

# AN2108NFHQ

## Camera Signal Processing(CDS + AGC + Gamma)

### ■ Overview

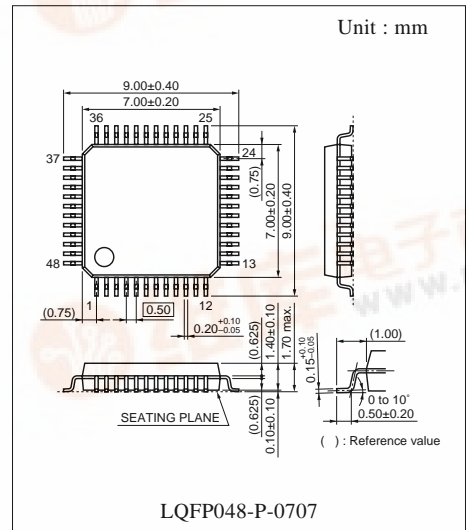
The AN2108NFHQ is a single-chip IC that processes video-signal of CCD-camera and has functions of CDS, AGC, pre-knee and pre-aperture circuits. This CDS circuit is capable of high speed sampling of max. 30 MHz to support high-resolution CCD-camera systems (XGA, SXGA, etc.). AGC and OB level(black level) adjustments can be controlled with on-chip 8-bit DAC.

### ■ Features

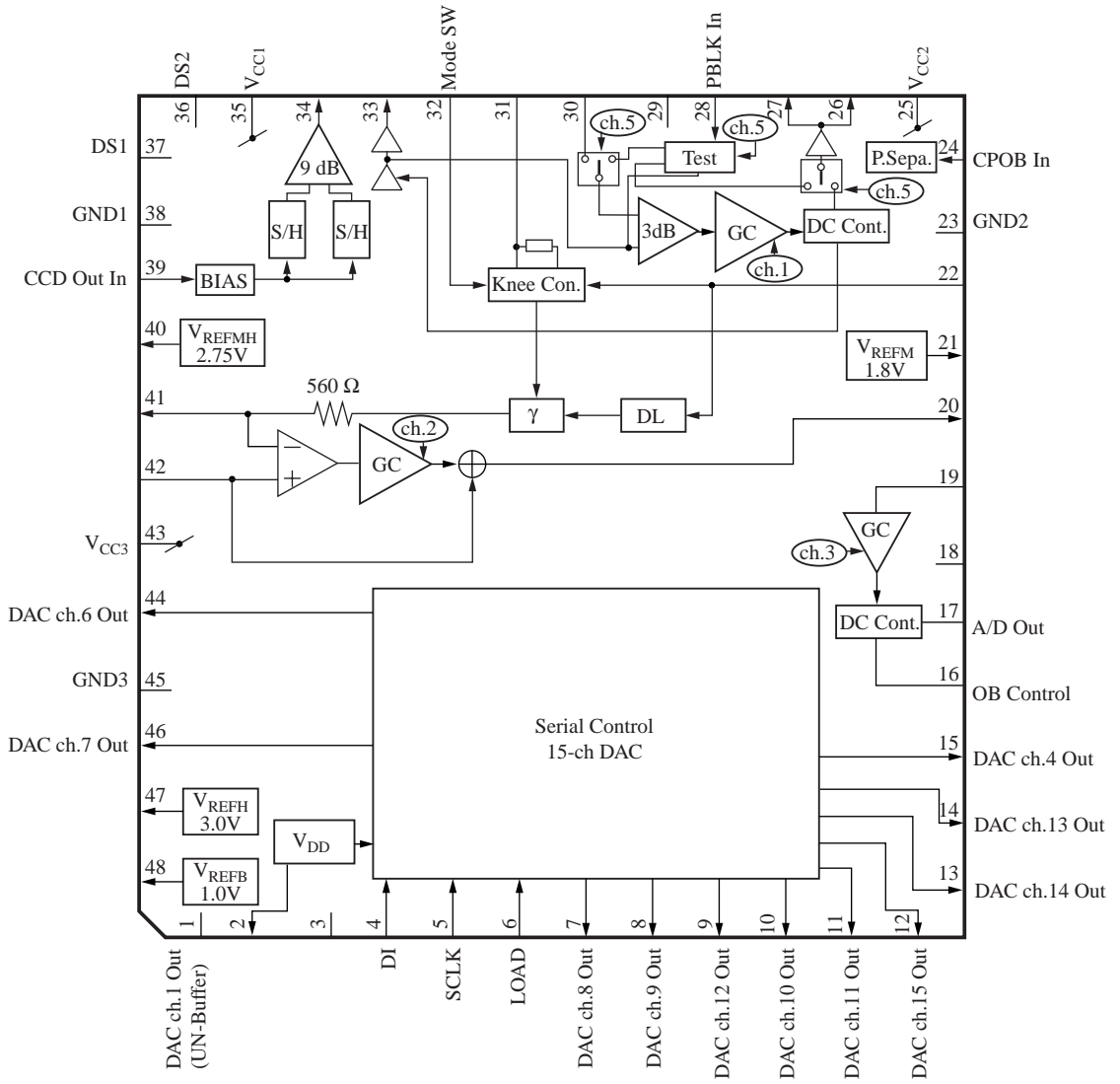
- Capable of high speed sampling of max. 30 MHz
- Capable of controlling OB level at the last output stage
- Capable of switching between 2 modes of pre-knee characteristic
- On-chip DAC(8-bit, 15-channel)for adjustment (11-channels for internal and external outputs)

### ■ Applications

- Digital still cameras, Camcorders, PC cameras, Monitoring cameras, CCD camera modules, CCD digital camera systems



■ Block Diagram



### ■ Pin Descriptions

| Pin No. | Description                  | Pin No. | Description                   |
|---------|------------------------------|---------|-------------------------------|
| 1       | DAC CH1 OUT(UN-Buffer)       | 25      | V <sub>CC2</sub>              |
| 2       | V <sub>DD</sub> OUT(3.5 V)   | 26      | AGC OUT 1                     |
| 3       | V <sub>SS</sub>              | 27      | AGC OUT 2                     |
| 4       | DI                           | 28      | PBLK IN                       |
| 5       | SCLK                         | 29      | AGC DET                       |
| 6       | LOAD                         | 30      | AGC IN                        |
| 7       | DAC ch.8 OUT                 | 31      | Trap OUT                      |
| 8       | DAC ch.9 OUT                 | 32      | Gamma MODE SW                 |
| 9       | DAC ch.12 OUT                | 33      | AGC REF OUT                   |
| 10      | DAC ch.10 OUT                | 34      | CDS OUT                       |
| 11      | DAC ch.11 OUT                | 35      | V <sub>CC2</sub>              |
| 12      | DAC ch.15 OUT                | 36      | Sampling Puls DS2 IN          |
| 13      | DAC ch.14 OUT                | 37      | Sampling Puls DS1 IN          |
| 14      | DAC ch.13 OUT                | 38      | GND 1                         |
| 15      | DAC ch.4 OUT                 | 39      | CCD OUT IN                    |
| 16      | OB Control                   | 40      | V <sub>REFMH</sub> OUT(2.7 V) |
| 17      | A/D OUT                      | 41      | Gamma OUT                     |
| 18      | Sub Amp. DET                 | 42      | Pre-aperture DL IN            |
| 19      | Sub Amp. IN                  | 43      | V <sub>CC3</sub>              |
| 20      | Pre-aperture OUT             | 44      | DAC ch.6 OUT                  |
| 21      | V <sub>REFM</sub> OUT(1.8 V) | 45      | GND 3                         |
| 22      | Gamma IN                     | 46      | DAC ch.7 OUT                  |
| 23      | GND 2                        | 47      | V <sub>REFH</sub> OUT(3.0 V)  |
| 24      | CPOB IN                      | 48      | V <sub>REFB</sub> OUT(1.0 V)  |

### ■ Absolute Maximum Ratings

| Parameter                        | Symbol    | Rating      | Unit |
|----------------------------------|-----------|-------------|------|
| Supply voltage                   | $V_{CC}$  | 5.5         | V    |
| Supply current                   | $I_{CC}$  | —           | mA   |
| Power dissipation *2             | $P_D$     | 226         | mW   |
| Operating ambient temperature *1 | $T_{opr}$ | -20 to +7.5 | °C   |
| Storage temperature *1           | $T_{stg}$ | -55 to +125 | °C   |

Note) \*1 :  $T_a = 25\text{ °C}$ , except storage temperature and operating ambient temperature.

\*2 : The above power dissipation shows the package power dissipation at  $T_a = 75\text{ °C}$ , in free-air.

### ■ Recommended Operating Range

| Parameter      | Symbol   | Range      | Unit |
|----------------|----------|------------|------|
| Supply voltage | $V_{CC}$ | 4.5 to 5.1 | V    |

### ■ Electrical Characteristics at $V_{CC} = 4.8\text{ V}$ , $T_a = 25 \pm 2\text{ °C}$

| Parameter                      | Symbol     | Conditions   | Min  | Typ  | Max  | Unit             |
|--------------------------------|------------|--|------|------|------|------------------|
| Circuit current                | $I_{TOT}$  | $V_{CC} = 4.8\text{ V}$                                  | 30   | 40   | 50   | mA               |
| Reference voltage 1            | $V_{REF1}$ | $V_{CC} = 4.8\text{ V}$                                  | 3.3  | 3.6  | 3.9  | V                |
| Reference voltage 2            | $V_{REF2}$ | $V_{CC} = 4.8\text{ V}$                                  | 2.9  | 3.0  | 3.1  | V                |
| Reference voltage 3            | $V_{REF3}$ | $V_{CC} = 4.8\text{ V}$                                  | 2.65 | 2.75 | 2.85 | V                |
| Reference voltage 4            | $V_{REF4}$ | $V_{CC} = 4.8\text{ V}$                                  | 1.7  | 1.8  | 1.9  | V                |
| Reference voltage 5            | $V_{REF5}$ | $V_{CC} = 4.8\text{ V}$                                  | 0.9  | 1.0  | 1.1  | V                |
| Pulse separation               | CPOB       | $V_{CC} = 4.8\text{ V}$                                  | 1.1  | 1.4  | 1.7  | V                |
| Sampling pulse threshold 1     | $V_{TH1}$  | $V_{CC} = 4.8\text{ V}$                                  | 1.15 | 1.45 | 1.75 | V                |
| Sampling pulse threshold 2     | $V_{TH2}$  | $V_{CC} = 4.8\text{ V}$                                  | 1.15 | 1.45 | 1.75 | V                |
| AGC frequency characteristic   | $G_{FA}$   | 10 MHz Sine wave 300 mV <sub>PP</sub>                    | -1.8 | -0.4 | 1.0  | dB               |
| AGC level adjustment           | $V_{ADJ1}$ | 10 stair step 300 mV <sub>PP</sub>                       | 46   | 60   | 7A   | Hex              |
| AGC output D-range             | $V_{AG3}$  | 10 stair step 1.2 V <sub>PP</sub>                        | 1080 | 1200 | 1320 | mV <sub>PP</sub> |
| AGC min. gain                  | $G_{AG4}$  | 10 stair step 1.2 V <sub>PP</sub>                        | —    | -3   | -5   | dB               |
| AGC max. gain                  | $G_{AG5}$  | 10 stair step 50 mV <sub>PP</sub>                        | 21   | 24   | —    | dB               |
| Test signal adjustment         | $V_{TE}$   | PBLK input   | C0   | CE   | DF   | Hex              |
| Gamma frequency characteristic | $G_{FG}$   | 10 MHz Sine wave 300 mV <sub>PP</sub>                    | -2.2 | -1.0 | 0.2  | dB               |
| Gamma characteristic 1         | $V_{GM1}$  | 10 stair step 600 mV <sub>PP</sub> 3rd stage Pin32 = GND | 162  | 180  | 198  | mV <sub>PP</sub> |
| Gamma characteristic 2         | $V_{GM2}$  | 10 stair step 600 mV <sub>PP</sub> 6th stage Pin32 = GND | -1.0 | 0    | 1.0  | dB               |
| Gamma characteristic 3         | $V_{GM}$   | 10 stair step 600 mV <sub>PP</sub> 9th stage Pin32 = GND | 30   | 80   | 130  | mV <sub>PP</sub> |

**■ Electrical Characteristics at  $V_{CC} = 4.8 \text{ V}$ ,  $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ (Continued)**

| Parameter                                 | Symbol     | Conditions   | Min  | Typ  | Max  | Unit             |
|---|------------|--|------|------|------|------------------|
| Gamma characteristic 4                    | $V_{GM4}$  | 10 stair step 720 mV <sub>PP</sub> Pin32 = GND           | 1.22 | 2.02 | 3.82 | dB               |
| Gamma characteristic 5                    | $V_{GM6}$  | 10 stair step 600 mV <sub>PP</sub> 9th stage Pin32 = GND | 10   | 30   | 50   | mV <sub>PP</sub> |
| Pre-aperture frequency characteristic     | $G_{FG}$   | 10 MHz Sine wave 300 mV <sub>PP</sub>                    | -1.6 | -0.4 | 0.8  | dB               |
| Pre-aperture output D-range               | $V_{PR3}$  | 10 stair step 800 mV <sub>PP</sub>                       | 700  | 800  | 900  | mV <sub>PP</sub> |
| Pre-aperture gain 1                       | $V_{PR5}$  | 9 MHz Sine wave 300 mV <sub>PP</sub>                     | —    | -0.2 | 0.5  | dB               |
| Pre-aperture gain 2                       | $V_{PR4}$  | 9 MHz Sine wave 300 mV <sub>PP</sub>                     | 5.0  | 7.0  | —    | dB               |
| Output amplifier frequency characteristic | $G_{FB}$   | 10 MHz Sine wave 300 mV <sub>PP</sub>                    | -1.6 | -0.4 | 0.8  | dB               |
| Output amplifier level adjustment         | $V_{ADJ2}$ | 10 stair step 300 mV <sub>PP</sub>                       | 7B   | 90   | A5   | Hex              |
| Output amplifier output D-range           | $V_{AD5}$  | 10 stair step 1000 mV <sub>PP</sub>                      | 2200 | 2450 | 2700 | mV <sub>PP</sub> |
| Output amplifier gain 1                   | $G_{AD1}$  | 10 stair step 300 mV <sub>PP</sub>                       | —    | 2.5  | 4.0  | dB               |
| Output amplifier gain 2                   | $G_{AD2}$  | 10 stair step 300 mV <sub>PP</sub>                       | 13.5 | 15.5 | —    | dB               |
| Output amplifier gain 3                   | $G_{AD4}$  | 10 stair step 600 mV <sub>PP</sub>                       | -1.0 | 0    | 1.0  | dB               |
| A/D Out output DC 1                       | $V_{OFF1}$ | Pin16 = 1.0 V  | -70  | 0    | 70   | mV               |
| A/D Out output DC 2                       | $V_{OFF2}$ | Pin16 = 1.4 V  | -70  | 0    | 70   | mV               |
| Total frequency characteristic            | $G_{FT}$   |  | -3.5 | -2.0 | -0.5 | dB               |
| 9 dB amplifier gain                       | $G_1$      | Sampling pulse 10 MHz CDS input 300 mV <sub>PP</sub>     | 7.6  | 8.6  | 9.6  | dB               |

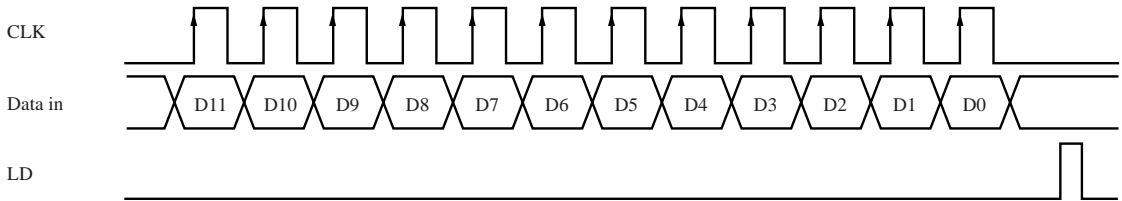
■ Electrical Characteristics(Continued)

• DAC serial Data Format

| D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Address Selection | Function                        |
|-----|-----|----|----|----|----|----|----|----|----|----|----|-------------------|---------------------------------|
| 0   | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | Don't Care        | —                               |
| 1   | 0   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | CH1               | AGC gain control                |
| 0   | 1   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | CH2               | Pre-aperture gain control       |
| 1   | 1   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | CH3               | Sub amp. gain control           |
| 0   | 0   | 1  | 0  | .  | .  | .  | .  | .  | .  | .  | .  | CH4               | Output DC control               |
| 1   | 0   | 1  | 0  | .  | .  | .  | .  | .  | .  | .  | .  | CH5               | D7 D6 D5 D4—D0                  |
|     |     |    |    |    |    |    |    |    |    |    |    |                   | AGC output pin signal switching |
|     |     |    |    |    |    |    |    |    |    |    |    |                   | Pre-apa. On/Off                 |
|     |     |    |    |    |    |    |    |    |    |    |    |                   | Test signal amplitude control   |
| 0   | 1   | 1  | 0  | .  | .  | .  | .  | .  | .  | .  | .  | CH6               | Output DC control               |
| 1   | 1   | 1  | 0  | .  | .  | .  | .  | .  | .  | .  | .  | CH7               | Output DC control               |
| 0   | 0   | 0  | 1  | .  | .  | .  | .  | .  | .  | .  | .  | CH8               | Output DC control               |
| 1   | 0   | 0  | 1  | .  | .  | .  | .  | .  | .  | .  | .  | CH9               | Output DC control               |
| 0   | 1   | 0  | 1  | .  | .  | .  | .  | .  | .  | .  | .  | CH10              | Output DC control               |
| 1   | 1   | 0  | 1  | .  | .  | .  | .  | .  | .  | .  | .  | CH11              | Output DC control               |
| 0   | 0   | 1  | 1  | .  | .  | .  | .  | .  | .  | .  | .  | CH12              | Output DC control               |
| 1   | 0   | 1  | 1  | .  | .  | .  | .  | .  | .  | .  | .  | CH13              | Output DC control               |
| 0   | 1   | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | CH14              | Output DC control               |
| 1   | 1   | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | CH15              | Output DC control               |

■ Electrical Characteristics(Continued)

DAC serial data timing



ch.5

AGC output pin signal switching

| D7 | D6 | Function                                 |
|----|----|--|
| 0  | 0  | CDS signal output at AGC on              |
| 1  | 0  | Test signal output at AGC on             |
| 1  | 1  | Through output of test signal at AGC off |

Pre-apa. on/off

| D5 | Function         |
|----|------------------|
| 0  | Pre-aperture off |
| 1  | Pre-aperture on  |

■ Terminal Equivalent Circuit

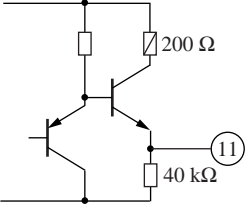
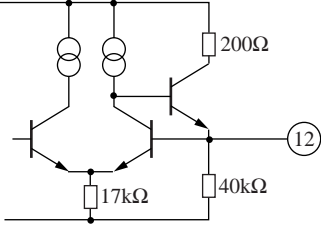
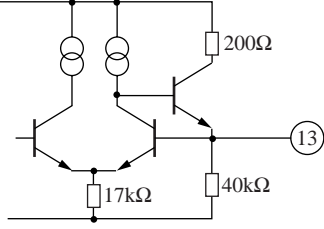
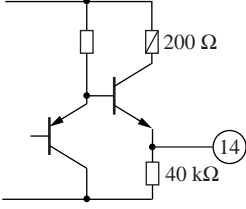
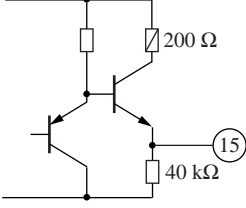
| Pin No. | Symbol          | Equivalent Circuit | Function     |
|---------|-----------------|--------------------|--------------|
| 1       | CH1             |                    | 0.6 to 2.9 V |
| 2       | V <sub>DD</sub> | —                  | 3.5 V        |
| 3       | V <sub>SS</sub> | —                  | —            |
| 4       | DI              |                    | —            |
| 5       | SCLK            |                    | —            |

■ Terminal Equivalent Circuit(Continued)

| Pin No. | Symbol | Equivalent Circuit | Function       |
|---------|--------|--------------------|----------------|
| 6       | LOAD   |                    | —              |
| 7       | CH8    |                    | 0.15 to 3.60 V |
| 8       | CH9    |                    | 0.15 to 3.60 V |
| 9       | CH12   |                    | 0.15 to 3.60 V |
| 10      | CH10   |                    | 0.15 to 3.60 V |



■ Terminal Equivalent Circuit(Continued)

| Pin No. | Symbol | Equivalent Circuit  | Function       |
|---------|--------|---|----------------|
| 11      | CH10   |    | 0.15 to 3.60 V |
| 12      | CH15   |    | 0 to 3.6 V     |
| 13      | CH14   |   | 0 to 3.6 V     |
| 14      | CH13   |  | 0.15 to 3.60 V |
| 15      | CH4    |  | 0.15 to 3.60 V |

■ Terminal Equivalent Circuit(Continued)

| Pin No. | Symbol     | Equivalent Circuit | Function     |
|---------|------------|--------------------|--------------|
| 16      | OB CONT    |                    | —            |
| 17      | A/D OUT    |                    | 1.0 to 1.4 V |
| 18      | SUB DET    |                    | —            |
| 19      | SUB AMP IN |                    | —            |
| 20      | PREAPA OUT |                    | 1.9 V        |

■ Terminal Equivalent Circuit(Continued)

| Pin No. | Symbol     | Equivalent Circuit | Function |
|---------|------------|--------------------|----------|
| 21      | $V_{REFM}$ | —                  | 1.8 V    |
| 22      | GAMMA IN   |                    | —        |
| 23      | GND2       | —                  | —        |
| 24      | CPOB IN    |                    | —        |
| 25      | $V_{CC2}$  | —                  | 4.8 V    |
| 26      | AGC OUT1   |                    | 1.8 V    |
| 27      | AGC OUT2   |                    | 1.8 V    |

■ Terminal Equivalent Circuit(Continued)

| Pin No. | Symbol   | Equivalent Circuit | Function |
|---------|----------|--------------------|----------|
| 28      | PBLK IN  |                    | —        |
| 29      | AGC DET  |                    | —        |
| 30      | AGC IN   |                    | —        |
| 31      | TRAP OUT |                    | 2.0 V    |

■ Terminal Equivalent Circuit(Continued)

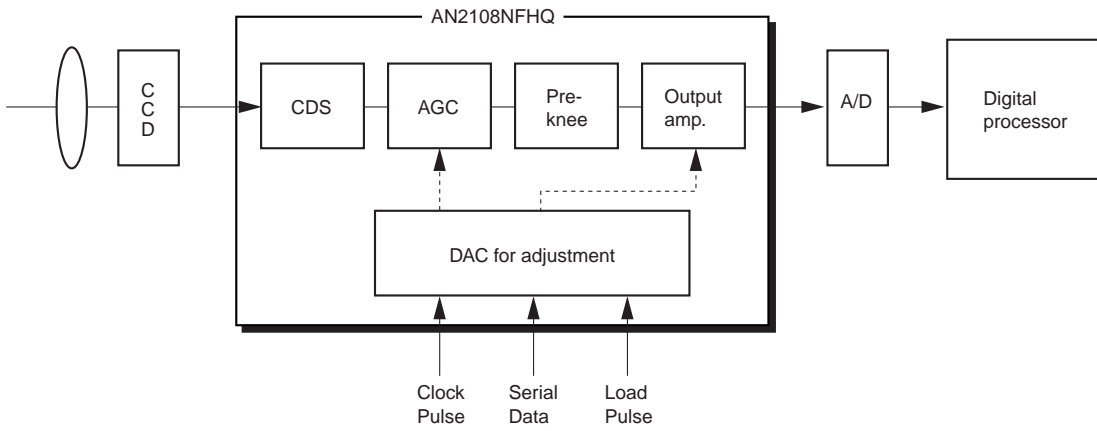
| Pin No. | Symbol           | Equivalent Circuit | Function |
|---------|------------------|--------------------|----------|
| 32      | MODE SW          |                    | —        |
| 33      | AGC REF          |                    | 1.2 V    |
| 34      | CDS OUT          |                    | 1.2 V    |
| 35      | V <sub>CC1</sub> | —                  | —        |
| 36      | DS2              |                    | —        |

■ Terminal Equivalent Circuit(Continued)

| Pin No. | Symbol      | Equivalent Circuit | Function |
|---------|-------------|--------------------|----------|
| 37      | DS1         |                    | —        |
| 38      | GND1        | —                  | —        |
| 39      | CCD IN      |                    | —        |
| 40      | $V_{REFMH}$ | —                  | 2.75 V   |
| 41      | PREAPA OUT  |                    | 1.9 V    |

■ Terminal Equivalent Circuit(Continued)

| Pin No. | Symbol            | Equivalent Circuit | Function       |
|---------|-------------------|--------------------|----------------|
| 42      | DL IN             |                    | —              |
| 43      | V <sub>CC3</sub>  | —                  | 4.8 V          |
| 44      | CH6               |                    | 0.15 to 3.60 V |
| 45      | GND2              | —                  | —              |
| 46      | CH7               |                    | 0.15 to 3.60 V |
| 47      | V <sub>REFH</sub> | —                  | 3.0 V          |
| 48      | V <sub>REFB</sub> | —                  | 1.0 V          |

**■ Application Circuit Example(CCD Camera)****■ Usage Notes**

- Supply power to Pins 25,35 and 43 simultaneously.