Instruction Book

for

3MC580

High Performance Microstepper Driver

20-50VDC / 5.7A

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CATALOG

1. Introduction

◆ Introduction

The 3MC580 is a versatility fully digital stepping driver based on a DSP with advanced control algorithm. The 3MC580 is the next generation of digital stepping motor controls. It brings a unique level of system smoothness, providing optimum torque and nulls mid-range instability. The driven motors can run with much smaller noise, lower heating, smoother movement than most of the drivers in the markets. Its unique features make the 3MC580 an ideal solution for applications that require low-speed smoothness.

◆ Features

- Supply voltage to +50 VDC;
- Output current programmable, from 1.5A to5.7A;
- Pulse input frequency up to 200kHz;
- 8 Microstep resolutions programmable, from200 to 10000 steps/rev;
- TTL compatible and optically isolated input;
- Pure-sinusoidal current control technology;
- Self-adjustment technology;
- Support PUL/DIR and CW/CCW modes;
- Short-voltage, over-voltage, over-current protections;
- Automatic idle-current reduction.
- Suitable for 3/6 leads Three-phase motors.

◆ Applications

Suitable for a wide range of stepping motors, from NEMA size 17 to 34. It can be used in various kinds of machines, such as X-Y tables, engraving machines, labeling machines, laser cutters, pick-place devices, and so on. Its unique features make the 3MC580 an ideal solution for applications that

require both low-speed smoothness and high speed performances.

2. Specifications

◆ Electrical Specifications (Tj = 25℃/77℉)

Parameters	Min	Typical	Max
Output current	1.5A		5.7 A
Supply voltage	+24VDC		+50VDC
Logic signal current	7mA	10 mA	16 mA
Pulse input frequency	0		200 kHz
Isolation resistance	500 M Ω		

◆ Operating Environment

Environment	Avoid dust, oil fog and corrosive gases
Ambient Temperature	0℃ — 50℃
Humidity	40%RH — 90%RH
Operating Temperature	70℃ Max
Vibration	5.9m/s2 Max
Storage Temperature	-20℃ — 65℃

◆ Installation specifications (unit: mm [inch])

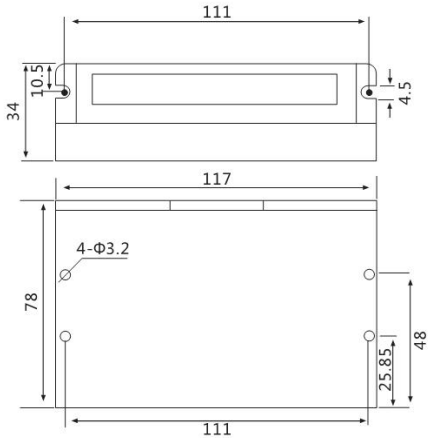


Figure 1: Installation specifications

◆ Elimination of Heat

- Driver's reliable working temperature should be <70℃(158℉), and motor working temperature should be <80℃(176℉);
- It is recommended to use automatic idle-current mode, namely current automatically reduce to 60% when motor stops, so as to reduce driver heating and motor heating;
- It is recommended to mount the driver vertically to maximize heat sink area. Use forced cooling method to cool the system if necessary.

3. External terminal instructions

◆ Control Signal Connector

Pin Function	Details
PUL+	Pulse signal: In single pulse (pulse/direction) mode, this input represents pulse signal, each rising or falling edge active (software configurable); 4-5V when PUL-HIGH, 0-0.5V when PUL-LOW. In double pulse mode (pulse/pulse) ,this input represents clockwise (CW) pulse， active both at high level and low level (software configurable). For reliable response, pulse width should be longer than 2.5 μs. Series connect resistors for current-limiting when +12V or+24V used. The same as DIR and ENA signals.
PUL-	
DIR+	DIR signal: In single-pulse mode, this signal has low/high voltage levels, representing two directions of motor rotation; in double-pulse mode (software configurable), this signal is counter-clock (CCW) pulse， active both at high level and low level (software configurable). For reliable motion response, DIR signal should be ahead of PUL signal by 5 μs at least. 4-5V when DIR-HIGH, 0-0.5V when DIR-LOW. Please note that rotation direction is also related to motor-driver wiring match. Exchanging the connection of two wires for a coil to the driver will reverse motion direction.
DIR-	
ENA+	Enable signal: This signal is used for enabling/disabling the driver. High level (NPN control signal, PNP and Differential control signals are on the contrary, namely Low level for enabling.) for enabling the driver and low level for disabling the driver. Usually left UNCONNECTED (ENABLED).
ENA-	

◆ **Main Circuit Connector**

Pin Function	Details
+V	Power supply, 24~50VDC, Including voltage fluctuation and EMF voltage.
GND	Power Ground.
U	Motor Phase U
V	Motor Phase V
W	Motor Phase W

4. Control Signal Connector Interface

The 3 can MC580accept differential and single-ended inputs (including open-collector and PNP output). The 3MC580 has 3 optically isolated logic inputs which are located on connector P1 to accept line driver control signals. These inputs are isolated to minimize or eliminate electrical noises coupled onto the drive control signals. Recommend use line driver control signals to increase noise immunity of the driver in interference environments. In the following figures, connections to open-collector and PNP signals are illustrated.

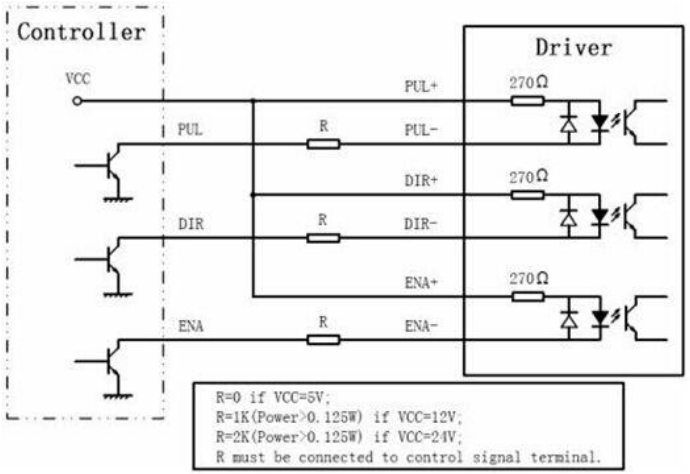


Figure 2: Connections to open-collector signal (common-anode)

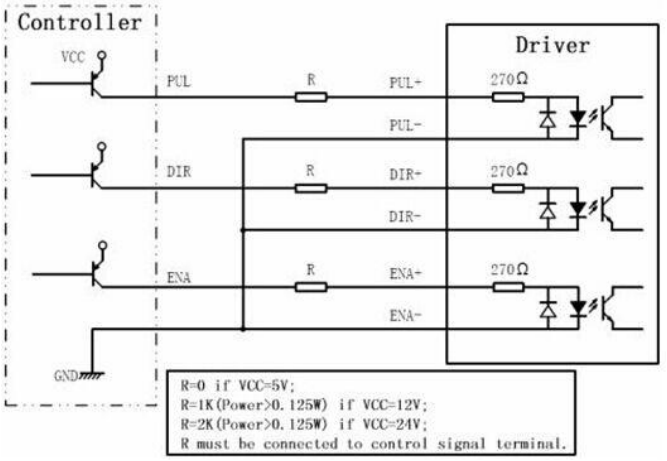


Figure 3: Connection to PNP signal (common-cathode)

◆ **Typical Connection**

A complete stepping system should include stepping motor, stepping driver, power supply and controller (pulse generator). A typical connection is shown as figure 4.

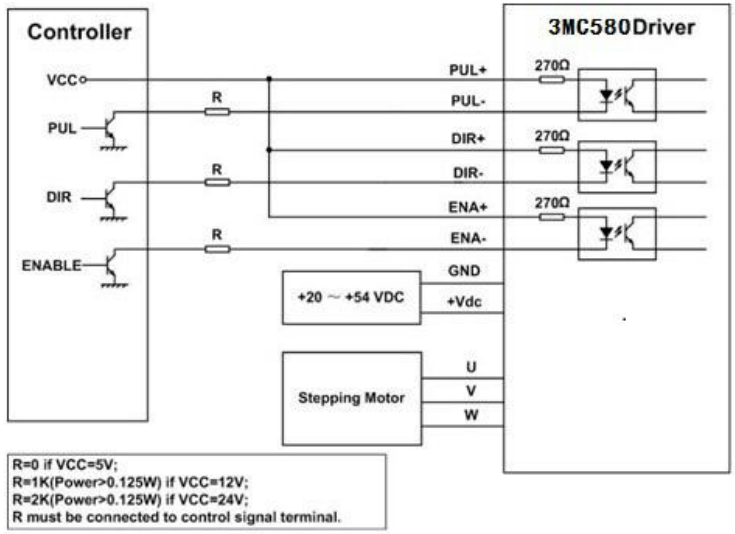


Figure 4: Typical connection

◆ **Sequence Chart of Control Signals**

In order to avoid some fault operations and deviations, PUL, DIR and ENA should abide by some rules, shown as following diagram:

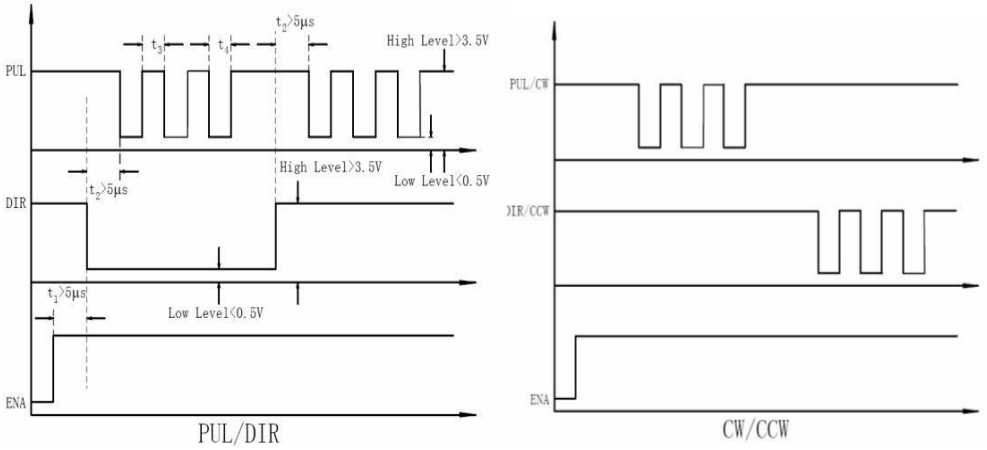


Figure 5: Sequence chart of control signals

Remark:

- t1: ENA must be ahead of DIR by at least 5 s. Usually, ENA+ and ENA- are NC (not connected). See "Connector P1 Configurations" for more information.
- t2: DIR must be ahead of PUL effective edge by 5 s to ensure correct direction;
- t3: Pulse width not less than 1.5 s;
- t4: Low level width not less than 1.5 s.

4. Connecting the Motor

The 3MC580 can drive any 3 lead or 6 lead three phase hybrid stepping motors. The connection between the driver and 3-phase stepping motors includes two different kinds of connections, namely delta-connection and star-connection. Using delta-connection, the performances of the motor under high speed condition are better, but the driver current is higher too (about 1.73 times the motor coil current); while using star-connection, the driver current equals to the motor coil current.

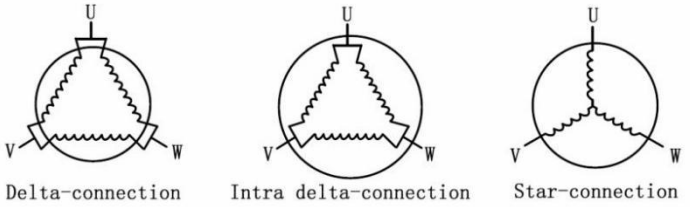


Figure 6: 4-lead Motor Connections

5. Power Supply Selection

The 3MC580 can match medium and small size stepping motors (from NEMA frame size 14 to 34) made by Li chuan or other motor manufactures around the world. To achieve good driving performances, it is important to select supply voltage and output current properly. Generally speaking, supply voltage determines the high speed performance of

the motor, while output current determines the output torque of the driven motor (particularly at lower speed). Higher supply voltage will allow higher motor speed to be achieved, at the price of more noise and heating. If the motion speed requirement is low, it's better to use lower supply voltage to decrease noise, heating and improve reliability.

◆ **Regulated or Unregulated Power Supply**

Both regulated and unregulated power supplies can be used to supply the driver. However, unregulated power supplies are preferred due to their ability to withstand current surge. If regulated power supplies (such as most switching supplies.) are indeed used, it is important to have large current output rating to avoid problems like current clamp, for example using 4A supply for 3A motor-driver operation. On the other hand, if unregulated supply is used, one may use a power supply of lower current rating than that of motor (typically 50%～70% of motor current). The reason is that the driver draws current from the power supply capacitor of the unregulated supply only during the ON duration of the PWM cycle, but not during the OFF duration. Therefore, the average current
withdrawn from power supply is considerably less than motor current. For example, two 3A motors can be well supplied by one power supply of 4A rating.

◆ **Multiple Drivers**

It is recommended to have multiple drivers to share one power supply to reduce cost, if the supply has enough capacity. To avoid cross interference, DO NOT daisy-chain the power supply input pins of the drivers. (Instead, please connect them to power supply separately.)

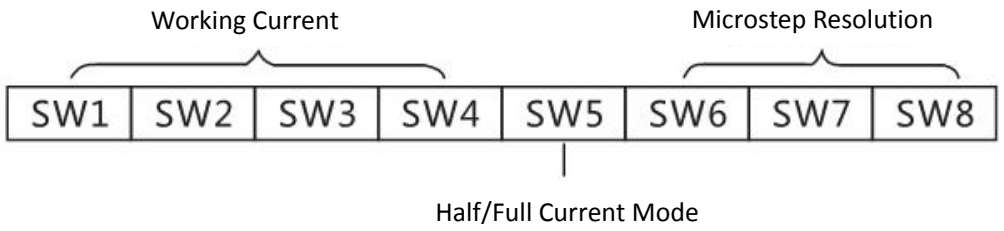
◆ **Selecting Supply Voltage**

The power MOSFETS inside the 3MC580 can actually operate within +20 ~ +50VDC, including power input fluctuation and back EMF voltage generated by motor coils during

motor shaft deceleration. Higher supply voltage can increase motor torque at higher speeds, thus helpful for avoiding losing steps. However, higher voltage may cause bigger motor vibration at lower speed, and it may also cause over-voltage protection or even driver damage. Therefore, it is suggested to choose only sufficiently high supply voltage for intended applications, and it is suggested to use power supplies with theoretical output voltage of +20 ~ +54VDC, leaving room for power fluctuation and back-EMF.

6. Selecting Microstep Resolution and Output Current

Microstep resolutions and output current are programmable, the former can be set from 200 to102,400 steps/rev and the latter can be set from 0.5A to 8.3A. See more information about
.This driver uses an 8-bit DIP switch to set microstep resolution, and motor operating current, as shown below:



◆ **Microstep Resolution Selection**

Microstep resolution is set by SW6,7,8 of the DIP switch as shown in the following table:

Steps/rev.(for 1.2° motor)	SW6	SW7	SW8
200	ON	ON	ON
400	OFF	ON	ON
500	ON	OFF	ON
1000	OFF	OFF	ON

2000	ON	ON	OFF
4000	OFF	ON	OFF
5000	ON	OFF	OFF
10000	OFF	OFF	OFF

◆ Current Settings

For a given motor, higher driver current will make the motor to output more torque, but at the same time causes more heating in the motor and driver. Therefore, output current is generally set to be such that the motor will not overheat for long time operation. Since parallel and serial connections of motor coils will significantly change resulting inductance and resistance, it is therefore important to set driver output current depending on motor phase current, motor leads and connection methods. Phase current rating supplied by motor manufacturer is important in selecting driver current, however the selection also depends on leads and connections.

The first three bits (SW1, 2, 3.4) of the DIP switch are used to set the dynamic current. Select a setting closest to your motor's required current.

Peak Current	RMS Current	SW1	SW2	SW3	SW3
2.1A	**1.5A**	OFF	OFF	OFF	OFF
2.5A	**1.8A**	ON	OFF	OFF	OFF
2.9A	**2.1A**	OFF	ON	OFF	OFF
3.2A	**2.3A**	ON	ON	OFF	OFF
3.6A	**2.6A**	OFF	OFF	ON	OFF
4.0A	**2.9A**	ON	OFF	ON	OFF
4.5A	**3.2A**	OFF	ON	ON	OFF
4.9A	**3.5A**	ON	ON	ON	OFF
5.3A	**3.8A**	OFF	OFF	OFF	ON
5.7A	**4.1A**	ON	OFF	OFF	ON
6.2A	**4.4A**	OFF	ON	OFF	ON

6.4A	**4.6A**	ON	ON	OFF	ON
6.9A	**4.9A**	OFF	OFF	ON	ON
7.3A	**5.2A**	ON	OFF	ON	ON
7.7A	**5.5A**	OFF	ON	ON	ON
8.0A	**5.7A**	ON	ON	ON	ON

Notes: Due to motor inductance, the actual current in the coil may be smaller than the dynamic current setting, particularly under high speed condition.

◆ Standstill current setting

SW5 is used for this purpose. OFF meaning that the standstill current is set to be half of the selected dynamic current, and ON meaning that standstill current is set to be the same as the selected dynamic current.

The current automatically reduced to 60% of the selected dynamic current one second after the last pulse. Theoretically, this will reduce motor heating to 36% (due to P=I2*R) of the original value. If the application needs a different standstill current, please contact Lichuan.