

# GS-R1005

## 50W STEP-DOWN SWITCHING REGULATOR

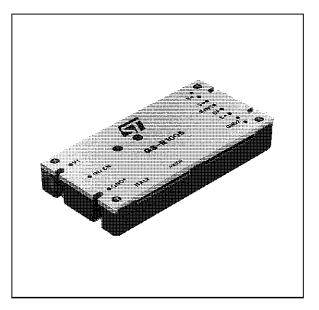
Туре	Vi	Vo	ا <sub>ہ</sub>
GS-R1005	12 to 36 V	5 V	10 A

#### FEATURES

- Wide input voltage range (12 to 36V)
- High efficiency (80% min.)
- Parallel operation with current sharing
- Synchronization
- Remote inhibit/enable
- Remote load voltage sense
- Output short-circuit protection
- Soft-start
- PCB or chassis mountable

#### DESCRIPTION

The GS-R1005 is a step-down switching voltage regulator suitable to provide 5V/10A output voltage from a wide input voltage range (12 to 36V).



#### **ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
Vi	DC Input Voltage	40	V
Viinh	High Inhibitvoltage	28	V
T <sub>cop</sub>	Operating Case Temperature Range	0 to +75	°C
Tstg	Storage Temperature Range	– 20 to +105	°C

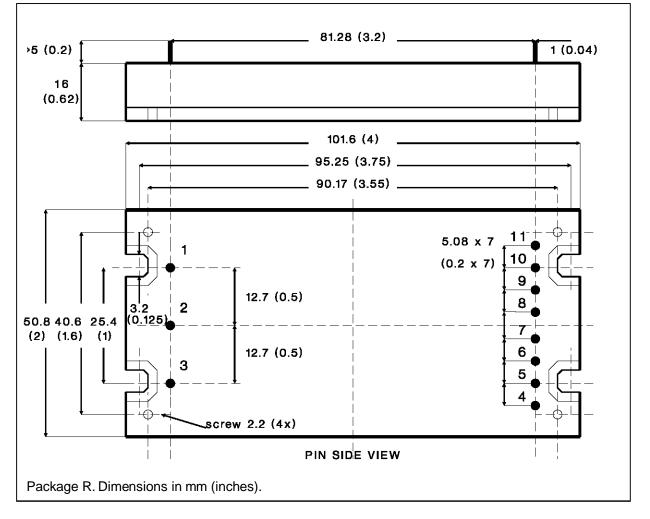
Symbol	Parameter Test Conditions		Min	Тур	Max	Unit
Vi	Input Voltage	V <sub>0</sub> = 5.05V I <sub>0</sub> = 1.2 to 10A	12	24	36	V
lj	Input Current	Vi = 24V Io = 10A	2.5			A
lir	Reflected Input Current	$V_i = 24V$ $I_0 = 10A$ with external filter (C = 470µF)	200		220	mApp
Vien	Enable Input Voltage	$V_i = 12 \text{ to } 36V \text{ I}_0 = 1.2 \text{ to } 10A$	0		1.2	V
Viinh	Inhibit Input Voltage	$V_i = 12 \text{ to } 36V \text{ I}_0 = 1.2 \text{ to } 10A$	2		24	V
liinh	Inhibit Input Current	$      V_i = 12 \text{ to } 36 \text{V} \text{ I}_0 = 1.2 \text{ to } 10 \text{A} \\       V_{iinh} = 5 \text{V}      $		0.3	0.5	mA
Vo	Output Voltage	$V_i = 12 \text{ to } 36V \text{ I}_0 = 1.2 \text{ to } 10A$	4.9	5.05	5.2	V
Vor	Output Ripple Voltage	Vi = 24V Io = 10A		100	120	mVpp
δνοι	Line Regulation	$V_i = 12 \text{ to } 36V \text{ I}_0 = 10A$			0.5	%
δνοο	Load Regulation	$V_i = 24V$ $I_0 = 1.2$ to 10A			1	%
$\Delta V_0$	Total Remote Sense Compensation	Vi = 24V I <sub>0</sub> = 10A			0.5	V
lo	Output Current*	$V_i = 12 \text{ to } 36V  V_0 = 5.05V$	0		10	Α
lol	Output Current Limiting	Vi = 12 to 36V	12.5		13.7	A
losc	Short-circuit Output Current	Vi = 24V			16	A
δΙο	Current Sharing Deviation	$V_i = 24V$ lo = 2 to 10A two modules in parallel			10	%
tss	Soft-start Time	Vi = 24V I <sub>0</sub> = 10A		15		ms
tr1	Line Transient Recovery Time	Vi = 12 to 36V I <sub>0</sub> = 5A	60			μs
tr2	Load Transient Recovery Time	Vi = 24V Io = 1.2 to 10A	i = 24V I <sub>0</sub> = 1.2 to 10A 10			μs
fs	Switching Frequency	Vi = 24V Io = 1.2 to 10A 100			kHz	
η	Efficiency	Vi = 12 to 36V Io = 10A 80 83			%	
Rthc	Thermal Resistance Case-to-ambient			7.5		°C/W

### **ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25^{\circ}C$ unless otherwise specified)

\* Note: when output current is less than 1.2A, output ripple voltage increases due to discontinuous operation.



#### CONNECTION DIAGRAM AND MECHANICAL DATA



#### **PIN DESCRIPTION**

Pin	Function	Description
1	GND Input	Return for input voltage source. Internally connected to pin 10,11.
2	Inhibit	The converter is ON (Enable) when this pin is unconnected or the voltage applied is lower than 1.2V. The converter is OFF (Inhibit) for a control voltage in the range of 2 to 24V.
3	+ Vin	DC Input voltage; recommended maximum voltage is 36V. External capacitor between pin 3 and pin 1 is mandatory; recommended value is $470\mu F/50V$ for switching application.
4,5	+ Vout	+5V output voltage.
6	+ Sense	Senses the remote load high side. To be connected to pin 4,5 when remote sense is not used.
7	Sync	Synchronization output. See figures 1,2,3,4. Open when not used.
8	Parallel	Parallel output. See figures 1,2,3,4. Open when not used.
9	- Sense	Senses the remote load return. To be connected to pin 10,11 when remote sense is not used. In parallel configuration, take care to connect all -S pins together (see figures 1,2,3,4).
10,11	GND Output	Return for output current path. Internally connected to pin 1.



### USER NOTES

#### Input Voltage

The recommended operating maximum DC input voltage is 36V inclusive of the ripple voltage. The use of an external low ESR, high ripple current capacitor located as close the module as possible is mandatory; recommended value is  $470\mu$ F/50V.

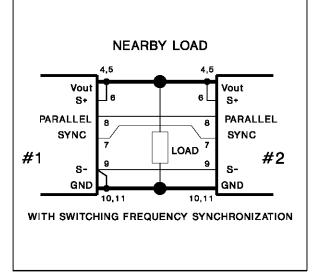
#### Softstart

To avoid heavy inrush current the output voltage rise time is typically 15ms in any condition of load.

#### **Remote Sensing**

The remote voltage sense compensation range is for a total drop of 500mV equally shared between the load connecting wires. It is a good practice to shield the sensing wires to avoid oscillations. See the connection diagram on figures 1, 2, 3, 4.

#### Figure 1.



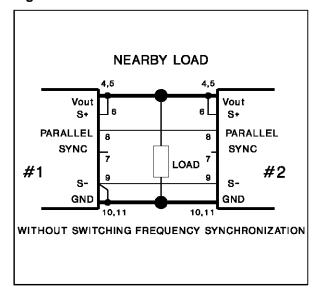
#### **Parallel Operation**

To increase available output regulated power, the module features the parallel connection possibility with equal current sharing and maximum deviation of 10% (two modules in parallel). See the connection diagram on figures 1, 2, 3, 4.

#### **Module Protection**

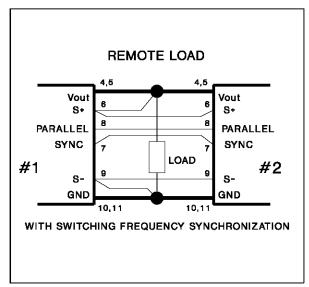
The module is protected against occasional and permanent shortcircuits of the output pins to ground, as well as against output current overload. It uses a current limiting protection circuitry, avoiding latch-up problems with certain types of loads.

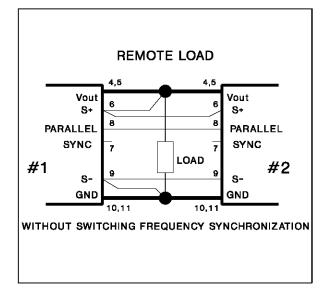
Figure 2.



#### Figure 3.

Figure 4.





# Thermal characteristics: how to choose the heat-sink

Sometimes the GS-R1005 requires an external heat-sink depending on both operating temperature conditions and power.

Before entering into calculations details, some basic concepts will be explained to better understand the problem.

The thermal resistance between two points is represented by their temperature difference in front of a specified dissipated power, and it is expressed in Degree Centigrade per Watt (°C/W).

For GS-R1005 the thermal resistance case to ambient is  $7.5^{\circ}$ C/W. This means that an internal power dissipation of 1W will bring the case temperature at  $7.5^{\circ}$ C above the ambient temperature.

The maximum case temperature, at which the module provides 10A, is  $75^{\circ}C$  (see fig. 6).

Let's suppose to have a GS-R1005 that delivers a load current of 10A at an ambient temperature of 40°C.

The dissipated power in this operating condition is about 10.2W (at typical efficiency of 83%), and the case temperature of the module will be:

$$T_{Case} = T_{Amb} + P_d \times R_{th} = 40 + 10.2 \times 7.5 = 116.8 \ ^{\circ}C$$

This value exceeds the maximum allowed temperature and an external heat-sink must be added. To this purpose four holes (see mechanical drawing) are provided on the metal surface of the module.

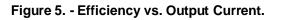
To calculate this heat-sink, let's first determine what the total thermal resistance should be.

$$R_{th} = \frac{T_{CaseMAX} - T_{amb}}{P_d} = \frac{75 - 40}{10.2} = 3.42^{\circ}C / W$$

This value is the resulting value of the additional heatsink thermal resistance.



### GS-R1005



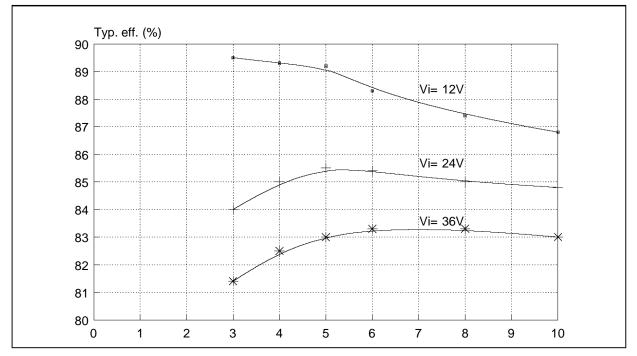
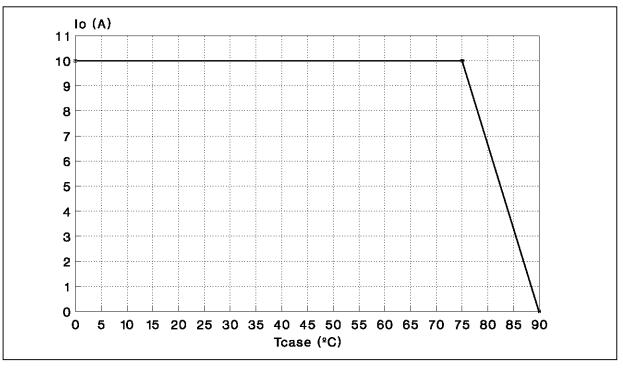


Figure 6. - Output Current vs. T case.



The following list may help the designer to select the proper commercially available heat-sink. Sometimes it can be more convenient to use a custom made heat-sink that can be experimently designed and tested.

Manufacturers	Туре	Height (mm)	Rth (°C/W)
ALUTRONIC	PR139	20	3
	PR140	19	2
	PR159	20	2.5
ASSMAN	V5440	19	3
	V5805	15	2
	V5280	19	2
AAVID	60885	14	4.5
	60660	25.5	1.5
	62355	33.5	3
AUSTERLITZ	KS50	12	3
	KS100.3	15	2.5
FISCHER	SK16	25.5	1.5
	SK52	19	2
SGE BOSARI	L30	21	3
	LZ50	24	3
THERMALLOY	6155	14	4.5
	6601	14	5
	6176	24	4.5
	6320	30	1.5

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