

#### Features

- ◆ Compact SMD package
- ◆ Very high efficiency up to 97%
- ◆ Excellent line / load regulation
- ◆ Low standby current
- ◆ Operating temperature range -40 to 90°C
- ◆ Over-temperature protection
- ◆ Remote On/Off input
- ◆ Adjustable output voltage
- ◆ Short circuit protection
- ◆ Moisture sensitivity level 2 as per IPC J-STD-020D.1
- ◆ 3-year product warranty



TSR-0.5SM is a series of step-down non-isolated switching regulators in compact SIP package. These converters are an ideal alternative to LM78 linear regulators when energy efficiency is a parameter of the design. The high efficiency up to 97 % allows full load operation up to +80°C (+90°C with 50% load) ambient temperature without the need of forced aircooling.

Excellent output voltage accuracy and low standby current are other features that distinguish switching regulators from linear regulators.

#### Models

| Order code      | Input voltage range <sup>1)</sup> | Output voltage |                          | Output current<br>max. | Efficiency typ. |             |
|-----------------|-----------------------------------|----------------|--------------------------|------------------------|-----------------|-------------|
|                 |                                   | nominal        | trim range <sup>2)</sup> |                        | @ Vin min.      | @ Vin 32VDC |
| TSR 0.5-2415SM  | 4.75 – 32 VDC                     | 1.5 VDC        | 1.4 – 2.5 VDC            | 0.5 A                  | 73 %            | 63 %        |
| TSR 0.5-2418SM  |                                   | 1.8 VDC        | 1.5 – 3.0 VDC            |                        | 82 %            | 71 %        |
| TSR 0.5-2425SM  |                                   | 2.5 VDC        | 1.5 – 3.0 VDC            |                        | 87 %            | 77 %        |
| TSR 0.5-2433SM  |                                   | 3.3 VDC        | 3.0 – 5.5 VDC            |                        | 91 %            | 81 %        |
| TSR 0.5-2450SM  | 6.5 – 32 VDC                      | 5.0 VDC        | 3.0 – 8.0 VDC            |                        | 94 %            | 86 %        |
| TSR 0.5-2465SM  | 8 – 32 VDC                        | 6.5 VDC        | 3.3 – 11.0 VDC           |                        | 95 %            | 88 %        |
| TSR 0.5-2490SM  | 11 – 32 VDC                       | 9.0 VDC        | 4.5 – 12.6 VDC           |                        | 96 %            | 92 %        |
| TSR 0.5-24120SM | 15 – 32 VDC                       | 12 VDC         | 4.5 – 13.5 VDC           |                        | 97 %            | 94 %        |
| TSR 0.5-24150SM | 18 – 32 VDC                       | 15 VDC         | 4.5 – 15.5 VDC           |                        | 97 %            | 95 %        |

1) For input voltage higher 24 VDC an input capacitor 22 µF/ 50 V is required

2) Input voltage must be higher than output voltage set: >1.5 V for 3.3–5.0V and >3 V for 6.5–15.0V

### Input Specifications

|                                  |  |
|----------------------------------|--|
| No load input current (at 24Vin) | 5 mA typ.  |
| Short circuit input power        | 1.5 W max.   |
| Surge voltage                    | -0.3 / 34 VDC max.   |
| Input filter                     | internal capacitor, see filter suggestion page 3 for to meet EN55022 class A, class B                                  |
| ESD (electrostatic discharge)    | EN 61000-4-2, air $\pm 8$ kV, perf. criteria A   |
| Radiated immunity                | EN 61000-4-3 3 V/m, perf. criteria A   |
| Fast transient                   | EN 61000-4-4, $\pm 0.5$ kV, perf. criteria A with external input capacitor e.g. Nippon chemi-con KY 330 $\mu$ F, 100 V |
| Conducted immunity               | EN 61000-4-6, 3 Vrms, perf. criteria A   |
| Magnetic field immunity          | EN 61000-4-8, 3 A/m, perf. criteria A  |

### Output Specifications

|                                     |  |
|-------------------------------------|--|
| Voltage set accuracy                | $\pm 3$ % (at full load)   |
| Regulation                          | <ul style="list-style-type: none"> <li>- Input variation 1.5 to 6.5 Vin models: 0.4 %</li> <li style="padding-left: 150px;">other models: 0.2 %</li> <li>- Load variation (10 – 100 %) 1.5 to 6.5 Vin models: 0.6 %</li> <li style="padding-left: 150px;">other models: 0.4 %</li> </ul> |
| Minimum load                        | not required   |
| Ripple and noise                    | <ul style="list-style-type: none"> <li>1.5 to 6.5 Vin models: 30 mVp-p max.</li> <li>other models: 40 mVp-p max.</li> </ul>  |
| Temperature coefficient             | $\pm 0.015$ %/K max.   |
| Dynamic load (50% load step change) | <ul style="list-style-type: none"> <li>- Peak variation <math>\pm 2</math> % max.</li> <li>- Response time 100 <math>\mu</math>S max.</li> </ul>   |
| Short circuit protection            | continuous, automatic recovery   |
| Capacitive load                     | 220 $\mu$ F max.   |

### General Specifications

|   |  |
|---|--|
| Temperature ranges  | <ul style="list-style-type: none"> <li>- Operating -40°C to +90°C</li> <li>- Case temperature +100°C. max.</li> <li>- Storage -55°C to +125°C</li> </ul>   |
| Derating  | - positive output circuit 5 %/K above +80°C  |
| Overtemperature protection  | at +160°C (on internal IC)   |
| Humidity (non condensing)   | 95 % rel H max.  |
| Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign) | >2'000'000 h   |
| Isolation voltage   | none   |
| Switching frequency   | 330 kHz $\pm 50$ kHz (pulse width modulation)  |
| Remote On/Off   | <ul style="list-style-type: none"> <li>- On: 2.4 – 5.0 VDC (ref. to GND) or open circuit.</li> <li>- Off: 0 – 1.6 VDC (ref. to GND) or connect. to GND</li> <li>- Off idle current (at 24 Vin): 35 <math>\mu</math>A max.</li> </ul> |
| Environmental compliance  | <ul style="list-style-type: none"> <li>- Reach <a href="http://www.tracopower.com/products/reach-declaration.pdf">www.tracopower.com/products/reach-declaration.pdf</a></li> <li>- RoHS RoHS directive 2011/65/EU</li> </ul>         |

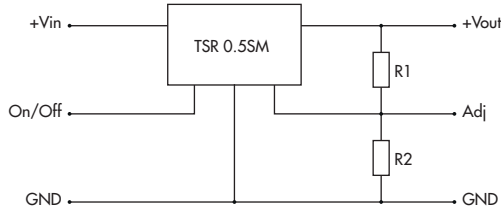
### Physical Specifications

|                                  |   |
|----------------------------------|---|
| Casing material                  | non-conductive plastic (UL94V-0 rated)  |
| Pin material                     | phosphor bronze   |
| Weight                           | 1.7 g (0.6 oz)  |
| Lead-free reflow solder process  | as per J-STD-020D.01  |
| Moisture sensitivity level (MSL) | level 2 as per IPC J-STD-020D.1 (to find at: <a href="http://www.jedec.org">www.jedec.org</a> - free registration required) |
| Washing                          | baking after washing: 100°C for 30 min.   |
| Packaging                        | <a href="http://www.tracopower.com/products/tsr0.5sm-pack.pdf">www.tracopower.com/products/tsr0.5sm-pack.pdf</a>            |

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

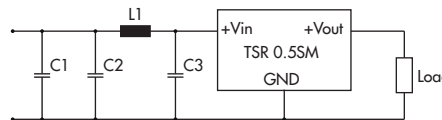
**Applications notes**

Output voltage adjustment



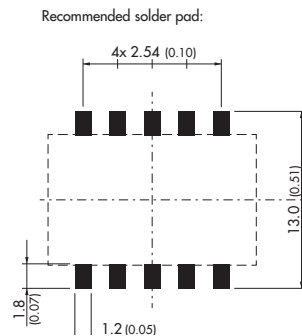
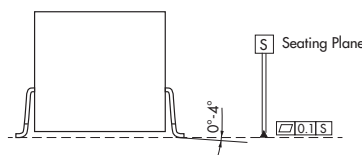
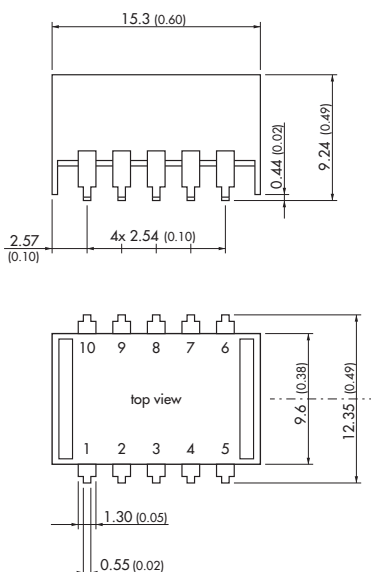
|                 | R1<br>[KOhm] | open    |         |          | R2<br>[KOhm] |
|-----------------|--------------|---------|---------|----------|--------------|
|                 |              | Min.    | Nominal | Max.     |              |
| TSR 0.5-2415SM  | 1.0          | 1.4 VDC | 1.5 VDC | 2.5 VDC  | 0.47         |
| TSR 0.5-2418SM  | 3            | 1.5 VDC | 1.8 VDC | 3.0 VDC  | 4.64         |
| TSR 0.5-2425SM  | 0.2          | 1.5 VDC | 2.5 VDC | 3.0 VDC  | 44.2         |
| TSR 0.5-2433SM  | 88.4         | 3.0 VDC | 3.3 VDC | 5.5 VDC  | 3.9          |
| TSR 0.5-2450SM  | 17           | 3.0 VDC | 5.0 VDC | 8.0 VDC  | 2.32         |
| TSR 0.5-2465SM  | 15           | 3.3 VDC | 6.5 VDC | 11 VDC   | 0.825        |
| TSR 0.5-2490SM  | 26           | 4.5 VDC | 9.0 VDC | 12.6 VDC | 0            |
| TSR 0.5-24120SM | 17           | 4.5 VDC | 12 VDC  | 13.5 VDC | 57.6         |
| TSR 0.5-24150SM | 10.5         | 4.5 VDC | 15 VDC  | 15.5 VDC | 300          |

EMI filter for EN 55022 class A & B



| Class | C1                      | C2 & C3                 | L1<br>value | order code<br>(SMD type) | datasheet:   |
|-------|-------------------------|-------------------------|-------------|--------------------------|--|
| A     | -                       | 4.7 µF / 50 V 1206 MLCC | 3.3 µH      | <b>TCK-044</b>           | <a href="http://www.tracopower.com/products/tck044.pdf">www.tracopower.com/products/tck044.pdf</a> |
| B     | 4.7 µF / 50 V 1206 MLCC |                         | 10 µH       | <b>TCK-047</b>           | <a href="http://www.tracopower.com/products/tck047.pdf">www.tracopower.com/products/tck047.pdf</a> |

**Outline Dimensions**



| Pinout |        |
|--------|--------|
| 1      | +Vin   |
| 2      | +Vin   |
| 3      | GND    |
| 4      | +Vout  |
| 5      | +Vout  |
| 6      | adj.   |
| 7      | GND    |
| 8      | GND    |
| 9      | GND    |
| 10     | On/Off |

Dimensions in [mm], ( ) = Inch  
Tolerances: ±0.5 (±0.02)  
Pin pitch tolerances: ±0.25 (±0.01)

Specifications can be changed without notice! Make sure you are using the latest documentation, downloadable at [www.tracopower.com](http://www.tracopower.com)

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