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

UVLO	OCP	OVP	OTP
ON/OFF Remote	EMC Filter Built-in	Class B EN 55022	2250VDC Isolation

Features

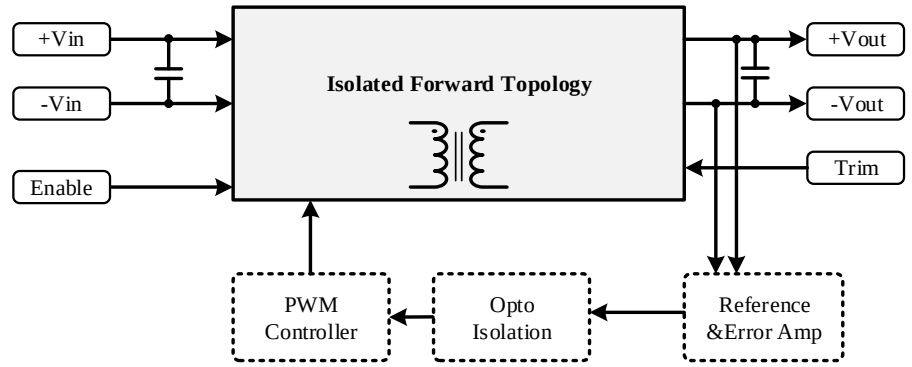
- **H**igh **F**fficiency up to **91%**
- **2:1 / 4:1 Ultra-Wide** input range
- Compact size – **1.6" x 1.0" x 0.4"**
  & 1.6" x 1.0" x 0.5"
- Standard DOSA pin out;
- **Fully replaceable** with 2"x1" standard case
- Metal Case Six-Sided Continuous Shield
- -40˚C to +70˚C operation without derating
- Save up to 20% board space
- Output current limit and short circuit protection
- No life-span constrained Capacitor inside
- **MTBF≥ 2,195,000 hours** @50˚C GB (BellCore TR-332)

Applications

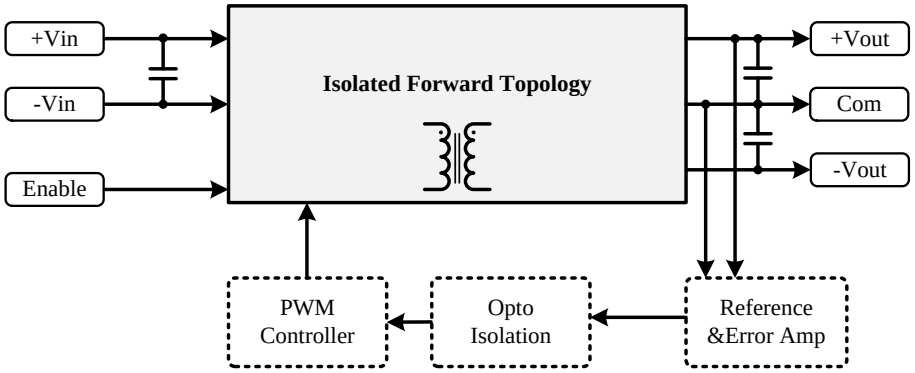
- Wireless Network
- Telecom / Datacom
- Industry Control System
- Distributed Power Architectures
- Semiconductor Equipment

Description

Evolving Sirius-Bishop series converter 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 six-sided metal case enclosed to provide protection from the harsh environments seen in many industrial and transportation applications



ESB Single Series Block Diagram



ESB Dual Series Block Diagram

MODEL NUMBER STRUCTURE

ESB	018	033	-	S	-	P	-	F	20V0
Series Name	**Input Voltage (VDC)**	**Output Voltage (VDC)**		**Output Quantity**		**Remote Control Option**		**Shape**	**Watt**
Evolving **S**irius- **B**ishop series –	**012 :** 9-18 **018** : 9-36 **024** : 18-36 **036** : 18-75 **048** : 36-75	**033** : 3.3 **050** : 5 **120** : 12 **150** : 15 **240** : 24		**S**: Single		**P**: Positive logic **N**: Negative logic **1**: Positive logic + EMC Filter **0**: Negative logic + EMC Filter		**F** : Flat **P** : PV	**15** **20** **30** **40**
		050 : ±5 **120** : ±12 **150** : ±15 **240** : ±24		**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.(%)
ESB012033-S-P-F15V0	9-18	12	1.40	3.3	4.5	15	89%
ESB012050-S-P-F15V0	9-18	12	1.39	5	3	15	90%
ESB012120-S-P-F15V0	9-18	12	1.42	12	1.3	15	88%
ESB012150-S-P-F15V0	9-18	12	1.42	15	1	15	88%
ESB012240-S-P-F15V0	9-18	12	1.42	24	0.7	15	88%
ESB012120-D-P-F15V0	9-18	12	1.42	±12	±0.63	15	88%
ESB012150-D-P-F15V0	9-18	12	1.42	±15	±0.5	15	88%
ESB012240-D-P-F15V0	9-18	12	1.42	±24	±0.3	15	88%
ESB012033-S-P-F20V0	9-18	12	1.87	3.3	6	20	89%
ESB012050-S-P-F20V0	9-18	12	1.85	5	4	20	90%
ESB012120-S-P-F20V0	9-18	12	1.89	12	1.7	20	88%
ESB012150-S-P-F20V0	9-18	12	1.89	15	1.3	20	88%
ESB012240-S-P-F20V0	9-18	12	1.89	24	0.8	20	88%
ESB012120-D-P-F20V0	9-18	12	1.89	±12	±0.8	20	88%
ESB012150-D-P-F20V0	9-18	12	1.89	±15	±0.7	20	88%
ESB012240-D-P-F20V0	9-18	12	1.89	±24	±0.4	20	88%
ESB024033-S-P-F15V0	18-36	24	0.70	3.3	4.5	15	89%
ESB024050-S-P-F15V0	18-36	24	0.69	5	3	15	90%
ESB024120-S-P-F15V0	18-36	24	0.70	12	1.3	15	89%
ESB024150-S-P-F15V0	18-36	24	0.70	15	1	15	89%
ESB024240-S-P-F15V0	18-36	24	0.70	24	0.7	15	89%
ESB024120-D-P-F15V0	18-36	24	0.70	±12	±0.7	15	89%
ESB024150-D-P-F15V0	18-36	24	0.70	±15	±0.5	15	89%
ESB024240-D-P-F15V0	18-36	24	0.70	±24	±0.3	15	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.(%)
ESB024033-S-P-F20V0	18-36	24	0.95	3.3	6	20	88%
ESB024050-S-P-F20V0	18-36	24	0.94	5	4	20	89%
ESB024120-S-P-F20V0	18-36	24	0.94	12	1.7	20	89%
ESB024150-S-P-F20V0	18-36	24	0.94	15	1.3	20	89%
ESB024240-S-P-F20V0	18-36	24	0.94	24	0.8	20	89%
ESB024120-D-P-F20V0	18-36	24	0.94	±12	±0.8	20	89%
ESB024150-D-P-F20V0	18-36	24	0.94	±15	±0.7	20	89%
ESB024240-D-P-F20V0	18-36	24	0.95	±24	±0.4	20	88%
ESB024033-S-P-F30V0	18-36	24	1.42	3.3	9.1	30	88%
ESB024050-S-P-F30V0	18-36	24	1.39	5	6	30	90%
ESB024120-S-P-F30V0	18-36	24	1.42	12	2.5	30	88%
ESB024150-S-P-F30V0	18-36	24	1.42	15	2	30	88%
ESB024240-S-P-F30V0	18-36	24	1.42	24	1.3	30	88%
ESB024120-D-P-F30V0	18-36	24	1.42	±12	±1.3	30	88%
ESB024150-D-P-F30V0	18-36	24	1.40	±15	±1.0	30	89%
ESB024240-D-P-F30V0	18-36	24	1.42	±24	±0.6	30	88%
ESB048033-S-P-F15V0	36-75	48	0.35	3.3	4.5	15	89%
ESB048050-S-P-F15V0	36-75	48	0.35	5	3	15	90%
ESB048120-S-P-F15V0	36-75	48	0.36	12	1.3	15	88%
ESB048150-S-P-F15V0	36-75	48	0.36	15	1	15	88%
ESB048240-S-P-F15V0	36-75	48	0.35	24	0.7	15	89%
ESB048120-D-P-F15V0	36-75	48	0.35	±12	±0.7	15	89%
ESB048150-D-P-F15V0	36-75	48	0.35	±15	±0.5	15	90%
ESB048240-D-P-F15V0	36-75	48	0.35	±24	±0.3	15	89%
ESB048033-S-P-F20V0	36-75	48	0.46	3.3	6	20	90%
ESB048050-S-P-F20V0	36-75	48	0.46	5	4	20	91%
ESB048120-S-P-F20V0	36-75	48	0.46	12	1.7	20	90%
ESB048150-S-P-F20V0	36-75	48	0.46	15	1.3	20	90%
ESB048240-S-P-F20V0	36-75	48	0.47	24	0.8	20	89%
ESB048120-D-P-F20V0	36-75	48	0.46	±12	±0.8	20	91%
ESB048150-D-P-F20V0	36-75	48	0.46	±15	±0.7	20	91%
ESB048240-D-P-F20V0	36-75	48	0.47	±24	±0.4	20	89%
ESB048050-S-P-F30V0	36-75	48	0.69	5	6	30	90%
ESB048120-S-P-F30V0	36-75	48	0.70	12	2.5	30	89%
ESB048150-S-P-F30V0	36-75	48	0.70	15	2	30	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.(%)
ESB018033-S-P-F15V0	9-36	18	0.95	3.3	4.5	15	88%
ESB018050-S-P-F15V0	9-36	18	0.94	5	3	15	89%
ESB018120-S-P-F15V0	9-36	18	0.95	12	1.3	15	88%
ESB018150-S-P-F15V0	9-36	18	0.95	15	1	15	88%
ESB018240-S-P-F15V0	9-36	18	0.95	24	0.7	15	88%
ESB018120-D-P-F15V0	9-36	18	0.95	±12	±0.7	15	88%
ESB018150-D-P-F15V0	9-36	18	0.95	±15	±0.5	15	88%
ESB018240-D-P-F15V0	9-36	18	0.96	±24	±0.3	15	87%
ESB018033-S-P-F20V0	9-36	18	1.26	3.3	6	20	88%
ESB018050-S-P-F20V0	9-36	18	1.25	5	4	20	89%
ESB018120-S-P-F20V0	9-36	18	1.26	12	1.7	20	88%
ESB018150-S-P-F20V0	9-36	18	1.26	15	1.3	20	88%
ESB018240-S-P-F20V0	9-36	18	1.26	24	0.8	20	88%
ESB018120-D-P-F20V0	9-36	18	1.26	±12	±0.8	20	88%
ESB018150-D-P-F20V0	9-36	18	1.26	±15	±0.7	20	88%
ESB018240-D-P-F20V0	9-36	18	1.28	±24	±0.4	20	87%
ESB018033-S-P-F25V0	9-36	18	1.60	3.3	7.6	25	87%
ESB018050-S-P-F25V0	9-36	18	1.56	5	5	25	89%
ESB018120-S-P-F25V0	9-36	18	1.58	12	2.1	25	88%
ESB018150-S-P-F25V0	9-36	18	1.58	15	1.7	25	88%
ESB018240-S-P-F25V0	9-36	18	1.58	24	1	25	88%
ESB018120-D-P-F25V0	9-36	18	1.58	±12	±1.0	25	88%
ESB018150-D-P-F25V0	9-36	18	1.58	±15	±0.8	25	88%
ESB018240-D-P-F25V0	9-36	18	1.60	±24	±0.5	25	87%
ESB036033-S-P-F15V0	18-75	36	0.48	3.3	4.5	15	87%
ESB036050-S-P-F15V0	18-75	36	0.47	5	3	15	89%
ESB036120-S-P-F15V0	18-75	36	0.47	12	1.3	15	88%
ESB036150-S-P-F15V0	18-75	36	0.47	15	1	15	88%
ESB036240-S-P-F15V0	18-75	36	0.47	24	0.7	15	88%
ESB036120-D-P-F15V0	18-75	36	0.47	±12	±0.7	15	88%
ESB036150-D-P-F15V0	18-75	36	0.47	±15	±0.5	15	88%
ESB036240-D-P-F15V0	18-75	36	0.48	±24	±0.3	15	87%
ESB036033-S-P-F20V0	18-75	36	0.64	3.3	6	20	87%
ESB036050-S-P-F20V0	18-75	36	0.62	5	4	20	89%
ESB036120-S-P-F20V0	18-75	36	0.63	12	1.7	20	88%
ESB036150-S-P-F20V0	18-75	36	0.63	15	1.3	20	88%
ESB036240-S-P-F20V0	18-75	36	0.63	24	0.8	20	88%
ESB036120-D-P-F20V0	18-75	36	0.63	±12	±0.8	20	88%
ESB036150-D-P-F20V0	18-75	36	0.63	±15	±0.7	20	88%
ESB036240-D-P-F20V0	18-75	36	0.64	±24	±0.4	20	87%

※ 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	ESB012 models (100ms max)			50	VDC
	ESB018 models (100ms max)			50	
	ESB024 models (100ms max)			50	
	ESB036 models (100ms max)			80	
	ESB048 models (100ms max)			80	
Operating Input Voltage Ranges	ESB012 models	9	18	36	VDC
	ESB018 models	9	18	36	
	ESB024 models	18	24	36	
	ESB036 models	18	36	75	
	ESB048 models	36	48	75	
Under-Voltage Lockout Start up Voltage	ESB012 models		8.5	9	VDC
	ESB018 models		8.5	9	
	ESB024 models		17.5	18	
	ESB036 models		17.5	18	
	ESB048 models		35	36	
Under-Voltage Lockout Shutdown Voltage	ESB012 models	7	8		VDC
	ESB018 models	7	8		
	ESB024 models	16	17		
	ESB036 models	16	17		
	ESB048 models	32	34		
Enable Function Input	Positive logic ON	Open or 4.5 ~ 5.5			VDC
	Positive logic OFF	Short or 0 ~ 1.2			
	Negative logic ON	Short or 0 ~ 1.2			VDC
	Negative logic OFF	Open or 4.5 ~ 5.5			
Input Filter	All models	Built-in PI or EMC 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 Capacitoreach output	3.3V&5V			100	m Vp-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)			120		%

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

Parameter	Notes and Conditions		Min.	Typ	Max.	Unit
Switching Frequency	V_{NOM}	2:1 wide	270	300	330	kHz
		4:1 wide	220	260	300	
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 (PV Metal Case)		7.2(Vertical)			°C/Watt
			7.8(horizontal)			
Isolation Voltage Input to Output	All models, 1 Minute		2250			VDC
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)		24(0.85)			g (oz.)
	Shape-P (Heat Sink)		28(1.0)			
Dimensions	Shape-F (Flat)		1.6” x 1.0” x 0.42” (40.64 x 25.4 x 10.7mm)			
	Shape-P (Heat Sink)		1.6” x 1.0” x 0.52” (40.64x 25.4 x 13.2mm)			
Case Material	Six-Sided Continuous Shield		Aluminum			
Potting Material			Silicone			

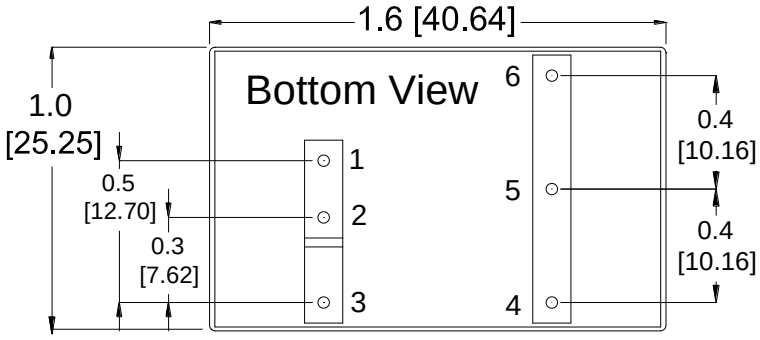
Standards Compliance

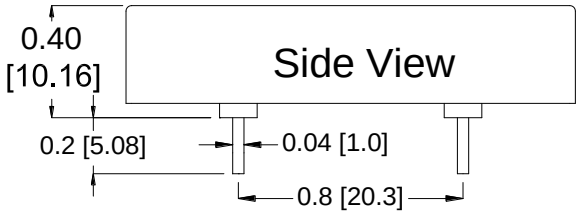
Parameter	Standard	Test Conditions	Performance Criteria
Environmental Compliance	Reach; RoHS		PASS
EMI	EN55022		Class B
ESD	EN61000-4-2	±4 kV Air Discharge ±4 kV Contact Discharge	Crit. A
Radiated Immunity	EN61000-4-3	Level 2, 3 V/m	Crit. A
Fast Transient	EN61000-4-4	±2 kV Applied	Crit. A
Surge	EN61000-4-5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

Mechanical Drawing & Pin Assignments:

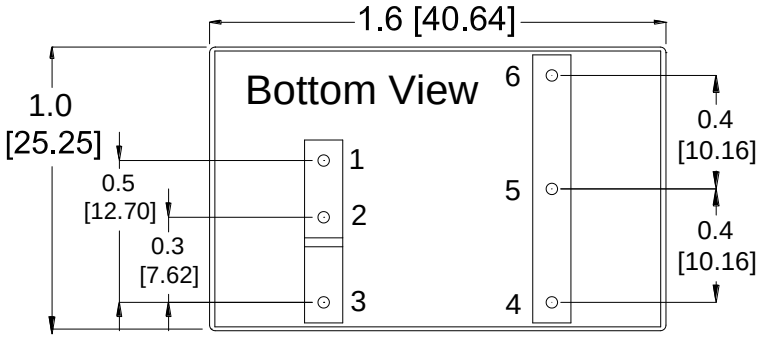
Suffix –F

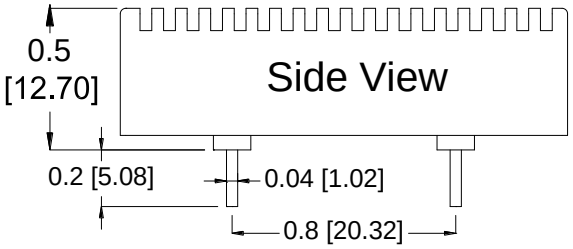




(Metal Case –Flat)

Suffix –P





(Metal case shell with 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: ±0.01 [0.25]
Pin Dimensions: .XX±0.02 [.X±0.5mm]
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

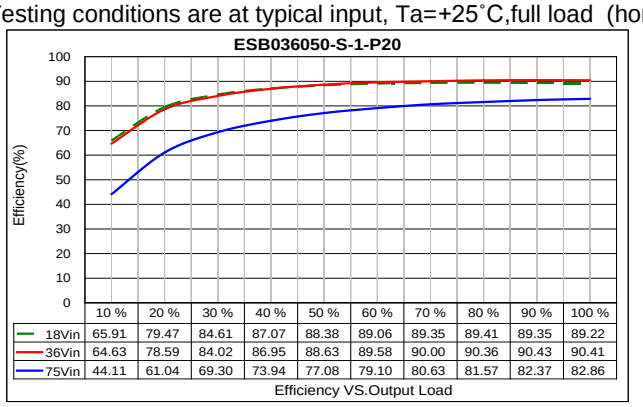


Figure 1:Efficiency at Minimum, Nominal and Maximum Input voltages VS. output load.

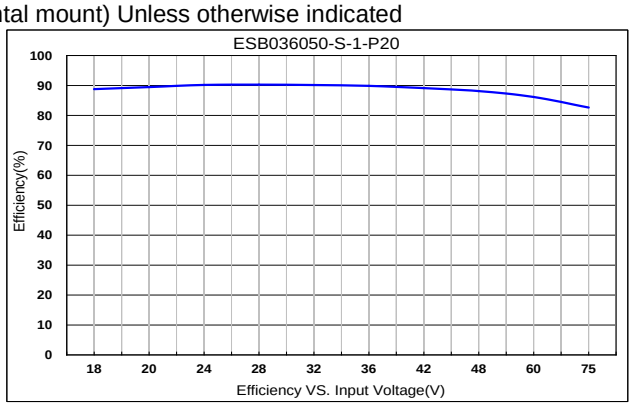


Figure 2: Efficiency VS. Input Voltagesat at 100% rated power

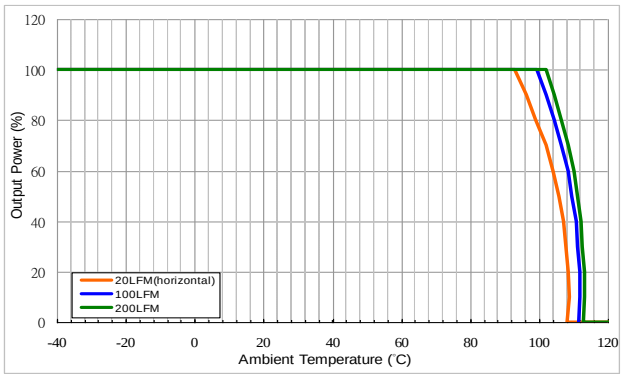


Figure 3: Ambient Temperature VS. Output Power Derating Curves

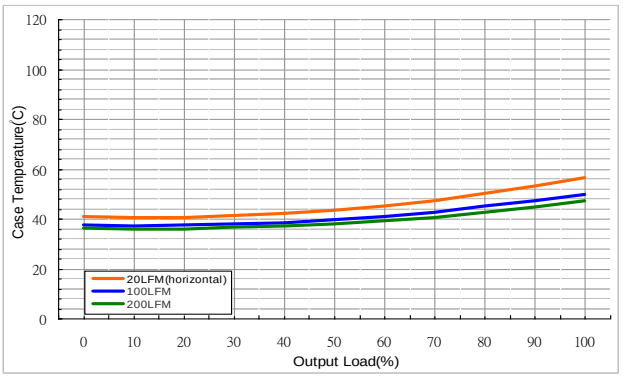


Figure 4: Case Temperature VS. Output rated Power

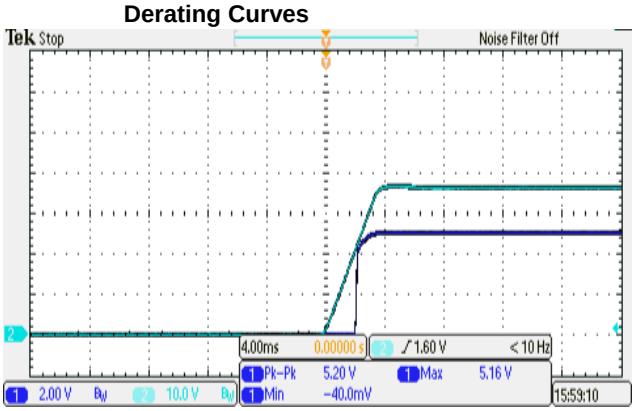


Figure 5: CH1 = Vout, CH2 = Nominal Input Typical Start-up waveform at Full load.

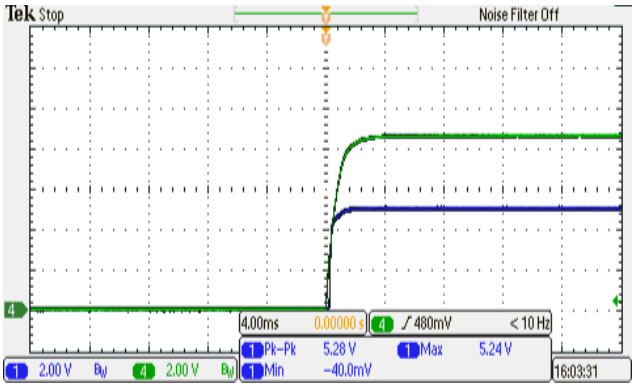


Figure 6: CH1 = Vout, CH4 = Enable Pin Typical Start-up waveform. Input voltage pre-applied

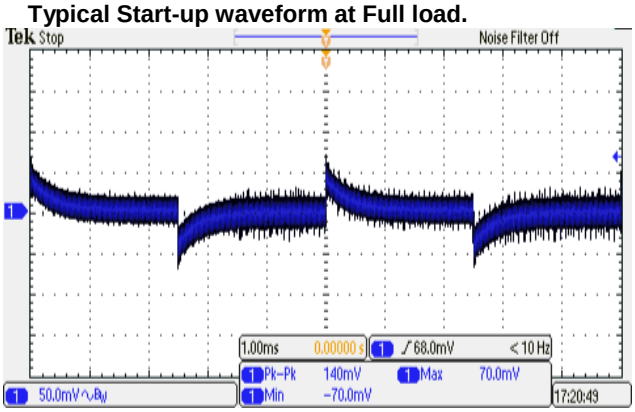


Figure 7: Transient Response at Output step load
(Vin: Typical ,50~75% of output current; ΔIo/Δt =0.01A/μS)

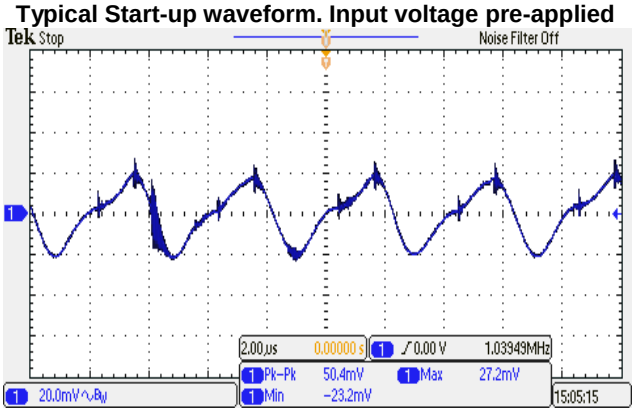
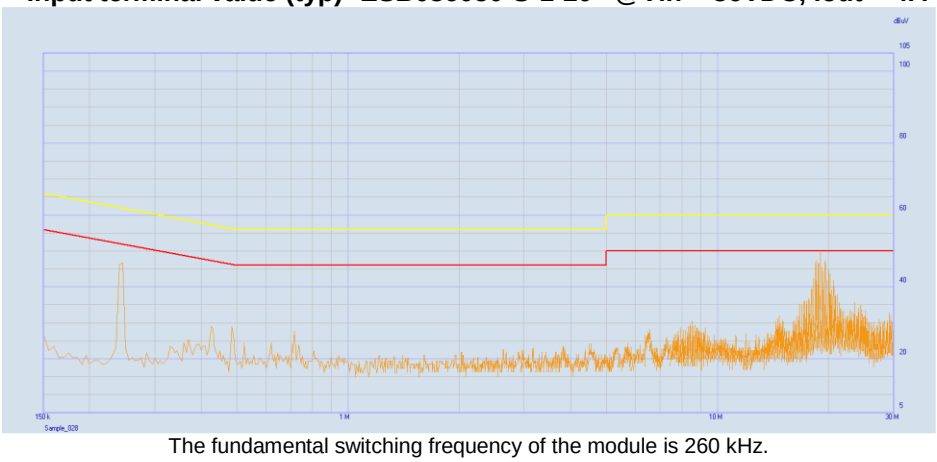


Figure 8: Output Voltage Ripple & Noise at full load.
(Vin: Typical, With Output Capacitor to add 1uF MLCC)

Conducted EMI Input terminal value (typ) ESB036050-S-1-20 @Vin = 36VDC, 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.

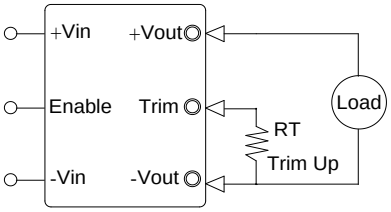


Figure 2. Trim Connections To increase Output Voltages Using Fixed Resistors

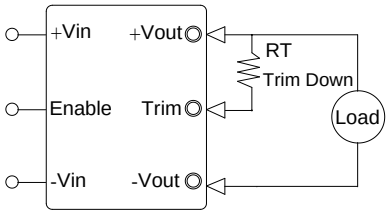


Figure 3. Trim Connections To Decrease Output Voltages Using Fixed Resistors

	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.

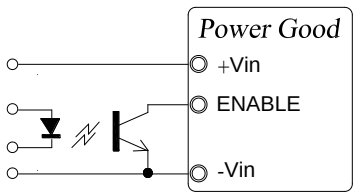


Figure 4. Driving the Enable Control pin

Output Ripple Noise

In Figure 5, the two copper strips simulate real-world PCB impedances between the converter and its load. Scope measuremen should be made using BNC connectors or the probe ground shouldbe less than 1/2 inch and soldered directly to the fixture. All external capacitors should have appropriate voltage ratings and b 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.

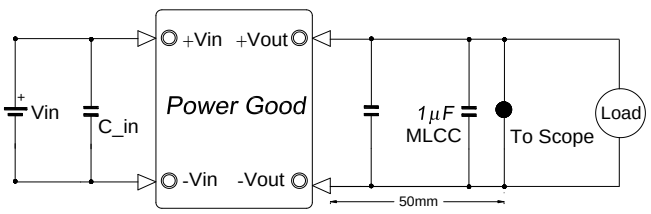


Figure 5. Measuring Output Ripple/Noise(20MHz bandwidth)