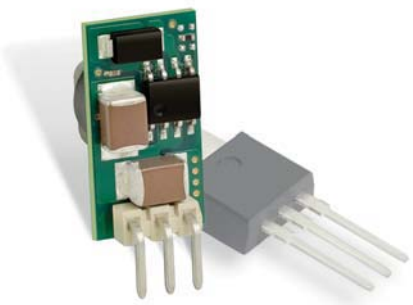
Murata Power Solutions

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 2002/95/EC

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

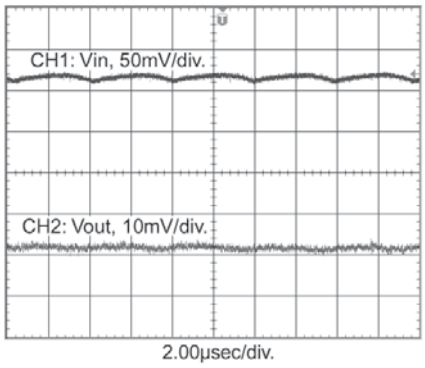
① See Technical Note 5.

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.

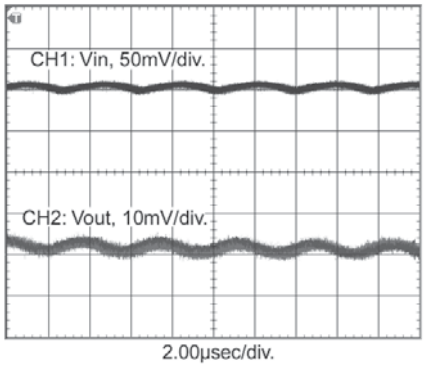
Typical Performance Curves T_A = +25°C, V_{IN} as indicated

Noise and Ripple - 10% and 100% Load, 20MHz Bandwidth

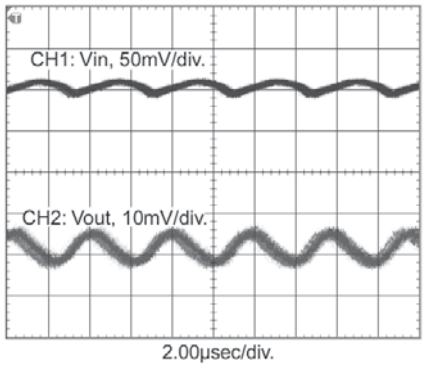
7803SR-C Vin = 12V, I_{LOAD} = 50mA



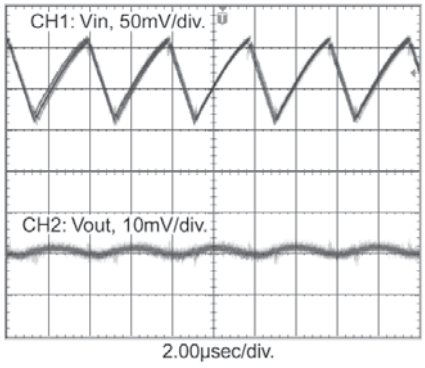
7805SR-C Vin = 12V, I_{LOAD} = 50mA



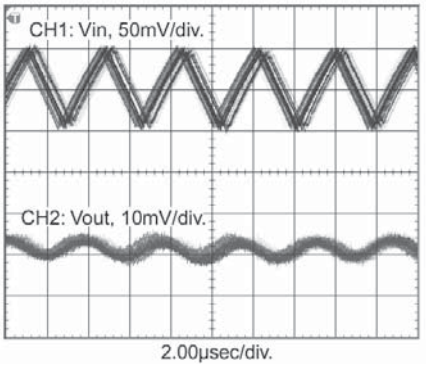
7812SR-C Vin = 24V, I_{LOAD} = 40mA



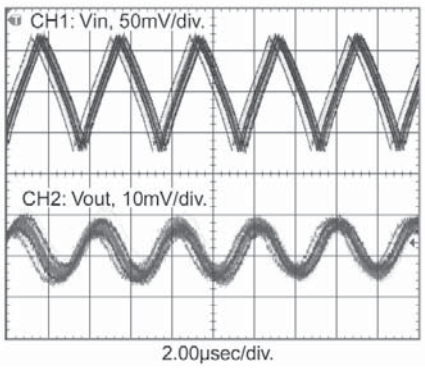
7803SR-C Vin = 12V, I_{LOAD} = 500mA



7805SR-C Vin = 12V, I_{LOAD} = 500mA

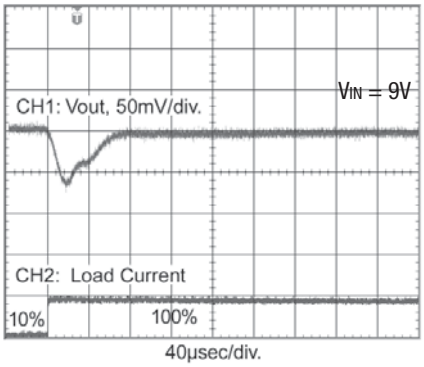


7812SR-C Vin = 24V, I_{LOAD} = 400mA

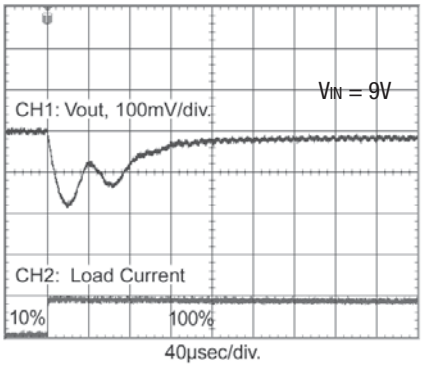


Transient Response - 90% Load Step

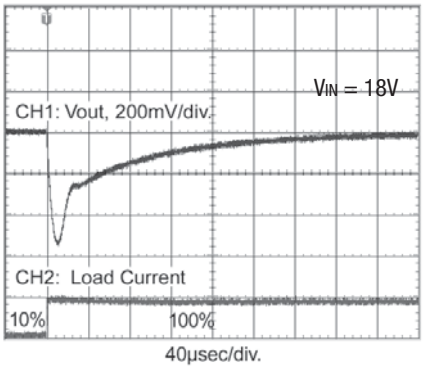
7803SR-C 10% to 100% Load Step



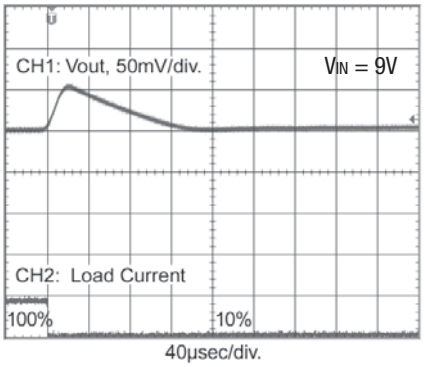
7805SR-C 10% to 100% Load Step



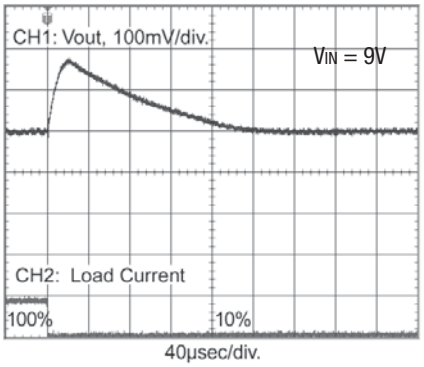
7812SR-C 10% to 100% Load Step



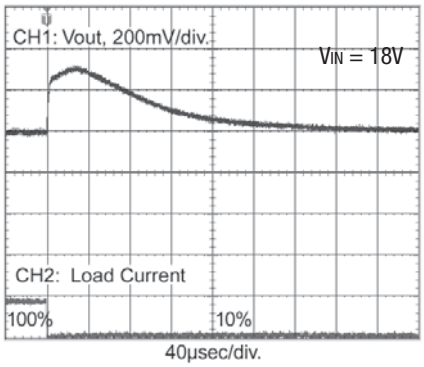
7803SR-C 100% to 10% Load Step



7805SR-C 100% to 10% Load Step

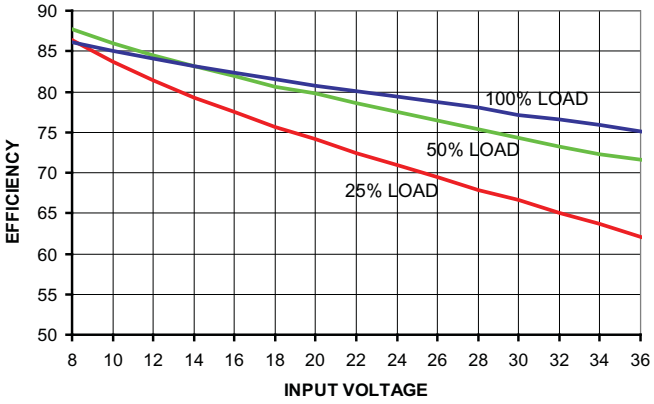


7812SR-C 100% to 10% Load Step

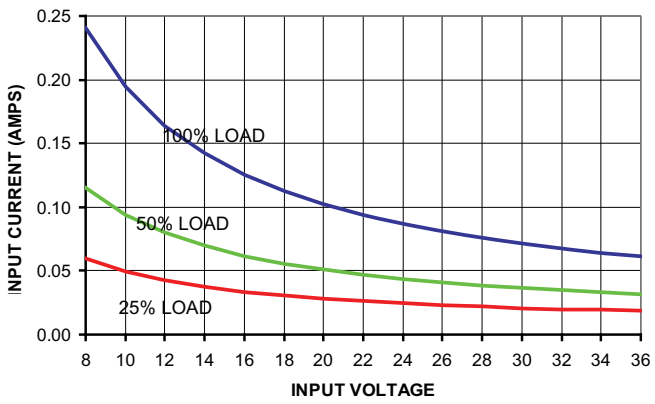


Efficience Curves

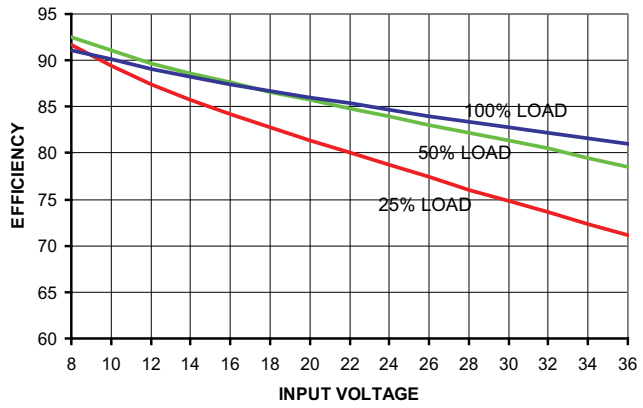
7803SR-C Efficiency



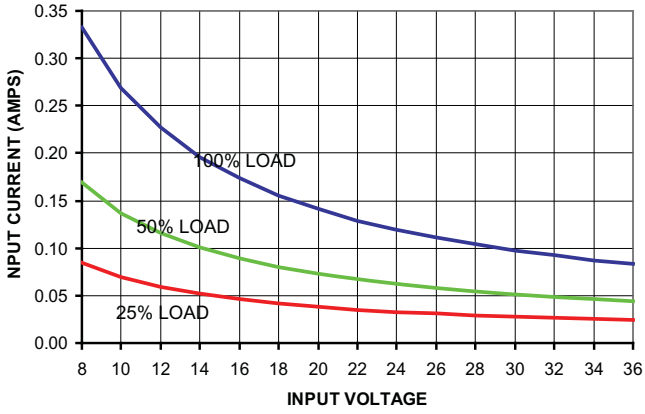
7803SR-C Input Current



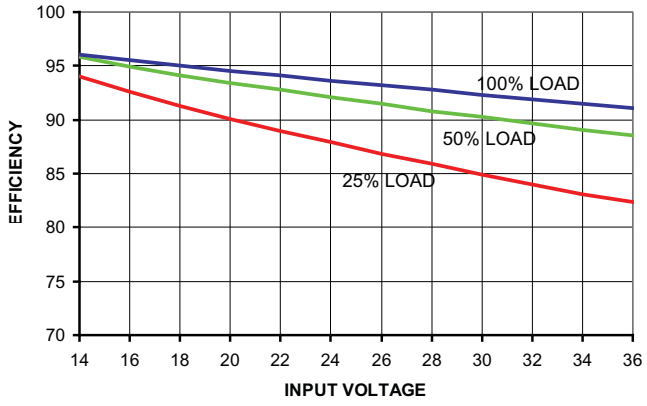
7805SR-C Efficiency



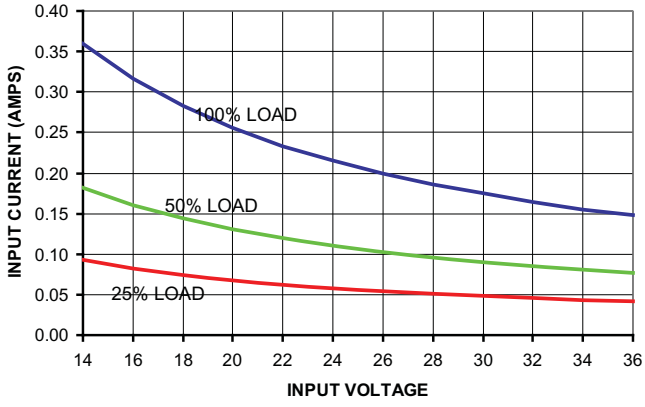
7805SR-C Input Current



7812SR-C Efficiency



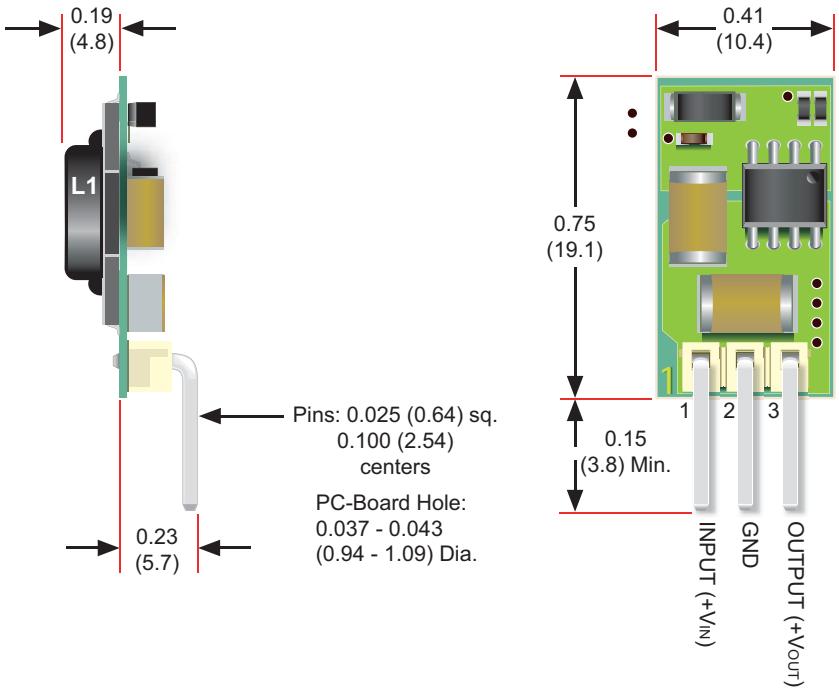
7812SR-C Input Current



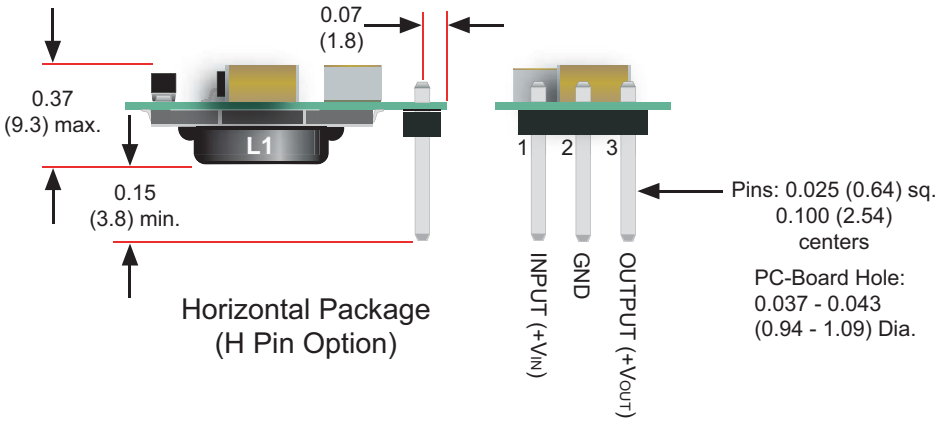
MECHANICAL DIMENSIONS: Inches (mm)

TOLERANCES: 2 PL DEC ±0.02 (±0.51)
3 PL DEC ±0.010 (±0.254)

Standard Package



low-profile package



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