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 (Tc=25˚C)

Item	Symbol	Condition	Rated value	Unit
Source voltage –1	$V_{CC1\,max}$	$V_{CC2}=0V$	52	V
Source voltage –2	$V_{CC2\,max}$	with no signal	7	V
Input voltage	$V_{in\,max}$	Logic input terminal	7	V
Phase current	$I_{OH\,max}$	0.5sec, 1pulse, V_{CC1} applied	4	A
Operating temperature on PCB	$T_{C\,max}$	–	105	˚C
Junction temperature	$T_{j\,max}$	–	150	˚C
Conservation temperature	T_{stg}	–	–40~125	˚C

Recommended Operating Conditions (Ta=25˚C)

Item	Symbol	Condition	Rated value	Unit
Source voltage –1	V_{CC1}	with signal	10~45	V
Source voltage –2	V_{CC2}	with signal	5.0±5%	V
Input voltage	V_{IH}	–	0~V_{CC2}	V
Phase current	I_{OH}	Duty 50%	3	A
Clock frequency	Clock	–	DC~50	kHz
Withstand voltage of phase driver	V_{DSS}	–	100	V

Dimensions (Unit: mm)

Pin No.	Terminal name
1.	B
2.	B
3.	P.GND A
4.	P.GND B
5.	A
6.	A
7.	V_{CC2}
8.	V_{ref}
9.	Mode 1
10.	Mode 2
11.	Mode 3

Pin No.	Terminal name
12.	V_{CC2}
13.	V_{CC2}
14.	Clock
15.	CW/CCW
16.	Reset
17.	Return
18.	Enable
19.	M_{OI}
20.	M_{O1}
21.	M_{O2}
22.	GND

PMM2301

67 / 60 / 25.5 / 5.6 / 11 / 16 / 1 / 22 / 2–3.6 / $0.5^{+0.2}_{-0.05}$ / (9) / 21x2=42 / 9 / 4 / $0.4^{+0.2}_{-0.05}$ / 2.9
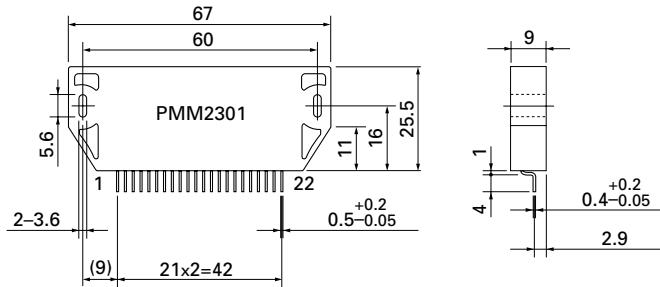
Each Terminal Function

Terminal name	Function	Functioning condition
V_{ref}	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_{OI}	Phase origin monitor output	"L" level output at the phase origin.
M_{O1}, M_{O2}	Monitor output on phase energization status	Outputs level signal on the present phase energization status.

Phase coordinate	A phase	B phase	$\overline{A}$ phase	$\overline{B}$ phase
M_{O1}	H	L	L	H
M_{O2}	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.	
V_{CC2} Power current	I_{CCO}	Enable="L"	–	4.5	15	mA
Effective output current	$I_{o\ ave}$	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_{df}	If=1A	–	1.2	1.8	V
Output saturating voltage	V_{sat}	RL=7.5Ω (I≒3.0A)	–	1.4	2.6	V
"H" level input voltage	V_{IH}	9~11,14~18 pins	4.0	–	–	V
"L" level input voltage	V_{IL}	9~11,14~18 pins	–	–	1.0	V
Input current	I_{IL}	9~11,14~18 pins=GND level Pull-up resistor 20kΩ	125	250	510	µA
V_{ref} input voltage	V_r	8-pin	0	–	$V_{CC2}/2$	V
V_{ref} input curren	I_r	8-pin	–	1	–	µA
"H" level output voltage M_{0I},M_{01},M_{02}	V_{OH}	19~21 pins I=3mA I=–3mA	2.4	–	–	V
"L" level output voltage M_{0I},M_{01},M_{02}	V_{OL}	19~21 pins I=3mA I=3mA	–	–	0.4	V
PWM frequency	F_C	–	37	47	57	kH

Example of Application Circuit
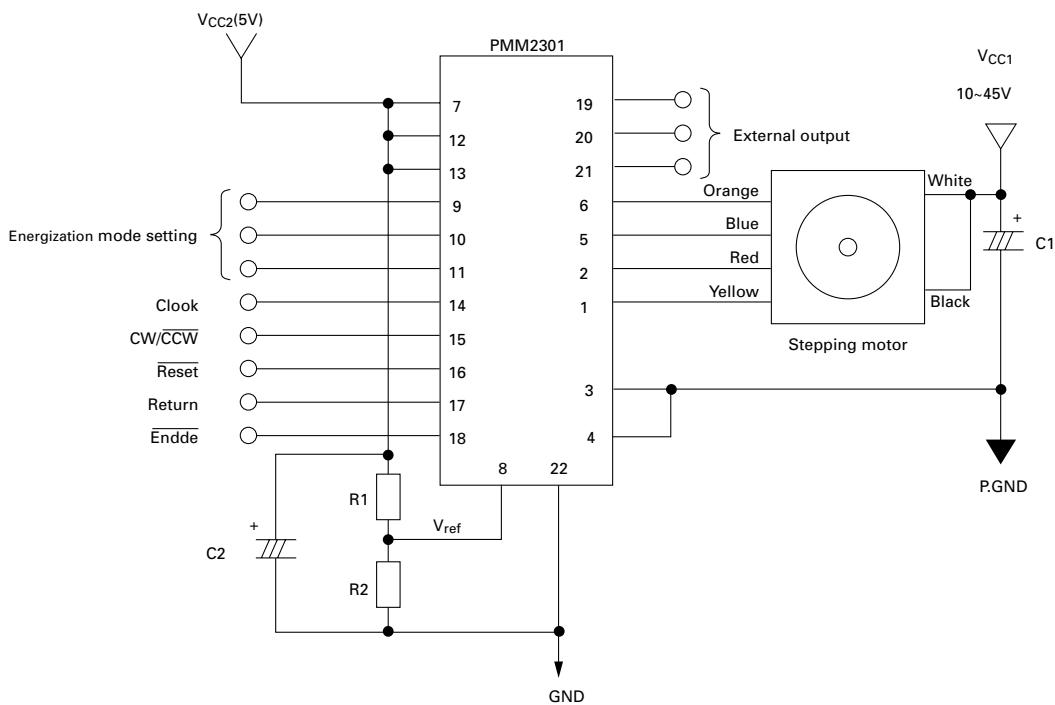
● Recommended circuit constants

C1	C2
100µF OR OVER	10µF

• Determine on the R1 and R2 constants based on the Vref voltage calculated from the following formula.
Vref(V)=Motor current adjusted value (A/phase) x 0.6