EF010

OEM High Voltage Power Supply Module

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This high voltage power supply module works in DC-DC conversion mode. They convert low DC voltage into high DC voltage with high efficiency. They have a wide variety of uses in many industries including electrostatic applications, electrospinning and electrospraying, laser, industrial measurement, control,medical equipment etc.

The main features are:

1. High efficiency: ≥ 70%
2. High output voltage stability: ≤±1%
3. Linear and deep modulation on output voltage: ＜0.2%
4. Short circuit and over current protection
5. Low leakage current at shutdown

Rev 20230706

FEATURES

Input Power Voltage: 24V ± 1V

Input Current Range: 550mA to 2.2A

Output Voltage: 0 to 40kV@CTRL = 0 to 5V

Monitor Voltage: 0 to 4V

Max. Output Current: 1mA

Reference Voltage: 5V ± 0.05V

Input Control Voltage: 0 to 5V

Full Span Modulation on Output Voltage

Electronic Shutdown Control

This power module series 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 related fields.

DESCRIPTION

The figure 1 shows the connecting wires of the unit, of which their detailed information is given in Table 1.

figure 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 40kV proportionally at the output VOUT port as shown in figure 2.

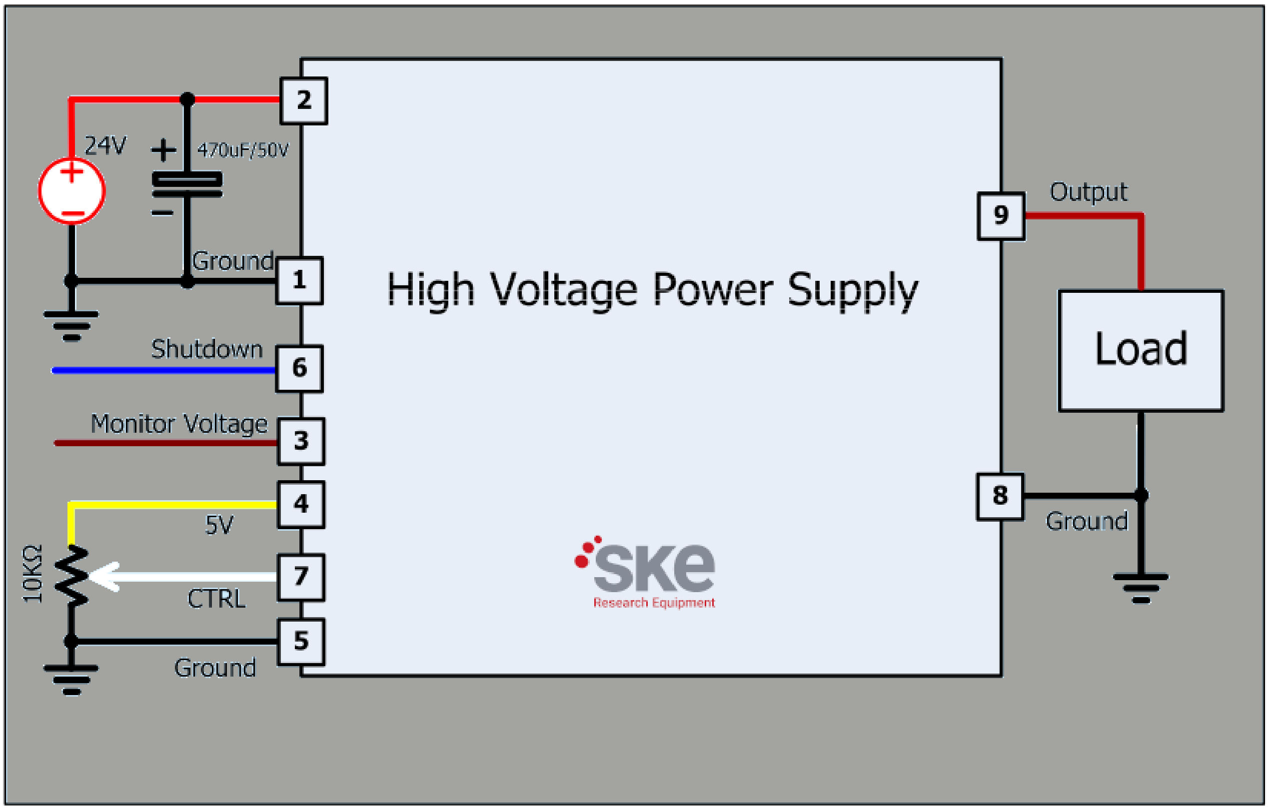


figure 2: Setting Output to be a Constant Voltage

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		4V
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		40kV

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

Please note that the modulation signal must have a low frequency ≤ 10Hz and the value range must be 0V ≤ VCTRL ≤ 5V. The equivalent input circuit for the MON port is shown in figure 3.

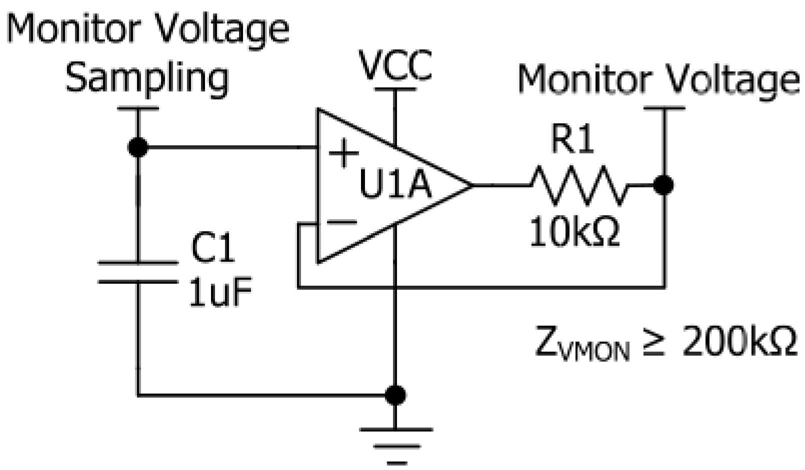


figure 3: The Equivalent Circuit for MON Port

The equivalent input circuit for the CTRL is shown in figure 4.

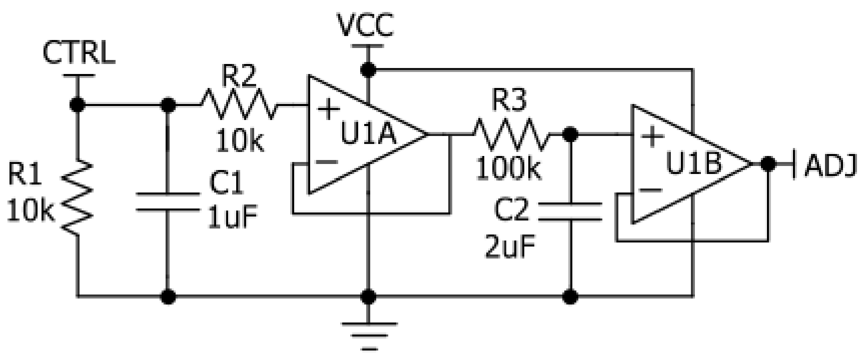


figure 4: The Equivalent Circuit for CTRL Port

To shutdown the unit, 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 5.

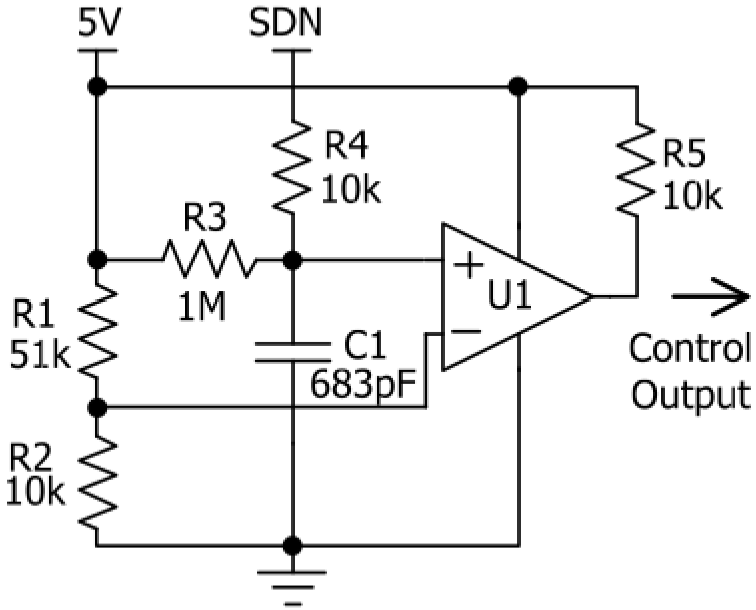


figure 5: The Equivalent Circuit for SDN Port

USING THE MODULE

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 the High Voltage Power Supply Module 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

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	450	500	550	mA
Input Power Current at Full Load		I_{VPS_FL}	I_{VOUT} = 1mA	2.1	2.2	2.3	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} = 40kV 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		40000	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 ~ 40kV	0		1.5	V
Output Load Range				40		∞	MΩ
Output Voltage Ripple		V_{VOUT_RP}	Bandwidth = 1MHz R_{LOAD} = 40 MΩ	≤40			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} = 40kV 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} = 40kV I_{VOUT} = 1mA 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		≤0.3		%/min

	Long Term Drift	$\frac{\lvert \Delta V_{VOUT}/V_{VOUT} \rvert}{\Delta t\ (h)}$	V_{VOUT} = 40kV I_{VOUT} = 1mA T_A = −10°C ~ 55°C		≤0.5		%/h
Output Voltage Rise Time		t_r	$V_{VOUT}(t_1)$ = 3kV $V_{VOUT}(t_2)$ = 37kV No-Load		30		ms
			$V_{VOUT}(t_1)$ = 3kV $V_{VOUT}(t_2)$ = 37kV R_{Load} =40 MΩ		TBD		ms
Output Voltage Fall Time		t_f	$V_{VOUT}(t_2)$ = 37kV $V_{VOUT}(t_3)$ = 3kV No-Load		100		ms
			$V_{VOUT}(t_2)$ = 37kV $V_{VOUT}(t_3)$ = 3kV R_{Load} =40 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} = 40kV I_{VOUT} = 1mA		≤0.05		%/mA
Full Load Efficiency		η (3)	V_{VPS} = 24V V_{VOUT} = 40kV 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} = 40kV I_{VOUT} = 1mA		TBD		°C/W
External Dimensions					170×100×55		mm
					5.51×6.69×2.17		inch
Weight					1200		g
					2.65		lbs
					42.33		Oz

table 2. Characteristics. TA = 25°C, unless otherwise noted.

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: $TCV_{VOUT} = \frac{\lvert \Delta V_{VOUT} \rvert}{V_{VOUT} \times \Delta T}$

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

TESTING DATA

Test conditions: VVPS = 24V, TA = 25°C, RLOAD = 40MΩ

DC Testing

The measured output voltage, VVOUT, corresponding to the control port input voltage, VCTRL, is shown in figure 6.

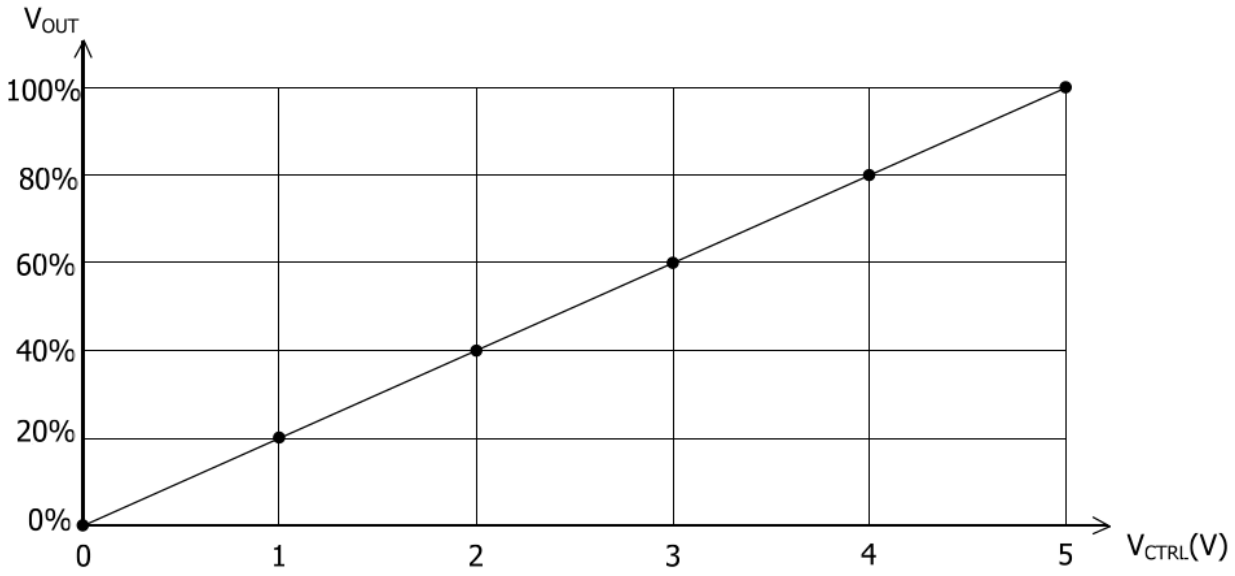


figure 6. VCTRL vs. VOUT

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 7 shows both the input signal and the output signal waveforms when using the triangle and sine-wave signals at the CTRL port respectively.

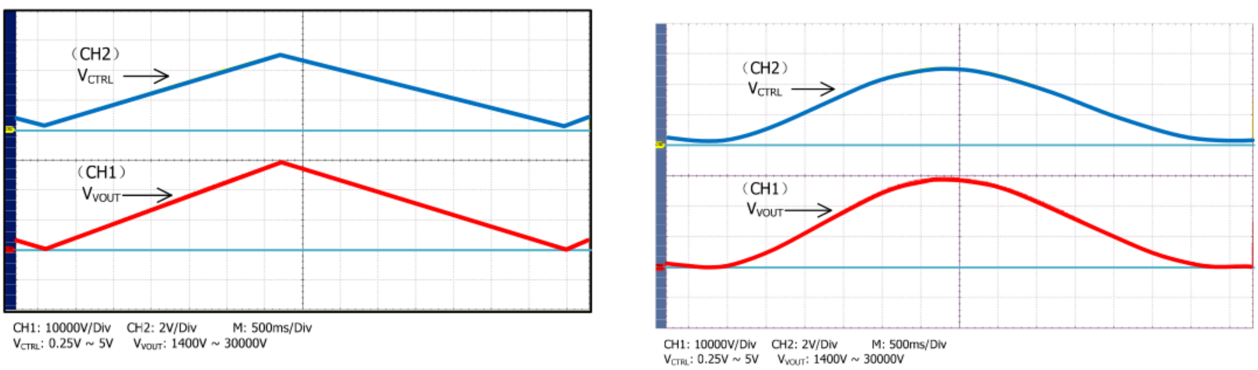


figure 7: Input vs. Output Waveforms for Triangle Wave Control (left) and Input vs. Output Waveforms for Sine Wave Control (right)

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 8, figure 9 and figure 10. As shown in Figure 9 and Figure 10, a square wave of 0.25V ~ 5V, f = 0.10Hz, is applied to the 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.

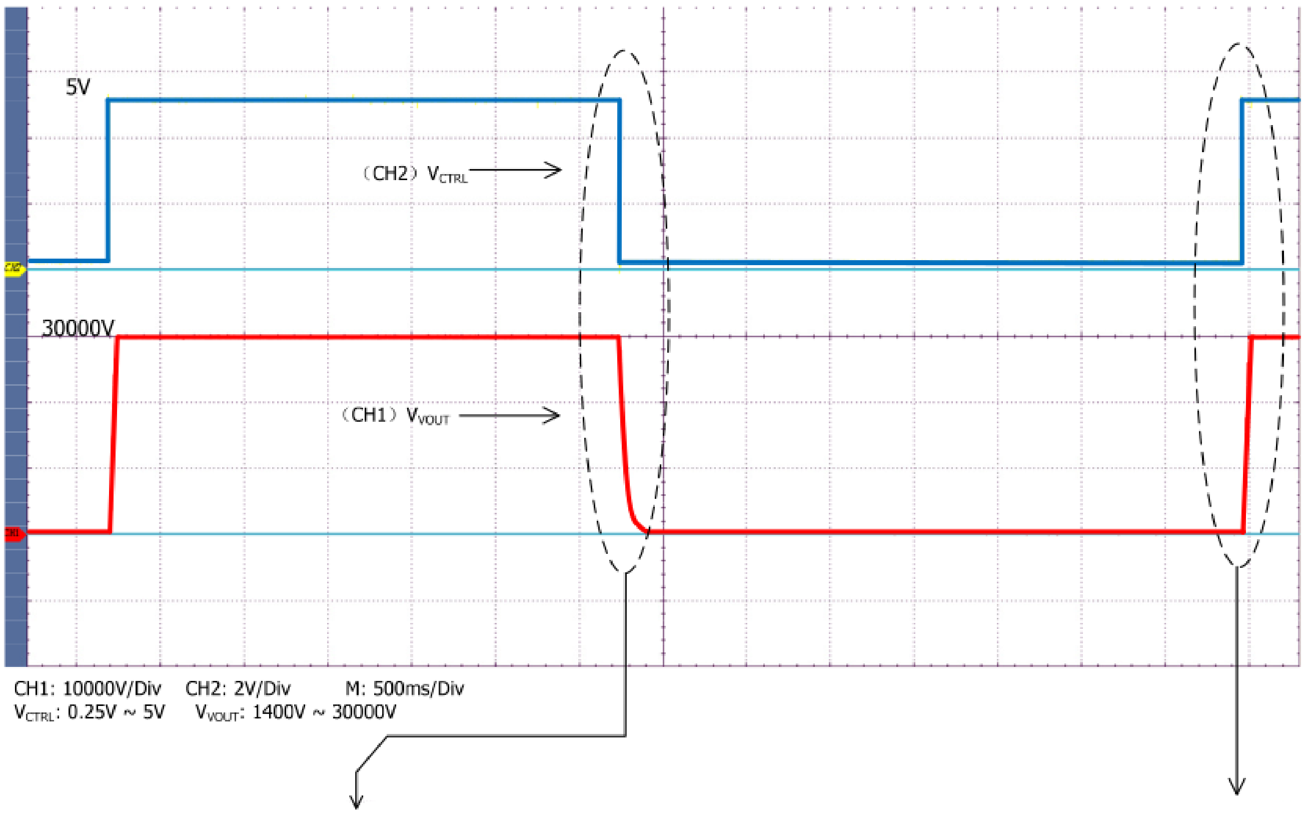
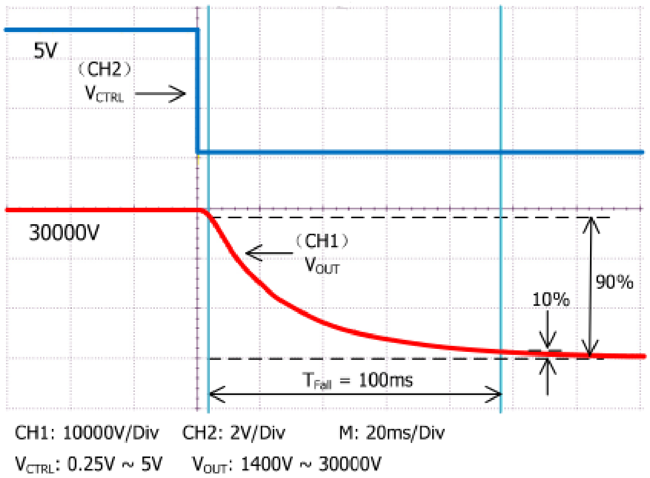


figure 8: Input vs Output Waveforms for Square Wave Control



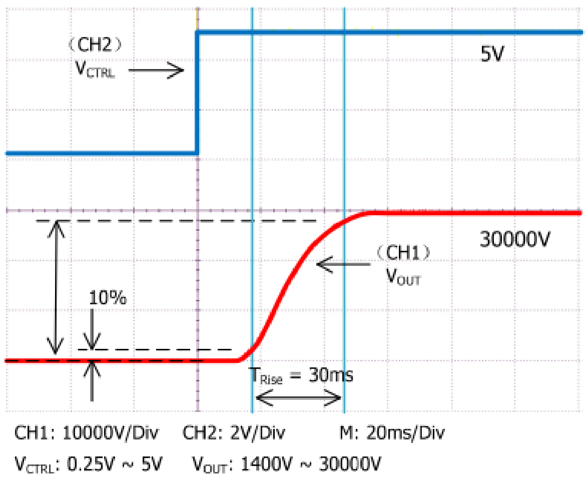


figure 9: falling trail for large signal response

figure 10: rising trail for large signal response

DIMENSIONS

Connecting Lead Wire Sizes and Lengths

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

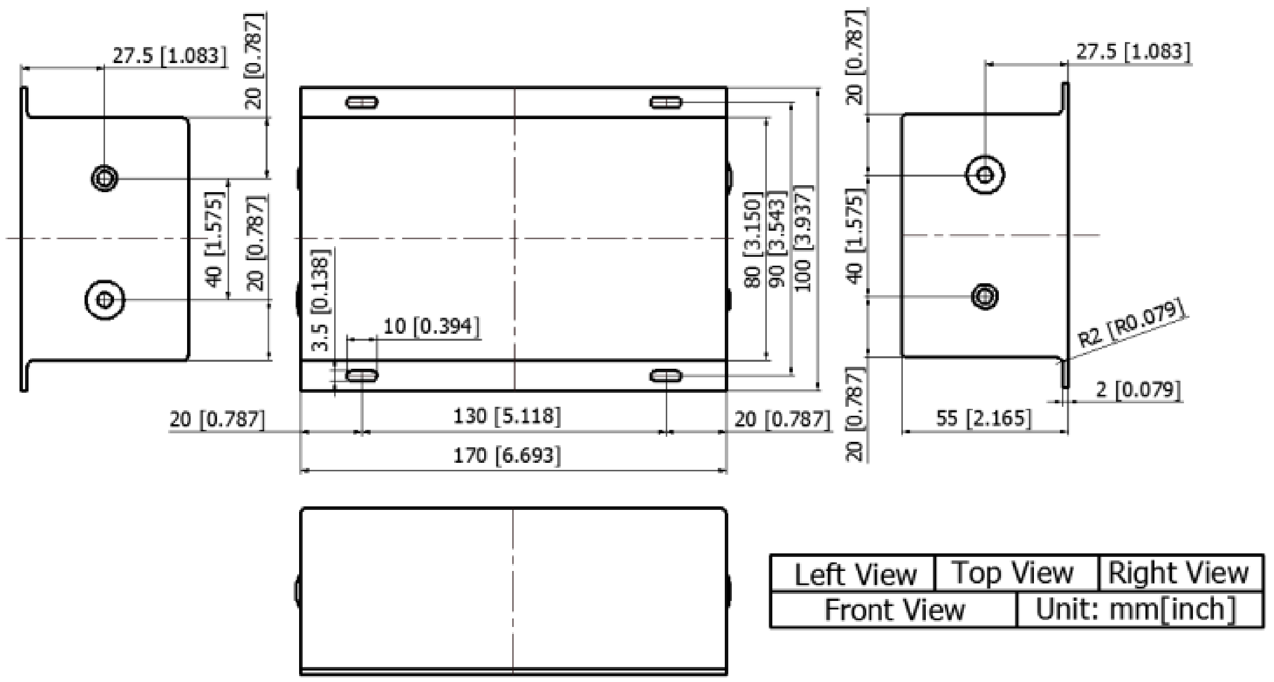


figure 11: outline dimensions

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Product code	EF010 (please specify HV output on your order)

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