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# HA19505/MP

10-bit D/A Converter

# HITACHI

November 1996

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## Description

The HA19505/MP are a high-speed, low-power 10-bit D/A converters. 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 ( $f_{CLK} = 40 \text{ MHz Min}$ ) make this device suitable for high-speed image processing applications.

## Features

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

## Applications

- Video signal processing
- Image processing, etc.

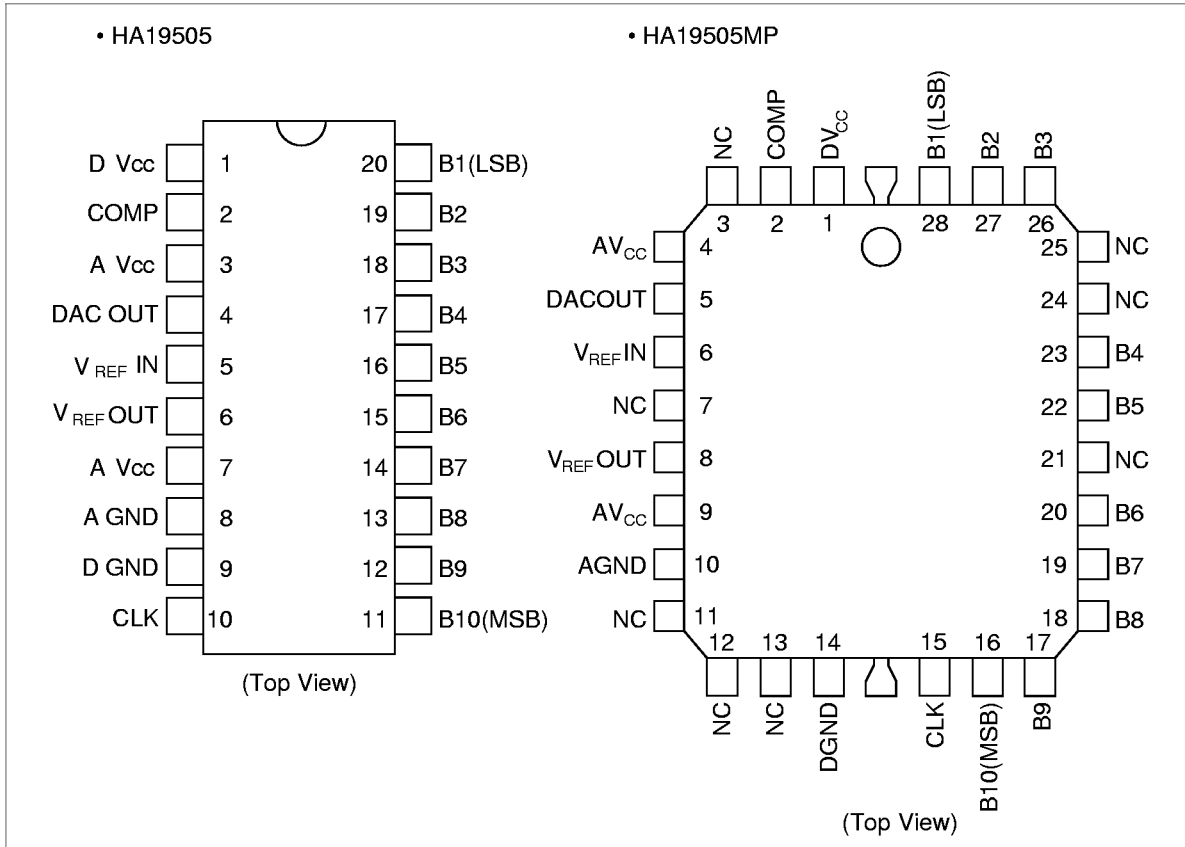
## Ordering Information

Type No.	Package
HA19505	300 mil 20 pin plastic DIP (DP-20N)
HA19505MP	28 pin plastic QFI (MP-28)

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## Pin Arrangement

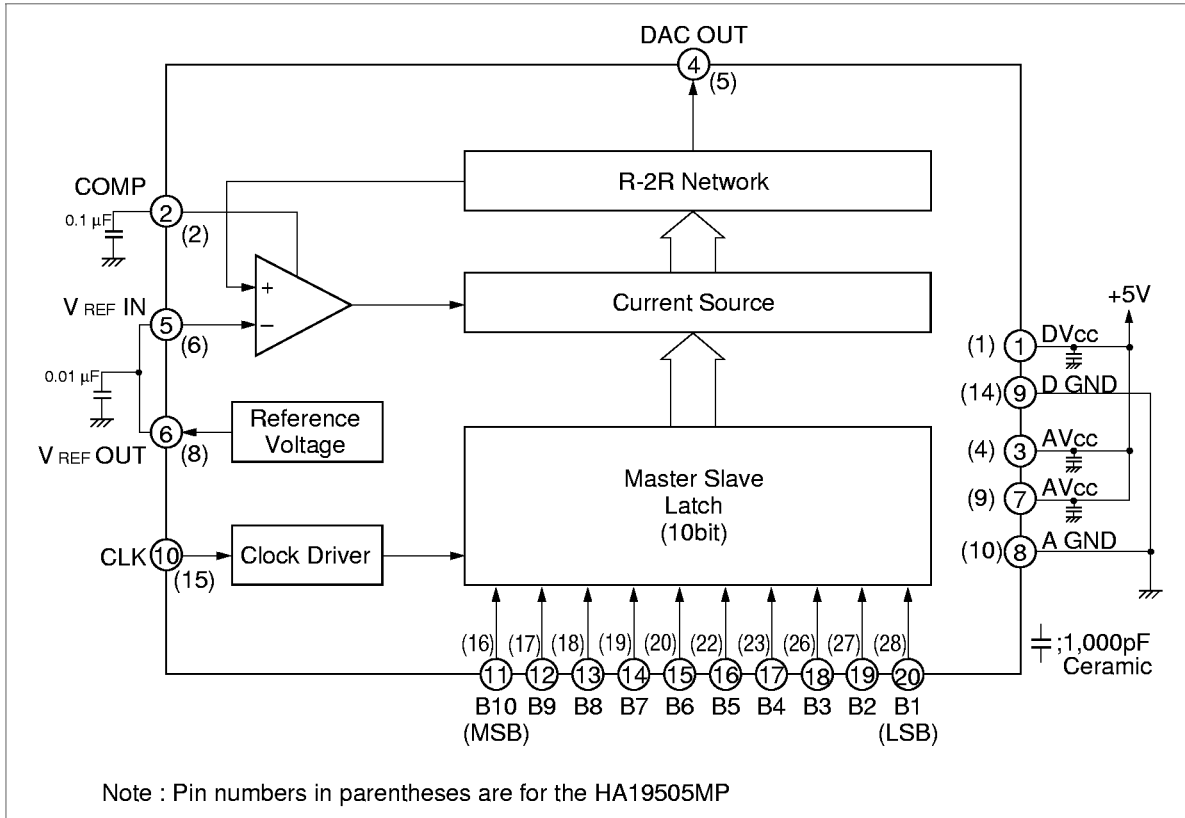


**Pin Descriptions**

Pin No.		Symbol	Function
HA19505	HA19505MP		
1	1	DV <sub>CC</sub>	Digital power supply (+5 V)
2	2	COMP	Phase compensation
3	4	AV <sub>CC</sub>	Analog power supply (+5 V)
4	5	DAC OUT	Analog voltage output
5	6	V <sub>REF</sub> IN	Reference voltage input
6	8	V <sub>REF</sub> OUT	Reference voltage output
7	9	A V <sub>CC</sub>	Analog power supply (+5 V)
8	10	AGND	Analog ground
9	14	DGND	Digital ground
10	15	CLK	Clock input
11	16	B10	Digital input (MSB)
12	17	B9	Digital input
13	18	B8	Digital input
14	19	B7	Digital input
15	20	B6	Digital input
16	22	B5	Digital input
17	23	B4	Digital input
18	26	B3	Digital input
19	27	B2	Digital input
20	28	B1	Digital input (LSB)

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## Block Diagram



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

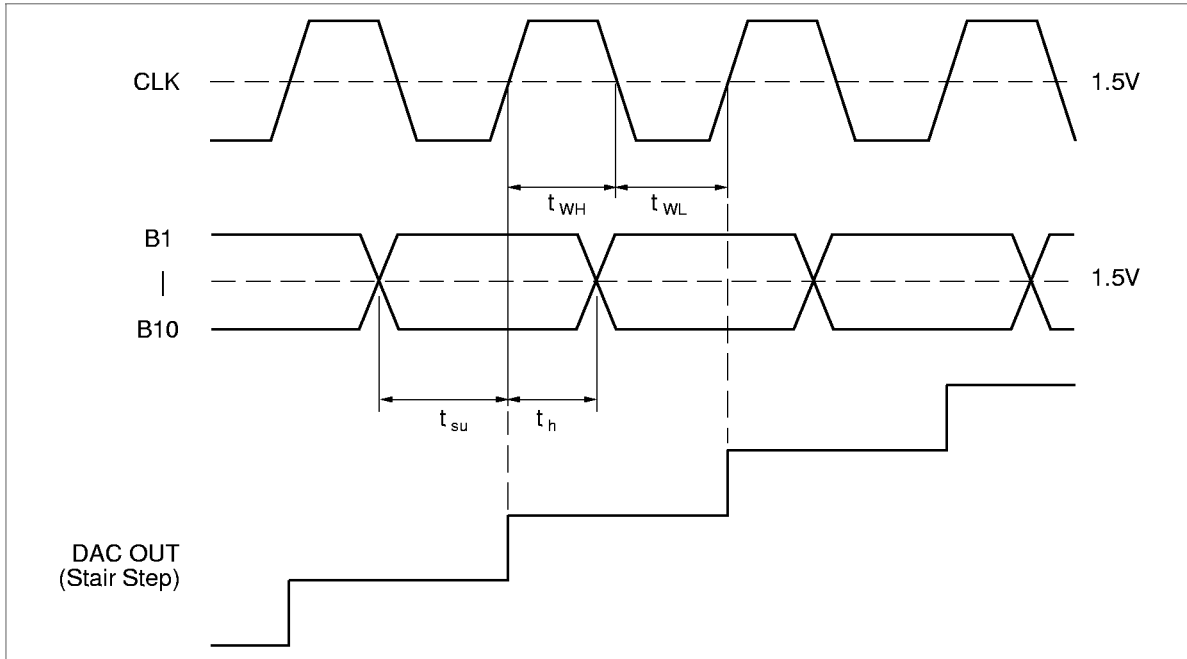
Item	Symbol	Rating	Unit
Power supply voltage	V <sub>CC</sub>	+7.0	V
Digital input voltage	V <sub>IN</sub>	0 to V <sub>CC</sub>	V
Power dissipation	P <sub>T</sub>	500	mW
Operating temperature	Topr	0 to +70	°C
Storage temperature	Tstg	-55 to +125	°C

**Electrical Characteristics** ( $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 5.0\text{ V}$ , and pins 5 and 6 are shorted, unless otherwise specified)

Item	Symbol	Min	Typ	Max	Unit	Test conditions	
Resolution		—	10	—	bits		
Linearity error	LE	-1.2	—	1.2	LSB		
Conversion rate	$f_{CLK}$	40	—	—	MHz		
Clock pulsewidth H level	$t_{WH}$	12.5	—	—	ns	$f_{CLK} = 40\text{ MHz}$	
Clock pulsewidth L level	$t_{WL}$	12.5	—	—	ns	$f_{CLK} = 40\text{ MHz}$	
Data setup time	$t_{su}$	10	—	—	ns	$f_{CLK} = 40\text{ MHz}$	
Data hold time	$t_h$	10	—	—	ns	$f_{CLK} = 40\text{ MHz}$	
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	$\mu\text{A}$	$V_{IH} = 2.7\text{ V}$	
	$I_{IL}$	-400	—	—	$\mu\text{A}$	$V_{IL} = 0.8\text{ V}$	
Reference input current	$I_{REF IN}$	-20	0	20	$\mu\text{A}$	$V_{REF IN} = 3.0\text{ V}$	
Reference input voltage	$V_{REF IN}$	2.0	3.0	4.0	V		
Reference output voltage	$V_{REF OUT}$	3.0	3.1	3.22	V		
Analog output voltage	Full scale	$V_{FS}$	$V_{CC} - 20\text{ m}$	$V_{CC}$	$V_{CC} + 15\text{ m}$	V	$V_{IH} \geq 2.0\text{ V}$
	Zero scale	$V_{ZS}$	3.940	4.000	4.060	V	$V_{IL} \leq 0.8\text{ V}$
Output impedance	Zout	55	75	95	$\Omega$		

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## Timing Chart



## Input Code Table

B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	Aout
0	0	0	0	0	0	0	0	0	0	$V_{ZS}$
0	0	0	0	0	0	0	0	0	1	$V_{ZS} + 1 \text{ LSB}$
1	1	1	1	1	1	1	1	1	0	$V_{FS} - 1 \text{ LSB}$
1	1	1	1	1	1	1	1	1	1	$V_{FS}$

Note:  $1 \text{ LSB} = (V_{FS} - V_{ZS})/1023$

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