



# SR25

NON-ISOLATED 20W TO 30W

SWITCHING REGULATOR

10 $\mu$ s Transient Response

## Key Features

- Efficiency up to 94%
- 3:1 wide input voltage range
- Adjustable output voltage
- Under/overvoltage protection
- Thermal protection
- Synchronous rectification
- 10 $\mu$ S transient response, NL to FL
- Soft start
- Six-sided EMI shielding



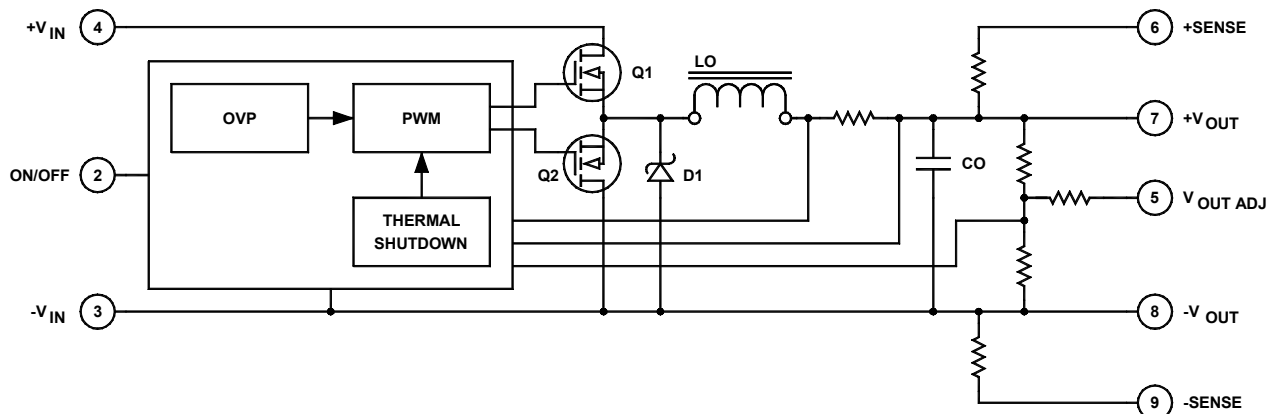
Beta Dyne is protected under various patents, including but not limited to U.S. Patent numbers: 5,777,519; 6,188,276; 6,262,901; 6,452,818; 6,473,3171.

## Applications

- Distributed Power
- Computers
- Portable Equipment

## Functional Description

The SR25 is a state-of-the-art, non-isolated step-down switching regulator with synchronous rectification enclosed in a 2 $\times$ 1 $\times$ 0.395-inch package. The wide input voltage of 4.2V<sub>IN</sub> to 14V<sub>IN</sub> gives the user a cost-effective solution for generating voltages of 5V<sub>OUT</sub> or lower. Combine this with a response time of 10 $\mu$ S and a fully adjustable output voltage range and you have a device that can supply up to 8A of output current on demand for any voltage range that will satisfy the most demanding power requirements for logic ICs. Reliability is enhanced with thermal protection, over/under voltage protection, 94% efficiency and surface mount technology.



Typical Block Diagram

## Electrical Specifications

Unless otherwise specified, all parameters are given under typical +25°C with nominal input voltage and under full output load conditions.

### INPUT SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Input Voltage Range, 3.3V <sub>OUT</sub> or lower	See Note 1	4.2		14	Vdc
Input Voltage Range, 5V <sub>OUT</sub>	See Note 1	6.2		14	Vdc
Input Current, No Load	V <sub>IN</sub> = 5		120		mA
Input Current, Full Load	V <sub>IN</sub> = 5V, V <sub>O</sub> = 3.3V, I <sub>O</sub> = 6A		4.45		A
	V <sub>IN</sub> = 5V, V <sub>O</sub> = 2.5V, I <sub>O</sub> = 6A		3.53		A
Input Reflected Ripple	V <sub>IN</sub> = 5V, V <sub>O</sub> = 3.3V, I <sub>O</sub> = 6A		50		mA <sub>PP</sub>
Off State Input Current	V <sub>IN</sub> = 5V		3.5		mA
Remote On/Off Control	Reference to GND, Open = ON, Short = OFF				
Turn On Delay	Including Soft Start		5		mS
Input Overvoltage Shutdown			15		Vdc

### OUTPUT SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Output Voltage Range	V <sub>IN</sub> > 6	2.5	3.3	5	Vdc
Output Voltage Range with External Reference	4 ≤ V <sub>IN</sub> ≤ 10	0	1.25	2.5	Vdc
Line Regulation	4 ≤ V <sub>IN</sub> ≤ 10, V <sub>O</sub> = 3.3V, I <sub>O</sub> = 6A; (See App. Note SR-001)		1	2	% of V <sub>OUT</sub>
Load Regulation	V <sub>IN</sub> = 5V, NL to FL; (See App. Note SR-001)		2		% of V <sub>OUT</sub>
Ripple and Noise	V <sub>IN</sub> = 5V, V <sub>O</sub> = 3.3V, I <sub>O</sub> = 6A		30	50	mV
Temperature Coefficient			0.01		%
Transient Response	V <sub>IN</sub> = 5V, NL to FL		5	10	μS
Thermal Shutdown	Case temperature	95	100	125	°C
Recovery from Thermal Shutdown	Case temperature		78		°C
Short Circuit Current			7.5	8.5	A

### GENERAL SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Efficiency	See Figure 1 for V <sub>IN</sub> > 5V				
V <sub>O</sub> = 5V	V <sub>IN</sub> = 6V, I <sub>O</sub> = 6A		93		%
	V <sub>IN</sub> = 12V, I <sub>O</sub> = 6A		86		%
V <sub>O</sub> = 3.3V	V <sub>IN</sub> = 5V, I <sub>O</sub> = 6A		87		%
	V <sub>IN</sub> = 12V, I <sub>O</sub> = 6A		80		%
V <sub>O</sub> = 2.5V	V <sub>IN</sub> = 5V, I <sub>O</sub> = 6A		86		%
	V <sub>IN</sub> = 12V, I <sub>O</sub> = 6A		76		%
Switching Frequency	Fixed	280	300	330	Hz
Isolation	None				
Thermal Resistance	Internally dissipated		0.3	0.4	°C/W
MTBF	per MIL-HNBK-217F (Ground benign, +25°C)		578,000		hours

### ENVIRONMENTAL / PHYSICAL SPECIFICATIONS

PARAMETER	CONDITION / NOTE	MIN	TYP	MAX	UNIT
Humidity	Non-condensing			95	%
Storage Temperature		-60		+125	°C
Operating Temperature, Commercial		-40		+75	°C
Operating Temperature, Extended	Ask for model number SR25X	-55		+85	°C
Dimensions (L×W×H)	2.00×1.00×0.39 in. (50.80×25.40×9.90mm)				
Weight	1.38 oz. (39g)				
Case Material	Coated metal				
Header	FR-4, non-conductive				
Potting	Thermally conductive				
Case Connection	-V <sub>N</sub>				

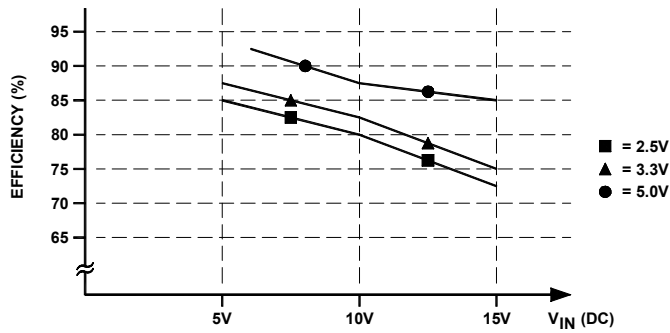


FIGURE 1. Efficiency vs. Input Voltage

**NOTE 1**

The SR25 is designed to supply an adjustable output range from 2.5 to 5.5Vdc. Only one precision 1% metal film resistor is required to be connected from the V<sub>OUT ADJ</sub> pin to ground (see Figure 2).

Neglecting the bleeding 100kΩ resistor, V<sub>OUT</sub> is given as:  $V_{OUT} = \left( \frac{2.49}{RX} + 1 \right) V_{REF}$ , where V<sub>REF</sub> = 2.5V

Solving for RX:  $\frac{V_{OUT}}{2.5} - 1 = \frac{2.49}{RX}$        $RX \text{ (in k}\Omega\text{)} = \frac{2.49}{\frac{V_{OUT}}{2.5} - 1} - 2$

For 3.3V<sub>OUT</sub>: **RX ≅ 5.1kΩ**  
 For 5.0V<sub>OUT</sub>: **RX ≅ 510Ω**

For any other output voltage lower than the internal reference voltage such as 1.8V, 1.5V, etc., an external low TC zener diode or other stable voltage source can be used with the SR25 or any other converter provided the internal resistor from the summing point to ground is very high and the gain setting resistors R<sub>F</sub>, R<sub>IN</sub> have low ohmic value R<sub>B</sub> » R<sub>F</sub>, R<sub>IN</sub>. The external reference source voltage (VS) must be higher than the internal reference voltage.

Using an external voltage reference (VS) forces current into the summing point. By summing the current at the inverting node, the following equation can be derived (neglecting R<sub>B</sub> = 100k):

$$\frac{VS}{-V_{REF}} \cdot \frac{R_{IN}}{R_{IN}} = \frac{V_{REF}}{-V_{OUT}} \cdot \frac{R_{IN}}{R_{F}} \Rightarrow \frac{(VS - V_{REF}) R_{F}}{V_{REF} R_{IN}} - V_{REF} = -V_{OUT}$$

For VS = 5V and V<sub>OUT</sub> = 1.8V:  $I_{RF} \frac{2.5V - 5V}{1.8V} - \frac{2.49}{2.5V} = -1.8V$       **RX ≅ 6.8k**

For VS = 5 and V<sub>OUT</sub> = 1.5: **RX ≅ 4.2k**      For VS = 5 and V<sub>OUT</sub> = 1.0: **RX ≅ 2.1k**

The 1μF ceramic capacitor is required for bypassing any noise to power ground, especially if RX is connected through a long wire run to the ground at the load.

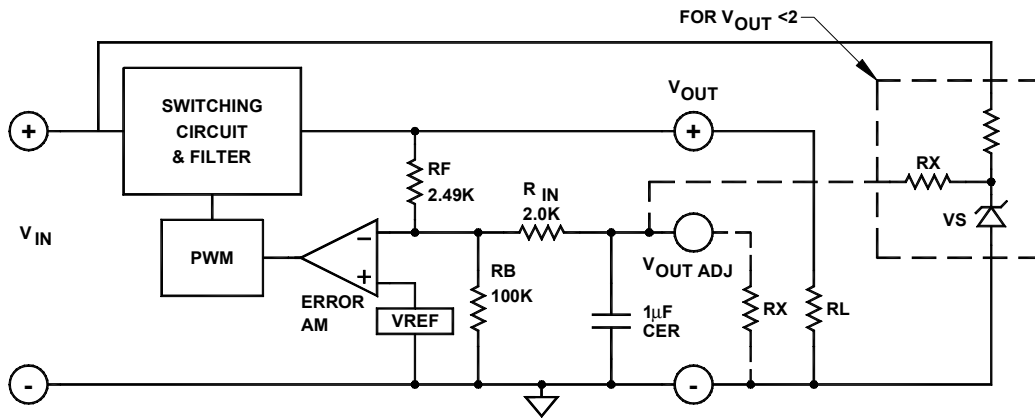
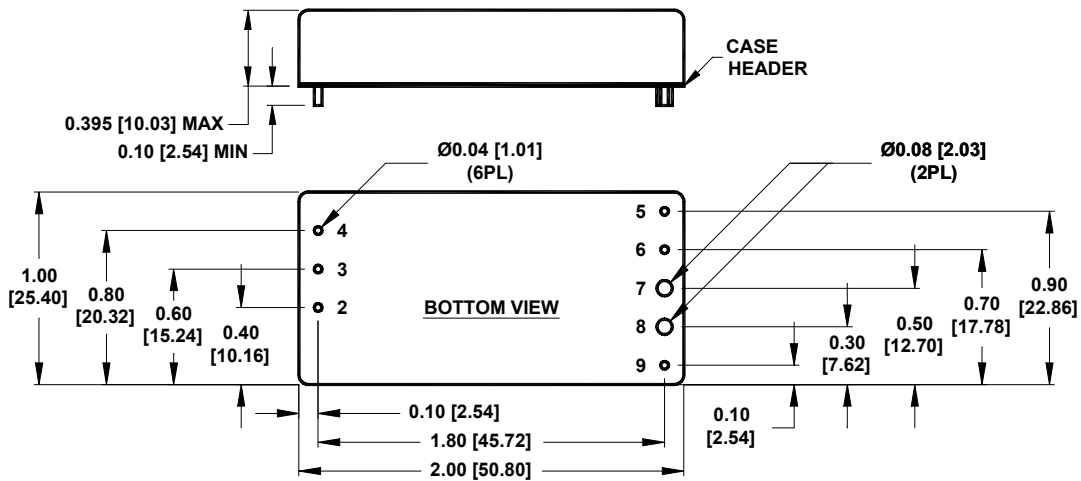


FIGURE 2. Output voltage trim circuit

**MECHANICAL SPECIFICATIONS**  
in inches [mm]



Pin	Function
1	No Pin
2	ON/OFF
3	-V <sub>IN</sub>
4	+V <sub>IN</sub>
5	V <sub>OUT ADJ</sub>
6	+SENSE
7	+V <sub>OUT</sub>
8	-V <sub>OUT</sub>
9	-SENSE