

5-Phase Stepping Motor Drive IC for Universal Controller

PMM8714PT

Outline

"PMM8714PT" is a Bi-CMOS monolithic IC to be used for controlling 5-phase stepping motor.

This IC has been developed for the purpose to further simplify the usage of 5-phase stepping motor. When combined only with the switching elements or a power hybrid IC, this IC can configure a driver device for a 5-phase stepping motor.

Characteristics

- Universal controller : Selection is possible from the following three different excitation modes.
4EX/4-5EX/5EX
- Power voltage: : $V_{CC}=4V\sim 16V$
- High output current: : 20mA min(source)
- High noise margin : Schmitt trigger circuit is integrated for the all input terminals
- two kinds of pulse input : double input system (CW, CCW input mode), single input system (CK,U/D input mode)
- Power-down functions : Makes all the output to "L" level.
- Reset functions : Shifts excitation status to the phase origin.
- Excitation mode preservation functions : Phase output does not change even when excitation mode is switched as follows: 4EX_4-5EX_5EX.
- Phase origin monitor : Outputs at the "H" level at the time of phase origin (the output in reset mode).
- Determination monitor for excitation status : Outputs monitor signal for the status of controller.
- Input pulse monitor : Outputs monitor signal for V_{CC} input pulse.

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

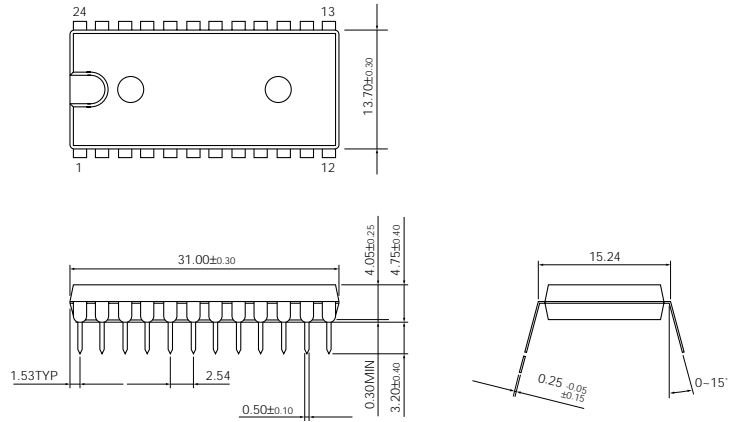
Item	Symbol	Rating	Unit
Power voltage	V_{CC}	-0.5~20	V
Output current I_{OH}	"H" level	-30	mA
	"L" level	2	
Output current I_{OL}	"H" level	-50	μA
	"L" level	2	mA
Input voltage	V_{IN}	-0.5~ V_{CC}	V
Input current	I_{IN}	± 1	mA
Tolerated loss	P_D	1000	mW
Operating temperature	T_{opr}	-20~85	$^{\circ}\text{C}$
Storage temperature	T_{stg}	-55~150	$^{\circ}\text{C}$

Recommended Operating Conditions ($T_a = -30$ to 85°C)

Item	Symbol	Rating			Unit
		Min.	Standard	Max.	
Power voltage	V_{CC}	4	—	16	V
Output current I_{OH}	"H" level	—	—	-10	mA
	"L" level	—	—	1.6	
Output current I_{OL}	"H" level	—	—	-40	μA
	"L" level	—	—	1.6	mA
Input voltage	V_{IN}	0	—	V_{CC}	V
Clock frequency	—	0	—	250	kHz

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	Alters rotation direction
5.	E _A	Input to switch excitation mode
6.	E _B	Input to switch excitation mode
7.	E _C	Input to switch excitation mode
8.	P _D	Power down input
9.	Z _O	Phase origin monitor output
10.	C _O	Input pulse monitor output
11.	E _M	Excitation monitor output
12.	GND	0V
13.	\bar{R}	Reset input
14.	$\phi \bar{E}$	$\phi \bar{E}$ output
15.	$\phi \bar{D}$	$\phi \bar{D}$ output
16.	$\phi \bar{C}$	$\phi \bar{C}$ output
17.	$\phi \bar{B}$	$\phi \bar{B}$ output
18.	$\phi \bar{A}$	$\phi \bar{A}$ output
19.	ϕE	ϕE output
20.	ϕD	ϕD output
21.	ϕC	ϕC output
22.	ϕB	ϕB output
23.	ϕA	ϕA output
24.	V _{CC}	4-16V



Electrical characteristics

Direct Current Characteristics (Ta=25°C)

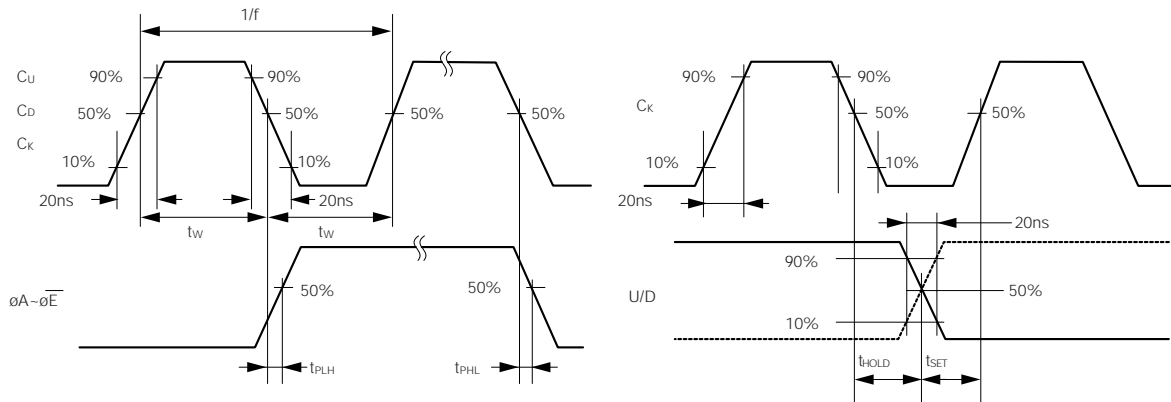
Item	Symbol	VCC [V]	Conditions	Standard Value			Unit
				Min.	Standard	Max.	
Output current $\phi A-\phi \bar{E}$	"H" level	5	$V_O = V_{CC}-2.0$	-20	—	—	mA
		10		-20	—	—	
	"L" level	5	$V_O = 0.3V$	1.6	—	—	
		10		1.6	—	—	
Output voltage C _O ,E _M ,Z _O	"H" level	5	$I_O = -40\mu A$	3.6	—	—	V
		10		8.6	—	—	
	"L" level	5	$I_O = 1.6mA$	—	—	0.4	
		10		—	—	0.6	
Input voltage	"H" level	5	—————	3.0	2.5	—	V
		10		6.0	5.0	—	
	"L" level	5	—————	—	2.0	1.5	
		10		—	4.0	3.0	
Input voltage C _U ,C _D ,C _K E _A ,E _B ,E _C	"H" level	5	$V_{IN} = V_{CC}-0.5$	—	—	0.4	mA
		10		—	—	0.7	
	"L" level	5	$V_{IN} = 0V$	—	—	±10	
		10		—	—	±10	
Input voltage U/D,P _D ,R	"H" level	5	$V_{IN} = V_{CC}-0.5$	—	—	-100	μA
		10		—	—	-100	
	"L" level	5	$V_{IN} = 0V$	—	—	-0.4	
		10		—	—	-0.7	
Static current consumption	I _{CC}	5	All terminals open	—	—	25	mA
		10		—	—	35	

Electrical characteristics

Switching Characteristics (Ta=25°C)

Item	Symbol	VCC [V]	Conditions	Standard Value			Unit
				Min.	Standard	Max.	
Max. clock frequency	f _{MAX}	5	-----	250	300	—	kHz
		10		270	350	—	
Min. clock pulse width	t _w	5	-----	—	300	500	ns
		10		—	300	500	
Min. reset pulse width	t _{wR}	5	-----	—	200	500	ns
		10		—	200	500	
Delay time (ø output from clock input)	t _{PHL}	5	-----	—	2500	3500	ns
		10		—	2500	3500	
Delay time (Each monitoring from clock input)	t _{PLH}	5	-----	—	3000	4000	ns
		10		—	3000	4000	
Preset time	t _{SET}	5	-----	4000	3000	—	ns
		10		4000	3000	—	
Holding time	t _{HOLD}	5	-----	500	0	—	ns
		10		500	0	—	

Switching Characteristics



Function table

Input mode and rotating direction

Input system	Input				Rotation direction
	C _u	C _d	C _k	U/D	
Double input system (CW,CCW)		L	L	L	CW
	L		L	L	CCW
Single input system (CK,U/D)	L	L		H	CW
	L	L		L	CCW

Excitation mode

Energization system	Input				
	\bar{R}	\bar{P}_d	E _A	E _B	E _C
4 EX	H	H	L	H	L
4-5EX	H	H	L	L	L
5 EX	H	H	H	L	L

Energization sequence

4EX

Pulse Phase	0 (Reset)	1	2	3	4	5	6	7	8	9	10
ϕA	1	0	0	0	0	0	0	1	1	1	1
ϕB	1	1	0	0	0	0	0	0	1	1	1
ϕC	1	1	1	0	0	0	0	0	0	1	1
ϕD	1	1	1	1	0	0	0	0	0	0	1
ϕE	0	1	1	1	1	0	0	0	0	0	0
$\phi \bar{A}$	0	0	1	1	1	1	0	0	0	0	0
$\phi \bar{B}$	0	0	0	1	1	1	1	0	0	0	0
$\phi \bar{C}$	0	0	0	0	1	1	1	1	0	0	0
$\phi \bar{D}$	0	0	0	0	0	1	1	1	1	0	0
$\phi \bar{E}$	0	0	0	0	0	0	1	1	1	1	0
Z_0	1	0	0	0	0	0	0	0	0	0	1
E_M	0	0	0	0	0	0	0	0	0	0	0
UP	→										
DOWN	←										

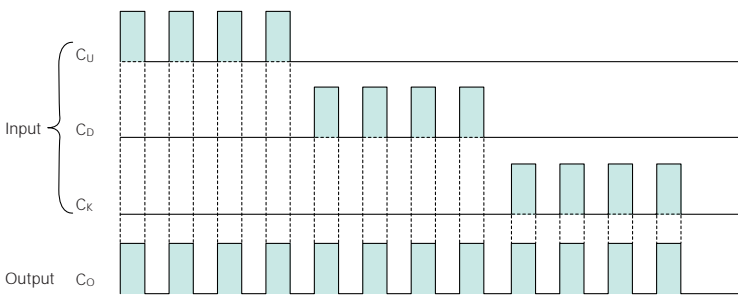
5EX

Pulse Phase	0 (Reset)	1	2	3	4	5	6	7	8	9	10
ϕA	1	1	0	0	0	0	0	1	1	1	1
ϕB	1	1	1	0	0	0	0	0	1	1	1
ϕC	1	1	1	1	0	0	0	0	0	1	1
ϕD	1	1	1	1	1	0	0	0	0	0	1
ϕE	0	1	1	1	1	1	0	0	0	0	0
$\phi \bar{A}$	0	0	1	1	1	1	1	0	0	0	0
$\phi \bar{B}$	0	0	0	1	1	1	1	1	0	0	0
$\phi \bar{C}$	0	0	0	0	1	1	1	1	1	0	0
$\phi \bar{D}$	0	0	0	0	0	1	1	1	1	1	0
$\phi \bar{E}$	1	0	0	0	0	0	1	1	1	1	1
Z_0	1	0	0	0	0	0	0	0	0	0	1
E_M	1	1	1	1	1	1	1	1	1	1	1
UP	→										
DOWN	←										

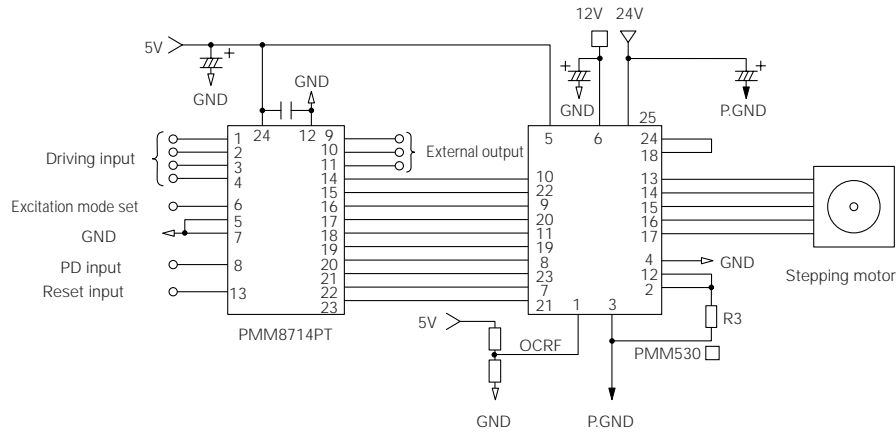
4-5EX

Pulse Phase	0 (Reset)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
ϕA	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
ϕB	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
ϕC	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
ϕD	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1
ϕE	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
$\phi \bar{A}$	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
$\phi \bar{B}$	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
$\phi \bar{C}$	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0
$\phi \bar{D}$	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0
$\phi \bar{E}$	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0
Z_0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
E_M	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0
UP	→																				
DOWN	←																				

Input pulse monitor



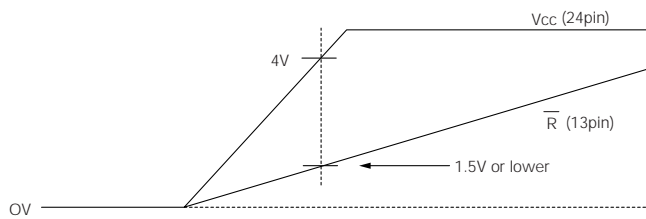
Example application circuit (full step/half step)



Excitation mode set

Pin No.	Terminal symbol	Input level	Motor operation
6	EB	H	Full step
		L	Half step

- When VCC is not stable, such as immediately after the power is on, normal initial reset can not always be performed. In order to perform firm reset, hold R terminal (13pin) at the "L" level until Vcc becomes stable.



- Refer to Page 343 for the specifications of power hybrid IC:PMM530 □.
- Refer to Operation Manual of PMM8714PT for other applications.