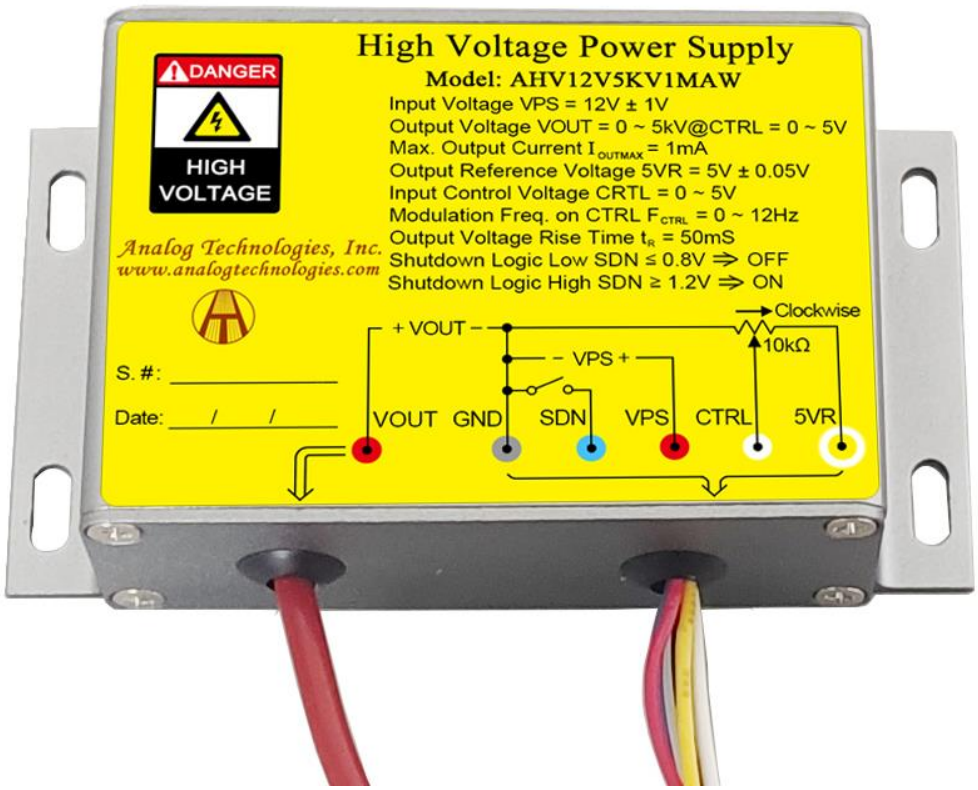


Figure 1.1. Top View of AHV12V5KV1MAW

Figure 1.2. Side View

Figure 1.3. Side View

Figure 1.4. Side View

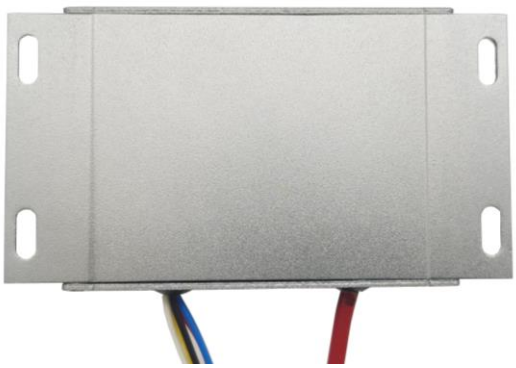


Figure 1.5. Bottom View

FEATURES

- Output Voltage: 0 to 5kV @CTRL = 0 to 5V
- Max. Output Current: 1mA
- Input Voltage: 12V ± 1V
- Input Current Range: 140mA to 600mA
  @V_{VPS} =12V, V_{SDN} = V_{CTRL} = 5V & I_{VOUT} = 0 ~ 1mA
- Control Voltage Range at VTRL Port: 0 to 5V
- Input Control Voltage: 0 to 5V
- High Efficiency: >70% @full load
- Electronic Shutdown Control Available
- Zero EMIs and Good Heat Sinking by Metal Enclosure

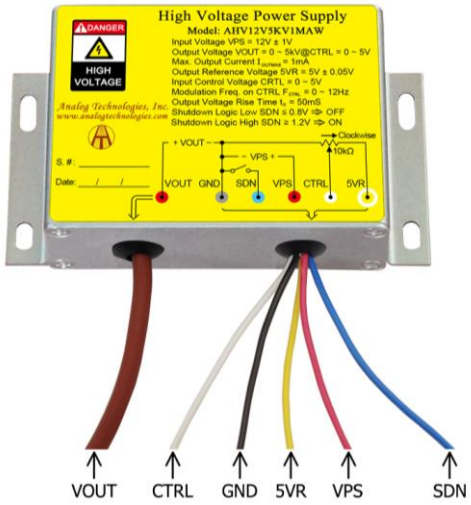


Figure 2. The Connecting Lead Wires of AHV12V5KV1MAW

APPLICATIONS

This power module, AHV12V5KV1MAW, is designed for achieving DC-DC conversion from low voltage to high voltage as a power supply source. It can be used for:

- X-ray Machine
- Spectral Analysis
- Nondestructive Inspection
- Semiconductor Manufacturing Equipment
- Particle Accelerator
- Capillary Electrophoresis
- Particles Injection
- Physical Vapor Phase Deposition
- Electrospinning Preparation of Nanofiber
- Glass/ Fabric Coating
- DC Reactive Magnetron Sputtering

Table 1. Wire Leads Specifications.

No.	Name	Color		Type	Function		Min.	Typ.	Max.
1	SDN		Blue	Digital input	Shutdown control	Logic low	0V		0.8V
						Logic high	1.2V		5V
2	5VR		Yellow	Analog output	Reference voltage		4.95V	5V	5.05V
3	CTRL		White	Analog input	Control input for output voltage		0V		5V
4	VPS		Red	Power input	Input voltage		11V	12V	13V
5	GND		Black	Ground for analog, digital and power signals.	Ground electrode			0V	
6	VOUT		Brown	Power output	Output high voltage		0V		5kV

DESCRIPTION

Figure 1 provides actual images of AHV12V5KV1MAW, while Figure 2 illustrates its connecting wire leads. Further details are available in Table 1. The high voltage output can be set between 0V to 5kV by connecting the CTRL lead (white color) to a POT's central tap or modulated by an AC signal ranging from 0V to 5V, as depicted in Figure 3 and Figure 4, respectively. Notably, the output voltage is 1000 times the input control voltage: $V_{VOUT} = 1000 \times V_{CTRL}$.

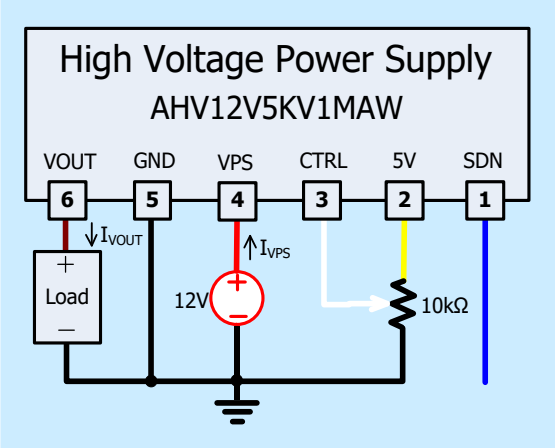


Figure 3. Setting Output to be a Constant Voltage

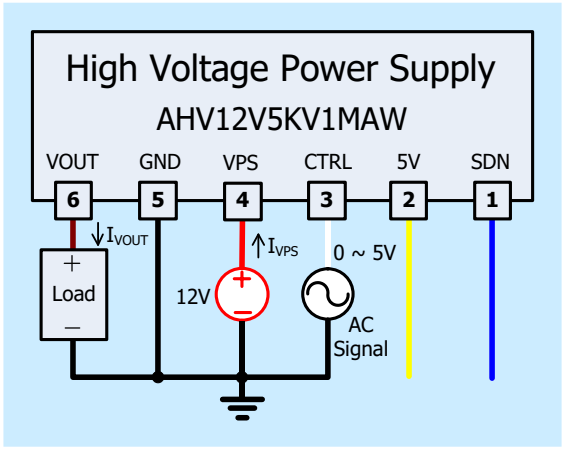


Figure 4. Modulating Output by an AC Signal Source

Please note that the modulation signal must have a low frequency ≤ 12Hz and the value range must be $0V \le V_{CTRL} \le 5V$. The equivalent input circuit for the CTRL is shown in Figure 5. It's input equivalent DC impedance is 50kΩ.

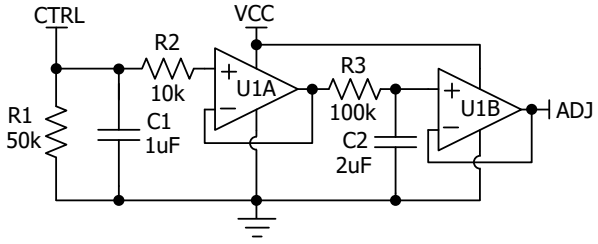


Figure 5. The Equivalent Circuit for CTRL Port

To initiate the shutdown of AHV12V5KV1MAW, pull down the SDN pin to <0.8V; to activate it, leave the SDN pin unconnected or pull it >1.2V. The maximum permissible voltage on the SDN pin is 5V. Refer to Figure 6 for the equivalent circuit of the SDN port.

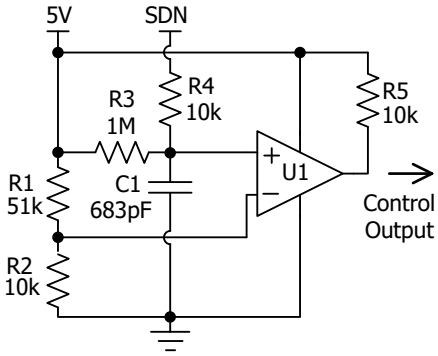


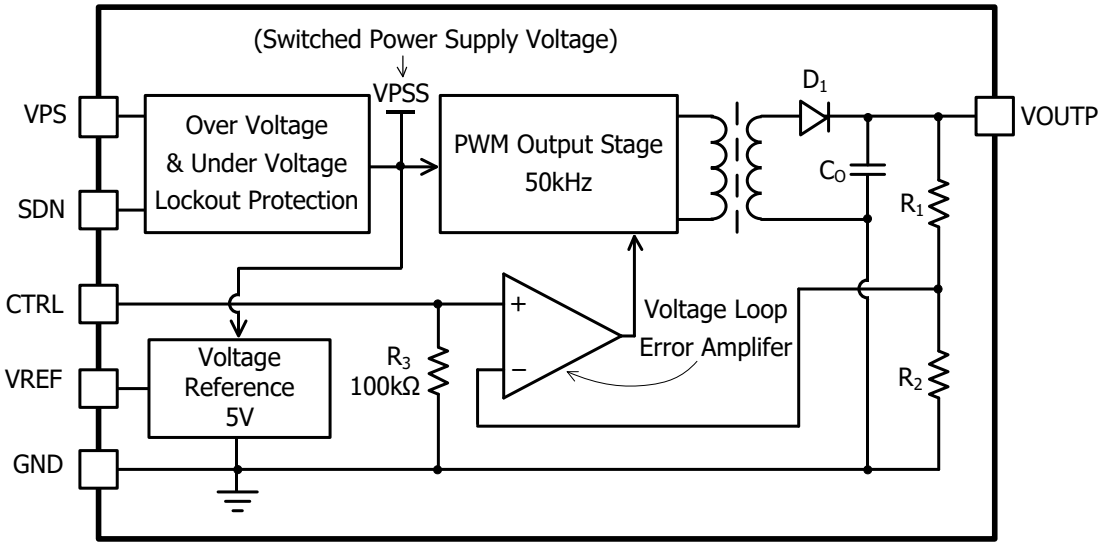
Figure 6. The Equivalent Circuit for SDN Port

USING AHV12V5KV1MAW

While this power supply operates efficiently without external heat sinking, enhancing its heat dissipation capacity through mounting on a metal plate with a robust thermal connection and ensuring proper ventilation is advisable, especially if the implementation does not entail significant extra costs. These measures contribute to maintaining the module's surface temperature below the specified maximum of 55°C, ultimately boosting its performance and longevity.

SAFETY PRECAUTIONS

While AHV12V5KV1MAW high voltage power supply includes an overcurrent protection circuit, it is essential to consistently prevent short circuits at the output. Ensure that the high voltage wire connecting the VOUT node possesses ample insulation capability to safeguard against any contact with surrounding objects.



$VOUTP = N \times V_{CTRL}$, where N is the amplification factor: $N = R_1/R_2$.

High Voltage Power Supply Function Block Diagram

SPECIFICATIONS

Table 2. Characteristics. T_A = 25°C, unless otherwise noted.

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Input Power Supply Voltage	V_{VPS}		11	12	13	V
Input Power Supply Quiescent Current	I_{VPS_QC}	I_{VOUT} = 0mA $V_{SDN} = V_{CTRL}$ = 5V	140	150	160	mA
Input Power Supply Current at Full Load	I_{VPS_FL}	I_{VOUT} = 1.0mA	550	600	650	mA
Input Power Supply Current at Shutdown	I_{VPS_SHDN}	T_A = −10°C ~ 55°C		13		mA
Modulation Voltage Range on CTRL	V_{CTRL}		0		5	V
Modulation Frequency Range on CTRL	f_{CTRL}		0		12	Hz
Shutdown Port Current	I_{SDNL}	$0 \le V_{SDNL} < 0.8V$	4		4.8	μA
	I_{SDNH}	$1.2V < V_{SDNL} < 5V$	0		3.6	μA
Shutdown Voltage Logic Low	V_{SDNL}		0		0.8	V
Shutdown Voltage Logic High	V_{SDNH}		1.2		5	V
Output Voltage Range	V_{VOUT}	I_{VOUT} = 0 ~ 1.0mA	0		5000	V
Output Current Range	$I_{VOUTMAX}$	V_{VPS} = 11V ~ 13V	0		1.0	mA
Reference Output Voltage Range	V_{5VR}	T_A = −10°C ~ 55°C I_{5VR} < 1mA	4.95	5	5.05	V
Reference Output Current Range	I_{5VR}	T_A = −10°C ~ 55°C V_{5VR} = 0 ~ 5V	0		1.0	mA

Parameter		Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Output Load Resistance Range				$\frac{V_{VOUT}}{I_{VOUT}}$		∞	MΩ
Output Voltage Ripple		V_{VOUT_RP}	Bandwidth = 1MHz R_{LOAD} = 5MΩ V_{VOUT} = 5kV		≤2.5		V_{P-P}
Output Voltage Temperature Coefficient		TC_{VOUT}	V_{VPS} = 12V V_{CTRL} = V_{5VR} = 5V V_{VOUT} = 5kV I_{VOUT} = 1mA T_A = −10°C ~ 55°C		≤0.01		%/°C
Output Voltage Range v.s. Temperature		$V_{VOUT}(T)$	V_{VPS} = 12V V_{CTRL} = V_{5VR} = 5V V_{VOUT} = 5kV I_{VOUT} = 1mA T_A = −10°C ~ 55°C	$0.99V_{VOUT}$	V_{VOUT}	$1.01V_{VOUT}$	V
Output Voltage Drift	Short Term Drift	$\frlvert\frac{\Delta V_{VOUT}/V_{VOUT}}{\Delta t\ (min)}\frrvert$	V_{VPS} = 12V V_{CTRL} = V_{5VR} = 5V V_{VOUT} = 5kV I_{VOUT} = 1mA T_A = −10°C ~ 55°C		≤0.5		%/min
	Long Term Drift	$\frlvert\frac{\Delta V_{VOUT}/V_{VOUT}}{\Delta t\ (h)}\frrvert$			≤1		%/h
Output Voltage Rise Time		t_r	V_{VOUT} (t_1) = 500V V_{VOUT} (t_2) = 4500V R_{Load} =5 MΩ		50		ms
Output Voltage Fall Time		t_f	V_{VOUT} (t_2) = 4500V V_{VOUT} (t_3) = 500V R_{Load} =5 MΩ		100		ms
Mean Time Between Failure		MTBF			1M		h
Instantaneous Short Circuit Current at the Output		I_{VOUT_SC}			≤100		mA
Load Regulation		$\frlvert\frac{\Delta V_{VOUT}/V_{VOUT}}{\Delta I_{VOUT}}\frrvert$	V_{VOUT} = 5kV I_{VOUT} = 1mA		≤0.05		%/mA
Full Load Efficiency		η	V_{VPS} = 12V V_{VOUT} = 5kV I_{VOUT} = 1mA		≥70		%
Operating Temperature Range		T_{opr}		−10		55	°C
Storage Temperature Range		T_{stg}		−20		85	°C
External Dimensions				82×55×28			mm
				3.23×2.17×1.10			inch
Weight					210		g
					0.46		lbs
					7.4		Oz

TESTING DATA

Test conditions: V_{VPS} = 12V, T_A = 25°C, R_{LOAD} = 5MΩ

DC Testing

Figure 7 below illustrates the relationship between the measured output voltage (V_{VOUT}) and the input voltage at the control port (V_{CTRL}) during DC testing.

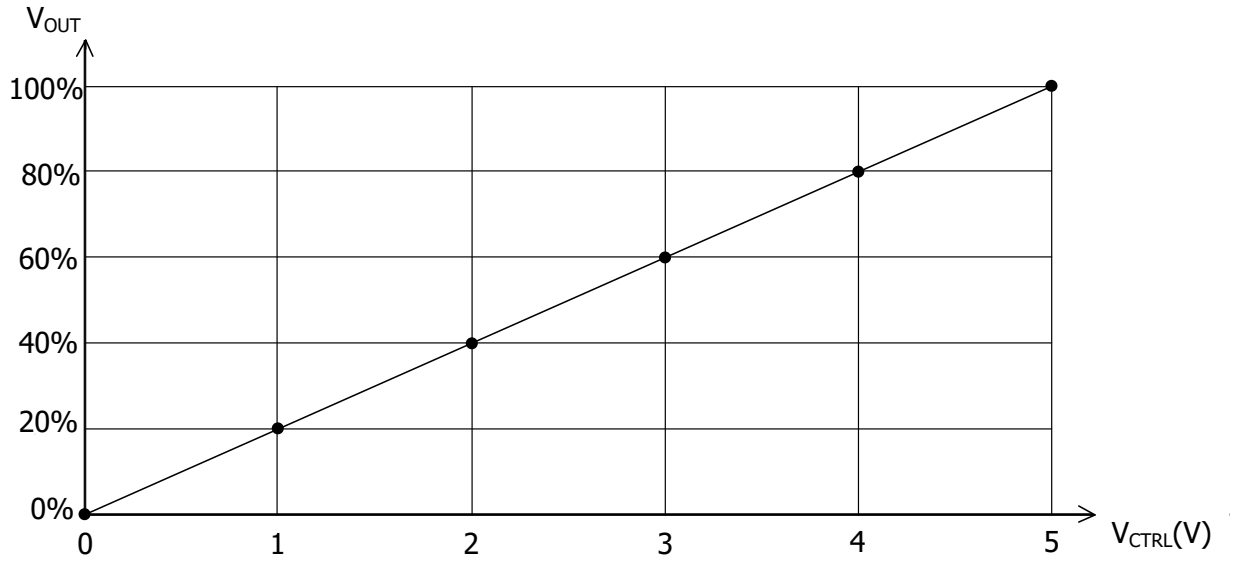


Figure 7. V_{CTRL} vs. V_{VOUT}

AC Testing

To evaluate the analog modulation function, triangle and sine-wave voltage signals are applied to the CTRL port as input sources. Figures 8 and 9 illustrate the resulting waveforms from these tests, respectively.

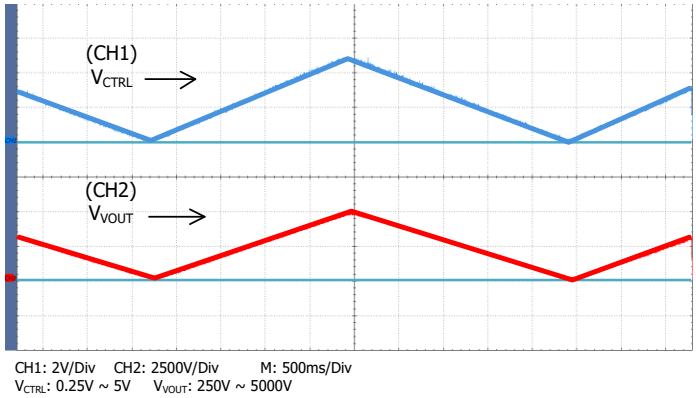


Figure 8. Triangle Wave Modulation

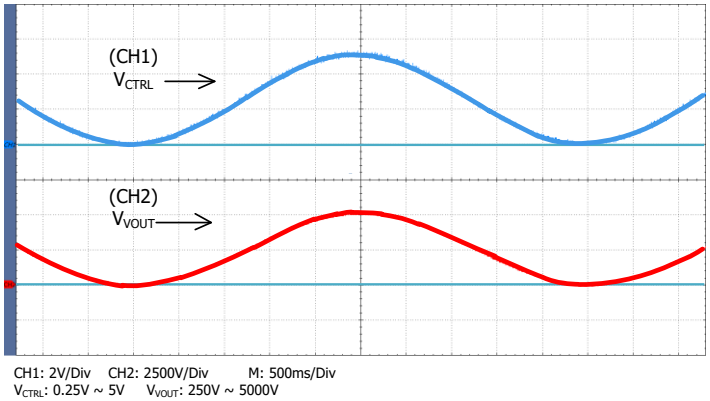


Figure 9. Input vs. Sine Wave Modulation

To assess the rise and fall times at the output, a step function signal is applied to the CTRL port, and the testing results are presented in Figure 10, Figure 11, and Figure 12. In Figure 11 and Figure 12, a square wave ranging from 0.25V to 5V with a frequency of 0.10Hz is applied to the CTRL port. The measured fall time is approximately 100ms, while the rise time is around 50ms. The disparity between these two values is attributed to the power supply injecting current to the load during the rising phase, whereas during the falling phase, the power supply stops its output current, allowing the load resistor to drain the output filtering capacitor to a lower voltage with a much smaller draining current.

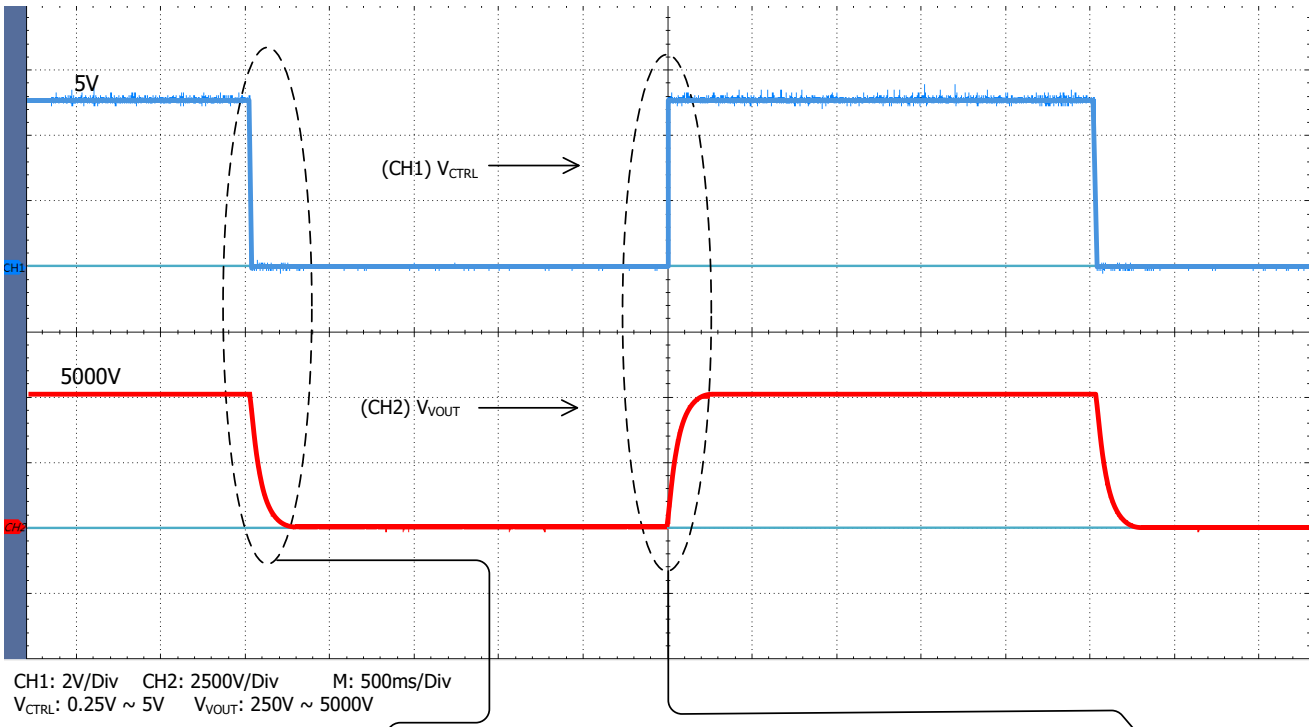


Figure 10. Input vs. Output Waveforms for Square Wave Control

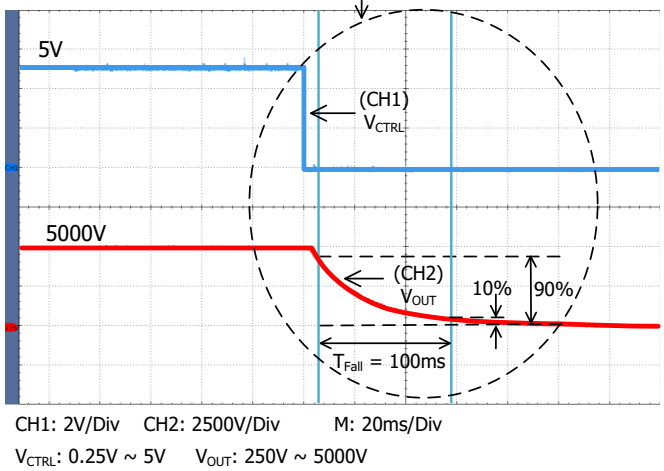


Figure 11. Falling Trail for Large Signal Response

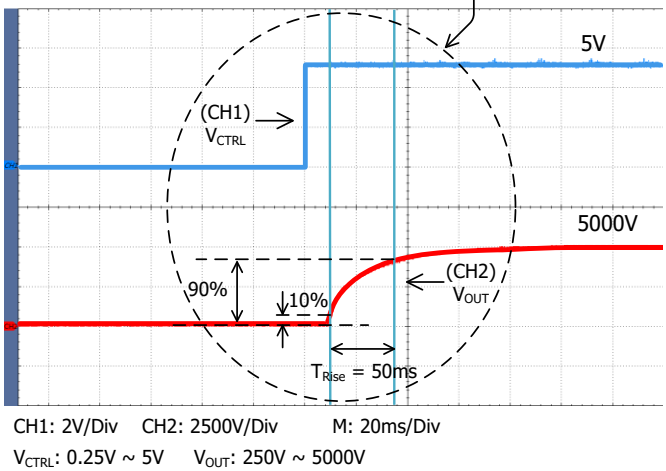
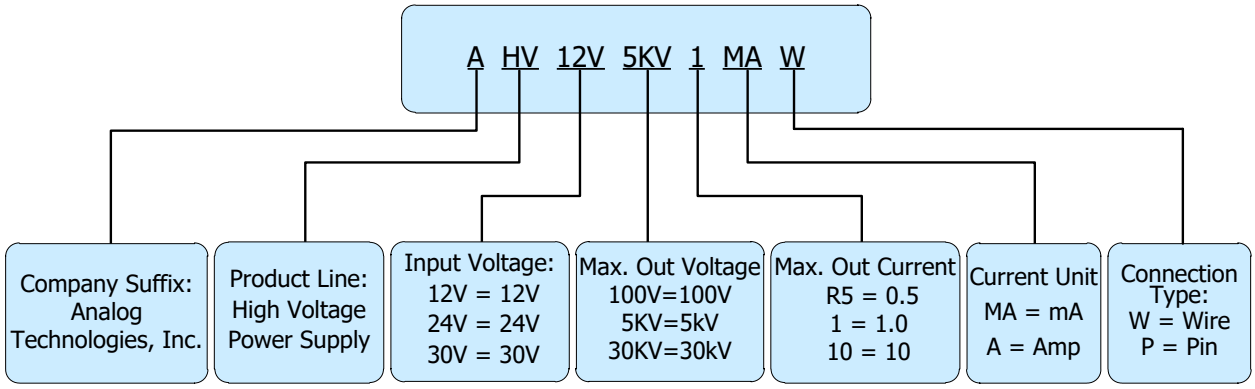


Figure 12. Rising Trail for Large Signal Response

NAMING PRINCIPLE



Naming Principle of AHV12V5KV1MAW

DIMENSIONS

Connecting Lead Wire Sizes and Lengths

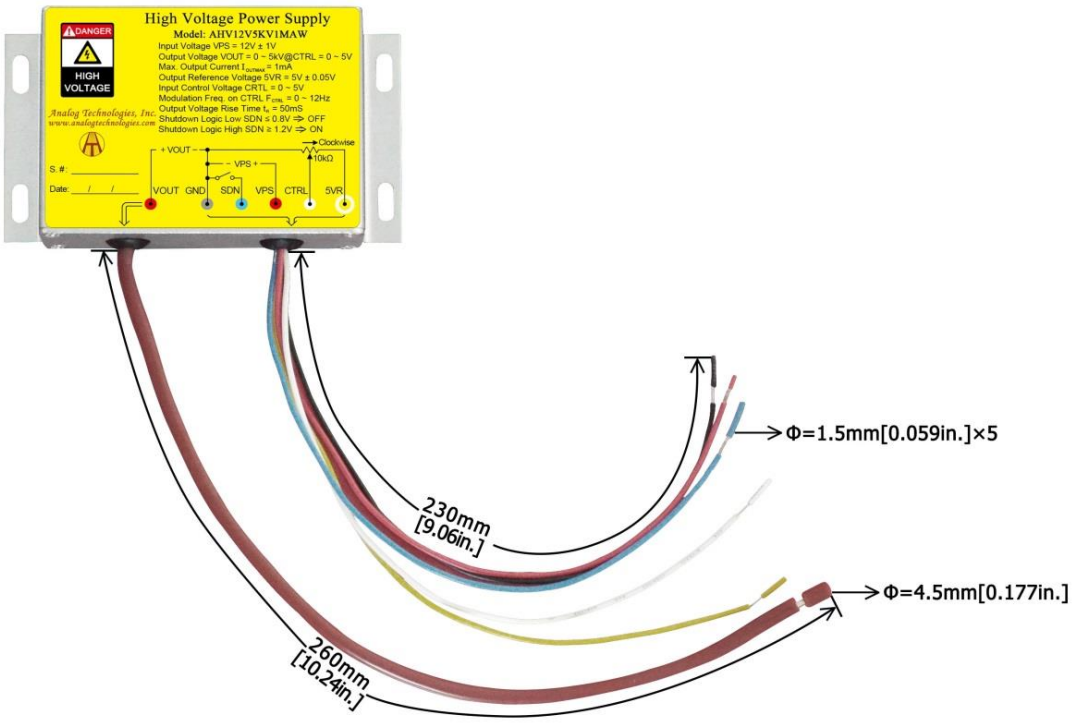


Figure 13. Connecting Lead Wires of AHV12V5KV1MAW

Lead Wires	Diameter		Length	
	mm	inch	mm	inch
Thick brown lead wire	4.5	0.177	260 ± 1	10.24 ± 0.039
Yellow, red, blue, black and white lead wires	1.5	0.059	230 ± 1	9.06 ± 0.039

Outline Dimensions

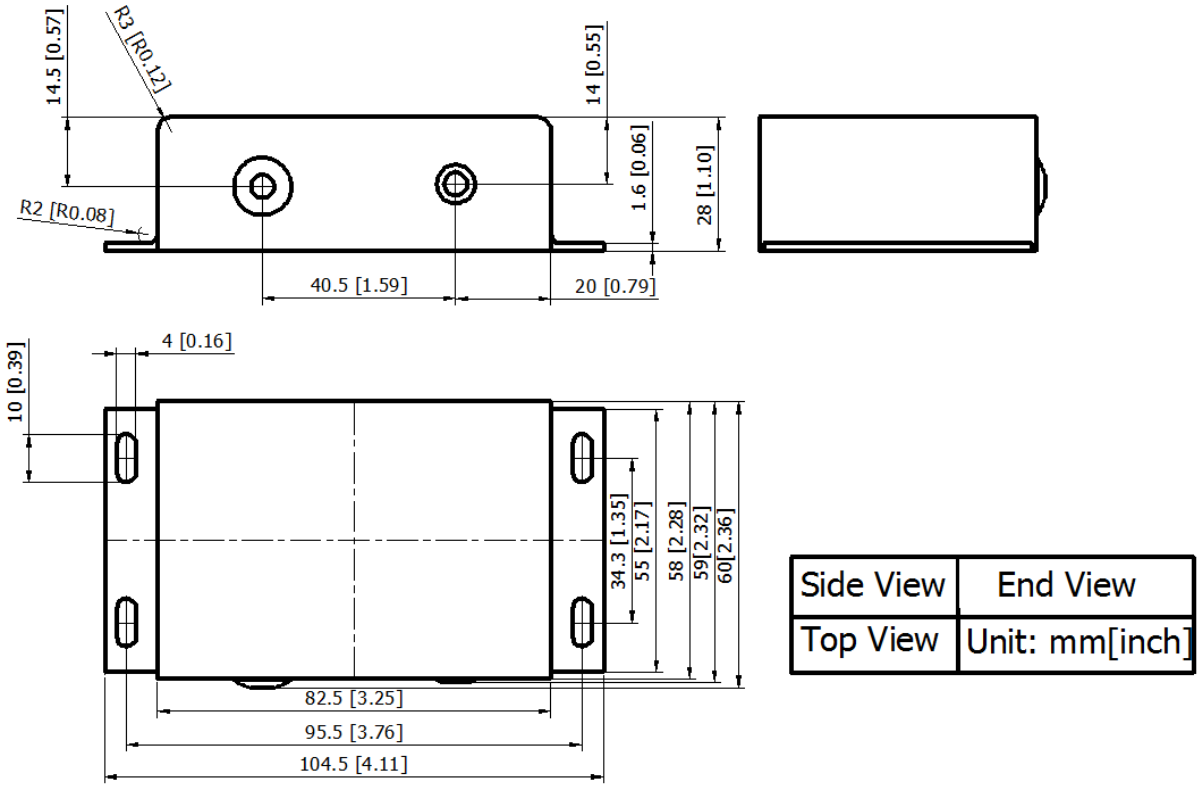


Figure 14. Outline Dimensions

ORDERING INFORMATION

Part Number	Buy Now
AHV12V5KV1MAW	

RELATED PRODUCTS

Input Voltage: 12V, Input Control Voltage: 0 to 5V, Efficiency: 70%.

Part #	Datasheet	Output Voltage (V)	Output Current (mA)	Description	Buy Now*
AHV12V500V1MAW		500	1	Positive 500V 1mA module with lead wires	
AHV12V500V2MAW		500	2	Positive 500V 2mA module with lead wires	
AHV12V500V5MAW		500	5	Positive 500V 5mA module with lead wires	
AHV12V500V10MAW		500	10	Positive 500V 10mA module with lead wires	
AHV12V500V20MAW		500	20	Positive 500V 20mA module with lead wires	
AHV12V500V50MAW		500	50	Positive 500V 50mA module with lead wires	

High Voltage Power Supply

AHV12V5KV1MAW

Part #	Datasheet	Output Voltage (V)	Output Current (mA)	Description	Buy Now*
AHV12V1KV1MAW		1000	1	Positive 1kV 1mA module with lead wires	
AHV12V1KV2MAW		1000	2	Positive 1kV 2mA module with lead wires	
AHV12V1KV3MAW		1000	3	Positive 1kV 3mA module with lead wires	
AHV12V1KV5MAW		1000	5	Positive 1kV 5mA module with lead wires	
AHV12V1KV10MAW		1000	10	Positive 1kV 10mA module with lead wires	
AHV12V1KV20MAW		1000	20	Positive 1kV 20mA module with lead wires	
AHV12V1500V1MAW		1500	1	Positive 1.5kV 1mA module with lead wires	
AHV12V1500V2MAW		1500	2	Positive 1.5kV 2mA module with lead wires	
AHV12V1500V3MAW		1500	3	Positive 1.5kV 3mA module with lead wires	
AHV12V1500V5MAW		1500	5	Positive 1.5kV 5mA module with lead wires	
AHV12V1500V10MAW		1500	10	Positive 1.5kV 10mA module with lead wires	
AHV12V2KV1MAW		2000	1	Positive 2kV 1mA module with lead wires	
AHV12V2KV3MAW		2000	3	Positive 2kV 3mA module with lead wires	
AHV12V2KV5MAW		2000	5	Positive 2kV 5mA module with lead wires	
AHV12V2KV10MAW		2000	10	Positive 2kV 10mA module with lead wires	
AHV12V2500V1MAW		2500	1	Positive 2.5kV 1mA module with lead wires	
AHV12V2500V3MAW		2500	3	Positive 2.5kV 3mA module with lead wires	
AHV12V2500V5MAW		2500	5	Positive 2.5kV 5mA module with lead wires	
AHV12V3KV1MAW		3000	1	Positive 3kV 1mA module with lead wires	
AHV12V3KV2MAW		3000	2	Positive 3kV 2mA module with lead wires	
AHV12V3KV3MAW		3000	3	Positive 3kV 3mA module with lead wires	
AHV12V3KV5MAW		3000	5	Positive 3kV 5mA module with lead wires	
AHV12V3KV10MAW		3000	10	Positive 3kV 10mA module with lead wires	
AHV12V4KV1MAW		4000	1	Positive 4kV 1mA module with lead wires	
AHV12V4KV2R5MAW		4000	2.5	Positive 4kV 2.5mA module with lead wires	
AHV12V4KV5MAW		4000	5	Positive 4kV 5mA module with lead wires	
AHV12V5KV1MAW		5000	1	Positive 5kV 1mA module with lead wires	
AHV12V5KV2MAW		5000	2	Positive 5kV 2mA module with lead wires	
AHV12V5KV4MAW		5000	4	Positive 5kV 4mA module with lead wires	
AHV12V6KV1MAW		6000	1	Positive 6kV 1mA module with lead wires	

Part #	Datasheet	Output Voltage (V)	Output Current (mA)	Description	Buy Now*
AHV12V6KV3MAW		6000	3	Positive 6kV 3mA module with lead wires	
AHV12V7KV1MAW		7000	1	Positive 7kV 1mA module with lead wires	
AHV12V7KV2MAW		7000	2	Positive 7kV 2mA module with lead wires	
AHV12V8KV1MAW		8000	1	Positive 8kV 1mA module with lead wires	
AHV12V8KV2R5MAW		8000	2.5	Positive 8kV 2.5mA module with lead wires	
AHV12V9KV1MAW		9000	1	Positive 9kV 1mA module with lead wires	
AHV12V10KV1MAW		10,000	1	Positive 10kV 1mA module with lead wires	
AHV12V25KV1MAW		25,000	1	Positive 30kV 0.7mA module with lead wires	
AHV12V30KVR5MAW		30,000	0.5	Positive 30kV 0.7mA module with lead wires	
AHV12VN500V1MAW		−500	1	Negative 500V 1mA module with lead wires	
AHV12VN500V2MAW		−500	2	Negative 500V 2mA module with lead wires	
AHV12VN500V5MAW		−500	5	Negative 500V 5mA module with lead wires	
AHV12VN500V10MAW		−500	10	Negative 500V 10mA module with lead wires	
AHV12VN500V20MAW		−500	20	Negative 500V 20mA module with lead wires	
AHV12VN500V50MAW		−500	50	Negative 500V 50mA module with lead wires	
AHV12VN1KV1MAW		−1000	1	Negative 1kV 1mA module with lead wires	
AHV12VN1KV2MAW		−1000	2	Negative 1kV 2mA module with lead wires	
AHV12VN1KV3MAW		−1000	3	Negative 1kV 3mA module with lead wires	
AHV12VN1KV5MAW		−1000	5	Negative 1kV 5mA module with lead wires	
AHV12VN1KV10MAW		−1000	10	Negative 1kV 10mA module with lead wires	
AHV12VN1KV20MAW		−1000	20	Negative 1kV 20mA module with lead wires	
AHV12VN1500V1MAW		−1500	1	Negative 1.5kV 1mA module with lead wires	
AHV12VN1500V2MAW		−1500	2	Negative 1.5kV 2mA module with lead wires	
AHV12VN1500V3MAW		−1500	3	Negative 1.5kV 3mA module with lead wires	
AHV12VN1500V5MAW		−1500	5	Negative 1.5kV 5mA module with lead wires	
AHV12VN1500V10MAW		−1500	10	Negative 1.5kV 10mA module with lead wires	
AHV12VN2KV1MAW		−2000	1	Negative 2kV 1mA module with lead wires	
AHV12VN2KV3MAW		−2000	3	Negative 2kV 3mA module with lead wires	
AHV12VN2KV5MAW		−2000	5	Negative 2kV 5mA module with lead wires	
AHV12VN2KV10MAW		−2000	10	Negative 2kV 10mA module with lead wires	

Part #	Datasheet	Output Voltage (V)	Output Current (mA)	Description	Buy Now*
AHV12VN2500V1MAW		−2500	1	Negative 2.5kV 1mA module with lead wires	
AHV12VN2500V3MAW		−2500	3	Negative 2.5kV 3mA module with lead wires	
AHV12VN2500V5MAW		−2500	5	Negative 2.5kV 5mA module with lead wires	
AHV12VN3KV1MAW		−3000	1	Negative 3kV 1mA module with lead wires	
AHV12VN3KV2MAW		−3000	2	Negative 3kV 2mA module with lead wires	
AHV12VN3KV3MAW		−3000	3	Negative 3kV 3mA module with lead wires	
AHV12VN3KV5MAW		−3000	5	Negative 3kV 5mA module with lead wires	
AHV12VN3KV10MAW		−3000	10	Negative 3kV 10mA module with lead wires	
AHV12VN4KV1MAW		−4000	1	Negative 4kV 1mA module with lead wires	
AHV12VN4KV2R5MAW		−4000	2.5	Negative 4kV 2.5mA module with lead wires	
AHV12VN4KV5MAW		−4000	5	Negative 4kV 5mA module with lead wires	
AHV12VN5KV1MAW		−5000	1	Negative 5kV 1mA module with lead wires	
AHV12VN5KV2MAW		−5000	2	Negative 5kV 2mA module with lead wires	
AHV12VN5KV4MAW		−5000	4	Negative 5kV 4mA module with lead wires	
AHV12VN6KV1MAW		−6000	1	Negative 6kV 1mA module with lead wires	
AHV12VN6KV3MAW		−6000	3	Negative 6kV 3mA module with lead wires	
AHV12VN7KV1MAW		−7000	1	Negative 7kV 1mA module with lead wires	
AHV12VN7KV2MAW		−7000	2	Negative 7kV 2mA module with lead wires	
AHV12VN8KV1MAW		−8000	1	Negative 8kV 1mA module with lead wires	
AHV12VN8KV2R5MAW		−8000	2.5	Negative 8kV 2.5mA module with lead wires	
AHV12VN9KV1MAW		−9000	1	Negative 9kV 1mA module with lead wires	
AHV12VN10KV1MAW		−10000	1	Negative 10kV 1mA module with lead wires	
AHV12VN25KV1MAW		−25000	1	Negative 25kV 1mA module with lead wires	
AHV12VN30KVR5MAW		−30000	0.5	Negative 30kV 0.5mA module with lead wires	

*: both and are our online store icons. Our products can be ordered from either one of them with the same pricing and delivery time.

NOTICE

1. It is important to carefully read and follow the warnings, cautions, and product-specific notes provided with electronic components. These instructions are designed to ensure the safe and proper use of the component

and to prevent damage to the component or surrounding equipment. Failure to follow these instructions could result in malfunction or failure of the component, damage to surrounding equipment, or even injury or harm to individuals. Always take the necessary precautions and seek professional assistance if unsure about proper use or handling of electronic components.

2. Please note that the products and specifications described in this publication are subject to change without prior notice as we continuously improve our products. Therefore, we recommend checking the product descriptions and specifications before placing an order to ensure that they are still applicable. We also reserve the right to discontinue the production and delivery of certain products, which means that not all products named in this publication may always be available.
3. This means that while ATI may provide information about the typical requirements and applications of their products, they cannot guarantee that their products will be suitable for all customer applications. It is the responsibility of the customer to evaluate whether an ATI product with the specified properties is appropriate for their particular application.
4. ATI warrants its products to perform according to specifications for one year from the date of sale, except when damaged due to excessive abuse. If a product fails to meet specifications within one year of the sale, it can be exchanged free of charge.
5. ATI reserves the right to make changes or discontinue products or services without notice. Customers are advised to obtain the latest information before placing orders.
6. All products are sold subject to terms and conditions of sale, including those pertaining to warranty, patent infringement, and limitation of liability. Customers are responsible for their applications using ATI products, and ATI assumes no liability for applications assistance or customer product design.
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9. ATI retains ownership of all rights for special technologies, techniques, and designs for its products and projects, as well as any modifications, improvements, and inventions made by ATI.
10. Despite operating the electronic modules as specified, malfunctions or failures may occur before the end of their usual service life due to the current state of technology. Therefore, it is crucial for customer applications that require a high level of operational safety, especially in accident prevention or life-saving systems where the malfunction or failure of electronic modules could pose a risk to human life or health, to ensure that suitable measures are taken. The customer should design their application or implement protective circuitry or redundancy to prevent injury or damage to third parties in the event of an electronic module malfunction or failure.

