temperature (˚c)	Supply Voltage (V)	Supply Current (A)	Output Voltage (V)	Output Current (A)
-40.00	7.50	22.33	0.82	24.00	4.86	47.84	2.20
-35.00	14.80	27.83	6.55	24.00	4.86	47.86	2.20
-30.00	20.45	33.57	12.57	24.00	4.85	47.89	2.20
-25.00	24.82	38.18	17.11	24.00	4.85	47.91	2.20
-20.00	30.84	43.73	22.72	24.00	4.85	47.93	2.20
-15.00	37.62	49.86	28.88	24.00	4.84	47.94	2.20
-10.00	42.66	55.10	34.11	24.00	4.84	47.95	2.20
-5.00	48.48	60.33	39.13	24.00	4.84	47.96	2.20
0.00	53.90	65.89	44.56	23.99	4.84	47.97	2.20
5.00	57.66	71.33	49.44	24.00	4.84	47.96	2.20
10.00	63.03	76.75	55.22	23.99	4.84	47.96	2.20
15.00	68.68	82.47	60.86	24.00	4.84	47.97	2.20
20.00	73.42	87.16	65.45	24.00	4.84	47.96	2.20
25.00	79.32	92.99	71.30	24.00	4.84	47.96	2.20
30.00	86.67	99.88	78.31	24.00	4.85	47.96	2.20
35.00	92.63	105.83	84.17	24.00	4.85	47.96	2.20
40.00	98.01	111.54	89.59	23.99	4.85	47.97	2.20
45.00	105.68	115.48	93.56	24.00	4.85	47.96	2.20
50.00	108.18	116.82	96.14	24.00	4.63	47.95	2.10
55.00	110.46	118.72	99.35	24.00	4.40	47.95	2.00
60.00	114.34	121.33	103.43	24.00	4.18	47.96	1.90
65.00	116.82	123.02	106.31	24.00	3.96	47.95	1.80
70.00	118.14	123.35	108.00	23.99	3.74	47.96	1.70
75.00	116.51	119.27	107.45	24.01	3.18	47.98	1.45
80.00	114.75	115.02	107.00	24.00	2.63	47.98	1.20
85.00	113.33	111.06	107.22	24.00	2.09	47.98	0.95

Ag7300 component temperature when outputting 48V