SGS-THOMSON MICROELECTRONICS

GS-R51212

TRIPLE OUTPUT SWITCHING VOLTAGE REGULATOR MODULE

- MTBF IN EXCESS OF 200.000 HOURS
- NO EXTERNAL COMPONENTS REQUIRED
- PC CARD OR CHASSIS MOUNTABLE
- HIGH OUTPUT CURRENT (3.5 A on 5 V output)
- HIGH INPUT VOLTAGE (40 V)
- TWO 12 V ; 0.15 A ISOLATED OUTPUTS
- HIGH EFFICIENCY
- SOFT START
- RESET OUTPUT
- NON-LATCHING SHORT CIRCUIT PROTECTION
- THERMAL PROTECTION
- CROW BAR PROTECTION FOR THE LOAD

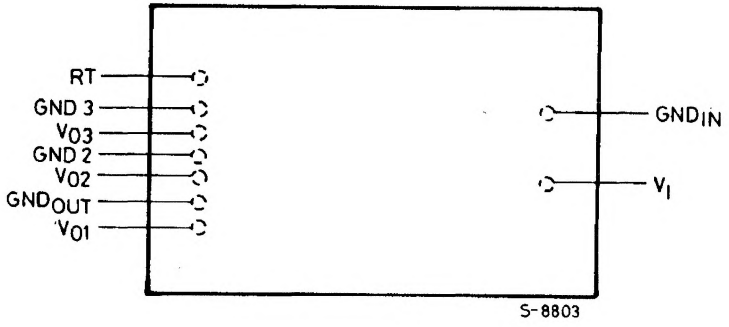
ORDER CODE : GS-R51212

DESCRIPTION

The GS-R51212 is a triple output HIGH CURRENT HIGH VOLTAGE SWITCHING VOLTAGE REGULATOR that provides +5 V and two isolated 12 V outputs.

This step down regulator shielded for EMI, provides local on-card regulation. The very large input voltage range allows flexibility in both professional and industrial applications.

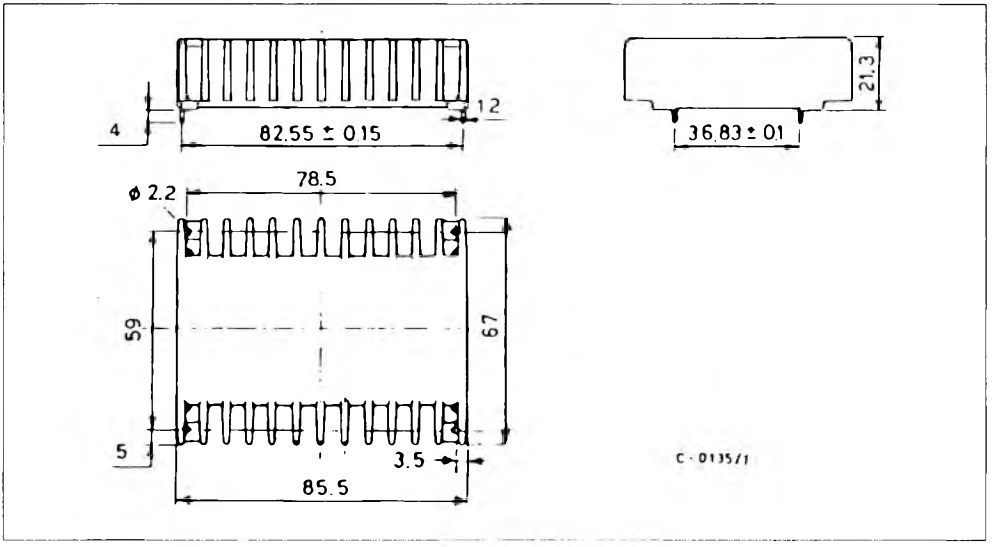
CONNECTION DIAGRAM (top view)



ABSOLUTE MAXIMUM RATINGS

V_i	DC input voltage	40 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

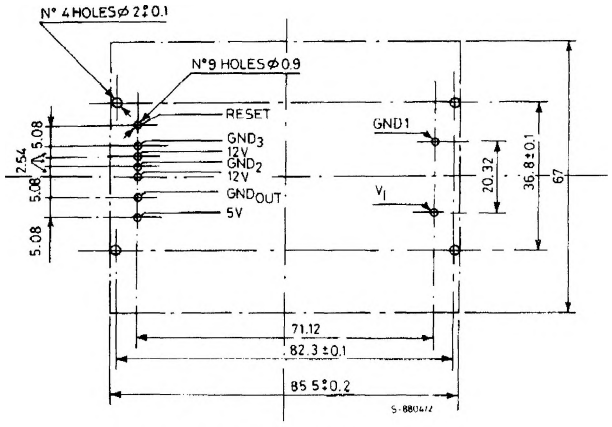
MECHANICAL DATA (dimensions in mm)



PIN FUNCTIONS

PIN		FUNCTION
RT	Reset Output	Reset output is high when output voltage reaches nominal value (5.1 V) and it is generated with a fixed 100 ms delay. A proper resistor (270 Ω min) must be connected between this pin and V_{O1}
V_i	Input Voltage	Unregulated DC voltage input. Maximum voltage must not exceed 40 V.
GND_{IN}	Ground	Common ground for input voltage.
GND_{OUT}	Ground	Common ground of high current path. The case of the module is connected to this pin.
V_{O1}	5 V Output Voltage	Regulated and stabilized DC voltage is available on this pin. Max output current is 3.5 A. The device is protected against short circuit of this pin to ground or to supply.
V_{O2}	12 V Output Voltage	Regulated and stabilized 12 V DC output at 150 mA max. current referred to GND_2. This output can float ± 200 V in respect to GND_{OUT} and GND_3.
GND_2	Ground	Reference ground for V_{O2} output.
V_{O3}	12 V Output Voltage	Regulated and stabilized 12 V DC output at 150 mA max. current referred to GND_3. This output can float ± 200 V in respect to GND_{OUT} and GND_2.
GND_3	Ground	Reference ground for V_{O3} output.

MOTHER BOARD LAYOUT Printed Circuit Drilling (components side).



Printed Circuit Drilling (component side).

ELECTRICAL CHARACTERISTICS (T_{amb} = 25°C unless otherwise specified)

PARAMETER		Test Conditions	Min	Typ	Max	Unit
V_{o1}	Output Voltage	V_i = 24 V I_{o1} = 2.5 A	4.95	5.1	5.2	V
V_{o2}	Output Voltage	V_i = 24 V I_{o2} = 0.1 A *	11.5		12.5	V
V_{o3}	Output Voltage	V_i = 24 V I_{o3} = 0.1 A *	11.5		12.5	V
V_o	Temperature Stability	All Outputs		0.2		mV/°C
V_i	Input Voltage		9.0		40	V
I_{o1}	Output Current	V_i = 24 V	0.5		3.5	A
I_{o2}	Output Current	V_i = 24 V *			.15	A
I_{o3}	Output Current	V_i = 24 V *			.15	A
I_{sc}	Average Input Current	V_i = 40 V V_{out1} = 0 V		0.2		A
I_{sc}	Average Input Current	V_i = 40 V $V_{out1/2/3}$ = 0 V		0.4		A
I_r	Reflected Iin	V_i = 24 V I_{o1} = 2.5 A I_{o2} = 0.1A I_{o3} = 0.1 A		160		mA
f_s	Switching Frequency			100		KHz
η	Efficiency	V_i = 24 V I_{o1} = 2.5 A I_{o2} = 0.1 A I_{o3} = 0.1 A		75		%
ΔV_o	Line Regulation	I_{o1} = 2.5 A V_I = 15 to 25 V I_{o2} = 0.1 A I_{o3} = 0.1 A		2		mV/V
ΔV_o	Load Regulation	V_i = 24 V I_{o1} = .5 to 2.5 A V_i = 24 V I_{o2} = .05 to .1 A V_i = 24 V I_{o3} = .05 to .1 A		20 1 1		mV/A mV/A mV/A
SVR	Supply Rejection	50/60Hz		4		mV/V
V_r	Ripple Voltage	V_i = 24 V I_{o1} = 2.5 A		30		mV
V_n	Noise Voltage	V_i = 24 V I_{o1} = 2.5 A		40		mV
I_{rh}	Reset leakage Current				100	µA
V_{rl}	Reset Low Level	I_{reset} = 5mA		0.2		V
T_{rd}	Reset Delay Time			100		ms
T_{r1}	Line Transient Recovery Time	I_{o1} = 2.5 A V_i = 15 to 35 V		500		µs
T_{r2}	Load Transient Recovery Time	V_i = 24 V I_o = .5 to 2.5 A		200		µs
R_{th}	Thermal Resistance			5		°C/W

* I_{out1} = 0.5 A.

MODULE OPERATION

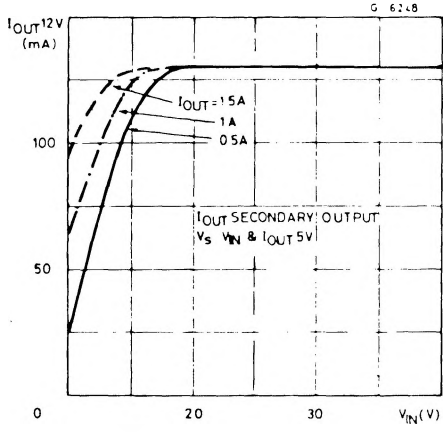
The GS-R51212 is a triple output switching mode voltage regulator.

Unregulated DC input voltage must be higher than nominal output voltage by, at least, 4V. Minimum input voltage is therefore 9 V while maximum input voltage is 40 V.

The main output voltage is 5V and the maximum current delivered is 3.5 A. A minimum output current of 500 mA is required for proper module operation.

The current available on the 12 Volt outputs depends on the current delivered by the main output and the value of the input voltage.

Figure 1 : Current available from 12 V output vs. input voltage and 5 V output current.



To prevent excessive over current at switch on, a soft start function is provided. Nominal output voltage is approached gradually in about 15 ms.

The switching frequency of the module is 100 KHz. To prevent EMI, the module is contained in a metal box that provides shielding and heat-sink.

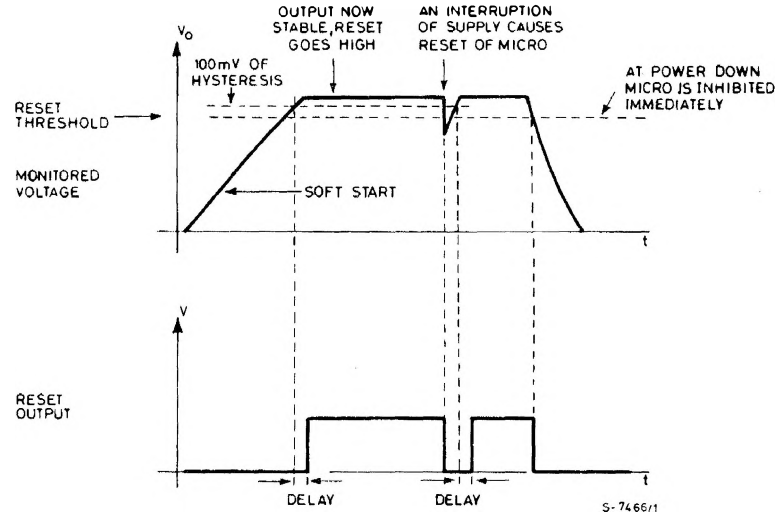
The RESET output is an auxiliary function useful to reset or inhibit microprocessors when the output voltage, at switch on and off, reaches a prefixed value of 4.9 to 5.1 V or when the output voltage, for any reason, drops below nominal value by more than 100 mV. In any case the minimum falling threshold value is 4.75 V or higher and the reset output voltage is generated with a fixed delay of 100 ms.

This is an open collector output to guarantee maximum flexibility.

Time delay of the reset function also rejects wrong information caused by occasional spikes generated during switch on and off.

MODULE OPERATION (continued)

Figure 2 : Reset as a function of output voltage and time.



MODULE PROTECTIONS

Thermal protection

The module has inside a thermal protection. When ambient temperature reaches prohibitive values, so that internal junction temperature to active components reaches 150°C, the module is switched off. Normal operation is restored when internal junction temperature falls below 130°C: this large hysteresis allows an extremely low frequency intermittent operation (ON-OFF) caused by thermal overload

Short circuit protection

The module is protected against occasional and permanent short circuits of the output pins to their respective grounds or against output current overloads.

When the 5 V output current exceed the maximum allowed value for safe operation, the output is automatically disabled. After a fixed time, the module starts again in a soft mode: if the overload is still present, the module switches off and the cycle is repeated until the overload condition is removed. The average overload current is limited to a safe value for the module itself. Input current during output short circuit is always lower than in regular operation.

Load protection

The module protects, by a crow bar circuit, the load connected to the 5 V output against overvoltages. This circuit senses continuously the output voltage: if, for any reason, the output voltage of the module exceeds 6 V, the crow bar protection is activated and it short circuits the output pin to ground.

THERMAL DATA

The thermal resistance module to ambient is about 5°C/W. This means that if the internal power dissipation is 10 W, the temperature of the module surface is about 50°C over ambient temperature. According to ambient temperature and/or to power dissipation, an additional heat-sink may be required. Four holes are provided on the metal box of the module to allow this mounting of this optional external heat-sink.

TYPICAL APPLICATION

The high input voltage range allows both cost saving on 50/60 Hz transformer when the module is supplied from the main and the possibility to supply the module with batteries that, according to their charge status, can show large spread on voltage.

The module has, internally, an input filtering capacitor between pin V_I and GND_1. At a high switching frequency the equivalent input circuit is as shown in Fig. 2.

Since I_I is a high frequency alternating current, the inductance associated to long input connecting wire can cause a voltage ripple on point. V_I that produces a ripple current across internal capacitor and a power dissipation on r.

When very long connecting wires are used, the input capacitor may be damaged by this power dissipation. For this reason it is suggested to keep input connecting wires as short as possible.

Figure 3 : Equivalent input circuit of GS-R51212 voltage regulator.

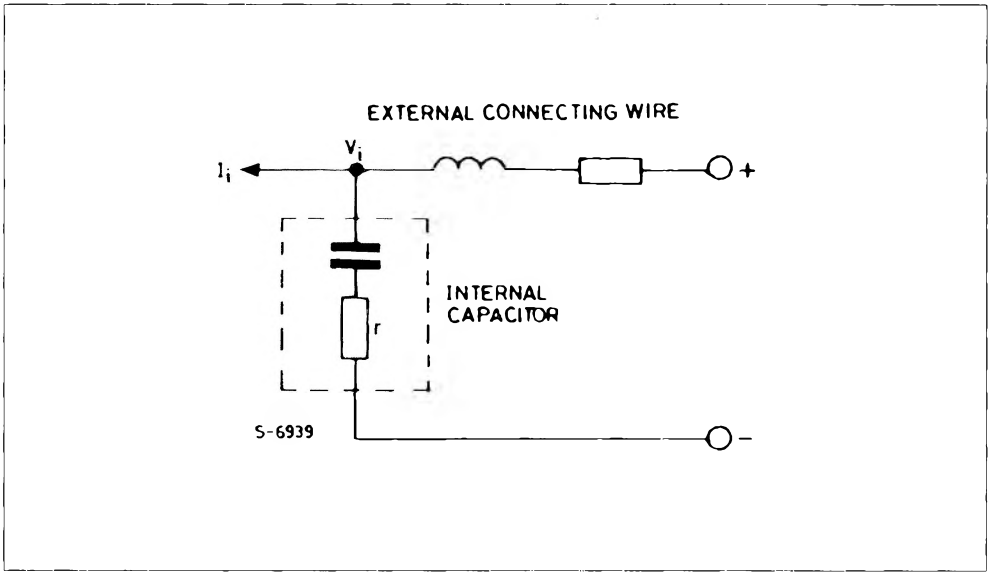
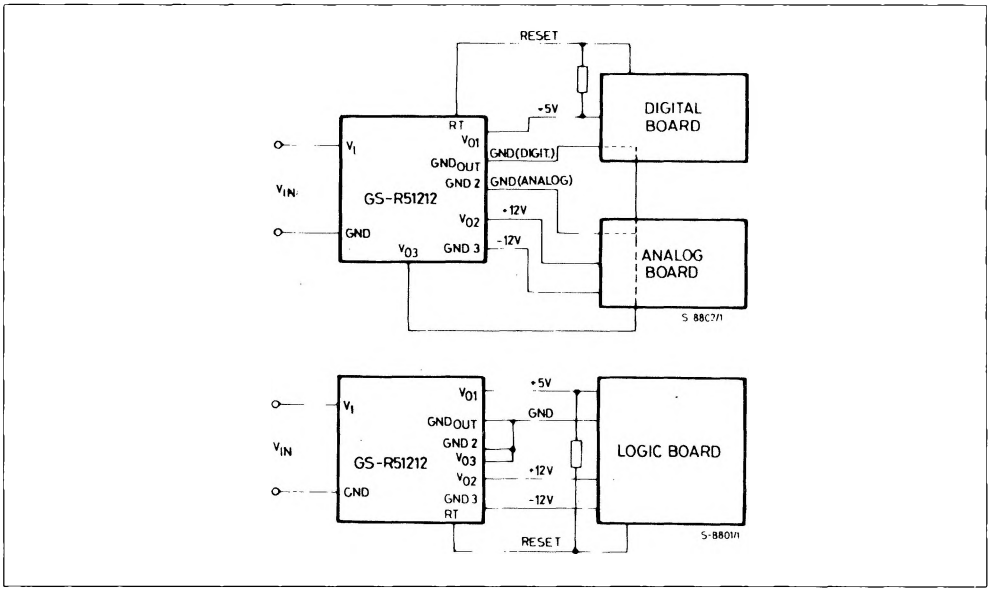


Figure 4 : GS-R51212 typical applications.



EFFICIENCY VS. INPUT VOLTAGE