RAGS50-24A05 DC-DC Converters

Input 16V～40V, Output 5V/10A, One Sixteen Standard Brick

Contents

DOSA Standard outline

Reference picture

RoHS

Features

- *One Sixteen Brick (36.6mm×26.6mm×12.7mm)*
- *Input Under Voltage Protection（13V～15V turn off）*
- *Positive Logic Control（3.5V～15V or floating turn on）*
- *Output Voltage Adjust Range: ±10%$V_{o,nom}$*
- *Output Over Voltage Protection（6V～7V）*
- *Output Over Current Protection、Short-circuit Protection（Clamped，auto-recovery）*
- *High Efficiency up to 92%（24V, full load）*
- *2250Vdc Isolation Voltage*
- *Operating Substrate Temperature -40 ℃~+100 ℃*
- *Over Temperature Protection 105 ℃Typ.*
- *Applications: Telecom/ Datacom, Electronic data processing, military industry，industrial control、vehicle and other applications with high quality requirements.*

Ordering Information

See Contents for individual product ordering numbers.

Ordering No.	Description
RAGS50-24A05	Shown as the specification
RAGS50-24A05P	Negative Logic Control,only logically different from the base model

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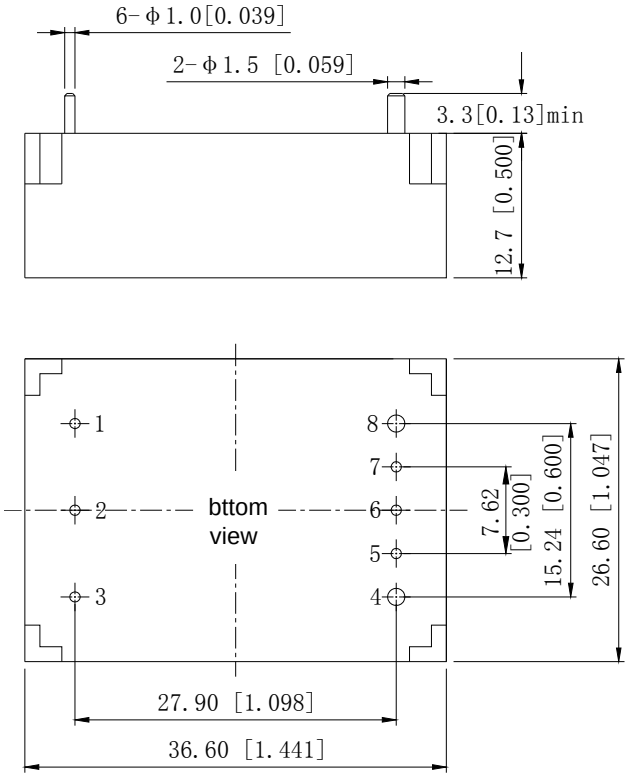
Outline Diagram



Pin	Symbol	Function
1	-Vin	Negative Input
2	CNT	Remote Control, turn on/off the converter. Output voltage on when CNT floating or high level applied
3	+Vin	Positive Input
4	+Vo	Positive Output
5	+S	Positive Remote Sense, connected to +Vo pin when not in use.
6	TRIM	Output Voltage Trim, voltage be trimmed up or down by applying external resistor connected to +S or -S output
7	-S	Negative Remote Sense, connected to -Vo pin if not used.
8	-Vo	Negative Output
Substrate material：aluminium； Case and cover material：plastics； Pin material：brass with gold plated surface.		

Notes：All dimensions in mm[inches]
Tolerances：X.X±0.5[X.XX±0.02]
X.XX±0.25[X.XXX±0.010]
Pin diameter tolerance：±0.10[±0.004]

Specification

Unless otherwise specified, all tests are at room temperature and standard atmosphere, pure resistive load and +S connected to +Vo、-S connected to -Vo.

Input		Symbol	Min	Typ	Max	Unit	Conditions
Input Voltage		V_{in}	16	24	40	V	—
Input Idling Current		$I_{in,nl}$	–	–	200	mA	I_o=0A
Input Current		I_{in}	–	–	3.5	A	—
Positive Logic Remote Control	On	–	3.5	–	15.0	V	Refer to -V_{in}； Turn on when CNT floating.
	Current	–	–	1.0	–	mA	CNT sink current when turn on
	Off	–	0	–	1.5	V	Refer to –V_{in}; Also turn on when CNT floating.
	Current	–	–	1.0	–	mA	CNT source current when turn off

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Continue

Input		Symbol	Min	Typ	Max	Unit	Conditions
Negative Logic Control	On	–	0	–	1.5	V	Refer to $-V_{in}$
	Current	–	–	1.0	–	mA	CNT source current when turn on
	Off	–	3.5	–	15.0	V	Refer to $-V_{in}$; Turn off when CNT floating
	Current	–	–	1.0	–	mA	CNT sink current when turn off.
Start-up Delay Time		T_{delay}	–	100	–	ms	—
Under Voltage Threshold		V_{UVLO}	13	–	15	V	Half test
Under Voltage Protection Hysteresis		$\triangle V_{UVLO}$	–	1	–	V	—

Output	Symbol	Min	Typ	Max	Unit	Conditions
Output Voltage	V_o	4.95	5.00	5.05	V	—
Output Current	I_o	–	10	–	A	—
Output Voltage Adjust Range	V_{trim}	4.5	–	5.5	V	$P_o \leq 50W, I_o \leq 10A$
Line Regulation	S_V	–	–	±0.2	$\%V_o$	V_{in}:16V～40V,I_o=10A
Load Regulation	S_I	–	–	±0.5	$\%V_o$	V_{in}=24V,I_o:0～10A
Output Over Voltage Protection Set Point	$V_{ov,set}$	6	–	7	V	—
Current Limit Inception	$I_{o,lim}$	11	—	17	A	—
Output Short-circuit Protection	hiccup mode ,auto-recovery					V_{in}=24V
Peak to Peak Ripple and Noise	$\triangle V_{pp}$	–	–	100	mV	V_{in}=24V,20MHz bandwidth, $I_{o,max}$; A 22 μF ceramic capacitor
Rise Time	T_{rise}	–	50	–	ms	Vin,nom, Io,max,pure resistive load
Output Overshoot	V_{to}	–	–	0.5	V	Vin,nom, Io,max,,pure resistive load
Capacitive Load	C_o	0	–	10000	μF	Pure resistive load
Remote Sense Compensation Range	V_{sense}	0	–	0.5	V	+S and -S twisted Pair, length is less than 20cm
Load Transient Recovery Time	t_{tr}	–	–	200	μs	25%～50%～25%$I_{o,nom}$ or 50%～75%～50% $I_{o,nom}$; 0.1A/μs. A 10μF tantalum capacitor and a 1μF ceramic capacitor are applied at output
Load Transient Voltage Deviation	$\triangle V_{tr}$	–	–	±200	mV	
Load Transient Recovery Time	t_{tr}	–	–	200	μs	10%～100%～10% $I_{o,nom}$; 0.1A/μs.output; output plus 1000μF capaxitor.
Load Transient Voltage Deviation	$\triangle V_{tr}$	–	–	±300	mV	

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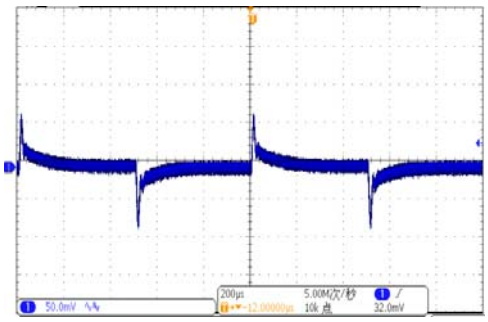
General	Symbol	Min	Typ	Max	Unit	Conditions	
Efficiency	η	90	–	–	%	$V_{in,nom}$, $I_{o,max}$	
Switching Frequency	f_s	200	–	400	kHz	—	
Isolation Resistance	R_{iso}	100	–	–	MΩ	Input -Output	500Vdc,90%RH
						Input -Substrate	
						Output -Substrate	
MTBF	–	–	2×10^6	–	h	BELLCORE TR-332, ambient temperature 25℃	
Isolation Voltage	V_{iso}	2250	–	–	Vdc	Input -Output	Time:1min，Leak Current≤1mA
						Input -Substrate	
						Output -Substrate	
Operating Substrate Temperature	–	-40	–	+100	℃	See the derating curve	
Storage Temperature	–	-55	–	+125	℃	—	
Temperature Coefficient	S_T	–	–	±0.02	%/℃	—	
Relative Humidity	–	10	–	90	%	No condensing,40℃±2℃	
Over Temperature Protection Reference Point	T_{ref}	–	105	–	℃	Substrate Temperature	
Over Temperature Protection Hysteresis	$\triangle T_{ref}$	–	10	–	℃		
Hand Soldering	Maximum soldering Temperature < 425℃， and duration < 5s						
Wave Soldering	Maximum soldering Temperature < 255℃， and duration < 10s						
Weight	–	–	31	–	g	—	

Characteristic Curves

Load Transient Response

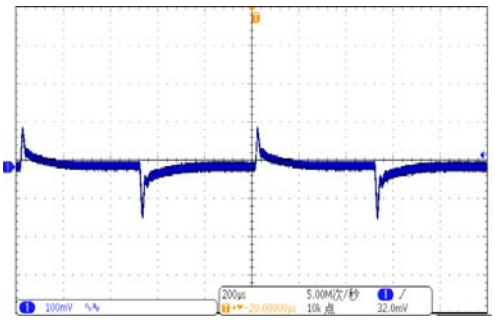


Load change:25%～50%～25% Io,nom, 0.1A/μs
Vin=24Vdc

Trace1: 50mV/div

Time scale:0.2ms/div

Load Transient Response



Load change: 50%~75%～25% Io,nom, 0.1A/μs
Vin=24Vdc

Trace1: 100mV/div

Time scale:0.2ms/div

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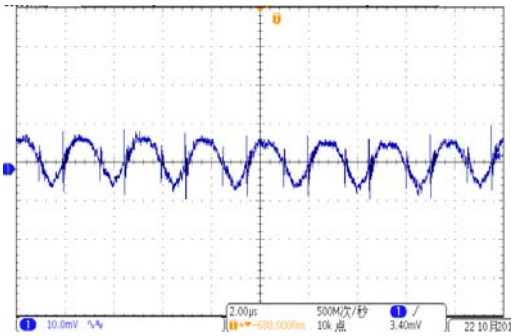
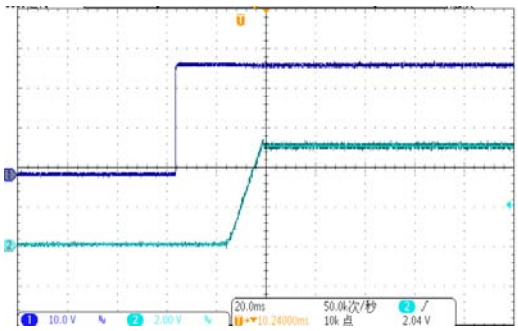
Output Ripple and noise



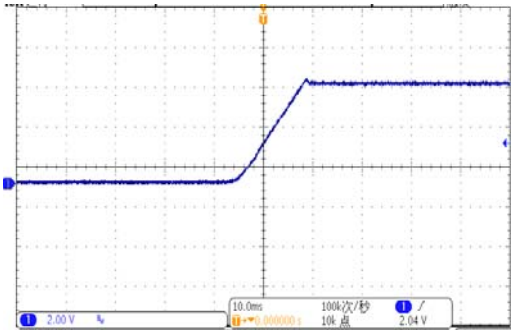
V_{in}=24V,I_o=10A

Start-up Delay Time



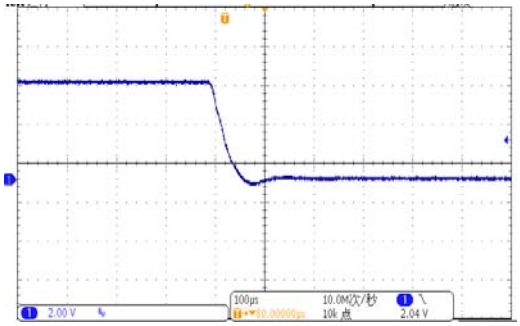
V_{in}=24V,I_o=10A

Rise Time



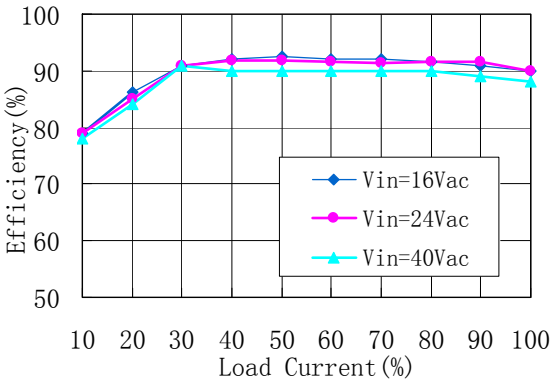
V_{in}=24V,I_o=10A

Turn-off

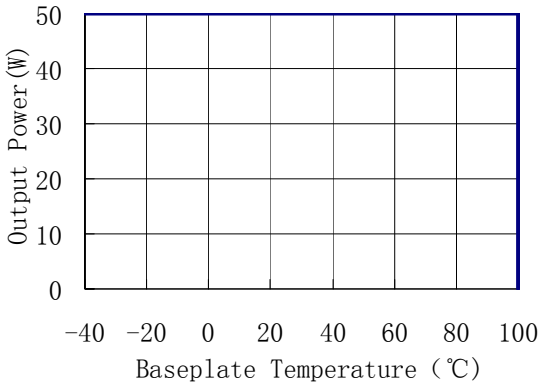


V_{in}=24V,I_o=10A

Efficiency vs Load current



Derating Curve



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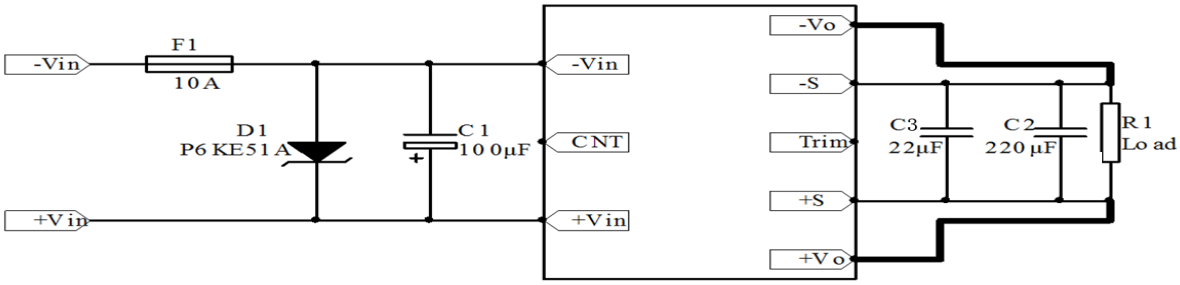
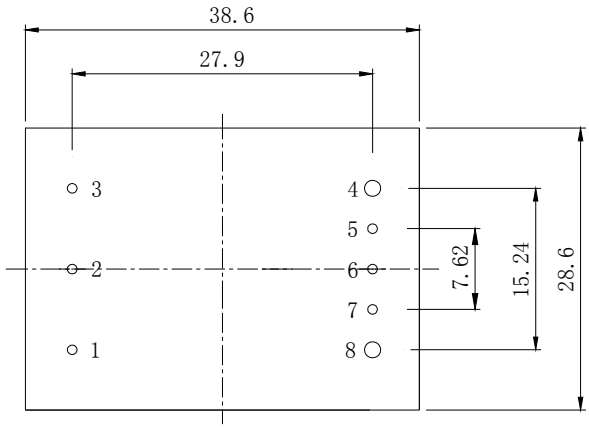
Design Considerations

Basic Connection



Notes: The basic connection indicates the basic requirements that the power module can provide rated output voltage and rated power only. Please refer the instruction followed for further information.

Recommended Layout



NO.	Recommendation & Notes
Pad Design	4&8 pad hole diameter is 2.0mm，pad diameter including hole is at least 3.0mm； the rest pad hole diameter is1.4mm and pad diameter including hole is at least 2.4 mm
Safety	Isolated Converters, care to the spacing between input and output≥2.5mm
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 product is 16V~40V. Due to the fact that this product belongs to a switching power supply, the input of the switching power supply has a negative impedance characteristic. Therefore, in order to ensure the stable operation of the system, it is required that the power supply equipment and power supply lines have a low source impedance. When the input wiring is too long, resulting in a high source impedance, the output voltage or ripple of the module power supply may be unstable.

The method to determine whether the impedance of the power bus too high or not is to decrease the converter's input voltage from higher to lower gradually. If the module power supply works normally when the input voltage is high, and the output voltage decreases or becomes unstable when the input voltage is low, and reducing the load current can restore normal, it may be due to high power supply impedance. For further confirmation, ordinary electrolytic capacitor of can be paralleled to the converter pins after the converter shuts down (in some cases,a ceramic capacitor of 1uF may be required to be connected between the electrolytic capacitor and the module pin), if the output is getting better, it will be sure that the impedance of the power supply circuit is too large.

Remote Control

Remote control can be offered by setting right control voltage level (or floating、high resistance) to CNT pin.

Positive logic remote control and negative logic remote control functions are optional，RAGS50-24A05 is provided with positive logic remote control.When the level is 3.5V～15V or be left floating, the converter will be turned on. When the level is 0V～0.5V ,the converter will be off.When low level applied, the outflow

current from the CNT pin is less than 2mA, and when high level (3.5～15V)applied, the inflow current from the CNT pin is less than 1mA.

Due to the internal logic comparator is a semiconductor integrated device,it has low endurance to surge. In practical applications, when introducing a voltage source that may cause surge voltage to the external signal, attention should be paid to the anti surge protection of the CNT, such as adding TVS tubes or bypass ceramic capacitors, to ensure that the CNT pins are not damaged by surge voltage. When the pin is floated, the voltage is approximately 2V-6V. The above diagram shows the recommended circuit for transistor control. If there is an isolation requirement for remote control in customer applications, the transistor can be replaced with an optocoupler to achieve isolation control.

RAGS50-24A05P is provided with negative logic remote control. It has the same characteristic as RAGS50-24A05, except control logic. When the level is less than 1.5V, the converter will turn on.When the pin is left floating or the voltage of the pin is 3.5V～15V, the converter will turn off. As with positive logic products, attention should also be paid to the protection of CNT surge voltage. When the pin is floated, the voltage is approximately 2V～6V.

The use of remote control functions can provide users with convenience in control. For example, using remote control function to achieve remote control on/off function; When using in series parallel or when multiple devices are started simultaneously, the system can also use signals to synchronize the output voltage of the module.

This product is a positive logic control. When the signal provided by the application end system exceeds the range of 3.5V～15V, or when the system requires only a very narrow control signal level to play a control role, an auxiliary circuit needs to be added outside the module power supply. If you need a specific solution, please contact us.

External Capacitance

Unless special purpose (i.e. prolonging hold-up time, input impedance matching), the recommended input filter's capacitance ranges 100μF～470μF, which not only offers a stable system, and reduces the cost, but also lessens the inrush current when the power supplies, optimizes the power supply source, and improves system reliability.

When larger capacitance is required, a circuit of suppressing the inrush current is recommended when the regulator start-up and a discharge circuit is recommended when the output dropped, ensuring the reliability and safety of other equipments in the system.

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. The maximum value of the trimmed up is 10%, even +S and –S pins are used to compensate the voltage simultaneously, the sum of the trimmed up and the compensation should not be more than 10%, or the characteristics will not be assured in compliant with the specification, even the over voltage protection may be triggered. The output power can not exceed 50W at increased output voltages, and the output current can not exceed 10A. When the trim pin is not used,it should be floated.At the same time, the –S pin and the –Vo pin are shorted ,the +S pin and the +Vo pin are shorted.

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 $R_{Trim\text{-}up}$ 、 $R_{Trim\text{-}down}$ are used simultaneously, users adjust the value based on the resistance applied.

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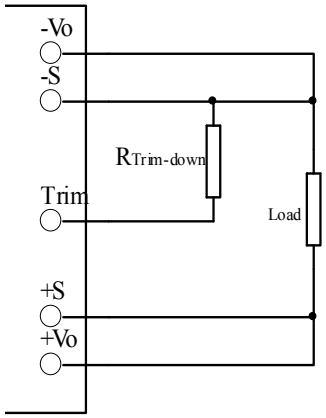
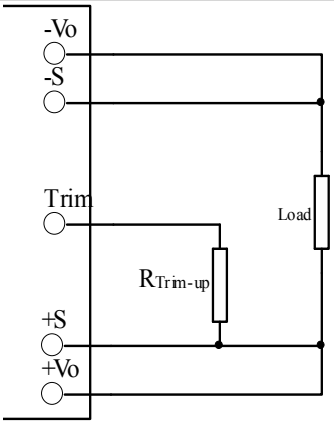


Connection for Trimming Down



Connection of Trimming Up

Resistance for trimming up ：

$$R_{Trim-up}=\left(\frac{5.11\times Vo(100(\%)+\Delta(\%))}{1.225\times\Delta(\%)}-\frac{5.11\times100(\%)}{\Delta(\%)}-10.22\right)(k\Omega)$$

Resistance for trimming down：

$$R_{Trim-down}=\left(\frac{5.11\times100(\%)}{\Delta(\%)}-10.22\right)(k\Omega)$$

Vo：rated output voltage，5V；

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

△（%）：Change rate, divide output voltage by rated output voltage.

For example, if the output voltage is 4.75V,then △（%）=【（5-4.5）/5】×100%=5%，$R_{Trim-down}$=5.11×100%/5%-10.22=91.98 (kΩ), it can be taken as 100kΩ；

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,about 0.5V.

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.To avoid damage caused by abnormal operations when not using the functions,it is recommended to use+S and+Vo, - S and - Vo short circuiting.

Thermal Consideration

The converters can operate in a variety of thermal environments, however, sufficient cooling should be provided to improve its reliability and life. The heat generated by the power module loss can be released externally through radiation, convection, and conduction.When the operating base plate temperature is higher thanthe normal operating base plate temperature of the power module,use additional heat dissiparion measures according to the derating curve,such as increasing the wind speed or installing a heat sink.

When adding air cooling, attention should be paid to the design of the air duct to avoid blocking the hot air or generating eddy currents, which may affect the heat dissipation effect; When adding a heat sink, the module heat dissipation substrate and heat sink should be tightly bonded. According to specific needs, thermal grease, thermal conduction double-sided adhesive or thermal silicone pad can be used to reduce the thermal resistance of heat dissipation.

Output Over Voltage Protection(OVP)

This product has an output over voltage protection function. When the output voltage exceeds 120%～150% of the rated voltage (the set point is between 120%～150%, there is the difference based on the specific parameters, but not beyond the range),the output voltage will be clamped. Be advised that to shut down the converter by using remote control (CNT) if it can not be repaired timely. Avoid the continuous resetting of the unit because that will damage the converter.

Safety Consideration

The converter, as a 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. The converter output is considered SELV, and the expected input is considered TNV2, the primary to secondary is basic insulation to EN60950.The maximum operating temperature for PCB is 170 ℃.
To avoid fire and be protected when short circuit occurred, it is recommended that a fast blow fuse with rating 2.5 to 3 times of converter's continuous input peak current is used at the input terminal.

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.

ESD Control

The converters are processed and manufactured in an ESD controlled environment and supplied in conductive packaging to prevent ESD damage from occurring before or during shipping. It is essential that they are unpacked and handled using an ESD control procedures. Failure to do so affects the lifetime of the converter.

Quality Statement

The converters are manufactured in accordance with ISO 9001 system requirements and are monitored 100% by auto-testing system, 100% burn in.
The warranty for the converters is 5-year.

Contact Information

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