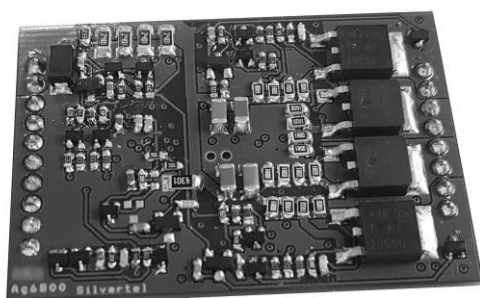# Silvertel

Ag6800

IEEE802.3bt PSE Module

1. Features

➢ Type 4 PSE Compliant with IEEE802.3bt(Draft V3.2)

➢ Backward compatible to IEEE802.3at Type 1(af) & Type 2

➢ Small DIL package size – 51mm (L) x 35mm (W) x 7mm (H)

➢ High Efficiency (99%)

➢ Low cost

➢ Output power up to 97W

➢ Minimal (low cost) external components required

➢ Over-current and short circuit protection

➢ Silvertel "design-in" assistance

2. Description

The Ag6800 is an IEEE802.3bt Power Sourcing Equipment (PSE) module designed to be compliant with draft version 3.2. It will also work with lower power IEEE802.3af, IEEE802.3at power devices and compatible with legacy protocols such as PoH and UPoE.

The Ag6800 is a complete, easy to implement solution for adding POE functionality to a wide variety of applications requiring higher power up to 97W such as lighting systems, digital signage, Point-of-Sale systems, LCD TVs, computer monitors and video projectors.

Ag6800 is a self-contained module, requiring just a few external components to provide the complete control and feedback to the Powered Device (PD) that is connected to the PSE.

Table of Contents

Table of Figures

3. Ag6800 Product Selector

Part Number†	Output Power (W)
Ag6800	97

† The Ag6800 fully meets the requirements of the RoHS directive 2002/95/EC on the restriction of hazardous substances in electronic equipment.
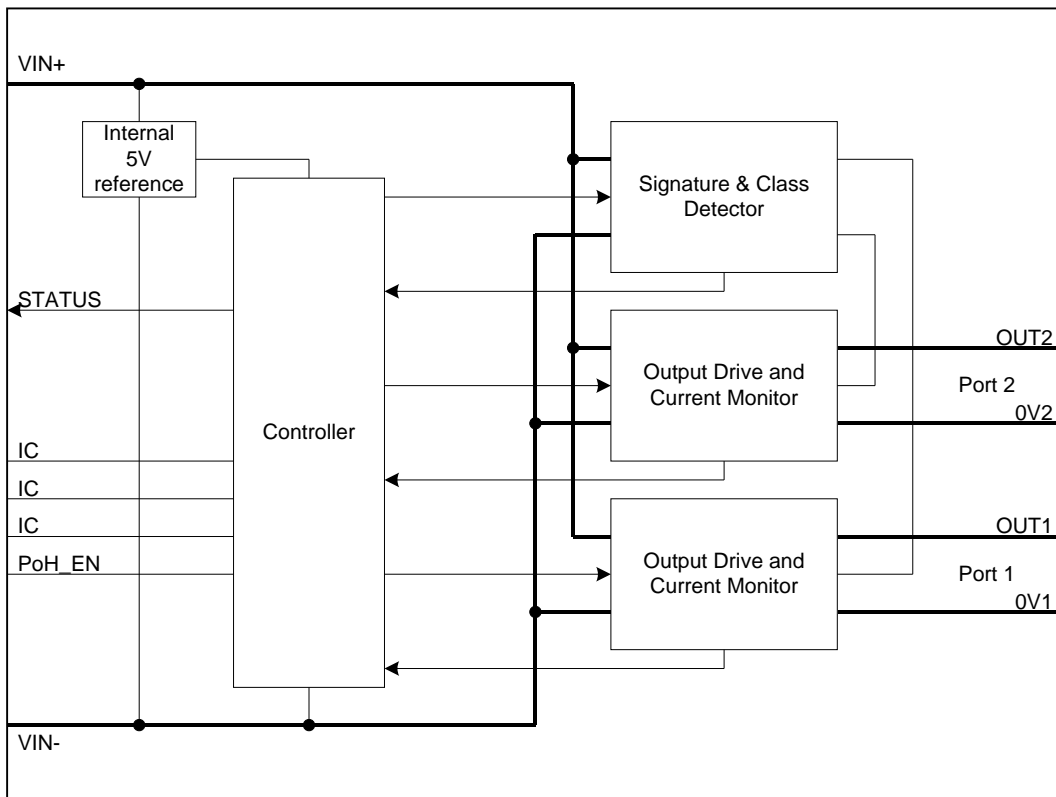
Table 1: Ordering Information
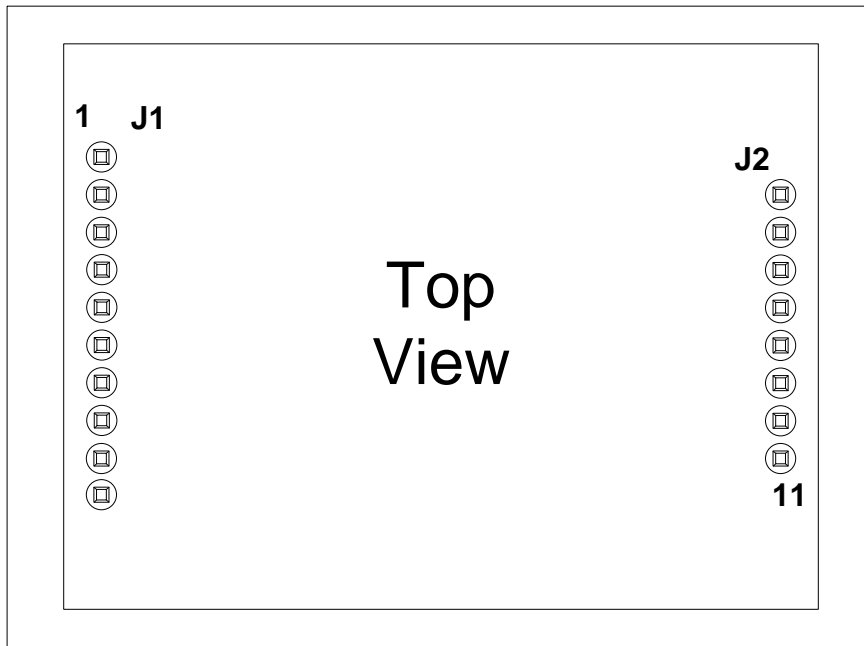
Figure 1: Block Diagram

Figure 2: Ag6800 Package Format

4. Pin Description

Input Connector pins J1

Pin #	Name	Description
1	VIN+	**Direct Input +**. These pins connect to the external supply, positive terminal.
2		
3	IC	**Internal Connection**. Do not connect to this pin
4	IC	**Internal Connection**. Do not connect to this pin
5	STATUS	**Output.** This output pin is used to indicate the Ag6800 status.
6	IC	**Internal Connection**. Do not connect to this pin
7	IC	**Internal Connection**. Do not connect to this pin
8	PoH_EN	**PoH_Enable Connection**. If the system is an HDBaseT PoH or UPOE system then this pin should be connected to ground to enable the PSE to provide full power to the Powered Device.
9	VIN-	**Direct Input -**. These pins connect to the external supply, negative terminal.
10		

Output Connector pins J2

Pin #	Name	Description
11	OUT1	**Port 1 Output.** This output detects the signature and classification, then monitors the line and supplies power to valid device.
12		
13	0V1	**Port 1 Return.** The ground return for the OUT1.
14		
15	0V2	**Port 2 Return.** The ground return for the OUT2.
16		
17	OUT2	**Port 2 Output.** This output detects the signature and classification, then monitors the line and supplies power to valid device.
18		

5. Functional Description

5.1 Power Supplies

The Ag6800 only requires one power supply which must be isolated from mains ground to conform to the IEEE802.3bt specification.
Due to the power supply being capable of supplying up to 170W of power we would highly recommend protection in the form of a fuse to be fitted to positive input rail of the Ag6800. This will help prevent damage to the Ag6800 during an over voltage or over current event.
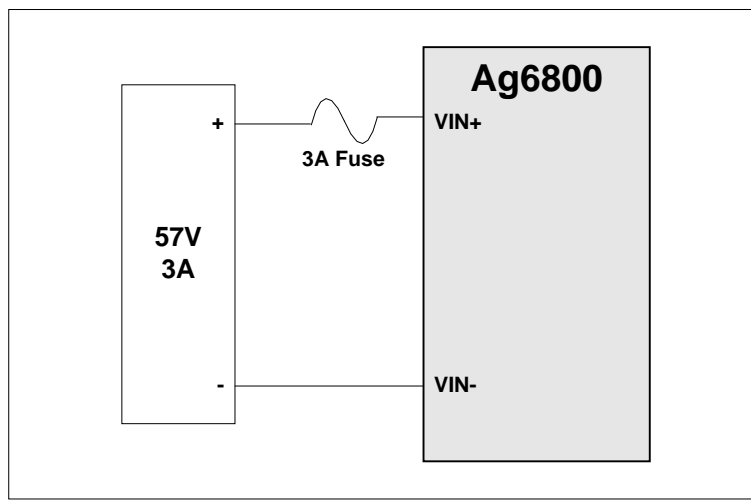
Figure 3: Power Supply Connections

5.2 UVLO (Under Voltage Lockout)

The Ag6800 requires a minimum input voltage of 53V to provide enough power to the connected PD. However if the input voltage during operation falls below ~47V the Ag6800 will turn off its output ports and remain in the idle state whilst monitoring the input voltage. Once the input voltage rises >51 V the Ag6800 will then begin its start up sequence and resume normal operation.

5.3 Port Outputs

The Ag6800 Port outputs are connected directly to the centre-tap of an IEEE802.3bt compliant data transformer for 1/10GBASE-T applications, as shown in Figure 4 and 5.

Figure 4: 4Pair PoE Connection Diagram

Figure 5: Dual Signature Connection Diagram

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6. Connection, Signature and Classification

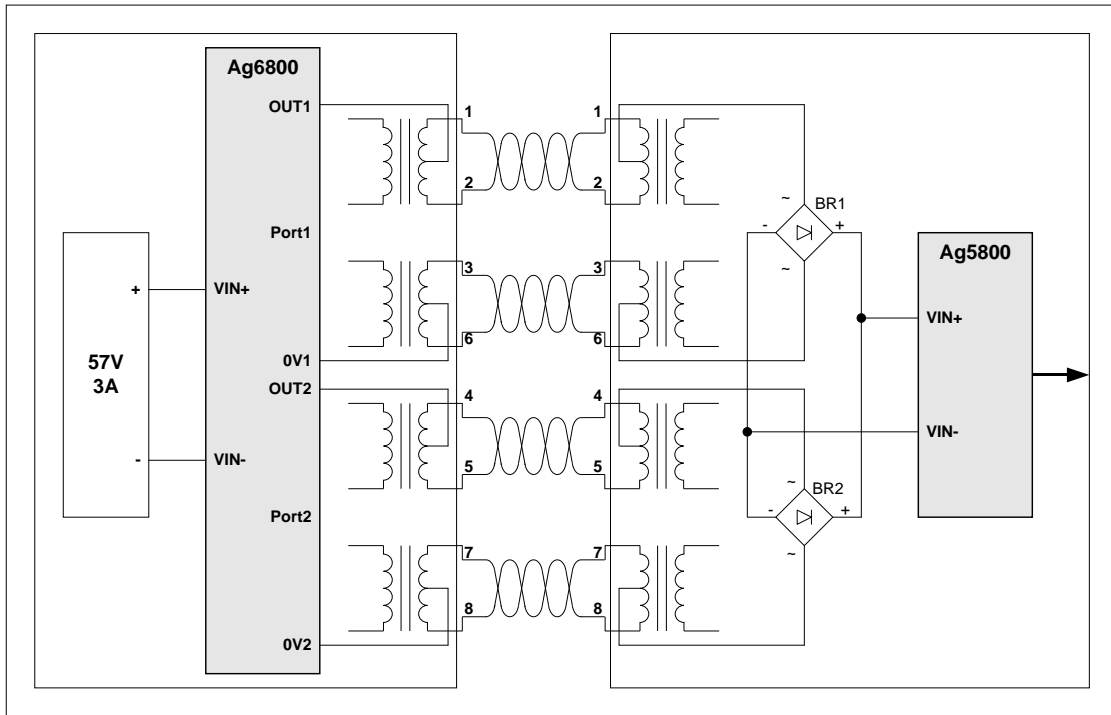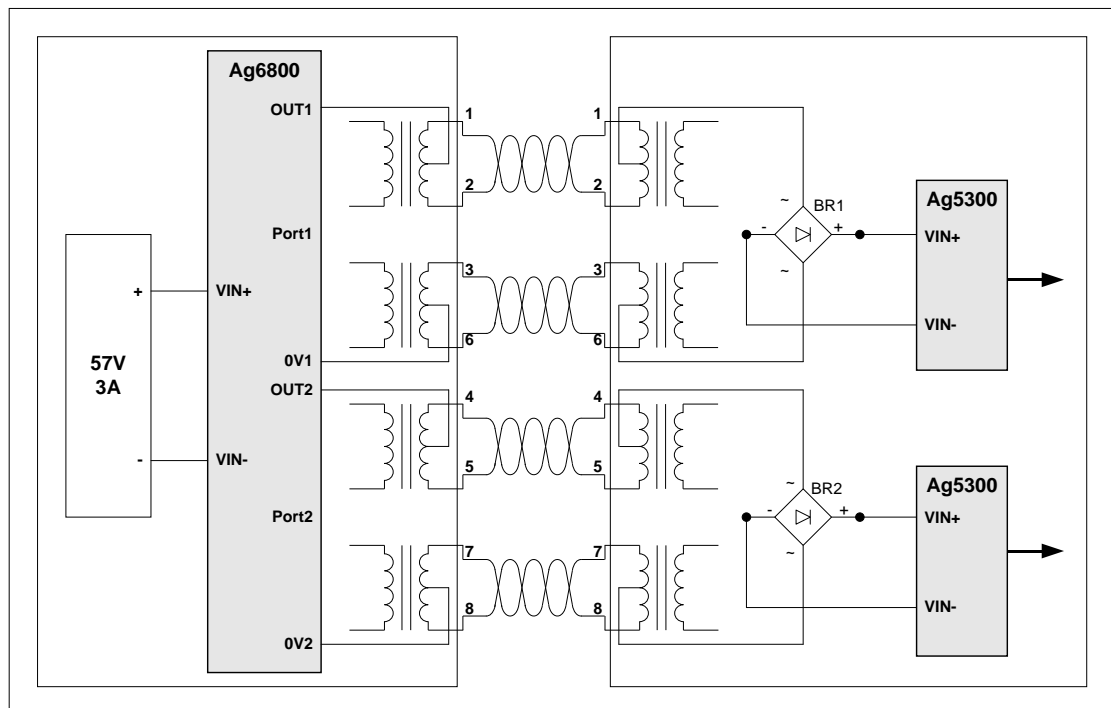The Ag6800 first checks the connections on each Port to see what type of device it is connected to i.e. a single signature PD or Dual signature PD, such that it can provide the correct signals on the connected pairsets. The next step is to ensure that the Ag6800 does not apply power to a non PoE enabled device by checking for a valid PoE signature on the connected pairset. If the Ag6800 does not see a valid signature on either Port, then it will remain disconnected and will wait approximately 2 seconds before trying the sequence again. The signature parameters are shown in Figure 6.
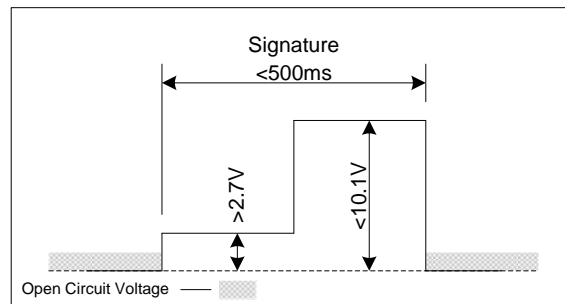
Figure 6: Signature

Upon the successful completion of a signature check, the Ag6800 will then check the Class setting of the Powered Device (PD). Depending on the type of PD connected to the Ag6800 will depend on the following class sequences.

Single Signature PD

If the connected device is a single signature PD the Port output will give the following waveforms (shown in Figure 7), dependant on the Class setting of the PD.
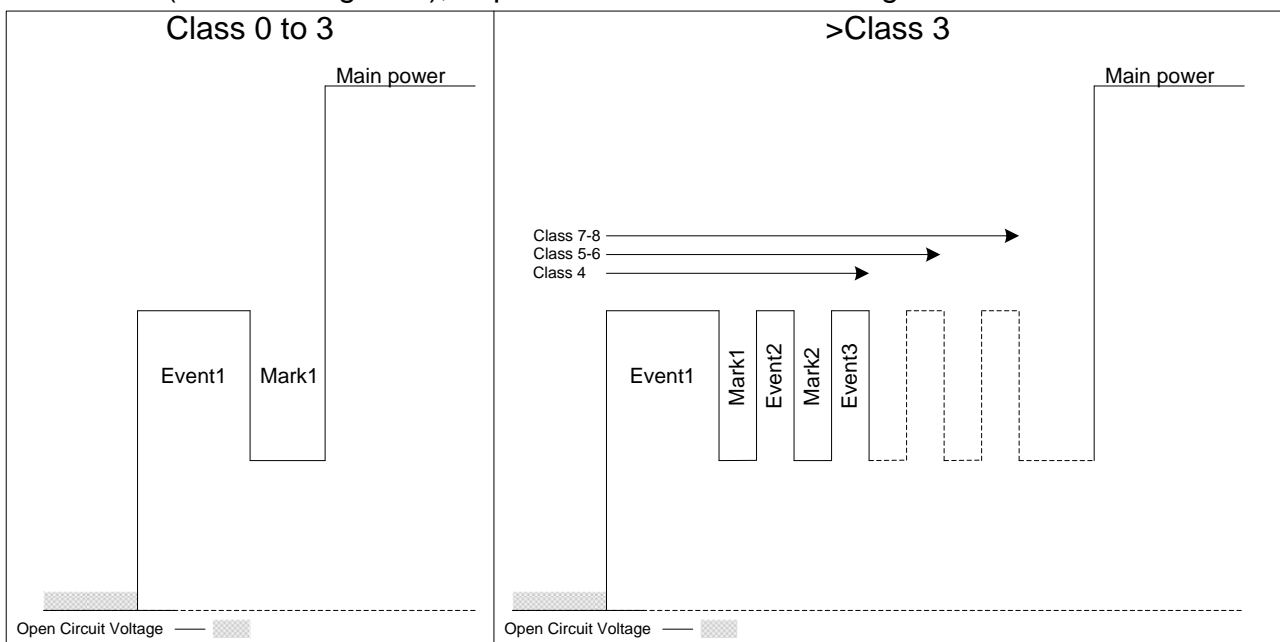
Figure 7: Single Signature Classification

Dual Signature

If the connected device is a Dual signature PD, each Port output will give the following classification waveforms (shown in Figure 8), dependant on the requested power over each pairset independently.
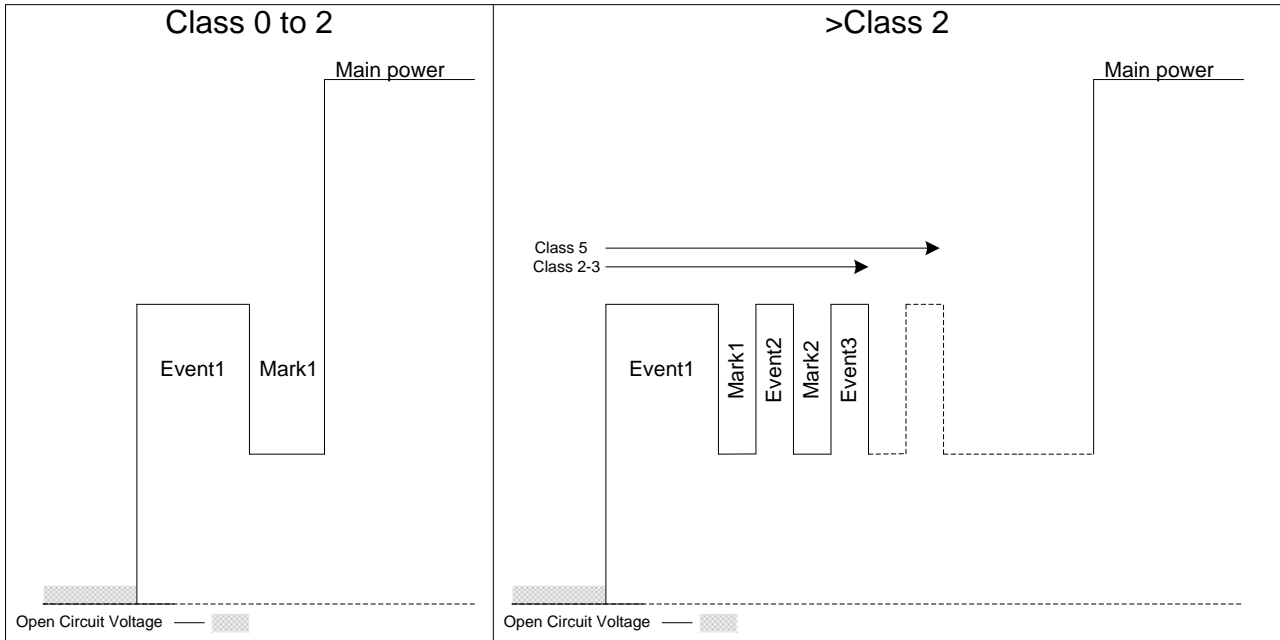
Figure 8: Dual Signature Classification

6.1 Classification

A PD displays classification from 0-8 to the Ag6800 with multiple pulses and varying class currents from Class 0-4. Table 2 below shows the allocated current classification for the measured current by the Ag6800.

Measured Current	Allocated Current Classification
0mA to 6 mA	Class 0
>6mA to 14.5mA	Class 1
>14.5mA to 23mA	Class 2
>23mA to 33mA	Class 3
>33mA to 48mA	Class 4
>48mA	Over Current

Table 2: Current Classification Table

6.2 Maintain Power Signature

On successful completion of a valid signature (and classification) the Ag6800 will apply main power to the Port outputs and the STATUS output will go to Logic 1.

Once main power has been applied, the Ag6800 will constantly monitor the Ports to ensure that they are still connected; this is referred to as the Maintain Power Signature (MPS).

The Ag6800 uses the dc detection method of MPS and will remove power if the current drawn falls below the detect threshold.

If the total current drawn exceeds the limits below for a duration of 6ms out of every 320ms, the Ag6800 output will remain on. If there is no current drawn or below the current limits for this duration then the Ag6800 will remove power from the powered ports and return to the connection cycle (looking once again for a valid signature).

Single Signature PD

	Remain On	**Turn Off**
Total Port Current	≥10mA	<8mA

Dual Signature PD

	Remain On	**Turn Off**
Individual Port Current	≥6mA	<6mA

6.3 Output Current Limits

The Ag6800 monitors the output currents on each individual pairset making sure the total current never exceeds the IEEE limits. The Ag6800 has two over current limits - Current Limit 1* and Current Limit 2*.

The Ag6800 will allow the Port output to exceed Current Limit 1 (but not Current Limit 2) for a short duration – T_{LIM1}*. If the Port output continues to exceed Current Limit 1; the output power will be removed and the STATUS output will indicate an over-current fault (See Section 7 – STATUS Output).

If the output exceeds Current Limit 2, the Ag6800 will remove power (without waiting for T_{LIM}) and the STATUS output will indicate an over-current fault.

During a Single Signature PD connection, the Ag6800 also checks for a current imbalance between ports. If one of the ports provides all the current reaching the maximum current limit per pairset of ~1A then the Ag6800 will consider this a fault condition and remove power.

*Note: See Section 10.3 Electrical Characteristics

6.4 Output Power

Along with the output current limits the Ag6800 also has a maximum power limit for each PD classification P_{MAX}* keeping the total power output within the IEEE limits. The Ag6800 is capable of delivering a maximum power output up to 97W (nominal).

Please note this is not the power available at the input of the Powered Device (PD). There are cable, connector and polarity protection losses to be taking into account.
*Note: See Section 10.3 Electrical Characteristics

7. STATUS Output

7.1 Single Signature Connection

The STATUS output pin is at Logic 0 when the Port outputs are disconnected. After completion of a valid signature (and classification) the STATUS output will go to Logic 1 ~60ms after the Port output applies main power.

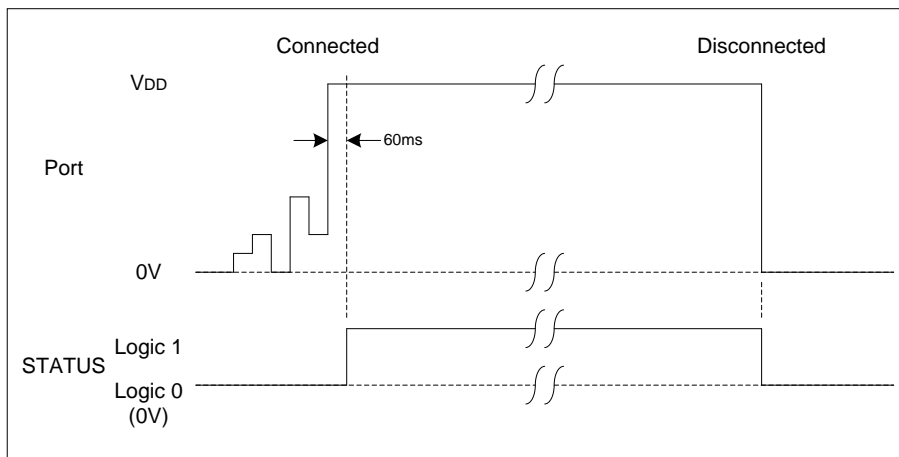When the Port output is disconnected the STATUS output will go to Logic 0, see Figure 9.

Figure 9: STATUS Output at Port Connect and Disconnect

In addition to the STATUS output reporting when the Port outputs are connected or disconnected, the STATUS output also reports when a fault has been detected.

If a fault condition occurs to one or both Port outputs the STATUS output goes to Logic 0 for 200ms followed by a number of pulses as shown in Table 3 below:

Fault Condition	Status Pulses (200ms)
Short Circuit	1 x Logic 1 Pulse
Over Current	2 x Logic 1 Pulse
Current Imbalance	2 x Logic 1 Pulse
Input Voltage <47V	4 x Logic 1 Pulse
Dual Signature - Overcurrent	1 x Logic 0 Pulse

Table 3: Status Output

An example of the Status output during an Over Current condition can be seen below in Figure 10:
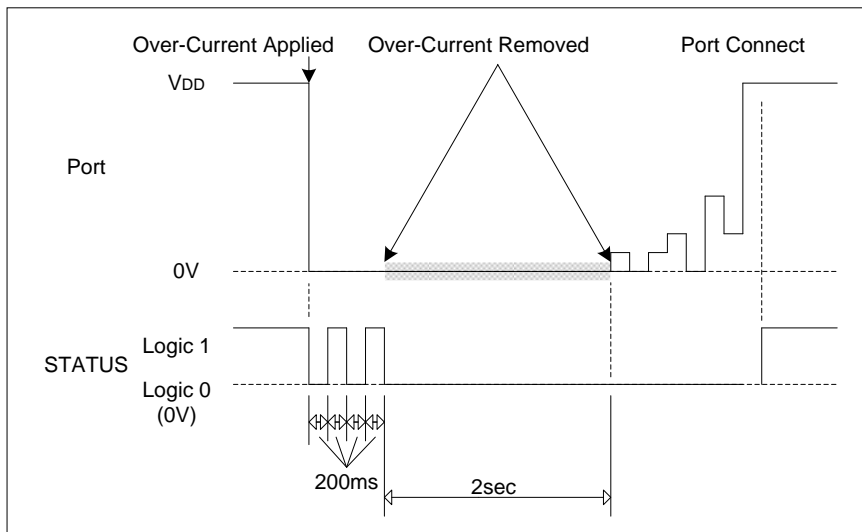
Figure 10: STATUS Output when an Over-Current is applied to the Output Port

If the over current is not removed the Ag6800 will start up again and repeat the fault shutdown cycle until the over-current fault is removed.

7.2 Dual Signature Connection

If the Ag6800 is connected to a Dual Signature PD the STATUS output pin is at Logic 0 when the Port outputs are disconnected. After completion of a valid signature (and classification) on one of the pairsets the STATUS output will go to Logic 1 ~1ms after the Port output applies main power.

If a fault condition occurs on one of the two connected pairsets i.e. an overcurrent, the Ag6800 will turn off that particular port and its STATUS output will remain at Logic 1 for ~500ms, dropping to Logic 0 for 200ms and returning to Logic 1 whilst the other pairset remains operating, see Figure 11.

If the fault is not removed the Ag6800 will begin its start up sequence on that port again and repeat the fault shutdown cycle until the over-current fault is removed.
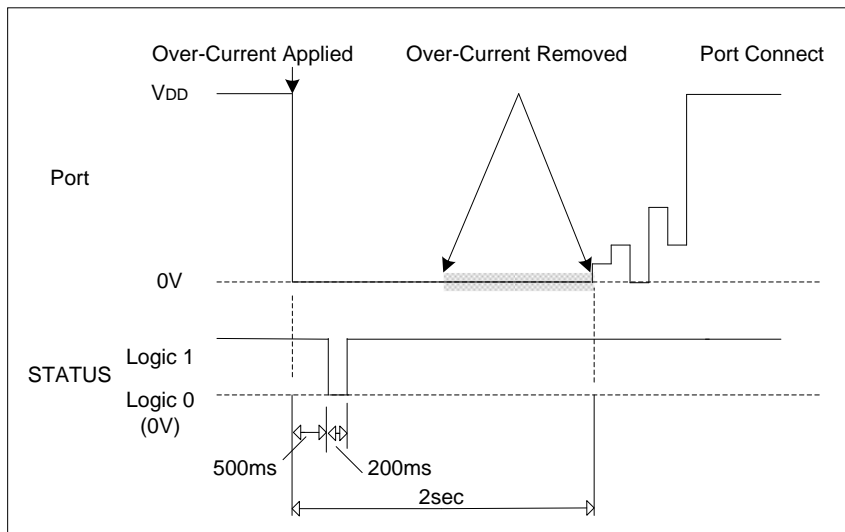
Figure 11: Dual Signature STATUS Output -Over-Current fault

The Ag6800 STATUS output pin has a limited drive capability. This is sufficient to drive a logic input, but does not have enough power to continually drive an LED. Figure 12 shows a simple circuit to drive an LED from the STATUS output. Over driving the STATUS output can result in damage to the internal 5V reference supply.
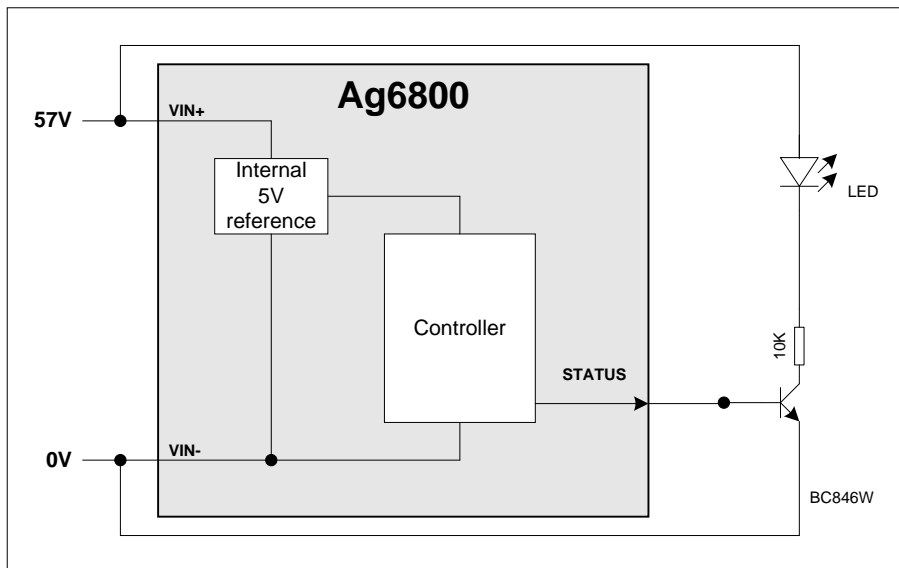

Figure 12: STATUS Output LED drive circuit

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8. Typical Connections

The Ag6800 only requires an external supply and an IEEE802.3bt compliant data transformer as shown in Figure 13.

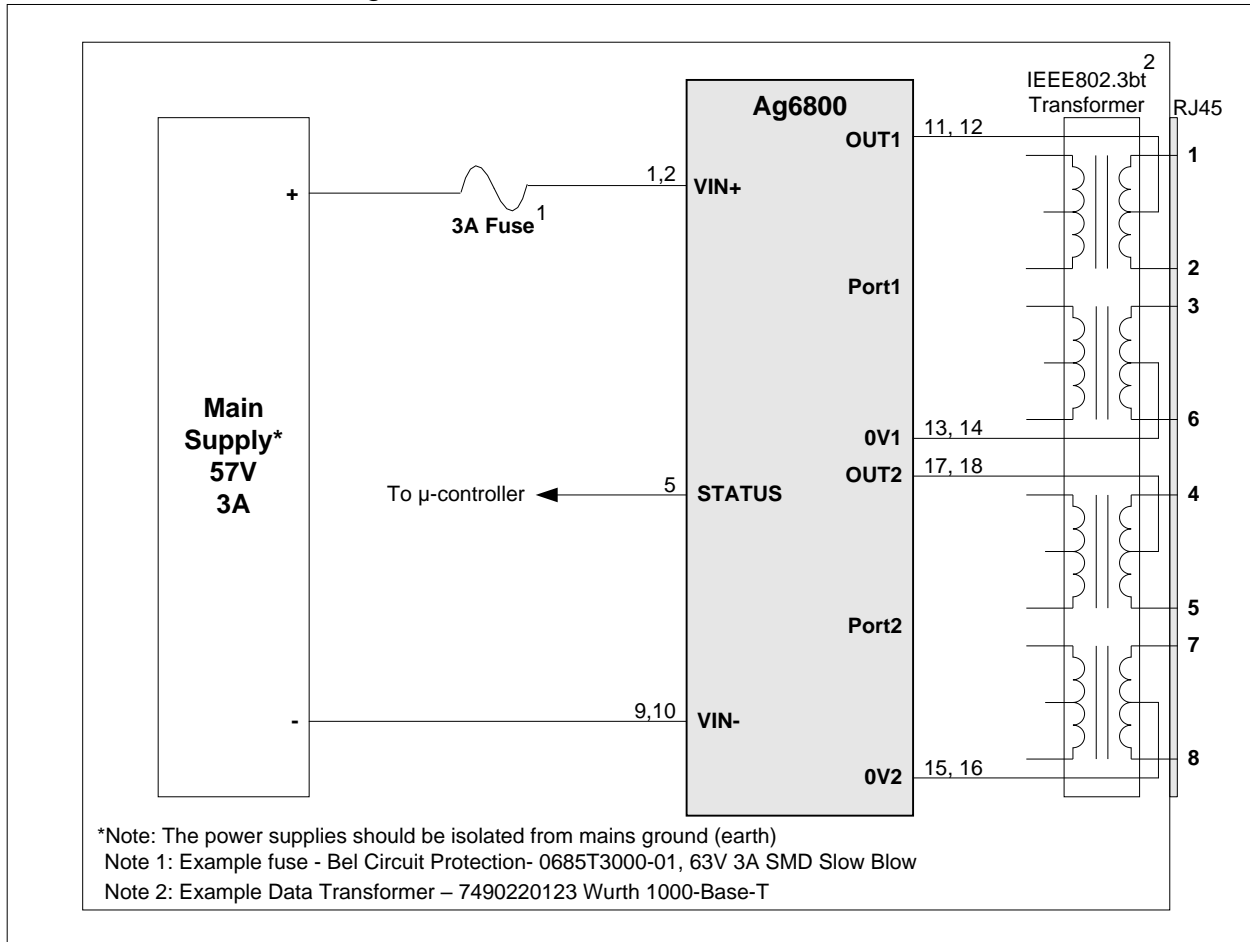
Figure 13: Typical Ag6800 Connection Diagram

9. Protection

9.1 Input Protection

The Ag6800 has a built-in Tranzorb diode across its input to protect the module from transients from the power supply. For further protection we would recommend a fuse to be fitted in line with the positive input rail due to the high power capability of the power supply as described in section 5.1 and shown in Figure 13 above.

9.2 Output Short-Circuit Protection

In addition to the over-current protection the Ag6800 has built-in output short-circuit protection.

If the Port output is shorted, the Ag6800 will limit the current and remove the power, the STATUS output will indicate a short-circuit fault.

10. Electrical Characteristics

10.1 Absolute Maximum Ratings[1]

	Parameter	Symbol	Min	Max	Units
1	DC Supply Voltage	V_{DD}	-0.3	60	V
2	Storage Temperature	T_S	-40	+100	^{O}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	V_{DD}	53	55	57	V
2	Standard Operating Temperature	T_{OP}	-40	25	85	Ta / ^{O}C

10.3 Electrical Characteristics

	Parameter	Sym	Min	Typ[1]	Max	Units	Condition
1	V_{DD} Idle Supply Current	I_{DD}			15	mA	
2	Signature Detection Voltage	V_{SIGL} V_{SIGH}	2.7	4.5 9	 10.1	V V	
3	Minimum Valid Signature	R_{SIGL}	18			kΩ	
4	Maximum Valid Signature	R_{SIGH}			30	kΩ	
5	Classification Voltage	V_{CLASS}	14.5		20.5	V	
6	Classification Mark Voltage	V_{MARK}	6.9		10	V	
7	Classification Threshold Current	I_{CLASS}	0 6 14.5 23 33.5	5 10 20 28 40	5.5 14 22.5 33 48	mA mA mA mA mA	Class 0 Class 1 Class 2 Class 3 Class 4
8	Maintain Power Signature [*]	V_{MPS}	5		10	mA	Combined Port Current
9	Maximum Output Power	P_{MAX}		21 39 79 97		W W W W	Class 0 - 3 Class 4 Class 5-6 Class 7-8
10	Current Limit 1 (Per Pairset)	I_{LIM1}		415 684 700 1010		mA mA mA mA	Class 0 - 3 Class 4 Class 5-6 Class 7-8

	Parameter	Sym	Min	Typ[1]	Max	Units	Condition
11	Current Limit 2 (Per Pairset)	I_{LIM2}		1200		mA	Class 0-8
12	Current Limit 1 Cut-Off Time	T_{LIM1}	60			ms	Class 0 - 8
13	STATUS Output	V_{OH} V_{OL}		0.7 0.3		V V	@ 0.5mA @ 0.5mA

Note 1: Typical figures are at 25°C with a nominal 57V supply.
*See section 6.2 for further details

11. Package

50.8

45.72

2.41

6.07

1
18

2.54
TYP

35

Top
View

10
11

2.5
MAX

2.54

1.6

3

0.6

(Recommended PCB hole diameter = 1.1 ± 0.05)

Dimensions (in mm) are nominal unless otherwise stated