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3-Phase Stepping Motor Drive IC for Universal Controller

PMM3501

Micro step

Outline

The PMM3501 IC for stepping motor drive is a power hybrid IC (HIC) that consists of an energization mode generation circuit and a switching device to drive 3-phase stepping motors in a single package.
It has been developed to facilitate the use of 3-phase stepping motors more easily so that you can easily configure a micro step drive device only with this HIC and a few peripheral parts.

Features

- Micro step sine wave drive driver
- Built-in current detection resistor
- Adopting MOSFET as the power drive device to reduce heat generation
- All-in-one package reducing the number of parts of the peripheral circuit
- 5 energization modes available with an external bit signal

Maximum ratings (TC=25˚C)

Item	Symbol	Condition	Rating	Unit
Source voltage–1	V_{CC1max}	V_{CC2}=0V	37	V
Source voltage–2	V_{CC2max}	Without signal	7	V
Input voltage	V_{inmax}	Logic input terminal	7	V
Phase current	I_{Omax}	V_{CC2}=5V,Clock≧100Hz	6	A
Board temperature during operation	T_{Cmax}	No condensation at low temperature	0~+105	˚C
Joint temperature	T_{jmax}	———	+150	˚C
Conservation temperature	T_{stg}	———	–40~+125	˚C

Recommended operating conditions (Ta=15˚C)

Item	Symbol	Condition	Rating	Unit
Source voltage–1	V_{CC1}	With signal	16~30	V
Source voltage–1	V_{CC2}	Without signal	5.0±5%	V
Input voltage	V_{IH}	———	0~V_{CC2}	V
Phase current–1	I_{O1}	Without heat sink	1.7	A
Phase current–2	I_{O2}	T_C=105˚C,Clock≧100Hz	4.4	A
Clock frequency	Clock	Pin 11 input frequency (pulse duty: 50%)	DC~50	kHz
Phase driver withstand voltage	V_{DSS}	I_D=10mA(T_C=25˚C)	60	V

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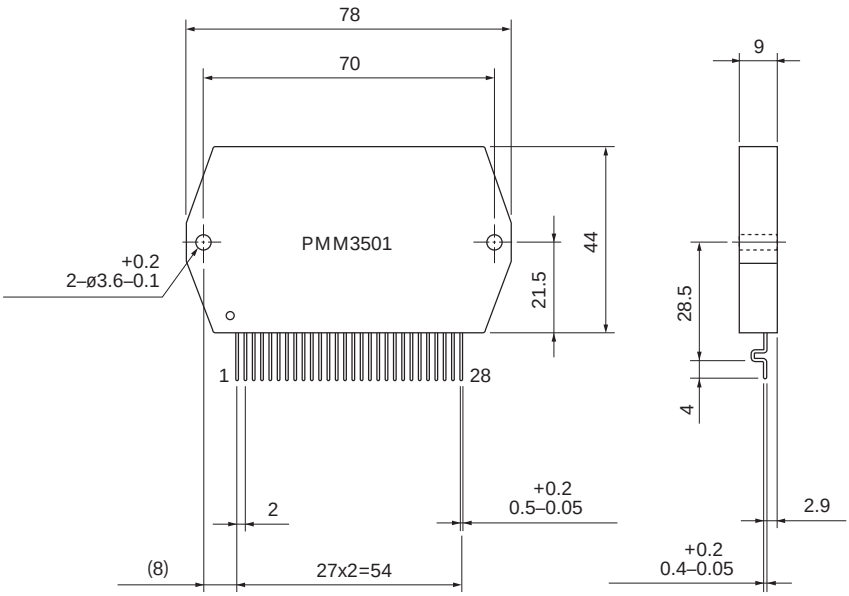
External Figures (unit: mm)

Pin connection

Pin No.	Name
1.	V_{CC1B}
2.	V_{CC1C}
3.	–
4.	UO
5.	WO
6.	VO
7.	Vz
8.	V_{CC1A}
9.	GND2
10.	V_{ref}
11.	Clock
12.	Mode A
13.	Mode B
14.	Hold
15.	CW/CCW
16.	Enable
17.	Reset
18.	Mode C
19.	GND1
20.	MOI
21.	V_{CC2}
22.	–
23.	UI
24.	VI
25.	WI
26.	–
27.	P.GNDA
28.	P.GNDB



Electrical characteristics (TC=25˚C, VCC1=24V, VCC2=5V)

Item	Symbol	Condition	Rating			Unit
			Min	Standard	Max	
V_{CC2} source current	I_{CCO}	Enable="L"	–	6.1	12	mA
Effective output current	I_{oe}	Each phase R/L=2Ω/6mH 2W2–3phase energization	0.92	1.03	1.14	A_{rms}
FET diode forward voltage	V_{df}	If=1A(RL=23Ω)	–	1.0	1.6	V
Output saturation voltage	V_{sat}	RL=23Ω	–	0.30	0.40	V
Output leak current	I_{OL}	RL=23Ω	–	–	0.1	mA
"H" level input voltage	V_{IH}	Pins 11 to 18	4.0	–	–	V
"L" level input voltage	V_{IL}	Pins 11 to 18	–	–	1.0	V
Input current	I_{IL}	Pins 11 to 18 = GND level Pull-up resistance:20kΩ	115	250	550	µA
V_{ref} input voltage	V_{rH}	Pin 10	0	–	V_{CC2}/2	V
V_{ref} input current	I_r	Pin 10 = 2.5 V Internal resistance:4kΩ	440	625	810	µA
"H" level MOI output voltage	V_{OH}	Pins 20 – 19 = 820kΩ	2.5	–	–	V
"L" level MOI output voltage	V_{OL}	Pins 21 – 20 = 1.6kΩ	–	–	0.4	V
PWM frequency	F_C	–	23	31	39	kHz

Function of each terminal

Function of each terminal	function	Input condition for operation
V_{ref}	Motor current setting input	–
Clock	Pulse input for motor drive	Mode C = "H": Rising edge operation Mode C = "L": Rising edge and falling edge operation
Hold	Pause input	Hold = "L" level
CW/CCW	Motor rotational direction setting input	"H" level = CW rotation "L" level = CCW rotation
Enable	Power off input	Enable = "L" level
Reset	System reset	Reset = "L" level
MOI	Rotation monitor output	"H" level output once for each phase current period

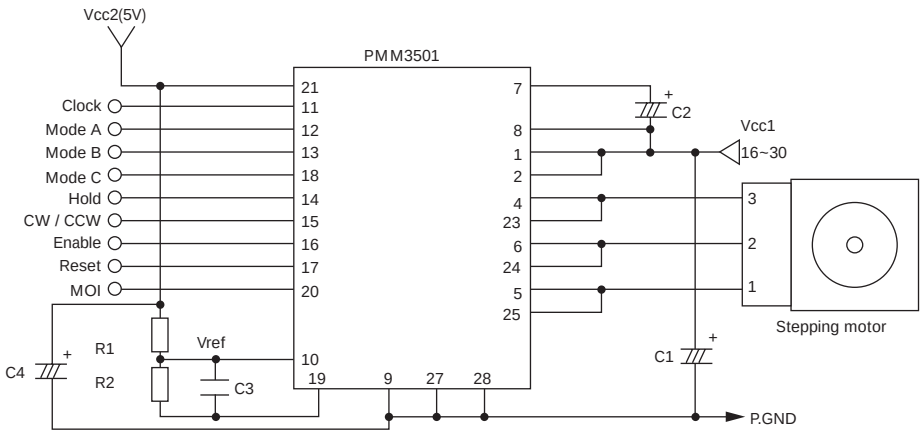
• The MOI output differs from the phase origin monitor output.

Energization mode table

Input			condition Energization mode	1 step angle (degree)	Basic step division
Mode A	Mode B	Mode C			
L	L	H	2EX	1.2	1
L	H	H	2–3EX	0.6	2
H	L	H	W2–3EX	0.3	4
H	H	H	2W2–3EX	0.15	8
H	H	L	4W2–3EX	0.075	16

• When Mode C = "L," 1 step operation is performed for each rising edge and falling edge of the Clock pulse.
If the duty ratio of the drive pulse moves out of the adjustment significantly by 50%, operation becomes unstable.

Example of Application Circuit



Recommended circuit part constants

C1	C2	C3	C4
470μF	6.8μF	0.1μF	10μF

- For the R1 and R2 constants, determine the Vref voltage according to the following equation.
  Vref (V) = motor current adjustment value (A/phase) x 0.41
  Notice that 100Ω is recommended for R2 due to the configuration of the internal circuit of the PMM3101.
- Place the GND side of the source by-pass capacitor of VCC1 (C1) as close to pins 27 and 28 as possible to reduce noise.