# 12V, 256 Micro-Step Silent Stepper Motor Driver Chip

## FEATURES

- Operating Power Supply Voltage: 4V ~ 18V
- Maximum Continuous Current: 1.4A
- On-resistance: 1Ω (High-side + Low-side)
- Microstepping: Up to 256 Micro-steps
- Speed & Position Configurable via Internal Registers
- Automatic Half-current Function
- I²C & SPI Interface
- Protection and Diagnostic Features:
  -Open-load Detection
  -Under-voltage Protection
  -Over-current Protection,
  -Over-temperature Protection
- Sleep Mode: Sleep Current<1μA
- Others:
  -Support both DC & Stepper Motor
  -Command Cache Buffer
  -SOP16、eTSSOP16、QFN16 Packages

## ORDERING GUIDE

| Part Number | Package | Marking |
|---|---|---|
| MS35233 | SOP16 | MS35233 |
| *MS35233TE | eTSSOP16 | MS35233TE |
| *MS35233N | QFN16 | MS35233N |

*The package is not available temporarily. If necessary, please contact Hangzhou Ruimeng Sales Department Center.

## PRODUCT DESCRIPTION

The MS35233 is a low-power, silent two-phase stepper motor driver chip. It supports a supply voltage of 4V to 18V and integrates high-side and low-side power transistors with a typical on-resistance of 1Ω. The device delivers a maximum continuous output current of 1.4A (peak sinusoidal current under normal operation; actual current capability depends on ambient temperature, supply voltage, and PCB thermal design).

Integrated micro-step logic enables up to 256 micro-step resolution, significantly reducing motor noise and vibration for smooth operation. Upon stopping, the built-in half-current function automatically reduces the coil current to the configured hold current without MCU intervention. A low-power sleep mode draws less than 1 μA, while advanced current control techniques minimize system power consumption, reduce motor heating, and improve overall energy efficiency.

The device features a command cache buffer that pre-loads the next instruction during motor run, enabling immediate execution of subsequent commands for smoother trajectory control. A flexible dual I²C/SPI interface allows independent configuration of motor speed, current, direction, and other parameters. Comprehensive protection functions include open-load detection, under-voltage lockout (UVLO), over-current protection (OCP), and over-temperature protection (OTP).

Equipped with an internal oscillator, the MS35233 features optimized EMC performance.

## APPLICATION

- White Goods

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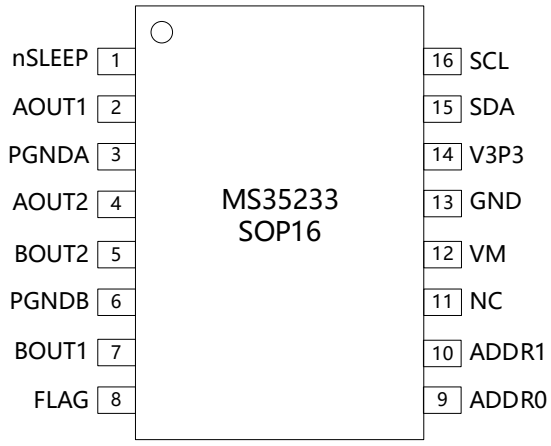
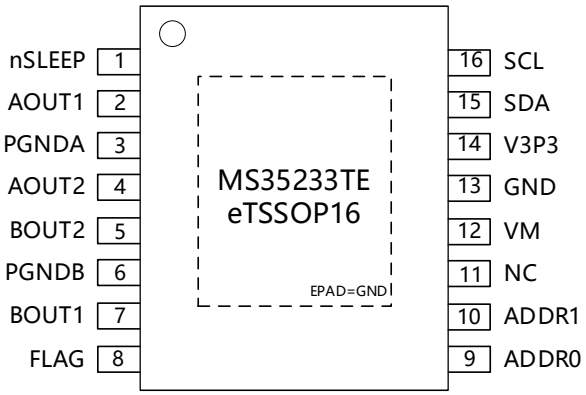
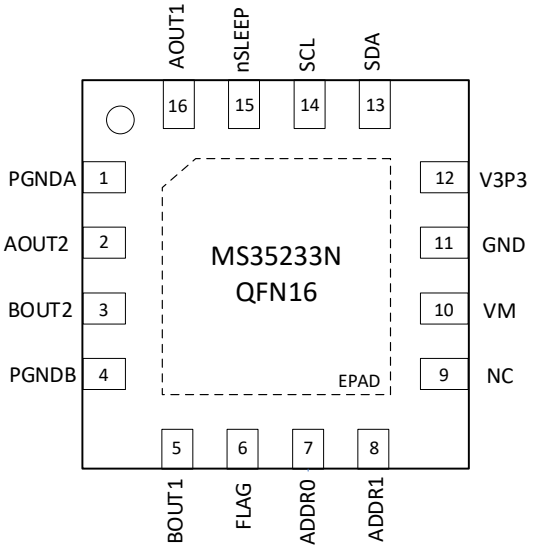
## PIN CONFIGURATION



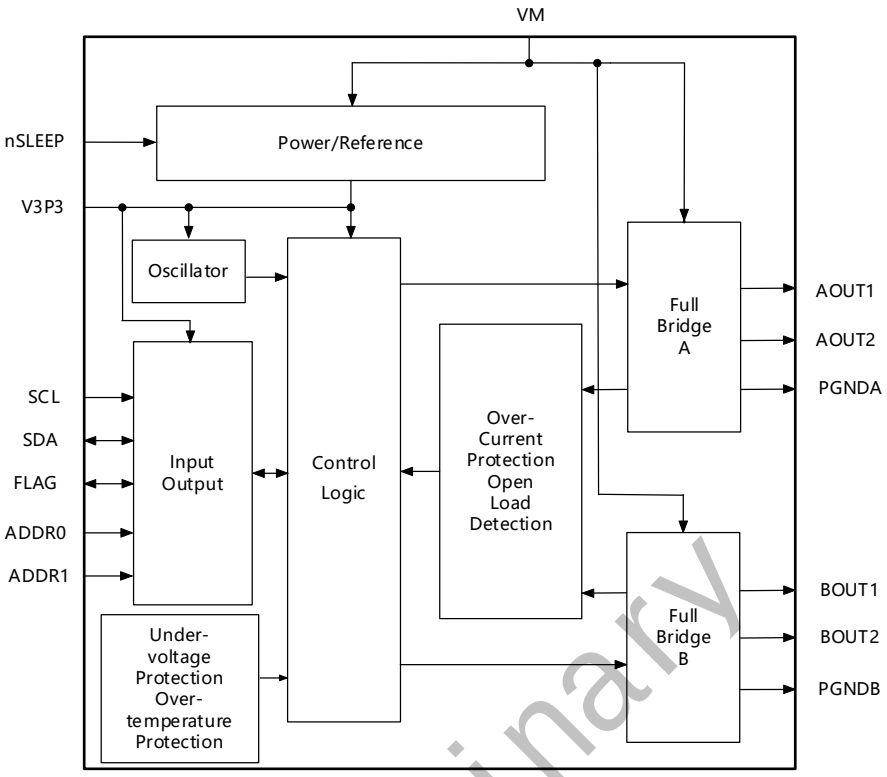




| Pin | Name | Type | Description |
|---|---|---|---|
| 1 | nSLEEP | I | Sleep Pin, Active Low |
| 2 | AOUT1 | O | Stepper Motor Channel A Output 1 |
| 3 | PGNDA | - | Channel A Power Ground |
| 4 | AOUT2 | O | Stepper Motor Channel A Output 2 |
| 5 | BOUT2 | O | Stepper Motor Channel B Output 2 |
| 6 | PGNDB | - | Channel B Power Ground |
| 7 | BOUT1 | O | Stepper Motor Channel B Output 1 |
| 8 | FLAG | IO | Motor Running Indicator Output. Can be Multiplexed as Communication Address Modification Enable Pin |
| 9 | ADDR0 | I | Chip Address Bit in I²C Mode<br>Data Input in SPI Mode |
| 10 | ADDR1 | I | Chip Address Bit in I²C Mode<br>Chip Select Input in SPI Mode |
| 11 | NC | - | No Connection |
| 12 | VM | - | Power Supply |
| 13 | GND | - | Ground |
| 14 | V3P3 | O | Built-in 3.3V Power Output |
| 15 | SDA | IO | Bus Data Line in I²C Mode<br>Data Output in SPI Mode |
| 16 | SCL | I | Bus Clock Line in I²C Mode<br>Communication Clock in SPI Mode |
| - | EPAD | - | Heat Sink, Must be Connected to Ground |




| Pin | Name | Type | Description |
|---|---|---|---|
| 1 | PGNDA | - | Channel A Power Ground |
| 2 | AOUT2 | O | Stepper Motor Channel A Output 2 |
| 3 | BOUT2 | O | Stepper Motor Channel B Output 2 |
| 4 | PGNDB | - | Channel B Power Ground |
| 5 | BOUT1 | O | Stepper Motor Channel B Output 1 |
| 6 | FLAG | IO | Motor Running Indicator Output. Can be Multiplexed as Communication Slave Address Modification Enable Pin |
| 7 | ADDR0 | I | Chip Address Bit in I²C Mode<br>Data Input in SPI Mode |
| 8 | ADDR1 | I | Chip Address Bit in I²C Mode<br>Chip Select Input in SPI Mode |
| 9 | NC | - | No Connection |
| 10 | VM | - | Power Supply |
| 11 | GND | - | Ground |
| 12 | V3P3 | O | Built-in 3.3V Power Output |
| 13 | SDA | IO | Bus Data Line in I²C Mode<br>Data Output in SPI Mode |
| 14 | SCL | I | Bus Clock Line in I²C Mode<br>Communication Clock in SPI Mode |
| 15 | nSLEEP | I | Sleep Pin, Active Low |
| 16 | AOUT1 | O | Stepper Motor Channel A Output 1 |
| - | EPAD | - | Heat Sink, Must be Connected to Ground |

## BLOCK DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

Any exceeding absolute maximum rating application causes permanent damage to device. Because long-time absolute operation state affects device reliability. Absolute ratings just conclude from a series of extreme tests. It doesn't represent chip can operate normally in these extreme conditions.

| Parameter | Symbol | Ratings | Unit |
|---|---|---|---|
| Power Supply Voltage | $V_{VM}$ | -0.3 ~ +20 | V |
| Maximum Instantaneous Current | $I_{OUT}$ | 1.6 | A |
| Logic Input Voltage | $V_{IN}$ | -0.3 ~ +6 | V |
| FLAG Output Voltage | $V_{FLAG}$ | -0.3 ~ +6 | V |
| Storage Temperature | $T_{STG}$ | -65 ~ +150 | °C |
| ESD (HBM) | $V_{HBM}$ | ±7000 | V |



### ESD Caution

Static electricity can be generated in many places. The following precautions can be taken to effectively prevent the damage of MOS circuit caused by electrostatic discharge:

1. The operator shall ground through the anti-static wristband.
2. The equipment shell must be grounded.
3. The tools used in the assembly process must be grounded.

Must use conductor packaging or anti-static materials packaging or transportation.

## RECOMMENDED OPERATING CONDITIONS

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Power Supply Voltage | $V_{VM}$ | 4 | | 18 | V |
| Continuous Current[1] | $I_{OUT}$ | | | 1.4 | A |
| Operating Temperature | $T_A$ | -40 | | 125 | °C |

Note 1: This value is the peak value of the sinusoidal current when the motor is running, measured on a Demo board under conditions of $V_{VM}$=12V and $T_A$=25°C.

## ELECTRICAL CHARACTERISTICS

Unless otherwise noted, $V_{VM}$=12V , $T_A$= 25°C。

**Current Consumption**

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| VM Standby Current | $I_{VM\_STB}$ | nSLEEP=1，CMD_NRST=0 | | 2.3 | | mA |
| VM Operating Current | $I_{VM}$ | nSLEEP=1，CMD_NRST=1，No Running PULSE Signal | | 2.7 | | mA |
| | | nSLEEP=1，CMD_NRST=1，PDEN=1， No Running PULSE Signal | | 4.8 | | mA |
| VM Sleep Current | $I_{VM\_SLEEP}$ | nSLEEP=0 | | | 1 | μA |

**Digital Input/Output**

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| High Level Input Voltage | $V_{IH}$ | SCL,SDA,ADDR0,ADDR1,nSLEEP | 1.8 | | | V |
| Low Level Input Voltage | $V_{IL}$ | SCL,SDA,ADDR0,ADDR1,nSLEEP | | | 0.9 | V |
| FLAG Saturation Voltage | $V_{SAT}$ | FLAG is Low, at 5mA Current | | 35 | | mV |
| Internal Clock Frequency | $f_{OSC}$ | | | 20 | | MHz |

**H-Bridge Drive**

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| On-resistance (High-side + Low-side) | $R_{DS\_ON}$ | $I_{OUT}$=500mA | | 1.0 | | Ω |
| Leakage Current, Driver Off | $I_{OUT\_LEAK}$ | | | 0 | | μA |

### Under-voltage Protection

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Under-voltage Protection Rising Threshold Voltage | $V_{RUV\_VM}$ | Voltage Rising, Output Enabled | | 3.6 | | V |
| Under-voltage Protection Falling Threshold Voltage | $V_{FUV\_VM}$ | Voltage Falling, Output Disabled | | 3.4 | | V |
| Under-voltage Protection Hysteresis Voltage | $V_{UV\_VM\_HYS}$ | | | 0.2 | | V |

### Open-load Detection

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Open-load Detection Threshold Resistance | $R_{OLD}$ | | | 22 | | kΩ |

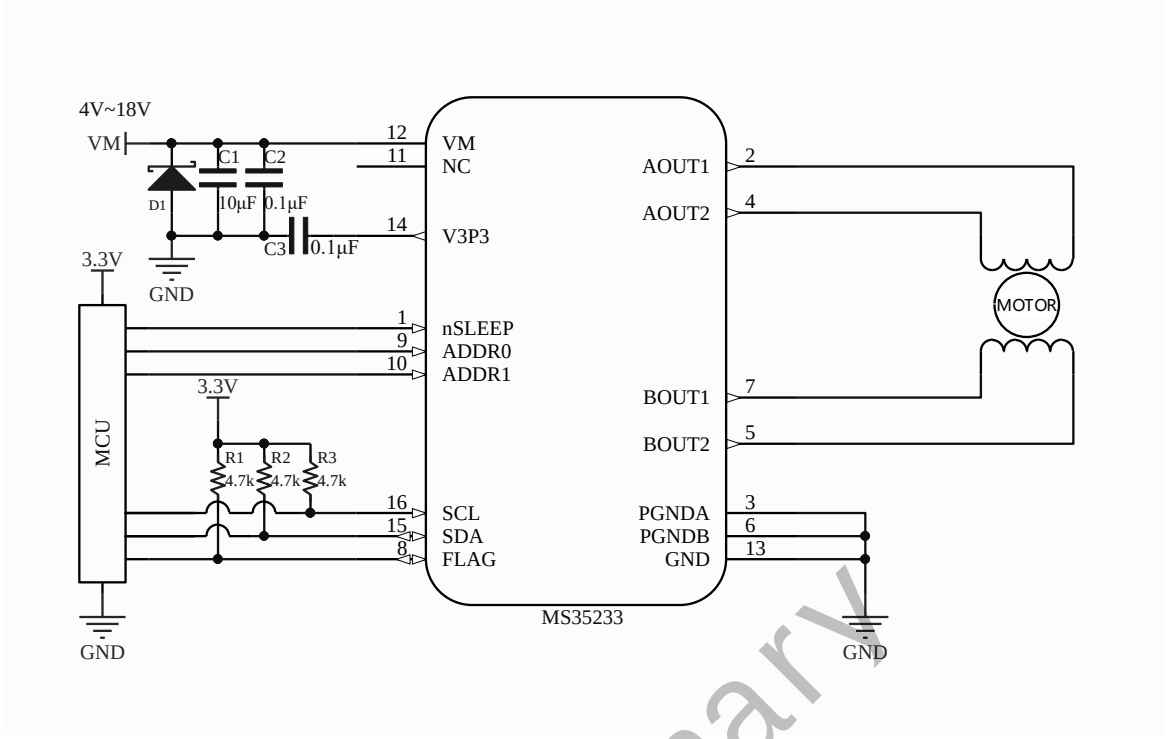
### Over-current Protection

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Over-current Protection Threshold Current | $I_{OCP}$ | | 1.6 | | | A |
| Over-current Protection Detection Delay | $t_{DEG\_OCP}$ | | | 2.5 | | μs |
| Over-current Protection Restart Time | $t_{RETRY\_OCP}$ | | | 12 | | ms |

### Over-temperature Protection

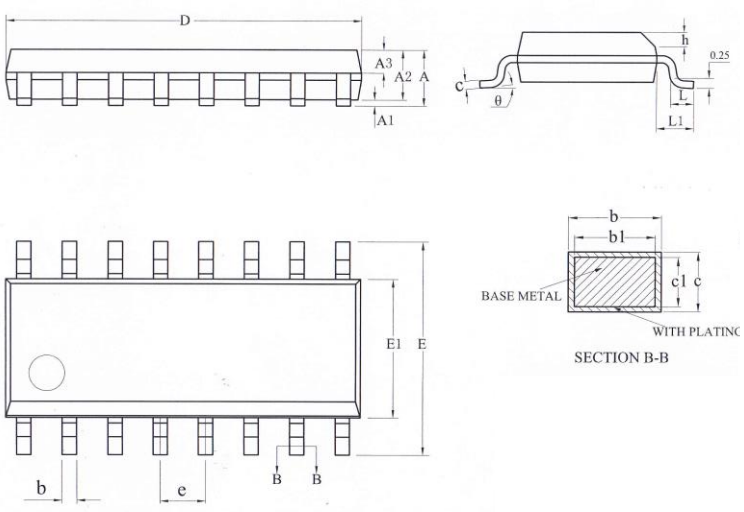
| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Over-temperature Protection Threshold Temperature | $T_{TSD}$ | | | 160 | | °C |
| Over-temperature Protection Hysteresis Temperature | $T_{TSD\_HYS}$ | | | 30 | | °C |

## TYPICAL APPLICATION



## PACKAGE OUTLINE DIMENSIONS

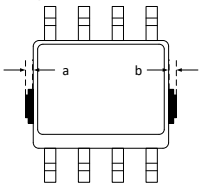
**SOP16**




| Symbol | Dimensions in Millimeters | | |
|---|---|---|---|
| | Min | Typ | Max |
| A | - | - | 1.75 |
| A1 | 0.10 | - | 0.225 |
| A2 | 1.30 | 1.40 | 1.50 |
| A3 | 0.60 | 0.65 | 0.70 |
| b | 0.39 | - | 0.47 |
| b1 | 0.38 | 0.41 | 0.44 |
| c | 0.20 | - | 0.24 |
| c1 | 0.19 | 0.20 | 0.21 |
| D | 9.80 | 9.90 | 10.00 |
| E | 5.80 | 6.00 | 6.20 |
| E1 | 3.80 | 3.90 | 4.00 |
| e | 1.27 BSC | | |
| h | 0.25 | - | 0.50 |
| L | 0.50 | - | 0.80 |
| L1 | 1.05 REF | | |
| θ | 0° | - | 8° |

Note: In addition to the package size, a, b are allowed to have the maximum size of 0.15mm for waste glue simultaneously.

The diagram is as follows: taking SOP8 package as an example.



## MARKING and PACKAGING SPECIFICATION

1. Marking Drawing Description


Product Name : MS35233, MS35233TE

Product Code : XXXXXXX

2. Marking Drawing Demand

Laser printing, contents in the middle, font type Arial.

3. Packaging Specification

| Device | Package | Piece/Reel | Reel/Box | Piece /Box | Box/Carton | Piece/Carton |
|---|---|---|---|---|---|---|
| MS35233 | SOP16 | 4000 | 1 | 4000 | 8 | 32000 |
| MS35233TE | eTSSOP16 | 3000 | 1 | 3000 | 8 | 24000 |

## DISCLAIMER

- All Revision Rights of Datasheets Reserved for Ruimeng. Don’ t release additional notice. Customer should get latest version information and verify the integrity before placing order.
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