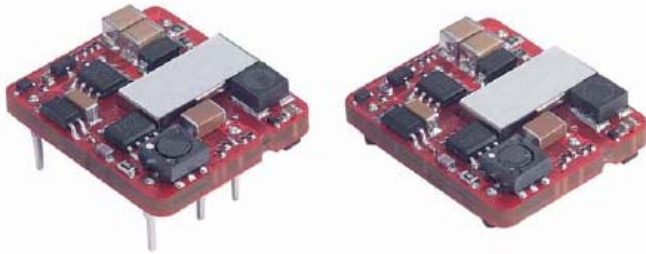


## Wall Industries, Inc.

# JF48S3.3-3500

**DC/DC Converter**  
**36-75 VDC Input**  
**3.3 VDC Output at 3.5A**



### Features:

- **RoHS Directive Compatible**
- **Low Profile: 1.10 x 0.94 x 0.335 inches**
- **Industry Standard Pin-Out**
- **2:1 Wide Input Voltage of 18-36, 36-75VDC**
- **15 Watts Output Power**
- **Over-Current Protection, Auto-Recovery**
- **Output Over Voltage Protection**
- **Under Voltage Lockout**
- **Remote On/Off Control**
- **Adjustable Output Voltage**
- **ISO 9001 Certified Manufacturing Facilities**
- **UL60950-1**
- **TUV EN60950-1**
- **CB**
- **CE Mark**
- **Input to Output Isolation: 2250VDC, min**
- **Approved for Basic Insulation**

### Applications:

- **Distributed Power Architectures**
- **Communication Equipment**
- **Computer Equipment**
- **Test Equipment**

### Options:

- **Positive Remote ON/OFF**
- **On/Off Control Function**
- **Trim Function**
- **Surface Mount**

### Description:

JF Series single output DC/DC converters provide up to 15 watts of output power in an industry standard package and footprint. These units are specifically designed to meet the power needs of low profile. All models feature a wide input range, comprehensively protected against over-current, over-voltage, and input under-voltage protection conditions, and trimmable output voltage. The JF Series converters are especially suited to Network, Data processing, Wireless and Enterprise equipment and microprocessor, intermediate bus voltage power application.



Wall Industries, Inc.

# TECHNICAL DATASHEET

JF48S3.3-3500

| Technical Specifications  |   | Model No. JF48S3.3-3500 |                     |              |                     |
|---|---|-------------------------|---------------------|--------------|---------------------|
| All specifications are based on 25 °C, Nominal Input Voltage and Maximum Output Current unless otherwise noted.<br>We reserve the right to change specifications based on technological advances. |   |                         |                     |              |                     |
| SPECIFICATION   | Related condition   | Min                     | Nom                 | Max          | Unit                |
| Switching Frequency   | Test at nominal Vin and full load   | -                       | 270                 | -            | kHz                 |
| <b>INPUT (Vin)</b>  |   |                         |                     |              |                     |
| Operating Voltage Range   |   | 36                      | 48                  | 75           | Vdc                 |
| UVLO Turn-on Threshold  |   |                         | 33                  |              | Vdc                 |
| UVLO Turn-off Threshold   |   |                         | 30.5                |              | Vdc                 |
| Input Surge Voltage (100ms max)   |   | -0.3                    |                     | 100          | Vdc                 |
| Input Voltage Variation   | Complies with EST300 132 part 4.4   |                         |                     | 5            | V/ms                |
| Input Current   | Full Load   |                         |                     | 297          | mA                  |
| Reflected Ripple Current  | Please see the Test Setup section (pg 9)  |                         | 30                  |              | mA <sub>pk-pk</sub> |
| <b>EFFICIENCY</b>   | Test at nominal Vin and full load (please see the Test Setup section – pg 9)              |                         | 85                  |              | %                   |
| <b>OUTPUT (Vo)</b>  |   |                         |                     |              |                     |
| Operating Output Range  |   | 3.267<br>-1%            | 3.3                 | 3.333<br>+1% | Vdc                 |
| Voltage Adjustment  | Please see the External Trim Adjustment section (pg 6)                                    | 2.97<br>-10%            | 3.3                 | 3.63<br>+10% | Vdc                 |
| Load Regulation   | 0% to 100% Full Load  |                         |                     | 0.2          | %                   |
| Line Regulation   | LL to HL at Full Load   |                         |                     | 0.2          | %                   |
| Output Ripple & Noise   | 1uF Ceramic & 10uF Tantalum at 20MHz bandwidth (please see the Test Setup section - pg 9) |                         |                     | 75           | mV <sub>pk-pk</sub> |
| Transient Response  | 50% to 75% to 50% load change, ΔIo / Δt = 0.1A/μs   |                         | 300                 |              | μs                  |
| Output Current  |   | 0                       |                     | 3.5          | A                   |
| Output Voltage Overshoot  |   |                         |                     | 3            | %                   |
| Output Capacitor Load   |   |                         |                     | 1000         | μF                  |
| Over Current Protection   |   | 3.85                    | 4.375               | 4.9          | A                   |
| Over Voltage Protection   | Control Voltage Clamp   | 3.7                     |                     | 5.4          | Vdc                 |
| <b>REMOTE ON/OFF</b>  | Please see the Remote ON/OFF Control section (pg 5)                                       |                         |                     |              |                     |
| Negative Logic  | DC-DC ON (Short)  | -0.7                    |                     | 1.2          | Vdc                 |
|   | DC-DC OFF (Open)  | 3                       |                     | 15           | Vdc                 |
| Positive Logic  | DC-DC ON (Open)   | 3                       |                     | 15           | Vdc                 |
|   | DC-DC OFF (Short)   | -0.7                    |                     | 1.2          | Vdc                 |
| <b>START UP TIME</b>  |   |                         |                     |              |                     |
| Power Up  | Test at nominal Vin and constant resistive load   |                         |                     | 30           | ms                  |
| Remote ON/OFF   |   |                         |                     | 30           | ms                  |
| <b>ISOLATION</b>  |   |                         |                     |              |                     |
| Isolation Voltage (Input-Output)  |   | 2250                    |                     |              | Vdc                 |
| Isolation Resistance  |   | 10                      |                     |              | MΩ                  |
| Isolation Capacitance   |   |                         | 1000                |              | pF                  |
| <b>ENVIRONMENTAL</b>  |   |                         |                     |              |                     |
| Operating Ambient Temperature   |   | -40                     |                     | 85           | °C                  |
| Storage Temperature   |   | -55                     |                     | 125          | °C                  |
| Temperature Coefficient   |   | -0.02                   |                     | +0.02        | % / °C              |
| <b>MTBF</b>   | Please see the MTBF and Reliability section (pg 14)                                       |                         | 2,200,000           |              | hours               |
| <b>MECHANICAL</b>   |   |                         |                     |              |                     |
| Weight  |   |                         | 10.5                |              | grams               |
| Dimensions  |   |                         | 1.10 x 0.94 x 0.335 |              | inches              |

Figure 1: Mechanical Dimensions

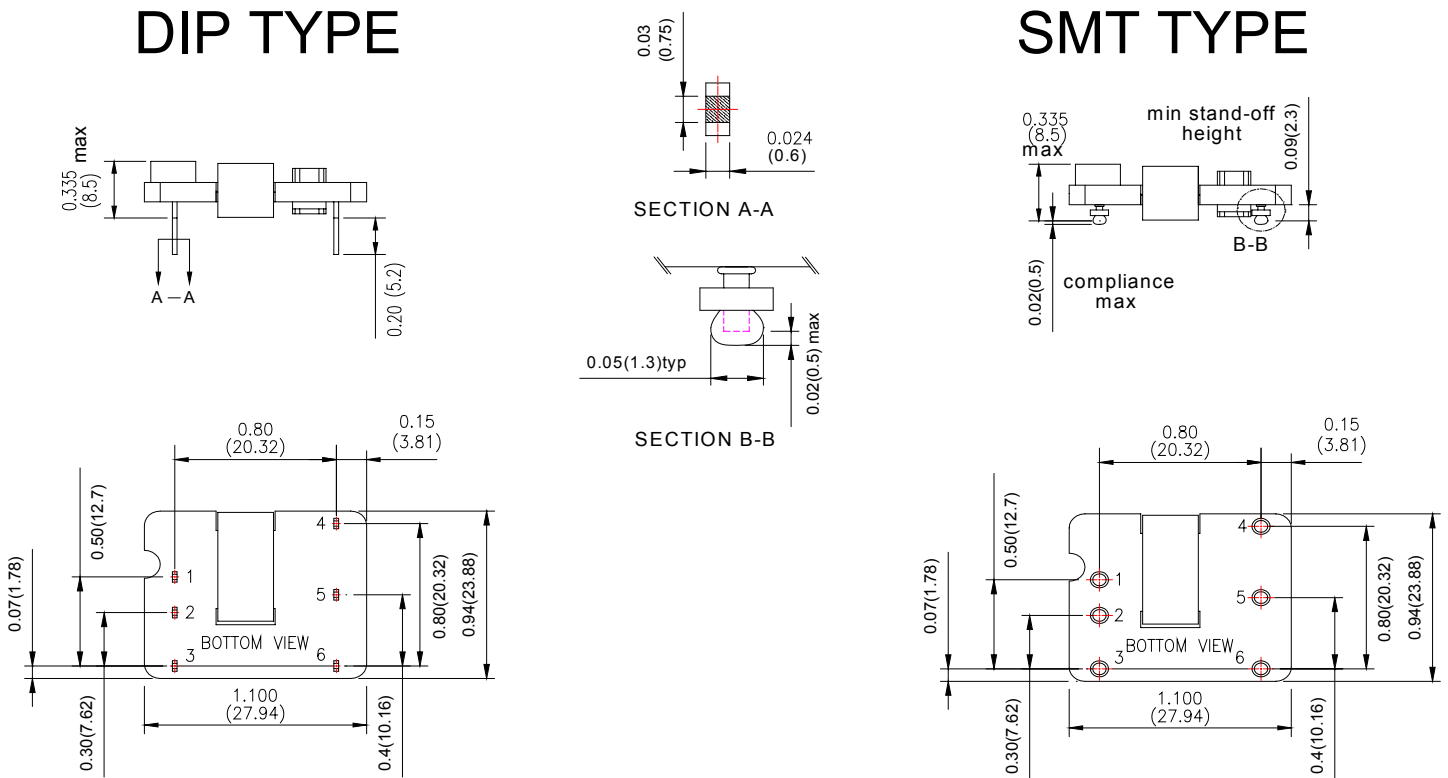


Table 1

| PIN CONNECTION |               |
|----------------|---------------|
| PIN            | JF48S3.3-3500 |
| 1              | + INPUT       |
| 2              | - INPUT       |
| 3              | ON/OFF        |
| 4              | +VOUT         |
| 5              | TRIM          |
| 6              | -VOUT         |

Figure 2

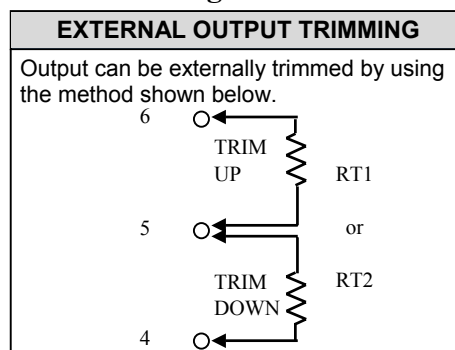


Table 2

| PRODUCT STANDARD TABLE             |        |
|------------------------------------|--------|
| Option                             | Suffix |
| Negative Remote ON/OFF with DIP    | R      |
| Negative Remote ON/OFF with SMT    | SR     |
| Positive Remote ON/OFF with DIP    | Blank  |
| Positive remote ON/OFF with SMT    | S      |
| 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 without TRIM pin          | F      |
| SMT type without TRIM pin          | SF     |

**NOTES:**

- All dimensions in inches (mm)
- Tolerance:  $x.xx \pm 0.02$  ( $x.x \pm 0.5$ )  
 $x.xxx \pm 0.010$  ( $x.xx \pm 0.25$ )
- Pin pitch tolerance:  $\pm 0.014$  (0.35)

**DESIGN CONSIDERATIONS:****Output Over Current Protection**

When excessive output currents occur in the system, circuit protection is required on all power supplies. Normally, overload current is maintained at approximately 110~140% of rated current for the JF 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 is removed. There are other ways of protecting the power supply when it is over-loaded, such as the maximum current limiting or current foldback methods.

One of the problems resulting from over current is that excessive heat may be generated in 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.

The operation of hiccup is as follows. When the current sense circuit sees an over-current event, the controller shuts off the power supply for a given time and then tries to start up the power supply again. If the over-load condition has been removed, the power supply will start up and operate normally; otherwise, the controller will see another over-current event and shut off the power supply again, repeating the previous cycle. Hiccup operation has none of the drawbacks of the other two protection methods, although its circuit is more complicated because it requires a timing circuit. The excess heat due to overload lasts for only a short duration in the hiccup cycle, hence the junction temperature of the power devices is much lower.

The hiccup operation can be done in various ways. For example, one can start hiccup operation any time an over-current event is detected; or prohibit hiccup during a designated start-up is usually larger than during normal operation and it is easier for an over-current event is detected; or prohibit hiccup during a designated start-up interval (usually a few milliseconds). The reason for the latter operation is that during start-up, the power supply needs to provide extra current to charge up the output capacitor. Thus the current demand during start-up is usually larger than during normal operation and it is easier for an over-current event to occur. If the power supply starts to hiccup once there is an over-current, it might never start up successfully. Hiccup mode protection will give the best protection for a power supply against over current situations, since it will limit the average current to the load at a low level, so reducing power dissipation and case temperature in the power devices.

**Short Circuit Protection**

Continuous, hiccup and auto-recovery mode.

During short circuit, converter still shut down. The average current during this condition will be very low and the device can be safety in this condition.

### Remote ON/OFF

Two remote ON/OFF controls are available for the JF Series

Positive logic remote ON/OFF turns the modules on during a logic-high voltage on the remote ON/OFF pin, and off during logic low. Negative logic remote ON/OFF turns the module off during logic high and on during logic low or when the remote ON/OFF pin is shorted to the -INPUT pin.

For negative logic remote ON/OFF control add the suffix “R” for DIP type and “SR” for SMT type. For the positive logic ON/OFF control there is no suffix for DIP type and add the suffix “S” for SMT type.

Ex: JF48S3.3-3500S

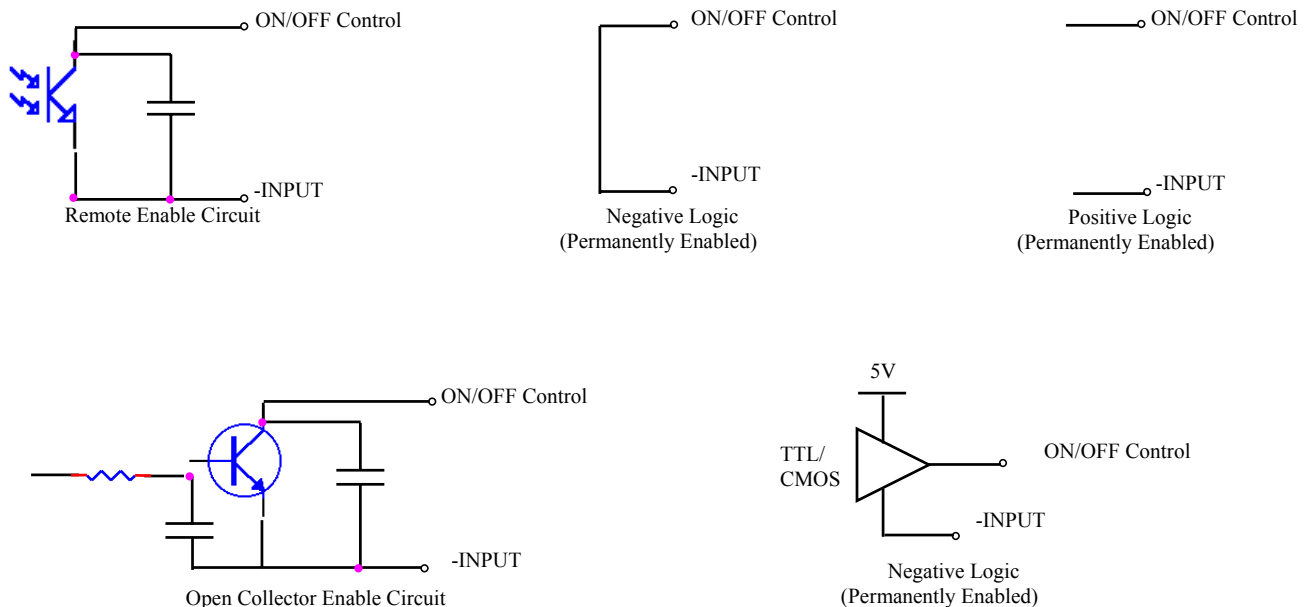
To turn the power module on and off, the user must supply a switch to control the voltage between the ON/OFF terminal ( $V_{ON/OFF}$ ) and the -INPUT. The switch may be an open collector or equivalent (see figure). A logic low is  $V_{ON/OFF} = -0.7V$  to  $1.2V$ . The maximum  $I_{ON/OFF}$  during a logic low is 1mA. The switch should maintain a logic-low voltage while sinking 1mA.

During logic high, the maximum  $V_{ON/OFF}$  generated by the power module is 15V. The maximum allowable leakage current of the switch at  $V_{on/off} = 15V$  is 50uA

The module has internal capacitance to reduce noise at the ON/OFF pin. Additional capacitance is not generally needed and may degrade the start-up characteristics of the module.

The Figure below details five possible circuits for driving the ON/OFF pin.

**Figure 3**



### 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.

$$R_{up} = \frac{5110 * 2.5}{V_o^+ - 2.5 - 0.8} - 2050 \quad (\text{in } \Omega)$$

$V_o^+$  is the desired up output voltage

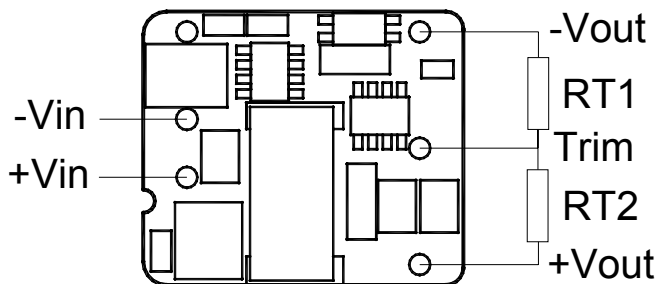
$$R_{down} = \frac{(V_o^- - 2.5) * 5110}{V_{out} - (V_o^-)} - 2050 \quad (\text{in } \Omega)$$

$V_o^-$  is the desired down output voltage

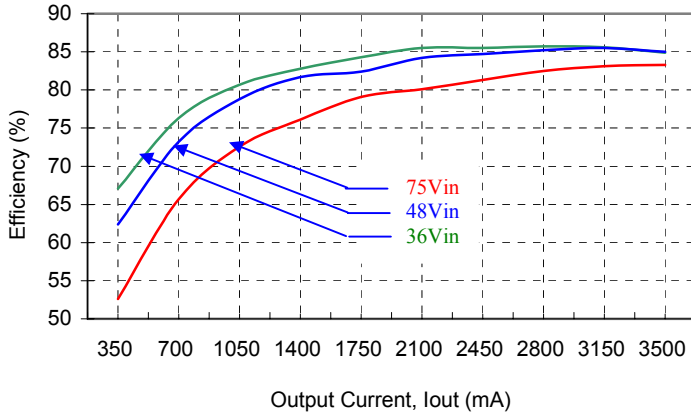
**Table 3 Trim Resistor Values**

| Trim | $V_o^+$ | $R_{up}$           | $V_o^-$ | $R_{down}$         |
|------|---------|--------------------|---------|--------------------|
| 1%   | 3.333V  | 385.071 k $\Omega$ | 3.267V  | 116.719 k $\Omega$ |
| 2%   | 3.366V  | 191.511 k $\Omega$ | 3.234V  | 54.779 k $\Omega$  |
| 3%   | 3.399V  | 126.99 k $\Omega$  | 3.201V  | 34.133 k $\Omega$  |
| 4%   | 3.432V  | 94.73 k $\Omega$   | 3.168V  | 23.810 k $\Omega$  |
| 5%   | 3.465V  | 75.374 k $\Omega$  | 3.135V  | 17.616 k $\Omega$  |
| 6%   | 3.498V  | 62.47 k $\Omega$   | 3.102V  | 13.486 k $\Omega$  |
| 7%   | 3.531V  | 53.253 k $\Omega$  | 3.069V  | 10.537 k $\Omega$  |
| 8%   | 3.564V  | 46.34 k $\Omega$   | 3.036V  | 8.325 k $\Omega$   |
| 9%   | 3.597V  | 40.963 k $\Omega$  | 3.003V  | 6.604 k $\Omega$   |
| 10%  | 3.63V   | 36.662 k $\Omega$  | 2.97V   | 5.228 k $\Omega$   |

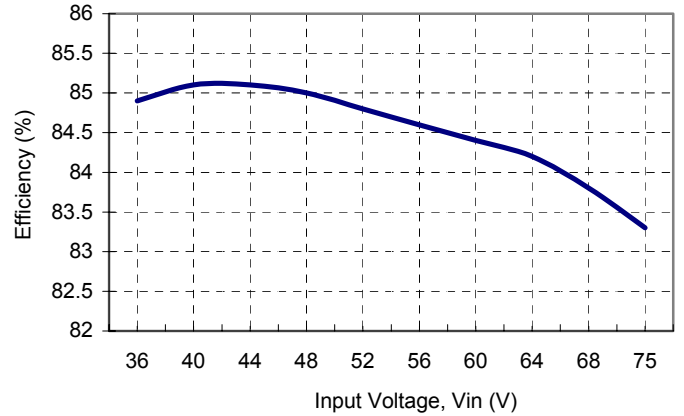
**Figure 4**



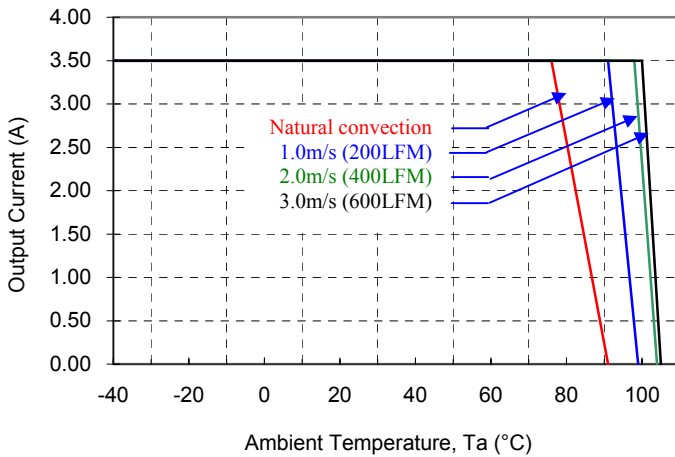
**Graph 1: Efficiency vs. Output Current**



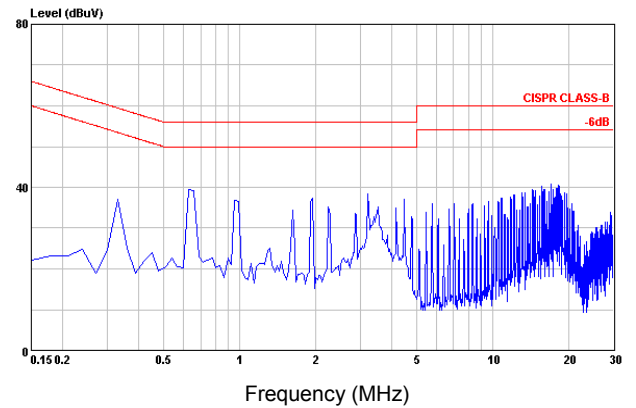
**Graph 2: Efficiency vs. Input Voltage (Io=Full Load)**



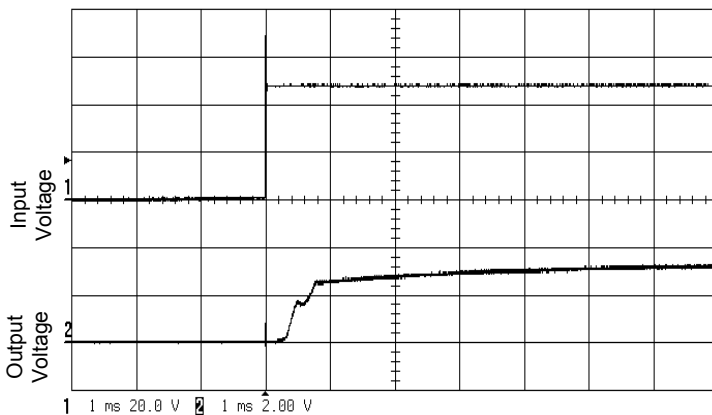
**Graph 3: Output Current vs. Ambient Temperature & Airflow**



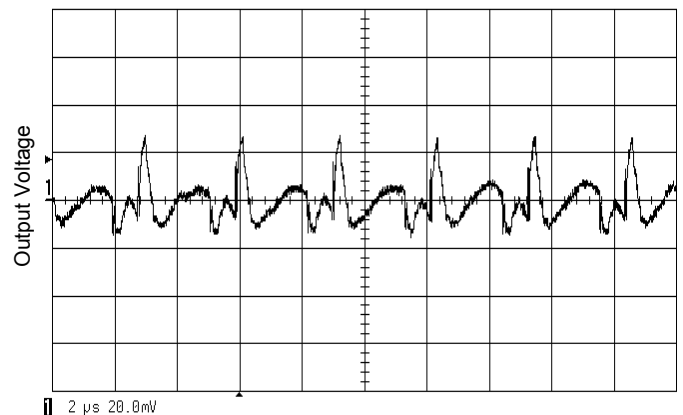
**Graph 4: Conducted Emission of EN55022 Class B (Nominal Vin, Io = Full Load)**



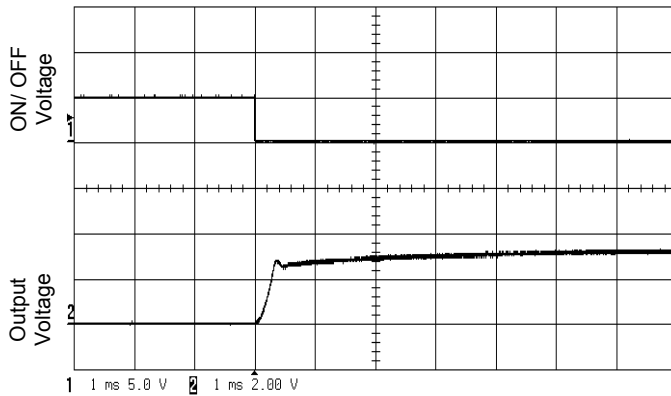
**Graph 5: Typical Input Start-Up and Output Rise Characteristic**



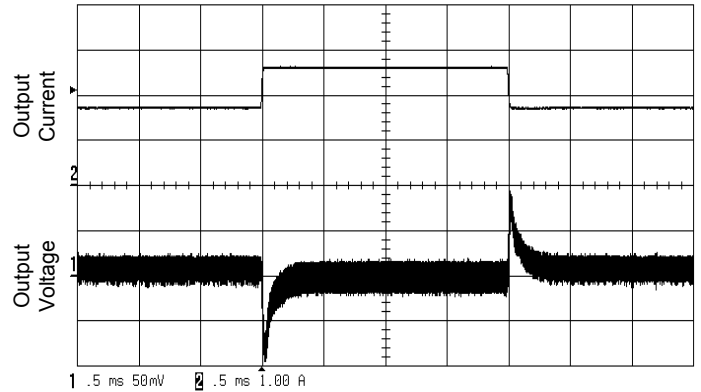
**Graph 6: Typical Output Ripple and Noise (Nominal Vin, Io = Full Load)**



**Graph 7:** Using ON/OFF Voltage Start-Up and Output Rise Characteristic



**Graph 8:** Transient Response to Dynamic Load Change from 70% to 50% to 75% of Full Load



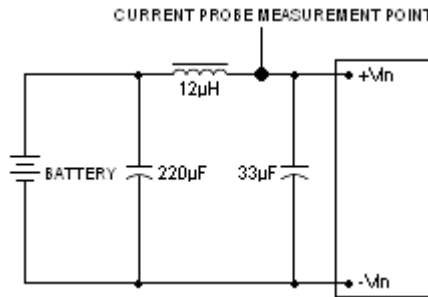


### TEST SETUP:

The JF48S3.3-3500 specifications are tested with the following configurations:

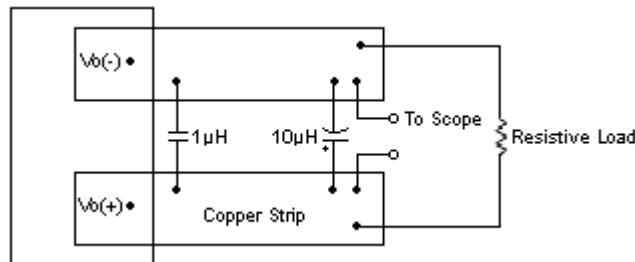
#### Input Reflected-Ripple Current Measurement Test Setup

Figure 5



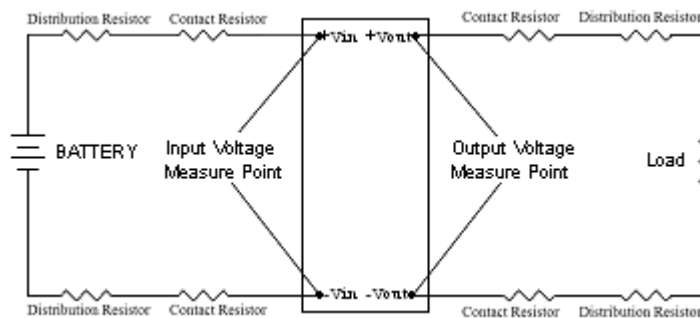
#### Peak-to-Peak Output Ripple & Noise Measurement Setup

Figure 6



#### Output Voltage and Efficiency Measurement Setup

Figure 7



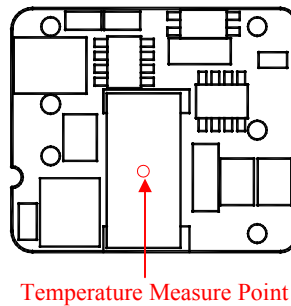
NOTE: All measurements are taken at the module terminals

$$Efficiency = \left( \frac{V_{out} \times I_{out}}{V_{in} \times I_{in}} \right) \times 100\%$$

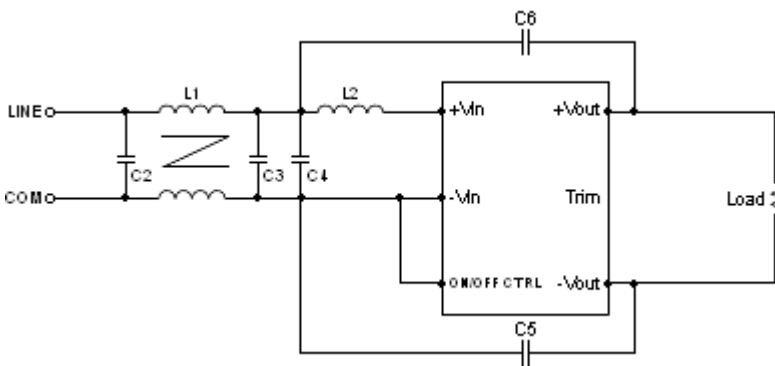
### Thermal Consideration

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, convection, and radiation to the surrounding environment. Proper cooling can be verified by measuring the point as 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.

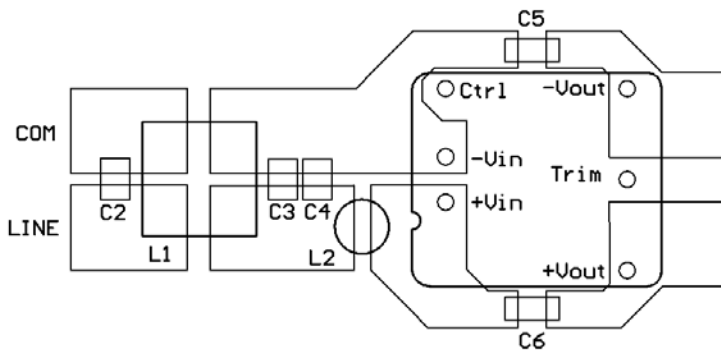
**Figure 8**



### EMC Considerations



**Figure 9**



**Figure 10 Recommended Layout with Input**

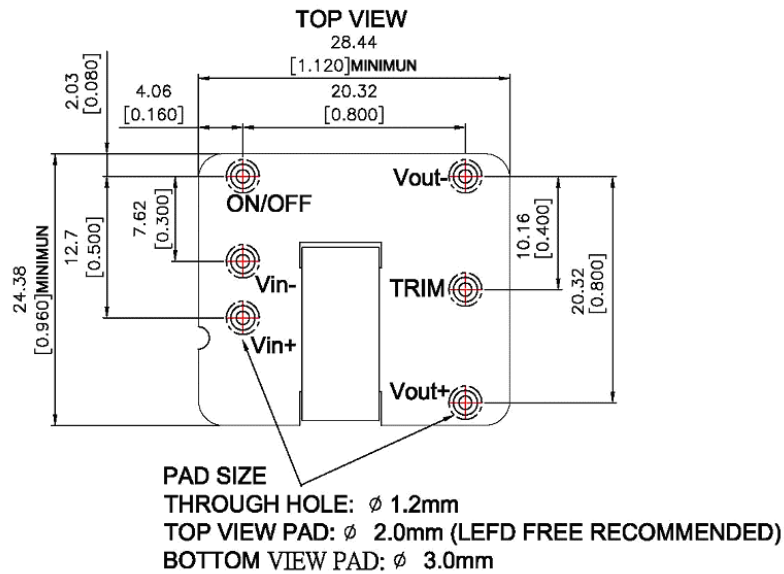
To meet conducted emissions EN55022 Class B needed the following components:

- C2, C3, C4: 2.2uF/100V MLCC
- C5, C6: 470pF/3KV MLCC
- L1: Pulse Engineering type P0354, 1.17mH
- L2: Inductor 10uH  $\varphi$ 0.35mm

### Recommended Pad Layout for DIP Type

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

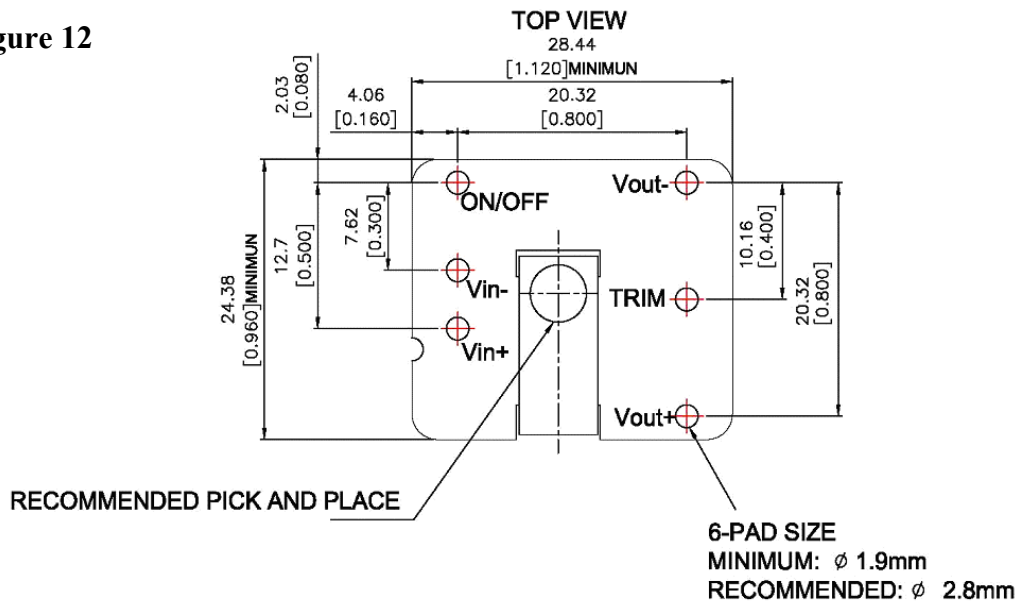
Figure 11



### Recommended Pad Layout for SMT Type

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

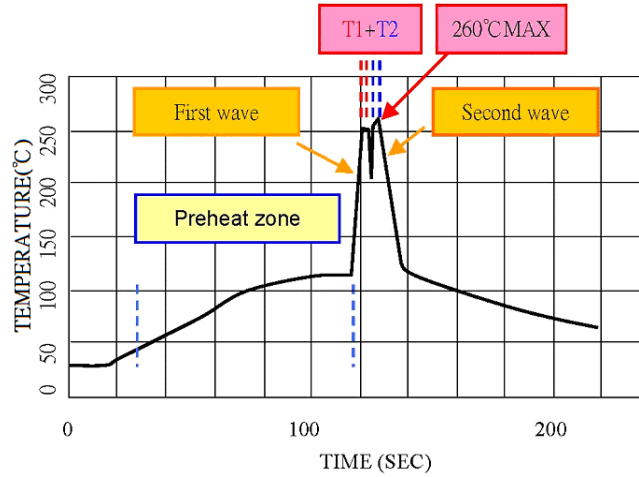
Figure 12



### Soldering and Reflow Considerations:

#### Lead Free Wave Solder Profile for DIP Type

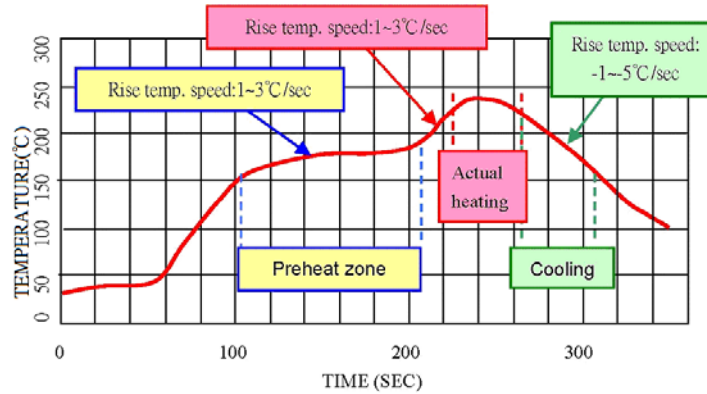
Figure 13



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

#### Lead free reflow profile for SMT type

Figure 14

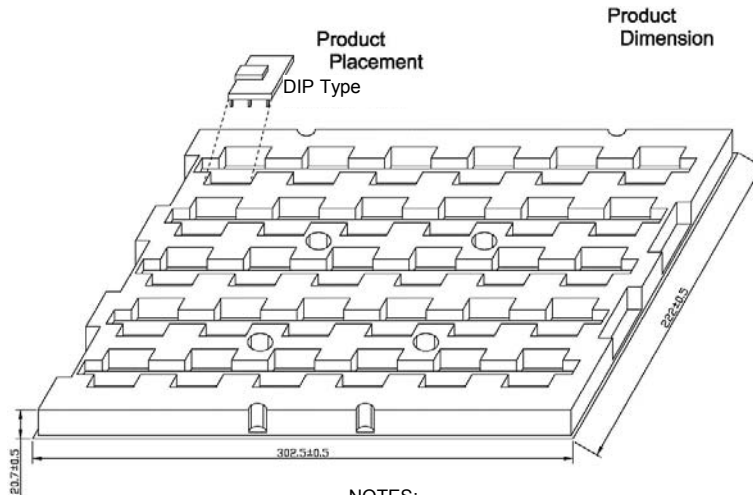


| Zone           | Reference Parameter   |
|----------------|---|
| Preheat Zone   | Rise temp. speed: 1~3°C/sec<br>Preheat time: 60~90sec<br>Preheat temp. 155~185°C  |
| Actual Heating | Rise temp. speed: 1~3°C/sec<br>Melting time: 20~40 sec<br>Melting temp: 220°C<br>Peak temp: 230~240°C<br>Peak time: 10~20 sec |
| Cooling        | Rise temp. speed: -1~-5°C/sec   |

### Packaging Information:

### DIP Type

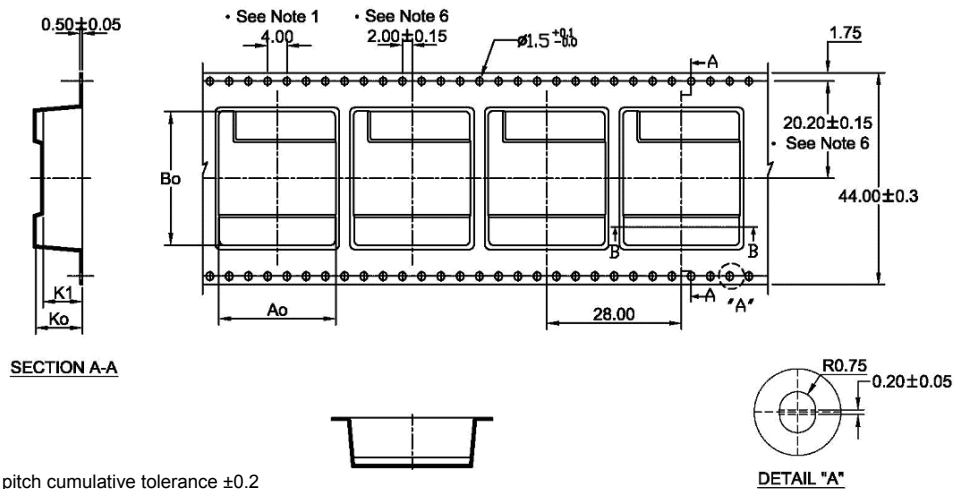
Figure 15



NOTES:  
1. Material: PS (thick=1.2mm)

### SMT Type

Figure 16



NOTES:  
1. 10 sprocket hole pitch cumulative tolerance  $\pm 0.2$   
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 Instruction:****Isolation Consideration**

The JF Series features 2250 Volt DC isolation from input to output. The input to output resistance is greater than 10MΩ. Nevertheless, if the system using the power module needs to receive safety agency approval, certain rules must be followed in the design of the system using the model. In particular, all of the creepage and clearance requirements of the end-use safety requirement must be observed. These documents include UL60950-1, EN60950-1 and CSA 22.2-960, although specific applications may have other or additional requirements.

**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 2A. 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.

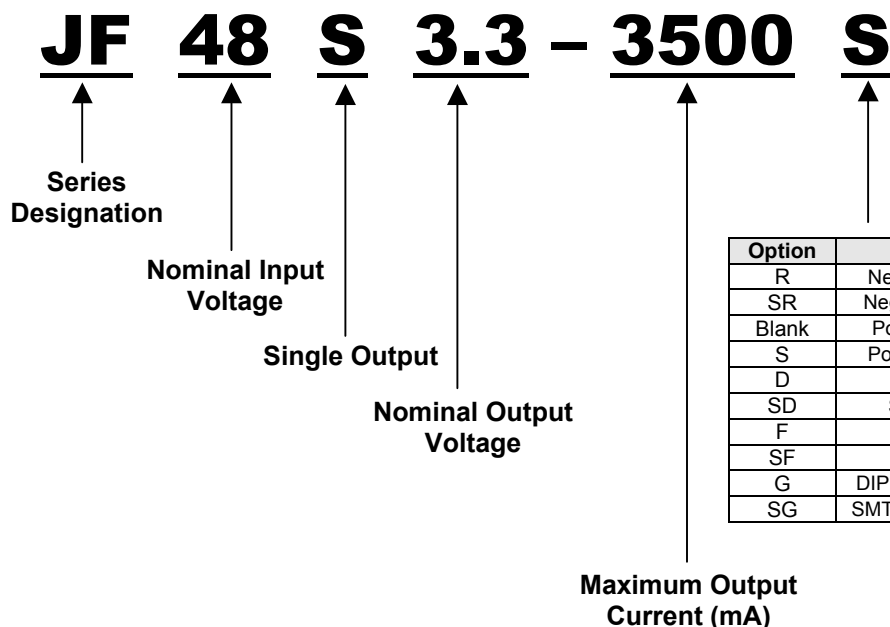
Refer to the fuse manufacturer's data for further information.

**MTBF and Reliability**

The MTBF of the JF 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  $2.2 \times 10^6$  hours.

### Ordering Information:

Part Number Example:



| Option | Description                        |
|--------|------------------------------------|
| R      | Negative Remote ON/OFF with DIP    |
| SR     | Negative Remote ON/OFF with SMT    |
| Blank  | Positive Remote ON/OFF with DIP    |
| S      | Positive Remote ON/OFF with SMT    |
| D      | DIP Type without ON/OFF pin        |
| SD     | SMT Type without ON/OFF pin        |
| F      | DIP Type without TRIM pin          |
| SF     | SMT Type without TRIM pin          |
| G      | DIP Type without ON/OFF & TRIM pin |
| SG     | SMT Type without ON/OFF & TRIM pin |

### Company Information:

Wall Industries, Inc. has created custom and modified units for over 40 years. Our in-house research and development engineers will provide a solution that exceeds your performance requirements on-time and on budget. Our ISO9001-2000 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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Fax: ☎ (603)778-9797  
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Web: [www.wallindustries.com](http://www.wallindustries.com)  
Address: 5 Watson Brook Rd.  
Exeter, NH 03833