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# HA17408P

## 8-Bit Multiplying Digital-to-Analog Converter

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### Description

The HA17408P is an 8-bit monolithic D/A converter that incorporates a reference current amplifier, an R-2R resistor ladder, and eight high-speed current switches.

Circuit designers can set the maximum output current to match the needs of their applications by setting the reference voltage and selecting a resistor value.

The reference current is distributed to the current value for each bit by the R-2R resistor ladder, and thus the maximum output current is 255/256 times the reference current. For example, the largest output current that can be acquired for a reference input current of 2.0 mA is 1.992 mA.

The HA17408P can be used in a wide range of applications including CRT displays, stepping motor control, programmable power supplies, audio equipment, and attenuators.

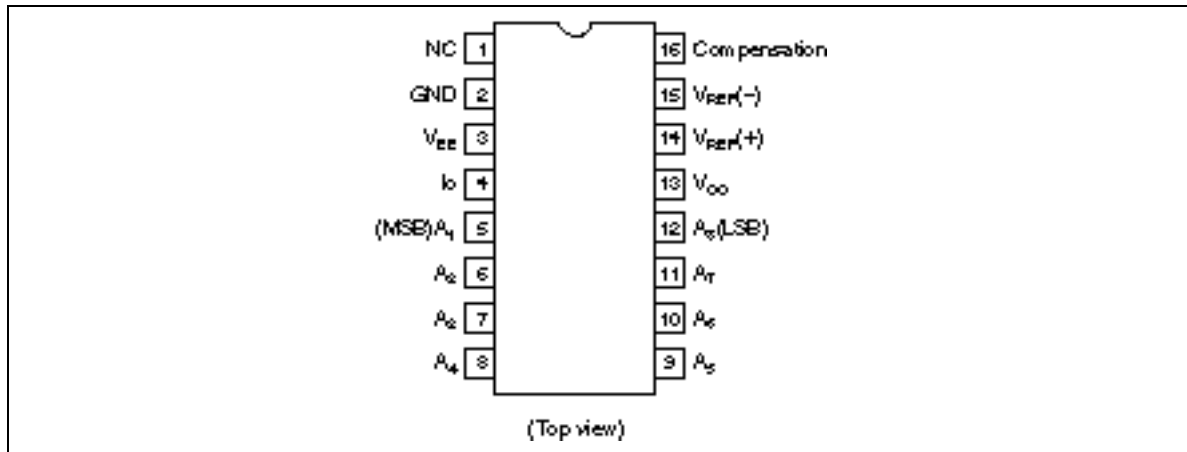
### Features

- A linearity of  $\pm 0.19\%$  ( $\pm 1/2$  LSB) is guaranteed.
- Short centering time (250 ns typical) for rapid conversions
- Low power dissipation: 157 mW typical
- Compatible with TTL and CMOS logic
- Standard supply voltages of  $V_{CC} = +5.0$  V,  $V_{EE} = -5.0$  V and  $-15.0$  V
- Wide output voltage range: +0.5 to -5.0 V

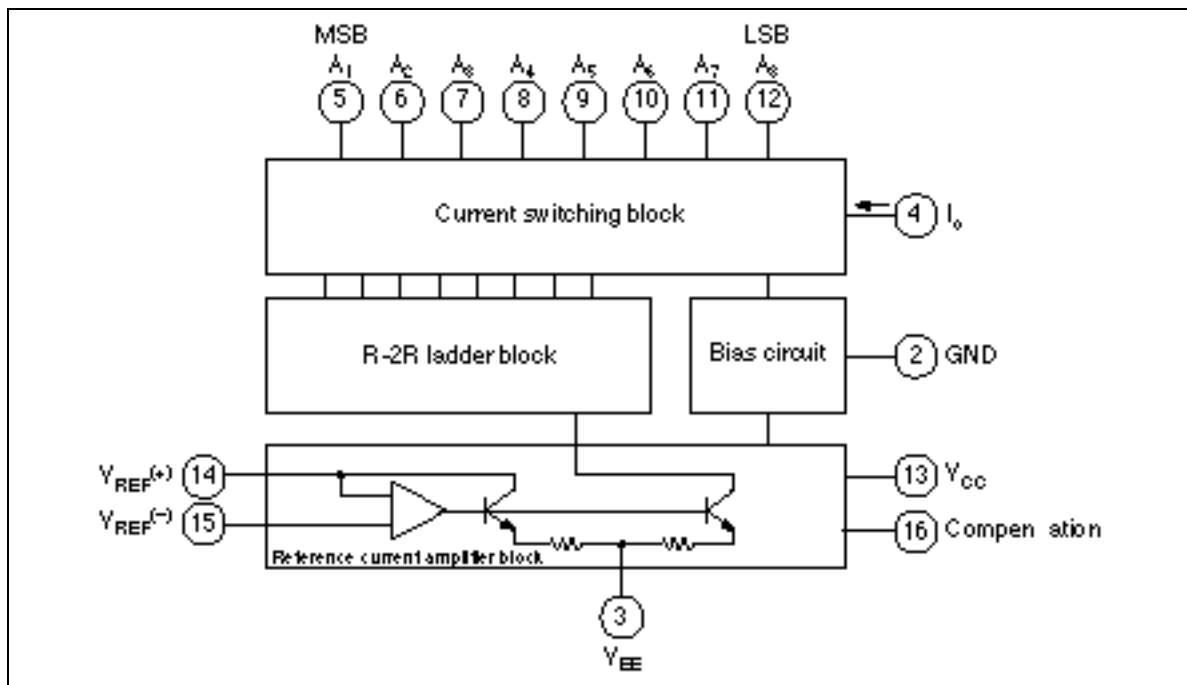
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## Pin Arrangement



## Block Diagram



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**Absolute Maximum Ratings** ( $T_a = 25^\circ\text{C}$ )

Item	Symbol	Rated Value	Unit
Power-supply voltage	$V_{CC}$	5.5	V
	$V_{EE}$	-16.5	V
Digital input voltage	$V_5$ to $V_{12}$	0 to +5.5	V
Output voltage	$V_O$	0.5 to -5.2	V
Reference current	$I_{14}$	5.0	mA
Reference amplifier input voltage range	$V_{REF}$	$V_{CC}, V_{EE}$	V
Allowable power dissipation	$P_T$	625	mW
Operating temperature	$T_{opr}$	-20 to +75	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-55 to +125	$^\circ\text{C}$

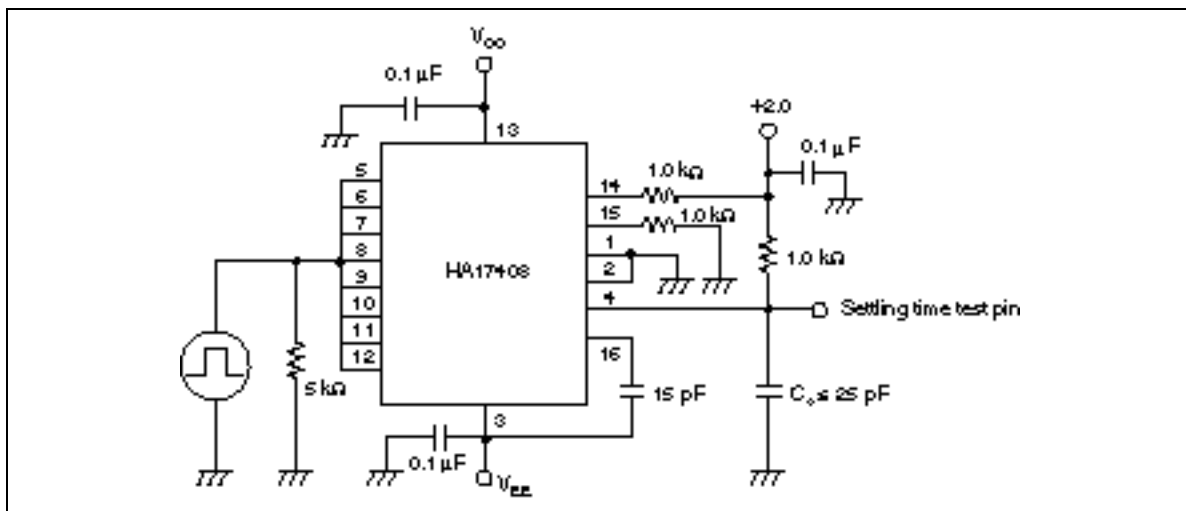
**Electrical Characteristics** ( $V_{CC} = 5.0\text{ V}$ ,  $V_{EE} = -15\text{ V}$ ,  $I_{ref} = 2\text{ mA}$ ,  $T_a = 25^\circ\text{C}$ )

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Relative error	$E_R$	—	—	$\pm 0.19$	%FS	
Settling time ( $\pm 1/2$ LSB)	$t_s$	—	250	—	ns	All bits OFF $\rightarrow$ ON
Transmission delay time	$t_{PLH}, t_{PHL}$	—	30	100	ns	
Maximum output current drift	$T_{CIO}$	—	$\pm 20$	—	ppm/ $^\circ\text{C}$	
Digital input level	$V_{IH}$	2.0	—	—	V	
	$V_{IL}$	—	—	0.8	V	
Digital input current	$I_{IH}$	—	0	0.04	mA	$V_{IH} = 5.0\text{ V}$
	$I_{IL}$	-0.8	-0.002	—	mA	$V_{IL} = 0.8\text{ V}$
Reference input bias current	$I_{15}$	-3.0	-1.0	—	$\mu\text{A}$	
Output current range	$I_{OR}$	0	2.0	2.1	mA	$V_{EE} = -5.0\text{ V}$
		0	2.0	4.2	mA	$V_{EE} = -7.0$ to $-15\text{ V}$
Output current	$I_O$	1.9	1.99	2.1	mA	$V_{ref} = 2.000\text{ V}$ , $R_{14} = 1.000$
	$I_{O(\min)}$	—	0	4.0	$\mu\text{A}$	All bits low
Output voltage range	$V_O$	-0.6	—	+0.5	V	$V_{EE} = -5\text{ V}$
		-5.0	—	+0.5	V	$V_{EE} < -10\text{ V}$
Reference current slew rate	STIref	—	4.0	—	mA/ $\mu\text{s}$	

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**Electrical Characteristics** ( $V_{CC} = 5.0\text{ V}$ ,  $V_{EE} = -15\text{ V}$ ,  $I_{ref} = 2\text{ mA}$ ,  $T_a = 25^\circ\text{C}$ ) (cont)

Item	Symbol	Min	Typ	Max	Unit	Test Condition	
Current drain	$I_{CC}$	—	1.9	14	mA		
	$I_{EE}$	-13	-5.8	—	mA		
Power-supply voltage	$V_{CC}$	4.5	5.0	5.5	V		
	$V_{EE}$	-16.5	-15	-4.5	V		
Power dissipation	$P_T$	—	34	136	mW	All bits	$V_{EE} = -5.0\text{ V}$
		—	97	265	mW	low	$V_{EE} = -15\text{ V}$
	—	34	—	mW	All bits	$V_{EE} = -5.0\text{ V}$	
	—	97	—	mW	high	$V_{EE} = -15\text{ V}$	



Settling Time Test Circuit

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