Figure 1.1. Top View of AHV24V1KV5MAW

Figure 1.2. Side View

Figure 1.3. Side View

Figure 1.4. Side View

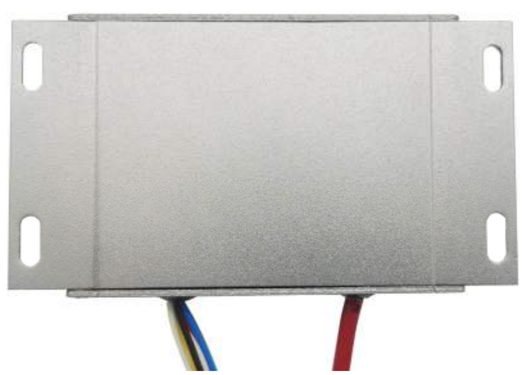


Figure 1.5. Bottom View

FEATURES

- Input Power Voltage: 24V ± 1V
- Input Current Range: 70mA to 275mA
- Output Voltage: 0 to 1kV@CTRL = 0 to 5V
- Max. Output Current: 5mA
- Reference Voltage: 5V ± 0.05V
- Input Control Voltage: 0 to 5V
- Full Span Modulation on Output Voltage
- Electronic Shutdown Control

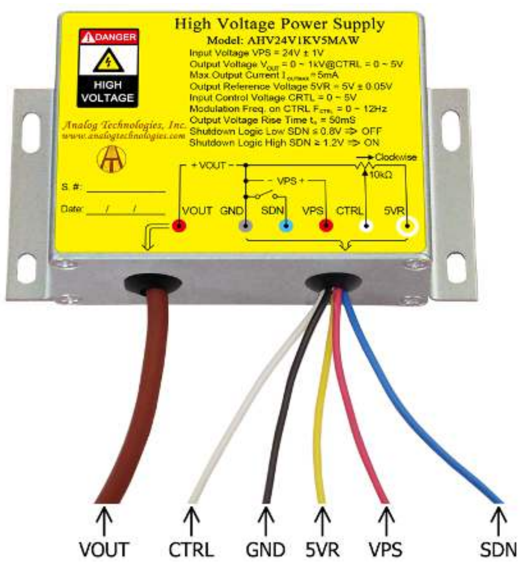


Figure 2. The Connecting Lead Wires of AHV24V1KV5MA

APPLICATIONS

This power module, AHV24V1KV5MAW, is designed for achieving DC-DC conversion from low voltage to high voltage as a power supply source which is widely used in scientific research and other fields including:

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

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

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

DESCRIPTION

Figure 2 shows the connecting wires of AHV24V1KV5MAW, 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) or modulated by an AC signal ranging from 0V to 5V corresponding to 0V to 1kV proportionally at the output VOUT port as shown in Figure 3 and Figure 4 respectively.

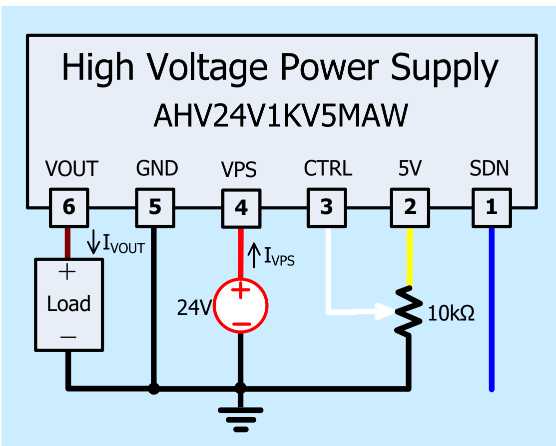


Figure 3. Setting Output to be a Constant Voltage

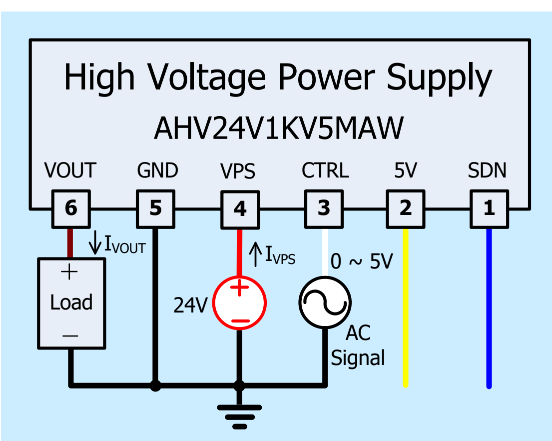


Figure 4. Modulating Output by an AC Signal Source

Please note that the modulation signal must have a low frequency ≤ 10Hz and the value range must be $0V \leq V_{CTRL} \leq 5V$. The equivalent input circuit for the CTRL is shown in Figure 5.

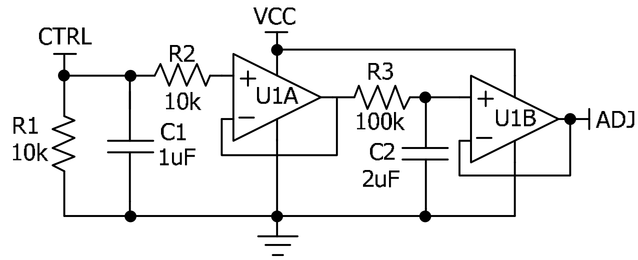


Figure 5. The Equivalent Circuit for CTRL Port

To shutdown AHV24V1KV5MAW, pull down SDN pin to <0.8V; to turn it on, leave SDN pin unconnected or pull it >1.2V. The maximum voltage allowed on the SDN pin is 5V. The equivalent circuit for SDN port is shown in Figure 6.

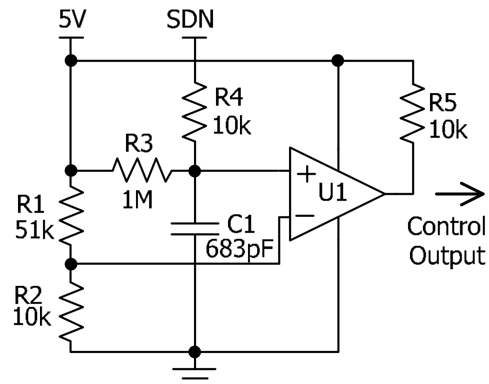


Figure 6. The Equivalent Circuit for SDN Port

USING AHV24V1KV5MAW

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 AHV24V1KV5MAW 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.

SPECIFICATIONS

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

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit/Note
Input Power Voltage	V_{VPS}		23	24	25	V
Input Power Quiescent Current	I_{VPS_QC}	I_{VOUT} = 0mA	70	80	90	mA
Input Power Current at Full Load	I_{VPS_FL}	I_{VOUT} = 5.0mA	255	275	300	mA
Input Power Current at Shutdown	I_{VPS_SHDN}	T_A = −10°C ~ 55°C		15		mA
Power Supply Rejection Ratio	PSRR (1)	V_{VPS} = 23V ~ 25V V_{CTRL} = V_{5VR} = 5V V_{VOUT} = 1kV I_{VOUT} = 5.0mA		TBD		dB
Modulation Voltage Range Frequency on CTRL	f_{CTRL}		0		12	Hz
Shutdown Port Current	I_{SDNL}	V_{SDNL} < 0.8V	−5		−4.2	μA
	I_{SDNH}	1.2V < V_{SDNL} < 5V	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	V_{VOUT}	I_{VOUT} = 0 ~ 5.0mA	0		1000	V
Output Current Range	$I_{VOUTMAX}$	V_{VPS} = 23V ~ 25V	0		5.0	mA
Reference Voltage Output Range	V_{5VR}	T_A = −10°C ~ 55°C I_{5VR} ≤ 5mA	4.98	5	5.02	V
Output Load Range			200		∞	kΩ
Output Voltage Ripple	V_{VOUT_RP}	Bandwidth = 1MHz R_{LOAD} = 200 kΩ		≤0.5		V_{P-P}
Output Voltage Ripple Frequency	f_{VOUT_RP}			TBD		Hz
Output Voltage Temperature Coefficient	TCV_{VOUT} (2)	V_{VPS} = 24V V_{CTRL} = V_{5VR} = 5V V_{VOUT} = 1kV I_{VOUT} = 5mA T_A = −10°C ~ 55°C		≤0.01		%/°C
Output Voltage Range v.s. Temperature	$V_{VOUT}(T)$	V_{VPS} = 24V V_{CTRL} = V_{5VR} = 5V V_{VOUT} = 1kV I_{VOUT} = 5mA T_A = −10°C ~ 55°C	$0.99V_{VOUT}$	V_{VOUT}	$1.01V_{VOUT}$	V
Output Voltage Drift: Short Term Drift	$\frac{\lvert\Delta V_{VOUT}/V_{VOUT}\rvert}{\Delta t\ (min)}$	V_{VPS} = 24V V_{CTRL} = V_{5VR} = 5V V_{VOUT} = 1kV I_{VOUT} = 5mA T_A = −10°C ~ 55°C		≤0.5		%/min
Output Voltage Drift: Long Term Drift	$\frac{\lvert\Delta V_{VOUT}/V_{VOUT}\rvert}{\Delta t\ (h)}$			≤1		%/h

Output Voltage Rise Time	t_r	$V_{VOUT}(t_1) = 100V$ $V_{VOUT}(t_2) = 900V$ No-Load		30		ms
		$V_{VOUT}(t_1) = 100V$ $V_{VOUT}(t_2) = 900V$ $R_{Load} = 200\ k\Omega$		TBD		ms
Output Voltage Fall Time	t_f	$V_{VOUT}(t_2) = 900V$ $V_{VOUT}(t_3) = 100V$ No-Load		100		ms
		$V_{VOUT}(t_2) = 900V$ $V_{VOUT}(t_3) = 100V$ $R_{Load} = 200\ k\Omega$		TBD		ms
Mean Time Between Failure	MTBF			TBD		h
Instantaneous Short Circuit Current at the Output	I_{VOUT_SC}			≤500		mA
Load Regulation	$\frac{\lvert \Delta V_{VOUT}/V_{VOUT} \rvert}{\Delta I_{VOUT}}$	$V_{VOUT} = 1kV$ $I_{VOUT} = 5mA$		≤0.05		%/mA
Full Load Efficiency	η (3)	$V_{VPS} = 24V$ $V_{VOUT} = 1kV$ $I_{VOUT} = 5mA$		≥75		%
Operating Temperature Range	T_{opr}		−10		55	°C
Storage Temperature Range	T_{stg}		−20		85	°C
Thermal resistance housing-ambient	θ_{HA} (4)	$V_{VPS} = 24V$ $V_{CTRL} = V_{5VR} = 5V$ $V_{VOUT} = 1kV$ $I_{VOUT} = 5mA$		TBD		°C/W
External Dimensions			82×55×28			mm
			3.23×2.17×1.10			inch
Weight				210		g
				0.46		lbs
				7.4		Oz

Note 1: $PSRR = 20\log_{10}\frac{\Delta V_{VOUT}/V_{VOUT}}{\Delta V_{VPS}/V_{VPS}}$ (dB)

$\Delta V_{VOUT} = V_{VOUT}(V_{VPS} = 24.5V) - V_{VOUT}(V_{VPS} = 23.5V)$, $V_{VOUT}(V_{VPS} = 24.5V) = V_{VOUT}(V_{VPS} = 24V)$

$\Delta V_{VPS} = 24.5V - 23.5V$, $V_{VPS} = 24V$

Note 2: $TCV_{VOUT} = \frac{\lvert \Delta V_{VOUT} \rvert}{V_{VOUT} \quad \Delta T}$

Note 3: $\eta = \frac{V_{VOUT} \quad I_{VOUT}}{V_{VPS} \quad I_{VPS}}$

TESTING DATA

Test conditions: V_{VPS} = 24V, T_A = 25°C, R_{LOAD} = 200kΩ

DC Testing

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

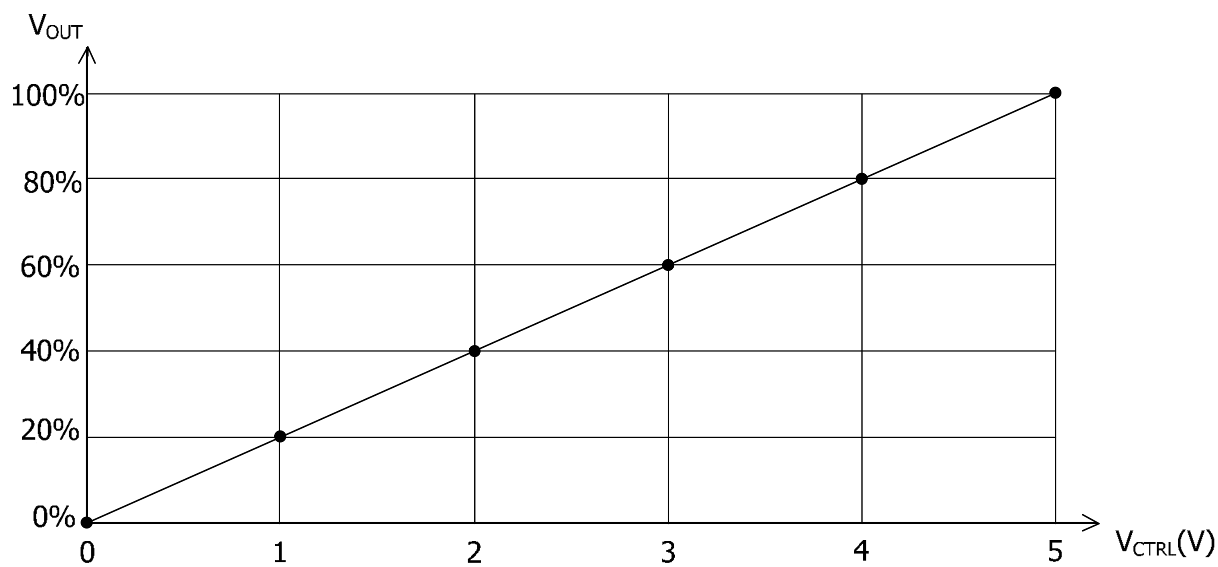


Figure 7. V_{CTRL} vs. V_{VOUT}

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.

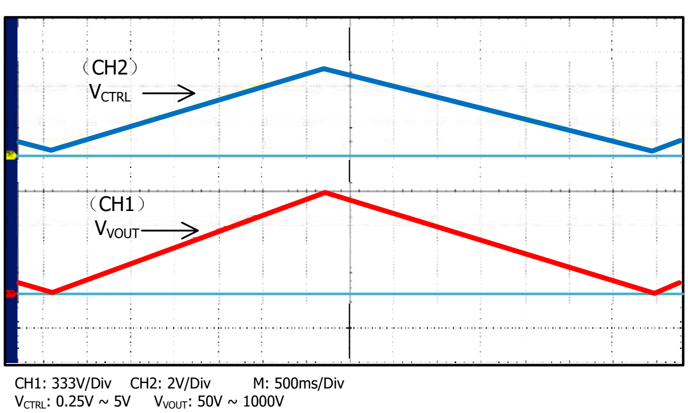


Figure 8. Input vs. Output Waveforms for Triangle Wave Control

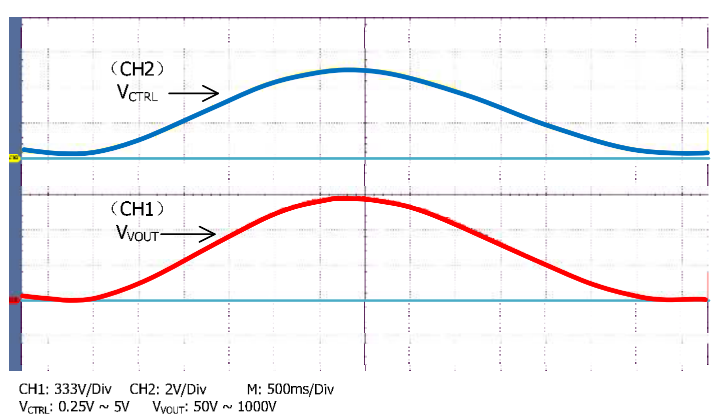


Figure 9. Input vs. Output Waveforms for Sine Wave Control

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 30ms. 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.

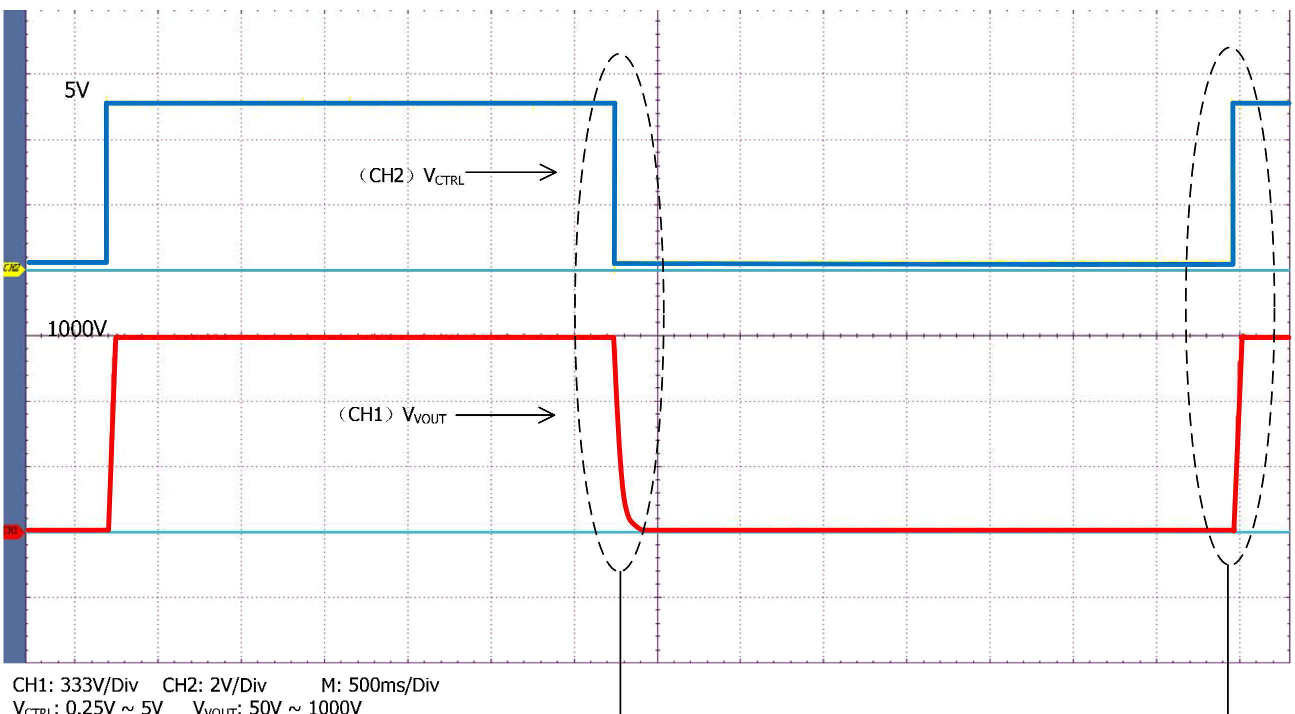


Figure 10. Input vs. Output Waveforms for Square Wave Control

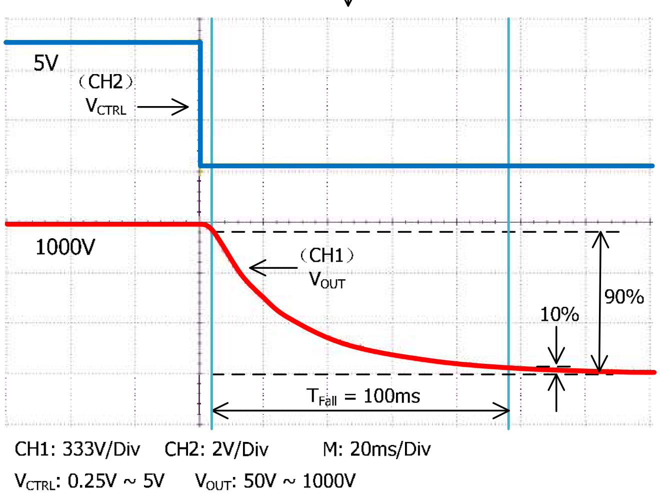


Figure 11. Falling Trail for Large Signal Response

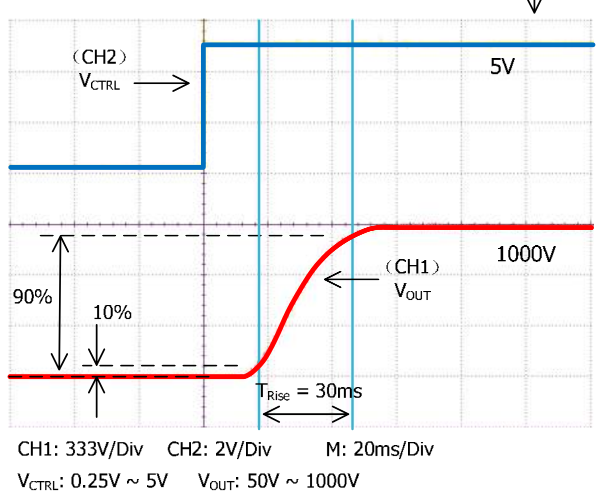
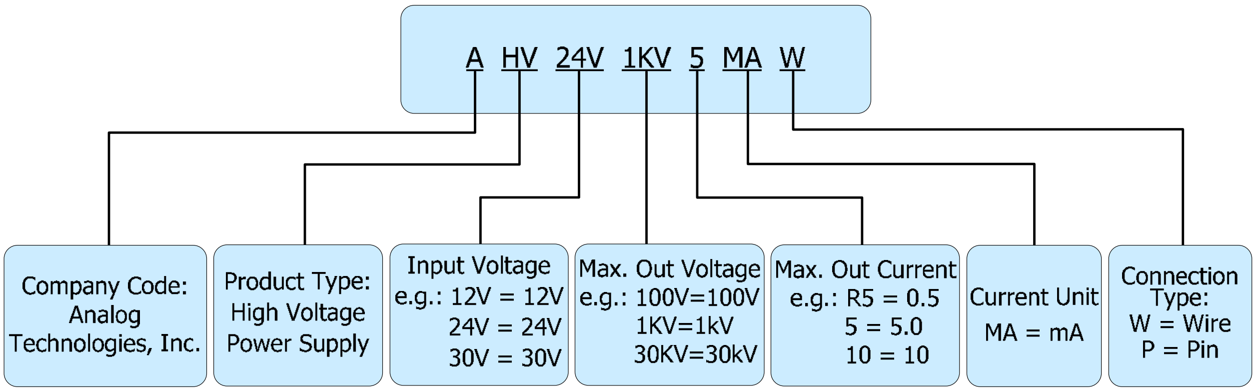


Figure 12. Rising Trail for Large Signal Response

NAMING PRINCIPLE



Naming Principle of AHV24V1KV5MAW

DIMENSIONS

Connecting Lead Wire Sizes and Lengths

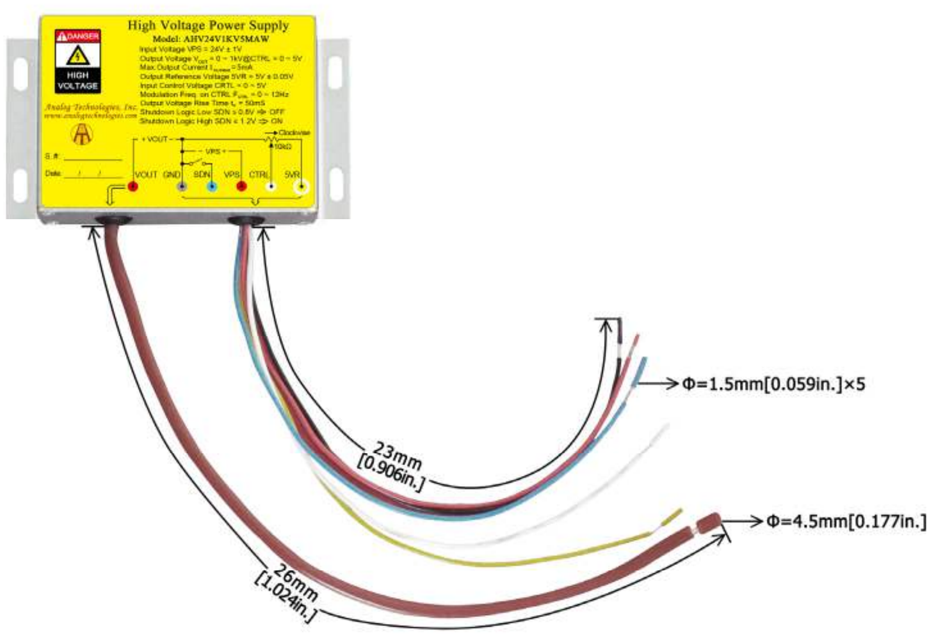


Figure 13. Connecting Lead Wires of AHV24V1KV5MAW

Lead Wires	Diameter		Length	
	mm	inch	mm	inch
Thick brown lead wire	4.5	0.177	26 ± 1	1.024 ± 0.039
Yellow, red, blue, black and white lead wires	1.5	0.059	23 ± 1	0.906 ± 0.039

Outline Dimensions

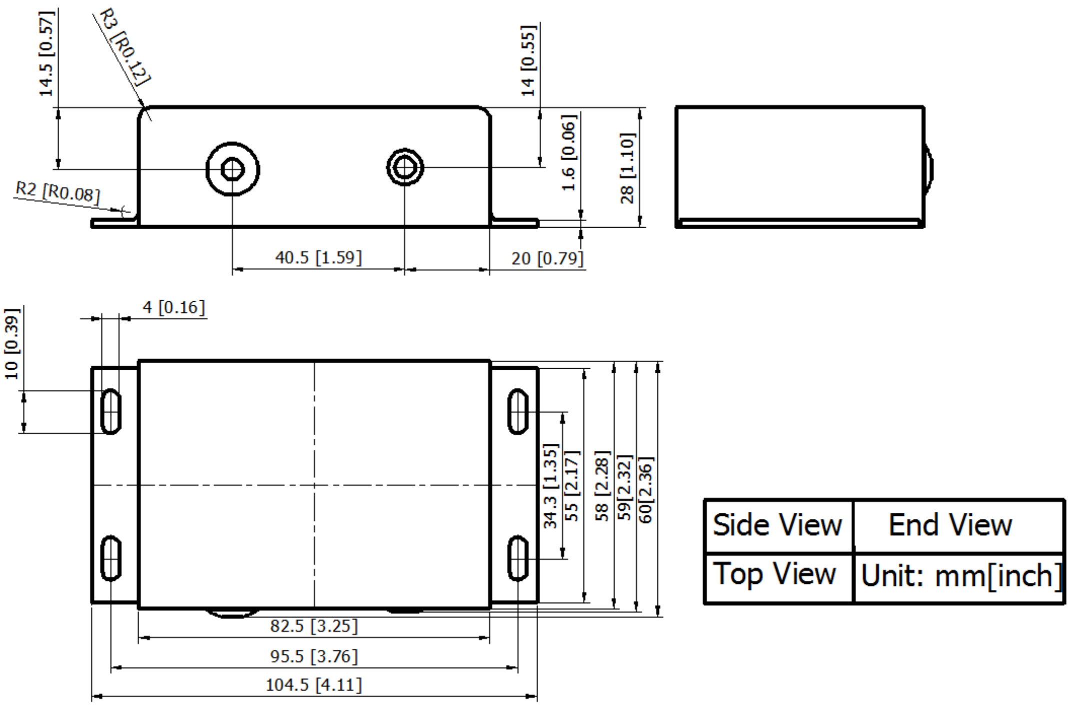


Figure 14. Outline Dimensions

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