

In Power over Ethernet (PoE), there's a minimum load requirement to ensure continuous power delivery.

Some Silvertel Powered Device (PD) modules can be operated below the minimum load, as specified in the datasheet's DC Electrical Characteristics, however doing so risks power cycling compatibility issues with legacy Power Sourcing Equipment (PSE's). The reason this happens is because the dc/dc converter reaches its minimum pulse width on time and has to operate in a gated pulse mode to maintain output regulation.

In this application note, to illustrate what happens under these conditions we have used an Ag5300 - which has a specified minimum load of 200mA (the principles explained below will be the same for our other modules).

With the Ag5300 input voltage set at 48V and the output load set to ~125mA (at 12V = 1.5W), the input current = ~50mA, as shown in Figure 1. At this point the modules dc/dc converter is operating in continuous pulse mode and the input current is constant.

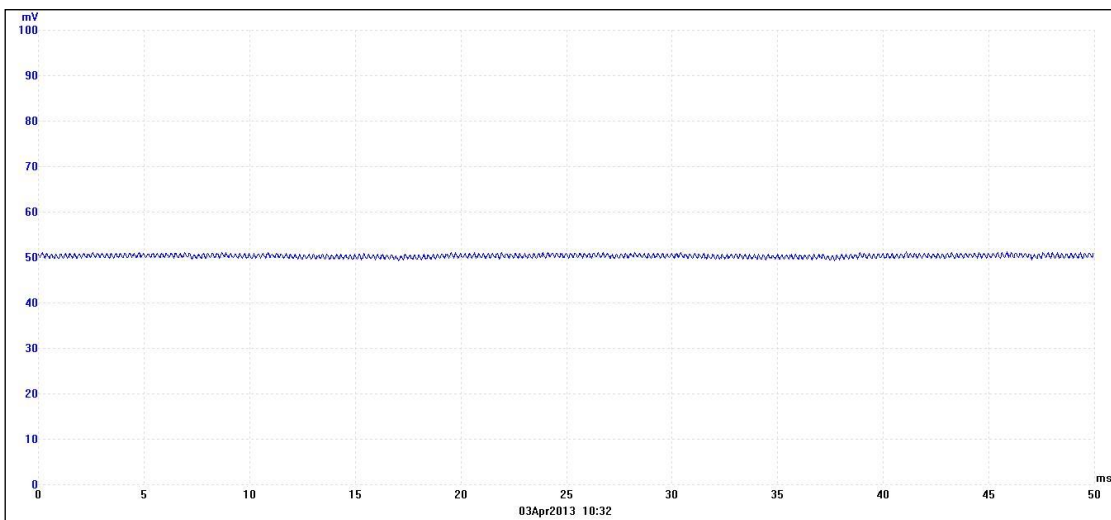


Figure 1: Input current in continuous mode

If we now reduce the load to ~116.67mA (1.4W), the average input current = ~47mA, as shown in Figure 2. Now the modules dc/dc converter is operating in gate pulse mode and the input current is fluctuating.

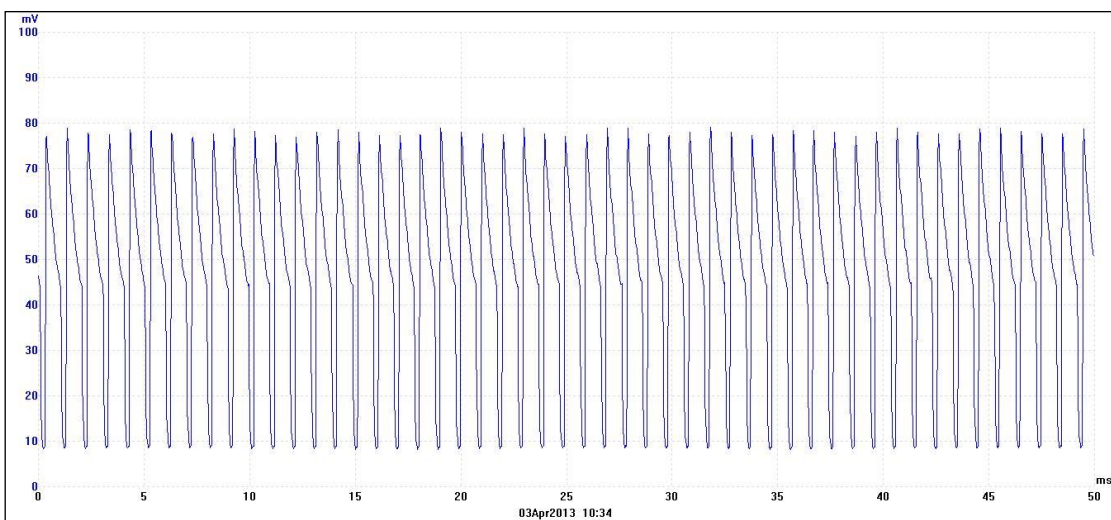


Figure 2: Input current in gated pulse mode

The reason that the minimum load is specified at 200mA and not 125mA; is because when the input voltage is at its maximum (57V); the input current will be at its lowest. So the load will need to be greater than ~125mA to ensure that the dc/dc converter is running in continuous pulse mode. In addition to this we also have to take into account component tolerances and to allow some margin of error.

In most cases, running the dc/dc converter in gated pulse mode has little effect on Power over Ethernet (PoE) operation, other than the audible noise. But unfortunately some Power Sourcing Equipment (PSE) can struggle to cope with the input current waveform, shown in Figure 2.

The Maintain Power Signature (MPS) parameter is used by the PSE to detect when the PD has been disconnected, so that the power can be removed from that port. There are two different MPS methods that are allowed in IEEE specification – “AC MPS” and “DC MPS”.

The most commonly used method is the DC MPS; this looks for a minimum current ( $I_{Hold}$ ) being drawn from the PSE port.

The following is an extract from IEEE802.3at Table 33-11: -

17	DC MPS current	$I_{Hold}$	A	0.005	0.010	1, 2	See 33.2.9.1.2.
18	PD Maintain Power Signature dropout time limit	$T_{MPDO}$	s	0.300	0.400	1, 2	See 33.2.9.
19	PD Maintain Power Signature time for validity	$T_{MPS}$	s	0.060		1, 2	See 33.2.9.

Item 17 shows the DC MSP minimum detection threshold is between 5mA (0.005A) to 10mA (0.010A). So we can say that if the PSE port current is >10mA, it will continue to supply power. But if the PSE port current is <5mA, it will remove the power.

In Figure 1, the current is a steady ~50mA, so the PSE should have no problem coping with this at all.

In Figure 2, the average current is still ~47mA, but because it now swings between ~8mA to 78mA some PSEs struggle to handle this (especially those that use the MAXIM MAX5971A single port PSE chip). Even if the lowest current is above 10mA these PSEs can fail the DC MPS and remove power from the port.

The PSE should ignore the current dips below  $I_{Hold}$ , because their duration does not exceed  $T_{MPDO}$ .

Many of our customers have successfully used our modules in applications with less than the specified minimum load connected. Some customers have even use techniques, switching the load from ~20mA for 250ms to the minimum load for 70ms (to conserve energy when in standby).

Most PSEs that we have tested are capable of handling the gated pulse mode input current swing, however the only way to 100% guarantee that this does not happen, is to ensure that the minimum load is always met.

We hope this application note has been useful in explaining about minimum load requirements. For more information about this topic, Silvertel PoE modules, or anything else please contact our applications engineering team at [apps.support@silvertel.com](mailto:apps.support@silvertel.com)