# **HA17408P**

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

# HITACHI

#### **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.

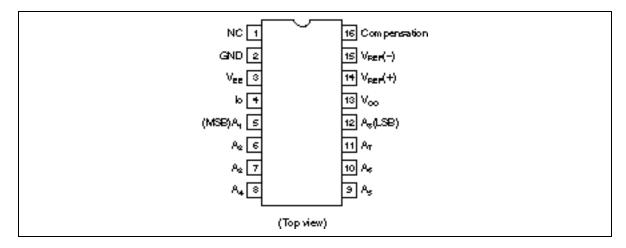
The HA17408P can be used in a wide range of applications including CRT displays, stepping motor control, programmable power supplies, audio equipment, and attenuators.

#### **Features**

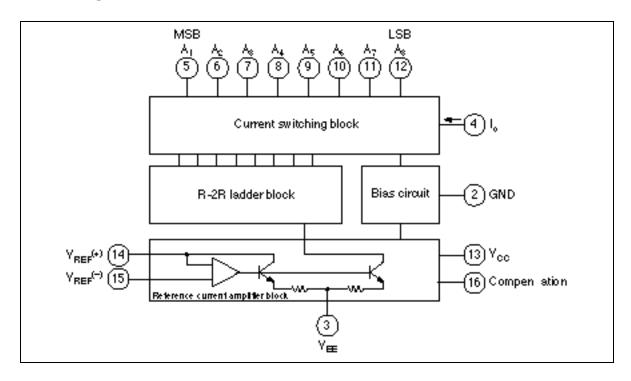
- A linearity of  $\pm 0.19\%$  ( $\pm 1/2$  LSB) is guaranteed.
- Short centering time (250 ns typical) for rapid conversions
- Low power dissipation: 157 mW typical
- Compatible with TTL and CMOS logic
- Standard supply voltages of  $V_{CC}$  = +5.0 V,  $V_{EE}$  = -5.0 V and = -15.0 V
- Wide output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

### HA17408P

#### **Pin Arrangement**



#### **Block Diagram**



## **Absolute Maximum Ratings** ( $Ta = 25^{\circ}C$ )

Item	Symbol	Rated Value	Unit
Power-supply voltage	V <sub>CC</sub>	5.5	V
	V <sub>EE</sub>	-16.5	V
Digital input voltage	V <sub>5</sub> to V <sub>12</sub>	0 to +5.5	V
Output voltage	V <sub>O</sub>	0.5 to -5.2	V
Reference current	I <sub>14</sub>	5.0	mA
Reference amplifier input voltage range	V <sub>REF</sub>	$V_{CC}, V_{EE}$	V
Allowable power dissipation	P <sub>T</sub>	625	mW
Operating temperature	Topr	−20 to +75	°C
Storage temperature	Tstg	-55 to +125	°C

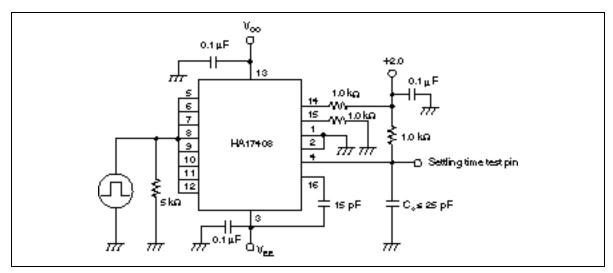
## Electrical Characteristics ( $V_{CC} = 5.0 \ V, \ V_{EE} = -15 \ V, \ Iref = 2 \ mA, \ Ta = 25 ^{\circ}C)$

Item	Symbol	Min	Тур	Max	Unit	Test Condition
Relative error	E <sub>R</sub>	_	_	±0.19	%FS	
Settling time (± 1/2 LSB)	t <sub>s</sub>	_	250	_	ns	All bits OFF $\rightarrow$ ON
Transmission delay time	$t_{PLH}, t_{PHL}$	_	30	100	ns	
Maximum output current drift	$T_{CIO}$	_	±20	_	ppm/°C	
Digital input level	$V_{IH}$	2.0	_	_	V	
	V <sub>IL</sub>	_	_	0.8	V	
Digital input current	I <sub>IH</sub>	_	0	0.04	mA	V <sub>IH</sub> = 5.0 V
	I <sub>IL</sub>	-0.8	-0.002	_	mA	V <sub>IL</sub> = 0.8 V
Reference input bias current	I <sub>15</sub>	-3.0	-1.0	_	μΑ	
Output current range	I <sub>OR</sub>	0	2.0	2.1	mA	V <sub>EE</sub> = -5.0 V
		0	2.0	4.2	mA	$V_{EE} = -7.0 \text{ to } -15 \text{ V}$
Output current	Io	1.9	1.99	2.1	mA	Vref = 2.000 V, R <sub>14</sub> = 1.000
	I <sub>O (min)</sub>	_	0	4.0	μΑ	All bits low
Output voltage range	Vo	-0.6	_	+0.5	V	V <sub>EE</sub> = −5 V
		-5.0	_	+0.5	V	V <sub>EE</sub> < -10 V
Reference current slew rate	STIref	_	4.0	_	mA/µs	

## HA17408P

## $\textbf{Electrical Characteristics} \ (V_{CC} = 5.0 \ V, \ V_{EE} = -15 \ V, \ Iref = 2 \ mA, \ Ta = 25^{\circ}C) \ (cont)$

Item	Symbol	Min	Тур	Max	Unit	Test Condition	
Current drain	I <sub>cc</sub>	_	1.9	14	mA		
	I <sub>EE</sub>	-13	-5.8	_	mA		
Power-supply voltage	V <sub>CC</sub>	4.5	5.0	5.5	V		
	V <sub>EE</sub>	-16.5	-15	-4.5	V		
Power dissipation	P <sub>T</sub>	_	34	136	mW	All bits low	V <sub>EE</sub> = -5.0 V
		_	97	265	mW		V <sub>EE</sub> = -15 V
		_	34	_	mW	All bits high	V <sub>EE</sub> = -5.0 V
		_	97	_	mW		V <sub>EE</sub> = -15 V



**Settling Time Test Circuit**