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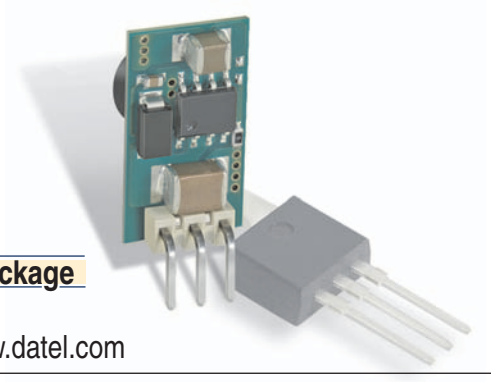
78SR Series

3.3V/5V/12V Outputs High-Efficiency Switching Regulators with LM78XX Pinouts



NEW
low-profile package

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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**

DATEL's 7805SR (5V output), 7812SR (12V output) and 7803SR (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 (±1.5% 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 and 7803SR, and to 0.3A for 7812SR. Under no circumstances should the input voltage be allowed to exceed 45Vdc.

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): 78XXSRH 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

Technical Notes (continued)

of the pc-board. However, because the surface of inductor L1 on 78XXSRH 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 and 7805SR, and 15.0V for 7812SR). 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	6.0V	6.2V	6.2V	6.3V
7805SR	6.3V	6.2V	6.2V	6.8V
7812SR	12.8V	13.0V	12.8V	13.0V

Performance/Functional Specifications

Typical at T_A = +25°C

Input/Output			
Models	**7803SR**	**7805SR**	**7812SR**
Output Voltage	+3.3Vdc	+5.0Vdc	+12.0Vdc
Rated Output Current	0.5A	0.5A	0.4A
Output Voltage Accuracy	±2%	±1.5%	±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**	**7805SR**	**7812SR**
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.

Ordering Information

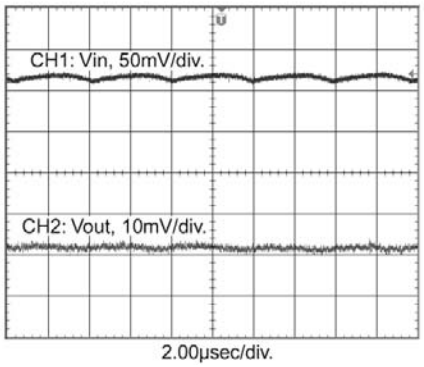
DATEL Part No.	Output Voltage	Output Current	Input Voltage
Standard Pin Package			
7803SR	**+3.3Vdc**	**0.5A**	**+7.5-36Vdc**
7805SR	**+5.0Vdc**	**0.5A**	**+7.5-36Vdc**
7812SR	**+12.0Vdc**	**0.4A**	**+15-36Vdc**
Horizontal Pin Package			
7803SRH	**+3.3Vdc**	**0.5A**	**+7.5-36Vdc**
7805SRH	**+5.0Vdc**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

Typical Performance Curves

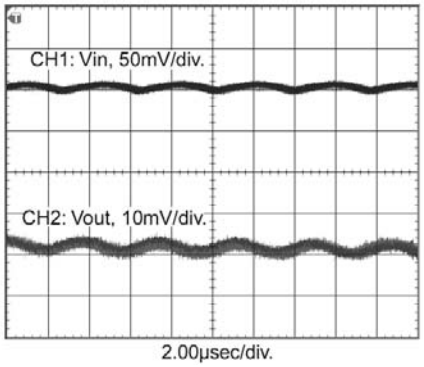
T_A = +25°C, V_{IN} as indicated

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

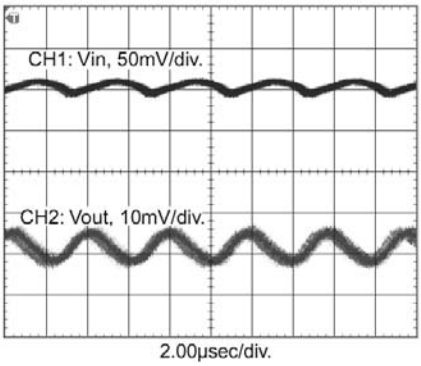
7803SR Vin = 12V, I_{LOAD} = 50mA



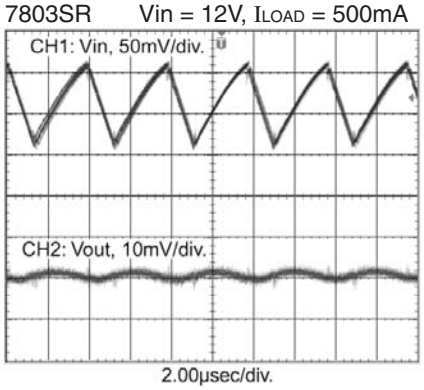
7805SR Vin = 12V, I_{LOAD} = 50mA



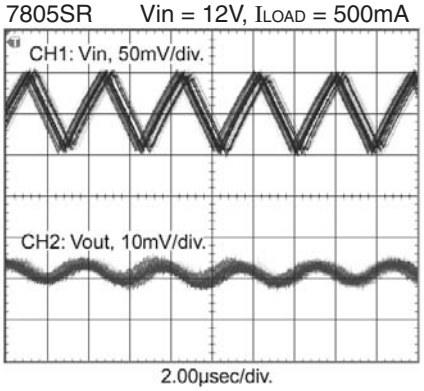
7812SR Vin = 24V, I_{LOAD} = 40mA



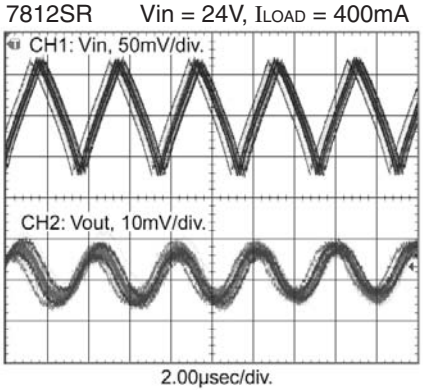
7803SR Vin = 12V, I_{LOAD} = 500mA



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

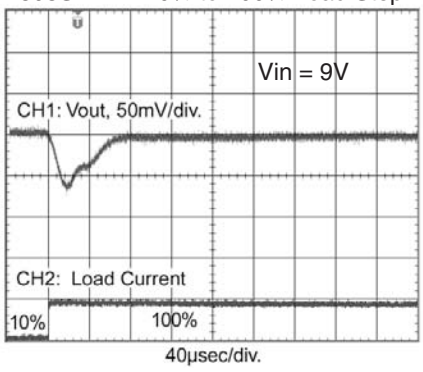


7812SR Vin = 24V, I_{LOAD} = 400mA

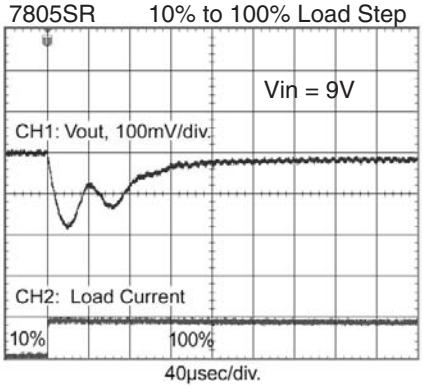


Transient Response - 90% Load Step

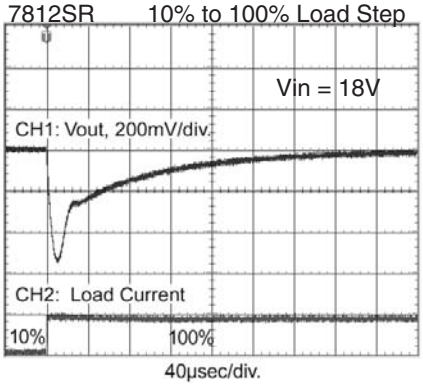
7803SR 10% to 100% Load Step



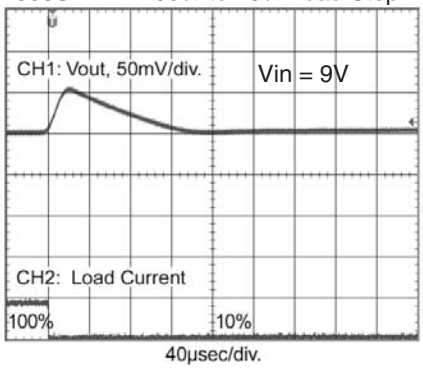
7805SR 10% to 100% Load Step



7812SR 10% to 100% Load Step



7803SR 100% to 10% Load Step



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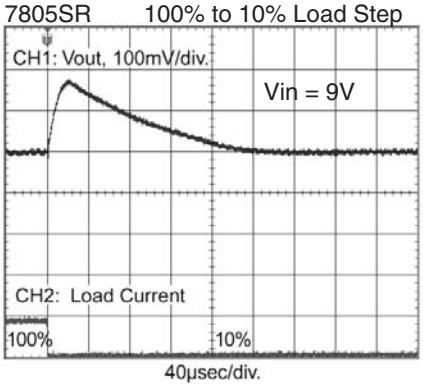
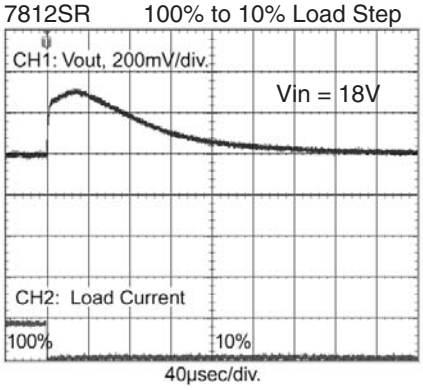
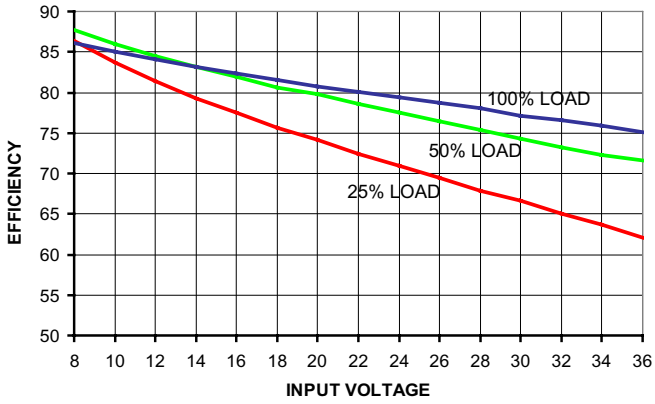


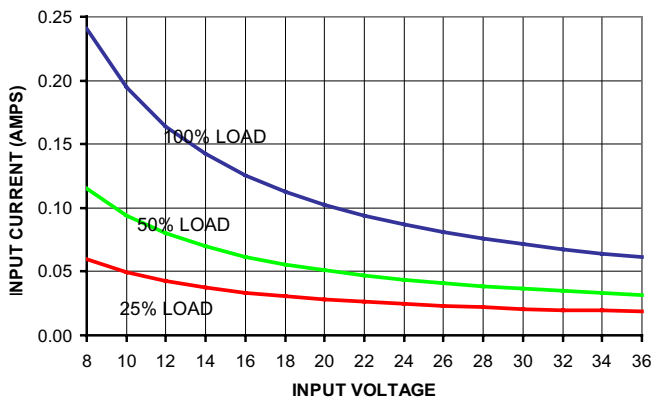
7812SR 100% to 10% Load Step



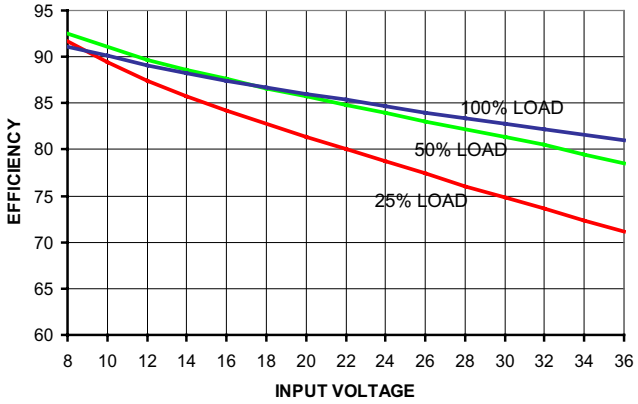
7803SR Efficiency



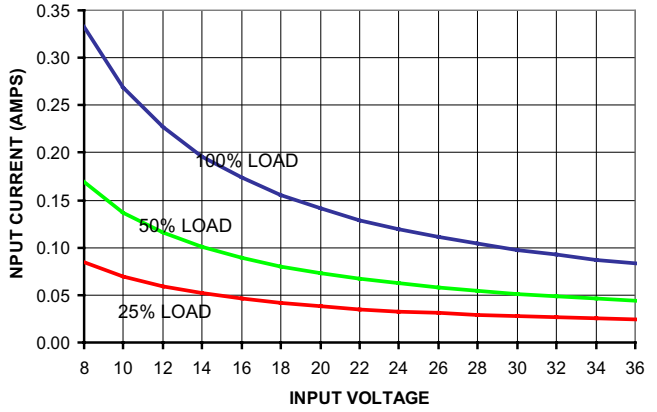
7803SR Input Current



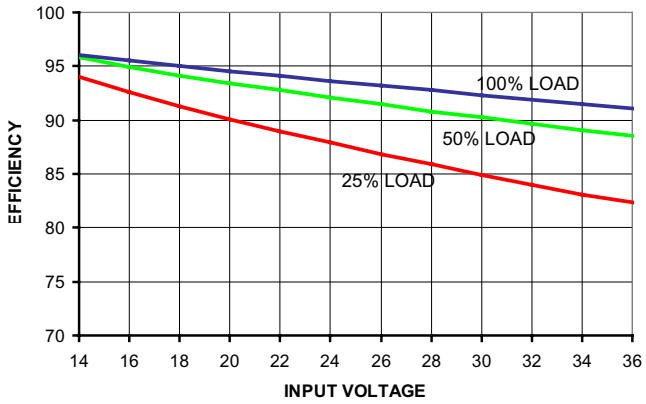
7805SR Efficiency



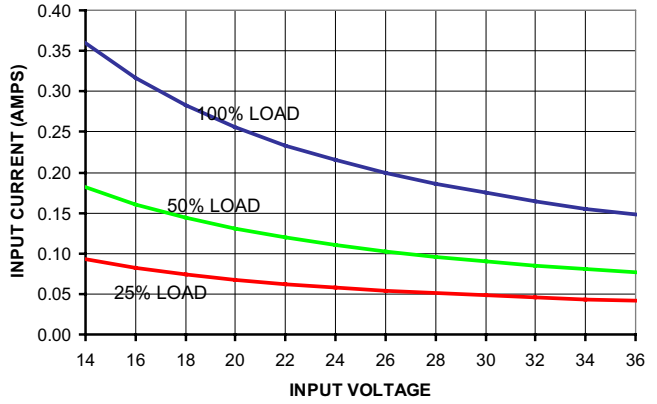
7805SR Input Current



7812SR Efficiency



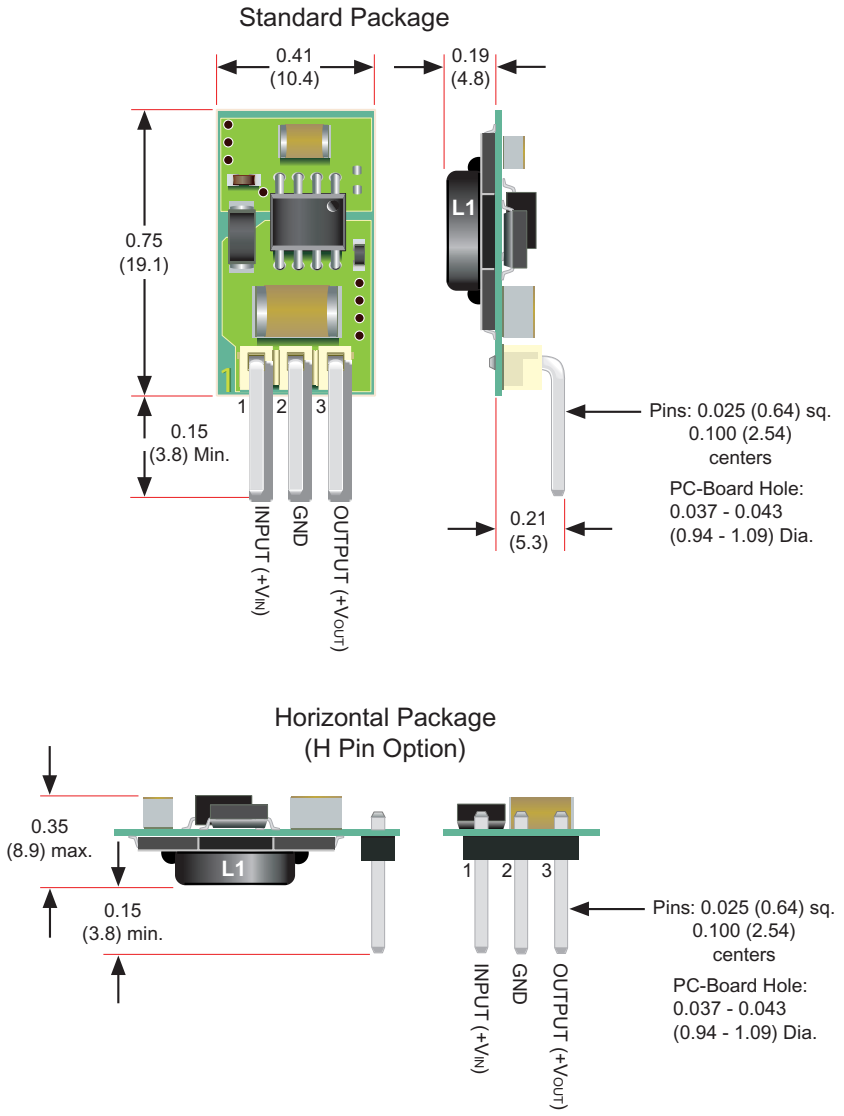
7812SR Input Current



Mechanical Specifications

MECHANICAL DIMENSIONS: Inches (mm)

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



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