DC/DC Converter
FD12-XXSXXA3(C)4(-XXX) Series

Typical Features

- Wide input voltage range (4:1), output power 12W
- Efficiency up to 89% (Typ.)
- Stand-by power consumption 0.1W (Typ.)
- Fast start-up
- Continuous short circuit protection, self-recovery
- Input under-voltage protection, output over-voltage, short-circuit and over-current protections
- Switching frequency 350KHz
- Isolation voltage 2150VAC
- Operating temperature from -40°C to +85°C
- Good EMI performance
- Standard pin-out alignment

Application Field

FD12-XXSXXA3(C)4(-XXX) Series ---- *PCB DIP mounted standard 1"X1" size DC-DC modular converters with wide input range 4:1, low stand-by power consumption, isolated & regulated single output 12W. 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 for the application with high EMC requirement.*

Typical Product List

Certificate	Part No.	Input Voltage Range (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
-	FD12-18S3V3A3(C)4	24	9-36	3.3	2400/0	407	2	6000	50	100	79	81
-	FD12-18S05A3(C)4	24	9-36	5	2000/0	502	2	3000	50	100	81	83
-	FD12-18S09A3(C)4	24	9-36	9	1333/0	588	2	2000	50	100	83	85
-	FD12-18S12A3(C)4	24	9-36	12	1000/0	575	2	2000	50	100	85	87
-	FD12-18S15A3(C)4	24	9-36	15	800/0	568	2	1500	50	100	86	88
-	FD12-18S24A3(C)4	24	9-36	24	500/0	568	2	600	50	100	86	88
-	FD12-36S3V3A3(C)4	48	18-75	3.3	2400/0	211	2	6000	50	100	76	78
-	FD12-36S05A3(C)4	48	18-75	5	2000/0	251	2	3000	50	100	81	83
-	FD12-36S09A3(C)4	48	18-75	9	1333/0	291	2	2000	50	100	84	86
-	FD12-36S12A3(C)4	48	18-75	12	1000/0	287	2	2000	50	100	85	87
-	FD12-36S15A3(C)4	48	18-75	15	800/0	281	2	1500	50	100	87	89
-	FD12-36S24A3(C)4	48	18-75	24	500/0	284	2	800	50	100	86	88

Note 1: In the parts numbers C indicates the part with ON/OFF Control, N indicates without ON/OFF Control. 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 2: The maximum capacitive load is the capacitance allowed to be used when the power supply starts at full load. The converter may not start if the capacitor exceeds this value.

Note 3: The chip could operate at jitter frequency situation with no load or light load to decrease the no-load power consumption, so no load is not available. ≥15% load or a high-frequency low resistance E-cap(≥100uF) load is recommended, to avoid the output ripple increasing.

Note 4: 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	/	0.1	/	W
Under-voltage Protection	24V nominal input series	5	6.5	9	VDC
	48V nominal input series	11	13	18	
Input Filter	/	Pi filter			
ON/OFF Control (Ctrl*)	Turn ON the converter	No connection or connect to high level (3.3V-12VDC)			
	Turn OFF the converter	Connected to -Vin or low voltage 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	±2	%
Voltage Regulation	Rated load, full input voltage range		/	±0.2	±0.5	%
Load Regulation	Nominal input voltage, 10% - 100% load		/	±0.5	±1	%
Ripple & Noise	15% - 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% rated load step, nominal input voltage	3.3 & 5V outputs	/	±3	±8	%
		Others	/	±3	±5	
Turn-on Delay Time	Nominal input voltage		/	150	/	mS
Over-voltage Protection	Full input voltage range		120	160	200	%Vo
Start-up Overshoot Voltage			/	/	10	%Vo
Over-current Protection			110	160	220	%Io
Short Circuit Protection			Continuous, self-recovery			

Note: Ripple & noise ≤5%Vo at 0% - 15% load, it is tested by the twisted pair method (refer to the following test instruction).

General Specifications

Item	Test Conditions	Min	Typ.	Max	Unit
Switching Frequency	Operating mode (PWM)	/	350	/	KHz
Operating Temperature	Refer to the temperature derating graph	-40	/	+85	°C
Storage Temperature		-55	/	+125	°C

Relative Humidity	No condensation	5	/	95	%RH
Isolation Voltage	I/P-O/P, test 1min, leakage current ≤5mA	2150	/	/	VAC
Insulation Resistance	I/P-O/P @500VDC	1000	/	/	MΩ
Isolation Capacitance	I/P-O/P, 100KHz/0.1V	/	1000	/	pF
MBTF	MIL-HDBK-217F@25℃	1000	/	/	K hours
Cooling Method	Natural air				
Case Material	Aluminum				

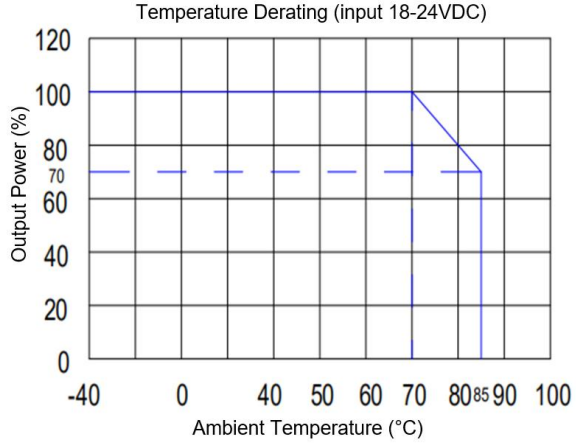
Weight/Dimension	Part No.	Weight (Typ.)	Dimensions L x W x H	
	FD12-XXSXXA3(C)4	15g	25.4X 25.4X11.0 mm	1.00X1.00 X0.433 inch
	FD12-XXSXXA3(C)4-H	18g	25.4X 25.4X16.0 mm	1.00X1.00 X0.630 inch
	FD12-XXSXXA3(C)4 -T	36g	76.0X31.5X21.3 mm	2.99X1.24X0.838 inch
	FD12-XXSXXA3(C)4 -TH	39g	76.0X31.5X26.0 mm	2.99X1.24X1.023 inch
	FD12-XXSXXA3(C)4 -TS	56g	76.0X31.5X26.0 mm	2.99X1.24X1.023 inch
	FD12-XXSXXA3(C)4 -TSH	59g	76.0X31.5X30.8 mm	2.99X1.24X1.212 inch

EMC Performance

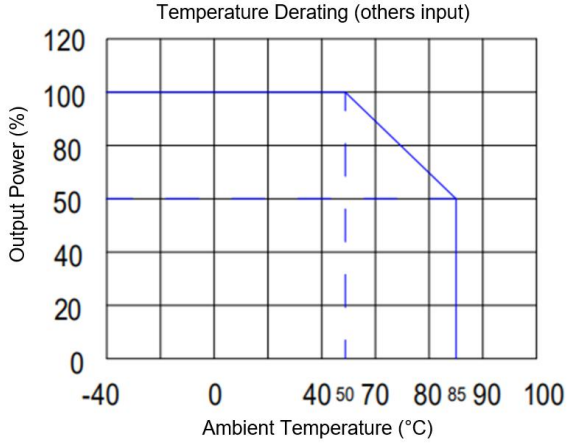
Total Items		Sub Items	Test Standard	Performance/Class
EMC	EMI	CE	CISPR32/EN55032	1, Class A 2, CLASS B (with the Recommended EMC circuit)
		RE	CISPR32/EN55032	1, Class A 2, CLASS B (with the Recommended EMC circuit)
	EMS	RS	IEC/EN61000-4-3	10V/m Perf.Criteria B
		CS	IEC/EN61000-4-6	3Vr.m.s Perf.Criteria 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)
		EFT	IEC/EN61000-4-4	±2KV Perf.Criteria B (with the Recommended EMC circuit)

Product Characteristics Graphs

Temperature Derating (input 18-24VDC)

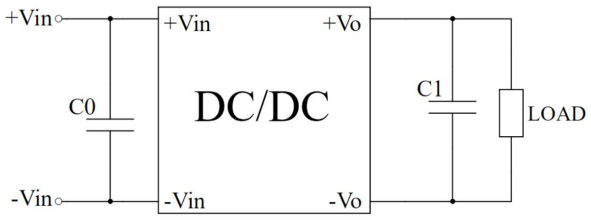


Temperature Derating (others input)



Recommended Circuits Diagrams for Application

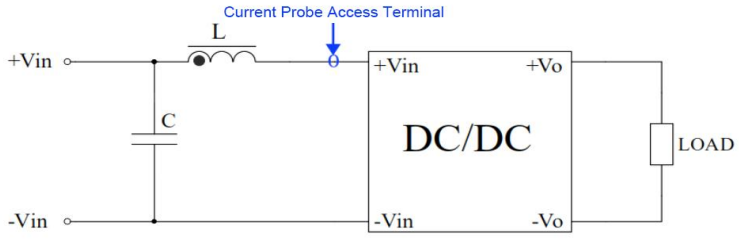
1. DC/DC test circuit diagram



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

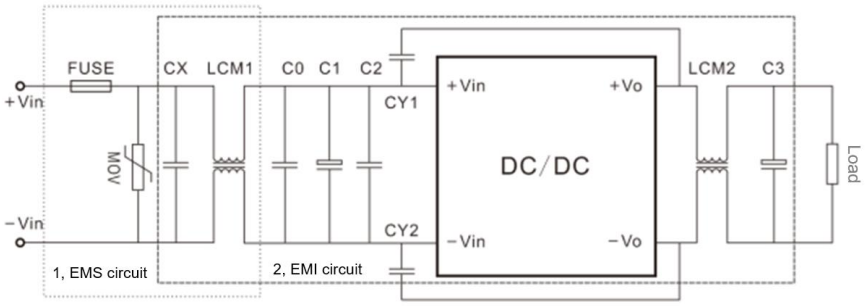
2. Input reflected ripple current test circuit diagram

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

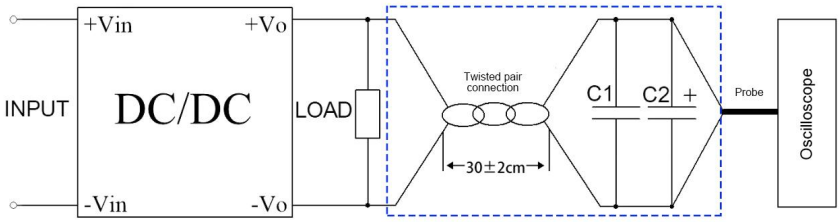


Note: Part 1 in the circuit diagram is for EMS, part 2 for EMI filtering, both can be adjusted according to the actual situation.

Component	Input 9-36V	Input 18-75V
FUSE	TBD by the customer	
MOV	14D560K	14D101K
CX	0.47uF	0.47uF
LCM1	10mH	10mH
C0	0.1uF/250V	0.1uF/250V
C1	220uF/100V	220uF/100V
C2	0.1uF/250V	0.1uF/250V
LCM2	30uH	30uH
C3	47uF/50V	47uF/50V
CY1, CY2	2.2nF/2000V	

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

Test circuit diagram:



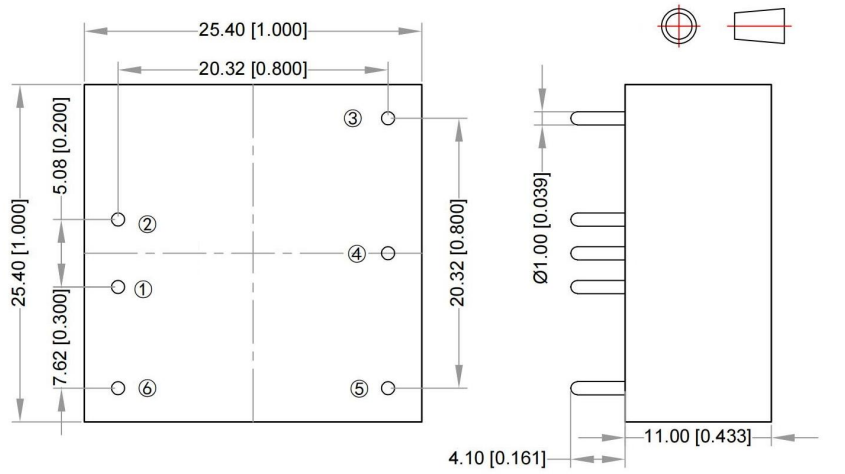
1) The Ripple & noise test needs 12# twisted pair cables, an oscilloscope which should be set at the Sample Mode, bandwidth 20MHz. 100M bandwidth probe with cap and ground removed. C1(0.1uF) polypropylene capacitor and C2(10uF) high-frequency low-resistance electrolytic capacitor are connected in parallel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

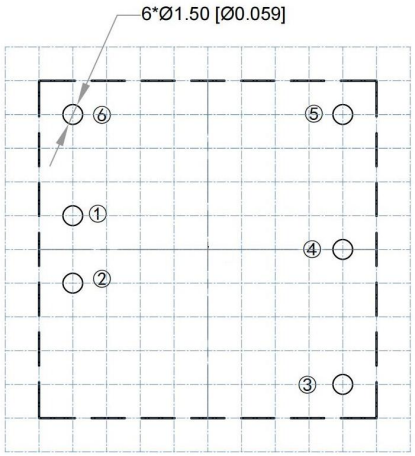
2) The power supply output connects to the load by the cables. The other side of the twisted pair (length 30cm±2 cm) should be connected in parallel with the load, the polarity of the output and the oscilloscope probe should not be reversed. The test can be start after input power on.

Note 1: The maximum capacitive load is tested at the pure resistive full load.

Note 2: It is recommended to connect a ≥15% 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)



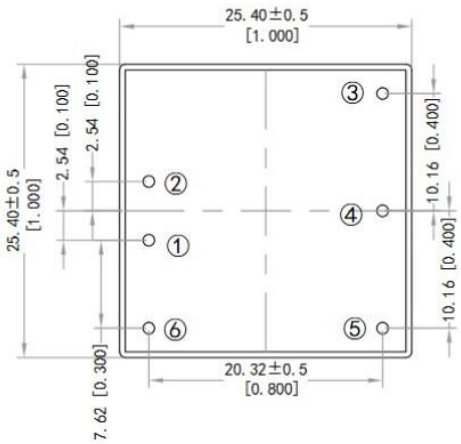


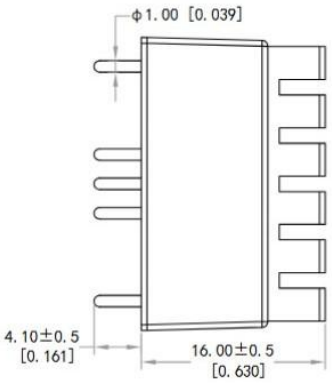
PCB layout vertical view
Grid 2.54x2.54[0.10x0.10]

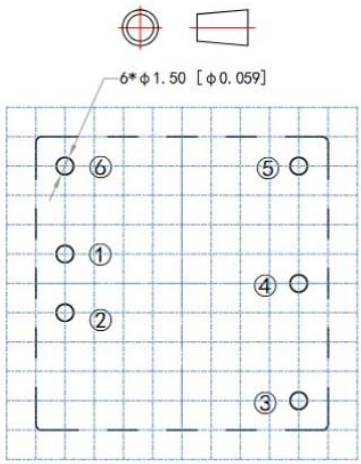
Unit: mm[inch]
General tolerance: ±0.50[±0.020]
Pin diameter tolerance: ±0.10[±0.004]

Pin No.	1	2	3	4	5	6
FD12-XXSXXA3C4	-Vin	+Vin	+Vout	No Pin	GND	Ctrl

A3-H Package Dimensions (with heat sink)





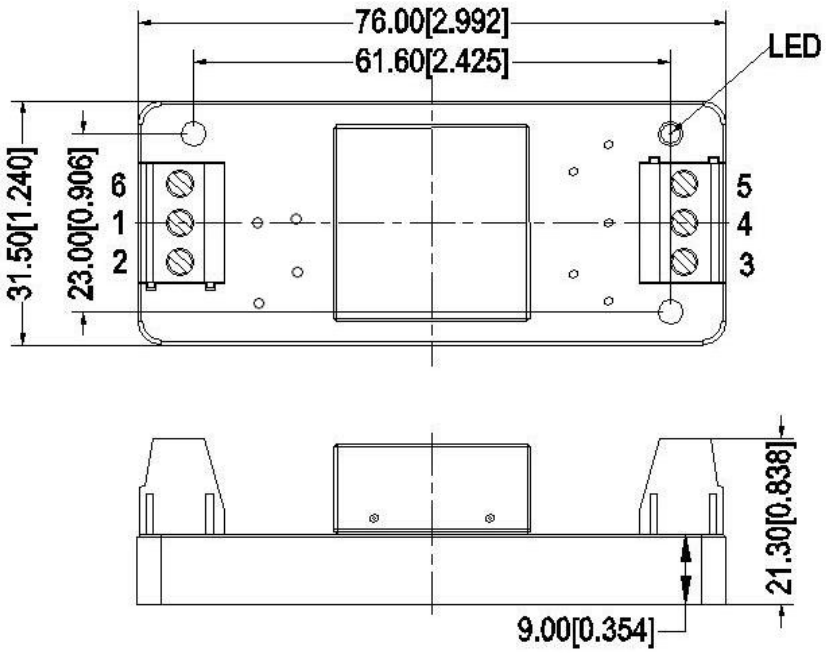


PCB layout vertical view
Grid 2.54x2.54[0.10x0.10]

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

Pin No.	1	2	3	4	5	6
FD12-XXSXXA3C4	-Vin	+Vin	+Vout	No Pin	GND	Ctrl

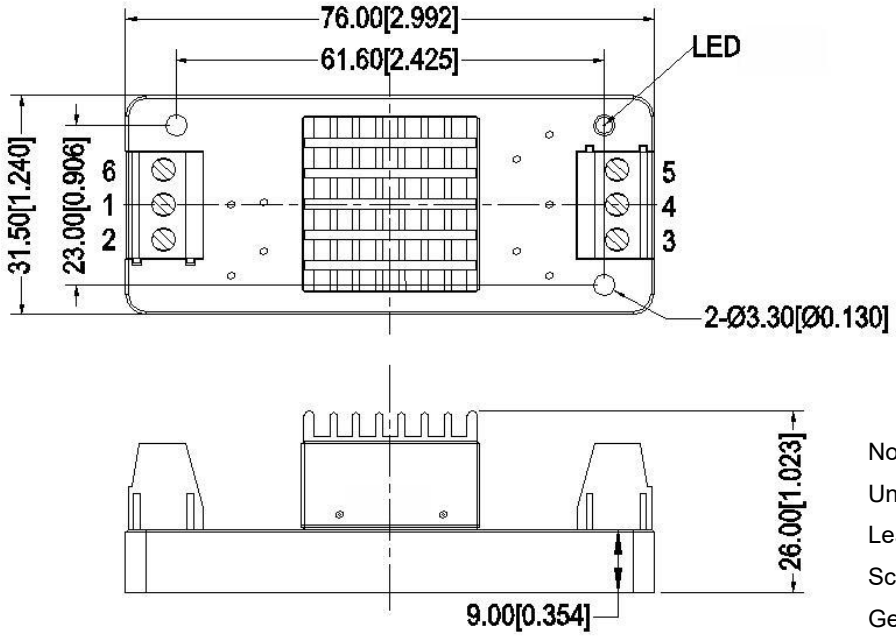
A3-T Package Dimensions (without heat sink)



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

Terminal No.	1	2	3	4	5	6
FD12-XXSXXA3C4	-Vin	+Vin	+Vout	No Connection	GND	Ctrl

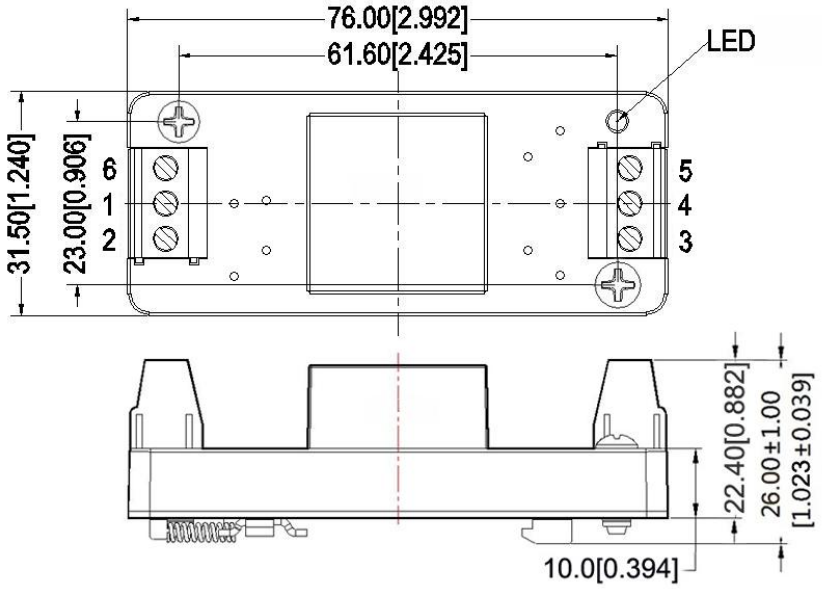
A3-TH Package Dimensions (with heat sink)



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

Terminal No.	1	2	3	4	5	6
FD12-XXSXXA3C4	-Vin	+Vin	+Vout	No Connection	GND	Ctrl

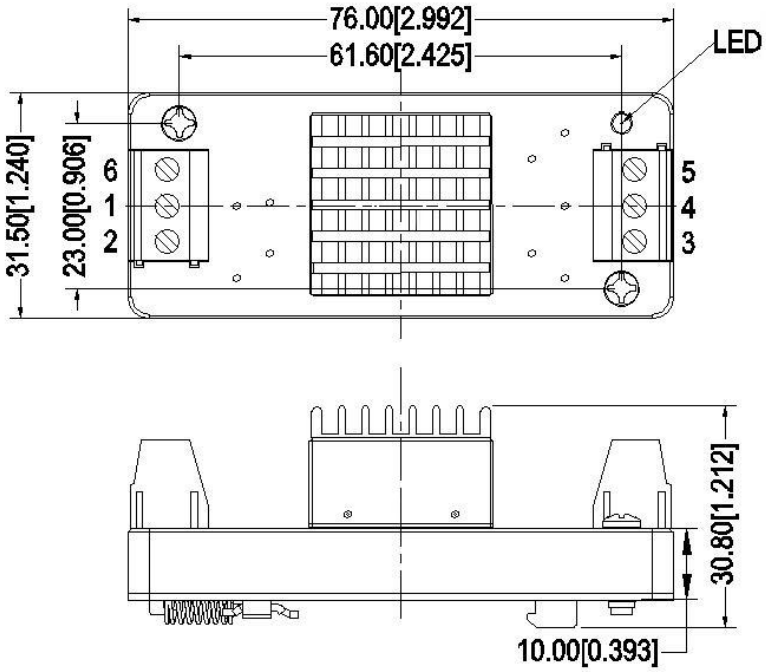
A3-TS Package Dimensions (without heat sink)



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

Terminal No.	1	2	3	4	5	6
FD12-XXSXXA3C4	-Vin	+Vin	+Vout	No Connection	GND	Ctrl

A3-TSH Package Dimensions (with heat sink)



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

Terminal No.	1	2	3	4	5	6
FD12-XXSXXA3C4	-Vin	+Vin	+Vout	No Connection	GND	Ctrl

Other Models Pin-out Function Description						
Pin/Terminal No.	1	2	3	4	5	6
FD12-XXSXXA3N4	-Vin	+Vin	+Vout	No Pin	GND	No Pin

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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