

# Pulse Input Bipolar Stepper Motor Driver

## ■ GENERAL DESCRIPTION

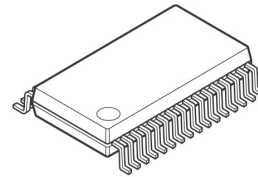
NJU7384 is a bipolar drive stepping motor driver.

The control method used is a simple pulse train input control (STEP & DIR) method of programming. Also, low power consumption was realized as a result of the adoption of a highly efficient CMOS.

As the control functions, the external input RESET and ENABLE functions are used, and as the protective function, a thermal shutdown (TSD) is incorporated.

The package uses the low thermal resistance SSOP32 which can withstand a high output current.

## ■ PACKAGE OUTLINE

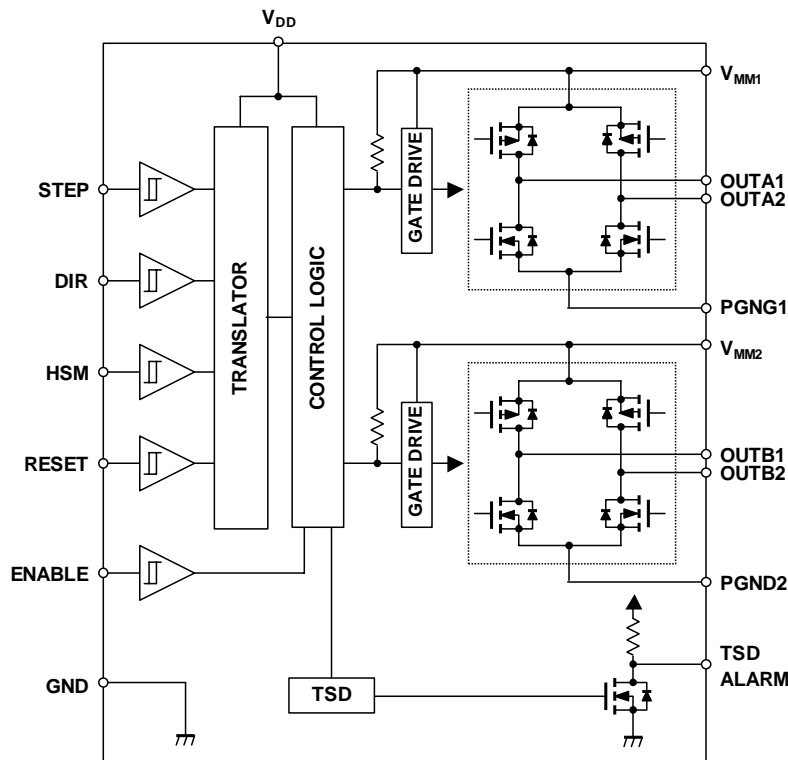


NJU7384V

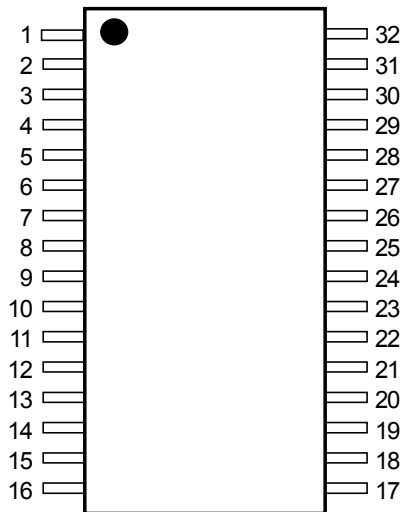
## ■ FEATURES

- Operating Voltage                    3.0 to 5.5V (Logic :  $V_{DD}$ )  
    4.0 to 8.0V (H bridge :  $V_{MM}$ )
- Maximum Output Current            700mA/ch
- Pulse Input (STEP & DIR) Control
- Half / Full Step Change Function
- Thermal Shutdown Circuit
- Thermal Shutdown Alarm Output
- RESET Function
- ENABLE Function
- CMOS Technology
- Package Outline                        SSOP32

## ■ BLOCK DIAGRAM



## ■ PIN FUNCTION



1. NC	32. V <sub>MM1</sub>
2. NC	31. V <sub>MM1</sub>
3. NC	30. OUTA1
4. V <sub>DD</sub>	29. OUTA1
5. NC	28. OUTA2
6. STEP	27. OUTA2
7. DIR	26. PGND1
8. HSM	25. PGND1
9. RESET	24. PGND2
10. ENABLE	23. PGND2
11. TSD ALARM	22. OUTB2
12. NC	21. OUTB2
13. GND	20. OUTB1
14. NC	19. OUTB1
15. NC	18. V <sub>MM2</sub>
16. NC	17. V <sub>MM2</sub>

## ■ PIN DESCRIPTION

PIN No.	SYMBOL	FUNCTION	NOTE
1,2,3	NC	Non connection pins	-
4	V <sub>DD</sub>	Logic Power-Supply input pin	-
5	NC	Non connection pin	-
6	STEP	Pulse signal input pin for motor rotation control pin	1 pulse input ⇒ 1 clock motion
7	DIR	Forward / Reverse rotation control	"H"= Forward (CW), "L"= Reverse (CCW)
8	HSM	Full / Half step mode control pin	"H"= Full step, "L"= Half step
9	RESET	Phase initialize signal input pin	"H"= Normal operation, "L"= Phase initialize
10	ENABLE	Output signal all off control signal input pin	"H"= Normal operation, "L"= Output all off
11	TSD ALARM	TSD alarm output pin	TSD operating ="L" signal output
12	NC	Non connection pins	-
13	GND	Logic ground (GND) pin	-
14,15,16	NC	Non connection pins	-
17,18	V <sub>MM2</sub>	H bridge power-supply pins	Connect to motor power-supply
19,20	OUTB1	Output pin B1	-
21,22	OUTB2	Output pin B2	-
23,24	PGND2	H bridge ground (GND) pin	-
25,26	PGND1	H bridge ground (GND) pin	-
27,28	OUTA2	Output pin A2	-
29,30	OUTA1	Output pin A1	-
31,32	V <sub>MM1</sub>	H bridge power-supply pins	Connect to motor power-supply

\* Short all logic ground terminals and the H bridge ground terminal externally.

\* Short all H bridge power supply voltage terminals externally.

\* Fix the potential of unused logic input terminals externally.

■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

PARAMETER	RATINGS	SYMBOL(unit)	NOTE
Logic Power Supply Voltage	+7.0	V <sub>DD</sub> (V)	*1)
H Bridge Power Supply Voltage	+9.0	V <sub>MM</sub> (V)	-
Logic Input Voltage	-0.3 ~ V <sub>DD</sub>	V <sub>ID</sub> (V)	-
Motor Output Current (Max)	700	I <sub>OPEAK</sub> (mA/ch)	-
Logic Input Current	10	I <sub>IPEAK</sub> (mA)	-
Operating Temperature Range	-40 ~ +85	T <sub>opr</sub> (°C)	-
Operating Junction Temperature Range	-40 ~ +150	T <sub>j</sub> (°C)	-
Storage Temperature Range	-50 ~ +150	T <sub>stg</sub> (°C)	-
Power Dissipation	1175	P <sub>D</sub> (mW)	*2)

\*1) : V<sub>DD</sub> ≤ V<sub>MM</sub>

\*2) : EIAJ/JEDEC STD 2 Layer substrate

■ RECOMMENDED OPERATING CONDITIONS

(Ta=25°C)

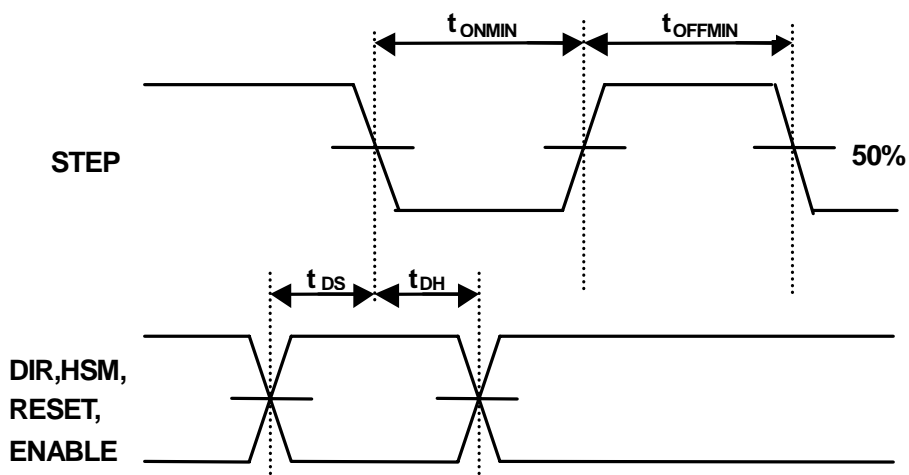
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Logic Power Supply Voltage Range	V <sub>DD</sub>	3.0	5.0	5.5	V	V <sub>DD</sub> ≤ V <sub>MM</sub>
H Bridge Power Supply Voltage Range	V <sub>MM</sub>	4.0	6.0	8.0	V	-
Logic H Input Voltage	V <sub>IH</sub>	3.5	-	V <sub>DD</sub>	V	V <sub>DD</sub> =5.0V, No load
Logic L Input Voltage	V <sub>IL</sub>	0	-	1.2	V	
STEP-ON Time	t <sub>ONMIN</sub>	10	-	-	μs	
STEP-OFF Time	t <sub>OFFMIN</sub>	10	-	-	μs	
Data Setup Time	t <sub>DS</sub>	1	-	-	μs	
Hold Time	t <sub>DH</sub>	1	-	-	μs	
Input Clock Frequency	f <sub>CLK</sub>	-	-	50	kHz	

## ■ ELECTRICAL CHARACTERISTICS

(Ta=25°C, V<sub>DD</sub>=5V, V<sub>MM</sub>=6V)

PARAMETER	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
<b>■ General</b>						
Operating Current	I <sub>DD</sub>	STEP, DIR, HSM, RESET, ENABLE="5V", No Load, V <sub>DD</sub> Meas.	-	0.3	0.6	mA
	I <sub>MM</sub>	STEP, DIR, HSM, RESET, ENABLE="5V", No load, V <sub>MM</sub> Meas.	-	0.3	0.6	mA
Thermal Shutdown Operating Temperature	T <sub>TSD</sub>	-	-	180	-	°C
Thermal Shutdown Hysteresis	T <sub>HYS</sub>	-	-	30	-	°C
<b>■ Input (STEP, DIR, HSM, ENABLE, RESET Terminals)</b>						
Logic Input Current	I <sub>IH</sub>	STEP, DIR, HSM, ENABLE, RESET ="5V"	-	-	1	μA
	I <sub>IL</sub>	STEP, DIR, HSM, ENABLE, RESET ="0V"	-1	-	-	μA
<b>■ H Bridge (Output)</b>						
H Output Voltage	V <sub>OH</sub>	I <sub>o</sub> =+400mA	5.5	5.7	-	V
L Output Voltage	V <sub>OL</sub>	I <sub>o</sub> = -400mA	-	0.2	0.4	V
Upper Side Output ON Resistance	R <sub>OH</sub>	I <sub>o</sub> =400mA	-	0.75	1.25	Ω
Under Side Output ON Resistance	R <sub>OL</sub>	I <sub>o</sub> =400mA	-	0.50	1.00	Ω
Output Leak Current	I <sub>O LEAK</sub>	-	-	1.0	-	μA
<b>■ Signal Output</b>						
TSD Alarm L Output Voltage	V <sub>TSD</sub>	No external pull-up resistance	-	-	0.3	V
TSD Pull-up Resistance	R <sub>TSD</sub>	-	-	10	-	kΩ

■ TIMING CONDITION



■ TRUTH TABLE

LOGIC IN		MODE
V <sub>DD</sub>	H	OPERATE
	L	Hi Z
DIR	H	CW
	L	CCW
HSM	H	FULL STEP
	L	HALF STEP
RESET	H	OPERATE
	L	RESET
ENABLE	H	OPERATE
	L	Hi Z

\*V<sub>MM</sub> : Motor voltage supply  
 \*OPERATE : Follow the input logic  
 \*Hi Z : Output all off (A1, A2, B1,B2)

■ EXCITATION SEQUENCE

Condition: FULL STEP, HSM=ENABLE=RESET

Pulse	0	1	2	3
OUTA1	L	H	H	L
OUTA2	H	L	L	H
OUTB1	L	L	H	H
OUTB2	H	H	L	L
IA	-	+	+	-
IB	-	-	+	+
DIR=HIGH	→ CW			
DIR=LOW	← CCW			

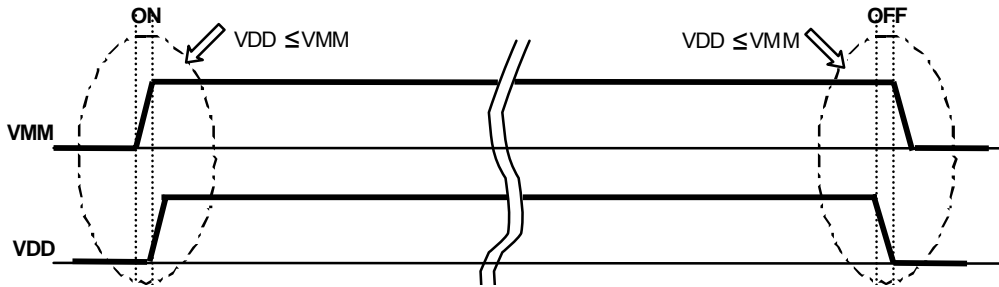
Condition: HALF STEP, HSM=LOW, ENABLE=RESET=HIGH

Pulse	0	1	2	3	4	5	6	7
OUTA1	L	Hi Z	H	H	H	Hi Z	L	L
OUTA2	H	Hi Z	L	L	L	Hi Z	H	H
OUTB1	L	L	L	Hi Z	H	H	H	Hi Z
OUTB2	H	H	H	Hi Z	L	L	L	Hi Z
IA	-	0	+	+	+	0	-	-
IB	-	-	-	0	+	+	+	0
DIR=HIGH	→ CW							
DIR=LOW	← CCW							

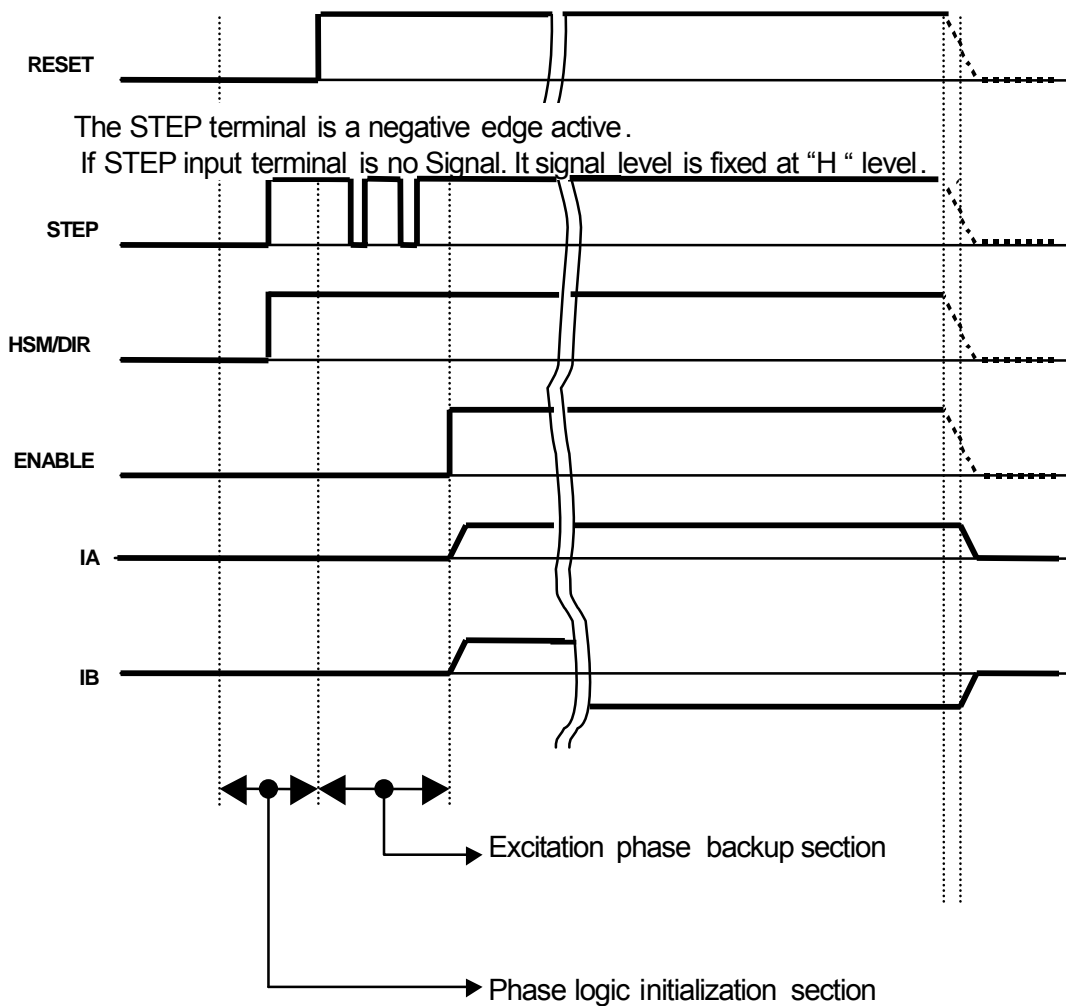
\* Regarding the current flow direction, the direction A1→A2 and B1→B2 is indicated as +, and the direction A2→A1 and B2→B1 is indicated as -.

## POWER SUPPLY ON/OFF TIMING

Regarding the switch-on sequence of the logic power supply  $V_{DD}$  and the motor power supply  $V_{MM}$ , input  $V_{DD}$  after  $V_{MM}$  has risen. The recommended sequence is shown below.



The RESET signal is "L" level in the range of turning ON. And Phase logic is initialized.



## RECOMMENDED STEP MODE CHANGEOVER (HSM)

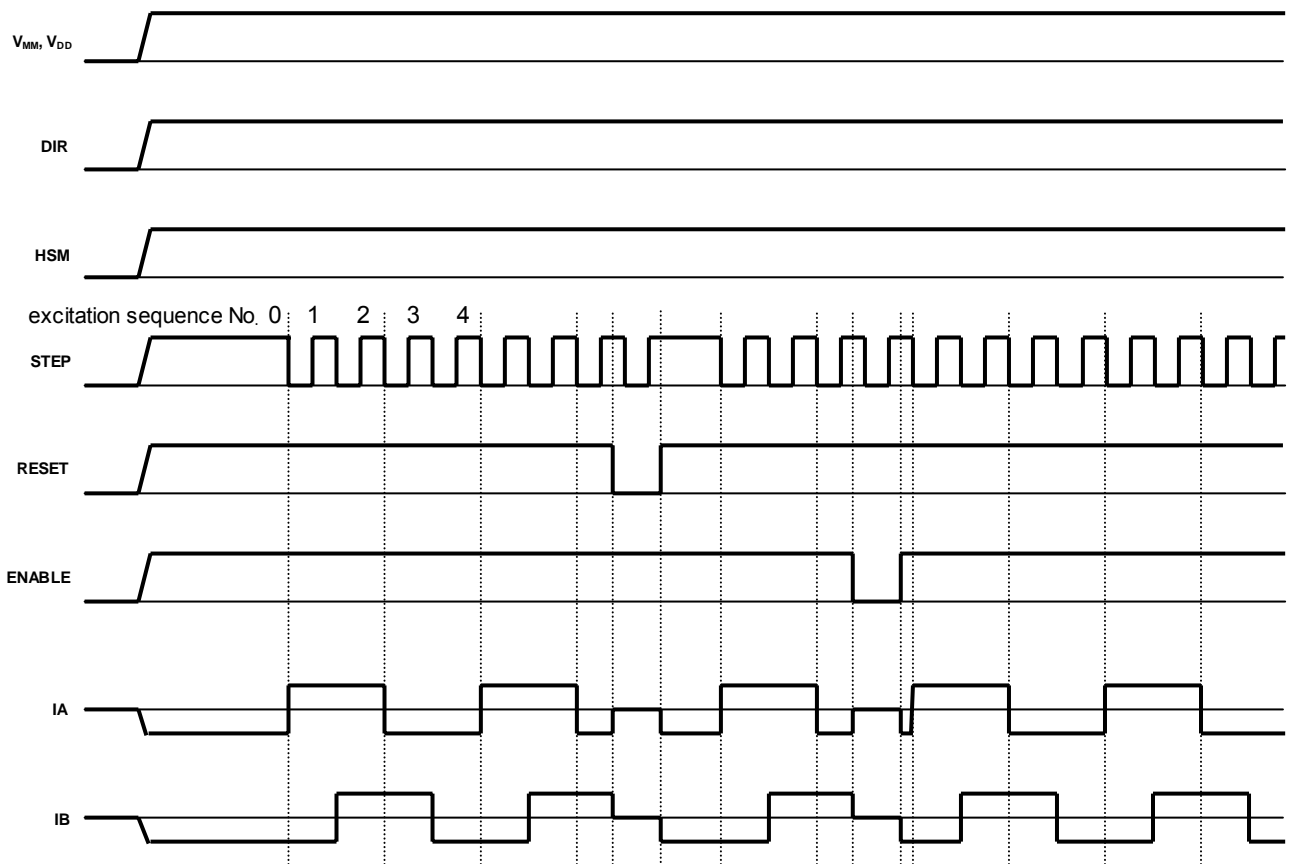
The current flowing through the stepping motor must be controlled continuously so that a mis-step does not occur. Also, the following precautions must be observed concerning changing of the setting of the HSM input.

- (1) A mis-step does not occur during changeover from a full step to a half step
- (2) Regarding changeover from a half step to a full step,
  - (a) A mis-step does not occur during changeover from a half step (excitation sequence 0, 2, 4, 6) to a full step.
  - (b) A mis-step occurs during changeover from a half step (excitation sequence 1, 3, 5, 7) to a full step.

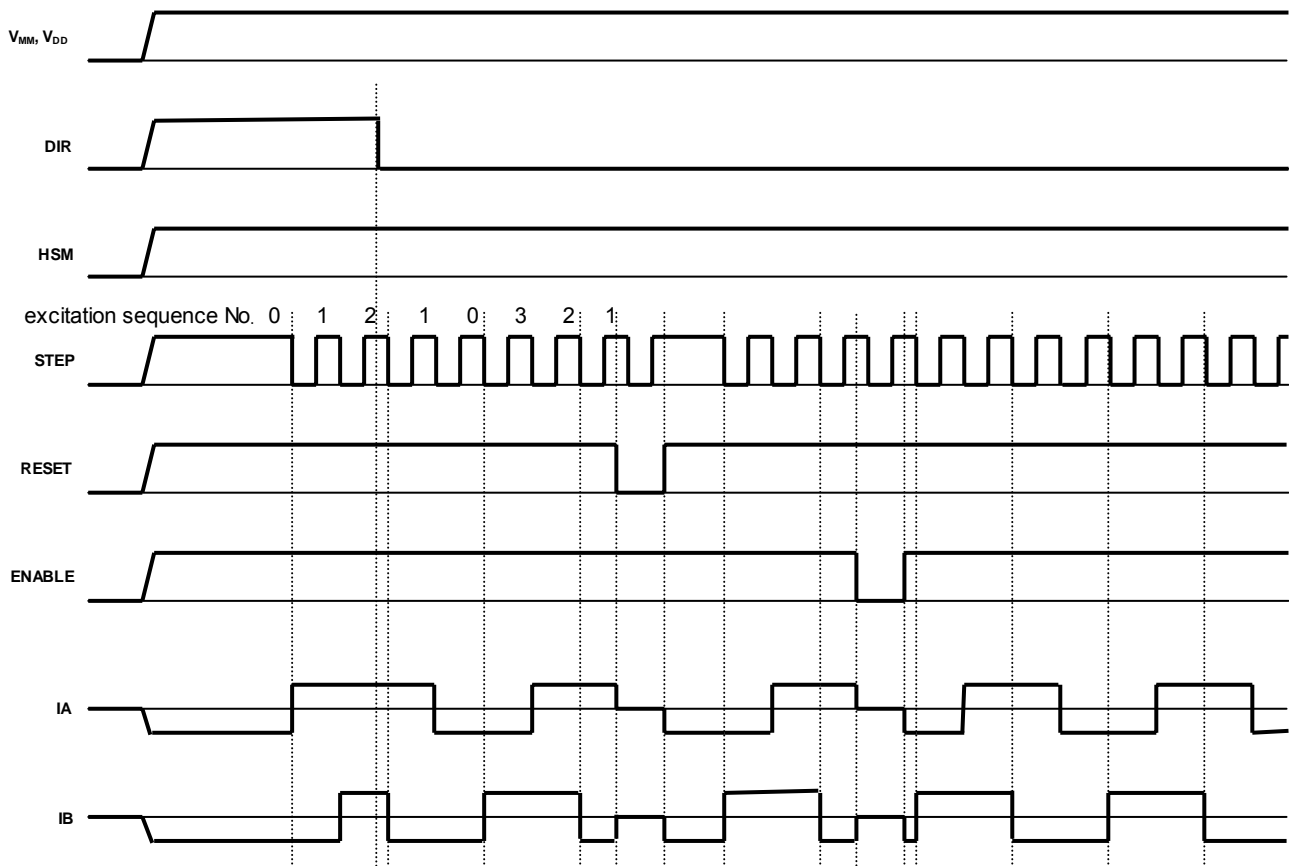
For the above reason, it is recommended that mode changeover from a half step to a full step be carried out during the period when the RESET input is "L" logic.

■ TIMING CHART

- Fixed mode (Full step / Forward direction)  
Condition : DIR="H", HSM="H"

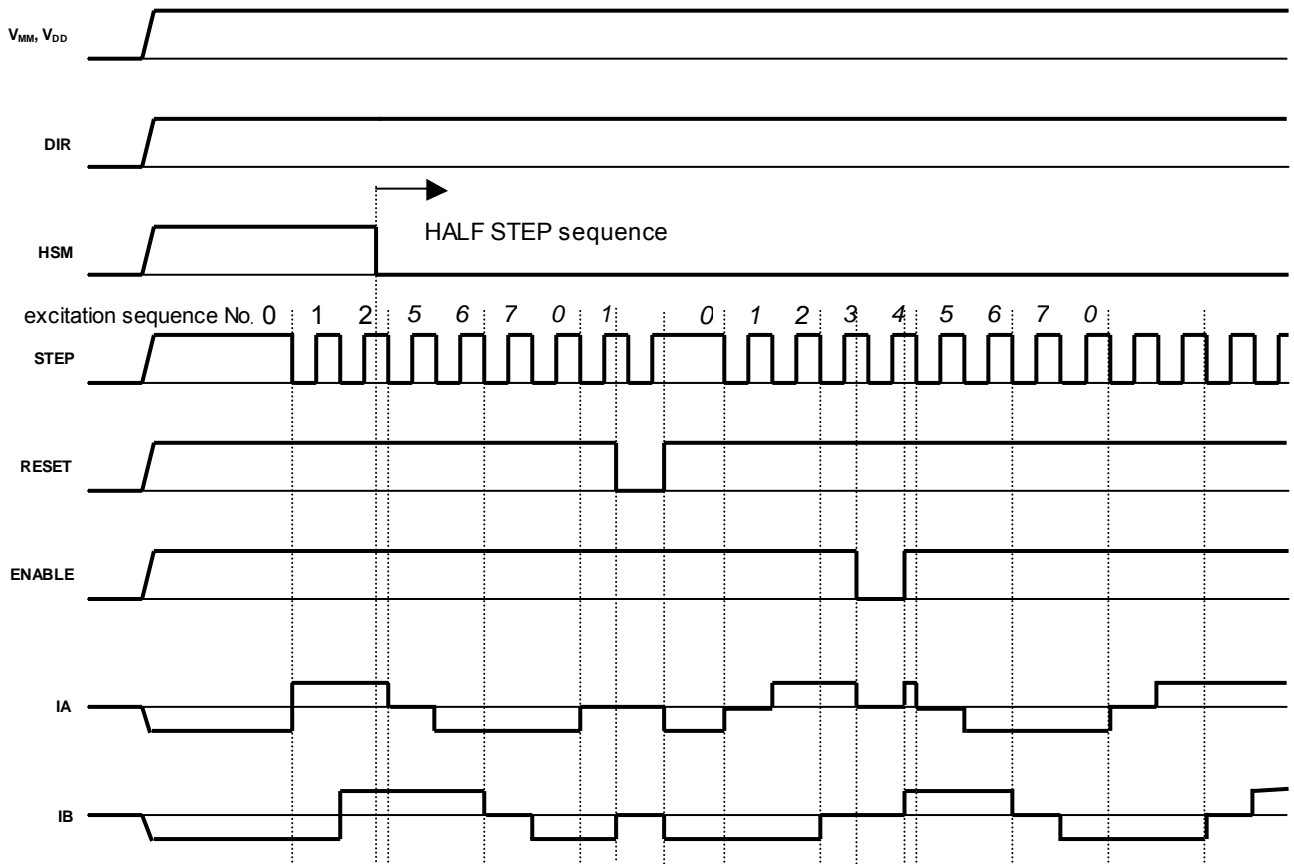


- Direction change (Full step / Forward direction ⇒ Reverse direction)  
 Condition : DIR="H" ⇒ "L", HSM="H"

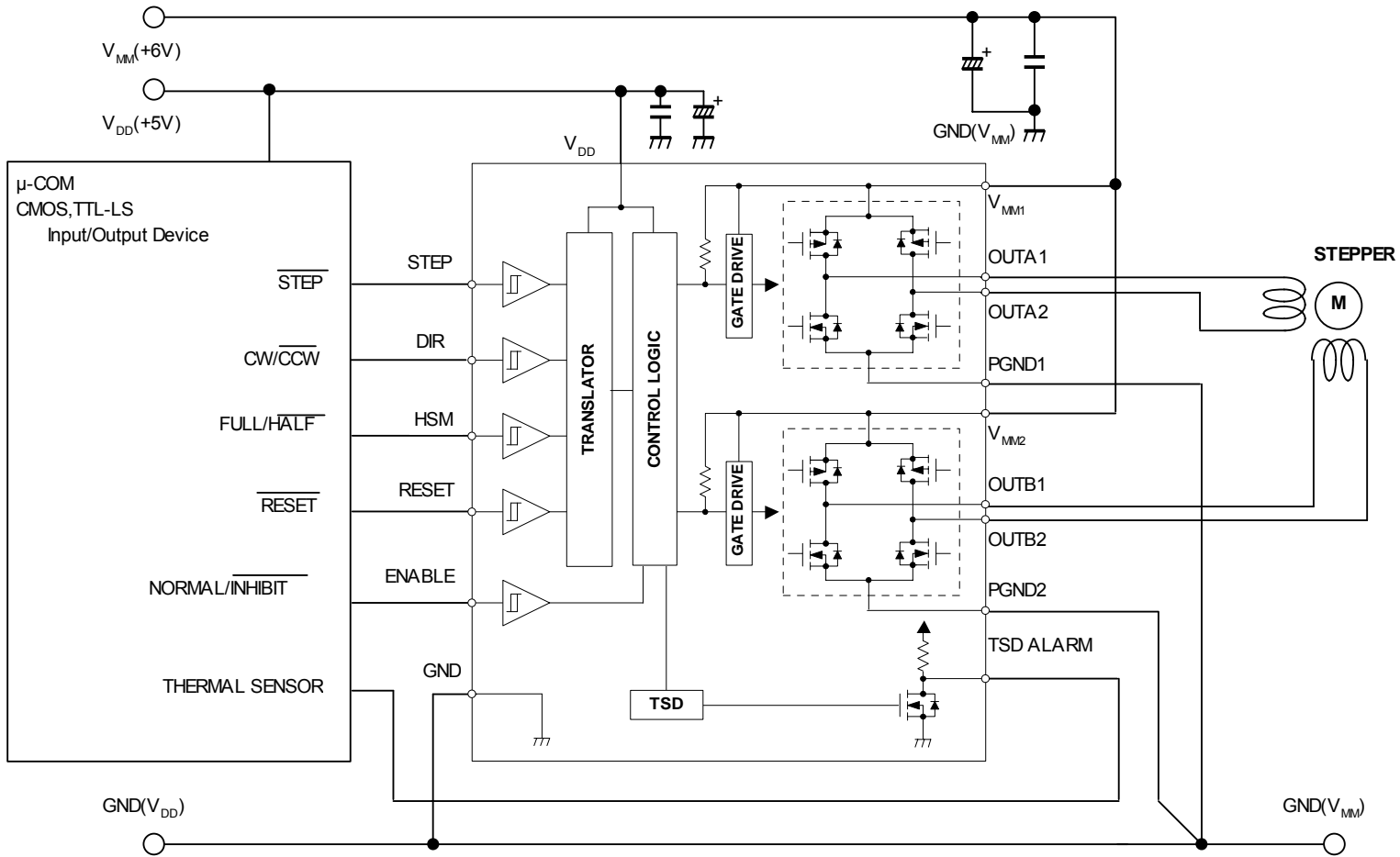




- Step mode change (Full step ⇒ Half step)  
 Condition : DIR="H", HSM="H" ⇒ "L"



## APPLICATION CIRCUIT



[CAUTION]  
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