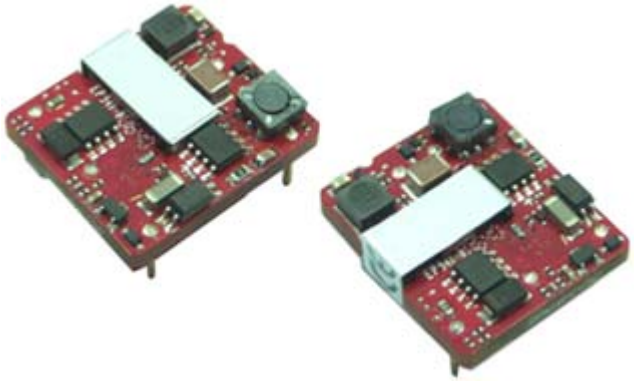
Wall Industries, Inc.

TECHNICAL DATASHEET
Rev. C

JFW24S5-3000

9-36VDC Wide Input Voltage Range
5VDC Output at 3A
DIP and SMT Type Packages
15W Open Frame DC/DC Power Converter



APPLICATIONS

- Wireless Networks
- Telecom / Datacom
- Industry Control Systems
- Measurement Equipment
- Semiconductor Equipment

OPTIONS

- SMT Type
- Without Trim Pin
- Without ON/OFF Pin
- Negative Logic Remote ON/OFF

FEATURES

- 15 Watts Maximum Output Power
- 5VDC Single Output
- Cost Efficient Open Frame Design
- Small Size and Low Profile: 1.10” x 0.94” x 0.34”
- 87% High Efficiency
- 9-36VDC Input Voltage Range
- Fixed Switching Frequency
- Input to Output Isolation: 2250VDC
- No Minimum Load Requirement
- Output Voltage Adjustability
- Industry Standard Pin-out
- Negative or Positive Remote ON/OFF Control
- Short Circuit, Over Current, Over Voltage, and Input Under Voltage Protection
- Surface Mount and Through Hole Types Available
- SMT Package Qualified for Lead-free Reflow Solder Process According to IPC J-STD-020D
- CE Mark Meets 2006/95/EC, 93/68/EEC, and 2004/108/EC
- UL60950-1, EN60950-1, and IEC60950-1 Licensed

DESCRIPTION

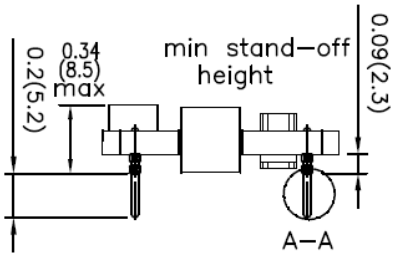
The JFW24S5-3000 DC/DC power converter provides 15 Watts of output power in a low profile industry standard package and footprint. This converter has a 5VDC single output and operate over a 4:1 input voltage range of 9-36VDC. The JFW24S5-3000 is also protected against short circuit, over current, over voltage, and input under voltage conditions. Some features include 87% high efficiency, adjustable output voltage, and positive or negative remote ON/OFF control. This converter is RoHS compliant and has UL60950-1, EN60950-1, and IEC60950-1 safety approvals. Both surface mount (“S” suffix) and DIP (standard) packages are available.

TECHNICAL SPECIFICATIONS				Model No. JFW24S5-3000			
All specifications are based on 25°C, Nominal Input Voltage, and Maximum Output Current unless otherwise noted. We reserve the right to change specifications based on technological advances.							
SPECIFICATION		**TEST CONDITIONS**		**Min**	**Typ**	**Max**	**Unit**
INPUT SPECIFICATIONS							
Input Voltage Range				9	24	36	VDC
Input Current		Nominal input and full load				754	mA
Input Standby Current		Nominal input and no load			70		mA
Input Surge Voltage (100ms)						50	VDC
UVLO Turn-On Threshold						9	VDC
UVLO Turn-Off Threshold					8		VDC
Start-Up Time	Power Up	Nominal input and constant resistive load			5	30	ms
	Remote ON/OFF				5	30	
Input Reflected Ripple Current *(See Page 9)*		5 to 20MHz, 12µH source impedance			30		mAp-p
OUTPUT SPECIFICATIONS							
Output Voltage		Nominal input, full load, and 25°C		4.95	5	5.05	VDC
Line Regulation		Low line to high line at full load		-0.2		+0.2	%
Load Regulation		No load to full load		-0.2		+0.2	%
Voltage Adjustability *(See Page 6)*				-10		+10	%
Output Power						15	W
Output Current						3000	mA
Output Capacitor Load						6000	µF
Ripple & Noise (20Hz BW) *(See Page 9)*		Measured with a 1µF M/C and a 10µF T/C			100	125	mVp-p
Output Voltage Overshoot		Low line to high line at full load and 25°C				3	%Vout
Minimum Load				0			%
Temperature Coefficient				-0.02		+0.02	%/°C
DYNAMIC LOAD RESPONSE							
Peak Deviation		75% to 100% or 100% to 75% of full load			300		mV
Setting Time (Vout < 10% peak deviation)		75% to 100% or 100% to 75% of full load			250		µs
REMOTE ON/OFF *(See Page 5)*							
Positive Logic (standard)	DC/DC ON (Open)	The ON/OFF pin is referenced to -Input		Open or 3V < Vr < 15V			
	DC/DC OFF (Short)			Short or 0V < Vr < 1.2V			
Negative Logic (optional)	DC/DC ON (Short)	The ON/OFF pin is referenced to -Input		Short or 0V < Vr < 1.2V			
	DC/DC OFF (Open)			Open or 3V < Vr < 15V			
Input Current of Remote Control Pin		Nominal Input		-0.5		1	mA
Remote Off State Input Current		Nominal Input			2.5		mA
PROTECTION							
Over Voltage Protection		Voltage clamped		5.6		7.0	VDC
Over Current Protection		% of FL at nominal input			150		%FL
Short Circuit Protection				Hiccup, automatic recovery			
GENERAL SPECIFICATIONS							
Efficiency		Nominal input and full load			87		%
Switching Frequency				315	350	385	KHz
Isolation Voltage (Input to Output)		For 1 minute		2250			VDC
Isolation Resistance				1			GΩ
Isolation Capacitance						1500	pF
ENVIRONMENTAL SPECIFICATIONS							
Operating Ambient Temperature		With derating		-40		+85	°C
Storage Temperature				-55		+125	°C
Relative Humidity				5		95	% RH
Thermal Shock				MIL-STD-810F			
Vibration				MIL-STD-810F			
Lead-Free Reflow Solder Process				IPC J-STD-020D			
Moisture Sensitivity Level (MSL)				IPC J-STD-033B Level 2a			
MTBF *(See Page 16)*		BELLCORE TR-NWT-000332, Tc=40°C		1,322,000 hours			
		MIL-HDBK-217F		514,700 hours			
PHYSICAL SPECIFICATIONS							
Weight				0.36oz (10.5g)			
Dimensions (L x W x H)				1.10 x 0.94 x 0.34 inches (27.9 x 23.9 x 8.5 mm)			
SAFETY & EMI CHARACTERISTICS							
Safety Approvals				IEC60950-1, UL60950-1, EN60950-1			
EMI *(See Page 10)*		EN55022		Class A			
Radiated Immunity		EN61000-4-3	10 V/m	Perf. Criteria A			
Fast Transient *(See Note1)*		EN61000-4-4	±2KV	Perf. Criteria A			
Surge *(See Note1)*		EN61000-4-5	±1KV	Perf. Criteria A			
Conducted Immunity		EN61000-4-6	3 Vrms	Perf. Criteria A			

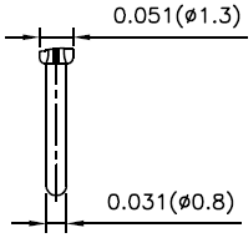
Note1: *An external input filter capacitor is required if the module has to meet EN61000-4-4 and EN61000-4-5. The filter capacitor suggested is Nippon Chemi-con KY series 220µF/100V, ESR 48mΩ.*

MECHANICAL DRAWING

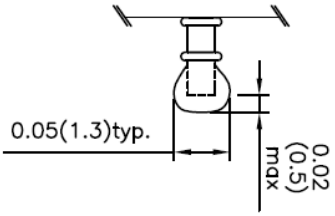
DIP TYPE (Standard)



1. Unit: inches (mm)
2. Tolerance: X.XX±0.02 (X.X±0.5)
   X.XXX±0.01 (X.XX±0.25)
3. Pin pitch tolerance: ±0.01 (±0.25)
4. Pin dimension tolerance: ±0.004 (±0.1)

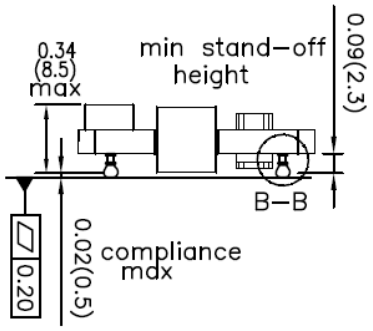


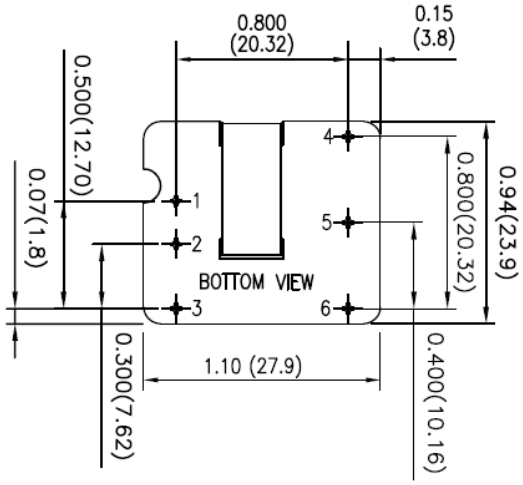
SECTION A–A

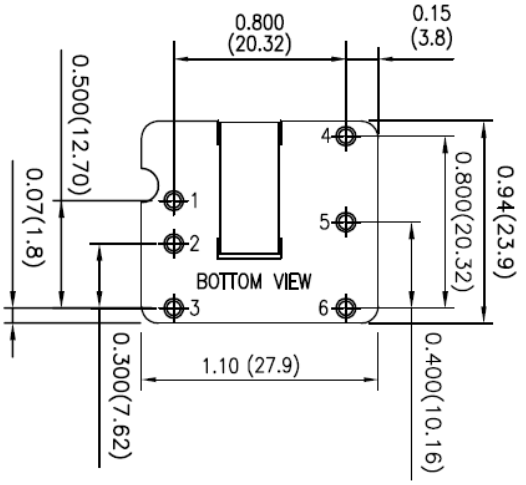


SECTION B–B

SMT TYPE (Suffix "S")



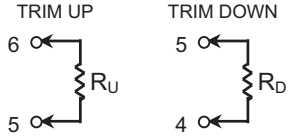




PAD LAYOUT 6 PADS ø2.8mm

PIN CONNECTIONS	
PIN	**JFW SERIES**
1	+INPUT
2	-INPUT
3	CTRL
4	+OUTPUT
5	TRIM
6	-OUTPUT

ETERNAL OUTPUT TRIMMING
Output can be externally trimmed by using the method shown below.



PRODUCT OPTIONS	
Option	**Suffix**
Positive Remote ON/OFF with DIP (standard)	No Suffix
Positive remote ON/OFF with SMT	S
Negative Remote ON/OFF with DIP	R
Negative Remote ON/OFF with SMT	SR
DIP type without ON/OFF pin	D
SMT type without ON/OFF pin	SD
DIP type without ON/OFF & TRIM pin	G
SMT type without ON/OFF & TRIM pin	SG
DIP type, negative remote ON/OFF, without TRIM pin	F
SMT type, negative remote ON/OFF, without TRIM pin	SF
DIP type, positive remote ON/OFF, without TRIM pin	J
SMT type, positive remote ON/OFF, without TRIM pin	SJ

DESIGN CONSIDERATIONS

Output Over Current Protection

When excessive output currents occur in the system, circuit protection is required on all power supplies. Normally, over load current is maintained at approximately 150% of rated current for the JFW Series.

Hiccup-mode is a method of operation in a power supply whose purpose is to protect the power supply from being damaged during an over current fault condition. It also enables the power supply to restart when the fault condition is removed.

One of the problems resulting from over current is that excessive heat may be generated in the power devices; especially MOSFET and Schottky diodes and the temperature of those devices may exceed their specified limits. A protection mechanism has to be used to prevent those power devices from being damaged.

Output Over Voltage Protection

The output over voltage protection consists of a Zener diode that monitors the output voltage on the feedback loop. If the voltage on the output terminals exceeds the over voltage protection threshold, then the Zener diode will send a current signal to the control IC to limit the output voltage.

Input Source Impedance

The power module should be connected to a low impedance input source. Highly inductive source impedance can affect the stability of the power module. Input external C-L-C filter is recommended to minimize input reflected ripple current. The inductor is simulated source impedance of 12µH and capacitor is Nippon chemi-con KZE series 220µF/100V and 33µF/100V. The capacitor must be placed as close as possible to the input terminals of the power module for lower impedance.

Short Circuit Protection

Continuous, hiccup and auto-recovery mode.

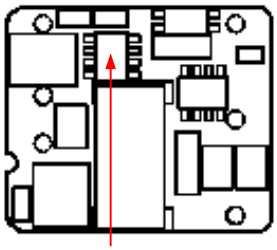
During a short circuit the converter will shut down. The average current during this condition will be very low and the device can be handled safely in this condition.

Thermal Consideration

The power module operates in a variety of thermal environments. However, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convention, and radiation to the surrounding environment. Proper cooling can be verified by measuring the point shown in the figure below. The temperature at this location should not exceed 120°C. When operating, adequate cooling must be provided to maintain the test point temperature at or below 120°C. Although the maximum point temperature of the power modules is 120°C, you can limit this temperature to a lower value for extremely high reliability.

TOP VIEW

Figure 1



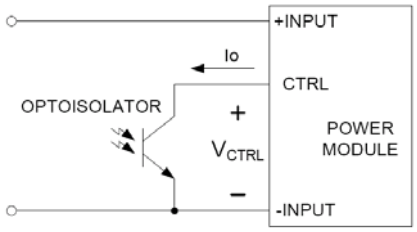
Temperature Measurement Point

Remote ON/OFF Control

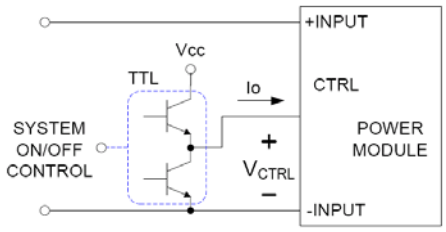
The remote ON/OFF pin allows the user to turn the DC/DC power module on and off from a remote switch device. The ON/OFF input can be switched by a number of switching devices. Figure 2 gives several examples of acceptable configurations. The remote ON/OFF switch is activated by the voltage difference between the ON/OFF pin and the –Vin pin (with –Vin as the reference voltage). The user-supplied switch must be capable of sinking up to 1mA of current at low-level logic voltage. The leakage current of the user-supplied switch must be 0.5mA or less at 15Vdc.

Remote ON/OFF Implementation Circuits

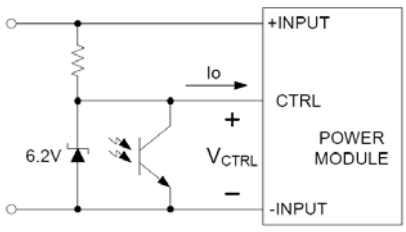
Figure 2



Isolated-Closure Remote ON/OFF



Level Control Using TTL Output

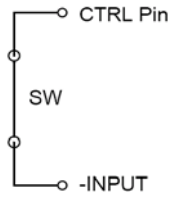


Level Control Using Line Voltage

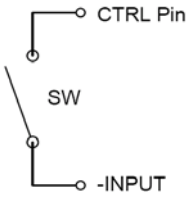
There are two remote control options available: Positive logic and Negative logic

a. The positive logic structure turned the DC/DC module ON when the ON/OFF pin is at high-level logic and turned the DC/DC module OFF when the ON/OFF pin is at low-level logic.

Figure 3



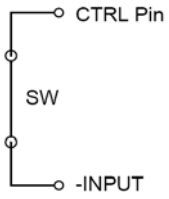
When JFW module is turned OFF at Low-level logic



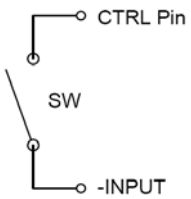
When JFW module is turned ON at High-level logic

b. The negative logic structure turned the DC/DC module ON when the ON/OFF pin is at low-level logic and turned the DC/DC module OFF when the ON/OFF pin is at high-level logic.

Figure 4



When JFW module is turned ON at Low-level logic



When JFW module is turned OFF at High-level logic

External Trim Adjustment

Output voltage set point adjustment allows the user to increase or decrease the output voltage set point of a module. This is accomplished by connecting an external resistor between the TRIM pin and either the +Vout or -Vout pins. With an external resistor between the TRIM and +Vout pin, the output voltage set point decreases. With an external resistor between the TRIM and -Vout pin, the output voltage set point increases. The external TRIM resistor needs to be at least 1/16W.

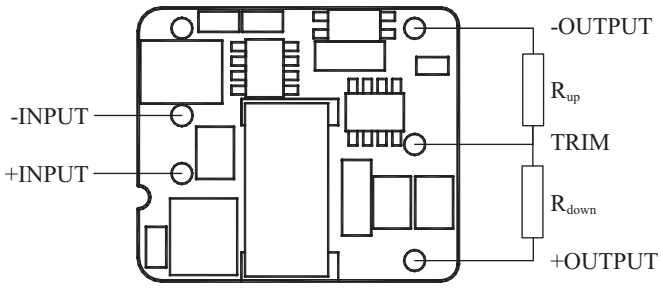
$$R_{up} = \left[\frac{5110 * 2.5}{(V_{out,up} - 2.5 - 2.5)} - 2050 \right] \Omega$$

$V_{out,up}$ *is the desired up output voltage*

$$R_{down} = \left[\frac{(V_{out,down} - 2.5) * 5110}{(V_{out} - V_{out,down})} - 2050 \right] \Omega$$

$V_{out,down}$ *is the desired down output voltage*

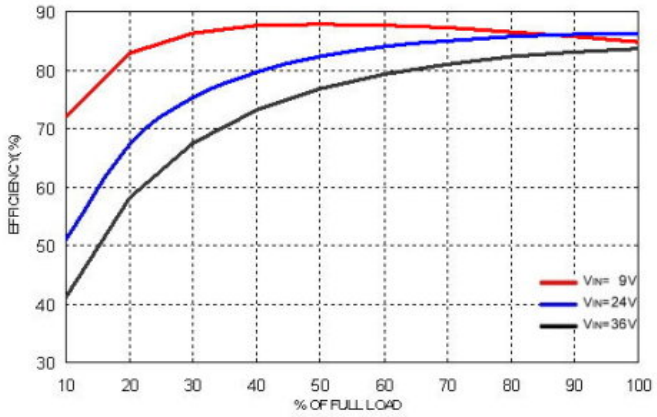
Figure 5



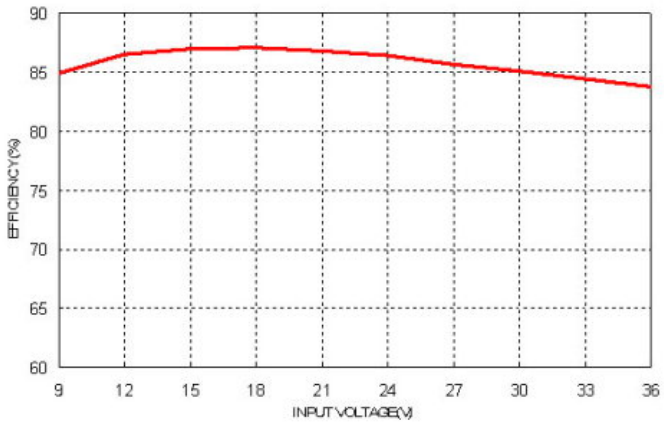
Trim Resistor Values

Trim	$V_{out,up}$	R_{up}	$V_{out,down}$	R_{down}
1%	5.050V	253.450 kΩ	4.950V	248.340 kΩ
2%	5100V	125.700 kΩ	4.900V	120.590 kΩ
3%	5.150V	83.117 kΩ	4.850V	78.007 kΩ
4%	5.200V	61.825 kΩ	4.800V	56.715 kΩ
5%	5.250V	49.050 kΩ	4.750V	43.940 kΩ
6%	5.300V	40.533 kΩ	4.700V	35.423 kΩ
7%	5.350V	34.450 kΩ	4.650V	29.340 kΩ
8%	5.400V	29.888 kΩ	4.600V	24.778 kΩ
9%	5.450V	26.339 kΩ	4.550V	21.229 kΩ
10%	5.500V	23.500 kΩ	4.500V	18.390 kΩ

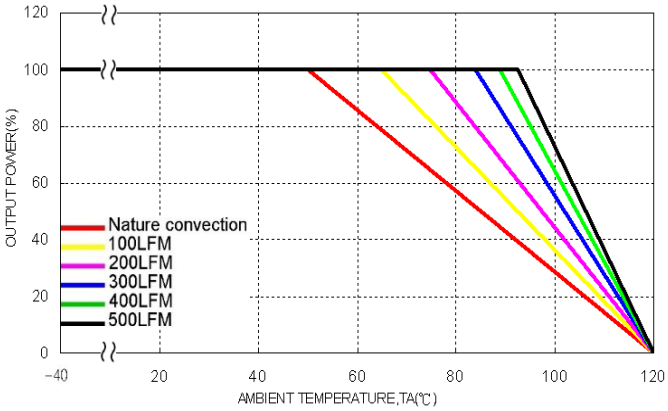
Graph 1: Efficiency vs. Output Current



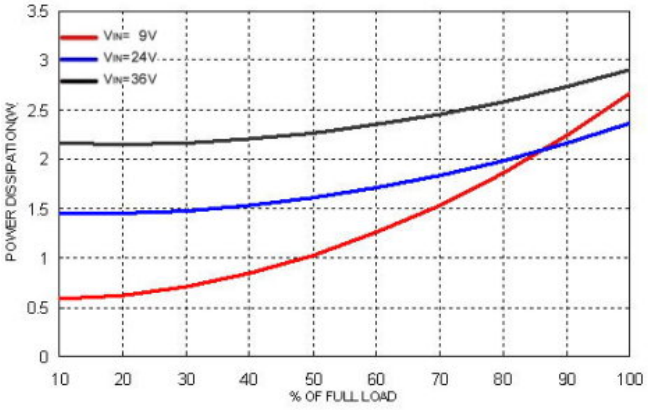
Graph 2: Efficiency vs. Input Voltage (Full Load)



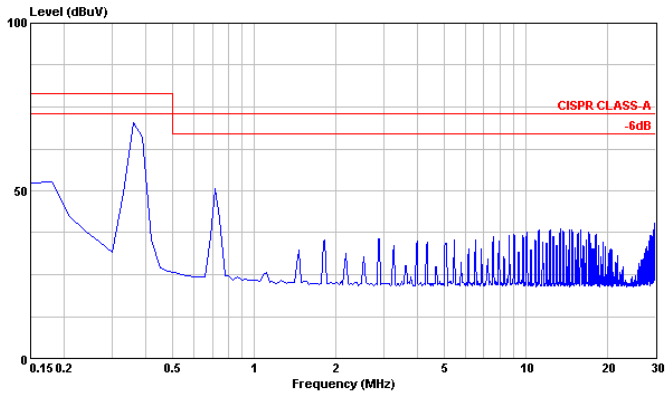
Graph 3: Output Power vs. Ambient Temperature & Airflow (Nominal Vin)



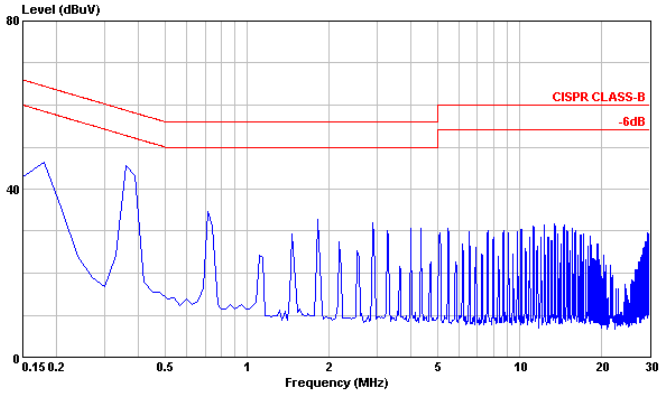
Graph 4: Power Dissipation Vs. Output Current



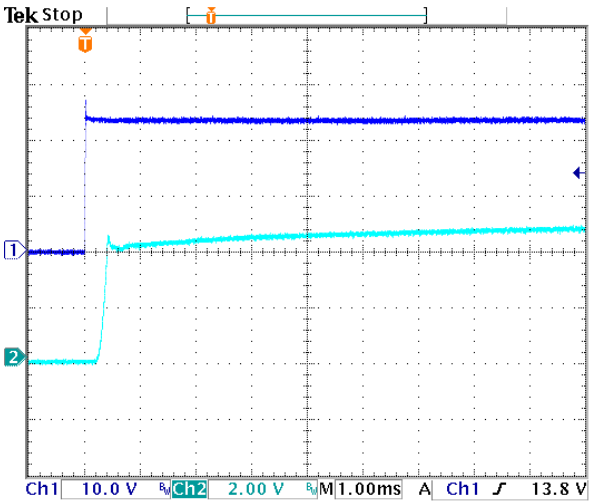
Graph 5: Conducted Emission of EN55022 Class A (Nominal Vin and Full Load)



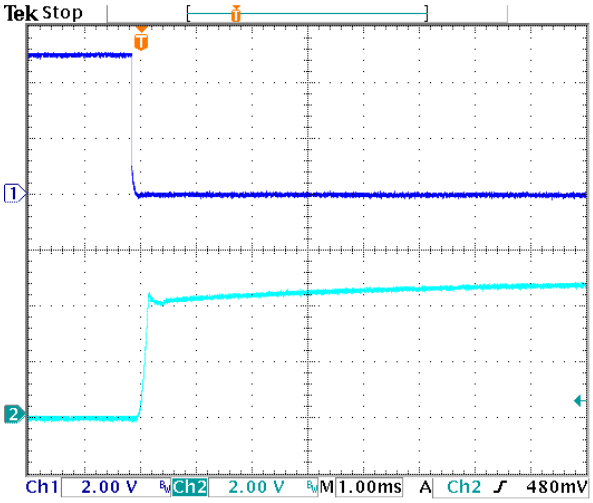
Graph 6: Conducted Emission of EN55022 Class B (Nominal Vin and Full Load)



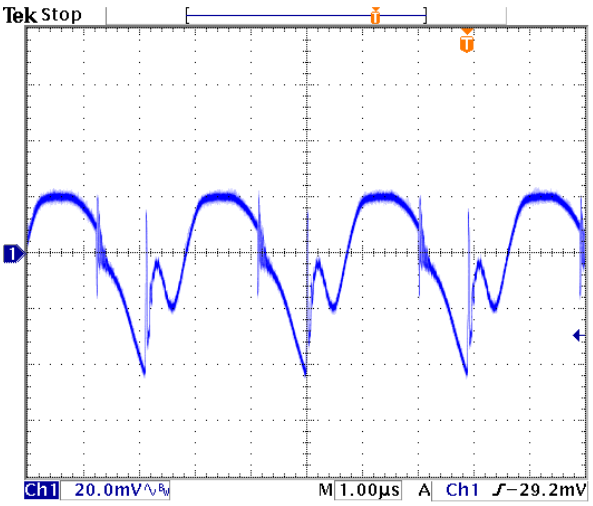
Graph 7: Typical Input Start-Up and Output Rise Characteristic (Nominal Vin and Full Load)



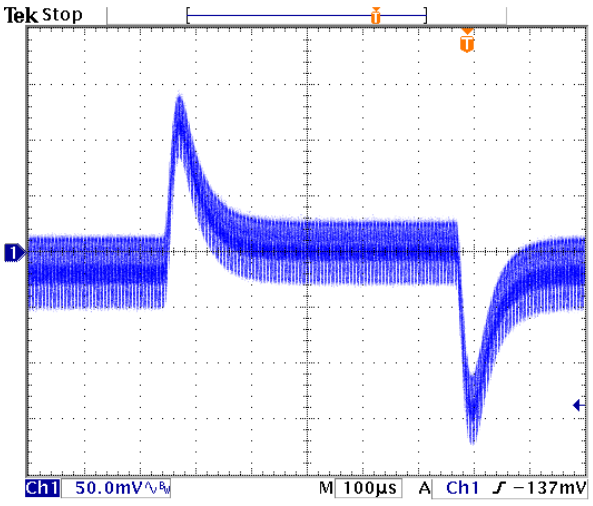
Graph 8: Using ON/OFF Voltage Start-Up and Vo Rise Characteristic (Nominal Vin and Full Load)



Graph 9: Typical Output Ripple and Noise (Nominal Vin and Full Load)



Graph 10: Transient Response to Dynamic Load Change from 100% to 75% to 100% of Full Load at Nominal Vin

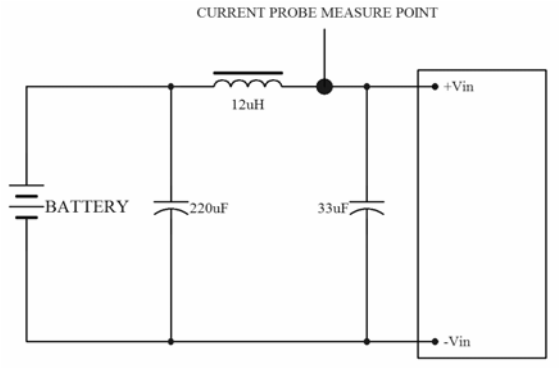


TEST SETUP:

The JFW24S5-3000 specifications are tested with the following configurations:

Input Reflected-Ripple Current Measurement Test Setup

Figure 6



Component	Value	Voltage	Reference
L	12µH	----	----
C	220µF	100V	Aluminum Electrolytic Capacitor
C	33µF	100V	Aluminum Electrolytic Capacitor

Peak-to-Peak Output Ripple & Noise Measurement Setup

Figure 7

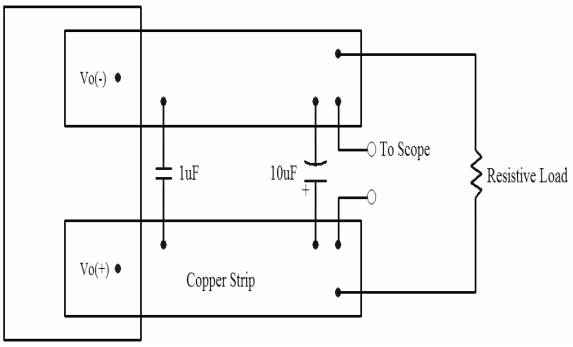
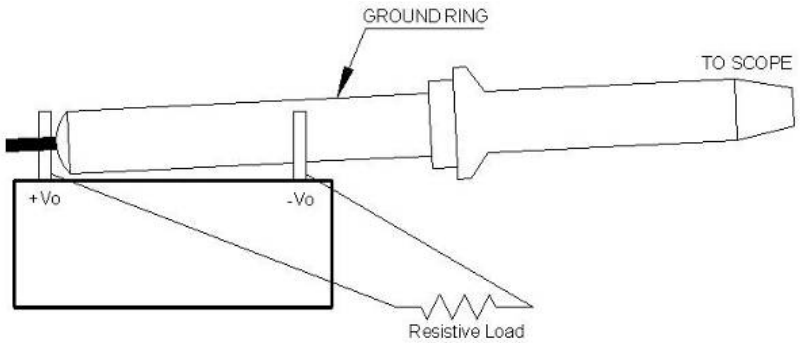
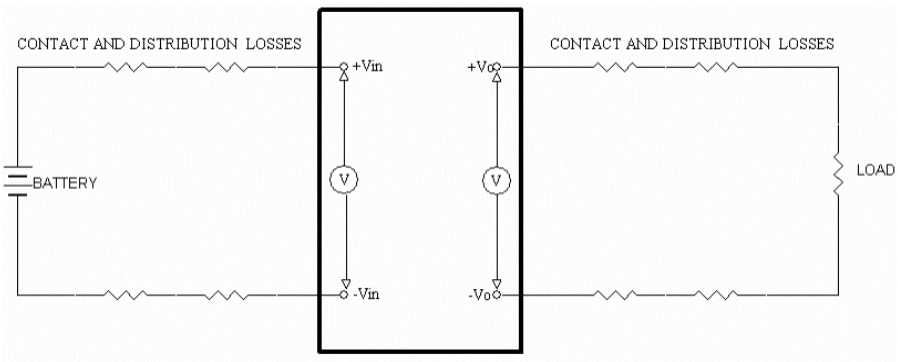


Figure 8



Output Voltage and Efficiency Measurement Setup

Figure 9



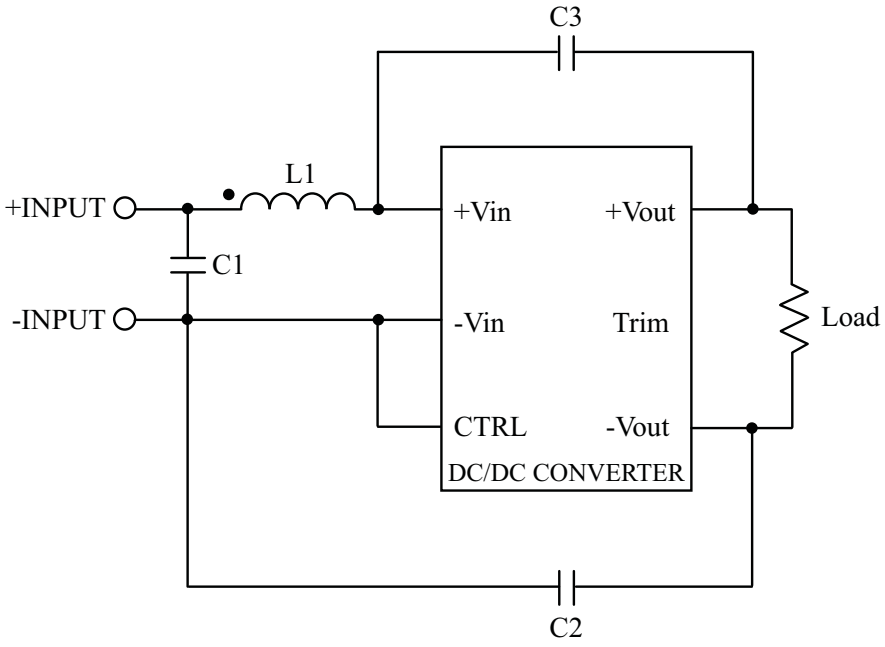
$$Efficiency = \left(\frac{Vout \times Iout}{Vin \times Iin} \right) \times 100\%$$

NOTE: All measurements are taken at the module terminals

EMI Considerations:

Suggested Schematic for EN55022 Conducted Emission Class A Limits

Figure 10

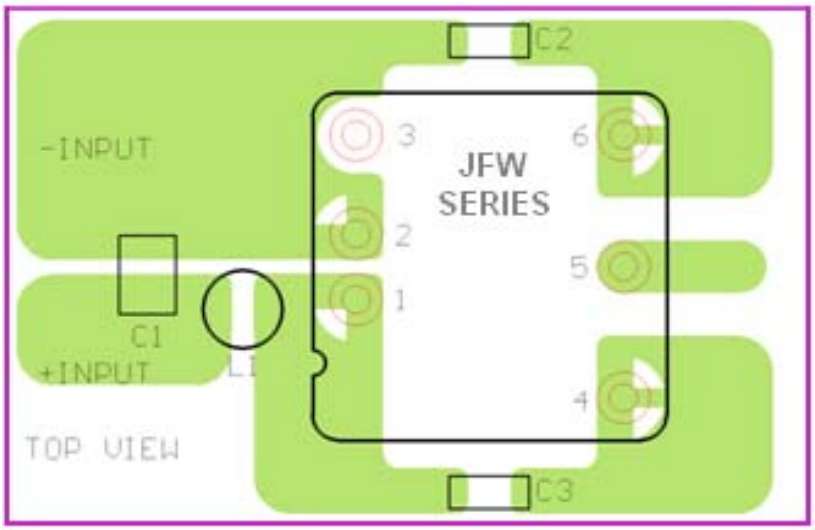


To meet conducted emissions EN55022 CLASS A the following components are needed:

JFW24S5-3000			
Component	**Value**	**Voltage**	**Reference**
L1	10µH	----	2.6A 0.04Ω 0705 SMD Inductor P/N: PMT-070
C1	6.8µF	50V	1812 MLCC
C2, C3	470pF	3KV	1808 MLCC

Recommended Layout with Input Filter

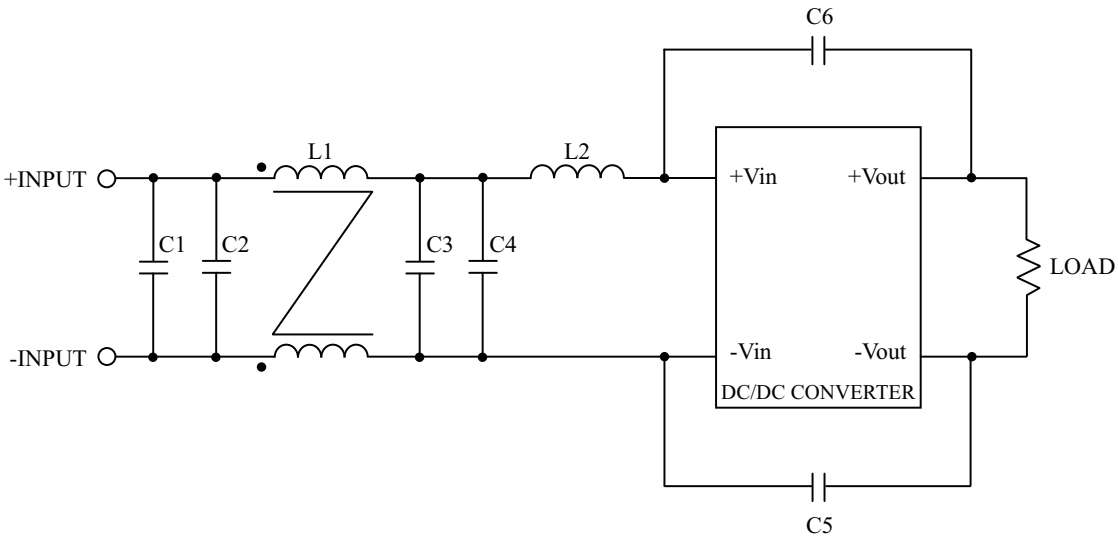
Figure 11



EMI Considerations (Continued):

Suggested Schematic for EN55022 Conducted Emission Class B Limits

Figure 12

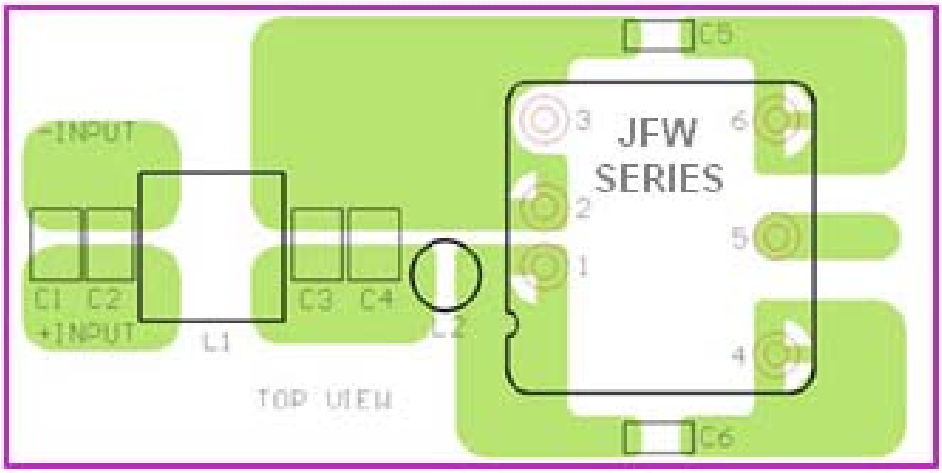


To meet conducted emissions EN55022 CLASS B the following components are needed:

JFW24S5-3000			
Component	**Value**	**Voltage**	**Reference**
L1	145µF	----	Common Choke, P/N: PMT-051
L2	10µF	----	2.6A 0.04Ω 0705 SMD Inductor P/N: PMT-070
C1	----	----	----
C2, C3, C4	6.8µF	50V	1812 MLCC
C5, C6	470pF	3KV	1808 MLCC

Recommended Layout with Input Filter

Figure 13



Recommended Pad Layout for DIP Type

ALL Dimensions in millimeters (inches)
Tolerances:xx.xx mm±0.25mm (xx.xxx in ±0.010 in)

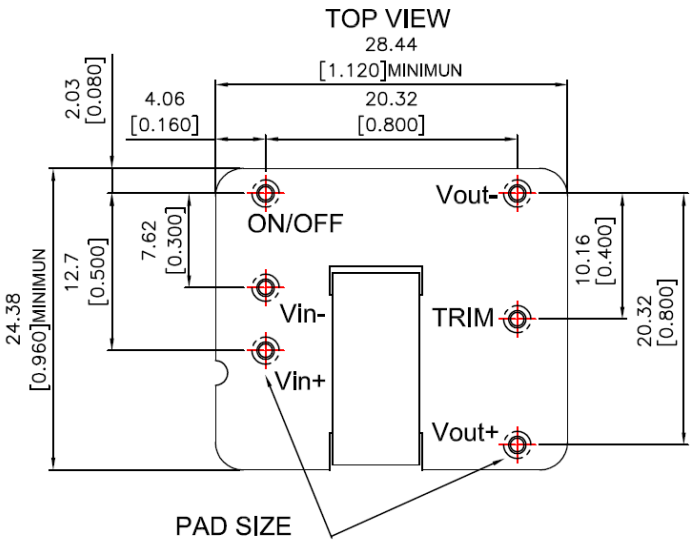


Figure 14

PAD SIZE
THROUGH HOLE: ø 1.1mm
TOP VIEW PAD: ø 1.4mm (LEAD FREE RECOMMENDED)
BOTTOM VIEW PAD: ø 2.2mm

Recommended Pad Layout for SMT Type

ALL Dimensions in millimeters (inches)
Tolerances:xx.xx mm±0.25mm (xx.xxx in ±0.010 in)

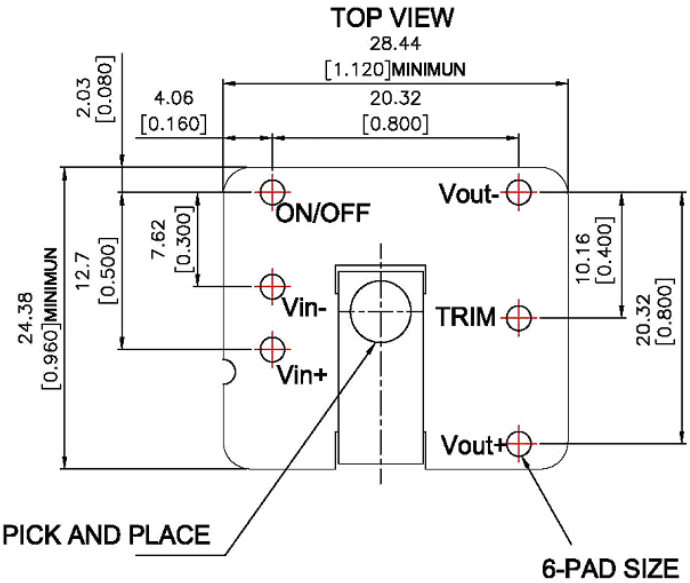


Figure 15

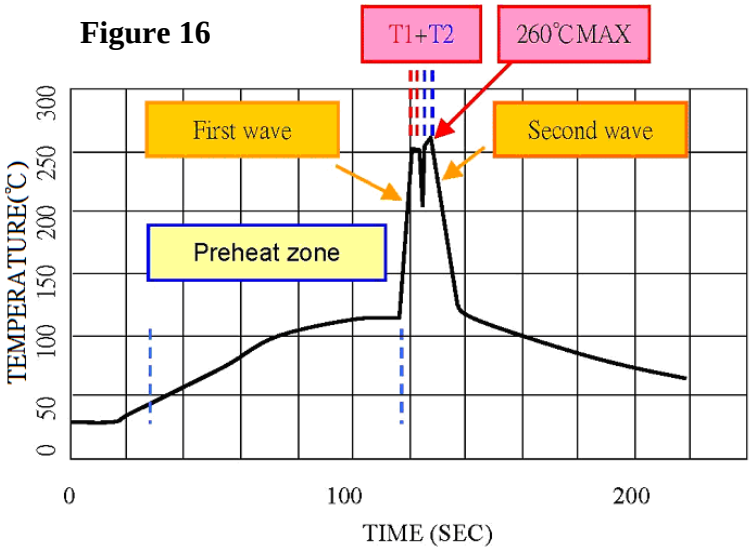
RECOMMENDED PICK AND PLACE

6-PAD SIZE
MINIMUM: ø 1.9mm
RECOMMENDED: ø 2.8mm

Soldering and Reflow Considerations:

Lead Free Wave Solder Profile for DIP Type

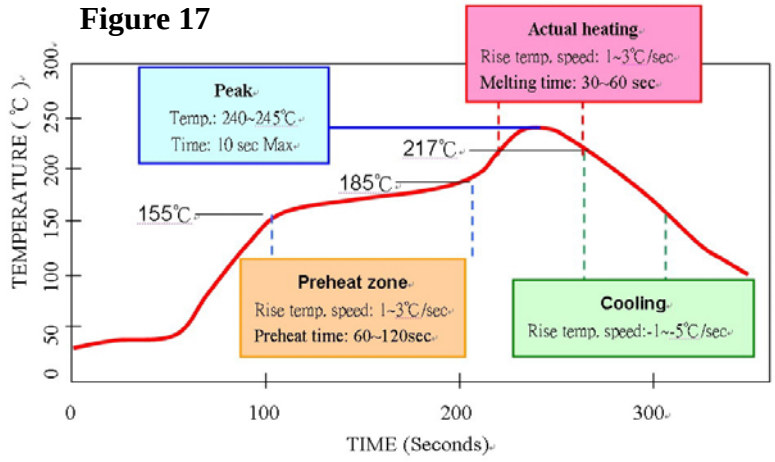
Figure 16



Zone	Reference Parameter
Preheat Zone	Rise temp. speed: 3°C/sec max. Preheat temp: 100~130°C
Actual Heating	Peak temp: 250~260°C Peak time (T1+T2 time): 4~6 sec

Lead free reflow profile for SMT type

Figure 17



Zone	Reference Parameter
Preheat Zone	Rise temp. speed: 1~3°C/sec Preheat time: 60~120sec Preheat temp.155~185°C
Actual Heating	Rise temp. speed: 1~3°C/sec Melting time: 30~60 sec Melting temp: 217°C Peak temp: 240~245°C Peak time: 10 sec max
Cooling	Rise temp. speed: -1~ -5°C/sec

NOTES:

1. Reference Solder: Sn-Ag-Cu
2. The curves define the maximum peak reflow temperature permissable to be measured on pin 1 or Vin pin of the DC/DC converter

Cleaning & Drying Considerations:

Cleaning

a. PWB Cooling Prior to Cleaning:
Power modules and their associated application PWB assemblies should not be wash-cleaned after soldering until the power modules have had an opportunity to cool to within the cleaning solution temperature. This will prevent vacuum absorption of the cleaning liquid into the module between the pins and the potting during cooling.

b. Cleaning Process
In aqueous cleaning, it is preferred to have an in-line cleaner system consisting of several cleaning stages (prewash, wash, rinse, final rinse, and drying). Deion-ized (DI) Water is recommended for aqueous cleaning, the minimum resistivity level is 1MΩ-cm. Tap-water quality varies per region in terms of hardness, chloride, and solid contents, therefore, the use of tap water is not recommended for aqueous cleaning. The total time of ultrasonic wave shall be less than 3 minutes.

Drying

After cleaning, dry converters at 100°C, more than 10 minutes to assure that the moisture and other potential foreign contaminants are driven out. For open power module constructions with magnetic structures (transformers and inductors) that have unspotted windings, a baking process of 100°C for 30 min. is recommended for the assembly to ensure that the moisture and other potential foreign contaminants are driven out from the open windings.

The drying section of the cleaner system should be equipped with blowers capable of generating 1000CFM-1500CFM of air so that the amount of rinse water left to be dried off with heat is minimal. Handheld air guns are not recommended due to the variability and consistency of the operation.

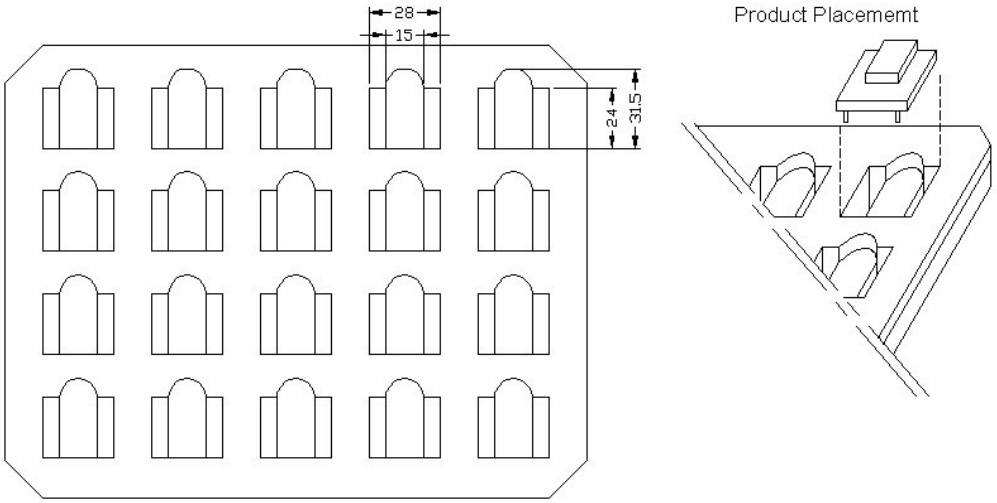
Product Post-Wash External Appearance

The marking or date-code may fade or disappear after cleaning. This is not a problem on the converter's characteristics.

Packaging Information:

DIP Type

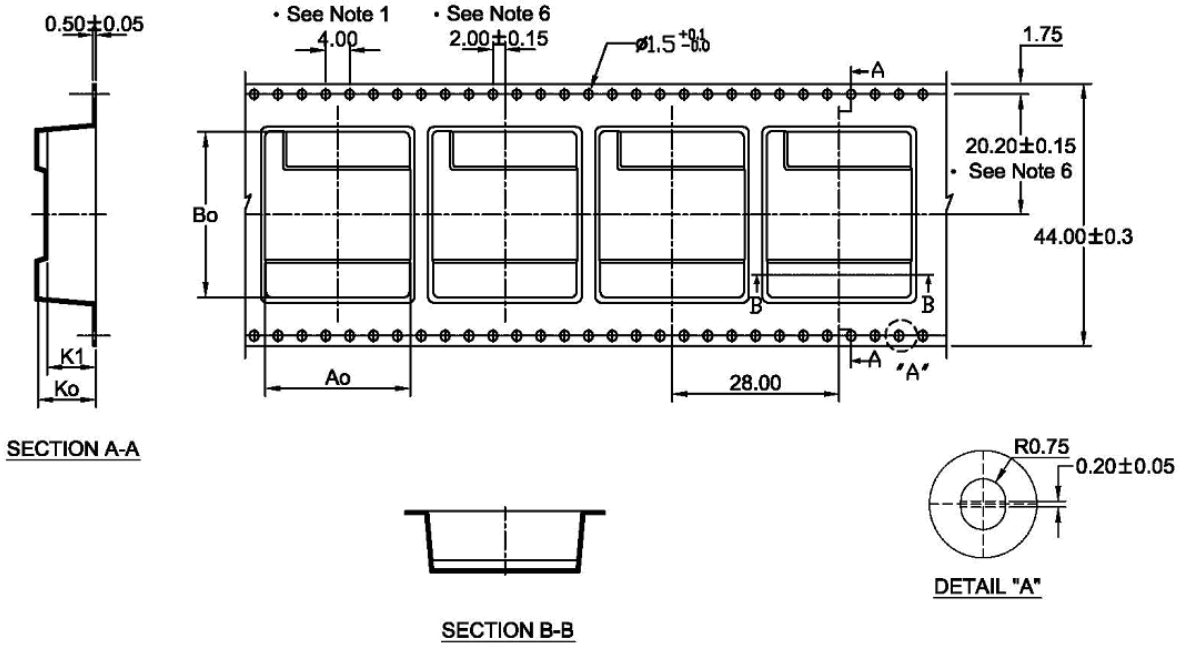
Figure 18



PS：
1.SPEC：230*180*28mm
2.MATERIAL：LDPE

SMT Type

Figure 19



Notes:

1. 10 sprocket hole pitch cumulative tolerance ± 0.2
2. Camber not to exceed 1mm in 100mm.
3. Material: Black Advantek Polystyrene.
4. Ao and Bo measured on a plane 0.3mm above the bottom of the pocket.
5. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier tape.
6. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.

Ao=24.30mm
Bo=27.80mm
Ko= 9.70mm
K1= 8.20mm

Safety and Installation Instructions:

Fusing Consideration

Caution: This power module is not internally fused. An input line fuse must always be used.
This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture. To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse. The safety agencies require a normal-blow fuse with maximum rating of 3A for JFW24Sxx-xxxx modules and 1.5A for JFW48Sxx-xxxx modules. Based on the information provided in this data sheet on Inrush energy and maximum DC input current; the same type of fuse with lower rating can be used. Refer to the fuse manufacturer's data for further information.

MTBF and Reliability

The MTBF of the JFW Series of DC/DC converters has been calculated using Bellcore TR-NWT-000332 Case I: 50% stress, Operating Temperature at 40°C (Ground fixed and controlled environment). The resulting figure for MTBF is 1.322×10^6 hours.

MIL-HDBK 217F NOTICE2 FULL LOAD, Operating Temperature at 25°C. The resulting figure for MTBF is 5.147×10^5 hours.

Ordering Information

Part Number Example:

JFW 24 S 5 – 3000 S

- **JFW** — Series Designation
- **24** — Nominal Input Voltage
- **S** — Single Output
- **5** — Nominal Output Voltage
- **3000** — Maximum Output Current (mA)
- **S** — Product Option (see table)

PRODUCT OPTIONS	
Option	**Suffix**
Positive Remote ON/OFF with DIP (standard)	No Suffix
Positive remote ON/OFF with SMT	S
Negative Remote ON/OFF with DIP	R
Negative Remote ON/OFF with SMT	SR
DIP type without ON/OFF pin	D
SMT type without ON/OFF pin	SD
DIP type without ON/OFF & TRIM pin	G
SMT type without ON/OFF & TRIM pin	SG
DIP type, negative remote ON/OFF, without TRIM pin	F
SMT type, negative remote ON/OFF, without TRIM pin	SF
DIP type, positive remote ON/OFF, without TRIM pin	J
SMT type, positive remote ON/OFF, without TRIM pin	SJ

Company Information

Wall Industries, Inc. has created custom and modified units for over 50 years. Our in-house research and development engineers will provide a solution that exceeds your performance requirements on-time and on budget. Our ISO9001-2008 certification is just one example of our commitment to producing a high quality, well-documented product for our customers.

Our past projects demonstrate our commitment to you, our customer. Wall Industries, Inc. has a reputation for working closely with its customers to ensure each solution meets or exceeds form, fit and function requirements. We will continue to provide ongoing support for your project above and beyond the design and production phases. Give us a call today to discuss your future projects.

Contact **Wall Industries** for further information:

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