

BE60 SERIES

60 Watts

KEY FEATURES

- Wide Input Voltage range (4:1)
- Ultra-Thin Package, Thickness 11.8mm
- Efficiency up to 93%(typ.)
- Low Standby Power Consumption 0.7W (typ.)
- Fast Start-up 20mS
- Continuous Short Circuit Protection, Auto-recovery
- Input Under Voltage Protection, Output Over Voltage, Short Circuit & Over Current Protections
- Various package options are available:
With Heatsink / Screw Terminal / DIN Rail Mounting Options
- Isolation Voltage 1500VDC
- Operating Temperature: -40°C~+105°C
- Good EMC Performance
- International Standard Pin-Out



ELECTRICAL SPECIFICATIONS

All specifications valid at normal input voltage, full load and +25°C after warm-up time unless otherwise stated

Model No.		BE60-24F-5S	BE60-24F-12S	BE60-24F-15S	BE60-24F-24S
Input Voltage (V.DC.)		24V (9-36V)	24V (9-36V)	24V (9-36V)	24V (9-36V)
Output Voltage (V.DC.)		5	12	15	24
Current (A)	Max.	12	5	4	2.5
Efficiency (%)	Min.	90	91	91	91
	Typ.	92	93	93	93
Capacitor Load (μF)	Max.	10000	6000	4000	2000

Model No.		BE60-48F-5S	BE60-48F-12S	BE60-48F-15S	BE60-48F-24S
Input Voltage (V.DC.)		48V (18-75V)	48V (18-75V)	48V (18-75V)	48V (18-75V)
Output Voltage (V.DC.)		5	12	15	24
Current (A)	Max.	12	5	4	2.5
Efficiency (%)	Min.	90	91	91	91
	Typ.	92	93	93	93
Capacitor Load (μF)	Max.	10000	6000	4000	2000

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ELECTRICAL SPECIFICATIONS

All specifications valid at normal input voltage, full load and +25°C after warm-up time unless otherwise stated

Model No.		BE60-24F-5S	BE60-24F-12S	BE60-24F-15S	BE60-24F-24S
		BE60-48F-5S	BE60-48F-12S	BE60-48F-15S	BE60-48F-24S
Max Output Wattage		60W			
Input	Stand-by Power Consumption (Typ.)	0.7W			
	Voltage	BE60-24F- x S: 24VDC (9-36VDC)			
		BE60-48F- x S: 48VDC (18-75VDC)			
	Input Surge Voltage Protection (1sec.max)	24VDC Normal Input: Min: -0.7VDC / Max: 50VDC			
		48VDC Normal Input: Min: -0.7VDC / Max: 100VDC			
	Start-Up Voltage	24VDC Normal Input: Min: 5VDC / Max: 9VDC			
		48VDC Normal Input: Min: 13VDC / Max: 18VDC			
Filter	π type				
Output	Voltage	5VDC	12VDC	15VDC	24VDC
	Voltage Accuracy (Max.)	±2%			
	Current (Max.)	12A	5A	4A	2.5A
	Line Regulation (LL-HL) (Max.)	±0.5%			
	Load Regulation (5-100%) (Max.)	±1%			
	Capacitor Load	10000μF	6000μF	4000μF	2000μF
	Ripple & Noise (5-100%) (Max.)	350mVp-p			
	Switching Frequency (Typ.)	370KHz			
	Voltage Adjustable (TRIM) (%Vo)	Min.: 90 / Max.: 110			
Protection	Over Power Protection (%Io)	Min.: 110 / Typ.: 140 / Max.: 200			
	Over Voltage Protection (%Vo)	Min.: 110 / Typ.: 140 / Max.: 160			
	Short Circuit Protection	Continuous, Auto-recovery			
Isolation	Voltage	1500VDC (I/P-O/P, Test 1min, Leakage Current<1mA)			
		1000VDC (I/P-O/P-case, Test 1min, Leakage Current<1mA)			
	Capacitance	2200pF (I/P-O/P, 100KHz/0.1V)			
Environment	Operating Temperature	-40°C...+105°C (with derating)			
	Storage Temperature	-55°C...+125°C			
	Max Case Temperature	+105°C			
	Relative Humidity	Min.: 5% RH / Max.: 95% RH			
	MTBF (Min.)	1000K Hrs @ 25°C (MIL-HDBK-217F)			
	Vibration	10-150Hz, 5G, 0.75mm, along X, Y and Z			

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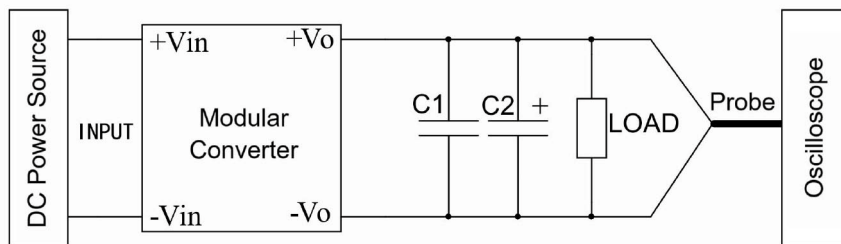
ELECTRICAL SPECIFICATIONS

All specifications valid at normal input voltage, full load and +25°C after warm-up time unless otherwise stated

Model No.				BE60-24F-5S	BE60-24F-12S	BE60-24F-15S	BE60-24F-24S
				BE60-48F-5S	BE60-48F-12S	BE60-48F-15S	BE60-48F-24S
Physical	Dimensions (L x W x H) Tolerance ±0.5 mm	Standard	BE60- x F- x S: 2.0 x 1.0 x 0.464 Inches / 50.8 x 25.4 x 11.8 mm				
		for Option	BE60- x F- x S-X: 2.0 x 1.0 x 0.858 Inches / 50.8 x 25.4 x 21.8 mm				
		for Option	BE60- x F- x S-A2: 2.99 x 1.24 x 0.838 Inches / 76.0 x 31.5 x 21.3 mm				
		for Option	BE60- x F- x S-XA2: 2.99 x 1.24 x 1.220 Inches / 76.0 x 31.5 x 31.0 mm				
		for Option	BE60- x F- x S-A2D: 2.99 x 1.24 x 1.023 Inches / 76.0 x 31.5 x 26.0 mm				
		for Option	BE60- x F- x S-XA2D: 2.99 x 1.24 x 1.397 Inches / 76.0 x 31.5 x 35.5 mm				
	Case Material		Aluminum				
	Weight (Typ.)	Standard	BE60- x F- x S: 41 g				
		for Option	BE60- x F- x S-X: 53 g				
		for Option	BE60- x F- x S-A2: 62 g				
		for Option	BE60- x F- x S-XA2: 74 g				
		for Option	BE60- x F- x S-A2D: 82 g				
		for Option	BE60- x F- x S-XA2D: 94 g				
	Cooling Method		Natural Air Cooling				
CTRL	Module is Turned On		CTRL is left floating or connected to high level (3V-12VDC)				
	Module Shutdown		CTRL connected to-Vin or low level (0-1.2VDC)				
	Input Current at Shutdown (Typ.)		30mA				
Parameter	Standards & Level				Performance		
EMC	EMI	Conduction	EN 55032		Class B	(EMC Recommended Circuit)	
		Radation	EN 55032		Class B	(EMC Recommended Circuit)	
	EMS	RS	IEC / EN 61000-4-3 10V/m		Perf.Criteria A	(EMC Recommended Circuit)	
		CS	IEC / EN 61000-4-6 3Vr.m.s		Perf.Criteria A	(EMC Recommended Circuit)	
		ESD	IEC / EN 61000-4-2, Contact ± 6KV		Perf.Criteria B	(EMC Recommended Circuit)	
		Surage	IEC / EN 61000-4-5 ± 2KV		Perf.Criteria A	(EMC Recommended Circuit)	
		EFT	IEC / EN 61000-4-4 ± 2KV		Perf.Criteria A	(EMC Recommended Circuit)	

NOTE

1. The voltage of the CTRL is relative to the input –DC IN
2. The efficiency is measured at the nominal input voltage and rated load
3. The maximum capacitive load is the capacitance allowed to be used when the power supply operates at full load. The converter may not start up if the capacitor exceeds this value.
4. It is not recommended to connect the power supply outputs in parallel to achieve a bigger power output.
5. Unless otherwise specified, the above data are measured at $T_a=25^{\circ}\text{C}$, humidity<75%, input nominal voltage and output rated load (pure resistance load).
6. If the product works below the minimum required load, it cannot be guaranteed that the product performance meets all the performance indicators in this manual.
7. If the product works beyond the product load range, it cannot be guaranteed that the product performance meets all the performance indicators in this manual.
8. The products should be used according to the specifications in this manual, otherwise it could be permanently damaged.
9. Please check the derating curve for more details.
10. All values or indicators in this manual had been tested based on ARCH test specifications.
11. The specifications are specially for the parts listed in this manual, any other non-standard model performances could be out of the specifications. Please contact our technician for specific requirements.
12. Product specifications are subject to change without prior notice. Please pay attention to the latest manual published on our official website.
13. ARCH can provide customization service.
14. Ripple & Noise Test Instruction (Parallel-line method, 20MHz Bandwidth)



Test Conditions:

1. The Ripple & Noise test needs the cables in parallel, an oscilloscope that should be set at the Sample Mode, bandwidth 20MHz. 100M bandwidth probe with cap and ground removed. One polypropylene capacitor C1(0.1uF) and one high-frequency low-resistance electrolytic capacitor C2(10uF) are connected in parallel with the probe.
2. Refer to the test diagram, the converter output connects to the electronic load by the jig with cables which size should be defined according to the output current value. The test can start at the converter output terminals after input power on.
3. It is recommended to connect a $\geq 5\%$ load or a high-frequency low resistance electrolytic capacitor ($\geq 470\mu\text{F}$) load at the output to avoid the output ripple increasing.

MODEL ENCODING

BE60-24F-12S-XA2

①

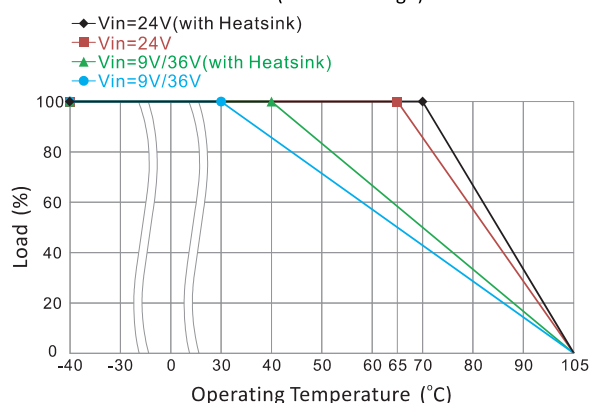
②

③

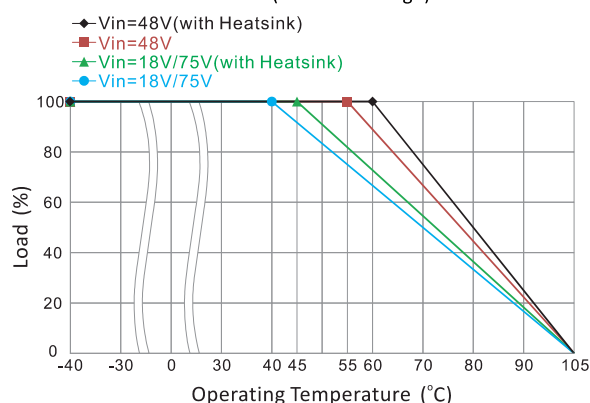
① Input Voltage	② Output Voltage	③ Option
24 = 24 Vdc (9-36 Vdc)	5 = 5 Vdc	X = Indicates the Part with Heat Sink
48 = 48 Vdc (18-75 Vdc)	12 = 12 Vdc	A2 = Indicates a Kind of Chassis Packaging with Terminals(without Heat Sink)
	15 = 15 Vdc	A2D =Indicates a Kind of Packaging of DIN Rail without Heat Sink
	24 = 24 Vdc	XA2 = Indicates a Kind of Chassis Packaging with Terminals and Heat Sink
		XA2D =Indicates a Kind of Packaging of DIN Rail with Heat Sink

DERATING

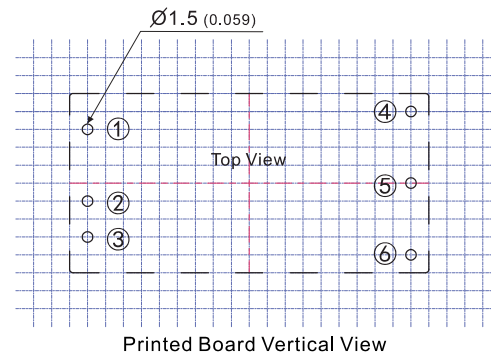
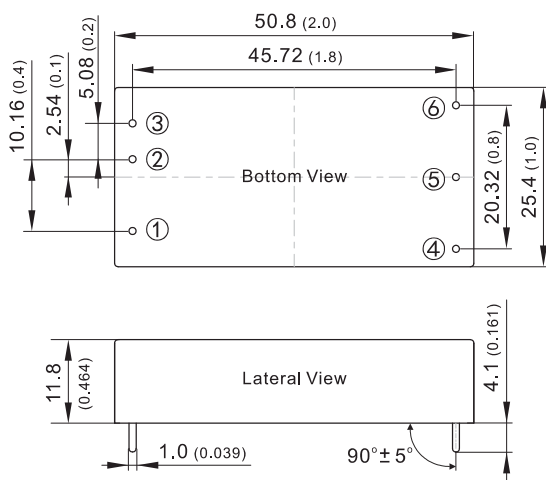
Derating Output Load versus Operating Temperature
24Vin (9-36Vdc Range)



Derating Output Load versus Operating Temperature
48Vin (18-75Vdc Range)



MECHANICAL DIMENSIONS



PIN#	Single
1	CTRL
2	-DC IN
3	+DC IN
4	TRIM
5	-DC OUT
6	+DC OUT

Dimension in mm (inch)

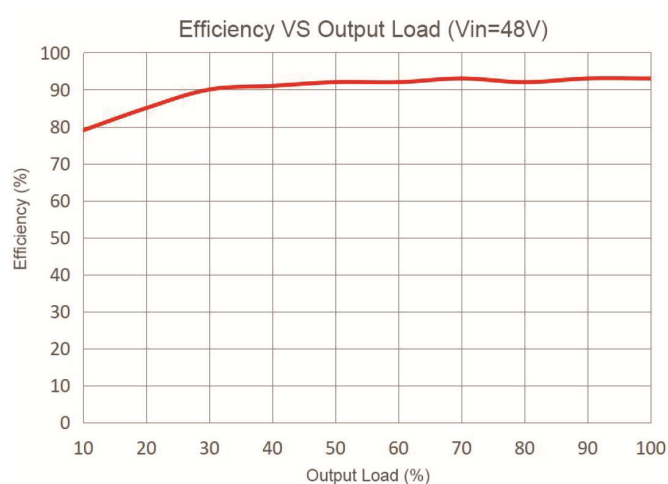
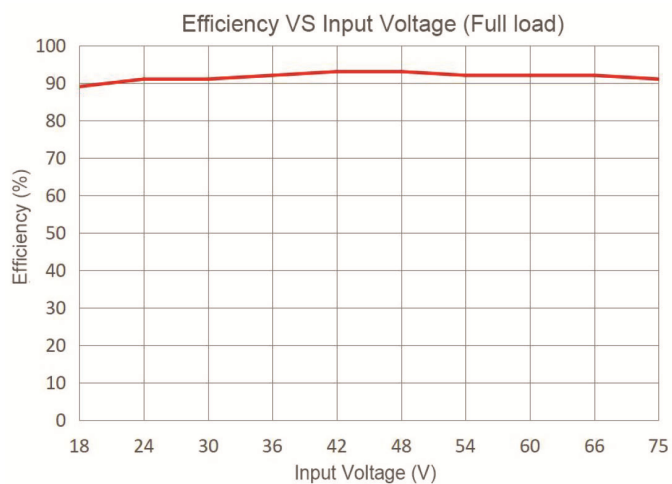
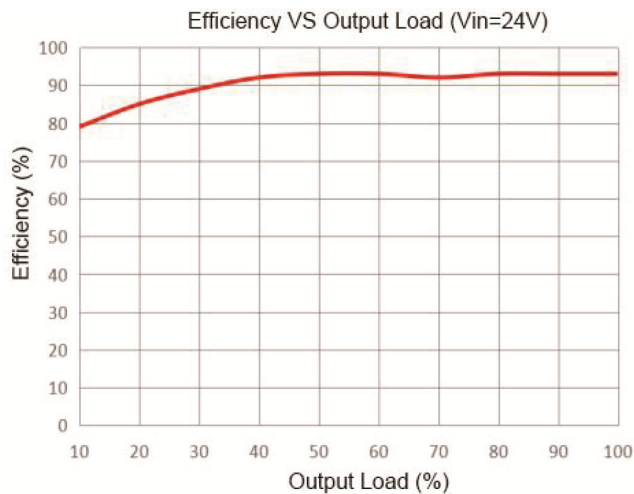
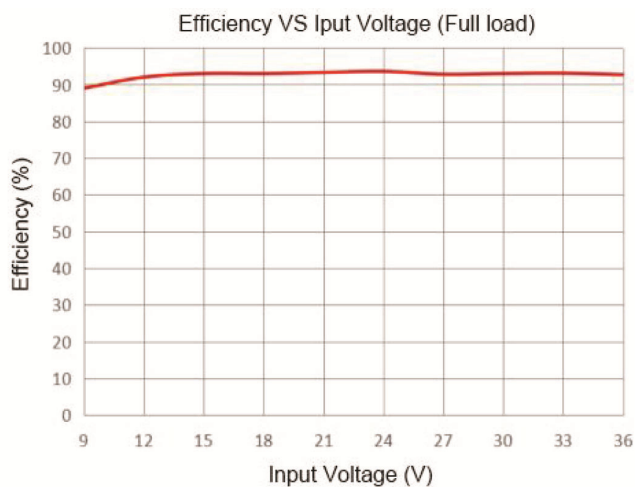
Tolerances:

x.x ±0.50 (x.xx ±0.02)

Pin Dimension Tolerance:

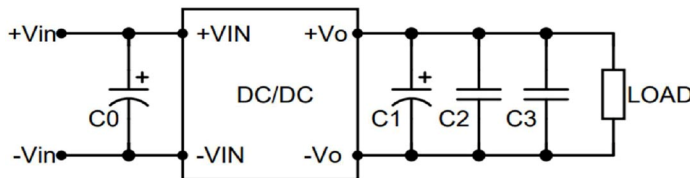
±0.10 (±0.004)

EFFICIENCY VERSUS LOAD



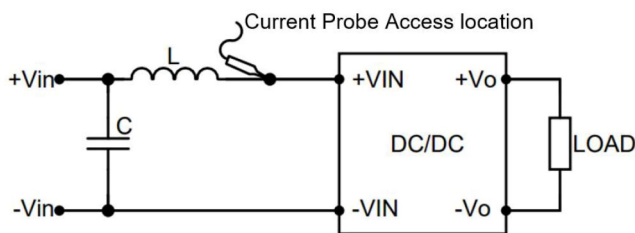
RECOMMENDED CIRCUITS FOR APPLICATION

1. DC/DC test circuit diagram



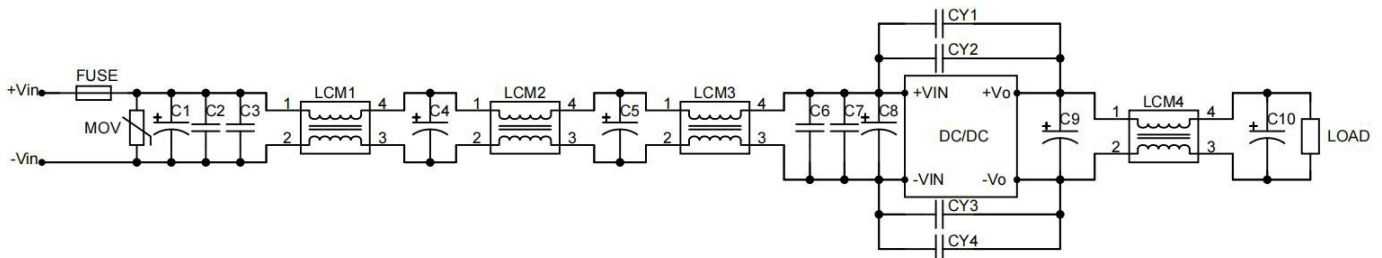
Vout (VDC)	C0	C1	C2	C3
5	100uF	330uF/50V	1uF/16V	10uF/16V
12			1uF/25V	10uF/25V
15	100V	100uF/850V	1uF/25V	10uF/25V
24			1uF/50V	10uF/50V

2. Input reflected ripple current test circuit diagram



Component	Parameter
C	220uF/100V
L	4.7uH/15A

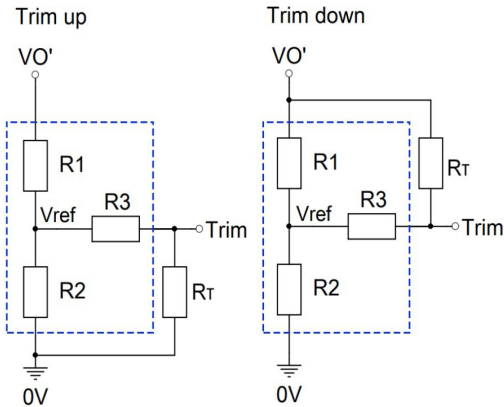
3. Recommended EMC circuits diagram



Component	Vin=24V	Vin=48V
FUSE	TBD by Customer	
MOV	14D470K	14D101K
LCM1	2.2mH	
LCM2	1.0mH	
LCM3,LCM4	270Uh	
C1,C4,C5,C8	330uF/100V	
C2,C3	4.7uF/100V	
C6,C7	10uF/100V	
C9,C10	100uF/100V	
CY1,CY3	2.2nF/2KV	
CY2,CY4	10nF/2KV	

RECOMMENDED CIRCUITS FOR APPLICATION

4. Trim and calculation of Trim resistance



Note: Trim up & down circuits, the components in the dotted area are inside of the convertor.

Calculation formula of Trim resistance:

$$\text{up: } R_T = \frac{\alpha R_2}{R_2 - \alpha} - R_3 \quad \alpha = \frac{V_{ref}}{V_{o'} - V_{ref}} \cdot R_1$$

$$\text{down: } R_T = \frac{\alpha R_1}{R_1 - \alpha} - R_3 \quad \alpha = \frac{V_{o'} - V_{ref}}{V_{ref}} \cdot R_2$$

R_T is the Trim resistor, α is a custom parameter, and $V_{o'}$ is the actual voltage of Trim up or Trim down.

Output	Internal circuit parameters for Trim			
Vout (DC)	R1(KΩ)	R2(KΩ)	R3(KΩ)	R1(KΩ)
5	24	24	68	2.5
12	18	4.7	30	2.5
15	24	4.78	30	2.5
24	25.5	2.955	18	2.5

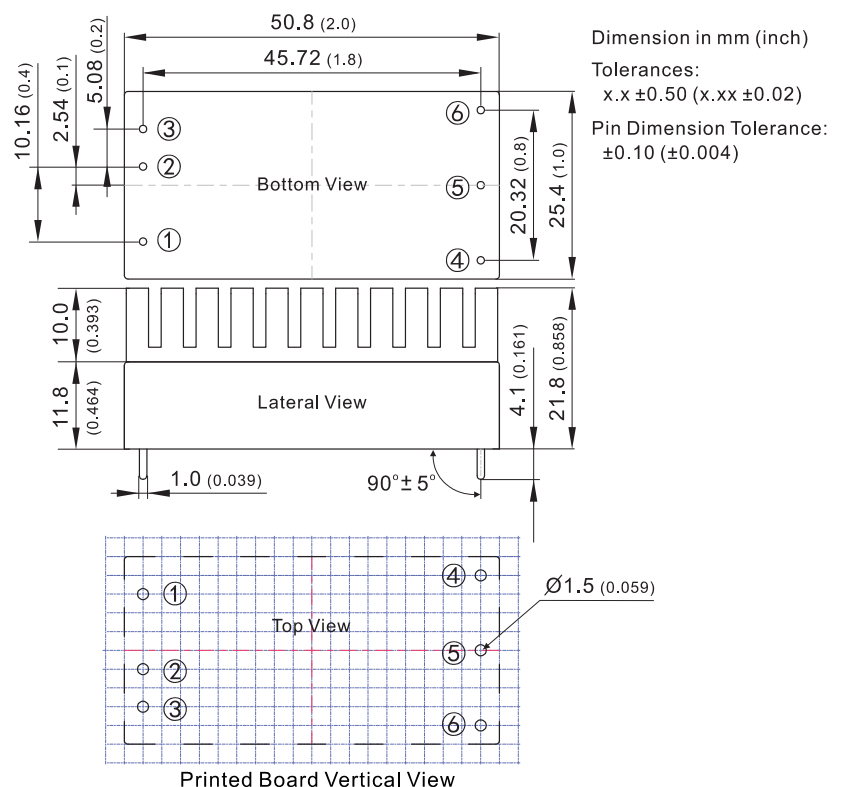
WITH HEATSINK & SCREW TERMINAL & DIN RAIL (for Option)

BE60-xF-xS-X

(with Heatsink)



PIN#	Single
1	CTRL
2	-DC IN
3	+DC IN
4	TRIM
5	-DC OUT
6	+DC OUT



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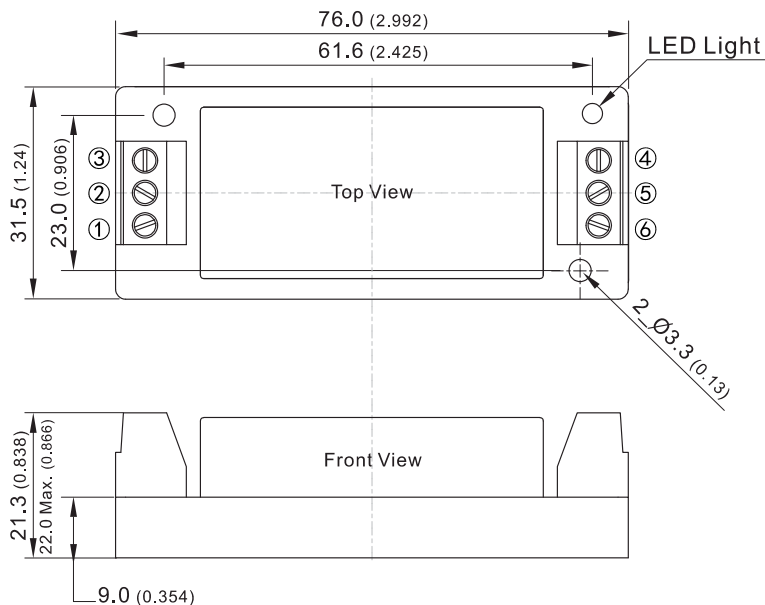
WITH HEATSINK & SCREW TERMINAL & DIN RAIL (for Option)

BE60-**x**F-**x**S-A2

(Screw Terminal for Option without Heatsink)



PIN#	Single
1	CTRL
2	-DC IN
3	+DC IN
4	TRIM
5	-DC OUT
6	+DC OUT



Dimension in mm (inch)

Tolerances: x.x ±0.50 (x.xx ±0.02)

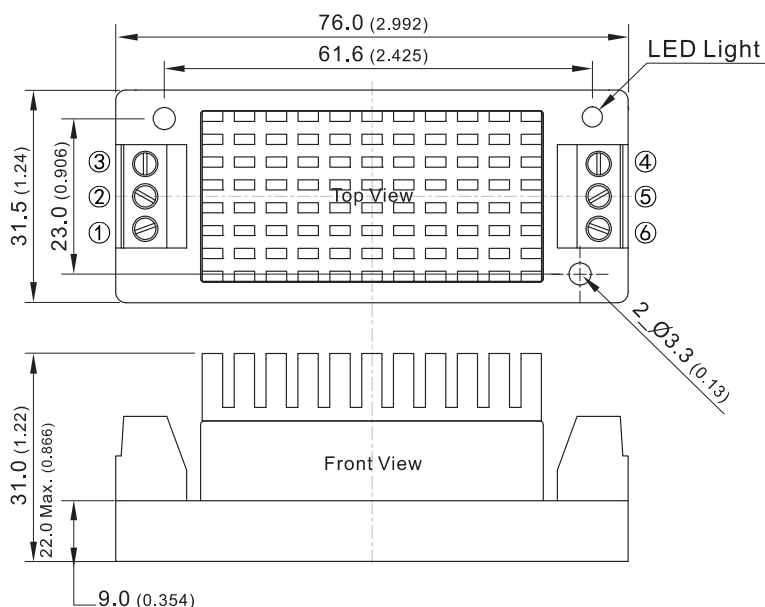
Pin Dimension Tolerance: ±0.10 (±0.004)

BE60-**x**F-**x**S-XA2

(Screw Terminal for Option with Heatsink)



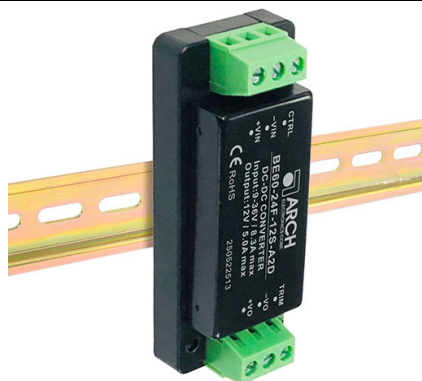
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4	TRIM
5	-DC OUT
6	+DC OUT



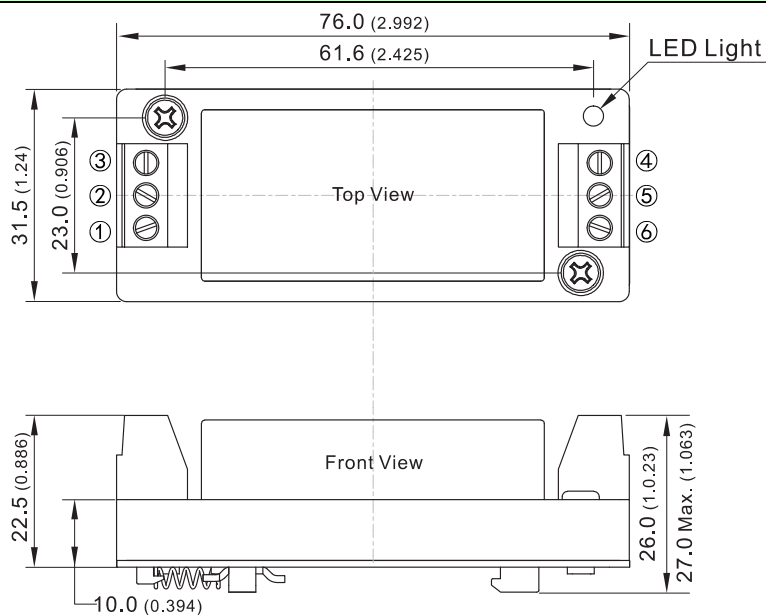
Dimension in mm (inch)

Tolerances: x.x ±0.50 (x.xx ±0.02)

Pin Dimension Tolerance: ±0.10 (±0.004)

BE60 SERIES
60 Watts
BE60-xF-xS-A2D
(Din Rail Kit for Option without Heatsink)


PIN#	Single
1	CTRL
2	-DC IN
3	+DC IN
4	TRIM
5	-DC OUT
6	+DC OUT

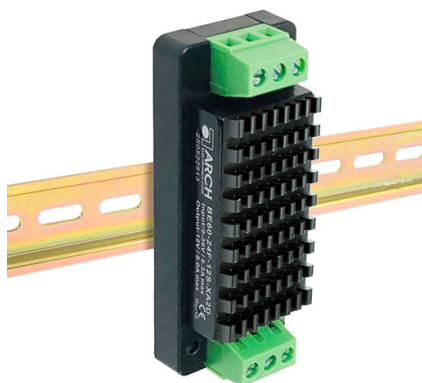


Dimension in mm (inch)

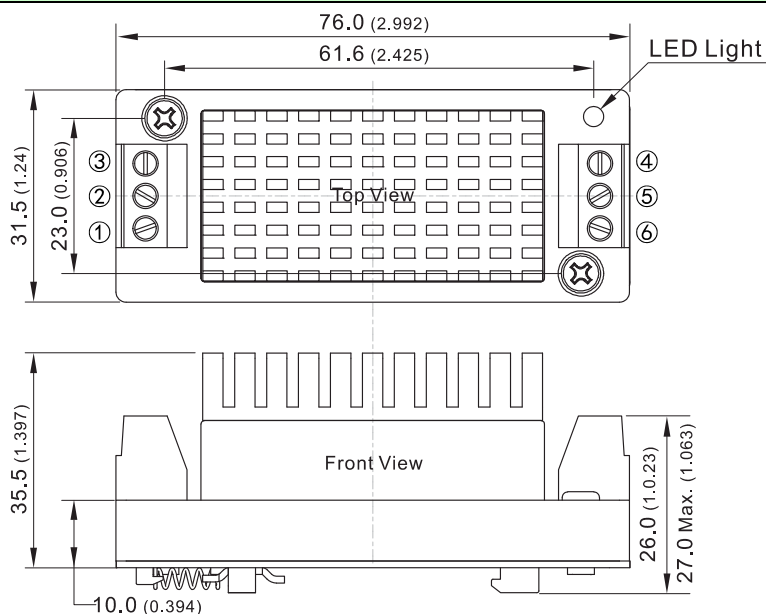
 Tolerances: $\pm 1.00 (\pm 0.039)$

Lead Wires Size:: 24-12AWG

Screwing Torque: 0.4N.m Max

BE60-xF-xS-XA2D
(Din Rail Kit for Option with Heatsink)


PIN#	Single
1	CTRL
2	-DC IN
3	+DC IN
4	TRIM
5	-DC OUT
6	+DC OUT



Dimension in mm (inch)

 Tolerances: $\pm 1.00 (\pm 0.039)$

Lead Wires Size:: 24-12AWG

Screwing Torque: 0.4N.m Max