



Application Note AN007

Using the AS1124 in 802.3af and 802.3at Applications

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CONTENTS

Contents	2
General Description	3
Using the AS1124 in 802.3af and higher power applications (802.3at)	3
Differences between 802.3af and higher power mode (802.3at Pre-standard)	3
AS1124 Classification	3
Conclusion	4
Notes	5
Contact Information	6

GENERAL DESCRIPTION

The Akros AS1113 and AS1124 are designed to be used in Power over Ethernet (PoE) Powered-device (PD) applications such as Voice over IP (VoIP) phones, Wireless LAN Access Points, security and web cameras, Analog Telephone Adapters (ATA), and Point of Sales terminals.

The AS1113 device for 802.3af specification power levels while the AS1124 is designed for both 802.3af or 802.3at pre-specification power levels. The PD controllers provides the functionality required for PoE PD applications. By using innovative silicon solutions built with standard CMOS technology, Akros enables its customers to bring to market higher performance PoE PD products with low cost and small footprint. The PD controllers integrate rectification and protection circuitry, PD controller, and DC-DC converter. This high level of integration provides significant reliability and protection advantages as well as simplifies the PoE PD design.

USING THE AS1124 IN 802.3AF AND HIGHER POWER APPLICATIONS (802.3AT)

The IEEE 802.3af standard defines the specifications to deliver power over standard Ethernet cables. Details can be found at this link: <http://grouper.ieee.org/groups/802/3/af/index.html>

The 802.3at standard extends the 802.3af power delivery and port-level resiliency capabilities. 802.3at will largely extend the number of applications that can benefit from Power over Ethernet. Details can be found at this link: <http://www.ieee802.org/3/at/public/index.html>

IEEE approved the creation of the IEEE802.3at DTE Power Enhancements Task Force in September 2005. Akros Silicon continues to be a key contributor to this effort.

The AS1124 is designed to meet both the existing 802.3af standard and the higher power application of 802.3at. System designers transitioning from a 13W design to a higher power application will find that the AS1124 will require only a second classification resistor to be added to the circuit. This application note will discuss the differences between 802.3af and the 802.3at pre-standard solutions.

Table 1. Comparison of 802.3af and AS1124 providing higher power		
Requirement	802.3af	AS1124 (pre-standard 802.3at)
Maximum power to PD	13W	24W
Voltage from PSE	44-57V	46-57V
Maximum operating current	350mA	625mA
Line resistance	20Ω	14.1 Ω
Voltage drop due to series line resistance	7V	8.8V
Min voltage at PD interface	37V	37V

DIFFERENCES BETWEEN 802.3AF AND HIGHER POWER MODE (802.3AT PRE-STANDARD)

Table 1 shows a comparison between 802.3af standard and the higher power capability delivered from the AS1124. The AS1124 is a pre-standard product that can support operation in either 802.3af or the higher power 802.3at pre-standard application.

AS1124 CLASSIFICATION

Before describing the AS1124 classification scheme it is useful to review the operation of a powered device (PD) in a PoE application. There are 5 states of operation involved in a PoE transaction.

- **Reset**—In this state, the classification state machine is reset, and all blocks are disabled.
- **Signature Detection** —The PD signature resistance of

typically 25kΩ is applied across the input. Once the PSE detects this resistance it recognizes the device as a Powered Device (PD) and transitions to the classification stage

- **Classification** — The PD indicates its power requirements to the PSE. Table 2 shows the classification resistor values, which corresponds to a classification current I_{class} that the PD generates and is measured by the PSE
- **Idle** — This state is entered after classification, and remains here until full-power input voltage is applied
- **ON** — In this state, the PD is enabled, and supplies power to the DC-DC converter and the local application circuitry.

As the supply voltage from the PSE increases from 0V, the PD Controller transitions through the modes of operation in this sequence:



Table 2. Classification Resistor Values

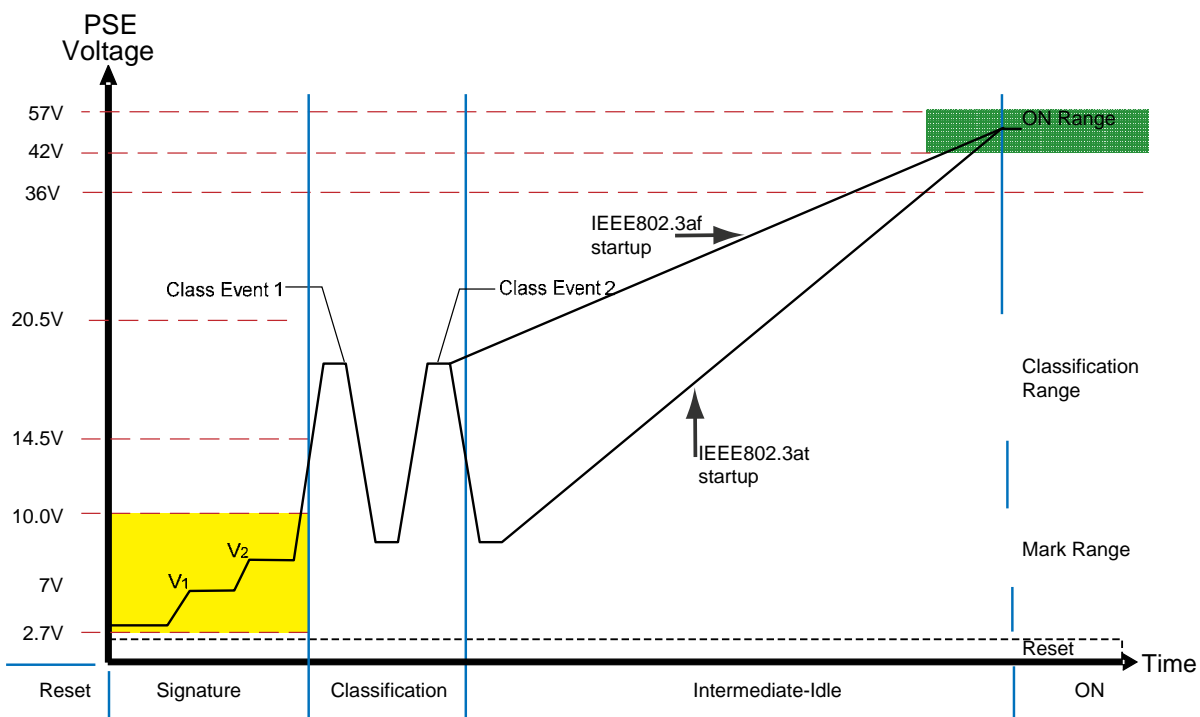
Class	802.3af Power (W)	Rclass
0	0.44-12.95	Pull-up
1	0.44-3.84	280k Ω
2	3.84-6.49	143k Ω
3	6.49-12.95	90.9k Ω
4	Reserved	63.4k Ω

higher power standard (802.3at) re-uses the classification current levels from 802.3af. In 802.3af, valid classification levels are 0 through 3, and for 802.3at, class 4 is used.. With the

AS1124, the classification current is defined with an external resistor on the RCLASS pin.

In 802.3at, two classification events are used, as depicted in figure 1. , The PD responds to the PSE with two current pulses . A negative 'mark' voltage is between the classification pulses. In 802.3af application, these transitions are ignored.

When a PSE observes two class-4 current pulses, it recognizes the remote device as a higher power 802.3at PD and allocates up to 30W. Figure 1 shows a typical 802.3at startup waveform.



Notes

1. Voltages V1 and V2 are applied by a PSE to extract a signature resistance value.
2. The PSE takes current readings during Class Events to determine the class of the PD. At this time, the PD presents a load current determined by the resistance on the RCLASS pin.
3. After the PSE measures the PD load current, if it is a high power PSE it presents a mark voltage (between 7V and 10V) followed by a second classification. The PD responds by presenting a load current as determined by the resistor on the RCLASS pin. After the PSE measures the PD load current the second time, and determines that it can deliver the requested power, it moves into the ON state by raising the voltage above 42V.

Figure 1: 802.3at Startup Voltage Waveform

CONCLUSION

The AS1124 is a good choice for the system designer who must create a 24W product prior to the completion of the 802.3at standard. It is also useful in applications where the designer wants to ensure an 802.3af design will still work for 802.3at, when it is finally ratified. The AS1124 will work in both 802.3af and 802.3at application without a redesign for the system PC board.

NOTES

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