

Figure 1.1. Top View of AHV12V4KV2R5MAW

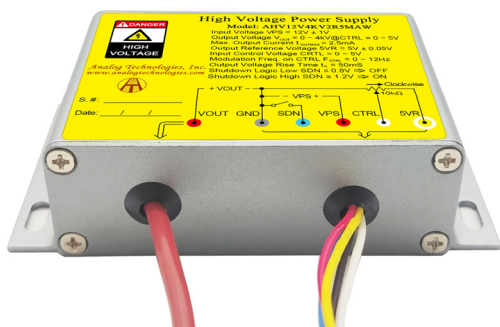


Figure 1.2. Side View

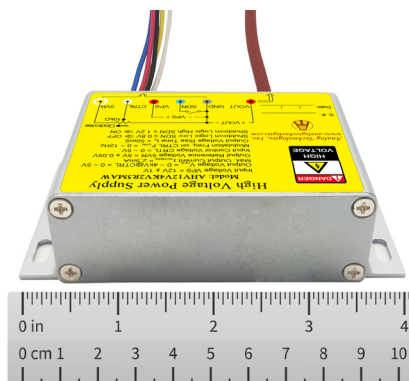


Figure 1.3. Side View

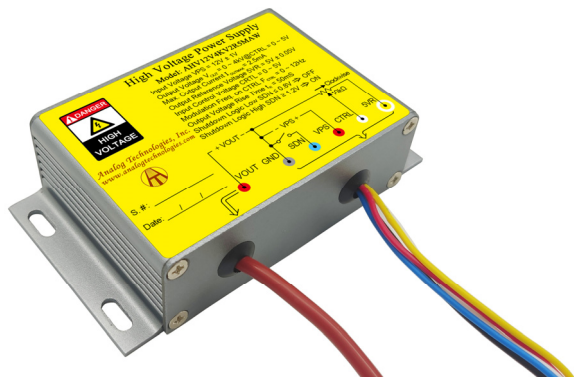


Figure 1.4. Side View

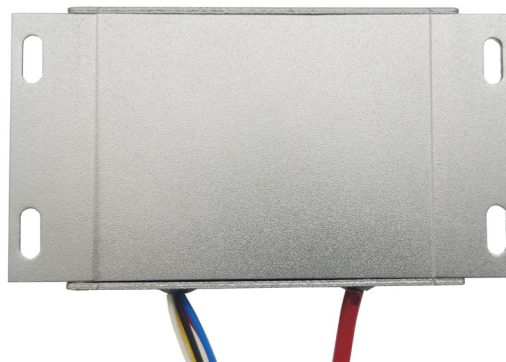


Figure 1.5. Bottom View



FEATURES

- Input Power Voltage: 12V \pm 1V
- Input Current Range: 140mA to 1200mA
- Output Voltage: 0 to 4kV@CTRL = 0 to 5V
- Max. Output Current: 2.5mA
- Reference Voltage: 5V \pm 0.05V
- Input Control Voltage: 0 to 5V
- Full Span Modulation on Output Voltage
- Electronic Shutdown Control

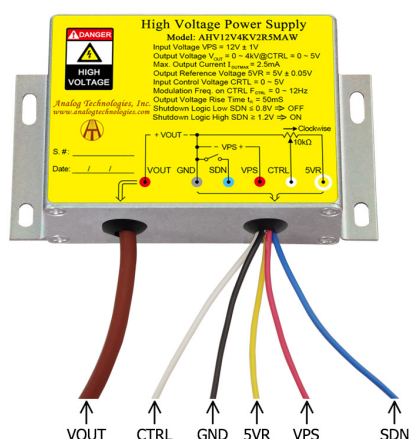


Figure 2. The Connecting Lead Wires of AHV12V4KV2R5MAW

APPLICATIONS

This power module, AHV12V4KV2R5MAW, 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		12V	
5	GND	Black		Ground for analog, digital and power signals.	Ground electrode		0V	
6	VOUT	Brown		Power output	Output high voltage	0V		4kV



DESCRIPTION

Figure 2 shows the connecting wires of AHV12V4KV2R5MAW, 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 4kV proportionally at the output VOUT port as shown in Figure 3 and Figure 4 respectively.

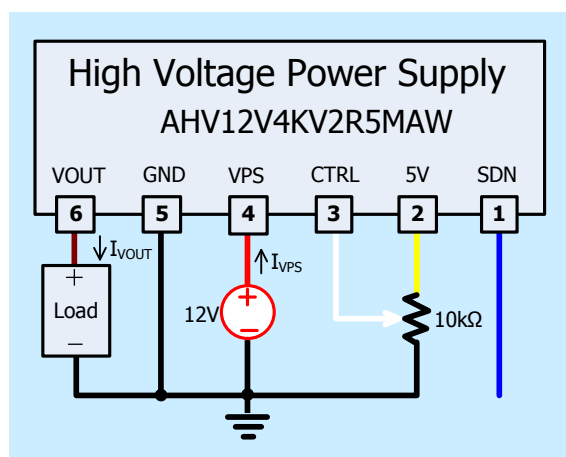


Figure 3. Setting Output to be a Constant Voltage

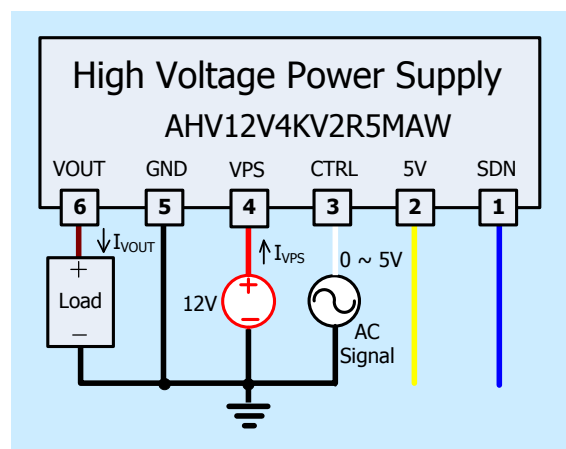


Figure 4. Modulating Output by an AC Signal Source

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

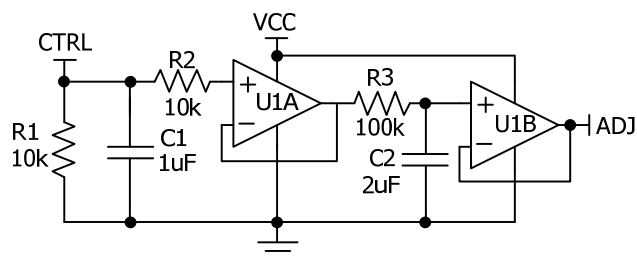


Figure 5. The Equivalent Circuit for CTRL Port

To shutdown AHV12V4KV2R5MAW, 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.

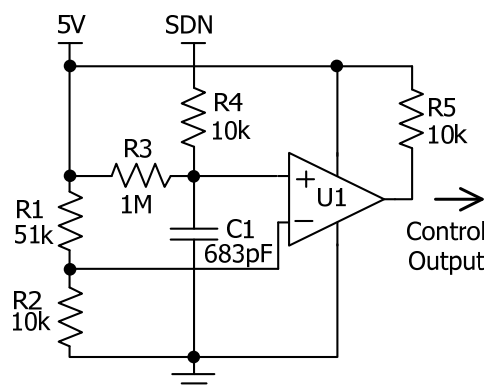


Figure 6. The Equivalent Circuit for SDN Port

USING AHV12V4KV2R5MAW

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 AHV12V4KV2R5MAW 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. $T_A = 25^\circ\text{C}$, unless otherwise noted.

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit/Note
Input Power Voltage	V_{VPS}		11	12	13	V
Input Power Quiescent Current	I_{VPS_QC}	$I_{VOUT} = 0\text{mA}$	140	150	160	mA
Input Power Current at Full Load	I_{VPS_FL}	$I_{VOUT} = 2.5\text{mA}$	1100	1200	1300	mA
Input Power Current at Shutdown	I_{VPS_SHDN}	$T_A = -10^\circ\text{C} \sim 55^\circ\text{C}$		18		mA
Power Supply Rejection Ratio	PSRR ⁽¹⁾	$V_{VPS} = 11\text{V} \sim 13\text{V}$ $V_{CTRL} = V_{5VR} = 5\text{V}$ $V_{VOUT} = 4\text{kV}$ $I_{VOUT} = 2.5\text{mA}$		TBD		dB
Modulation Voltage Range Frequency on CTRL	f_{CTRL}		0		12	Hz
Shutdown Port Current	I_{SDNL}	$V_{SDNL} < 0.8\text{V}$	-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	V_{VOUT}	$I_{VOUT} = 0 \sim 2.5\text{mA}$	0		4000	V
Output Current Range	$I_{VOUTMAX}$	$V_{VPS} = 11\text{V} \sim 13\text{V}$	0		2.5	mA
Reference Voltage Output Range	V_{5VR}	$T_A = -10^\circ\text{C} \sim 55^\circ\text{C}$ $I_{5VR} \leq 5\text{mA}$	4.98	5	5.02	V
Output Load Range			1.6		∞	$\text{M}\Omega$
Output Voltage Ripple	V_{VOUT_RP}	Bandwidth = 1MHz $R_{LOAD} = 4\text{M}\Omega$	≤ 2.0			V_{P-P}
Output Voltage Ripple Frequency	f_{VOUT_RP}		TBD			Hz
Output Voltage Temperature Coefficient	TCV_{VOUT} ⁽²⁾	$V_{VPS} = 12\text{V}$ $V_{CTRL} = V_{5VR} = 5\text{V}$ $V_{VOUT} = 4\text{kV}$ $I_{VOUT} = 2.5\text{mA}$ $T_A = -10^\circ\text{C} \sim 55^\circ\text{C}$		≤ 0.01		$\%/^\circ\text{C}$
Output Voltage Range v.s. Temperature	$V_{VOUT}(T)$	$V_{VPS} = 12\text{V}$ $V_{CTRL} = V_{5VR} = 5\text{V}$ $V_{VOUT} = 4\text{kV}$ $I_{VOUT} = 2.5\text{mA}$ $T_A = -10^\circ\text{C} \sim 55^\circ\text{C}$	$0.99V_{VOUT}$	V_{VOUT}	$1.01V_{VOUT}$	V
Output Voltage Drift	Short Term Drift	$\frac{\Delta V_{VOUT}}{V_{VOUT}}$ Δt (min)		≤ 0.5		$\%/min$
	Long Term Drift	$\frac{\Delta V_{VOUT}}{V_{VOUT}}$ Δt (h)		≤ 1		$\%/h$



Output Voltage Rise Time	t_r	$V_{VOUT}(t_1) = 400V$ $V_{VOUT}(t_2) = 3600V$ No-Load		30		ms
		$V_{VOUT}(t_1) = 400V$ $V_{VOUT}(t_2) = 3600V$ $R_{Load} = 4M\Omega$		TBD		ms
Output Voltage Fall Time	t_f	$V_{VOUT}(t_2) = 3600V$ $V_{VOUT}(t_3) = 400V$ No-Load		100		ms
		$V_{VOUT}(t_2) = 3600V$ $V_{VOUT}(t_3) = 400V$ $R_{Load} = 4M\Omega$		TBD		ms
Mean Time Between Failure	MTBF			TBD		h
Instantaneous Short Circuit Current at the Output	I_{VOUT_SC}			≤ 500		mA
Load Regulation	$\frac{\Delta V_{VOUT}/V_{VOUT}}{\Delta I_{VOUT}}$	$V_{VOUT} = 4kV$ $I_{VOUT} = 2.5mA$		≤ 0.05		%/mA
Full Load Efficiency	$\eta^{(3)}$	$V_{VPS} = 12V$ $V_{VOUT} = 4kV$ $I_{VOUT} = 2.5mA$		≥ 70		%
Operating Temperature Range	T_{opr}		-10		55	°C
Storage Temperature Range	T_{stg}		-20		85	°C
Thermal resistance housing-ambient	$\theta_{HA}^{(4)}$	$V_{VPS} = 12V$ $V_{CTRL} = V_{SVR} = 5V$ $V_{VOUT} = 4kV$ $I_{VOUT} = 2.5mA$		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)

$$\Delta V_{VOUT} = V_{VOUT}(V_{VPS} = 12.5V) - V_{VOUT}(V_{VPS} = 11.5V), V_{VOUT}(V_{VPS} = 12.5V) = V_{VOUT}(V_{VPS} = 12V)$$

$$\Delta V_{VPS} = 12.5V - 11.5V, V_{VPS} = 12V$$

Note 2: $TCV_{VOUT} = \frac{|\Delta V_{VOUT}|}{V_{VOUT} \times \Delta T}$

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



TESTING DATA

Test conditions: $V_{PS} = 12V$, $T_A = 25^\circ C$, $R_{LOAD} = 1.6M\Omega$

DC Testing

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

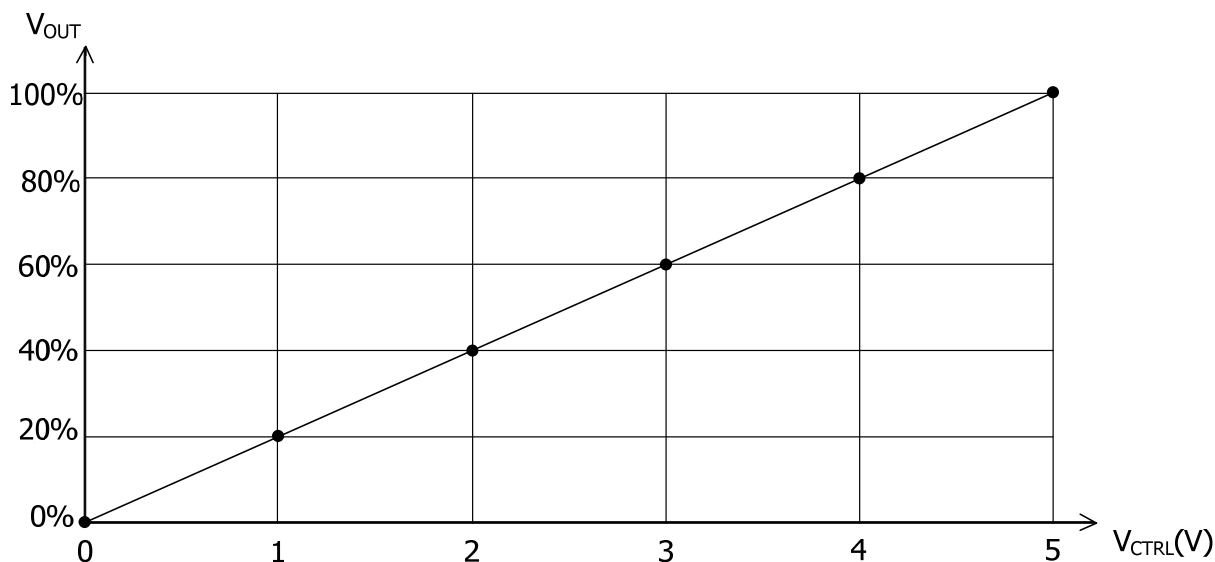


Figure 7. V_{CTRL} vs. V_{OUT}

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.

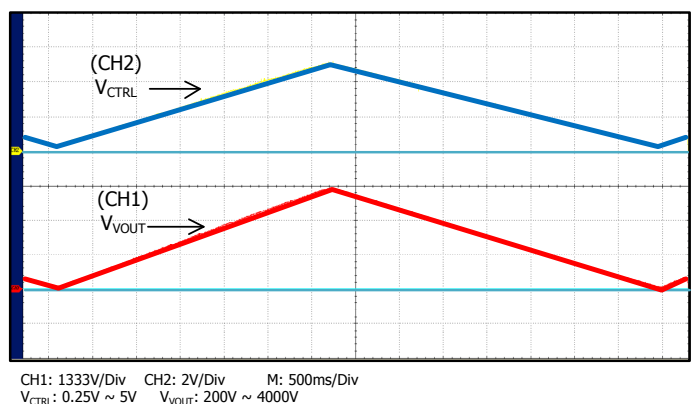


Figure 8. Input vs. Output Waveforms for Triangle Wave Control

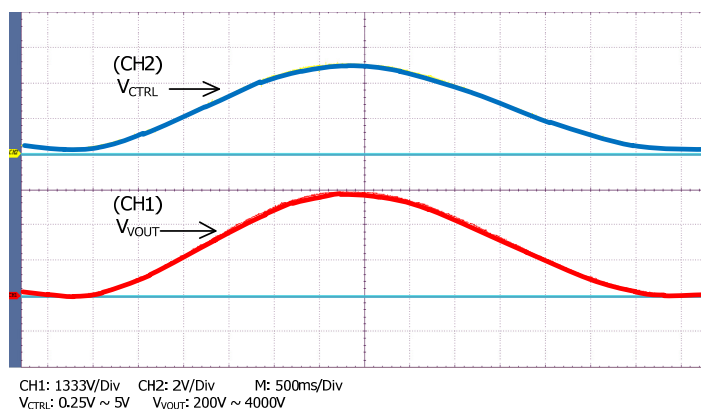


Figure 9. Input vs. Output Waveforms for Sine Wave Control



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, $f = 0.10\text{Hz}$, 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.

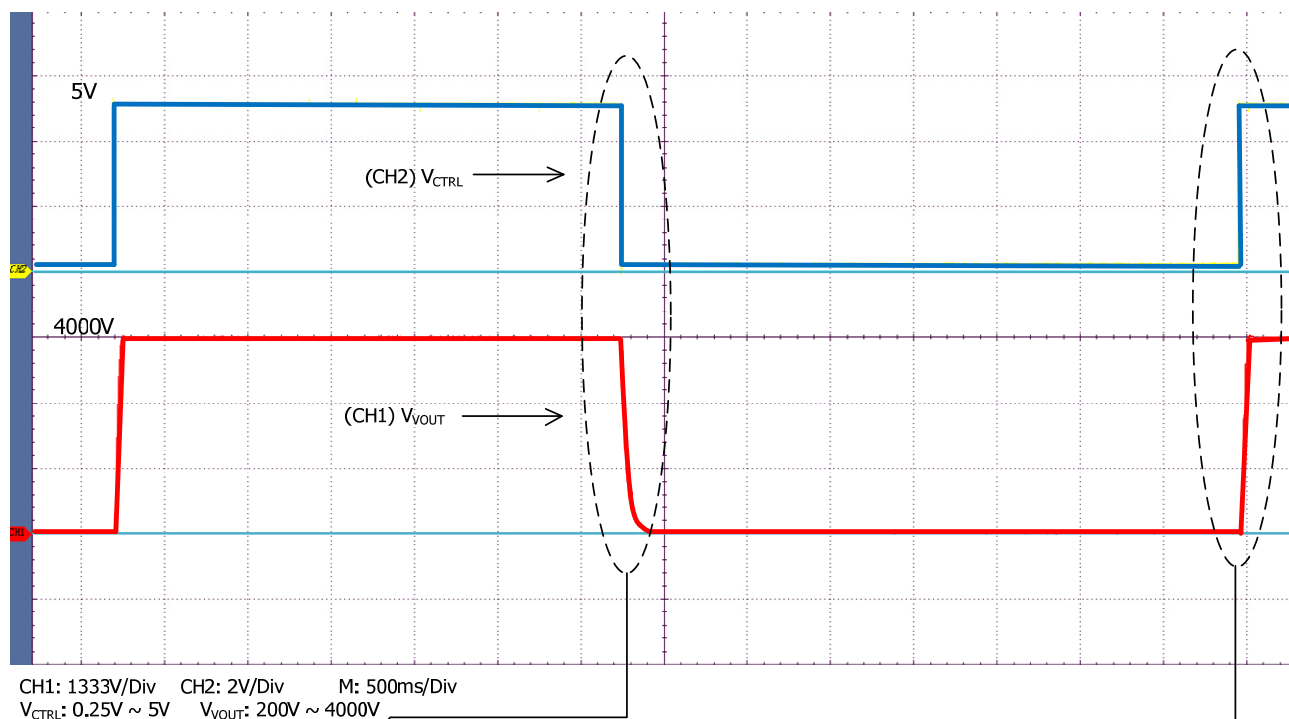


Figure 10. Input vs. Output Waveforms for Square Wave Control

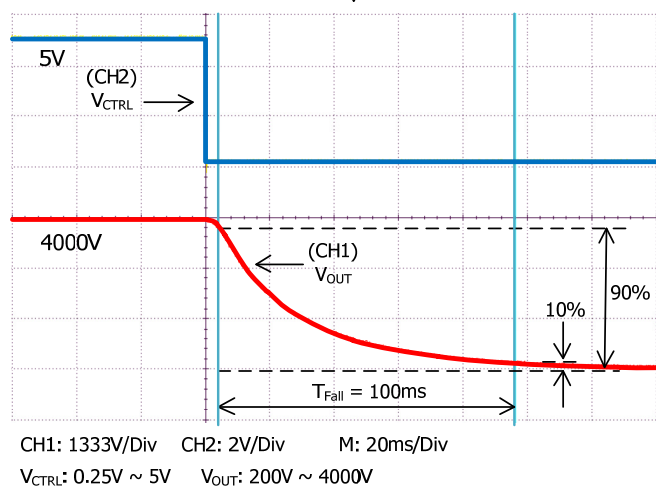


Figure 11. Falling Trail for Large Signal Response

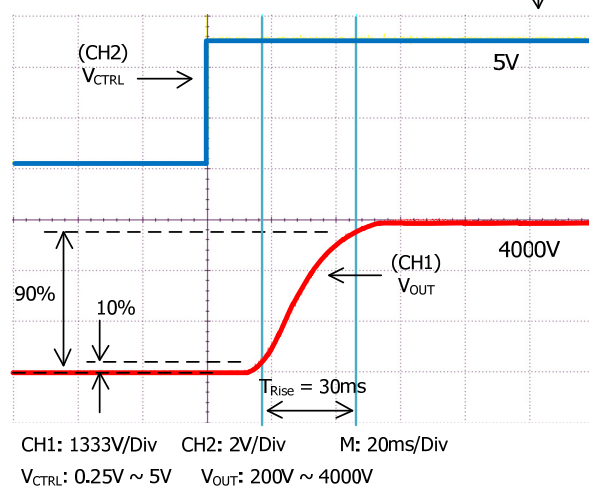
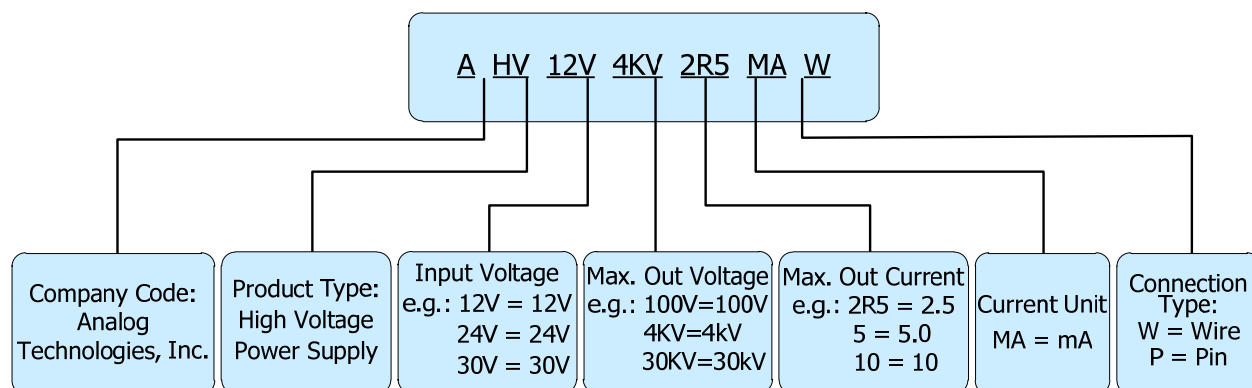


Figure 12. Rising Trail for Large Signal Response



NAMING PRINCIPLE



Naming Principle of AHV12V4KV2R5MAW

DIMENSIONS

Connecting Lead Wire Sizes and Lengths

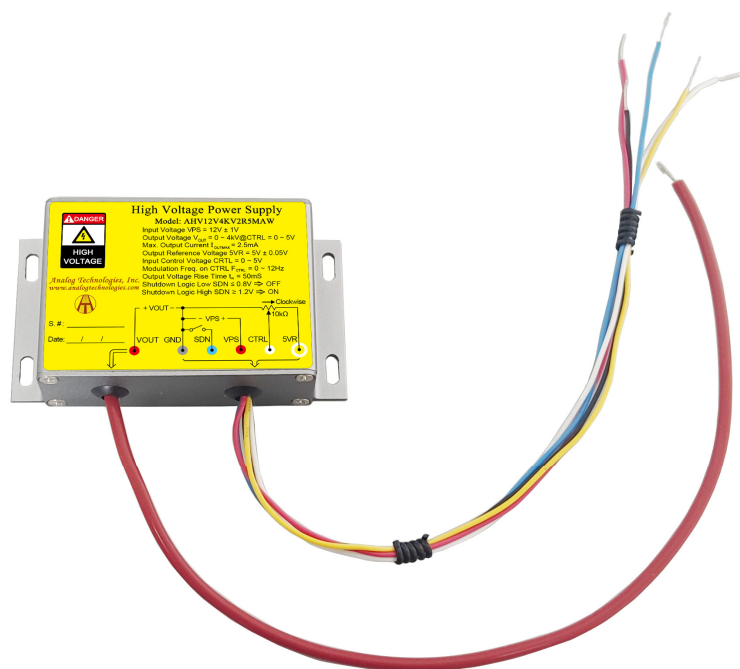


Figure 13. Connecting Lead Wires of AHV12V4KV2R5MAW

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



Technical drawing of a mechanical part showing three views: Front View, Top View, and Side View. The drawing includes dimensions in millimeters and inches in brackets.

Front View (Top): Shows a rectangular part with two circular holes. Dimensions include 14.5 [0.57], R3 [R0.12], 14 [0.55], 1.6 [0.06], 28 [1.10], 40.5 [1.59], 20 [0.79], and R2 [R0.08].

Top View (Bottom): Shows a rectangular part with four elongated holes. Dimensions include 10 [0.39], 4 [0.16], 82.5 [3.25], 95.5 [3.76], 104.5 [4.11], 34.3 [1.35], 55 [2.17], 58 [2.28], 59 [2.32], and 60 [2.36].

Side View (Right): Shows a rectangular part with dimensions 14 [0.55] and 28 [1.10].

Table:

Side View	En
Top View	Unit:

ORDERING INFORMATION

Quantity	1~9pcs	10~49pcs	50~99pcs	≥100pcs
AHV12V4KV2R5MAW	\$169	\$159	\$149	\$139



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