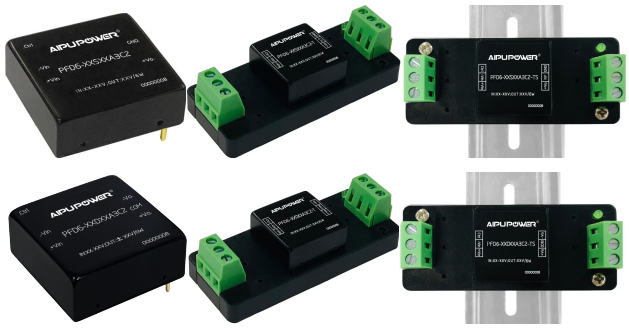
# DC/DC Converter

## PFD6-XXS&DXXA3(C)2 Series

## Product Typical Features

- Wide input voltage range (4:1)
- Efficiency 88% (Typ.)
- No-load power consumption 0.12W (Typ.)
- Operating Temperature from -40°C to +85°C
- Input under-voltage protection, output short circuit, over current, over voltage protections
- Isolation Voltage 1500VDC
- International standard pin-out



## Application Field

**PFD6-XXS&DXXA3(C)2 series** ----- *Compact size modular DC-DC converters with 4:1 wide input voltage range, isolation voltage 1500VDC, output short circuit, over-current and over-voltage protections, operating temperature from –40℃ to +85℃ and remote-control function. This series of products can be widely used in the fields of industrial control, instrument, communication, Electricity power & IoT, etc. The additional EMC circuit in the datasheet is recommended for higher EMC requirement.*

## Typical Product List

| Certificate | Part No. | Input Voltage Range (VDC) | | Output Voltage/Current (Vo/Io) | | Input Current (mA) Typ. @Nominal Voltage | | Max Capacitive Load | Ripple & Noise (mVp-p) | | Full Load Efficiency (%) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Nom. | Range | Vo (VDC) | Io(mA) Max/Min | Full Load | No Load | uF | Typ. | Max | Min | Typ. |
| - | PFD6-18S3V3A3(C)2 | 24 | 9~36 | 3.3 | 1500/0 | 267 | 5 | 2200 | 50 | 100 | 75 | 77 |
| - | PFD6-18S05A3(C)2 | | | 5 | 1200/0 | 301 | | 2200 | | | 81 | 83 |
| - | PFD6-18S09A3(C)2 | | | 9 | 667/0 | 298 | | 1000 | | | 82 | 84 |
| - | PFD6-18S12A3(C)2 | | | 12 | 500/0 | 294 | | 680 | | | 83 | 85 |
| - | PFD6-18S15A3(C)2 | | | 15 | 400/0 | 291 | | 680 | | | 84 | 86 |
| - | PFD6-18S24A3(C)2 | | | 24 | 250/0 | 291 | | 680 | | | 84 | 86 |
| - | PFD6-18S25A3(C)2 | | | 25 | 200/0 | 294 | | 680 | | | 83 | 85 |
| - | PFD6-18S40A3(C)2 | | | 40 | 150/0 | 291 | | 220 | | | 84 | 86 |
| - | PFD6-18D05A3(C)2 | | | ±5 | ±600/0 | 305 | | 1000 | | | 80 | 82 |
| - | PFD6-18D09A3(C)2 | | | ±9 | ±333/0 | 298 | | 330 | | | 82 | 84 |
| - | PFD6-18D12A3(C)2 | | | ±12 | ±250/0 | 294 | | 330 | | | 83 | 85 |
| - | PFD6-18D15A3(C)2 | | | ±15 | ±200/0 | 291 | | 330 | | | 84 | 86 |
| - | PFD6-18D18A3(C)2 | | | ±18 | ±167/0 | 291 | | 220 | | | 84 | 86 |
| - | PFD6-18D24A3(C)2 | | | ±24 | ±125/0 | 291 | | 220 | | | 84 | 86 |
| - | PFD6-36S3V3A3(C)2 | 48 | 18~75 | 3.3 | 1500/0 | 129 | 4 | 2200 | | | 78 | 80 |
| - | PFD6-36S05A3(C)2 | | | 5 | 1200/0 | 149 | | 2200 | | | 82 | 84 |
| - | PFD6-36S09A3(C)2 | | | 9 | 667/0 | 147 | | 1000 | | | 83 | 85 |
| - | PFD6-36S12A3(C)2 | | | 12 | 500/0 | 144 | | 680 | | | 85 | 87 |
| - | PFD6-36S15A3(C)2 | | | 15 | 400/0 | 142 | | 680 | | | 86 | 88 |
| - | PFD6-36S24A3(C)2 | | | 24 | 250/0 | 144 | | 680 | | | 85 | 87 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| - | PFD6-36D05A3(C)2 | | | ±5 | ±600/0 | 151 | | 1000 | | | 81 | 83 |
| - | PFD6-36D09A3(C)2 | | | ±9 | ±333/0 | 149 | | 330 | | | 82 | 84 |
| - | PFD6-36D12A3(C)2 | | | ±12 | ±250/0 | 144 | | 330 | | | 85 | 87 |
| - | PFD6-36D15A3(C)2 | | | ±15 | ±200/0 | 142 | | 330 | | | 86 | 88 |
| - | PFD6-36D24A3(C)2 | | | ±24 | ±125/0 | 145 | | 220 | | | 84 | 86 |

Note:

1. In the part numbers C indicates the part with Remote Control function, N indicates with NO Control function. The suffix -T indicates a kind of chassis packaging, -TS indicates a kind of packaging of DIN Rail which width is 35mm.
2. The typical value of efficiency is tested at 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 if the capacitor exceeds this value.
4. The control chip could work at lower frequency at no load or low load to decrease the no load power consumption and improve the efficiency.
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 |
|---|---|---|---|---|---|
| Stand-by Power | Nominal input voltage, no load | / | 0.12 | / | W |
| Input Inrush voltage (1 sec. Max) | Nominal 24VDC input | -0.7 | / | 50 | VDC |
| | Nominal 48VDC input | -0.7 | / | 100 | |
| Start-up voltage | Nominal 24VDC input | / | / | 9 | |
| | Nominal 48VDC input | / | / | 18 | |
| Input Under-voltage Protection | Nominal 24VDC input | 5.5 | 6.5 | / | |
| | Nominal 48VDC input | 12 | 15 | / | |
| Hot Plug | / | Unavailable | | | |
| Input Filter | / | π filter | | | |
| Reflected Ripple Current | Refer to the recommended circuit, Nominal input voltage | 20mA (Typ) | | | |

## Output Specifications

| Item | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output Voltage Accuracy | 5%-100% load | | / | ±1 | ±3 | % |
| | 0%-5% load | Single output | / | ±1 | ±3 | |
| | | Dual output | / | ±2 | ±5 | |
| Output Voltage Balance | Dual output, balanced load | | / | ±0.5 | ±1.5 | % |
| Voltage Regulation | Full voltage range, full load | Positive output | / | ±0.2 | ±0.5 | |
| | | Negative output | / | ±0.5 | ±1 | |
| Load Regulation | 5%-100% load | Positive output | / | ±0.5 | ±1 | |
| | | Negative output | / | ±0.5 | ±1.5 | |
| Ripple & Noise | 5%-100% load, 20MHz bandwidth | | / | 50 | 100 | mVp-p |
| Dynamic response deviation | 25% rated load step change | | / | ±3 | ±5 | % |
| Dynamic response Time | 25% of rated load step, input voltage range | | / | 300 | 500 | uS |

| | | | | | |
|---|---|---|---|---|---|
| Temperature drift coefficient | Full load | / | / | ±0.03 | %/℃ |
| Turn-on delay time | Nominal input voltage & constant resistance load | / | 10 | / | mS |
| Output over voltage protection | Input voltage range | 110 | 160 | 230 | %Vo |
| Output over current protection | | 110 | 150 | 260 | %Io |
| Output overshoot | | / | / | 10 | %Vo |
| Short circuit protection | | Continuous, self-recovery | | | |

Note: The ripple & noise ≤5%Vo at 0% - 5% load, it is tested by the twisted pair method. For detailed understood, please refer to the Ripple & Noise test Instructions.

## General Specifications

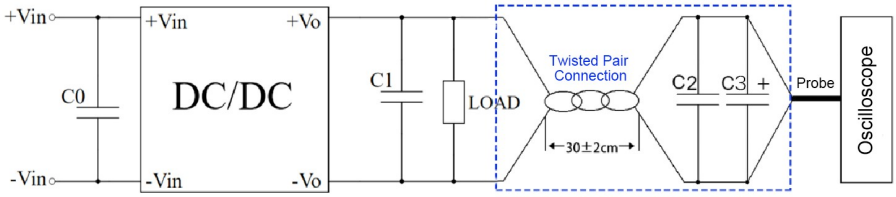
| Item | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Switching Frequency | Operating Mode (PWM) | / | 300 | / | KHz |
| Operating Temperature | Refer to the Temperature Derating Curve | -40 | / | +85 | ℃ |
| Storage Temperature | / | -55 | /. | +125 | |
| Pin soldering temperature | 1.5mm from the case, time ≤10S | / | / | 300 | |
| Relative Humidity | No condensing | 5 | / | 95 | %RH |
| Isolation Voltage | I/P-O/P, test 1 min, leakage current ⩽1mA | 1500 | / | / | VDC |
| Insulation resistance | Input-output, @ 500VDC | 1000 | / | / | MΩ |
| Isolation capacitor | Input-output, @100KHz/0.1V | | 1000 | | pF |
| MTBF | MIL-HDBK-217F@25℃ | 1000 | / | / | K hours |
| Cooling Method | Nature air | | | | |
| Case Material | Aluminum | | | | |

| Weight / Dimensions | Part No. | Weight (Typ.) | Dimensions L x W x H | |
|---|---|---|---|---|
| | PFD6-XXS&DXXA3(C)2 | 15g | 25.4X25.4X11.0 mm | 1.00X1.00X0.433 inch |
| | PFD6-XXS&DXXA3(C)2-T | 36g | 76.0X31.5X21.3 mm | 2.99X1.24X0.838 inch |
| | PFD6-XXS&DXXA3(C)2-TS | 56g | 76.0X31.5X26.0 mm | 2.99X1.24X1.023 inch |

## EMC Performance

| Total Items | | Sub Items | Test Standard | Performance/Class |
|---|---|---|---|---|
| EMC | EMI | CE | CISPR32/EN55032 | CLASS B （with EMC Recommended Circuit） |
| | | RE | CISPR32/EN55032 | CLASS B （with EMC Recommended Circuit） |
| | EMS | CS | IEC/EN61000-4-6 | 3Vr.m.s Perf.Criteria A |
| | | RS | IEC/EN61000-4-3 | 10V/m Perf.Criteria A |
| | | ESD | IEC/EN61000-4-2 | Contact ±4KV Perf.Criteria B |
| | | Surge | IEC/EN61000-4-5 | ±2KV Perf.Criteria B（with EMC Recommended Circuit） |
| | | EFT | IEC/EN61000-4-4 | ±2KV Perf.Criteria B（with EMC Recommended Circuit） |
| | | Voltage Dips & Interruptions | IEC/EN61000-4-29 | 0%~70% Perf.Criteria B |

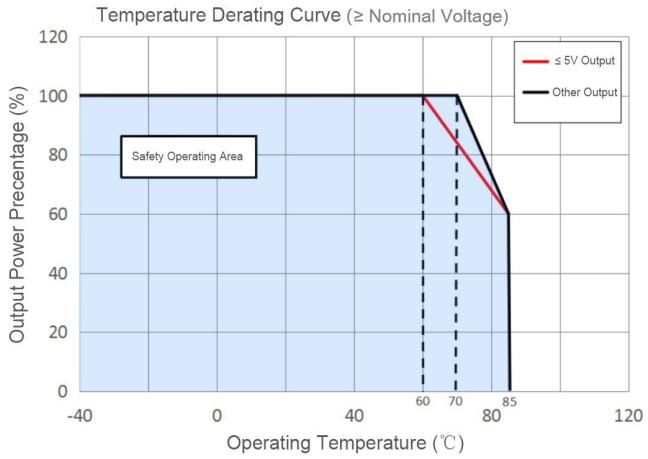
## Ripple & Noise Test Instruction (Twisted Pair Method, 20MHZ bandwidth)

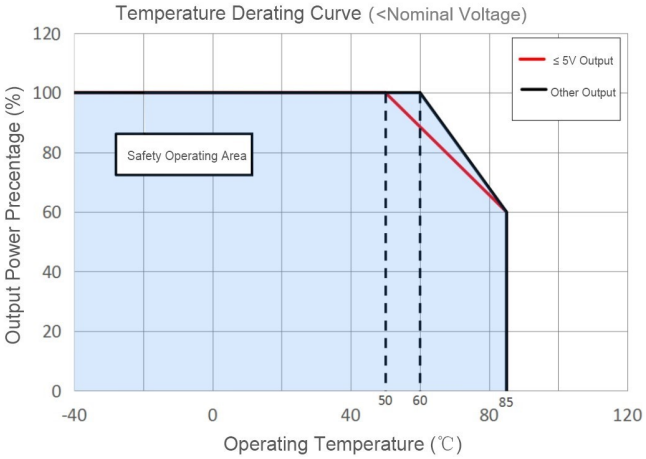



1) The Ripple & noise test need 12# twisted pair cables, an oscilloscope which should be set at the Sample Mode, bandwidth 20MHz. 100M bandwidth probe with cap and ground removed. C2(0.1uF) polypropylene capacitor and C3(10uF) high-frequency low-resistance electrolytic capacitor are connected in parallel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

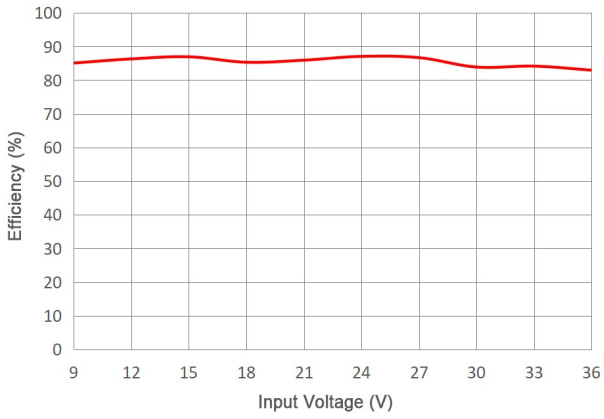
2) The power supply output connects to the load by the cables. The other side of the twisted pair (length 30cm±2 cm) should be connected in parallel with the load, the polarity of the output and the oscilloscope probe should not be reversed. The test can be started after input power on.

## Product Performance Curves

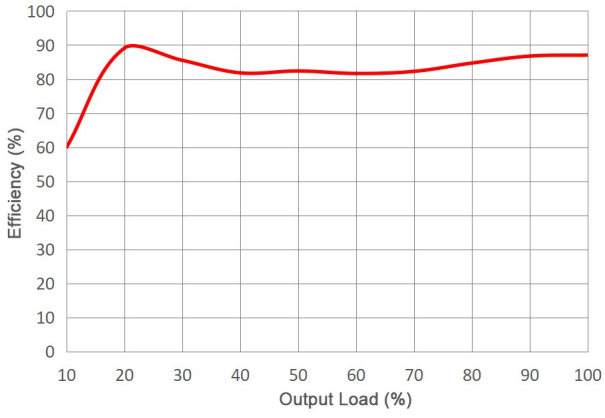


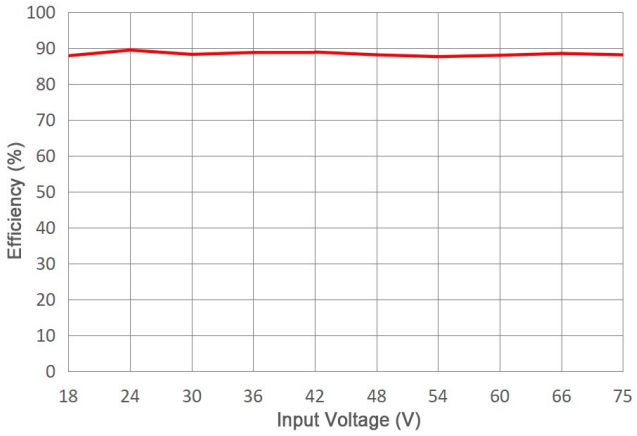

**Efficiency VS Input Voltage（PFD6-18D15A3(C)2）**



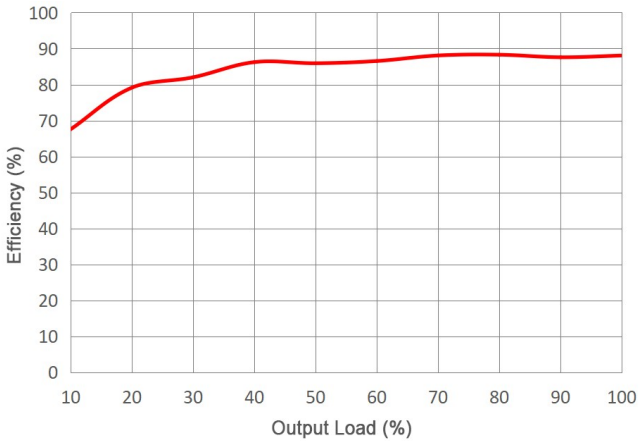

**Efficiency VS Output Load（PFD6-18D15A3(C)2）**



**Efficiency VS Input Voltage（PFD6-36S12A3(C)2）**



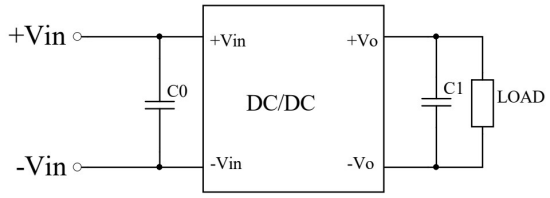

**Efficiency VS Output Load（PFD6-36S12A3(C)2）**




## Recommended Circuits for Application

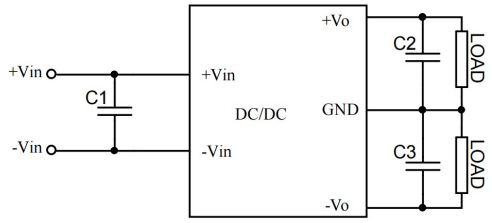
1. All this series of converters will be tested according to this circuit below before shipping.

Single



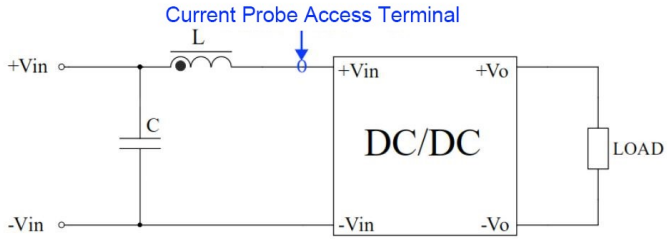

| Single output | |
|---|---|
| Component | Parameter |
| C0 | 100uF/100V |
| C1 | 10uF/50V |

Dual



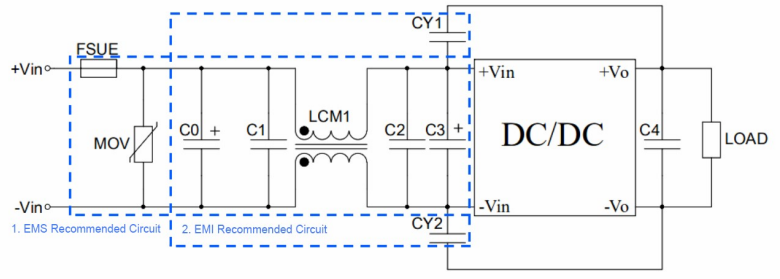

| Dual outputs | |
|---|---|
| Component | Parameter |
| C1 | 100uF/100V |
| C2，C3 | 10uF/50V |

2. Input reflected ripple current test circuit




| Component | Parameter |
|---|---|
| C | 100uF/100V |
| L | 4.7uH |

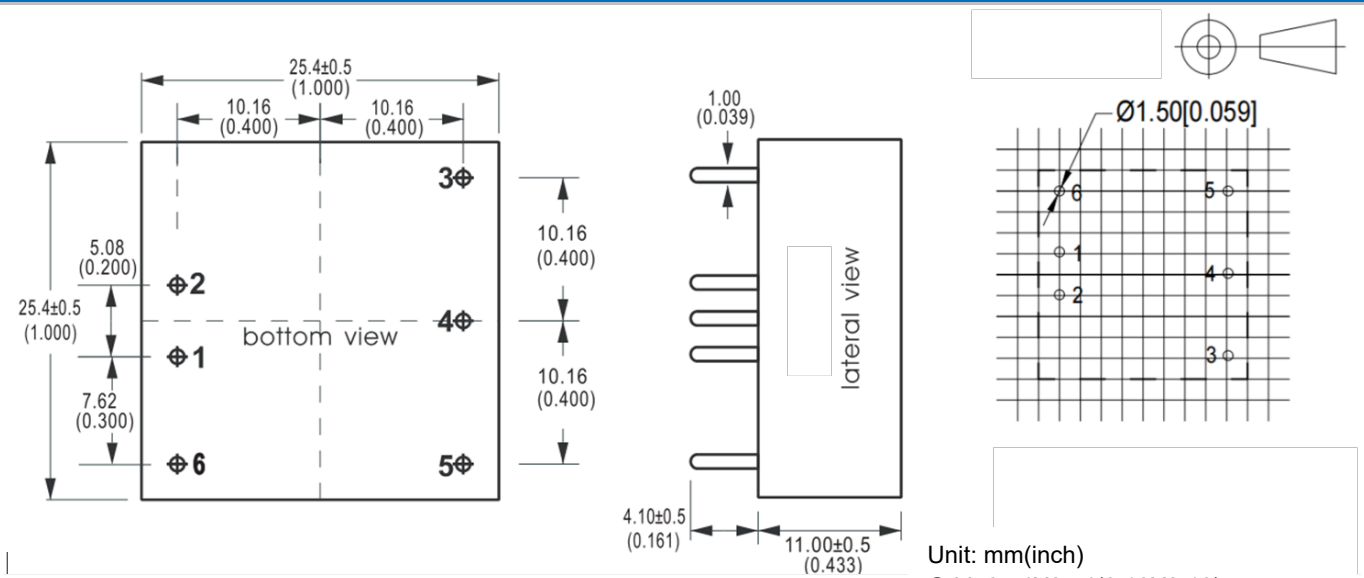
3. Recommended Circuit for EMC




| Components | 24VDC Input | 48VDC Input |
|---|---|---|
| FUSE | TBD by customer | |
| MOV | 10D470K | 10D101K |
| C0, C3 | 330uF/50V | 100uF/100V |
| C1, C2, C4 | 10uF/50V | 10uF/100V |
| LCM1 | 10mH | |
| CY1, CY2 | 1nF/3KV | |

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

## A3C2 Packaging Dimensions

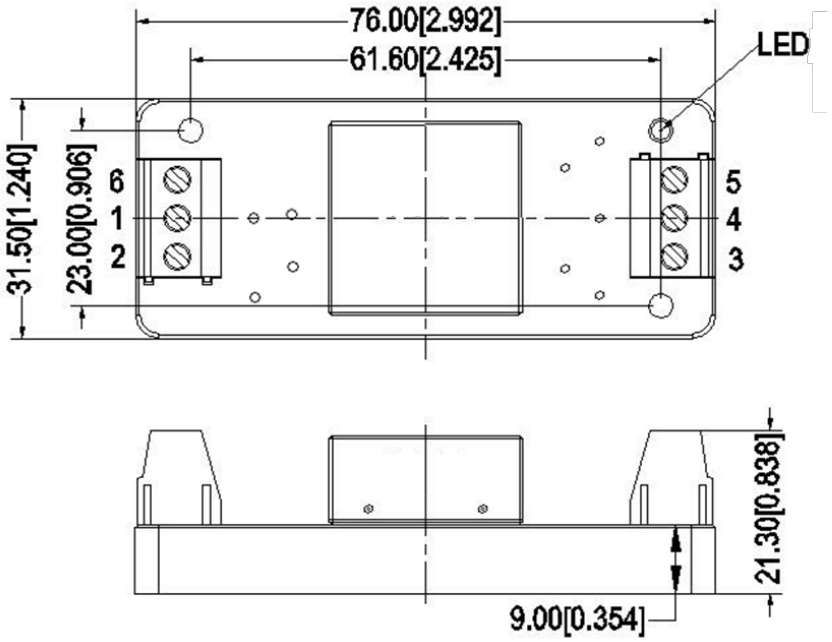



Unit: mm(inch)
Grid: 2.54X2.54(0.10X0.10)
General tolerance ±0.50(±0.020)
Pin diameter tolerance ±0.10(±0.004)

**Pin function definition**

| Pin No. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| PFD6-XXSXXA3C2 | -Vin | +Vin | +Vo | No Pin | GND | Ctrl |
| PFD6-XXDXXA3C2 | -Vin | +Vin | +Vo | COM | -Vo | Ctrl |

## A3C2-T Packaging Dimensions

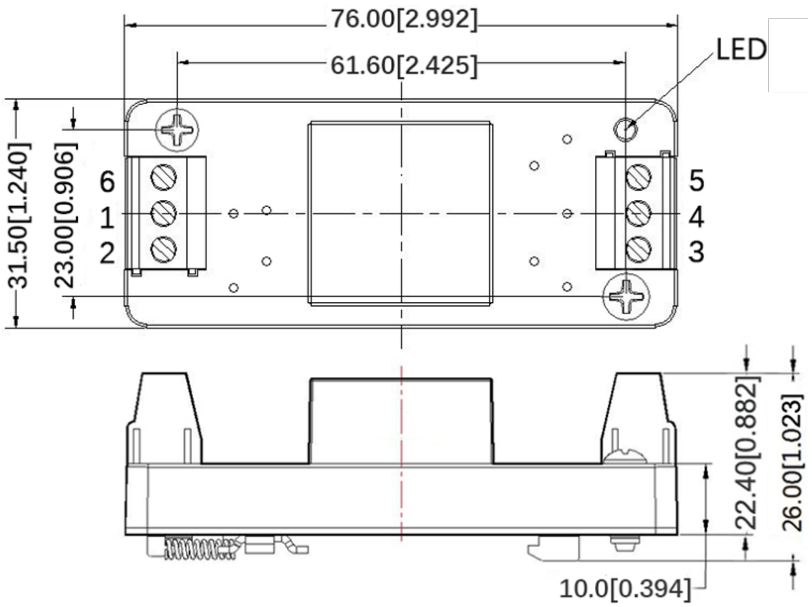



Unit: mm [inch]
Lead wire: 24-12AWG
Screwing torque: 0.4N.m Max
General tolerance: ±1.00 [±0.039]

**Terminal function definition**

| Terminal No. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| PFD6-XXSXXA3C2 | -Vin | +Vin | +Vo | No Pin | GND | Ctrl |
| PFD6-XXDXXA3C2 | -Vin | +Vin | +Vo | COM | -Vo | Ctrl |

## A3C2-TS Packaging Dimension




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

**Terminal function definition**

| Terminal No. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| PFD6-XXSXXA3C2 | -Vin | +Vin | +Vo | No Pin | GND | Ctrl |
| PFD6-XXDXXA3C2 | -Vin | +Vin | +Vo | COM | -Vo | Ctrl |

## Other Part numbers Pin function definition

| Pin No. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| PFD6-XXSXXA3N2 | -Vin | +Vin | +Vo | No Pin | GND | No pin |
| PFD6-XXDXXA3N2 | -Vin | +Vin | +Vo | COM | -Vo | No pin |

**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 under 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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