DC/DC Converters

TSRN-1SM Series, 1 A Switching Regulator

Features

- Compact SMD package
- Suitable for positive & negative output circuit
- Adjustable output voltage
- Wide input up to 42 VDC
- Remote On/Off input
- Built in filter capacitors
- Operation temp. range –40°C to +85°C
- No heat-sink required
- Over-temperature protection
- Short circuit protection
- Excellent line / load regulation
- Low standby current
- Not moisture sensitivity level (MSL) 1
- Qualified for leadfree reflow solder process
- 3-year product warranty

The new TSRN-1SM series are step-down non–isolated switching regulators in compact SMD package. They are an ideal solution to replace inefficient linear regulators. The high efficiency up to 95 % allows full load operation up to +55°C (+85°C with derating) ambient temperature without the need of forced aircooling.
The TSRN-1SN switching regulators provide other significant features over linear regulators, i.e. better output accuracy (±2 %), lower standby current of ~4 mA and no requirement of external capacitors. They are suitable for positive or negative output circuits and offer a trim input for output voltage adjustment. The high efficiency, low standby power consumption and remote On/Off function make these regulators an ideal solution for energy sensitive applications.

Models

Order code [1]	Input voltage range [2] / (nominal)	Output voltage nominal	Output voltage trim range [3]	Output current max.	Efficiency typ. @ Vin min.	Efficiency typ. @ Vin max.
	Positive output circuit					
TSRN 1-0525SM	3.0 – 5.5 VDC (5 VDC)	2.5 VDC	1.2 – 3.6 VDC	1.0 A	95.5 %	95 %
TSRN 1-2433SM	4.6 – 42 VDC (12 VDC)	3.3 VDC	1.5 – 5.5 VDC		87 %	80 %
TSRN 1-2450SM	6.5 – 42 VDC (12 VDC)	5.0 VDC	2.5 – 8.0 VDC		91.5 %	83 %
TSRN 1-2490SM	10.5 – 42 VDC (12 VDC)	9.0 VDC	4.5 – 12.6 VDC		94.5 %	89 %
TSRN 1-24120SM	13.5 – 42 VDC (24 VDC)	12 VDC	4.5 – 13.5 VDC		95 %	91 %
TSRN 1-24150SM	16.5 – 42 VDC (24 VDC)	15 VDC	4.5 – 15.5 VDC		95.5 %	92.5 %
	Negative output circuit					
TSRN 1-2433SM	4.6 – 32 VDC (12 VDC)	-3.3 VDC	-1.5 – -5.5 VDC	0.6 A	74 %	77 %
TSRN 1-2450SM	4.6 – 31 VDC (12 VDC)	-5.0 VDC	-2.5 – -8.0 VDC	0.4 A	80 %	78 %
TSRN 1-2490SM	7 – 27 VDC (12 VDC)	-9.0 VDC	-4.5 – -12.6 VDC	0.3 A	85 %	82 %
TSRN 1-24120SM	7 – 24 VDC (12 VDC)	-12 VDC	-4.5 – -13.5 VDC	0.3 A	84 %	86 %
TSRN 1-24150SM	7 – 21 VDC (12 VDC)	-15 VDC	-4.5 – -15.5 VDC	0.2 A	85 %	84 %

1) Same order code for positive and negative output operation, see page 3 for circuits.
2) For input voltage higher 36 VDC an input capacitor 22 µF/ 50 V is required.
3) For positive output circuit, input voltage must be higher than output voltage set: >0.5 V for TSRN1-0525SM and >1.5 V for other models. For negative output circuit, input voltage plus absolute output voltage set must not exceed 36 VDC (Vin + |Vout| < 36 VDC)

Input Specifications

No load input current	– positive output circuit	TSRN 1-0525SM:	6 mA typ.
		TSRN 1-2433SM:	1.5 mA typ.
		other models:	4 mA typ.
	– negative output circuit	-3.3 / -5.5 Vout models:	3 mA typ.
		-9.0 / -12 Vout models:	7 mA typ.
		TSRN 1-24150SM:	10 mA typ.
Reflected ripple current			100 mA typ.
Input filter			internal capacitors

Output Specifications

Voltage set accuracy		±2 % (at full load)
Regulation	– Input variation	0.2 %
	– Load variation 0 – 100 %	0.6 %
	– Load variation 10 – 90 %	0.3 %
Startup voltage overshoot		1.0 % max.
Minimum load		not required
Ripple and noise (20 MHz Bandwidth)	– |Vout| = 1.2V – 8V	50 mVpk-pk max.
	– |Vout| = 8.1V – 15V	75 mVpk-pk max.
Temperature coefficient		±0.015 % / °C max.
Dynamic load response (change of 50% to 100% load)		150 mV max. peak variation 250 µS max. response time
Startup time	– start up time at nominal Vin, constant resistive load	5 mS typ.
Short circuit protection		continuous, automatic recovery
Current limitation	TSRN 1-0525SM:	at 4.0 A typ.
	other models:	at 2.0 A typ.
Capacitive load		470 µF max.

General Specifications

Temperature ranges	– Operating	–40°C to +85°C
	– Max. casing temperature	tba.
	– Storage	–55°C to +125°C
Derating	– positive output circuit	1.7 %/K above +55°C
	– negative output circiut	2.5 %/K above +65°C
Thermal shock		acc. MIL-STD-810F
Vibration		acc. MIL-STD-810F
Overtemperature protection		at +170°C (on internal IC)
Humidity (non condensing)		90 % rel H max.
Reliability, calculated MTBF (MIL-HDBK-217F, at +25°C, ground benign)		>4'500'000 h
Isolation voltage		none
Switching frequency	TSRN 1-0525SM:	410 kHz typ.
	TSRN 1-2433SM:	300 kHz typ.
	other models:	580 kHz typ.
Remote On/Off	– Control pin referance for positive output circuit	GND
	– Control pin referance for negative output circuit	-Vout
	– On:	2 – 5 VDC or open circuit.
	– Off:	0 – 0.8 VDC or short circuit
	– Off idle current:	1.2 mA typ.

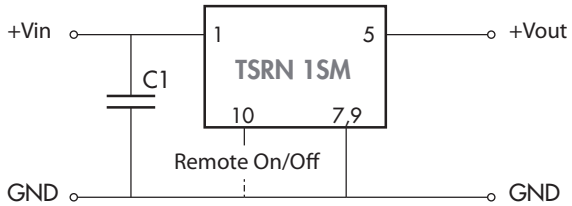
All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.

Physical Specifications

Casing material	non-conductive plastic
Weight	1.7 g (0.06 oz)
Lead-free reflow solder process – max. peak body temperature	as per J-STD-020D.01 (to find at: www.jedec.org - free registration rqueired) 245°C
Moisture sensitivity level (MSL)	level 1 as per J-STD-033B.1 (to find at: www.jedec.org - free registration required)
Washing	baking after washing: 100°C for 30 min.
Packaging	www.tracopower.com/products/tsrn1sm-pack.pdf

Applications notes

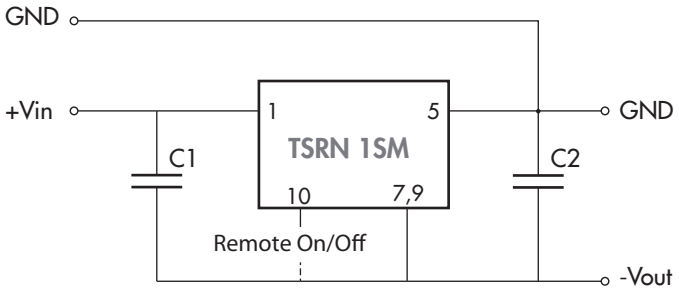
Positive output operation:



C1 = 22 µF/ 50 V (required only if input voltage is higher than 36 V)

(Open Remote On/Off input = On)

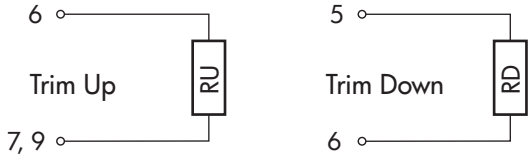
Negative output operation (not for model TSRN 1-0525SM):



C1 = 10 µF / 50 V, 1210 X5R MLCC
C2 = 10 µF / 25 V, 1206 X5R MLCC

(Open Remote On/Off input = On)

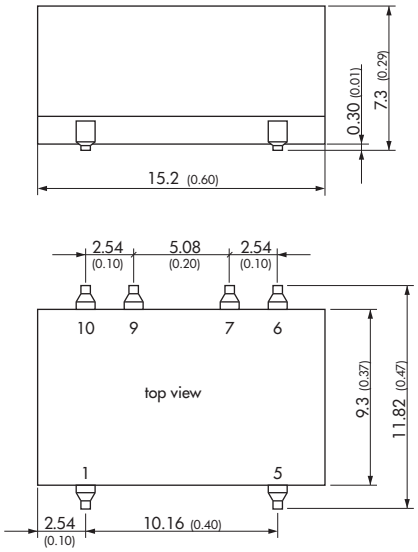
Output voltage adjustment:



Model	RU [KOhm]	RD [KOhm]
TSRN 1-0525SM	40.75 / (Vo – 2.5)	(Vo • 50.75 – 40.75) / (2.5 – Vo)
TSRN 1-2433SM	26.4 / (Vo – 3.3)	(Vo • 33 – 26.4) / (3.3 – Vo)
TSRN 1-2450SM	160 / (Vo – 5)	(Vo • 200 – 160) / (5 – Vo)
TSRN 1-2490SM	80 / (Vo – 9)	(Vo • 100 – 80) / (9 – Vo)
TSRN 1-24120SM	240 / (Vo – 12)	(Vo • 300 – 240) / (12 – Vo)
TSRN 1-24150SM	240 / (Vo – 15)	(Vo • 300 – 240) / (15 – Vo)

Vo = output voltage to be adjusted.
Calculate with absolute values for negative output circuit
Open Trim = nominal output voltage

Outline Dimensions



Pin-Out		
Pin	pos.	neg.
1	+Vin	+Vin
5	+Vout	GND
6	Trim	
7	GND	-Vout
9	GND	-Vout
10	Remote On/Off	

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

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