SGS-THOMSON MICROELECTRONICS

# L4901A

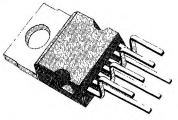
## DUAL 5V REGULATOR WITH RESET

**PRELIMINARY DATA**

- OUTPUT CURRENTS: $I_{01}$ = 400mA, $I_{02}$ = 400mA
- FIXED PRECISION OUTPUT VOLTAGE 5V ± 2%
- RESET FUNCTION CONTROLLED BY INPUT VOLTAGE AND OUTPUT 1 VOLTAGE
- RESET FUNCTION EXTERNALLY PROGRAMMABLE TIMING
- RESET OUTPUT LEVEL RELATED TO OUTPUT 2
- OUTPUT 2 INTERNALLY SWITCHED WITH ACTIVE DISCHARGING
- LOW LEAKAGE CURRENT, LESS THAN 1μA AT OUTPUT 1
- LOW QUIESCENT CURRENT (INPUT 1)
- INPUT OVERVOLTAGE PROTECTION UP TO 60V
- RESET OUTPUT HIGH
- OUTPUT TRANSISTORS SOA PROTECTION
- SHORT CIRCUIT AND THERMAL OVERLOAD PROTECTION

The L4901A is a monolithic low drop dual 5V regulator designed mainly for supplying microprocessor systems.

Reset and data save functions during switch on/off can be realized.



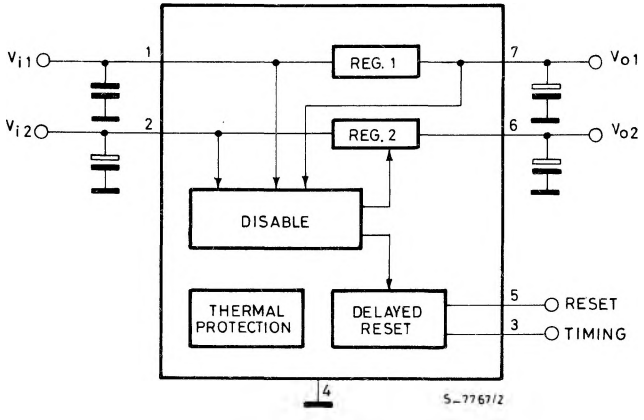
**Heptawatt**

**ORDERING NUMBER:** L4901A

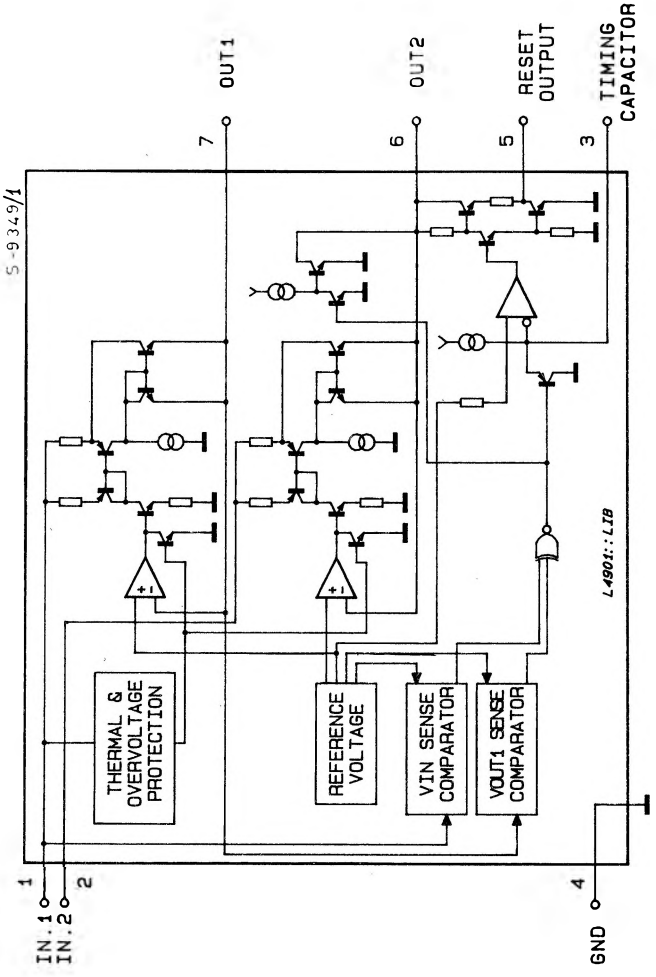
### ABSOLUTE MAXIMUM RATINGS

| | | | |
|---|---|---|---|
| $V_{IN}$ | DC input voltage | 24 | V |
| | Transient input overvoltage (t = 40 ms) | 60 | V |
| $I_o$ | Output current | internally limited | |
| $T_j$ | Storage and junction temperature | -40 to 150 | °C |

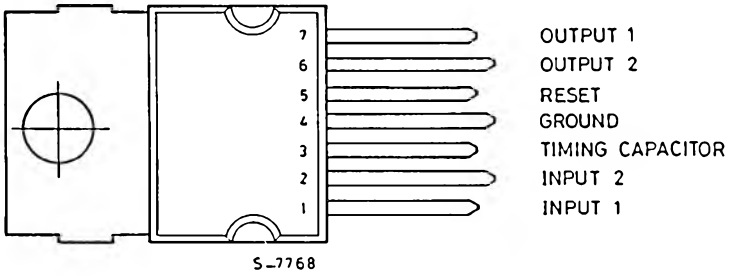
### BLOCK DIAGRAM



## SCHEMATIC DIAGRAM



## CONNECTION DIAGRAM
(Top view)



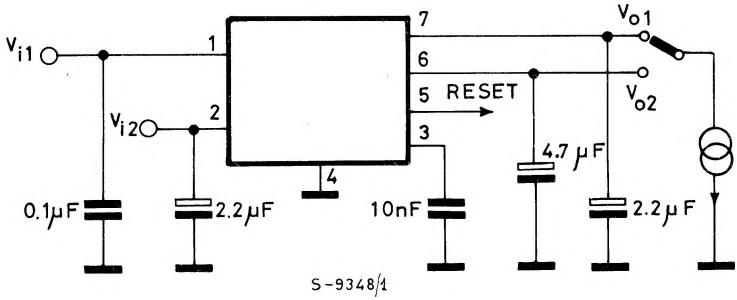

## PIN FUNCTIONS

| N° | NAME | FUNCTION |
|---|---|---|
| 1 | INPUT 1 | Low quiescent current 400mA regulator input. |
| 2 | INPUT 2 | 400mA regulator input. |
| 3 | TIMING CAPACITOR | If Reg. 2 is switched-ON the delay capacitor is charged with a 10μA constant current. When Reg. 2 is switched-OFF the delay capacitor is discharged. |
| 4 | GND | Common ground. |
| 5 | RESET OUTPUT | When pin 3 reaches 5V the reset output is switched high. Therefore $t_{RD} = C_t \left( \frac{5V}{10\mu A} \right)$; $t_{RD}$ (ms) = $C_t$ (nF) |
| 6 | OUTPUT 2 | 5V - 400mA regulator output. Enabled if $V_O 1 > V_{RT}$ and $V_{IN2} > V_{IT}$. If Reg. 2 is switched-OFF the $C_{02}$ capacitor is discharged. |
| 7 | OUTPUT 1 | 5V - 400mA regulator output with low leakage (in switch-OFF condition). |

## THERMAL DATA

| | | | | |
|---|---|---|---|---|
| $R_{th\ j\text{-}case}$ | Thermal resistance junction-case | max | 4 | °C/W |

## TEST CIRCUIT




## ELECTRICAL CHARACTERISTICS ($V_{IN1} = V_{IN2} = 14,4V$, $T_{amb} = 25°C$ unless otherwise specified)

| Parameter | | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_i$ | DC operating input voltage | | | | 20 | V |
| $V_{01}$ | Output voltage 1 | R load 1KΩ | 4,95 | 5.05 | 5.15 | V |
| $V_{02H}$ | Output voltage 2 HIGH | R load 1KΩ | $V_{01}$-0.1 | 5 | $V_{01}$ | V |
| $V_{02L}$ | Output voltage 2 LOW | $I_{02}$ = -5mA | | 0.1 | | V |
| $I_{01}$ | Output current 1 | $\Delta V_{01}$ = -100mV | 400 | | | mA |
| $I_{LO1}$ | Leakage output 1 current | $V_{IN}$ = 0<br>$V_{01} \leq 3V$ | | | 1 | µA |
| $I_{02}$ | Output current 2 | $\Delta V_{02}$ = -100mV | 400 | | | mA |
| $V_{i01}$ | Output 1 dropout voltage (*) | $I_{01}$ = 10mA<br>$I_{01}$ = 100mA<br>$I_{01}$ = 300mA | | 0.7<br>0.8<br>1.1 | 0,8<br>1<br>1.4 | V<br>V<br>V |
| $V_{IT}$ | Input threshold voltage | | $V_{01}$+1.2 | 6.4 | $V_{01}$+1.7 | V |
| $V_{ITH}$ | Input threshold voltage hyst. | | | 250 | | mV |
| $\Delta V_{01}$ | Line regulation 1 | 7V < $V_{IN}$ < 18V<br>$I_{01}$ = 5mA | | 5 | 50 | mV |
| $\Delta V_{02}$ | Line regulation 2 | $I_{02}$ = 5mA | | 5 | 50 | mV |
| $\Delta V_{01}$ | Load regulation 1 | 5mA < $I_{01}$ < 400mA | | 50 | 100 | mV |
| $\Delta V_{02}$ | Load regulation 2 | 5mA < $I_{02}$ < 400mA | | 50 | 100 | mV |
| $I_Q$ | Quiescent current | 0 < $V_{IN}$ < 13V<br>7V < $V_{IN}$ < 13V<br>$I_{02}$ = $I_{01} \leq$ 5mA | | 4.5<br>1.6 | 6.5<br>3.5 | mA<br>mA |
| $I_{Q1}$ | Quiescent current 1 | 6.3V < $V_{IN1}$ < 13V<br>$V_{IN2}$ = 0<br>$I_{01} \leq$ 5mA $I_{02}$ = 0 | | 0.6 | 0.9 | mA |

## ELECTRICAL CHARACTERISTICS (continued)

| Parameter | | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{RT}$ | Reset threshold voltage | | $V_{02}$-0.15 | 4.9 | $V_{02}$-0.05 | V |
| $V_{RTH}$ | Reset threshold hysteresis | | 30 | 50 | 80 | mV |
| $V_{RH}$ | Reset output voltage HIGH | $I_R$ = 500μA | $V_{02}$-1 | 4.12 | $V_{02}$ | V |
| $V_{RL}$ | Reset output voltage LOW | $I_R$ = -5mA | | 0.25 | 0.4 | V |
| $t_{RD}$ | Reset pulse delay | $C_t$ = 10nF | 3 | 5 | 11 | ms |
| $t_d$ | Timing capacitor discharge time | $C_t$ = 10nF | | | 20 | μs |
| $\frac{\Delta V_{01}}{\Delta T}$ | Thermal drift | -20°C ⩽ $T_{amb}$ ⩽ 125°C | | 0.3<br>-0.8 | | mV/°C |
| $\frac{\Delta V_{02}}{\Delta T}$ | Thermal drift | -20°C ⩽ $T_{amb}$ ⩽ 125°C | | 0.3<br>-0.8 | | mV/°C |
| SVR1 | Supply voltage rejection | f = 100Hz $V_R$ = 0.5V $I_o$ = 100mA | 50 | 84 | | dB |
| SVR2 | Supply voltage rejection | | 50 | 80 | | dB |
| $T_{JSD}$ | Thermal shut down | | | 150 | | °C |

* The dropout voltage is defined as the difference between the input and the output voltage when the output voltage is lowered of 25mV under constant output current condition.

## APPLICATION INFORMATION

In power supplies for μP systems it is necessary to provide power continuously to avoid loss of information in memories and in time of day clocks, or to save data when the primary supply is removed. The L4901A makes it very easy to supply such equipments; it provides two voltage regulators (both 5V high precision) with separate inputs plus a reset output for the data save function.

### CIRCUIT OPERATION (see Fig. 1)

After switch on Reg. 1 saturates until $V_{01}$ rises to the nominal value.

When the input 2 reaches $V_{IT}$ and the output 1 is higher than $V_{RT}$ the output 2 ($V_{02}$) switches on and the reset output ($V_R$) also goes high after a programmable time $T_{RD}$ (timing capacitor).

$V_{02}$ and $V_R$ are switched together at low level when one of the following conditions occurs:

- an input overvoltage
- an overload on the output 1 ($V_{01} < V_{RT}$);
- a switch off ($V_{IN} < V_{IT} - V_{ITH}$);

and they start again as before when the condition is removed.

An overload on output 2 does not switch Reg. 2, and does not influence Reg. 1.

The $V_{01}$ output features:

- 5V internal reference without voltage divider between the output and the error comparator;
- very low drop series regulator element utilizing current mirrors;

permit high output impedance and then very low leakage current error even in power down condition.

This output may therefore be used to supply circuits continuously, such as volatile RAMs, allowing the use of a back-up battery. The $V_{01}$

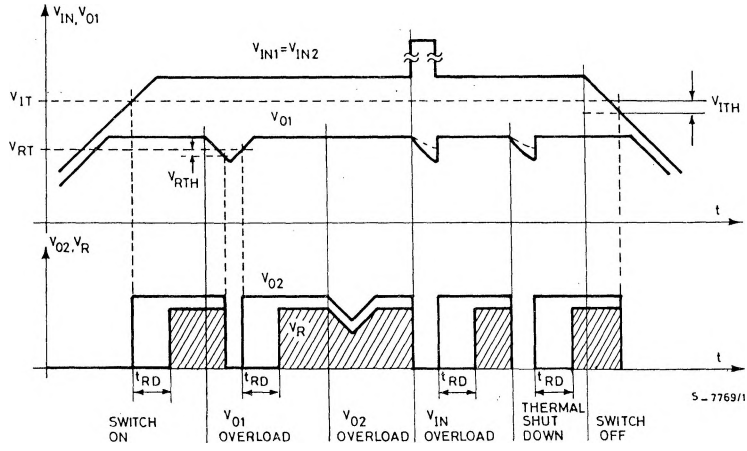
## CIRCUIT OPERATION (continued)

regulator also features low consumption (0.6mA typ.) to minimize battery drain in applications where the $V_1$ regulator is permanently connected to a battery supply.

The $V_{02}$ output can supply other non essential 5V circuits wich may be powered down when the system is inactive, or that must be powered down to prevent uncorrect operation for supply voltages below the minimum value.

The reset output can be used as a "POWER DOWN INTERRUPT", permitting RAM access only in correct power conditions, or as a "BACK-UP ENABLE" to transfer data into in a NV SHADOW MEMORY when the supply is interrupted.

Fig. 1




## APPLICATION SUGGESTIONS

Fig. 2 shows an application circuit for a $\mu$P system typically used in trip computers or in car radios with programmable tuning.

Reg. 1 is permanently connected to a battery and supplies a CMOS time-of-day clock and a CMOS microcomputer chip with volatile memory.

Reg. 2 may be switched OFF when the system is inactive.

Fig. 4 shows the L4901A with a back up battery on the $V_{01}$ output to maintain a CMOS time-of-day clock and a stand by type N-MOS $\mu$P. The reset output makes sure that the RAM is forced into the low consumption stand by state, so the access to memory is inhibit and the back up battery voltage cannot drop so low that memory contents are corrupted.

In this case the main on-off switch disconnects both regulators from the supply battery.

The L4901A is also ideal for microcomputer systems using battery backup CMOS static RAMs. As shown in fig. 5 the reset output is used both to disable the $\mu$P and, through the address decoder M74HC138, to ensure that the RAMS are disabled as soon as the main supply starts to fall.

Another interesting application of the L4901A is in $\mu$P system with shadow memories. (see fig. 6)

When the input voltage goes below $V_{IT}$, the reset output enables the execution of a routine that saves the machine's state in the shadow RAM (xicor x 2201 for example).

Thanks to the low consumption of the Reg. 1 a 680$\mu$F capacitor on its input is sufficient to provide enough energy to complete the operation. The diode on the input guarantees the supply of the equipment even if a short circuit on $V_1$ occurs.

## APPLICATION SUGGESTION (continued)

Fig. 2

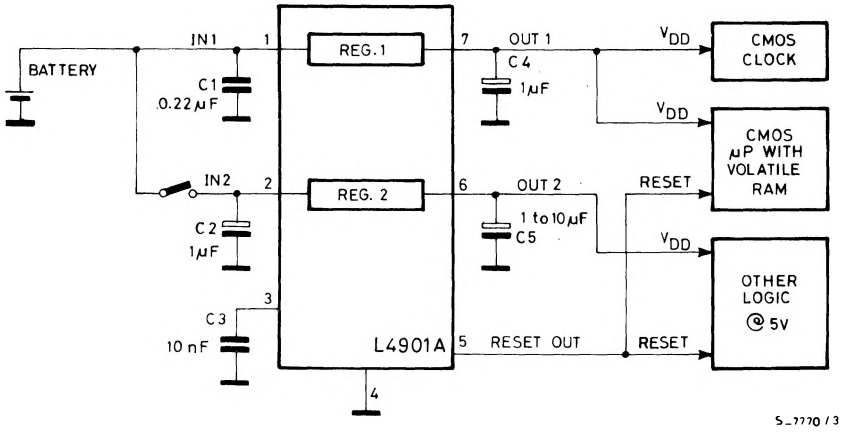
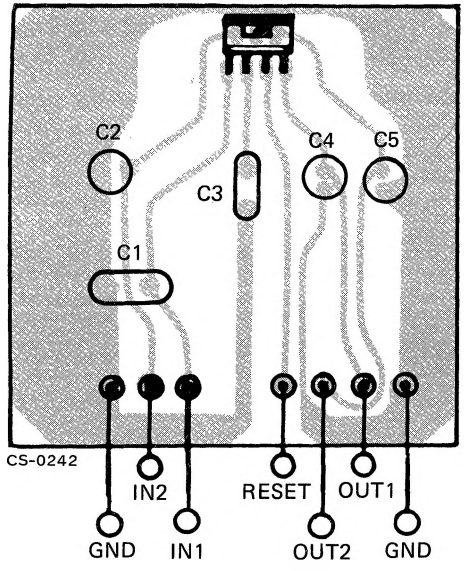



Fig. 3 - P.C. board component layout of fig. 2 (1 : 1 scale)



## APPLICATION SUGGESTION (continued)

Fig. 4

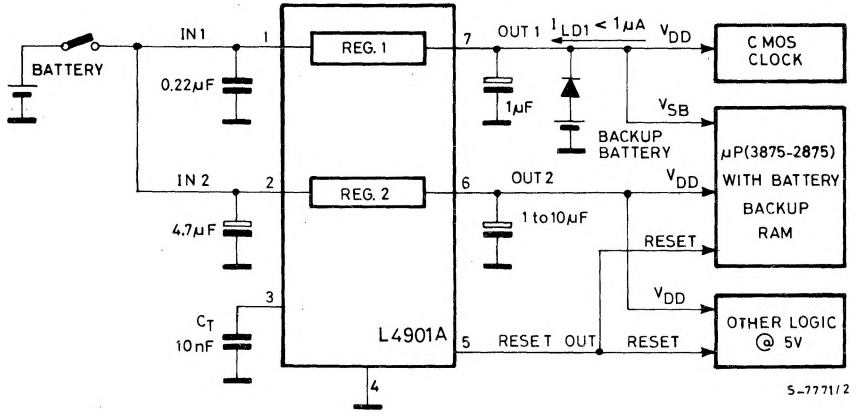
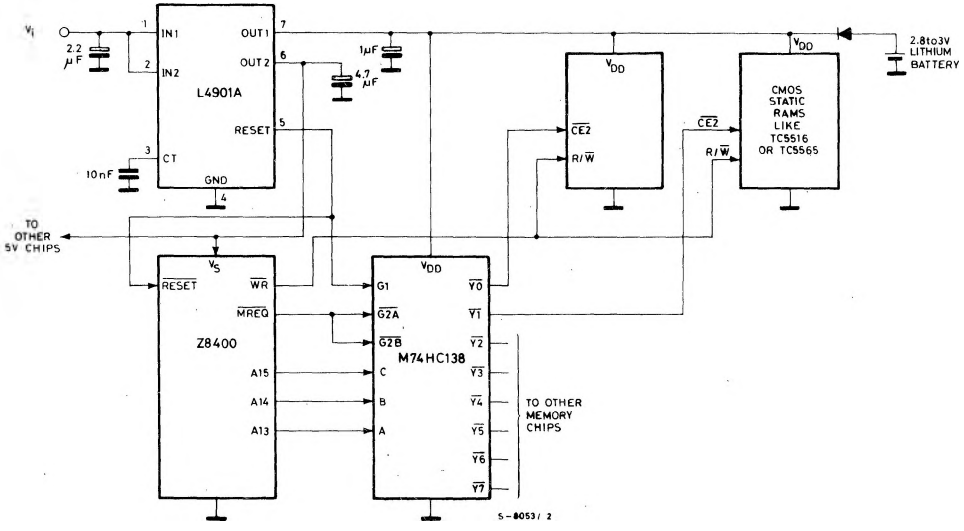



Fig. 5



## APPLICATION SUGGESTION (continued)

Fig. 6

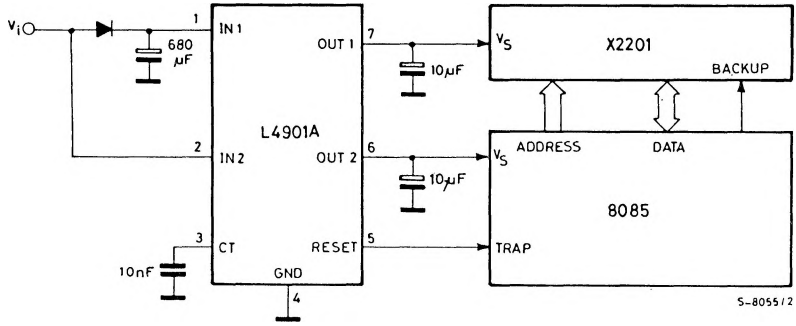



Fig. 7 - Quiescent current (Reg. 1) vs. output current

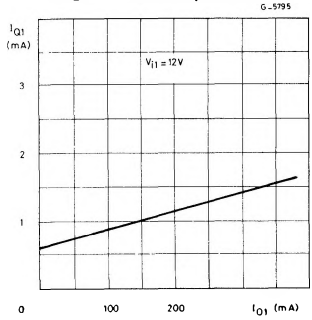



Fig. 8 - Quiescent current (Reg. 1) vs. input voltage

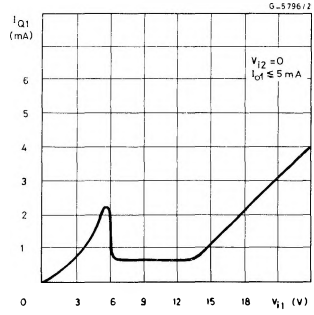



Fig. 9 - Total quiescent current vs. input voltage

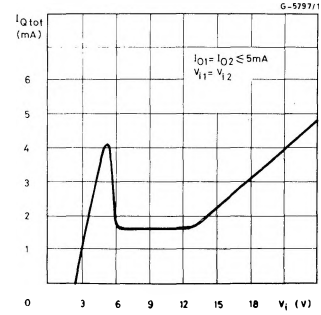



Fig. 10 - Regulator 1 output current and short circuit current vs. input voltage

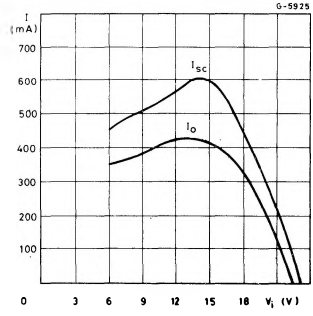



Fig. 11 - Regulator 2 output current and short circuit current vs. input voltage

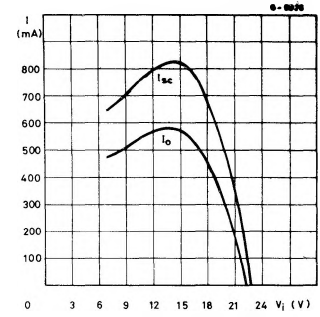



Fig. 12 - Supply voltage rejection regulators 1 and 2 vs. input ripple frequence