
HA17408P

8-Bit Multiplying Digital-to-Analog Converter

HITACHI

ADE-204-061 (Z)

Rev. 0

Dec. 2000

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.

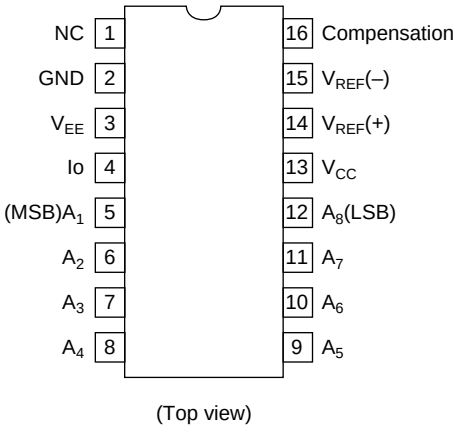
The reference current is distributed to the current value for each bit by the R-2R resistor ladder, and thus the maximum output current is 255/256 times the reference current. For example, the largest output current that can be acquired for a reference input current of 2.0 mA is 1.992 mA.

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

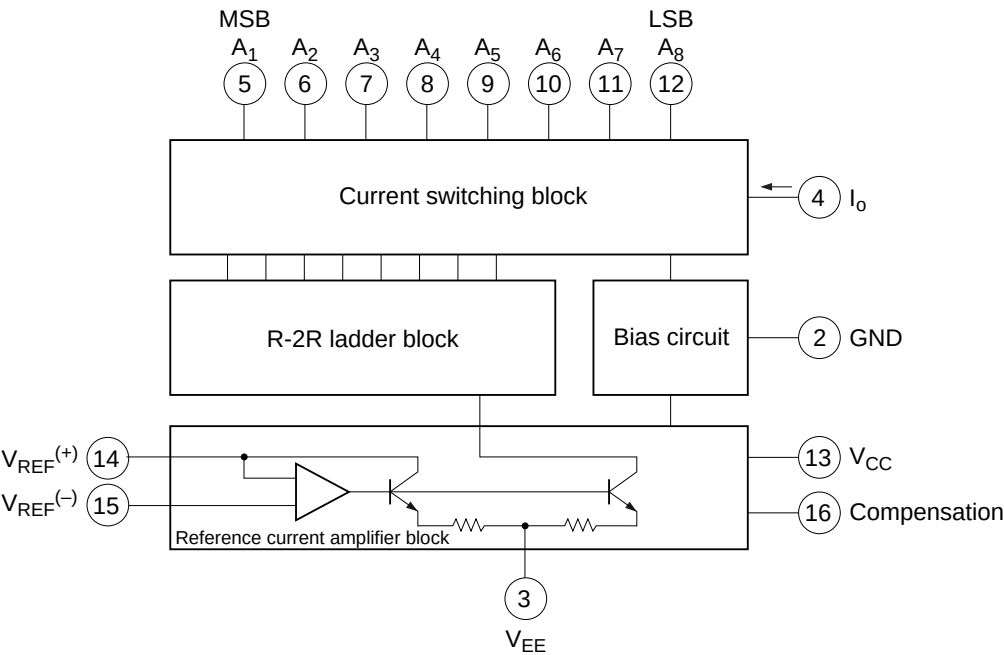
Features

- A linearity of $\pm 0.19\%$ ($\pm 1/2$ LSB) is guaranteed.
- Short settling 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

Pin Arrangement



Block Diagram



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

Item	Symbol	Rating	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
Power dissipation	P_T	625	mW
Operating temperature	T_{opr}	−20 to +75	$^\circ\text{C}$
Storage temperature	T_{stg}	−55 to +125	$^\circ\text{C}$

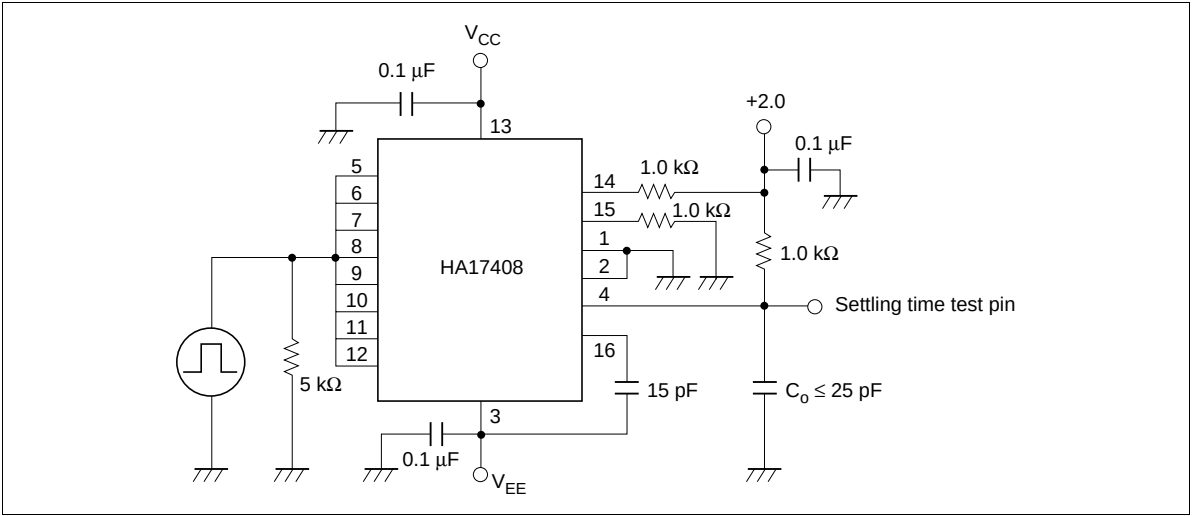
Electrical Characteristics ($V_{CC} = 5.0\text{ V}$, $V_{EE} = -15\text{ V}$, $I_{ref} = 2\text{ mA}$, $T_a = 25^\circ\text{C}$)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Relative error	E_R	—	—	± 0.19	%FS	
Settling time ($\pm 1/2$ LSB)	t_s	—	250	—	ns	All bits OFF to ON
Transmission delay time	t_{PLH} , t_{PHL}	—	30	100	ns	
Maximum output current drift	T_{CIO}	—	± 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	—	μA	
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 V
Output current	I_O	1.9	1.99	2.1	mA	$V_{ref} = 2.000\text{ V}$, $R_{14} = 1.000\ \Omega$
	$I_{O\ (min)}$	—	0	4.0	μA	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/ μs	

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)

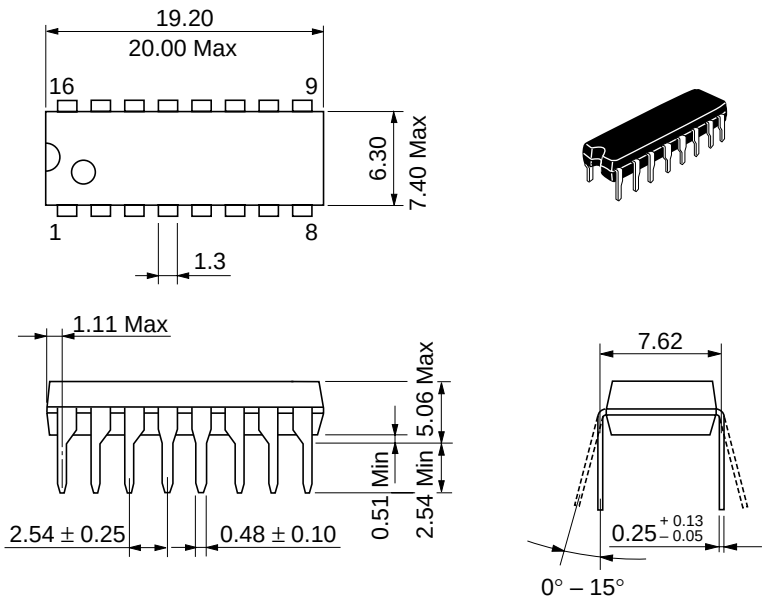
Item	Symbol	Min	Typ	Max	Unit	Test Conditions	
Power supply current	I_{CC}	—	1.9	14	mA		
	I_{EE}	-13	-5.8	—	mA		
Power-supply voltage	V_{CC}	4.5	5.0	5.5	V		
	V_{EE}	-16.5	-15	-4.5	V		
Power dissipation	P_T	—	34	136	mW	All bits low	$V_{EE} = -5.0\text{ V}$
		—	97	265	mW		$V_{EE} = -15\text{ V}$
		—	34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

Settling Time Test Circuit



Package Dimensions

Unit: mm



Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Mass (reference value)	1.07 g

Cautions

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi's or any third party's patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party's rights, including intellectual property rights, in connection with use of the information contained in this document.
 2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.
 3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi's sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.
 4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safes, so that the equipment incorporating Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.
 5. This product is not designed to be radiation resistant.
 6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.
 7. Contact Hitachi's sales office for any questions regarding this document or Hitachi semiconductor products.

HITACHI

Hitachi, Ltd.

Semiconductor & Integrated Circuits.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

URL	NorthAmerica	:	http://semiconductor.hitachi.com/
	Europe	:	http://www.hitachi-eu.com/hel/ecg
	Asia	:	http://sicapac.hitachi-asia.com
	Japan	:	http://www.hitachi.co.jp/Sicd/indx.htm

For further information write to:

Hitachi Semiconductor (America) Inc. 179 East Tasman Drive, San Jose, CA 95134 Tel: <1> (408) 433-1990 Fax: <1> (408) 433-0223	Hitachi Europe GmbH Electronic Components Group Dornacher Straße 3 D-85622 Feldkirchen, Munich Germany Tel: <49> (89) 9 9180-0 Fax: <49> (89) 9 29 30 00 Hitachi Europe Ltd. Electronic Components Group. Whitebrook Park Lower Cookham Road Maidenhead Berkshire SL6 8YA, United Kingdom Tel: <44> (1628) 585000 Fax: <44> (1628) 585160
--	---

Hitachi Asia Ltd. Hitachi Tower 16 Collyer Quay #20-00, Singapore 049318 Tel : <65>-538-6533/538-8577 Fax : <65>-538-6933/538-3877 URL : http://www.hitachi.com.sg Hitachi Asia Ltd. (Taipei Branch Office) 4/F, No. 167, Tun Hwa North Road, Hung-Kuo Building, Taipei (105), Taiwan Tel : <886>-(2)-2718-3666 Fax : <886>-(2)-2718-8180 Telex : 23222 HAS-TP URL : http://www.hitachi.com.tw

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower,
World Finance Centre,
Harbour City, Canton Road
Tsim Sha Tsui, Kowloon,
Hong Kong
Tel : <852>-(2)-735-9218
Fax : <852>-(2)-730-0281
URL : <http://www.hitachi.com.hk>

Copyright © Hitachi, Ltd., 2000. All rights reserved. Printed in Japan.
Colophon 2.0