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

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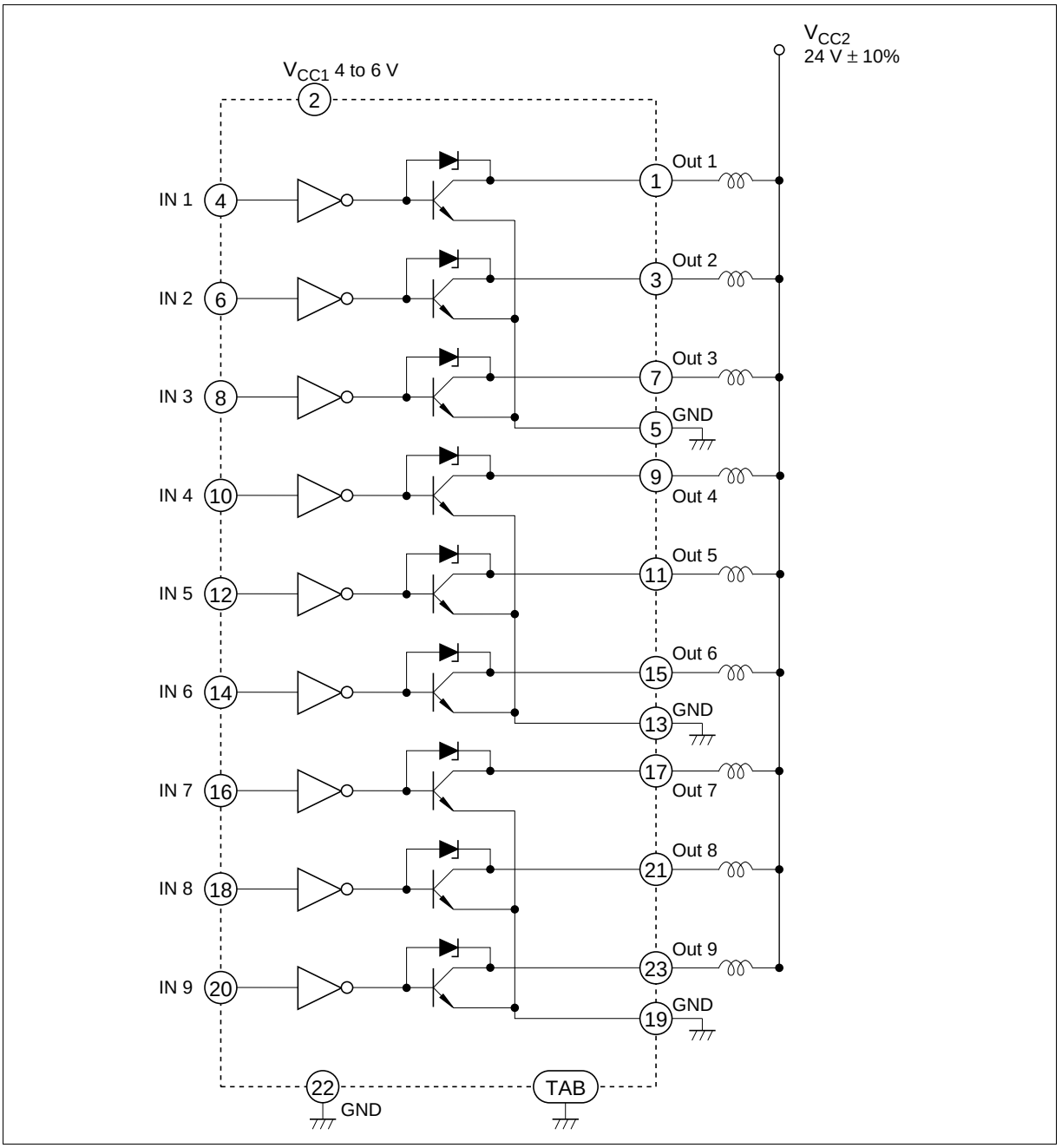
Block Diagram



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.

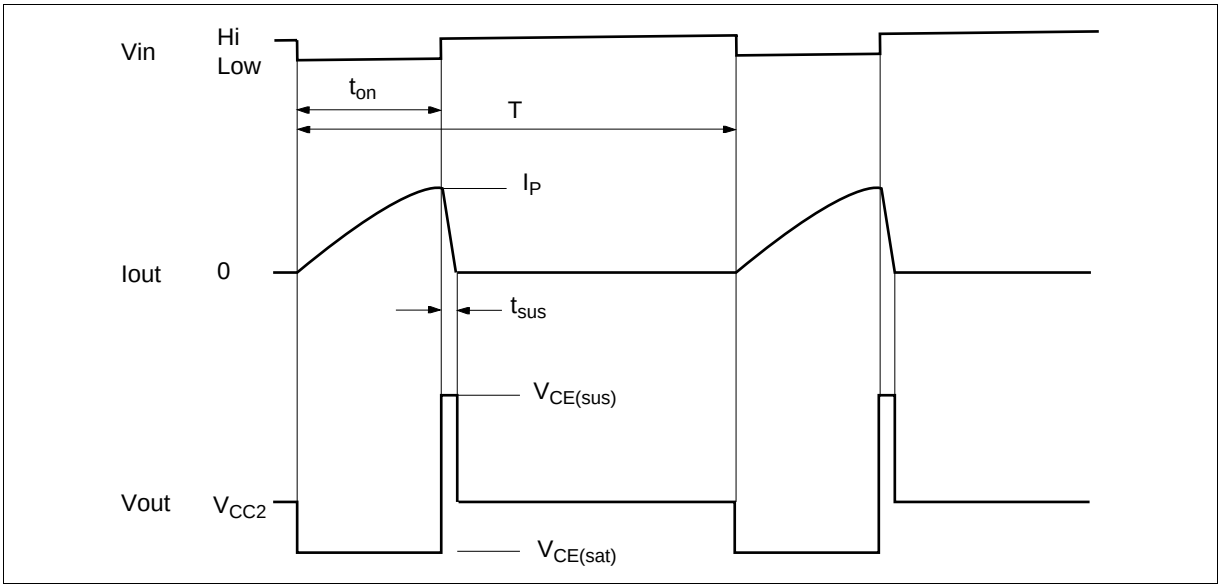


Figure 1 Output Waveforms

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

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

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

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

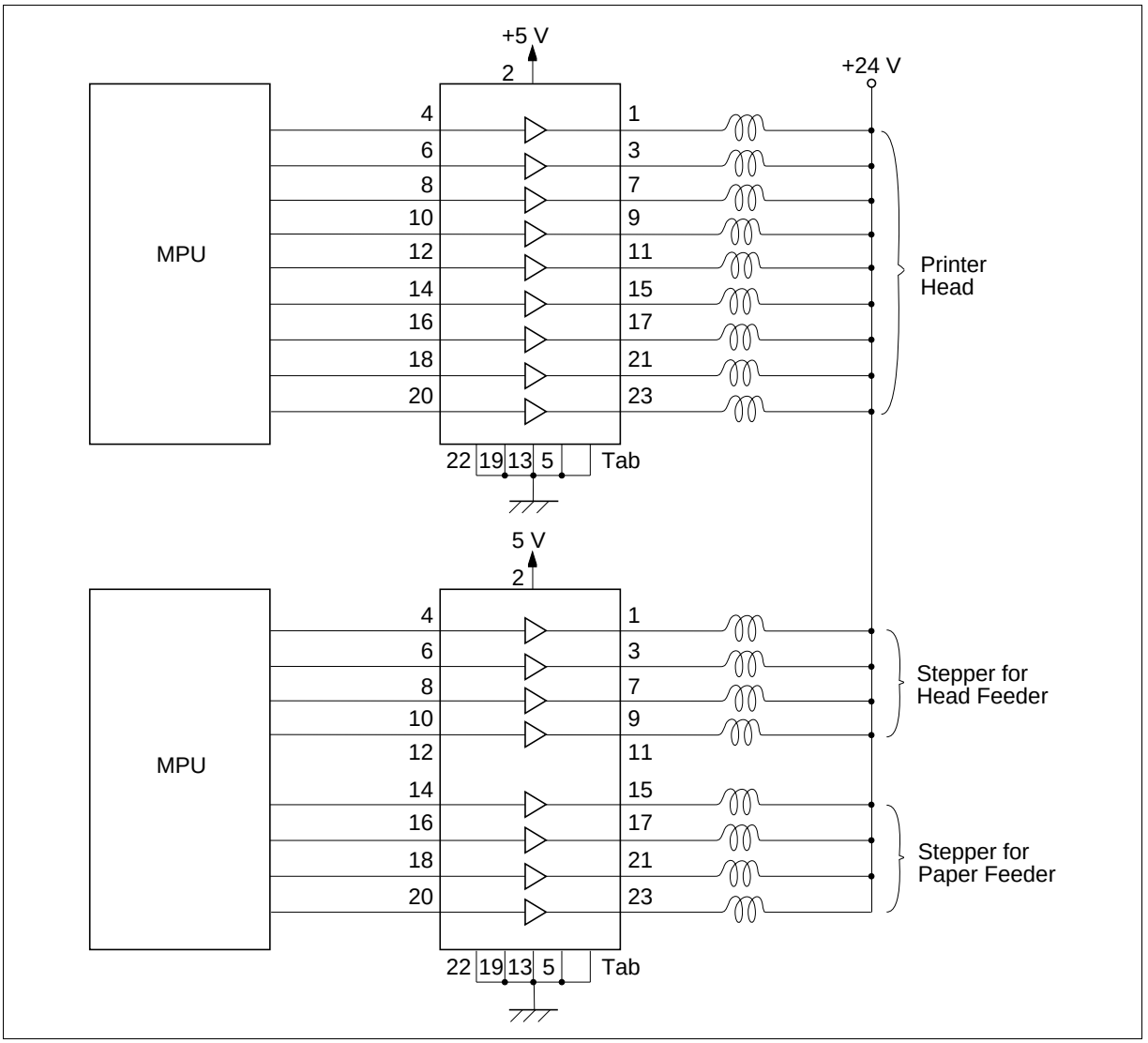


Figure 2 Dot Matrix Printer

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

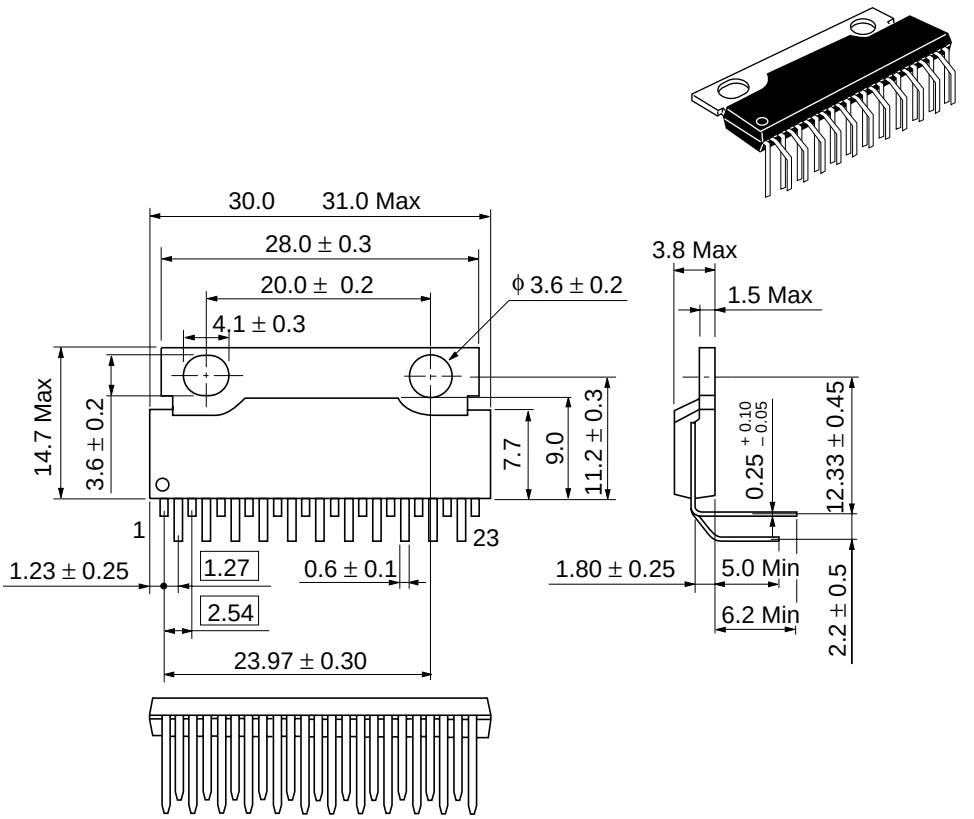
Electrical Characteristics (Ta = 25°C, V_{CC1} = 5 V)

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

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