# STEPPER MOTOR DRIVER

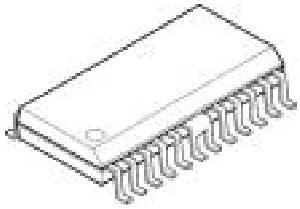
## ■ GENERAL DESCRIPTION

The NJM2673 is a stepper motor driver, which consists of a LS-TTL compartible logic input stage, off time control circuits and a pair of high power H-bridges and protection diodes.

The output current is up to 1000mA.

The NJM2673 with small number of external components conforms a complete control and drive unit for stepper motor systems.

## ■ PACKAGE OUTLINE

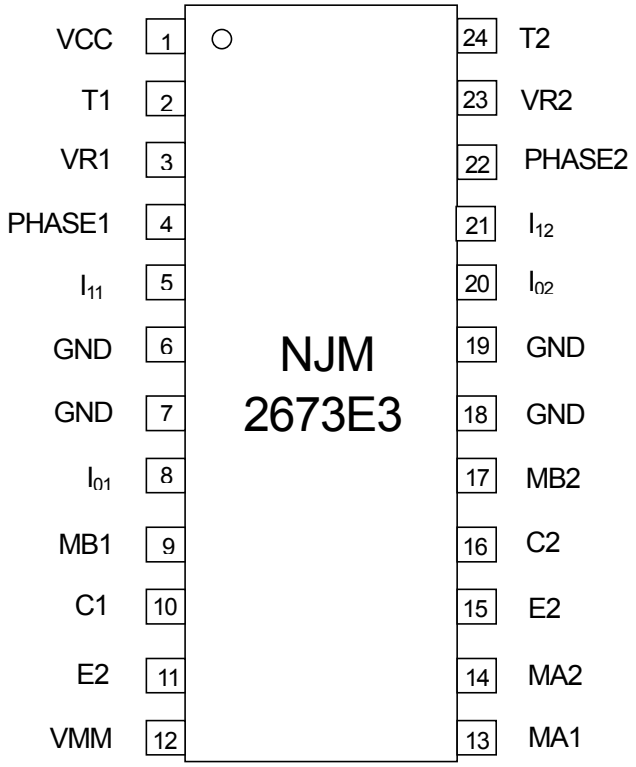


NJM2673E3

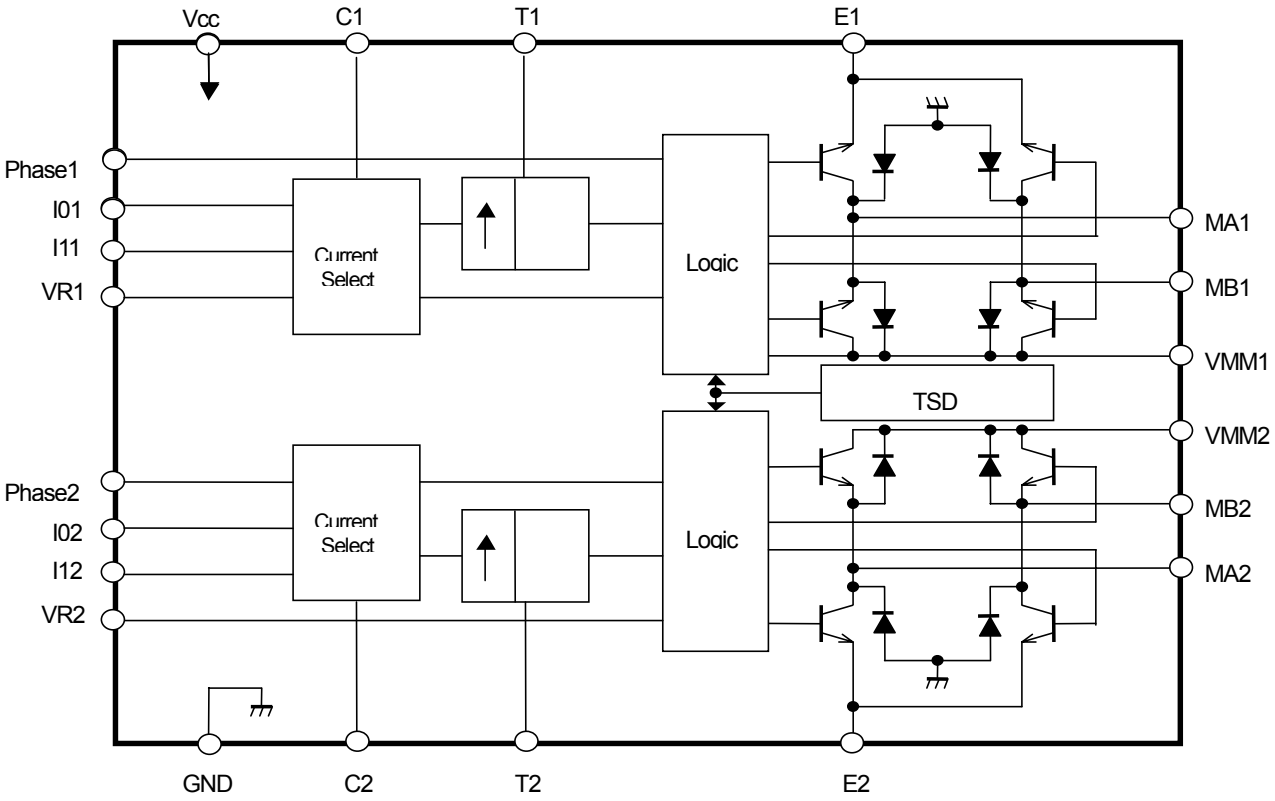
## ■ FEATURES

- Switched mode bipolar constant current drive
- Wide voltage range 4 to 45V
- Wide range of current control 5 to 1000mA
- Half- step and full-step operation
- Thermal overload protection
- Package EMP24

## ■ PIN CONNECTION



## ■ BLOCK DIAGRAM



## ■ PIN DESCRIPTION

| EMP | Symbol | Description |
|---|---|---|
| 1 | $V_{CC}$ | Logic voltage supply normally +5V. |
| 2 | $T_1$ | Clock Oscillator, channel 1. Timing pin connect a 56kΩ resistance and a 820pF in parallel between T and ground. |
| 3 | $V_{R1}$ | Reference voltage, channel 1. Controls the threshold voltage for the comparator and hence the output current. |
| 4 | Phase1 | Controls the direction of the motor current of $M_{A1}$ and $M_{B1}$ outputs. Motor current flows from $M_{A1}$ to $M_{B1}$ when Phase1 is HIGH. |
| 5 | $I_{11}$ | Logic input, channel 1. It controls, together with the $I_{01}$ input, the current level in the output stage. |
| 6,7,18,19 | GND | Ground and negative supply. These pins are used for heat sinking. Make sure that all ground pins are soldered onto a suitable large copper ground plane for efficient heat sinking. |
| 8 | $I_{01}$ | Logic input, channel 1. It controls, together with the $I_{11}$ input, the current level in the output stage. |
| 9 | $M_{B1}$ | Motor output B, channel 2. Motor current flows from $M_{A1}$ to $M_{B1}$ when Phase1 is high. |
| 10 | $C_1$ | Comparator input, channel 1. This input senses the instantaneous voltage across the sensing resistor, filtered through a RC network. |
| 11 | $E_1$ | Common emitter, channel 1. Connect the Sense resistor between this pin and ground. |
| 12 | $V_{MM}$ | Motor supply voltage, 4 to 40V. |
| 13 | $M_{A1}$ | Motor output A, channel 1. Motor current flows from $M_{A1}$ to $M_{B1}$ when Phase1 is high. |
| 14 | $M_{A2}$ | Motor output A, channel 2. Motor current flows from $M_{A2}$ to $M_{B2}$ when Phase2 is high. |
| 15 | $E_2$ | Common emitter, channel 2. Connect the Sense resistor between this pin and ground. |
| 16 | $C_2$ | Comparator input, channel 2. This input senses the instantaneous voltage across the sensing resistor, filtered through a RC network. |
| 17 | $M_{B2}$ | Motor output B, channel 2. Motor current flows from $M_{A2}$ to $M_{B2}$ when Phase2 is high. |
| 20 | $I_{02}$ | Logic input, channel 2. It controls, together with the $I_{12}$ input, the current level in the output stage. |
| 21 | $I_{12}$ | Logic input, channel 2. It controls, together with the $I_{02}$ input, the current level in the output stage. |
| 22 | Phase2 | Controls the direction of the motor current of $M_{A2}$ and $M_{B2}$ outputs. Motor current flows from $M_{A2}$ to $M_{B2}$ when Phase2 is HIGH. |
| 23 | $V_{R2}$ | Reference voltage, channel 2. Controls the threshold voltage for the comparator and hence the output current. |
| 24 | $T_2$ | Clock Oscillator, channel 2. Timing pin connect a 56kΩ resistance and a 820pF in parallel between T and ground. |

## ■ ABSOLUTE MAXIMUM RETINGS

(Ta=25°C)

| PARAMETER | SYMBOL | MIN. | MAX. | UNIT |
|---|---|---|---|---|
| **Voltage** | | | | |
| Logic Supply | $V_{CC}$ | 0 | 7 | V |
| Motor Supply | $V_{MM}$ | 0 | 45 | V |
| Logic Input Voltage | $V_I$ | -0.3 | $V_{CC}$ | V |
| Comparator Input Voltage | $V_C$ | -0.3 | $V_{CC}$ | V |
| Reference Input Voltage | $V_C$ | -0.3 | $V_{CC}$ | V |
| **Current** | | | | |
| Motor Output Current | $I_M$ | -1000 | +1000 | mA |
| Logic Input Current | $I_I$ | -10 | - | mA |
| Analog Input Current | $I_A$ | -10 | - | mA |
| **Temperature** | | | | |
| Operating Temperature | $T_{opr}$ | -40 | 85 | °C |
| Storage Temperature | $T_{stg}$ | -55 | 150 | °C |

## ■ RECOMMENDED OPERATING CONDITIONS

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|
| Logic Supply | $V_{CC}$ | 4.75 | 5.00 | 5.25 | V |
| Motor Supply | $V_{MM}$ | 4 | - | 40 | V |
| Motor Output Current | $I_M$ | -800 | - | 800 | mA |
| Operating Junction Temperature | Tj | -20 | - | +125 | °C |
| Rise time Logic Inputs | $t_r$ | - | - | 2 | μS |
| Fall Time Logic Inputs | $t_f$ | - | - | 2 | μS |

■ **ERECTRICAL CHARACTERISTICS** ($T_j$=+25°C, $V_{CC}$=5V,$V_{MM}$=40V,$C_T$=820pF,$R_T$=56kΩ)

| PARAMETER | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| **General** | | | | | | |
| Supply Current | $I_{CC}$ | | - | - | 60 | mA |
| Turn Off | td | dVc/dt≥50mV/μs | - | 0.9 | - | μS |
| Thermal Shutdown Temperature | TSD | | - | 170 | - | °C |
| **Logic Input** | | | | | | |
| H Level Input Voltage | $V_{IH}$ | | 2.0 | - | - | V |
| L Level Input Voltage | $V_{IL}$ | | - | - | 0.8 | V |
| H Level Input Current | $I_{IH}$ | $V_I$=2.4V | - | - | 20 | μA |
| L Level Input Current | $I_{IL}$ | $V_I$=0.4V | -250 | - | - | μA |
| **Input Resistance** | | | | | | |
| Input Resistance | $R_R$ | | - | 8.8 | - | kΩ |
| **Analog Input** | | | | | | |
| Threshold Voltgae | $V_{CH}$<br>$V_{CM}$<br>$V_{CL}$ | $V_R$=5.0V,$I_0$=$I_1$=L<br>$V_R$=5.0V,$I_0$=H,$I_1$=L<br>$V_R$=5.0V,$I_0$=L,$I_1$=H | 405<br>284<br>134 | 450<br>315<br>150 | 495<br>347<br>163 | mV<br>mV<br>mV |
| Input Current | $I_C$ | | -20 | - | - | μA |
| **Motor Output** | | | | | | |
| Lower Transistor Saturation Voltage | $V_{OL}$ | $I_M$=500mA<br>$I_M$=800mA | -<br>- | 1.1<br>1.3 | 1.4<br>1.7 | V<br>V |
| Upper Transistor Saturation Voltage | $V_{OU}$ | $I_M$=500mA<br>$I_M$=800mA | -<br>- | 1.1<br>1.3 | 1.4<br>1.7 | V<br>V |
| Lower Diode Forward Voltage Drop | $V_{fL}$ | $I_M$=500mA<br>$I_M$=800mA | -<br>- | 1.0<br>1.2 | 1.3<br>1.6 | V<br>V |
| Upper Diode Forward Voltage Drop | $V_{fU}$ | $I_M$=500mA<br>$I_M$=800mA | -<br>- | 1.1<br>1.3 | 1.4<br>1.7 | V<br>V |
| Output Leak Current | $I_{IL}$ | $I_0$=$I_1$=H | - | - | 100 | μA |
| **Monostable** | | | | | | |
| Cut Off Time | $t_{off}$ | | - | 31 | - | μs |

■ **THERMAL CHARACTERISTICS**

| PARAMETER | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Thermal Resistance | $Rth_{J-GND}$ | | - | 13 | - | °C |
| | $Rth_{J-A}$ | Note2 | - | 42 | - | °C |

Notes

1. All voltages are with respect to ground. Currents are positive into, negative out of specified terminal.
2. All ground pins soldered onto 20cm$^2$ PCB copper area with free air condition, $T_A$=25°C.