

# AN6608, AN6609N, AN6609NS

## DC Motor Forward/Reverse Dual Speed Electronic Governors

### ■ Overview

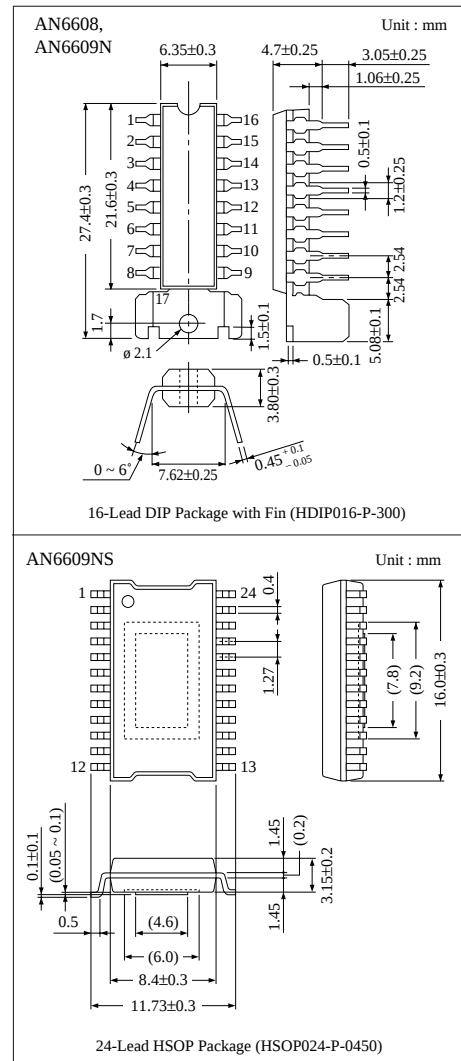
The AN6608, the AN6609N and the AN6609NS are the electronic governors which incorporate the forward/reverse rotation and double speed controls of the DC motors used for radio/cassette tape recorder, and the functions such as fast forward, rewind, brake, and pause. They are also available for controlling the video tape deck mechanisms such as the VCRs and DATs. The AN6608, the AN6609N and the AN6609NS are identical with each other except the operating logic by 3-bit input.

### ■ Features

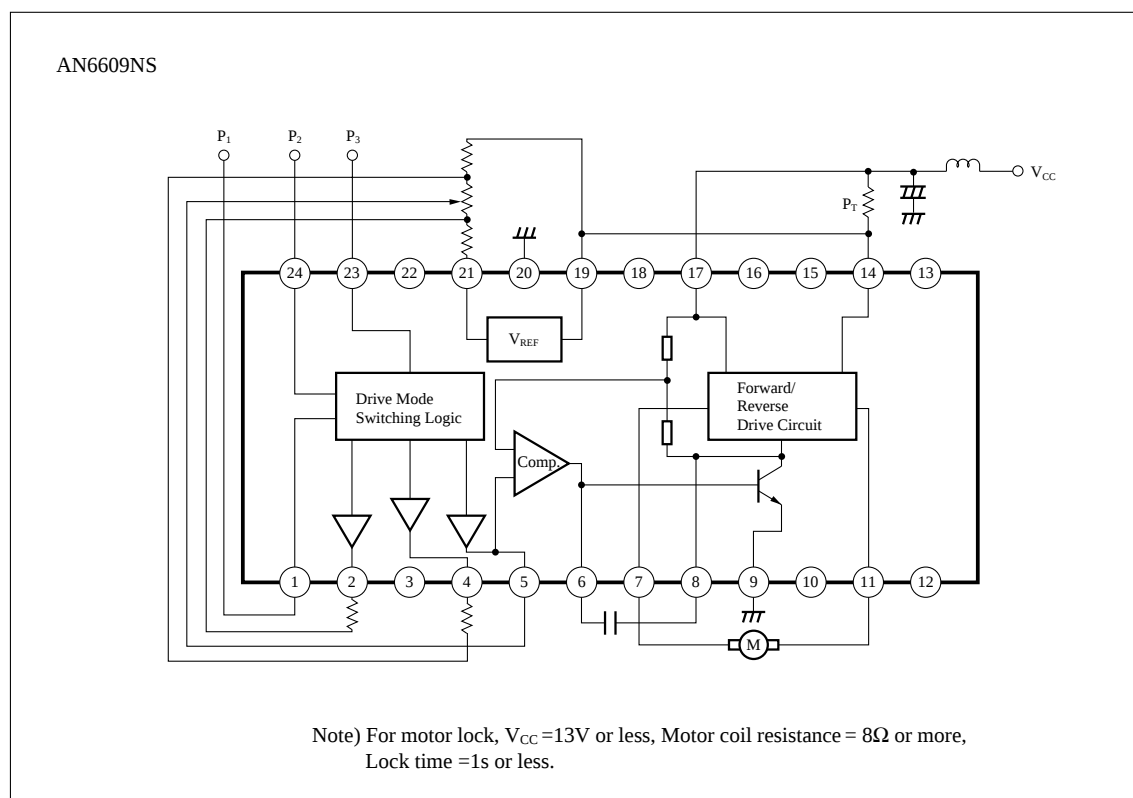
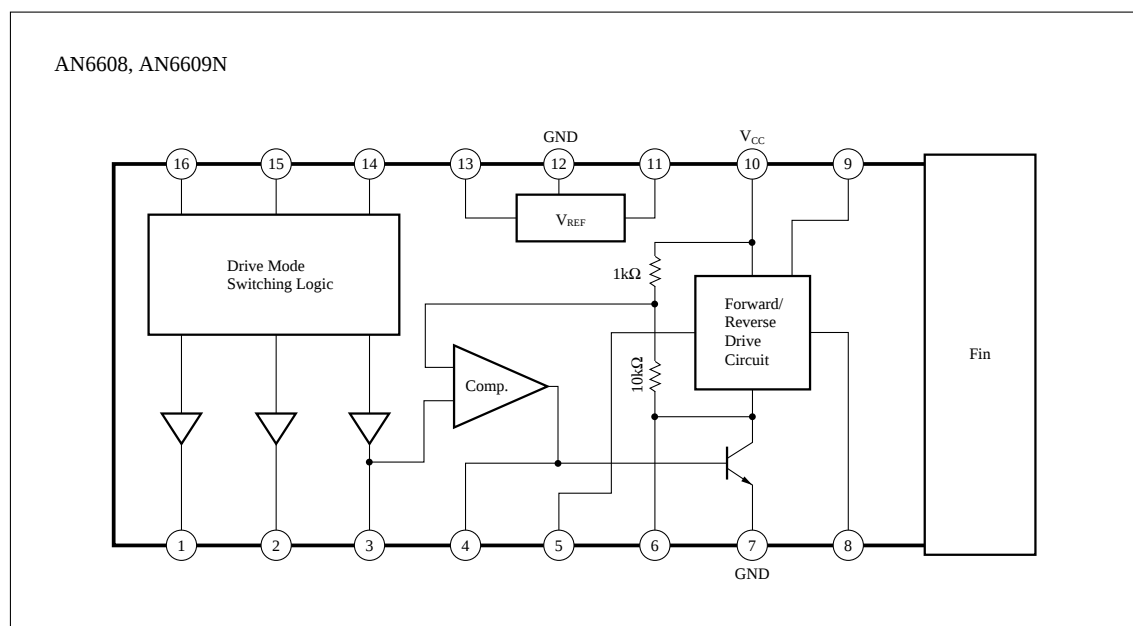
- Operating supply voltage range ;  $V_{CC} = 8V$  to  $16V$
- Stable reference voltage ( $1.27V$ ) and easy speed adjustment
- Large starting torque and maximum control torque
- Built-in power transistor
- Forward/reverse constant speed and double speed controls, and fast forward, brake, and pause functions available by 3-bit input

### ■ Applications

VCRs, cassette decks, radio/cassette tape recorders, car cassette tape players, tape loading DC motor control such as DATs.



# ■ Block Diagram



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

| Parameter                     | Symbol           | Rating                      | Unit                        |
|-------------------------------|------------------|-----------------------------|-----------------------------|
| Supply Voltage                | V <sub>CC</sub>  | 18                          | V                           |
| Supply Current                | I <sub>CC</sub>  | 1800 <small>Note 1)</small> | mA                          |
| Power Dissipation             | P <sub>D</sub>   | AN6608, AN6609N             | 2 <small>Note 2)</small>    |
|                               |                  | AN6609NS                    | 2.08 <small>Note 3)</small> |
| Operating Ambient Temperature | T <sub>opr</sub> | -20 ~ + 70                  | °C                          |
| Storage Temperature           | T <sub>stg</sub> | -50 ~ +150                  | °C                          |

Note 1) t ≤ 200ms

Note 2) Mounting on PCB (20mm × 20mm of copperfoil is used for heat sink)

Note 3) Glass epoxy PCB (50mm × 50mm × 1.2mm)

### ■ Recommended Operating Range (Ta = 25°C)

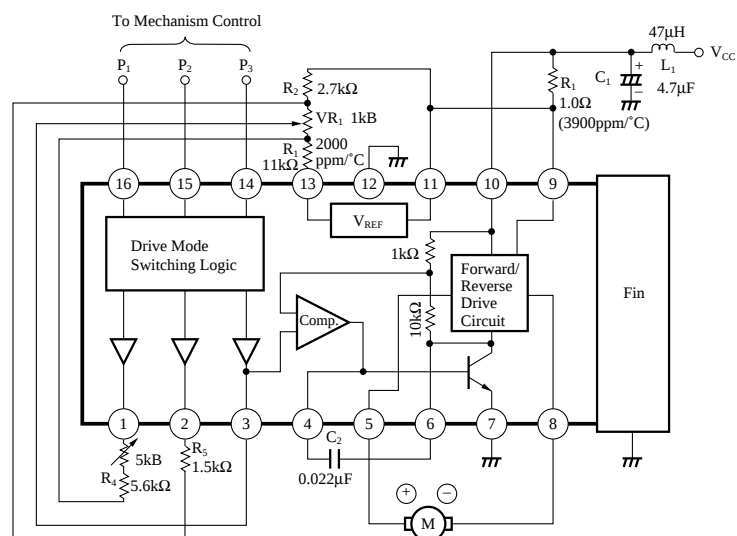
| Parameter                      | Symbol          | Range    |
|--------------------------------|-----------------|----------|
| Operating Supply Voltage Range | V <sub>CC</sub> | 8V ~ 16V |

### ■ Electrical Characteristics (Ta = 25°C)

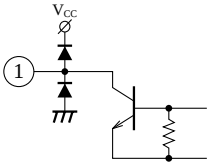
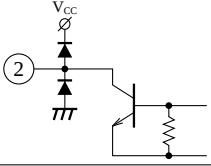
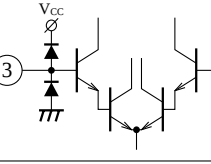
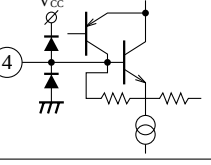
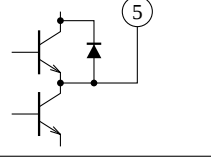
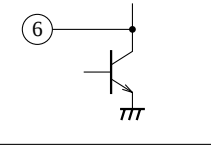
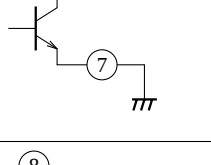
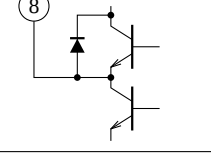
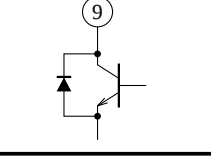
| Parameter                                      | Symbol               | Condition                                         | min.  | typ. | max. | Unit   |
|------------------------------------------------|----------------------|---------------------------------------------------|-------|------|------|--------|
| Bias Current at No Load                        | I <sub>bias</sub>    | V <sub>CC</sub> =12V                              | —     | 7    | 15   | mA     |
| Reference Voltage                              | V <sub>ref</sub>     | V <sub>CC</sub> =12V                              | 1.15  | 1.27 | 1.4  | V      |
| Rated Load Start Voltage                       | V <sub>CC(s)</sub>   | Supply voltage with which a motor starts rotating | 6.5   | —    | —    | V      |
| Rated r.p.m.                                   | N <sub>L</sub>       | V <sub>CC</sub> =12V, N=1600rpm                   | -8.75 | —    | 8.75 | %      |
| r.p.m. Characteristics on Load Change          | DN <sub>L</sub>      | V <sub>CC</sub> =8V, I <sub>L</sub> =55mA ~ 120mA | -100  | —    | 100  | rpm    |
| r.p.m. Characteristics on Voltage Change       | DN <sub>V</sub>      | V <sub>CC</sub> =8V ~ 16V, N=1600rpm              | -22   | 0    | 22   | rpm    |
| Double Speed Forward/Reverse r.p.m. Difference | DN <sub>Logi</sub>   | V <sub>CC</sub> =12V, N=3200rpm                   | -3    | 0    | 3    | %      |
| Output Saturation Voltage 1                    | V <sub>sat (1)</sub> | V <sub>CC</sub> =8V, I <sub>O</sub> =1A           | —     | —    | 2    | V      |
| Output Saturation Voltage 2                    | V <sub>sat (2)</sub> | V <sub>CC</sub> =8V, I <sub>O</sub> =1A           | —     | —    | 1.5  | V      |
| r.p.m. Characteristics on Temperature Change   | DN <sub>A</sub>      | V <sub>CC</sub> =12V, Ta= -10°C ~ + 60°C          | —     | 100  | —    | rpm/°C |
| r.p.m. Drift Characteristics by Time           | DN <sub>T</sub>      | V <sub>CC</sub> =12V, t=15s ~ 10ms                | —     | 0.4  | —    | %      |

### ■ Application Circuit

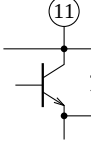
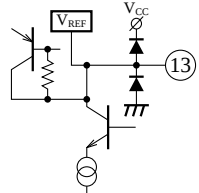
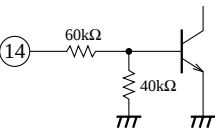
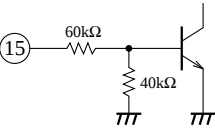
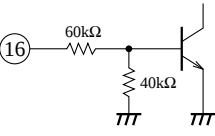
AN6608  
AN6609N



## ■ Pin Descriptions

| Pin No.           |          | Pin Name                     | Typ. Waveform                                                                       | Description                                                                      | Input Impedance  | Equivalent Circuit                                                                    |
|-------------------|----------|------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|------------------|---------------------------------------------------------------------------------------|
| AN6608<br>AN6609N | AN6609NS |                              |                                                                                     |                                                                                  |                  |                                                                                       |
| 1                 | 2        | Double Speed Setting         | —                                                                                   | Pin to set the double speed r.p.m.                                               | $Tr_C$           |    |
| 2                 | 4        | FF, REW Speed Setting        | —                                                                                   | Pin to set the FF/REW r.p.m.                                                     | $Tr_C$           |    |
| 3                 | 5        | Speed Control                | —                                                                                   | Speed control pin<br>A fixed resistor will do if fine adjustment is unnecessary. | $Tr_E$           |    |
| 4                 | 6        | Phase Adjustment             | —                                                                                   | Phase adjustment pin for oscillation prevention                                  | $Tr_E$           |   |
| 5                 | 7        | Motor Connection ⊕           |  | Pin to connect the motor ⊕ side                                                  | $Tr_E$<br>$Tr_C$ |  |
| 6                 | 8        | Phase Adjustment             |  | Phase adjustment pin for oscillation prevention                                  | $Tr_C$           |  |
| 7                 | 9        | GND                          | —                                                                                   | GND pin for the power section inside the IC                                      | $Tr_E$           |  |
| 8                 | 11       | Motor Connection ⊖           |  | Pin to connect the motor ⊖ side                                                  | $Tr_E$<br>$Tr_C$ |  |
| 9                 | 14       | Load Characteristics Setting |  | Pin to set the load characteristics (S-T curve) of the motor                     | $Tr_C$           |  |

## ■ Pin Descriptions (Cont.)

| Pin No.           |          | Pin Name                                      | Typ. waveform                                                                     | Description                                                   | Input Impedance | Equivalent Circuit                                                                    |
|-------------------|----------|-----------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------|
| AN6608<br>AN6609N | AN6609NS |                                               |                                                                                   |                                                               |                 |                                                                                       |
| 10                | 17       | V <sub>CC</sub>                               | —                                                                                 | IC power pin                                                  | —               | —                                                                                     |
| 11                | 19       | Connect to Pin9 .<br>Ref. Voltage<br>⊕ Output |  | Reference voltage⊕ output pin when connecting to the pin9.    | Tr <sub>C</sub> |    |
| 12                | 20       | GND                                           | —                                                                                 | GND pin for the IC bias section                               | —               |    |
| 13                | 21       | Ref. Voltage<br>⊖ Output                      |  | Reference voltage⊖ output pin                                 | Tr <sub>C</sub> |    |
| 14                | 23       | Logic Input P <sub>3</sub>                    | —                                                                                 | Logic input pin P <sub>3</sub> to set the motor control state | 60kΩ            |   |
| 15                | 24       | Logic Input P <sub>2</sub>                    | —                                                                                 | Logic input pin P <sub>2</sub> to set the motor control state | 60kΩ            |  |
| 16                | 1        | Logic Input P <sub>1</sub>                    | —                                                                                 | Logic input pin P <sub>1</sub> to set the motor control state | 60kΩ            |  |

■ Supplementary Explanation

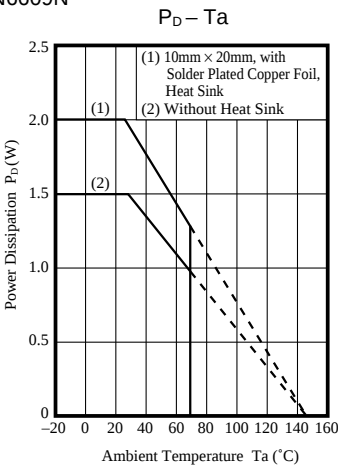
• Operating Logic

| Input Pins |    |    | Output Pins (AN6608) |   |     |     |                        | Output Pins (AN6609N) |   |     |     |                        |
|------------|----|----|----------------------|---|-----|-----|------------------------|-----------------------|---|-----|-----|------------------------|
| 14         | 15 | 16 | 5                    | 8 | 1   | 2   | Operating Mode         | 5                     | 8 | 1   | 2   | Operating Mode         |
| H          | H  | H  | H                    | L | OFF | ON  | FF                     | —                     | — | OFF | OFF | Pause                  |
| L          | H  | H  | L                    | H | OFF | ON  | REW                    | H                     | L | ON  | OFF | Double speed           |
| H          | L  | H  | H                    | L | OFF | OFF | Constant speed         | H                     | L | OFF | OFF | Constant speed         |
| H          | H  | L  | H                    | H | OFF | OFF | Brake                  | H                     | H | OFF | OFF | Brake                  |
| L          | L  | H  | H                    | L | ON  | OFF | Double speed           | H                     | L | OFF | ON  | FF                     |
| L          | H  | L  | L                    | H | ON  | OFF | Reverse double speed   | L                     | H | ON  | OFF | Reverse double speed   |
| H          | L  | L  | L                    | H | OFF | OFF | Reverse constant speed | L                     | H | OFF | OFF | Reverse constant speed |
| L          | L  | L  | —                    | — | OFF | OFF | Pause                  | —                     | — | OFF | OFF | Pause                  |

\* Input level H : 3V or more, Input level L : 0.7V or less  
For the AN6609NS, the above pin numbers must be replaced.

• Characteristics Curve

AN6608, AN6609N



AN6609NS

