SYPD150-280S24

Contents

Features

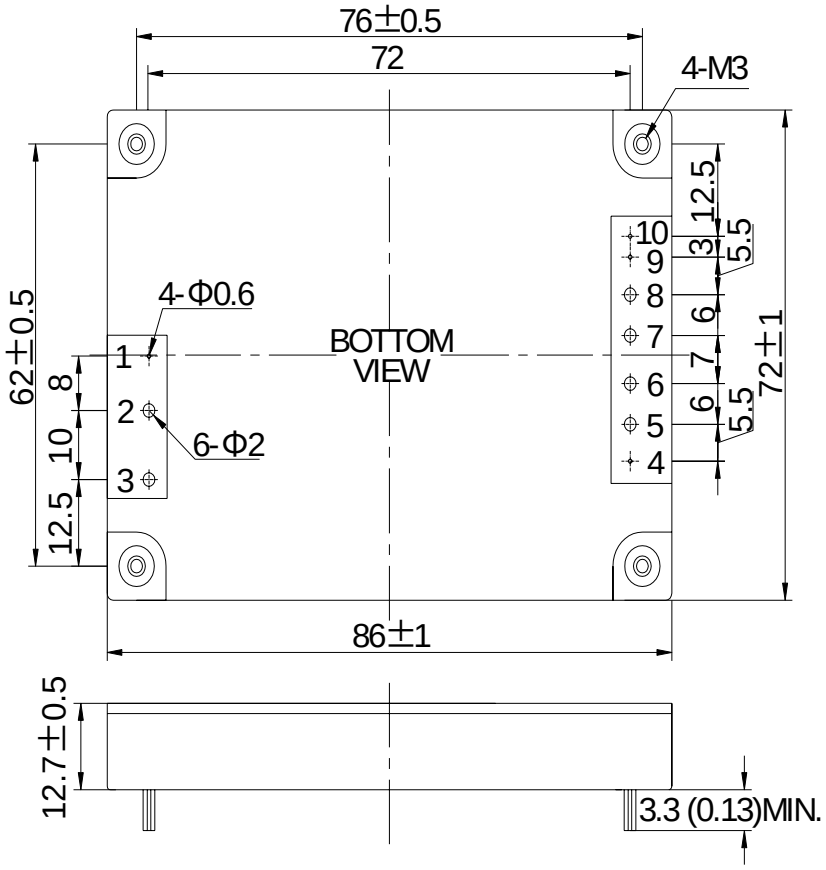
- Dim. (86.0mm×72.0mm×12.7mm)
- Input Under Voltage Protection (180V to 195V Turn off)
- Positive Logic Control (Turn on Between -0.3V to 1.5V)
- Output Over Voltage Protection (30.0V to 34.8V)
- Output Voltage Adjust Range:-10% to 10% of the rated output voltage
- Output Short-circuit Protection, hiccup, auto-recovery
- High Efficiency, 89% (280V, Full Load)
- 1500V_{ac} Isolation Voltage
- -40℃ to 100℃ Operating Ambient Temperature
- 105℃ typ. Over Temperature Protection

Ordering Information

See Contents for individual product ordering numbers.

Suffix	Description	Ordering No.
--	Basic Model	SYPD150-280S24
P	Negative Logic Control	SYPD150-280S24/P

Outline Diagram



Case material:Black flame retardant Plastic; Pins: copper with tin-cerium plating

Aluminum baseplate can be connected to Protective Earth pin by M3 screw

Notes:all dimensions in mm

Tolerances:±0.1mm

Pin	Symbol	Function	Pin	Symbol	Function
1	CNT	Remote On/Off	5、6	+Vo	Positive output
2	-Vin	Negative Input	7、8	-Vo	Negative Output
3	+Vin	Positive Input	9	-S	Negative Remote Sense, connected to $-V_O$ when not be used
4	+S	Positive Remote Sense, connected to $+V_O$ when not be used	10	TRIM	Output adjustment trim pin

Specifications

Unless otherwise specified, all values are given at: 25℃,one standard atmosphere pressure, pure resistive load and basic connection.

Input		Symbol	Min	Typ	Max	Unit	Conditions
Input Voltage		V_{in}	200	280	400	V	—
Input Current		I_{in}	–	–	0.89	A	V_{in}=200V，full load
Positive Logic Remote Control	ON	–	3.5	–	30	V	Refer to -Vin
	Current	–	–	–	1.0	mA	CNT sink current when turn on
	OFF	–	-0.3	–	1.5	V	Refer to -Vin
	Current	–	–	–	1.0	mA	CNT source current when turn off
Negative Logic Remote Control	ON	–	-0.3	–	1.5	V	Refer to -Vin
	Current	–	–	–	1.0	mA	CNT source current when turn on
	OFF	–	3.5	–	30	V	Refer to -Vin
	Current	–	–	–	1.0	mA	CNT sink current when turn off
Start-up Delay Time		T_{delay}	–	440	–	ms	V_{in}=280V，I_O=6.25A
Under Voltage Threshold		V_{UVLO}	180	–	195	V	—
Under Voltage Protection Hysteresis		$\triangle V_{UVLO}$	5	–	15	V	—

Output	Symbol	Min	Typ	Max	Unit	Conditions
Output Power	P_o	0	–	150	W	—
Output Voltage	V_O	23.76	24.00	24.24	V	—
Output Current	$I_{O,nom}$	0.625	—	6.25	A	—
Output Voltage Adjust Range	V_{trim}	21.6	–	26.4	V	Io≤6.25A，Po≤150W
Line Regulation	S_V	–	–	±0.2	% V_O	V_{in}:200V～400V, I_O=6.25A
Load Regulation	S_I	–	–	±0.5	% V_O	V_{in}:280V, I_O=0.625A～6.25A
OVP Set Point	$V_{ov,set}$	30.0	–	34.8	V	—
OCP Set Point	$I_{O,lim}$	6.56	–	9.45	A	—
Output Short-circuit Protection	Hiccup mode, automatic recovery					
Peak to Peak Ripple and Noise	$\triangle V_{pp}$	–	–	240	mV	20MHz bandwidth

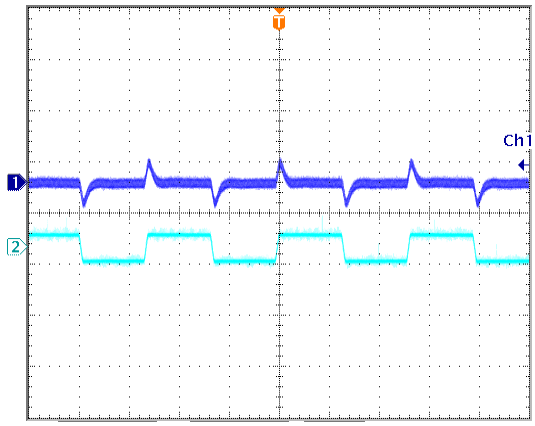
Continue

Output		Symbol	Min	Typ	Max	Unit	Conditions
Rise Time		T_{rise}	–	13	–	ms	$I_{O,nom}$,Pure resistive load
Capacitive Load Range		C_O	0	–	1000	μF	—
Load Transient	Recovery Time	t_{tr}	—	200	—	μs	Load change:25%-50%-25% & 50%-75%-50% Current change: 0.1A/μs
	Voltage Deviation	$\triangle V_{tr}$	—	±720	—	mV	

General	Symbol	Min	Typ	Max	Unit	Conditions
Efficiency	η	88	89	–	%	V_{in}=280V，$I_{O,nom}$
Switching Frequency	f_s	–	240	–	kHz	—
Isolation Resistance	R_{iso}	50	–	–	MΩ	—
Isolation Voltage	V_{iso}	1500	–	–	V_{ac}	Input to output，leakage current≤10mA
		1500	–	–	V_{ac}	Input to case，leakage current≤10mA
		500	–	–	V_{dc}	Output to case, leakage current≤0.5mA
Operating Baseplate Temperature	—	-40	–	110	℃	—
Storage Temperature	—	-55	–	125	℃	—
Temperature Coefficient	S_T	—	—	±0.02	%/℃	—
OTP set Point	T_{ref}	100	105	110	℃	—
OTP Hysteresis	$\triangle T_{ref}$	—	10	—	℃	
MTBF	—	—	2×10^6	—	h	BELLCORE TR-332
Vibration	Sine，Frequency:10Hz to 55Hz，Amplitude:0.35mm，30 min in each of 3 perpendicular directions					
Shock	Half sine, peak acceleration:300m/s², duration:6 ms ; continuous 6 times of pulse in each of 3 perpendicular directions					
Hand Soldering	Maximum soldering Temperature < 425℃，and duration < 5s					
Wave Soldering	Maximum soldering Temperature < 255℃，and duration < 10s					
Weight	—	—	114	—	g	—

Characteristic Curves

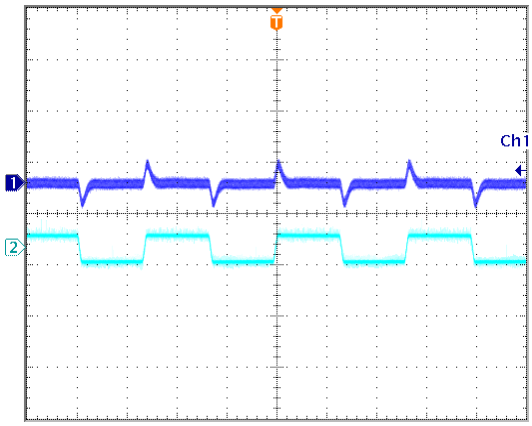
Load Transient Response



Load change:25%～50%～25% Io,nom, 0.1A/μs
Vin=280V

Trace1: 500mV/div
Trace2: 0.12A/div
Time scale: 0.4ms/div

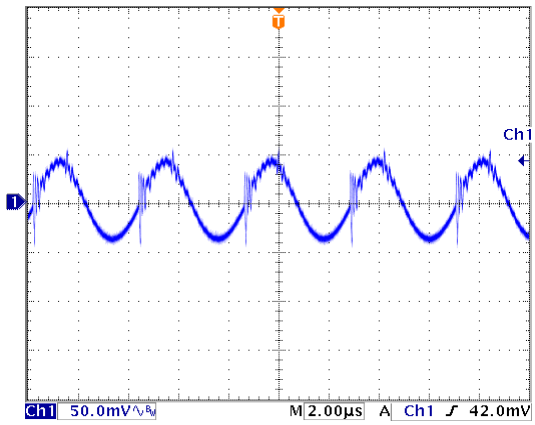
Load Transient Response



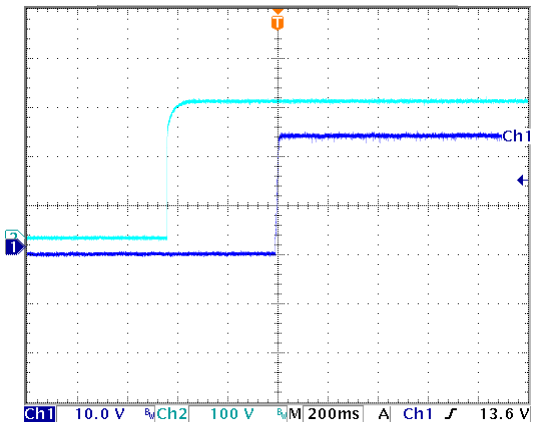
Load change:50%～75%～50% Io,nom, 0.1A/μs
Vin=280V

Trace1: 500mV/div
Trace2: 0.12A/div
Time scale: 0.4ms/div

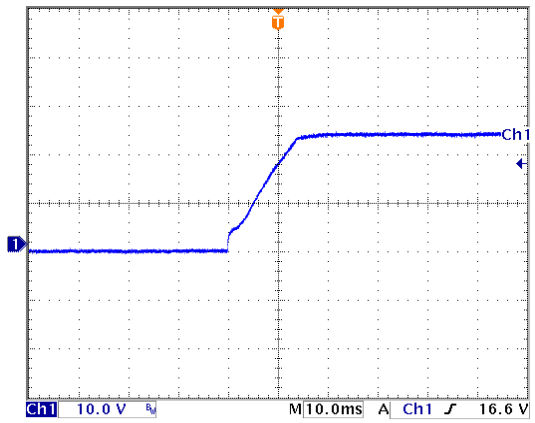
Output Ripple and noise



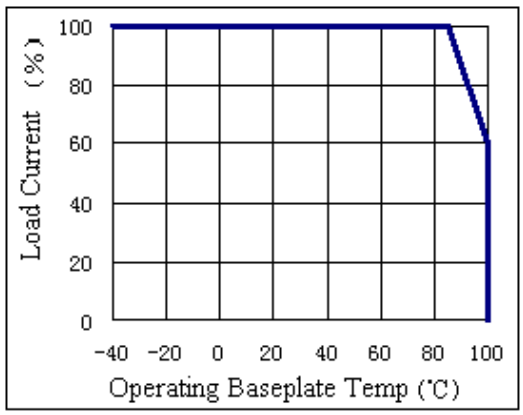
Start-up Delay Time



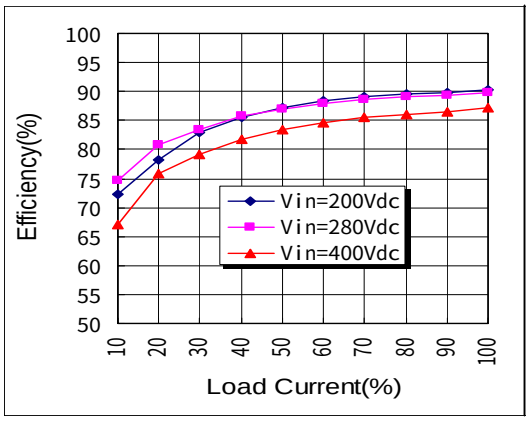
Rise Time



Derating

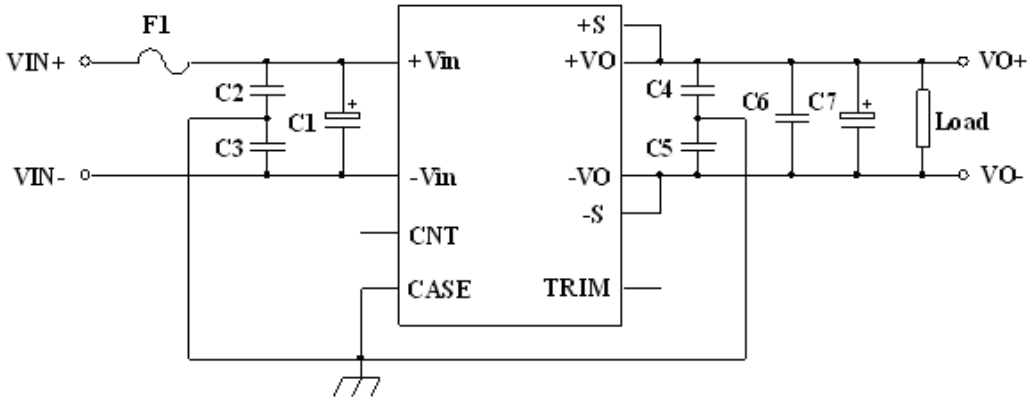


Efficiency



Design Considerations

Basic Connection



The recommended parameters in the circuit are as follows:

F1:3A，fast recovery.

C1:22uF electrolytic capacitor with low ESR, when ambient temperature below -20℃ or input lines have greater inductance, two or more 22uF electrolytic capacitors should be paralleled.

C2、C3:330pF high-voltage ceramic capacitors，withstand voltage >1.5kVac, the wire connected to the case should be as short as possible.

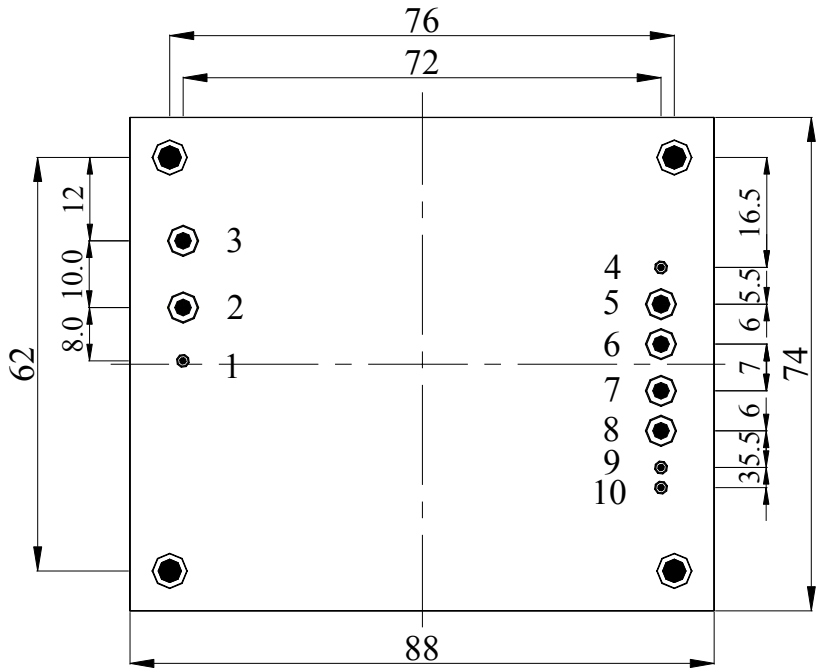
C4、C5:22nF high-voltage ceramic capacitors，withstand voltage >500Vdc,the wire connected to the case should be as short as possible.

C6:2.2uF ceramic capacitor.

C7:100uF electrolytic capacitor, when ambient temperature below-20℃, two or more capacitors with 100uF should be paralleled.

Notes: The basic connection indicates the basic requirements. Please refer to the instruction followed for further information.

Recommended Layout



Notes: all dimensions in mm
Tolerances: ±0.1mm

NO.	Recommendation & Notes
Pad Design	1、4、9、10 Pad holes: 1.0mm，pad diameter including hole:1.8mm; Pad hole 2、3、5-8 are 2.5mm,pad diameter including hole:4.50mm; the fixed holes at the four corners are metallized, with diameter of 3.3mm and pad diameter including hole: 5.3mm-6.3mm.
Airflow Direction	The air should flow along the direction of the heat sink.
Safety	Isolated Converters, care to the spacing between input and output, input and protective ground、output and protective ground.
Electrical	The Vin(-) and Vo(-) planes should be placed under of the converter separately. Avoid routing sensitive signal or high disturbance AC signal under the converter.

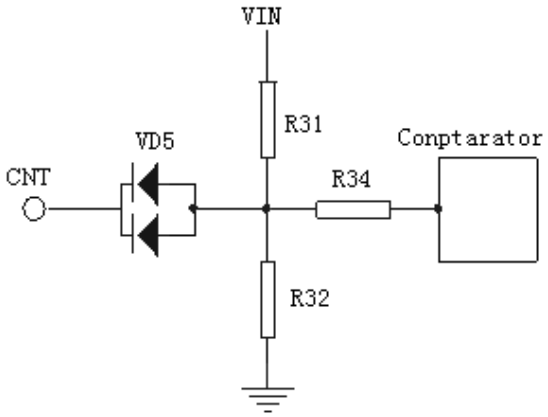
Input Voltage Range

The input voltage range of the DC/DC converter is 200V～400V.The input impedance of the converter looks like a negative resistor, which can interact with the reactance of the power bus (including any filter elements that have been added to the input of the converter), causes an unstable condition. Depending on the internal transformer's impedance, the external impedance usually should not exceed the 10% of the

internal. The source impedance of the Power bus should be kept as low as possible.
Wherever the input voltage of the converter comes from, AC mains or switching modules, the peak to peak of the voltage ripple should not be more than 20V. Otherwise the output voltage ripple will increase, unless protection circuit is equipped.

Remote Control

Remote control can be offered by setting right control voltage level (refer to -Vin pin)to CNT pin. When the level is higher than 3.5V or be left floating, the converter will be off. When the level is less than 1.5V , the converter will be on. The circuit diagram is shown as " internal circuit diagram for positive logic control", when low level applied, the CNT source current is less than 1mA, due to VD5 is signal diode, and the logic comparator is semiconductor integrated chip with low resistance to surge. Care should be taken to prevent CNT from surge, A TVS should be used in some cases.

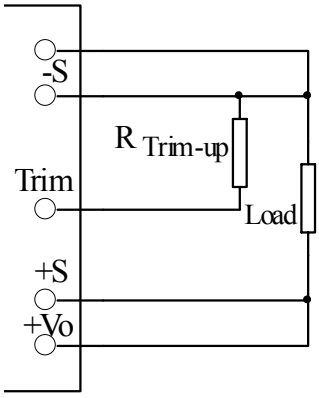


Internal circuit diagram for positive logic control

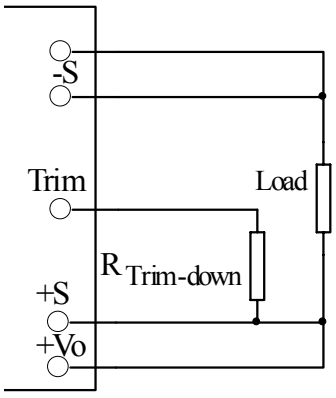
In some applications, extra controls will be designed for the converter in user's PCB, such as output short circuit protection, over voltage protection, under voltage protection, synchronous control to the converter output voltage, and so on, remote control will give you help. The controls can be achieved by external circuit applied to the CNT pin.

Output Voltage Adjust

The converters have an Output Voltage adjust pin (Trim). This pin can be used to adjust the output voltage above or below Output voltage initial setting. When increasing the output voltage, the voltage at the output pins (including any remote sense offset) must be kept below the maximum output adjust range, or the characteristics will not be assured in compliant with the specification, even the over voltage protection may be triggered. Also note that at increased output voltages the maximum power rating of the converter 150W remains the same, and the output current capability will decrease correspondingly, at decrease output voltages the maximum current should not exceed 6.25A. When the trim pins are not used, they should be floated.



Connection for Trimming Up



Connection of Trimming Down

External circuit is connected as the figure shown, the resistance is calculated as the formula below, please note that the formula will be invalid when $R_{Trim-up}$、$R_{Trim-down}$ are used simultaneously, users adjust the value based on the resistance applied.

Resistance for trimming up ：$R_{Trim-up}=\left(\frac{53.585}{\Delta V}-15\right)(k\Omega)$

Resistance for trimming down：$R_{Trim-down}=\left(\frac{461.33}{\Delta V}-36.5\right)(k\Omega)$

Vo：rated The output voltage you need,V;

$R_{Trim-up}$、$R_{Trim-down}$ ：Resistance for trimming up or down, kΩ;

△V：The output voltage Change (The output voltage you need minus output voltage), V;

For example, trimmed up voltage to 25V，then △V=25-24=1;

$R_{Trim-up}=\left(\frac{53.585}{1}-15\right)=38.585(k\Omega)$, it can be taken as 39 kΩ.

Remote Sense

The remote sense can be used to compensate for the voltage drop between the output pins of the converter and the load input pins by +S、-S pins. The +S and –S pins should be connected to the input pins of the load respectively. The remote sense circuit will compensate for up to 10% voltage drop between the sense voltage and the voltage at the output pins.

The anti-interference design should be considered when the +S、-S pins are connected to the pins to be compensated. The +S、-S traces should be located close to a ground trace or ground plane, and the area they surrounded should be minimized (just for electrical isolation); If cable connection presents, twisted pair wires should be used, EMI core are equipped with the twisted pair wires to reduce common mode noise when necessary, the sense leads should not be longer than 200mm,or the system characteristics may not be assured.

The sense leads only can carry very little current, and are not used for converter power output. Care should be taken in operation to avoid damaging the converter.

Over Temperature Protection

The regulators are protected from thermal overload by an internal over temperature shutdown circuit. When the baseplate temperature exceeds the temperature trig point, the OTP circuit will cut down output power. The regulator will stop until safe operating temperature is restared. Hysteresis temperature between OTP trig point and restart is approx 10°C. Time between OTP and restart is dependent on cooling of the regulator.

Output Over Voltage Protection

The switching-off type over voltage protection feature is used to protect the converter, when output voltage exceeds 115% to140% of the rated output voltage (the set point is between 125%-145%, there is the difference based on the specific parameters, but not beyond the range), the output voltage will shut down. Until input voltage applied or restart up after remote off,the output will not resume. Please make sure the input voltage is below 10V before input voltage applied.

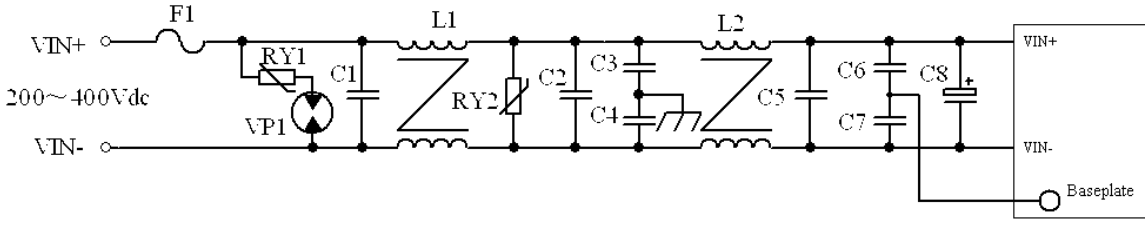
Safety Consideration

The converter, as one component for the end user, should be installed into the equipment, and all the safety considerations are achieved under certain condition. It is required to meet safety requirements in system design for the user. The converter output is considered SELV, and the expected input is hazardous voltage, the primary to secondary is reinforced insulation to EN60950.The maximum operating temperature for PCB is 130 ℃.

To avoid fire and be protected when short circuit occurred, it is recommended that a fast blow fuse with rating 2.5-3 times of converter continuous input peak current is used in series at the input terminal.(Inrush current suppression circuit is required for greater filter capacitance at input terminal, or it will result in the misoperation of the fuse).

EMC Consideration

Conductive Interference will be emphasized in the following consideration, surge、EFT、conducted interference generated from the converter to power supply system, and so on. Some tests, like static, radiation, should be considered in the whole system design.



Input Filter and Protection Schematic

RY1、RY2、VP1 in the figure are VDR and discharge tube respectively, for the suppression of the differential mode interference conducted along with the wire. The maximum surge current of the VDR and Impulse Discharge Current of the discharge tube, Imax should not less than 3KA, Varistor voltage or DC

Spark over Voltage: 800V to 1000V.For lower level protection, RV2 can be remained only. It is advised to remain L2，if not, the differential mode inductor should be set, or others to make sure inductive resistance exists in the circuit, for a longer life to RY2.

The function of L1、L2、C1-C7 is for filtering differential mode and common mode interference. L1&L2 are for low frequency and high frequency separately. If only one common mode choke is required to remain for some reasons, the impedance characteristic of input voltage source should be considered comprehensively, L2 may be removed for low impedance and L1 may be removed for high impedance, the inductor for filtering within 10MHz should be focused on. L1 in the converter should employ high magnetic core (like TIANTONG Group TS10A),inducatance:1mH; and L2 should employ Nanocrystalline Core (like ANTAI Group G8), inducatance:1mH, C3、C4、C6、C7:1000pF，C1、C2:0.1μF.

Series and Parallel Operation

The converters should not be paralleled directly to increase power, but they can be paralleled each other through o-ring switches or diodes. Make sure that every converter's maximum load current should not exceed the rated current at anytime, if they are paralleled without using external current sharing circuits.

The converters can operate in series. To prevent against start-up failure due to start up time difference, SBD with low voltage difference can be paralleled at the output pins(SBD negative terminal connect to the positive pin of the output) for each converter.

Cleaning Notice

The converter is suitable for water washing, because it does not have any pockets where water could be trapped long-term. Users should ensure that the drying process is adequate and of sufficient duration to remove all water from the converter after washing, do not power up the unit until it is completely dry.

Quality Statement

The converters are manufactured in accordance with ISO 9001 system requirements, in compliant with YD/T1376-2005, and are monitored 100% by auto-testing system, 100% burn in.

The warranty for the converters is 5-years.