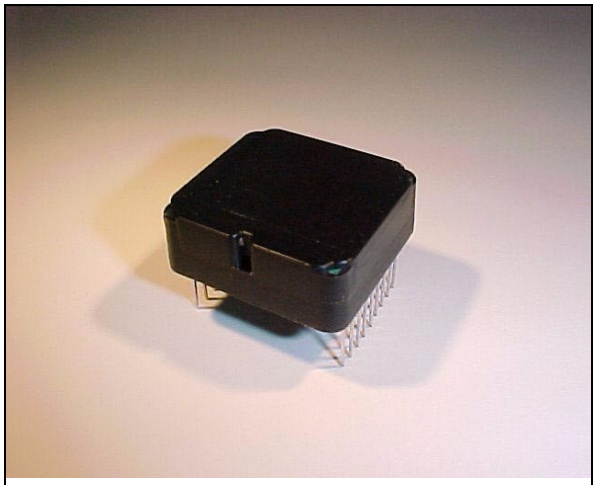
GS-R12HXXX2

2.5W TO 24W STEP-DOWN SWITCHING REGULATOR FAMILY

PRELIMINARY

FEATURE

- MTBF 1 000 000 hours (T_{amb}=25°C)
- 2A max output current
- 35V max input voltage
- 1.5V max drop-out voltage
- 3.3V ± 2% reference voltage
- Remote logic inhibit/enable
- Synchronization
- Not-latching overload and short circuit protection
- Thermal shutdown
- Fixed or adjustable output
- No heatsink required



ORDERING NUMBER: GS-R12HXXX2

DESCRIPTION

The GS-R12HXXX2 series is a family of high efficiency step down switching voltage regulator, designed to replace linear regulators.

Based on STM L5973 device, this non isolated family of regulators are suitable for the full spectrum of applications including telecom, industry, computer and distributed power system applications having a widely ranging input voltage.

SELECTION CHART

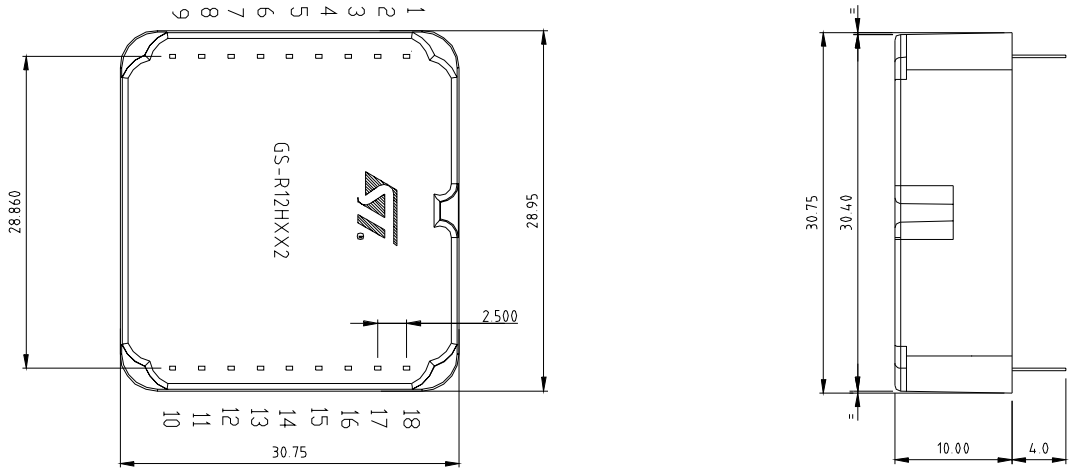
Type Ordering Number	Output Voltage [V]	Input Voltage [V]	Output Ripple [mVpp]	Efficiency [%]	Notes
GS-R12H0122	1.235 ± 3%	4.5 ÷ 15	20	68	Fixed output voltage
GS-R12H0182	1.8 ± 4%	4.5 ÷ 15	20	72	Fixed output voltage
GS-R12H0252	2.5 ± 4%	4.5 ÷ 15	20	76	Fixed output voltage
GS-R12H0332	3.3 ± 4%	4.5 ÷ 15	20	82	Fixed output voltage
GS-R12H0502	5.0 ± 4%	6.6 ÷ 15	20	85	Fixed output voltage
GS-R12H0002	1.235 ÷ 5.0	4.5 ÷ 15	20	68 ÷ 85	Progr. output voltage
GS-R24H0332	3.3 ± 4%	16 ÷ 35	20	82	Fixed output voltage

Type Ordering Number	Output Voltage [V]	Input Voltage [V]	Output Ripple [mVpp]	Efficiency [%]	Notes
GS-R24H0502	5.0 ± 4%	16 ÷ 35	20	85	Fixed output voltage
GS-R24H1201.5	12 ± 4%	16 ÷ 35	100	91	Fixed output voltage
GS-R24H0001	3.3 ÷ 24	16 ÷ 35	100 ÷ 250	78 ÷ 96	Progr. output voltage

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_i	DC Input Voltage (for GS-R12HXXX2)	16	V
	DC Input Voltage (for GS-R24HXXX)	36	V
I_{out}	Maximum Output Current	int. limit	
V_9	INH	-0.3 to V_i	V
V_{10}	Sync	-0.3 to 4	V
V_{11}	FB	4	V
T_{stg}	Storage Temperature Range	-40 ÷ 105	°C
T_{op}	Operating Ambient Temperature	-25 ÷ 70	°C
T_{op1}	Operating Ambient Temperature with current derating	-25 ÷ 85	°C

CONNECTION DIAGRAM AND MECHANICAL DATA



PIN DESCRIPTION

Pin	Function	Description
1	Input GND	Return for input voltage source
2	Input GND	Return for input voltage source
3	Input GND	Return for input voltage source
4	Input +	DC input voltage
5	Input +	DC input voltage
6	Input +	DC input voltage
7	Input +	DC input voltage
8	V_{ref}	3.3V reference voltage
9	INH	A logical level (active high) disables the device, when it is open an internal pull up disables the device
10	Sync	Master/Slave synchronization
11	FB	Feedback input, available on adjustable device
12	V_{out}	Regulated output
13	V_{out}	Regulated output

Pin	Function	Description
14	V_{out}	Regulated output
15	V_{out}	Regulated output
16	Output GND	Return for output voltage
17	Output GND	Return for output voltage
18	Output GND	Return for output voltage

ELECTRICAL CHARACTERISTICS All versions (T_{amb}=25°C, unless otherwise specified.)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
	Temperature Stability	$V_i = V_o$ + 1.5V I_o = 2A				mV/°C
I_{oL}	Current Limit	V_i =4.5 ÷ 15V		2.5		A
I_q	Quiescent Current	V_i =12V I_o = 0A		1.8	2.5	mA
$I_{qst\text{-}by}$	Total Stand-by Quiescent Current	V_{inh}>2.2V		50	100	µA
f_s	Switching Frequency	V_i =12V I_o = 1.5A	225	250	275	kHz
V_{ref}	Reference Voltage	V_i =4.5 ÷ 15V 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 =4.5 ÷ 15V 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

ELECTRICAL CHARACTERISTICS for GS-R12HXXX2 only (T_{amb}=25°C, unless otherwise specified.)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
I_o	Output Current	V_i =4.5 ÷ 15V	0		2	A
V_r	Ripple Voltage	V_i =12V I_o = 2A		20		mVpp

ELECTRICAL CHARACTERISTICS for GS-R24HXXX only (T_{amb}=25°C, unless otherwise specified.)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
I_o	Output Current	V_i =16 ÷ 35V for GS-R24H0332 GS-R24H0502	0		2	A
I_o	Output Current	V_i =16 ÷ 35V for GS-R24H1201.5	0		1.5	A
I_o	Output Current	V_i =16 ÷ 35V for GS-RH0001	0		1-2	A
V_r	Ripple Voltage	V_i =24V I_o = 2A for GS-R24H0332 GS-R24H0502		20		mVpp
V_r	Ripple Voltage	V_i =24V I_o = 2A for GS-R24H1201.5		100		mVpp
V_r	Ripple Voltage	V_i =24V I_o = 2A for GS-R24H0001		100-250		mVpp

USER NOTES

Input Voltage

The recommended operating maximum DC Input Voltage is 15V inclusive of ripple voltage.

Reference voltage

No capacitor is required for stability.

Inhibit function

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

With INH pin 9 higher than 2.2V the device is disabled and the power consumption is reduced to less than 100µA.

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 is also V_{cc} compatible.

Multiple units synchronization

Using more than one unit on the same circuit, it is possible to synchronize the switching frequency, connecting all pin 10 together (see figure 3).

The unit with higher frequency becomes the master.

Current protection

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

The current is sensed through a resistor and if 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 250 Hz, the output current, in strong overcurrent or short circuit conditions, could increase again.

For this reason the switching frequency is also reduced, so keeping the inductor current under its maximum threshold.

The frequency depends on the feedback voltage.

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

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 ºC).

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 20ºC avoids that the devices turns on and off continuously.

Thermal Characteristics

Output voltage programming (GS-R12H0002 only)

The GS-R12H0002 output voltage is 5.05V ±4%, to reduce this value connect a resistor between pin 11 (FB) and pin 12 (V_{out}).

The resistor must be located very close to the proper pins, to minimize the injected noise (see figure 1).

The resistor value is calculated using the following formula:

$Rv=[(V_{out}-1.235)*10.2]/(5.05-V_{out})$ [kOhm]

V_{out} can be adjusted between 1.235V (Rv=0 Ohm) and 5.05V (Rv=open)

Loop compensation (GS-R12H0002 only)

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 12 (V_{out}), which will act as speed up (see figure 2).

ADDITIONAL FEATURES AND PROTECTIONS

Feedback disconnection

In case of feedback disconnection, the duty cycle increases versus the maximum allowed value, bringing the output voltage close to the input supply.

THis condition could destroy the load.

To avoid this dangerous condition, the device is turned off if the internal feedback pin remains floating.

Output overvoltage protection

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

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

Figure 1

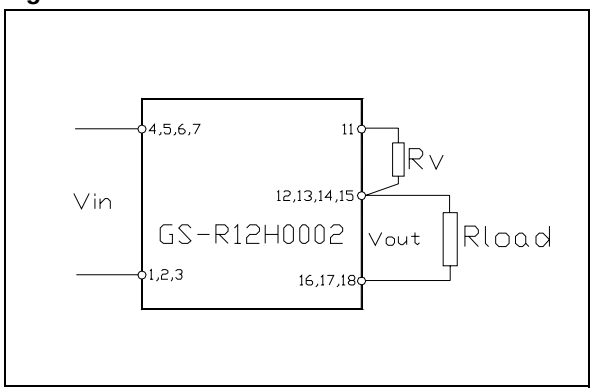


Figure 2

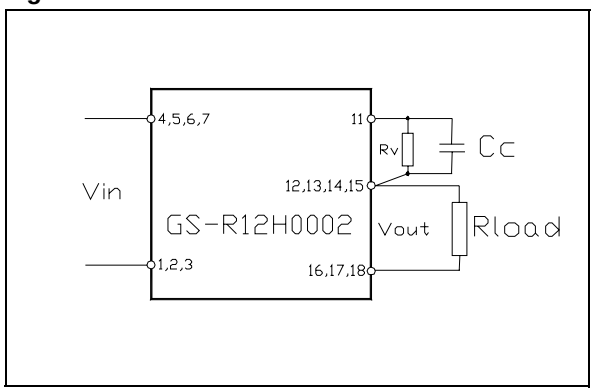


Figure 3