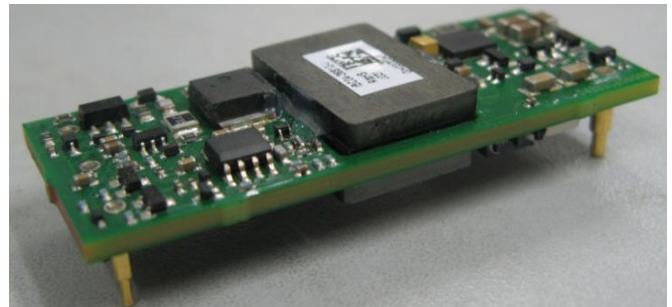


## Description

The IBC04-36S12 is a single output DC-DC converter with standard eighth-brick outline and pin configuration. It delivers up to 4A output current with 12V output voltage. Pre-bias start-up capability is realized. Efficiency is above 89.5% @ 2.8A<sub>out</sub>~4A<sub>out</sub> & 18V<sub>in</sub>~55V<sub>in</sub>. With excellent thermal performance, it is an ideal choice for telecom and data-com applications. It will operate under the temperature range of -40°C to +85°C.



## Operational Features

- Delivering up to 4A output current
- Ultra-high efficiency >92% at full load and typical operating conditions
- Wide input range: 18V ~ 60V
- Pre-bias function
- Excellent thermal performance
- Low min load requirement 0.4Amps
- Fixed frequency operation
- Intended for reflow or wave soldering
- RoHS 6 compliant
- Withstands short-interrupt

## Mechanical Features

- Industry standard 1/8thbrick outline
- Optimized for contact-cooling
- Open frame
- Pin length: 2.8mm
- Surface mount option can be available on request

## Control and protection

### Features

- Remote control function
- Input under voltage lockout
- Output over current protection
- Output over voltage protection
- Over temperature protection

## Safety & EMC

- Meets safety standards UL 60950-1, IEC/EN 60950-1 and GB4943
- Meets conducted emission's requirements of EN55022 Class A with external filter

## Electrical Characteristics

Full operating ambient temperature range is -40°C to +85°C.

Specifications are subject to change without notice.

Parameter		Min.	Typ.	Max.	Unit	Notes & Conditions
<b>Absolute max. ratings</b>						
Input voltage	Non-operating			100	V	100mSec
	Operating	18	48	60	V	Continuous
Operating temperature		-40		85	°C	
Storage temperature		-40		105	°C	
<b>Input characteristics</b>						
Operating input voltage range		18	48	60	V	
Input under-voltage lockout	Turn-on voltage threshold	16	17	18	V	
	Turn-off voltage threshold	14	15	16	V	
	Lockout voltage hysteresis	-	2	-	V	
Max. input current			4	5	A	
Standing loss				3.5W		Maximum
Inrush current transient				0.05	A2s	
Input reflected ripple current			10	30	mAp-p	
Recommended input fuse				5	A	recommend use LITTLE FUSE R451005
Input filter component values (C/L)			3.2/1		μF/μH	Internal values
<b>Output characteristics</b>						
Output voltage set point (standard option)		11.87	12	12.13	V	48Vin, full load
Output voltage line regulation				1	%	
				120	mV	
Output voltage load regulation				1	%	
				120	mV	
Output voltage temperature regulation				0.016	%/°C	%Vout per degC
Total output voltage range (TEB)				600	mV	Over sample, line, load, temperature & life 5% max

## Electrical Characteristics (Continued)

Parameter		Min.	Typ.	Max.	Unit	Notes & Conditions
Output voltage ripple and noise			130	200	mVpp	mV pk-pk 20MHz bandwidth Fig 6
				50	mV	mV rms
Operating output current range		0.4		4	A	
Output DC current-limit inception			6	8	A	Hiccup: auto-restart restart when over-current condition is removed
Output capacitance		100		2000	μF	470uF O/P for best performance
<b>Dynamic characteristics</b>						
Dynamic response (O/P cap =100u) 25%-50%-25% Io,max, 0.1A/μs	Vpeak.		400	600	mV	Figure 8, 9 Test condition: 25°C, nominal input voltage, see Figure 12
	Settling time		300	600	μs	Recovery to within 1% Vo,nom
Turn-on transient	I/P to O/P delay		100	150	Msec	Iout max Vo to 90%Vout
	Rise time		20	40	mSec	Iout max Vo to 90%Vout
	Enable to output		25	45	ms	Iout max Vo to 90%Vout
	O/P V overshoot			10	%Vo	I out max, Tamb = 25°C
<b>Efficiency</b> 70% to 100% load		89.5	91%		%	Tamb = 25 degC 2.8Aout~4Aout & 18Vin~55Vin
Isolation voltage (conditions: 10mA for 60 sec)		1500			Vdc	Basic insulation, pollution degree 2, input to output
<b>Feature characteristics</b>						
Switching frequency		265	300	335	kHz	At 25degC
Switching frequency		255	300	350	kHz	Across -40degC to +85degC
Remote ON/OFF control (Negative logic)		Off-state voltage 2.95V		12	V	Remote on/off floating is non-active.
		On-State voltage -0.3		1.2	V	
Output voltage remote sense range					V	No remote sense function
Output over-voltage protection			15	18	V	Hiccup: auto-restart when over-voltage condition is removed
Over-temperature shutdown			115	125	°C	Auto recovery
Over-temperature hysteresis			10		°C	
<b>Reliability characteristics</b>						
Calculated MTBF (Telecordia)				6.38	10 <sup>6</sup> h	Hours – Telecordia SR332, Method-1 case-3

# Qualification Testing

Parameter	Unit	Test condition
Vibration(non-operation)	3 pcs	10-190Hz 0.01g <sup>2</sup> /Hz 190-210Hz -36dB/Oct 210-2000Hz 0.003g <sup>2</sup> /Hz 2.7gRMS, 3 mutually perpendicular axis, 20mins/axis
Vibration(operating)	3pcs	5-350Hz 0.0001g <sup>2</sup> /Hz 350-500Hz -6dB/Oct 500Hz 0.00005g <sup>2</sup> /Hz 0.21gRMS 3 mutually perpendicular axis, 20mins/axis
Shock(non-operating)	3pcs	30g, halfsine, 18ms, all 6 faces, 3 times in each positive and negative directions
Shock(operating)	3pcs	4g, halfsine, 22ms, all 6 faces, 3 times in each positive and negative directions
Thermal shock(non-operating)	10pcs	-40-105degC, 700cycles, 15min/15min
Power thermal cycling	3pcs	Tmax op-Tmin op, 100cycles, 30min/30min, maximum input voltage and 50% rated load
Temperature humidity bias	10pcs	Pre-soak with 85°C ambient temperature, 85%RH for 72 hours with unpowered units. Then expose to maximum rated ambient temperature or 85°C, whichever is less with 85%RH, rated maximum input voltage and minimum rated load for 1,000 hours.
HALT combined cycle	5pcs	13cycles,  Toperating = Tdestruct -10°C, detailed test condition see Figure 1

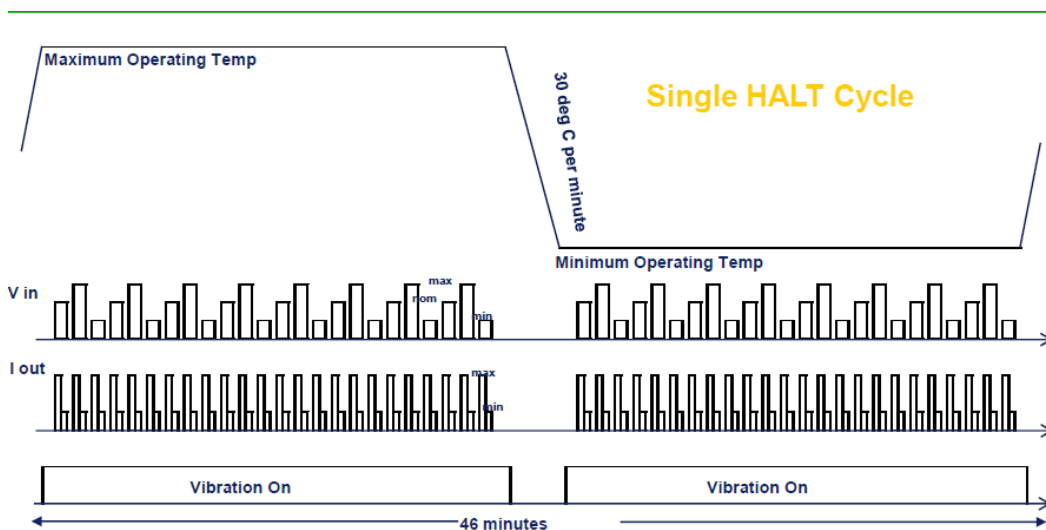


Figure 1 Test condition of HALT combined cycle

### Efficiency and dissipation curves

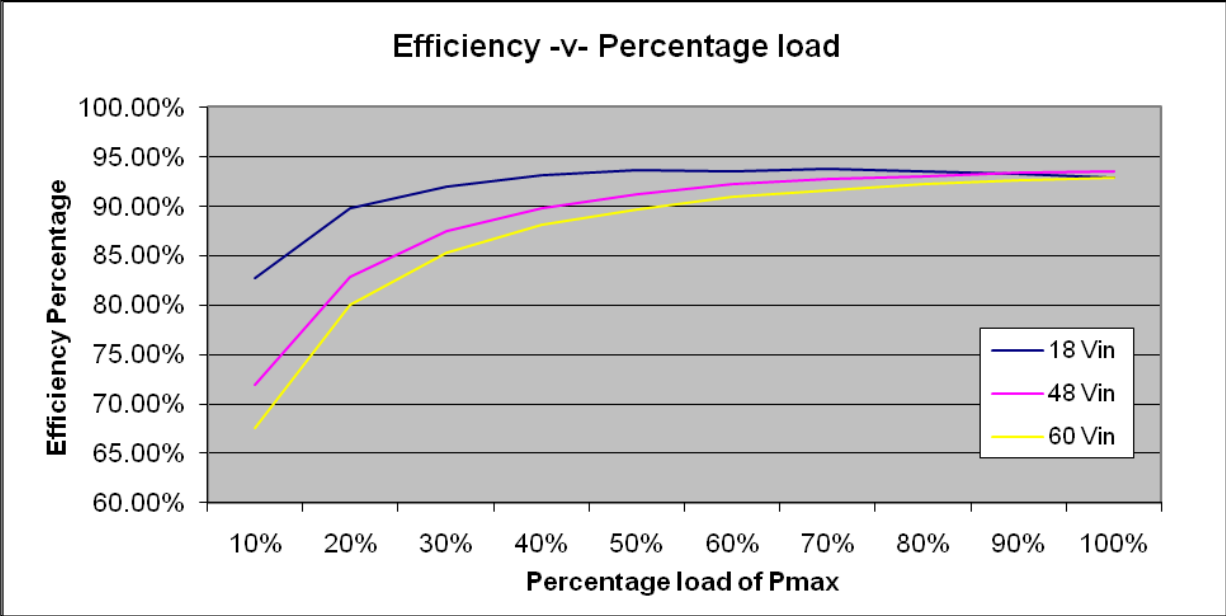


Figure 2 Efficiency vs. Percentage of load,  $T_a=25^{\circ}\text{C}$ ,  $V_o=12\text{V}$

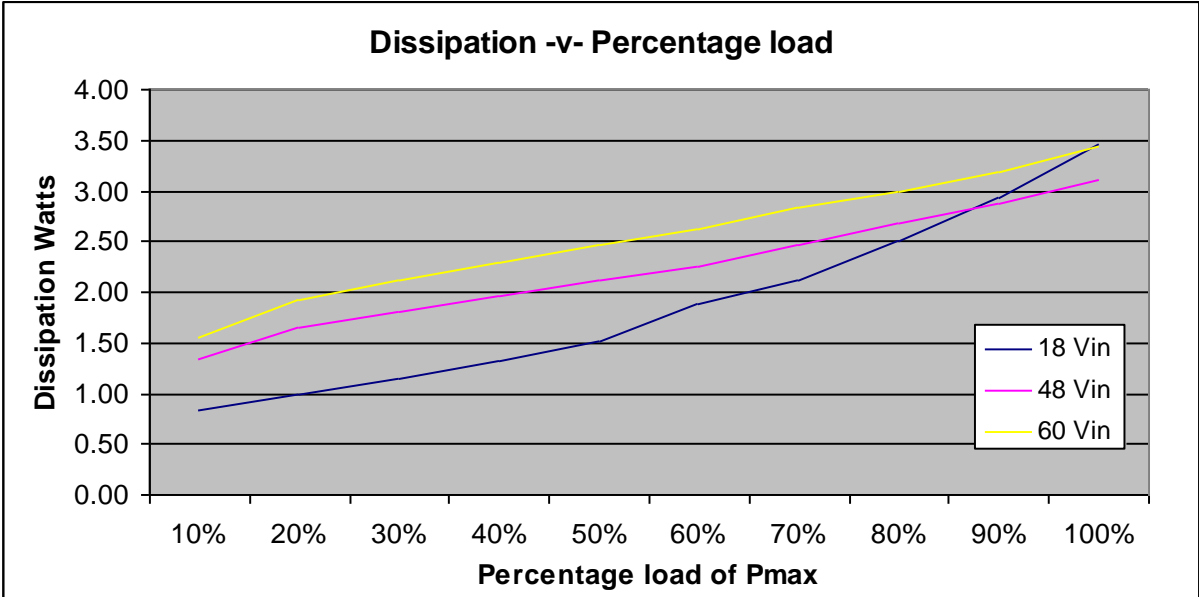


Figure 3 Dissipation vs. Percentage of load,  $T_a=25^{\circ}\text{C}$ ,  $V_o=12\text{V}$

# Thermal characteristics and dissipation

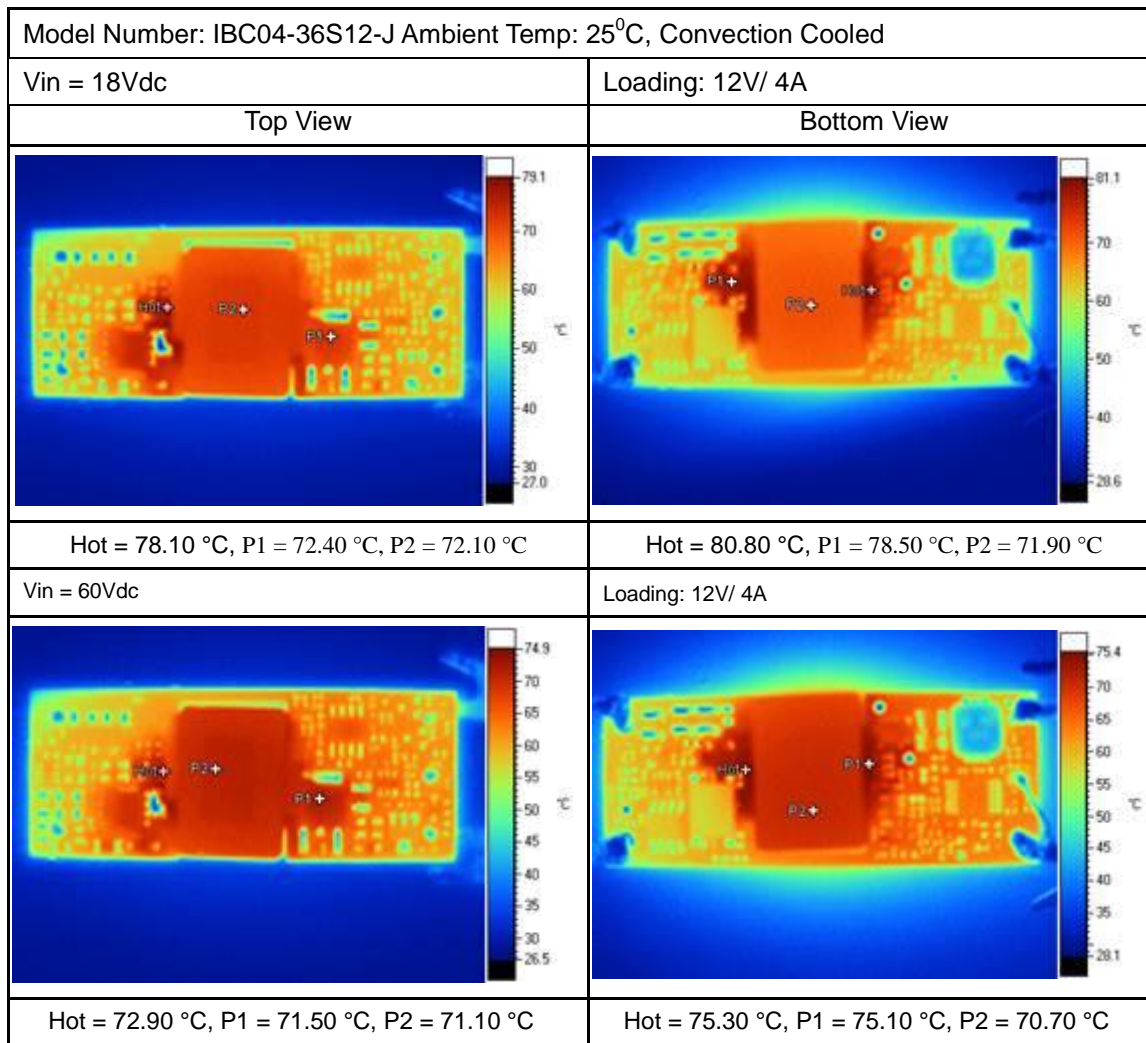


Figure 4 Thermal image and data for unit under variable line and load conditions (air flowing from pin 1 to pin 3)

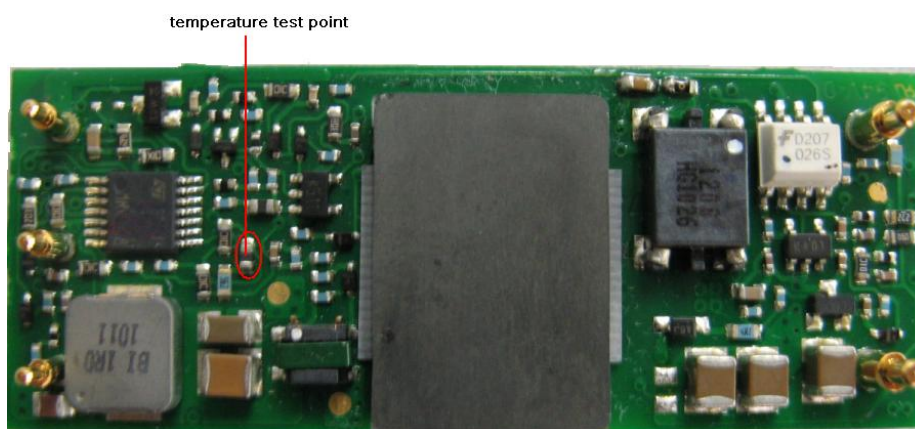


Figure 5 Temperature sensor test point on converter

# Electrical characteristics

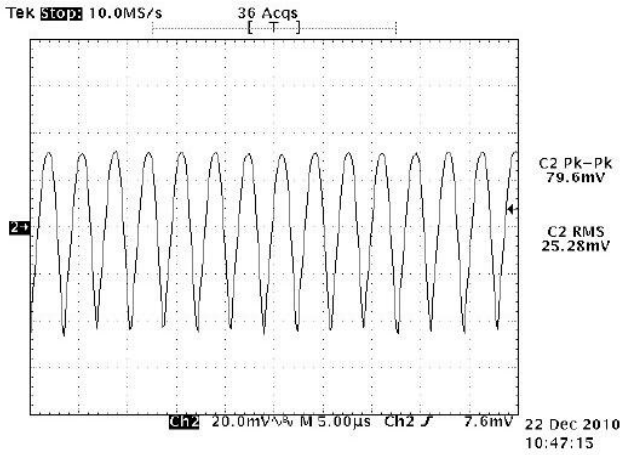


Figure 6 Output ripple & noise (5µs/div, 20mV/div), see Figure 16

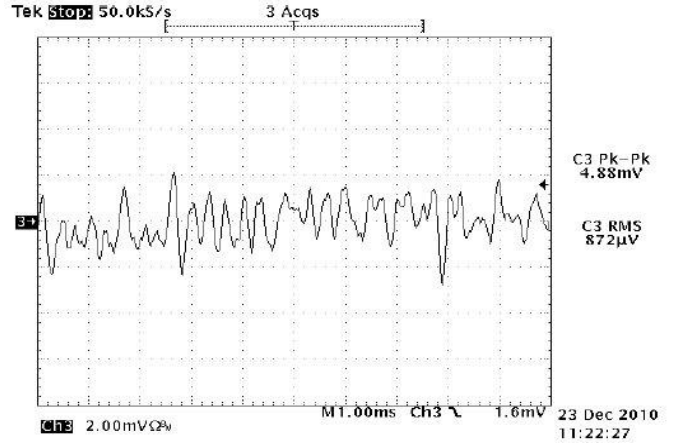


Figure 7 Input reflected ripple current (5ms/div, 10mA/div) Min Vin, Max Iout,

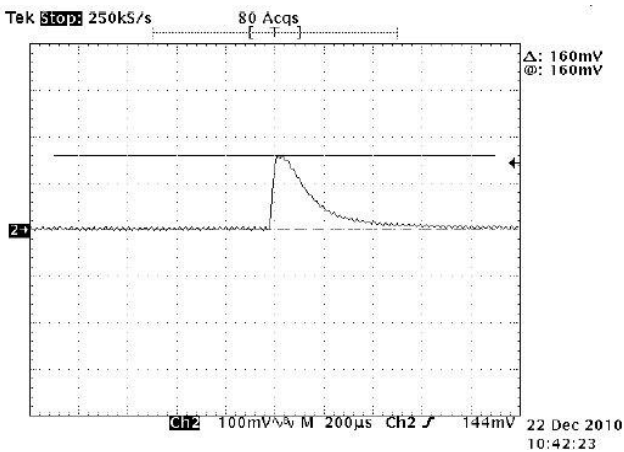


Figure 8 Dynamic response for 25% load step (25% ~ 50%) and 0.1A/µs slew rate, (200us/div)

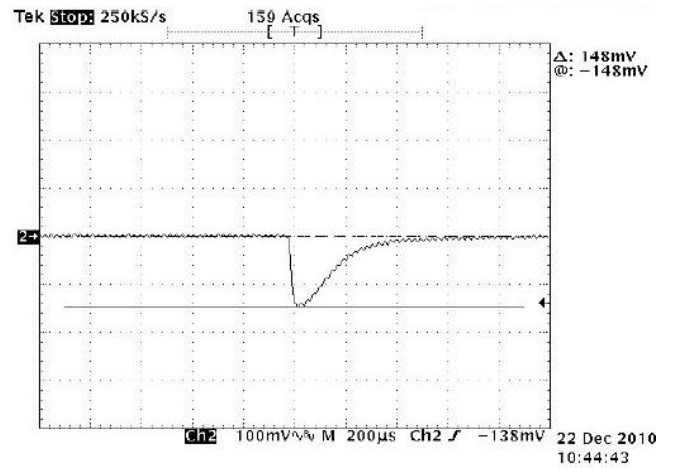


Figure 9 Dynamic response for 25% load step (50% ~ 75% ~ 50%) and 1A/µs slew rate, (200us/div),

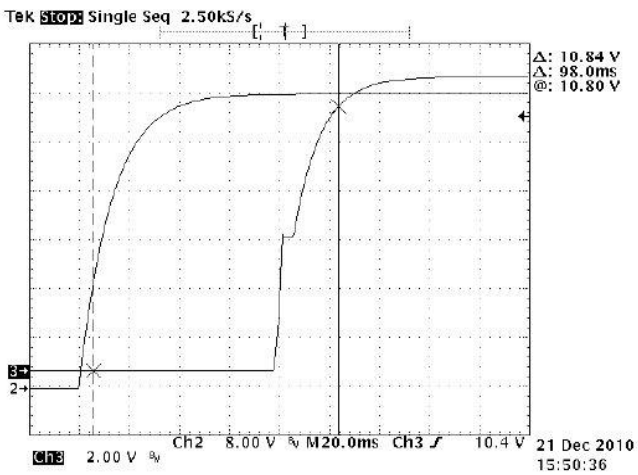


Figure10 Output voltage startup by power on,

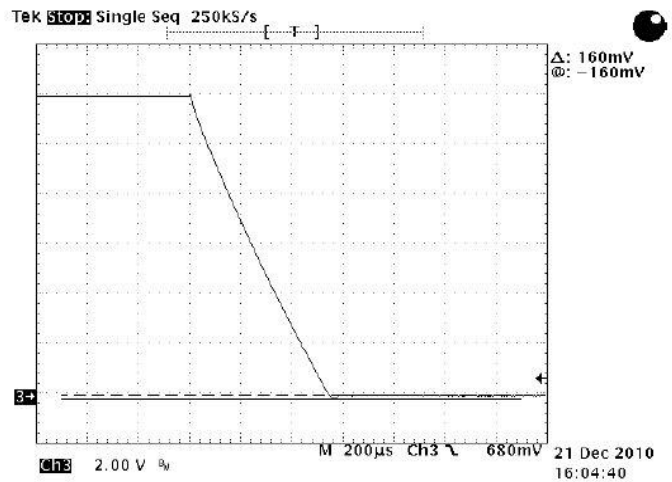


Figure 11 Output voltage shut down by power off,

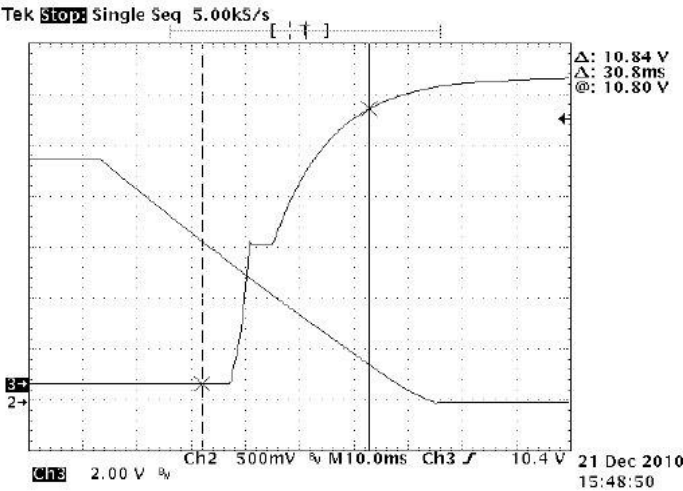


Figure 12 Output voltage startup by remote enable,

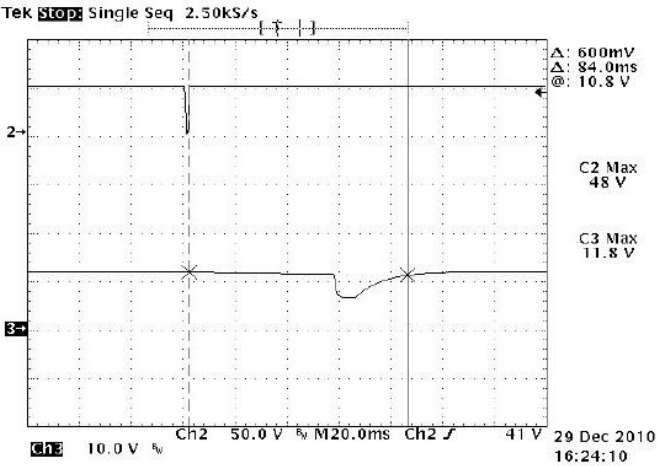


Figure 13 Input Short interrupt characteristics  
Worst case conditions of 48Vin, 0A load,  
1mSec Interrupt



# Application Note

## Typical Application

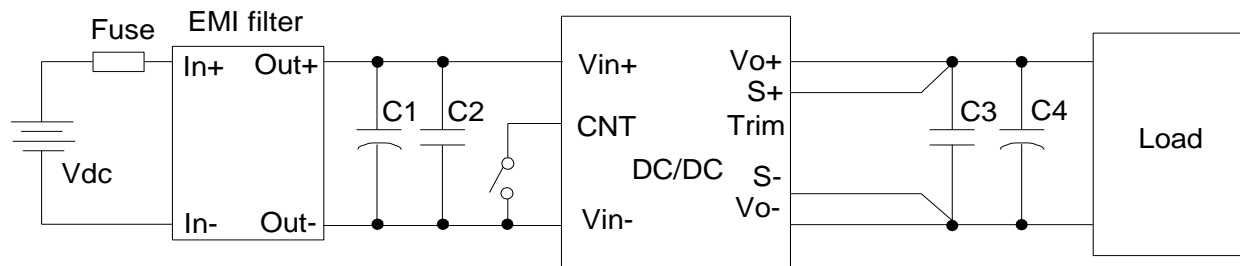


Figure 14 Typical application

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..

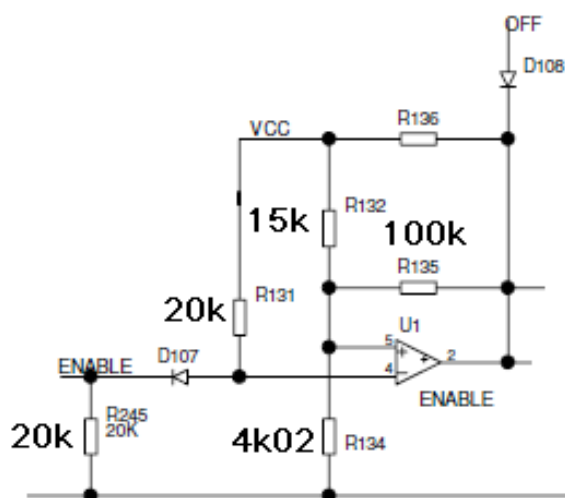


Figure 15 Remote ON/OFF internal diagram

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

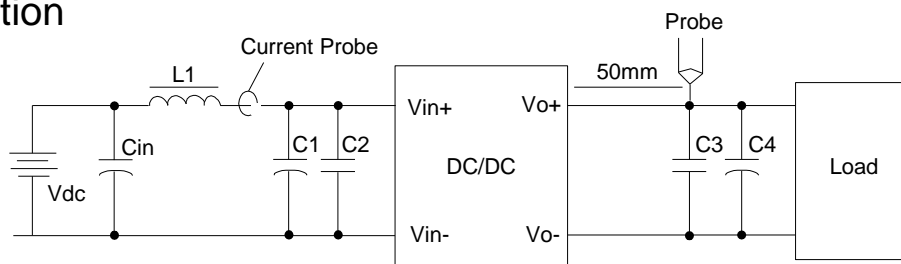


Figure 16 Input ripple & inrush current, ripple & noise test configuration

Vdc: DC power supply

L1: 12μH

Cin: 220μF/100V electrolytic capacitor

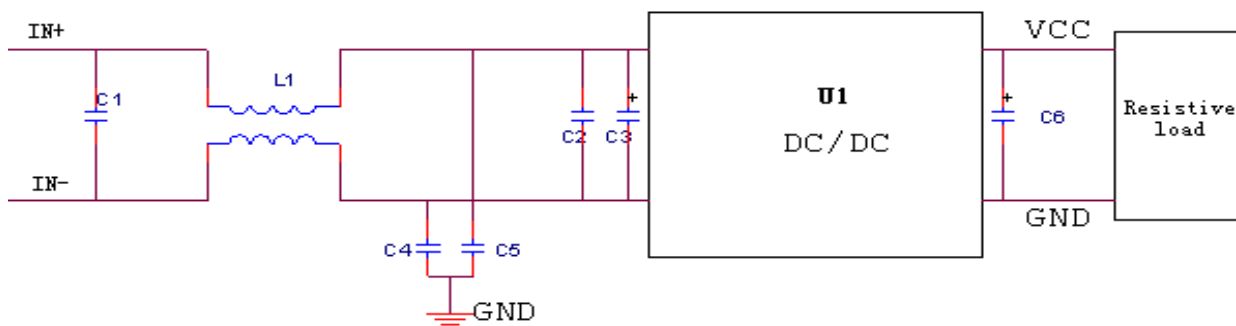
C1: 150μF/100V electrolytic capacitor

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.

## EMC test conditions



Part no.	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
----	------------------------------

Figure EMC

17

test configuration

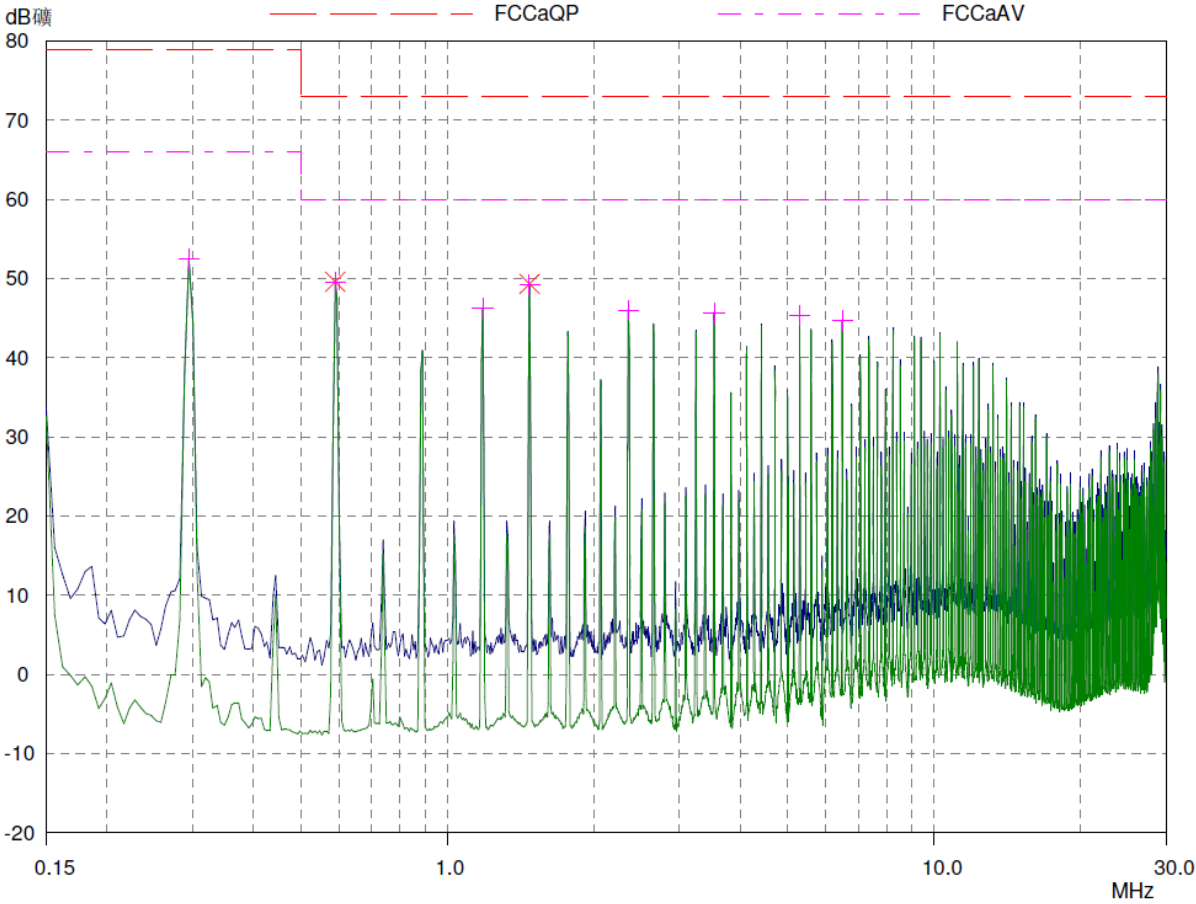


Figure 18 conducted EMC result with 48Vin@full load

### Mechanical Diagram

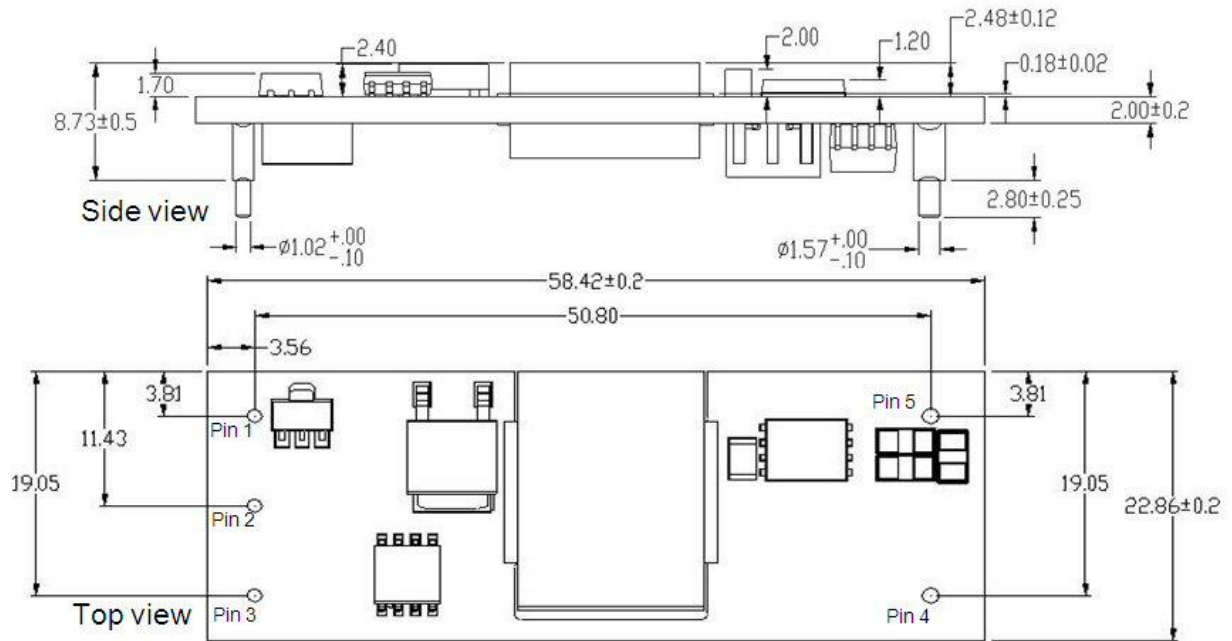


Figure 19 Mechanical diagram

### 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 20.

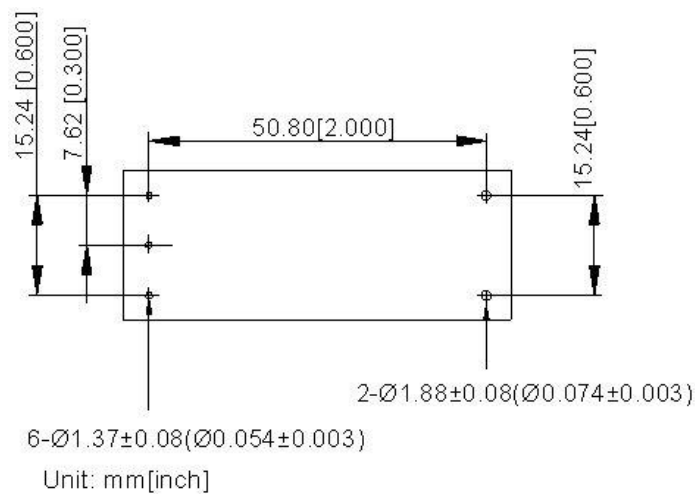


Figure 20 Recommended hole pattern

## 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	$V_{in+}$	Positive input voltage
2	Remote ON/OFF	Remote control
3	$V_{in-}$	Negative input voltage
4	$V_{o-}$	Negative output voltage
5	$V_{o+}$	Positive output voltage

## 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°C for maximum 10s.

When wave soldering is used, the temperature on pins is specified to maximum 260°C for maximum 7s.

When soldering by hand, the iron temperature should be maintained at 300°C ~ 380°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

- 1、 Package type: Moisture sensitivity level 3, Moisture Barrier Bags
- 2、 minimal Package QTY: 128 PCS
- 3、 Package disassembly

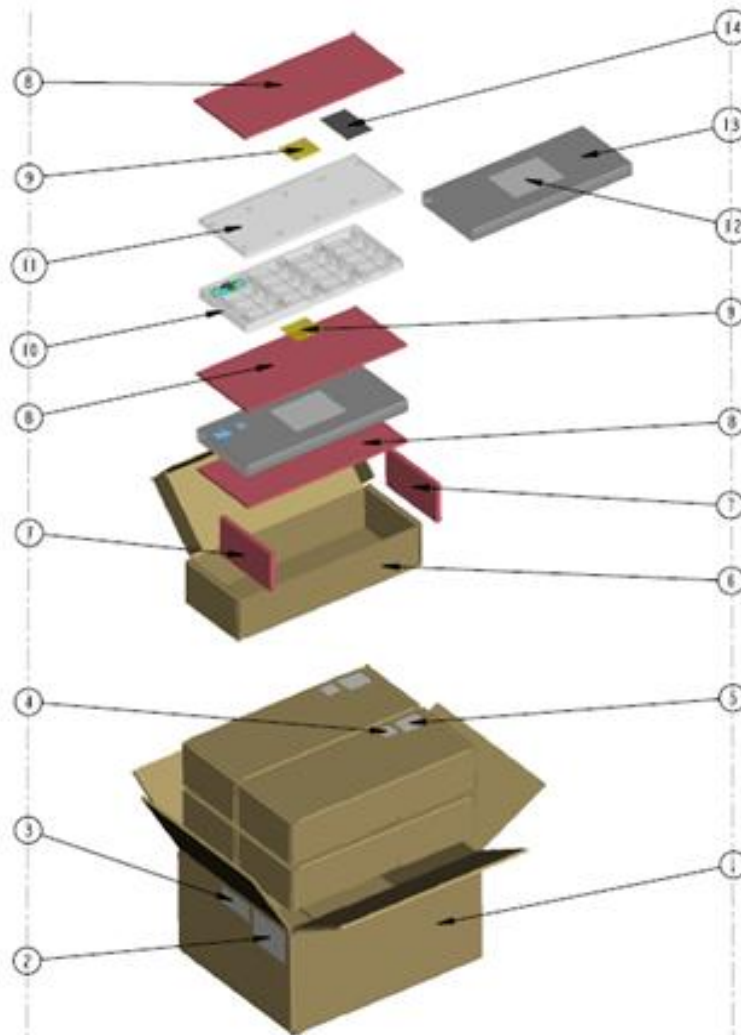


Figure 21 packaging break down

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 ALD12A48N-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
ITEM	DESCRIPTION	QTY	UNIT

4、Package tray information

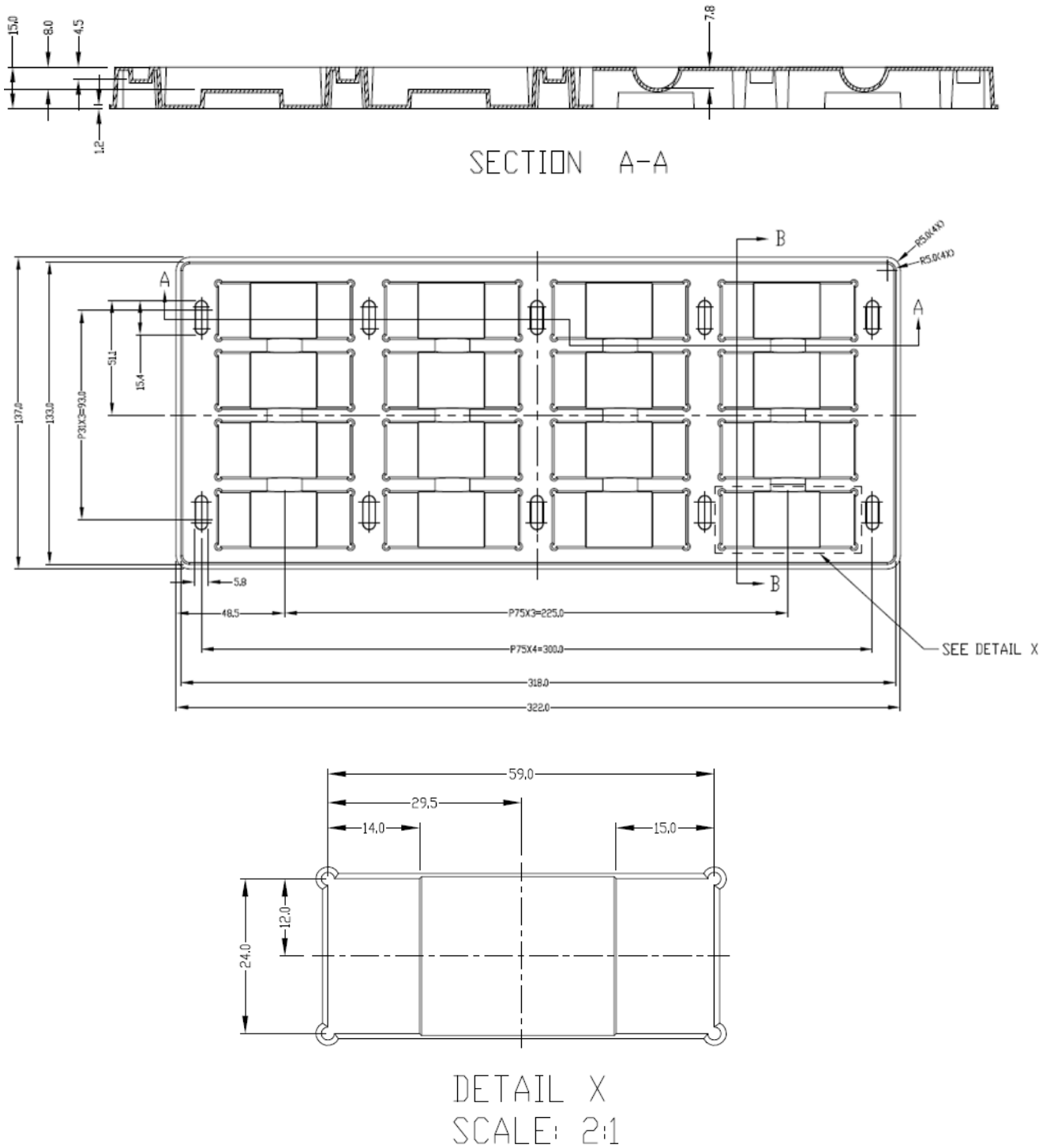


Figure 22 Packaging Tray dimensions detail

### Ordering Information

<b>IBC04</b>	<b>-</b>	<b>36</b>	<b>S</b>	<b>12</b>		<b>-</b>		<b>J</b>
①		②	③	④	⑤		⑥	⑦

①	Model series	IBC: standard eighth-brick series, 4A: output power 60W
②	Input voltage	48: 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
⑥	Pin length	Default: 2.8mm, S; Surface mount
⑦	RoHS status	J: RoHS, R6

Model number	Description
IBC04-36S12-J	2.8mm pin length; negative on/off logic; Open-Frame 1/8 <sup>th</sup> brick; R6 compliant

### Hazardous Substances Announcement (RoHS Of China)

Parts	Hazardous substances					
	Pb	Hg	Cd	Cr <sup>6+</sup>	PBB	PBDE
IBC04-48S12	○	○	○	○	○	○
○: 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						
Emerson Network Power Co., Ltd. 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						