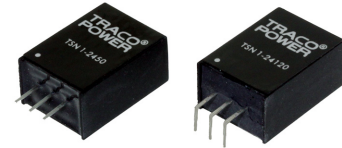


#### Features

- ◆ Non-isolated converter for negative output
- ◆ Small size and low profile
- ◆ Pin compatible with LM79xx linear regulators
- ◆ No heatsink required
- ◆ High efficiency up to 96%
- ◆ Operation temp. range -40°C to +85°C
- ◆ Protection against overload, short circuit and over-temperature
- ◆ Fixed switching frequency
- ◆ Wide input range up to -32 VDC
- ◆ Excellent line / load regulation
- ◆ Low standby current
- ◆ 3-year product warranty



The new TSN-1 series step-down switching regulators are drop-in replacement for inefficient 79xx linear regulators. A high efficiency up to 96 % allows full load operation up to +70°C (+85°C with derating) ambient temperature without the need of any heat-sink or forced air cooling.

The TSN-1 switching regulators provide other significant features over linear regulators, i.e. better output accuracy ( $\pm 2\%$ ), lower standby current of ~2 mA and no requirement of external capacitors. They are suitable for negative output circuits. The high efficiency and low standby power consumption make these regulators an ideal solution for energy sensitive applications.

#### Models

| Order code    |              | Input voltage             | Output voltage | Output current | Efficiency typ. |            |
|---------------|--------------|---------------------------|----------------|----------------|-----------------|------------|
| straight pins | angular pins | range / (nominal)         |                | max.           | @ Vin min.      | @ Vin max. |
| TSN 1-2450    | TSN 1-2450A  | -7.0 – -32 VDC (1.2 VDC)  | -5.0 VDC       | -1.0 A         | 91.5 %          | 84.5 %     |
| TSN 1-2452    | TSN 1-2452A  | -7.0 – -32 VDC (1.2 VDC)  | -5.2 VDC       |                | 92.0 %          | 85.0 %     |
| TSN 1-2460    | TSN 1-2460A  | -8.0 – -32 VDC (1.2 VDC)  | -6.0 VDC       |                | 92.5 %          | 86.5 %     |
| TSN 1-2480    | TSN 1-2480A  | -10.5 – -32 VDC (1.2 VDC) | -8.0 VDC       |                | 94.0 %          | 89.0 %     |
| TSN 1-2490    | TSN 1-2490A  | -11.5 – -32 VDC (2.4 VDC) | -9.0 VDC       |                | 94.5 %          | 90.5 %     |
| TSN 1-24120   | TSN 1-24120A | -15 – -32 VDC (2.4 VDC)   | -12.0 VDC      |                | 96.0 %          | 92.0 %     |
| TSN 1-24150   | TSN 1-24150A | -18 – -32 VDC (2.4 VDC)   | -15.0 VDC      |                | 96.0 %          | 93.5 %     |

## Input Specifications

|                          |                     |
|--------------------------|---------------------|
| No load input current    | -3 mA typ.          |
| Reflected ripple current | 100 mAp-p typ.      |
| Input filter             | internal capacitors |

## Output Specifications

|                                                    |                                                                                                                              |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Voltage set accuracy                               | ±2 % (at full load)                                                                                                          |
| Regulation                                         | - Input variation      1.0 % max.<br>- Load variation (10 – 100 %)      0.6 % max.                                           |
| Startup voltage overshoot                          | 1.0 % max.                                                                                                                   |
| Minimum load                                       | not required                                                                                                                 |
| Ripple and noise (20 MHz Bandwidth)                | 5.0 – 5.2 VDC models: 50 mVpk-pk max.<br>6 – 15 VDC models: 75 mVpk-pk max.                                                  |
| Temperature coefficient                            | ±0.015 % / °C max.                                                                                                           |
| Dynamic load response (change of 50% to 100% load) | 5% of Vout mV peak variation<br>250 µs max. response time                                                                    |
| Startup time                                       | - start up time at nominal Vin, constant resistive load      15 mS typ.<br>- rise time for 10 % to 90 % Vout      10 mS typ. |
| Short circuit protection                           | continuous, automatic recovery                                                                                               |
| Capacitive load                                    | 5.0 – 5.2 VDC models: 1600 µF max.<br>6.0 – 9.0 VDC models: 1000 µF max.<br>12 – 15 VDC models: 470 µF max.                  |

## General Specifications

|                                                                      |                                                                                                                                      |
|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Temperature ranges                                                   | - Operating      -40°C to +85°C<br>- Storage      -55°C to +125°C                                                                    |
| Derating                                                             | 3.3 %/K above +70°C                                                                                                                  |
| Thermal shock, mechanical shock & vibration                          | MIL-STD-810F<br>- Test conditions <a href="http://www.tracopower.com/products/mil810.pdf">www.tracopower.com/products/mil810.pdf</a> |
| Overtemperature protection                                           | at +165°C (on internal IC)                                                                                                           |
| Humidity (non condensing)                                            | 5 – 95 % rel H max.                                                                                                                  |
| Reliability, calculated MTBF (MIL-HDBK217F, at +25°C, ground benign) | >8'475'000 h                                                                                                                         |
| Isolation voltage                                                    | none                                                                                                                                 |
| Switching frequency                                                  | 5.0 – 5.2 VDC models: 380 kHz typ.<br>6.0 – 15 VDC models: 500 kHz typ.                                                              |

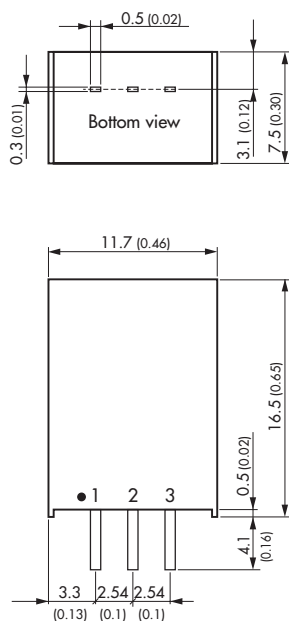
## Physical Specifications

|                          |                                                                                                                                         |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Casing material          | non-conductive plastic                                                                                                                  |
| Potting material         | silicon (flammability to UL 94V-0 rated)                                                                                                |
| Weight                   | 3.1 g (0.11 oz)                                                                                                                         |
| Soldering profile        | max. +265°C / 10 sec. (wave soldering)                                                                                                  |
| Environmental compliance | - Reach <a href="http://www.tracopower.com/overview/tsn1">www.tracopower.com/overview/tsn1</a><br>- RoHS      RoHS directive 2011/65/EU |

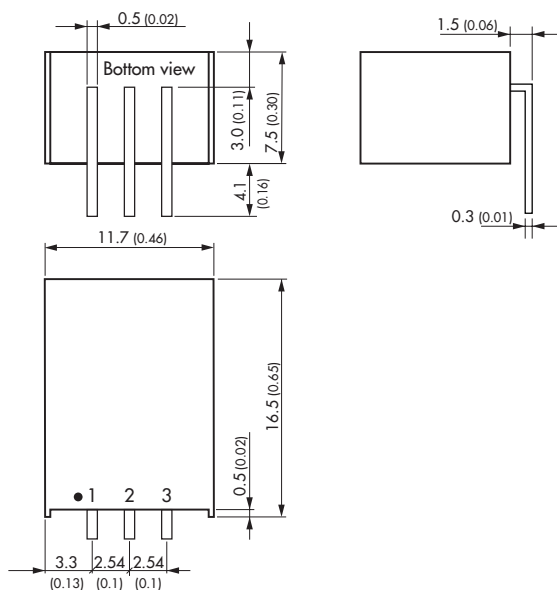
All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.

## Outline Dimensions

Straight pin version



Angular pin version (suffix A)



| Pin-Out |        |
|---------|--------|
| Pin     | Single |
| 1       | GND    |
| 2       | -Vin   |
| 3       | -Vout  |

Dimensions in [mm], ( ) = Inch  
 Pin pitch tolerances:  $\pm 0.25$  ( $\pm 0.01$ )  
 Pin profile tolerance:  $\pm 0.1$  ( $\pm 0.004$ )  
 Other tolerances:  $\pm 0.5$  ( $\pm 0.02$ )