HA13408

9-Channel Power Driver

HITACHI

ADE-207-206 (Z)
1st Edition
July 1996

Description

The HA13408 9-channel power driver IC is designed to drive dot matrix printer head. This IC can drive 9 pins without using any external components. HA13408 can be used for 2 system four-phase step drive, as every channel is used independently.

Features

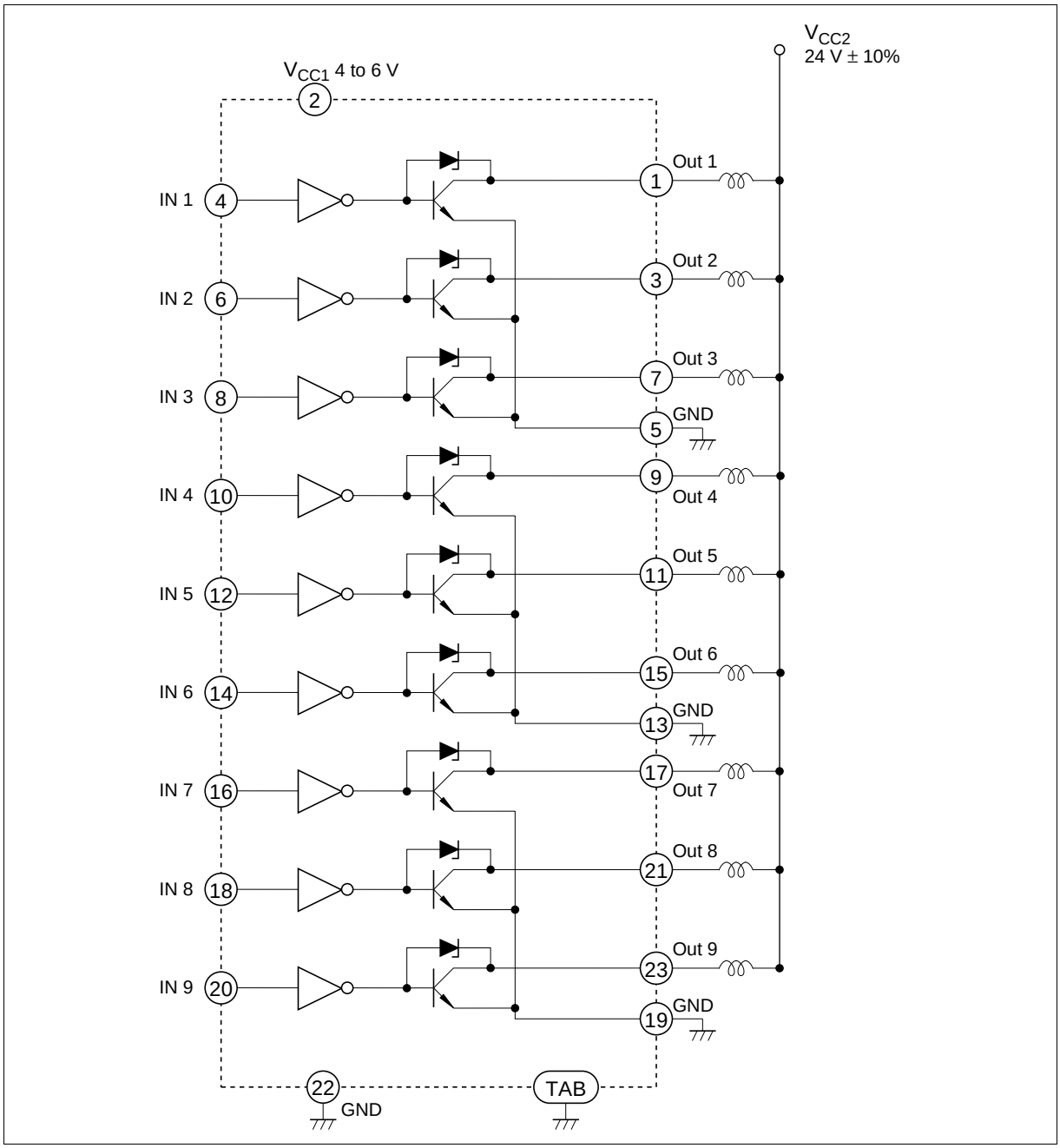
- High output current: 1.5 A/channel Max
- High sustaining voltage: 50 V Min
- Low saturation voltage
- Low supply current
- Low input current
- Compatible with TTL, LSTTL & 5 V CMOS
- Low thermal resistance package
- Zener diodes

Truth Table

Input	Output
Low	On
High	Off
Open	Off

Hitachi semiconductor

Block Diagram



Peak Current and Turn-Off Time

Figure 1 shows load current (Iout) and output terminal voltage (Vout) waveforms for the HA13408 driving an inductive load.

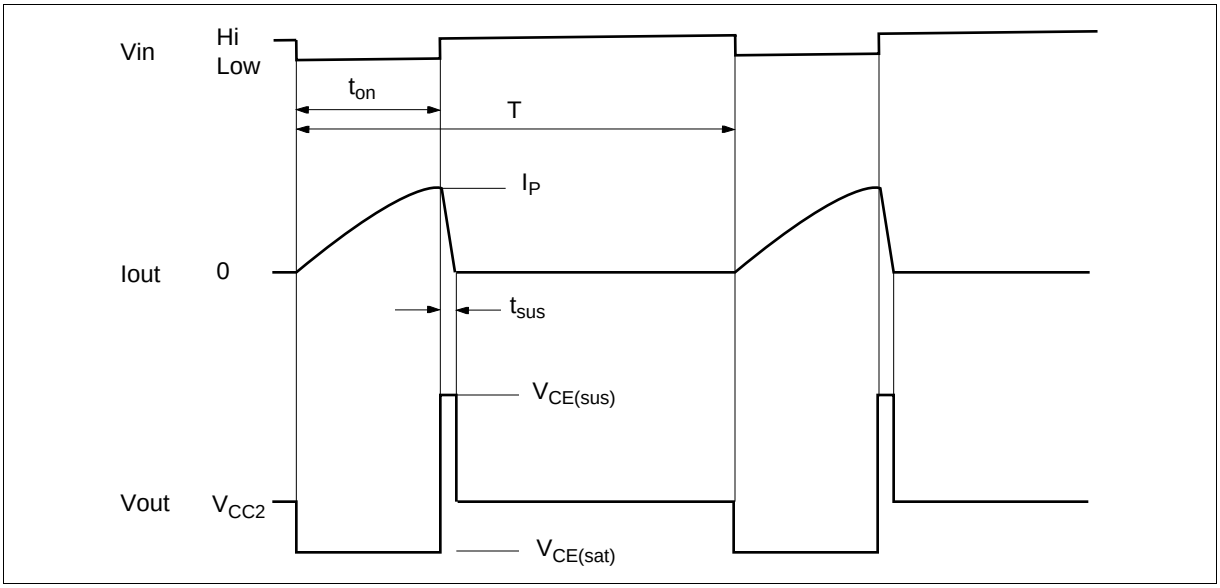


Figure 1 Output Waveforms

The peak output current (Ip) and sustain time (tsus) are obtained as follows;

$$I_P = \frac{V_{CC2} - V_{CE(sat)}}{R}\left(1 - \exp\left(-\frac{R}{L}t_{on}\right)\right) \fallingdotseq \frac{V_{CC2}}{R}\left(1 - \exp\left(-\frac{R}{L}t_{on}\right)\right) \quad (1)$$

$$t_{sus} = \frac{L}{R}\ln\left(1 + \frac{I_P \cdot R}{V_{CE(sus)} - V_{CC2}}\right) \quad (2)$$

Where L is load self-inductance and R is load direct current resistance.

For example, under the following conditions:

L = 5 mH,

R = 22 Ω

Supply voltage V_{CC2} = 24 V,

Time to drive load ton = 0.42 ms.

Peak current (Ip) and sustain time (tsus) are then:

I_p = 0.87 A

t_{sus} = 0.118 ms

Where $V_{CE(sat)}$ = 1.3 V typ and $V_{CE(sus)}$ = 52 V typ.

Power Dissipation

Power dissipation driving an inductive load for an HA13408 is determined as follows:

First, average power dissipation (Pon) per channel at ton is obtained as follows:

$$Pon \fallingdotseq V_{CE(sat)} I_P \left(\frac{V_{CC2}}{R \bullet I_P} - \frac{1}{t_{on}} \frac{L}{R} \right) \quad (3)$$

Average power dissipation (Psus) at t_{sus}:

$$Psus \fallingdotseq V_{CE(sus)} I_P \left(\frac{1}{t_{sus}} \frac{L}{R} - \frac{V_{CE(sus)} - V_{CC2}}{R \bullet I_P} \right) \quad (4)$$

Where I_P and tsus are obtained in equations (1) and (2).

Average power dissipation (P_T) per channel for a period is obtained as follows:

$$P_T \fallingdotseq \frac{1}{T} (Pon \bullet t_{on} + Psus \bullet t_{sus}) \quad (5)$$

Where drive period is defined as T.

Power dissipation (P_T) for 9 channels driven at the same time:

$$P_T \fallingdotseq \frac{9}{T} (Pon \bullet t_{on} + Psus \bullet t_{sus}) \quad (6)$$

Application

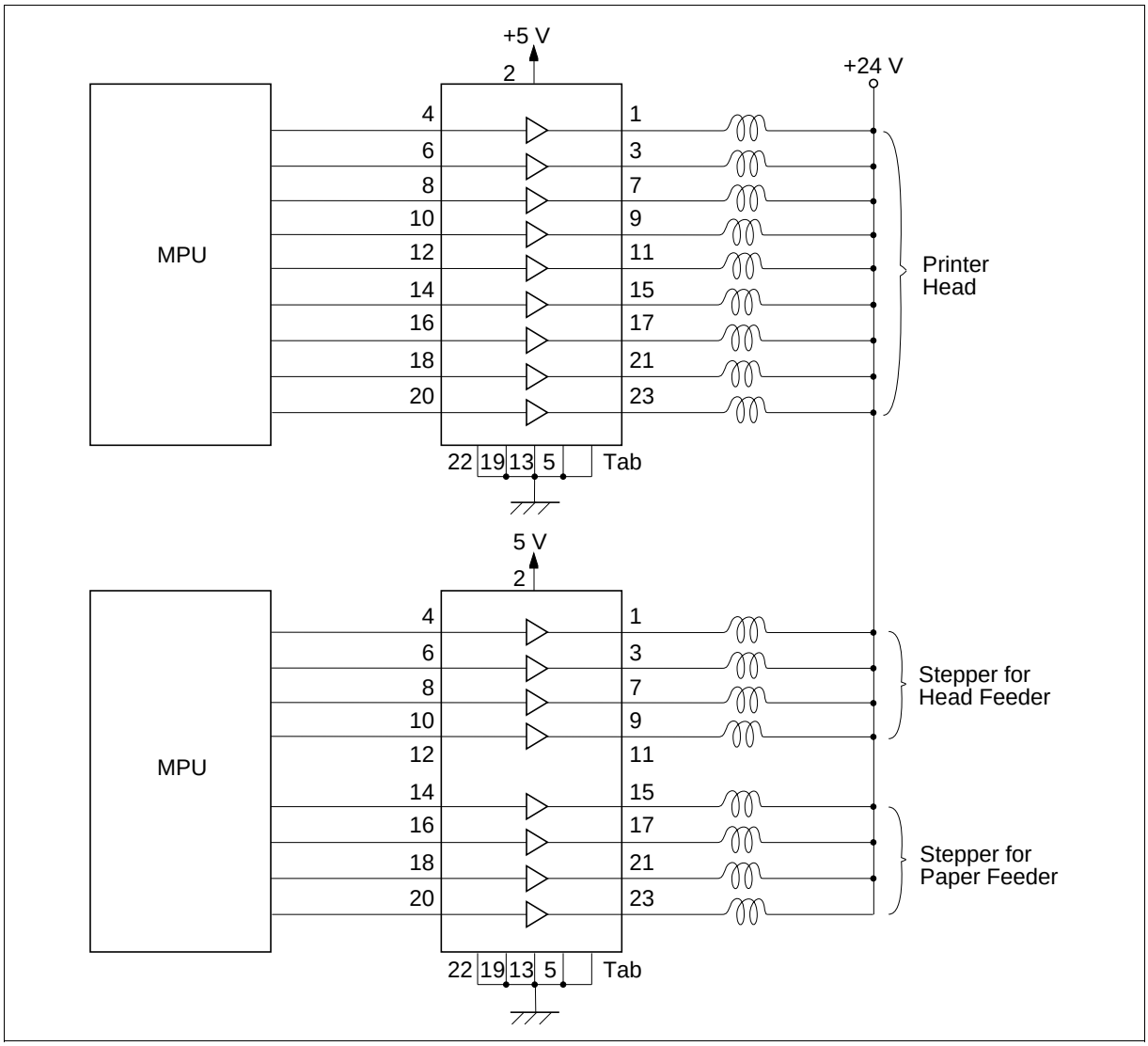


Figure 2 Dot Matrix Printer

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Rating	Unit	Notes
Supply voltage	V_{CC1}	7.0	V	
Input voltage	V_I	V_{CC1}	V	
Output voltage	$V_{CE(sus)}$	50	V	
Output current	I_O	1.5	A	
Power dissipation	P_T	20	W	1
Junction temperature	Tj	150	°C	
Operating junction temperature range	Tjop	–20 to +125	°C	
Storage temperature range	Tstg	–55 to +125	°C	

Notes: 1. Thermal resistance $\theta_{j-a} \leq 40$°C/W
$\theta_{j-c} \leq 3$°C/W

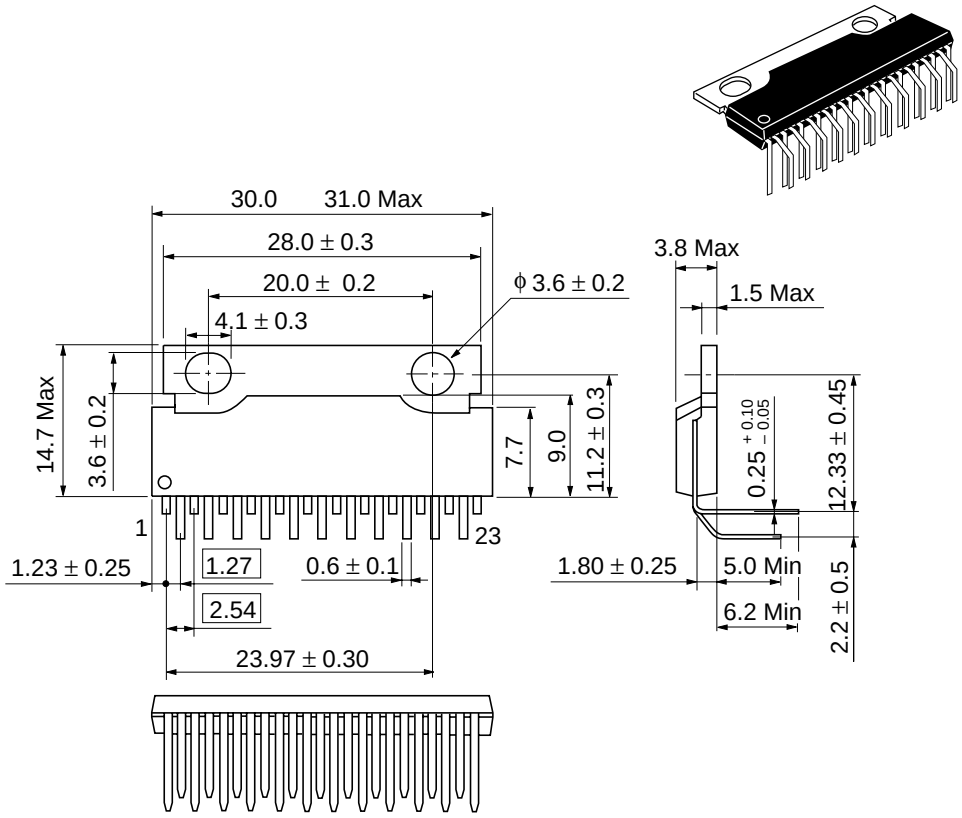
Electrical Characteristics (Ta = 25°C, V_{CC1} = 5 V)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions	Note
Input Low voltage	V_{IL}	—	—	0.8	V	V_{CC1} = 4.0 V	
Input High voltage	V_{IH}	2.0	—	—	V	V_{CC1} = 6.0 V	
Input Low current	I_{IL}	–100	–15	+10	µA	V_I = 0 V	
Input HIgh current	I_{IH}	–10	0	+10	µA	V_I = 2.4 V	
Supply current	I_{CCO}	—	30	45	mA	All V_I = 2.4 V	
	I_{CC}	—	33	50	mA	All V_I = 0 V	
Output cut off current	I_{CEO}	—	—	1.0	mA	V_{CC1} = 6 V, V_{CC2} = 40 V, V_I =2 .0 V	
Output saturation voltage	$V_{CE(sat)}$	—	1.6	2.2	V	V_{CC1} = 4 V, I_O = 1.0 A, V_I = 0.8 V	
Output sustaining voltage	$V_{CE(sus)}$	50	—	—	V	I_O = 1.0 A	1
Delay time	t_{PLH}	—	1.5	5	µs	Turn OFF	
	t_{PHL}	—	0.3	5	µs	Turn ON	

Note: 1. The conditions of loading; Measure at Ls = 5 mH, Rs = 22 Ω.

Package Dimensions

Unit: mm



Hitachi Code	SP-23TA
JEDEC	—
EIAJ	—
Weight (reference value)	4.61 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 (Singapore) : http://www.has.hitachi.com.sg/grp3/sicd/index.htm
Asia (Taiwan) : http://www.hitachi.com.tw/E/Product/SICD_Frame.htm
Asia (HongKong) : http://www.hitachi.com.hk/eng/bo/grp3/index.htm
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) 778322

Hitachi Asia Pte. Ltd.
16 Collyer Quay #20-00
Hitachi Tower
Singapore 049318
Tel: 535-2100
Fax: 535-1533

Hitachi Asia Ltd.
Taipei Branch Office
3F, Hung Kuo Building. No.167,
Tun-Hwa North Road, Taipei (105)
Tel: <886> (2) 2718-3666
Fax: <886> (2) 2718-8180

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
Telex: 40815 HITEC HX