

# FAN8002D2

## 2-Channel Motor Drive

### Features

- 2-Channel BTL driver with mute circuit
- Built-in 2-regulator
- Built-in 2-comparator
- Built-in thermal shutdown circuit
- Built-in mute circuit
- Built-in switch circuit
- Built-in OP-AMP circuit
- Operating supply voltage: 4.5~13.2V
- Corresponds to 3.6V DSP

### Description

The FAN8002D is a monolithic integrated circuit, suitable for a 2-ch motor driver which drives the focus actuator, tracking actuator.

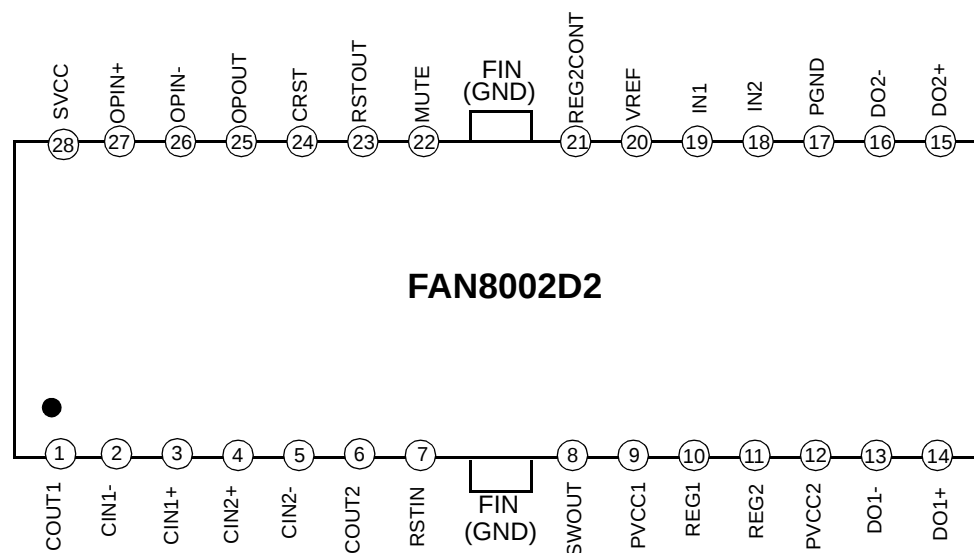
28-SSOPH-300



### Ordering Information

| Device     | Package      | Operating Temperature |
|------------|--------------|-----------------------|
| FAN8002D2  | 28-SSOPH-300 | -35°C ~ 85°C          |
| FAN800D2TF | 28-SSOPH-300 | -35°C ~ 85°C          |

## Pin Assignments



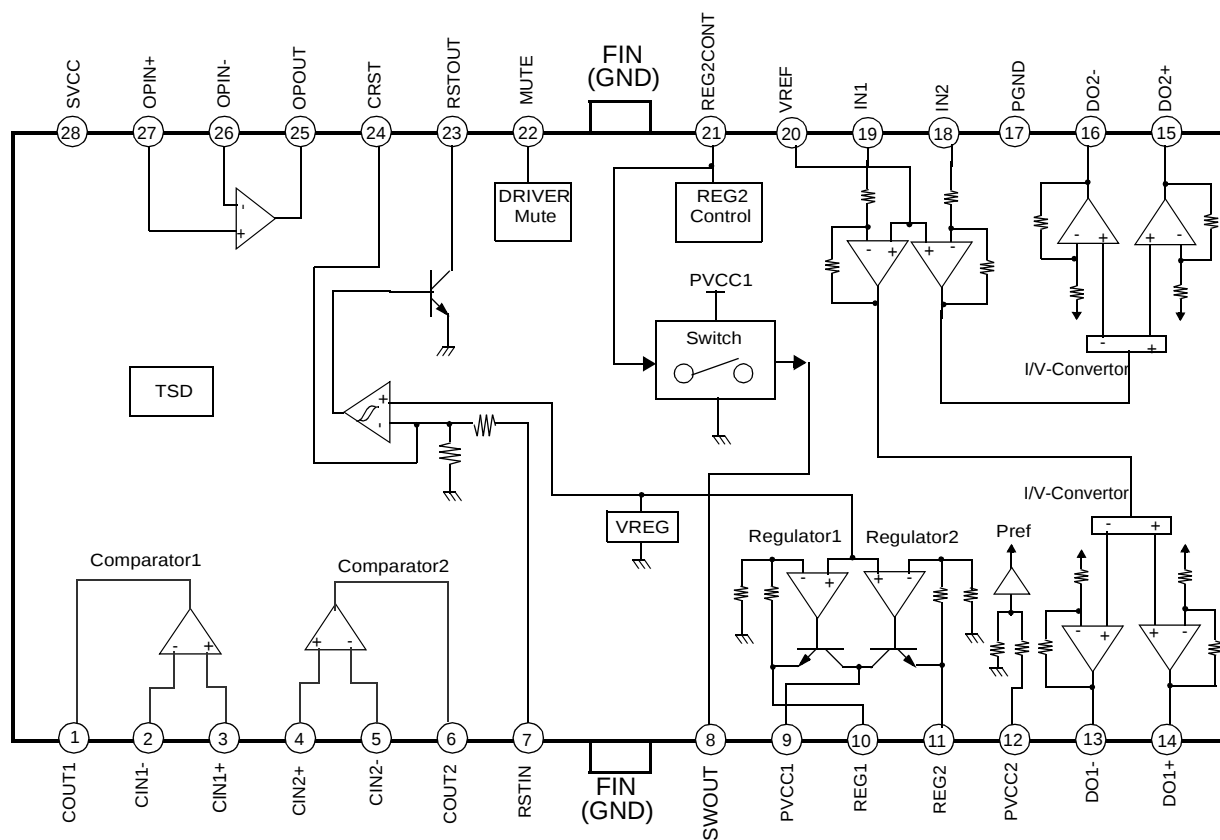
## Pin Definitions

| Pin Number | Pin Name  | I/O | Pin Function Description                  |
|------------|-----------|-----|-------------------------------------------|
| 1          | COUT1     | O   | Comparator1 Output                        |
| 2          | CIN1-     | I   | Comparator1 (-) Input                     |
| 3          | CIN1+     | I   | Comparator1 (+) Input                     |
| 4          | CIN2+     | I   | Comparator2 (+) Input                     |
| 5          | CIN2-     | I   | Comparator2 (-) Input                     |
| 6          | COUT2     | O   | Comparator2 Output                        |
| 7          | RSTIN     | I   | Reset Input                               |
| 8          | SWOUT     | O   | Switch Output                             |
| 9          | PVCC1     | -   | Power Supply1 (Reg,switch Part)           |
| 10         | REG1      | O   | Regulator1 Output                         |
| 11         | REG2      | O   | Regulator2 Output                         |
| 12         | PVCC2     | -   | Power Supply 2 ( Drive Power Output Part) |
| 13         | DO1-      | O   | Drive1 Output (-)                         |
| 14         | DO1+      | O   | Drive1 Output (+)                         |
| 15         | DO2+      | O   | Drive1 Output (+)                         |
| 16         | DO2-      | O   | Drive1 Output (-)                         |
| 17         | PGND      | -   | Power Ground                              |
| 18         | IN2       | I   | CH2 Drive Input                           |
| 19         | IN1       | I   | CH1 Drive Input                           |
| 20         | VREF      | I   | Reference Voltage                         |
| 21         | REG2 CONT | I   | Regulator2 On/off Control                 |
| 22         | MUTE      | I   | Drive Mute                                |

## Pin Definitions (Continued)

| Pin Number | Pin Name | I/O | Pin Function Description                                    |
|------------|----------|-----|-------------------------------------------------------------|
| 23         | RSTOUT   | O   | Reset Output                                                |
| 24         | CRST     | -   | Reset Capacitor                                             |
| 25         | OPOUT    | -   | Opamp Output                                                |
| 26         | OPIN -   | -   | Opamp Input -                                               |
| 27         | OPIN +   | -   | Opamp Input +                                               |
| 28         | SVCC     | -   | Signal Supply (Comparator, Reset, Opamp Drive Pre-amp Part) |

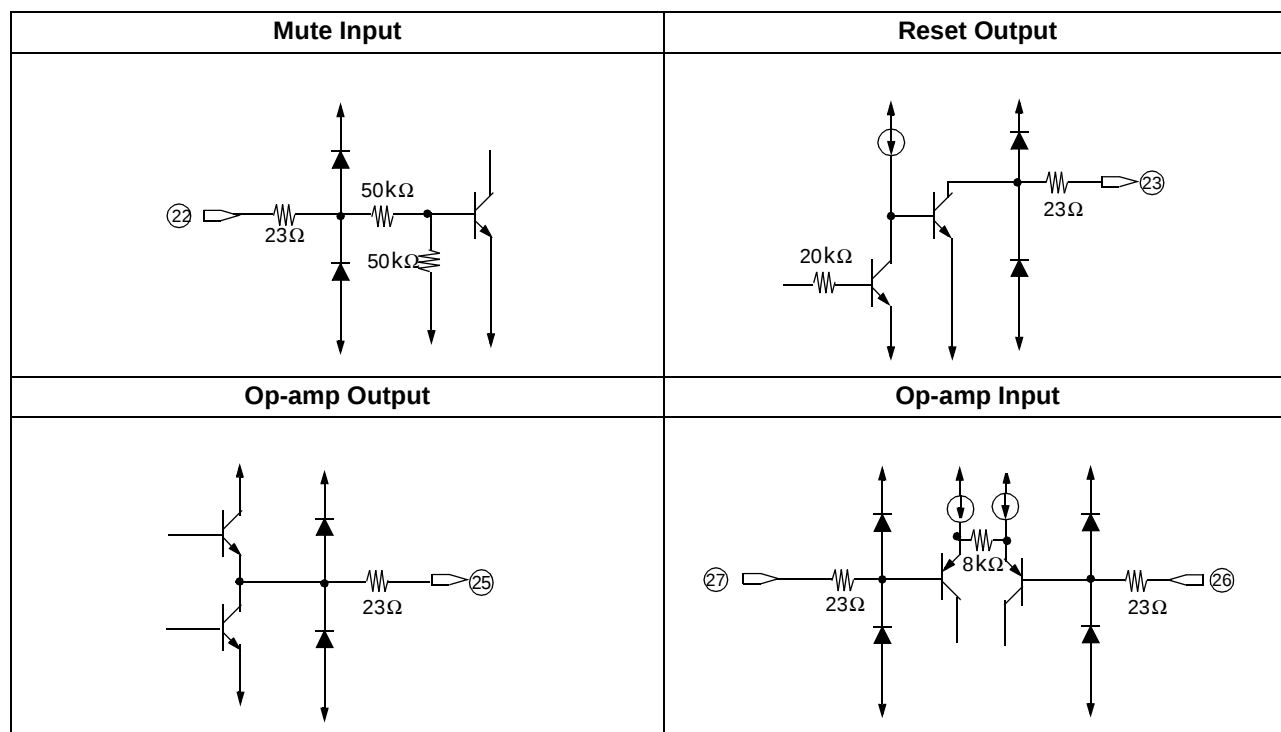
## Block Diagram



## Equivalent Circuits

| Comparator Output             | Comparator Input            |
|-------------------------------|-----------------------------|
|                               |                             |
| Reset Input & Reset Capacitor | Switch Output               |
|                               |                             |
| Regulator Output              | Btl Driver Output           |
|                               |                             |
| Vref & Btl Driver Input       | Reg2 & Switch Control Input |
|                               |                             |

## Equivalent Circuits (Continued)

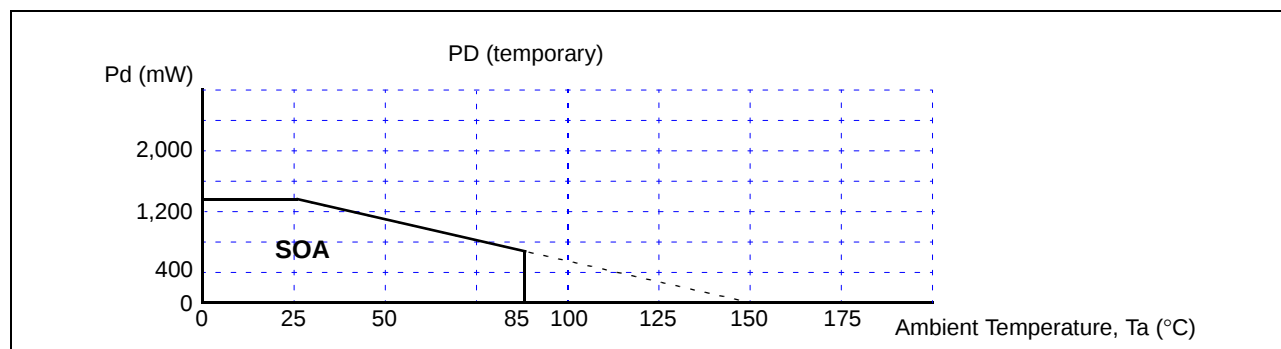


## Absolute Maximum Ratings (Ta = 25 °C)

| Parameter                   | Symbol             | Value               | Unit |
|-----------------------------|--------------------|---------------------|------|
| Maximum supply voltage      | V <sub>CCmax</sub> | 15                  | V    |
| Power dissipation           | P <sub>d</sub>     | 1.4 <sup>note</sup> | W    |
| Operating temperature range | T <sub>opr</sub>   | -35 ~ +85           | °C   |
| Storage temperature range   | T <sub>stg</sub>   | -55 ~ +150          | °C   |

### NOTE:

- When mounted on a 76.2mm × 114mm × 1.57mm PCB (Phenolic resin material).
- Power dissipation reduces 11.2mW/°C for using above Ta = 25°C
- Do not exceed P<sub>d</sub> and SOA(Safe operating area).



## Recommended Operating Conditions

| Parameter              | Symbol | Min. | Typ. | Max. | Unit |
|------------------------|--------|------|------|------|------|
| Signal Supply Voltage  | SVCC   | 4.5  | -    | 13.2 | V    |
| Power Supply Voltage 1 | PVCC1  | 4.5  | -    | SVCC | V    |
| Power Supply Voltage 2 | PVCC2  | 4.0  | -    | SVCC | V    |

## Electrical Characteristics

(Unless otherwise specified, Ta = 25 °C, VCC = VM12 = VM3,4 = 5V, Vref=1.65V, Comparator out=Hi-Z)

| Parameter                 | Symbol  | Conditions                     | Min. | Typ. | Max. | Unit |
|---------------------------|---------|--------------------------------|------|------|------|------|
| Quiescent Current 1       | ICC1    | VIN = Vref, Pin21=0V, Pin22=5V | -    | 9    | -    | mA   |
| Quiescent Current 2       | ICC2    | VIN = Vref, Pin21=5V, Pin22=5V | -    | 19   | -    | mA   |
| Quiescent Current 3       | ICC3    | VIN = Vref, Pin21=5V, Pin22=0V | -    | 15   | -    | mA   |
| Quiescent Current 4       | ICC4    | VIN = Vref, Pin21=0V, Pin22=0V | -    | 6    | -    | mA   |
| <b>DRIVE PART</b>         |         |                                |      |      |      |      |
| Output Offset Voltage     | VOO     | VIN = Vref                     | -50  | -    | +50  | mV   |
| Maximum output voltage1   | VOM1    | SVCC=5V, RL=24ohm,             | 3.1  | 3.5  | -    | V    |
| Maximum output voltage2   | VOM2    | SVCC=12V, RL=24ohm             | 3.6  | 4.0  | -    | V    |
| Closed loop voltage gain  | GVC     | VIN=0.1Vrms, f=1KHz, Rext=0    | 10.5 | 12   | 13.5 | dB   |
| Mute on voltage           | VMON    | Pin22 = Variation              | GND  | -    | 0.5  | V    |
| Mute off voltage          | VMOFF   | Pin22 = Variation              | 2    | -    | Vcc  | V    |
| <b>REGULATOR PART</b>     |         |                                |      |      |      |      |
| Maximum output current    | Iomax   | -                              | 200  | -    | -    | mA   |
| Regulator output voltage  | Vreg    | IL=50mA                        | 3.5  | 3.6  | 3.7  | V    |
| Load regulation           | ΔVrl    | IL=0~200mA                     | -40  | -    | 10   | mV   |
| Line regulation           | ΔVcc    | VCC=4.5~5.5V                   | -    | 10   | 30   | mV   |
| Regulator2 on voltage     | Vr2on   | Pin21=Variation                | 2.0  | -    | Vcc  | V    |
| Regulator2 off voltage    | Vr2off  | Pin21=Variation                | GND  | -    | 0.5  | V    |
| <b>COMPARATOR PART</b>    |         |                                |      |      |      |      |
| Input offset voltage      | Vio     | -                              | -    | -    | 4.0  | mV   |
| Input offset current      | Iio     | -                              | -    | 5.0  | -    | nA   |
| Input bias current        | Ib      | -                              | -    | 25   | 250  | nA   |
| Common mode input voltage | Vicm    | -                              | 0    | -    | 3.5  | V    |
| Output sink current       | Isink   | -                              | 3.0  | -    | -    | mA   |
| Slew rate                 | SR      | VIN=4Vp_p, f=100KHz, Square    | -    | 1.3  | -    | us   |
| <b>RESET PART</b>         |         |                                |      |      |      |      |
| Reset on voltage          | Vrston  | VCTI=H / L                     | 4.1  | 4.2  | 4.3  | V    |
| Reset hysteresis voltage  | Vrsthys | VCTI=H / L /H                  | 100  | -    | 200  | mV   |
| Low level output voltage  | VoL     | RL=4.7 K                       | -    | 100  | 200  | mV   |
| <b>SWITCH PART</b>        |         |                                |      |      |      |      |
| Upper saturation voltage  | Vupsat  | VCC=5V, Iout=150mA             | -    | 0.13 | 0.2  | V    |
| Output off current        | Ioff    | VCC=5V                         | -    | -    | 20   | μA   |
| <b>OP-AMP PART</b>        |         |                                |      |      |      |      |

## Electrical Characteristics (Continued)

(Unless otherwise specified, Ta = 25 °C, VCC = VM12 = VM3,4 = 5V, Vref=1.65V, Comparator out=Hi-Z

| Parameter                   | Symbol | Conditions         | Min. | Typ. | Max. | Unit |
|-----------------------------|--------|--------------------|------|------|------|------|
| Input offset voltage        | VOF    | -                  | -7   | 0    | +7   | mV   |
| Input bias current          | IB1    | -                  | -    | -    | 200  | nA   |
| High level output voltage   | VOH1   | -                  | 4.4  | 4.7  | -    | V    |
| Low level output voltage    | VOL1   | -                  | -    | 0.1  | 0.4  | V    |
| Output sink current         | ISINK  | RL=1Kohm           | 2    | 4    | -    | mA   |
| Output source current       | ISOU1  | RL=1Kohm           | 2    | 4    | -    | mA   |
| Common mode input range     | VICM   | -                  | -0.3 | -    | 4.0  | V    |
| Open Loop voltage gain      | GVO1   | f=1kHz, VIN=-75dB  | -    | 80   | -    | dB   |
| Ripple rejection ratio      | RR1    | f=120Hz, VIN=-20dB | -    | 65   | -    | dB   |
| slew rate                   | SR1    | f=120Hz, 2Vp-p     | -    | 1.2  | -    | V/us |
| Common Mode rejection ratio | CMRR   | f=1kHz, VIN=-20dB  | -    | 80   | -    | dB   |

## Application Information

### 1. Reference Input

Pin 20 (REF) is a reference Input pin.

- Reference Input  
The applied voltage at the reference input pin must be between 1.5 (V) and 3.5 (V), when  $V_{cc} = 5V$ .

### 2. Channel Mute Function

These pins are used for channel mute operation.

- When the mute pin (pin22) is Low level, the mute circuit is enabled and the output circuits are muted.(both CH1, CH2)
- When the voltage of the mute pin (pin22) is High level, the mute circuit is disabled and the output circuits operate normally.
- If the chip temperature rises above 175 °C, then the thermal shutdown (TSD) circuit is activated and the output circuits are muted.
- Mute(pin 22)-CH1, 2 mute control input pin.

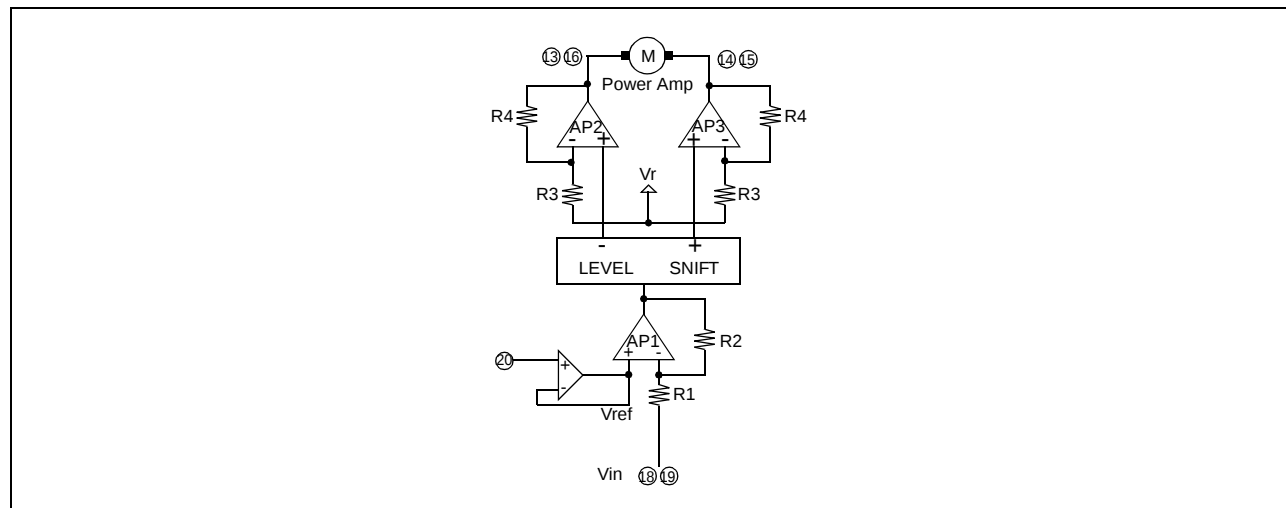
### 3. Protection Function

Thermal Shutdown (TSD)

- 1) If the chip temperature rises above 175 °C the thermal shutdown (TSD) circuit is activated and the output circuit is in the Mute state, that is Off state.
- The TSD circuit has a temperature hysteresis of 25°C.

### 4. Focus, Tracking Actuator

- The reference voltage REF is given externally through pin 20
- The input signal is amplified by  $R2/R1$  times and then fed to the level shift circuit.
- The level shift circuit produces the differential output voltages and drives the two output power amplifiers.  
Since the differential gain of the output amplifiers is equal to  $2 \times (1 + R4/R3)$ , the input signal is amplified by  $(R2/R1) \times 2 \times (1 + R4/R3)$ .
- If the total gain is too high, you can reduce the closed loop gain by adding an external resistance at pin18, 19
- The power reference voltage ( $V_r$ ) is about a half of the supply voltage( $V_M$ ).



## 5. Regulator & Control Function

The regulator circuit is illustrated in the figure.1.

- The capacitor is used as a ripple eliminator and should have a good temperature characteristics.
- The regulator output voltage is calculated as follows

$$V_{REG} = (1 + R1/R2) \times 2.5 = 3.4V$$

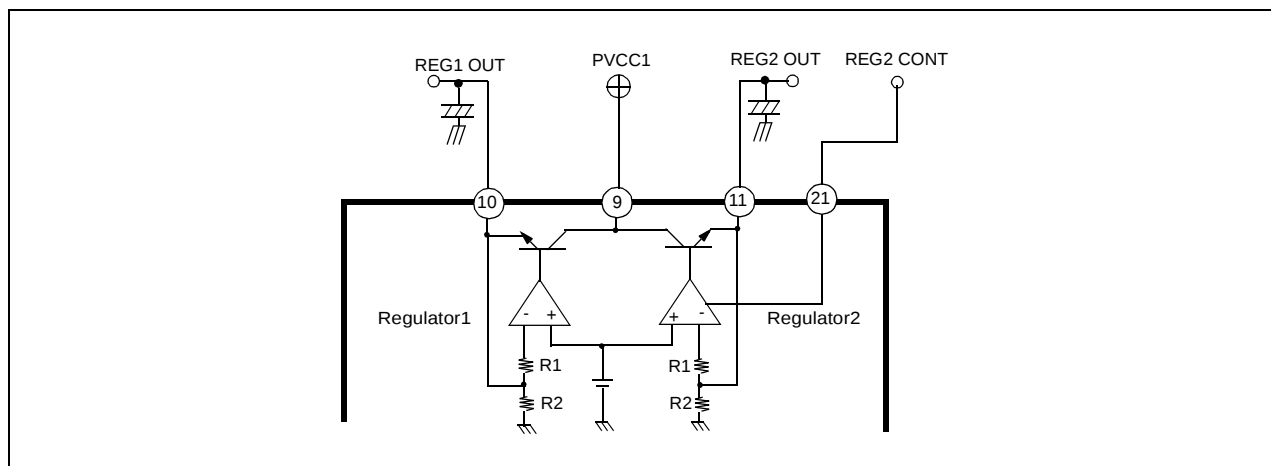


Figure 1.

- When the voltage of the pin21 is high (above 2.0V), the regulator operates normally.  
On the other hand, when the voltage of the pin21 is low (below 0.5V), the regulator will be turned off.  
Truth table is as follows

| Pin#21 | Regulator 2 |
|--------|-------------|
| High   | Turn On     |
| Low    | Turn Off    |

## 6. Reset Circuit

The reset circuit is illustrated in the figure.2.

- 1) The capacitor is used for delay.

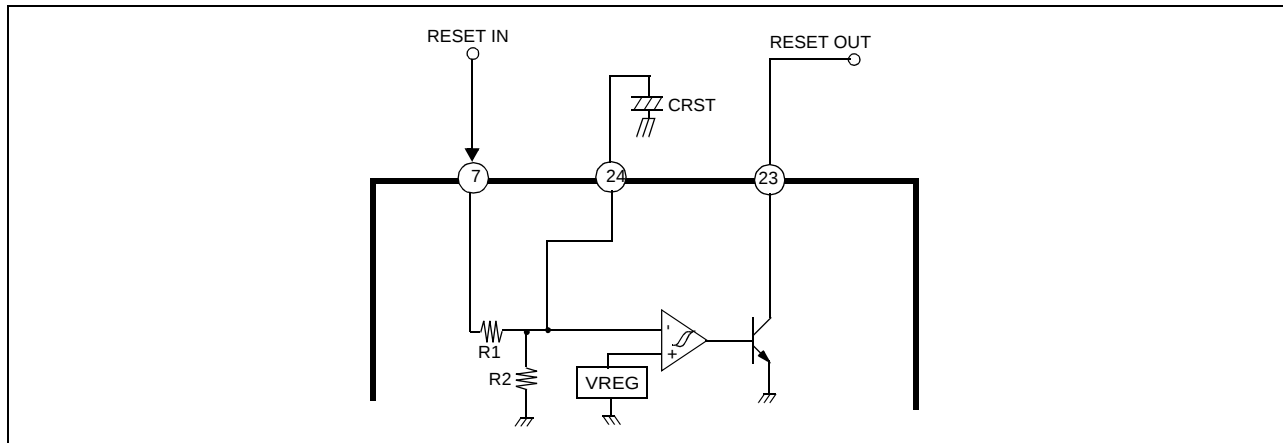


Figure 2.

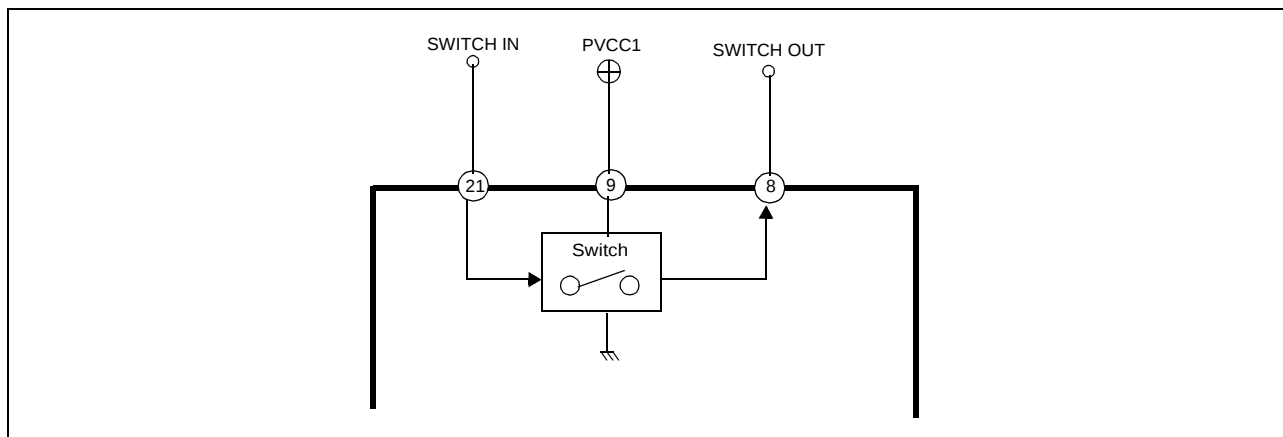
- 2) When the voltage of the pin7 is above 4.2V, the output of the reset circuit is OPEN (no load). On the other hand, when the voltage of the pin7 is low , the output of the reset circuit is low.

Truth table is as follows

| Pin#7 | Reset Output |
|-------|--------------|
| High  | Open         |
| Low   | Low          |

## 7. Switch Circuit

The switch circuit is illustrated in the figure.3.



When the voltage of the pin21 is high (above 2.0V), the output of the switch circuit is above 4.8V. On the other hand, when the voltage of the pin21 is low (below 0.5V), the routput of the reset circuit is below 0.5V.

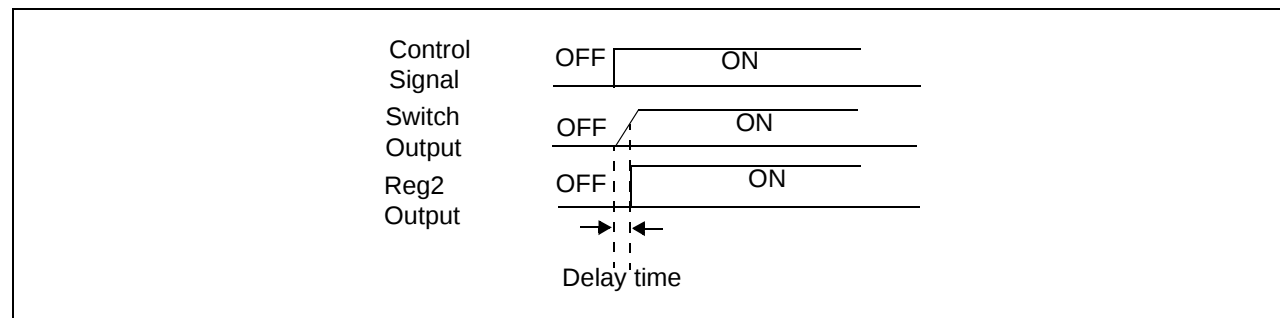
Truth table is as follows

| Pin#21 | Switch Output |
|--------|---------------|
| High   | Above 4.8v    |
| Low    | Below 0.5v    |

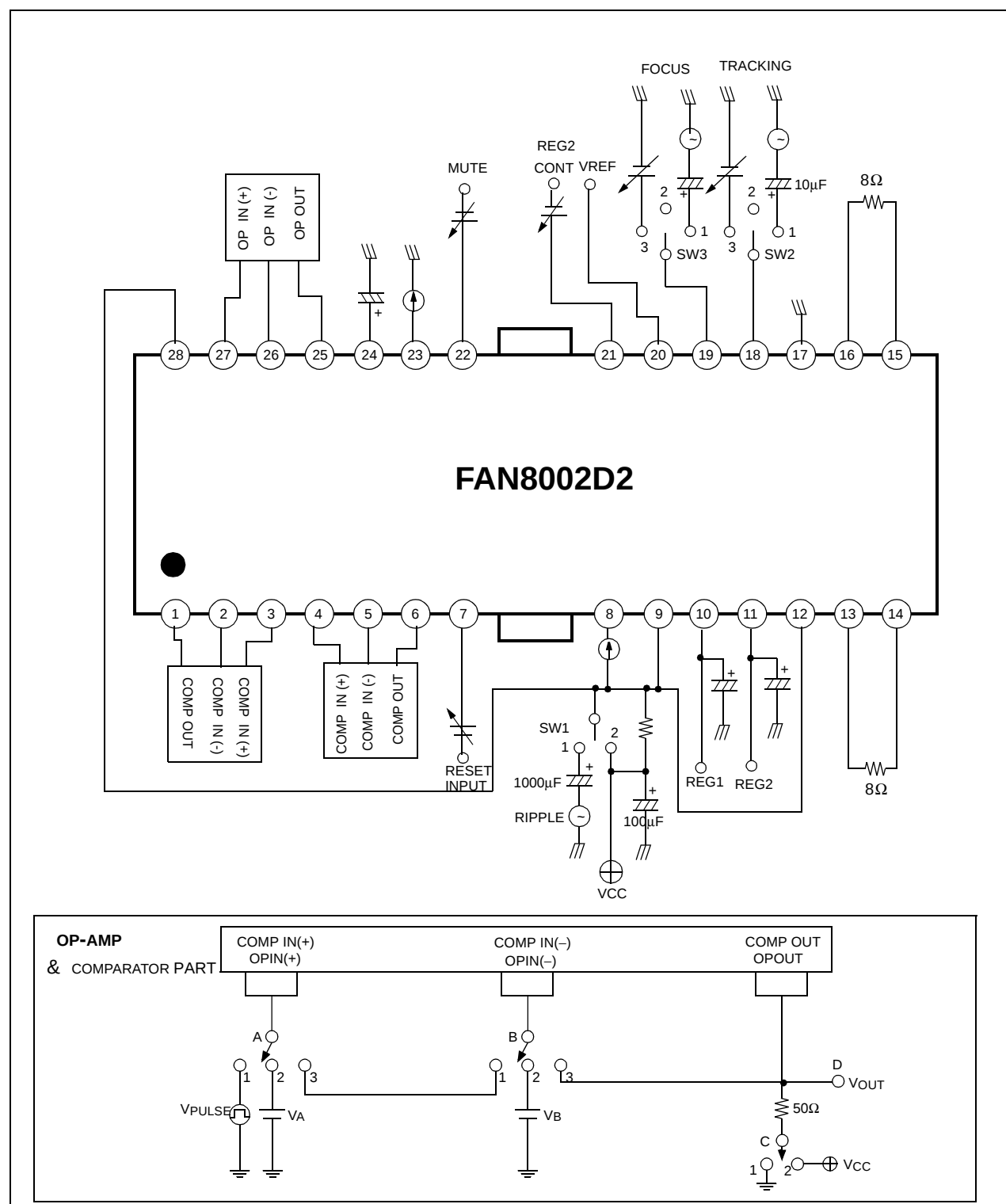
The regulator2 control pin and the switch control pin is same(pin21).

If the pin21 is high, first switch circuit operates and then regulator circuit operates normally.

The operation is illustrated in the following time table

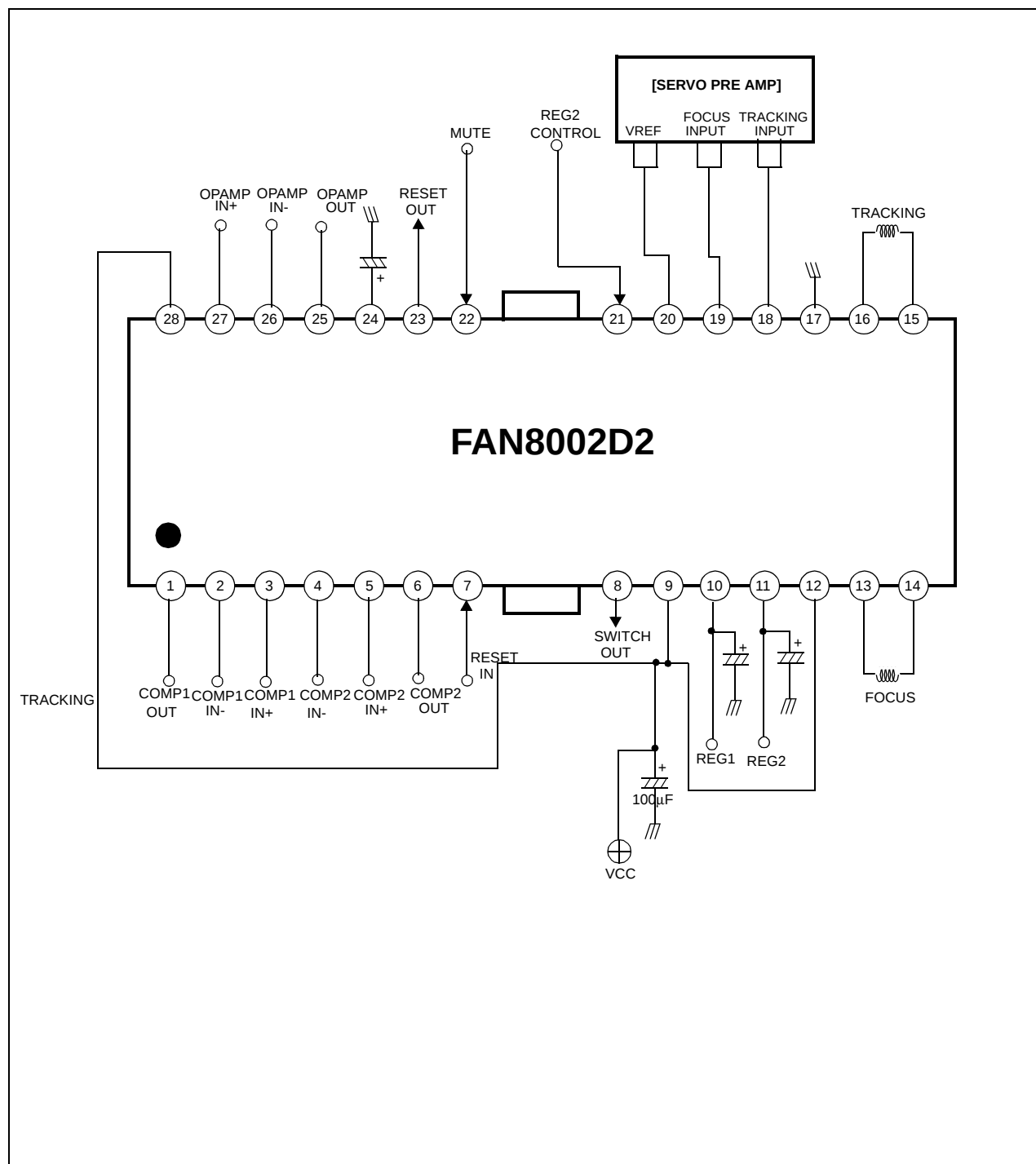


# Test Circuit



# Application Circuit

(Voltage Control Mode)



#### **DISCLAIMER**

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS.

#### **LIFE SUPPORT POLICY**

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR INTERNATIONAL. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.