

Pulse Input Bipolar Stepper Motor Driver

■ GENERAL DESCRIPTION

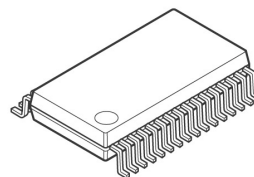
NJU7384 is a bipolar drive stepping motor driver.

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

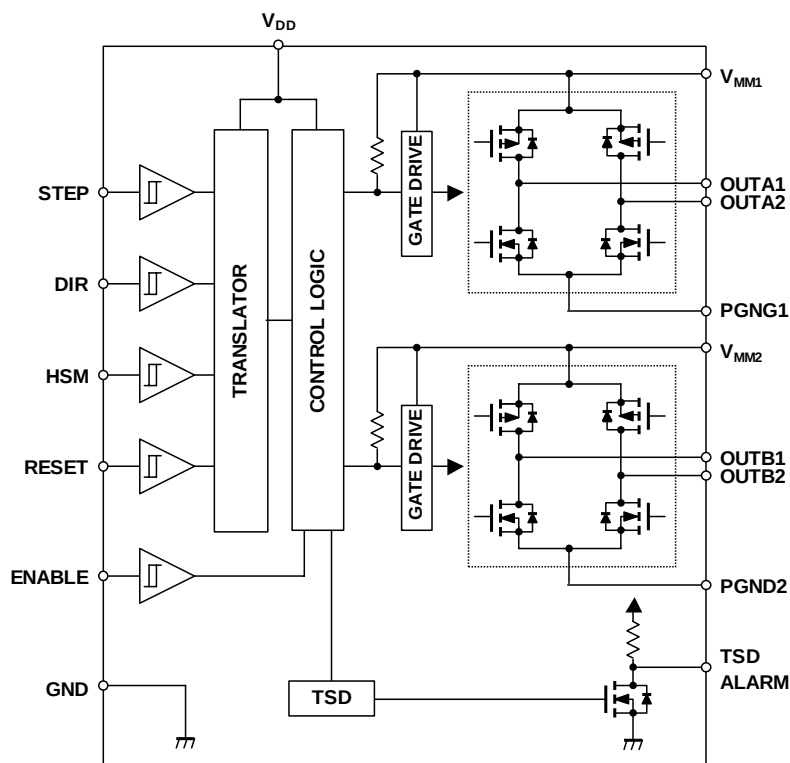


NJU7384V

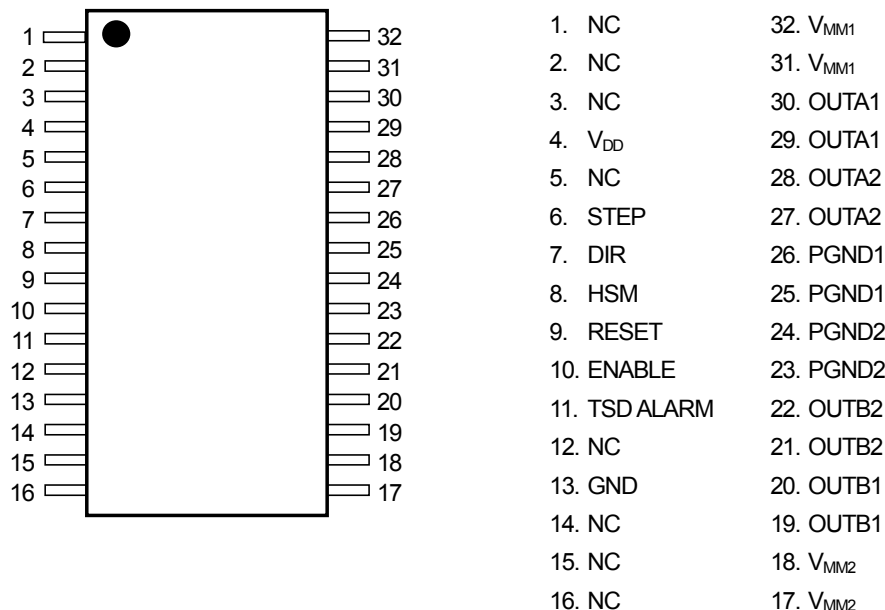
■ FEATURES

- 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



PIN DESCRIPTION

PIN No.	SYMBOL	FUNCTION	NOTE
1,2,3	NC	Non connection pins	-
4	V _{DD}	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 _{MM2}	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 _{MM1}	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 _{DD} (V)	*1)
H Bridge Power Supply Voltage	+9.0	V _{MM} (V)	-
Logic Input Voltage	-0.3 ~ V _{DD}	V _{ID} (V)	-
Motor Output Current (Max)	700	I _{OPEAK} (mA/ch)	-
Logic Input Current	10	I _{IPEAK} (mA)	-
Operating Temperature Range	-40 ~ +85	T _{opr} (°C)	-
Operating Junction Temperature Range	-40 ~ +150	T _j (°C)	-
Storage Temperature Range	-50 ~ +150	T _{stg} (°C)	-
Power Dissipation	1175	P _D (mW)	*2)

*1) : V_{DD} ≤ V_{MM}

*2) : EIAJ/JEDEC STD 2 Layer substrate

■ RECOMMENDED OPERATING CONDITIONS

(Ta=25°C)

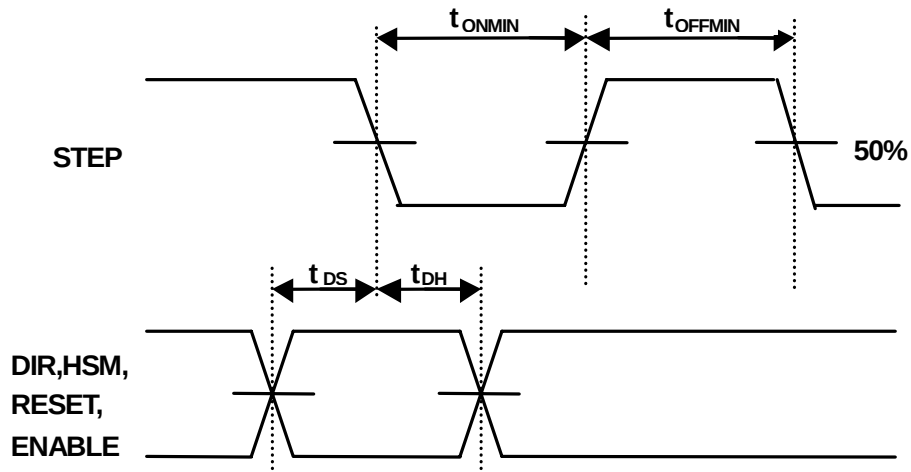
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
Logic Power Supply Voltage Range	V _{DD}	3.0	5.0	5.5	V	V _{DD} ≤ V _{MM}
H Bridge Power Supply Voltage Range	V _{MM}	4.0	6.0	8.0	V	-
Logic H Input Voltage	V _{IH}	3.5	-	V _{DD}	V	V _{DD} =5.0V, No load
Logic L Input Voltage	V _{IL}	0	-	1.2	V	
STEP-ON Time	t _{ONMIN}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

■ ELECTRICAL CHARACTERISTICS

(Ta=25°C, V_{DD}=5V, V_{MM}=6V)

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

TIMING CONDITION



TRUTH TABLE

LOGIC IN		MODE
V _{DD}	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_{MM} : 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			

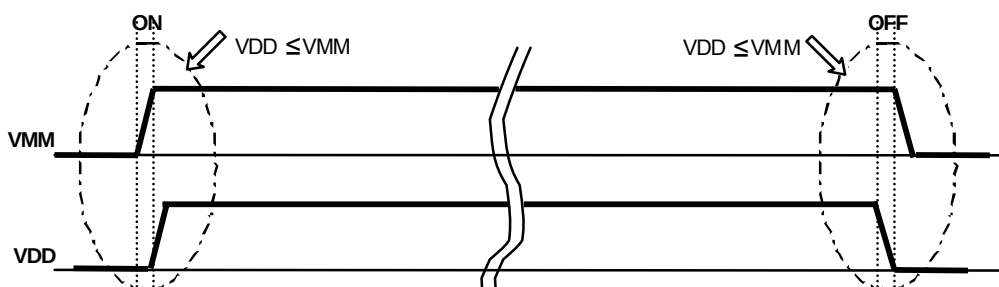
Condition: HALF STEP, HSM=LOW, ENABLE=RESET=HIGH

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							

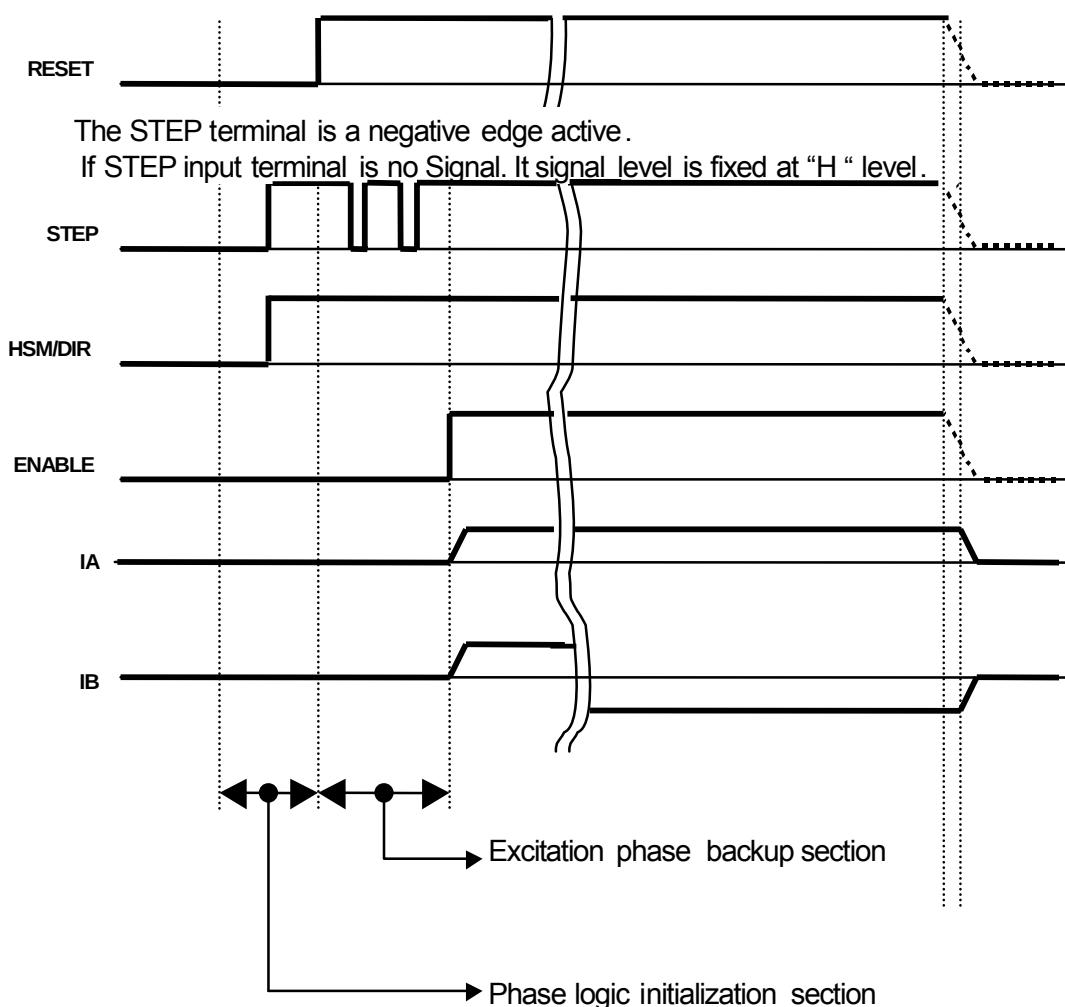
* Regarding the current flow direction, the direction A1→A2 and B1→B2 is indicated as +, and the direction A2→A1 and B2→B1 is indicated as -.

■ 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)

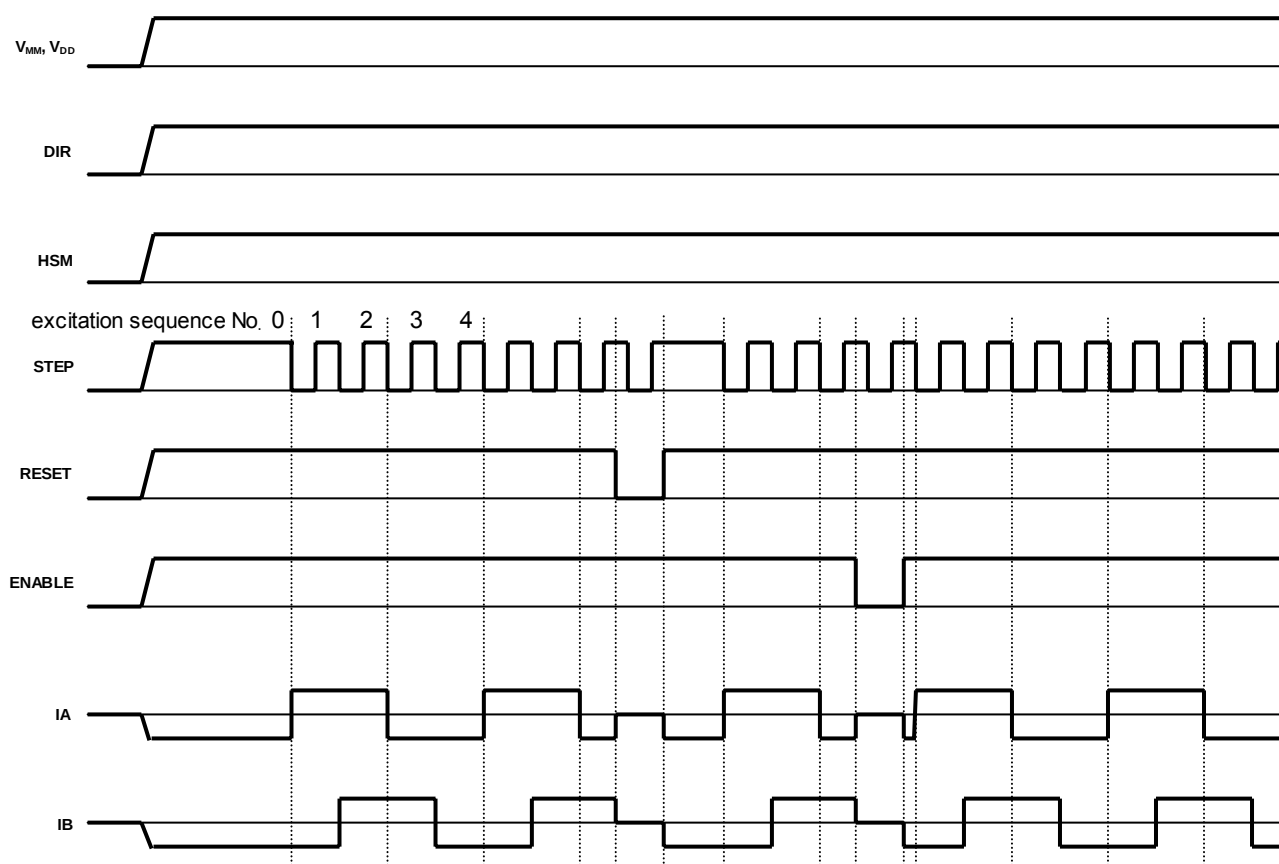
The current flowing through the stepping motor must be controlled continuously so that a mis-step does not occur. Also, the following precautions must be observed concerning changing of the setting of the HSM input.

- (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.

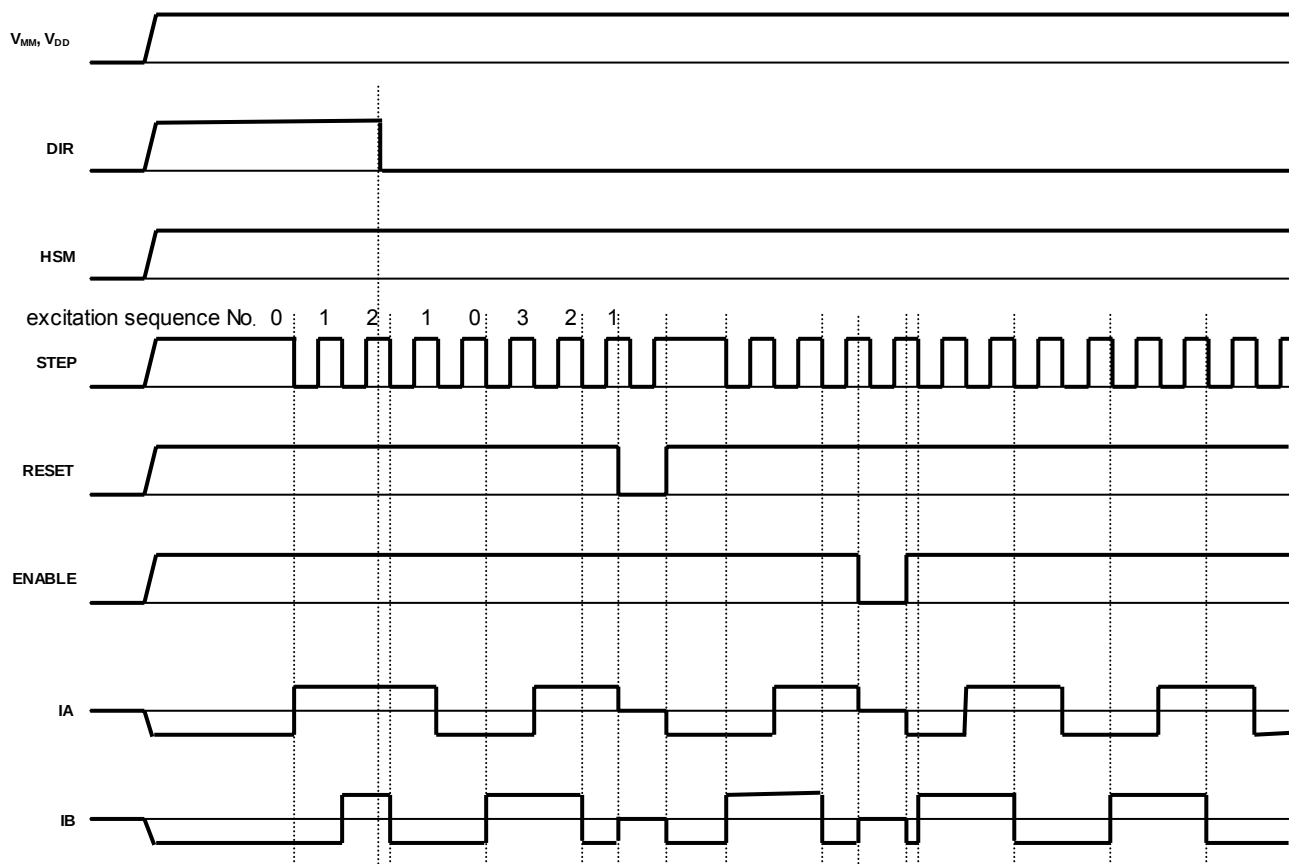
■ TIMING CHART

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



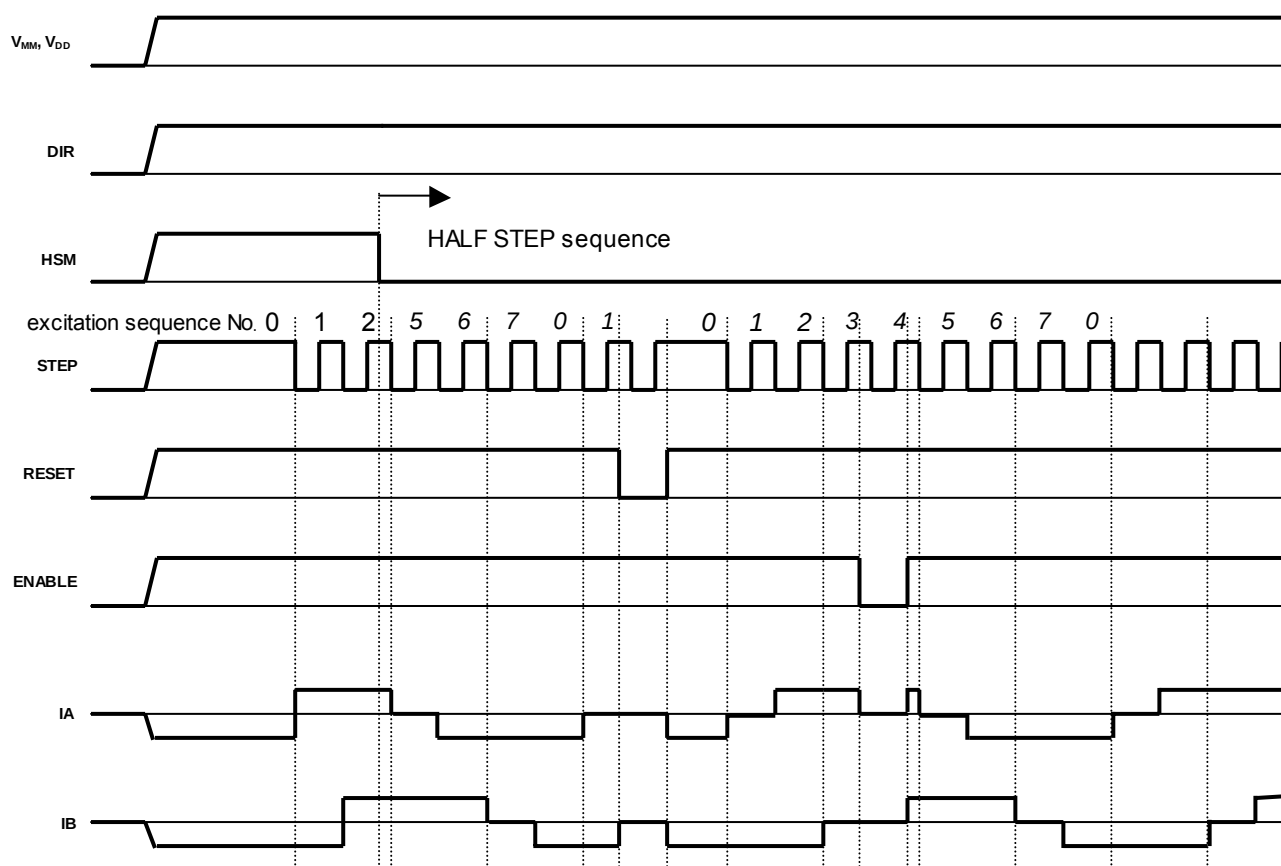
- Direction change (Full step / Forward direction $\Rightarrow$ Reverse direction)

Condition : DIR="H" $\Rightarrow$ "L", HSM="H"

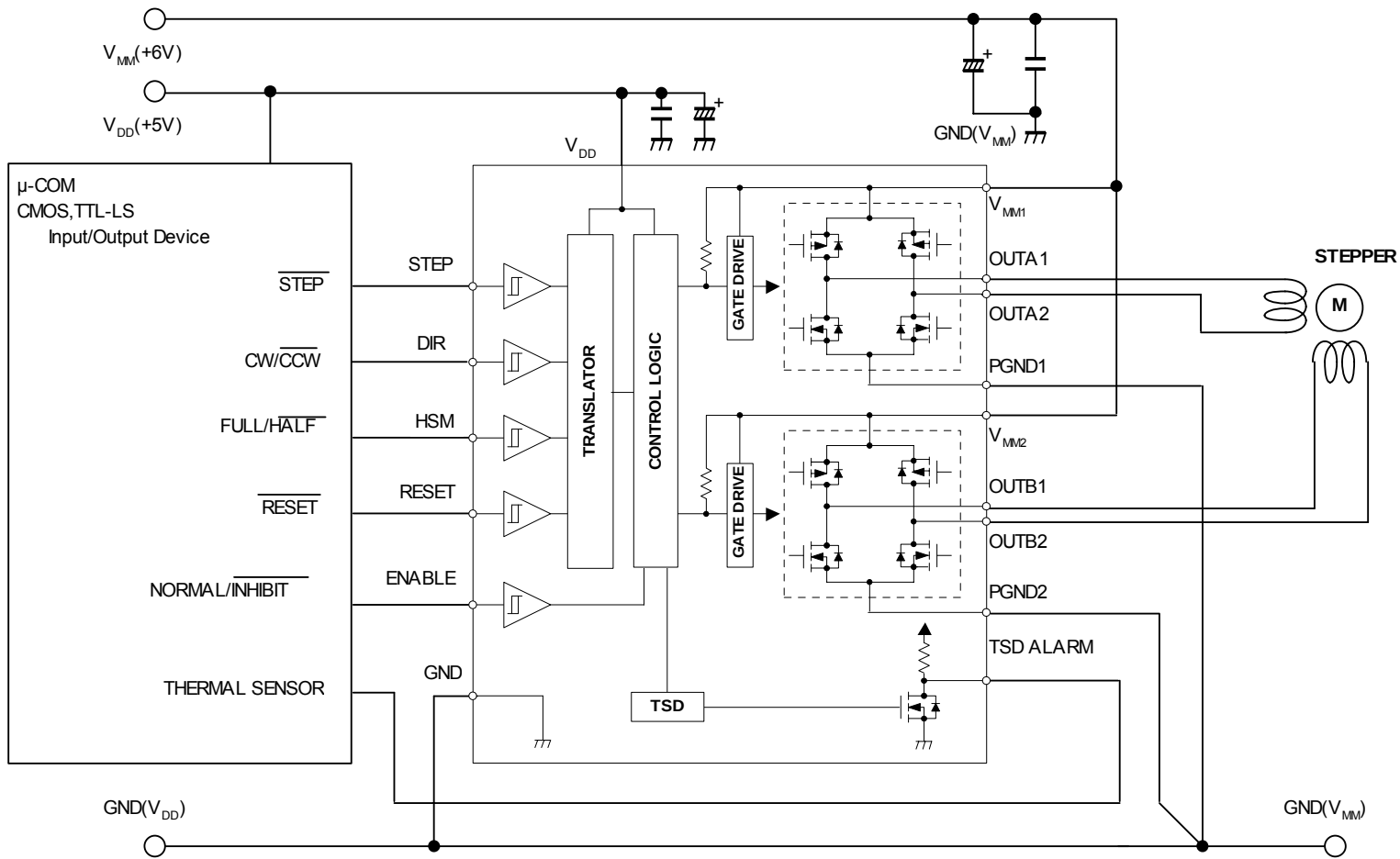


- Step mode change (Full step $\Rightarrow$ Half step)

Condition : DIR="H", HSM="H" $\Rightarrow$ "L"



APPLICATION CIRCUIT



[CAUTION]

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