# DC/DC Converter

## K78xxW-500R3 Series

MORNSUN®

Wide input voltage, non-isolated and regulated single output







CE Report EN 62368-1

UKCA Report BS EN 62368-1

RoHS

## FEATURES

- High efficiency up to 94%
- No-load input current as low as 0.2mA
- Operating ambient temperature range: -40℃ to +85℃
- Support the negative output
- Output short circuit protection
- Pin compatible with LM78XX series linear regulators

*K78xxW-500R3 series are high efficiency switching regulators and ideal substitutes of LM78xx series three-terminal linear regulators. The product is featured with high efficiency, low loss, short circuit protection, support the negative output and no heat sink requirement. These products are widely used in applications such as industrial control, instrumentation and electric power.*

## Selection Guide

| Certification | Part Number | Input Voltage (VDC) | Output | | Full Load Efficiency(%) typ. Vin Min. / Vin Max. | Max. Capacitive Load (μF) |
|---|---|---|---|---|---|---|
| | | Nominal (Range) | Voltage (VDC) | Max. Output Current (mA) | | |
| EN/BS EN | K7805W-500R3 | 24 (6.5-36) | 5 | 500 | 90/84 | 680 |
| | | 12 (7-31) | -5 | -300 | 80/81 | 330 |
| | K7809W-500R3 | 24 (12-36) | 9 | 500 | 93/90 | 680 |
| | K7812W-500R3 | 24 (15-36) | 12 | 500 | 94/91 | 680 |
| | | 12 (8-24) | -12 | -150 | 84/85 | 330 |

Note: When the input voltage exceeds 30VDC, the input needs to be connected with an electrolytic capacitor of 22uF/50V to prevent the module from being damaged by voltage spikes.

## Input Specifications

| Item | Operating Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| No-load Input Current | Positive output | -- | 0.2 | 1.5 | mA |
| Input Reverse Polarity | | Avoid / Not protected | | | |
| Input Filter | | Capacitor filter | | | |

## Output Specifications

| Item | Operating Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Voltage Accuracy | Full load, input voltage range | -- | ±2 | ±3 | % |
| Linear Regulation | Full load, input voltage range | -- | ±0.2 | ±0.4 | |
| Load Regulation | 10% -100% load step; nominal input voltage | -- | ±0.4 | ±1.5 | |
| Ripple & Noise* | 20MHz bandwidth, nominal input, 10% -100% load | -- | 20 | 75 | mVp-p |
| Temperature Coefficient | Operating temperature -40℃ to +85℃ | -- | -- | ±0.03 | %/℃ |
| Transient Response Deviation | Nominal input, 25% load step | -- | 50 | 250 | mV |
| Transient Recovery Time | | -- | 0.2 | 1 | ms |
| Short-circuit Protection | Nominal input | Continuous, self-recovery | | | |

Note: *1. The "parallel cable" method is used for ripple and noise test, please refer to *Non-isolated DC-DC Converter Application Notes* for specific information;
*2. With light loads at or below 10%, ripple & noise for 5V output parts increases to 150mVp-p max, and for 9V/12V output parts to 2%Vo max.


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## General Specifications

| Item | Operating Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Operating Temperature | See Fig. 1 | -40 | -- | +85 | ℃ |
| Storage Temperature | | -55 | -- | +125 | |
| Pin Soldering Resistance | Soldering time: 10s (Max.) | -- | -- | +260 | |
| Storage Humidity | Non-condensing | 5 | -- | 95 | %RH |
| Switching Frequency | Full load, nominal input | 550 | -- | 850 | kHz |
| MTBF | MIL-HDBK-217F@25℃ | 2000 | -- | -- | k hours |

## Mechanical Specifications

| | |
|---|---|
| Case Material | Black plastic; flame-retardant and heat-resistant (UL94V-0) |
| Dimensions | 11.50 x 9.00 x 17.50 mm |
| Weight | 5.0g (Typ.) |
| Cooling Method | Free air convection |

## Electromagnetic Compatibility (EMC)

| | | | | |
|---|---|---|---|---|
| Emissions | CE | CISPR32/EN55032 | CLASS B (see Fig. 5-② for recommended circuit) | |
| | RE | CISPR32/EN55032 | CLASS B (see Fig. 5-② for recommended circuit) | |
| Immunity | ESD | IEC/EN 61000-4-2 | Contact ±4kV | perf. Criteria B |
| | RS | IEC/EN 61000-4-3 | 10V/m | perf. Criteria A |
| | EFT | IEC/EN 61000-4-4 | ±1kV (see Fig. 5-① for recommended circuit) | perf. Criteria B |
| | Surge | IEC/EN 61000-4-5 | line to line ±1kV (see Fig. 5-① for recommended circuit) | perf. Criteria B |
| | CS | IEC/EN 61000-4-6 | 3Vr.m.s | perf. Criteria A |

## Typical Characteristic Curves

Temperature Derating Curve

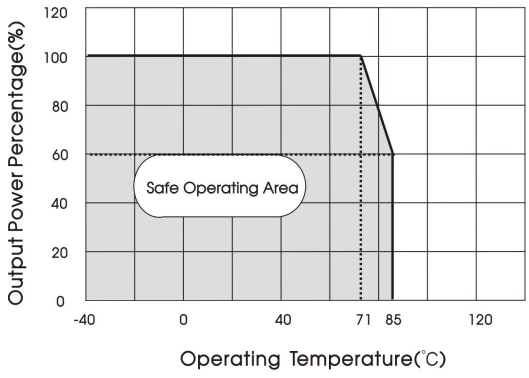
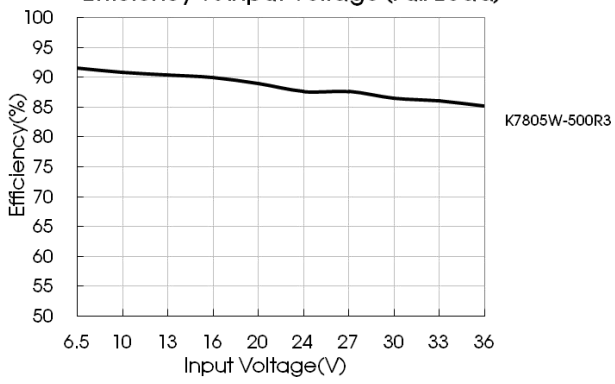
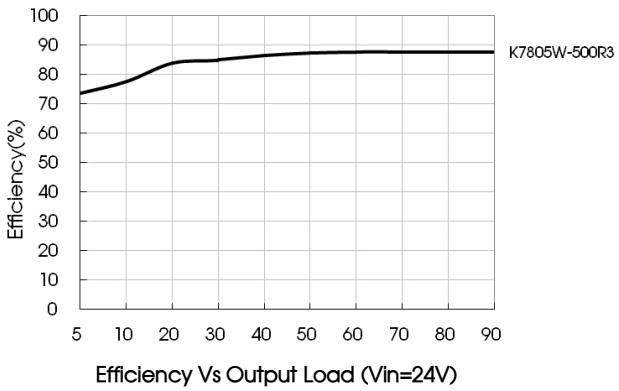



Fig. 1

Efficiency Vs input Voltage (Full Load)




Efficiency Vs Output Load (Vin=24V)




Efficiency Vs Output Load (Vin=24V)

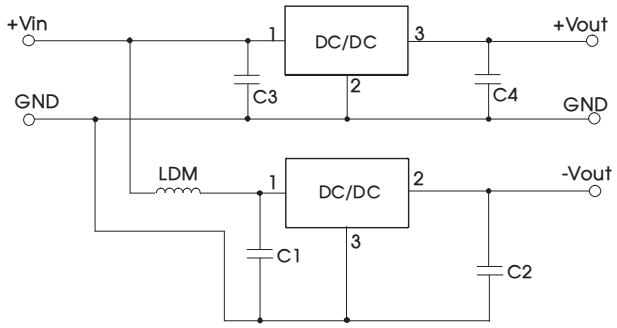

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## Design Reference

### 1. Typical application




Fig. 2 Typical application




Sheet 1

| Part No. | C1/C3 (ceramic capacitor) | C2/C4 (ceramic capacitor) |
|---|---|---|
| K7805W-500R3 | 10μF/50V | 22μF/10V |
| K7809W-500R3 | | 22μF/16V |
| K7812W-500R3 | | 22μF/25V |

Fig. 3 Positive and Negative output in parallel application

Note:

1. The required capacitors C1 and C2 (C3 and C4) must be connected as close as possible to the terminals of the module;
2. Refer to Table 1 for C1 and C2 (C3 and C4) capacitor values. For certain applications, increased values and/or tantalum or low ESR electrolytic capacitors may also be used instead;
3. When using configurations as shown in figure 3, we recommended to add an inductor (LDM) with a value of up to 10μH which helps reducing mutual interference;
4. The products do not support parallel connection of their output and hot plug;
5. To reduce the output ripple and noise further, it is suggested the use of a "LC" filter at the output terminals, and recommend with value of L is 10μH-47μH.

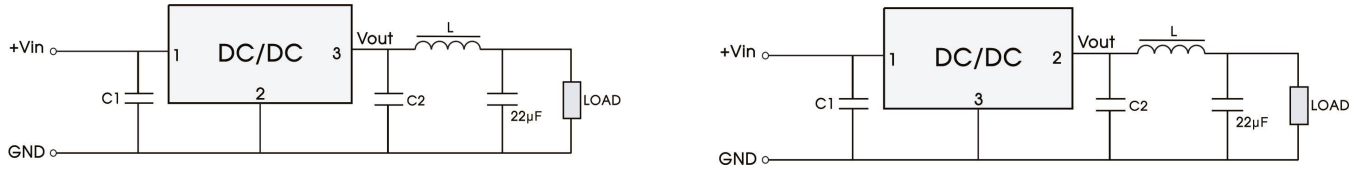



Fig. 4 "LC" filter application

### 2. EMC compliance circuit

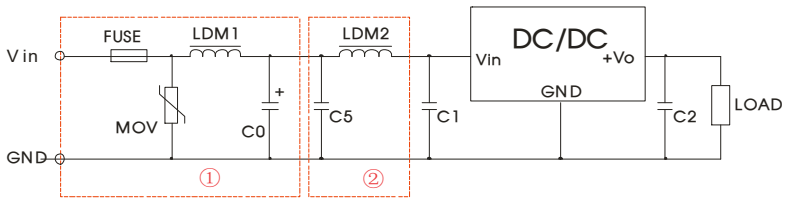



Fig. 5 EMC recommended circuit

| FUSE | MOV | LDM1 | C0 | C1/C2 | C5 | LDM2 |
|---|---|---|---|---|---|---|
| Selected based on the actual input current from the customer | S20K30 | 82μH | 680μF /50V | Refer to Sheet 1 | 4.7μF /50V | 12μH |

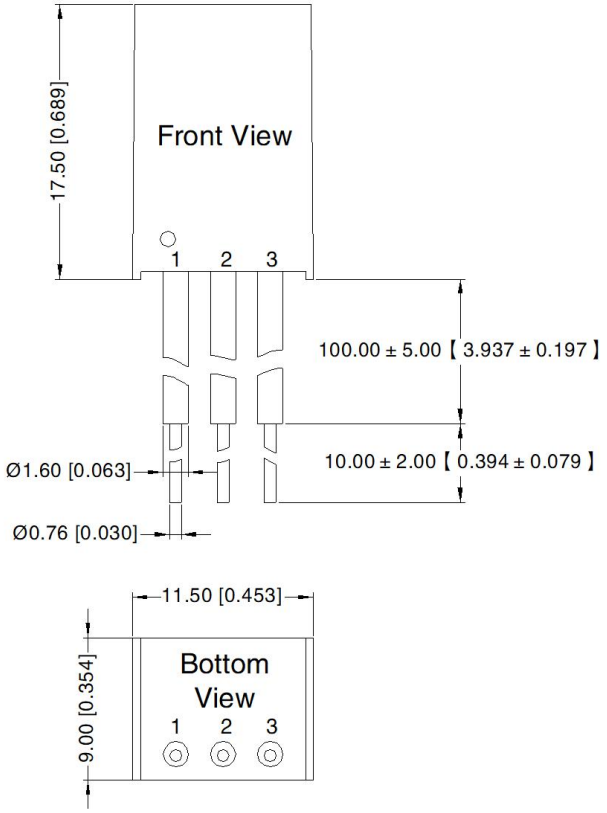
Notes: For EMC tests we use Part ① in Fig. 5 for immunity and part ② for emissions test.

### 3. For additional information please refer to DC-DC converter application notes on www.mornsun-power.com


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## Dimensions and Recommended Layout

THIRD ANGLE PROJECTION




| Pin–Out | | |
|---|---|---|
| Pin | Positive Output | Negative Output |
| 1 | Vin | Vin |
| 2 | GND | –Vo |
| 3 | +Vo | GND |

Note:
Unit: mm[inch]
Wire type: UL1569 AWG22 ( 300V 105℃ )
General tolerances: ± 0.50[ ± 0.020]

Notes:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Packaging bag number: 58010119;
2. The specified maximum capacitive load is tested under full load condition and over the input voltage range;
3. Unless otherwise specified, parameters in this datasheet were measured under the conditions of Ta=25℃, humidity<75%RH with nominal input voltage and rated output load;
4. All index testing methods in this datasheet are based on our company corporate standards;
5. We can provide product customization service, please contact our technicians directly for specific information;
6. Products are related to laws and regulations: see "Features" and "EMC";
7. Our products shall be classified according to ISO14001 and related environmental laws and regulations, and shall be handled by qualified units.

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