

Figure 1.1. Top View of AHV24VN2KV2MAW



Figure 1.2. Side View

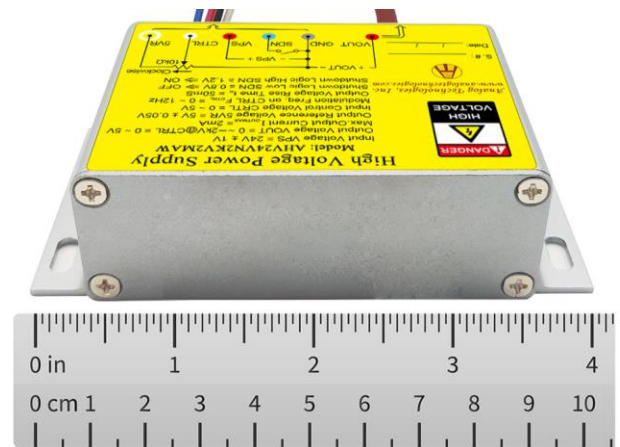


Figure 1.3. Side View



Figure 1.4. Side View

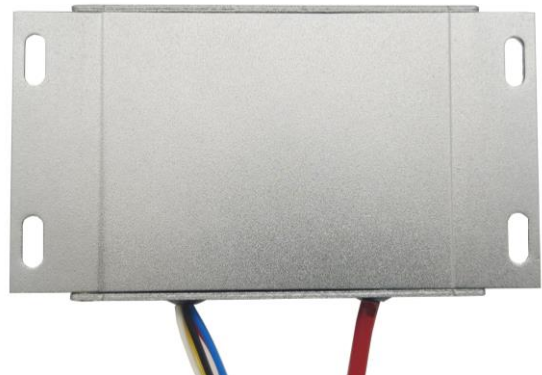


Figure 1.5. Bottom View



FEATURES

- Input Power Voltage: 24V ± 1V
- Input Current Range: 50mA to 240mA
- Output Voltage: 0 to -2kV@CTRL = 0 to 5V
- Max. Output Current: 2mA
- Reference Voltage: 5V ± 0.05V
- Input Control Voltage: 0 to 5V
- Electronic Shutdown Control Available
- Zero EMIs and Good Heat Sinking by Metal Enclosure

APPLICATIONS

This power module, AHV24VN2KV2MAW, 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

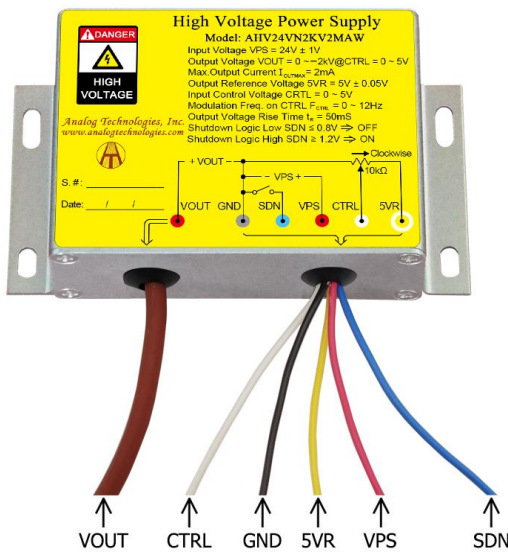


Figure 2. The Connecting Lead Wires of AHV24VN2KV2MAW

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

No.	Name	Description	Type	Color		Min.	Typ.	Max.
1	SDN	Shutdown logic low	Digital input	●	Blue	0V		0.8V
		Shutdown logic high				1.2V		5V
2	5VR	Reference voltage	Analog output	●	Yellow		5V	
3	CTRL	Regulation	Analog input	○	White	0V		5V
4	VPS	Input voltage	Power supply input	●	Red	23V	24V	25V
5	GND	Ground	Ground for power supply and analog & digital signals	●	Black		0V	
6	VOUT	Output high voltage	Power output	●	Brown	0V		-2kV



DESCRIPTION

Figure 1 shows the actual pictures of AHV24VN2KV2MAW. Figure 2 shows its connecting wires. More detail information is given in Table 1. The high voltage output can be set to a constant value between 0V to -2kV by connecting the CTRL port to the central tap of a POT (Potentiometer) or modulated by an AC signal ranging from 0V to 5V, as see Figure 3 and Figure 4 respectively. The output voltage equals to 400 times the input control voltage: $V_{OUT} = 400 \times V_{CTRL}$.

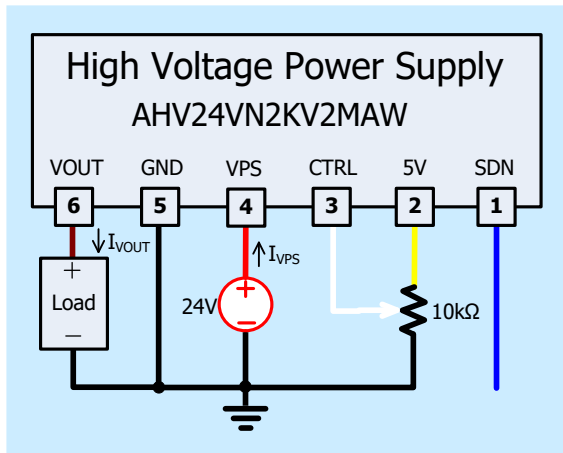


Figure 3. Setting Output to be a Constant Voltage

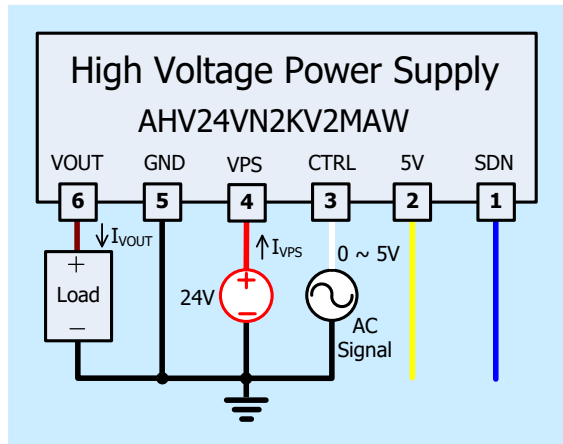


Figure 4. Modulating Output by an AC Signal Source

Please note that the modulation signal must have a low frequency $\leq 12\text{Hz}$ and the value range must be $0\text{V} \leq V_{CTRL} \leq 5\text{V}$. The equivalent input circuit for the CTRL is shown in Figure 5.

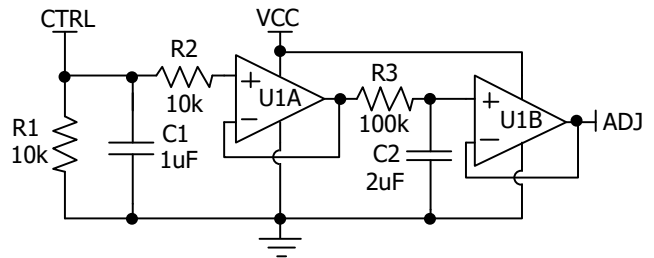


Figure 5. The Equivalent Circuit for CTRL Port

To shutdown AHV24VN2KV2MAW, pull down SDN pin to $< 0.8\text{V}$; to turn it on, leave SDN pin unconnected or pull it $> 1.2\text{V}$. The maximum voltage allowed on the SDN pin is 5V. The equivalent circuit for SDN port is shown in Figure 6.

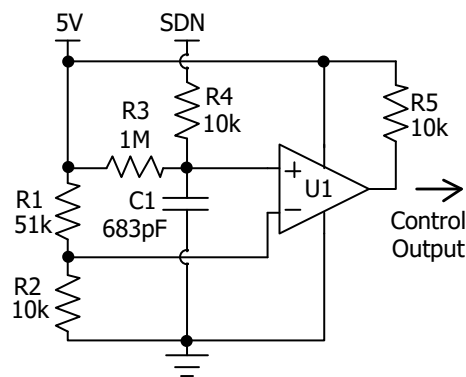


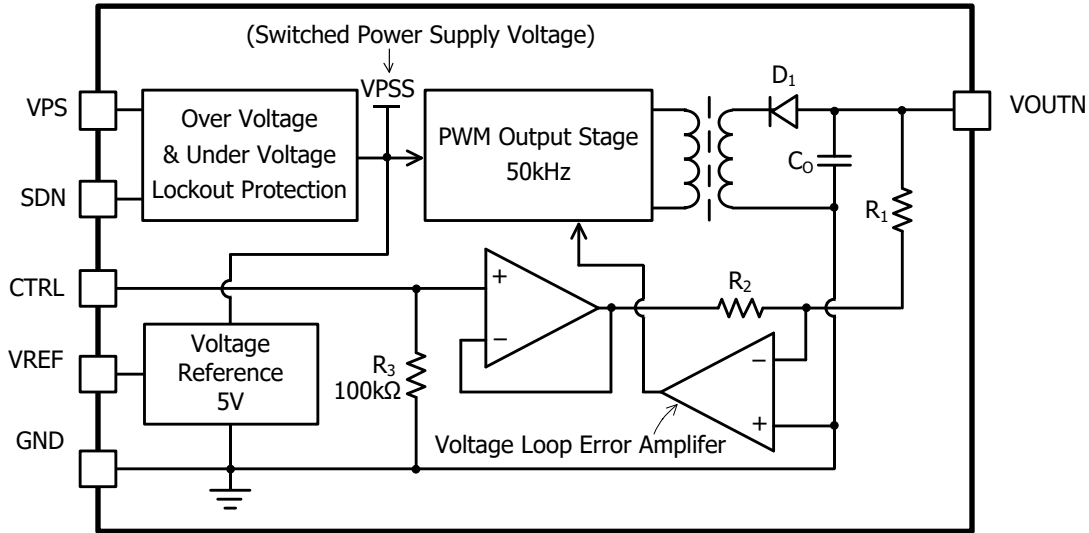
Figure 6. The Equivalent Circuit for SDN Port

USING AHV24VN2KV2MAW

This high voltage power supply must be mounted tightly onto a metal plate, ideally, thus expanding its heating sinking capacity of the metal enclosure. Sufficient ventilation must be provided to keep the power supply surface temperature under 55°C .

SAFETY PRECAUTIONS

Although AHV24VN2KV2MAW high voltage power supply comes with an over current protection circuit, a short circuit at the output should always be avoided. Make sure the high voltage wire for connecting VOUT node has sufficient insulation capability with its surrounding objects.



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

High Voltage Power Supply Function Block Diagram

SPECIFICATIONS

Table 2. Characteristics. $T_A = 25^\circ\text{C}$, unless otherwise noted.

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit/Note
Input Power Supply Voltage	V_{VPS}		23	24	25	V
Input Power Supply Quiescent Current	I_{VPS_QC}	$I_{VOUT} = 0\text{mA}$ $V_{SDN} = V_{CTRL} = 5\text{V}$	50	60	70	mA
Input Power Supply Current at Full Load	I_{VPS_FL}	$I_{VOUT} = 3.0\text{mA}$	190	240	290	mA
Input Power Supply Current at Shutdown	I_{VPS_SHDN}	$T_A = -10^\circ\text{C} \sim 55^\circ\text{C}$		16		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}	$0 \leq V_{SDNL} < 0.8\text{V}$	-5		-4.2	μA
	I_{SDNH}	$1.2\text{V} < V_{SDNL} < 5\text{V}$	0		3.8	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}	$I_{VOUT} = 0 \sim 2.0\text{mA}$	0		-2000	V
Output Current Range	$I_{VOUTMAX}$	$V_{VPS} = 23\text{V} \sim 25\text{V}$	0		2.0	mA
Reference Output Voltage 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
Reference Output Current Range	I_{5VR}	$T_A = -10^\circ\text{C} \sim 55^\circ\text{C}$ $V_{5VR} = 0 \sim 5\text{V}$	0		1	mA



Parameter		Symbol	Test Conditions	Min.	Typ.	Max.	Unit/Note
Output Load Resistance Range				$\frac{V_{VOUT}}{I_{VOUT}}$		∞	M Ω
Output Voltage Ripple		V_{VOUT_RP}	Bandwidth = 1MHz $R_{LOAD} = 1M\Omega$ $V_{VOUT} = -2kV$	≤ 1.0			V_{P-P}
Output Voltage Temperature Coefficient		TCV_{VOUT}	$V_{VPS} = 24V$ $V_{CTRL} = V_{5VR} = 5V$ $V_{VOUT} = -2kV$ $I_{VOUT} = 2mA$ $T_A = -10^{\circ}C \sim 55^{\circ}C$		≤ 0.01		%/ $^{\circ}C$
Output Voltage Range v.s. Temperature		$V_{VOUT}(T)$	$V_{VPS} = 24V$ $V_{CTRL} = V_{5VR} = 5V$ $V_{VOUT} = -2kV$ $I_{VOUT} = 2mA$ $T_A = -10^{\circ}C \sim 55^{\circ}C$	$0.99V_{VOUT}$	V_{VOUT}	$1.01V_{VOUT}$	V
Output Voltage Drift	Short Term Drift	$\frac{ \Delta V_{VOUT} }{V_{VOUT}}$ Δt (min)	$V_{VPS} = 24V$ $V_{CTRL} = V_{5VR} = 5V$ $V_{VOUT} = -2kV$ $I_{VOUT} = 2mA$ $T_A = -10^{\circ}C \sim 55^{\circ}C$		≤ 0.5		%/min
	Long Term Drift	$\frac{ \Delta V_{VOUT} }{V_{VOUT}}$ Δt (h)			≤ 1		%/h
Output Voltage Rise Time		t_r	$V_{VOUT}(t_1) = -200V$ $V_{VOUT}(t_2) = -1800V$ $R_{Load} = 1M\Omega$		50		ms
Output Voltage Fall Time		t_f	$V_{VOUT}(t_2) = -1800V$ $V_{VOUT}(t_3) = -200V$ $R_{Load} = 1M\Omega$		100		ms
Mean Time Between Failure		MTBF			1M		h
Instantaneous Short Circuit Current at the Output		I_{VOUT_SC}			≤ 200		mA
Load Regulation		$\frac{ \Delta V_{VOUT} }{V_{VOUT}}$ ΔI_{VOUT}	$V_{VOUT} = -2kV$ $I_{VOUT} = 2mA$		≤ 0.05		%/mA
Full Load Efficiency		η	$V_{VPS} = 24V$ $V_{VOUT} = -2kV$ $I_{VOUT} = 2mA$		≥ 70		%
Operating Temperature Range		T_{opr}		-10		55	$^{\circ}C$
Storage Temperature Range		T_{stg}		-20		85	$^{\circ}C$
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: $V_{PS} = 24V$, $T_A = 25^{\circ}C$, $R_{LOAD} = 1M\Omega$

DC Testing

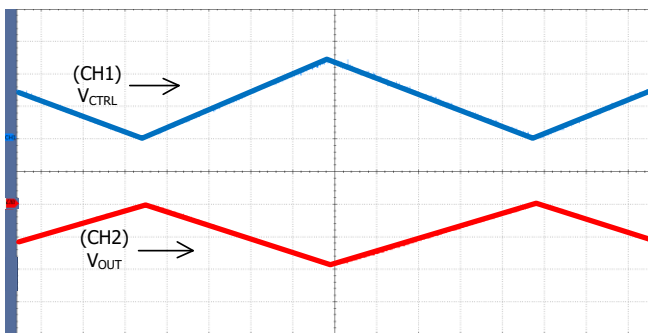
The measured output voltage, V_{OUT} , corresponding to the control port input voltage, V_{CTRL} , is shown in Figure 7.



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

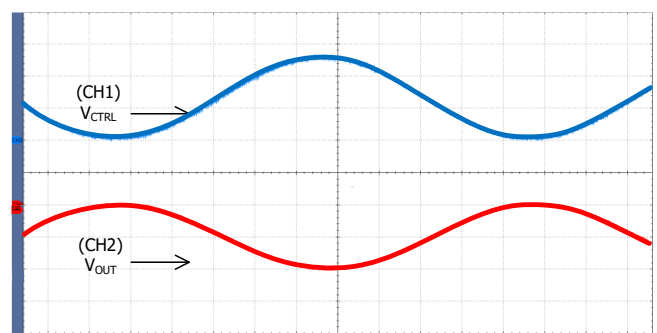
AC Testing

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 8 and 9 show both the input signal and the output signal waveforms when using the triangle and sine-wave signals at the CTRL port respectively.



CH1: 2V/Div CH2: 1000V/Div M: 500ms/Div
 V_{CTRL} : 0.25V ~ 5V V_{OUT} : -100V ~ -2000V

Figure 8. Triangle Wave Modulation



CH1: 2V/Div CH2: 1000V/Div M: 500ms
 V_{CTRL} : 0.25V ~ 5V V_{OUT} : -100V ~ -2000V

Figure 9. Sine Wave Modulation



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 10, Figure 11, and Figure 12. As shown in Figure 11 and Figure 12, a square wave of 0.25V ~ 5V, f = 0.10Hz, 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.

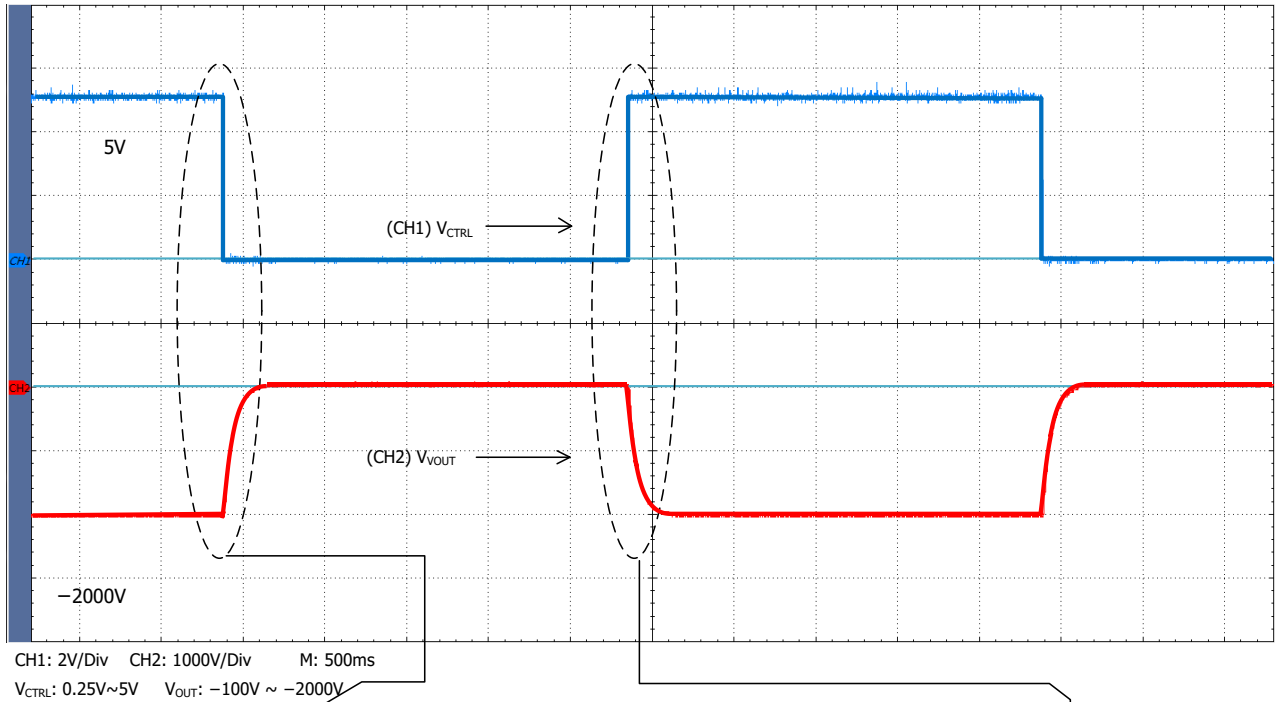


Figure 10. Input vs. Output Waveforms for Square Wave Control

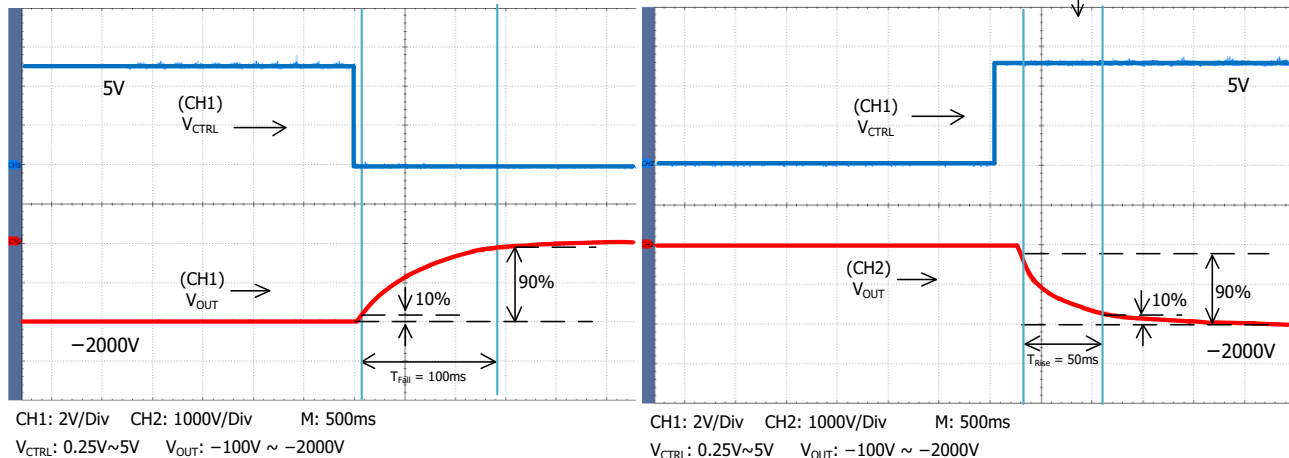
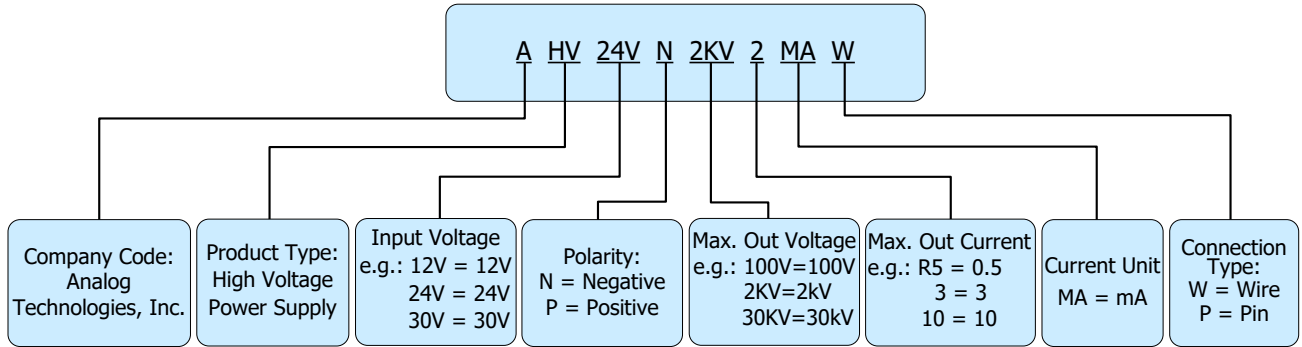


Figure 11. Falling Trail for Large Signal Response

Figure 12. Rising Trail for Large Signal Response



NAMING PRINCIPLE



Naming Principle of AHV24VN2KV2MAW

DIMENSIONS

Connecting Lead Wire Sizes and Lengths

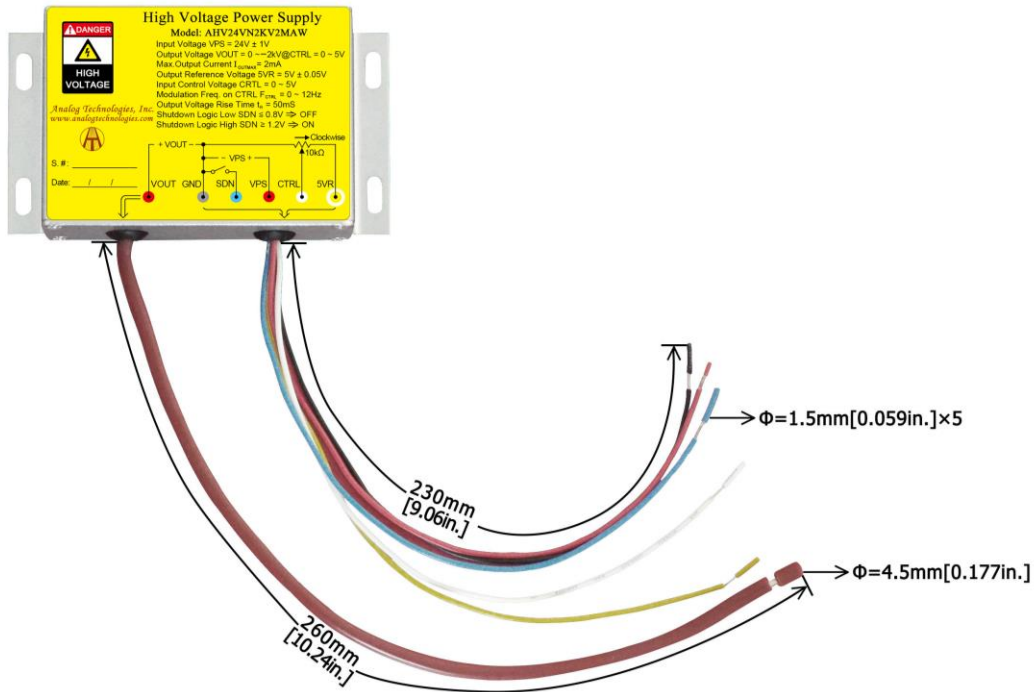


Figure 13. Connecting Lead Wires of AHV24VN2KV2MAW

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

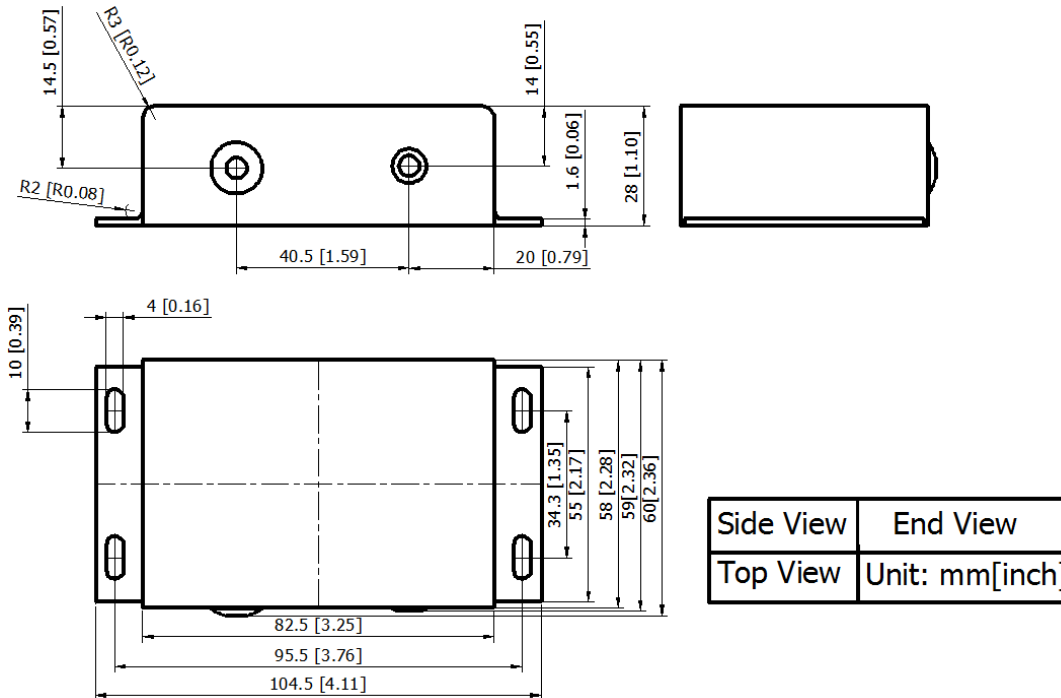


Figure 14. Outline Dimensions

ORDERING INFORMATION

Part Number	Buy Now
AHV24VN2KV2MAW	* *

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

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