



## HIC for 2-Phase Stepping Motor

# PMM2301

### Micro Step

### Outline

The Stepping motor driver IC “PMM2301” is a power hybrid IC (HIC) packaging the integrated excitation mode generation circuits and related switching elements for 2-phase stepping motor driving.

This product is developed for the purpose to further simplify 2-phase stepping motor use, as combined only with a few peripheral parts to configure a 2-phase stepping motor driver.

### Characteristics

- Sine wave driven micro-step driver.
- The current detection resistor is incorporated.
- MOSFET is used for the power driving circuit to reduce heating.
- Totally packaged to reduce parts for the peripheral circuit.
- Enables selection from the 5 various excitation modes by the external bit signal.

### Maximum Rating (T<sub>c</sub>=25°C)

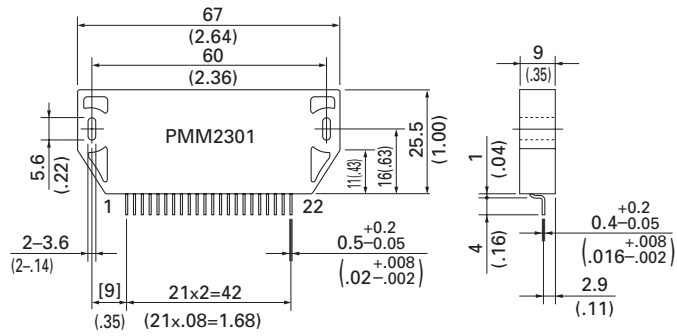
Item	Symbol	Condition	Rated value	Unit
Source voltage -1	V <sub>CC1</sub> max	V <sub>CC2</sub> =0V	52	V
Source voltage -2	V <sub>CC2</sub> max	With no signal	7	V
Input voltage	V <sub>in</sub> max	Logic input terminal	7	V
Phase current	I <sub>OH</sub> max	0.5sec, 1pulse, V <sub>CC1</sub> applied	4	A
Operating temperature on PCB	T <sub>C</sub> max	–	105	°C
Junction temperature	T <sub>J</sub> max	–	150	°C
Conservation temperature	T <sub>stg</sub>	–	–40~125	°C

### Recommended Operating Conditions (T<sub>a</sub>=25°C)

Item	Symbol	Condition	Rated value	Unit
Source voltage -1	V <sub>CC1</sub>	With signal	10~45	V
Source voltage -2	V <sub>CC2</sub>	With signal	5.0±5%	V
Input voltage	V <sub>IH</sub>	–	0~V <sub>CC2</sub>	V
Phase current	I <sub>OH</sub>	Duty 50%	3	A
Clock frequency	Clock	–	DC~50	kHz
Withstand voltage of phase driver	V <sub>DSS</sub>	–	100	V

## Dimensions [Unit: mm(inch)]

Pin No.	Terminal name	Pin No.	Terminal name
1.	$\bar{B}$	12.	V <sub>CC2</sub>
2.	B	13.	V <sub>CC2</sub>
3.	P.GND A	14.	Clock
4.	P.GND B	15.	CW/CCW
5.	$\bar{A}$	16.	Reset
6.	A	17.	Return
7.	V <sub>CC2</sub>	18.	Enable
8.	V <sub>ref</sub>	19.	M <sub>01</sub>
9.	Mode 1	20.	M <sub>01</sub>
10.	Mode 2	21.	M <sub>02</sub>
11.	Mode 3	22.	GND



## Each Terminal Function

Terminal name	Function	Functioning condition															
V <sub>ref</sub>	Motor current setting input	-															
Clock	Motor driving pulse input	Mode 3="H" level: Operates at rising edge Mode 3="L" level: Operates at rising and falling edges															
CW/CCW	Motor rotation direction setting input	"H" level= CW rotation "L" level= CCW rotation															
Reset	System reset	Reset="L"															
Return	Forced return to phase origin	Forced shift to the origin of the present energization phase with Return="H".															
Enable	Power OFF input	Enable="L"															
M <sub>01</sub>	Phase origin monitor output	"L" level output at the phase origin.															
M <sub>01</sub> , M <sub>02</sub>	Monitor output on phase energization status	Outputs level signal on the present phase energization status.															
		<table border="1"> <thead> <tr> <th>Phase coordinate</th> <th>A phase</th> <th>B phase</th> <th><math>\bar{A}</math> phase</th> <th><math>\bar{B}</math> phase</th> </tr> </thead> <tbody> <tr> <td>M<sub>01</sub></td> <td>H</td> <td>L</td> <td>L</td> <td>H</td> </tr> <tr> <td>M<sub>02</sub></td> <td>L</td> <td>H</td> <td>L</td> <td>H</td> </tr> </tbody> </table>	Phase coordinate	A phase	B phase	$\bar{A}$ phase	$\bar{B}$ phase	M <sub>01</sub>	H	L	L	H	M <sub>02</sub>	L	H	L	H
Phase coordinate	A phase	B phase	$\bar{A}$ phase	$\bar{B}$ phase													
M <sub>01</sub>	H	L	L	H													
M <sub>02</sub>	L	H	L	H													

## Energization Mode Table

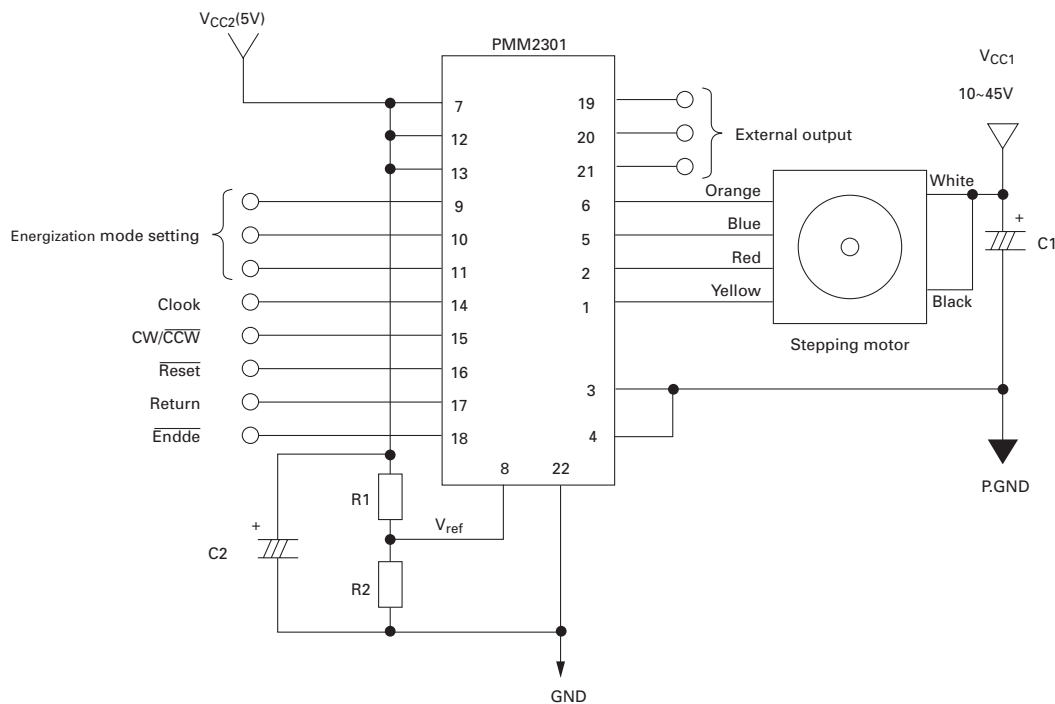
Input condition			Energization mode	1 step angle (degree)	Number of basic angle division
Mode 1	Mode 2	Mode 3			
L	L	H	2EX	1.8	1/1
H	L	H	1-2EX	0.9	1/2
L	H	H	W1-2EX	0.45	1/4
H	H	H	2W1-2EX	0.225	1/8
H	H	L	4W1-2EX	0.1125	1/16

- Conditioned on the Mode 3=L, one pulse operation is performed at every rising and falling edge of the clock pulse. Accordingly, the operation becomes unstable if the driving pulse duty ratio deviates from 50%.

## Electrical Characteristics (Tc=25°C, Vcc1=24V, Vcc2=5V)

Item	Symbol	Condition	Rating			Unit
			MIN.	Standard	MAX.	
Vcc2 Power current	Icco	Enable="L"	-	4.5	15	mA
Effective output current	I <sub>o ave</sub>	Each phase R/L=3.5Ω/3.8mH Vref=0.6V	0.45	0.50	0.55	A
Forward direction voltage of FET diode	V <sub>df</sub>	I <sub>f</sub> =1A	-	1.2	1.8	V
Output saturating voltage	V <sub>sat</sub>	RL=7.5Ω (I≐3.0A)	-	1.4	2.6	V
"H" level input voltage	V <sub>IH</sub>	9~11,14~18 pins	4.0	-	-	V
"L" level input voltage	V <sub>IL</sub>	9~11,14~18 pins	-	-	1.0	V
Input current	I <sub>IL</sub>	9~11,14~18 pins=GND level Pull-up resistor 20kΩ	125	250	510	μA
Vref input voltage	V <sub>r</sub>	8-pin	0	-	Vcc2/2	V
Vref input curren	I <sub>r</sub>	8-pin	-	1	-	μA
"H" level output voltage	V <sub>OH</sub>	19~21 pins I=3mA I=-3mA	2.4	-	-	V
"L" level output voltage	V <sub>OL</sub>	19~21 pins I=3mA	-	-	0.4	V
M <sub>0i</sub> ,M <sub>01</sub> ,M <sub>02</sub>						
PWM frequency	F <sub>C</sub>	-	37	47	57	kH

## Example of Application Circuit



### ● Recommended circuit constants

C1	C2
100μF OR OVER	10μF

- Determine on the R1 and R2 constants based on the Vref voltage calculated from the following formula.  
 $V_{ref}(V) = \text{Motor current adjusted value (A/phase)} \times 0.6$