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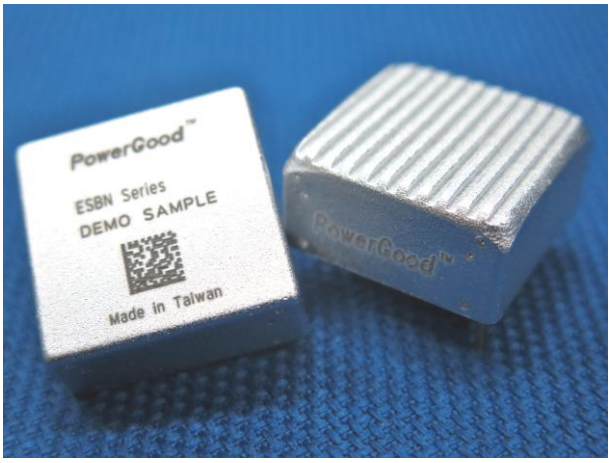
POWERGOOD

ESBN Series

1" x 1" Converter Power range 10- 30W



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

UVLO	OCP	OVP	OTP
Metal Case	ON/OFF Remote	PI Filter Built-in	2000V_{DC} Isolation

Features

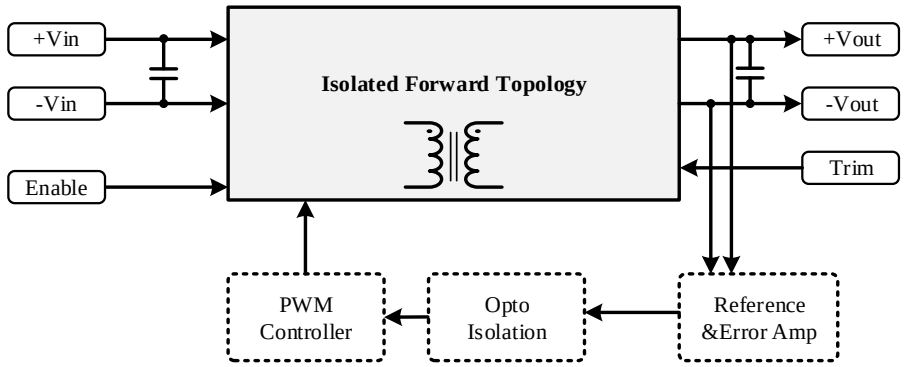
- High efficiency – **89%@ 5V /4A** Full Load
- Compact size – **1.0" x 1.0" x 0.4"**
  & 1.0" x 1.0" x 0.5"
- **2:1 / 4:1 Ultra-Wide** input range
- Input range Min **5**Vin or Max **110**Vin Series
- -40˚C to +70˚C operation without derating
- Fixed Switching frequency provides predictable EMI
- Output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

Applications

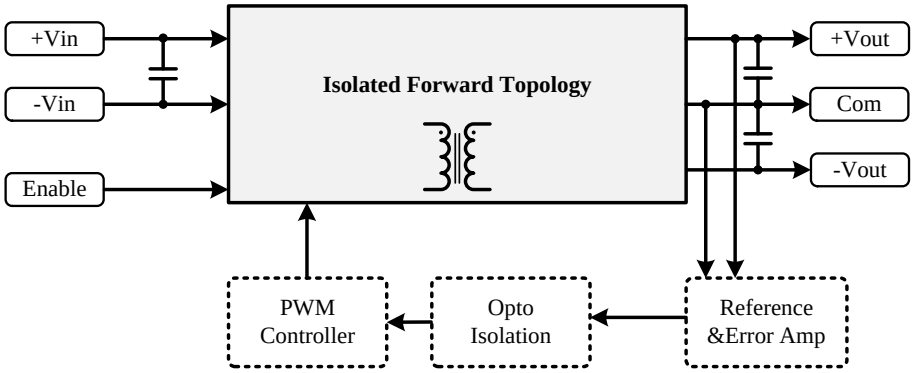
- Railway System
- Wireless Network
- Telecom / Datacom
- Industry Control System
- Distributed Power Architectures
- Semiconductor Equipment

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

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MODEL NUMBER STRUCTURE

ESBN	018	033	-	S	-	P	-	F	20
Series Name	**Input Voltage (VDC)**	**Output Voltage (VDC)**		**Output Quantity**		**Remote Control Option**		**Shape**	**Watt**
Evolving **S**irius- **B**ishop series – **N**ew generation	**018**： 9-36 **024**：18-36 **036**：18-75 **048**：36-75 **110:** 40-160	**033**：3.3 **050**： 5 **120**：12 **150**：15		**S**: Single		**P**: Positive logic **N**: Negative logic		**F**：Flat **P**：HeatSink	**10** **15** **20** **30**
		050：±5 **120**：±12 **150**：±15		**D**: Dual					

Model Selection Guide

Typical @ Ta=+25 ℃ 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-F10	9-36	18	0.64	3.3	3	10	87%
ESBN018050-S-P-F10	9-36	18	0.63	5	2	10	88%
ESBN018120-S-P-F10	9-36	18	0.64	12	0.8	10	87%
ESBN018150-S-P-F10	9-36	18	0.63	15	0.7	10	88%
ESBN018050-D-P-F10	9-36	18	0.66	±5	±1.0	10	84%
ESBN018120-D-P-F10	9-36	18	0.64	±12	±0.4	10	87%
ESBN018150-D-P-F10	9-36	18	0.63	±15	±0.3	10	88%
ESBN018033-S-P-F15	9-36	18	0.95	3.3	4.5	15	88%
ESBN018050-S-P-F15	9-36	18	0.94	5	3	15	89%
ESBN018120-S-P-F15	9-36	18	0.95	12	1.3	15	88%
ESBN018150-S-P-F15	9-36	18	0.94	15	1	15	89%
ESBN018050-D-P-F15	9-36	18	0.98	±5	±1.5	15	85%
ESBN018120-D-P-F15	9-36	18	0.95	±12	±0.6	15	88%
ESBN018150-D-P-F15	9-36	18	0.94	±15	±0.5	15	89%
ESBN018033-S-P-F20	9-36	18	1.26	3.3	6.1	20	88%
ESBN018050-S-P-F20	9-36	18	1.25	5	4	20	89%
ESBN018120-S-P-F20	9-36	18	1.26	12	1.7	20	88%
ESBN018150-S-P-F20	9-36	18	1.25	15	1.3	20	89%
ESBN018120-D-P-F20	9-36	18	1.26	±12	±0.8	20	88%
ESBN018150-D-P-F20	9-36	18	1.25	±15	±0.7	20	89%

※ Modification or customized design is available. Please contact us for detail.

Model Selection Guide

Typical @ Ta=+25 ℃ 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-F10	18-75	36	0.32	3.3	3	10	87%
ESBN036050-S-P-F10	18-75	36	0.32	5	2	10	88%
ESBN036120-S-P-F10	18-75	36	0.32	12	0.8	10	87%
ESBN036150-S-P-F10	18-75	36	0.32	15	0.7	10	88%
ESBN036050-D-P-F10	18-75	36	0.33	±5	±1.0	10	84%
ESBN036120-D-P-F10	18-75	36	0.32	±12	±0.4	10	87%
ESBN036150-D-P-F10	18-75	36	0.32	±15	±0.3	10	88%
ESBN036033-S-P-F15	18-75	36	0.47	3.3	4.5	15	88%
ESBN036050-S-P-F15	18-75	36	0.47	5	3	15	89%
ESBN036120-S-P-F15	18-75	36	0.47	12	1.3	15	88%
ESBN036150-S-P-F15	18-75	36	0.47	15	1	15	89%
ESBN036120-D-P-F15	18-75	36	0.47	±12	±0.6	15	88%
ESBN036150-D-P-F15	18-75	36	0.47	±15	±0.5	15	89%
ESBN036033-S-P-F20	18-75	36	0.62	3.3	6.1	20	89%
ESBN036050-S-P-F20	18-75	36	0.62	5	4	20	90%
ESBN036120-S-P-F20	18-75	36	0.63	12	1.7	20	88%
ESBN036150-S-P-F20	18-75	36	0.62	15	1.3	20	89%
ESBN036120-D-P-F20	18-75	36	0.63	±12	±0.8	20	88%
ESBN036150-D-P-F20	18-75	36	0.62	±15	±0.7	20	89%
ESBN110033-S-P-F10	40-160	110	0.10	3.3	3	10	87%
ESBN110050-S-P-F10	40-160	110	0.10	5	2	10	88%
ESBN110120-S-P-F10	40-160	110	0.10	12	0.8	10	87%
ESBN110150-S-P-F10	40-160	110	0.10	15	0.7	10	88%
ESBN110050-D-P-F10	40-160	110	0.11	±5	±1.0	10	84%
ESBN110120-D-P-F10	40-160	110	0.10	±12	±0.4	10	87%
ESBN110150-D-P-F10	40-160	110	0.10	±15	±0.3	10	88%
ESBN110033-S-P-F15	40-160	110	0.15	3.3	4.5	15	88%
ESBN110050-S-P-F15	40-160	110	0.15	5	3	15	89%
ESBN110120-S-P-F15	40-160	110	0.15	12	1.3	15	88%
ESBN110150-S-P-F15	40-160	110	0.15	15	1	15	89%
ESBN110050-D-P-F15	40-160	110	0.16	±5	±1.5	15	85%
ESBN110120-D-P-F15	40-160	110	0.15	±12	±0.6	15	88%
ESBN110150-D-P-F15	40-160	110	0.15	±15	±0.5	15	89%
ESBN110033-S-P-F20	40-160	110	0.21	3.3	6.1	20	88%
ESBN110050-S-P-F20	40-160	110	0.20	5	4	20	89%
ESBN110120-S-P-F20	40-160	110	0.21	12	1.7	20	88%
ESBN110150-S-P-F20	40-160	110	0.20	15	1.3	20	89%
ESBN110120-D-P-F20	40-160	110	0.21	±12	±0.8	20	88%
ESBN110150-D-P-F20	40-160	110	0.20	±15	±0.7	20	89%

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Model Selection Guide

Typical @ Ta=+25 ℃ 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-F10	18-36	24	0.47	3.3	3	10	88%
ESBN024050-S-P-F10	18-36	24	0.47	5	2	10	89%
ESBN024120-S-P-F10	18-36	24	0.47	12	0.8	10	88%
ESBN024150-S-P-F10	18-36	24	0.47	15	0.7	10	89%
ESBN024050-D-P-F10	18-36	24	0.49	±5	±1.0	10	85%
ESBN024120-D-P-F10	18-36	24	0.47	±12	±0.4	10	88%
ESBN024150-D-P-F10	18-36	24	0.47	±15	±0.3	10	88%
ESBN024033-S-P-F15	18-36	24	0.70	3.3	4.5	15	89%
ESBN024050-S-P-F15	18-36	24	0.69	5	3	15	90%
ESBN024120-S-P-F15	18-36	24	0.70	12	1.3	15	89%
ESBN024150-S-P-F15	18-36	24	0.70	15	1	15	89%
ESBN024050-D-P-F15	18-36	24	0.73	±5	±1.5	15	86%
ESBN024120-D-P-F15	18-36	24	0.70	±12	±0.6	15	89%
ESBN024150-D-P-F15	18-36	24	0.70	±15	±0.5	15	89%
ESBN024033-S-P-F20	18-36	24	0.94	3.3	6.1	20	89%
ESBN024050-S-P-F20	18-36	24	0.93	5	4	20	90%
ESBN024120-S-P-F20	18-36	24	0.94	12	1.7	20	89%
ESBN024150-S-P-F20	18-36	24	0.94	15	1.3	20	89%
ESBN024120-D-P-F20	18-36	24	0.94	±12	±0.8	20	89%
ESBN024150-D-P-F20	18-36	24	0.94	±15	±0.7	20	89%
ESBN048033-S-P-F10	36-75	48	0.24	3.3	3	10	88%
ESBN048050-S-P-F10	36-75	48	0.23	5	2	10	89%
ESBN048120-S-P-F10	36-75	48	0.24	12	0.8	10	88%
ESBN048150-S-P-F10	36-75	48	0.23	15	0.7	10	89%
ESBN048050-D-P-F10	36-75	48	0.25	±5	±1.0	10	85%
ESBN048120-D-P-F10	36-75	48	0.24	±12	±0.4	10	88%
ESBN048150-D-P-F10	36-75	48	0.24	±15	±0.3	10	88%
ESBN048033-S-P-F15	36-75	48	0.35	3.3	4.5	15	89%
ESBN048050-S-P-F15	36-75	48	0.35	5	3	15	90%
ESBN048120-S-P-F15	36-75	48	0.35	12	1.3	15	89%
ESBN048150-S-P-F15	36-75	48	0.35	15	1	15	89%
ESBN048050-D-P-F15	36-75	48	0.36	±5	±1.5	15	86%
ESBN048120-D-P-F15	36-75	48	0.35	±12	±0.6	15	89%
ESBN048150-D-P-F15	36-75	48	0.35	±15	±0.5	15	89%
ESBN048033-S-P-F20	36-75	48	0.47	3.3	6.1	20	89%
ESBN048050-S-P-F20	36-75	48	0.46	5	4	20	90%
ESBN048120-S-P-F20	36-75	48	0.47	12	1.7	20	89%
ESBN048150-S-P-F20	36-75	48	0.47	15	1.3	20	89%
ESBN048120-D-P-F20	36-75	48	0.47	±12	±0.8	20	89%
ESBN048150-D-P-F20	36-75	48	0.47	±15	±0.7	20	89%

※ Modification or customized design is available. Please contact us for detail.

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	ESCN012&18&24 Models (100ms max)			50	VDC
	ESCN036&48 Models (100ms max)			80	
	ESCN110 Models (100ms max)			180	
Operating Input Voltage Ranges	ESC012&18 Models	9	18	36	VDC
	ESC024 Models	18	24	36	
	ESC036 Models	18	36	75	
	ESC048 Models	36	48	75	
	ESC110 Models	40	110	160	
Under-Voltage Lockout Start Up Voltage	ESC012&18 Models		8.5	9	VDC
	ESC024 Models		17.5	18	
	ESC036 Models		17.5	18	
	ESC048 Models		35	36	
	ESC110 Models		38	40	
Under-Voltage Lockout Shutdown Voltage	ESC012&18 Models	7	8		VDC
	ESC024 Models	16	17		
	ESC036 Models	16	17		
	ESC048 Models	32	34		
	ESC110 Models	35	37		
Enable Function Input	Positive Logic ON	Open or 8 ~ 20			VDC
	Positive Logic OFF	Short or 0 ~ 1.2			
	Negative Logic ON	Short or 0 ~ 1.2			VDC
	Negative Logic OFF	Open or 8 ~ 20			
Input Filter	All Models	Built-in PI Filter			

Output Specifications

Parameter	Notes and Conditions		Min.	Typ	Max.	Unit
Output Voltage Accuracy	V_{NOM} 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 With 1uFMLCC.Output Capacitor Each Output	3.3V&5V			100	mVp-p
		All others		1	1.5	$\%V_{pk-pk}$
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_{NOM} 10% Load			±10		%
Over Voltage Protection	V_{NOM} 10% Load			120		%
Output Power Protection	V_{NOM} (Current limit / Hiccup Mode)			120		%

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1" x 1" Converter Power range 10- 30W

General Specifications

Parameter	Notes and Conditions	Min.	Typ	Max.	Unit
Switching Frequency	V_{NOM}	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 (Metal Case –Flat)	11(Vertical)			˚C/Watt
		13(horizontal)			
Isolation Voltage	All Models, 1 Minute	1600			VDC
Input to Output		2000			
Isolation Resistance Input to Output	All Models, 500VDC,At 70%RH	100			MΩ
Isolation Capacitance 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 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 (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 (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 Aluminum + Metal Base (Full Metal Case)			
	Shape-P (Heat Sink)				
Potting Material		Silicone			

Standards Compliance

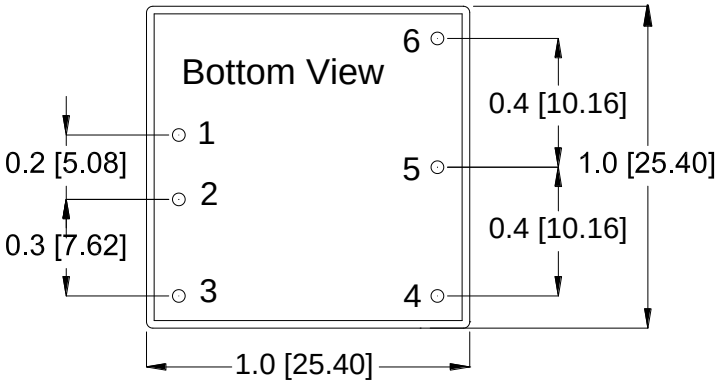
Parameter	Standard	Test Conditions	Performance Criteria
Environmental Compliance	Reach; RoHS		PASS
EMI	EN55022		Class A / Class B
ESD	EN61000-4-2	±4 kV Air Discharge ±4 kV Contact Discharge	Crit. A
Radiated Immunity	EN61000-4-3	Level 2, 3 V/m	Crit. A
Fast Transient	EN61000-4-4	±2 kV Applied	Crit. A
Surge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

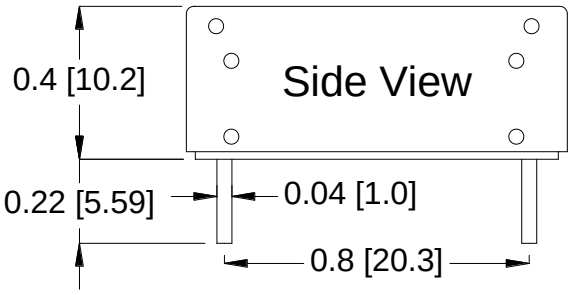
It is recommended to protect the input by fuses or other protection devices.

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

Mechanical Dimensions

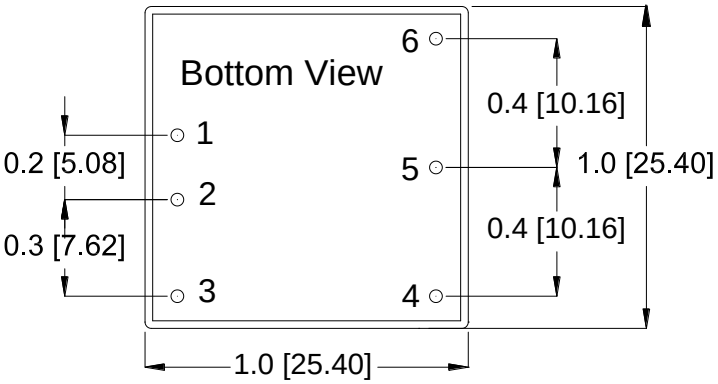
Shape –F

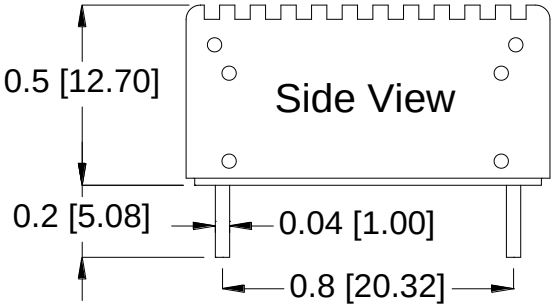




(Metal Case –Flat) "Non-Conductive Base"

Shape –P (Heat Sink)





(Metal Case –Case Heat-Sink) "Non-Conductive Base"

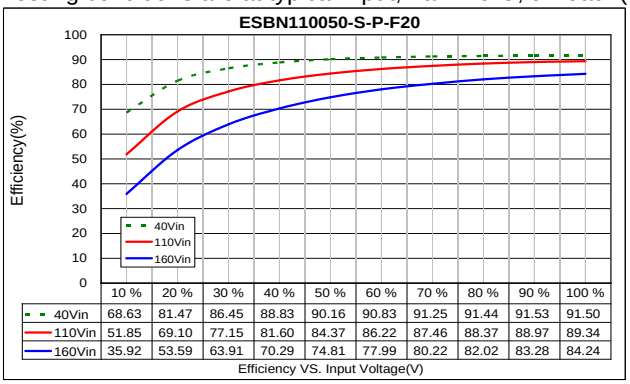
Pin Assignments:

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: ±0.01 [0.25]
Pin Dimensions: .XX±0.03 [.X±0.76mm]
Pin Material: Copper Alloy
Pin Plating: Gold
Dimensions in inches [mm]
Tolerances: .XX±0.02 [.X±0.5mm]
.XXX±0.001 [.X±0.025mm]

Characteristic Curves

Testing conditions are at typical input, Ta=+25˚C,full load (horizontal mount) Unless otherwise indicated



	10 %	20 %	30 %	40 %	50 %	60 %	70 %	80 %	90 %	100 %
40Vin	68.63	81.47	86.45	88.83	90.16	90.83	91.25	91.44	91.53	91.50
110Vin	51.85	69.10	77.15	81.60	84.37	86.22	87.46	88.37	88.97	89.34
160Vin	35.92	53.59	63.91	70.29	74.81	77.99	80.22	82.02	83.28	84.24

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

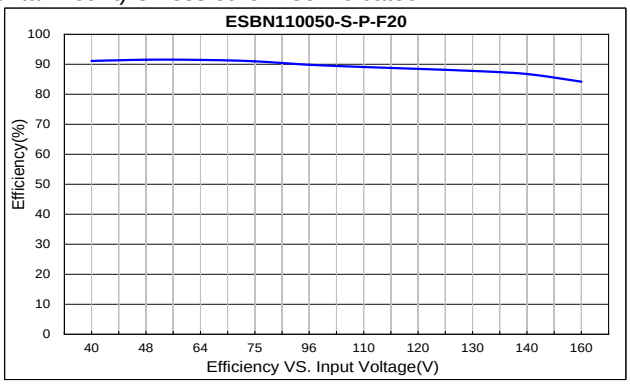


Figure 2: Efficiency VS. Input Voltagesat at 100% rated power

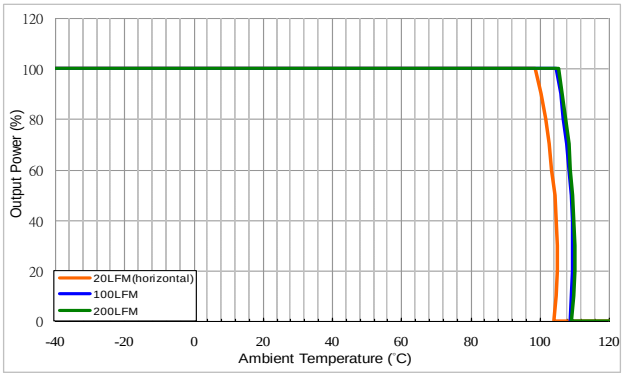


Figure 3: Ambient Temperature VS. Output Power Derating Curves

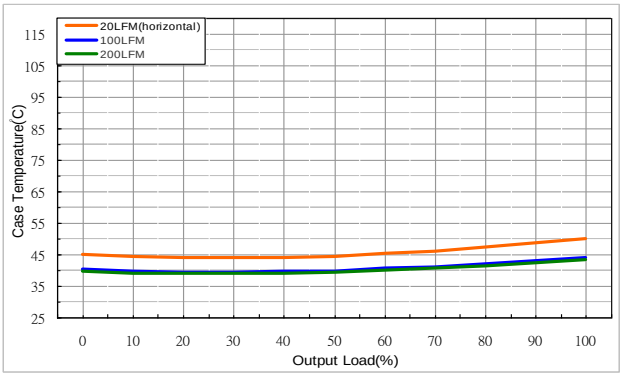


Figure 4: Case Temperature VS. Output rated Power

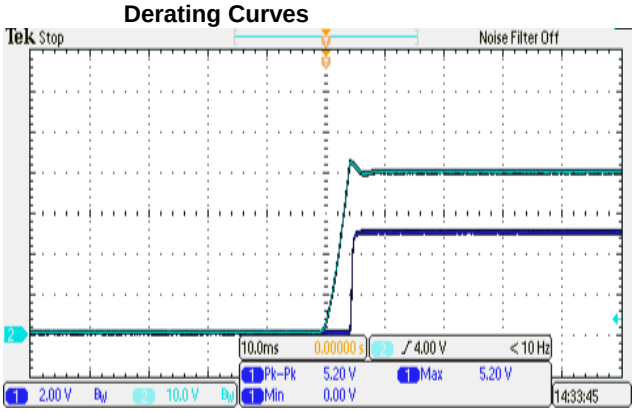


Figure 5: CH1 = Vout, CH2 = Nominal Input Typical Start-up waveform at Full load.

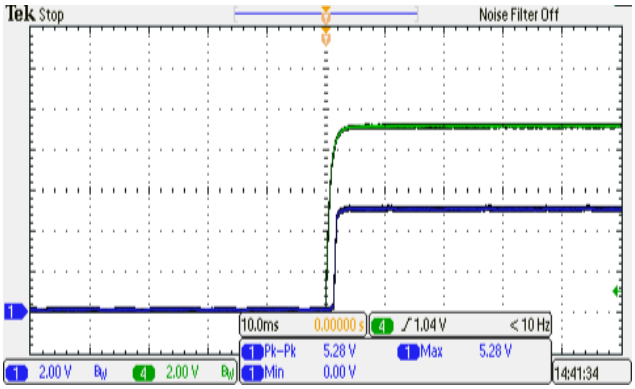


Figure 6: CH1 = Vout, CH4 = Enable Pin Typical Start-up waveform. Input voltage pre-applied

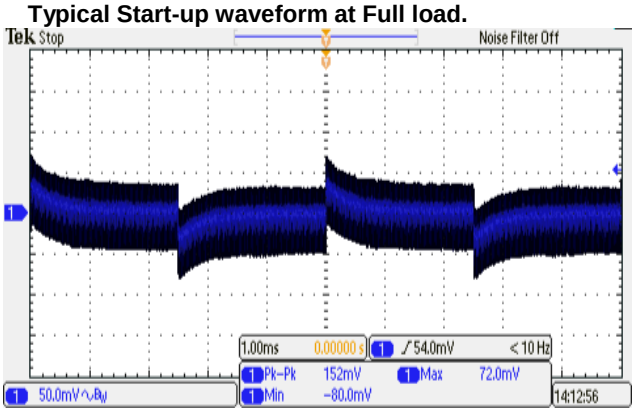


Figure 7: Transient Response at Output step load
(Vin: Typical ,50~75% of output current; ΔIo/Δt =0.01A/μS)

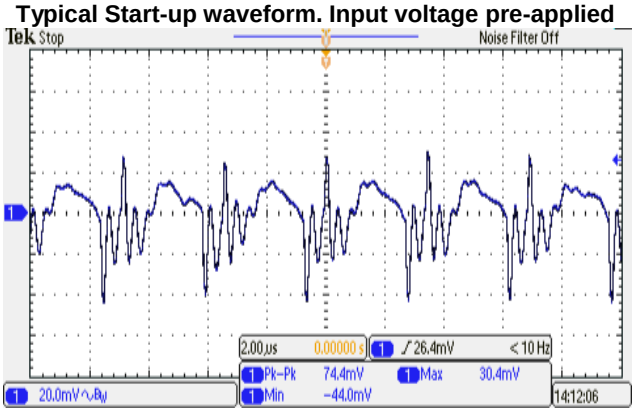
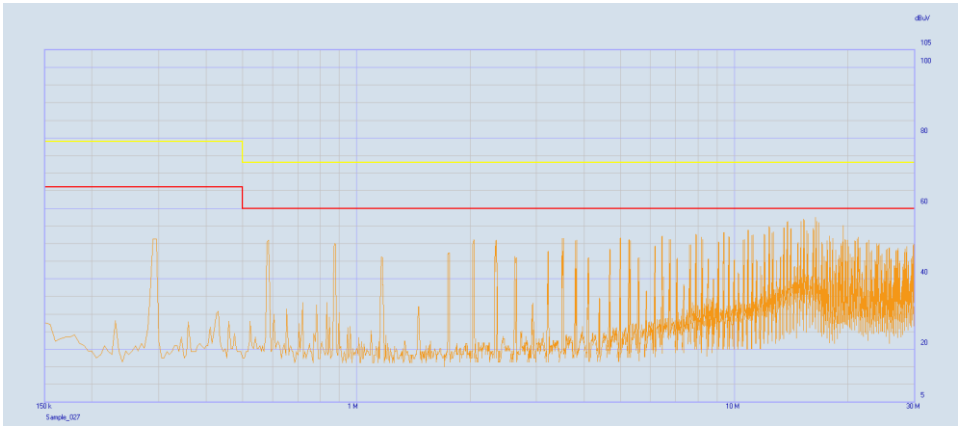


Figure 8: Output Voltage Ripple & Noise at full load.
(Vin: Typical, With Output Capacitor to add 1uF MLCC)

Conducted EMI Input terminal value (typ) ESBN110050-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.

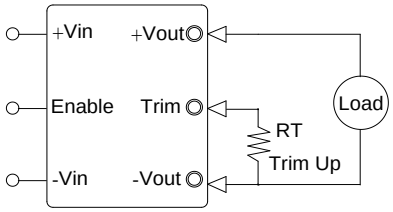


Figure 2. Trim Connections To increase Output Voltages Using Fixed Resistors

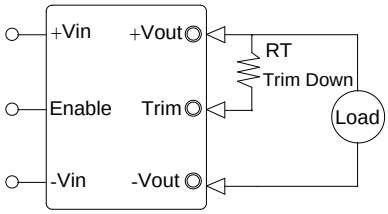


Figure 3. Trim Connections To Decrease Output Voltages Using Fixed Resistors

	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

	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.

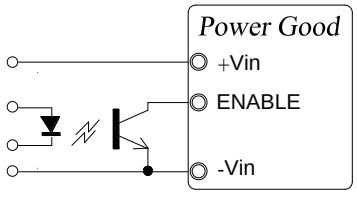


Figure 4. Driving the Enable Control pin

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.

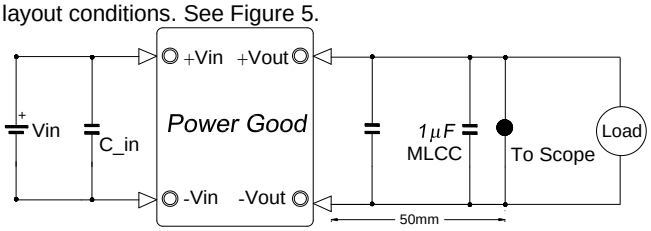


Figure 5. Measuring Output Ripple/Noise(20MHz bandwidth)