

HA13408

9-Channel Power Driver

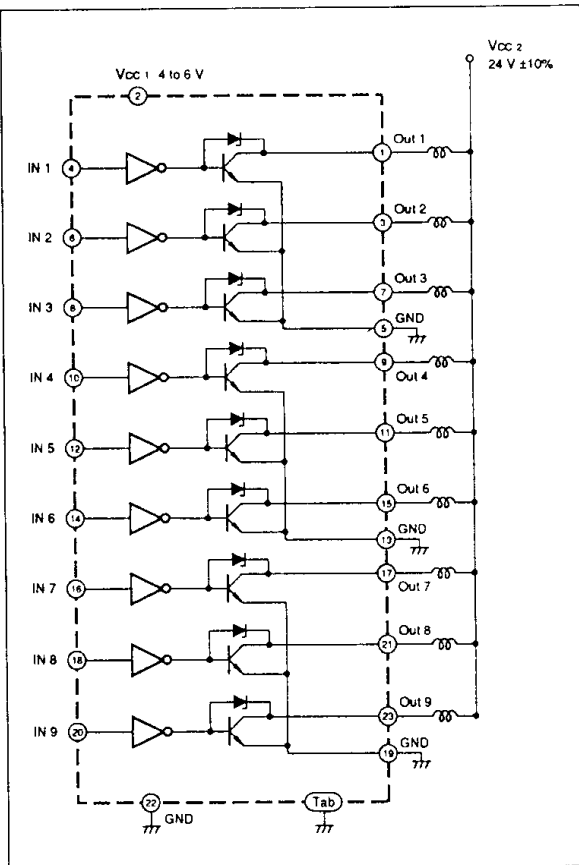
Description

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.

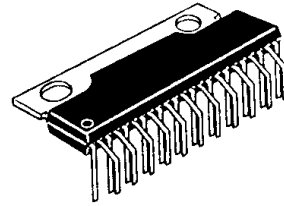
Table 1 Truth Table

Input	Output
Low	On
High	Off
Open	Off

Block Diagram



HA13408



(SP-23TA)

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

Ordering Information

Type No.	Package
HA13408	SP-23TA



Peak Current and Turn-Off Time

Figure 1 shows load current (I_{out}) and output terminal voltage (V_{out}) waveforms for the HA13408 driving an inductive load.

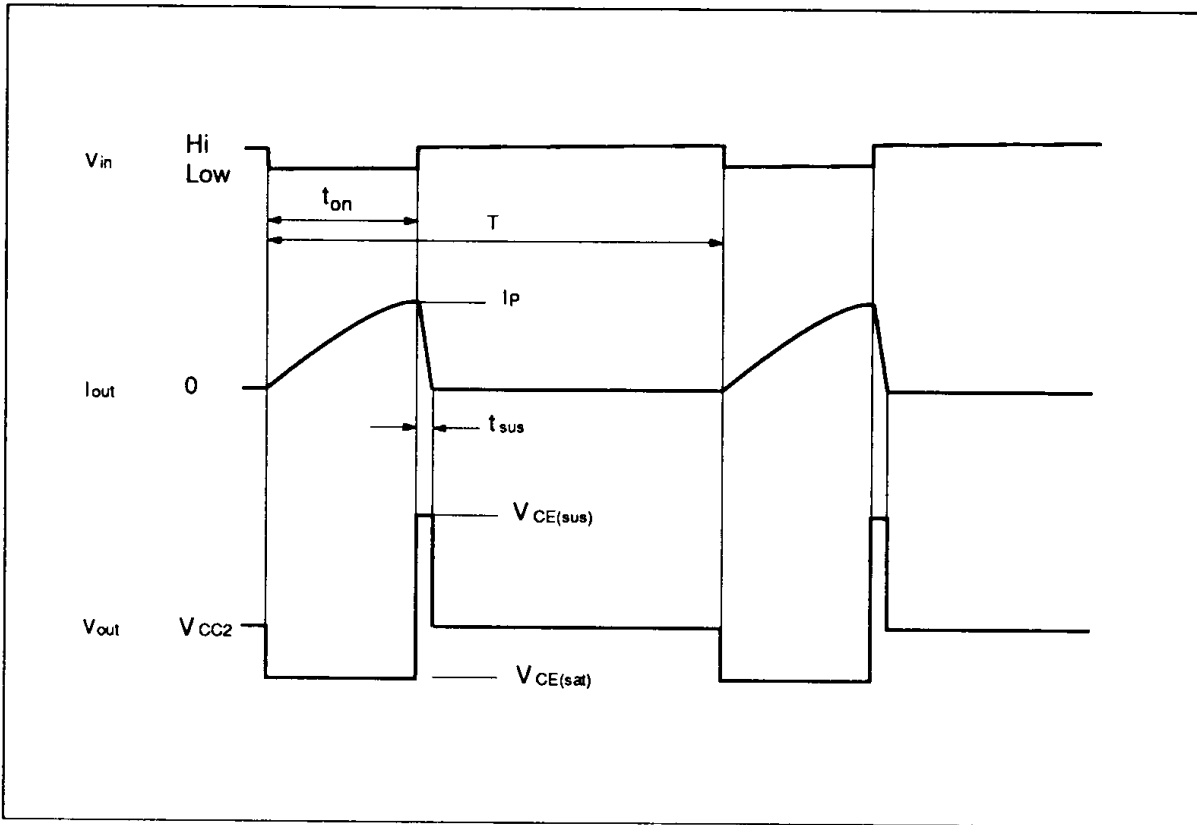


Figure 1 Output Waveforms

The peak output current (I_p) and sustain time (t_{sus}) are obtained as follows;

$$I_p = \frac{V_{CC2} - V_{CE(sat)}}{R} \left(1 - \exp\left(-\frac{R}{L} t_{on}\right) \right) \cong \frac{V_{CC2}}{R} \left(1 - \exp\left(-\frac{R}{L} t_{on}\right) \right) \dots\dots (1)$$

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

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 t_{on} = 0.42 ms.

Peak current (I_p) and sustain time (t_{sus}) 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 (P_{on}) per channel at t_{on} is obtained as follows:

$$P_{on} \cong V_{CE(sat)} I_P \left(\frac{V_{CC2}}{R \cdot I_P} - \frac{1}{t_{on} R} \right) \dots\dots\dots (3)$$

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

$$P_{sus} \cong V_{CE(sus)} I_P \left(\frac{1}{t_{sus} R} - \frac{V_{CE(sus)} - V_{CC2}}{R \cdot I_P} \right) \dots\dots\dots (4)$$

Where I_P and t_{sus} are obtained in equations (1) and (2).

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

$$P_T = \frac{1}{T} (P_{on} \cdot t_{on} + P_{sus} \cdot t_{sus}) \dots\dots\dots (5)$$

Where drive period is defined as T.

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

$$P_T = \frac{9}{T} (P_{on} \cdot t_{on} + P_{sus} \cdot t_{sus}) \dots\dots\dots (6)$$

Application

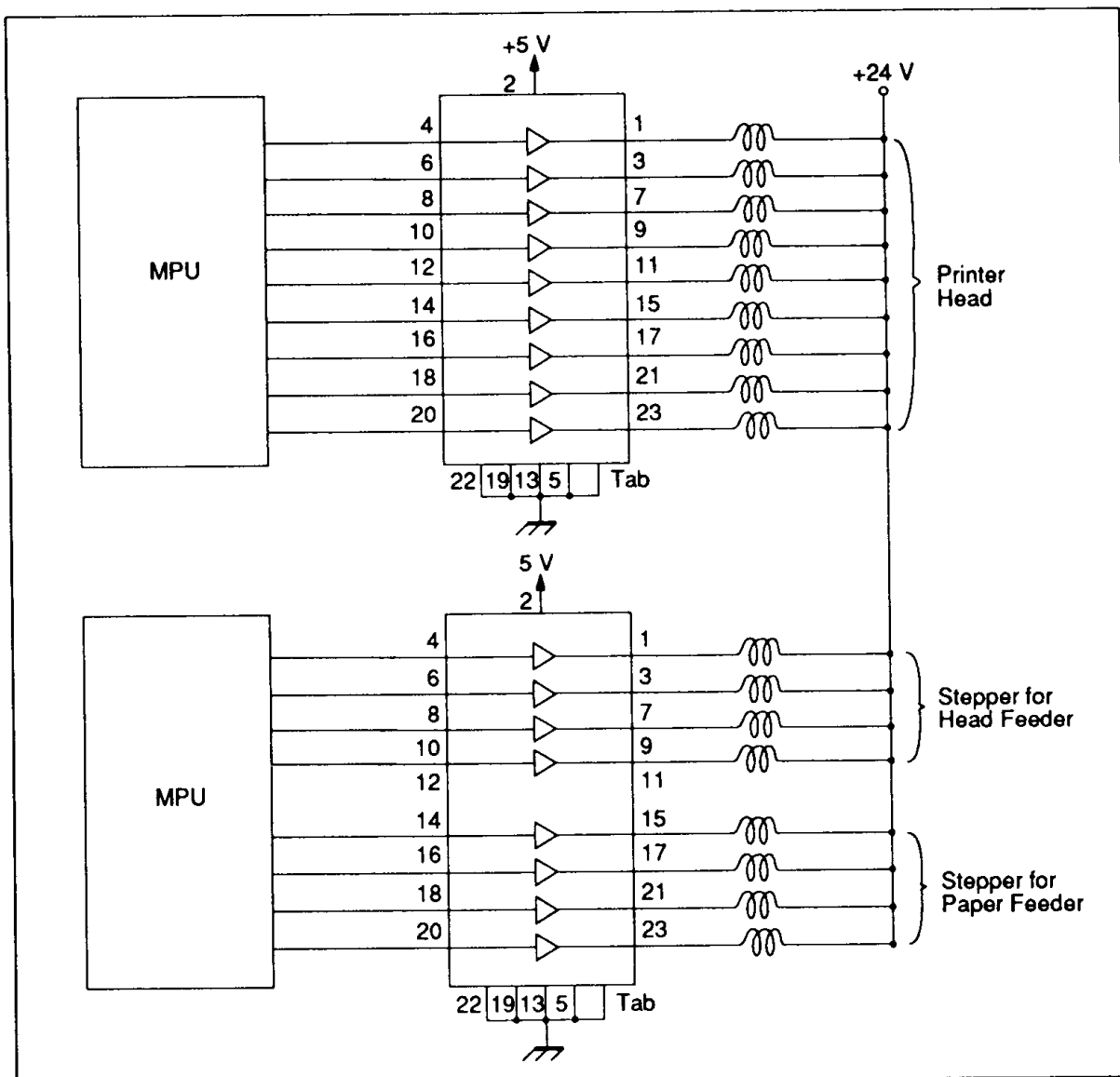


Figure 2 Dot Matrix Printer



HA13408

Table 2 Absolute Maximum Ratings (Ta=25 °C)

Item	Symbol	Rating	Unit	Note
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	T _j	150	°C	
Operating junction temperature hange	T _{jop}	-20 to +125	°C	
Storage temperature range	T _{stg}	-55 to +125	°C	

The absolute maximum ratings are limiting values, to be applied individually, beyond which the device may be permanently damaged. Functional operation under any of these conditions is not guaranteed. Exposing a circuit to its absolute maximum rating for extended periods of time may affect the device's reliability.

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

Table 3 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 L_s=5 mH, R_s=22 Ω.

