Ag9900

Thermal considerations

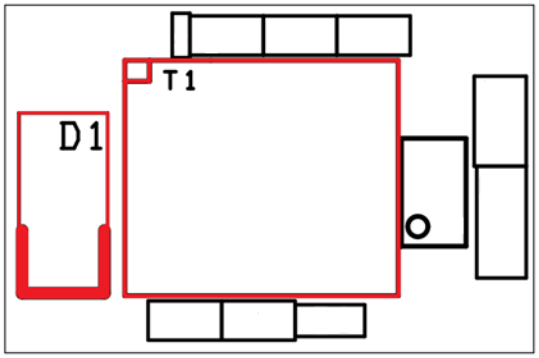
Version 1.1

The following document details the thermal performance of the Ag9900 series for use with designing thermal management of the Ag9900 range when integrating into designs.

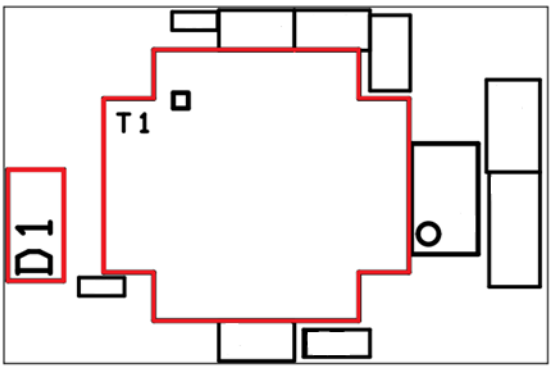
The Ag9900 module is a compact power component and as a result will generate heat in a small footprint. The amount of heat generated by the module will depend on the load it is required to drive and the input voltage supplied by the PSE. To obtain maximum power it is important that any enclosure used has sufficient ventilation and airflow over the Ag9900, It is also highly recommended that heat is drawn away from the module and into a larger thermal mass, such as the host PCB, through use of Thermally Conductive Oxime Cure paste.

The Ag9900 series is capable of supplying up to 12W of power depending on the variant chosen, with the maximum output power of the MT and LP variants reducing as the module nears their thermal maximum if this thermal energy is not adequately removed from the device. The Ag9900M range does not include thermal protection, so care must be taken to ensure that the thermal maximums are not exceeded.

Indicated in the pictures below are the hottest components on both the top and bottom sides of the Ag9900.

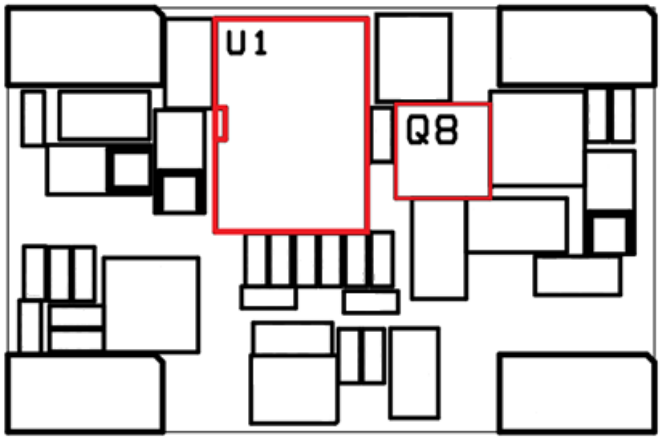


Ag9900M & Ag9900MT



Ag9900LP

The hottest components on the top side of the board are D1 followed by the transformer, T1.



Ag9900 All Variants

The hottest components on the Underside of the board are U1 and Q8.

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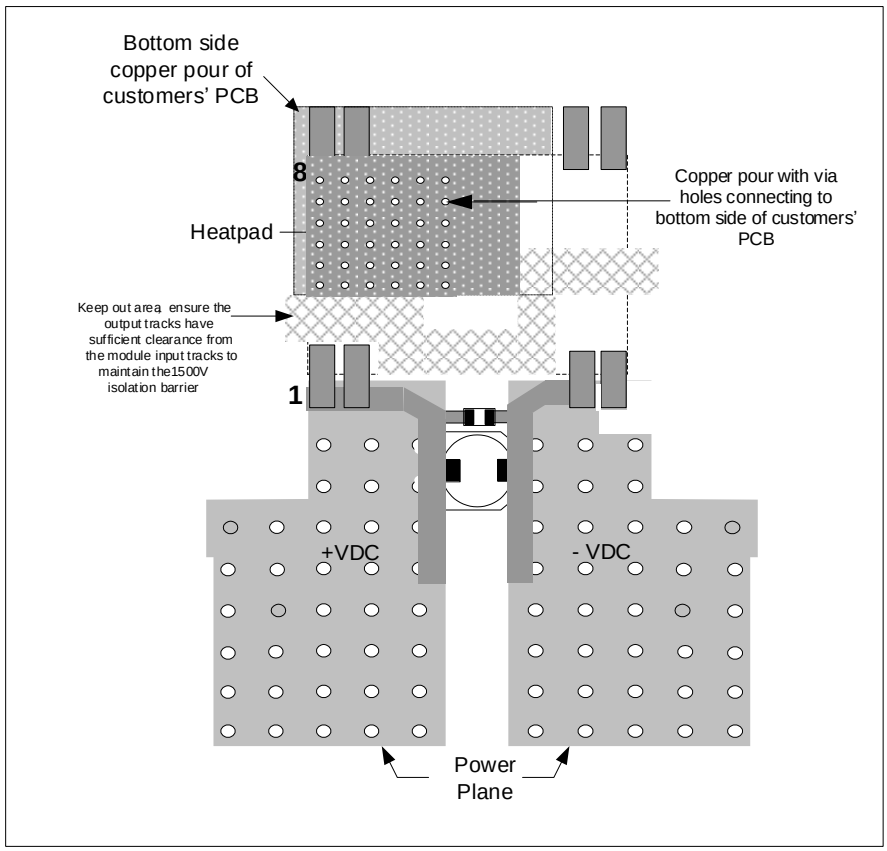
In order to dissipate the generated heat away from the components, Silvertel recommends that a combination of copper pours and via arrays are used to thermally connect the Ag9900 module to the host PCB. Below is a suggested layout of the copper pour and vias. This layout suggestion is applicable to both the surface mount, Ag9900M and Ag9900MT, variants as well as the through hole, Ag9900LP Variants.



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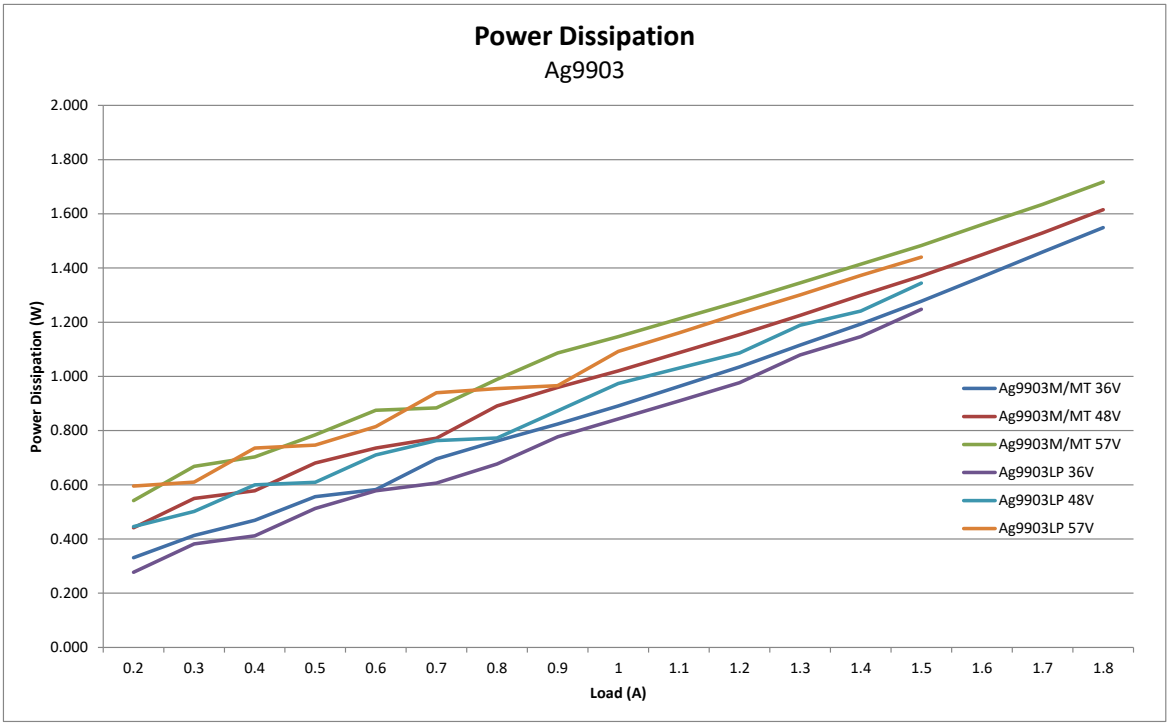
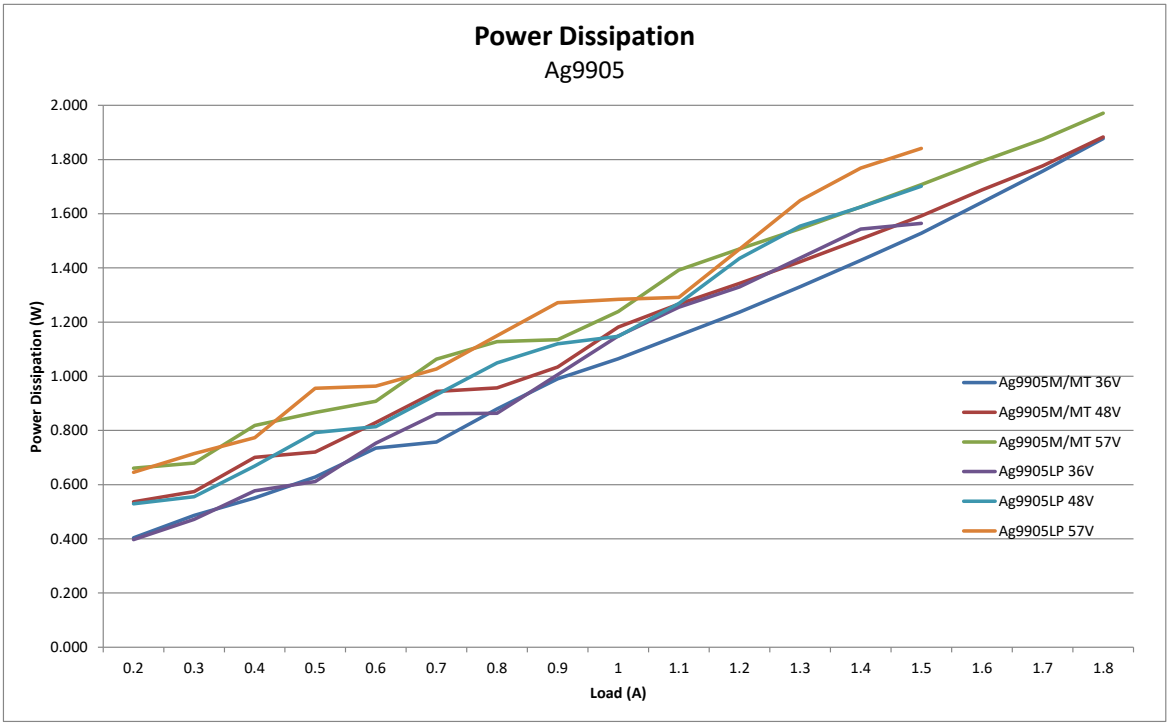
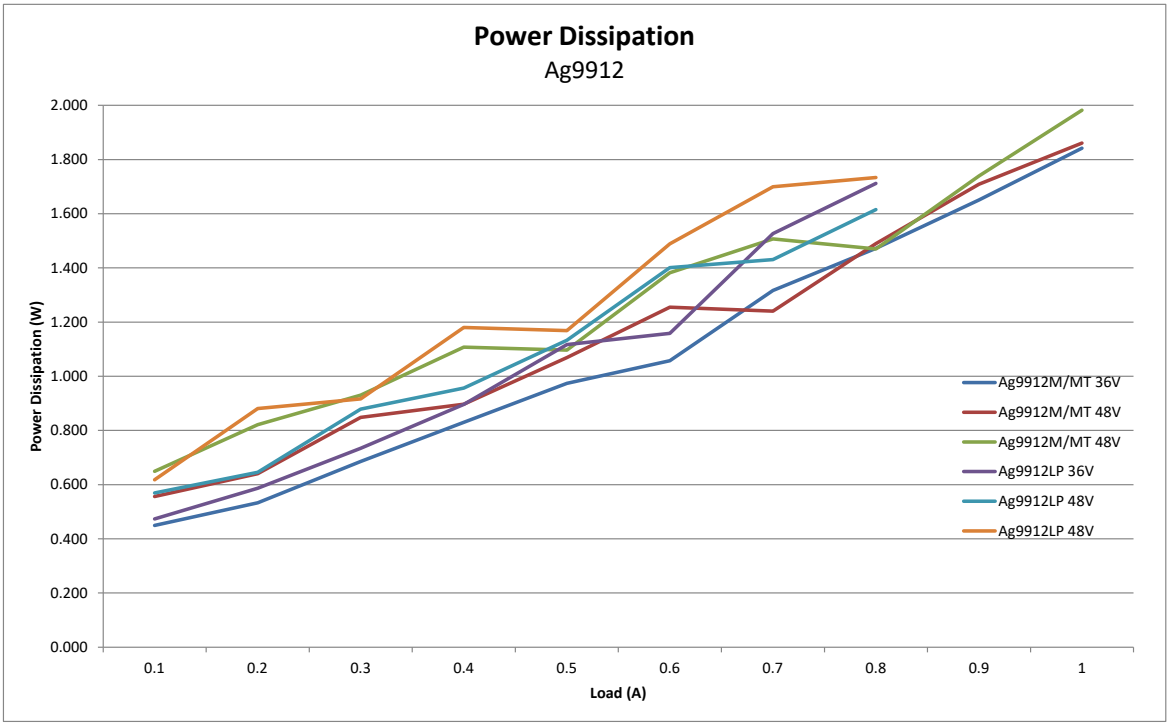
Any enclosure that a Ag9900 series module is to be housed in should be designed to dissipate the total energy of the system. In addition, to the power consumed by the output of the module, up to 2W will be added due to the power dissipation across the Ag9900.



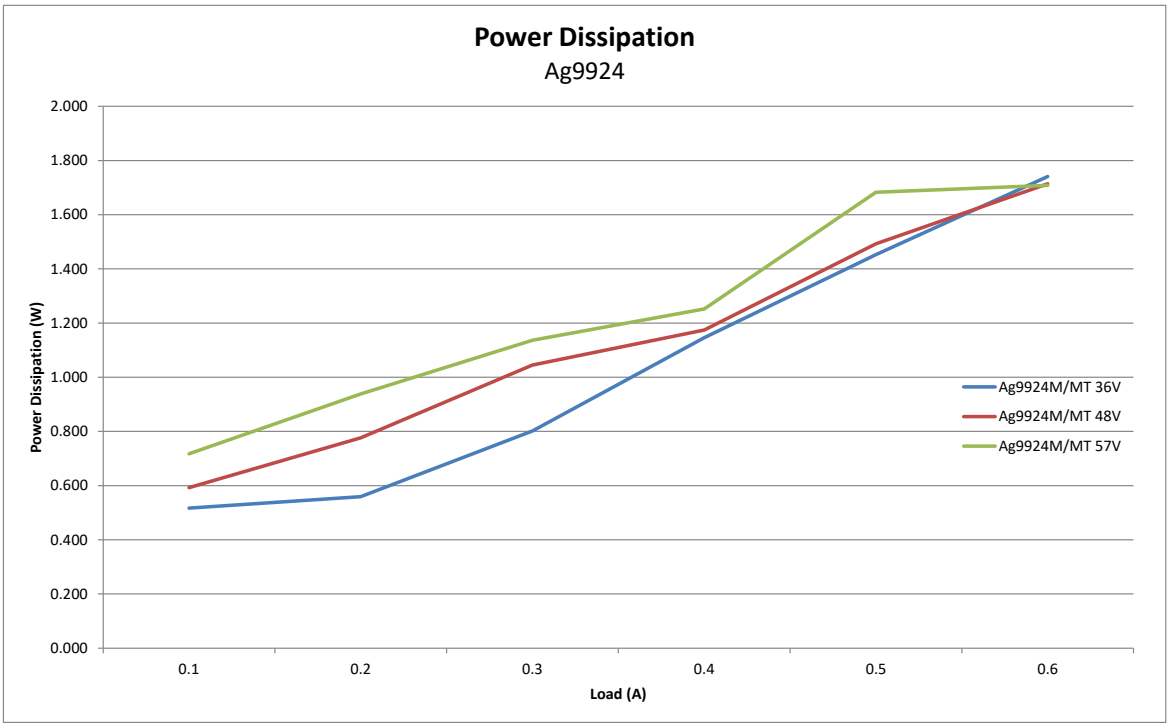
Ag9903 power dissipation vs load



Ag9905 power dissipation vs load



Ag9912 power dissipation vs load



Ag9924 power dissipation vs load

Note: data calculated using the efficiency curves of the module.

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The following tests show typical component temperatures while operating in ambient temperatures of 30˚C and 70˚C. These test were performed in an Associated Environmental Systems SD-302 chamber with gentle circulating air, with the Ag9900 modules soldered into an evaluation board, with Thermally Conductive Oxime Cure paste between the module and the board.

Module	Ambient Temperature	U1	Q8	T1	D1	Output Voltage	Output Power
Ag9903M/MT	30˚C	53˚C	63˚C	45˚C	68˚C	3V	6W
	70˚C	92˚C	102˚C	83˚C	103˚C		
Ag9903LP	30˚C	48˚C	53˚C	47˚C	60˚C	3V	5W
	70˚C	90˚C	94˚C	87˚C	101˚C		
Ag9905M/MT	30˚C	55˚C	73˚C	53˚C	70˚C	5V	9W
	70˚C	113˚C	94˚C	89˚C	109˚C		
Ag9905LP	30˚C	52˚C	57˚C	51˚C	67˚C	5V	7W
	70˚C	93˚C	98˚C	92˚C	107˚C		
Ag9912M/MT	30˚C	55˚C	75˚C	55˚C	67˚C	12V	12W
	70˚C	93˚C	116˚C	91˚C	109˚C		
Ag9912LP	30˚C	49˚C	56˚C	51˚C	58˚C	12V	10W
	70˚C	92˚C	101˚C	95˚C	103˚C		
Ag9924M/MT	30˚C	54˚C	71˚C	50˚C	58˚C	24V	12W
	70˚C	88˚C	93˚C	-	102˚C		

Below are the derating diagrams for the various modules in the Ag9900 range. The Ag9900M models have a maximum operating temperature of 70˚C while the Ag9900MT and Ag9900LP models are capable of operating in temperatures up to 85˚C at lower output powers.

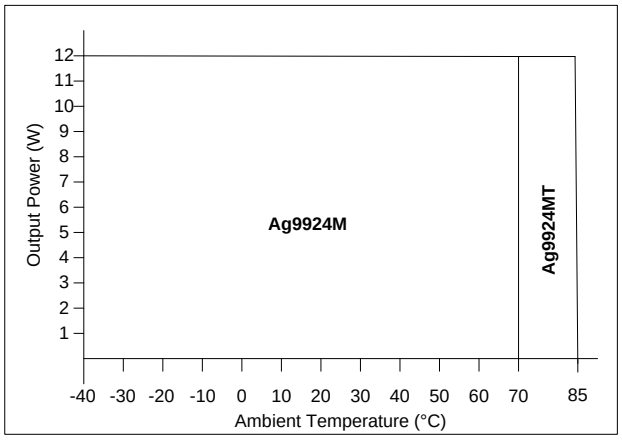

Figure 1: Ag9924M Operating Profile

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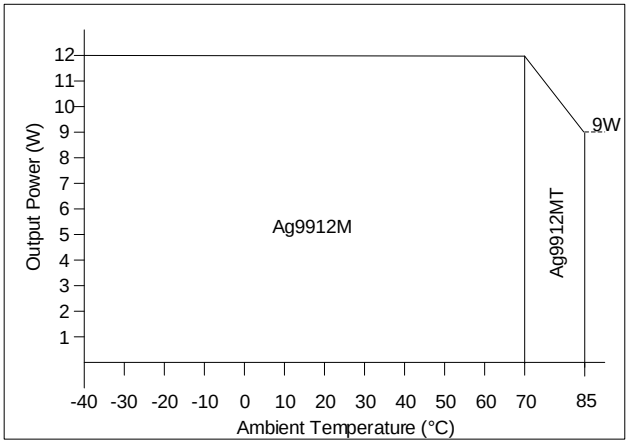
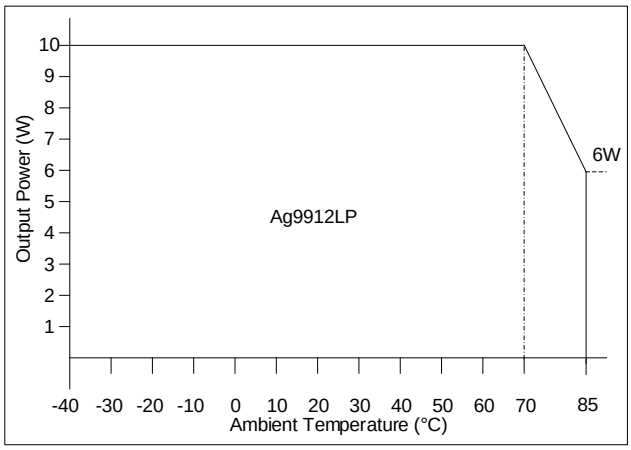
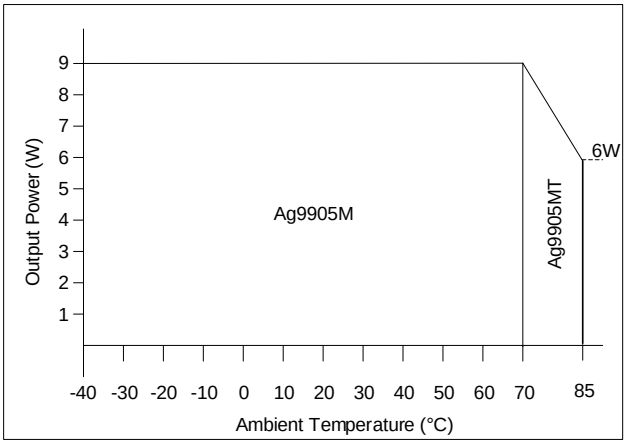


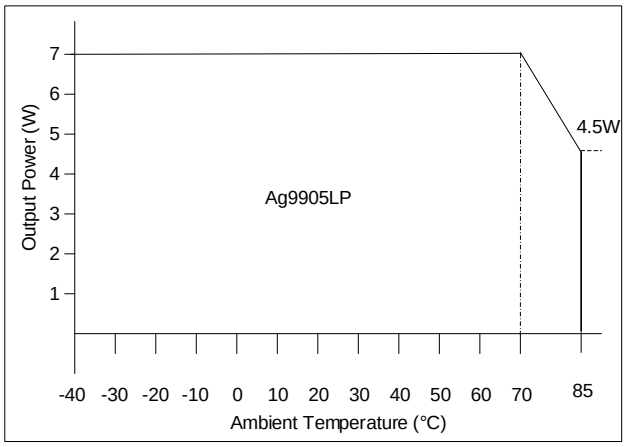
Ag9912M Operating Profile



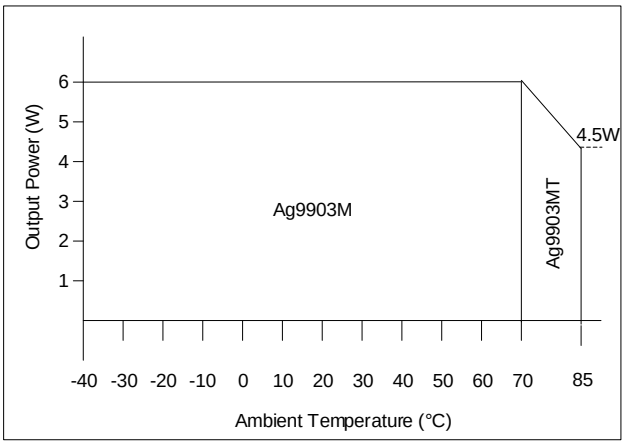
Ag9912LP Operating Profile



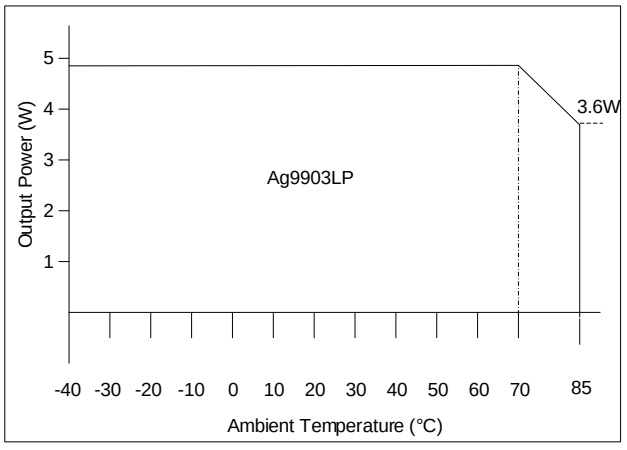
Ag9905M Operating Profile



Ag9905LP Operating Profile



Ag9903M Operating Profile



Ag9903LP Operating Profile