# LH50506/N

## CMOS 8-Bit A/D Converter

### DESCRIPTION

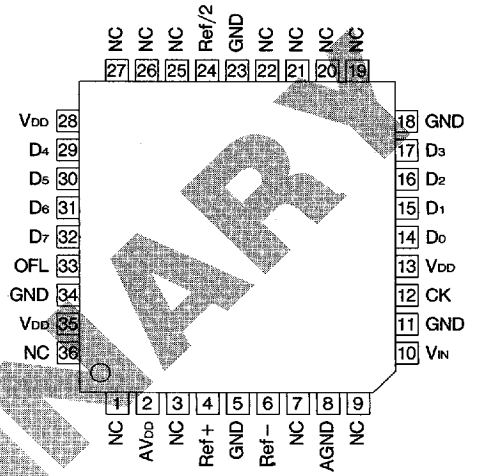
LH50506/N is an 8-bit flash A/D converter using high-speed 0.8 $\mu$m CMOS process.

### FEATURES

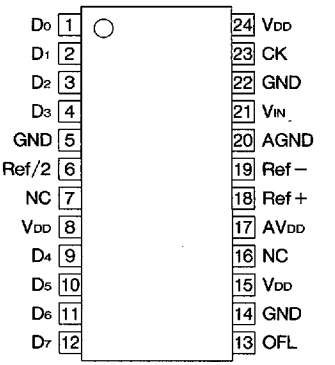
- 8-bit flash A/D converter
- 16 Msps sampling rate
- 75 mW low power ($V_{DD}$=3.0 V, Sampling=1 MHz)
- +3.3 V DC operation
- Unnecessary external S/H circuit
- Package :
  LH50506 : 36-pin QFP(QFP036-P-1010)
  LH50506N : 24-pin SOP(SOP024-P-0450B)

### PIN CONNECTIONS

**36-PIN QFP** TOP VIEW




**24-PIN SOP**

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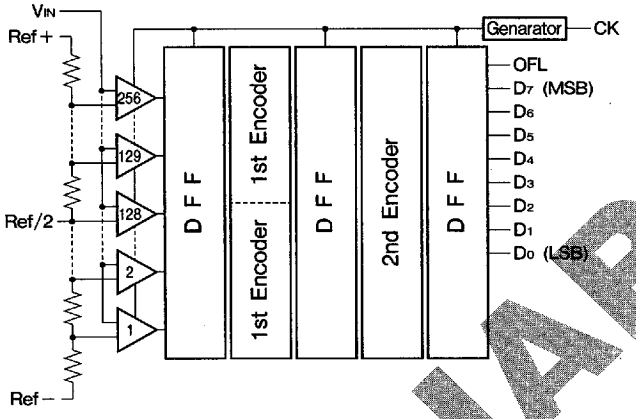
## BLOCK DIAGRAM




DFF : D-Flip Flop

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## PIN DESCRIPTION

### ● LH50506

| PIN NO. | NAME | FUNCTION | I/O |
|---|---|---|---|
| 1 | NC | No Connection | – |
| 2 | $AV_{DD}$ | Analog Power Supply | – |
| 3 | NC | No Connection | – |
| 4 | Ref+ | Reference Voltage (Top) | – |
| 5 | GND | Digital Ground | – |
| 6 | Ref– | Reference Voltage (Bottom) | – |
| 7 | NC | No Connection | – |
| 8 | AGND | Analog Ground | – |
| 9 | NC | No Connection | – |
| 10 | $V_{IN}$ | Analog Input | I |
| 11 | GND | Digital Ground | – |
| 12 | CK | Clock Input | I |
| 13 | $V_{DD}$ | Digital Power Supply | – |
| 14 | $D_0$ | Digital Output (LSB) | O |
| 15 | $D_1$ | Digital Output | O |
| 16 | $D_2$ | Digital Output | O |
| 17 | $D_3$ | Digital Output | O |
| 18 | GND | Digital Ground | – |

| PIN NO. | NAME | FUNCTION | I/O |
|---|---|---|---|
| 19 | NC | No Connection | – |
| 20 | NC | No Connection | – |
| 21 | NC | No Connection | – |
| 22 | NC | No Connection | – |
| 23 | GND | Digital Ground | – |
| 24 | Ref/2 | Reference Voltage (Middle) | – |
| 25 | NC | No Connection | – |
| 26 | NC | No Connection | – |
| 27 | NC | No Connection | – |
| 28 | $V_{DD}$ | Digital Power Supply | – |
| 29 | $D_4$ | Digital Output | O |
| 30 | $D_5$ | Digital Output | O |
| 31 | $D_6$ | Digital Output | O |
| 32 | $D_7$ | Digital Output (MSB) | O |
| 33 | OFL | Over Flow Output | O |
| 34 | GND | Digital Ground | – |
| 35 | $V_{DD}$ | Digital Power Supply | – |
| 36 | NC | No Connection | – |

### ● LH50506N

| PIN NO. | NAME | FUNCTION | I/O |
|---|---|---|---|
| 1 | $D_0$ | Digital Output (LSB) | O |
| 2 | $D_1$ | Digital Output | O |
| 3 | $D_2$ | Digital Output | O |
| 4 | $D_3$ | Digital Output | O |
| 5 | GND | Digital Ground | – |
| 6 | Ref/2 | Reference Voltage (Middle) | – |
| 7 | NC | No Connection | – |
| 8 | $V_{DD}$ | Digital Power Supply | – |
| 9 | $D_4$ | Digital Output | O |
| 10 | $D_5$ | Digital Output | O |
| 11 | $D_6$ | Digital Output | O |
| 12 | $D_7$ | Digital Output (MSB) | O |

| PIN NO. | NAME | FUNCTION | I/O |
|---|---|---|---|
| 13 | OFL | Over Flow Output | O |
| 14 | GND | Digital Ground | – |
| 15 | $V_{DD}$ | Digital Power Supply | – |
| 16 | NC | No Connection | – |
| 17 | $AV_{DD}$ | Analog Power Supply | – |
| 18 | Ref+ | Reference Voltage (Top) | – |
| 19 | Ref– | Reference Voltage (Bottom) | – |
| 20 | AGND | Analog Ground | – |
| 21 | $V_{IN}$ | Analog Input | I |
| 22 | GND | Digital Ground | – |
| 23 | CK | Clock Input | I |
| 24 | $V_{DD}$ | Digital Power Supply | – |

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## ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Supply voltage | $V_{DD}$ | −0.3 to +7.0 | V |
| Input voltage | $V_{IN}$ | GND to $V_{DD}$ | V |
| Reference voltage | Ref+, Ref− | GND to $V_{DD}$ | V |
| Output voltage | $V_{OUT}$ | −0.3 to $V_{DD}$+0.3 | V |
| Storage temperature | Tstg | −50 to +150 | °C |

## RECOMMENDED OPERATING CONDITIONS

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|
| Supply voltage | $V_{DD}$ | 2.7 | 3.3 | 3.6 | V |
| Reference voltage (Top) | Ref+ | 2.0 | | $V_{DD}$ | V |
| Reference voltage (Bottom) | Ref− | GND | | | V |
| Reference range | WRef | 1.0 | | | V |
| Analog input voltage | $V_{IN}$ | Ref− | | Ref+ | V |
| Operating temperature | Topr | −20 | | 70 | °C |

## ELECTRICAL CHARACTERISTICS

($V_{DD}$=3.0 V, CK=16 MHz, Ref+=2.0 V Ref−=1.0 V, Topr=25°C)

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|
| Resolution | | | 8 | | bit |
| Supply current | Idd | | 100 | | mA |
| Reference resistance | Rref | | 256 | | Ω |
| Linearity error | INE | | | | LSB |
| Differential linearity error | DNE | | | ±1 | LSB |
| Maximum conversion rate | | 16.0 | | | Msps |

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## FUNCTIONAL OPERATION

1. Each of internal 256 chopper type comparators has two input terminals. One is given a reference voltage, that is divided into 256 equal voltages between Ref+ and Ref− by reference resistors.The other is given an analog input ($V_{IN}$).
2. While clock input CK is "High", every comparator samples the reference voltage.
3. While clock input CK is "Low", every comparator compares $V_{IN}$ with the sampled reference voltage previously.
4. When the clock has been "High", DFF of every comparator stores the latest comparison result and outputs the thermometer code such as "11 ··· 1100 ··· 00" from Ref− side in oder.
5. The transition point of the thermometer code is detected, based on the outputs of two adjoining comparators. And then the code is converted into the 8-bit binary code by the 1st encoder.
6. The 1st encoder encodes the thermometer code for the upper 128 comparators and the lower 128 comparators separately. DFF of the 1st encoder stores the converted data on the rising edge of the next clock.
7. The 2nd encoder converts the data received from the two 1st encoders into 8-bit digital data.
8. On the rising edge of the next clock, the data is stored in the output DFF and is output through the output buffer. The output data is output at 2-clock after the rising edge of sampling clock.

* A single-phase input with 50% duty ratio is enough for the clock. However, it should be designed so that "High" period is 8 ns or more at least.

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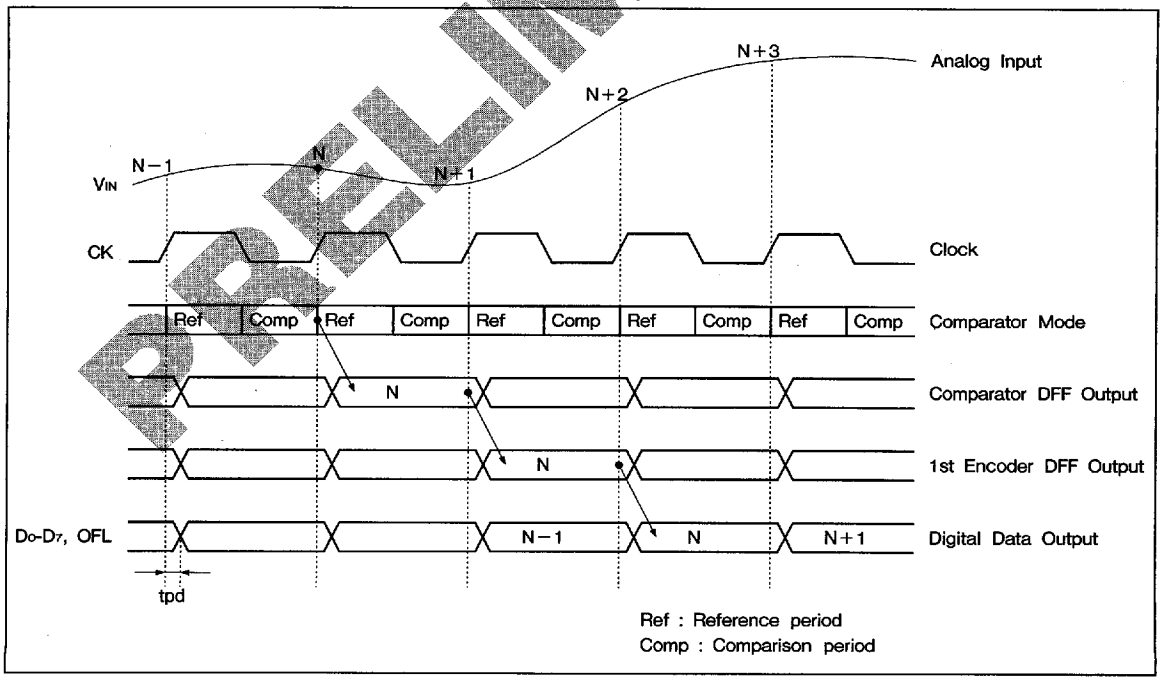




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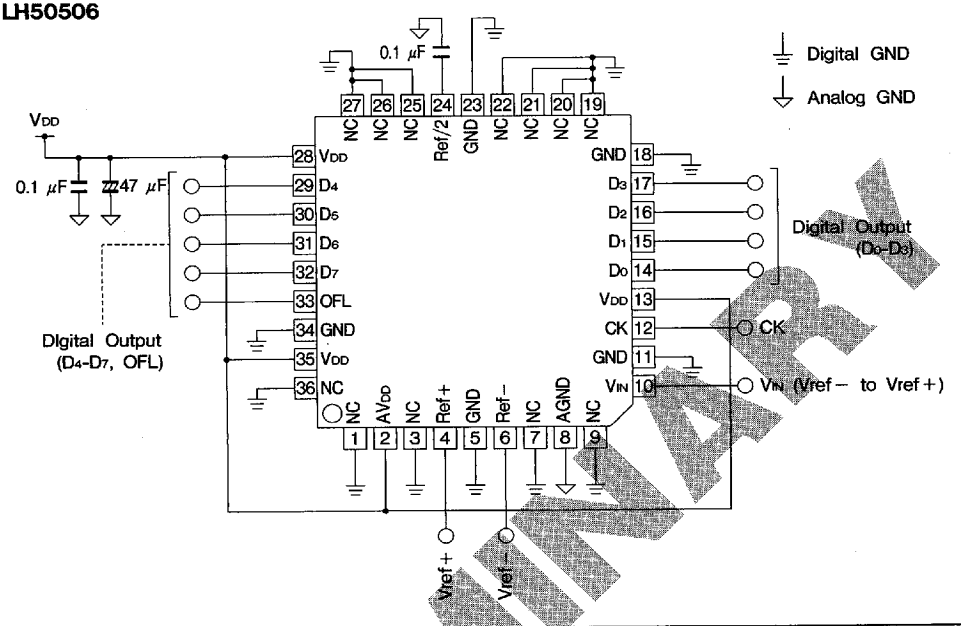
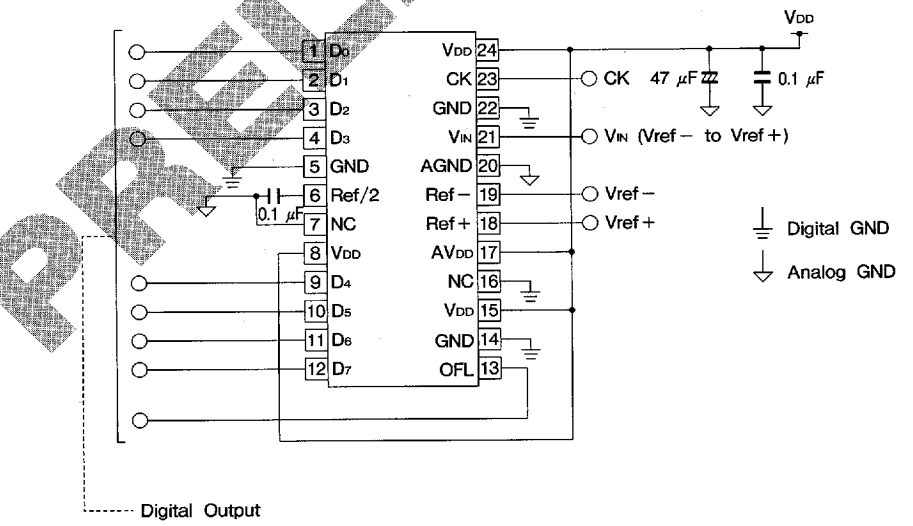
## SYSTEM CONFIGURATION EXAMPLE

### LH50506




### LH50506N

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