



## Features

High efficiency – 89%@ 5V /4A Full Load  
 Compact size – 1.0" x 1.0" x 0.4"  
 & 1.0" x 1.0" x 0.5"  
 2:1 / 4:1 Ultra-Wide input range  
 Input range Min 5Vin or Max 110Vin Series -  
 40°C to +70°C operation without derating  
 Fixed Switching frequency provides predictable EMI  
 Output current limit and short circuit protection  
 No life-span constrained Capacitor inside  
 1600V<sub>DC</sub> / 2KV Basic Insulation (input to output)  
 MTBF≥1.5M hours @50°C GB (BellCoreTR-332)

Demo photo only. Actual product outlook and marking may vary.



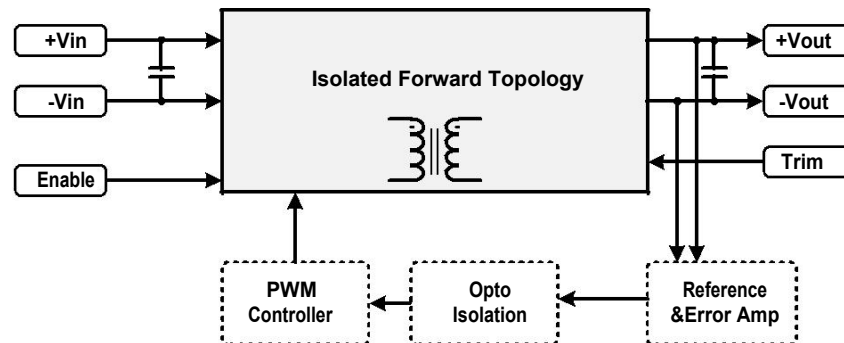
| UVLO       | OCP           | OVP                | OTP                           |
|------------|---------------|--------------------|-------------------------------|
| Metal Case | ON/OFF Remote | PI Filter Built-in | 2000V <sub>DC</sub> Isolation |

## Applications

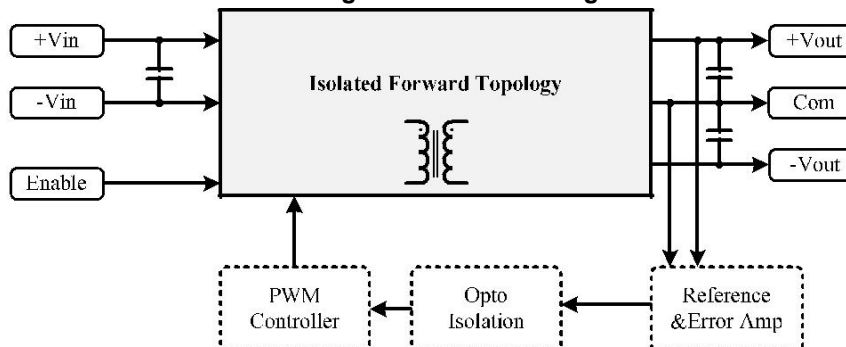
Railway System  
 Wireless Network  
 Telecom / Datacom  
 Industry Control System  
 Distributed Power Architectures  
 Semiconductor Equipment

## Description

Evolving Sirius-Bishop series – New generation converter series is composed of Isolated, board-mountable, fixed switching frequency dc-dc converters that use synchronous rectification to achieve extremely high power conversion efficiency. These DC-DC converter modules use advanced power processing, control and packaging technologies to enhance the performance, flexibility, reliability and cost effectiveness of mature power components. Each module is supplied completely encased to provide protection from the harsh environments seen in many industrial and transportation applications.



ESBN Single Series Block Diagram



ESBN Dual Series Block Diagram

## MODEL NUMBER STRUCTURE

| ESBN                                            | 018                 | 033                  | - S             | - P                                    | - F              | 20V0 |
|-------------------------------------------------|---------------------|----------------------|-----------------|----------------------------------------|------------------|------|
| Series Name                                     | Input Voltage (VDC) | Output Voltage (VDC) | Output Quantity | Remote Control Option                  | Shape            | Watt |
| Evolving Sirius- Bishop series – New generation | 018: 9-36           | 033: 3.3             |                 |                                        |                  |      |
|                                                 | 024: 18-36          | 050: 5               |                 |                                        |                  | 10   |
|                                                 | 036: 18-75          | 120: 12              | S: Single       | P: Positive logic<br>N: Negative logic | F: Flat<br>P: PV | 15   |
|                                                 | 048: 36-75          | 150: 15              |                 |                                        |                  | 20   |
|                                                 | 110: 40-160         |                      |                 |                                        |                  |      |
|                                                 |                     | 050: $\pm 5$         |                 |                                        |                  |      |
|                                                 |                     | 120: $\pm 12$        | D: Dual         |                                        |                  |      |
|                                                 |                     | 150: $\pm 15$        |                 |                                        |                  |      |

## Model Selection Guide

Typical @ Ta=+25 °C under nominal line voltage conditions unless noted.

| Model                | Input      |         |             | Output   |           |       | Efficiency |
|----------------------|------------|---------|-------------|----------|-----------|-------|------------|
|                      | Voltage(V) |         | Current (A) | Voltage  | Current   | Power |            |
|                      | Range      | Nominal | Full load   | (V)      | (A)       | (W)   | Typ.(%)    |
| ESBN018033-S-P-F10V0 | 9-36       | 18      | 0.64        | 3.3      | 3         | 10    | 87%        |
| ESBN018050-S-P-F10V0 | 9-36       | 18      | 0.63        | 5        | 2         | 10    | 88%        |
| ESBN018120-S-P-F10V0 | 9-36       | 18      | 0.64        | 12       | 0.8       | 10    | 87%        |
| ESBN018150-S-P-F10V0 | 9-36       | 18      | 0.63        | 15       | 0.7       | 10    | 88%        |
| ESBN018050-D-P-F10V0 | 9-36       | 18      | 0.66        | $\pm 5$  | $\pm 1.0$ | 10    | 84%        |
| ESBN018120-D-P-F10V0 | 9-36       | 18      | 0.64        | $\pm 12$ | $\pm 0.4$ | 10    | 87%        |
| ESBN018150-D-P-F10V0 | 9-36       | 18      | 0.63        | $\pm 15$ | $\pm 0.3$ | 10    | 88%        |
| ESBN018033-S-P-F15V0 | 9-36       | 18      | 0.95        | 3.3      | 4.5       | 15    | 88%        |
| ESBN018050-S-P-F15V0 | 9-36       | 18      | 0.94        | 5        | 3         | 15    | 89%        |
| ESBN018120-S-P-F15V0 | 9-36       | 18      | 0.95        | 12       | 1.3       | 15    | 88%        |
| ESBN018150-S-P-F15V0 | 9-36       | 18      | 0.94        | 15       | 1         | 15    | 89%        |
| ESBN018050-D-P-F15V0 | 9-36       | 18      | 0.98        | $\pm 5$  | $\pm 1.5$ | 15    | 85%        |
| ESBN018120-D-P-F15V0 | 9-36       | 18      | 0.95        | $\pm 12$ | $\pm 0.6$ | 15    | 88%        |
| ESBN018150-D-P-F15V0 | 9-36       | 18      | 0.94        | $\pm 15$ | $\pm 0.5$ | 15    | 89%        |
| ESBN018033-S-P-F20V0 | 9-36       | 18      | 1.26        | 3.3      | 6.1       | 20    | 88%        |
| ESBN018050-S-P-F20V0 | 9-36       | 18      | 1.25        | 5        | 4         | 20    | 89%        |
| ESBN018120-S-P-F20V0 | 9-36       | 18      | 1.26        | 12       | 1.7       | 20    | 88%        |
| ESBN018150-S-P-F20V0 | 9-36       | 18      | 1.25        | 15       | 1.3       | 20    | 89%        |
| ESBN018120-D-P-F20V0 | 9-36       | 18      | 1.26        | $\pm 12$ | $\pm 0.8$ | 20    | 88%        |
| ESBN018150-D-P-F20V0 | 9-36       | 18      | 1.25        | $\pm 15$ | $\pm 0.7$ | 20    | 89%        |

### Model Selection Guide

Typical @ Ta=+25 °C under nominal line voltage conditions unless noted.

| Model                | Input      |         |             | Output  |         |       | Efficiency |
|----------------------|------------|---------|-------------|---------|---------|-------|------------|
|                      | Voltage(V) |         | Current (A) | Voltage | Current | Power |            |
|                      | Range      | Nominal | Full load   | (V)     | (A)     | (W)   | Typ.(%)    |
| ESBN036033-S-P-F10V0 | 18-75      | 36      | 0.32        | 3.3     | 3       | 10    | 87%        |
| ESBN036050-S-P-F10V0 | 18-75      | 36      | 0.32        | 5       | 2       | 10    | 88%        |
| ESBN036120-S-P-F10V0 | 18-75      | 36      | 0.32        | 12      | 0.8     | 10    | 87%        |
| ESBN036150-S-P-F10V0 | 18-75      | 36      | 0.32        | 15      | 0.7     | 10    | 88%        |
| ESBN036050-D-P-F10V0 | 18-75      | 36      | 0.33        | ±5      | ±1.0    | 10    | 84%        |
| ESBN036120-D-P-F10V0 | 18-75      | 36      | 0.32        | ±12     | ±0.4    | 10    | 87%        |
| ESBN036150-D-P-F10V0 | 18-75      | 36      | 0.32        | ±15     | ±0.3    | 10    | 88%        |
| ESBN036033-S-P-F15V0 | 18-75      | 36      | 0.47        | 3.3     | 4.5     | 15    | 88%        |
| ESBN036050-S-P-F15V0 | 18-75      | 36      | 0.47        | 5       | 3       | 15    | 89%        |
| ESBN036120-S-P-F15V0 | 18-75      | 36      | 0.47        | 12      | 1.3     | 15    | 88%        |
| ESBN036150-S-P-F15V0 | 18-75      | 36      | 0.47        | 15      | 1       | 15    | 89%        |
| ESBN036120-D-P-F15V0 | 18-75      | 36      | 0.47        | ±12     | ±0.6    | 15    | 88%        |
| ESBN036150-D-P-F15V0 | 18-75      | 36      | 0.47        | ±15     | ±0.5    | 15    | 89%        |
| ESBN036033-S-P-F20V0 | 18-75      | 36      | 0.62        | 3.3     | 6.1     | 20    | 89%        |
| ESBN036050-S-P-F20V0 | 18-75      | 36      | 0.62        | 5       | 4       | 20    | 90%        |
| ESBN036120-S-P-F20V0 | 18-75      | 36      | 0.63        | 12      | 1.7     | 20    | 88%        |
| ESBN036150-S-P-F20V0 | 18-75      | 36      | 0.62        | 15      | 1.3     | 20    | 89%        |
| ESBN036120-D-P-F20V0 | 18-75      | 36      | 0.63        | ±12     | ±0.8    | 20    | 88%        |
| ESBN036150-D-P-F20V0 | 18-75      | 36      | 0.62        | ±15     | ±0.7    | 20    | 89%        |
| ESBN110033-S-P-F10V0 | 40-160     | 110     | 0.10        | 3.3     | 3       | 10    | 87%        |
| ESBN110050-S-P-F10V0 | 40-160     | 110     | 0.10        | 5       | 2       | 10    | 88%        |
| ESBN110120-S-P-F10V0 | 40-160     | 110     | 0.10        | 12      | 0.8     | 10    | 87%        |
| ESBN110150-S-P-F10V0 | 40-160     | 110     | 0.10        | 15      | 0.7     | 10    | 88%        |
| ESBN110050-D-P-F10V0 | 40-160     | 110     | 0.11        | ±5      | ±1.0    | 10    | 84%        |
| ESBN110120-D-P-F10V0 | 40-160     | 110     | 0.10        | ±12     | ±0.4    | 10    | 87%        |
| ESBN110150-D-P-F10V0 | 40-160     | 110     | 0.10        | ±15     | ±0.3    | 10    | 88%        |
| ESBN110033-S-P-F15V0 | 40-160     | 110     | 0.15        | 3.3     | 4.5     | 15    | 88%        |
| ESBN110050-S-P-F15V0 | 40-160     | 110     | 0.15        | 5       | 3       | 15    | 89%        |
| ESBN110120-S-P-F15V0 | 40-160     | 110     | 0.15        | 12      | 1.3     | 15    | 88%        |
| ESBN110150-S-P-F15V0 | 40-160     | 110     | 0.15        | 15      | 1       | 15    | 89%        |
| ESBN110050-D-P-F15V0 | 40-160     | 110     | 0.16        | ±5      | ±1.5    | 15    | 85%        |
| ESBN110120-D-P-F15V0 | 40-160     | 110     | 0.15        | ±12     | ±0.6    | 15    | 88%        |
| ESBN110150-D-P-F15V0 | 40-160     | 110     | 0.15        | ±15     | ±0.5    | 15    | 89%        |
| ESBN110033-S-P-F20V0 | 40-160     | 110     | 0.21        | 3.3     | 6.1     | 20    | 88%        |
| ESBN110050-S-P-F20V0 | 40-160     | 110     | 0.20        | 5       | 4       | 20    | 89%        |
| ESBN110120-S-P-F20V0 | 40-160     | 110     | 0.21        | 12      | 1.7     | 20    | 88%        |
| ESBN110150-S-P-F20V0 | 40-160     | 110     | 0.20        | 15      | 1.3     | 20    | 89%        |
| ESBN110120-D-P-F20V0 | 40-160     | 110     | 0.21        | ±12     | ±0.8    | 20    | 88%        |
| ESBN110150-D-P-F20V0 | 40-160     | 110     | 0.20        | ±15     | ±0.7    | 20    | 89%        |

### Model Selection Guide

Typical @ Ta=+25 °C under nominal line voltage conditions unless noted.

| Model                | Input      |         |             | Output  |         |       | Efficiency |
|----------------------|------------|---------|-------------|---------|---------|-------|------------|
|                      | Voltage(V) |         | Current (A) | Voltage | Current | Power |            |
|                      | Range      | Nominal | Full load   | (V)     | (A)     | (W)   | Typ.(%)    |
| ESBN024033-S-P-F10V0 | 18-36      | 24      | 0.47        | 3.3     | 3       | 10    | 88%        |
| ESBN024050-S-P-F10V0 | 18-36      | 24      | 0.47        | 5       | 2       | 10    | 89%        |
| ESBN024120-S-P-F10V0 | 18-36      | 24      | 0.47        | 12      | 0.8     | 10    | 88%        |
| ESBN024150-S-P-F10V0 | 18-36      | 24      | 0.47        | 15      | 0.7     | 10    | 89%        |
| ESBN024050-D-P-F10V0 | 18-36      | 24      | 0.49        | ±5      | ±1.0    | 10    | 85%        |
| ESBN024120-D-P-F10V0 | 18-36      | 24      | 0.47        | ±12     | ±0.4    | 10    | 88%        |
| ESBN024150-D-P-F10V0 | 18-36      | 24      | 0.47        | ±15     | ±0.3    | 10    | 88%        |
| ESBN024033-S-P-F15V0 | 18-36      | 24      | 0.70        | 3.3     | 4.5     | 15    | 89%        |
| ESBN024050-S-P-F15V0 | 18-36      | 24      | 0.69        | 5       | 3       | 15    | 90%        |
| ESBN024120-S-P-F15V0 | 18-36      | 24      | 0.70        | 12      | 1.3     | 15    | 89%        |
| ESBN024150-S-P-F15V0 | 18-36      | 24      | 0.70        | 15      | 1       | 15    | 89%        |
| ESBN024050-D-P-F15V0 | 18-36      | 24      | 0.73        | ±5      | ±1.5    | 15    | 86%        |
| ESBN024120-D-P-F15V0 | 18-36      | 24      | 0.70        | ±12     | ±0.6    | 15    | 89%        |
| ESBN024150-D-P-F15V0 | 18-36      | 24      | 0.70        | ±15     | ±0.5    | 15    | 89%        |
| ESBN024033-S-P-F20V0 | 18-36      | 24      | 0.94        | 3.3     | 6.1     | 20    | 89%        |
| ESBN024050-S-P-F20V0 | 18-36      | 24      | 0.93        | 5       | 4       | 20    | 90%        |
| ESBN024120-S-P-F20V0 | 18-36      | 24      | 0.94        | 12      | 1.7     | 20    | 89%        |
| ESBN024150-S-P-F20V0 | 18-36      | 24      | 0.94        | 15      | 1.3     | 20    | 89%        |
| ESBN024120-D-P-F20V0 | 18-36      | 24      | 0.94        | ±12     | ±0.8    | 20    | 89%        |
| ESBN024150-D-P-F20V0 | 18-36      | 24      | 0.94        | ±15     | ±0.7    | 20    | 89%        |
| ESBN048033-S-P-F10V0 | 36-75      | 48      | 0.24        | 3.3     | 3       | 10    | 88%        |
| ESBN048050-S-P-F10V0 | 36-75      | 48      | 0.23        | 5       | 2       | 10    | 89%        |
| ESBN048120-S-P-F10V0 | 36-75      | 48      | 0.24        | 12      | 0.8     | 10    | 88%        |
| ESBN048150-S-P-F10V0 | 36-75      | 48      | 0.23        | 15      | 0.7     | 10    | 89%        |
| ESBN048050-D-P-F10V0 | 36-75      | 48      | 0.25        | ±5      | ±1.0    | 10    | 85%        |
| ESBN048120-D-P-F10V0 | 36-75      | 48      | 0.24        | ±12     | ±0.4    | 10    | 88%        |
| ESBN048150-D-P-F10V0 | 36-75      | 48      | 0.24        | ±15     | ±0.3    | 10    | 88%        |
| ESBN048033-S-P-F15V0 | 36-75      | 48      | 0.35        | 3.3     | 4.5     | 15    | 89%        |
| ESBN048050-S-P-F15V0 | 36-75      | 48      | 0.35        | 5       | 3       | 15    | 90%        |
| ESBN048120-S-P-F15V0 | 36-75      | 48      | 0.35        | 12      | 1.3     | 15    | 89%        |
| ESBN048150-S-P-F15V0 | 36-75      | 48      | 0.35        | 15      | 1       | 15    | 89%        |
| ESBN048050-D-P-F15V0 | 36-75      | 48      | 0.36        | ±5      | ±1.5    | 15    | 86%        |
| ESBN048120-D-P-F15V0 | 36-75      | 48      | 0.35        | ±12     | ±0.6    | 15    | 89%        |
| ESBN048150-D-P-F15V0 | 36-75      | 48      | 0.35        | ±15     | ±0.5    | 15    | 89%        |
| ESBN048033-S-P-F20V0 | 36-75      | 48      | 0.47        | 3.3     | 6.1     | 20    | 89%        |
| ESBN048050-S-P-F20V0 | 36-75      | 48      | 0.46        | 5       | 4       | 20    | 90%        |
| ESBN048120-S-P-F20V0 | 36-75      | 48      | 0.47        | 12      | 1.7     | 20    | 89%        |
| ESBN048150-S-P-F20V0 | 36-75      | 48      | 0.47        | 15      | 1.3     | 20    | 89%        |
| ESBN048120-D-P-F20V0 | 36-75      | 48      | 0.47        | ±12     | ±0.8    | 20    | 89%        |
| ESBN048150-D-P-F20V0 | 36-75      | 48      | 0.47        | ±15     | ±0.7    | 20    | 89%        |

**Electrical Specifications** (Typical @ Ta=+25°C under nominal line voltage conditions unless noted.)

**Input Specifications**

| Parameter                                 | Notes and Conditions                | Min.                               | Typ  | Max. | Unit |
|-------------------------------------------|-------------------------------------|------------------------------------|------|------|------|
| Transient Input Voltage ranges            | ESBN012&18&24 models<br>(100ms max) |                                    |      | 50   | VDC  |
|                                           | ESBN036 &48models (100ms max)       |                                    |      | 80   |      |
|                                           | ESBN110 models (100ms max)          |                                    |      | 180  |      |
| Operating Input Voltage ranges            | ESBN012&18 models                   | 9                                  | 18   | 36   | VDC  |
|                                           | ESBN024 models                      | 18                                 | 24   | 36   |      |
|                                           | ESBN036 models                      | 18                                 | 36   | 75   |      |
|                                           | ESBN048 models                      | 36                                 | 48   | 75   |      |
|                                           | ESBN110 models                      | 40                                 | 110  | 160  |      |
| Under-Voltage Lockout<br>Start up voltage | ESBN012&18 models                   |                                    | 8.5  | 9    | VDC  |
|                                           | ESBN024 models                      |                                    | 17.5 | 18   |      |
|                                           | ESBN036 models                      |                                    | 17.5 | 18   |      |
|                                           | ESBN048 models                      |                                    | 35   | 36   |      |
|                                           | ESBN110 models                      |                                    | 38   | 40   |      |
| Under-Voltage Lockout<br>Shutdown voltage | ESBN012&18 models                   | 7                                  | 8    |      | VDC  |
|                                           | ESBN024 models                      | 16                                 | 17   |      |      |
|                                           | ESBN036 models                      | 16                                 | 17   |      |      |
|                                           | ESBN048 models                      | 32                                 | 34   |      |      |
|                                           | ESBN110 models                      | 35                                 | 37   |      |      |
| Enable Function Input                     | Positive logic ON<br>OFF            | Open or 8 ~ 20<br>Short or 0 ~ 1.2 |      |      | VDC  |
|                                           | Negative logic ON<br>OFF            | Short or 0 ~ 1.2<br>Open or 8 ~ 20 |      |      | VDC  |
| Input Filter                              | All models                          | Built-in PI Filter                 |      |      |      |

**Output Specifications**

| Parameter                     | Notes and Conditions                                                |            | Min. | Typ | Max.   | Unit                |
|-------------------------------|---------------------------------------------------------------------|------------|------|-----|--------|---------------------|
| Output Voltage Accuracy       | V <sub>NOM</sub> 50% Load                                           |            |      |     | ±1.5   | %                   |
| Line Regulation               | Low line to High line                                               |            |      |     | ±0.3   | %                   |
| Load Regulation               | 10% to 100% load                                                    |            |      |     | ±0.5   | %                   |
| Minimum Load                  | Single output                                                       |            | 0    |     |        | %                   |
|                               | Dual output                                                         |            | 10   |     |        | %                   |
| Output Ripple & Noise Voltage | Bandwidth 20MHz and<br>with 1uFMLCC.Output<br>Capacitor each output | 3.3V&5V    |      |     | 75/100 | mVp-p               |
|                               |                                                                     | All others |      | 1   | 1.5    | %V <sub>pk-pk</sub> |
| Temperature Drift             |                                                                     |            |      |     | ±0.04  | % / °C              |
| Transient Recovery Time       | 25% load step change                                                |            |      | 800 |        | µSec.               |
| Transient Peak Deviation      | Io/ t=2.5A/us                                                       |            |      |     | ±2     | %Vo                 |
| Start-Up time                 | When use Enable Function                                            |            |      | 20  |        | mSec.               |
| Trimming Output Voltage       | V <sub>NOM</sub> 10% Load                                           |            |      | ±10 |        | %                   |
| Over voltage protection       | V <sub>NOM</sub> 10% Load                                           |            |      | 120 |        | %                   |
| Output Power Protection       | V <sub>NOM</sub> ( Current limit / Hiccup Mode)                     |            |      | 120 |        | %                   |

## General Specifications

| Parameter                                | Notes and Conditions                            | Min.                                         | Typ  | Max. | Unit    |
|------------------------------------------|-------------------------------------------------|----------------------------------------------|------|------|---------|
| Switching Frequency                      | V <sub>NOM</sub>                                | 220                                          |      | 330  | KHz     |
| Storage Temperature range                | All models                                      | -60                                          |      | 125  | °C      |
| Operating Case Temperature               | All models                                      | -45                                          |      | 115  | °C      |
| Over temperature Protection              | All models, Auto. Recovery                      |                                              | 120  |      |         |
| Thermal impedance                        | Natural convection<br>( Metal Case –Flat )      | 11(Vertical)                                 |      |      | °C/Watt |
|                                          |                                                 | 13(horizontal)                               |      |      |         |
| Isolation Voltage<br>Input to Output     | All models, 1 Minute                            | 1600                                         |      |      | VDC     |
|                                          |                                                 | 2000                                         |      |      |         |
| Isolation Resistance<br>Input to Output  | All models,<br>500VDC,At 70%RH                  | 100                                          |      |      | MΩ      |
| Isolation Capacitance<br>Input to Output | All models                                      |                                              | 1500 |      | pF      |
| Humidity (non condensing)                | All models                                      |                                              |      | 95   | %       |
| Calculated MTBF                          | BellCore-TR-332@ 50°C G.B                       |                                              | 1.5  |      | M HR    |
| Thermal shock                            | Environmental<br>engineering experimental tests | MIL-STD-810F                                 |      |      |         |
| Vibration                                |                                                 | MIL-STD-810F                                 |      |      |         |
| Drop                                     |                                                 | MIL-STD-810F                                 |      |      |         |
| Weight                                   | Shape-F (Flat)                                  | 15(0.5)                                      |      |      | g (oz.) |
|                                          | Shape-P (Groove cover/ Heat Sink)               | 18(0.6)                                      |      |      |         |
| Dimensions                               | Shape-F (Flat)                                  | 1.00” x 1. 0” x 0.4” (25.4 x 25.4 x 10.16mm) |      |      |         |
|                                          | Shape-P (Groove cover/ Heat Sink)               | 1.00” x 1. 0” x 0.5” (25.4x 25.4 x 12.7mm)   |      |      |         |
| Case Material                            | Shape-F (Flat)                                  | Aluminum + FR4 (Non-Conductive Base) OR      |      |      |         |
|                                          | Shape-P (Groove cover/ Heat Sink)               | Aluminum + Metal Base (Full metal jacket)    |      |      |         |
| Potting Material                         |                                                 | Silicone                                     |      |      |         |

## Standards Compliance

| Parameter                | Standard    | Test Conditions                                | Performance Criteria |
|--------------------------|-------------|------------------------------------------------|----------------------|
| Environmental Compliance | Reach; RoHS |                                                | PASS                 |
| EMI                      | EN55022     |                                                | Class A / Class B    |
| ESD                      | EN61000-4-2 | ±4 kV Air Discharge<br>±4 kV Contact Discharge | Crit. A              |
| Radiated Immunity        | EN61000-4-3 | Level 2, 3 V/m                                 | Crit. A              |
| Fast Transient           | EN61000-4-4 | ±2 kV Applied                                  | Crit. A              |
| Surge                    | EN61000-4-5 | ±2 kV Applied                                  | Crit. A              |
| Conducted Immunity       | EN61000-4-6 | Level 2, 3 V rms                               | Crit. A              |

It is recommended to protect the input by fuses or other protection devices.

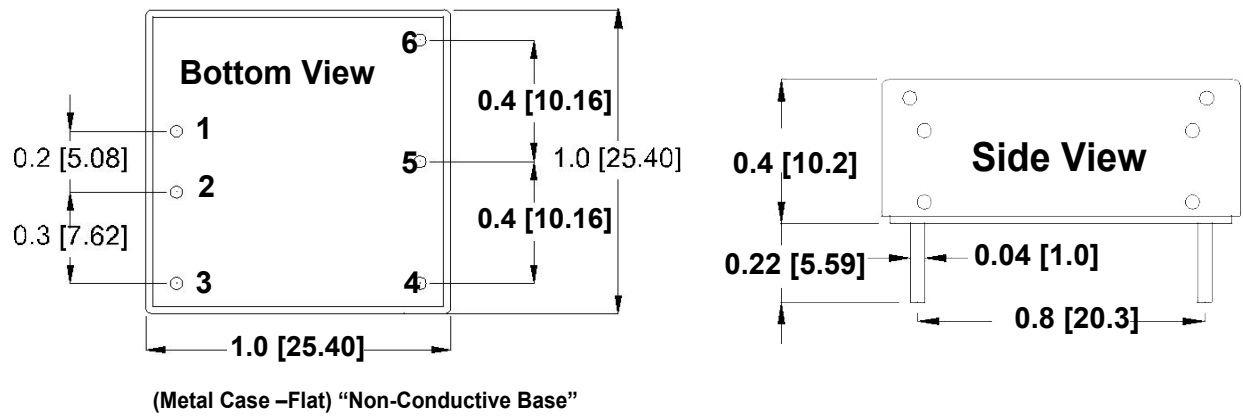
**The standard modules meet EN55022 Class A. Then Class B standard with external components.**

The information and specifications contained in this data sheet are believed to be correct at time of publication. All specifications are subject to change without notice. No rights under any patent accompany the sale of any such products or information contained herein.

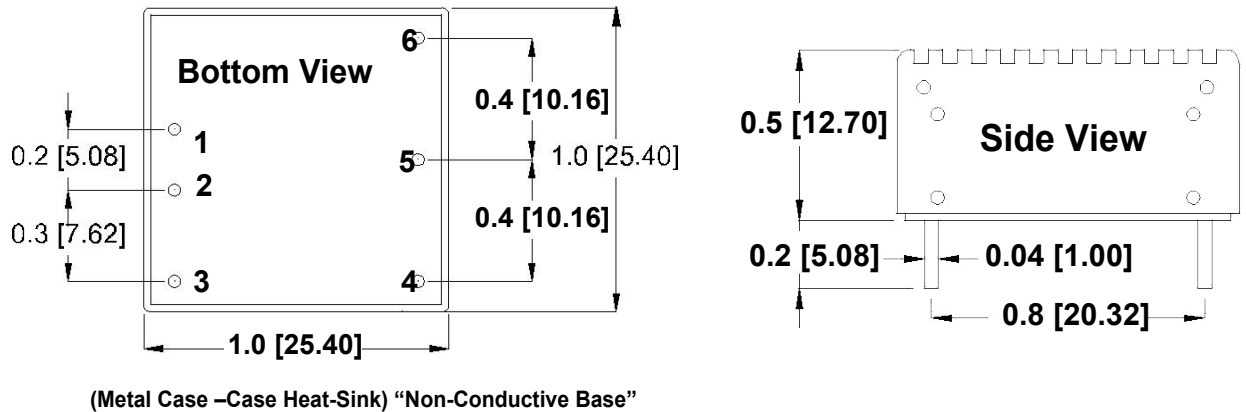


### Mechanical Dimensions

Shape –F



Shape –P (Groove cover/ Heat Sink)



#### Pin Assignments:

| Pin# | Single | Dual   |
|------|--------|--------|
| 1    | +Vin   | +Vin   |
| 2    | -Vin   | -Vin   |
| 3    | Enable | Enable |
| 4    | -Vout  | -Vout  |
| 5    | Trim   | Com    |
| 6    | +Vout  | +Vout  |

#### Note:

Pin Pitch tolerance:  $\pm 0.01$  [0.25]  
Pin Dimensions:  $.XX \pm 0.03$  [  $.X \pm 0.76\text{mm}$  ]  
Pin Material: Copper Alloy Pin  
Plating: Gold Dimensions in  
inches [mm] Tolerances:  $.XX \pm 0.02$   
[  $.X \pm 0.5\text{mm}$  ]  
 $.XXX \pm 0.001$  [  $.X \pm 0.025\text{mm}$  ]

## Characteristic Curves

Testing conditions are at typical input,  $T_a = +25^\circ\text{C}$ , full load (horizontal mount) Unless otherwise indicated

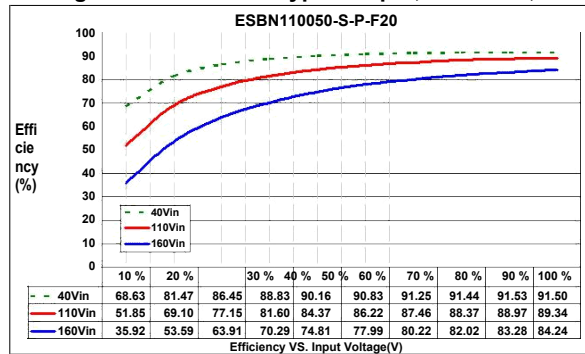


Figure 1: Efficiency at Minimum, Nominal and Maximum Input voltages VS. output load.

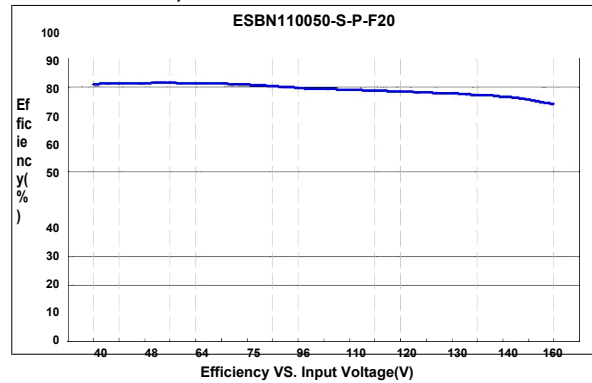


Figure 2: Efficiency VS. Input Voltage at 100% rated power

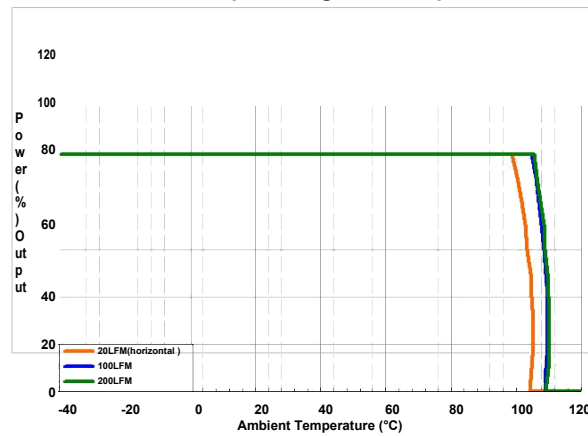


Figure 3: Ambient Temperature VS. Output Power Derating Curves

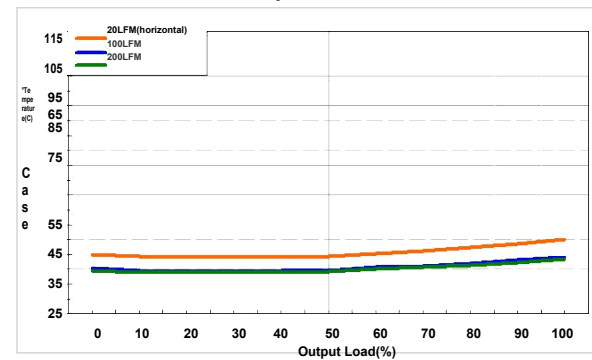


Figure 4: Case Temperature VS. Output rated Power

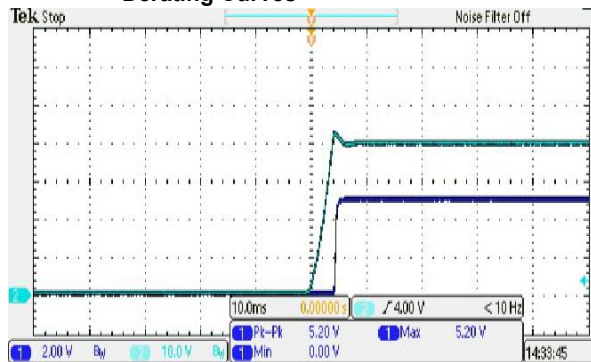


Figure 5: CH1 = Vout, CH2 = Nominal Input Typical Start-up waveform at Full load.

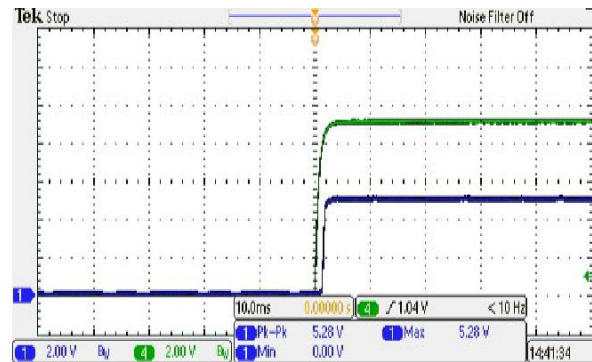


Figure 6: CH1 = Vout, CH4 = Enable Pin Typical Start-up waveform. Input voltage pre-applied

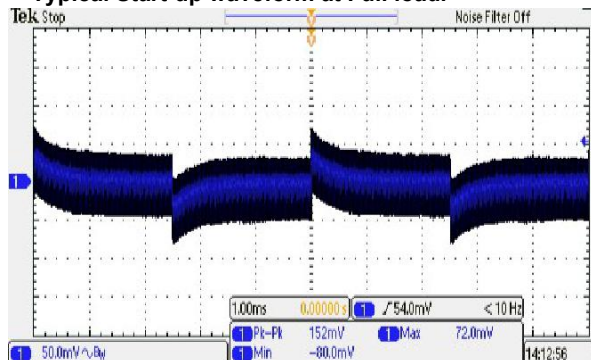


Figure 7: Transient Response at Output step load ( $V_{in}$ : Typical, 50~75% of output current;  $\Delta I_o/\Delta t = 0.01\text{A}/\mu\text{S}$ )

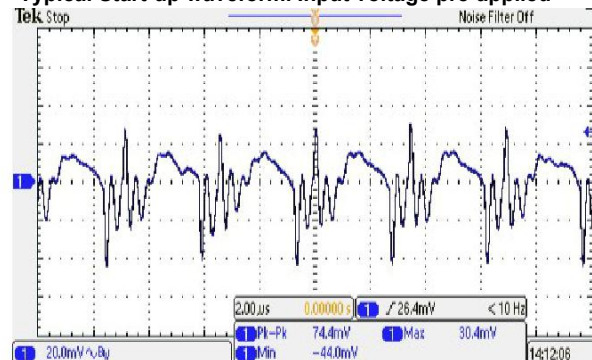
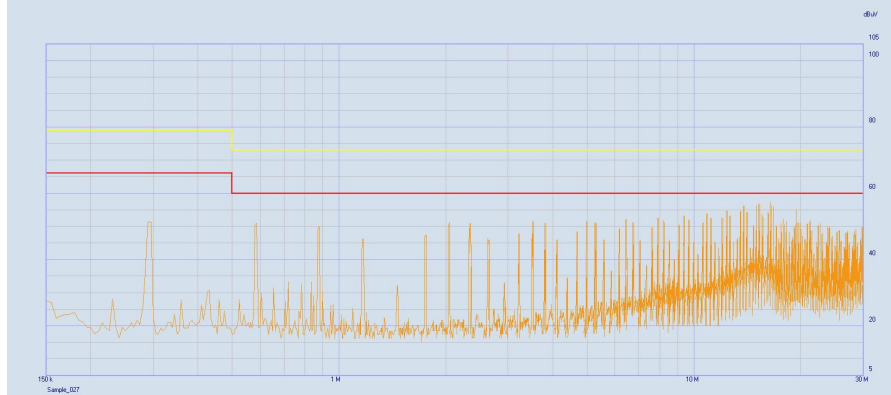


Figure 8: Output Voltage Ripple & Noise at full load. ( $V_{in}$ : Typical, With Output Capacitor to add 1uF MLCC)





Conducted EMI Input terminal value (typ) ESB110050-S-P-F20 @Vin = 110VDC, Iout = 4A



The fundamental switching frequency of the module is 260 kHz.

### Trimming Output Voltage – for Single output models

Only the single output converters have a trim function. that allows users to adjust the output voltage from +10% to -10%, please refer to the trim table that follow for details. Adjustments to the output voltage can be used with a simple fixed resistor as shown in Figures 2 and 3. A single fixed resistor can increase or decrease the output voltage depending on its connection.

#### Note:

- ✧ Trim adjustments higher than the specified range can have an adverse effect on the converter's performance and are not recommended.
- ✧ If the trim function is not used, leave the trim pin open.

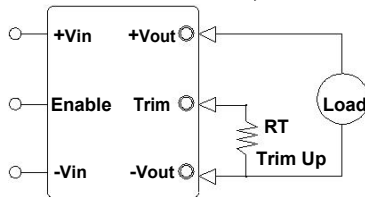


Figure 2. Trim Connections To increase Output Voltages Using Fixed Resistors

| Trim Up register value(KΩ) RT |     |     |      |      |      |      |      |      |      |      |  |
|-------------------------------|-----|-----|------|------|------|------|------|------|------|------|--|
| Vout                          | 1%  | 2%  | 3%   | 4%   | 5%   | 6%   | 7%   | 8%   | 9%   | 10%  |  |
| 3.3                           | 75  | 34  | 20.6 | 13.7 | 9.6  | 6.9  | 4.9  | 3.5  | 2.3  | 1.4  |  |
| 5                             | 113 | 51  | 31.0 | 20.7 | 14.6 | 10.5 | 7.6  | 5.4  | 3.7  | 2.3  |  |
| 12                            | 274 | 128 | 79.5 | 55.1 | 40.5 | 30.7 | 23.8 | 18.6 | 14.5 | 11.2 |  |
| 15                            | 341 | 157 | 95.6 | 64.9 | 46.6 | 34.3 | 25.5 | 19.0 | 13.9 | 9.8  |  |
| 24                            | 542 | 247 | 149  | 100  | 70.7 | 51.1 | 37.1 | 26.6 | 18.4 | 11.9 |  |

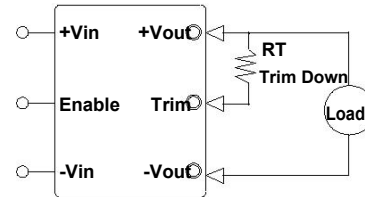


Figure 3. Trim Connections To Decrease Output Voltages Using Fixed Resistors

| Trim Down register value(KΩ) RT |     |     |      |      |      |      |      |      |      |      |  |
|---------------------------------|-----|-----|------|------|------|------|------|------|------|------|--|
| Vout                            | -1% | -2% | -3%  | -4%  | -5%  | -6%  | -7%  | -8%  | -9%  | -10% |  |
| 3.3                             | 83  | 37  | 21.9 | 14.3 | 9.7  | 6.7  | 4.5  | 2.9  | 1.6  | 0.6  |  |
| 5                               | 117 | 52  | 30.5 | 19.7 | 13.3 | 9.0  | 5.9  | 3.6  | 1.8  | 0.4  |  |
| 12                              | 230 | 103 | 61.0 | 39.9 | 27.2 | 18.8 | 12.8 | 8.2  | 4.7  | 1.9  |  |
| 15                              | 329 | 147 | 86.8 | 56.5 | 38.4 | 26.2 | 17.6 | 11.1 | 6.1  | 2.0  |  |
| 24                              | 592 | 266 | 158  | 104  | 70.9 | 49.2 | 33.7 | 22.1 | 13.0 | 5.8  |  |

### Enable Control Function

The primary-side, Enable Control function can be specified to operate with either positive or negative polarity. Positive-polarity devices are enabled when the enable pin is left open or is pulled high. See "Enable Function Input." Positive-polarity devices are disabled when the enable pin is pulled low (under +1.0V with respect to -input). Negative-polarity devices are off when the enable pin is high/open and on when the enable pin is pulled low. See Figure 4.

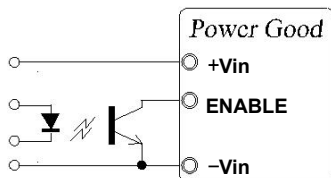


Figure 4. Driving the Enable Control pin

### Output Ripple Noise

the two copper strips simulate real-world PCB impedances between the converter and its load. Scope measurements should be made using BNC connectors or The probe ground should be less than 1/2 inch and soldered directly to the fixture. All external capacitors should have appropriate voltage ratings and be located as close to the converter as possible. Temperature variations for all relevant parameters should be taken into consideration. The most effective combination of external I/O capacitors will be a function of line voltage and source impedance, as well as particular load and layout conditions. See Figure 5.

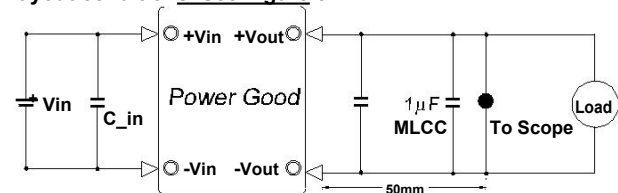


Figure 5. Measuring Output Ripple/Noise(20MHz bandwidth)