

## Universal Controller IC for the 2-Phase Stepping Motor Drive PMM8713PT

### Outline

The universal controller "PMM8713PT" is the gate array IC (HIC) to control the 2-phase stepping motor drive. This product has been developed for the purpose to further simplify 2-phase stepping motor use, as combined only with switching elements or power hybrid ICs to configure a 2-phase stepping motor driver.

### Characteristics

- Universal controller : The following 3 types of energization mode can be selected by switching at the energization mode switching terminal  
1EX / 1-2EX / 2EX
- Source voltage :  $V_{CC}=4.5\sim 5.5V$
- High output current : 24mA min (sink, source)
- High noise margin : Schmitt trigger circuit is incorporated for the all input terminals.
- 2 types of pulse input : 2 input mode (CW, CCW input mode)  
1 input mode (CK, U/D input mode)
- Excited status verification monitor : Outputs the monitor signal of the controller status.

### Maximum Rating ( $T_a=25^{\circ}C$ )

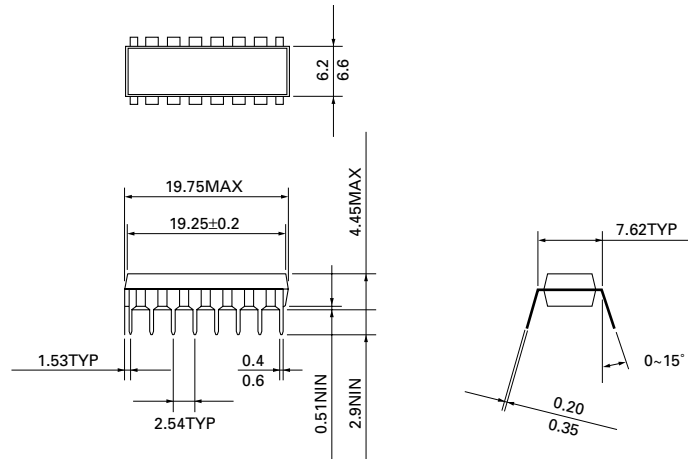
Item	Symbol	Rating	Unit
Source voltage	$V_{CC}$	-0.3~7	V
Output current $\phi_n$	"H" level $I_{OH\ \phi}$	-35	mA
	"L" level $I_{OL\ \phi}$	35	
Output current $I_{Co,Em}$	"H" level $I_{OH}$		$\mu A$
	"L" level $I_{OL}$		
Input voltage	$V_{IN}$	-0.3~ $V_{CC}+0.3$	V
Input current	$I_{IN}$	$\pm 10$	mA
Operating current	$T_{opr}$	-20~85	$^{\circ}C$
Conservation temperature		$T_{stg}$	-40~125 $^{\circ}C$

### Recommended Operating Conditions ( $T_a=20\sim 85^{\circ}C$ )

Item	Symbol	Rating			Unit
		Min.	Standard	Max.	
Source voltage	$V_{CC}$	4.5	-	5.5	V
Output current $\phi_n$	"H" level $I_{OH\ \phi}$	-24	-	-	mA
	"L" level $I_{OL\ \phi}$	24	-	-	
Output current $I_{Co,Em,Zo}$	"H" level $I_{OH}$	-2	-	-	mA
	"L" level $I_{OL}$	2	-	-	
Input voltage	$V_{IN}$	0	-	$V_{CC}$	V

## Dimensions (Unit: mm)

Pin No.	Name	Function
1.	C <sub>U</sub>	Input pulse UP clock input
2.	C <sub>D</sub>	Input pulse DOWN clock input
3.	C <sub>K</sub>	Input pulse clock input
4.	U/D	Rotation direction conversion
5.	E <sub>A</sub>	energization mode switching input
6.	E <sub>B</sub>	energization mode switching input
7.	øC	energization mode switching input
8.	V <sub>SS</sub>	GND
9.	R	Reset input
10.	ø4	ø4 output
11.	ø3	ø3 output
12.	ø2	ø2 output
13.	ø1	ø1 output
14.	E <sub>M</sub>	energization monitor output
15.	C <sub>O</sub>	Input pulse monitor output
16.	V <sub>CC</sub>	4.5~5.5V



## Electrical Characteristics

### Direct current characteristics (T<sub>a</sub>=-20~85°C)

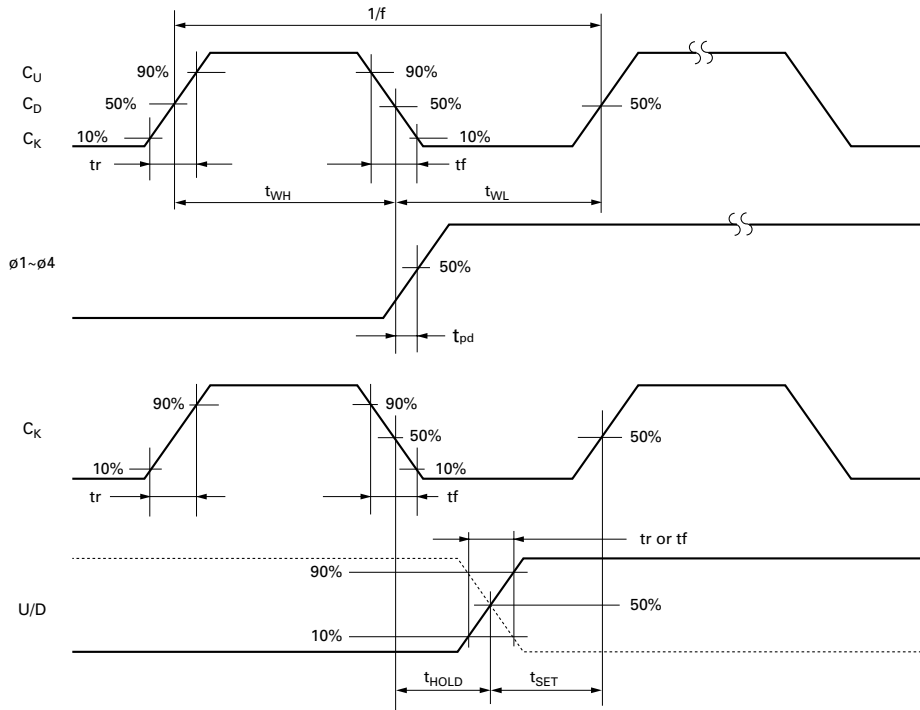
Item	Symbol	V <sub>CC</sub> [V]	Condition	Standard value			Unit	
				Min.	Standard	Max.		
Input voltage	"H" level	V <sub>IH</sub>	5	—	3.5	—	—	V
	"L" level	V <sub>IL</sub>	5	—	—	—	1.5	
Output voltage	"H" level	V <sub>OH</sub>	5	V <sub>H</sub> = 5V V <sub>L</sub> = 0V I <sub>OH</sub> = 0	4.9	—	—	V
	"L" level	V <sub>OL</sub>	5	V <sub>H</sub> = 5V V <sub>L</sub> = 0V I <sub>OH</sub> = 0	—	—	0.1	
Output current ø1~ø4	"H" level	I <sub>OH</sub>	5	V <sub>H</sub> = 5V V <sub>L</sub> = 0V V <sub>OUT</sub> = 2.4V	-24	—	—	mA
	"L" level	I <sub>OL</sub>	5	V <sub>H</sub> = 5V V <sub>L</sub> = 0V V <sub>OUT</sub> = 0.4V	24	—	—	
Output current C <sub>O</sub> ,E <sub>M</sub>	"H" level	I <sub>OH</sub>	5	V <sub>H</sub> = 5V V <sub>L</sub> = 0V V <sub>OUT</sub> = 2.4V	-2	—	—	mA
	"L" level	I <sub>OL</sub>	5	V <sub>H</sub> = 5V V <sub>L</sub> = 0V V <sub>OUT</sub> = 0.4V	2	—	—	
Input current	I	5	—	—	—	10	—	μA
Static current consumption	I <sub>CC</sub>	5	V <sub>H</sub> = 5V V <sub>L</sub> = 0V	—	—	1	—	mA

### Switching characteristics (T<sub>a</sub>=20~85°C)

Item	Symbol	V <sub>CC</sub> [V]	Condition	Standard value			Unit
				Min.	Standard	Max.	
Max. clock frequency	f <sub>MAX</sub>	5	t <sub>r</sub> =t <sub>f</sub> =20ns,CL=50pF	1	—	—	MHz
Min. width of clock pulse	t <sub>WL</sub> ,t <sub>WH</sub>	5	t <sub>r</sub> =t <sub>f</sub> =20ns,CL=50pF	—	—	500	ns
Min. width of reset pulse	t <sub>WR</sub>	5	t <sub>r</sub> =t <sub>f</sub> =20ns,CL=50pF	—	—	1000	ns
Time delay (from clock input to ø output)	t <sub>pd</sub>	5	t <sub>r</sub> =t <sub>f</sub> =20ns,CL=50pF	—	—	2000	ns
Set time	t <sub>SET</sub>	5	t <sub>r</sub> =t <sub>f</sub> =20ns,CL=50pF	0	—	—	ns
Holding time	t <sub>HOLD</sub>	5	t <sub>r</sub> =t <sub>f</sub> =20ns,CL=50pF	250	—	—	ns

## Electrical Characteristics

### Measured waveforms on switching time scale



## Function Table

### Input modes and rotation direction

Input mode	Input				Rotation direction
	C <sub>U</sub>	C <sub>D</sub>	C <sub>K</sub>	U/D	
2 input mode (CW,CCW)		L	L	L	CW
	L		L	L	CCW
1 input mode (CK, U/D)	L	L		H	CW
	L	L		L	CCW

### Energization modes

Excitation mode	Input			
	$\bar{R}$	E <sub>A</sub>	E <sub>B</sub>	$\phi_c$
1 EX	H	H	L	H
1-2EX	H	H	H	H
2 EX	H	L	L	H

## Energization Sequence

### 1EX

Pulse \ Phase	0 (Reset)	1	2	3	4
$\phi_1$	1	0	0	0	1
$\phi_2$	0	1	0	0	0
$\phi_3$	0	0	1	0	0
$\phi_4$	0	0	0	1	0
E <sub>M</sub>	0	0	0	0	0
UP					▶
DOWN	◀				

### 2EX

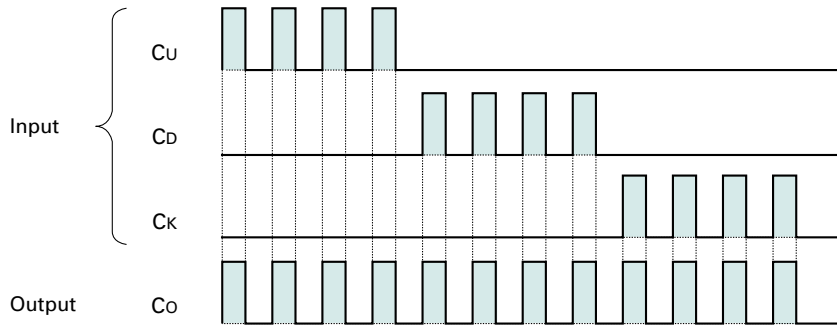
Pulse \ Phase	0 (Reset)	1	2	3	4
$\phi_1$	1	1	0	0	1
$\phi_2$	0	1	1	0	0
$\phi_3$	0	0	1	1	0
$\phi_4$	1	0	0	1	1
E <sub>M</sub>	1	1	1	1	1
UP					▶
DOWN	◀				

### 1-2EX

Pulse \ Phase	0 (Reset)	1	2	3	4	5	6	7	8
$\phi_1$	1	1	1	0	0	0	0	0	1
$\phi_2$	0	0	1	1	1	0	0	0	0
$\phi_3$	0	0	0	0	1	1	1	0	0
$\phi_4$	1	0	0	0	0	0	1	1	1
E <sub>M</sub>	1	0	1	0	1	0	1	0	1
UP									▶
DOWN	◀								

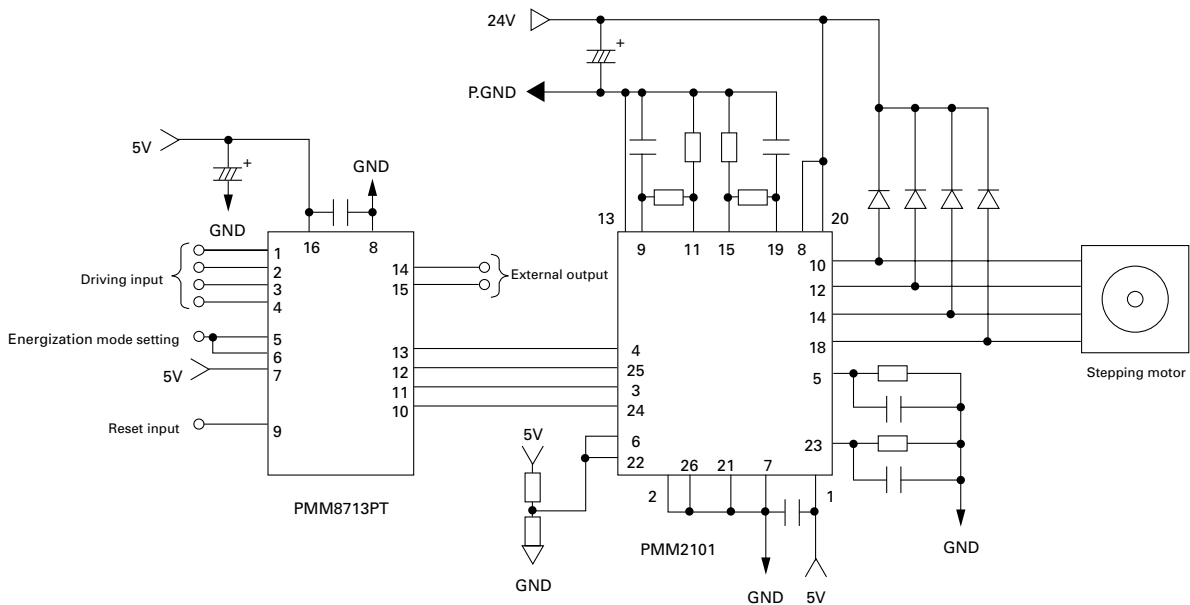
- Reset after changing the energization mode.

## Input Pulse Monitor



## Example of Application Circuit (Bipolar wiring motor)

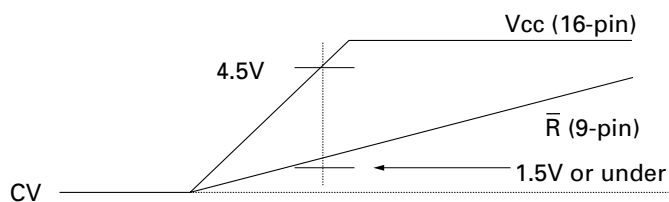
- Combined with the power hybrid IC



### Energization mode setting

Pin No.	Terminal symbol	Input level	Motor operation
5,6	E <sub>A</sub> , E <sub>B</sub>	H	1-2EX
		L	2EX

- The normal initial reset may not be performed during unstable VCC after turning the power ON. For reliable resetting, hold the R terminal (9-pin) at the "L" level till the VCC becomes stable.



- Power hybrid IC: Refer to page 146 for the PMM2101 specifications.
- Refer to the PMM8713PT Operation Manual for other application circuit examples.