



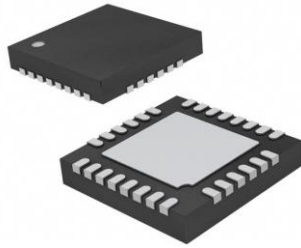
## Serial Controlled, 16-Channel SPCO Switch

### FEATURES

- ◆ 16 individually serial controlled SPCO switches
- ◆ SPI-compatible serial interface
- ◆ multiple devices can be daisy chained
- ◆ compact 28-Pin package: QFN-28

### Applications

- Electronic music
- Instrumentation
- Signal Routing
- Audio commutation
- Data Acquisition and Process Control



**QFN-28 5x5 mm 0,5 mm**

### General Description

The AS16M1 analog switch with serial digital interface offers 16 individually controlled single-pole-change-over (SPCO) switches. All switches conduct equally in either direction and on-resistance (170 Ω) is constant over the analog signal range.

These CMOS switches can operate continuously with power supply +5V and switch input currents in any combination to output node (summing) or ground them.

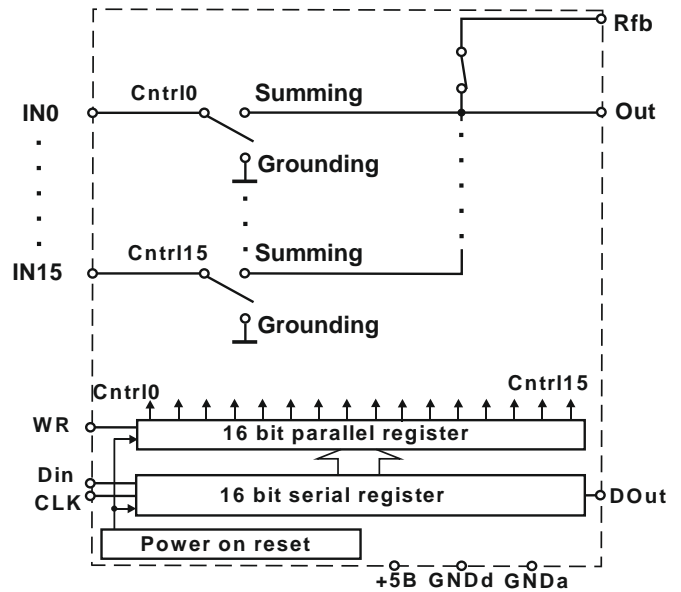
Upon power-up, all summing switches are off, grounding switches are on and the internal serial and parallel shift registers are reset to zero.

The AS16M1 is controlled by a serial interface. The interface is compatible with the SPI interface standard.

### Absolute Maximum Ratings

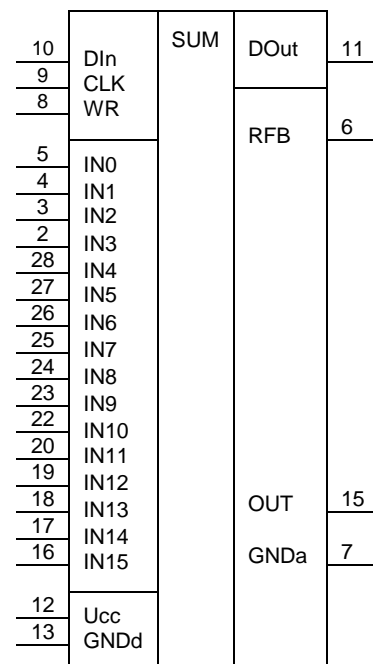
|  |                 |
|--|-----------------|
| Ucc to GND                               | -0,3V to +6V    |
| Power Dissipation                        | 50mW            |
| Current through summing/grounding switch | -1mA to +2 mA   |
| Current through Rfb                      | -1mA to +2mA    |
| URfb                                     | -0,3V to +0,3V  |
| Operating Temperature Range AS16M1       | - 40°C to 85°C  |
| Maximum Junction Temperature             | 150°C           |
| Storage Temperature Range                | - 65°C to 150°C |

### Block Diagram



### Pin Information

| Pin on package | Function | Pin on package | Function |
|----------------|----------|----------------|----------|
| 1, 14, 21      | NC       | 15             | OUT      |
| 2              | IN3      | 16             | IN15     |
| 3              | IN2      | 17             | IN14     |
| 4              | IN1      | 18             | IN13     |
| 5              | IN0      | 19             | IN12     |
| 6              | RFB      | 20             | IN11     |
| 7              | GNDa     | 22             | IN10     |
| 8              | WR       | 23             | IN9      |
| 9              | CLK      | 24             | IN8      |
| 10             | DIn      | 25             | IN7      |
| 11             | DOut     | 26             | IN6      |
| 12             | Ucc      | 27             | IN5      |
| 13             | GNDd     | 28             | IN4      |





**DC ELECTRICAL CHARACTERISTICS**

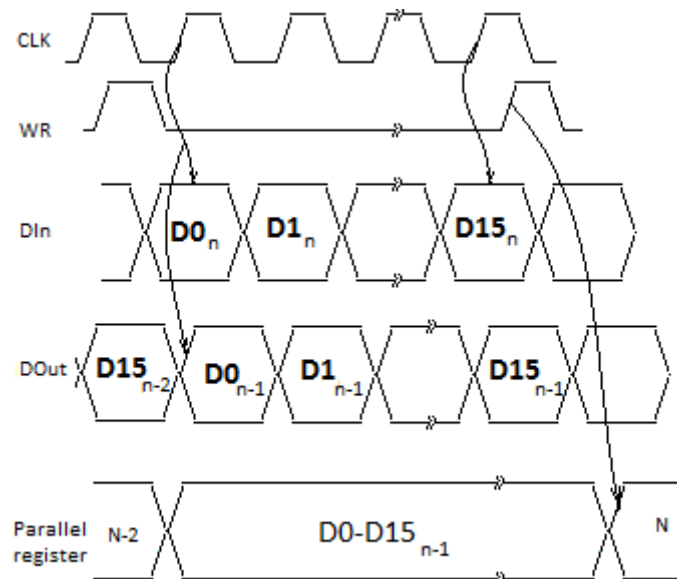
U<sub>cc</sub>= +5V. Typical values are at T<sub>A</sub> = +25°C

| PARAMETER  | SYMBOL              | CONDITIONS  | MIN                 | TYP | MAX                | UNITS |
|--|---------------------|---|---------------------|-----|--------------------|-------|
| <b>SWITCH</b>  |                     |   |                     |     |                    |       |
| Input Analog Signal Range                            | I <sub>ANALOG</sub> | U <sub>cc</sub> =5V, U <sub>IN</sub> =5V                              | -1                  |     | +2                 | mA    |
| Resistance of summing switch                         | R <sub>SUM</sub>    | U <sub>cc</sub> =5V, I <sub>SUM</sub> =1 mA                           |                     | 100 | 150                | Ohm   |
| Current through summing switch                       | I <sub>SUM</sub>    | U <sub>cc</sub> =5V, U <sub>IN</sub> =5V                              | -1 <sup>2)</sup>    |     | +2 <sup>2)</sup>   | mA    |
| Resistance of grounding switch                       | R <sub>GROUND</sub> | U <sub>cc</sub> =5V, I <sub>GROUND</sub> =1 mA                        |                     | 200 | 250                | Ohm   |
| Current through grounding switch                     | I <sub>GROUND</sub> | U <sub>cc</sub> =5V, U <sub>IN</sub> =5V                              | -1 <sup>2)</sup>    |     | +2 <sup>2)</sup>   | mA    |
| Current through R <sub>fb</sub>                      | I <sub>RFB</sub>    | U <sub>cc</sub> =5V, U <sub>IN</sub> =5V                              | -1 <sup>2)</sup>    |     | +2 <sup>2)</sup>   | mA    |
| <b>DIGITAL I/O</b>                                   |                     |   |                     |     |                    |       |
| D <sub>in</sub> , CLK, WR Input Logic Threshold High | U <sub>IH</sub>     |   | 2/3 U <sub>cc</sub> |     |                    | V     |
| D <sub>in</sub> , CLK, WR Input LogicThreshold Low   | U <sub>IL</sub>     |   |                     |     | 1/3U <sub>cc</sub> | V     |
| OUT Output Voltage Logic High                        | U <sub>DOUT</sub>   | I <sub>DOUT</sub> = 0,8mA   | 3,5                 |     | U <sub>cc</sub>    | V     |
| OUT Output Voltage Logic Low                         | U <sub>DOUT</sub>   | I <sub>DOUT</sub> = -1,6mA  |                     |     | 0,4                | V     |
| U <sub>L</sub> RESET Voltage                         | U <sub>LL</sub>     | (Note 1)  | TBD                 |     |                    | V     |
| U <sub>h</sub> RESET Voltage                         | U <sub>LH</sub>     |   |                     |     | TBD                | V     |
| <b>SWITCH DYNAMIC CHARACTERISTICS</b>                |                     |   |                     |     |                    |       |
| Turn-On Time   | t <sub>ON</sub>     | From rising edge of WR  |                     |     | 400                | ns    |
| Turn-Off Time  | t <sub>OFF</sub>    | From rising edge of WR  |                     |     | 400                | ns    |
| Maximum frequency                                    | F <sub>clk</sub>    |   |                     |     | 20                 | MHz   |
| <b>POWER SUPPLIES</b>                                |                     |   |                     |     |                    |       |
| Power-Supply Voltage Range                           | U <sub>cc</sub>     |   | 4,5                 |     | 5,2                | V     |
| U <sub>cc</sub> Supply Current                       | I <sub>cc</sub>     | U <sub>IL</sub> / U <sub>IH</sub> (D <sub>in</sub> , CLK, WR) = 0V/5V |                     |     | 1                  | mA    |

**Note 1:** When U<sub>L</sub> falls below this voltage internal shift and parallel registers are cleared (all zero), summing switches closed and grounding switches are open.

**Note 2:** Sum of all currents trough Input must not exceed limitation for Current through R<sub>fb</sub> limitation.

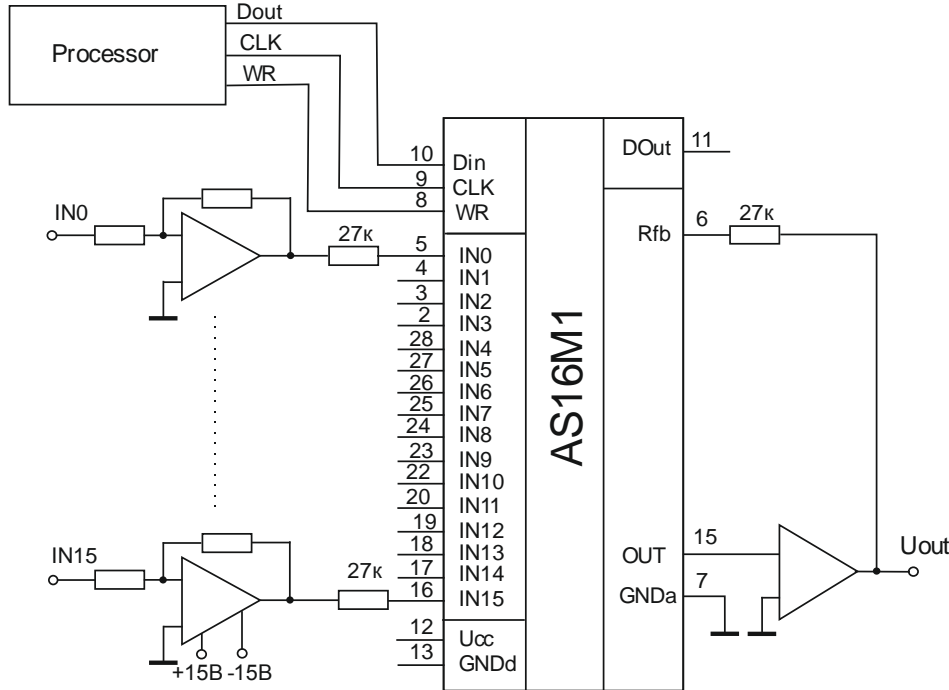
**Timing Diagram**



**Application examples:**

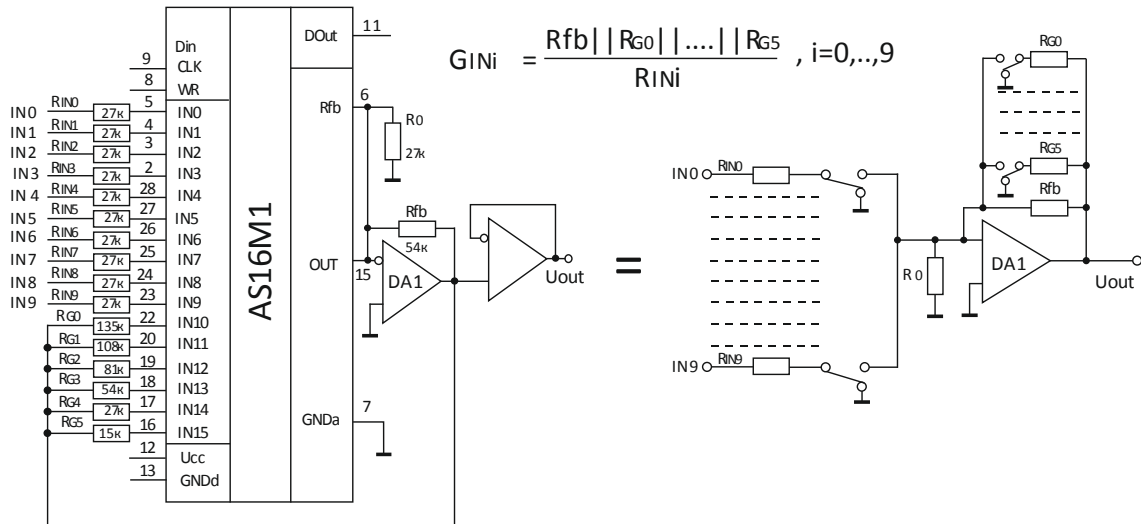
**1. Summing and amplification of signals:**

$$U_{out} = \sum_{i=0}^{15} (K_i \cdot IN_i); K_i = 0,1; i=0,\dots,15$$



**2. Summing and programmable gain of signals:**

$$U_{out} = \sum_{i=0}^9 (K_i \cdot G_{INi} \cdot IN_i); K_i = 0,1; i=0,\dots,9$$



Example - summing of any combination of signals IN0-IN9 with programmable gain.

Programmable gain is determined by Rx (input resistor) for any input and by feedback resistor which is formed from parallel connection of Rfb and connected in parallel any combination of resistors RG0-RG5 (64 combinations - levels of gain).

Resistor R0 is required to provide a zero signal when all inputs are disconnected.

Note: grounding of RGx will increase load current for operational amplifier.



Package Information

QFN-28 5x5 mm 0,5 mm

