



Application Note AN024

**A Universal 13W/30W
802.3af/at PD Reference
Design using AS1138**

Rev 2.0

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ABOUT APPLICATION NOTE AN024

Application Note AN024 describes the general framework for using the AS1138 PD / PWM Controller in a single standard reference design which accommodates all current and future Power-Over-Ethernet (PoE) PD design requirements.

Refer to <http://www.kinet-ic.com/> for further details on these and other Kinetic Technologies components. For any further assistance, please contact your Kinetic sales representation or contact us at support@kinet-ic.com.

INTRODUCTION

MOTIVATION

This Universal Reference Design provides the general framework for using the AS1138 PD / PWM Controller in a single standard reference design which accommodates all current and future Power-Over-Ethernet (PoE) PD design requirements, covering IEEE802.3af (13W), IEEE802.3at (25W) and semi-proprietary designs like IEEE802.3af-based 30W designs.

Standard IEEE802.3at Type 1 and Type 2 PD designs have been well adopted in today's market. End applications include IP Phones, IP Cameras, AP routers, RFID terminals etc.

Kinetic Technologies's AS1138 is a highly-integrated, fully-featured PD / PWM Controller device which simplifies the development of a single universal PD platform that can be used across the full range of the 13W-30W 802.3af / 802.3at based PD products.

This universal design minimizes the component change to only three (3) components, with no additional design effort, when switching between Type 1 and Type 2 802.3at PDs. All different power schemes using this universal reference design are mapped to the same pinout, PCB layout and solution size – making design development, validation and the production process extremely simple.

CUSTOMER BENEFITS

Key benefits for customers using the universal reference design:

- Same base PD & DC-DC design is used across complete product line, from 13W to 30W systems.
- 30W PDs can be designed to work with legacy 802.3af-based 30W power injectors, PSEs or mid-spans, and can be seamlessly migrated to 802.3at-compliant designs.
- Use of one common design across platforms reduces engineering development and validation time.
- Common BOM simplifies production logistics and delivers cost savings.
- Same EMC signature and performance across all platforms reduces compliance engineering and testing, delivering significant cost savings.
- Faster time to market for product releases.

REFERENCE DESIGN

A PD & DC-DC reference design with flyback configuration and 12V output is used to illustrate the concept of the Universal Reference Design. Below, sections highlight different usage modes of the common design and their associated assembly options. A detailed schematic of the design is available in the Universal Reference Design Schematic section of this document (page 9 and 10).

UNIVERSAL PD OPERATION WITH 13W 802.3AF-BASED PSE

AS1138-ASYNC-FL12V 13W-AF – Use this design configuration when an 802.3af standard PSE is employed as the power source and a standard 13W PD is connected. The AS1138 is set for 400mA of current limiting. Resistor R7 and RCLASS are set at 0 – 3 classification, following the IEEE 802.3af specification (see Table 2). ATDET stays low, since 2-event detection from the PSE is not presented.

This design has been widely implemented in today's end products, such as standard PoE IP security cameras and standard desktop IP phones.

Figure 1 - 13Watt PD "af" Examples



Figure 2 - 30Watt PD "at" Examples



UNIVERSAL PD OPERATION WITH 802.3AT-BASED PSE

In this case, the 802.3at PSE is available but depending on the power requirement of the PD, there are two different solutions:

- If 13Watt maximum is required, set the RCLASS resistor to Class 0-3 (Type1 PD recognition).
- If >13Watt maximum is required, set the RCLASS resistor to Class 4 (Type2 PD recognition).

Type1 (<13W) Configuration

AS1138-ASYNC-FL12V Type1-AT – Use this design when the 802.3at PSE is employed as the power source, but the PD itself does not require high power (less than 13W). The AS1138 is design-limited to 13Watts of input power by selecting the current-limiting resistor R7 to 400mA mode. The proper RCLASS resistor can be selected to set the classification between 0 – 3 for different power levels to be supplied by the PSE. ATDET stays low because IEEE802.3at PSE detects low power classification and only a single-event classification signal is presented to the AS1138.

This configuration is often used when an upgrade to the application, from 13W maximum to 30W maximum is planned, or simply to generate different product SKUs from the same base design.

Figure 3 - Type1 PD "at" Examples

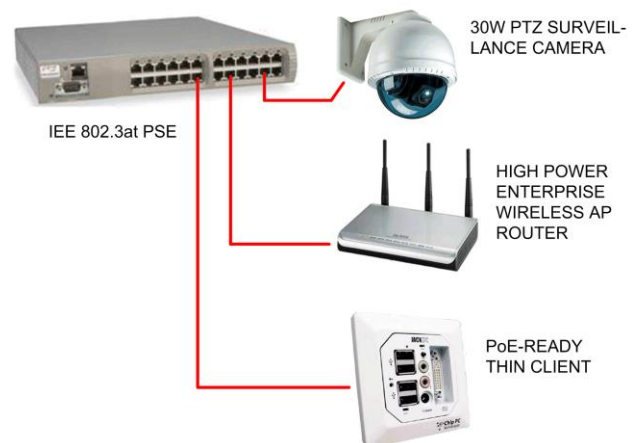


Type2 (>13W) Configuration

AS1138-ASYNC-FL12V Type2-AT - In this design, an 802.3at PSE is used as the power source for this high-power PD. Typical applications are PTZ surveillance cameras, enterprise wireless AP routers, video-conferencing IP phones, high-resolution CCD IP cameras, Thin Client Computers, etc. The AS1138 is set for 800mA current limit and RCLASS is set to Class 4 for maximum power request from the PSE. ATDET will assert high since AT PSE 2-event classification is presented.

Note that although the AS1138 current limit is set to handle up to 30W of incoming power, an 802.3at-compliant PSE will only provision a maximum of 24.5W of power at the PD input. A standards compliant system should be designed with the PSE power limit in mind.

Figure 4 - Type2 PD "at" Examples



SUMMARY

The different power scenarios described above can be solved using this AS1138 Universal Reference Design. It offers the designer an easy-to-design, lower-BOM and smaller-area solution for today's 802.3at POE standard for Type 1 and Type 2 PDs.

CONFIGURATIONS SUMMARY

CURRENT LIMIT RESISTOR AND TRANSFORMER SELECTION

Only three (3) components need to be changed from the universal design to support the entire range of power options. The following table shows the components selections:

Table 1 - Current Limit Resistor and Transformer Selection

Design Configuration	Component Loading Options		
	R7	R11	Transformer
AS1138-ASYNC-FL12V 13W-AF	0Ω	0.24Ω	TGSP-P042EFD15LF
AS1138-ASYNC-FL12V 30W-AF	NL	0.18Ω	TGSP-P028EFD20LF
AS1138-ASYNC-FL12V 13W-AT	0Ω	0.24Ω	TGSP-P042EFD15LF
AS1138-ASYNC-FL12V 30W-AT	NL	0.18Ω	TGSP-P028EFD20LF

Note: For input current limiting resistor R7, leave open to set the input current limit to 800mA or short to GND to set at 400mA. R11 is the internal DC/DC current-sense resistor that needs to be populated differently between 13W and 30W operation.

RCLASS RESISTOR SELECTION

The following table shows the different classification setting with proper RCLASS resistor value (Table 2). This Class setting is independent of the reference design and follows the standard PoE Classification Mode definitions.

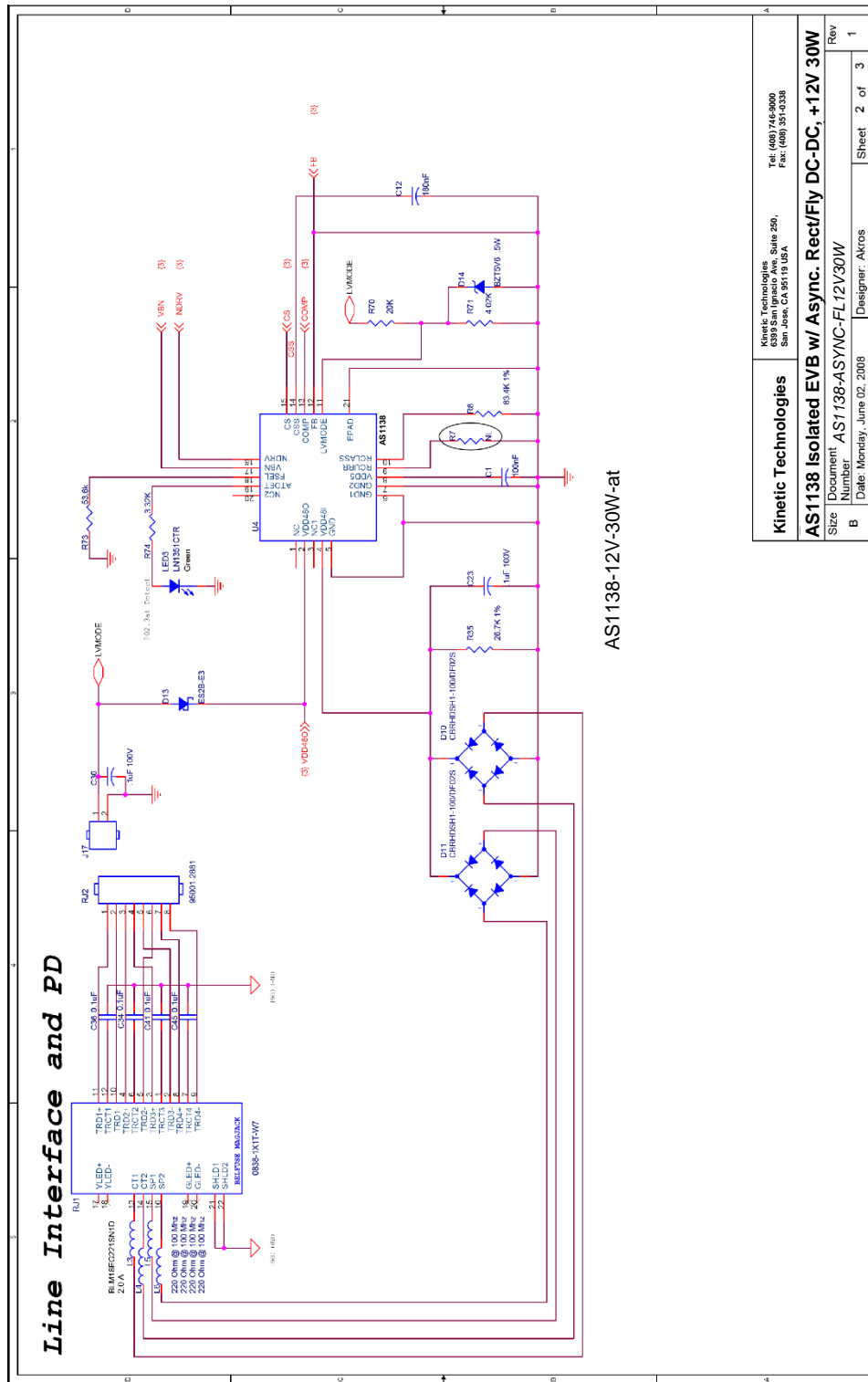
Table 2 - RCLASS Resistor Selection

Design Configuration	RCLASS Resistor R8				
	Class 0	Class 1	Class 2	Class 3	Class 4
AS1138-ASYNC-FL12V 13W-AF	Pull Up	280 KΩ	143 KΩ	90.9 KΩ	
AS1138-ASYNC-FL12V 30W-AF					63.4 KΩ
AS1138-ASYNC-FL12V 13W-AT	Pull Up	280 KΩ	143 KΩ	90.9 KΩ	
AS1138-ASYNC-FL12V 30W-AT					63.4 KΩ

Note: For details on Classification Mode operation and the power and current classification corresponding to the RCLASS resistor value, please refer to the AS1138 Datasheet, "Classification Mode" on page 18.

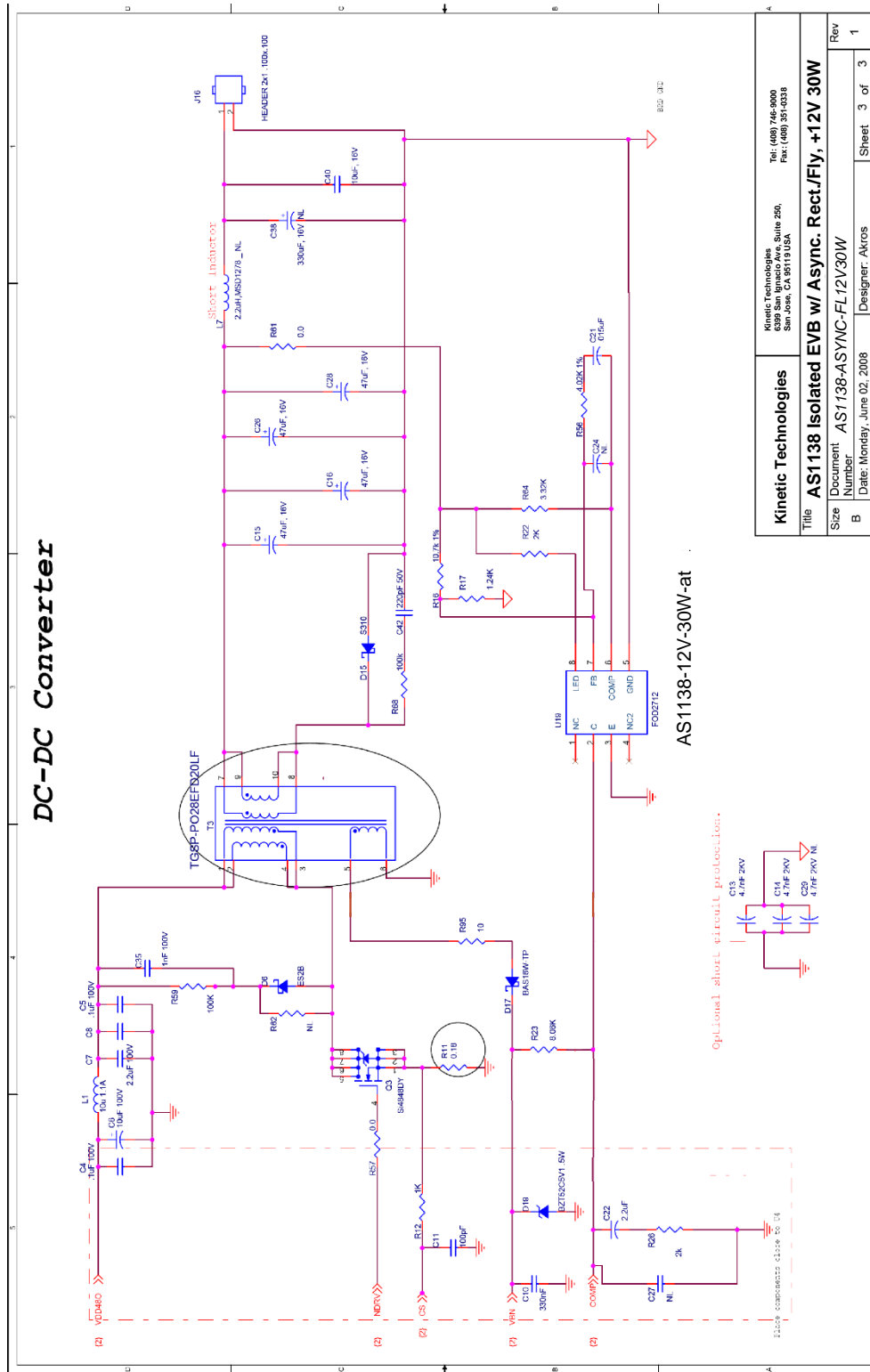
UNIVERSAL REFERENCE DESIGN SCHEMATIC

Figure 5 - Line Interface and PD



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6395 San Ignacio Ave, Suite 250, San Jose, CA 95119 USA			
AS1138 Isolated EVB w/ Async. Rect/Fly DC-DC, +12V 30W			
Size	Document	AS1138-ASYNC-FL12V30W	Rev
Number	B		1
Date	Monday, June 02, 2008	Designer	Akros
Sheet	2 of 3		

Figure 6 - DC-DC Converter



Kinetic Technologies		Kinetic Technologies 6399 San Ignacio Ave, Suite 250, San Jose, CA 95119 USA Tel: (408) 746-2000 Fax: (408) 945-0338	
Title		AS1138 Isolated EVB w/ Async. Rect./Fly. +12V 30W	
Size	Document	Number	Rev
B	AS1138-ASYNC-FL12V30W	1	1
Date: Monday, June 02, 2008		Designer: Akros	
		Sheet	3 of 3

Note: This reference design shows standard PoE to 12V conversion. For reference design and BOM information for different output voltages and/or with use of an auxiliary power supply using the LVMODE feature, please contact Kinetic Technologies.

CONCLUSION

Kinetic Technologies is committed to providing industry-leading technology to help customers improve their design cycle when transitioning between Type 1 and Type 2 PDs. The component loading options between different power configurations are very simple to manage, with no major redesign, layout or validation effort required.

The AS1138 integrates the PD and PWM total PoE solution into a small 5x5 QFN thermal-enhanced package, further shrinking the solution area dramatically. Kinetic Technologies has already performed extensive validation of the reference design in various configurations to reduce customer design cycles.

REFERENCE MATERIALS

- AS1138 Datasheet

CONTACT INFORMATION

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