

Features

4:1 Wide Input Range

Operating Temperature Range: -40°C~105°C

Approved to UKCA, CE, cURus, TUV

Safety Standards to IEC/UL/EN62368-1

Efficiency up to 88%

EMC meets EN 55022 class B and FCC Level B

Single & Dual output 5~24V DC



28ESBxy-x-x-x30-IP Series DC/DC PCB Mount Power Supply



Certified to UKCA, CE, cURus, RoHS, REACH & EN 62368-1/IEC 62368-1/UL 62368-1/EN 50155 Standards and complies with Efficiency Regulations. These are primarily used in ITE, Audio & Video, Railway Industries and customised solutions are available upon request.

Part Number Structure

28ESB	-	018	033	-	S	-	P	-	F	30
Series Name		Input Voltage (VDC)	Output Voltage (VDC)		Output Quantity		Remote control option		Shape	Watt
Evolving		012 : 9-18	033 : 3.3				P: Positive logic		F : Flat	15
Sirius		018 : 9-36	050 : 5		S : single		N: Negative logic		P : Groove	20
Bishop series		024 : 18-36	120 : 12						Cover	25
		036 : 18-75	150 : 15							30
		048 : 36-75	240 : 24							
			120 : ±12				1 : Positive logic			
		150 : ±15			D : Dual	+ EMC Filter				
		240 : ±24				0 : Negative logic				
						+ EMC Filter				

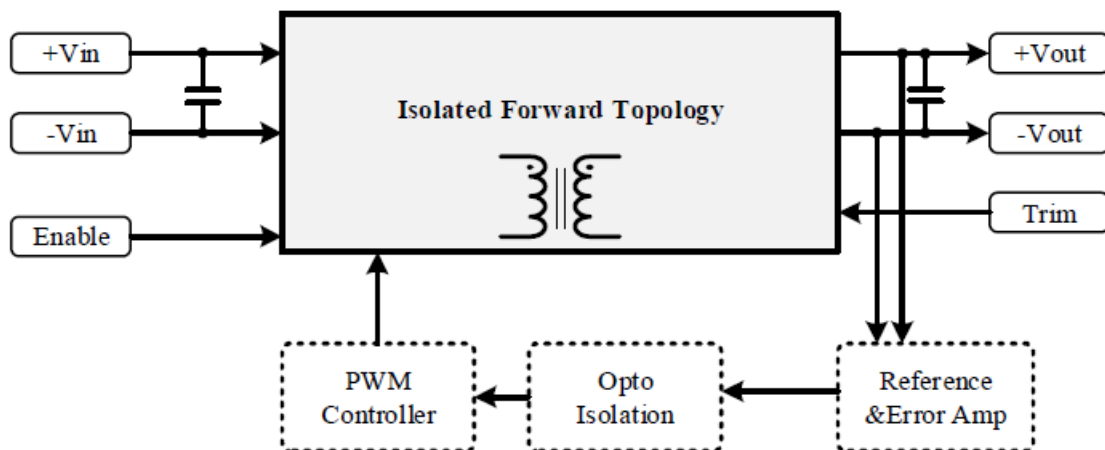
Models							
Model	Input			Output			Efficiency Typ.(%)
	Voltage (V) Range	Nominal	Current (A) Full load	Voltage (V)	Current (A)	Power (W)	
28ESB012033-S-□-□50-IP	9-18	12	1.40	3.3	4.5	15	89
28ESB012050-S-□-□50-IP	9-18	12	1.39	5	3	15	90
28ESB012120-S-□-□50-IP	9-18	12	1.42	12	1.3	15	88
28ESB012150-S-□-□50-IP	9-18	12	1.42	15	1	15	88
28ESB012240-S-□-□50-IP	9-18	12	1.42	24	0.7	15	88
28ESB012120-D-□-□50-IP	9-18	12	1.42	±12	±0.63	15	88
28ESB012150-D-□-□50-IP	9-18	12	1.42	±15	±0.5	15	88
28ESB012240-D-□-□50-IP	9-18	12	1.42	±24	±0.3	15	88
28ESB012033-S-□-□20-IP	9-18	12	1.87	3.3	6	20	89
28ESB012050-S-□-□20-IP	9-18	12	1.85	5	4	20	90
28ESB012120-S-□-□20-IP	9-18	12	1.89	12	1.7	20	88
28ESB012150-S-□-□20-IP	9-18	12	1.89	15	1.3	20	88
28ESB012240-S-□-□20-IP	9-18	12	1.89	24	0.8	20	88
28ESB012120-D-□-□20-IP	9-18	12	1.89	±12	±0.8	20	88
28ESB012150-D-□-□20-IP	9-18	12	1.89	±15	±0.7	20	88
28ESB012240-D-□-□20-IP	9-18	12	1.89	±24	±0.4	20	88
28ESB018033-S-□-□50-IP	9-36	18	0.95	3.3	4.5	15	88
28ESB018050-S-□-□50-IP	9-36	18	0.94	5	3	15	89
28ESB018120-S-□-□50-IP	9-36	18	0.95	12	1.3	15	88
28ESB018150-S-□-□50-IP	9-36	18	0.95	15	1	15	88
28ESB018240-S-□-□50-IP	9-36	18	0.95	24	0.7	15	88
28ESB018120-D-□-□50-IP	9-36	18	0.95	±12	±0.7	15	88
28ESB018150-D-□-□50-IP	9-36	18	0.95	±15	±0.5	15	88
28ESB018240-D-□-□50-IP	9-36	18	0.96	±24	±0.3	15	87
28ESB018033-S-□-□20-IP	9-36	18	1.26	3.3	6	20	88
28ESB018050-S-□-□20-IP	9-36	18	1.25	5	4	20	89
28ESB018120-S-□-□20-IP	9-36	18	1.26	12	1.7	20	88
28ESB018150-S-□-□20-IP	9-36	18	1.26	15	1.3	20	88
28ESB018240-S-□-□20-IP	9-36	18	1.26	24	0.8	20	88
28ESB018120-D-□-□20-IP	9-36	18	1.26	±12	±0.8	20	88
28ESB018150-D-□-□20-IP	9-36	18	1.26	±15	±0.7	20	88
28ESB018240-D-□-□20-IP	9-36	18	1.28	±24	±0.4	20	87
28ESB018033-S-□-□25-IP	9-36	18	1.60	3.3	7.6	25	87
28ESB018050-S-□-□25-IP	9-36	18	1.56	5	5	25	89
28ESB018120-S-□-□25-IP	9-36	18	1.58	12	2.1	25	88
28ESB018150-S-□-□25-IP	9-36	18	1.58	15	1.7	25	88
28ESB018240-S-□-□25-IP	9-36	18	1.58	24	1	25	88
28ESB018120-D-□-□25-IP	9-36	18	1.58	±12	±1.0	25	88
28ESB018150-D-□-□25-IP	9-36	18	1.58	±15	±0.8	25	88
28ESB018240-D-□-□25-IP	9-36	18	1.60	±24	±0.5	25	87
28ESB024033-S-□-□50-IP	18-36	24	0.70	3.3	4.5	15	89
28ESB024050-S-□-□50-IP	18-36	24	0.69	5	3	15	90
28ESB024120-S-□-□50-IP	18-36	24	0.70	12	1.3	15	89
28ESB024150-S-□-□50-IP	18-36	24	0.70	15	1	15	89
28ESB024240-S-□-□50-IP	18-36	24	0.70	24	0.7	15	89

28ESB024120-D-□-□50-IP	18-36	24	0.70	±12	±0.7	15	89
28ESB024150-D-□-□50-IP	18-36	24	0.70	±15	±0.5	15	89
28ESB024240-D-□-□50-IP	18-36	24	0.70	±24	±0.3	15	89
28ESB024033-S-□-□20-IP	18-36	24	0.95	3.3	6	20	88
28ESB024050-S-□-□20-IP	18-36	24	0.94	5	4	20	89
28ESB024120-S-□-□20-IP	18-36	24	0.94	12	1.7	20	89
28ESB024150-S-□-□20-IP	18-36	24	0.94	15	1.3	20	89
28ESB024240-S-□-□20-IP	18-36	24	0.94	24	0.8	20	89
28ESB024120-D-□-□20-IP	18-36	24	0.94	±12	±0.8	20	89
28ESB024150-D-□-□20-IP	18-36	24	0.94	±15	±0.7	20	89
28ESB024240-D-□-□20-IP	18-36	24	0.95	±24	±0.4	20	88
28ESB024033-S-□-□30-IP	18-36	24	1.42	3.3	9.1	30	88
28ESB024050-S-□-□30-IP	18-36	24	1.39	5	6	30	90
28ESB024120-S-□-□30-IP	18-36	24	1.42	12	2.5	30	88
28ESB024150-S-□-□30-IP	18-36	24	1.42	15	2	30	88
28ESB024240-S-□-□30-IP	18-36	24	1.42	24	1.3	30	88
28ESB024120-D-□-□30-IP	18-36	24	1.42	±12	±1.3	30	88
28ESB024150-D-□-□30-IP	18-36	24	1.40	±15	±1.0	30	89
28ESB024240-D-□-□30-IP	18-36	24	1.42	±24	±0.6	30	88
28ESB036033-S-□-□50-IP	18-75	36	0.48	3.3	4.5	15	87
28ESB036050-S-□-□50-IP	18-75	36	0.47	5	3	15	89
28ESB036120-S-□-□50-IP	18-75	36	0.47	12	1.3	15	88
28ESB036150-S-□-□50-IP	18-75	36	0.47	15	1	15	88
28ESB036240-S-□-□50-IP	18-75	36	0.47	24	0.7	15	88
28ESB036120-D-□-□50-IP	18-75	36	0.47	±12	±0.7	15	88
28ESB036150-D-□-□50-IP	18-75	36	0.47	±15	±0.5	15	88
28ESB036240-D-□-□50-IP	18-75	36	0.48	±24	±0.3	15	87
28ESB036033-S-□-□20-IP	18-75	36	0.64	3.3	6	20	87
28ESB036050-S-□-□20-IP	18-75	36	0.62	5	4	20	89
28ESB036120-S-□-□20-IP	18-75	36	0.63	12	1.7	20	88
28ESB036150-S-□-□20-IP	18-75	36	0.63	15	1.3	20	88
28ESB036240-S-□-□20-IP	18-75	36	0.63	24	0.8	20	88
28ESB036120-D-□-□20-IP	18-75	36	0.63	±12	±0.8	20	88
28ESB036150-D-□-□20-IP	18-75	36	0.63	±15	±0.7	20	88
28ESB036240-D-□-□20-IP	18-75	36	0.64	±24	±0.4	20	87
28ESB048033-S-□-□50-IP	36-75	48	0.35	3.3	4.5	15	89
28ESB048050-S-□-□50-IP	36-75	48	0.35	5	3	15	90
28ESB048120-S-□-□50-IP	36-75	48	0.36	12	1.3	15	88
28ESB048150-S-□-□50-IP	36-75	48	0.36	15	1	15	88
28ESB048240-S-□-□50-IP	36-75	48	0.35	24	0.7	15	89
28ESB048120-D-□-□50-IP	36-75	48	0.35	±12	±0.7	15	89
28ESB048150-D-□-□50-IP	36-75	48	0.35	±15	±0.5	15	90
28ESB048240-D-□-□50-IP	36-75	48	0.35	±24	±0.3	15	89
28ESB048033-S-□-□20-IP	36-75	48	0.46	3.3	6	20	90
28ESB048050-S-□-□20-IP	36-75	48	0.46	5	4	20	91
28ESB048120-S-□-□20-IP	36-75	48	0.46	12	1.7	20	90
28ESB048150-S-□-□20-IP	36-75	48	0.46	15	1.3	20	90
28ESB048240-S-□-□20-IP	36-75	48	0.47	24	0.8	20	89
28ESB048120-D-□-□20-IP	36-75	48	0.46	±12	±0.8	20	91
28ESB048150-D-□-□20-IP	36-75	48	0.46	±15	±0.7	20	91

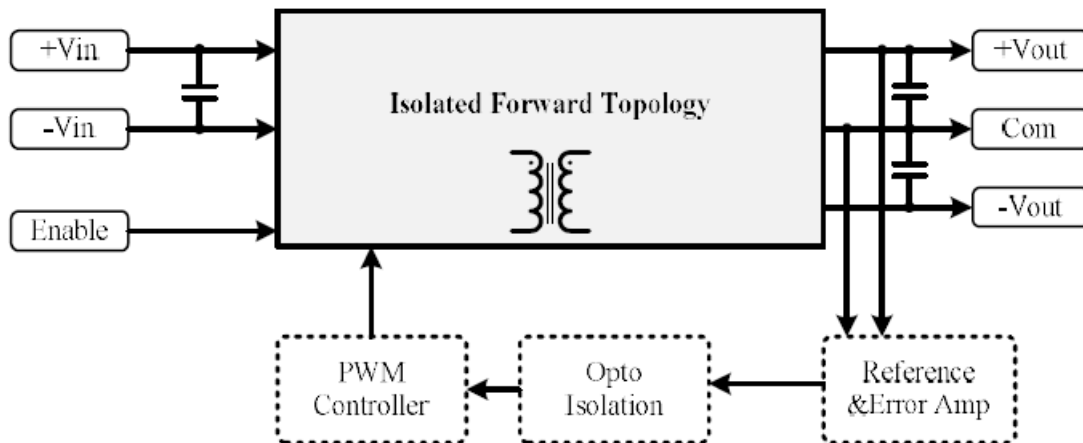
28ESB048240-D-□-□20-IP	36-75	48	0.47	±24	±0.4	20	89
28ESB048050-S-□-□30-IP	36-75	48	0.69	5	6	30	90
28ESB048120-S-□-□30-IP	36-75	48	0.70	12	2.5	30	89
28ESB048150-S-□-□30-IP	36-75	48	0.70	15	2	30	89

Description

Ideal Power **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 a six-sided metal case enclosed to provide protection from the harsh environments seen in many industrial and transportation applications.



28ESB Single Series Block Diagram



28ESB Dual Series Block Diagram

Input Data					
Parameter	Notes and Conditions	Min.	Typ.	Max.	Unit
Transient Input Voltage Ranges	28ESB012 models (100ms max)			50	VDC
	28ESB018 models (100ms max)			50	
	28ESB024 models (100ms max)	--	--	50	
	28ESB036 models (100ms max)			80	
	28ESB048 models (100ms max)			80	
Operating Input Voltage Ranges	28ESB012 models	9	12	18	VDC
	28ESB018 models	9	18	36	
	28ESB024 models	18	24	36	
	28ESB036 models	18	36	75	
	28ESB048 models	36	48	75	
Under-Voltage Lockout Start-up Voltage	28ESB012 models		8.5	9	VDC
	28ESB018 models		8.5	9	
	28ESB024 models	--	17.5	18	
	28ESB036 models		17.5	18	
	28ESB048 models		35	36	
Under-Voltage Lockout Shutdown Voltage	28ESB012 models	7	8		VDC
	28ESB018 models	7	8		
	28ESB024 models	16	17	--	
	28ESB036 models	16	17		
	28ESB048 models	32	34		
Input filter	All models, Built-in PI or EMC Filter				
Enable Function Input	Positive logic	ON OFF	Open or 4.5 ~ 5.5 Short or 0 ~ 1.2		
	Negative logic	ON OFF	Short or 0 ~ 1.2 Open or 4.5 ~ 5.5		

Output Data					
Parameter	Notes and Conditions	Min.	Typ.	Max.	Unit
Voltage Accuracy	VNOM 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	--	--	%
Ripple & Noise Voltage	Bandwidth 20MHz and with 1µF MLCC Output Capacitor each output	5V	--	--	2
	All others		--	1	1.5
Temperature Coefficient		--	--	+0.04	% / °C
Transient Recovery Time	25% load step change	--	800	--	µSec
Transient Peak Deviation	$\Delta I_o / \Delta t = 2.5A/\mu s$	--	--	+3	%Vo
Start-Up Time	When use Enable Function	--	20	--	mSec.
Trimming Output Protection	VNOM 10% Load	--	+10	--	%
Power Protection	VNOM 10% Load	--	120	--	%
Over Voltage Protection	VNOM (Current limit / Hiccup Mode)	--	120	--	%

General Specifications & Environmental Data

Parameter	Notes and Conditions	Min.	Typ.	Max.	Unit
Storage temperature range	All models	-55	--	125	C
Switching frequency	VNOM 2:1 wide 4:1	270	300	330	kHz
		220	260	300	
Operating case temperature	All models	-45	--	115	m
Over temperature protection	All models, Auto. Recovery	--	120	--	C
Thermal impedance	Natural convection (Flat)	7.8 (Vertical) 8.4 (horizontal)			°C/Watt
	Natural convection (Groove Cover)	7.2 (Vertical) 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	--	1.54	--	M HR
Thermal shock		MIL-STD-810F			
Vibration	Environmental Engineering Experimental Tests	MIL-STD-810F			
Drop		MIL-STD-810F			
Weight	Shape-B (Base Plate)	24 (0.85)			g (oz.)
	Shape-F (No Flange Base Plate)	28 (1.0)			
Dimensions	Shape-B (Base Plate)	1.60" x 1.00" x 0.40" (40.6 x 25.4 x 10.2mm)			
	Shape-F (No Flange Base Plate)	1.60" x 1.00" x 0.50" (40.6 x 25.4 x 12.7mm)			
Case Material	Six-Sided Continuous Shield	aluminium			
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

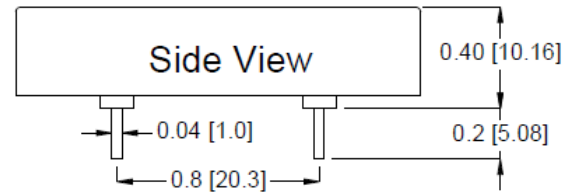
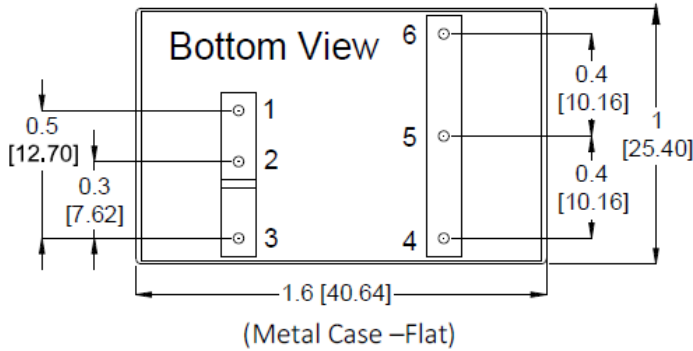
It is recommended to protect the input by fuses or other protection devices.

Modules could meet EN55032 Class A and Class B standard with external components.

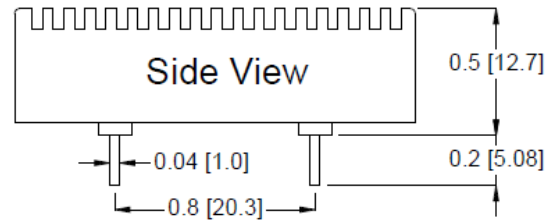
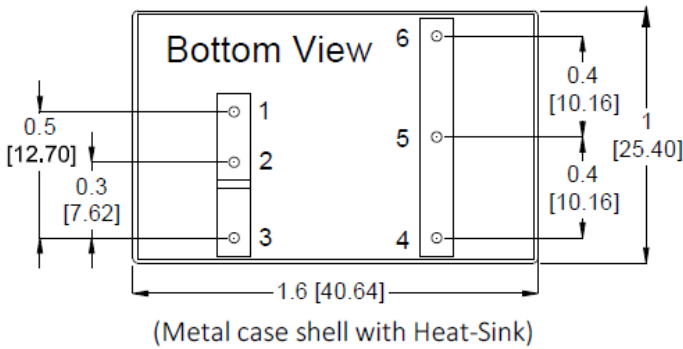
The information and specifications contained in this data sheet are believed to be correct at time of publication. All specifications are subject to change without notice. No rights under any patent accompany the sale of any such products or information contained herein.

Conducted EMI

Shape F



Shape P (Grove Cover/Heat Sink)

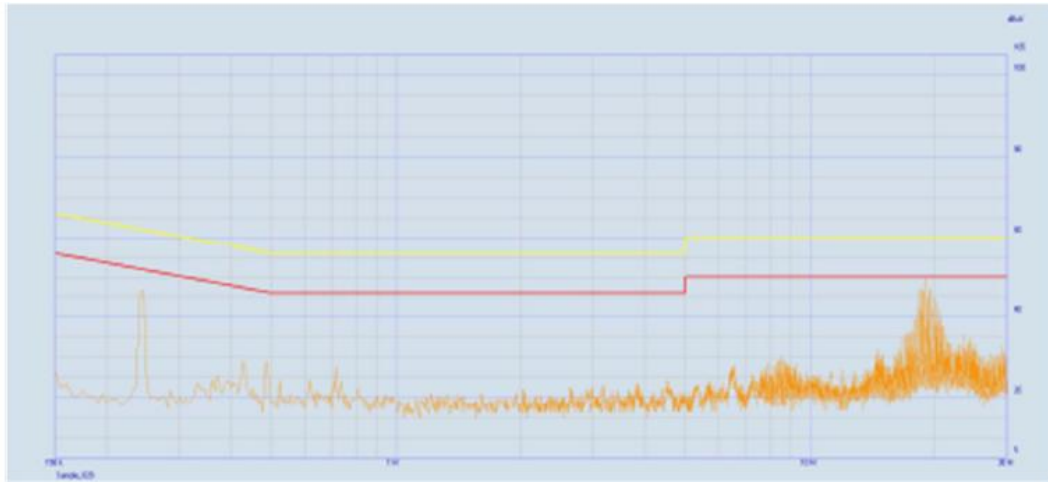


Pin#	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	Enable	Enable
4	-Vout	-Vout
5	Trim	Com
6	+Vout	+Vout

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

Conducted EMI

Input terminal value (typ.) 28ESB036050-S-1-P20-IP @Vin = 36VDC, Iout = 4A



The fundamental switching frequency of the module is 260 kHz.

Characteristic curves

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

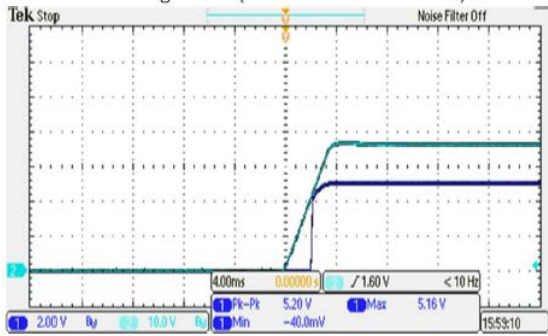


Figure 5 : CH1 = Vout, CH3 = Nominal Input
Typical Start-up waveform at Full load.

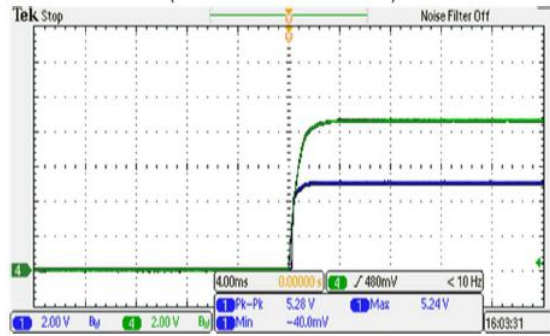


Figure 6 : CH1 = Vout, CH3 = Enable Pin
Typical Start-up waveform. Input voltage pre-applied

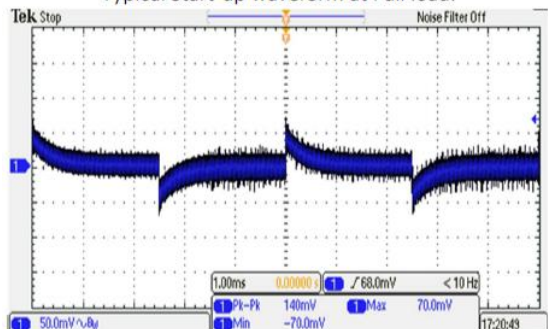


Figure 7 : Transient Response at Output step load
(V_{in} : Typical, 50~75% of output current; $\Delta I_o/\Delta t = 1\text{A}/\mu\text{s}$)

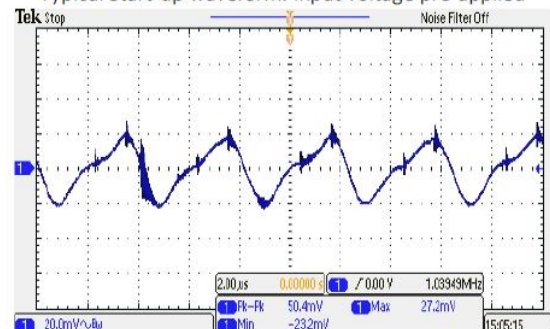


Figure 8 : Output Voltage Ripple & Noise at full load.
(V_{in} : Typical, With Output Capacitor to add 1uF MLCC)

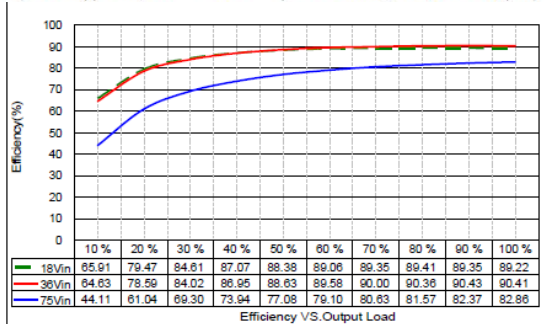


Figure 1 : Efficiency at Minimum, Nominal and Maximum Input voltages VS. Output load.

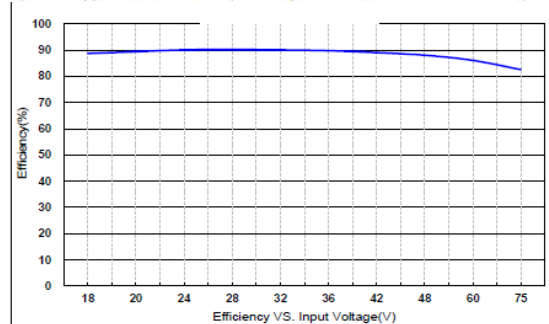


Figure 2 : Efficiency VS. Input Voltages at 100% rated power

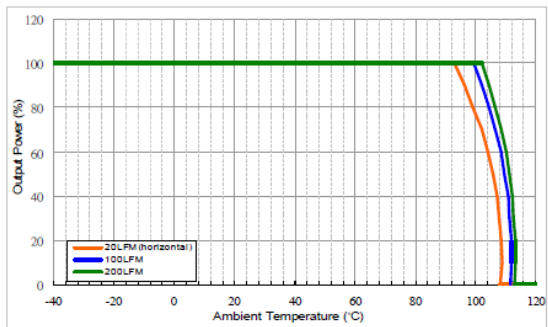


Figure 3 : Ambient Temperature VS. Output Power Derating Curves (Note: 20LFM = Free Air)

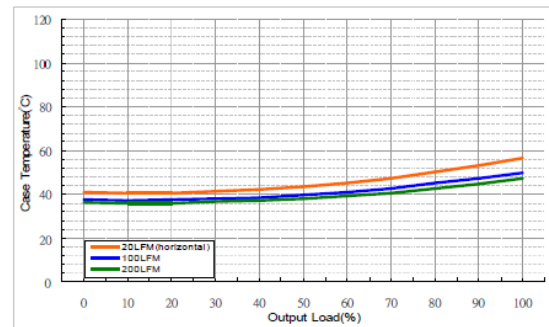


Figure 4 : Case Temperature VS. Output rated Power (Note: 20LFM = Free Air)

Characteristic curves

Testing conditions are at typical input, Ta=+25°C, full load (horizontal mount) Unless otherwise indicated. The figures of 28ESBS024W120-S-P-F30

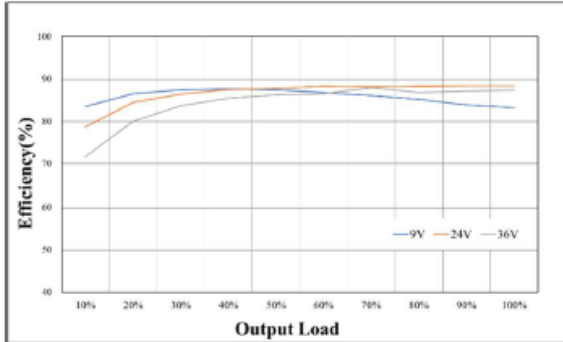


Figure 1 : Efficiency at Minimum, Nominal and Maximum Input voltages VS. Output load.

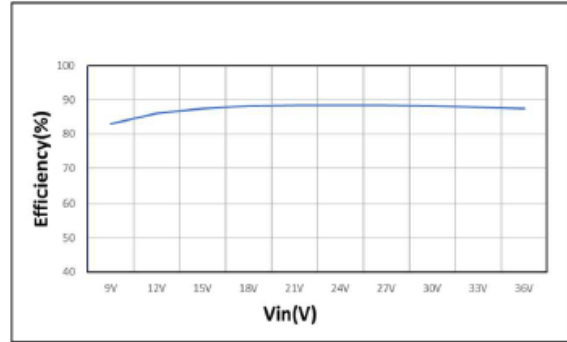


Figure 2 : Efficiency VS. Input Voltages at 100% rated power

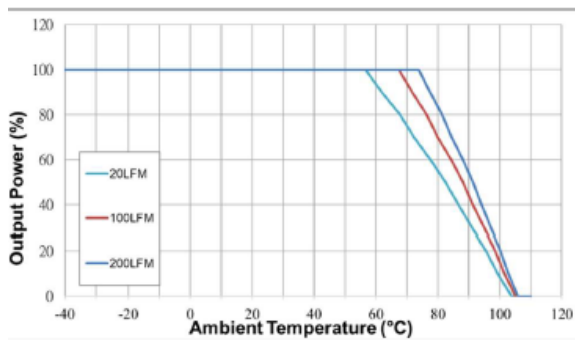


Figure 3 : Ambient Temperature VS. Output Power Derating Curves(Note: 20LFM = Free Air)

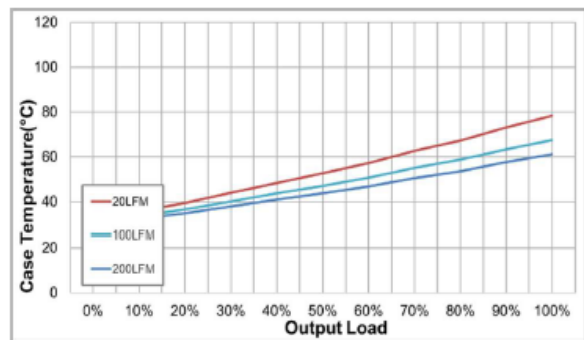


Figure 4 : Case Temperature VS. Output rated Power (Note: 20LFM = Free Air)

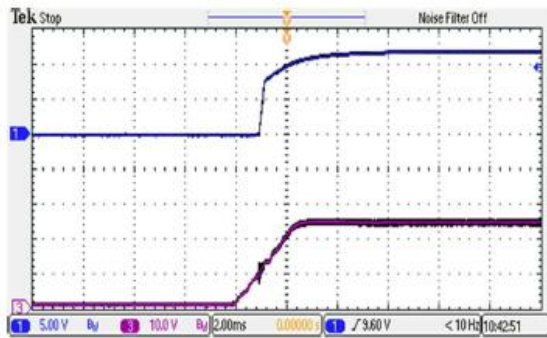


Figure 5 : CH1 = Vout, CH3 = Nominal Input Typical Start-up waveform at Full load.

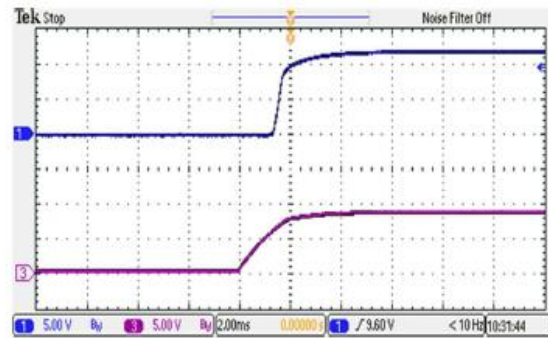


Figure 6 : CH1 = Vout, CH3 = Enable Pin Typical Start-up waveform. Input voltage pre-applied

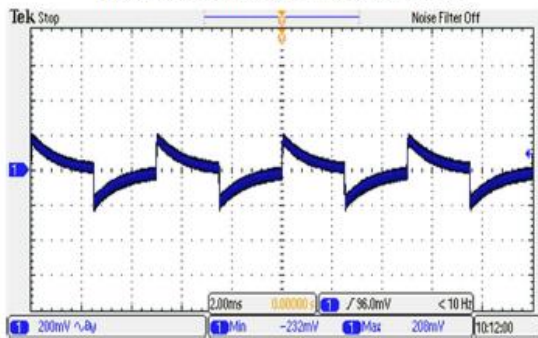


Figure 7 : Transient Response at Output step load (Vin: Typical ,50~75% of output current; $\Delta I_o/\Delta t = 1A/\mu s$)

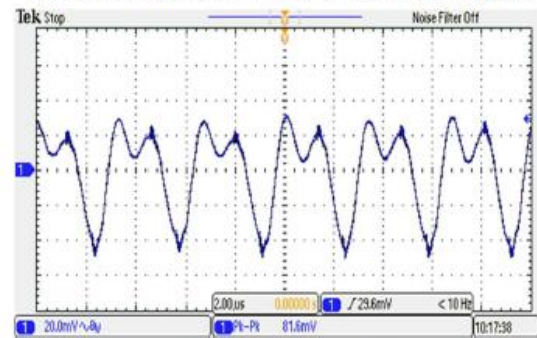


Figure 8 : Output Voltage Ripple & Noise at full load. (Vin: Typical, With Output Capacitor to add 10 μ F MLCC)

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 1 and 2. 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.

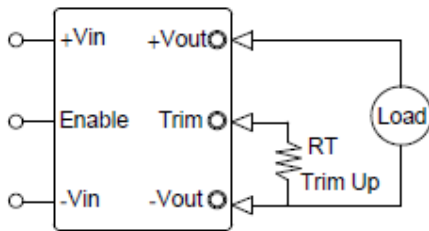


Figure 1. Trim Connections To increase Output Voltages Using Fixed Resistors

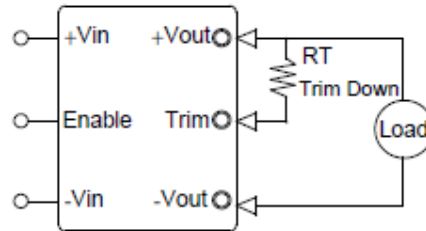


Figure 2. Trim Connections To Decrease Output Voltages Using Fixed Resistors

Trim up resistor value(KΩ)										
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	112.2	51.1	30.7	20.5	14.4	10.4	7.5	5.3	3.6	2.2
12	267.8	121.9	73.3	49.0	34.3	24.6	17.7	12.5	8.4	5.2
15	332.9	151.5	91	60.7	42.6	30.5	21.8	15.4	10.3	6.3
24	542	247	149	100	70.7	51.1	37.1	26.6	18.4	11.9

Trim down resistor value(KΩ)										
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	139.8	63.5	38.1	25.4	17.8	12.7	9.0	6.3	4.2	2.5
12	342.5	155.9	93.7	362.6	44.0	31.5	22.7	16.0	10.8	6.7
15	454.5	205	125.8	84.7	60.1	43.6	31.9	323.1	16.2	10.7
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 3.

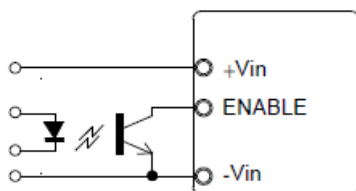


Figure 3. Driving the Enable Control pin

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 load and layout conditions. See Figure 4

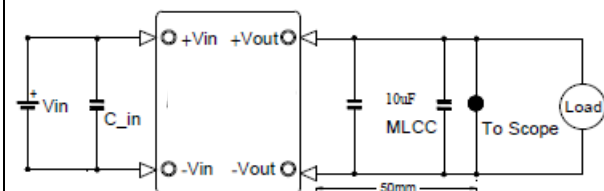


Figure 4. Measuring Output Ripple/Noise(20MHz bandwidth)