

### 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 ( $\pm 0.2\%$ ) and line ( $\pm 0.3\%$ ) regulation
- Ideal for powering instrumentation from 9V/12V/24V/28V supplies or batteries
- Can be used with unregulated dc supplies protection

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 ( $\pm 2\%$  vs.  $\pm 5\%$ ). 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 47 $\mu$ F/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.

### Ordering Information

| MPS Part No.                  | Output Voltage | Output Current | Input Voltage |
|-------------------------------|----------------|----------------|---------------|
| <b>Standard Pin Package</b>   |                |                |               |
| 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     |
| <b>Horizontal Pin Package</b> |                |                |               |
| 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     |



### 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<sub>A</sub> = +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                      |

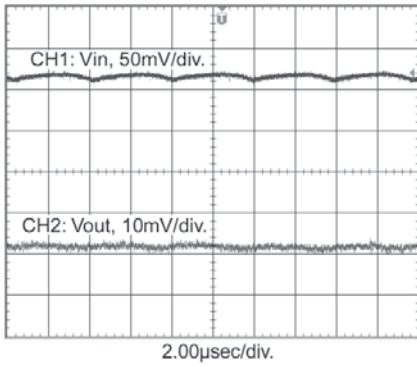
① See Technical Note 5.

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.

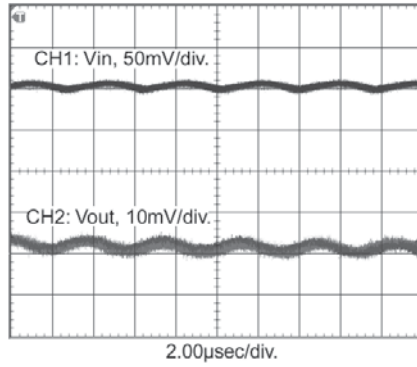
Typical Performance Curves  $T_A = +25^\circ\text{C}$ ,  $V_{IN}$  as indicated

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

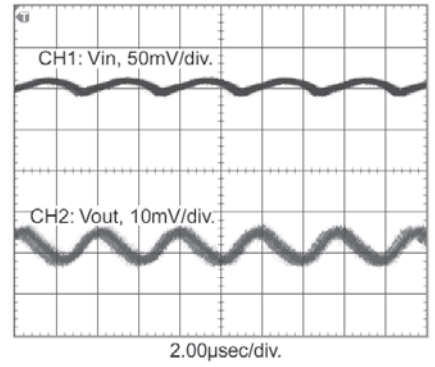
7803SR-C  $V_{in} = 12\text{V}$ ,  $I_{LOAD} = 50\text{mA}$



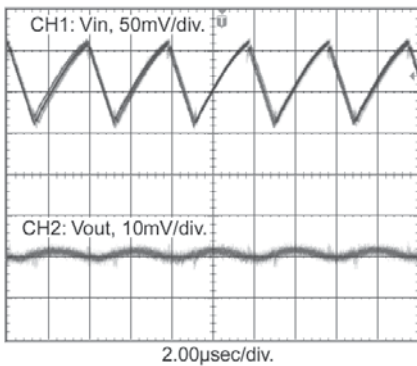
7805SR-C  $V_{in} = 12\text{V}$ ,  $I_{LOAD} = 50\text{mA}$



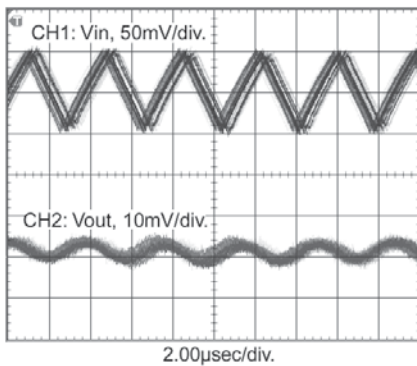
7812SR-C  $V_{in} = 24\text{V}$ ,  $I_{LOAD} = 40\text{mA}$



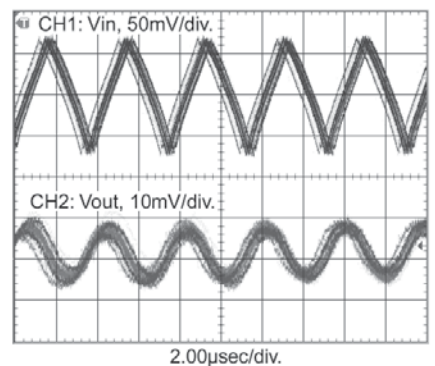
7803SR-C  $V_{in} = 12\text{V}$ ,  $I_{LOAD} = 500\text{mA}$



7805SR-C  $V_{in} = 12\text{V}$ ,  $I_{LOAD} = 500\text{mA}$

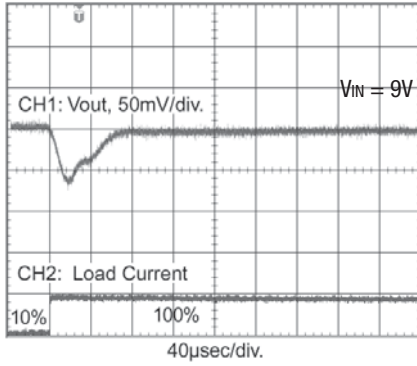


7812SR-C  $V_{in} = 24\text{V}$ ,  $I_{LOAD} = 400\text{mA}$

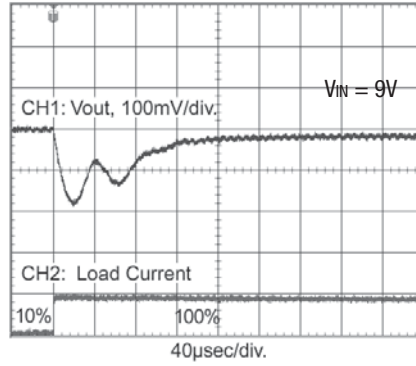


## Transient Response - 90% Load Step

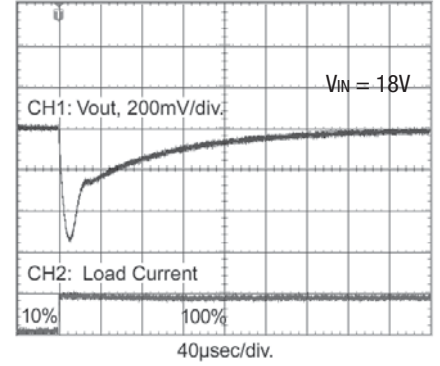
7803SR-C 10% to 100% Load Step



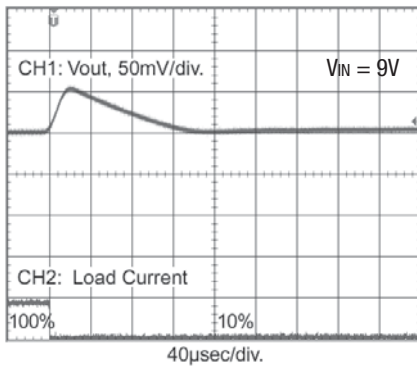
7805SR-C 10% to 100% Load Step



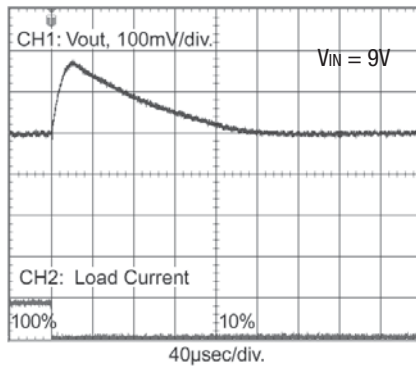
7812SR-C 10% to 100% Load Step



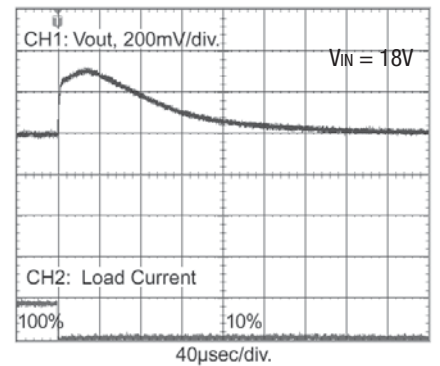
7803SR-C 100% to 10% Load Step



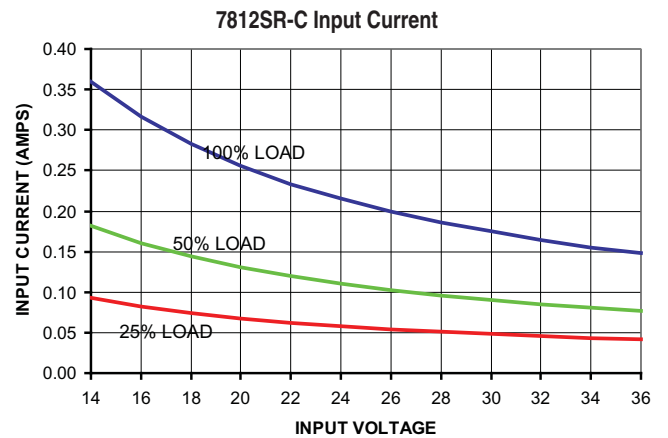
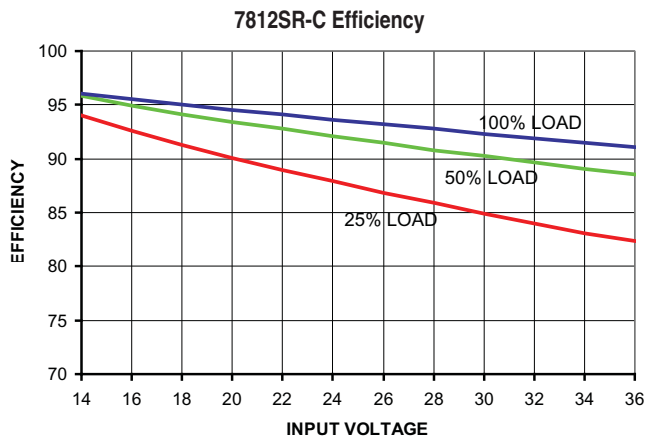
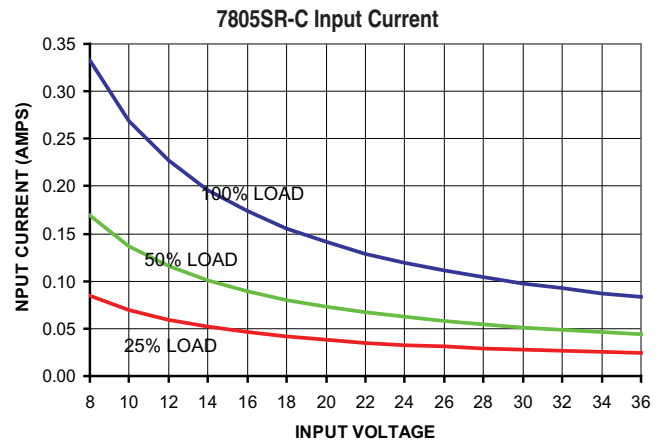
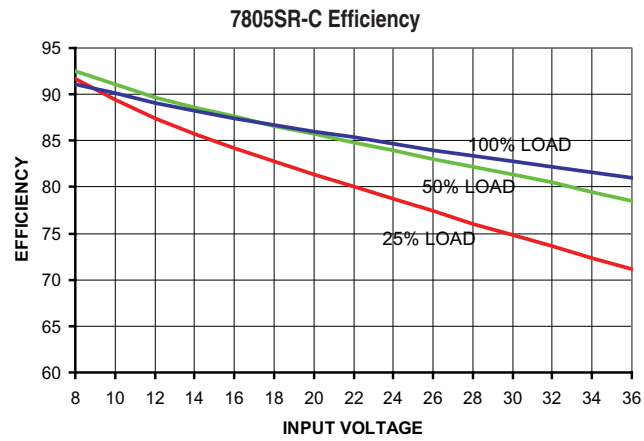
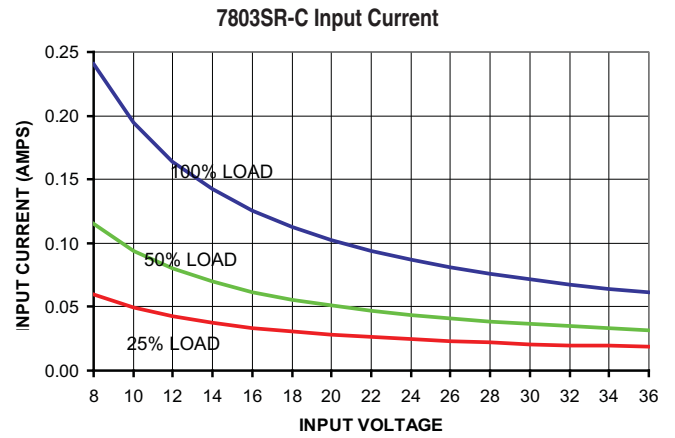
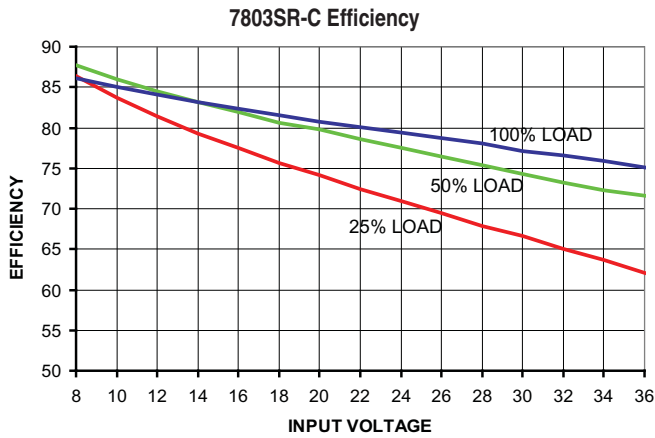
7805SR-C 100% to 10% Load Step



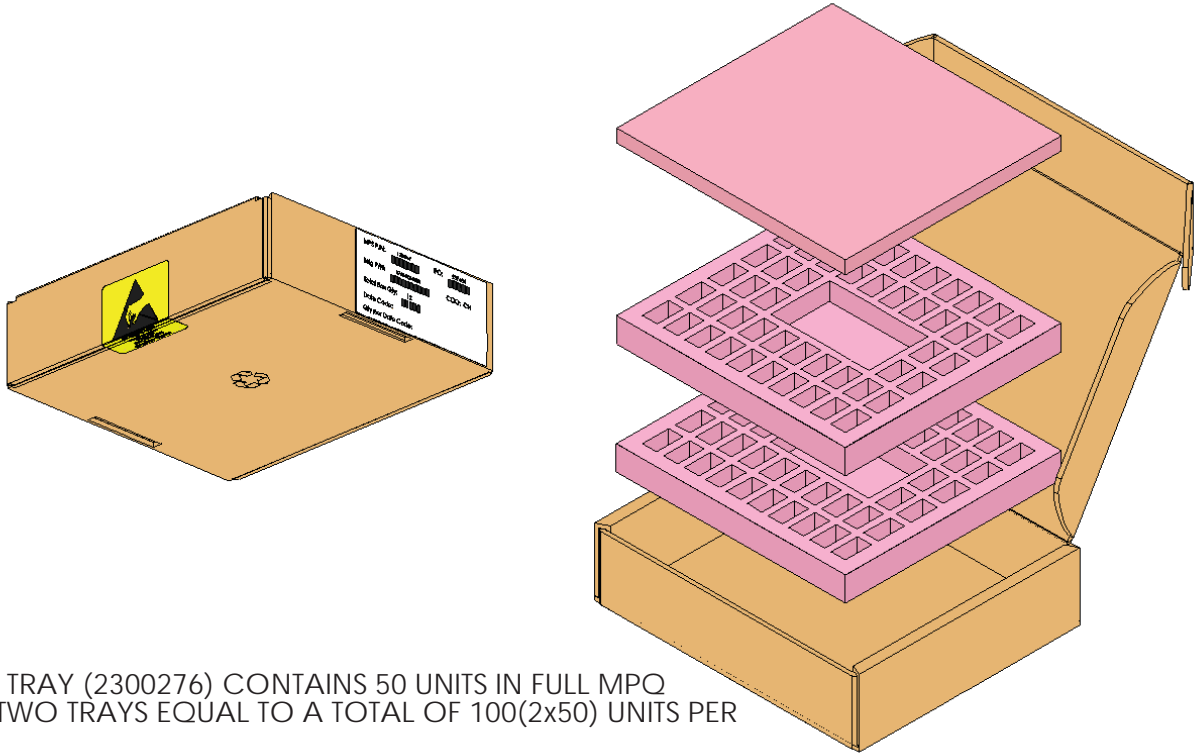
7812SR-C 100% to 10% Load Step



## Efficiency Curves



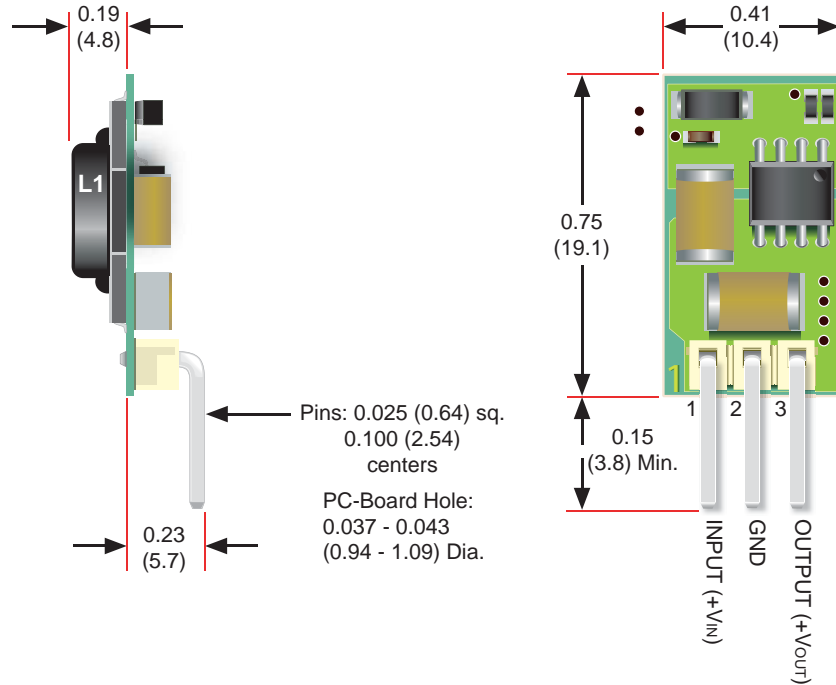
## SHIPPING TRAYS AND BOXES



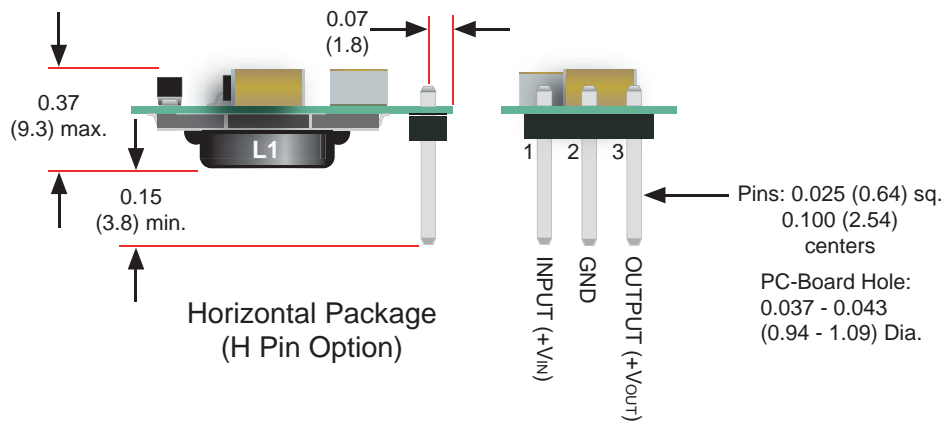
EACH FOAM TRAY (2300276) CONTAINS 50 UNITS IN FULL MQQ QUANTITIES, TWO TRAYS EQUAL TO A TOTAL OF 100(2x50) UNITS PER CARTON.

MECHANICAL DIMENSIONS: Inches (mm)  
TOLERANCES: 2 PL DEC  $\pm 0.02$  ( $\pm 0.51$ )  
3 PL DEC  $\pm 0.010$  ( $\pm 0.254$ )

**Standard Package**



**low-profile package**



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ISO 9001 and 14001 REGISTERED



**This product is subject to the following operating requirements and the Life and Safety Critical Application Sales Policy:**  
Refer to: <http://www.murata-ps.com/requirements/>

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