IEEE802.3bt Compliant Type 4, Class 8, 85W PoE PD Module

Features

- Type 4, Class 8, 85W PoE PD Module
- Highly efficient (93%) 1500V isolated DC-DC converter
- Compact Size 29mm x 70mm
- Maintain Power Signature (MPS) for low power operation
- 12V and 24V DC output voltage models
- Support for 12.5KΩ legacy signature
- Continuous output short circuit and overload protection
- High temperature operation up to 80°C with airflow
- Auto-class support for automatic power budgeting
- In-built primary side auxiliary wall adapter support
- Dedicated signal pin for Load Sharing
- Low electromagnetic interference (EMI)
- Low output ripple and noise

Applications

- Thin Client computers, LED intelligent lighting
- Security and alarm systems
- Thin clients and Single board computers
- High power Pan-Tilt-Zoom (PTZ) IP video surveillance cameras
- LCD displays, video panels, kiosks, Network monitors
- Small computers, Digital Signage
- Public address systems
- Industrial control and automation
- 802.11n wireless, mesh networks, Bluetooth access points
- Environmental control, sensors, transducers and telemetry

Brief Description

The KPM5900 is the world's smallest 85 watts IEEE802.3bt PoE Powered Device (PD) module solution in its class. It is a low-cost solution compliant with the IEEE802.3bt Power over Ethernet (PoE) standard, with full backward compatibility to IEEE802.3at and IEEE802.3af standards. The module presents a Type 4, Class 8 PD signature and supports output power of up to 85W when powered by an IEEE802.3bt compliant Power Sourcing Equipment (PSE) capable of delivering the required power.

The KPM5900 is designed with Kinetic's **KTA1142** and provides advanced features typically not available in standard PoE PD modules. These include Maintain Power Signature (MPS) to maintain connection to a compliant PSE during low-power operation, Auto-class for automatic power budgeting, and in-built support for automatic switchover to an external DC power source, such as a wall adapter. The module also provides power class and PSE type indications for system monitoring and control. It delivers a well-regulated, low-noise, and low-ripple output, and includes overload protection, output short-circuit protection, and inrush current protection.

The KPM5900 is available in 12V and 24V output voltage variants. It features a low-EMI, highly efficient isolated DC-DC converter achieving efficiencies of up to 93%, while maintaining 1500V safety isolation between the input and output.



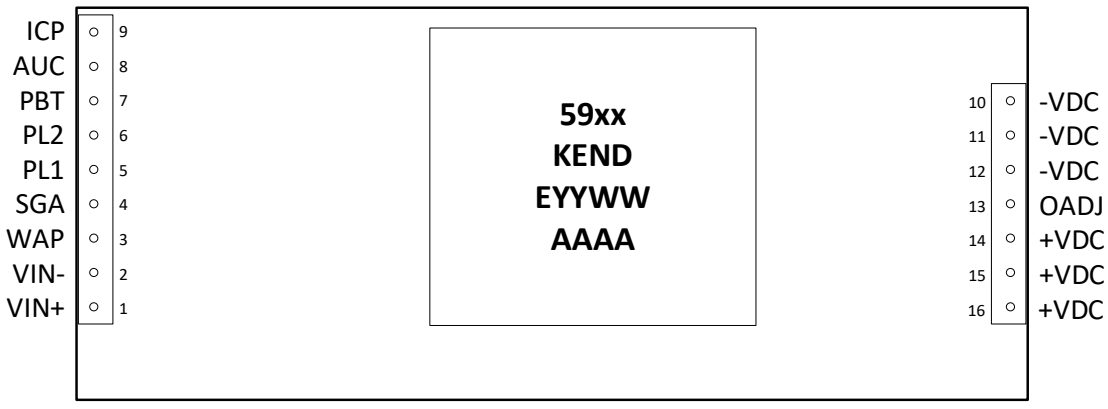
Ordering Information[1]

Part Number[2]	Marking[3]	Output Voltage[4]	Efficiency[5]	IEEE Power Classification	Maximum Output Power
		(Volts DC)	(%)	(%)	(Watts)
KPM5912KEND-TV	5912 KEND EYYWW AAAA	12	93	Class 4	85
KPM5924KEND -TV	5924 KEND EYYWW AAAA	24	93	Class 4	

Pin Descriptions

	INPUT PINS
1	**VIN+.** Connects to the positive (+) output of the input bridge rectifiers
2	**VIN-.** Connects to the negative (-) output of the input bridge rectifiers and wall adapter.
3	**WAP.** Connect to wall adapter positive (+) output. See WALL ADAPTOR (WAP) SUPPLY.
4	**SGA.** Connect to Pin 1 (VIN+) to provide 12.5K ohm signature resistance for PoE PSE solutions. Do not connect for standard 25K resistance.
5	**PL1.** PSE Type and Power level Indicator. See POWER LEVEL INDICATION section for the truth table.
6	**PL2**. PSE Type and Power level Indicator. See POWER LEVEL INDICATION section for the truth table.
7	**PBT.** PSE Type and Indicator. See POWER LEVEL INDICATION section for the truth table.
8	**AUC.** Auto Class configuration. See AUTO-CLASS section.
9	**ICP.** Input Capacitor Positive (+). Connect across Pin 2 (VIN-). Can connect an optional external low ESR bulk capacitor of approximately 33µF, 100V for additional filtering and surge handling.
	OUTPUT PINS
10, 11, 12	**-VDC.** Output negative. Internally connected. Must be connected together on the target motherboard.
13	**OADJ.** The output voltage can be adjusted from its nominal value. See OUTPUT VOLTAGE ADJUSTMENT section.
14, 15, 16	**+VDC.** Output positive. Internally connected. Must be connected together on the target motherboard.

Pin Diagram



1. All specifications are generally provided at a T_A of 25°C, with a standard input voltage and rated output current, unless stated otherwise. These values are intended for design assistance only and are indicative, not guaranteed.
2. Part numbers in **Bold**, are available today. For non-bold part numbers, please contact your local sales representative for availability.
3. 59xx = Device ID, KEN = Part Number Extension, D = Dithering Function, E = Manufacturing Code, YYWW = Date Code, AAAA = Serial Number.
4. Output voltage is typical ±3% at an ambient temperature of 25°C with nominal input voltage and rated output current.
5. Typical values are measured at nominal V_{IN} with >75% output load at an ambient temperature of 25°C.

Absolute Maximum Ratings

Supply Voltage (V_{CC})	0V ~ 57V DC
Input Current (A)	2A
Storage Temperature (T_S)	-25^{O}C ~ +100^{O}C
Output Voltage (V_{OUT})	0V to controlled output voltage (operating or non-operating)

Electrical Characteristics

INPUT CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Units
Input Voltage (V_{IN})	V_{IN}	42	55	57	Volts
Input Current (DC)[6]	I_{IN}	0		1.70	A
Maximum Inrush Current	I_{PK}			1.80	A
Under Voltage Lockout	V_{UVLO}	39		42	Volts
Operating Temperature	T_{OP}	-20		70	^{O}C
IEEE 802.3bt Classification	Type 4 Class 8				

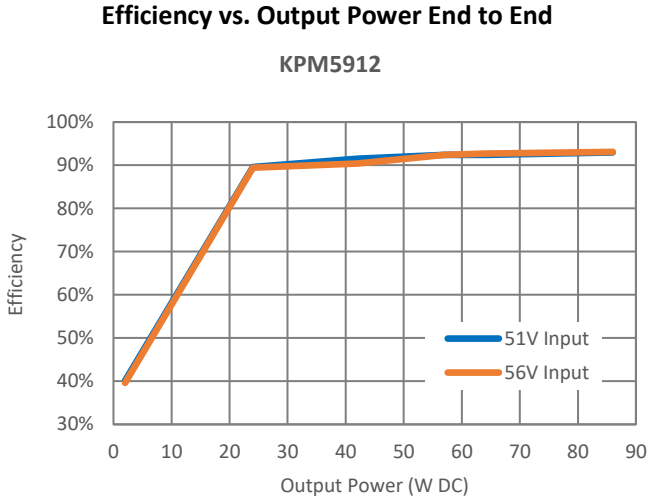
DC OUTPUT CHARACTERISTICS

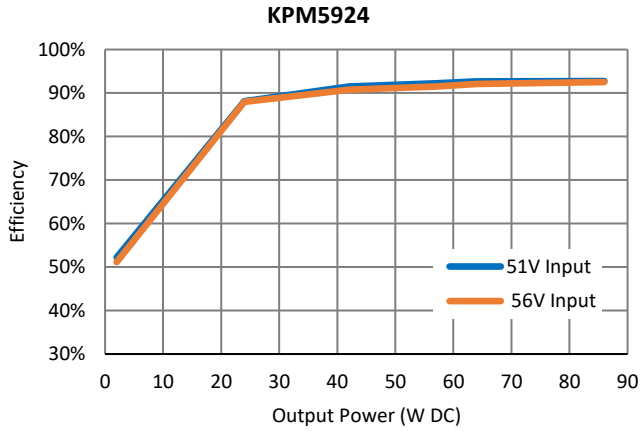
Parameter	Symbol	Min.	Typ.[5]	Max.	Units
Line Regulation	V_{LNRG}		0.1%		%
Load Regulation	V_{LDRG}		0.2%		%
Output Ripple and Noise	V_{RIP}		100	150	mV
Isolation Voltage (DC)	V_{ISOL}			1500	V
Temperature Coefficient	TC		100	300	ppm/ ^{O}C
Output Short Circuit Duration				∞	Sec

6. Please refer to IEEE 802.3af / 802.3at / 802.3bt standards document. Maximum input and inrush current are dependent on power class.

Typical Characteristics

EFFICIENCY v/s OUTPUT POWER[7]





7. Product use must comply with input and output characteristics and not exceed absolute maximum ratings.

Functional Block Diagram

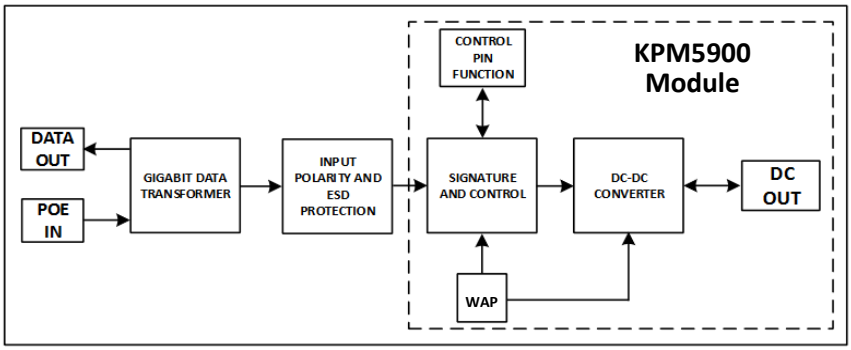


Figure 1. KPM5900 Block Diagram

Functional Description

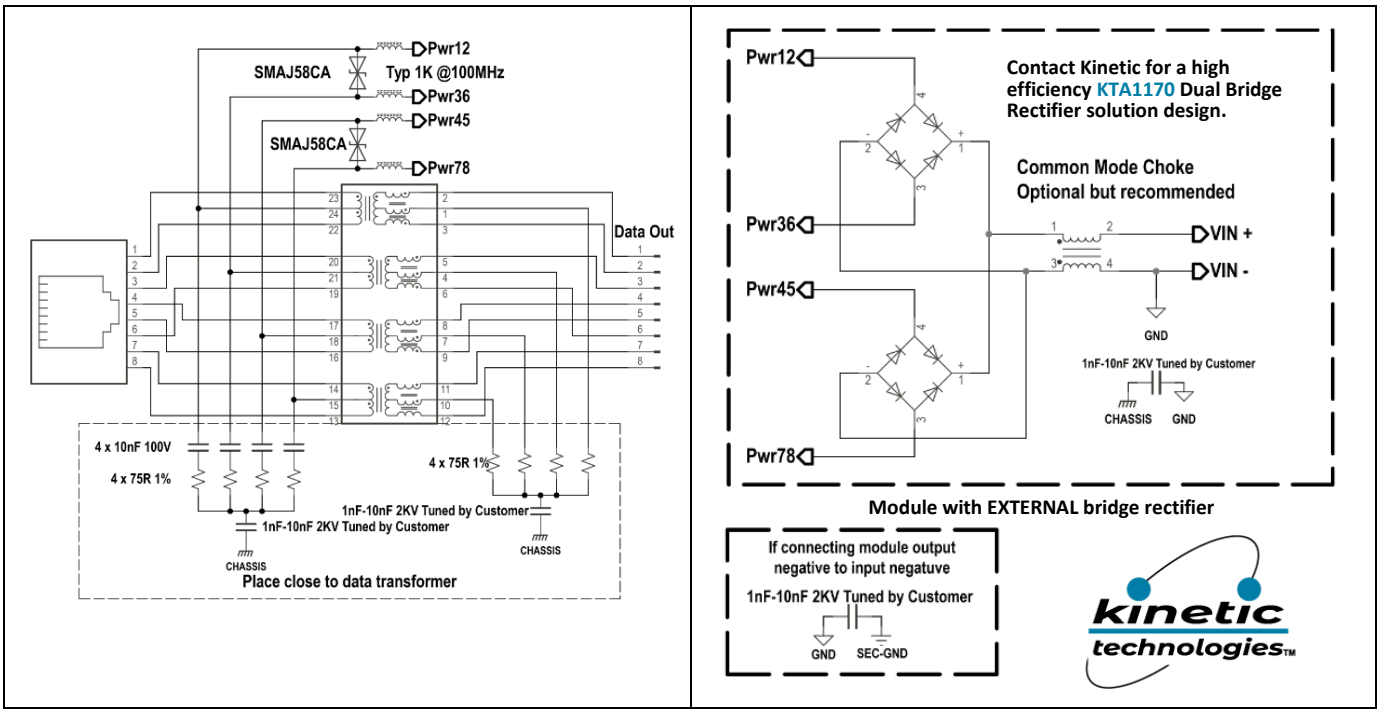


Figure 2. Typical Input Connections

INPUTS

The KPM5900 is designed to be powered by a IEEE 802.3bt compliant PSE capable of providing the required power, or an auxiliary external DC power supply like a wall adapter. When powered by a PSE, the system designer must provide input polarity protection using bridges for each of the input lines. Please see *Figure 2. Typical Input Connections*. The bridges can be constructed using diodes or MOSFET H-Bridges or a hybrid MOSFET-diode bridges. Kinetic offers **KTA1170**, a single chip highly integrated dual MOSFET bridge rectifier that is ideally suited for 802.3bt applications. This compact solution can improve power conversion efficiency by up to 2% at higher loads, thereby reducing need for extensive heat sinking. Please *contact Kinetic Technologies technical support* for more information.

WALL ADAPTOR (WAP) SUPPLY

The KPM5900 has built-in support for an auxiliary external DC power supply like a wall-adapter. To support the module's maximum power of 85 watts we recommend an external supply with a minimum current rating of 3 amperes (3A) and a voltage output of a minimum of 51 volts up to a maximum of 55 volts. The positive of the external DC power supply should be connected to the WAP pin and the negative of the supply to the VIN- pin. The KPM5900 detects the voltage supplied by the external DC power supply and automatically switches over to an external DC supply when the input voltage exceeds 48V. The KPM5900 will de-prioritise the external DC power supply when the voltage falls below 42V. When the external DC power is prioritised all IEEE 802.3bt/at/af related functions like Maintain Power Signature, Auto Class, etc. will be turned off.

MAINTAIN POWER SIGNATURE (MPS)

The KPM5900 module features a Maintain Power Signature (MPS) function that supports applications requiring low-power standby modes, compliant with the IEEE 802.3bt standard.

As per the IEEE 802.3 POE standard, a minimum current of 10mA is necessary to prevent power disconnection from the Power Sourcing Equipment (PSE) during standby conditions. The KPM5900 automatically enters MPS mode when the input current drops below 16mA and exits this mode once the current exceeds 16 mA. This ensures minimal power consumption while maintaining the KPM5900 Series connection to a compliant PSE.

The MPS function is enabled by default in the KPM5900, with predefined duty cycles and current as mentioned in *Table 1- Maintain Power Signature (MPS)* below.

Table 1- Maintain Power Signature (MPS)

PSE type	Duty Cycle	Ton	Toff	MPS current
3,4	8.1%	16ms	184ms	16mA

POWER LEVEL INDICATION

PL1, PL2 and PBT are open-drain and active-low output pins, referenced to VIN-, and used to indicate the PD Power Class and the PSE Type. PL1 and PL2 indicate the allocated power level. The PBT pin provides an indication on the type of PSE connected. If the KPM5900 is connected to an IEEE 802.3bt compliant type 3 or type 4 PSE, the PBT pin will go low. The PBT, PL1, and PL2 pins will be reset to high by the occurrence of a reset or a power-down event.

Table 2- Power Level Indication provides complete details on the behaviour of the pins. To preserve the primary to secondary 1500V isolation, the system designer must use opto-isolators when connecting the PL1, PL2, and/or PBT pins to a host board control device such as a micro-controller. Please see *Figure 3. Power level indication connections to host-board*.

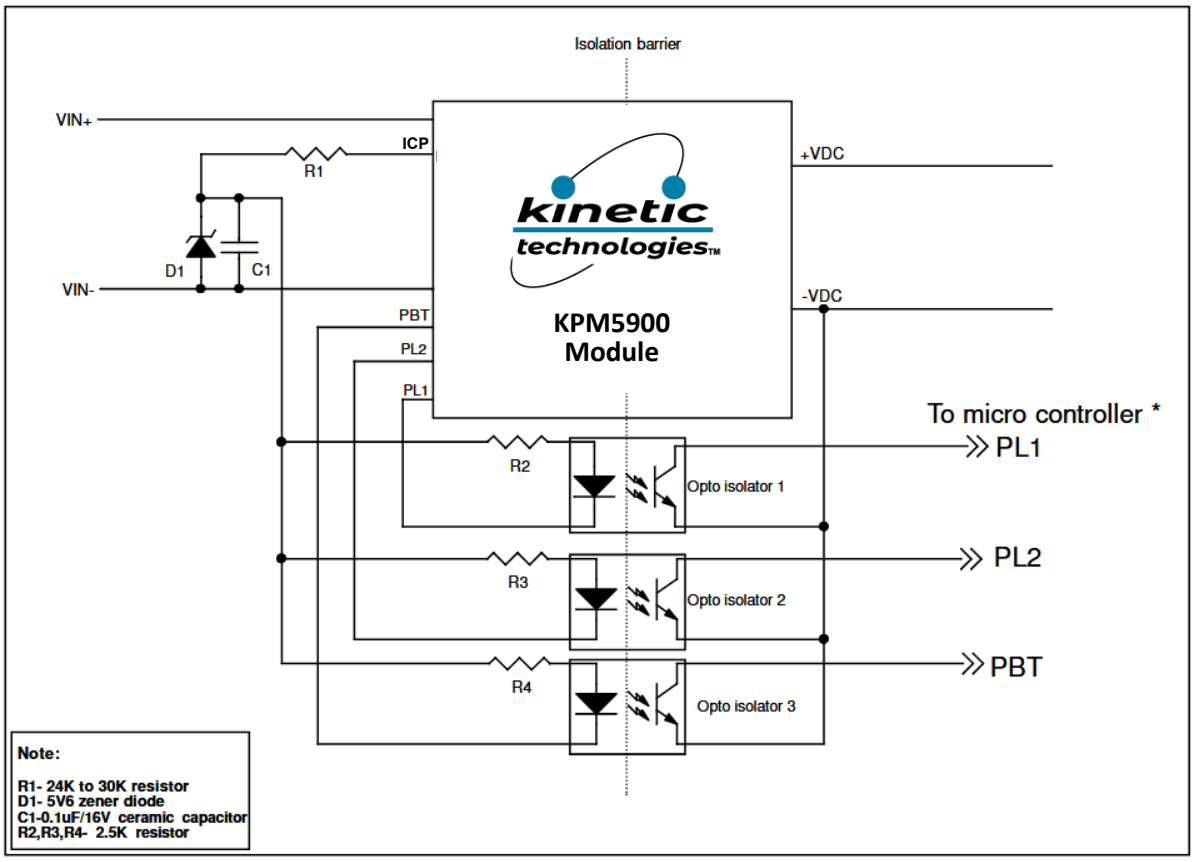


Figure 3. Power level indication connections to host-board

Table 2- Power Level Indication

PSE Type	PD Class	Class Events	Minimum Requested Power(W)	PL1	PL2	PBT
1 or 2	0	1	12.95	High	High	High
1 or 2	1	1	3.84	High	High	High
1 or 2	2	1	6.49	High	High	High
1 or 2	3	1	12.95	High	High	High
2	4	2	25.5	Low	High	High
3 or 4	0	1	12.95	High	High	Low
3 or 4	1	1	3.84	High	High	Low
3 or 4	2	1	6.49	High	High	Low
3 or 4	3	1	12.95	High	High	Low
3 or 4	4	2 or 3	25.5	Low	High	Low
3 or 4	5	4	38.25	High	Low	Low
3 or 4	6	4	51	High	Low	Low
4	7	5	62	Low	Low	Low
4	8	5	71.3	Low	Low	Low

AUTO-CLASS

Auto-class is a mechanism introduced in the IEEE 802.3bt standard that allows a Type 3 or Type 4 Powered Device (PD) to communicate its effective maximum power consumption to a Type 3 or Type 4 Power Sourcing Equipment (PSE). This allows the PSE to efficiently budget power. KPM5900 supports this feature allowing Type 3 and Type 4 PSEs to optimise their power management. To enable Auto-class of KPM5900 connect AUC pin to VIN-.

ISOLATION

The IEEE PoE specifications require that a Powered Device (PD) meets safety isolation standards by passing the electrical strength test specified in IEC 60950, sub-clause 6.2. Kinetic Technologies KPM5900 modules comply with these requirements by meeting or exceeding the 1500V impulse test, commonly referred to as the "Hi-Pot Test," "Flash Test," "Withstand Voltage," "Proof Voltage," "Dielectric Withstand Voltage," and "Isolation Test Voltage". The KPM5900 module includes two M2.5 mounting holes, each surrounded by 4mm diameter pads, with MH1 and MH2 providing 1500V isolation from the surrounding circuitry.

OUTPUT VOLTAGE ADJUSTMENT

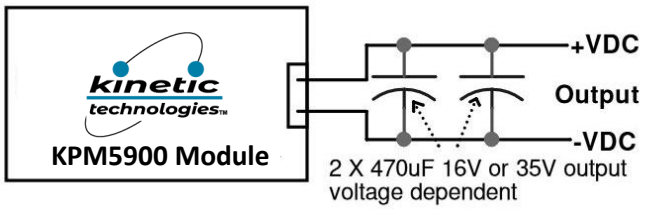


Figure 4. Output Connection

The KPM5900 series features an OADJ pin that enables adjustment of the output voltage from its nominal value. This adjustment is accomplished by connecting a resistor with a power rating of at least 1/16W and a tolerance of 1% between the OADJ pin and either the +VDC or –VDC pin, as specified in the provided table. It is important to connect only one resistor at a time—either between OADJ and +VDC or between OADJ and –VDC. Users should ensure that the output voltage is not adjusted by more than ±10% or ±1.5V (whichever is lower) from the nominal voltage to maintain safe and effective operation. The voltages are to be measured at the output pins of the module. Please ***contact Kinetic Technologies technical support*** for any further clarifications.

Table 3. Output Voltage Adjustment provides estimated resistance values for certain commonly observed voltage adjustments. The most appropriate resistance value to be tuned by customers.

Table 3. Output Voltage Adjustment

KPM5912		
Output Voltage	OADJ to +VDC	OADJ to -VDC
11V	34.8KΩ	
11.5V	64.9KΩ	
12V	DNP	DNP
12.50V		32.4KΩ
13V		13.7KΩ

KPM5924		
Output Voltage	OADJ to +VDC	OADJ to -VDC
22V	83.5KΩ	
22.9V	152KΩ	
24V	DNP	DNP
24.99V		38.3KΩ
25.99V		15KΩ

THERMAL MANAGEMENT

The KPM5900 boards generate heat during operation. To ensure optimal performance and reliability, it's crucial to incorporate adequate ventilation and airflow during the design phase. The amount of heat generated by the KPM5900 will vary based on the output power draw. As an example, the thermal performance of the KPM5912 with a 51VDC input in still air with no additional thermal pad or heat sinking or airflow, is illustrated in the *Figure 5. Thermal Performance Profile at 51V DC Input* below.

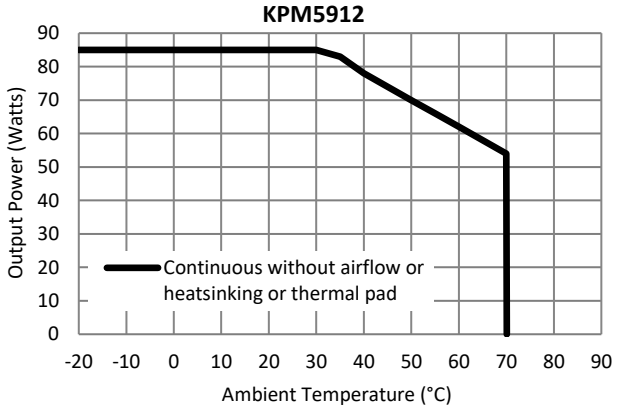


Figure 5. Thermal Performance Profile at 51V DC Input

To enhance thermal performance a combination of airflow cooling over the module and/or heatsinking using the mounting holes and/or thermal pad materials from 3M, Würth, Berquist, Aavid, etc. can be implemented, to help maintain the module within safe operating temperatures. If using the mounting holes, the system designer must ensure maintenance of the 1500V primary to secondary isolation.

The KPM5912 is capable of handling 85W up to 70°C with just a continuous airflow of 9 cfm without any thermal pad or heatsinking. The thermal performance with just airflow is illustrated in the *Figure 6. Thermal Performance Profile at 51V DC Input* below.

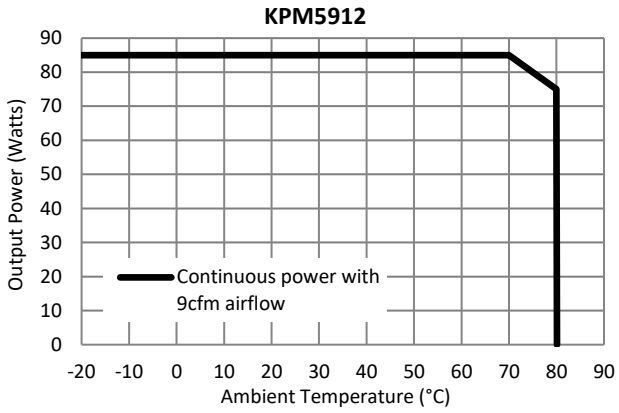


Figure 6. Thermal Performance Profile at 51V DC Input

Thermal Pad Diagram (all dimensions in mm)

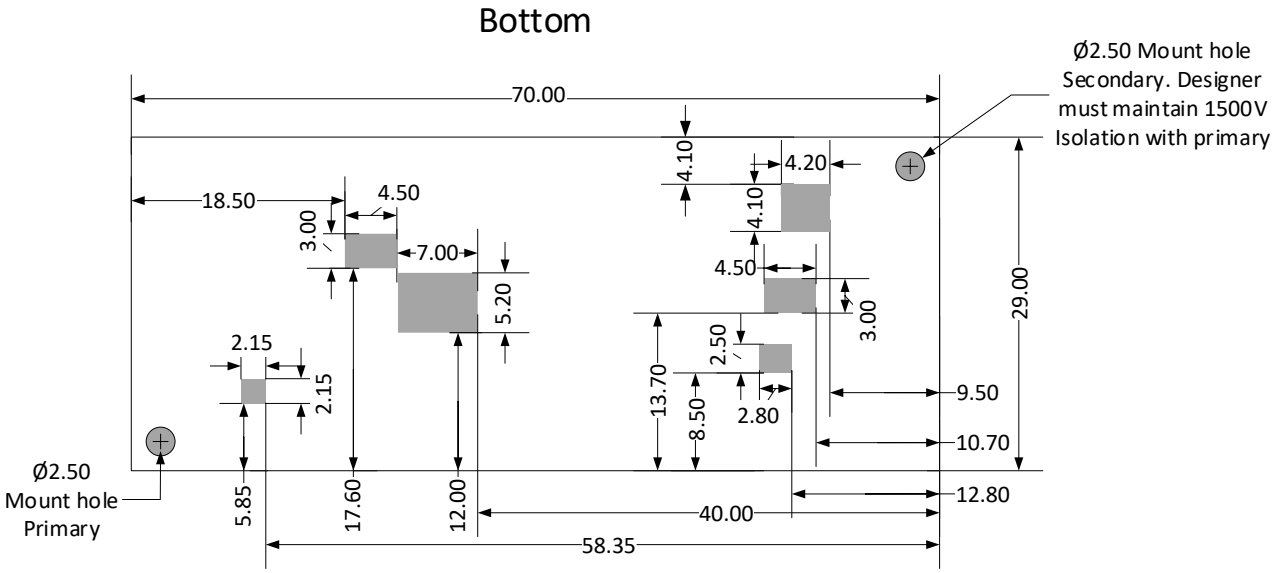


Figure 7. Thermal Pad Diagram

IEEE 802.3 Power Levels and Classes

IEEE 802.3 Power levels and Classifications for POE Powered Devices

IEEE Standard	Common Name	PD Class	PD / PSE Type	Max num. of events	PD Power[1]	PSE Power[2]	Wire pairs energised	AUC[3]
802.3af	POE	0	1	-	12.95W	15.4W	2	No Support
802.3af	POE	1	1	1	3.84W	4W	2	No Support
802.3af	POE	2	1	1	6.49W	7W	2	No Support
802.3af	POE	3	1	1	12.95W	15.4W	2	No Support
802.3at	POE+	4	2	2	25.5W	30W	2	No Support
802.3bt	POE++	5	3	4	38.25W	45W	4	Optional
802.3bt	POE++	6	3	4	51W	60W	4	Optional
802.3bt	POE+++	7	4	5	62W	75W	4	Optional
802.3bt	POE+++	8	4	5	71.3W	90W	4	Optional

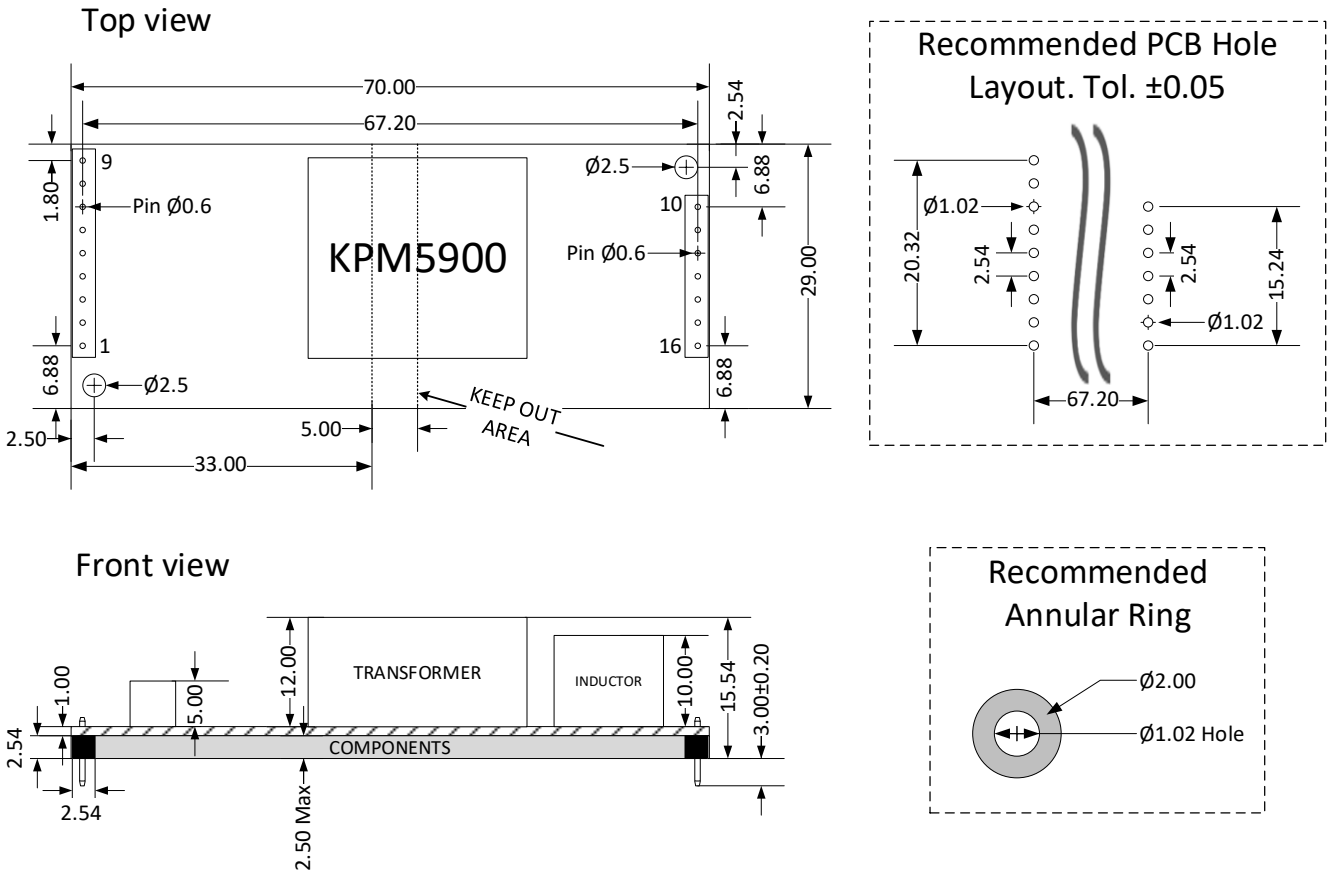
[1] Min. power delivered to PD / Module input. Max. PD / module output depends on operating conditions

[2] Power delivered from the Power Sourcing Equipment (PSE) (switch or injector) at its output port

[3] Auto Class is supported. It is optional to enable or not.

Packaging Information

(all dimensions in mm. Tol. ±0.50mm)



ESD AND SURGE PROTECTION

It is essential for system designers to incorporate Electrostatic Discharge (ESD) and surge protection measures at the input of the KPM9312BT to safeguard against damage from over-voltage surges and to ensure compliance with system EMC and ESD standards. This can be achieved by using a TVS diode, such as the SMAJ58A (uni-directional) or SMAJ58CA (bi-directional). These diodes effectively clamp voltage spikes, providing protection for the module and enhancing the overall reliability of the system.

Legal notice

Copyright © Kinetic Technologies. Other names, brands and trademarks are the property of others.
Kinetic Technologies assumes no responsibility or liability for information contained in this document. Kinetic Technologies reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or services without notice. The information contained herein is believed to be accurate and reliable at the time of printing.

Life support policy

LIFE SUPPORT: KINETIC TECHNOLOGIES' PRODUCTS ARE NOT DESIGNED, INTENDED, OR AUTHORIZED FOR USE AS COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS. NO WARRANTY, EXPRESS OR IMPLIED, IS MADE FOR THIS USE. AUTHORIZATION FOR SUCH USE SHALL NOT BE GIVEN BY KINETIC TECHNOLOGIES, AND THE PRODUCTS SHALL NOT BE USED IN SUCH DEVICES OR SYSTEMS, EXCEPT UPON THE WRITTEN APPROVAL OF THE PRESIDENT OF KINETIC TECHNOLOGIES FOLLOWING A DETERMINATION BY KINETIC TECHNOLOGIES THAT SUCH USE IS FEASIBLE. SUCH APPROVAL MAY BE WITHHELD FOR ANY OR NO REASON.

"Life support devices or systems" are devices or systems which (1) are intended for surgical implant into the human body, (2) support or sustain human life, or (3) monitor critical bodily functions including, but not limited to, cardiac, respirator, and neurological functions, and whose failure to perform can be reasonably expected to result in a significant bodily injury to the user. A "critical component" is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.