# DC-DC Converter
## NN1-XXSXXANR3 Series

## Typical Features

- ◆ Fixed input voltage, Isolated & unregulated, Output power 1W
- ◆ Efficiency up to 86% (Typ.)
- ◆ Mini size SIP packaging
- ◆ Isolation Voltage 1500VDC
- ◆ Operating Temperature from -40°C to +105°C
- ◆ Plastic Case, flame class UL94 V-0


**Test Condition:** Unless otherwise specified, all parameter values had been tested at nominal input voltage, pure resistive rated load, and at room temperature 25°C.

## Application Field

***This series of products can be widely used in the fields of instrument, communication, pure digital circuit, general low frequency analog circuit, relay drive circuit, data exchange circuit, etc.***

## 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 (20MHz) Max/Typ. | Efficiency (%) @full load/nom. voltage | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Nom. | Range | Vo (VDC) | Io(mA) Max/Min | Full Load | No Load | uF | mVp-p | Min | Typ. |
| - | NN1-3V3S3V3ANR3 | 3.3 | 2.97 - 3.63 | 3.3 | 303/30 | 370 | 8 | 2400 | 75/40 | 74 | 76 |
| - | NN1-3V3S05ANR3 | | | 5 | 200/20 | 358 | 8 | 2400 | 75/40 | 81 | 83 |
| - | NN1-3V3S12ANR3 | | | 12 | 83/9 | 340 | 10 | 560 | 75/40 | 83 | 85 |
| - | NN1-3V3S15ANR3 | | | 15 | 67/7 | 345 | 20 | 560 | 75/40 | 81 | 83 |
| - | NN1-3V3S24ANR3 | | | 24 | 42/5 | 360 | 30 | 220 | 100/80 | 81 | 83 |
| - | NN1-05S3V3ANR3 | 5 | 4.5 - 5.5 | 3.3 | 303/30 | 250 | 8 | 2400 | 75/40 | 78 | 80 |
| UL/CE | NN1-05S05ANR3 | | | 5 | 200/20 | 225 | 8 | 2400 | 75/40 | 83 | 85 |
| - | NN1-05S09ANR3 | | | 9 | 111/12 | 227 | 10 | 1000 | 75/40 | 83 | 85 |
| - | NN1-05S12ANR3 | | | 12 | 83/9 | 220 | 10 | 560 | 75/40 | 83 | 85 |
| - | NN1-05S15ANR3 | | | 15 | 67/7 | 220 | 18 | 560 | 75/40 | 83 | 85 |
| - | NN1-05S24ANR3 | | | 24 | 42/5 | 266 | 18 | 220 | 100/80 | 82 | 84 |
| - | NN1-09S09ANR3 | 9 | 8.1- 9.9 | 9 | 111/12 | 128 | 10 | 560 | 75/40 | 82 | 84 |
| - | NN1-12S3V3ANR3 | 12 | 10.8 - 13.2 | 3.3 | 303/30 | 98 | 10 | 2400 | 75/40 | 75 | 77 |
| - | NN1-12S05ANR3 | | | 5 | 200/20 | 96 | 10 | 2400 | 75/40 | 84 | 86 |
| - | NN1-12S09ANR3 | | | 9 | 111/12 | 92 | 10 | 1000 | 75/40 | 84 | 86 |
| - | NN1-12S12ANR3 | | | 12 | 83/9 | 90 | 10 | 560 | 75/40 | 84 | 86 |
| - | NN1-12S15ANR3 | | | 15 | 67/7 | 90 | 10 | 560 | 75/40 | 84 | 86 |
| - | NN1-12S24ANR3 | | | 24 | 42/5 | 92 | 10 | 220 | 100/80 | 83 | 85 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| - | NN1-15S05ANR3 | 15 | 13.5 - 16.5 | 5 | 200/20 | 78 | 10 | 2400 | 75/40 | 83 | 85 |
| - | NN1-15S12ANR3 | | | 12 | 83/9 | 76 | 10 | 1000 | 75/40 | 84 | 86 |
| - | NN1-15S15ANR3 | | | 15 | 67/7 | 76 | 10 | 560 | 75/40 | 83 | 85 |
| - | NN1-24S3V3ANR3 | 24 | 21.6 - 26.4 | 3.3 | 303/30 | 48 | 8 | 2400 | 75/40 | 75 | 77 |
| - | NN1-24S05ANR3 | | | 5 | 200/20 | 47 | 8 | 2400 | 75/40 | 82 | 84 |
| - | NN1-24S09ANR3 | | | 9 | 111/12 | 48 | 8 | 1000 | 75/40 | 83 | 85 |
| - | NN1-24S12ANR3 | | | 12 | 83/9 | 48 | 8 | 560 | 75/40 | 84 | 86 |
| - | NN1-24S15ANR3 | | | 15 | 67/7 | 48 | 8 | 560 | 75/40 | 83 | 85 |
| - | NN1-24S24ANR3 | | | 24 | 42/5 | 49 | 8 | 220 | 100/80 | 83 | 85 |

Note: The ripple & noise are tested by the twisted pair method.

## Input Specifications

| Item | Operating Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Input Inrush Voltage (1Sec max.) | 3.3Vdc Input | -0.7 | - | 7 | VDC |
| | 5Vdc Input | -0.7 | - | 9 | |
| | 9Vdc Input | -0.7 | - | 12 | |
| | 12Vdc Input | -0.7 | - | 18 | |
| | 15Vdc Input | -0.7 | - | 21 | |
| | 24Vdc Input | -0.7 | - | 30 | |
| Input Filter | Capacitor Filter | | | | |
| Hot Plug | Unavailable | | | | |

## Output Specifications

| Item | Operating Condition | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Output Power | | | 0.1 | -- | 1 | W |
| Output Voltage Accuracy | Please refer to the Output Voltage Deviation Graph (Figure 1) | | | | | |
| Load Regulation | 10% ~ 100% load | 3.3Vdc output | -- | 15 | 20 | % |
| | | Others | -- | 10 | 15 | |
| Line Voltage Regulation | Input Voltage Change ±1% | 3.3Vdc output | -- | -- | 1.5 | -- |
| | | Others | -- | -- | 1.2 | |
| Temperature Drift Coefficient | 100% Load | | -- | -- | ±0.03 | %/°C |
| Short Circuit Protection | Continuous, self-recovery | | | | | |

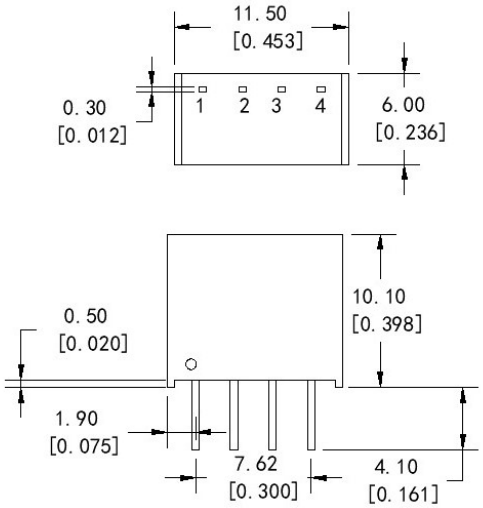
## General Specifications

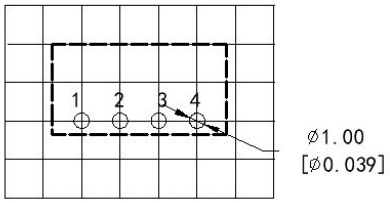
| Item | Operating Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Switching Frequency | Nominal input voltage, full load | -- | 260 | -- | KHz |
| Operating Temperature | Refer to the Temperature Derating Graph (Figure 2) | -40 | -- | 105 | ℃ |
| Storage Temperature | | -55 | -- | +125 | |
| Case temperature rise | Ta=25℃ | -- | 30° | -- | |
| Pin soldering temperature | 1.5mm from the case, 10S | -- | -- | 300 | |
| Relative Humidity | No condensing | 5 | -- | 95 | %RH |
| Isolation Voltage | I/P-O/P, test 1 minute, leakage current ＜1mA | 1500 | -- | -- | VDC |
| Insulation Resistance | I/P-O/P, @ 500VDC | 1000 | -- | -- | MΩ |
| Isolation Capacitor | Input/Output, 100KHz/0.1V | -- | 20 | -- | pF |
| Vibration | | 10-150Hz, 5G, 30 Min. along X, Y and Z | | | |
| MTBF | MIL-HDBK-217F@25℃ | 3500 | -- | -- | K hours |
| Case Material | Plastic in Black, flame class UL94-V0 | | | | |
| Unit Weight | 1.4g (Typ.) | | | | |
| Cooling Method | Natural air | | | | |
| Packing | Tube size (525x18x10mm) | 43PCS/Tube | | | |
| | Carton size (542x110x155mm) | 3440PCS/Carton (Total 80 Tubes) | | | |
| Unit Dimensions | L x W x H | 11.50× 6.00 × 10.10 mm | | 0.453 × 0.236 × 0.398 inch | |

## EMC Performance

| | | |
|---|---|---|
| EMI | CE | CISPR32/EN55032 CLASS B (with the Recommended EMC circuit) |
| | RE | CISPR32/EN55032 CLASS B (with the Recommended EMC circuit) |
| EMS | ESD | IEC/EN61000-4-2 Air±8kV, Contact±6kV perf.Criteria B |

## Mechanical Dimensions




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

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

## Pin Function Description

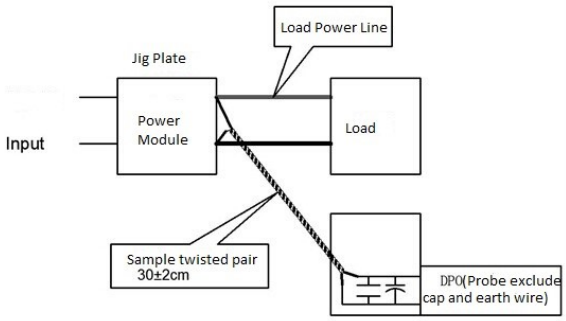
| Pin No. | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Single output | GND | +Vin | -Vout | +Vout |

Note - Please take the pin definition on the product label as the right one if there is any difference between the data sheet and the one printed on the product label.

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

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

2) The test diagram is shown on the right. The converter output connects to the electronic load by the jig with cables which size should be defined according to the output current value. The twisted pair (length 30cm±2 cm) should be connected in parallel with the load, the location is as close as possible to the output pins or terminals. The test can be started after input power on.




## Product Characteristics Graphs

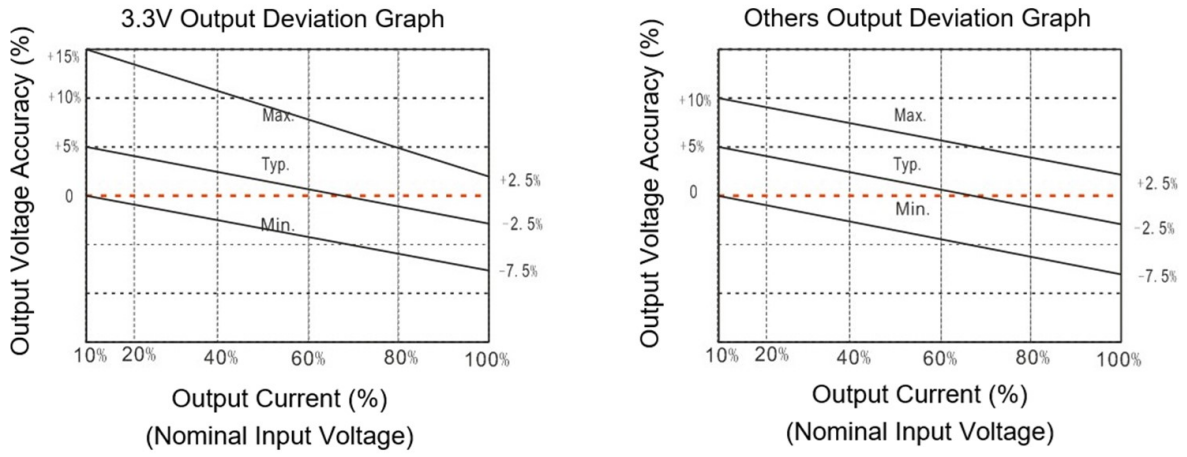



Figure 1

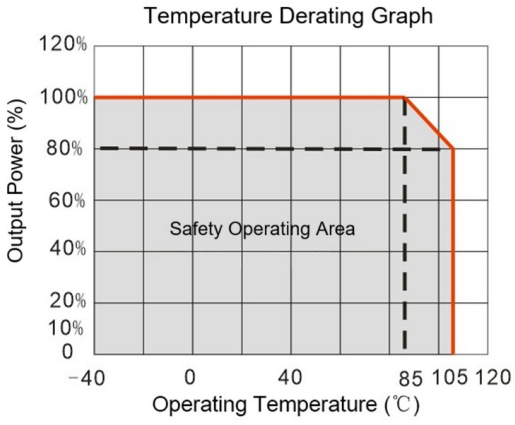



Figure 2

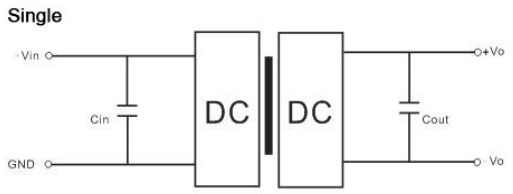
## Recommended Circuits for Application

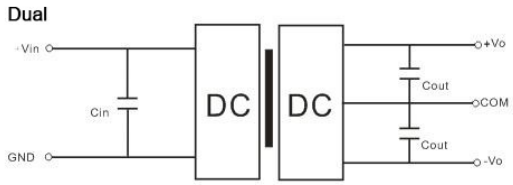
### 1. Requirement for Output load

The maximum capacitive load was tested at the rated full load. The converter may not start or be damaged if the output capacitors exceed this value.

### 2. Typical application circuit

To ensure effectively decrease the input and output ripple and noise, a capacitor filter can be connected at the input and output, the application circuit is shown in the figure below. The suitable filter capacitors should be chosen as the recommended capacitive load values in Table 1. The converter could not start if the capacitance is too big.

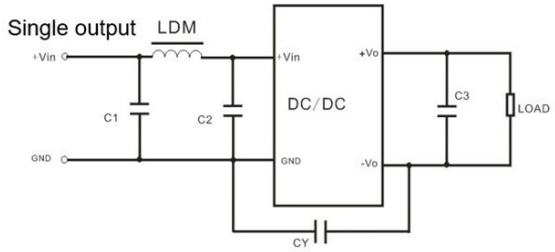



Recommended capactive load value (Table 1)

| Vin (Vdc) | Cin | Single Vout (Vdc) | Cout (μF) | Dual Vout (Vdc) | Cout (μF) |
|---|---|---|---|---|---|
| 5 | 10μF/16V | 3.3 | 10μF/16V | ±3.3 | 4.7μF/16V |
| 12 | 2.2μF/25V | 5 | 10μF/16V | ±5 | 4.7μF/16V |
| 15 | 2.2μF/25V | 9 | 2.2μF/25V | ±9 | 2.2μF/25V |
| 24 | 1μF/50V | 12 | 2.2μF/25V | ±12 | 1μF/25V |
| -- | -- | 15 | 1μF/25V | ±15 | 1μF/16V |
| -- | -- | 24 | 1μF/50V | ±24 | 0.47μF/50V |

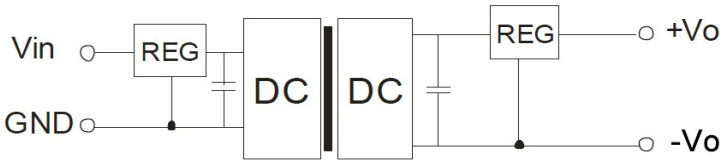
### 3. Recommended EMC Circuit




| Input voltage | | 5VDC | 12/15/24VDC |
|---|---|---|---|
| EMI | C1/C2 | 4.7μF/16V | 4.7μF/50V |
| | CY | 270pF/2KV | 270pF/2KV |
| | C3 | Refer to Cout in Table 1 | |
| | LDM | 6.8μH | 6.8μH |

### 4. Output voltage regulation and overvoltage protection

The simple solution to achieve the output regulated voltage, over voltage and over current protections is to connect a linear regulator with overheat protection at input or output, and a capacitor filter connected in parallel as below circuit. Filter capacitive value recommended see table 1, Linear regulator should be chosen according to the actual voltage & current for operating. Or Aipu NW series products are recommended instead.




### Application Notice

1.This series of converters should not be used in parallel, and they do not support hot-plugging.

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

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

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