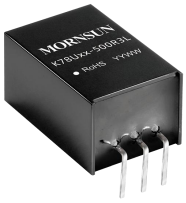
# DC/DC Converter

## K78UXX-500R3 (L) Series

MORNSUN®

Wide input voltage non-isolated and regulated single output




CE Report Patent Protection RoHS

EN 62368-1

## FEATURES

- Input voltage range up to 10:1
- High efficiency up to 93%
- No-load input current as low as 1.5 mA
- Operating ambient temperature range: -40℃ to 85℃
- Output short-circuit protection
- Pin compatible with K78XX series
- International standard pin package

*K78Uxx-500R3(L) series are high efficiency switching regulators. The converters feature high efficiency, low loss and short-circuit protection in a compact DFN package. These products are widely used in applications such as industrial control, instrumentation and electric power.*

## Selection Guide

| Certification | Part No. | Input Voltage (VDC)* | Output | | Full Load Efficiency (%) Typ. Vin Min./Vin Max. | Capacitive Load (μF) Max. |
|---|---|---|---|---|---|---|
| | | Nominal (Range) | Voltage (VDC) | Current (mA) Max. | | |
| EN | K78U03-500R3（L） | 48 (9-90) | 3.3 | 500 | 82/69 | 100 |
| | K78U05-500R3（L） | 48 (9-90) | 5 | 500 | 87/75 | |
| | K78UX6-500R3（L） | 48 (9-90) | 6.5 | 500 | 91/78 | |
| | K78U09-500R3（L） | 48 (14-90) | 9 | 500 | 91/80 | |
| | K78U12-500R3（L） | 48 (18-90) | 12 | 500 | 91/83 | |
| | K78U15-500R3（L） | 48 (20-90) | 15 | 500 | 93/84 | |
| | K78U24-300R3（L） | 48 (36-90) | 24 | 300 | 93/85 | |

Note: * For input voltage exceeding 80 VDC, an input capacitor of 22uF/100V is required.

## Input Specifications

| Item | Operating Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| No-load Input Current | Nominal input voltage | -- | -- | 1.5 | mA |
| Reverse Polarity at Input | | Avoid / Not protected | | | |
| Input Filter | | Capacitance filter | | | |

## Output Specifications

| Item | Operating Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Voltage Accuracy | 10%-100%, input voltage range | 3.3V output | -- | ±3.5 | ±4.5 | % |
| | | Others | -- | ±2 | ±3 | |
| Linear Regulation | Full load, input voltage range | K78U03/05/X6-500R3 | -- | ±0.6 | ±1.5 | |
| | | K78U09/12/15-500R3 | - | ±0.6 | ±2.0 | |
| | | K78U24-300R3 | - | ±1.2 | ±2.5 | |
| Load Regulation | Nominal input voltage,10% -100% load | | -- | ±1.0 | ±2.0 | |
| Ripple & Noise* | 20MHz bandwidth, nominal input voltage, full load | | -- | 40 | 80 | mVp-p |
| Temperature Coefficient | Operating temperature -40℃ to +85℃ | | -- | -- | ±0.03 | %/℃ |

| | | | | | |
|---|---|---|---|---|---|
| Transient Response Deviation | Nominal input voltage, 25% load step change | -- | ±0.4 | ±1.5 | % |
| Transient Recovery Time | Nominal input voltage, 25% load step change | -- | 0.2 | 1 | ms |
| Short-circuit Protection | Nominal input voltage | Continuous, self-recovery | | | |
| Note: * 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 |
|---|---|---|---|---|---|
| Operating Temperature | See Fig.1, Fig.2. | -40 | -- | +85 | ℃ |
| 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 |
| Switching Frequency* | Full load, nominal input voltage | -- | 300 | -- | kHz |
| MTBF | MIL-HDBK-217F@25℃ | 2000 | -- | -- | k hours |
| Note: *Different output voltage with different switching frequency. | | | | | |

## Mechanical Specifications

| | | |
|---|---|---|
| Case Material | Black plastic; flame-retardant and heat-resistant (UL94 V-0) | |
| Dimensions | K78U-500R3 / K78U24-300R3 | 11.50 x 9.00 x 17.50 mm |
| | K78U-500R3L / K78U24-300R3L | 19.00 x 11.50 x 9.00 mm |
| Weight | 3.8g(typ.) | |
| Cooling Method | Free air convection | |

## Electromagnetic Compatibility (EMC)

| | | | |
|---|---|---|---|
| Emissions | CE | CISPR32/EN55032 CLASS B (see Fig. 6-② for recommended circuit) | |
| | RE | CISPR32/EN55032 CLASS B (see Fig. 6-② 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 B |
| | EFT | IEC/EN 61000-4-4 100kHz ±1kV (see Fig. 6-① for recommended circuit) | perf. Criteria B |
| | Surge | IEC/EN 61000-4-5 line to line ±1kV (see Fig. 6-① for recommended circuit) | perf. Criteria B |
| | CS | IEC/EN 61000-4-6 3Vr.m.s | perf. Criteria B |

## Typical Characteristic Curves

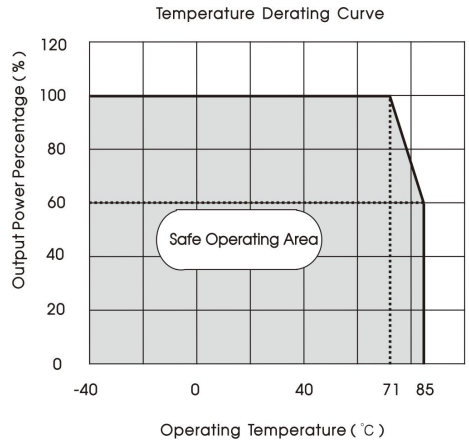



Fig.1 K78UXX-500R3(L)
K78U24-300R3(L) ( Vin=36V~60V)

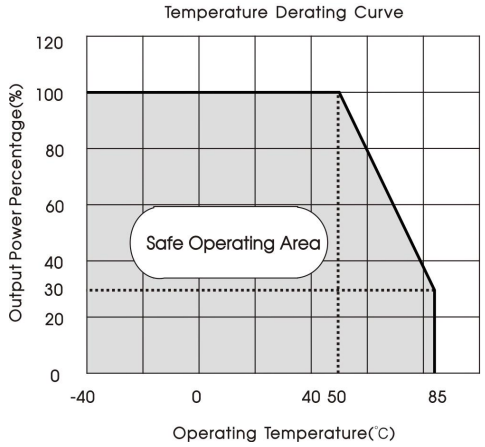



Fig.2 K78U24-300R3(L) (Vin≥60V)

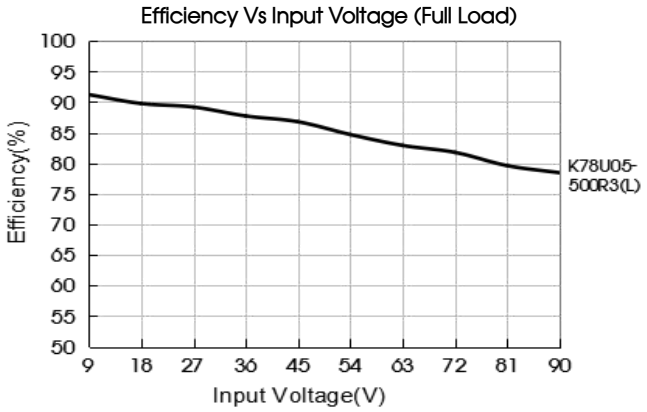



Fig.3

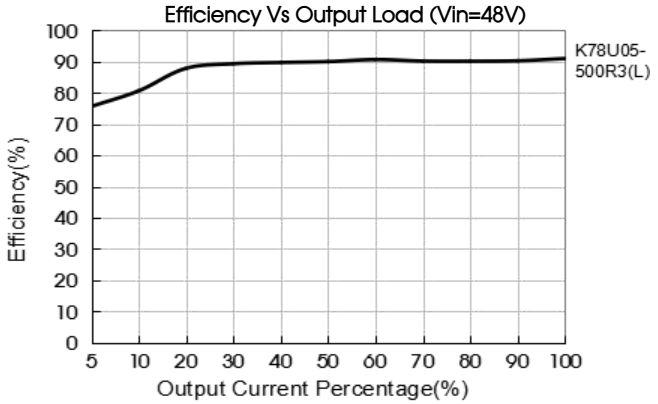



Fig.4

## Design Reference

### 1. Typical application

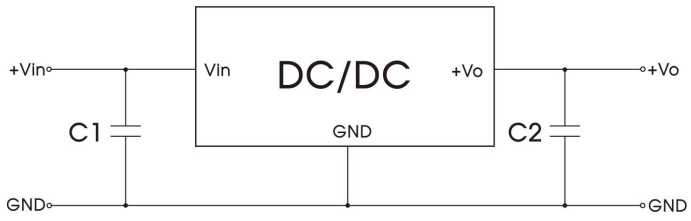



Fig. 5

| Part No. | C1 (ceramic capacitor) | C2 (ceramic capacitor) |
|---|---|---|
| K78U03-500R3（L） | 10μF/100V | 22μF/10V |
| K78U05-500R3（L） | | 22μF/10V |
| K78UX6-500R3（L） | | 22μF/10V |
| K78U09-500R3（L） | | 22μF/16V |
| K78U12-500R3（L） | | 22μF/25V |
| K78U15-500R3（L） | | 22μF/25V |
| K78U24-300R3（L） | | 10μF/50V |

Table 1

Notes:
1. The required C1 and C2 capacitors must be connected as close as possible to the terminals of the module;
2. Refer to Table 1 for C1 and C2 capacitor values. For certain applications, increased values and/or tantalum or low ESR electrolytic capacitors may also be used instead;
3. Converter cannot be used for hot swap and with output in parallel.

### 2. EMC compliance circuit

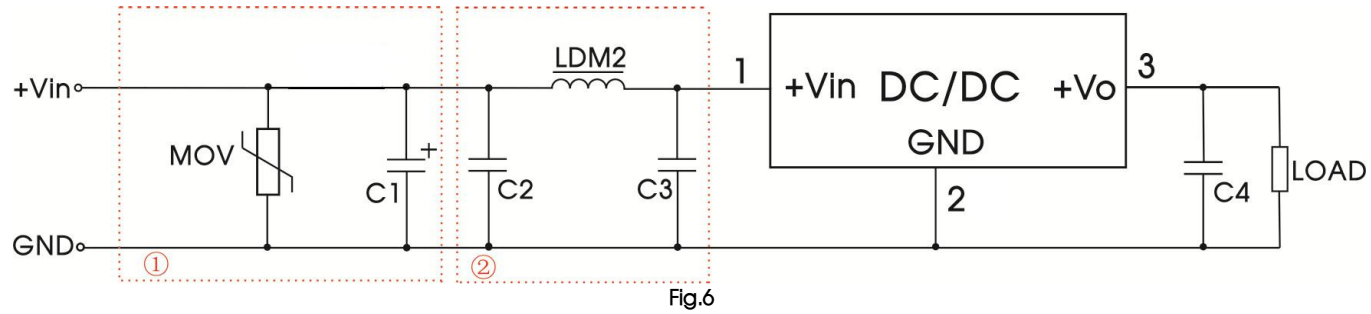


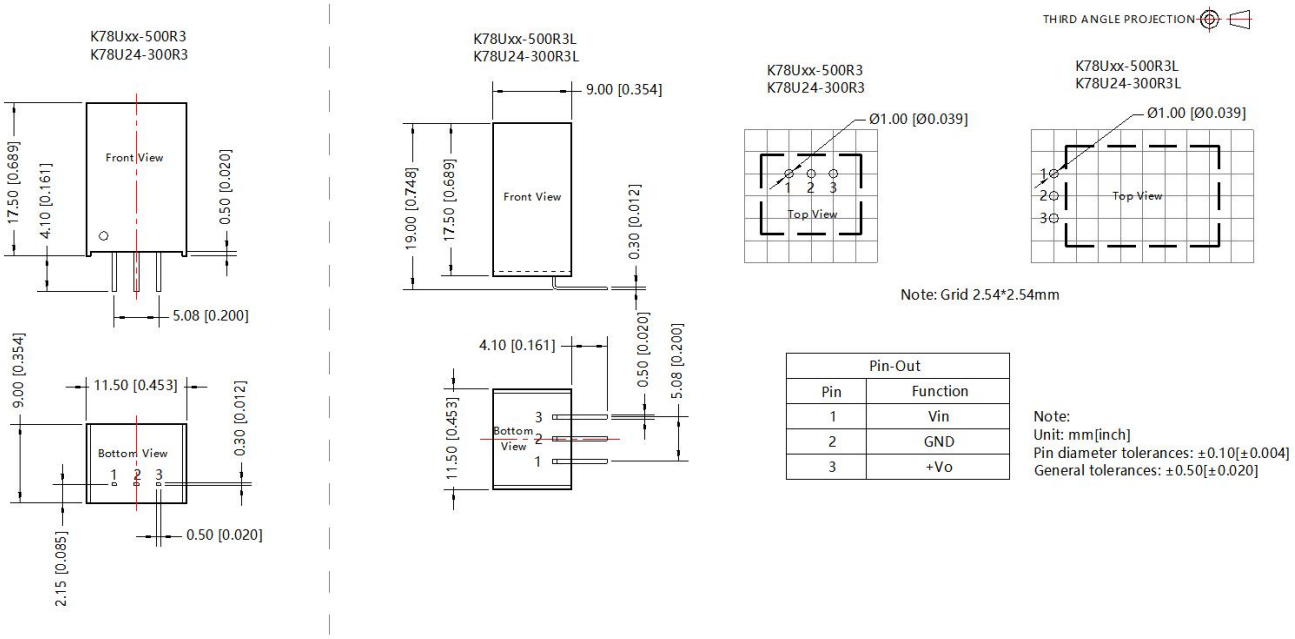

Fig.6

| Part No. | MOV | C1 | C2 | LDM2 | C3 | C4 |
|---|---|---|---|---|---|---|
| K78UXX-500R3(L) | S10K75 | 680μF /100V | 4.7μF/100V | 120μH | 4.7μF/100V | 10μF/50V |

Table.2

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

## Dimensions and Recommended Layout




| Pin-Out | |
|---|---|
| Pin | Function |
| 1 | Vin |
| 2 | GND |
| 3 | +Vo |

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

Notes:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Tape/Reel packaging bag number: 58210021(K78UXX-500R3, K78U24-300R3); 58210027(K78U-500R3L, K78U24-300R3L);
2. The maximum capacitive load offered were tested at nominal input voltage and full load;
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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