

**20W TRIPLE OUTPUT STEP-DOWN  
SWITCHING REGULATOR**

**FEATURES**

- MTBF in excess of 200,000 hours
- 4V max drop-out voltage
- Soft start
- Reset output
- Non-latching short circuit protection
- Crow-bar output overvoltage protection

**DESCRIPTION**

The GS-R51212 is a versatile triple output, high current, high voltage step-down switching regulator module that provides a +5V and two isolated 12V outputs. It is ideal for microprocessor based boards because it powers the logic and the communication ports and it has a Reset output for the correct system start-up.

The integral heatsink allows a large power handling capability and it provides also an effective shielding to minimize EMI.



**MAIN CHARACTERISTICS**

|                      |                                  |              |
|----------------------|----------------------------------|--------------|
| $V_i$                | Input Voltage                    | 9 to 40V     |
| $V_{o1}$<br>$I_{o1}$ | Output Voltage<br>Output Current | 5.1V<br>3.5A |
| $V_{o2}$<br>$I_{o2}$ | Output Voltage<br>Output Current | 12V<br>0.1A  |
| $V_{o3}$<br>$I_{o3}$ | Output Voltage<br>Output Current | 12V<br>0.1A  |

**ABSOLUTE MAXIMUM RATINGS**

| Symbol    | Parameter                        | Value        | Unit |
|-----------|----------------------------------|--------------|------|
| $V_i$     | DC Input Voltage                 | 42           | V    |
| $I_{rt}$  | Reset Output Sink Current        | 20           | mA   |
| $T_{stg}$ | Storage Temperature Range        | - 40 to +105 | °C   |
| $T_{cop}$ | Operating Case Temperature Range | - 20 to +85  | °C   |

**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise specified)

| Symbol                | Parameter                      | Test Conditions   | Min  | Typ       | Max  | Unit          |
|-----------------------|--------------------------------|---|------|-----------|------|---------------|
| $V_{O1}$              | Output Voltage                 | $V_i = 24\text{V}$ $I_{O1} = 2.5\text{A}$   | 4.95 | 5.1       | 5.2  | V             |
| $V_{O2}$              | Output Voltage                 | $V_i = 24\text{V}$ $I_{O2} = 0.1\text{A}$   | 11.5 |           | 12.5 | V             |
| $V_{O3}$              | Output Voltage                 | $V_i = 24\text{V}$ $I_{O3} = 0.1\text{A}$   | 11.5 |           | 12.5 | V             |
| $\Delta V_O/\Delta T$ | Temperature Stability          | All Outputs   |      | 0.2       |      | mV/°C         |
| $V_i$                 | Input Voltage                  |   | 9    |           | 40   | V             |
| $I_{O1}$              | Output Current                 | $V_i = 24\text{V}$  | 0.5  |           | 3.5  | A             |
| $I_{O2}$              | Output Current                 | $V_i = 24\text{V}$  |      |           | 0.1  | A             |
| $I_{O3}$              | Output Current                 | $V_i = 24\text{V}$  |      |           | 0.1  | A             |
| $I_{isc}$             | Average Input Current          | $V_i = 40\text{V}$ $V_{O1} = 0\text{V}$   |      | 0.1       | 0.2  | A             |
| $I_{isc}$             | Average Input Current          | $V_i = 40\text{V}$ $V_{O1/2/3} = 0\text{V}$   |      | 0.1       | 0.2  | A             |
| $I_{ir}$              | Reflected Input Current        | $V_i = 24\text{V}$ $I_{O1} = 2.5\text{A}$ $I_{O2,3} = 0.1\text{A}$  |      | 200       |      | mApp          |
| $V_{is}$              | 5V to 12V Isolation Voltage    |   | 200  |           |      | VDC           |
| $f_s$                 | Switching Frequency            |   |      | 100       |      | kHz           |
| $\eta$                | Efficiency                     | $V_i = 24\text{V}$ $I_{O1} = 2.5\text{A}$ $I_{O2,3} = 0.1\text{A}$  |      | 70        |      | %             |
| $\Delta V_O$          | Line Regulation                | $I_{O1} = 2.5\text{A}$ $V_i = 15$ to $25\text{V}$ $I_{O2,3} = 0.1\text{A}$                                  |      | 2         |      | mV/V          |
| $\Delta V_O$          | Load Regulation                | $V_i = 24\text{V}$ $I_{O1} = 0.5$ to $2.5\text{A}$<br>$V_i = 24\text{V}$ $I_{O2,3} = 0.05$ to $0.1\text{A}$ |      | 35<br>600 |      | mV/A          |
| SVR                   | Supply Voltage Rejection       | 50/60Hz   |      | 4         |      | mV/V          |
| $V_{or}$              | Output Ripple Voltage          | $V_i = 24\text{V}$ $I_{O1} = 2.5\text{A}$   |      | 30        |      | mVpp          |
| $V_{on}$              | Output Noise Voltage           | $V_i = 24\text{V}$ $I_{O1} = 2.5\text{A}$   |      | 40        |      | mVpp          |
| $I_{rh}$              | Reset Leakage Current          |   |      | 100       |      | $\mu\text{A}$ |
| $V_{rl}$              | Reset Low Level                | $I_{reset} = 5\text{mA}$  |      | 0.2       |      | V             |
| $t_{rd}$              | Reset Delay Time               |   |      | 100       |      | ms            |
| $t_{r1}$              | Line Transient Recovery Time   | $I_{O1} = 2.5\text{A}$ $V_i = 15$ to $35\text{V}$   |      | 500       |      | $\mu\text{s}$ |
| $t_{r2}$              | Load Transient Recovery Time   | $V_i = 24\text{V}$ $I_O = 0.5$ to $2.5\text{A}$   |      | 200       |      | $\mu\text{s}$ |
| $t_{ss}$              | Soft Start Time                |   |      | 10        |      | ms            |
| $t_{cd}$              | Crowbar Delay Time             |   |      | 5         |      | $\mu\text{s}$ |
| $V_{cth}$             | Crowbar Intervention Threshold |   |      | 6.37      |      | V             |
| $R_{th}$              | Thermal Resistance             | Case to ambient   |      | 5         |      | °C/W          |



**USER NOTES**

**Input Voltage**

The recommended operating maximum DC input voltage is 40V inclusive of the ripple voltage.

**Case Grounding**

The module case is internally connected to pin 2 and pin 8.

The PCB area below the module can be used as an effective sixth side shield against EMI.

**Thermal Characteristics**

The case-to-ambient thermal resistance of the GS-R51212 module is about 5°C/W. This produces a 50°C temperature increase of the module surface for a 10W of internal power dissipation.

Depending on the ambient temperature and/or on the power dissipation, an additional heatsink or forced ventilation may be required.

**Input Impedance**

The module has an internal capacitor connected between the input pins in order to assure PWM stability. This capacitor cannot handle large values of high frequency ripple current, and it can be permanently damaged if the primary energy source impedance is not adequate.

The use of an external low ESR, high ripple current capacitor located as close to the module as possible is recommended. Suitable capacitors should have a RMS current capability of 2,5 ARMS with a working voltage of 50 VDC and an ESR of 0,1Ω at 100 kHz. When space is a limitation, a 22μF ceramic multilayer capacitor must be connected to the module input pins.

**Module Protection**

The module is protected against occasional and permanent short circuits of the output pins to ground, as well as against output current overload. When the output current at 5V output exceeds the maximum value, the output is automatically disabled. After a fixed time the module starts again in a soft mode. The cycle is repeated until the overload condition is removed.

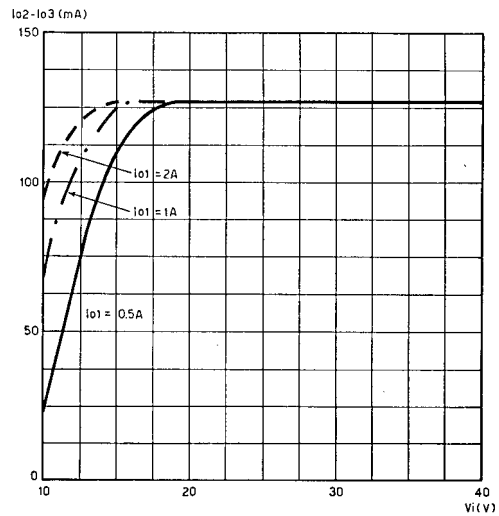
A crow-bar output overvoltage protection is activated when the output voltage on V<sub>o1</sub> exceeds 6.37V.

**Output Current**

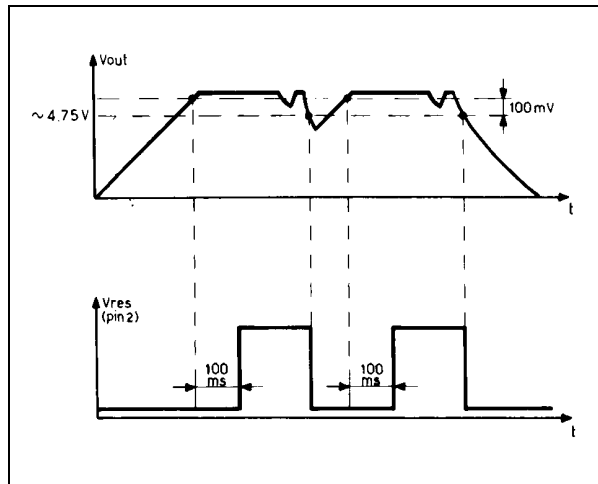
The output current of the main output is 3.5A. The max output current of the two 12V outputs is a function of the input voltage and of the main output current as shown in fig. 1.

If the main current is zero, no voltage will be available on the 12V outputs.

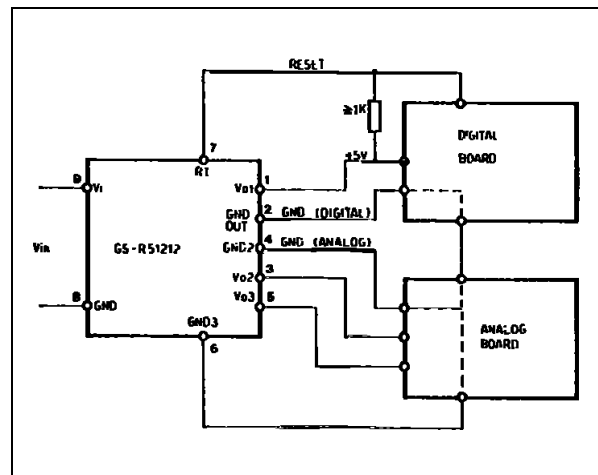
**Figure 1. Output Current Capability vs. Operating Conditions**



**Figure 2. Reset Operation**



**Figure 3. Typical application**



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