DC/DC Converter
PFD12-XXSXXA3(C)2(-XXX) Series

Typical Features

- Wide input voltage range (4:1), Output Power 12W
- Efficiency up to 89% (Typ.)
- Stand-by power consumption 0.15W (Typ.)
- Very fast start (turn-on delay 10ms)
- Continuous short circuit protection, self-recovery
- Input under-voltage, output over-voltage, short-circuit and over-current protections
- Switching frequency 330KHz
- Isolation voltage 1500VDC
- Operating temperature from -40°C to +85°C
- Good EMI performance
- Standard pin-out alignment

EN62368-1

Application Field

PFD12-XXSXXA3(C)2(-XXX) Series ---- *PCB DIP mounted standard 1"X1" size 12W output DC-DC converters with wide input range 4:1, low stand-by power consumption, isolated & regulated. This series of products can be widely used in the fields of Industrial control, Instrument, Communication, Electricity power, Internet of things, etc. The additional circuit diagram for EMC is recommended in this data sheet for the application with high EMC requirement.*

Typical Product List

Certificate	Part No.	Input Voltage (VDC)		Output Voltage/Current (Vo/Io)		Input Current (mA) Typ. @Nominal Volt.		Max. Capacitive Load	Ripple & Noise (mVp-p)		Full load efficiency (%)	
		Nom.	Range	Vo (VDC)	Io (mA)	Full load	No load	uF	Typ	Max	Min	Typ
CE	PFD12-18S3V3A3(C)2	24	9-36	3.3	2400/0	407	2	5000	50	100	79	81
CE	PFD12-18S05A3(C)2	24	9-36	5	2000/0	502	2	3000	50	100	81	83
CE	PFD12-18S06A3(C)2	24	9-36	6	2000/0	588	2	3000	50	100	83	85
CE	PFD12-18S09A3(C)2	24	9-36	9	1333/0	581	2	1500	50	100	84	86
CE	PFD12-18S12A3(C)2	24	9-36	12	1000/0	575	2	1000	50	100	85	87
CE	PFD12-18S15A3(C)2	24	9-36	15	800/0	568	2	1000	50	100	86	88
CE	PFD12-18S17A3(C)2	24	9-36	17	706/0	568	2	1000	50	100	86	88
CE	PFD12-18S20A3(C)2	24	9-36	20	600/0	581	2	680	50	100	84	86
CE	PFD12-18S24A3(C)2	24	9-36	24	500/0	568	2	470	50	100	86	88
CE	PFD12-18S48A3(C)2	24	9-36	48	250/0	575	2	100	50	100	85	87
CE	PFD12-36S3V3A3(C)2	48	18-75	3.3	2400/0	211	2	5000	50	100	76	78
CE	PFD12-36S05A3(C)2	48	18-75	5	2000/0	251	2	3000	50	100	81	83
CE	PFD12-36S5V1A3(C)2	48	18-75	5.1	2353/0	301	2	3000	50	100	81	83
CE	PFD12-36S5V5A3(C)2	48	18-75	5.5	2181/0	297	2	3000	50	100	82	84
CE	PFD12-36S09A3(C)2	48	18-75	9	1333/0	291	2	1500	50	100	84	86

CE	PFD12-36S12A3(C)2	48	18-75	12	1000/0	287	2	1000	50	100	85	87
CE	PFD12-36S15A3(C)2	48	18-75	15	800/0	281	2	1000	50	100	87	89
CE	PFD12-36S24A3(C)2	48	18-75	24	500/0	284	2	1000	50	100	86	88
CE	PFD12-36S48A3(C)2	48	18-75	48	250/0	287	2	100	50	100	85	87

Note 1: In the parts numbers R indicates the part with both Control & Trim functions, C indicates the part with Control function, T indicates with Trim function, N indicates with none of Control or Trim. The suffix -H indicates the part with Heat sink, -T (H) indicates a kind of chassis package (with heat sink), -TS (H) indicates a kind of package of DIN Rail (with heat sink).

Note 2: 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 3: Please contact Aipu sales for other output voltages requirement in this series but not listed in this table.

Note 4: PFD12-36S5V1A3(C)2 output power should be derated to 10W at the input voltage from 18V to 24V.

Input Specifications

Item	Test Conditions	Min	Typ.	Max	Unit
Standby power consumption	Full input voltage range	/	0.15	/	W
Reflected ripple current	24V input series, nominal input voltage	/	40	/	mA
	48V input series, nominal input voltage	/	30	/	
Under-voltage protection	24V input series	5.5	6.5	/	VDC
	48V input series	12	13	/	
Input Inrush voltage (1sec.max)	24V input series	-0.7	/	50	
	48V input series	-0.7	/	100	
Input filter	/	Pi filter			
Ctrl*	Turn-on the converter	No connection or connect to high level (3.5V-12VDC)			
	Turn-off the converter	Connect to -Vin or connect to low level (0-1.2VDC)			
	Current value for switching off	2mA (Typ.)			

*Note: The voltage of CTRL is relative to the input -Vin.

Output Specifications

Item	Test Conditions	Min	Typ.	Max	Unit
Output Voltage Accuracy	Full input voltage range	/	±1	±3	%
Voltage Regulation	Rated load, full input voltage range	/	±0.2	±0.5	%
Load Regulation	Nominal input voltage, 5% - 100% load	/	±0.5	±1	%
Ripple & Noise	5% - 100% load, 20MHz bandwidth	/	50	100	mVp-p
Dynamic response time	25% load step, full input voltage range	/	250	500	uS
Dynamic response deviation	25% load step, nominal input voltage	/	±3	±5	%
Turn-on delay time	Nominal input voltage	/	10	/	mS
Over-voltage protection	Full input voltage range	110	160	200	%Vo
Start-up overshoot voltage		/	/	10	%Vo
Output voltage adjustment (Trim)		90	/	110	%Vo

Over-current protection		110	180	250	%Io
Short circuit protection		Continuous, self-recovery			

Note: The ripple & noise ≤5%Vo at 0% - 5% load, it is tested by the twisted pair method (please refer to the following Ripple & Noise test instruction).

General Specifications

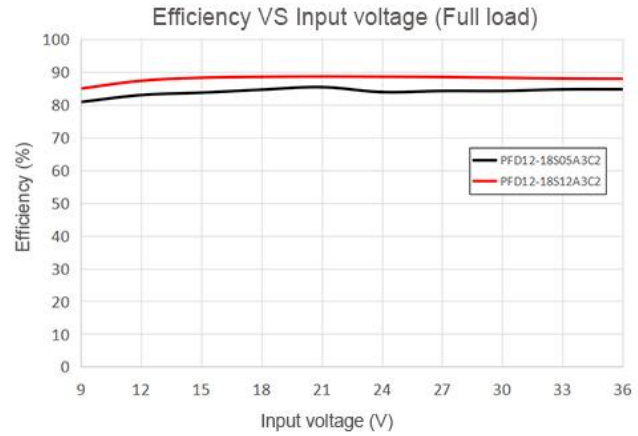
Item	Test Conditions	Min	Typ.	Max	Unit
Switching Frequency	Operating mode (PWM)	/	330	/	KHz
Operating Temperature	Refer to the temperature derating graph	-40	/	+85	℃
Storage Temperature		-55	/	+125	
Relative Humidity	No condensation	5	/	95	%RH
Isolation Voltage	I/P-O/P, test 1min, leakage current ≤1mA	1500	/	/	VDC
Insulation Resistance	I/P-O/P @500VDC	1000	/	/	MΩ
Isolation Capacity	I/P-O/P, 100KHz/0.1V	/	1000	/	pF
MBTF	MIL-HDBK-217F@25℃	1000	/	/	K hours
Cooling Method	Natural air				
Case Material	Aluminum				

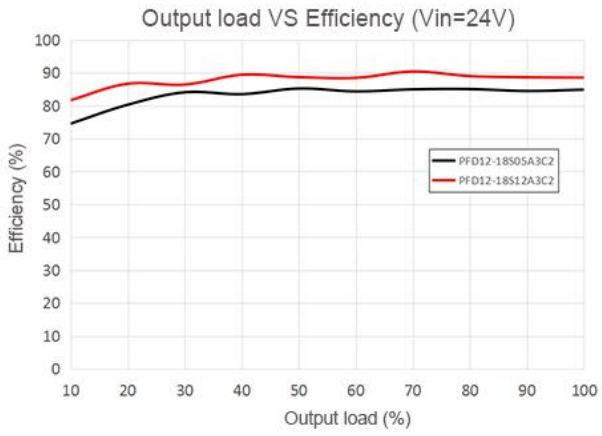
Weight/Dimension	Part No.	Weight (Typ.)	Dimensions L x W x H	
	PFD12-XXSXXA3(C)2	15g	25.4X 25.4X11.0 mm	1.00X1.00 X0.433 inch
	PFD12-XXSXXA3(C)2-H	18g	25.4X 25.4X16.0 mm	1.00X1.00 X0.630 inch
	PFD12-XXSXXA3(C)2 -T	36g	76.0X31.5X21.3 mm	2.99X1.24X0.838 inch
	PFD12-XXSXXA3(C)2 -TH	39g	76.0X31.5X26.0 mm	2.99X1.24X1.023 inch
	PFD12-XXSXXA3(C)2 -TS	56g	76.0X31.5X26.0 mm	2.99X1.24X1.023 inch
	PFD12-XXSXXA3(C)2 -TSH	59g	76.0X31.5X30.8 mm	2.99X1.24X1.212 inch

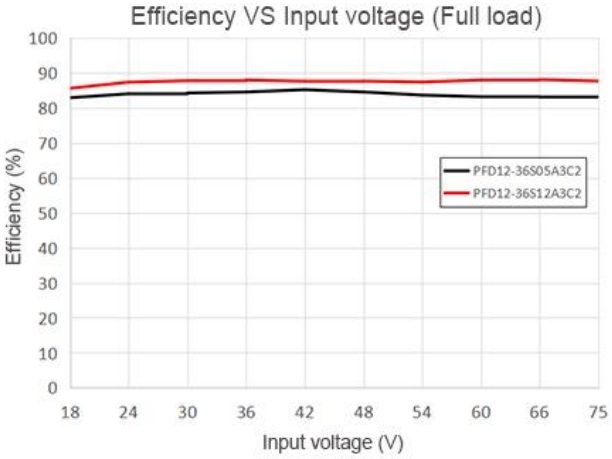
EMC Performance

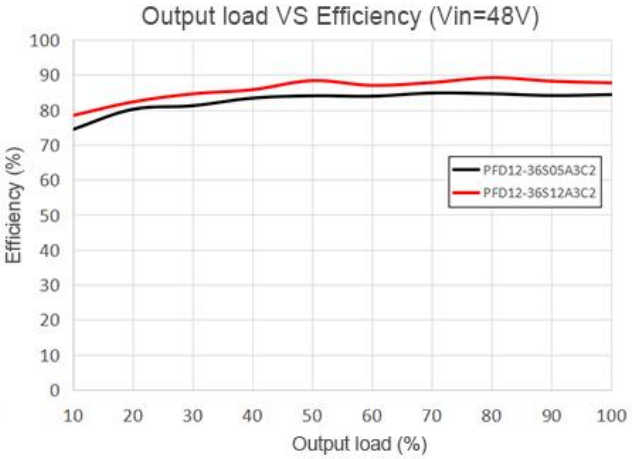
Total Items		Sub Items	Test Standard	Performance/Class
EMC	EMI	CE	CISPR22/EN55032	CLASS B (with the Recommended EMC circuit part 2)
		RE	CISPR22/EN55032	CLASS B (with the Recommended EMC circuit part 2)
	EMS	RS	IEC/EN61000-4-3	10V/m Perf.Criteria B
		CS	IEC/EN61000-4-6	3Vr.m.s Perf.Criteria B
		ESD	IEC/EN61000-4-2	Contact ±4KV Perf.Criteria B
		Surge	IEC/EN61000-4-5	±2KV Perf.Criteria B (with the Recommended EMC circuit part 1)
		EFT	IEC/EN61000-4-4	±2KV Perf.Criteria B (with the Recommended EMC circuit part 1)
		Voltage Dips & Interruptions	IEC/EN61000-4-11	0% ~70% Perf.Criteria B

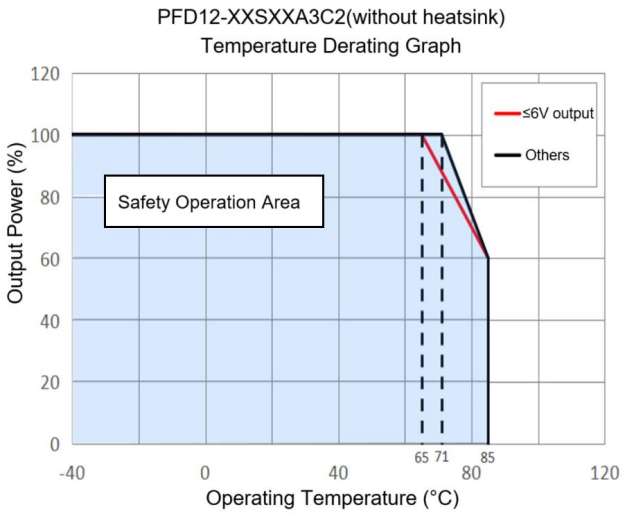
Product Characteristics Graphs

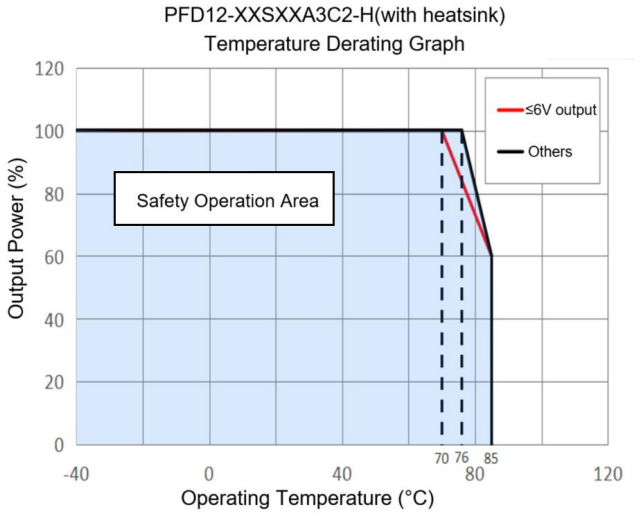






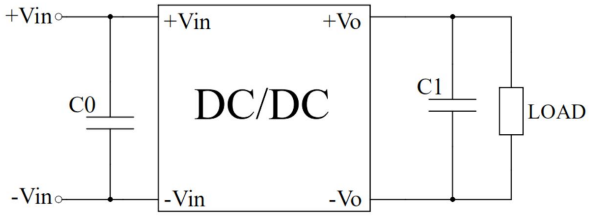






Recommended Circuits Diagrams for Application

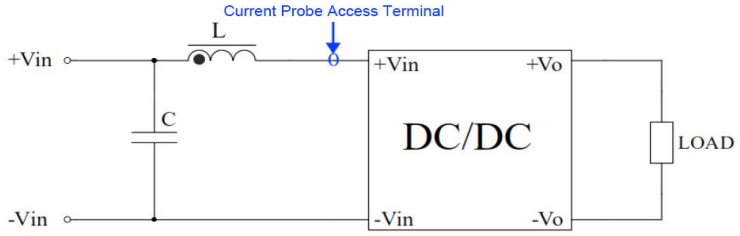
1. DC/DC test circuit



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

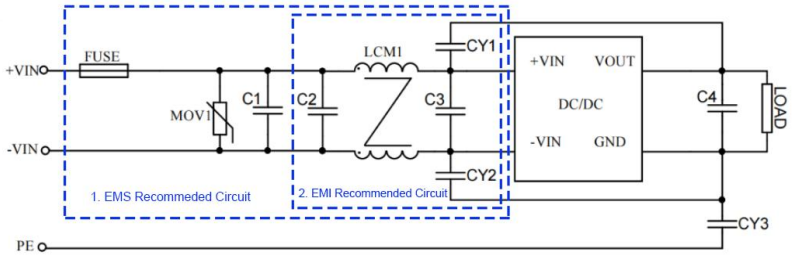
2. Input reflected ripple current test circuit diagram

A low ESR capacitor is recommended for C which withstand voltage should be more than the maximum input voltage.



Components	Parameter
C	220uF
L	4.7uH

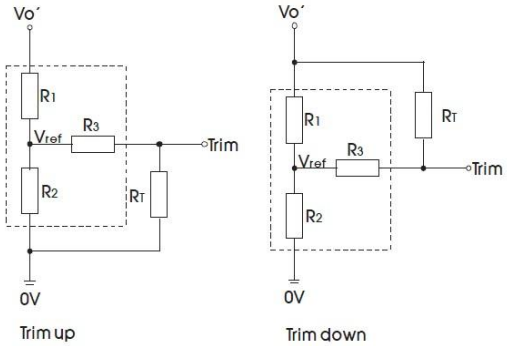
3. Recommended EMC circuit diagram



Note: Part 1 in the circuit diagram is for EMS, part 2 for EMI filtering, both can be adjusted according to the actual situation.

Components	24V input series	48V input series
FUSE	TBD by the customer	
MOV1	14D560K	14D101K
LCM1	5mH	5mH
C1, C2, C3	330uF/50V	330uF/100V
C4	47uF/50V	47uF/50V
CY1, CY2	2.2nF/2000V	

4. Trim and Calculation of Trim Resistance



Rrim Resistance calculating fomula

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

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

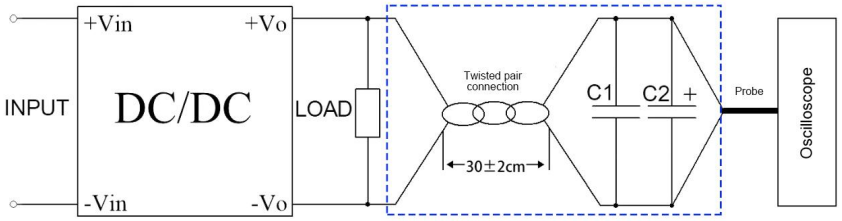
R_T is the Trim resistance
a is a self-defined parameter
Vo' is the required Up-voltage or Down-voltage

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

Output Voltage	Internal circuit parameters for Trim			
Vo (VDC)	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref(V)
3.3	4.22	2.55	18	1.25
5	5.1	5.1	20	2.5
9	9.31	3.58	24	2.5
12	18	4.75	33	2.5
15	18	3.6	30	2.5
24	30	3.48	30	2.5
48	45.3	2.47	18	2.5
Note: The Trim function is only available for the output voltages in the table.				

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

Test circuit diagram:



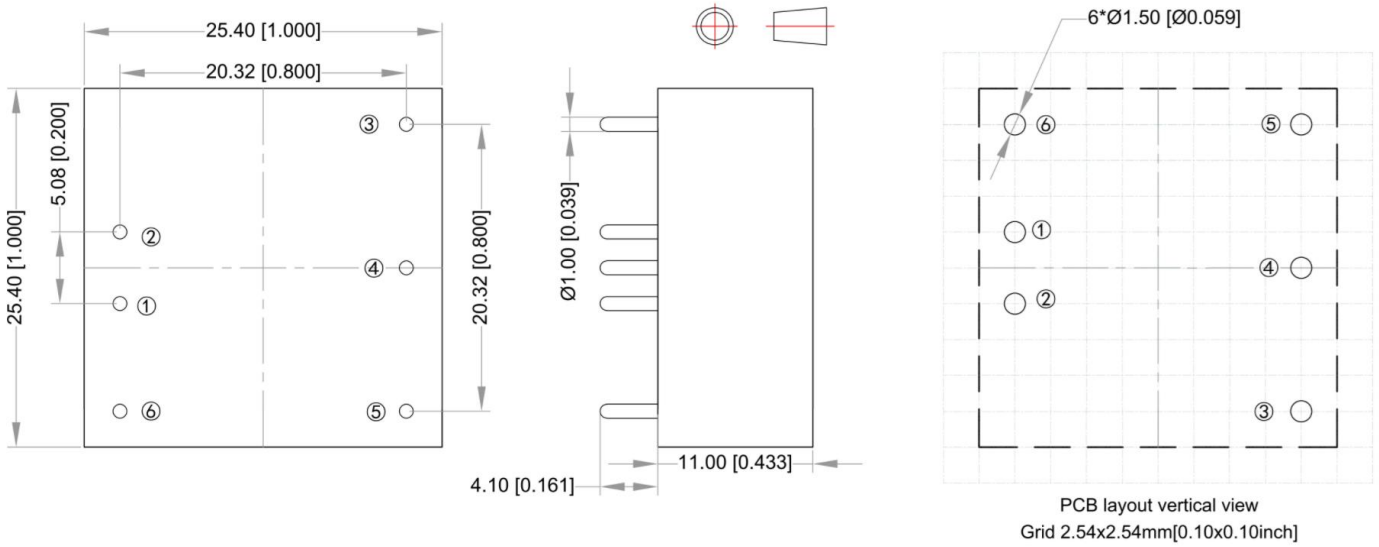
1) The Ripple & noise test needs 12# twisted pair cables, an oscilloscope which should be set at the Sample Mode, bandwidth 20MHz. 100M bandwidth probe with cap and ground removed. C1(0.1uF) polypropylene capacitor and C2(10uF) high-frequency low-resistance electrolytic capacitor are connected in parallel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

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 start after input power on.

Note:

1. The maximum capacitive load is tested at the pure resistive full load.
2. It is recommended to connect a ≥5% load or a high-frequency low resistance E-cap(≥100uF) load at output to avoid the output ripple increasing.

A3 Package Dimensions (without heat sink)

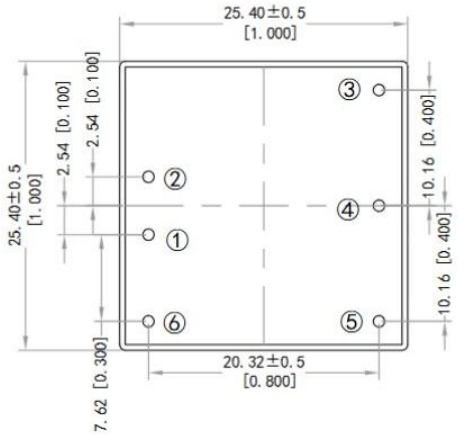


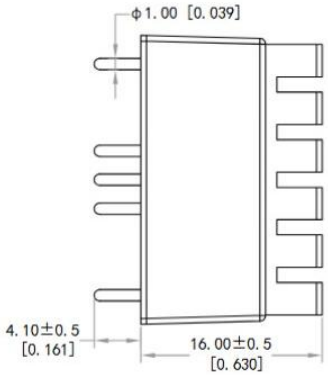
PCB layout vertical view
Grid 2.54x2.54mm[0.10x0.10inch]

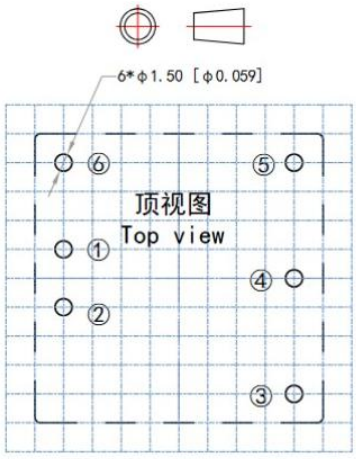
Unit: mm[inch]
General tolerance: ±0.50[±0.020]
Pin diameter tolerance: ±0.10[±0.004]

Pin No.	1	2	3	4	5	6
PFD12-XXSXXA3R2	-Vin	+Vin	+Vout	Trim	GND	Ctrl

A3-H Package Dimensions (with heat sink)





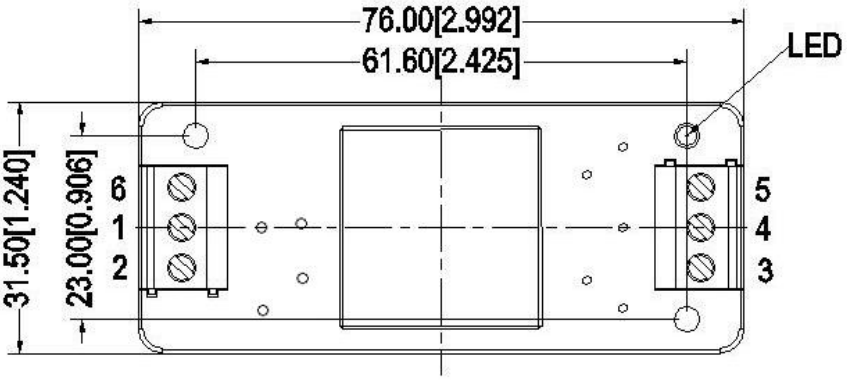


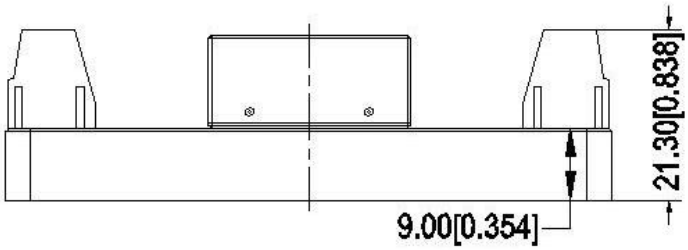
PCB layout vertical view
Grid 2.54x2.54[0.10x0.10]

Unit: mm(inch)
General tolerance: ±0.50(±0.020)
Pin diameter tolerance: ±0.10(±0.004)

Pin No.	1	2	3	4	5	6
PFD12-XXSXXA3R2	-Vin	+Vin	+Vout	Trim	GND	Ctrl

A3-T Package Dimensions (without heat sink)

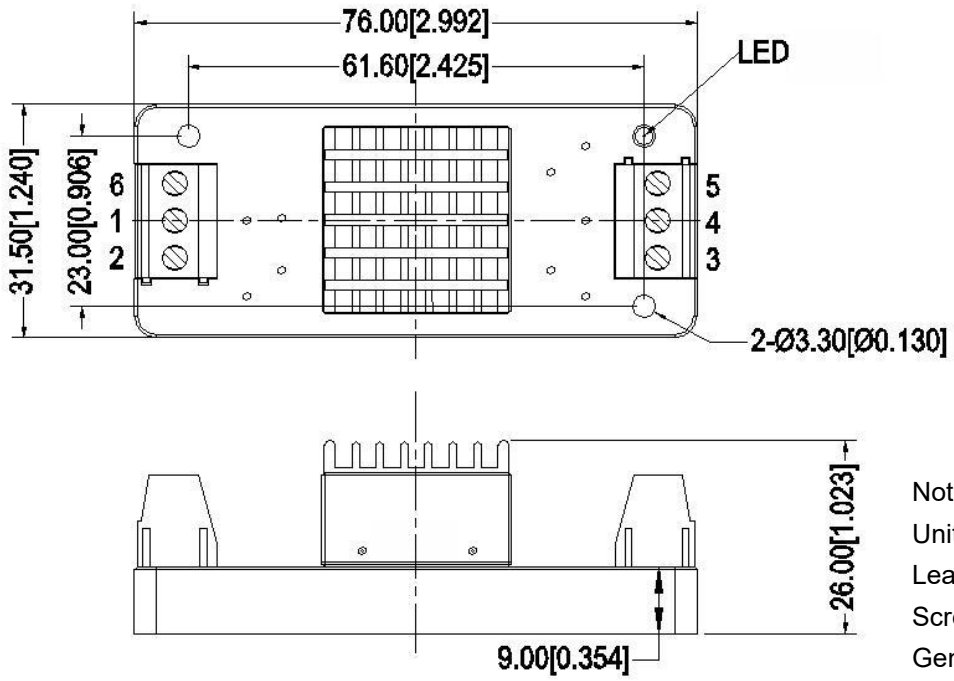




Note:
Unit: mm [inch]
Lead wires size: 24-12AWG
Screwing torque: 0.4N.m Max
General tolerance: ±1.00[±0.039]

Terminal No.	1	2	3	4	5	6
PFD12-XXSXXA3R2	-Vin	+Vin	+Vout	Trim	GND	Ctrl

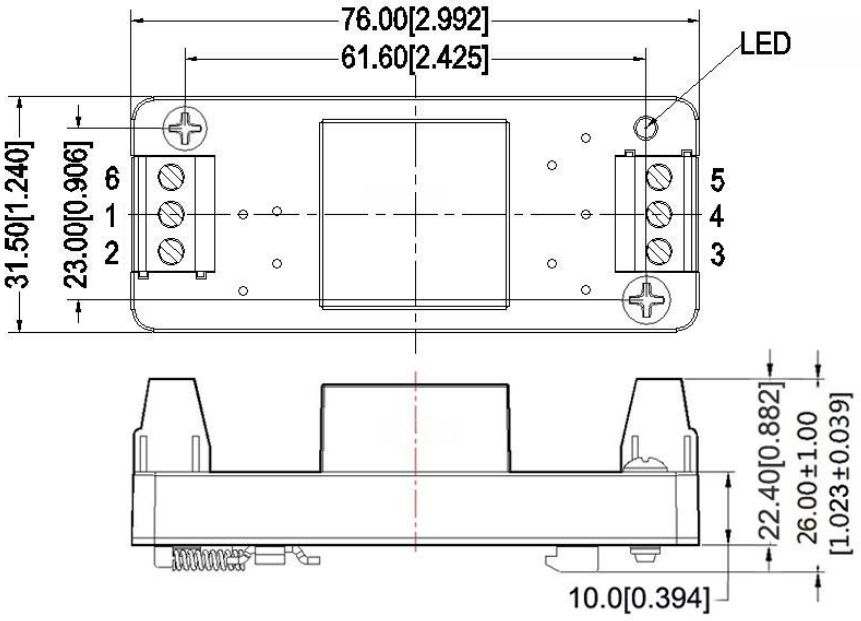
A3-TH Package Dimensions (with heat sink)



Note:
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
PFD12-XXSXXA3R2	-Vin	+Vin	+Vout	Trim	GND	Ctrl

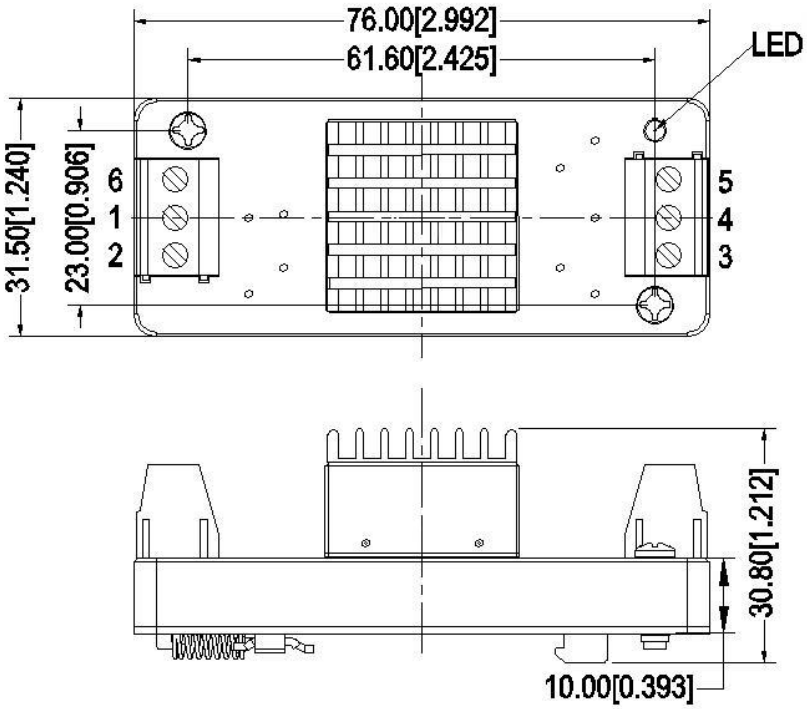
A3-TS Package Dimensions (without heat sink)



Note:
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
PFD12-XXSXXA3R2	-Vin	+Vin	+Vout	Trim	GND	Ctrl

A3-TSH Package Dimensions (with heat sink)



Note:
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
PFD12-XXSXXA3R2	-Vin	+Vin	+Vout	Trim	GND	Ctrl

Application Notice

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

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

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

4. 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).

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

6.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.

7. Aipupower can provide customization service.

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