# **SERIES:** P78-2000R-S | **DESCRIPTION:** NON-ISOLATED SWITCHING REGULATOR

## FEATURES

- 2 A output current
- 3 ~ 12 Vdc output options
- 36 Vdc max input voltage
- -40°C to +85°C temperature range
- pin compatible with LM78XX linear regulators
- wide input voltage range
- no-load input current as low as 0.1 mA
- designed to meet EN/BS EN 62368

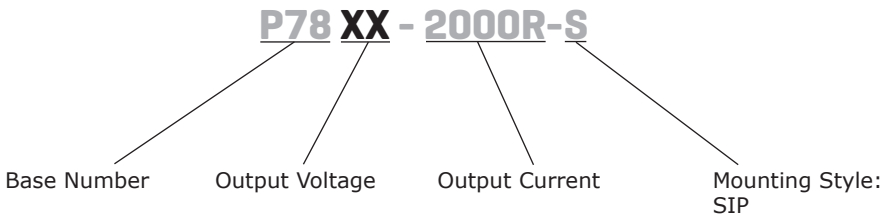
RoHS

## MODEL

| MODEL | input voltage[1] typ (Vdc) | input voltage[1] range (Vdc) | output voltage (Vdc) | output current max (mA) | output power max (W) | ripple and noise[2] max (mVp-p) | efficiency[3] max (%) |
|---|---|---|---|---|---|---|---|
| P7803-2000R-S | 24 | 6~36 | 3.3 | 2000 | 6.6 | 75 | 89 |
| | 12 | 8~31 | -3.3 | 1000 | -3.3 | 150 | 83 |
| P7805-2000R-S | 24 | 8~36 | 5 | 2000 | 10 | 75 | 92 |
| | 12 | 8~30 | -5 | 1000 | -5 | 150 | 84 |
| P7806-2000R-S | 24 | 10~36 | 6.5 | 2000 | 13 | 75 | 92 |
| | 12 | 8~29 | -6.5 | 1000 | -6.5 | 150 | 85 |
| P7809-2000R-S | 24 | 13~36 | 9 | 2000 | 18 | 75 | 95 |
| | 12 | 8~26 | -9 | 1000 | -9 | 150 | 84 |
| P7812-2000R-S | 24 | 16~36 | 12 | 2000 | 24 | 75 | 96 |
| | 12 | 8~23 | -12 | 1000 | -12 | 150 | 85 |

Notes:
1. For input voltage exceeding 30 Vdc, an input capacitor of 22µF/50V is required.
2. The ripple and noise are measured at 20 MHz BW using the parallel cable method at nominal input voltage, full load. See Application notes.
3. Measured at minimum Vin and 100% load.

## PART NUMBER KEY



## INPUT

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| no load input current | positive output<br>at nominal input | | 0.1 | 1 | mA |
| | negative output<br>at nominal input -3.3, -5. -6.5 Vdc output<br>all other output models | | -<br>- | 1<br>2 | mA<br>mA |
| reverse polarity at input | avoid / not protected | | | | |
| input filter | capacitance filter | | | | |

## OUTPUT

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| capacitive load | 3.3 Vdc output model<br>5 & 6.5 Vdc output models<br>9 Vdc output model<br>12 & 15 Vdc output models | | | 1800<br>1000<br>680<br>470 | µF<br>µF<br>µF<br>µF |
| line regulation | Vin = min ~ max, at full load | | ±0.4 | ±0.8 | % |
| load regulation | at nominal input, 10% ~ 100% load | | ±0.5 | ±1.5 | % |
| voltage accuracy | at nominal input, 10% ~ 100% load | | | ±3.0 | % |
| switching frequency | at nominal input, full load | | 400 | | kHz |
| temperature coefficient | -40°C ~ 80°C | | | ±0.03 | %/°C |
| transient response deviation | at nominal input, 25% load step change<br>(25%~50%~25%, 50%~75%~50% step)<br>positive output<br>negative output | | <br><br>±50<br>±50 | <br><br>±150<br>±150 | <br><br>mV<br>mV |
| transient recovery time | at nominal input, 25% load step change<br>(25%~50%~25%, 50%~75%~50% step) | | 0.2 | 1 | ms |

## PROTECTIONS

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| short circuit protection | continuous, auto recovery | | | | |

## SAFETY AND COMPLIANCE

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| safety approvals | designed to meet 62368: EN, BS EN | | | | |
| conducted emissions | CISPR32/EN55032 CLASS B (see Fig. 2-2 for recommended circuit) | | | | |
| radiated emissions | CISPR32/EN55032 CLASS B (see Fig. 2-2 for recommended circuit) | | | | |
| ESD | IEC/EN 61000-4-2 Contact ±6kV, perf. Criteria B | | | | |
| radiated immunity | IEC/EN 61000-4-3 10V/m, perf. Criteria A | | | | |
| EFT/burst | IEC/EN 61000-4-4 ±1kV, perf. Criteria B (see Fig. 2-1 for recommended circuit) | | | | |
| surge | IEC/EN 61000-4-5 line to line ±1kV, perf. Criteria B (see Fig. 2-1 for recommended circuit) | | | | |
| conducted immunity | IEC/EN 61000-4-6 3Vr.m.s, perf. Criteria A | | | | |
| MTBF | as per MIL-HDBK-217 at 25°C | 2,000,000 | | | hours |
| RoHS compliant | yes | | | | |

## ENVIRONMENTAL

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| operating temperature | see derating curves | -40 | | 85 | °C |
| storage temperature | | -55 | | 125 | °C |
| storage humidity | non-condensing | 5 | | 95 | % |
| pin soldering resistance temperature | for max 10 seconds | | | 260 | °C |

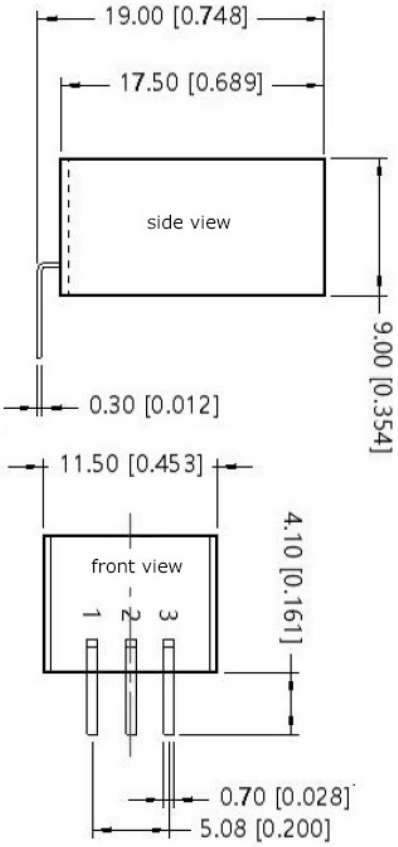
## MECHANICAL

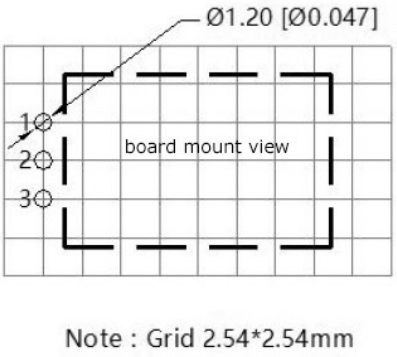
| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| dimensions | 11.50 x 9.00 x 17.50 [0.453 x 0.354 x 0.689 inch] | | | | mm |
| case material | black plastic, flame retardant and heat resistant (UL94-V0) | | | | |
| weight | | | 3.8 | | g |
| cooling | natural convection | | | | |

## MECHANICAL DRAWING

units: mm [inches]
tolerance: ±0.50 [±0.020]
pin section tolerance: ±0.10 mm [±0.004]

| PIN CONNECTIONS | | |
|---|---|---|
| Pin | Function (positive output) | Function (negative output) |
| 1 | +Vin | +Vin |
| 2 | GND | -Vo |
| 3 | +Vo | GND |



## TYPICAL APPLICATION CIRCUIT

**Figure 1**
**positive output**

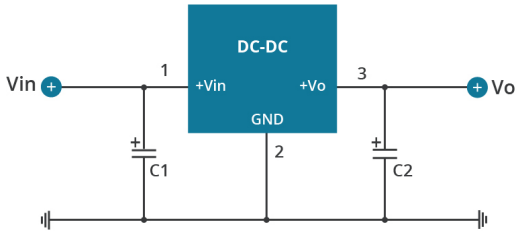



**Figure 1**
**negative output**

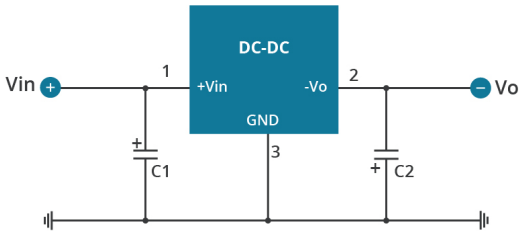



**Table 1**

| Output Voltage (Vdc) | C1 (ceramic capacitor) | C2 (ceramic capacitor) |
|---|---|---|
| 3.3 | 22μF/50V | 22μF/10V |
| 5 | | 22μF/10V |
| 6.5 | | 22μF/10V |
| 9 | | 22μF/16V |
| 12 | | 22μF/25V |

1. The required C1 and C2 capacitors must be connected as close as possible to 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. For certain applications, increased values of C2 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.

## EMC RECOMMENDED CIRCUIT

**Figure 2**

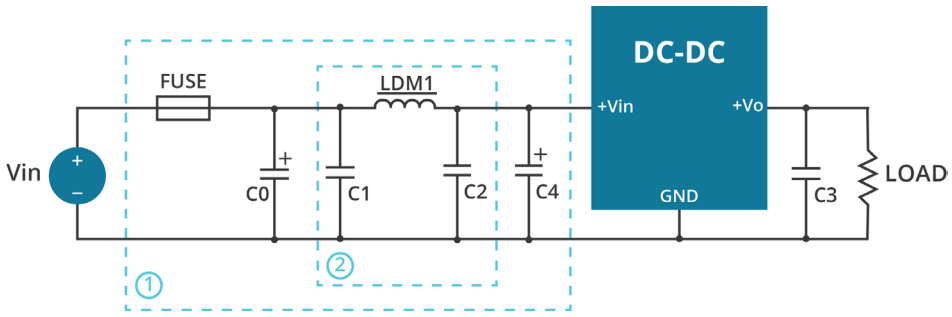
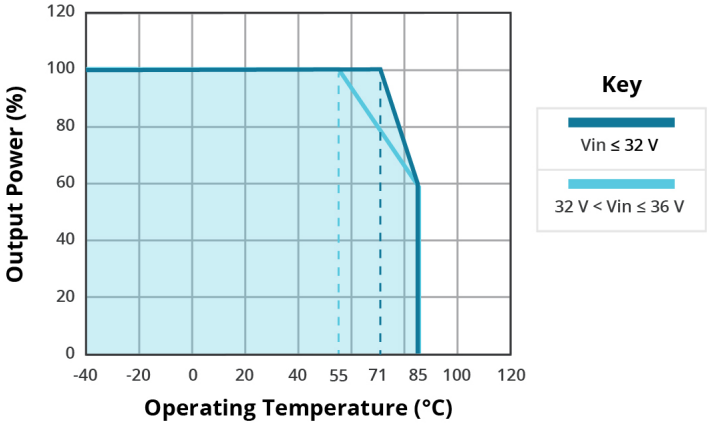



**Table 2**

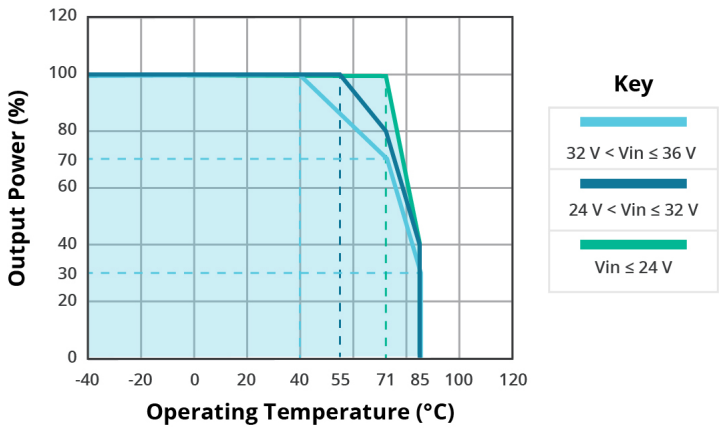
| Component | Recommended value |
|---|---|
| FUSE | selected based on the actual input current in application |
| C0 | 100μF/100V |
| LDM1 | 22μH |
| C4 | 680μF/50V |
| C1 | 10μF/50V |
| C2 | 10μF/50V |
| C3 | 22μF/25V |

## DERATING CURVES

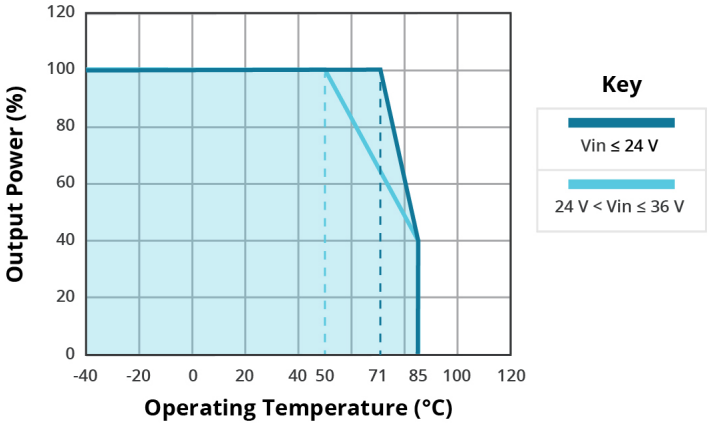
***TEMPERATURE DERATING CURVE***
***3.3, 5V output***
***(Forced air - 0.6 m/s)***



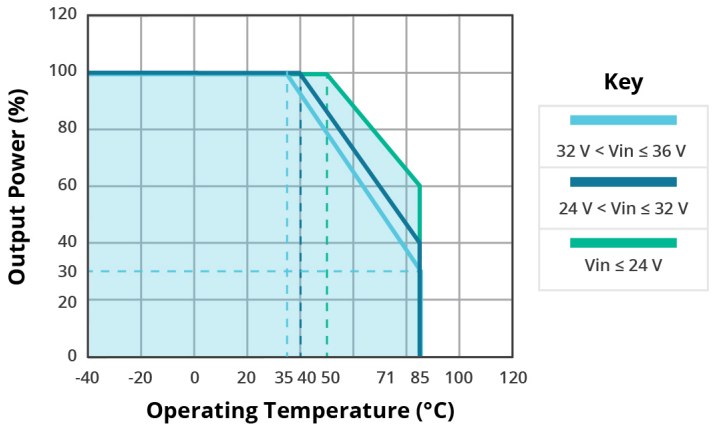

***TEMPERATURE DERATING CURVE***
***6.5, 9, 12 V output***
***(Forced air - 1.7 m/s)***



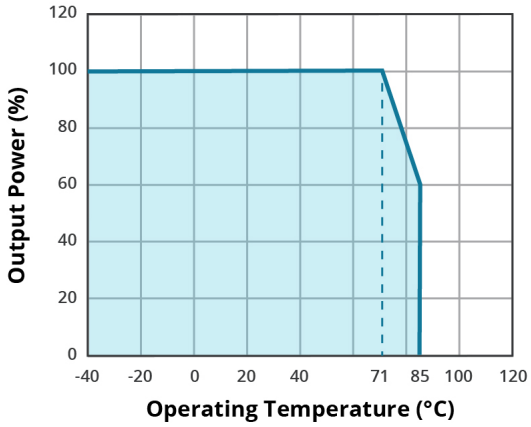

***TEMPERATURE DERATING CURVE***
***3.3, 5, 6.5V output***
***(Natural convection)***



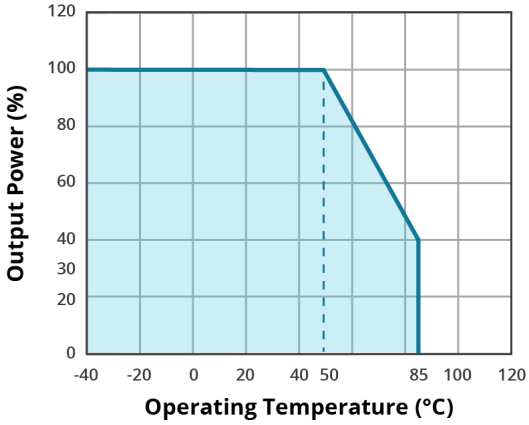

***TEMPERATURE DERATING CURVE***
***9, 12 V output***
***(Natural convection)***




***TEMPERATURE DERATING CURVE***
***-3.3, -5, -6.5V output***
***(Natural convection)***

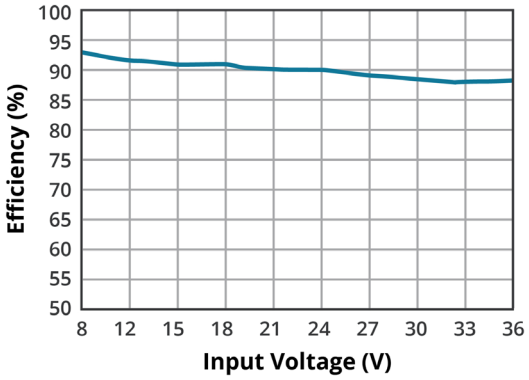



***TEMPERATURE DERATING CURVE***
***-9, -12 V output***
***(Natural convection)***

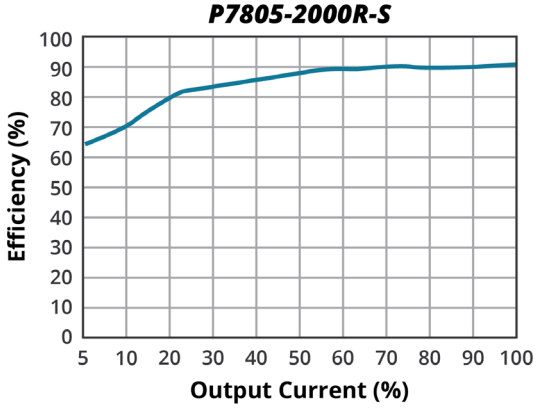


## EFFICIENCY CURVES

***EFFICIENCY VS INPUT VOLTAGE***
***(full load)***
***P7805-2000R-S***




***EFFICIENCY VS OUTPUT CURRENT***
***(Vin = 24V)***
***P7805-2000R-S***



## REVISION HISTORY

| rev. | description | date |
|---|---|---|
| 1.0 | initial release | 07/31/2022 |
| 1.01 | updated efficiency | 08/08/2022 |
| 1.02 | 6.5V output model added | 03/29/2023 |
| 1.03 | 9V input model added | 07/17/2023 |
| 1.04 | model numbers updated | 09/27/2023 |

The revision history provided is for informational purposes only and is believed to be accurate.

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