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 : Vcc=4.5~5.5V
- 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 (Ta=25˚C)

Item		Symbol	Rating	Unit
Source voltage		V_{CC}	−0.3~7	V
Output current	"H" level	I_{OH} ø	−35	mA
øn	"L" level	I_{OL} ø	35	
Output current	"H" level	I_{OH}		μA
C_O, E_M	"L" level	I_{OL}		
Input voltage		V_{IN}	−0.3~V_{CC}+0.3	V
Input current		I_{IN}	±10	mA
Operating current		T_{opr}	−20~85	˚C
Conservation temperature		T_{stg}	−40~125 ˚C	

Recommended Operating Conditions (Ta=20~85˚C)

Item		Symbol	Rating			Unit
			Min.	Standard	Max.	
Source voltage		V_{CC}	4.5	–	5.5	V
Output current	"H" level	I_{OH} ø	−24	–	–	mA
øn	"L" level	I_{OL} ø	24	–	–	
Output current	"H" level	I_{OH}	−2	–	–	mA
C_O, E_M, Z_O	"L" level	I_{OL}	2	–	–	
Input voltage		V_{IN}	0	–	V_{CC}	V

Dimensions (Unit: mm)

Pin No.	Name	Function
1.	C_U	Input pulse UP clock input
2.	C_D	Input pulse DOWN clock input
3.	C_K	Input pulse clock input
4.	U/D	Rotation direction conversion
5.	E_A	energization mode switching input
6.	E_B	energization mode switching input
7.	ϕ_C	energization mode switching input
8.	V_{SS}	GND
9.	R	Reset input
10.	$\phi4$	$\phi4$ output
11.	$\phi3$	$\phi3$ output
12.	$\phi2$	$\phi2$ output
13.	$\phi1$	$\phi1$ output
14.	E_M	energization monitor output
15.	C_O	Input pulse monitor output
16.	V_{CC}	4.5~5.5V
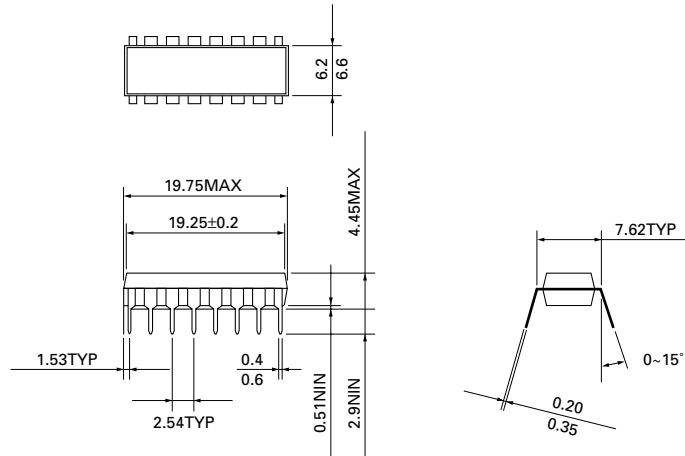
Electrical Characteristics

Direct current characteristics (Ta=-20~85°C)

Item		Symbol	V_{CC} [V]	Condition	Standard value			Unit
					Min.	Standard	Max.	
Input voltage	"H" level	V_{IH}	5	——	3.5	–	–	V
	"L" level	V_{IL}	5	——	–	–	1.5	
Output voltage	"H" level	V_{OH}	5	$V_H = 5V$ $V_L = 0V$ $I_{OH} = 0$	4.9	–	–	V
	"L" level	V_{OL}	5	$V_H = 5V$ $V_L = 0V$ $I_{OH} = 0$	–	–	0.1	
Output current $\phi1~\phi4$	"H" level	I_{OH}	5	$V_H = 5V$ $V_L = 0V$ $V_{OUT} = 2.4V$	–24	–	–	mA
	"L" level	I_{OL}	5	$V_H = 5V$ $V_L = 0V$ $V_{OUT} = 0.4V$	24	–	–	
Output current C_O, E_M	"H" level	I_{OH}	5	$V_H = 5V$ $V_L = 0V$ $V_{OUT} = 2.4V$	–2	–	–	mA
	"L" level	I_{OL}	5	$V_H = 5V$ $V_L = 0V$ $V_{OUT} = 0.4V$	2	–	–	
Input current		I	5	——	–	10	–	µA
Static current consumption		I_{CC}	5	$V_H = 5V$ $V_L = 0V$	–	1	–	mA

Switching characteristics (Ta=20~85°C)

Item	Symbol	V_{CC} [V]a	Condition	Standard value			Unit
				Min.	Standard	Max.	
Max. clock frequency	f_{MAX}	5	tr=tf=20ns,CL=50pF	1	–	–	MHz
Min. width of clock pulse	t_{WL}, t_{WH}	5	tr=tf=20ns,CL=50pF	–	–	500	ns
Min. width of reset pulse	t_{WR}	5	tr=tf=20ns,CL=50pF	–	–	1000	ns
Time delay (from clock input to ϕ output)	t_{pd}	5	tr=tf=20ns,CL=50pF	–	–	2000	ns
Set time	t_{SET}	5	tr=tf=20ns,CL=50pF	0	–	–	ns
Holding time	t_{HOLD}	5	tr=tf=20ns,CL=50pF	250	–	–	ns

Electrical Characteristics

Measured waveforms on switching time scale
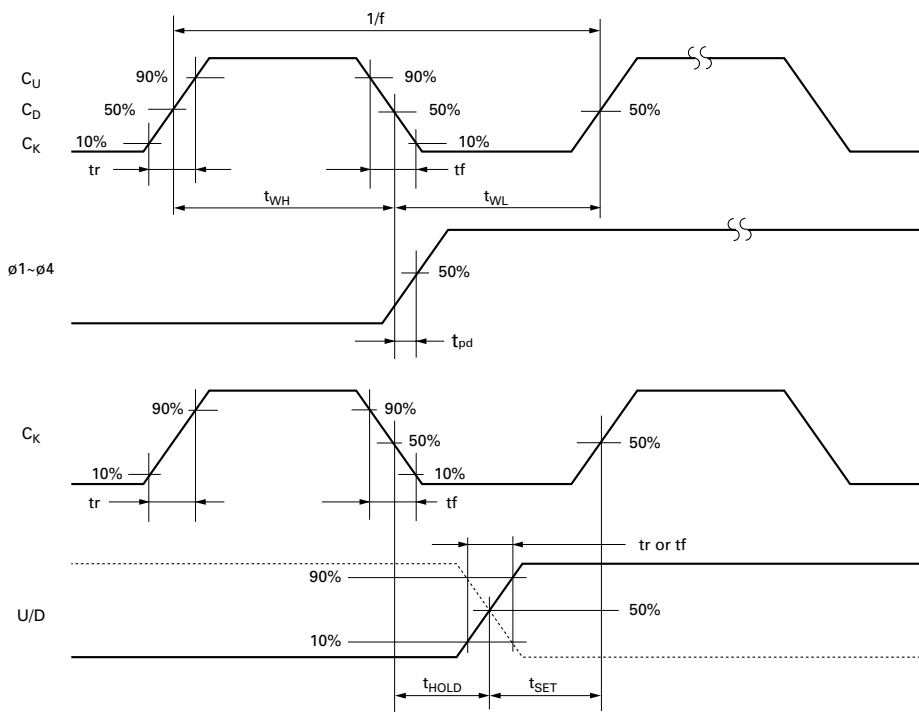
Function Table

Input modes and rotation direction

Input mode	Input				Rotation direction
	C_U	C_D	C_K	U/D	
2 input mode	⌐_	L	L	L	CW
(CW,CCW)	L	⌐_	L	L	CCW
1 input mode	L	L	⌐_	H	CW
(CK, U/D)	L	L	⌐_	L	CCW

Energization modes

Excitation mode	Input			
	$\overline{R}$	E_A	E_B	$ø_C$
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
ø1	1	0	0	0	1
ø2	0	1	0	0	0
ø3	0	0	1	0	0
ø4	0	0	0	1	0
E_M	0	0	0	0	0
UP	—————————————▶				
DOWN	◀—————————————				

2EX

Pulse / Phase	0 (Reset)	1	2	3	4
ø1	1	1	0	0	1
ø2	0	1	1	0	0
ø3	0	0	1	1	0
ø4	1	0	0	1	1
E_M	1	1	1	1	1
UP	—————————————▶				
DOWN	◀—————————————				

1–2EX

Pulse / Phase	0 (Reset)	1	2	3	4	5	6	7	8
ø1	1	1	1	0	0	0	0	0	1
ø2	0	0	1	1	1	0	0	0	0
ø3	0	0	0	0	1	1	1	0	0
ø4	1	0	0	0	0	0	1	1	1
E_M	1	0	1	0	1	0	1	0	1
UP	—————————————————————▶								
DOWN	◀—————————————————————								

• Reset after changing the energization mode.

Input Pulse Monitor

Input
C_U
C_D
C_K

Output
C_O
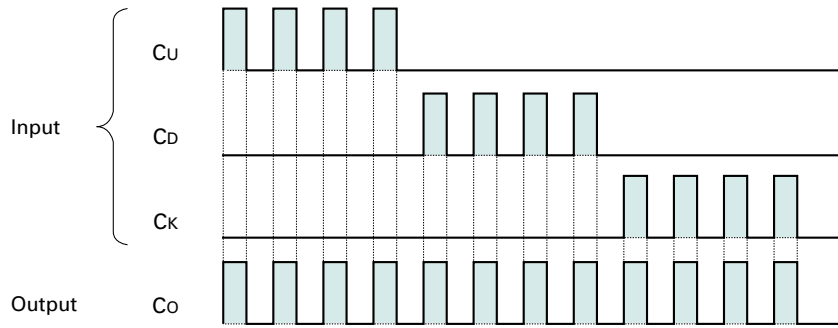
Example of Application Circuit (Bipolar wiring motor)

● Combined with the power hybrid IC
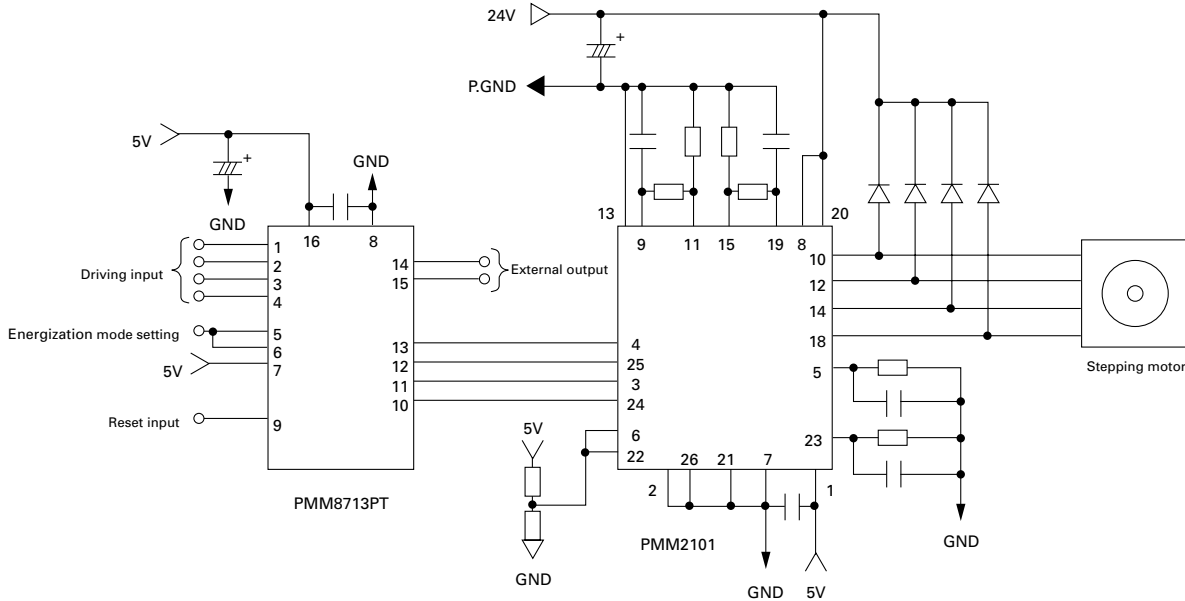
Energization mode setting

Pin No.	Terminal symbol	Input level	Motor operation
5,6	E_A, E_B	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.

Vcc (16-pin)
4.5V
$\overline{R}$ (9-pin)
1.5V or under
CV
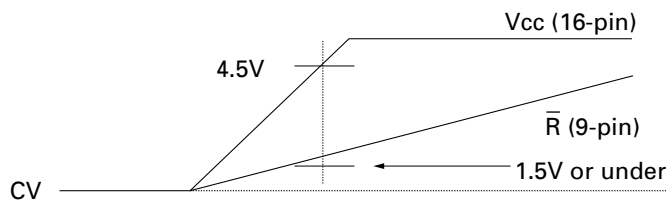
● Power hybrid IC: Refer to page 146 for the PMM2101 specifications.
● Refer to the PMM8713PT Operation Manual for other application circuit examples.