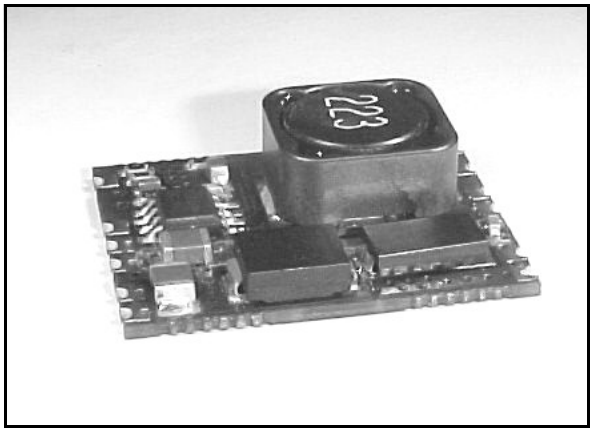
GS-R24F

2A DC/DC converter modules



Features

- MTBF 1 000 000 hours (T_A = 25° C)
- 2A max output current
- 35V max input voltage
- 1.5V max drop-out voltage
- Remote logic inhibit/enable
- Synchronization
- Not-latching overload and short circuit protection
- Thermal shutdown
- Fixed or adjustable output
- No heatsink required
- Operating temperature range -25°C ÷ 85°C

Description

The GS-R24F series is a family of high efficiency step down switching voltage regulator, designed to replace linear regulators.

Based on ST L5973 device, these non isolated regulators are suitable for various applications, including telecom, industry, computer and distributed power supply system having a wide range input voltage.

Order codes

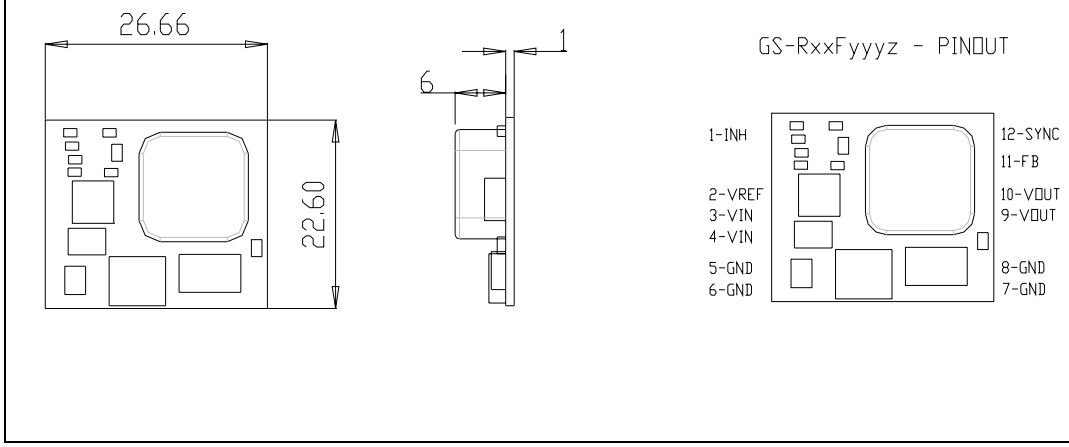
Part number	Output Voltage [V]	Input Voltage [V]	Output Ripple [mVpp]	Efficiency [%]	Notes
GS-R24F0182.0	1.8 ± 4%	16 ÷ 35	25	72	Fixed output voltage
GS-R24F0252.0	2.5 ± 4%	16 ÷ 35	25	76	Fixed output voltage
GS-R24F0332.0	3.3 ± 4%	16 ÷ 35	25	82	Fixed output voltage
GS-R24F0502.0	5.0 ± 4%	16 ÷ 35	25	85	Fixed output voltage
GS-R24F0002.0	1.235 ÷ 5.5	16 ÷ 35	25	68 ÷ 85	Progr. output voltage
GS-R24F1201.5	12 ± 4%	16 ÷ 35	100	91	Fixed output voltage
GS-R24F0001.0	3.3 ÷ 24	16 ÷ 35	100 ÷ 250	78 ÷ 96	Progr. output voltage

Contents

1 Pin settings

1.1 Pin connection

Figure 1. Pin connection and mechanical data (dimensions in mm)



1.2 Pin description

Table 1. Pin description

Name	Function	Description
1	INH	A logic high level disables the device. When the pin is open, an internal pull up disables the device
2	V_{ref}	3.3V reference voltage
3	Input +	DC input voltage
4	Input +	DC input voltage
5	Input GND	Return for input voltage source
6	Input GND	Return for input voltage source
7	Output GND	Return for output voltage source
8	Output GND	Return for output voltage source
9	V_{out}	Regulated power output
10	V_{out}	Regulated power output
11	FB	Feedback input, available on adjustable device and on request for additional compensation
12	Sync	Master/Slave synchronization

2 Maximum ratings

2.1 Absolute maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_I	DC input voltage	36	V
I_{OUT}	Maximum output current	internally limit	
V_1	INH	-0.3 to V_I	V
V_{12}	Sync	-0.3 to 4	V
V_{11}	FB	4	V

2.2 Thermal data

Table 3. Absolute maximum ratings

Symbol	Parameter	Value	Unit
T_{stg}	Storage temperature range	-40 ÷ 105	°C
T_{op}	Operating ambient temperature	-25 ÷ 85	°C

2.3 Thermal de-rating

Table 4. Thermal de-rating for free air condition (all versions)

Symbol	Parameter	Test condition		Value	Unit
I_o	Output current	V_I = 16 ÷ 35V	T_A = 60°C	1.95	A
		V_I = 16 ÷ 35V	T_A = 65°C	1.85	
		V_I = 16 ÷ 35V	T_A = 70°C	1.75	
		V_I = 16 ÷ 35V	T_A = 75°C	1.65	
		V_I = 16 ÷ 35V	T_A = 80°C	1.55	
		V_I = 16 ÷ 35V	T_A = 85°C	1.40	

3 Electrical characteristics

T_A = 25°C, unless otherwise specified

Table 5. Electrical characteristics (all version)

Symbol	Parameter	Test condition	Min	Typ	Max	Unit
V_r	Ripple voltage	V_I =24V I_o = 2A for GS-R24Fyyy2.0		25	35	mVpp
V_r	Ripple voltage	V_I =24V I_o = 1.5A for GS-R24F1201.5			100	mVpp
V_r	Ripple voltage	V_I =24V I_o = 1A for GS-R24F0001.0		100	250	mVpp
	Temperature stability	V_I =V_o + 1.5V I_o = 2A				mV/°C
I_o	Output current	V_I =16 ÷ 35V for GS-R24Fyyy2.0	0		2	A
I_o	Output current	V_I =16 ÷ 35V for GS-R24F1201.5	0		1.5	A
I_o	Output current	V_I =16 ÷ 35V for GS-R24F0001.0	0		1	A
I_{oL}	Current limit	V_I =16 ÷ 35V		2.5		A
I_q	Quiescent current	V_I =24V I_o = 0A		1.8	2.5	mA
$I_{qst\text{-}by}$	Total stand-by quiescent current	V_{inh}>2.2V V_i = 35V		80	150	µA
f_s	Switching frequency	V_I = 24V I_o = 2A	225	250	275	kHz
V_{ref}	Reference voltage	V_I = 16 ÷ 35V I_{ref} = 0 ÷ 5mA	3.234	3.3	3.366	V
	Short circuit current		8	10	30	mA
INH	INH threshold voltage	Device ON			0.8	V
		Device OFF	2.2			V
V_{FB}	Feedback voltage	V_i=16 ÷ 35V I_O=0 ÷ 2A	1.22	1.235	1.25	V
SRV	Supply voltage rejection					mV/V
R_{th}	Thermal resistance	Case to ambient				°C/W

4 Application information

4.1 Input voltage

The recommended maximum operating DC Input Voltage is 35V including ripple voltage.

4.2 Reference voltage

No capacitor is required for stability.

4.3 Inhibit function

The inhibit feature allows to put the device in stand-by mode.

With INH pin 1 is higher than 2.2V the device is disabled and the current consumption is reduced to less than 150µA for V_I = 35V.

With INH pin lower than 0.8V, the device is enabled.

If the INH pin is left floating, an internal pull up ensures that the voltage at the pin reaches the inhibit threshold and the device is disabled.

The pin can be pulled to V_I to disable the device.

4.4 Multiple units synchronization

Using more than one unit on the same circuit, it is possible to synchronize the switching frequency, connecting all pin 12 together (see *Figure 4*).

The unit with higher frequency becomes the master.

4.5 Current limitation

The device has two current limit protections, pulse by pulse and frequency fold back.

The current is sensed through a resistor and if it reaches the threshold, the on time is reduced and consequently the output voltage, too.

Since the minimum switch ON time (necessary to avoid false overcurrent signal) is not enough to obtain a sufficiently low duty cycle at 250Hz, the output current could increase again, in strong overcurrent or short circuit conditions.

For this reason the switching frequency is also reduced to keep the inductor current within its maximum threshold limit.

The frequency depends on the feedback voltage.

As the feedback voltage decreases (due to the reduced duty cycle), the switching frequency decrease too.

4.6 Thermal shutdown

The shutdown block generates a signal that turns off the power stage if the temperature of the internal chip goes higher than a fixed internal threshold (150° C min).

The sensing element of the chip is very close to the PDMOS area, so ensuring an accurate and fast temperature detection.

An hysteresis of approximately 20° C avoids that the devices turns on and off continuously.

4.7 Output voltage programming (GS-R24F0002.0 and GS-R24F0001.0)

The GS-R24F0002.0 output voltage is 5.54V ±4%, the GS-R24F0001.0 output voltage is 24.44V ±4%, to reduce these values connect a resistor between pin 11 (FB) and pin 10 (V_{out}).

The resistor must be located very close to the proper pins, to minimize the injected noise (see figure 2).

The resistor value is calculated using the following formula:

for GS-R24F0002.0 $Rv = [(V_{out} - 1.235) * 11.3] / (5.54 - V_{out})$ [kΩ];

for GS-R24F0001.0 $Rv = [(V_{out} - 1.235) * 62] / (24.44 - V_{out})$ [kΩ].

V_{out} can be adjusted between 1.235V (Rv = 0Ω) and 5.54V/24.44V (Rv = open).

4.8 Loop compensation (GS-R24F0002.0 and GS-R24F0001.0)

If required by particular load conditions, it is possible to change the feedback loop compensation, adding an external capacitor between pin 11 (FB) and pin 10 (V_{out}), which will act as speed up (see *Figure 3*).

5 Additional features and protections

5.1 Output overvoltage protection

The overvoltage protection, OVP, is realized by using an internal comparator, whose input is connected to the feedback. It turns off the power stage when the OVP threshold is reached.

This threshold is typically 30% higher than the feedback voltage.

Figure 2. Output voltage programming

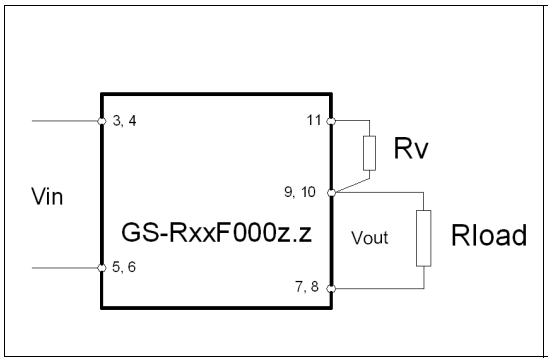


Figure 3. Loop compensation

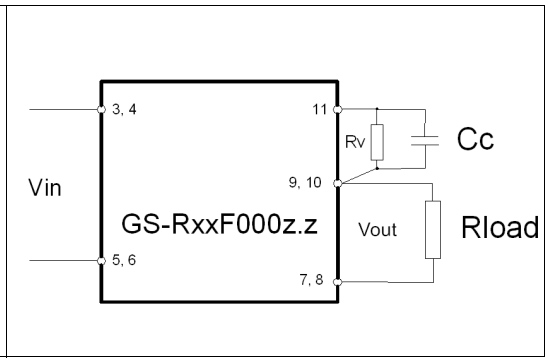


Figure 4. Multiple units synchronization

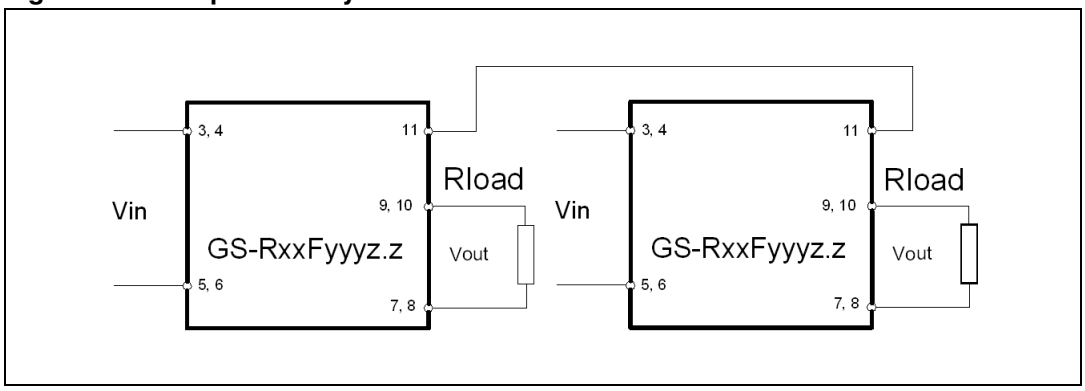
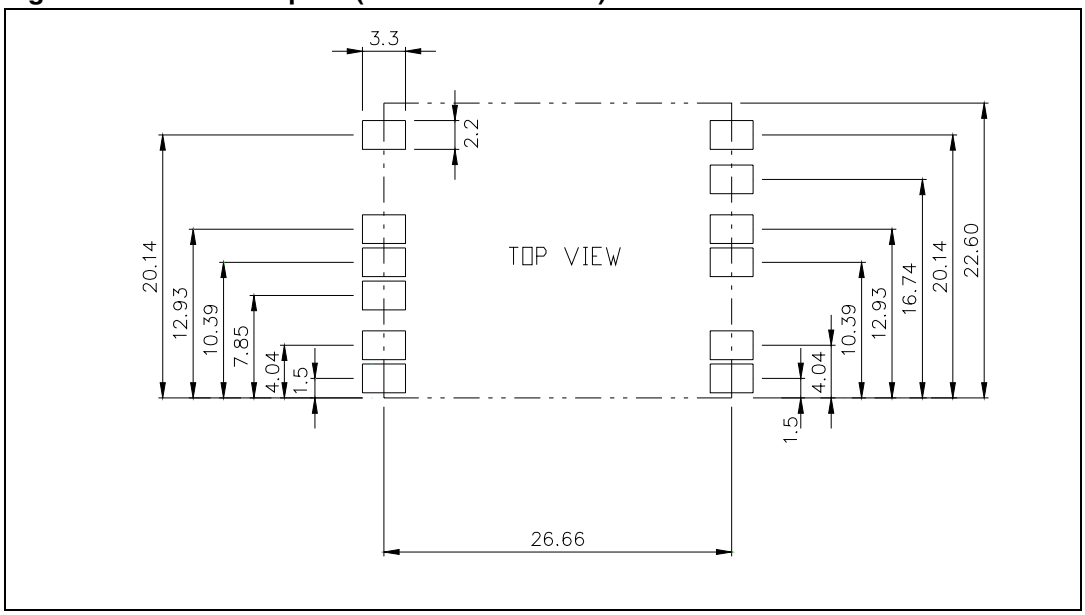


Figure 5. P.C.B. Footprint (dimensions in mm)



6 Ordering scheme

Table 6. Ordering information scheme

GS- R24 F018 2.0

Input Voltage

24 = 24V

Output Voltage

018 = 1.8V

025 = 2.5V

033 = 3.3V

050 = 5.0V

120 = 12V

000 = 1.235 ÷ 5.5V / 3.3 ÷ 24V

Output Current

2.0 = 2A

1.5 = 1.5A

1.0 = 1A

7 Revision history

Table 7. Revision history

Date	Revision	Changes
13-Oct-2006	1	Initial release

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