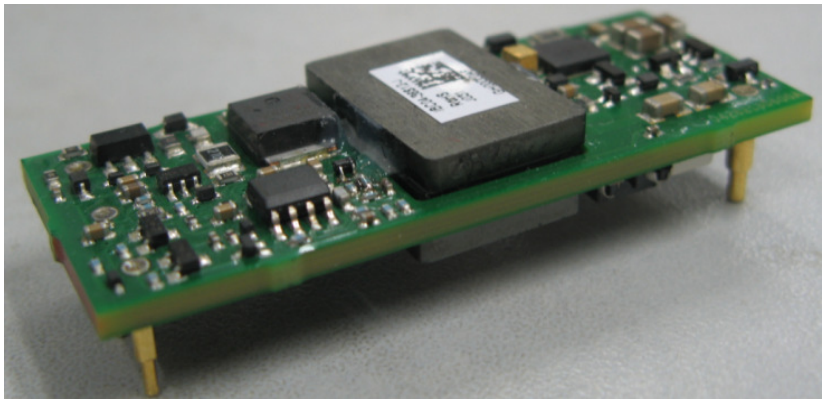
IBC04-36S12

48 Watts

Eighth-brick Converter

Total Power: 48 Watts
Input Voltage: 18 to 60 Vdc
# of Outputs: Single



Special Features

- Delivers up to 4A output current
- Industry standard eighth brick foot print 57.9mm x 22.9mm x 8.9mm (2.28" x 0.9" x 0.35")
- Low minimum load requirement 0.4Amps
- Ultra high efficiency >92% at full load and typical operating conditions
- Excellent thermal performance
- High power density
- Fixed frequency operation
- Intended for reflow or wave soldering
- Wide input voltage of 18V-60V
- Remote control function (negative or positive logic optional)
- Pre-bias function
- Output pre-bias startup capability
- Withstands short-interrupt
- Input under-voltage lockout
- Output over-current protection
- Output over-voltage protection
- Over-temperature protection
- RoHS 6 compliant

Safety

IEC/EN/ 60950
CE Mark
UL
GB4943

Product Descriptions

The IBC04-36S12 series is a single output DC/DC converter with standard eighth-brick form factor and pin configuration. It delivers up to 4A output current with 12V output. Ultra-high 92% efficiency and excellent thermal performance makes it an ideal choice for small space, high current and low voltage applications and can operate over an ambient temperature range of -40 ^{O}C ~ +85 ^{O}C.

Applications

Telecom/ Datacom

ARTESYN™
EMBEDDED TECHNOLOGIES

Model Numbers

Standard	Output Voltage	Structure	Remote ON/OFF logic	RoHS Status
IBC04-36S12-J	12Vdc	Open-frame	Negative	R6

Ordering information

IBC04	-	36	S	12		-		J
①		②	③	④	⑤		⑥	⑦

①	Model series	IBC04: high efficiency eighth brick series
②	Input voltage	36: 18V ~ 60V input range, rated input voltage 48V
③	Output number	S: single output
④	Rated output voltage	12: 12V output
⑤	Remote ON/OFF logic	Default: negative logic
⑥	Pin length	Default: 2.8mm; S: Surface mount
⑦	RoHS status	J: RoHS, R6

Options

None

Electrical Specifications

Absolute Maximum Ratings

Stress in excess of those listed in the "Absolute Maximum Ratings" may cause permanent damage to the power supply. These are stress ratings only and functional operation of the unit is not implied at these or any other conditions above those given in the operational sections of this TRN. Exposure to any absolute maximum rated condition for extended periods may adversely affect the power supply's reliability.

Table 1. Absolute Maximum Ratings:

Parameter	Model	Symbol	Min	Typ	Max	Unit
Input Voltage Operating -Continuous Non-operating -100mS	 All All	$V_{IN,DC}$	 18 0	 48 -	 60 100	 Vdc Vdc
Maximum Output Power	All	$P_{O,max}$	0	-	48	W
Isolation Voltage[1] Input to output	All		1500	-	-	Vdc
Ambient Operating Temperature	All	T_A	-40	-	+85	^{O}C
Storage Temperature	All	T_{STG}	-40	-	+105	^{O}C
Humidity Non-operating	All		-	-	85	%

Note 1 - 10mA for 60s, slew rate of 2000V/10s

Input Specifications

Table 2. Input Specifications:

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Operating Input Voltage, DC	All	$V_{IN,DC}$	18	48	60	Vdc
Turn-on Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,ON}$	16	17	18	Vdc
Turn-off Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,OFF}$	14	15	16	Vdc
Lockout voltage hysteresis	All		-	2	-	Vdc
Maximum Input Current ($I_O = I_{O,max}$)	$V_{IN,DC} = V_{IN,min}$	$I_{IN,max}$	-	4	5	A
Standing loss	All		-	-	3.5	W
Inrush current transient	All		-	-	0.05	A^2s
Input filter component values (C\L)	Internal values	C_{IN}	-	3.2/1	-	µF\µH
Input Reflected Ripple Current	Rated input and output		-	10	30	mAp-p
Recommended Input Fuse	Recommended use LITTLE FUSE R451005		-	-	5	A
Operating Efficiency	T_A=25 ^{O}C V_{IN}=18V~55V I_O = 2.8A~4A	η	89.5	91	-	%

Output Specifications

Table 3. Output Specifications:

Parameter		Condition	Symbol	Min	Typ	Max	Unit
Factory Set Voltage		$V_{IN,DC}$ = 48V_{DC} I_O=$I_{O,max}$	V_O	11.87	12	12.13	Vdc
Total output voltage range (TEB)		Over sample, line, load, temperature & life 5% max	V_O	-	-	600	mV
Output Voltage Line Regulation		$V_{IN,DC}$ = $V_{IN,min}$ to $V_{IN,max}$	%V_O	-	-	1	%
Output Voltage Load Regulation		I_O = $I_{O,min}$ to $I_{O,max}$	%V_O	-	-	1	%
Output Voltage Temperature Regulation		All	%V_O	-	-	0.016	%/^{O}C
Output Ripple and Noise		Measure with a 1uF ceramic capacitor in parallel with a 10uF tantalum capacitor, 0 to 20MHz bandwidth	V_O V_O	- -	130 -	200 50	mV_{PK-PK} mV rms
Output Current		All	I_O	0.4	-	4	A
Output DC current-limit inception[1]			I_O	-	6	8	A
Output Capacitance[2]		All	C_O	100	-	2000	uF
V_O Dynamic Response	Peak Deviation Settling Time	25%~50%~25% 25% load change slew rate = 0.1A/us Output capacitance 100uF	$\pm V_O$ T_s	- -	400 300	600 600	mV uSec
Turn-on transient	I/P to O/P delay	I_O = I_{max}		-	100	150	mS
	Rise time	I_O = I_{max}	T_{rise}	-	20	40	mS
	Enable to output	I_O = I_{max}		-	25	45	mS
	Output voltage overshoot	I_O = $I_{O,max}$	%V_O	-	-	10	%
Remote ON/OFF control (Negative logic)	Off-state voltage	Remote on/off floating is non-active		2.95	-	12	V
	On-state voltage			-0.3	-	1.2	V
Switching frequency		T_A = 25^{O}C T_A = -40~+85^{O}C	f_{SW} f_{SW}	265 255	300 300	335 350	KHz KHz

Note 1 - Hiccup: auto-restart when over-current condition is removed.

Note 2 - Recommended to be used with 470uF O/P for optimum performance

Output Specifications

Table 3. Output Specifications, con't:

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Output over-voltage protection[3]	All	V_O	-	15	18	V
Output over-temperature protection[4]	All	T	-	115	125	^OC
Over-temperature hysteresis	All	T	-	10	-	^OC
Calculated MTBF	Telcordia SR-332		-	6.38	-	10^6 h

Note 3 - Hiccup: auto-restart when over-voltage condition is removed.
Note 4 - Auto recovery.

IBC04-36S12 Performance Curves

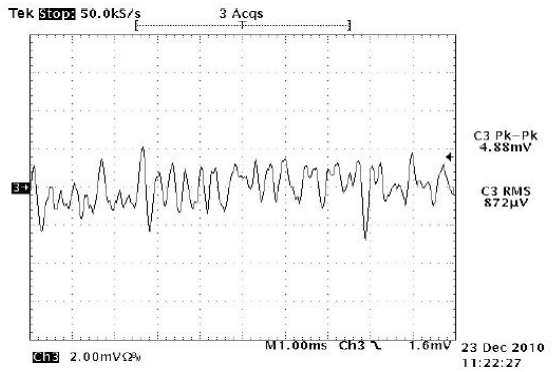


Figure 1: IBC04-36S12 Input Reflected Ripple Current Waveform

Ch 3: Iin (5ms/div, 10mA/div)

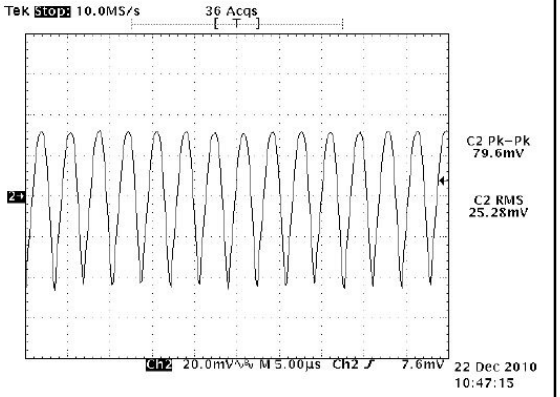


Figure 2: IBC04-36S12 Ripple and Noise Measurement

Ch 2: Vo (5us/div, 20mV/div)

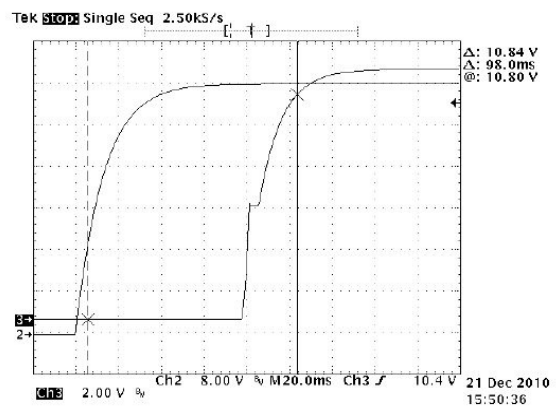


Figure 3: IBC04-36S12 Output Voltage Startup Characteristic

Ch 2: Vin **Ch 3: Vo**

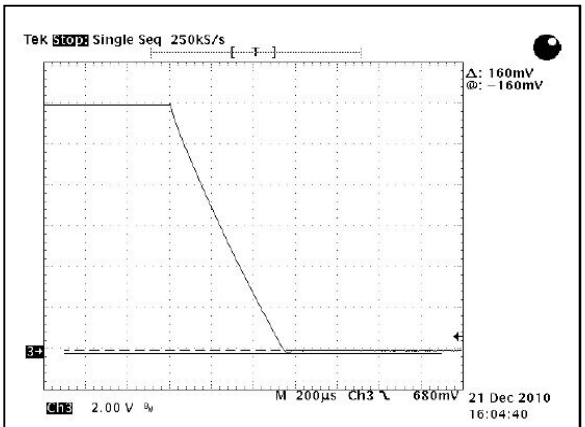


Figure 4: IBC04-36S12 Output Voltage Turn Off Characteristic

Ch 3: Vo

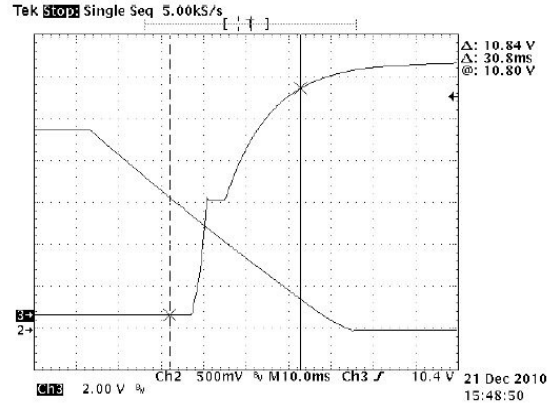


Figure 5: IBC04-36S12 Remote ON Waveform

Ch 2: Remote ON **Ch 3: Vo**

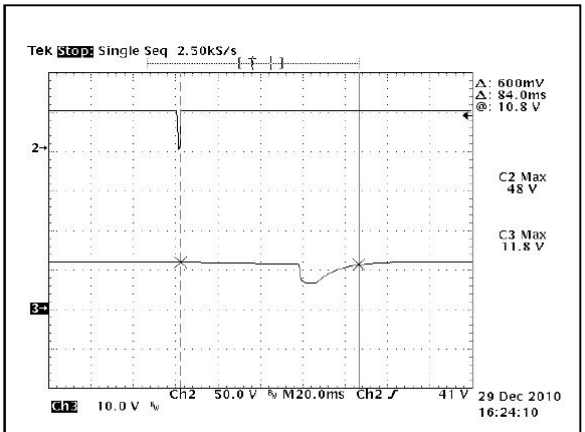


Figure 6: IBC04-36S12 Input Short interrupt characteristics
Io=0A; Tinterrupt=1mS

Ch 2: Vin **CH3: Vo**

IBC04-36S12 Performance Curves

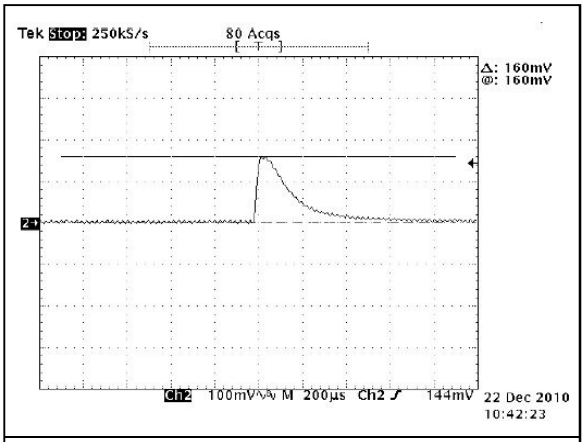


Figure 7: IBC04-36S12 Transient Response (200uS/div)
25%~50%~25% load change, 0.1A/uS slew rate
Ch 2: Vo (100mV/div)

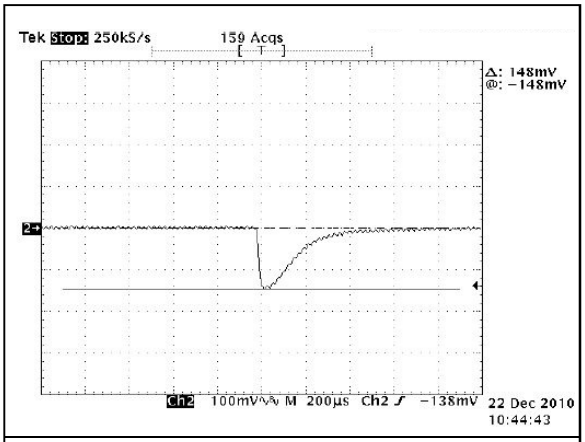


Figure 8: IBC04-36S12 Transient Response (200uS/div)
50%~75%~50% load change, 1A/uS slew rate
Ch 2: Vo (100mV/div)

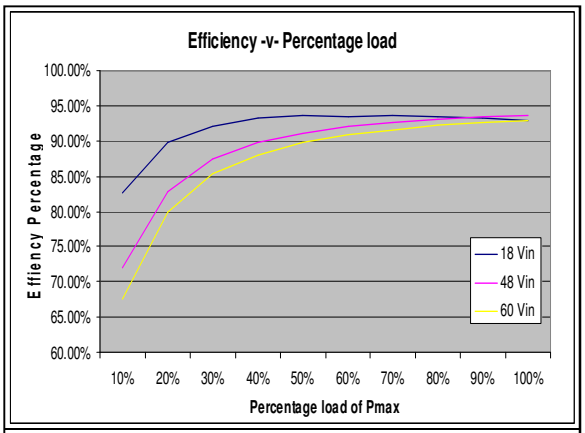


Figure 9: IBC04-36S12 Efficiency Curves @ 25 degC

Loading: Io = 10% increment to 4A

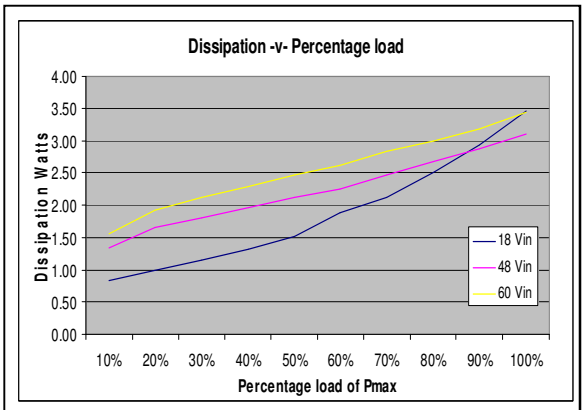
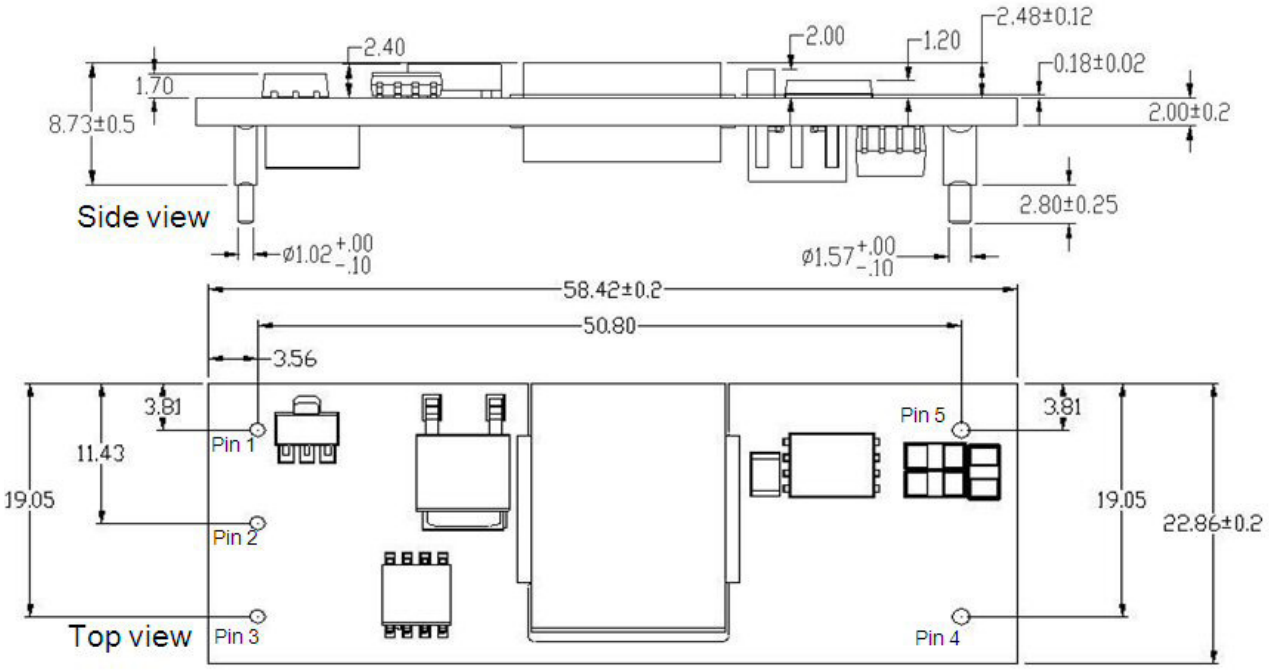


Figure 10: IBC04-36S12 Dissipation vs. Percentage of load

Mechanical Specifications

Mechanical Outlines



Recommended hole pattern

Through hole with diameter 1.37mm (0.054 inch) is recommended for pin1, pin2, pin3 soldering. Hole with diameter 1.88mm (0.074 inch) is for pin4 and pin5. See Figure 11.

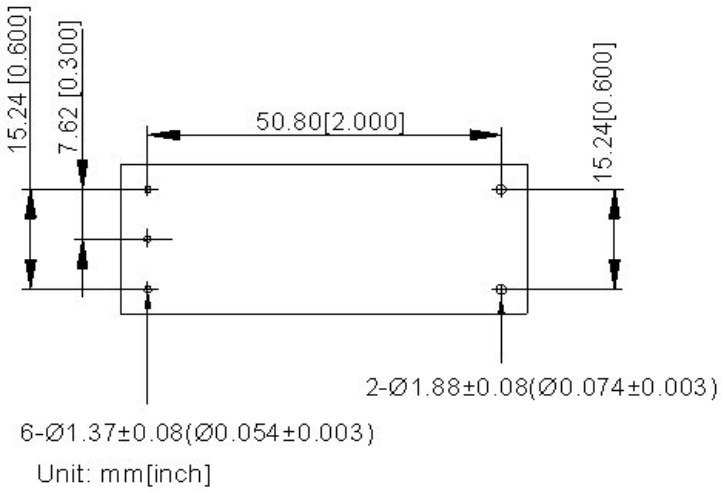


Figure 11 Recommended hole pattern

Pin Length Option

Device code suffix	L
-SJ	Surface mount
-J	Through hole pin length 2.8mm±0.25mm

Pin Designations

Pin No	Name	Function
1	Vin+	Positive input voltage
2	Remote On/Off	Remote control
3	Vin-	Negative input voltage
4	Vo-	Negative output voltage
5	Vo+	Positive output voltage

Environmental Specifications

EMC Test Conditions

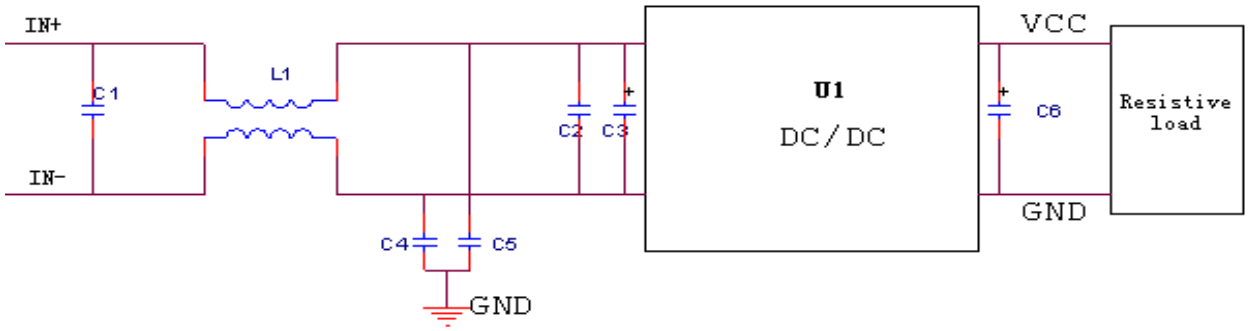


Figure 12 EMC test configuration

Table 4. Recommended Values:

Component	Parts description(parameter)
C1	100V-1uF (recommend SMD ceramic capacitor or film capacitor)
C2	100V-1uF (recommend SMD ceramic capacitor or film capacitor)
L1	Common-mode inductor Single phase phase,2500uH-±25%
C4, C5	DIP film capacitor with safety certified, Rated voltage:250Vrms , Nominal capacitance:0.022uF, dimension:4*9*10.5mm(B*H*L),Pitch:7.5mm Dielectric strength:1KV(In our test, there is no C4 & C5.)
C3	150μF/100V electrolytic capacitor
C6	100μF/25V electrolytic capacitor
U1	Module to test : IBC04-36S12

Conducted EMC result

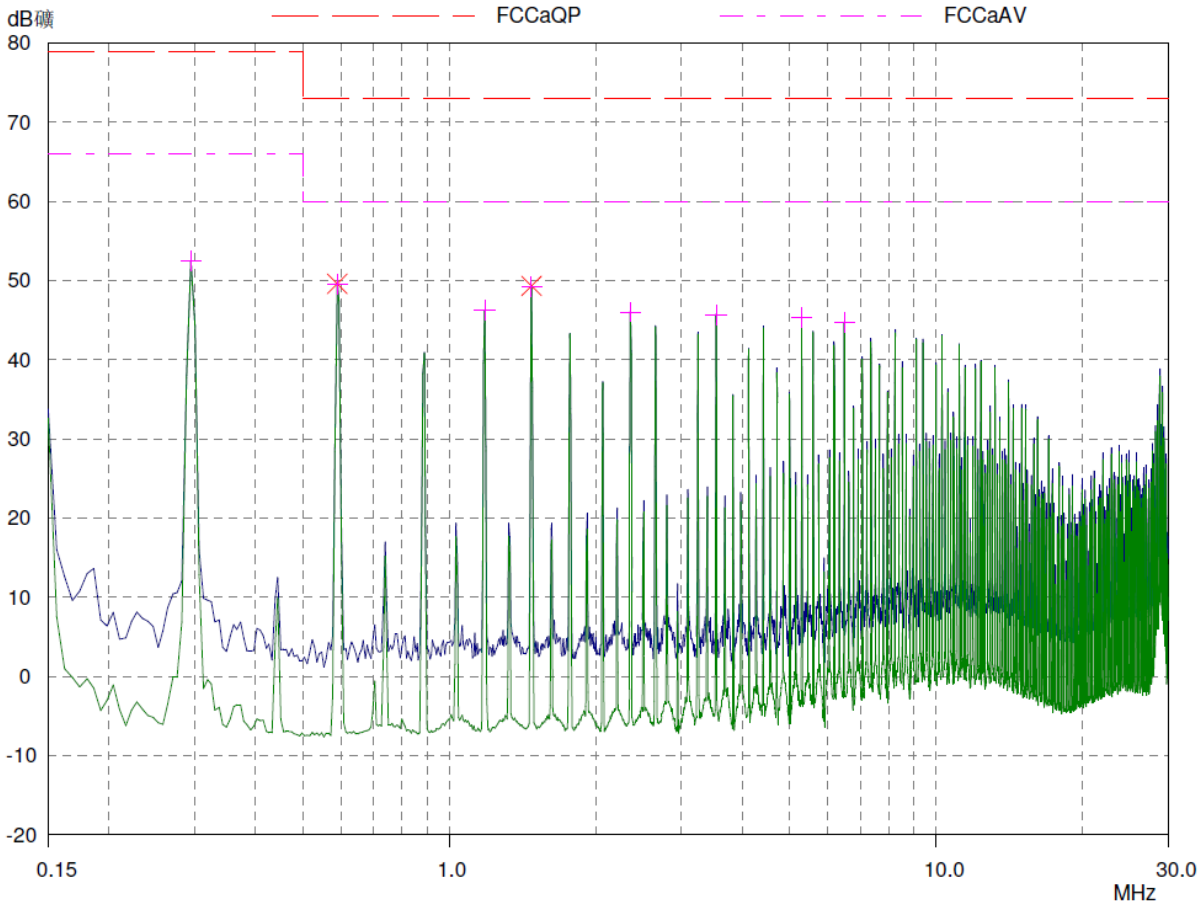


Figure 13 Conducted EMC result with 48Vin@full load

Safety Certifications

The IBC04-36S12 power supply is intended for inclusion in other equipment and the installer must ensure that it is in compliance with all the requirements of the end application. This product is only for inclusion by professional installers within other equipment and must not be operated as a stand alone product.

Table 5. Safety Certifications for IBC04-36S12 series power supply system

Document	File #	Description
UL 60950-1		US Requirements
EN60950-1		European Requirements
IEC60950-1		International Requirements
GB4943		China Requirements
EN55022 Class A		Meets conducted emission's requirements with external filter
CE		CE Marking

Thermal characteristics and dissipation

The converter is designed to operate in different thermal environments and sufficient cooling must be provided. Proper cooling can be verified by measuring the temperature at the test points.

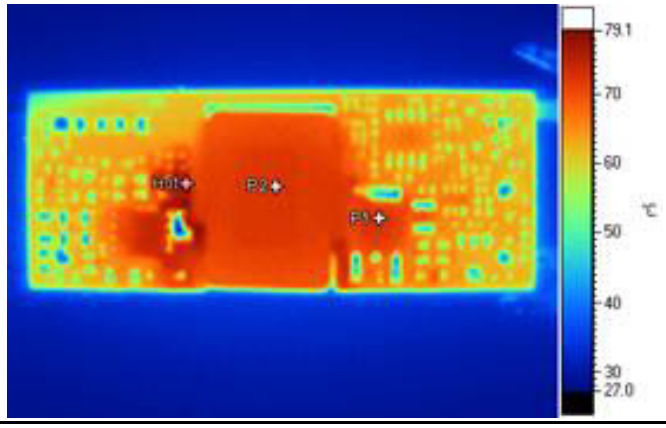
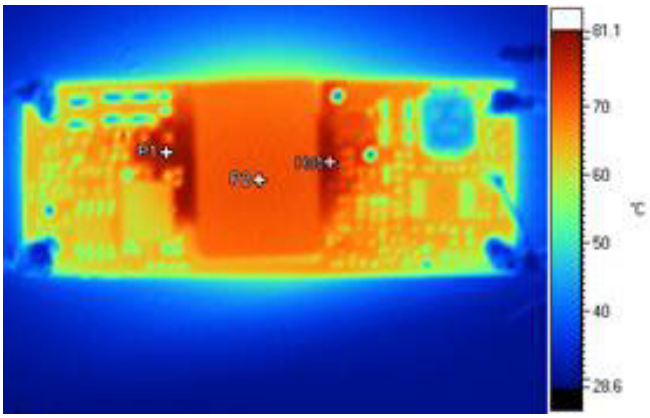
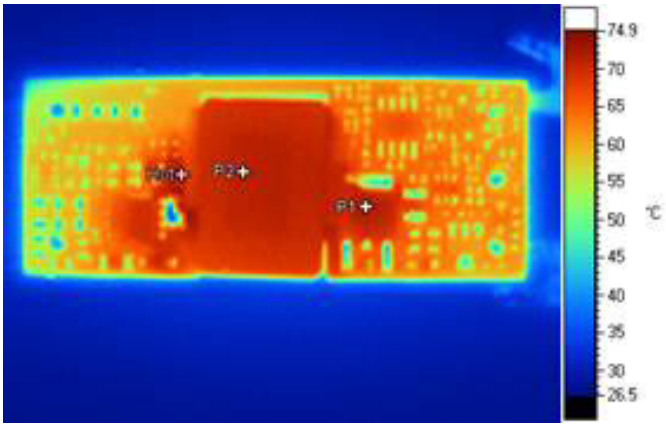
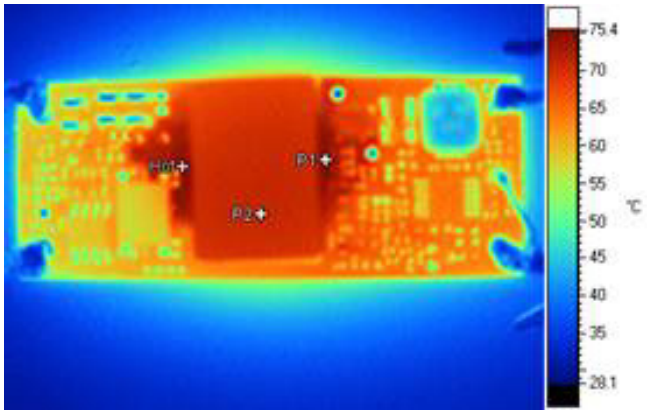
Model Number: IBC04-36S12-J Ambient Temp: 25^{O}C, Convection Cooled	
Vin = 18Vdc	Loading: 12V/ 4A
Top View	Bottom View
	
Hot = 78.10 ^{O}C, P1 = 72.40 ^{O}C, P2 = 72.10 ^{O}C	Hot = 80.80 ^{O}C, P1 = 78.50 ^{O}C, P2 = 71.90 ^{O}C
Vin = 60Vdc	Loading: 12V/ 4A
	
Hot = 72.90 ^{O}C, P1 = 71.50 ^{O}C, P2 = 71.10 ^{O}C	Hot = 75.30 ^{O}C, P1 = 75.10 ^{O}C, P2 = 70.70 ^{O}C

Figure 14 Thermal image and data for unit under variable line and load conditions (air flowing from pin 1 to pin 3)

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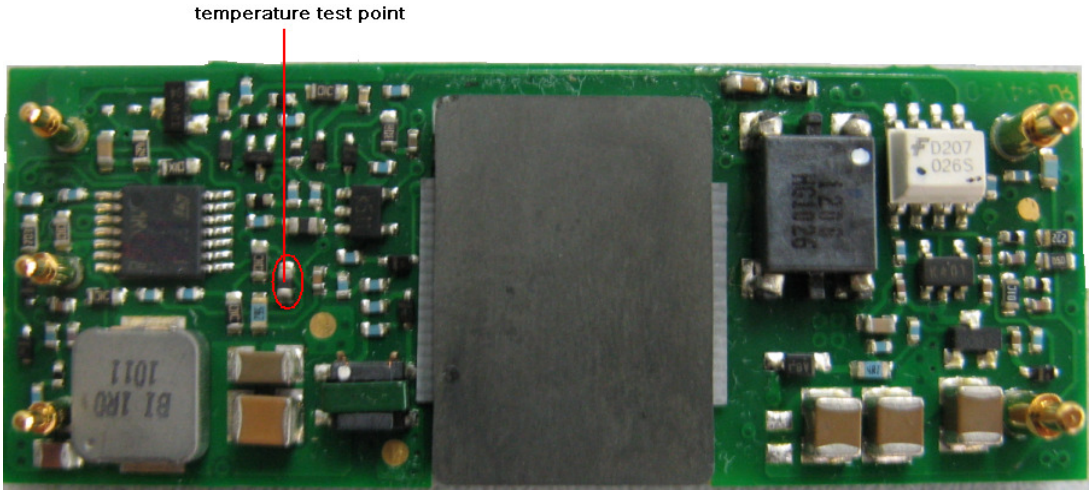

Figure 15 Temperature sensor test point on converter

Qualification Testing

Parameter	Unit (pcs)	Test condition
Vibration(non-operation)	3	10-190Hz 0.01g²/Hz 190-210Hz -36dB/Oct 210-2000Hz 0.003g²/Hz 2.7gRMS, 3 mutually perpendicular axis, 20mins/axis
Vibration(operating)	3	5-350Hz 0.0001g²/Hz 350-500Hz -6dB/Oct 500Hz 0.00005g²/Hz 0.21gRMS 3 mutually perpendicular axis, 20mins/axis
Shock(non-operating)	3	30g, halfsine, 18ms, all 6 faces, 3 times in each positive and negative directions
Shock(operating)	3	4g, halfsine, 22ms, all 6 faces, 3 times in each positive and negative directions
Thermal shock(non-operating)	10	-40-105degC, 700cycles, 15min/15min
Power thermal cycling	3	Tmax op-Tmin op, 100cycles, 30min/30min, maximum input voltage and 50% rated load
Temperature humidity bias	10	Pre-soak with 85 ^{O}C ambient temperature, 85%RH for 72 hours with unpowered units. Then expose to maximum rated ambient temperature or 85 ^{O}C, whichever is less with 85%RH, rated maximum input voltage and minimum rated load for 1,000 hours.
HALT combined cycle	5	13cycles,|Toperating|=|Tdestruct|-10 ^{O}C, detailed test condition see Figure 16

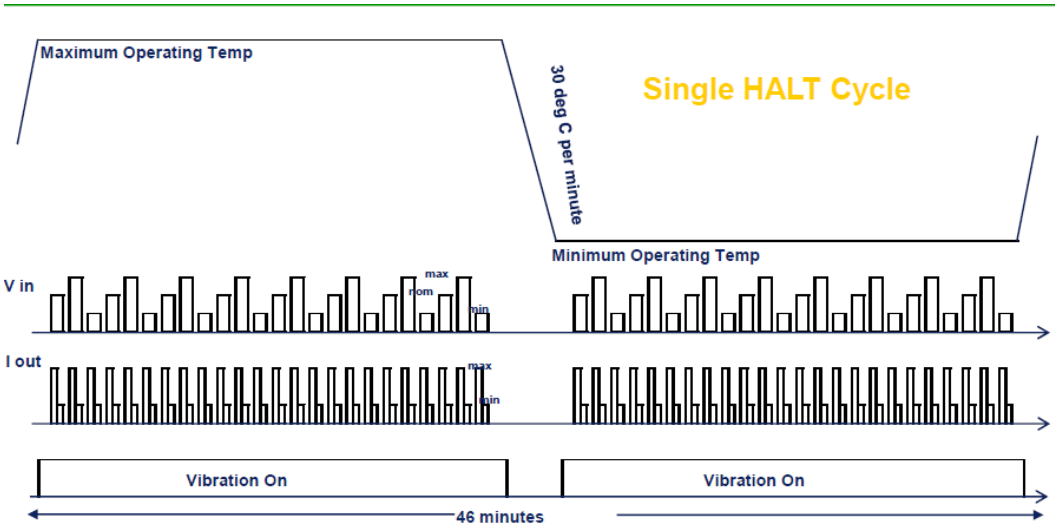

Figure 16 Test condition of HALT combined cycle

Application Notes

Typical Application

Below is the typical application of the IBC04-36S12 series power supply.

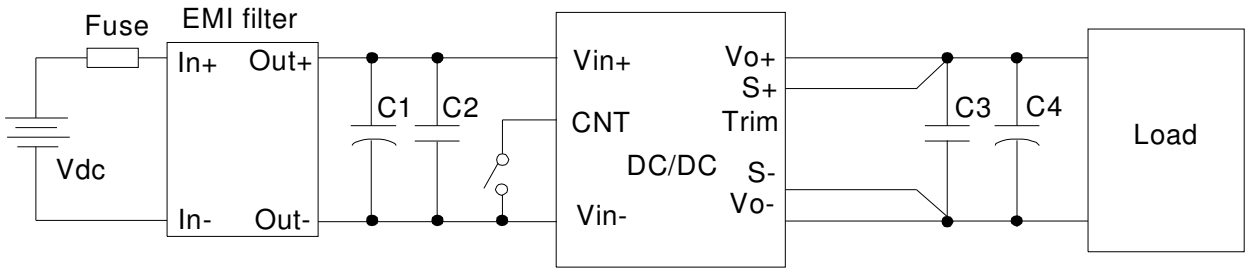

Figure 17 Typical application

C1: 150μF/100V electrolytic capacitor

C2, C3: 1μF/100V X7R ceramic capacitor

C4: 100μF/25V electrolytic capacitor

Fuse: External fast blow fuse with a rating of 5A. The recommended fuse model is R451005 from LITTLEFUSE.

Remote ON/OFF

Negative remote ON/OFF logic provided in the IBC04-36S12. Below is the detailed internal circuit in IBC04..

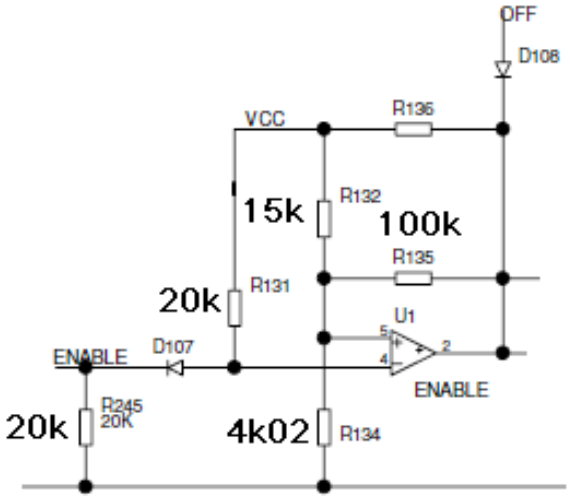

Figure 18 Remote ON/OFF internal diagram

Input Ripple & Inrush Current and Output Ripple & Noise Test Configuration

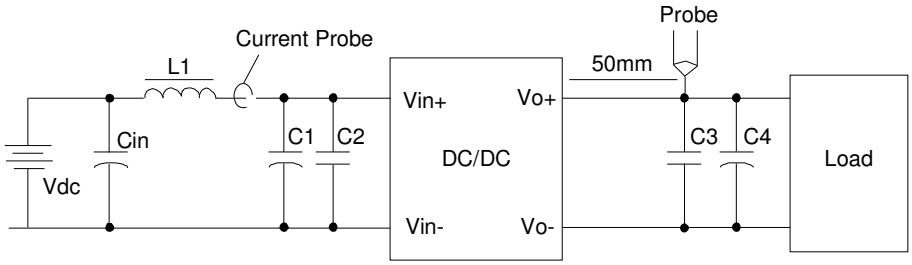

Figure 19 Input ripple & inrush current output ripple & noise test configuration

Vdc: DC power supply

L1: 12μH

Cin: 220μF/100V electrolytic capacitor

C1: 150μF/100V electrolytic capacitor

C2,C3: 1μF/100V X7R ceramic capacitor

C4: 100μF/25V electrolytic capacitor

Note: Using a coaxial cable with series 50Ω resistor and 0.68μF ceramic capacitor or a ground ring of probe to test output ripple & noise is recommended.

Soldering

The product is intended for standard manual, reflow or wave soldering.

When reflow soldering is used, the temperature on pins is specified to maximum 260 ^{O}C for maximum 10s.

When wave soldering is used, the temperature on pins is specified to maximum 260 ^{O}C for maximum 7s.

When soldering by hand, the iron temperature should be maintained at 300 ^{O}C ~ 380 ^{O}C and applied to the converter pins for less than 10s. Longer exposure can cause internal damage to the converter.

Cleaning of solder joint can be performed with cleaning solvent IPA or similar.

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Package Information

Package type

moisture sensitivity level 3, moisture barrier bags.

Minimal package QTY

128 pcs.

Package disassembly

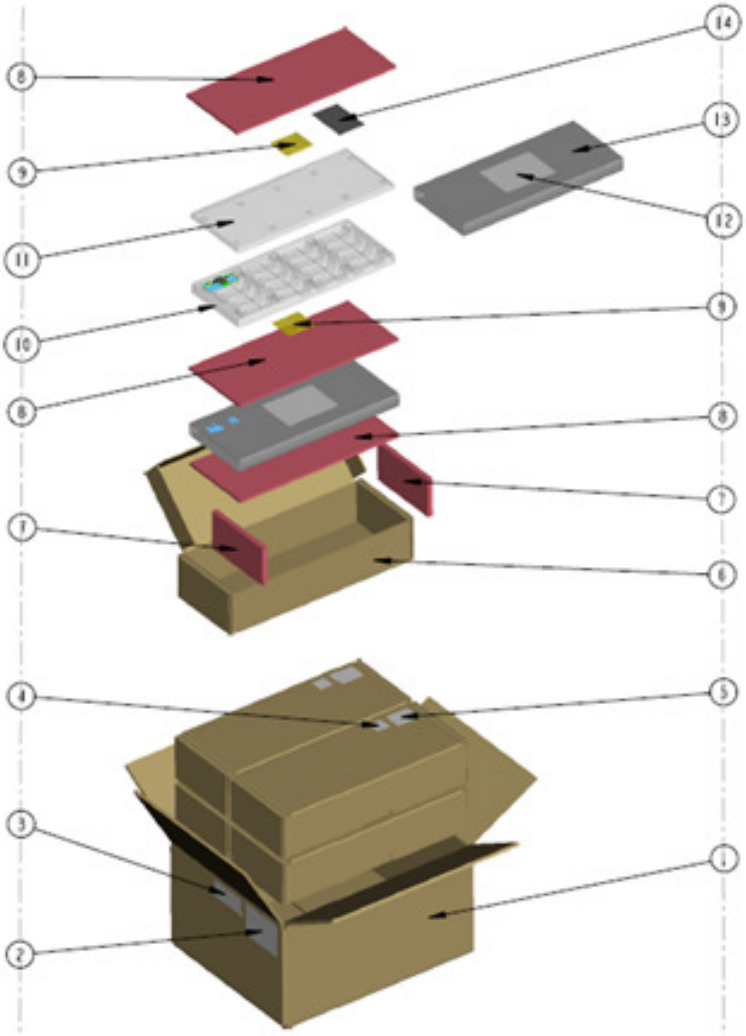
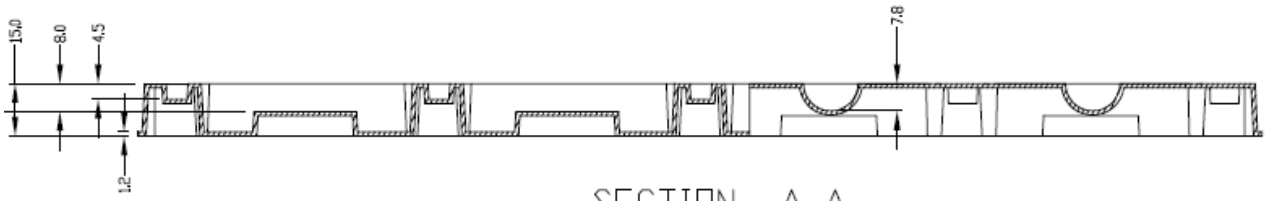


Figure 20 Package break down

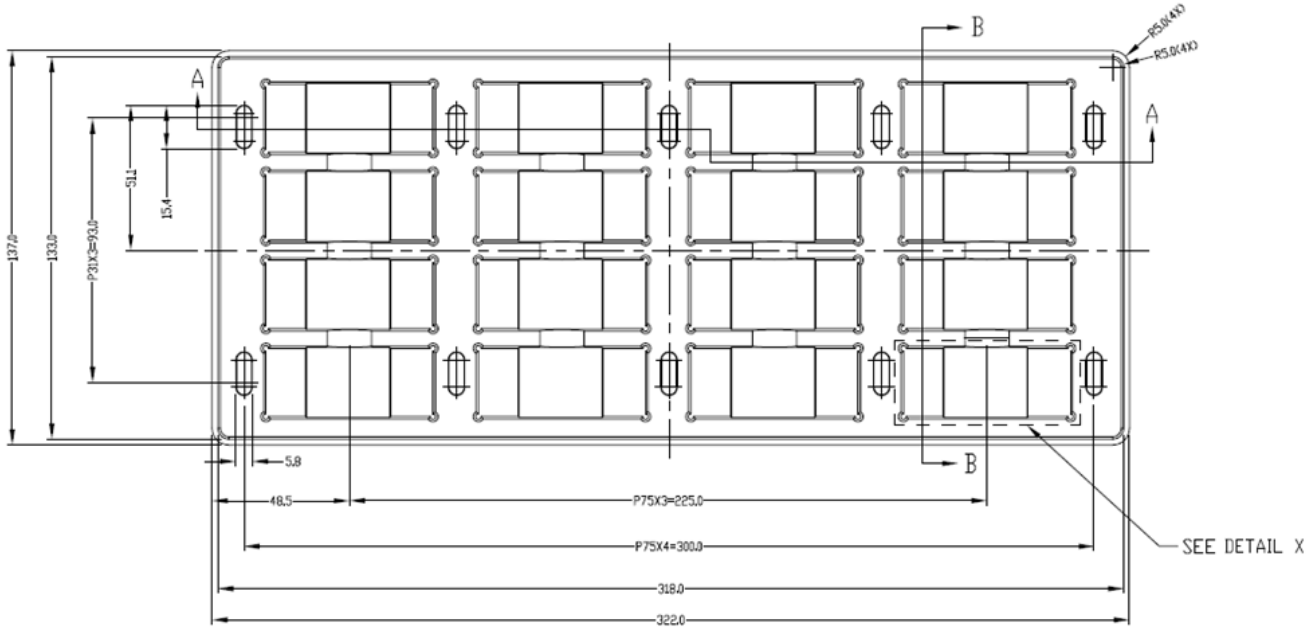
Assemblies description

ITEM	DESCRIPTION	QTY	UNIT
14	HUMIDITY INDICATING CARD	8	EA
13	MOISTURE BAR BAG 16X6.5 IN	8	EA
12	LABEL-BLANK 101.6X76.2 JAC	8	EA
11	VACUUM TRAY 6610614-0000	8	EA
10	VACUUM DRAW TRAY IBC04	8	EA
9	DESICCANT	16	EA
8	PE FOAM 325X140X10	12	EA
7	PE FOAM 140X75X10	8	EA
6	CTN-TRAY 347X142X80	4	EA
5	LABEL-BLANK IBC04-36S12-J	4	EA
4	LABEL-WARNING ALDI2A48N-BTRL	4	EA
3	LABEL-PKG IBC04-36S12-J	1	EA
2	LABEL-BLANK PACKAGING IBC04	1	EA
1	SHPNG CRTN-DC 380X305X180	1	EA

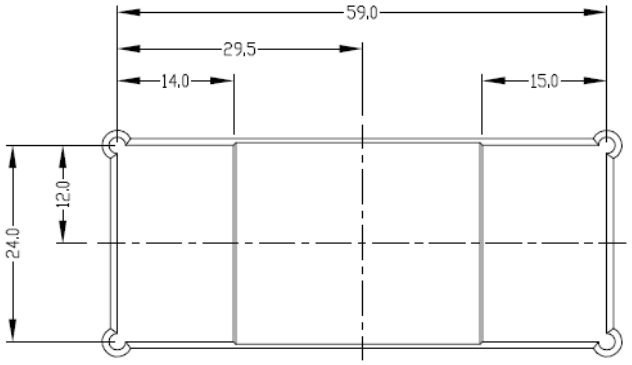
Package tray information



SECTION A-A



Packaging Tray dimensions detail



DETAIL X
SCALE: 2:1

Hazardous Substances Announcement (RoHS of China R6)

Parts	Hazardous Substances					
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
IBC04-36S12	x	x	x	x	x	x

x: Means the content of the hazardous substances in all the average quality materials of the part is within the limits specified in SJ/T-11363-2006

√: Means the content of the hazardous substances in at least one of the average quality materials of the part is outside the limits specified in SJ/T11363-2006

Artesyn Embedded Technologies has been committed to the design and manufacturing of environment-friendly products. It will reduce and eventually eliminate the hazardous substances in the products through unremitting efforts in research. However, limited by the current technical level, the following parts still contain hazardous substances due to the lack of reliable substitute or mature solution:

1. Solders (including high-temperature solder in parts) contain plumbum.
2. Glass of electric parts contains plumbum.
3. Copper alloy of pins contains plumbum

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