Analog Technologies

Figure 1.1. Top View of AHV24V10KVR6MAW

Figure 1.2. Side View

Figure 1.3. Side View
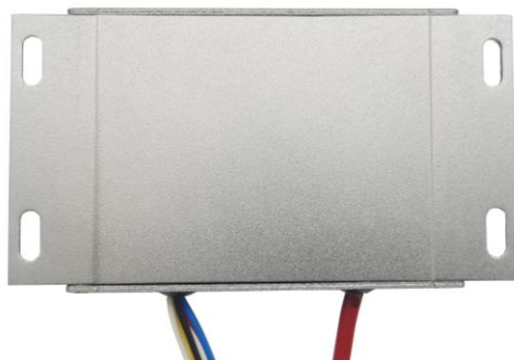

Figure 1.4. Side View

Figure 1.5. Bottom View

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FEATURES

- Input Power Voltage: 24V ± 1V
- Input Current Range: 80mA to 350mA
- Output Voltage: 0 to 10kV@CTRL = 0 to 5V
- Max. Output Current: 0.6mA
- Reference Voltage: 5V ± 0.05V
- Input Control Voltage: 0 to 5V
- Electronic Shutdown Control Available
- Zero EMIs and Good Heat Sinking by Metal Enclosure

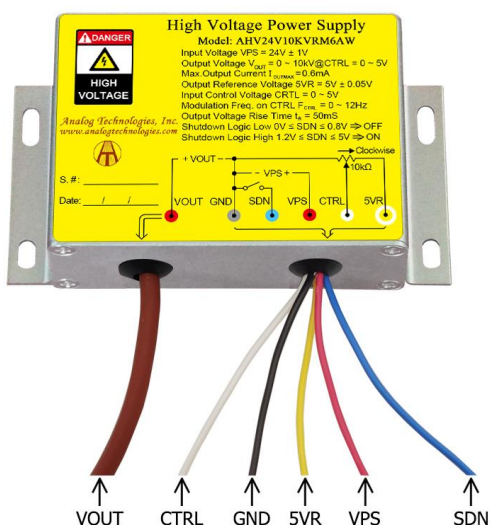## APPLICATIONS

This power module, AHV24V10KVR6MAW, 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
AHV24V10KVR6MAW

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		10kV

DESCRIPTION

Figure 1 shows the actual pictures of AHV24V10KVR6MAW. 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 10kV 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 2000 times the input control voltage: $V_{VOUT}=2000 \times V_{CTRL}$.
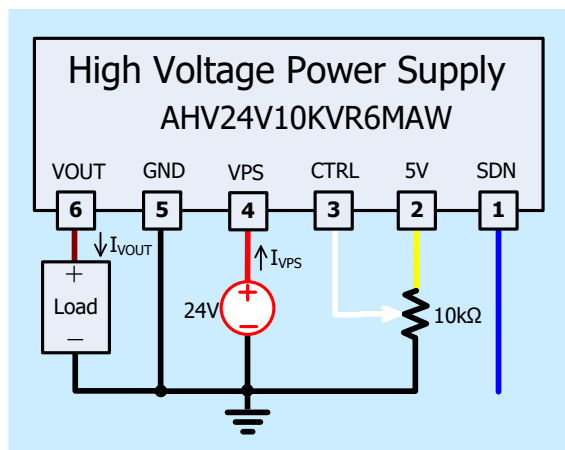

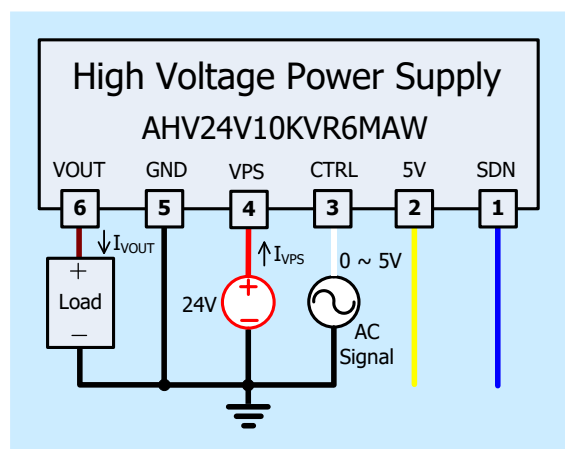Figure 3. Setting Output to be a Constant Voltage

Figure 4. Modulating Output by an AC Signal Source

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

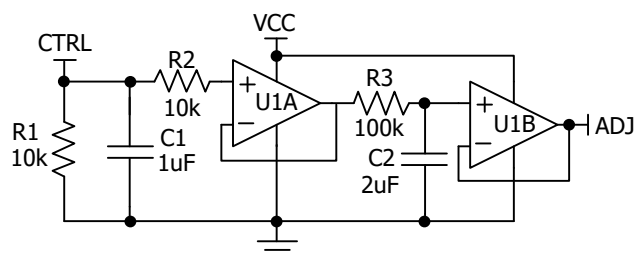Figure 5. The Equivalent Circuit for CTRL Port

To shutdown AHV24V10KVR6MAW, 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.
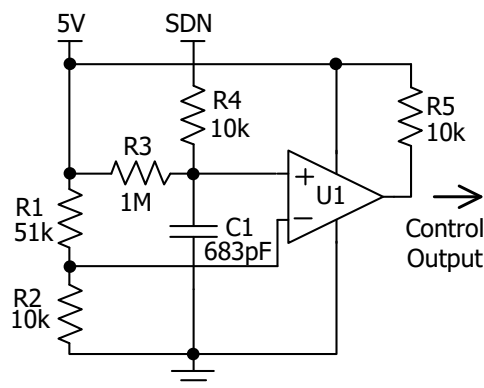
Figure 6. The Equivalent Circuit for SDN Port

USING AHV24V10KVR6MAW

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 AHV24V10KVR6MAW 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.

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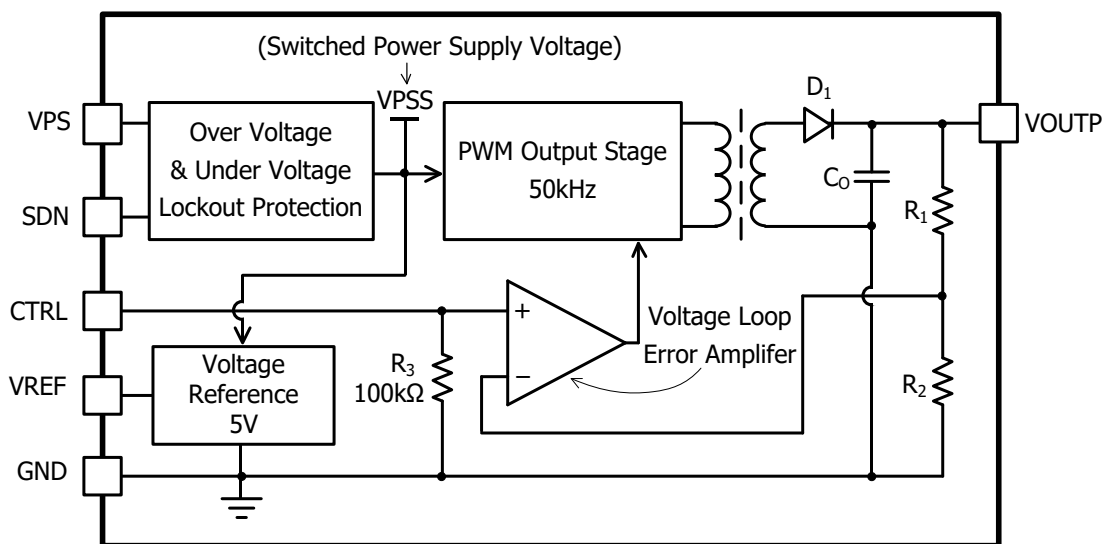
VOUTP = N×V$_{CTRL}$, where N is the amplification factor: N = R$_1$/R$_2$.

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/Note
Input Power Supply Voltage	V$_{VPS}$		23	24	25	V
Input Power Supply Quiescent Current	I$_{VPS\_QC}$	I$_{VOUT}$ = 0mA V$_{SDN}$ = V$_{CTRL}$ = 5V	80	90	100	mA
Input Power Supply Current at Full Load	I$_{VPS\_FL}$	I$_{VOUT}$ = 0.6mA	300	350	400	mA
Input Power Supply Current at Shutdown	I$_{VPS\_SHDN}$	T$_A$ = −10°C ~ 55°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 ≤ 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 ~ 0.6mA	0		10,000	V
Output Current Range	I$_{VOUTMAX}$	V$_{VPS}$ = 23V ~ 25V	0		0.6	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/Note
Output Load Resistance Range				$\dfrac{V_{VOUT}}{I_{VOUT}}$		∞	MΩ
Output Voltage Ripple		V_{VOUT_RP}	Bandwidth = 1MHz R_{LOAD} = 16MΩ V_{VOUT} = 10kV		≤5.0		V_{P-P}
Output Voltage Temperature Coefficient		TCV_{VOUT}	V_{VPS} = 24V V_{CTRL} = V_{5VR} = 5V V_{VOUT} = 10kV I_{VOUT} = 0.6mA 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} = 10kV I_{VOUT} = 1mA T_A = −10°C ~ 55°C	$0.99V_{VOUT}$	V_{VOUT}	$1.01V_{VOUT}$	V
Output Voltage Drift	Short Term Drift	$\dfrac{\|\Delta V_{VOUT}/V_{VOUT}\|}{\Delta t \text{ (min)}}$	V_{VPS} = 24V V_{CTRL} = V_{5VR} = 5V V_{VOUT} = 10kV I_{VOUT} = 0.6mA T_A = −10°C ~ 55°C		≤0.5		%/min
	Long Term Drift	$\dfrac{\|\Delta V_{VOUT}/V_{VOUT}\|}{\Delta t \text{ (h)}}$			≤1		%/h
Output Voltage Rise Time		t_r	$V_{VOUT}(t_1)$ = 1000V $V_{VOUT}(t_2)$ = 9000V R_{Load} = 16MΩ		50		ms
Output Voltage Fall Time		t_f	$V_{VOUT}(t_2)$ = 9000V $V_{VOUT}(t_3)$ = 1000V R_{Load} = 16MΩ		100		ms
Mean Time Between Failure		MTBF			1M		h
Instantaneous Short Circuit Current at the Output		I_{VOUT_SC}			≤60		mA
Load Regulation		$\dfrac{\|\Delta V_{VOUT}/V_{VOUT}\|}{\Delta I_{VOUT}}$	V_{VOUT} = 10kV I_{VOUT} = 0.6mA		≤0.05		%/mA
Full Load Efficiency		η [3]	V_{VPS} = 24V V_{VOUT} = 10kV I_{VOUT} = 0.6mA		≥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} = 24V, T_A = 25°C, R_{LOAD} = 16MΩ

DC Testing

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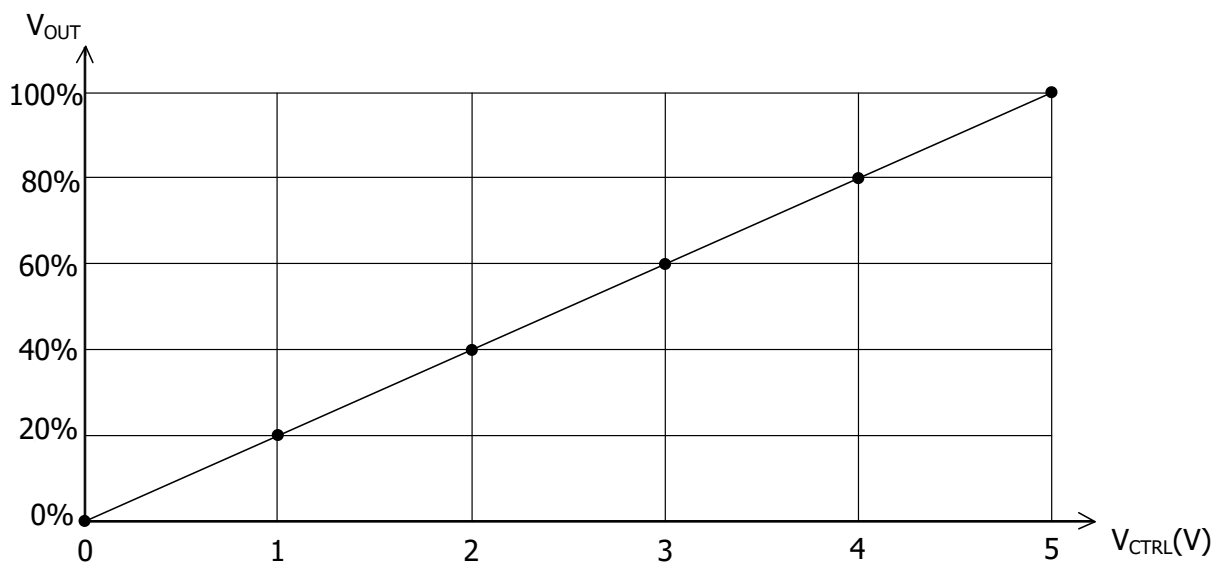

Figure 7. V_{CTRL} vs. V_{VOUT}

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.
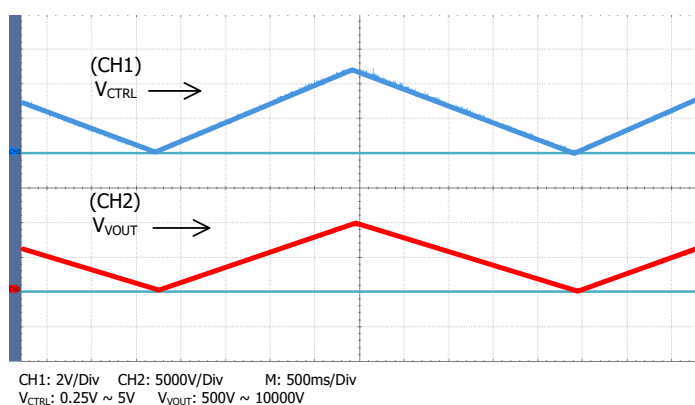

CH1: 2V/Div   CH2: 5000V/Div   M: 500ms/Div
V_{CTRL}: 0.25V ~ 5V V_{VOUT}: 500V ~ 10000V

Figure 8. Triangle Wave Modulation

CH1: 2V/Div   CH2: 5000V/Div   M: 500ms/Div
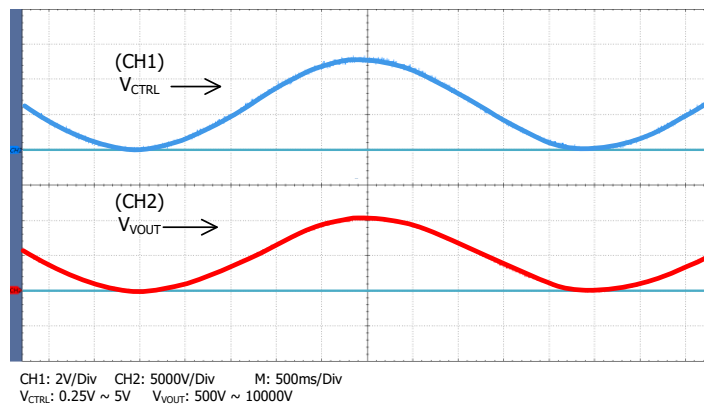V_{CTRL}: 0.25V ~ 5V V_{VOUT}: 500V ~ 10000V

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.
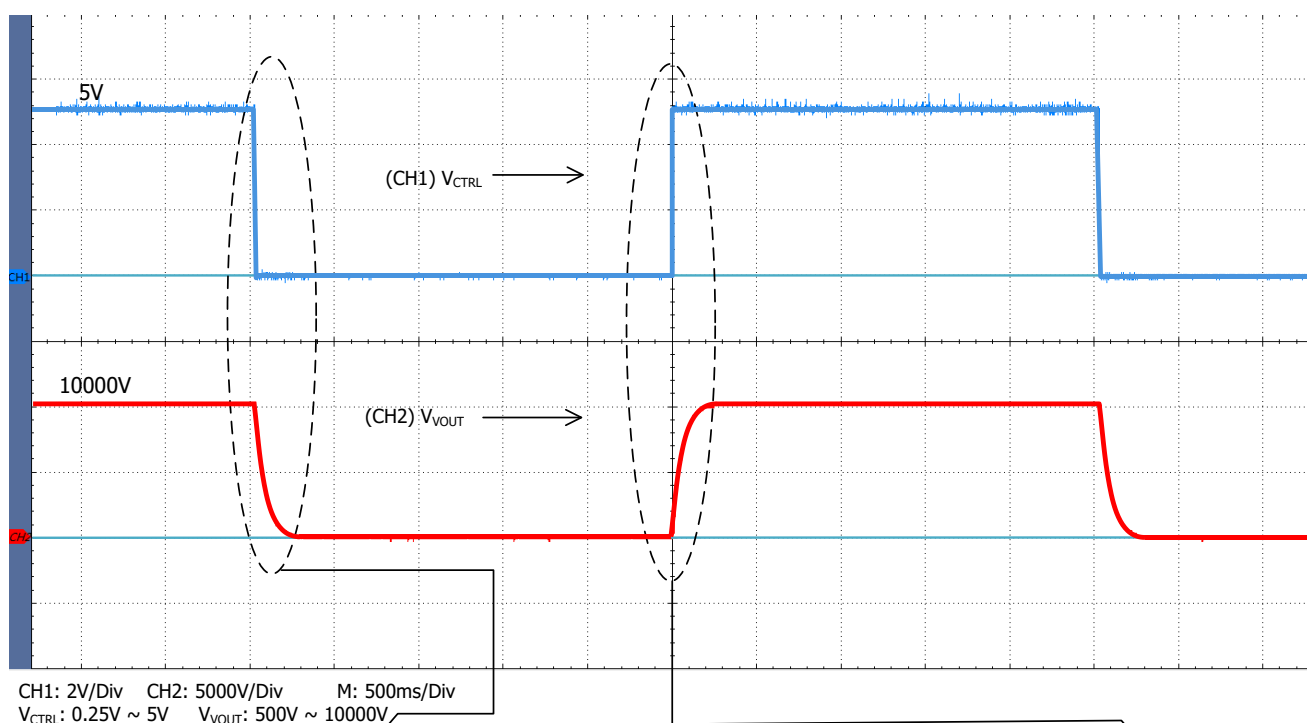

CH1: 2V/Div   CH2: 5000V/Div   M: 500ms/Div
V_CTRL: 0.25V ~ 5V   V_VOUT: 500V ~ 10000V

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

CH1: 2V/Div   CH2: 5000V/Div   M: 20ms/Div
V_CTRL: 0.25V ~ 5V   V_OUT: 500V ~ 10000V
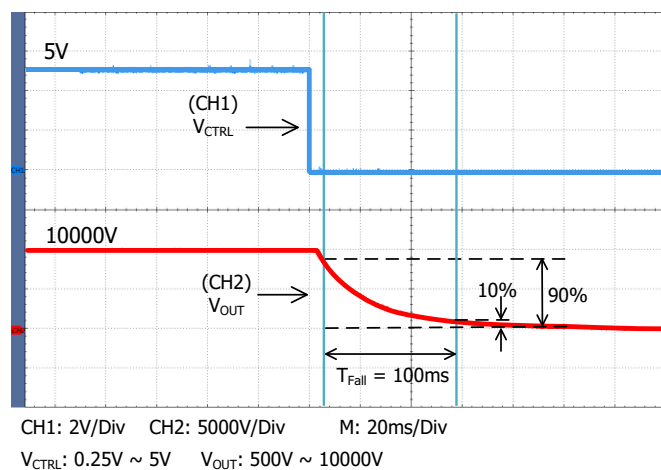
Figure 11. Falling Trail for Large Signal Response

CH1: 2V/Div   CH2: 5000V/Div   M: 20ms/Div
V_CTRL: 0.25V ~ 5V   V_OUT: 500V ~ 10000V
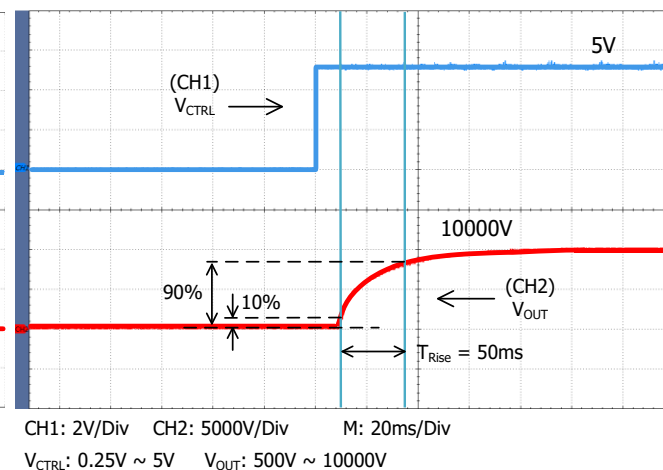
Figure 12. Rising Trail for Large Signal Response

NAMING PRINCIPLE

| A | HV | 24V | 10KV | R6 | MA | W |

| Company Suffix: Analog Technologies, Inc. | Product Line: High Voltage Power Supply | Input Voltage: 12V = 12V 24V = 24V 30V = 30V | Max. Out Voltage 100V=100V 10KV=10kV 30KV=30kV | Max. Out Current R6 = 0.6 1 = 1.0 10 = 10 | Current Unit MA = mA A = Amp | Connection Type: W = Wire P = Pin |
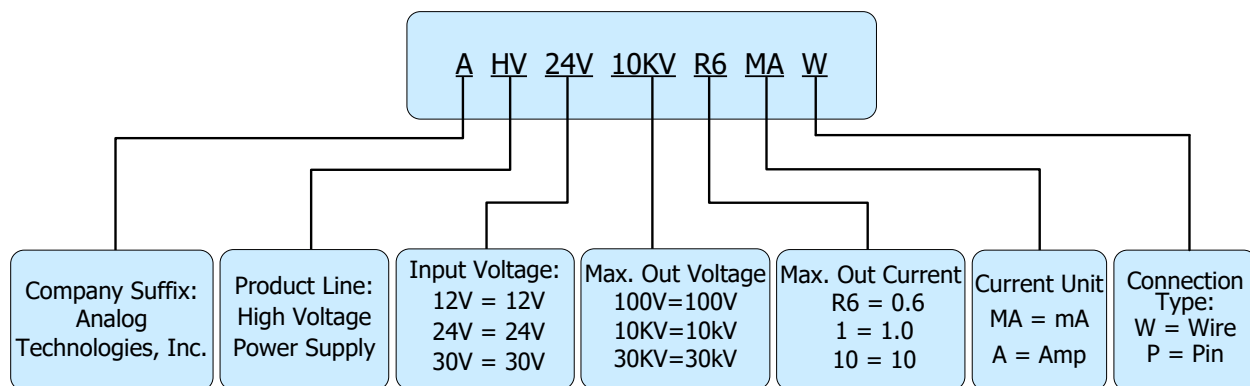
Naming Principle of AHV24V10KVR6MAW

DIMENSIONS

Connecting Lead Wire Sizes and Lengths
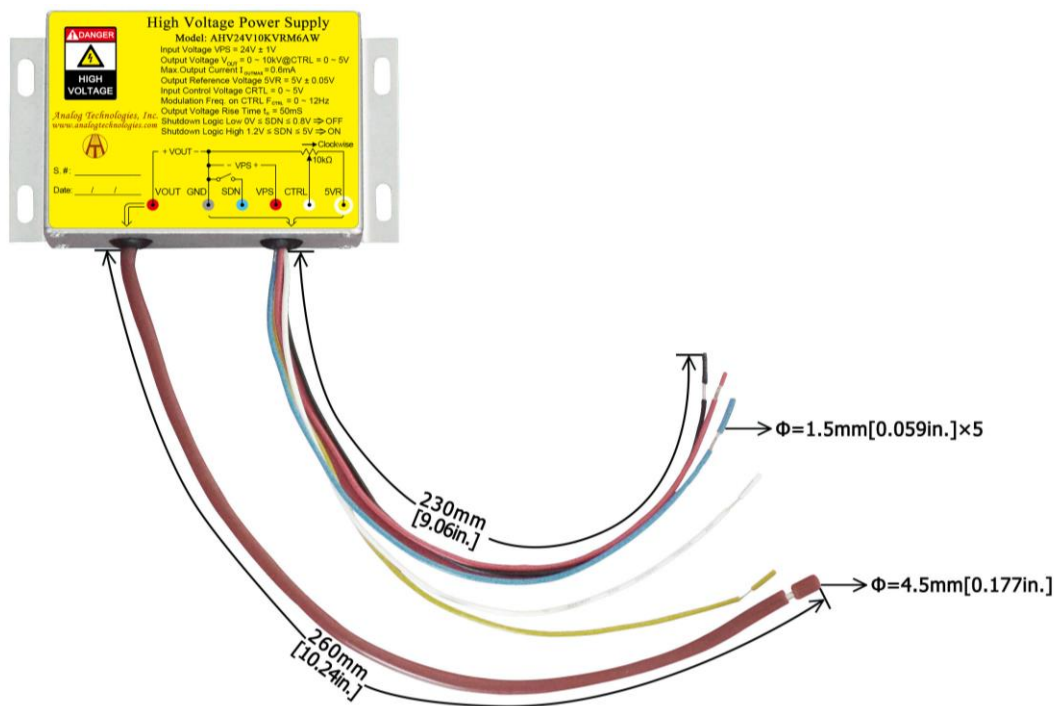
Figure 13. Connecting Lead Wires of AHV24V10KVR6MAW

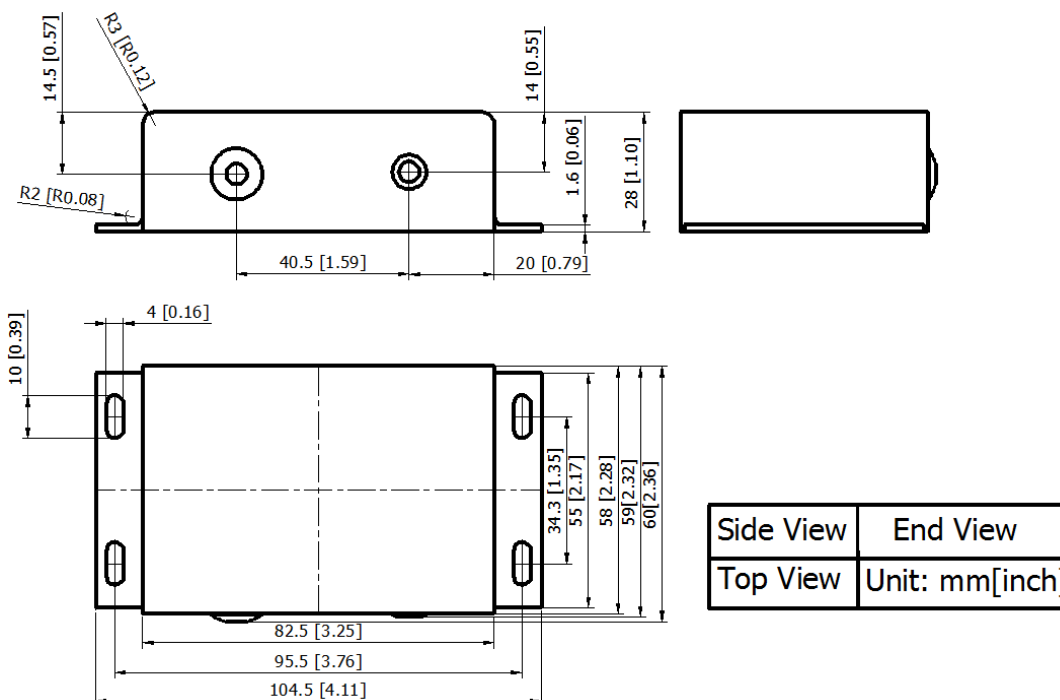| Lead Wires	Diameter		Length	
	mm	inch	mm	inch
Thick brown lead wire	4.5	0.177	260 ± 1	10.24 ± 0.039
Yellow, red, blue, black and white lead wires	1.5	0.059	230 ± 1	9.06 ± 0.039

Outline Dimensions

Figure 14. Outline Dimensions

ORDERING INFORMATION

Part Number	Buy Now
AHV24V10KVR6MAW	🛒* 🛒*

*: 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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