

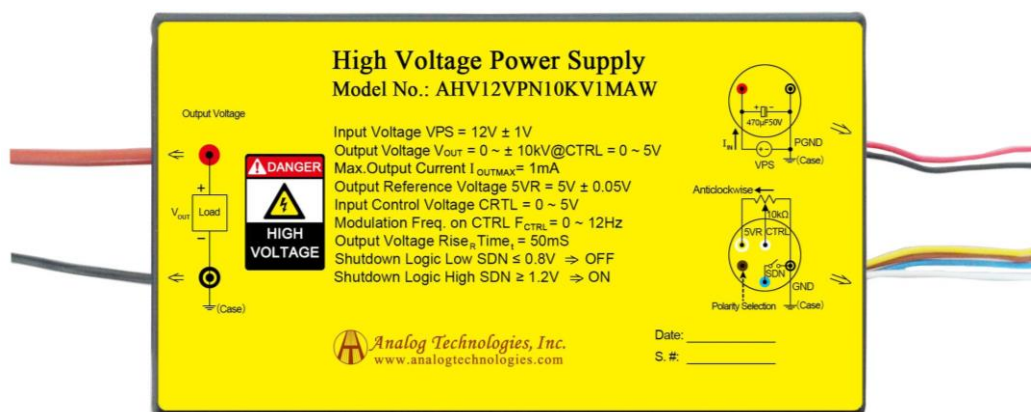


Figure 1. Top View of AHV12VPN10KV1MAW

FEATURES

- Input Power Voltage: 12V ± 1V
- Input Current Range: 250mA to 1.2A
- Output Voltage: 0 to ±10kV@CTRL = 0 to 5V
- Max. Output Current: 1mA
- Reference Voltage: 5V ± 0.05V
- Input Control Voltage: 0 to 5V
- Full Span Modulation on Output Voltage
- Electronic Shutdown Control

APPLICATIONS

This power module, AHV12VPN10KV1MAW, 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

DESCRIPTION

Figure 2 shows the connecting wires of AHV12VPN10KV1MAW, of which their detail information given in Table 1. The output voltage can be set to a constant value by connecting the CTRL port to the central tap of a POT (Potentiometer) corresponding to 0V to ±10kV proportionally at the output VOUT port as shown in Figure 3.

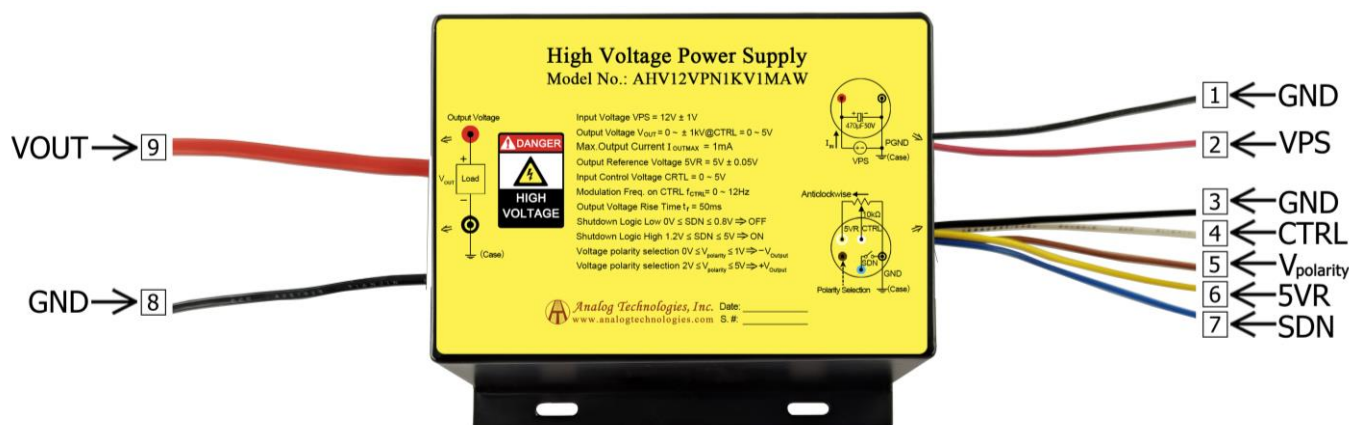


Figure 2. The Connecting Lead Wires of AHV12VPN10KV1MAW

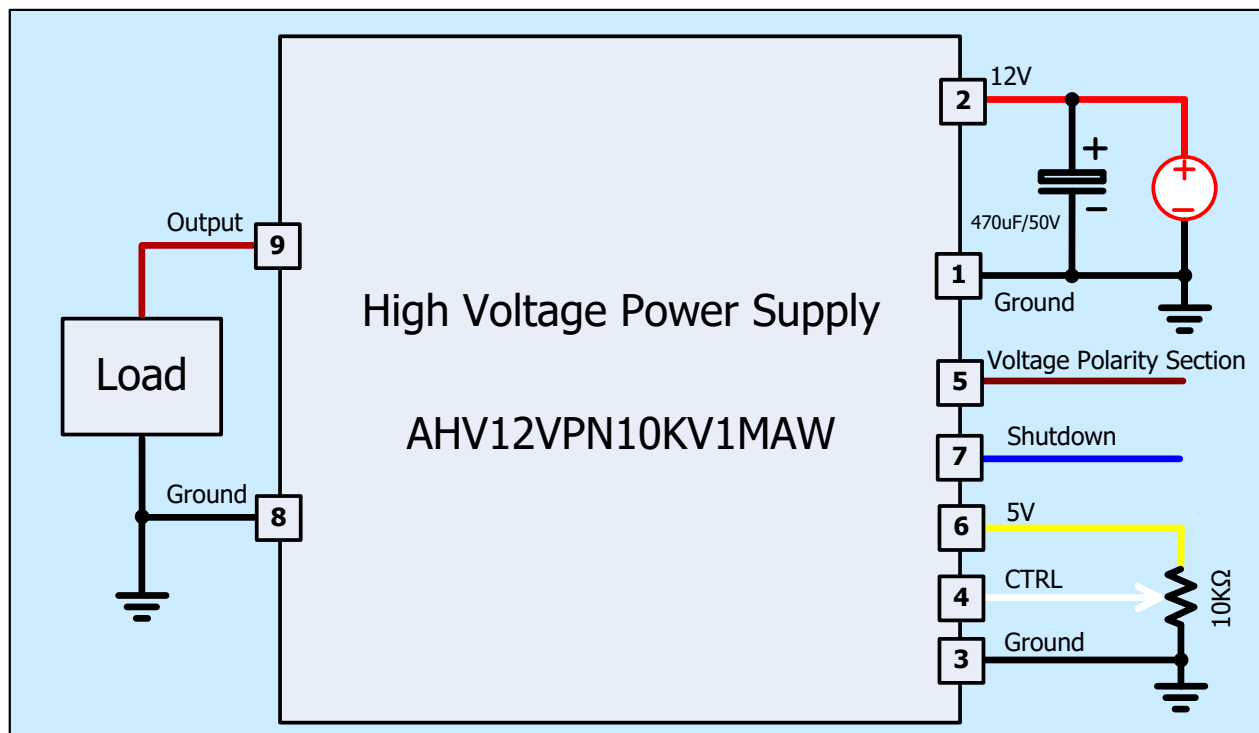
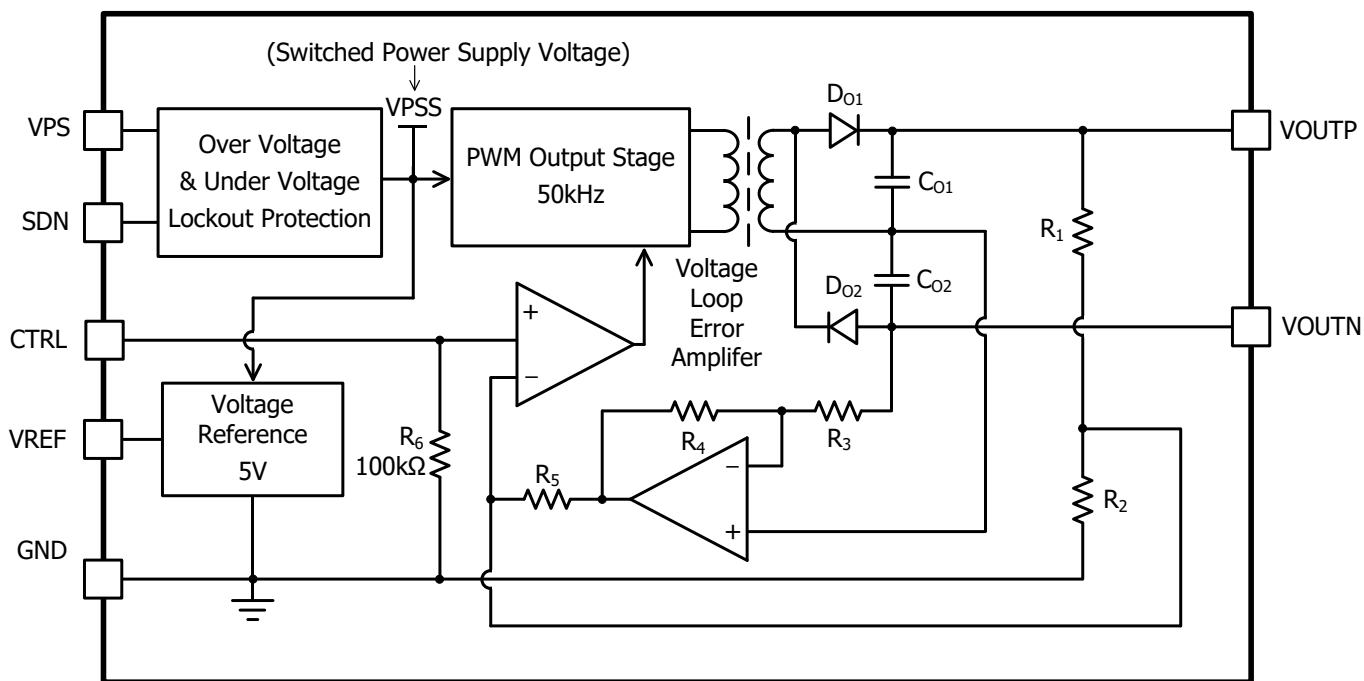


Figure 3. Setting Output to be a Constant Voltage



$$VOUTP = -VOUTN = N \times V_{CTRL}, \text{ Where } N \text{ is the amplification factor: } N = R_1/R_2 = R_3/R_4, R_5 = R_1//R_2$$

Figure 4. High Voltage Power Supply Function Block Diagram



Table 1. Pin Names, Colors, Functions and Specifications.

No.	Name	Color		Type	Description	Min.	Typ.	Max.
1	GND	Black		Ground for analog, digital and power signals.	Input GND		0V	
2	VPS	Red		Power input	Input voltage		12V	
3	GND	Black		Ground for analog, digital and power signals.	Control GND		0V	
4	CTRL	White		Analog input	Regulation	0V		5V
5	V _{Polarity}	Brown		Analog input Voltage Polarity Section	Positive Output Voltage	2V		5V
					Negative Output Voltage	0V		1V
6	5VR	Yellow		Analog output	Reference voltage		5V	
7	SDN	Blue		Digital input	Shutdown logic low	0V		0.8V
					Shutdown logic high	1.2V		5V
8	GND	Black		Power output	Output GND		0V	
9	VOUT	Brown		Power output	Output high voltage	0V		±10kV

SPECIFICATIONS

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

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit/Note
Input Power Supply Voltage	V _{VPS}		11	12	13	V
Input Power Supply Quiescent Current	I _{VPS_QC}	I _{VOUT} = 0mA	250	300	350	mA
Input Power Supply Current at Full Load	I _{VPS_FL}	I _{VOUT} = 1mA	1.1	1.2	1.3	A
Input Power 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}	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	V _{VOUT}	I _{VOUT} = 0 ~ 1mA	0		±10000	V
Output Current Range	I _{VOUTMAX}	V _{VPS} = 11V ~ 13V	0		1	mA



Parameter		Symbol	Test Conditions	Min.	Typ.	Max.	Unit/Note
Reference Voltage Output Range		V_{5VR}	$T_A = -10^{\circ}\text{C} \sim 55^{\circ}\text{C}$ $I_{5VR} \leq 1\text{mA}$	4.95	5	5.05	V
Output Load Resistance Range				$\frac{V_{VOUT}}{I_{VOUT}}$		∞	$\text{M}\Omega$
Output Voltage Ripple		V_{VOUT_RP}	Bandwidth = 1MHz $R_{LOAD} = 10\text{M}\Omega$	≤ 5			V_{P-P}
Output Voltage Temperature Coefficient		TCV_{VOUT}	$V_{VPS} = 12\text{V}$ $V_{CTRL} = V_{5VR} = 5\text{V}$ $V_{VOUT} = \pm 10\text{kV}$ $I_{VOUT} = 1\text{mA}$ $T_A = -10^{\circ}\text{C} \sim 55^{\circ}\text{C}$		≤ 0.1		$\%/^{\circ}\text{C}$
Output Voltage Range v.s. Temperature		$V_{VOUT}(T)$	$V_{VPS} = 12\text{V}$ $V_{CTRL} = V_{5VR} = 5\text{V}$ $V_{VOUT} = \pm 10\text{kV}$ $I_{VOUT} = 1\text{mA}$ $T_A = -10^{\circ}\text{C} \sim 55^{\circ}\text{C}$	$0.99V_{VOUT}$	V_{VOUT}	$1.01V_{VOUT}$	V
Output Voltage Drift	Short Term Drift	$\frac{\Delta V_{VOUT}/V_{VOUT}}{\Delta t (\text{min})}$	$V_{VPS} = 12\text{V}$ $V_{CTRL} = V_{5VR} = 5\text{V}$ $V_{VOUT} = \pm 10\text{kV}$ $I_{VOUT} = 1\text{mA}$ $T_A = -10^{\circ}\text{C} \sim 55^{\circ}\text{C}$		≤ 0.3		$\%/ \text{min}$
	Long Term Drift	$\frac{\Delta V_{VOUT}/V_{VOUT}}{\Delta t (\text{h})}$			≤ 0.5		$\%/ \text{h}$
Output Voltage Rise Time		t_r	$V_{VOUT}(t_1) = \pm 1000\text{V}$ $V_{VOUT}(t_2) = \pm 9000\text{V}$ $R_{LOAD} = 10\text{M}\Omega$		50		ms
Output Voltage Fall Time		t_f	$V_{VOUT}(t_2) = \pm 9000\text{V}$ $V_{VOUT}(t_3) = \pm 1000\text{V}$ $R_{LOAD} = 10\text{M}\Omega$		100		ms
Mean Time Between Failure		MTBF			1M		h
Instantaneous Short Circuit Current at the Output		I_{VOUT_SC}			≤ 100		mA
Load Regulation		$\frac{\Delta V_{VOUT}/V_{VOUT}}{\Delta I_{VOUT}}$	$V_{VOUT} = \pm 10\text{kV}$ $I_{VOUT} = 1\text{mA}$		≤ 0.05		$\%/ \text{mA}$
Full Load Efficiency		η	$V_{VPS} = 12\text{V}$ $V_{VOUT} = \pm 10\text{kV}$ $I_{VOUT} = 1\text{mA}$		≥ 70		%
Operating Temperature Range		T_{opr}		-10		55	$^{\circ}\text{C}$
Storage Temperature Range		T_{stg}		-20		85	$^{\circ}\text{C}$
External Dimensions				140×100×55			mm
				5.51×3.94×2.17			inch
Weight					1000		g
					2.21		lbs
					35.27		Oz



TESTING DATA

Test conditions: $V_{PS} = 12V$, $T_A = 25^\circ C$, $R_{LOAD} = 10M\Omega$

DC Testing

The measured output voltage, V_{OUT} , corresponding to the control port input voltage, V_{CTRL} , is shown in Figure 5. A 2V or higher input voltage is applied to voltage polarity selection, the output voltage is positive. When a 1V or lower input voltage is applied to voltage polarity selection, the output voltage is negative.

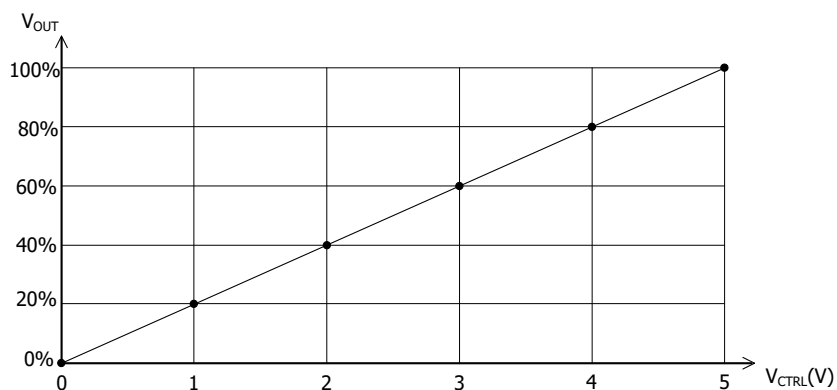


Figure 5. V_{CTRL} vs. V_{OUT}

AC Testing

To test the analog modulation function, a triangle and sine-wave voltage signals are applied to the CTRL port as the input source signal respectively. Figure 6 and 7 show both the input signal and the output signal waveforms when using the triangle and sine-wave signals at the CTRL port respectively.

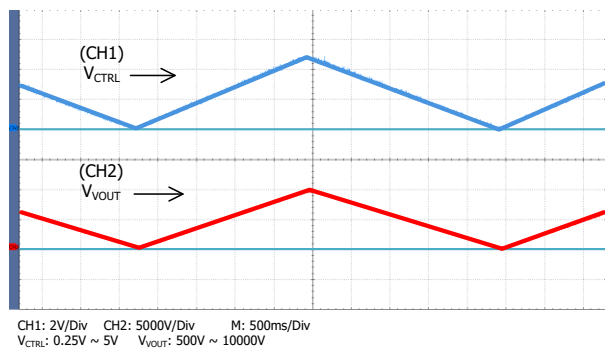


Figure 6A. Triangle Wave Modulation ($V_{OUT}=10kV$)

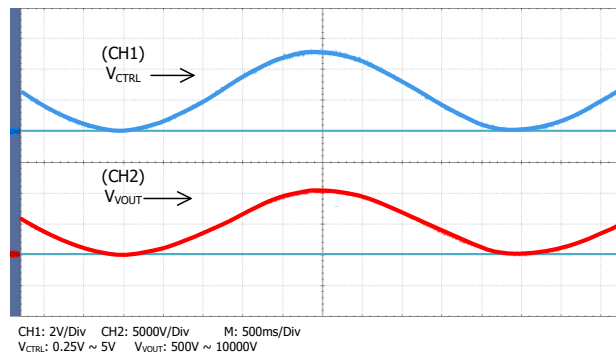


Figure 7A. Sine Wave Modulation ($V_{OUT}=10kV$)

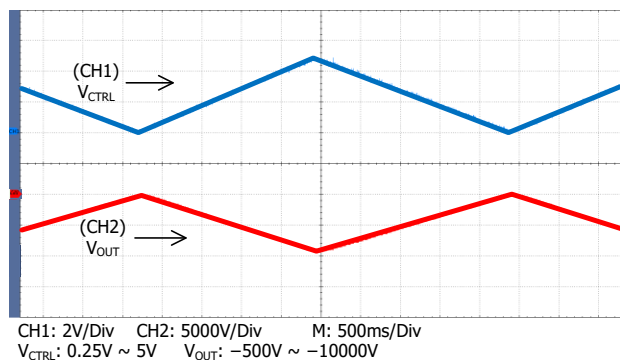


Figure 6B. Triangle Wave Modulation ($V_{OUT}= -10kV$)

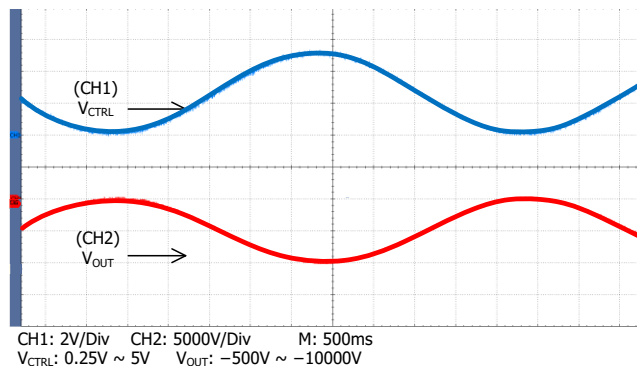


Figure 7B. Sine Wave Modulation ($V_{OUT}= -10kV$)



To test the rise and fall times at the output, a step function signal is applied to the CTRL port. The testing results are shown in Figure 8, Figure 9, and Figure 10. As shown in Figure 9 and Figure 10, a square wave of 0.25V ~ 5V, $f = 0.1\text{Hz}$, is applied to CTRL port, the output waveform fall time is measured to be about 100ms and the rise time is about 50ms. These two values are not the same, that is because on the rising trail, the power supply injects a current to the load; while on the falling trail, the best the power supply can do is to stop its output current and let the load resistor drain the output filtering capacitor to a lower voltage, and the draining current is much smaller than the injection current.

V_{OUT} = 10kV

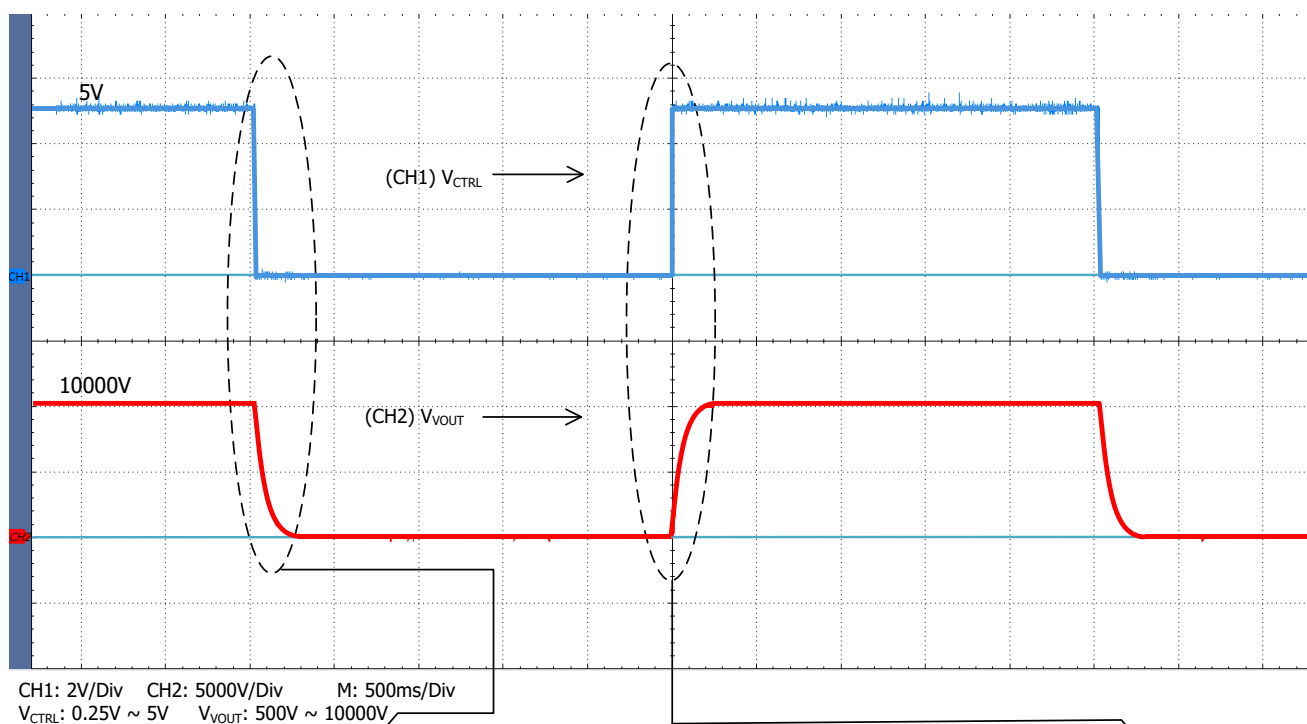


Figure 8A. Input vs. Output Waveforms for Square Wave Control

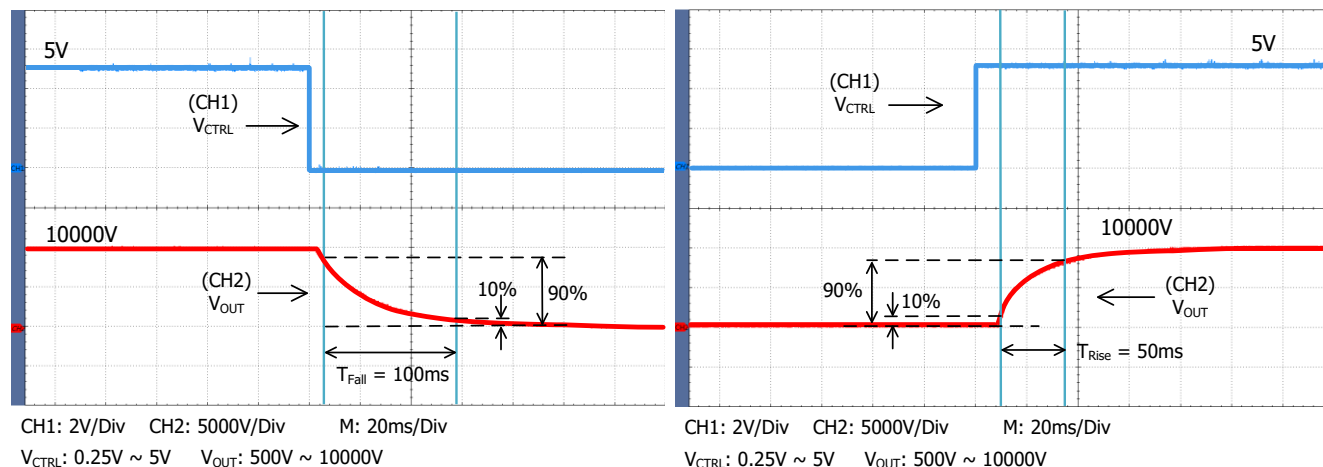


Figure 9A. Falling Trail for Large Signal Response

Figure 10A. Rising Trail for Large Signal Response



$V_{OUT} = -10kV$

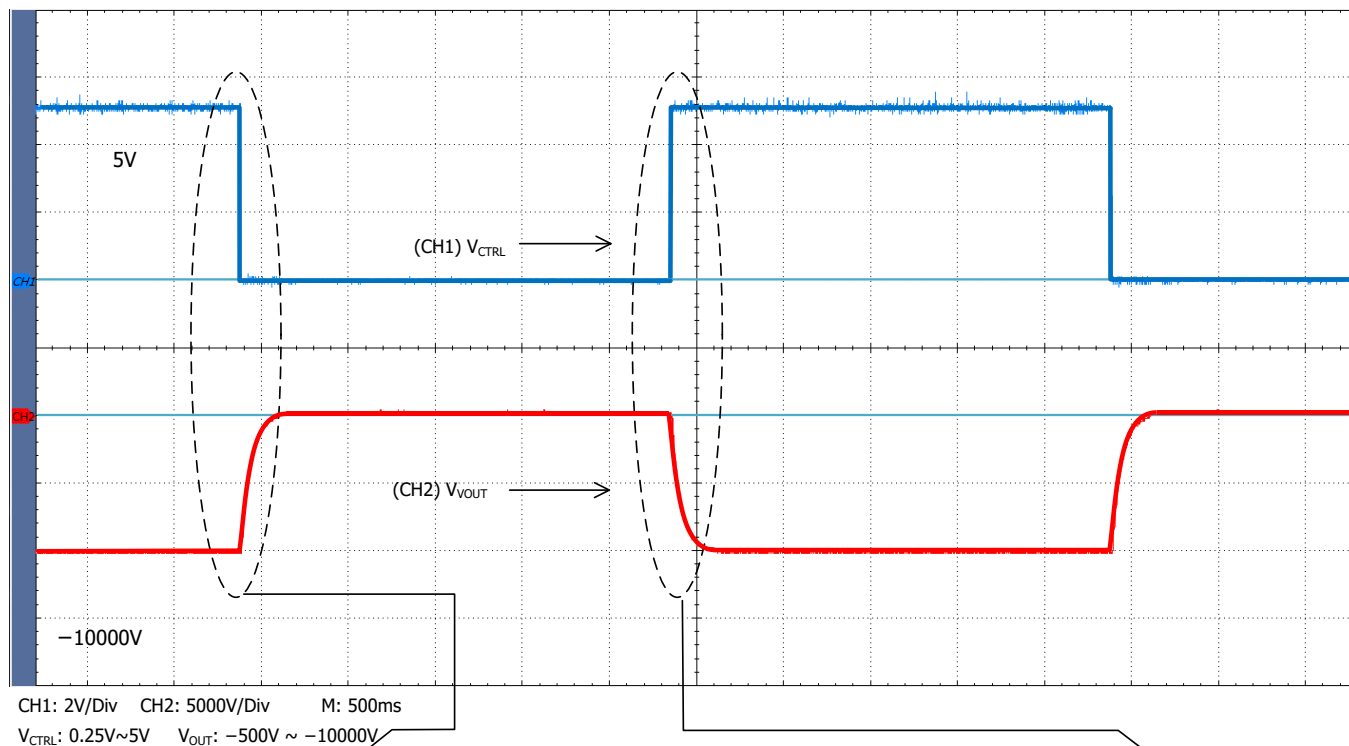


Figure 8B. Input vs. Output Waveforms for Square Wave Control

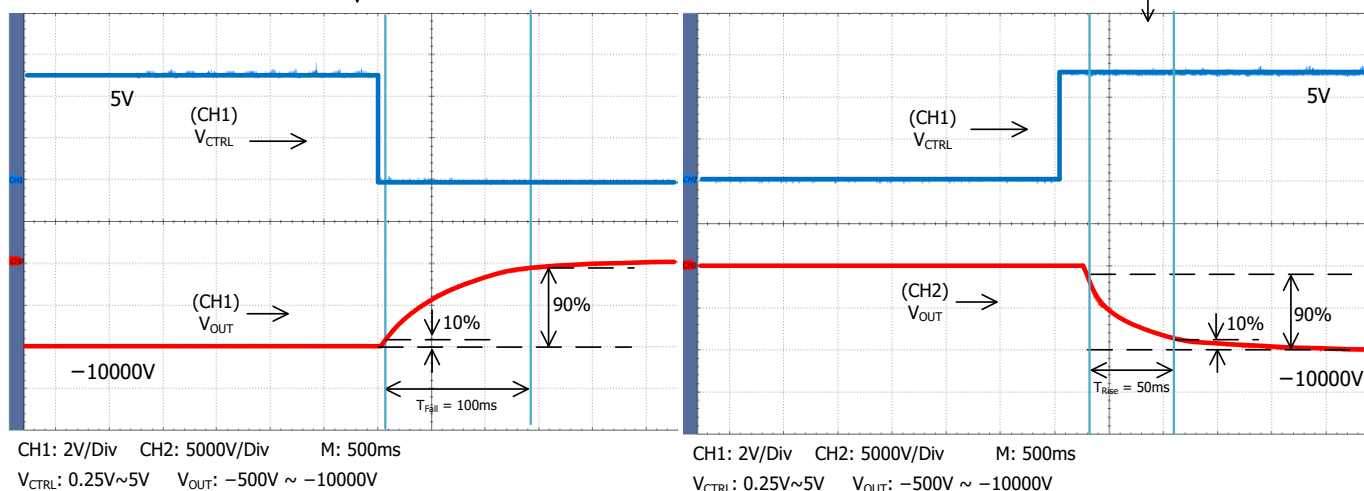


Figure 9B. Falling Trail for Large Signal Response

Figure 10B. Rising Trail for Large Signal Response



NAMING PRINCIPLE

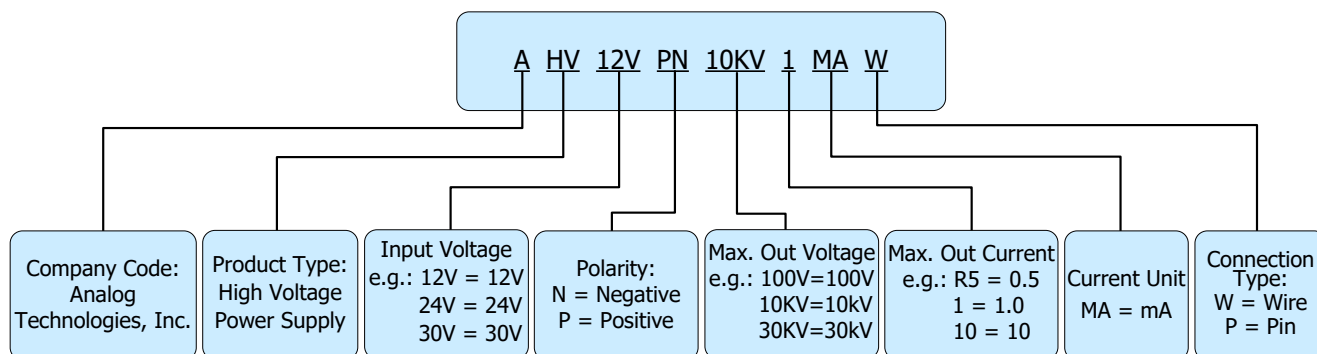


Figure 11. Naming Principle of AHV12VPN10KV1MAW

DIMENSIONS

Connecting Lead Wire Sizes and Lengths

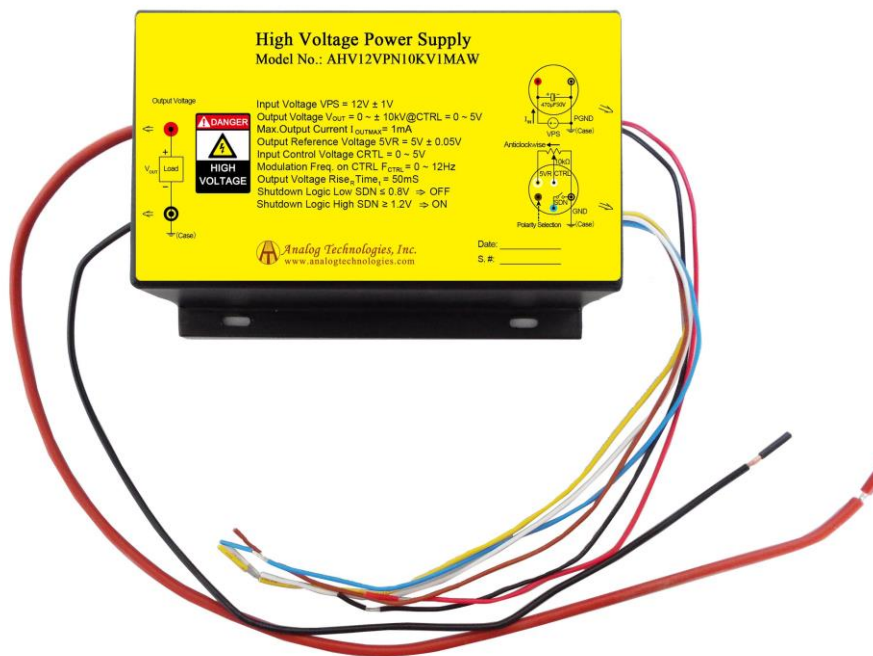


Figure 12. Connecting Lead Wires of AHV12VPN10KV1MAW

Lead Wires	Diameter		Length	
	mm	inch	mm	inch
Thick brown lead wire	8.0	0.32	330 ± 1	12.99 ± 0.039
Black lead wire	2.6	0.10	330 ± 1	12.99 ± 0.039
Yellow, red, blue, black and white lead wires	2.6	0.10	330 ± 1	12.99 ± 0.039

Outline Dimensions

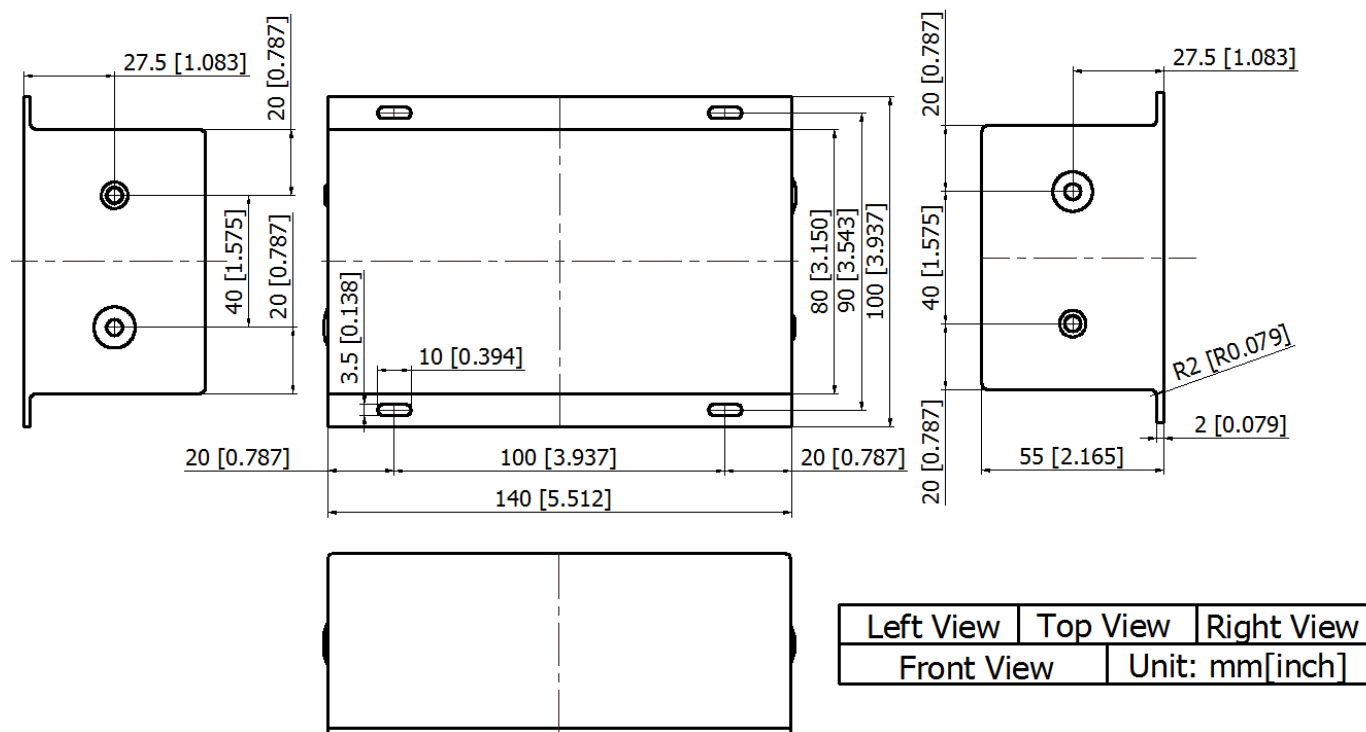


Figure 13. Outline Dimensions

ORDERING INFORMATION

Part Number	Buy Now
AHV12VPN10KV1MAW	 *  *

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	 *  *



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	 * 

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