Figure 1.1. Top View of AHV24V15KV1MAW

Figure 1.2. Side View

Figure 1.3. Bottom View

Figure 1.4. Side View

Figure 1.5. Side View

FEATURES

- Input Power Voltage: 24V ± 1V
- Input Current Range: 140mA to 800mA
- Output Voltage: 0 to 15kV@CTRL = 0 to 5V
- Monitor Voltage: 0 to 1.5V
- 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, AHV24V15KV1MAW, 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
- Nondestructive Detection
- Particles Injection
- Semiconductor Technology
- Physical Vapor Phase Deposition
- Radio Frequency Amplification
- Electrospinning Preparation of Nanofiber
- Glass / Fabric Coating
- DC Reactive Magnetron Sputtering

DESCRIPTION

Figure 2 shows the connecting wires of AHV24V15KV1MAW, 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 15kV proportionally at the output VOUT port as shown in Figure 3.

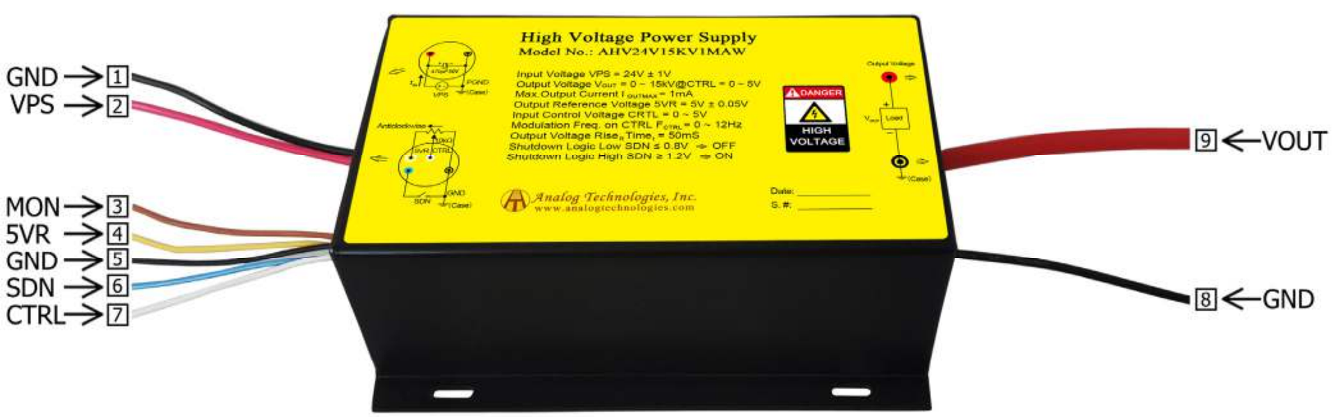


Figure 2. The Connecting Lead Wires of AHV24V15KV1MAW

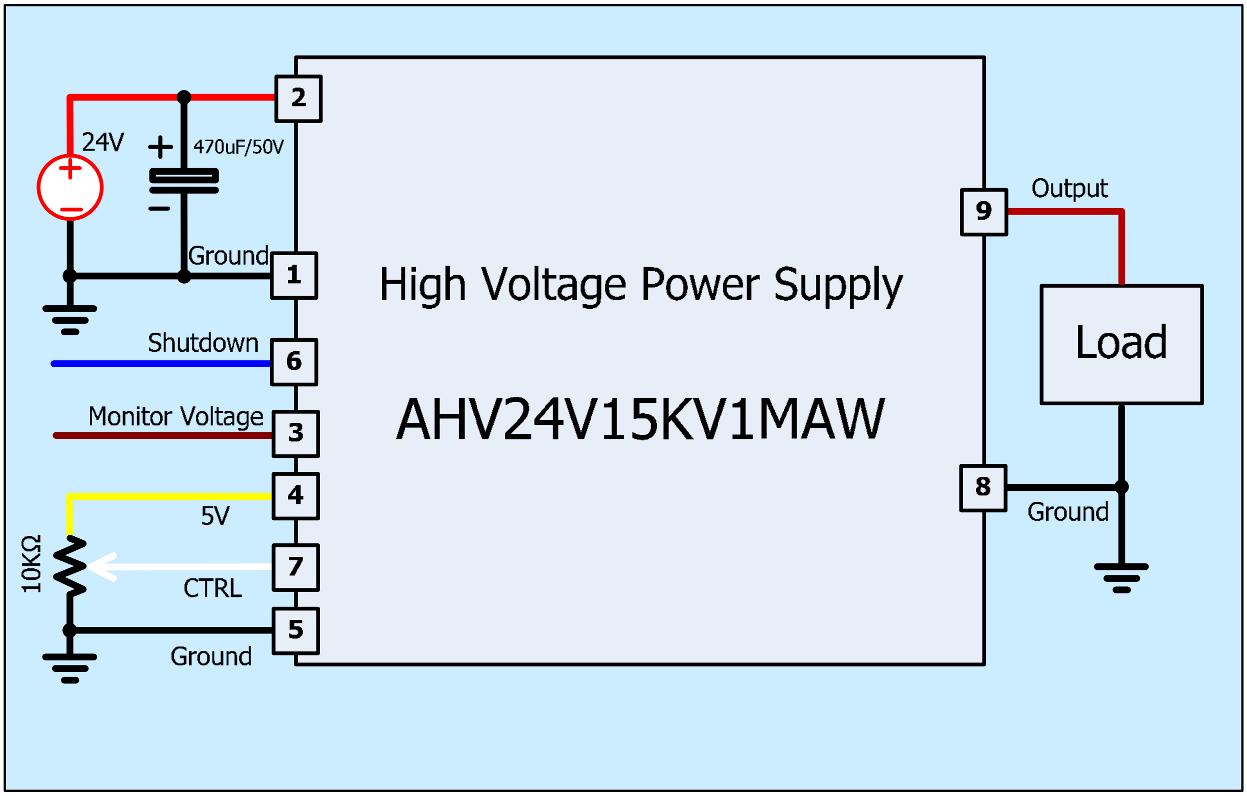


Figure 3. Setting Output to be a Constant Voltage

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		24V	
3	MON	Red	●	Analog output	Monitor Voltage	0V		1.5V
4	5VR	Yellow	●	Analog output	Reference voltage		5V	
5	GND	Black	●	Ground for analog, digital and power signals.	Control GND Monitor GND		0V	
6	SDN	Blue	●	Digital input	Shutdown logic low	0V		0.8V
					Shutdown logic high	1.2V		5V
7	CTRL	White	○	Analog input	Regulation	0V		5V
8	GND	Black	●	Power output	Output GND		0V	
9	VOUT	Brown	●	Power output	Output high voltage	0V		15kV

Please note that the modulation signal must have a low frequency ≤ 10Hz and the value range must be 0V ≤ V_{CTRL} ≤ 5V. The equivalent input circuit for the MON port is shown in Figure 4.

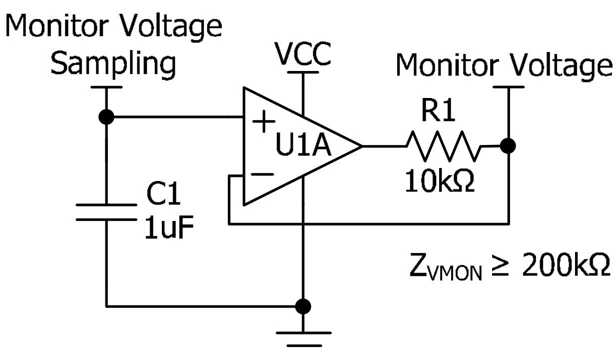


Figure 4. The Equivalent Circuit for MON Port

The equivalent input circuit for the CTRL is shown in Figure 5.

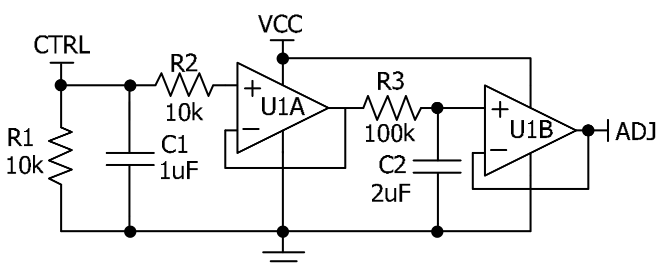


Figure 5. The Equivalent Circuit for CTRL Port

To shutdown AHV24V15KV1MAW, 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.

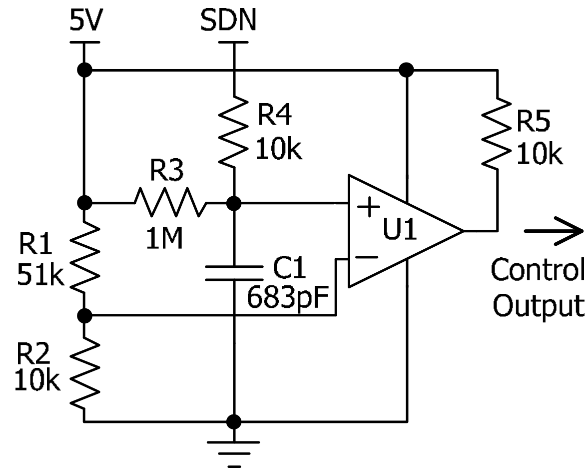


Figure 6. The Equivalent Circuit for SDN Port

USING AHV24V15KV1MAW

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 AHV24V15KV1MAW 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	140	150	160	mA
Input Power Current at Full Load	I_{VPS_FL}	I_{VOUT} = 1mA	700	800	900	A
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} = 15kV I_{VOUT} = 1mA		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 ~ 1mA	0		15000	V
Output Current Range	$I_{VOUTMAX}$	V_{VPS} = 23V ~ 25V	0		0.5	mA
Reference Voltage Output Range	V_{5VR}	T_A = −10°C ~ 55°C I_{5VR} ≤ 5mA	4.95	5	5.05	V
Monitor Voltage Out Impedance	Z_{VMON}			1		MΩ
Monitor Voltage	V_{MON}	V_{OUT} = 0 ~ 15kV	0		1.5	V
Output Load Range			15		∞	MΩ
Output Voltage Ripple	V_{VOUT_RP}	Bandwidth = 1MHz R_{LOAD} = 15 MΩ		≤7.5		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} = 15kV I_{VOUT} = 1mA T_A = −10°C ~ 55°C		≤0.1		%/°C
Output Voltage Range v.s. Temperature	$V_{VOUT}(T)$	V_{VPS} = 24V V_{CTRL} = V_{5VR} = 5V V_{VOUT} = 15kV I_{VOUT} = 1mA T_A = −10°C ~ 55°C	$0.99V_{VOUT}$	V_{VOUT}	$1.01V_{VOUT}$	V
Output Voltage Drift: Short Term Drift	$\dfrac{\lvert\Delta V_{VOUT}/V_{VOUT}\rvert}{\Delta t\ (min)}$	V_{VPS} = 24V V_{CTRL} = V_{5VR} = 5V		≤0.3		%/min

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Long Term Drift	$\frac{\lvert\Delta V_{VOUT}/V_{VOUT}\rvert}{\Delta t\ (h)}$	V_{VOUT} = 15kV I_{VOUT} = 1mA T_A = −10°C ~ 55°C		≤0.5		%/h
Output Voltage Rise Time	t_r	$V_{VOUT}(t_1)$ = 3kV $V_{VOUT}(t_2)$ = 27kV No-Load		30		ms
		$V_{VOUT}(t_1)$ = 3kV $V_{VOUT}(t_2)$ = 27kV R_{Load} =15 MΩ		TBD		ms
Output Voltage Fall Time	t_f	$V_{VOUT}(t_2)$ = 27kV $V_{VOUT}(t_3)$ = 3kV No-Load		100		ms
		$V_{VOUT}(t_2)$ = 27kV $V_{VOUT}(t_3)$ = 3kV R_{Load} =15 MΩ		TBD		ms
Mean Time Between Failure	MTBF			TBD		h
Instantaneous Short Circuit Current at the Output	I_{VOUT_SC}			≤150		mA
Load Regulation	$\frac{\lvert\Delta V_{VOUT}/V_{VOUT}\rvert}{\Delta I_{VOUT}}$	V_{VOUT} = 15kV I_{VOUT} = 1mA		≤0.05		%/mA
Full Load Efficiency	η (3)	V_{VPS} = 24V V_{VOUT} = 15kV I_{VOUT} = 1mA		≥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} = 15kV I_{VOUT} = 1mA		TBD		°C/W
External Dimensions				140×100×55		mm
				5.51×3.94×2.17		inch
Weight				1000		g
				2.21		lbs
				35.27		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} = 15MΩ

DC Testing

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

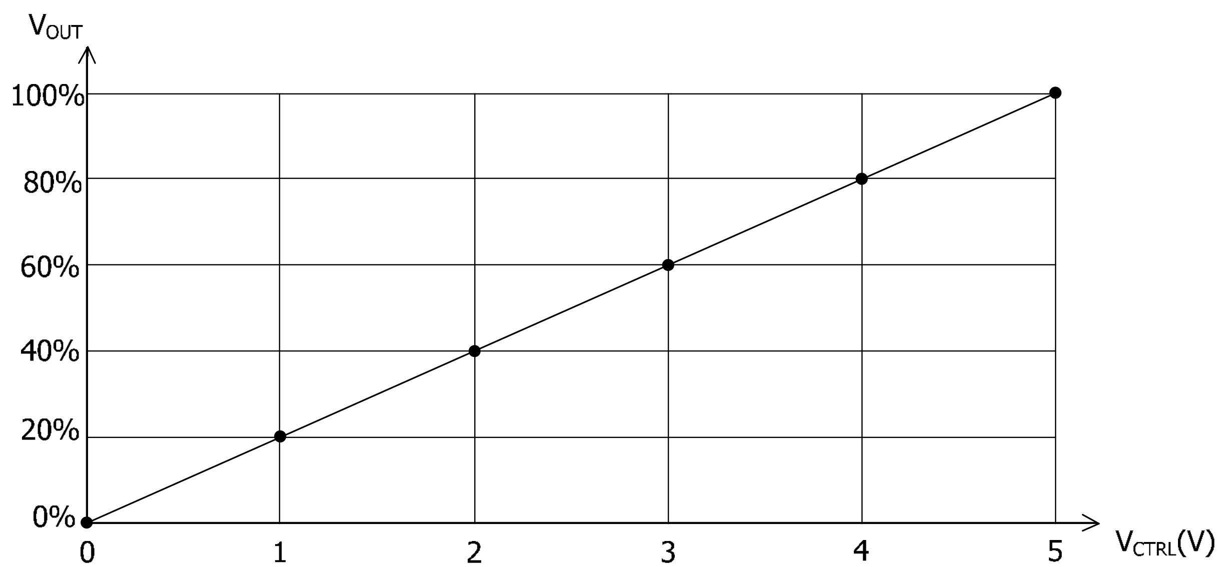
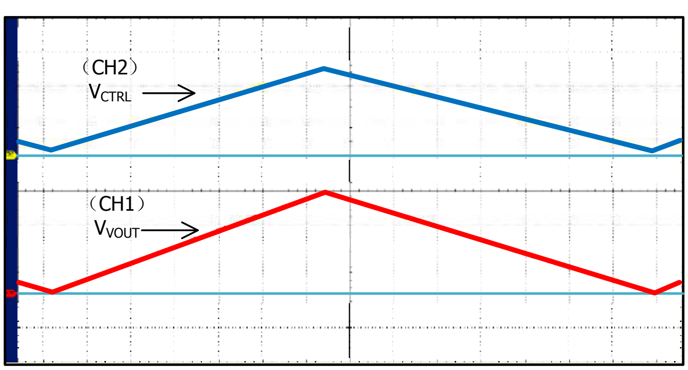


Figure 7. V_{CTRL} vs. V_{VOUT}

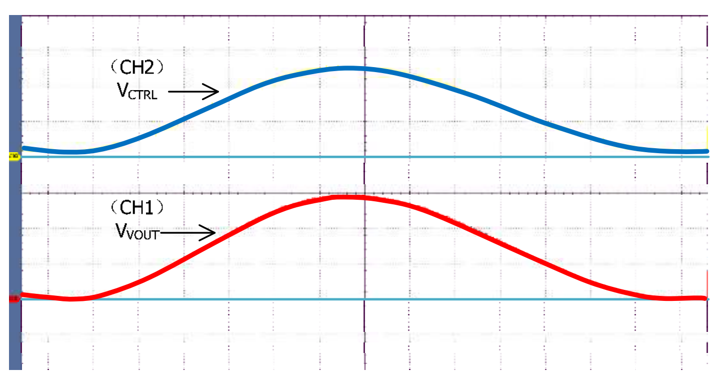
AC Testing

To test the analog modulation function, a triangle and sine-wave voltage signals of 0.25V ~ 5V, f = 0.10Hz, 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: 5000V/Div CH2: 2V/Div M: 500ms/Div
V_{CTRL}: 0.25V ~ 5V V_{VOUT}: 750V ~ 15000V

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



CH1: 5000V/Div CH2: 2V/Div M: 500ms/Div
V_{CTRL}: 0.25V ~ 5V V_{VOUT}: 750V ~ 15000V

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.

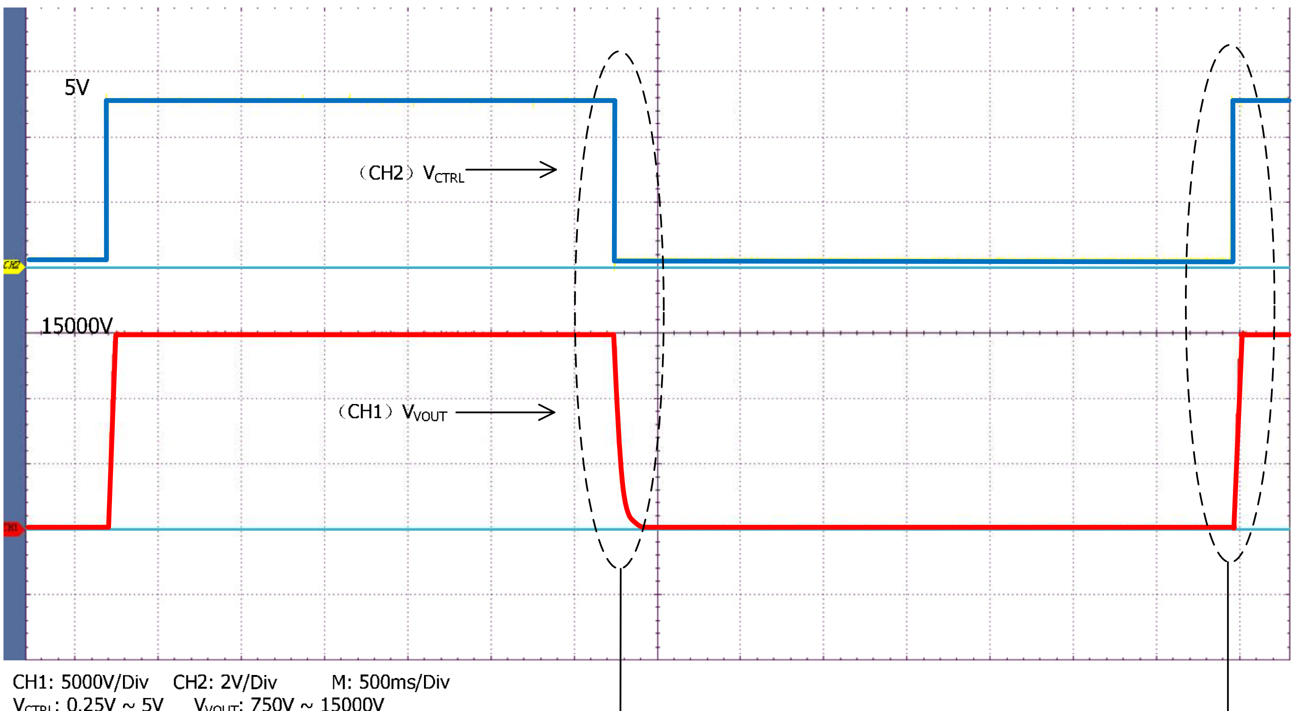


Figure 10. Input vs. Output Waveforms for Square Wave Control

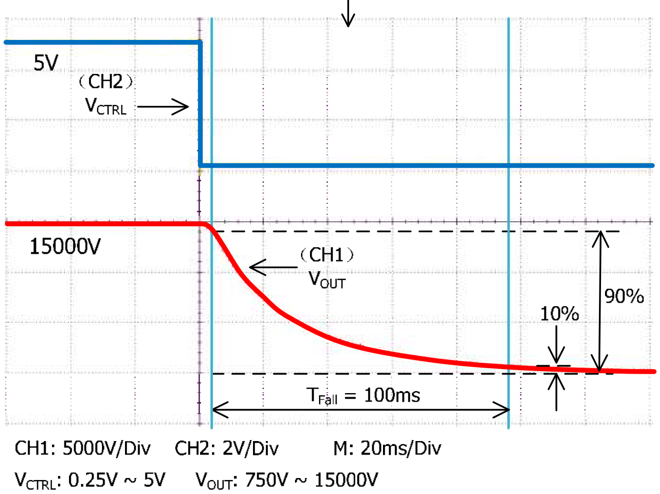


Figure 11. Falling Trail for Large Signal Response

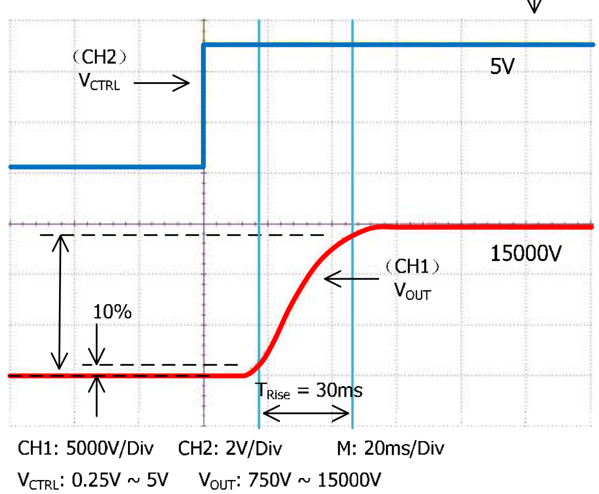
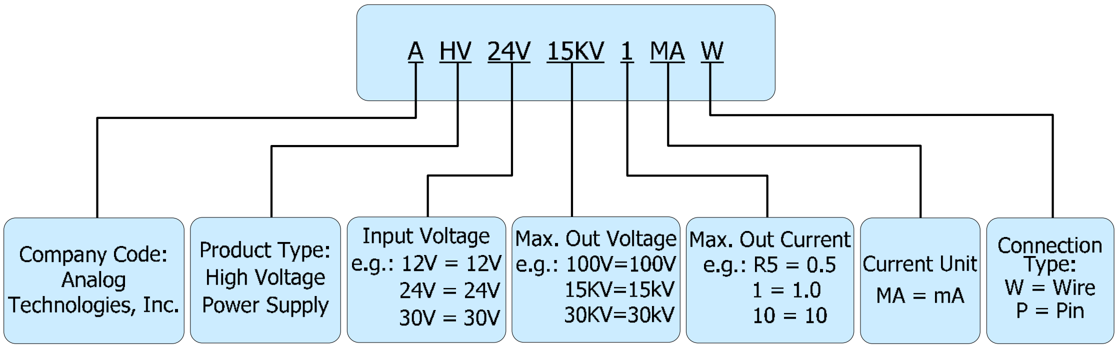


Figure 12. Rising Trail for Large Signal Response

NAMING PRINCIPLE



Naming Principle of AHV24V15KV1MAW

DIMENSIONS

Connecting Lead Wire Sizes and Lengths

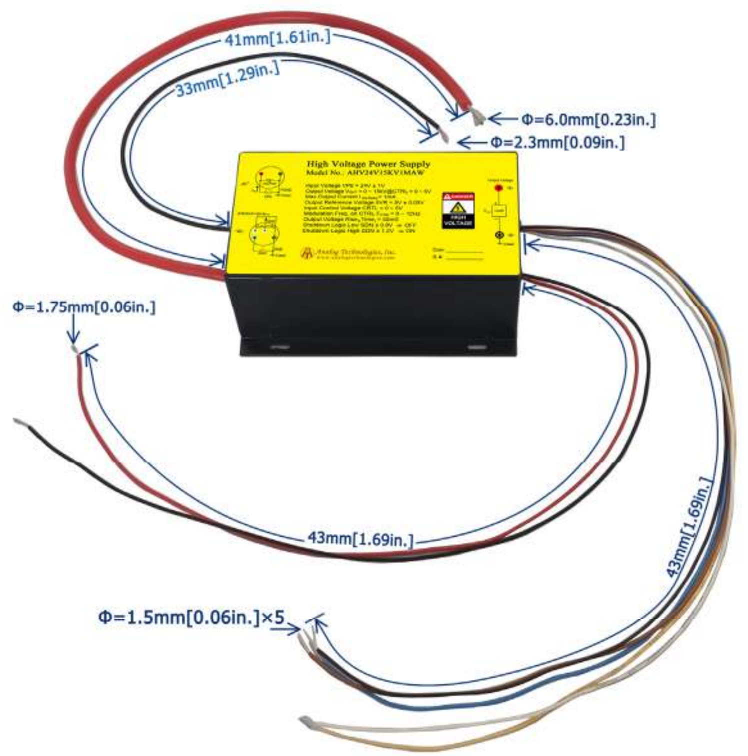


Figure 13. Connecting Lead Wires of AHV24V15KV1MAW

Lead Wires	Diameter		Length	
	mm	inch	mm	inch
Thick brown lead wire	4.5	0.177	120 ± 1	4.724 ± 0.039
Yellow, red, blue, black and white lead wires	1.5	0.059	23 ± 1	0.906 ± 0.039

Outline Dimensions

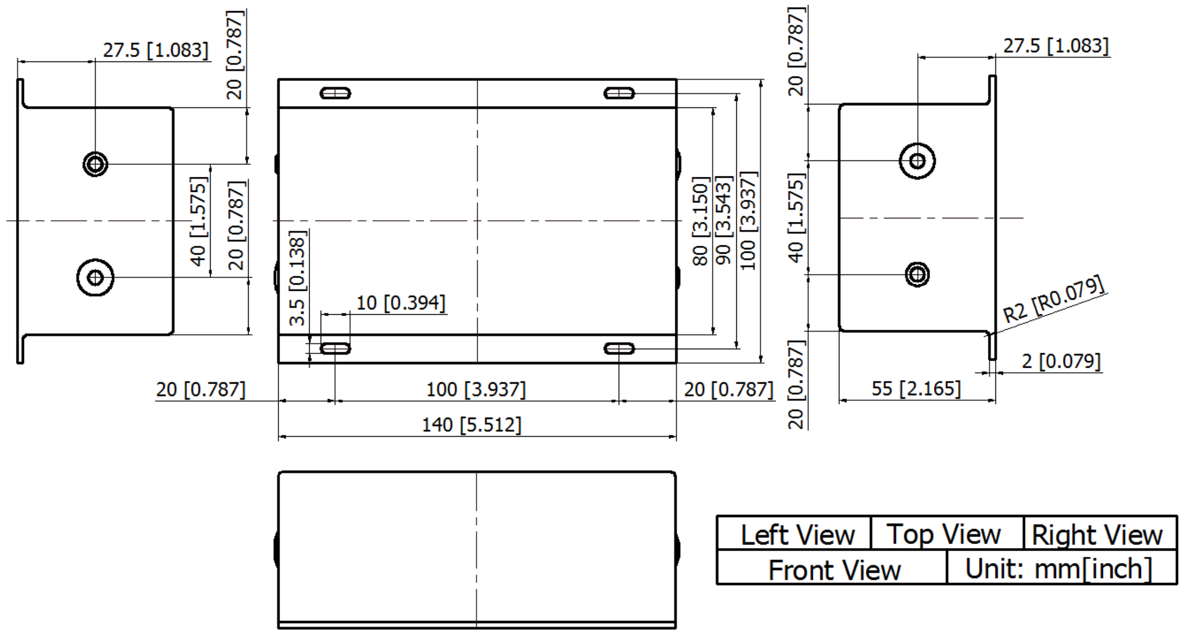


Figure 14. Outline Dimensions

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