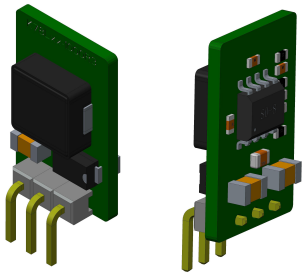
# DC/DC Converter

## K78Lxx-1000R3 Series

MORNSUN®

Wide input voltage non-isolated and regulated single output



Patent Protection

3 years Warranty

cULus Report CE Report UKCA Report CB RoHS

UL 62368-1 EN 62368-1 BS EN 62368-1 IEC 62368-1

## FEATURES

- High efficiency up to 96%
- No-load input current as low as 0.1mA
- Operating ambient temperature range: -40℃ to +85℃
- Negative output available
- Output short-circuit protection
- Pin-out compatible with LM78XX linear regulators

*K78Lxx-1000R3 series are high efficiency switching regulators and ideal substitutes of LM78xx series three-terminal linear regulators. The converters feature high efficiency, low loss, short circuit protection, positive or negative output voltage, and there is no need for a heat sink. 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 (%) Vin Min. / Vin Max. | Capacitive Load (μF) Max. |
|---|---|---|---|---|---|---|
| | | Nominal (Range) | Voltage (VDC) | Current (mA) Max. | | |
| UL/EN/BS EN/IEC | K78L03-1000R3 | 24 (6-36) | 3.3 | 1000 | 89/80 | 680 |
| | K78L05-1000R3 | 24 (8-36) | 5 | 1000 | 93/86 | 680 |
| | | 12 (8-27) | -5 | -500 | 86/82 | 330 |
| | K78LX6-1000R3 | 24 (10-36) | 6.5 | 1000 | 93/87 | 680 |
| | K78L12-1000R3 | 24 (16-36) | 12 | 1000 | 95/92 | 680 |
| | | 12 (8-20) | -12 | -300 | 88/87 | 330 |
| | K78L15-1000R3 | 24 (20-36) | 15 | 1000 | 96/94 | 680 |
| | | 12 (8-18) | -15 | -300 | 89/89 | 330 |

Note: * For input voltage exceeding 30 VDC, an input electrolytic capacitor of 22uF/50V is required 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 | -- | 0.1 | 1 | mA |
| Reverse Polarity at Input | | Avoid / Not protected | | | |
| Input Filter | | PI filter | | | |

## Output Specifications

| Item | Operating Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Voltage Accuracy | Full load, input voltage range | K78L03-1000R3 | -- | ±2 | ±4 | % |
| | | Other output | -- | ±2 | ±3 | |
| Linear Regulation | Full load, input voltage range | | -- | ±0.2 | ±0.4 | |
| Load Regulation | Nominal input,10% -100% load | | -- | ±0.4 | ±0.6 | |
| Ripple & Noise① | 20MHz bandwidth, nominal input, 20% -100% load | | -- | 20 | 75 | mVp-p |

| | | | | | |
|---|---|---|---|---|---|
| Temperature Coefficient | Operating ambient temperature -40℃ to +85℃ | -- | -- | ±0.03 | %/℃ |
| Transient Response Deviation | Nominal input, 25% load step change | -- | 50 | 300 | mV |
| Transient Recovery Time | Nominal input, 25% load step change | -- | 0.1 | 1 | ms |
| Short-circuit Protection | Nominal input | Continuous, self-recovery | | | |

Notes:
① The "parallel cable" method is used for Ripple and Noise test, please refer to DC-DC Converter Application Notes for specific information;
②With the load lower than 20%, the maximum ripple and noise of 3.3V/5V output products will be 100mVp-p, 12V/15V output products will be 2%Vo.

## General Specifications

| Item | Operating Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Operating Temperature | Derating when operating temperature≥71℃ (see Fig. 1) | | -40 | -- | 85 | ℃ |
| Storage Temperature | | | -55 | -- | 125 | |
| Pin Soldering Resistance Temperature | Soldering time: 10 seconds | | -- | -- | 260 | |
| Storage Humidity | Non-condensing | | 5 | -- | 95 | %RH |
| Switching Frequency | Full load, nominal input | K78L03-1000R3/K78L05-1000R3 /K78X6-1000R3(L) | 420 | 520 | 620 | kHz |
| | | Other output | 580 | 680 | 780 | |
| MTBF | MIL-HDBK-217F@25℃ | | 2000 | -- | -- | k hours |

## Mechanical Specifications

| | |
|---|---|
| Dimensions | 11.50mm x 7.50mm x 17.50mm |
| Weight | 2.1g (Typ.) |
| Cooling Method | Free air convection |

## Electromagnetic Compatibility (EMC)

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

## Typical Characteristic Curves

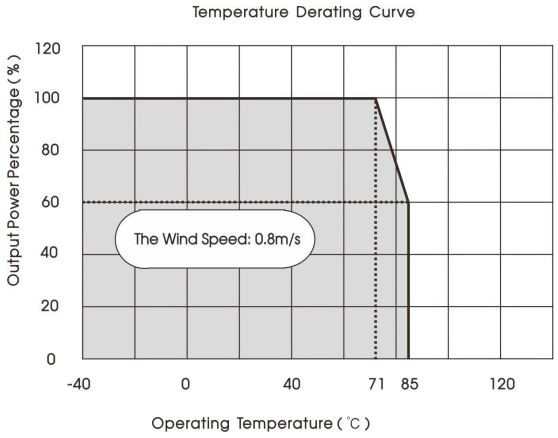
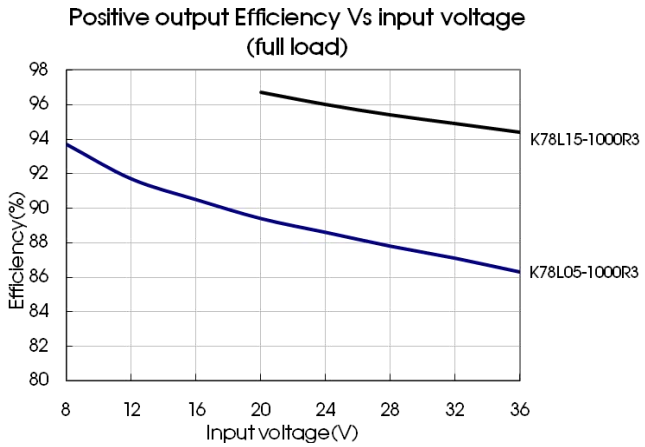
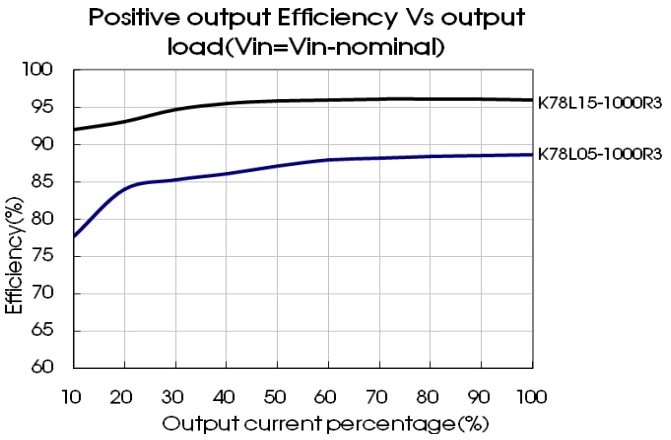
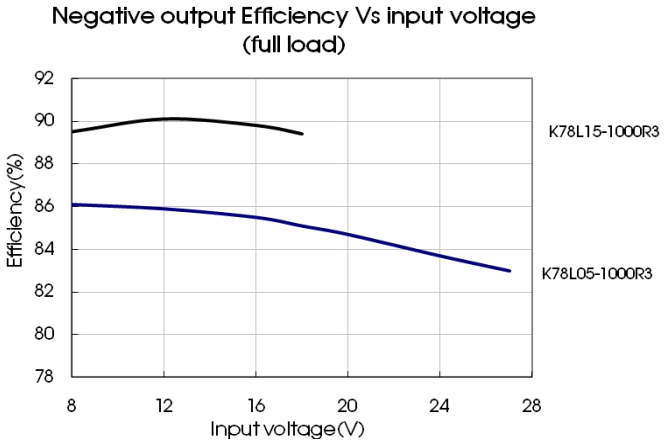
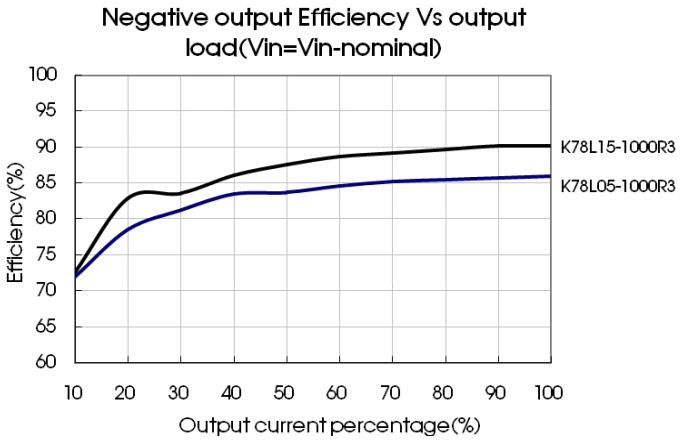



Fig. 1



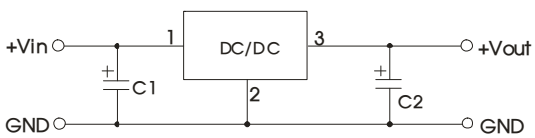




## Design Reference

### 1. Typical application



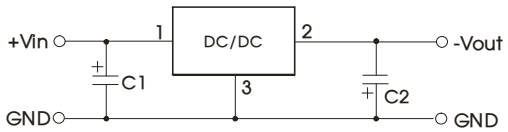




Fig. 2 Typical application circuit

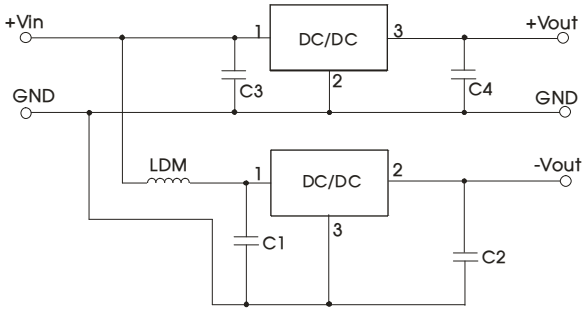



Fig. 3 Positive and negative output application circuit

Table 1

| Part No. | C1/C3 (ceramic capacitor) | C2/C4 (ceramic capacitor) |
|---|---|---|
| K78L03-1000R3 | 10μF/50V | 22μF/10V |
| K78L05-1000R3 | | 22μF/10V |
| K78LX6-1000R3 | | 22μF/10V |
| K78L12-1000R3 | | 22μF/25V |
| K78L15-1000R3 | | 22μF/25V |

Note:
1. The required C1 and C2 (C3 and C4) capacitors 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;
3. For certain applications, increased values for C2 and C4 and/or tantalum or low ESR electrolytic capacitors may also be used instead;
4. 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;
5. Converter cannot be used for hot swap and with output in parallel.

## 2. EMC compliance circuit

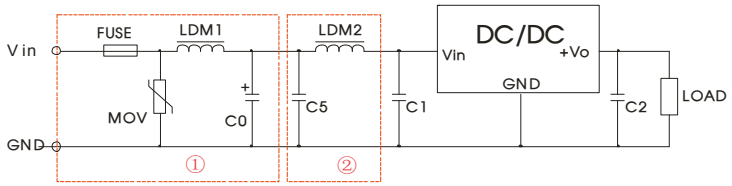



Fig.4 Recommended compliance circuit

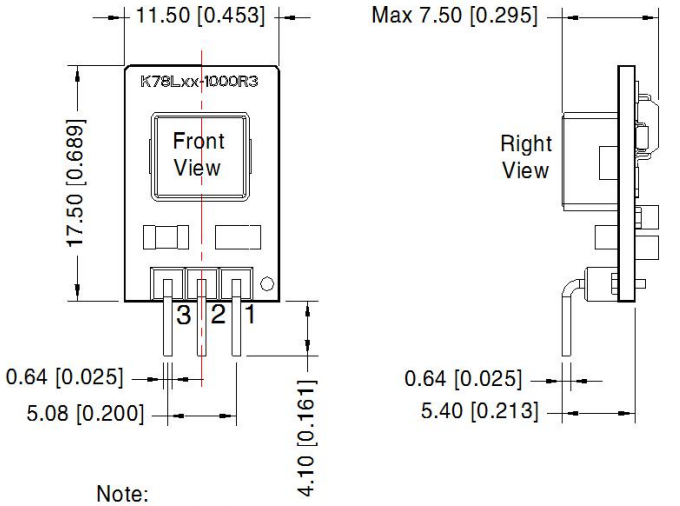
| FUSE | MOV | LDM1 | C0 | C1/C2 | C5 | LDM2 |
|---|---|---|---|---|---|---|
| Selected fuse value according to actual input current | S20K30 | 82μH | 680μF /50V | Refer to table 1 | 4.7μF /50V | 12μH |

Note: For EMC tests we use Part ① in Fig. 4 for immunity and part ② for emissions test. Selecting based on needs.

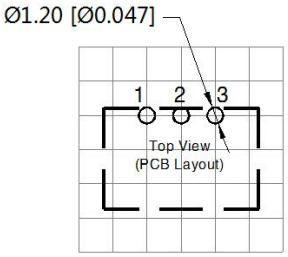
## 3. For additional information please refer to DC-DC converter application notes on www.mornsun-power.com

## Dimensions and Recommended Layout

THIRD ANGLE PROJECTION




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




Note: Grid 2.54*2.54mm

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

Notes:

1. For additional information on Product Packaging please refer to www.mornsun-power.com. Tape/Reel packaging bag number: 58210081;
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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