HIC for 2-Phase Stepping Motor

PMM2101
Full Step / Half Step

Outline

The stepping motor driver IC "PMM2101" is a monolithic-type power hybrid driver IC (HIC) packaging the circuits 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 the universal controller "PMM8713PT" for stepping motor driving, or the step sequence circuit, to configure a 2-phase stepping motor driver.

Characteristics

• Enables high speed and high torque operation by using bipolar constant current switching method.

• Enables compact driving circuit configuration with few of externally attached parts.

• The overheat protection circuit is incorporated to assist the safety design.

Maximum Rating (Tc=25°C)

Item	Symbol	Rated value	Unit
Source voltage –1	V_{CC1}	8~60	V
Source voltage –2	V_{CC2}	0~7	V
Output current	I_O	1.4	A
Allowable loss	P_T	35 (Tc=25°C)	W
Thermal resistance	θ_{jc}	3.57	°C/W
	θ_{ja}	25	°C/W
Junction temperature	T_{jmax}	150	°C
Conservation temperature	T_{stg}	−40~150	°C

Recommended Operating Conditions (Tc=25°C)

Item	Symbol	Rated value	Unit
Source voltage –1	V_{CC1}	100~50	V
Source voltage –2	V_{CC2}	4.75~5.25	V
Output current	I_O	1.0	A
Oscillator frequency	F_C	20~27	kHz
Operation temperature	T_C	−25~85	°C

Dimensions [Unit: mm(inch)]

Pin No.	Name	Function
1.	V$_{CC2}$	Power terminal for controller section
2.	ENA A	Enable input terminal
3.	ø1	Arm drive input
4.	ø2	Arm drive input
5.	CR A	One shot time constant setting terminal
6.	V$_{ref}$ A	Motor current setting terminal
7.	LG A	GND
8.	V$_{CC1}$ A	Motor driver power terminal
9.	VsA	Motor current detection terminal
10.	M1	Motor output
11.	R$_S$ A	Detection resistor connecting terminal
12.	M2	Motor output
13.	PG	P.GND
14.	M3	Motor output
15.	R$_S$ B	Detection resistor connecting terminal
16.	NC	–
17.	NC	–
18.	M4	Motor output
19.	Vs B	Motor current detection terminal
20.	V$_{CC1}$ B	Motor driver power terminal
21.	LG B	GND
22.	V$_{ref}$ B	Motor current setting terminal
23.	CR B	One shot time constant setting terminal
24.	ø3	Arm drive input
25.	ø4	Arm drive input
26.	ENA B	Enable terminal
27.	AL	Overheat alarm output terminal
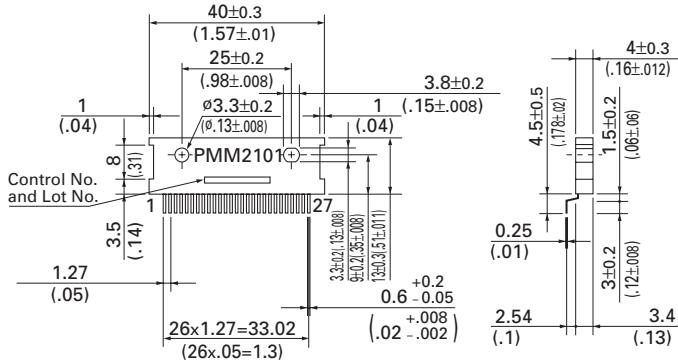
● Operational truth value table

ENA A (ENA B)	ø1 (ø3)	ø2 (ø4)	M1 (M3)	M2 (M4)
L	L	L	OFF	OFF
L	L	H	L	H
L	H	L	H	L
L	H	H	OFF	OFF
H	–	–	OFF	OFF

Electrical Characteristics (Ta= −20∼120℃)

| Item	Symbol	Condition	Rating			Unit
			MIN.	Standard	MAX.	
"H" level input voltage	V$_{IH}$	V$_{CC2}$=5V	2.7	–	VCC2	V
"L" level input voltage	V$_{IL}$	V$_{CC2}$=5V	0	–	1.0	V
"H" level input current	I$_{IH}$	V$_{CC2}$=5V,V$_I$=5V	–	–	10	µA
"L" level input current	I$_{IL}$	V$_{CC2}$=5V,V$_I$=0V	–	–	−50	µA
Reference voltage (V$_{ref}$) input current	I$_{ref}$	V$_{CC2}$=5V,V$_{ref}$=0V	–	–	−10	µA
Current detection (V$_S$) input current	I$_S$	V$_{CC2}$=5V,V$_S$=0V	–	–	−10	µA
Forward direction voltage of FET diod	V$_F$	I$_F$=1A	–	1.3	1.5	V
High output saturating voltage	V$_{ce (sat)H}$	I$_C$=1A	–	1.0	1.4	V
Low output saturating voltage	V$_{ce (sat)L}$	I$_C$=1A	–	1.0	1.3	V
Output leak current	I$_R$	V$_{CC1}$=60V,V$_{OUT}$=0V	–	–	10	µA
		V$_{OUT}$=60V,V$_{RS}$=0V	–	–	10	µA
Power current to controller section	I$_{CC2}$	V$_{CC2}$=5V(during circuit operation)	–	–	75	mA
Alarm terminal current	I$_{alm}$	V$_{CC2}$=5V,V$_{alm}$=0.5V	–	–	2	mA
Overheat alarm operating temperature	–	–	–	125	–	℃
Overheat protection stop temperature	–	–	–	150	–	℃

Overheat Alarm Output

The overheat protection circuit outputs an alarm signal at +125℃ at the internal junction in the IC, and activates (motor excitation OFF) at +150℃.
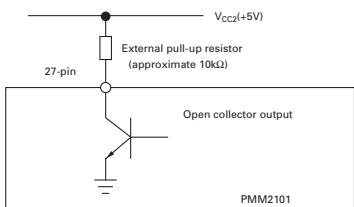
- Transistor ON during alarming
  Vce (ON): 0.5V MAX.
  Ialm: 2mA MAX.
- The alarming signal output and overheat protection circuit recover automatically when the temperature lowers.

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Example of Application Circuit

24V

C5

P.GND

5V

GND

GND

Driving input
1
2
3
4

16
8
14
15

External output

Energization mode setting
5
6
7

5V

13
12
11
10

Reset input
9

PMM8713PT

C1 R1 R2 C2
R3 R4
13 9 11 15 19 8 20

D1~D4

10 Orange
12 Blue
14 Red
18 Yellow

Stepping motor

4
25
3
24

6
22

R7
C3
R8
C4

5

23

5V

R5

R6

26 21 7

2   1

GND

PMM2101

GND 5V

GND
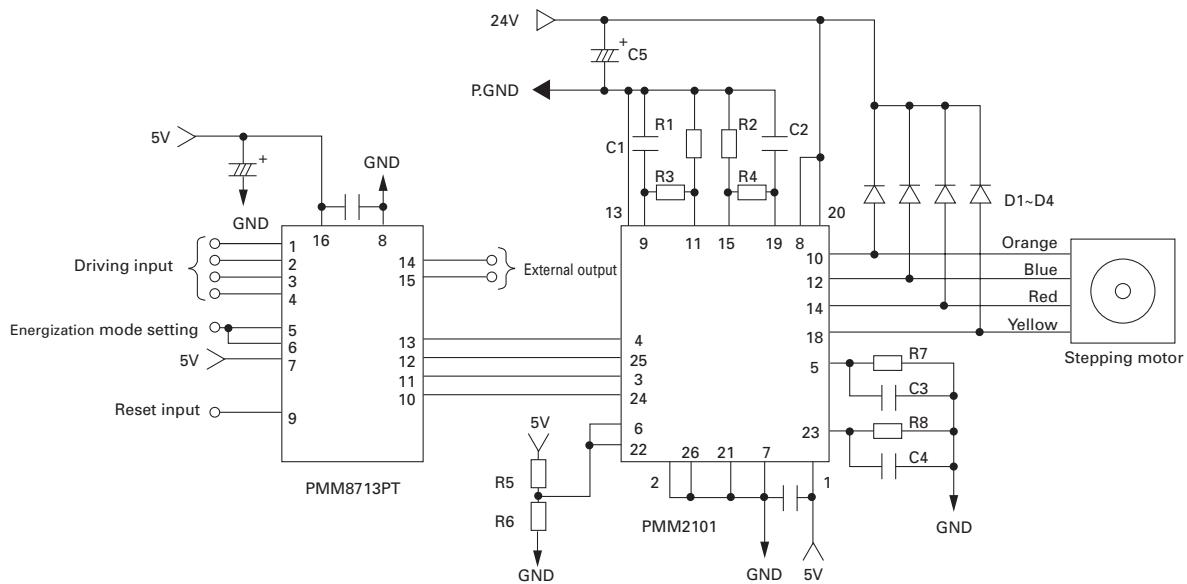
● Refer to page 113 for the PMM8713PT specifications.

● Recommended circuit constants for PMM2101

APPLICABLE	CONSTANT	APPLICABLE	CONSTANT
R1,R2	5W 0.68Ω	C1,C2	1000pF
R3,R4	1/4W 3.9kΩ	C3,C4	3300pF
R7,R8	1/4W 15kΩ	C5	330µF

● Determine on the R5 and R6 constants referring to
  the Vref-output current characteristics.

● Determine on D1~D4.
  Peak reverse voltage ≧ 100V
  Output current ≧ 1A
  Reverse recovery time ≦ 100ns

V_{ref}–Output current characteristics

Output current (A)

1.2
1.0
0.8
0.6
0.4
0.2
0.0

0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9

V_{ref} Voltage (V)