# HA19505

**10-Bit D/A Converter**

The HA19505 is a high-speed, low-power 10-bit D/A converter. The digital and clock inputs of this monolithic bipolar LSI are fully TTL/CMOS compatible. The noise-minimizing internal reference voltage generator and high conversion rate ($f_{CLK}$ = 50MHz typ) make this device suitable for high-speed image processing applications.

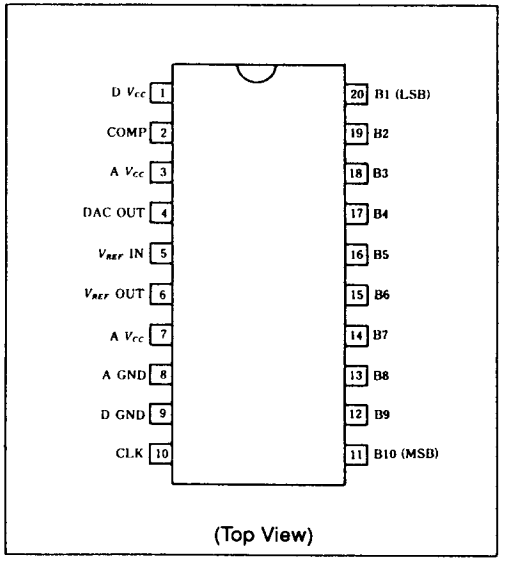
## Features

- 10-bit resolution
- 50MHz (typ) conversion rate
- Single power supply: +5V
- TTL/CMOS compatible digital and clock inputs
- Internal reference voltage (+3.0V typ)
- Low power consumption: 225mW (typ)

## Applications

- Video signal processing
- Image processing, etc.

## Pin Arrangement




(Top View)

## Ordering Information

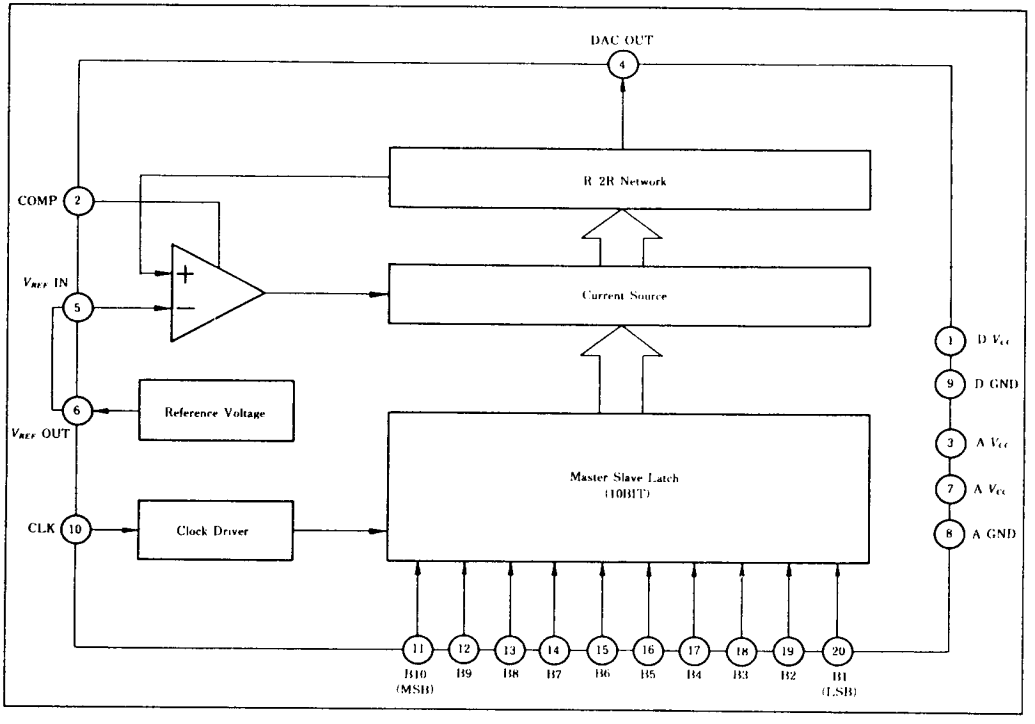
| Type No. | Package |
|---|---|
| HA19505 | DP-20N |

## Pin Descriptions

| Pin | Symbol | Function |
|---|---|---|
| 1 | DVcc | Digital power supply (+5V) |
| 2 | COMP | Phase compensation |
| 3 | AVcc | Analog power supply (+5V) |
| 4 | DAC OUT | Analog voltage output |
| 5 | VREF IN | Reference voltage input |
| 6 | VREF OUT | Reference voltage output |
| 7 | A Vcc | Analog power supply (+5V) |
| 8 | AGND | Analog ground |
| 9 | DGND | Digital ground |
| 10 | CLK | Clock input |

| Pin | Symbol | Function |
|---|---|---|
| 11 | B10 | Digital input (MSB) |
| 12 | B9 | Digital input |
| 13 | B8 | Digital input |
| 14 | B7 | Digital input |
| 15 | B6 | Digital input |
| 16 | B5 | Digital input |
| 17 | B4 | Digital input |
| 18 | B3 | Digital input |
| 19 | B2 | Digital input |
| 20 | B1 | Digital input (LSB) |

## Block Diagram



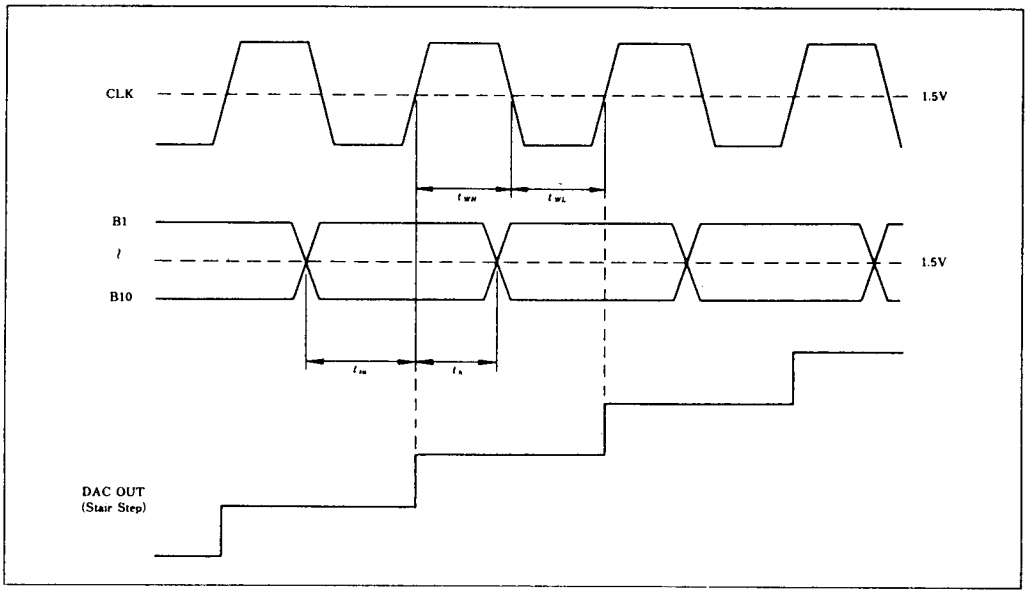
**Absolute Maximum Ratings** (Ta = 25°C, unless otherwise specified)

| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| Power supply voltage | $V_{CC}$ | +7.0 | V |
| Digital input voltage | $V_{IN}$ | 0 to $V_{CC}$ | V |
| Power dissipation | $P_T$ | 500 | mW |
| Operating temperature | $T_{opr}$ | 0 to +70 | °C |
| Storage temperature | $T_{stg}$ | −55 to +125 | °C |

**Electrical Characteristics** (Ta = 25°C, $V_{CC}$ = 5.0V, and pins 5 and 6 are shorted, unless otherwise specified)

| Parameter | | Symbol | Min | Typ | Max | Unit | Test Conditions |
|---|---|---|---|---|---|---|---|
| Resolution | | | — | 10 | — | bit | |
| Conversion rate | | $f_{CLK}$ | 40 | 50 | — | MHz | |
| Linearity error | | LE | −0.12 | — | +0.2 | % FS | |
| Clock pulsewidth H level | | $t_{WH}$ | 12.5 | — | — | ns | $f_{CLK}$ = 40MHz |
| Clock pulsewidth L level | | $t_{WL}$ | 12.5 | — | — | ns | $f_{CLK}$ = 40MHz |
| Data setup time | | $t_{su}$ | 10 | — | — | ns | $f_{CLK}$ = 40MHz |
| Data hold time | | $t_h$ | 10 | — | — | ns | $f_{CLK}$ = 40MHz |
| Power supply voltage | | $V_{CC}$ | 4.75 | 5.00 | 5.25 | V | |
| Current consumption | | $I_{CC}$ | — | 45 | 60 | mA | |
| Digital input voltage | | $V_{IH}$ | 2.0 | — | $V_{CC}$ | V | |
| | | $V_{IL}$ | 0 | — | 0.8 | V | |
| Digital input current | | $I_{IH}$ | — | — | 20 | µA | $V_{IH}$ = 2.7V |
| | | $I_{IL}$ | −400 | — | — | µA | $V_{IL}$ = 0.4V |
| Reference input current | | $I_{REF\ IN}$ | −20 | 0 | 20 | µA | $V_{REF\ IN}$ = 3.0V |
| Reference input voltage | | $V_{REF\ IN}$ | 2.0 | 3.0 | 4.0 | V | |
| Reference output voltage | | $V_{REF\ OUT}$ | — | 3.0 | — | V | |
| Analog output | Full scale | $V_{FS}$ | $V_{CC}$ − 15m | $V_{CC}$ | $V_{CC}$ + 15m | V | $V_{IH} \geq 2.0V$ |
| voltage | Zero scale | $V_{ZS}$ | — | 4.001 | — | V | $V_{IL} \leq 0.8V$ |
| Output impedance | | $Z_{out}$ | 55 | 75 | 95 | Ω | |

## Timing Chart




## Input Code Table

| B10 | B9 | B8 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | $A_{out}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | $V_{ZS}$ |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | $V_{ZS}$ + 1 LSB |
| . | . | . | . | . | . | . | . | . | . | . |
| . | . | . | . | . | . | . | . | . | . | . |
| . | . | . | . | . | . | . | . | . | . | . |
| . | . | . | . | . | . | . | . | . | . | . |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | $V_{FS}$ – 1 LSB |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | $V_{FS}$ |

**Note:** 1 LSB = ($V_{FS}$ – $V_{ZS}$)/1023