WSD100-48S12 DC-DC Converters

Input18V～75V, Output 12V/8.33A, Industry Standard Sixteenth-brick

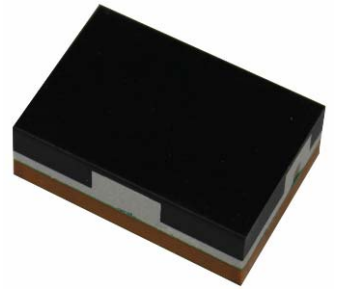
Contents

Features

- *Industry Standard Sixteenth-brick*
  Without metal baseplate: 33.0×22.9×10.7mm
  With metal baseplate: 33.0×22.9×12.7mm
- *Rated Power 100W*
- *Ultra High Power Density:*
  14.7W/cm3（Without metal baseplate）
  12.3W/cm3（With metal baseplate）
- *Ultra-wide 4:1 Input Voltage Range（18V to 75V）*
- *Input Under Voltage Protection（14V to 18V turn off）*
- *Positive Logic Control（3.5V to 15.0V or floating turn on）*
- *Output Voltage Adjust Range: -20%~+10%Vo,nom*
- *Output Over Voltage Protection，auto-recovery (13.2V to 18V）*
- *Output Over Current Protection, Output Short-time Short-circuit Protection,auto-recovery*
- *High Efficiency,92% typ.（48V,full load）*
- *1500Vdc Isolation Voltage*
- *Operation Ambient Temperature: -40 ℃ to +85 ℃*
- *OverTemperature Protection:*
  115 ℃（Without metal baseplate）
  100 ℃（With metal baseplate）
- *Applications：telecommunication applications, electronic data Processing, distributed power architecture,Industrial control equipments and Instrument.etc.*

DOSA Standard outline

Without metal baseplate



With metal baseplate

RoHS

Ordering Information

See Contents for individual product ordering numbers.

Suffix	Description	Ordering No.
--	Shown as the specification	WSD100-48S12
P	Negative Logic Control: 3.5V～15V or floating, turn off; 0～0.5V, turn on	WSD100-48S12P
B	Positive Logic Control, With metal baseplate	WSD100-48S12B
PB	Negative Logic Control, With metal baseplate	WSD100-48S12PB

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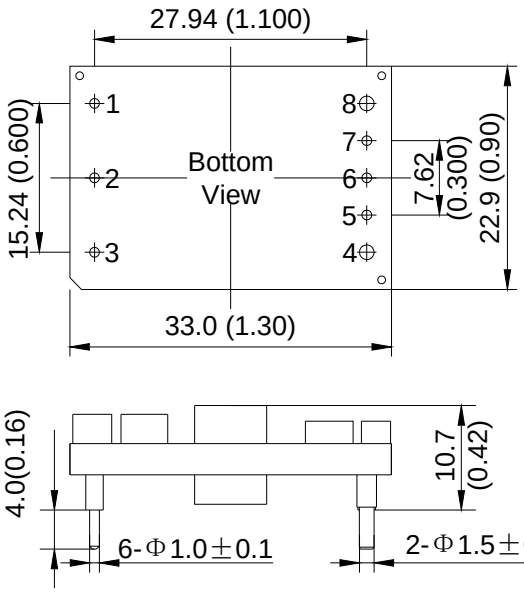
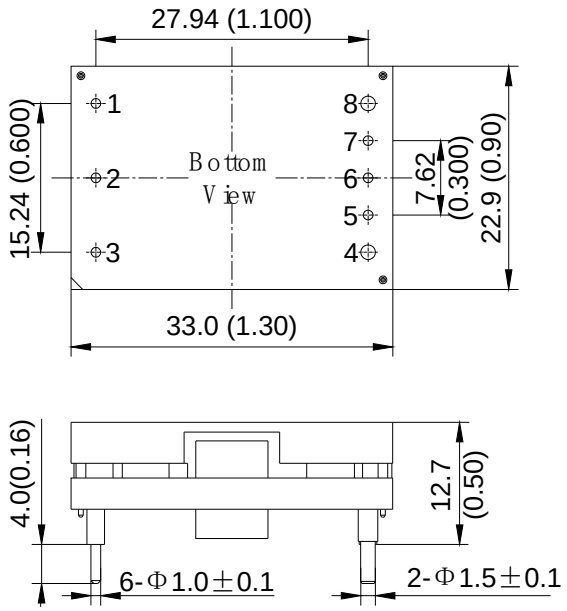
Outline Diagram

Without metal baseplate



With metal baseplate



Pin definition:		
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 $+V_O$ 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 $-V_O$ pin if not used
8	-Vo	Negative Output
Notes：All dimensions in mm(inches) Tolerances:X.X±0.5(X.XX±0.02) X.XX±0.25(X.XXX±0.010)		

Specification

Unless otherwise specified, all tests are at room temperature,standard atmosphere,pure resistive and load basic connection.

Input	Symbol	Min	Typ	Max	Unit	Conditions
Input Voltage	V_{in}	18	48	75	V	I_o:0~8.33A
Maximum transient input voltage	–	–	–	100	V	Transient < 100ms
Input Current	I_{in}	–	–	6.31	A	$V_{in,min}$， $I_{o,max}$
Input reflected ripple current	–	–	50	150	mA	A 12μH/7A inductor (20MHz) in series
No-load input current	–	–	75	150	mA	$V_{in,nom}$， I_o=0A

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Continue

Input		Symbol	Min	Typ	Max	Unit	Conditions
Positive Logic Control	On	–	3.5	–	15.0	V	Refer to $-V_{in}$; Turn on when CNT floating.
	Off	–	0	–	0.5	V	Refer to $-V_{in}$
Negative Logic Control	On	–	0	–	0.5	V	Refer to $-V_{in}$
	Off	–	3.5	–	15.0	V	Refer to $-V_{in}$; Turn off when CNT floating.
Start-up Delay Time		T_{delay}	–	50	–	ms	$V_{in,nom}$, $I_{o,max}$
Under Voltage Threshold		V_{UVLO}	14	–	18	V	—
Under Voltage Protection Hysteresis		$\triangle V_{UVLO}$	1	–	3	V	—
Standby input current		–	–	3	–	mA	—

Output	Symbol	Min	Typ	Max	Unit	Conditions
Output Voltage	V_o	11.76	12.00	12.24	V	—
Output Current	I_o	–	–	8.33	A	V_{in}:18~75V
Output Power	–	–	–	100	W	V_{in}:18~75V
Output Voltage Adjust Range	V_{trim}	9.6	–	13.2	V	$I_o \leq 8.33A, P_o \leq 100W$
Line Regulation	S_V	–	–	±0.3	% V_o	V_{in}:18~75V, $I_{o,max}$
Load Regulation	S_I	–	–	±0.5	% V_o	$V_{in,nom}$, I_o:0~8.33A
Output Over Voltage Protection Set Point	$V_{ov,set}$	13.2	–	18.0	V	$V_{in,nom}$, $P_o \leq 100W$ Hiccup mode
Output Over Current Protection Range	$I_{o,lim}$	8.75	–	16	A	V_{in}:18~75V, $V_{o,nom}$
Output Short-circuit Protection	short-time short-circuit protection, auto-recovery					
Peak to Peak Ripple and Noise	$\triangle V_{pp}$	–	240	360	mV	20MHz bandwidth, $V_{in,nom}$, $I_{o,max}$, A 47μF aluminum electrolytic capacitor and a 1μF ceramic capacitor are applied at output
Rise Time	T_{rise}	–	25	–	ms	$V_{in,nom}$, $I_{o,max}$
Capacitive Load	C_O	0	–	2000	μF	pure resistive load
Remote Sense Compensation Range	V_{sense}	0	–	0.6	V	+S and -S twisted Pair, length is less than 20cm
Output Overshoot	V_{TO}	0	–	1.2	V	$V_{in,nom}$, $I_{o,max}$
Load Transient – Recovery Time	t_{tr}	–	–	400	μs	25%～50%～25%$I_{o,nom}$ or 50%～75%～50% $I_{o,nom}$; 0.1A/μs. A47μF aluminum electrolytic capacitor and a 1μF ceramic capacitor are applied at output
Load Transient – Voltage Deviation	$\triangle V_{tr}$	–	–	±600	mV	

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General		Symbol	Min	Typ	Max	Unit	Conditions
Efficiency		η	90	92	–	%	$V_{in,nom}$, $I_{o,max}$
Isolation Resistance	Input ~ Output	R_{iso}	10	–	–	MΩ	Under normal atmospheric pressure, Relative humidity:90%, Test voltage:500Vdc The products without metal baseplate：only the test input~output
	Input ~ substrate						
	Output ~ substrate						
Isolation Voltage	Input ~ Output	V_{iso}	1500	–	–	Vdc	Time:1min ,Leak Current: 1mA,no breakdown and flaring. The products without metal baseplate：only the test input~output
	Input ~ substrate		1050	–	–		
	Output ~ substrate		500	–	–		
Switching frequency		–	–	350	–	kH_Z	—
MTBF		–	2×10^6	–	–	h	BELLCORE TR-332 40℃
Storage Temperature		–	-55	–	+125	℃	—
Temperature Coefficient		S_T	–	±0.03	±0.05	%/℃	The ambient temperature：-40℃～85℃
Operating PCB Board Temperature		–	-40	–	+100	℃	—
Operating baseplate temperature		–	-40	–	+100	℃	—
Operating Ambient Temperature		–	-40	–	+85	℃	The PCB board temperature or the baseplate temperature≤ 100℃
Over Temperature Protection Reference Point（Without metal baseplate）		T_{ref}	–	115	–	℃	See Over Temperature Protection consideration
Over-temperature protection point (With metal baseplate).		T_{ref}	–	100	–	℃	
Over Temperature Protection Hysteresis		$\triangle T_{ref}$	–	10	–	℃	
Vibration		Sine，Frequency：10Hz-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		–	–	18	–	g	without heatsink
		–	–	33	–	g	with heatsink

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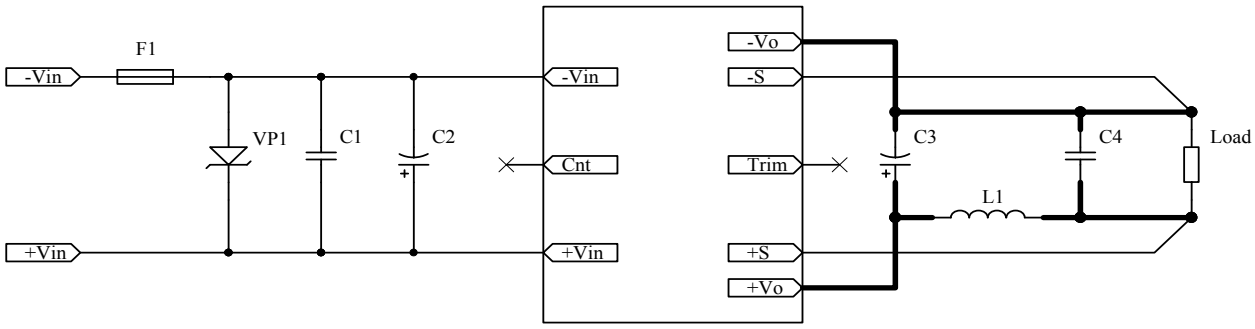
Design Considerations

Basic Connection

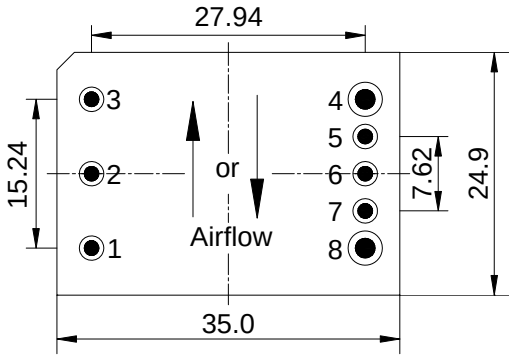


Notes: The basic connection indicates the basic requirements that the power module can provide rated output voltage and rated power only. Please refer the instruction followed for further information.

Parameter description：

Part No.	Components	Part No.	Components
F1	16~19A insurance	C3	electrolytic capacitor or solid-state capacitor (-40°C ,100uF/25V)
VP1	1.5KE75A	L1	A inductor of 0.22~0.33uH and ≥8.33A is recommended for applications that require lower ripple
C1	Ceramic capacitor 2.2uF/100V		
C2	electrolytic capacitor or solid-state capacitor (-40°C ,100uF/100V)	C4	47uF/25V ceramic capacitor

Recommended Layout



Printer board cloth board recommended schematic

NO.	Recommendation & Notes
Pad Design	The hole diameter of 4 and 8 pad shall be 2.0mm,and the diameter of pad shall be at least 3.5mm; The diameter of other pad holes shall be 1.5mm,and the diameter of pad shall be at least 2.5mm.
Airflow Direction	It is recommended to give priority to the upward or downward direction in the illustration on the left, and the wind speed can also be used when the vertical direction is shown.
Safety	This product is an isolated power module, pay attention to the input and output copper spacing.
Electrical	It is recommended that the coverage area of this product is the input or output ground (covering their respective areas), or DC electrical signals, and it is not recommended to lay sensitive signal lines or highly interference AC signals. Due to the large input and output currents, the current density of the trace connected to the input and output pins is recommended to be less than 7A/mm².

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Input Voltage Range

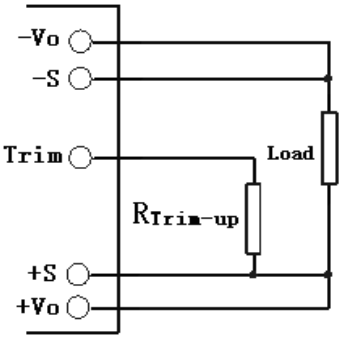
The input voltage range of the converter is 18V to 75V. The continuous input voltage s not allowed to exceed 80V under any conditions,and exceeding the specified range will result in failure of the converter.It is recommended to connect a electrolytic capacitor or solid-state capacitance of 100μF or more at input to suppress the pulse spike from the input voltage.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 should be required to have low source impedance.When source impedance of the power bus is high, the output voltage or ripple 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 input lower voltage to the converter which works normally when the input voltage is high,then the output voltage of the converter can decrease or be unstable and it can return to normal after reducing the load current,it will be considered the impedance too large.Tht method for further confirmation is to connect a 100 uF/100V electrolytic capacitor or solid-state capacitance to the module power pin in parallel after the module power is powered off (Individual cases may require a 2.2uF/100V ceramic capacitor to be connected between the electrolytic capacitor and the module pin), if the output getting better, it will be sure that the impedance is too large.

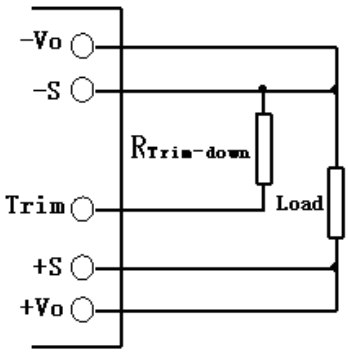
Output Voltage Adjust

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 100 W at increased output voltages, and the output current can not exceed 8.33A. When the trim pins are not used, they should be floated.

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.



Connection of Trimming Up



Connection for Trimming Down

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，12V；

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

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

For example, if the output voltage is 9.6V after adjusting 20% down, then △(%) = [(12-9.6)/12]×100% = 20%,

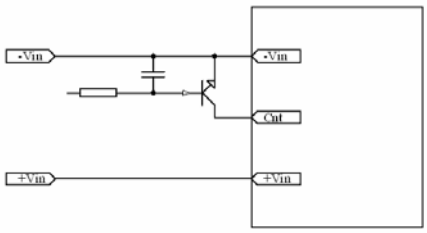
which is brought into the equation
Down-regulation resistance: 5.11×100%/20%-10.22=15.33 (kΩ), you can actually take 15kΩ resistance;
If the output voltage is 13.2V after adjusting the output voltage by 10%, △(%) = [(13.2-12)/12]×100%=10%, which is brought into the formula
Up-regulation resistance: [(5.11×12(100%+10%))/1.225×10%]-[(5.11×100%)/10%]-10.22=489.3(kΩ), the actual 487kΩ resistor can be taken.

External Capacitance

Unless special purpose (i.e. prolonging hold-up time, input impedance matching), the recommended input filter's capacitance ranges 68μF～220μF, which not only offers a stable system, and reduces the cost, but also lessens the inrush current when the power supplies.
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.
The maximum capacitive load capacity of the power supply itself is 2000uF, such as in order to reduce the output ripple or reduce the load transient current impact on the power supply, can appropriately increase the output filter electrolytic capacitor. Additional capacitance of 220~820uF is recommended if no special requirement.
Because the capacitance of the electrolytic capacitor decreases and the ESR value increases at low temperature, if the output ripple needs to be lower in the whole operating temperature range (-40~85°C) , it is suggested that solid state capacitors with better low temperature characteristics can be selected for output capacitors. At the same time, adding 0.22-0.33μH and ≥8.33A differential-mode inductor before the output energy storage filter electrolytic capacitor is advantageous to obtain lower output ripple demand.

Remote Control

This function is obtained by applying the correct control level (or floating, high-impedance state) to the CNT pin. Positive logic remote control and negative logic remote control function is optional, WSD100-48S12 is a positive logic control product, when the applied level is 3.5~15V or floating when the module power output is on, when the applied level is 0~0.5V, the module power output is off. When the low level is applied, the external output current of the module CNT is less than 2mA, and the input current of the module CNT pin is less than 2mA when the high level (3.5~15V) is applied.



Temperature Reference Point A

Due to the logic comparator is semiconductor integrated chip with low resistance to surge,care should be taken to prevent CNT from surge, like application of TVS. When the pin is left floating, 1.25V～3.5V voltage appears on the pin.
WSD100-48S12P is provided with negative logic remote control. It has the same characteristic as WSD100-48S12, except control logic. When the level applied is less than 0.5V, the converter will be turned on, When the level is higher than 3.5V and less than 15V or be left floating, the converter will be off.Like positive logic control converters, care should be taken to prevent CNT from surge. When the pin is left floating, the voltage of the pin is 2.5V～12.5V.
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.
When the signal from the system is beyond 3.5V～15V, or it can be enabled only within a very narrow control level, the aux circuit will be required. Please contact us for more information.

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. If the remote sense is not needed, the –S should be connected to -Vout and +S should be connected to +Vout.

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.

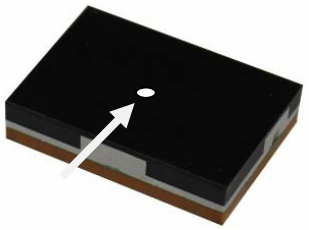
Over Temperature Protection

The series of products provide over-temperature protection function, due to the different structure of products, test over-temperature point location and temperature is slightly different.

Locations of the test points with and without radiating substrates are shown in the diagram below.The typical temperature of the over-temperature protection point of the non-radiating substrate is 115℃. The typical temperature of the over-temperature protection point with the heat sink base plate is 100°C(the typical temperature of the center of the heat sink plate is 100℃when the temperature sensor is 115℃ over-temperature protection because of the heat resistance of the pouring sealant to the center of the heat sink plate).

No matter what structure is chosen for the series,When in use, make sure the test point is less than 100℃ with enough temperature drop to avoid over-temperature protection. When the over-temperature protection occurs, the module power supply will turn off the output, after the temperature drops about 10°C, the module power supply will start the restart process, the over-temperature protection duration depends on the surrounding cooling environment, from a few seconds to a few minutes, if the high temperature environment can not be improved, the restart process will continue.

Location of heatless substrate test points



Test point location with thermal baseplate

Output Over Voltage Protection

The converter is designed with clamped over voltage protection, when output voltage exceeds 110% to 150% of the rated output voltage (the set point is between 110% to 150%, there is the difference based on the specific parameters, but not beyond the range), the output voltage will be clamped.If the output voltage returns to normal,the converter works normally.

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.

Thermal Consideration

The converters operate in a variety of thermal environments; however, sufficient cooling should be provided to ensure reliable operation of the unit. Heat is removed by conduction, convection and radiation to the surrounding environment.

When adding air cooling, we should pay attention to the design of air duct to avoid hot air being blocked or vortex, which will affect the heat dissipation effect, heat transfer grease or heat transfer insulation double-sided adhesive or heat transfer silicone pad can be used to reduce the thermal resistance of heat dissipation.
Therefore customers should optimize the thermal design of the module in practical application, so that PCB board temperature or substrate temperature has enough design margin to avoid the module into the over-temperature protection state. Thus, the reliability and service life of the power supply can be improved.

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.

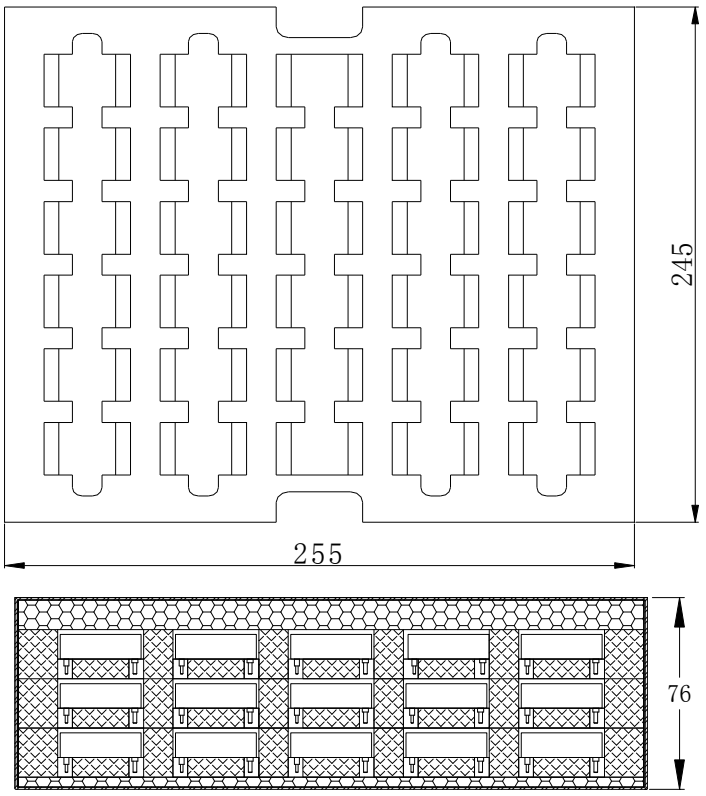
ESD Control

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.

Delivery Package Information



Package material is multiple wall corrugated，internal material is anti-static foam，it's surface resistance is from 10^5 Ω to 10^{12} Ω.

Substrate module without heat dissipation: small package is 3×30=90 pieces per box, weighing about 1.8kg; 4×90=360 pieces per large package, weighing about 8.0kg. Module with heat dissipation substrate: small package for 3×30=90 pieces per box, weight about 3.15kg; 4×90=360 pieces per large package, weighing about 13.5kg.

Contact Information

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