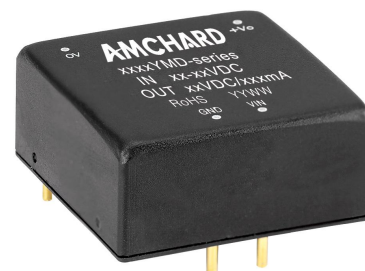


### FEATURES

1. Ultra-wide 4:1 input voltage range
2. High efficiency up to 86%
3. I/O isolation test voltage: 2250 VDC
4. Operating ambient temperature range: -40°C to +85°C
5. Input under-voltage protection, output short-circuit, over-current, over-voltage protection
6. Low ripple & noise
7. Input reverse polarity protection available with chassis(A2S) or Din-Rail mounting (A4S) version
8. Meets EN50155 railway standard
9. Industry standard pin-out



3 years  
Warranty

### Selection Guide

| Part No. ①      | Input Voltage (VDC) |        | Output        |                        | Full Load Efficiency ③ (%) Min./Typ. | Capacitive Load ⑤ (μF)Max. |
|-----------------|---------------------|--------|---------------|------------------------|--------------------------------------|----------------------------|
|                 | Nominal ② (Range)   | Max. ③ | Voltage (VDC) | Current (mA) Max./Min. |                                      |                            |
| ATA1D05YMD-6WR3 | 110<br>(40-160)     | 170    | ±5            | ±600/0                 | 80                                   | 470                        |
| ATA1D12YMD-6WR3 |                     |        | ±12           | ±250/0                 | 84                                   | 100                        |
| ATA1D15YMD-6WR3 |                     |        | ±15           | ±200/0                 | 85                                   | 100                        |
| ATB1D05YMD-6WR3 |                     |        | 5             | 1200/0                 | 80                                   | 1000                       |
| ATB1D12YMD-6WR3 |                     |        | 12            | 500/0                  | 84                                   | 470                        |
| ATB1D15YMD-6WR3 |                     |        | 15            | 400/0                  | 85                                   | 220                        |
| ATB1D24YMD-6WR3 |                     |        | 24            | 250/0                  | 86                                   | 100                        |

Note:

- ① Use "H" suffix for heat sink mounting, "A2S" suffix for chassis mounting and "A4S" suffix for Din-Rail mounting. We recommend to choose modules with a heat sink for enhanced heat dissipation and applications with extreme temperature requirements;
- ② The minimum input voltage and starting voltage of A2S and A4S Model are 1VDC higher than those of DIP package due to input reverse polarity protection function;
- ③ Exceeding the maximum input voltage may cause permanent damage;
- ④ Efficiency is measure at nominal input voltage and rated output load; efficiencies for A2S and A4S Model's is decreased by 2% due to the input reverse polarity protection circuit.
- ⑤ The specified maximum capacitive load for Vo1 and Vo2 output is identical.

### Input Specifications

| Item                                | Operating Conditions                             | Min.        | Typ. | Max. | Unit |
|-------------------------------------|--------------------------------------------------|-------------|------|------|------|
| Input Current (full load / no-load) | Nominal input voltage                            | –           | 68/3 | 70/8 | mA   |
| Reflected Ripple Current            | Nominal input voltage                            | –           | 25   | –    |      |
| Surge Voltage (1sec. max.)          |                                                  | -0.7        | –    | 180  | VDC  |
| Start-up Voltage                    |                                                  | –           | –    | 40   |      |
| Input Under-voltage Protection      |                                                  | 28          | 33   | –    |      |
| Start-up Time                       | Nominal input voltage & constant resistance load | –           | 10   | –    | ms   |
| Input Filter                        |                                                  | Pi filter   |      |      |      |
| Hot Plug                            |                                                  | Unavailable |      |      |      |

|        |                        |                                          |   |   |    |
|--------|------------------------|------------------------------------------|---|---|----|
| Ctrl * | Module on              | Ctrl pin open or pulled high (3.5-12VDC) |   |   |    |
|        | Module off             | Ctrl pin pulled low to GND (0-1.2VDC)    |   |   |    |
|        | Input current when off | –                                        | 3 | 8 | mA |

Note: \*The Ctrl pin voltage is referenced to input GND.

## Output Specifications

| Item                                                                                                                                                                                                                                                                                                                                                                     | Operating Conditions                                        |                       | Min.                      | Typ.  | Max.  | Unit  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|-----------------------|---------------------------|-------|-------|-------|
| Voltage Accuracy <sup>①</sup>                                                                                                                                                                                                                                                                                                                                            | 0%-100% load                                                |                       | --                        | ±1    | ±3    | %     |
| Linear Regulation                                                                                                                                                                                                                                                                                                                                                        | Input voltage variation from low to high at full load       | Vo1                   | --                        | ±0.2  | ±0.5  |       |
|                                                                                                                                                                                                                                                                                                                                                                          |                                                             | Vo2                   | --                        | ±0.5  | ±1    |       |
| Load Regulation <sup>②</sup>                                                                                                                                                                                                                                                                                                                                             | 0%-100% load                                                | ATB1D_YMD-6WR3        | --                        | ±0.5  | ±1    |       |
|                                                                                                                                                                                                                                                                                                                                                                          | 5%-100% load                                                | Vo1 of ATA1D_YMD-6WR3 |                           | ±0.5  | ±1    |       |
|                                                                                                                                                                                                                                                                                                                                                                          |                                                             | Vo2 of ATA1D_YMD-6WR3 |                           | ±0.5  | ±1.5  |       |
| Cross Regulation                                                                                                                                                                                                                                                                                                                                                         | Dual output, Vo1 load at 50%, Vo2 load at range of 25%-100% |                       | --                        | —     | ±10   |       |
| Transient Recovery Time                                                                                                                                                                                                                                                                                                                                                  | 25% load step change, nominal input voltage                 |                       | --                        | 300   | 500   | μs    |
| Transient Response Deviation                                                                                                                                                                                                                                                                                                                                             |                                                             | 5V, ±5V output        | --                        | ±3    | ±8    | %     |
|                                                                                                                                                                                                                                                                                                                                                                          |                                                             | Others                | --                        | ±3    | ±5    |       |
| Temperature Coefficient                                                                                                                                                                                                                                                                                                                                                  | Full load                                                   |                       | --                        | ±0.02 | ±0.03 | %/°C  |
| Ripple & Noise <sup>③</sup>                                                                                                                                                                                                                                                                                                                                              | 20MHz bandwidth, 5%-100% load                               |                       | --                        | 50    | 100   | mVp-p |
| Over-voltage Protection                                                                                                                                                                                                                                                                                                                                                  | Input voltage range                                         |                       | 110                       | —     | 160   | %Vo   |
| Over-current Protection                                                                                                                                                                                                                                                                                                                                                  |                                                             |                       | 120                       | —     | 210   | %Io   |
| Short-circuit Protection                                                                                                                                                                                                                                                                                                                                                 |                                                             |                       | Continuous, self-recovery |       |       |       |
| Note:<br>①Vo2 output voltage accuracy of ±5VDC output converter for 0%-5% load is ±5% max;<br>②ATA1D_YMD-6WR3 load regulation for 0%-100% load is ±5%;<br>③Under 0% -5% load conditions, ripple & noise does not exceed 5%Vo. The “parallel cable” method is used for Ripple and Noise test, please refer to DC-DC Converter Application Notes for specific information. |                                                             |                       |                           |       |       |       |

## General Specifications

| Item                                 | Operating Conditions                                                                     | Min.                           | Typ. | Max. | Unit    |
|--------------------------------------|------------------------------------------------------------------------------------------|--------------------------------|------|------|---------|
| Isolation                            | Input-output Electric Strength Test for 1 minute with a leakage current of 1mA max.      | 2250                           | –    | –    | VDC     |
|                                      | Input/output-case Electric Strength Test for 1 minute with a leakage current of 1mA max. | 1600                           | –    | –    |         |
| Insulation Resistance                | Input-output resistance at 500VDC                                                        | 1000                           | –    | –    | MΩ      |
| Isolation Capacitance                | Input-output capacitance at 100kHz/0.1V                                                  | –                              | 1000 | –    | pF      |
| Operating Temperature                | See Fig.1                                                                                | –40                            | –    | +85  | °C      |
| Storage Temperature                  |                                                                                          | –55                            | –    | +125 |         |
| Pin Soldering Resistance Temperature | Soldering spot is 1.5mm away from case for 10 seconds                                    | –                              | –    | +300 |         |
| Storage Humidity                     | Non-condensing                                                                           | 5                              | –    | 95   | %RH     |
| Vibration                            |                                                                                          | IEC61373 - Category 1, Grade B |      |      |         |
| Switching Frequency *                | PWM Mode                                                                                 | –                              | 300  | –    | kHz     |
| MTBF                                 | MIL-HDBK-217F@25°C                                                                       | 1000                           | –    | –    | k hours |

Note: \*Switching frequency is measured at full load. The module reduces the switching frequency for light load (below 50%) efficiency improvement.

## Mechanical Specifications

|               |                                         |                          |
|---------------|-----------------------------------------|--------------------------|
| Case Material | Aluminum alloy                          |                          |
| Dimensions    | Horizontal package( without heat sink)  | 25.40 × 25.40 × 11.70 mm |
|               | Horizontal package( with heat sink)     | 25.40 × 25.40 × 16.20 mm |
|               | A2S wiring package ( without heat sink) | 76.00 × 31.50 × 21.20 mm |
|               | A2S wiring package( with heat sink)     | 76.00 × 31.50 × 25.20 mm |
|               | A4S rail package( without heat sink)    | 76.00 × 31.50 × 25.80 mm |
|               | A4S rail package( with heat sink)       | 76.00 × 31.50 × 29.80 mm |

|                 |                     |                                                        |                          |
|-----------------|---------------------|--------------------------------------------------------|--------------------------|
| Weight          | Without heat sink   | Horizontal package/A2S wiring package/A4S rail package | 21.0g/36.0g/56.0g (Typ.) |
|                 | With heat sink      | Horizontal package/A2S wiring package/A4S rail package | 26.5g/40.0g/59.0g (Typ.) |
| Cooling Methods | Free air convection |                                                        |                          |

### EMC Specifications

|           |       |                 |                                                                                                                                                                                                      |                  |
|-----------|-------|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| Emissions | CE    | CISPR32/EN55032 | CLASS B (see Fig.3 or Fig.4-② for recommended circuit)                                                                                                                                               |                  |
|           | RE    | CISPR32/EN55032 | CLASS B (see Fig.3 or Fig.4-② for recommended circuit)                                                                                                                                               |                  |
| Immunity  | ESD   | IEC/EN61000-4-2 | Contact $\pm 6\text{kV}$ /Air $\pm 8\text{kV}$                                                                                                                                                       | perf. Criteria B |
|           | RS    | IEC/EN61000-4-3 | 20V/m                                                                                                                                                                                                | perf. Criteria A |
|           | EFT   | IEC/EN61000-4-4 | $\pm 4\text{kV}$ (see Fig.3 or Fig.4-① for recommended circuit)                                                                                                                                      | perf. Criteria B |
|           | Surge | IEC/EN61000-4-5 | line to line $\pm 2\text{kV}$ (2 $\Omega$ , 18 $\mu\text{F}$ see Fig.3 for recommended circuit)<br>line to ground $\pm 4\text{kV}$ (12 $\Omega$ , 9 $\mu\text{F}$ see Fig.3 for recommended circuit) | perf. Criteria B |
|           | CS    | IEC/EN61000-4-6 | 10 Vr.m.s                                                                                                                                                                                            | perf. Criteria A |

### Typical Characteristic Curves

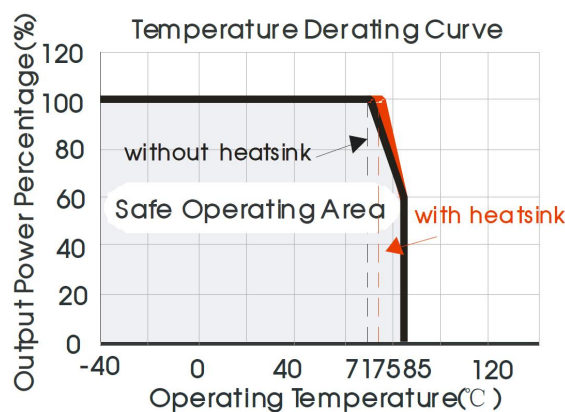
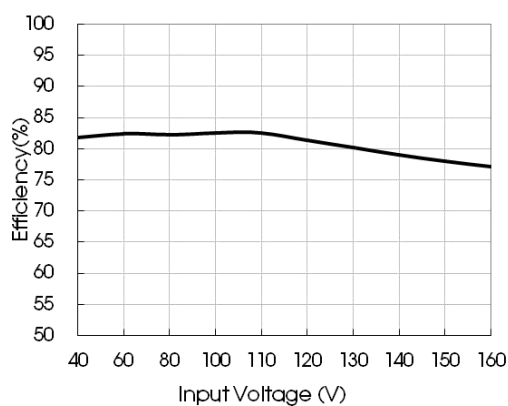
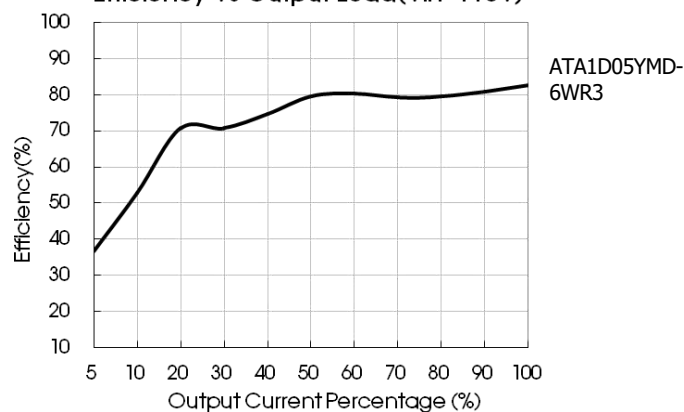


Fig. 1

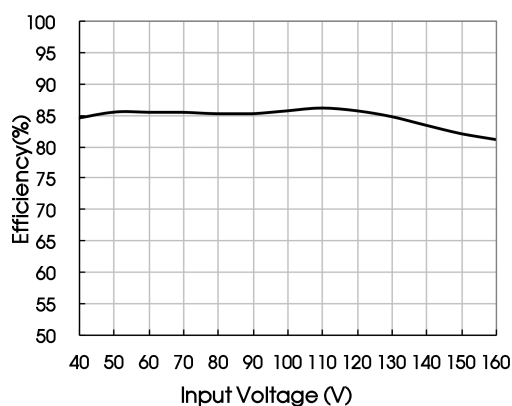
Efficiency Vs Input Voltage (Full Load)



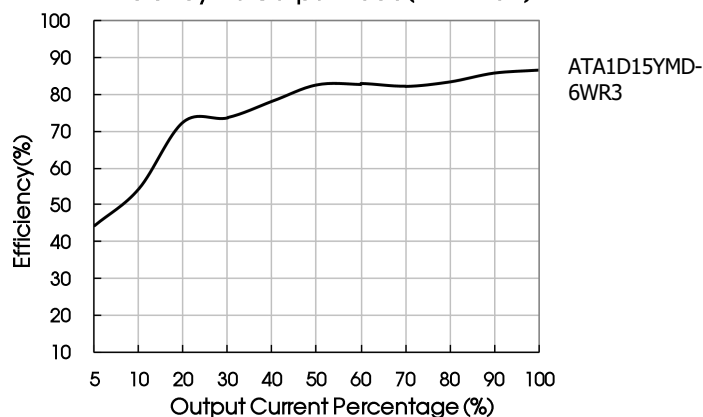
Efficiency Vs Output Load (Vin=110V)



Efficiency Vs Input Voltage (Full Load)



Efficiency Vs Output Load (Vin=110V)



### Design Reference

#### 1. Typical application

All the DC/DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 2.

Input and/or output ripple can be further reduced by appropriately increasing the input & output capacitor values  $C_{in}$  and  $C_{out}$  and/or by selecting capacitors with a low ESR (equivalent series resistance). Also make sure that the capacitance is not exceeding the specified max. capacitive load value of the product.

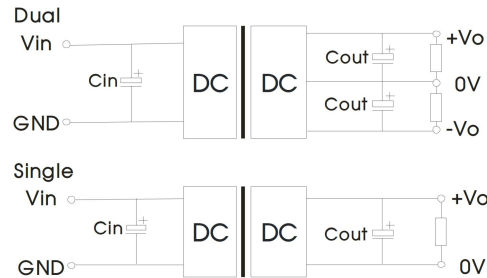


Fig. 2

| $C_{in}$                            | $V_o(VDC)$            | $C_{out}$      |
|-------------------------------------|-----------------------|----------------|
| 10 $\mu$ F/250V<br>-47 $\mu$ F/250V | $\pm 5/5$             | 10 $\mu$ F/16V |
|                                     | $\pm 12/12/\pm 15/15$ | 10 $\mu$ F/25V |
|                                     | 24                    | 10 $\mu$ F/50V |

#### 2. EMC compliance circuit

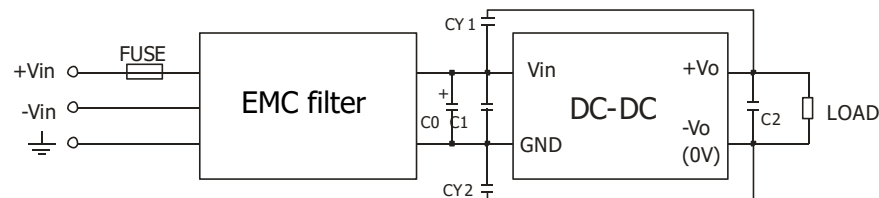


Fig. 3

Fig. 3 Parameter description:

|            |                                          |
|------------|------------------------------------------|
| FUSE       | Choose according to actual input current |
| EMC filter | Input voltage range: 40V-160V            |
| $C_0$      | 100 $\mu$ F/200V                         |
| $C_1$      | Refer to the $C_{in}$ in Fig.2           |
| $C_2$      | Refer to the $C_{out}$ in Fig.2          |
| $CY1/CY2$  | 1nF/3kV                                  |

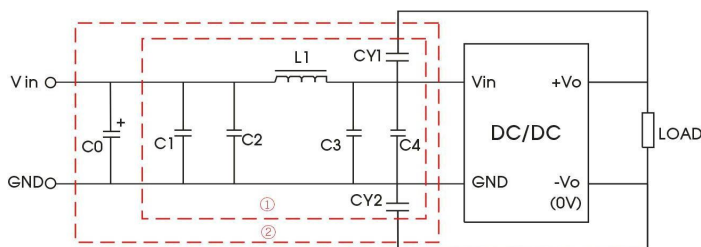


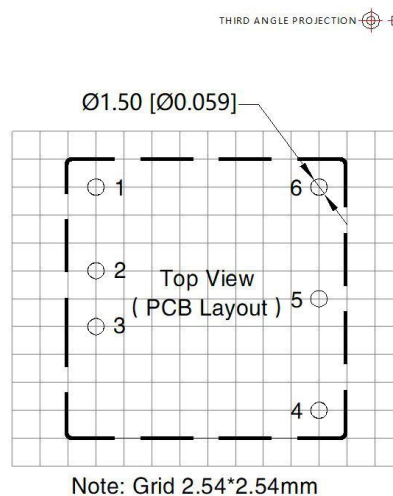
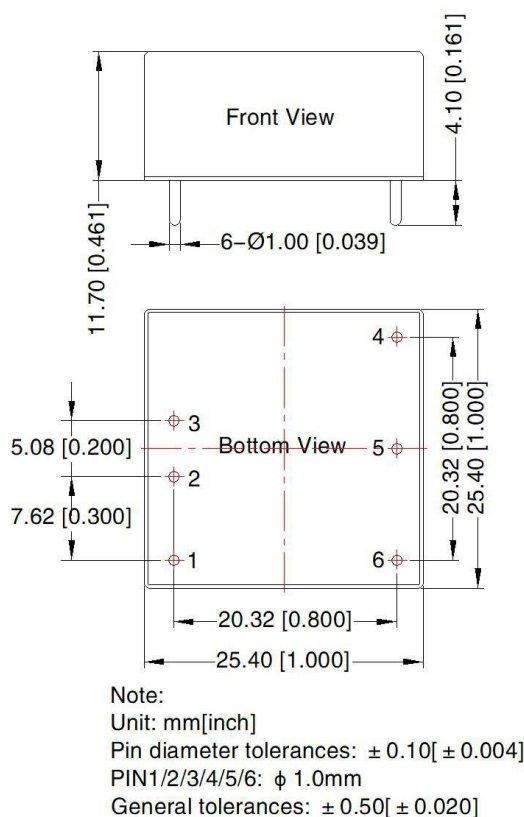
Fig. 4

Fig. 4 Parameter description:

|                   |                   |
|-------------------|-------------------|
| $C_0$             | 100 $\mu$ F/200V  |
| $C_1/C_2/C_3/C_4$ | 0.22 $\mu$ F/250V |
| $L_1$             | 68 $\mu$ H        |
| $CY1/CY2$         | 1nF/3kV           |

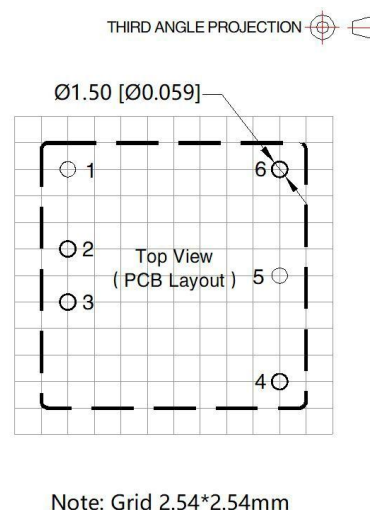
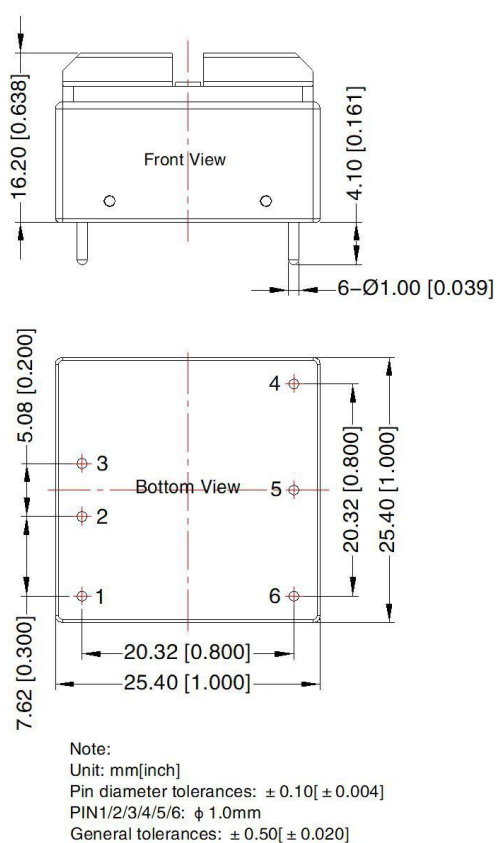
#### 3. The products do not support parallel connection of their output

### Horizontal Package (without heat sink) Dimensions and Recommended Layout



| Pin-Out |        |      |
|---------|--------|------|
| Pin     | Single | Dual |
| 1       | No pin | Ctrl |
| 2       | GND    | GND  |
| 3       | Vin    | Vin  |
| 4       | +Vo    | +Vo  |
| 5       | No pin | 0V   |
| 6       | 0V     | -Vo  |

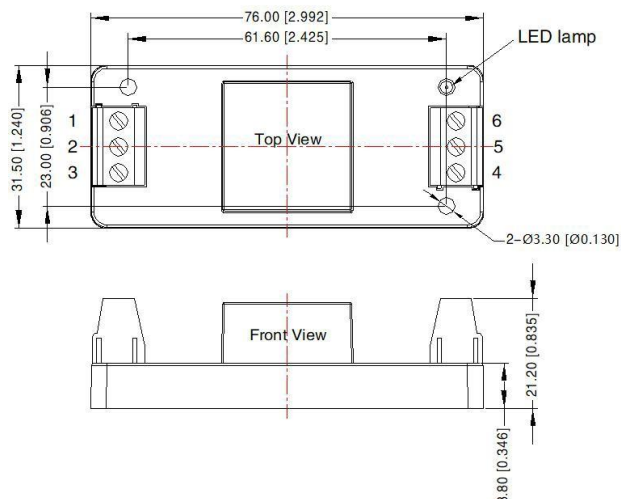
### Horizontal Package (with heat sink) Dimensions



| Pin-Out |        |      |
|---------|--------|------|
| Pin     | Single | Dual |
| 1       | No pin | Ctrl |
| 2       | GND    | GND  |
| 3       | Vin    | Vin  |
| 4       | +Vo    | +Vo  |
| 5       | No pin | 0V   |
| 6       | 0V     | -Vo  |

### ATA1D\_YMD-6WR3A2S & ATB1D\_YMD-6WR3A2S (without heat sink) Dimensions

THIRD ANGLE PROJECTION

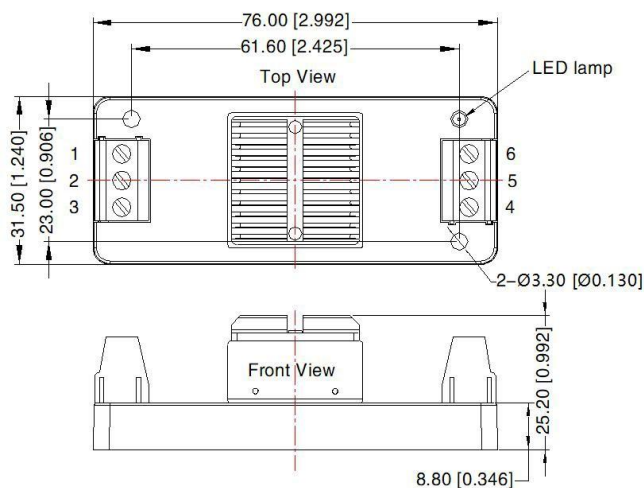


| Pin-Out |      |     |     |     |    |     |
|---------|------|-----|-----|-----|----|-----|
| Pin     | 1    | 2   | 3   | 4   | 5  | 6   |
| Single  | NC   | GND | Vin | +Vo | NC | 0V  |
| Dual    | Ctrl | GND | Vin | +Vo | 0V | -Vo |

Note:  
Unit: mm[inch]  
Wire range: 24-12 AWG  
Tightening torque: Max 0.4 N·m  
General tolerances:  $\pm 0.50 [\pm 0.020]$

### ATA1D\_YMD-6WHR3A2S & ATB1D\_YMD-6WHR3A2S (with heat sink) Dimensions

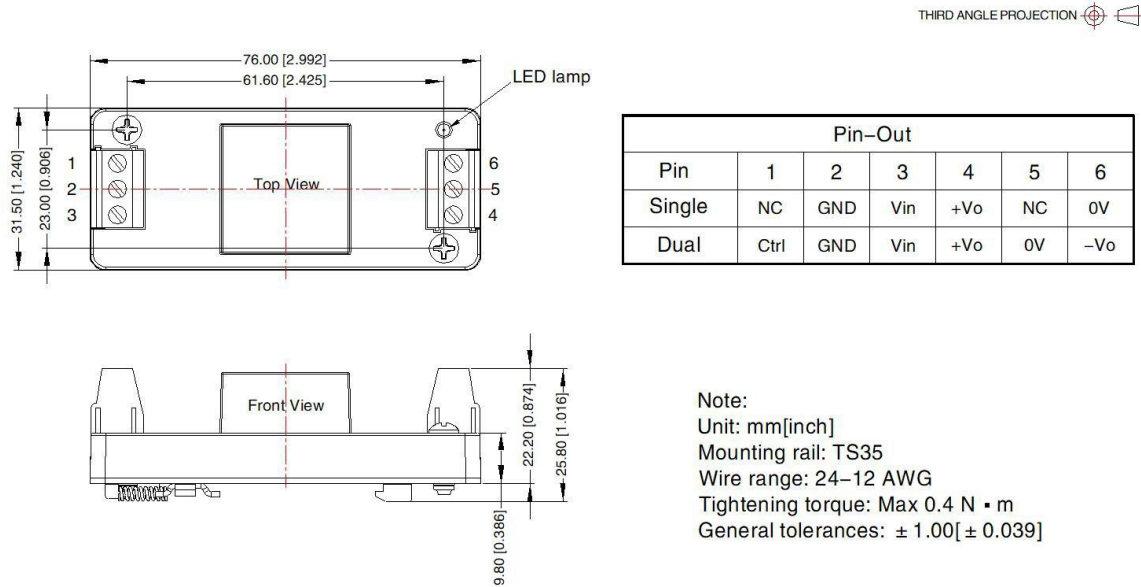
THIRD ANGLE PROJECTION



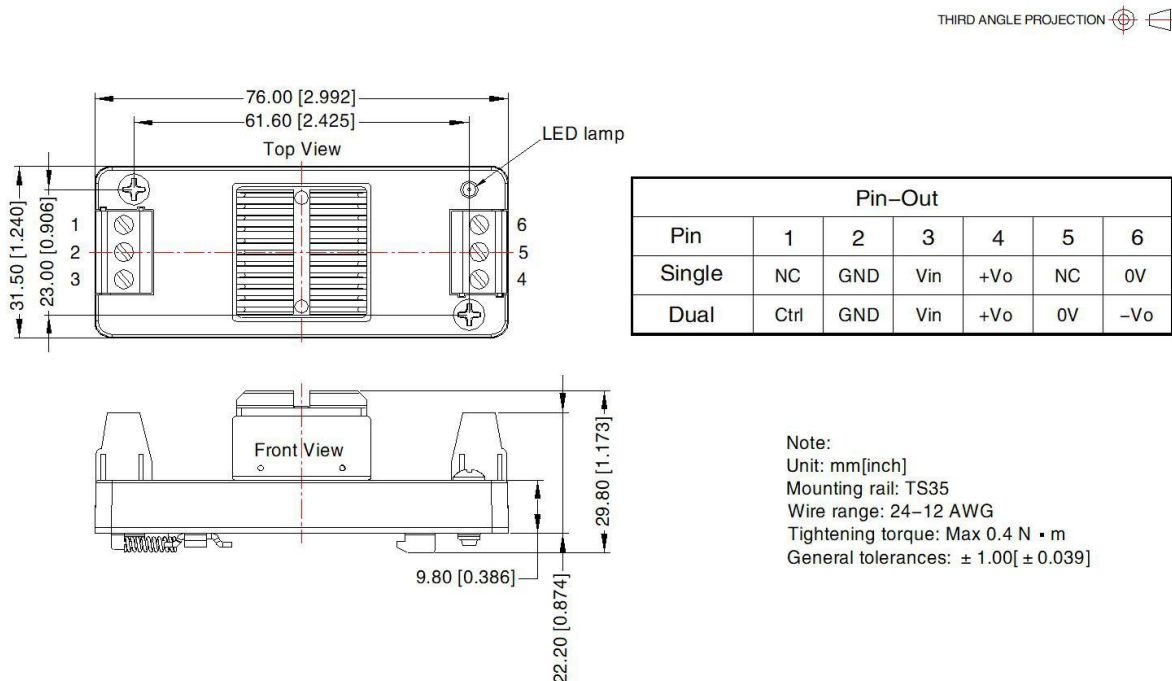
| Pin-Out |      |     |     |     |    |     |
|---------|------|-----|-----|-----|----|-----|
| Pin     | 1    | 2   | 3   | 4   | 5  | 6   |
| Single  | NC   | GND | Vin | +Vo | NC | 0V  |
| Dual    | Ctrl | GND | Vin | +Vo | 0V | -Vo |

Note:  
Unit: mm[inch]  
Wire range: 24-12 AWG  
Tightening torque: Max 0.4 N·m  
General tolerances:  $\pm 1.00 [\pm 0.039]$

### ATA1D\_YMD-6WR3A4S & ATB1D\_YMD-6WR3A4S (without heat sink) Dimensions



### ATA1D\_YMD-6WHR3A4S & ATB1D\_YMD-6WHR3A4S(with heat sink) Dimensions



#### Note:

1. If the product works under the minimum required load, it cannot guarantee that the performance of the product complies with all the performance indicators in this manual;
2. The maximum capacitive load is tested under the input voltage range and full load condition;
3. Unless otherwise stated, all indexes in this manual are measured at  $T_a=25^{\circ}\text{C}$ , humidity  $<75\%\text{RH}$ , nominal input voltage and rated output load;
4. All index testing methods in this manual are based on the enterprise standards of the company;
5. Our company can provide product customization, specific needs can directly contact our technical staff;