Typical 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, self-recovery
- Input under voltage, output over voltage, short circuit & over current protections
- Isolation Voltage 1500VDC
- Operating Temperature from -40°C to +105°C
- Good EMI performance
- International standard pin-out

Application Field

FD60-XXSXXB3R2 Series ***------*** *DC-DC modular converters with 4:1 wide input voltage range, fast start-up, isolated & regulated single output 60W, DIP/Chassis/DIN-rail flexible packages, isolation voltage 1500VDC, with input under voltage protection, output over-current, short circuit, over-voltage protections. This series of products can be widely used in fields of industrial control, electric power, communications, industrial robots and railway electronic devices, etc. The additional circuit for EMC is recommended in this data sheet for the application with high EMC requirement.*

Typical Product List

Certificate	Part No.	Input Voltage Range (VDC)		Output Voltage/Current		Input Current (mA) Typ. @Nominal Volt.		Max. Capacitive Load	Ripple & Noise (mVp-p)	Efficiency (%) @Full load	
		Nom.	Range	Voltage (VDC)	Current (A)	Full load	No Load	(uF)	Typ.	Min	Typ.
-	FD60-18S05B3R2	24	9-36	5	12	2718	30	10000	100	90	92
-	FD60-18S12B3R2			12	5	2718	30	6000	100	91	93
-	FD60-18S15B3R2			15	4	2718	30	4000	100	91	93
-	FD60-18S24B3R2			24	2.5	2718	30	2000	130	91	93
-	FD60-36S05B3R2	48	18-75	5	12	1344	15	10000	100	90	92
-	FD60-36S12B3R2			12	5	1344	15	6000	100	91	93
-	FD60-36S15B3R2			15	4	1344	15	4000	100	91	93
-	FD60-36S24B3R2			24	2.5	1344	15	2000	130	91	93

Note 1 - In the part number, letter R means the part includes remote control and output voltage Trim functions.

Note 2 - The suffix -H indicates the part with Heat sink, -T (H) indicates the chassis package (with heat sink), -TS (H) indicates the package of DIN Rail (with heat sink) which width is 35mm.

Note 3 - The efficiency is measured at the nominal input voltage and rated load.

Note 4 - The maximum capacitive load is the capacitance allowed to be used when the power supply operates at full load. The converter may not start if the capacitor exceeds this value.

Note 5 - Please contact Aipu sales for other output voltages requirement in this series but not listed in this table.

Input Specifications

Item	Test Conditions	Min	Typ.	Max	Unit
Standby power consumption	Full input voltage range	/	0.7	/	W
Input surge voltage (1Sec.max)	24Vdc Input	-0.7	/	50	VDC
	48Vdc Input	-0.7	/	100	
Start-up voltage	24Vdc Input	5	/	9	
	48Vdc Input	13	/	18	
Input filter	/	Pi filter			
Hot Plug	/	Unavailable			
CTRL	Turn-on the converter	No connection or connect to high level (3V-12VDC)			
	Shut-off the converter	Connect to -Vin or connect to low level (0-1.2VDC)			
	Current value to shut off the converter	30mA (TYP)			

*CTRL voltage is relative to the input -Vin

Output Specifications

Items	Test Conditions	Min	Typ.	Max	Unit
Output Voltage Accuracy	Input voltage range, rated load	/	±1	±2	%
Voltage Regulation	Full input voltage range, rated load	/	±0.2	±0.5	%
Load Regulation	5%~100% rated load	/	±0.5	±1	%
Ripple & Noise	5%-100%load, nominal voltage (20MHz)	/	130	350	mVp-p
Dynamic response deviation	25% rated load step, 5V output voltage	/	±5	±10	%
	25% of rated load step, other output voltages	/	±3	±5	
Dynamic Response	25% of rated load step, nominal input voltage	/	250	500	uS
Output voltage adjustment (Trim)	Full input voltage range, rated load	90	/	110	%Vo
Output over-voltage protection		110	140	160	%Vo
Output over-current protection		110	140	200	%Io
Output Short circuit Protection		Continuous, self-recovery			

General Specifications

Items	Test Conditions	Min	Typ.	Max	Unit
Switching Frequency	Operating mode（PWM）	/	370	/	KHz
Operating Temperature	Refer to the Temperature Derating Graph	-40	/	+105	℃
Storage Temperature	/	-55	/	+125	
Case Temperature	/	/	/	+105	
Pin Soldering temperature	1.5mm from the case, 10S	/	/	300	

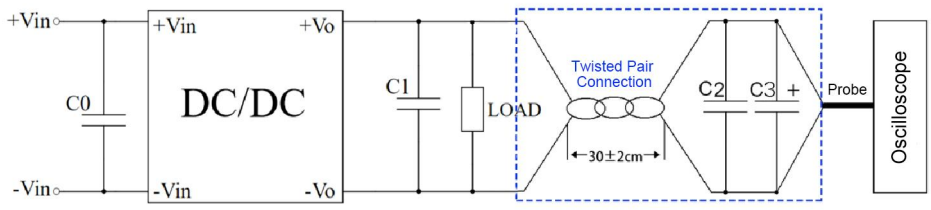
Relative Humidity	No condensation	5	/	95	%RH
Isolation Voltage	I/P-O/P, test 1 Min, leakage current ≤1mA	1500	/	/	VDC
	I/P&O/P-CASE, test 1 Min, leakage current ≤1mA	1000	/	/	VDC
Isolation capacitance	I/P-O/P, 100KHz/0.1V	/	2200	/	pF
MTBF	MIL-HDBK-217F@25℃	1000	/	/	KHrs
Vibration	/	10-150Hz, 5G, 0.75mm, along X, Y and Z			
Cooling method	Nature air				
Shell material	Aluminum				

Weight/Dimension	Part No.	Weight (Typ.)	Dimensions L x W x H	
	FD60-18SXXB3R2	41g	50.8 X 25.4 X 11.8 mm	2.00 X 1.00 X 0.464 inch
	FD60-18SXXB3R2-H	53g	50.8 X 25.4 X 21.8 mm	2.00 X 1.00 X 0.858 inch
	FD60-18SXXB3R2-T	62g	76.0 X 31.5 X 21.3 mm	2.99 X 1.24 X 0.838 inch
	FD60-18SXXB3R2-TH	74g	76.0 X 31.5 X 31.0 mm	2.99 X 1.24 X 1.220 inch
	FD60-18SXXB3R2-TS	82g	76.0 X 31.5 X 26.0 mm	2.99 X 1.24 X 1.023 inch
	FD60-18SXXB3R2-TSH	94g	76.0 X 31.5 X 35.5 mm	2.99 X 1.24 X 1.397 inch

EMC Performance

Total Items	Sub Items	Standard	Performance/Class
EMI	CE	CISPR22/EN55032	CLASS B (with the Recommended EMC Circuit)
	RE	CISPR22/EN55032	CLASS B (with the Recommended EMC Circuit)
EMS	RS	IEC/EN61000-4-3	10V/m Perf.Criteria A (with the Recommended EMC Circuit)
	CS	IEC/EN61000-4-6	3Vr.m.s Perf.Criteria A (with the Recommended EMC Circuit)
	ESD	IEC/EN61000-4-2	Contact ±6KV Perf.Criteria B (with the Recommended EMC Circuit)
	Surge	IEC/EN61000-4-5	±2KV Perf.Criteria A (with the Recommended EMC Circuit)
	EFT	IEC/EN61000-4-4	±2KV Perf.Criteria A (with the Recommended EMC Circuit)

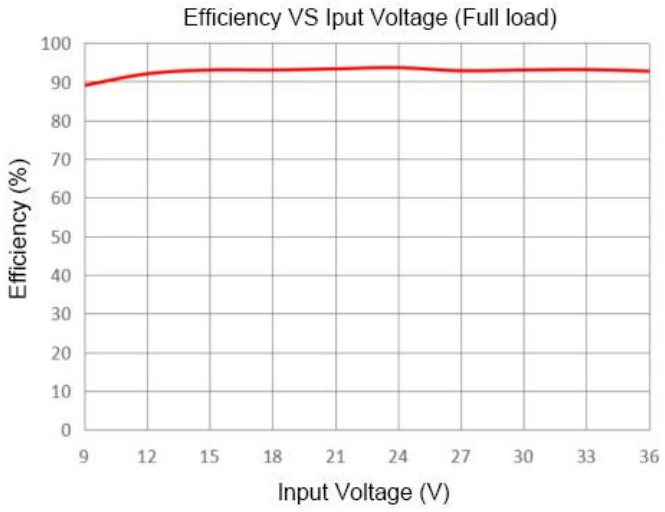
Ripple & Noise Test Instructions (Twisted Pair Method, 20MHz Bandwidth)

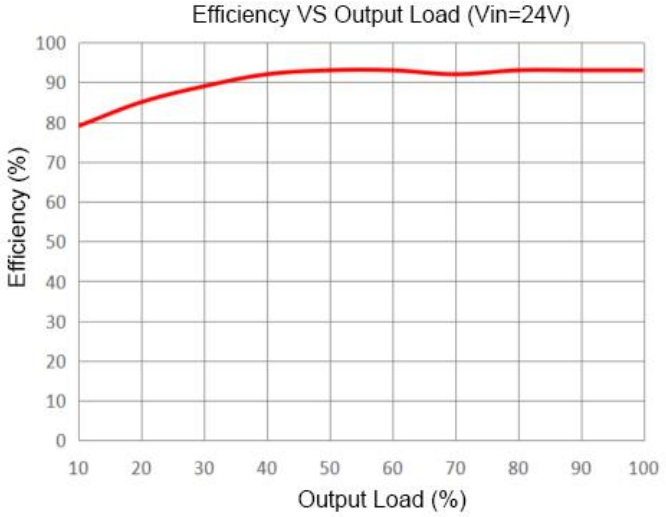


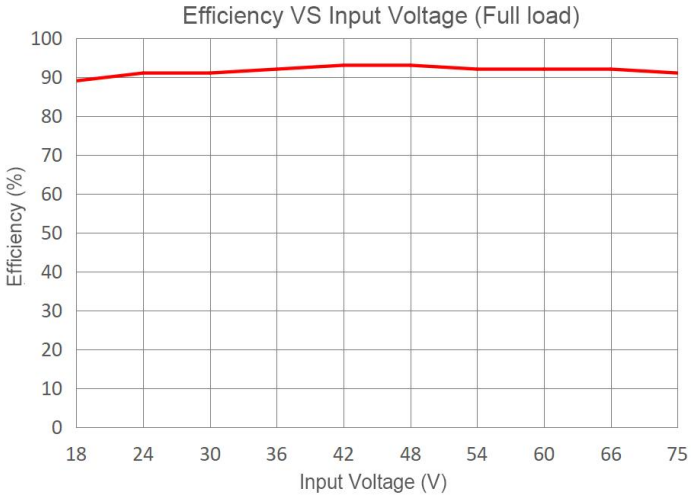
1) The Ripple & noise test needs 12# twisted pair cables, an oscilloscope which should be set at the Sample Mode, bandwidth 20MHz. 100M bandwidth probe with cap and ground removed. C2(0.1uF) polypropylene capacitor and C3(10uF) high-frequency low-resistance electrolytic capacitor are connected in parallel with the probes and one side of the twisted pair. C0 & C1 refer to the application circuit recommended.

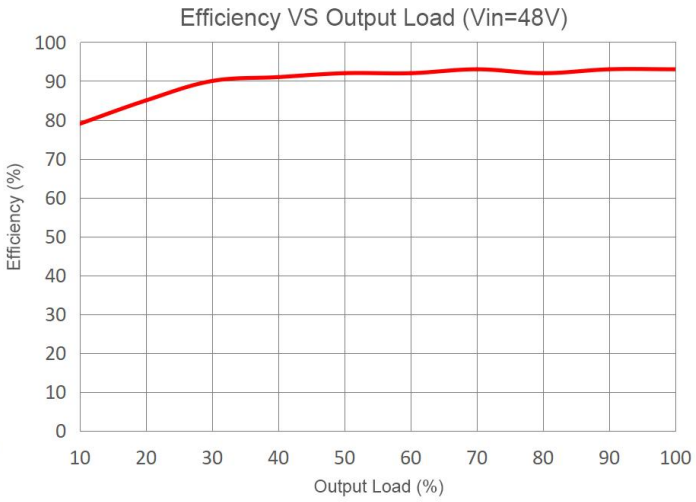
2) The power supply output connects to the load by the cables. The other side of the twisted pair (length 30cm±2 cm) should be connected in parallel with the load, the polarity of the output and the oscilloscope probe should not be reversed. The test can be started after input power on.

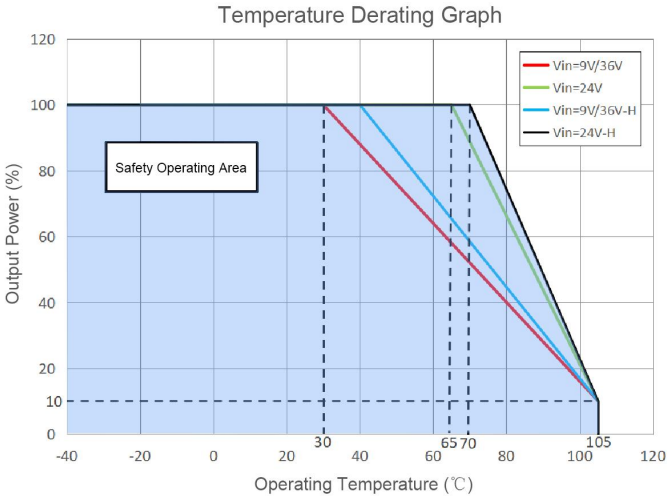
Product Characteristics Graphs

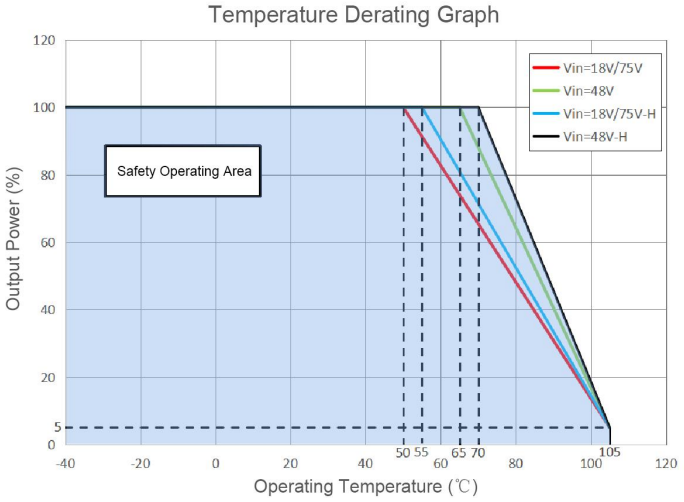






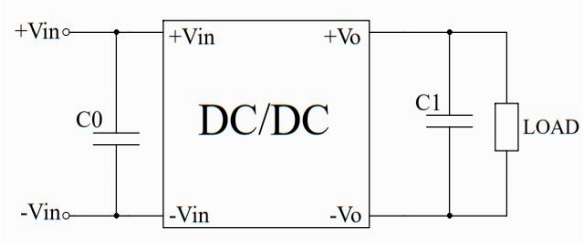






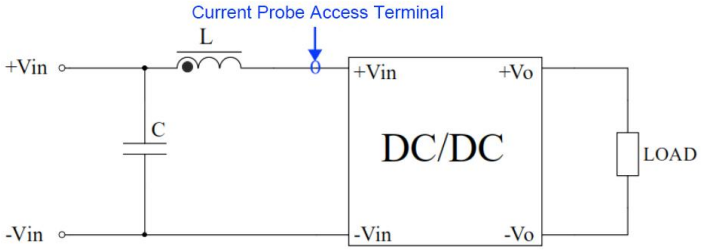
Recommended Circuits for Application

1. This series of power supplies will be tested according to this circuit below before shipping. Increasing the capacitances of C0 or C1 can decrease the output ripples, but the output capacitance must be less than the maximum capacitive load.



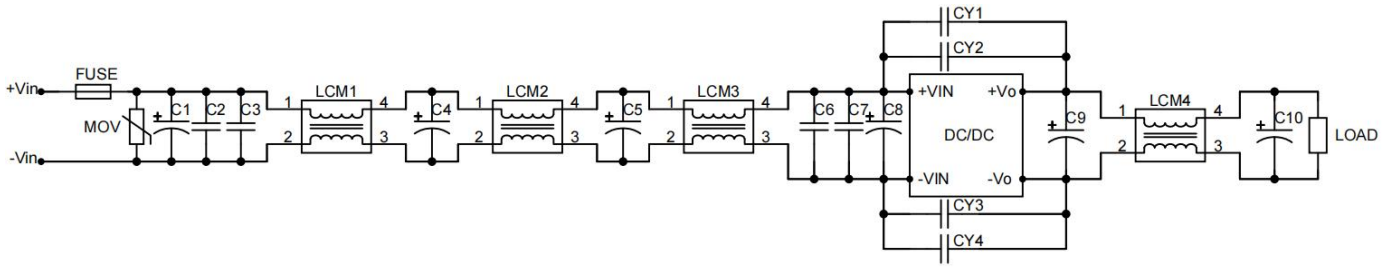
Components	Parameter
C0	47-220uF/100V
C1	47uF/50V

2. **Input reflected ripple current test circuit**



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

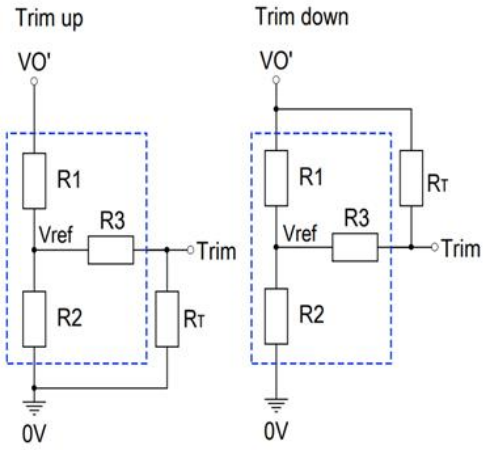
3. **Recommended EMC circuit**



Recommended parameters

Component No.	Nominal 24V input series	Nominal 48V input series
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	

4. Trim and calculation of Trim resistance



Rrim Resistance calculating fomula

$$up:\ R_T=\frac{aR_2}{R_2-a}-R_3 \qquad a=\frac{Vref}{Vo'-Vref}\cdot R_1$$

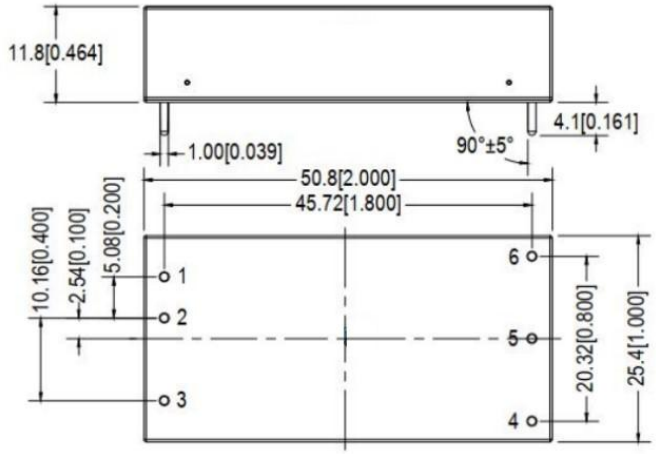
$$down:\ R_T=\frac{aR_1}{R_1-a}-R_3 \qquad a=\frac{Vo'-Vref}{Vref}\cdot R_2$$

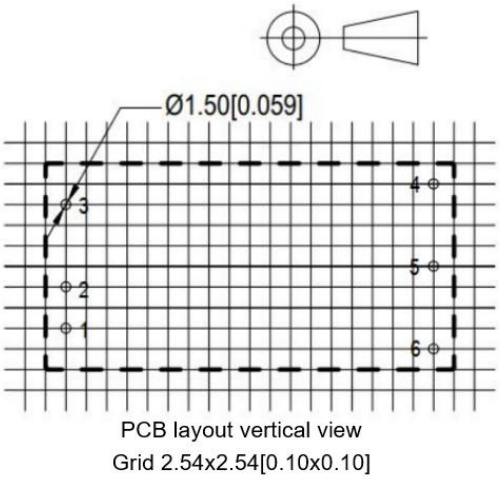
R_T is the Trim resistance
a is a self-defined parameter
Vo' is the required Up-voltage or Down-voltage

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

Output Voltage	Trim Internal circuit components parameters			
Vout(VDC)	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref(V)
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

B3 Packaging (without Heat Sink) dimensions



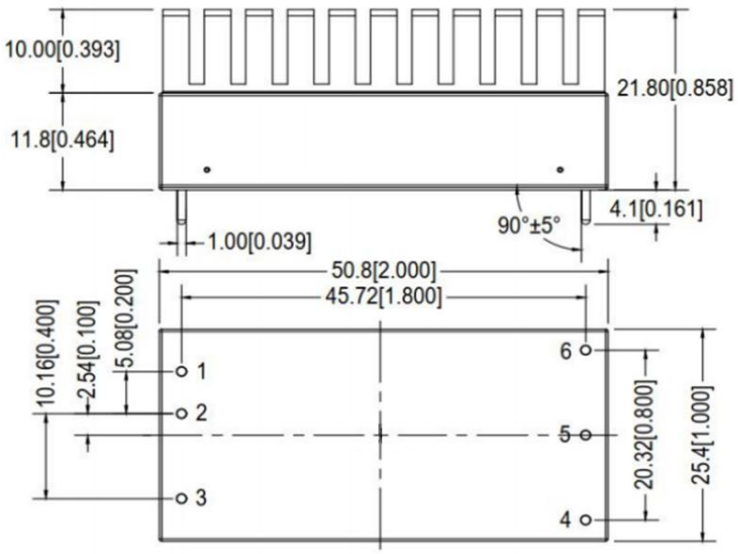


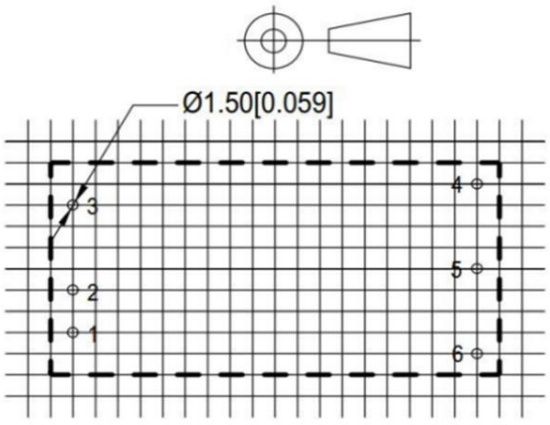
PCB layout vertical view
Grid 2.54x2.54[0.10x0.10]

Unit: mm[inch]
Pin diameter tolerance ±0.10[±0.004]
General tolerance ±0.50[±0.020]

Pin No.	1	2	3	4	5	6
Function	+Vin	-Vin	CTRL	Trim	-Vo	+Vo

B3-H Packaging (with Heat Sink) dimensions



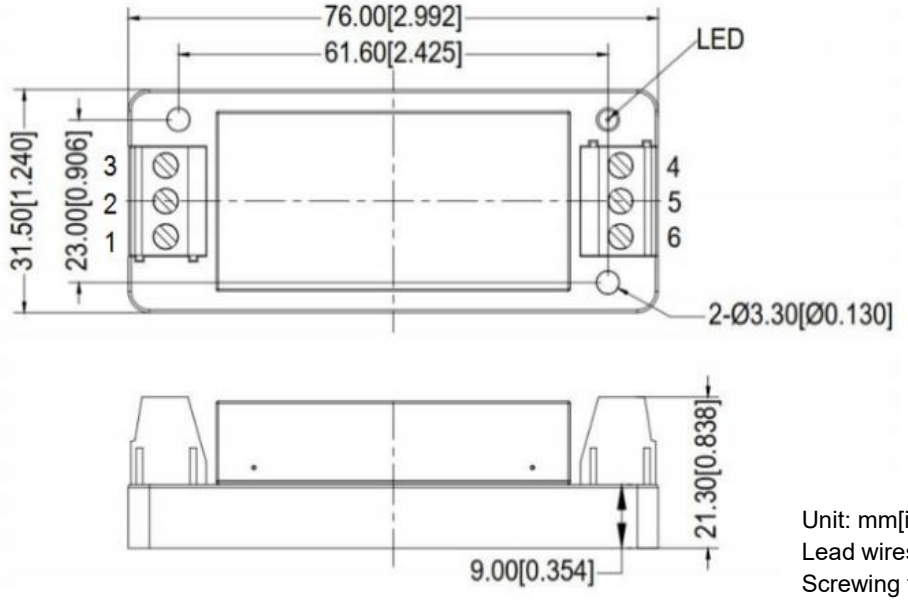


PCB layout vertical view
Grid 2.54x2.54 [0.10x0.10]

Unit: mm[inch]
Pin diameter tolerance ±0.10[±0.004]
General tolerance ±0.50[±0.020]

Pin No.	1	2	3	4	5	6
Function	+Vin	-Vin	CTRL	Trim	-Vo	+Vo

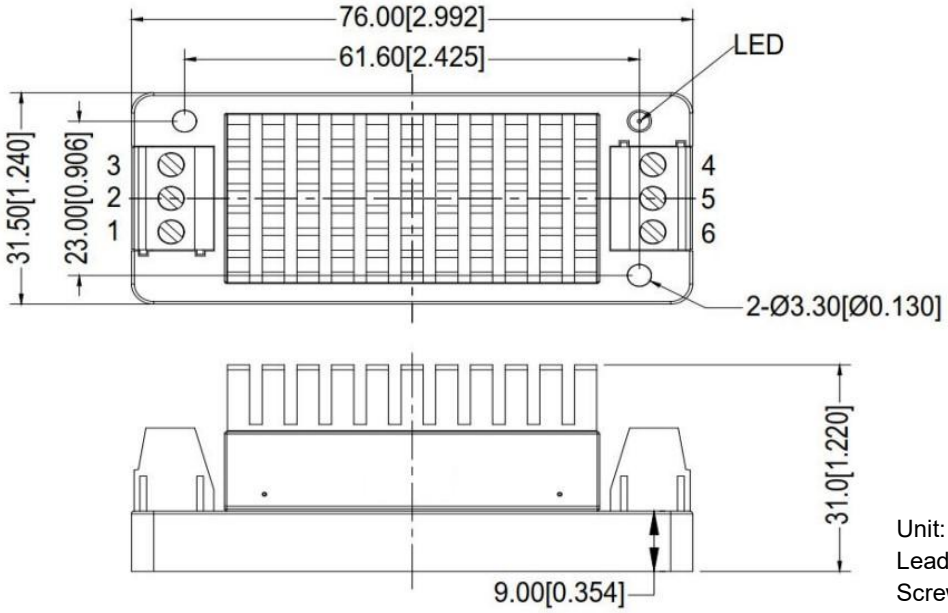
B3-T Packaging (without Heat Sink) dimensions



Unit: mm[inch]
Lead wires size: 24-12AWG
Screwing torque: 0.4N.m Max
General tolerance ±1.00[±0.039]

Terminal No.	1	2	3	4	5	6
Function	+Vin	-Vin	CTRL	Trim	-Vo	+Vo

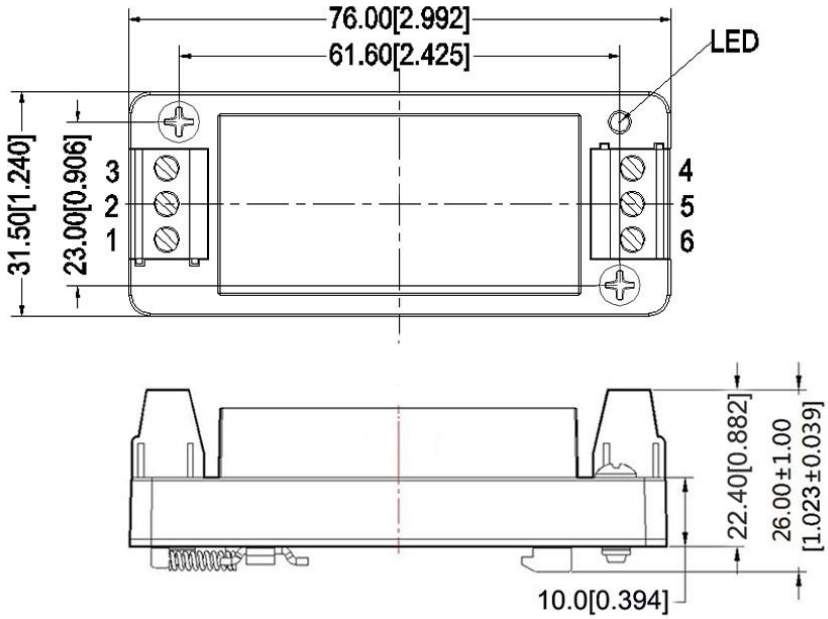
B3-TH Packaging (with Heat Sink) dimensions



Unit: mm[inch]
Lead wires size: 24-12AWG
Screwing torque: 0.4N.m Max
General tolerance ±1.00[±0.039]

Terminal No.	1	2	3	4	5	6
Function	+Vin	-Vin	CTRL	Trim	-Vo	+Vo

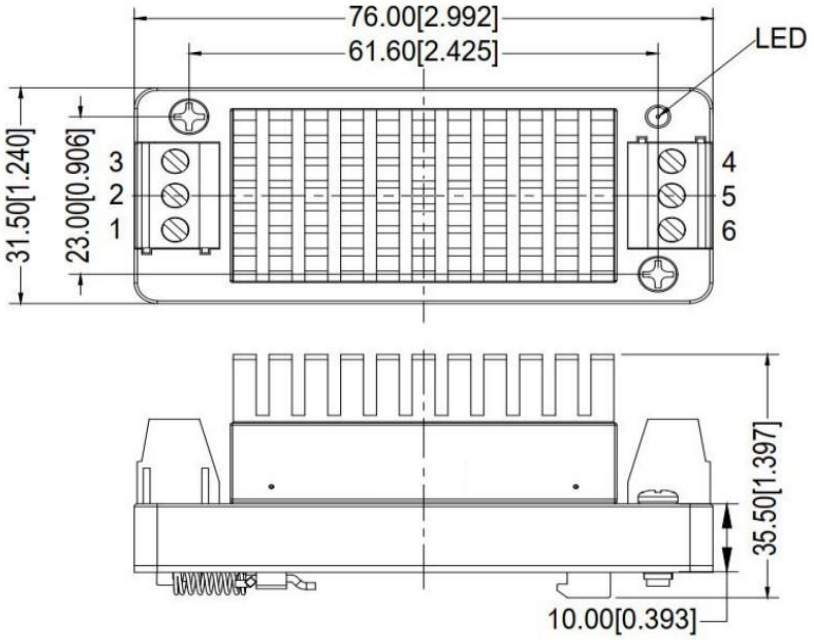
B3-TS Packaging (without Heat Sink) dimensions



Unit: mm[inch]
Lead wires size: 24-12AWG
Screwing torque: 0.4N.m Max
General tolerance ±1.00[±0.039]

Terminal No.	1	2	3	4	5	6
Function	+Vin	-Vin	CTRL	Trim	-Vo	+Vo

B3-TSH Packaging (with Heat Sink) dimensions



Unit: mm[inch]
Lead wires size: 24-12AWG
Screwing torque: 0.4N.m Max
General tolerance ±1.00[±0.039]

Terminal No.	1	2	3	4	5	6
Function	+Vin	-Vin	CTRL	Trim	-Vo	+Vo

Application Notice

1.The products should be used according to the specifications in this datasheet, otherwise it could be permanently damaged.

2. It is not recommended to connect the converters in parallel to achieve a bigger power output.

3. The product performance in this datasheet cannot be guaranteed if it works at a lower load than the minimum load defined.

4. The product performance in this datasheet cannot be guaranteed if it works at over-load condition.

5. Unless otherwise specified, all values or indicators in this datasheet are tested at Ta=25℃, humidity<75%RH, nominal input voltage and rated load (pure resistance load).

6. All values or indicators in this datasheet had been tested based on Aipupower test specifications.

7.The specifications are specially for the parts listed in this datasheet, any other non-standard model performances could be out of the specifications. Please contact our technician for specific requirements.

8. Aipupower can provide customization service.

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