

# SIRIUS DC/DC CONVERTER

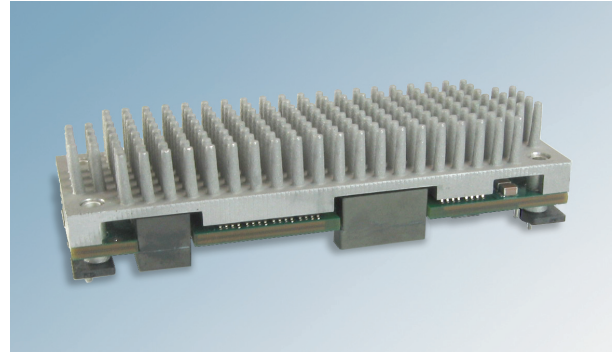
## 48V Input – 9.6VDC – 47A Output



GALW9V647

### GALW9V647 – 1/4 Brick Sirius

- High efficiency: 93.5% at 9.6V, 47A  
94.5% at 9.6V, 23.5A
- Very low common-mode noise for a commercial DC/DC converter
- Two-stage input filter
- Constant switching frequency
- Single board design, very low parts count
- "Stretched" quarter-brick 1.45" x 4.25" x 0.95" including integrated heat sink



### Typical Characteristics

- Output setpoint accuracy:  $\pm 5\%$
- Load regulation:  $\pm 2\%$
- Line regulation:  $\pm 0.2\%$
- Regulation over line, load, and temperature:  $\pm 10\%$
- Low output ripple
- Output trim

### Control Functions

- Uses patented power supply control and architecture
- Microprocessor controlled
- Primary-side enable, choice of logic

### Protection Features

- Over temperature protection
- Over voltage protection
- Over current protection
- Over/Under input voltage protection

### Ordering Information

| Standard Model Number | Input Voltage | Output Voltage | Max Current |
|-----------------------|---------------|----------------|-------------|
| GALW9V647*            | 48V           | 9.6V           | 47A         |

\* **Options:**  
E = 0.18" Pins ( $\pm .01"$ )

Note: Standard unit is positive logic and requires 2000 $\mu$ F of output load capacitance for stability.

**Example Part Number:**  
(All options)

**GALW9V647 E**

Part Number \_\_\_\_\_

Options:  
Pin Length \_\_\_\_\_

E = 0.18"



Certified to ISO 9001:2000

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## Input Specifications

| Parameter                  | Min | Typical | Max  | Units           |
|----------------------------|-----|---------|------|-----------------|
| Operating Input Voltage    | 36  |         | 75   | V <sub>DC</sub> |
| Input Current, Low Line    |     |         | 13.5 | A               |
| Input Capacitance          |     | 8       |      | μF              |
| Input Hysteresis, Low Line |     | 2       |      | V <sub>DC</sub> |

V<sub>IN</sub> = 48V<sub>DC</sub>, T<sub>A</sub>@25° C, 300 LFM Airflow, V<sub>OUT</sub> = 9.6V<sub>DC</sub>, I<sub>OUT</sub> = Full load unless otherwise noted.  
 Available output power depends on ambient temperature and good thermal management.  
 (See application graphs for limits.)

## Output Specifications

| Parameter                          | Min   | Typical | Max   | Units |
|------------------------------------|-------|---------|-------|-------|
| Output Voltage                     | 9.2   | 9.6     | 10    | V     |
| Output Power                       |       |         | 450   | W     |
| Over Voltage Protection, Latching  | 11.04 | 11.52   | 12.48 | V     |
| Operating Output Current Range     | 0     |         | 47    | A     |
| Output Current Limit               | 50    |         | 65    | A     |
| Efficiency, Full Load <sup>1</sup> | 93    |         |       | %     |

1. For temperature rise design calculation.

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## Features

| Parameter                                                          | Min  | Typical | Max   | Units |
|--------------------------------------------------------------------|------|---------|-------|-------|
| Over Temperature Protection, Thermal Sensor, Latching <sup>2</sup> |      |         | 125   | ° C   |
| Switching Frequency, Fixed                                         |      | 250     |       | kHz   |
| Trim Range                                                         | 8.64 |         | 10.56 | V     |

2. PCB less than 130° C.

## General Specifications

|                           |                                       |
|---------------------------|---------------------------------------|
| Operating Temperature     | -40° C to + 100° C                    |
| Storage Temperature       | -55° C + 125° C                       |
| Relative Humidity         | 10% to 95% RH, Non-condensing         |
| Vibration                 | 2 to 9 Hz, 3mm disp., 9 to 200 Hz, 1g |
| Material Flammability     | UL V-0                                |
| Weight                    | TBD                                   |
| MTBF Telcordia (Bellcore) | TBD                                   |

### Application Notes

## CoolConverter™

### Bel Power's Proprietary CoolConverter™

- Patented single-stage power conversion architecture, control and magnetic design allow unprecedented power density and efficiency in an isolated power supply.
- An advanced microcontroller reduces parts count while adding features, performance and flexibility in the design.

### Protection and Control

#### Valid Input Voltage Range

The converter measures the input voltage and will not allow operation outside of the input voltage specification. As shown by the graphs, hysteresis is added to both the high and low voltage to prevent the converter from turning on and off repeatedly when the voltage is held near either voltage extreme. At low line, this assures the maximum input current is not exceeded; at high line, this assures the semiconductor devices in the converter are not damaged by excessive voltage stress.

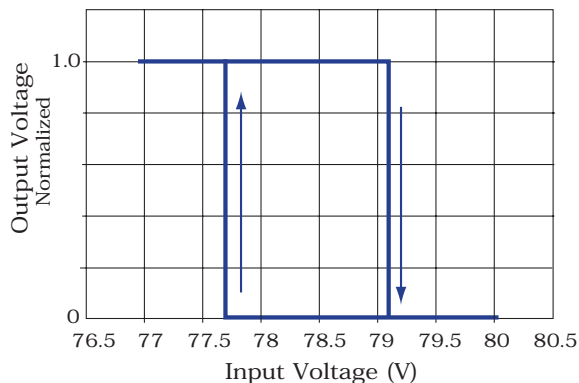
#### ON/OFF Logic Option

The ON/OFF control logic can be either Negative (standard) or Positive to enable the converter. For Negative logic, the ON/OFF pin is brought to below 1.0V with respect to the –INPUT pin to enable the converter. The pull-down must be able to sink 100μA. For Positive logic, the ON/OFF pin is brought to greater than 4.0V with respect to the –INPUT pin and be limited to less than 10V. To request the Positive logic version, add the suffix (P) to the standard part number. The ON/OFF pin has a built-in pull-up resistor of approximately 100k to +5V.

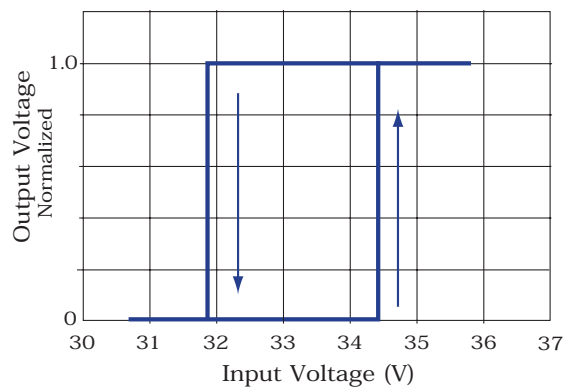
#### Output Over Voltage Protection

The output voltage is constantly monitored by the microprocessor with a redundant secondary-side measurement circuit that both shuts down the duty cycle and triggers the microprocessor to shut down. If the output voltage exceeds the over voltage specification, the microprocessor will latch the converter off. To turn the converter on required either cycling the ON/OFF pin or power to the converter. This advanced feature prevents the converter from damaging the load if there is a converter failure or application error. If non-latching is required, consult factory.

Over Voltage Hysteresis



Under Voltage Hysteresis



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## CoolConverter™

### Protection and Control

#### Thermal Shutdown

The printed circuit board temperature is measured using a semiconductor sensor. If the maximum rated temperature is exceeded, the converter is latched off. To re-enable the converter requires cycling the ON/OFF pin or power to the converter. If non-latching is required, consult factory.

#### Control Options

As the behavior of the circuit is determined by firmware in the microcontroller, specific requirements, such as:

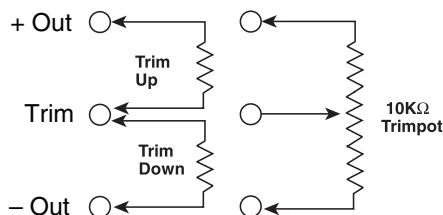
- non-latching thermal protection
- custom valid input voltage range
- controlled delay from initiating an ON/OFF signal for power sequencing

can be accomplished with no change to hardware. The standard behavior was chosen based on system design experience, but customers may have their own requirements. Please contact Bel Power for any special needs.

#### Safety

An external input fuse must always be used to meet these safety requirements.

### External Output Trimming



#### Trim

To trim the output voltage higher, connect the required trim resistor from the Trim pin to the +Out pin. To trim the output voltage lower, connect the required trim resistor from the Trim pin to the -Out pin.

#### Trim-up

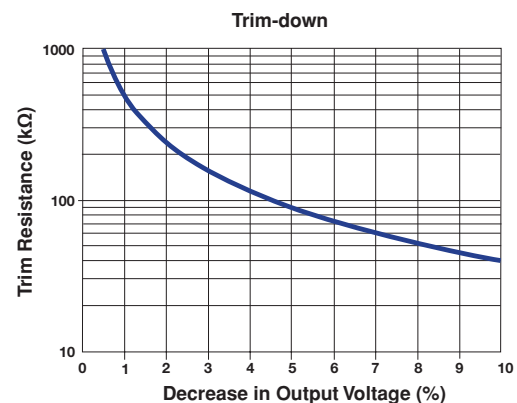
$$R_{\text{TRIM-UP}} = \left\{ \frac{V_o (100+\Delta\%)}{1.225\Delta\%} - \frac{(100+2\Delta\%)}{\Delta\%} \right\} 5.11k$$

9.6V Trim-up

N/A

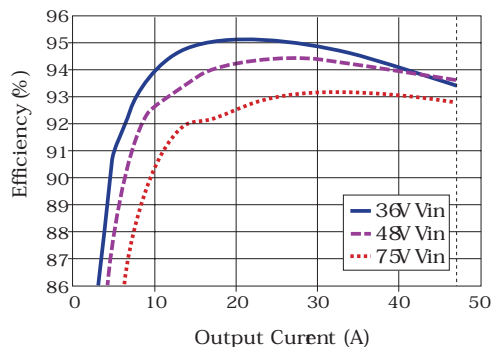
#### Trim-down

$$R_{\text{TRIM-DOWN}} = \left\{ \frac{100}{\Delta\%} - 2 \right\} 5.11k$$

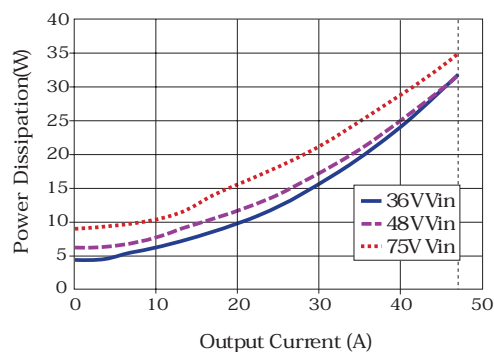


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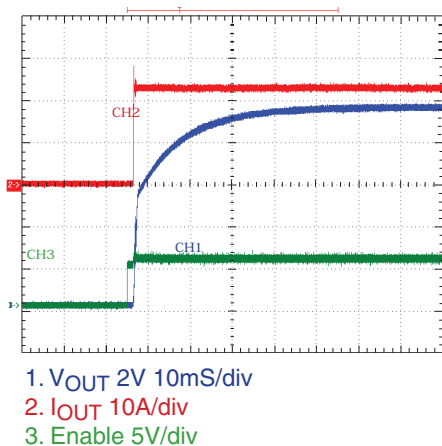
### Efficiency Data



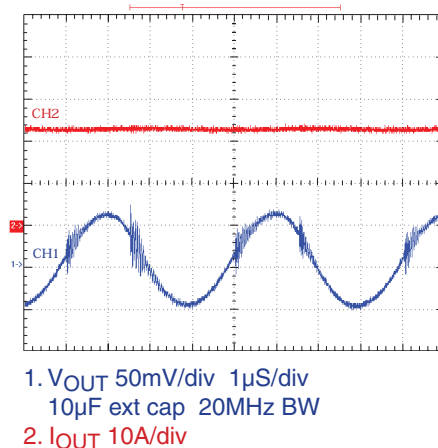
### Power Dissipation



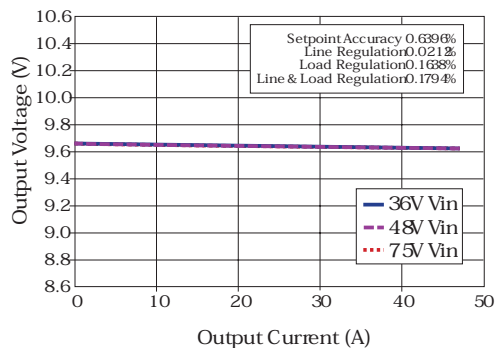
### Start Up



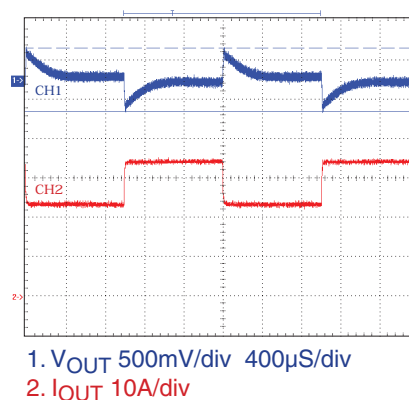
### Voltage Ripple



### Line/Load Regulation



### Transient Response



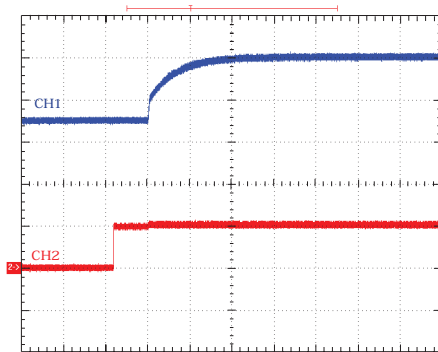
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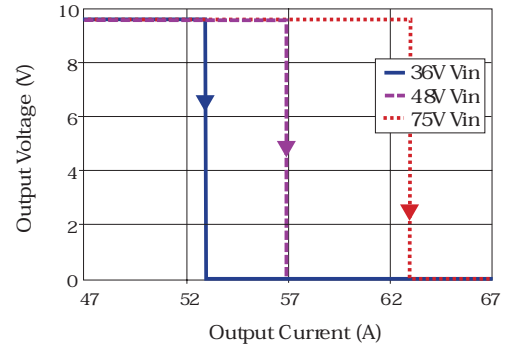
## Back Bias



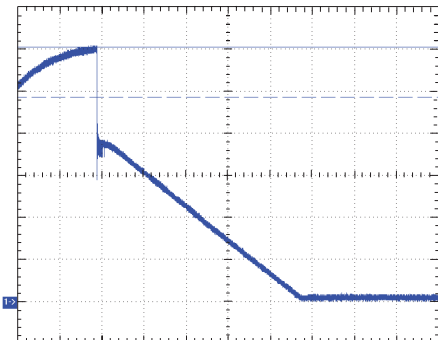
1.  $V_{OUT}$  2V/div 10mS/div  
2. Enable 5V/div

## Over Current Protection

Note: Over current protection is blip-mode (aka hiccup).

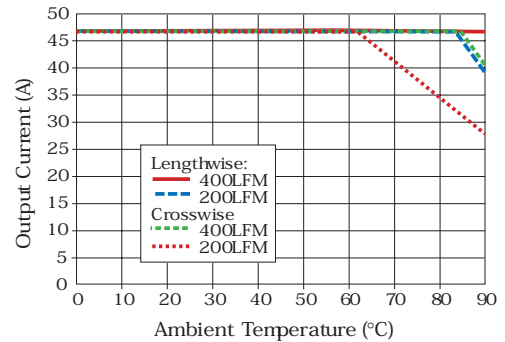


## Over Voltage Protection



1.  $V_{OUT}$  2V/div 4mS/div

## Thermal Derating



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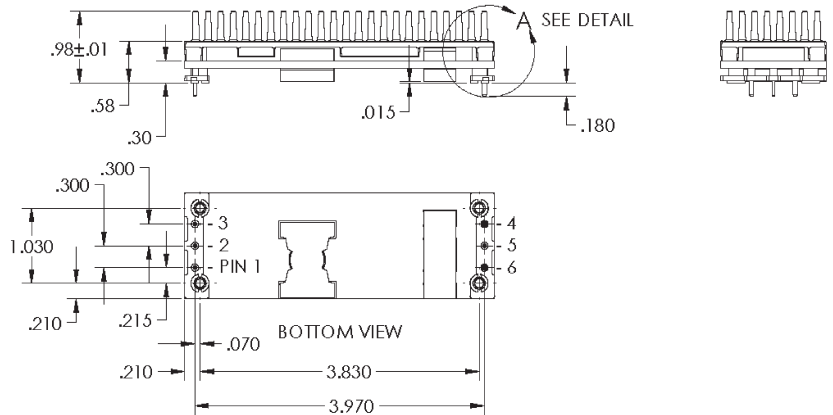
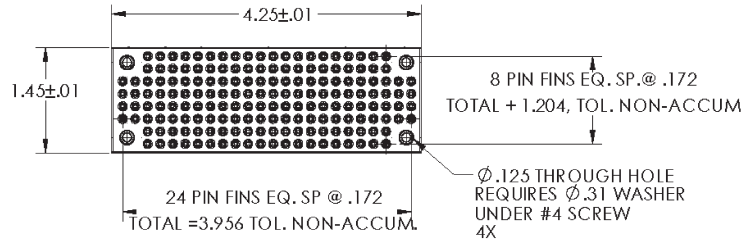
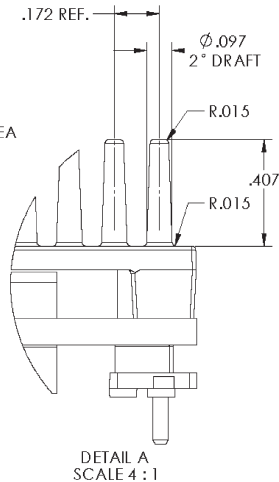
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## Mechanical

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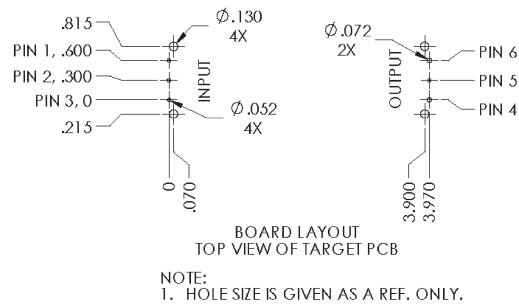
HEAT SINK INFORMATION:  
PIN FINS MAY BE CHANGED FOR  
CUSTOM APPLICATIONS.

1. PIN FIN AREA = .105" sq
2. PIN FIN COUNT = 176
3. TOTAL PIN FIN AREA = 18.5" sq
4. PIN FIN DENSITY = 50% OF HS AREA



## Pin Configuration – Bottom View

| Pin | Function | Pin Dia. (In.) |
|-----|----------|----------------|
| 1   | + Input  | 0.040          |
| 2   | On/Off   | 0.040          |
| 3   | – Input  | 0.040          |
| 4   | – Output | 0.060          |
| 5   | Trim     | 0.040          |
| 6   | + Output | 0.060          |



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