# HIC for 5-Phase Stepping Motor

# PMM5301
# PMM5303

## Outline

PMM530 □ is a single packaged power hybrid IC of the switching elements to be used for driving 5-phase stepping motor. This HIC has been developed for the purpose to further simplify the usage of 5-phase stepping motor. When combined only with the controller IC to generate the excitation mode, this HIC can configure a driver device for a 5-phase stepping motor.

## Characteristics

• High speed and high torque rotation by 5-phase pentagon system.
• Constant voltage and constant current PWM driving system (excited by others).
• Power voltage (driving power)　　: VCC1=18~42V
• High output current　　　　　　: 4A max. (1A/phase)
• Reduced heat generation by using MOSFET for the power drive element.
• The all-in-one packaging reduces number of parts around peripheral circuits.
• Two package types are available, enabling flexible PCB designing.

## Maximum rating (Tc = 25°C)

| Item | Symbol | Condition | Rated value | Unit |
|---|---|---|---|---|
| Power voltage-1 | $V_{CC1\ max}$ | Without signal (25pin terminal) | 52 | V |
| Power voltage-2 | $V_{CC2\ max}$ | Without signal (5pin terminal) | 7 | V |
| Power voltage-3 | $V_{CC3\ max}$ | FET drive power (6pin terminal) | 15 | V |
| Phase current | $I_{O\ max}$ | 1 pulse 100ms,Tc=25°C | 7 | A |
| Loss-1 | $P_{D\ max1}$ | Single FET for phase switching,Tc=25°C | 12.5 | W |
| Loss-2 | $P_{D\ max2}$ | Single FET for constant current control,Tc=25°C | 27 | W |
| Operating temperature on PCB | $T_C$ | No-condensing at a low temperature | 0~105 | °C |
| Temperature at joint | $T_{j\ max}$ | —————— | 150 | °C |
| Storage temperature | $T_{stg}$ | —————— | -40~125 | °C |

## Recommended operation condition (Ta = 25°C)

| Item | Symbol | Condition | Rated value | Unit |
|---|---|---|---|---|
| Power voltage-1 | $V_{CC1}$ | With signal (25pin terminal) | 18~42 | V |
| Power voltage-2 | $V_{CC2}$ | With signal (5pin terminal) | 5.0±5% | V |
| Power voltage-3 | $V_{CC3}$ | With signal (6pin terminal) | 12.0±10% | V |
| Power voltage-4 | $V_{CCO}$ | With signal (24pin terminal) | 10~42 | V |
| Output current | $I_{O\ max}$ | Total current | 4 | A |
| Phase driver withstanding voltage | $V_{DSS}$ | ID=10mA(TC=25°C) | 60min | V |

## Dimensions (Unit: mm)

| Pin No. | Code | Functions |
|---------|------|-----------|
| 1 | OCRF | Set input for motor current |
| 2. | RS2 | Detecting terminal for motor current |
| 3. | GND | 0V |
| 4. | RS3 | 0V |
| 5. | $V_{CC2}$ | 5V system power |
| 6. | $V_{CC3}$ | 12V system power |
| 7. | NA | Lower arm drive input |
| 8. | ND | Lower arm drive input |
| 9. | NE | Lower arm drive input |
| 10. | NC | Lower arm drive input |
| 11. | NB | Lower arm drive input |
| 12. | RS1 | Input voltage applied to motor |
| 13. | AO | Motor output |
| 14. | BO | Motor output |
| 15. | CO | Motor output |
| 16. | DO | Motor output |
| 17. | EO | Motor output |
| 18. | $V_M$ | Input voltage applied to motor |
| 19. | PC | Upper arm drive input |
| 20. | PA | Upper arm drive input |
| 21. | PB | Upper arm drive input |
| 22. | PD | Upper arm drive input |
| 23. | PE | Upper arm drive input |
| 24. | $V_{CCO}$ | Output terminal for power source |
| 25. | $V_{CC1}$ | Power system input |

● PMM5301
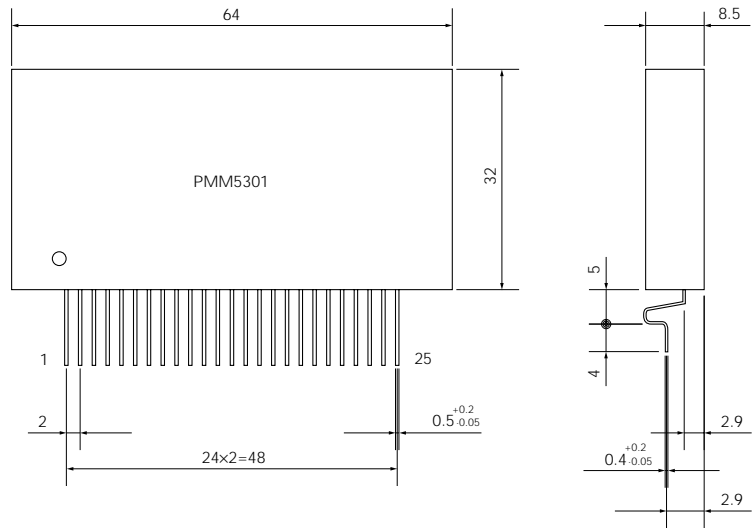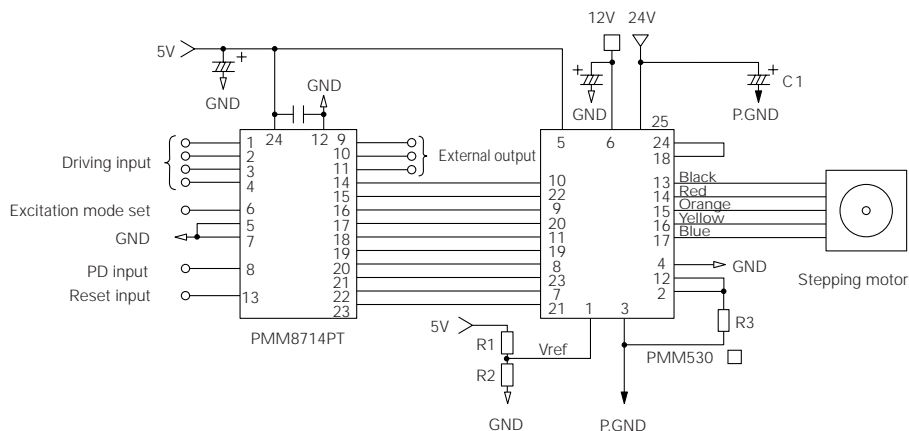


● PMM5303
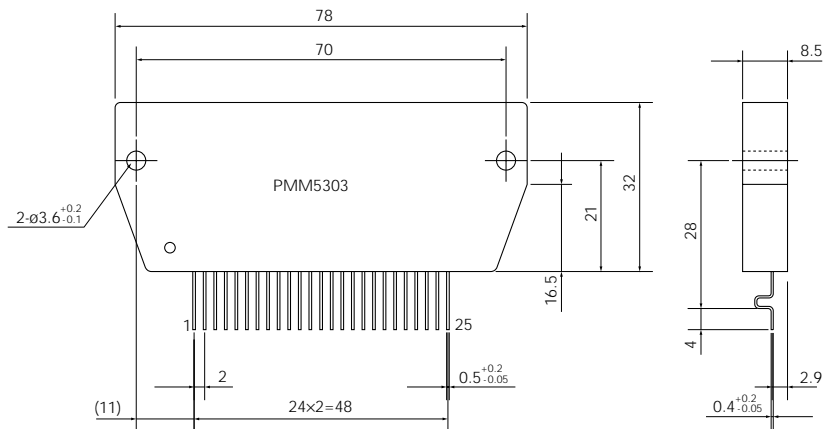


## Electrical characteristics (Tc = 25°C, VCC1 = 24V, VCC2 = 5V, VCC3 = 12V)

| Item | Symbol | Condition | Rating | | | Unit |
|------|--------|-----------|--------|--------|--------|------|
| | | | Min. | Standard | Max. | |
| Oscillation frequency | $F_C$ | — | 20 | 25 | 30 | kHz |
| "H" level input voltage | $V_{IH}$ | NA-NE terminals | 2.0 | — | — | V |
| "L" level input voltage | $V_{IL}$ | NA-NE terminals | — | — | 0.8 | |
| "H" level input voltage | $V_{IH}$ | PA-PE terminals | 3.5 | — | — | V |
| "L" level input voltage | $V_{IL}$ | PA-PE terminals | — | — | 1.5 | |
| Input current | $I_I$ | PA-PE terminals VIN=VCC2 or GND | — | — | ±1 | µA |
| "H" level input current | $I_{OH}$ | NA-NE terminals $V_{IN}$=2.7V | — | — | 20 | µA |
| "L" level input current | $I_{OL}$ | NA-NE terminals $V_{IN}$=0.4V | — | — | -0.4 | mA |
| $V_{CC2}$ current consumption | $I_{CCO2}$ | 5 pin terminal | — | 23 | 45 | mA |
| $V_{CC3}$ current consumption | $I_{CCO3}$ | 6 pin terminal | — | 15 | 25 | mA |

## Example application circuit



● Make common for the logic system grounding (GDN) and the driving power system grounding on the C1 minus side.

● Refer to Page 337 for the specifications of PMM8714PT.

● Recommended fixed numbers of circuit for PMM530□ :

| Applied for | Constant value |
|---|---|
| R3 | 5W 0.5Ω |
| C1 | 330 µF |

● Select the fixed numbers R1 and R2 referring to the Vref-output current characteristics.

● The value shown in the graph was measured during operation of 103H7521-7051.

The Vref voltage differs according to the combined motor, power voltage and pattern status of PCB.

For protection of the motor and hybrid IC, actual motor current may have to be measured under the using conditions.

Vref-output current characteristics