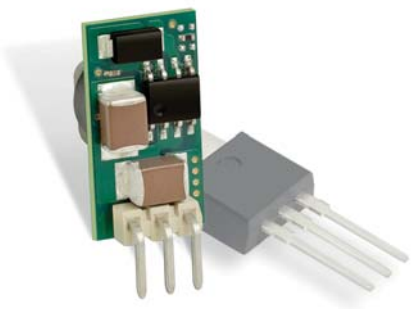
Murata Power Solutions

# 78xxSR Series

## 3.3V/5V/12V Outputs High-Efficiency Switching Regulators with LM78xx Pinouts



## FEATURES

- 3.3V/0.5A, 5V/0.5A or 12V/0.4A outputs; Pin and size-compatible with LM7805 & LM7812 regulators
- Up to 95% efficiency – no heat sinks or thermal derating required
- Two SIP-packages fit existing TO-220 footprints:
  - Vertical-pin models occupy less than 0.1 square in.
  - Optional horizontal pins provide 0.350 in. installed height
- +7.5-36Vdc operating input range; Low 3mA quiescent current
- Built-in filter capacitors – no external components required
- –40 to +70°C operation at full load; Short-circuit protection
- Excellent load (±0.2%) and line (±0.3%) regulation
- Ideal for powering instrumentation from 9V/12V/24V/28V supplies or batteries
- Can be used with unregulated dc supplies protection

## Ordering Information

| MPS Part No. | Output Voltage | Output Current | Input Voltage |
|---|---|---|---|
| **Standard Pin Package** | | | |
| **7803SR-C** | +3.3Vdc | 0.5A | +7.5-36Vdc |
| **7805SR-C** | +5.0Vdc | 0.5A | +7.5-36Vdc |
| **7812SR-C** | +12.0Vdc | 0.4A | +15-36Vdc |
| **Horizontal Pin Package** | | | |
| **7803SRH-C** | +3.3Vdc | 0.5A | +7.5-36Vdc |
| **7805SRH-C** | +5.0Vdc | 0.5A | +7.5-36Vdc |
| **7812SRH-C** | +12.0Vdc | 0.4A | +15-36Vdc |

RoHS COMPLIANT

For full details go to www.murata-ps.com/rohs

Murata Power Solutions' 7805SR-C (5V output), 7812SR-C (12V output) and 7803SR-C (3.3V output) step-down switching regulators are modern drop-in replacements for older, inefficient, LM7805 and LM7812 linear regulators. The 78XXSR's are pin- and size-compatible with industry-standard TO-220 SIP packages. A 260kHz switching frequency provides for efficiencies as high as 95%. Full-load (up to 0.5A) operation from 9V, 12V, 24V, or 36V supplies at ambient temperatures up to +70°C requires no heat sinks, no temperature derating, no forced-air cooling, and no external capacitors.

78SR switching regulators provide many significant improvements over their linear counterparts: lower quiescent current (3mA vs. 5 mA), higher input voltage (40V vs. 32V), and better output accuracy (±2% vs. ±5%). All these features combine to make 78SR regulators ideal for new or existing LM7805 & LM7812 applications requiring full-load operation at elevated voltages.

### TECHNICAL NOTES

1. **Input/Output (I/O) Filtering:** As shown in the noise and ripple graphs, 78SR switching regulators exhibit excellent low-noise performance with no external I/O capacitors. However, if additional noise reduction is required, be sure to use low-ESR capacitors that are rated for continuous operation (with an additional 20% safety margin) at the highest system voltages and temperatures. Adding external output capacitors will also improve the unit's load-transient response.

   Applications in which 78SR regulators are located more than 24 inches (61cm) from the input power supply should include an external 47uF/50V (or greater) aluminum electrolytic capacitor, connected as close as possible to the regulator's +Vin and GND terminals (pins 1 and 2). An external input capacitor is particularly important if the input voltage is applied to the regulator via a mechanical switch or relay. Contact bounce at turn-on can produce large inductive current-spikes, and these current spikes can generate damaging voltage transients at the regulator's input terminals.
2. **Input Fusing:** 78SR switching regulators are not internally fused. If fusing their input and/or output terminals is required, use the data shown in the Efficiency Curves as a guide to selecting an appropriate slow-blow fuse.
3. **Input-Output Isolation:** 78SR regulators' internal input and output circuits share a common connection (GND, pin 2); there is no electrical isolation between the INPUT (pin 1) and OUTPUT (pin 3) terminals.
4. **Overvoltage Protection:** 78SR switching regulators do not provide input or output overvoltage protection. In the extremely rare situation in which a catastrophic failure occurs, the output voltage may rise to excessively high levels. If your load must be protected against all possible overvoltage situations, external voltage-limiting circuitry must be provided.
5. **Operation at 40Vdc:** Operating with inputs up to 40Vdc is permissible if, for inputs between 36 and 40Vdc, the maximum load current is reduced to 0.35A for 7805SR-C and 7803SR-C, and to 0.3A for 7812SR-C. Under no circumstances should the input voltage be allowed to exceed 45Vdc.

**TECHNICAL NOTES** (continued)

6. **Soldering & Handling Precautions:** All units are designed to be hand soldered to pc-boards using no-clean solders (+260°C, 5 seconds max.). Water-soluble solders can also be used, but the units must be washed and dried using processes appropriate to the type of solder employed. See the Mechanical Specifications section for pin 1 orientation and recommended plated-through hole dimensions.

   While 78SR regulators easily withstand a 2kV ESD discharge to any terminal (using human body model), they should always be treated as ESD sensitive devices.

7. **Horizontal-Pin Models (78XXSRH-C):** 78XXSRH-C switching regulators are pin-compatible replacements for TO-220 style LM78XX linear regulators that are installed with their metal tabs lying flat on the surface of the pc-board. However, because the surface of inductor L1 on 78XXSRH-C models is electrically conductive, it must not be allowed to come in contact with any exposed pc-board traces, other than power ground (GND). While the 2-mil-thick (0.05mm) polyester label attached to L1 provides some degree of electrical insulation (only if L1 sits perfectly flat on the pc-board), it is recommended that a 0.020" (0.5mm) clearance be maintained between L1 and all exposed pc-board traces.

8. **Dropout Voltage:** 78SR series regulators described in this data sheet specify a minimum input voltage at which full-load accuracy and output regulation are guaranteed (7.5V for 7803SR-C and 7805SR-C, and 15.0V for 7812SR-C). However, these devices will stay in regulation at lower input voltages if they are operated at less than their rated loads.

   The following dropout-voltage data, derived from sample testing performed at an ambient temperature of +25°C with resistive loads, should be used for information purposes only. For these tests, a unit was considered to be out of regulation when its output changed by more +/–0.005Vdc from its nominal value. All voltages were measured directly at the regulator's I/O pins.

**Typical Dropout Voltage**

| | 0% Load | 25% Load | 50% Load | 100% Load |
|---|---|---|---|---|
| **7803SR-C** | 6.0V | 6.2V | 6.2V | 6.3V |
| **7805SR-C** | 6.3V | 6.2V | 6.2V | 6.8V |
| **7812SR-C** | 12.8V | 13.0V | 12.8V | 13.0V |

## Performance/Functional Specifications

Typical at $T_A$ = +25°C

**Input/Output**

| Models | 7803SR-C | 7805SR-C | 7812SR-C |
|---|---|---|---|
| **Output Voltage** | +3.3Vdc | +5.0Vdc | +12.0Vdc |
| **Rated Output Current** | 0.5A | 0.5A | 0.4A |
| **Output Voltage Accuracy** | ±2% | ±2% | ±2% |
| **Input Voltage Range** ① | +7.5-36Vdc | +7.5-36Vdc | +15-36Vdc |
| **Line Regulation (100% load)** | ±0.3% | ±0.3% | ±0.3% |
| **Load Regulation (0-100% load)** | ±0.2% | ±0.2% | ±0.2% |
| **Quiescent Current** | 3mA typ., 5mA max. | | |
| **Input Current** | See Performance Curves | | |
| **Efficiency** | See Performance Curves | | |
| **Transient Response** | See Performance Curves | | |
| **Input & Output Noise** | See Performance Curves | | |
| **Short Circuit Protection** ② | Continuous | | |
| **Isolation** | None | | |
| **Overvoltage Protection** | None | | |
| **Undervoltage Protection** | None | | |

**Environmental**

| Models | 7803SR-C | 7805SR-C | 7812SR-C |
|---|---|---|---|
| **Operating Temperature** | –40 to +70°C | | |
| **Storage Temperature** | –40 to +85°C | | |
| **Cooling** | Free Air Convection | | |
| **Humidity (Non-condensing)** | 0 to 85% | | |

**Physical**

| | |
|---|---|
| **Mechanical** | See Mechanical Specifications |
| **Package** | Open-frame SIP |
| **Pins** | 0.025" (0.64mm) square, tin-plated bronze |
| **Weight** | 0.08 ounces (2.2g) |
| **Pin Soldering** | +260°C for 5 seconds |

① See Technical Note 5.

② While these regulators can withstand a continuous short-circuit across their output terminals, they will experience a significant temperature rise. Extended short-circuit operation will adversely affect the unit's reliability.