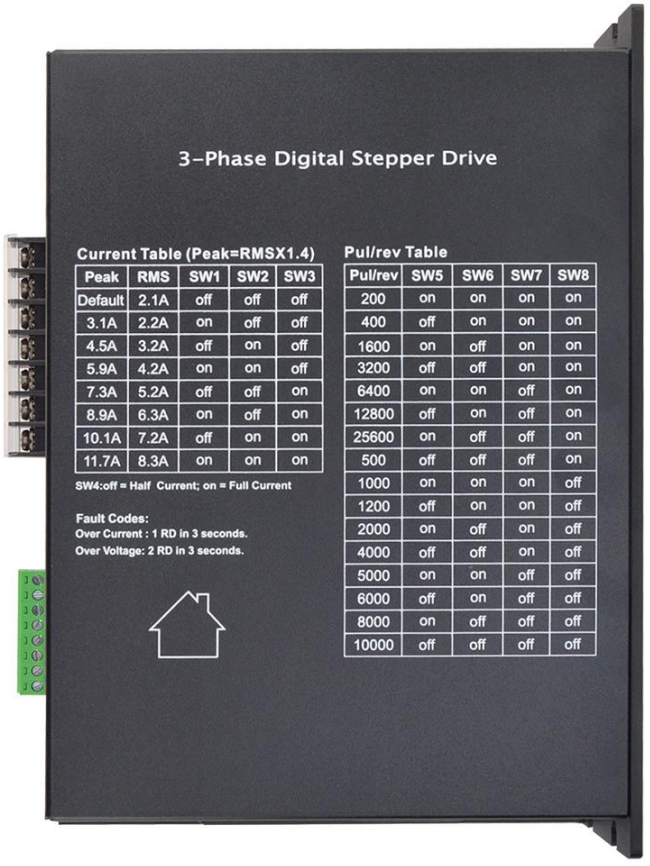
User's Manual

For

3DM2283T

Fully Digital Stepper Drive



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1. Introduction, Features and Applications

Introduction

The 3 DM2283T is a fully digital stepper drive developed with advanced DSP control algorithm based on the latest motion control technology. It has achieved a unique level of system smoothness, providing optimal torque and nulls mid-range instability. Its motor auto-identification and parameter auto-configuration feature offers quick setup to optimal modes with different motors. Compared with traditional analog drives, 3DM2283T can drive a stepper motor at much lower noise, lower heating, and smoother movement. Its unique features make 3DM2283T an ideal choice for high requirement applications.

Features

- Anti-Resonance provides optimal torque and nulls mid-range instability
- Motor auto-identification and parameter auto-configuration technology, offers optimal responses with different motors
- Multi-Stepping allows a low resolution step input to produce a higher microstep output, thus offers smoother motor movement
- Microstep resolutions programmable, from 200 to 25600. It can also be set via DIP switches.
- Soft-start with no “jump” when powered on
- Supply voltage up to 240 VAC
- Output current programmable, from 2.1A to 11.7A. It can also be set via DIP switches.
- Pulse input frequency up to 200 KHz, TTL compatible and optically isolated input
- Automatic idle-current reduction
- Suitable for 3-phase motors
- Support PUL/DIR and CW/CCW modes
- Over-voltage, Under-voltage, over-current, phase-error protections

Applications

Suitable for a wide range of stepping motors, size from NEMA34 to 42. 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. Particularly adapt to the applications desired with low noise, low heating, high speed and high precision.

2. Specifications

Electrical Specifications (Tj = 25℃/77℉)

Parameters	DM2282T			
	Min	Typical	Max	Unit
Output Peak Current	2.1	-	11.7	A
Input Voltage	176	220	253	VAC
Logic Signal Current	7	10	16	mA
Pulse input frequency	0	-	200	kHz
Pulse Width	2.5	-	-	uS
Isolation resistance	500			MΩ

Operating Environment and other Specifications

Cooling	Natural Cooling or Forced cooling	
Operating Environment	Environment	Avoid dust, oil fog and corrosive gases
	Ambient Temperature	0℃ – 50℃
	Humidity	40%RH – 90%RH
	Operating Temperature	45℃ Max
	Vibration	10-55Hz/0.15mm
Storage Temperature	-20℃ – 65℃	
Weight	Approx. 1.3Kg(45.86oz)	

Mechanical Specifications (unit: mm [1inch=25.4mm])

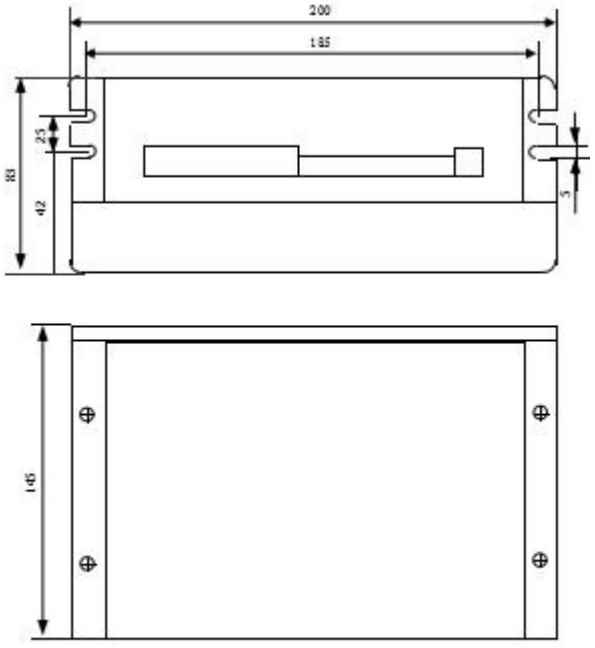


Figure 1: Mechanical specifications

***Recommend use side mounting for better heat dissipation**

Elimination of Heat

- Drive's reliable working temperature should be <45℃(113 ˚F), and motor working temperature should be <80℃(176˚F);
- It is recommended to use automatic idle-current mode, namely current automatically reduce to 50% when motor stops, so as to reduce drive heating and motor heating;
- It is recommended to mount the drive vertically to maximize heat sink area. Use forced cooling method to cool the system if necessary.

3. Pin Assignment and Description

The 3DM2283T has two connectors, connector P1 for control signals connections, and connector P2 for power and motor connections. The following tables are brief descriptions of the two connectors. More detailed descriptions of the pins and related issues are presented in section 4, 5, 9.

Connector P1 Configurations

Pin Function	Details
DIR-	DIR signal: In single-pulse mode, this signal has low/high voltage levels, representing two directions of motor rotation; in CW/CCW mode (software configurable), this signal is counter-clock (CCW) pulse, active both at high level and low level. For reliable motion response, DIR signal should be ahead of PUL signal by 5μs 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. Series connect resistors for current-limiting when +12V or +24V used. The same as DIR and ENA signal.
DIR+	
PUL-	Pulse signal: In single pulse (pulse/direction) mode, this input represents pulse signal, each rising or falling edge active ; in CW/CCW mode (software configurable),this input represents clockwise(CW) pulse, active both at high level and low level. 4-5V when PUL-HIGH, 0-0.5V when PUL-LOW. For reliable response, pulse width should be longer than 2.5μs.
PUL+	
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+	
FAULT+	Fault Signal: OC output signal, active when one of the following protection is activated: over-voltage, over current, low voltage, phase error and over-temperature. This port can sink or source 20mA current at 24V. In default, the resistance between FAULT+ and FAULT- is high impedance in normal operation and become low when 3DM2283T goes into error.
FAULT-	

Connector P2 Configurations

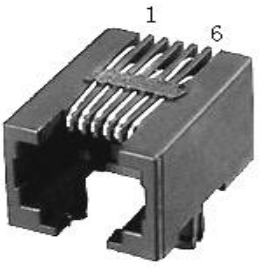
Pin Function	Details
PE	Recommend connect this port to the ground for better safety.
L	Power supply inputs. If AC input, recommend use isolation transformers with theoretical output voltage of 176~253VAC.
N	
NC	No Connection
U	Motor Phase U
V	Motor Phase V
W	Motor Phase W

RS232 Communication Port

The RS232 communication port is used to configure the 3DM2283T's peak current, microstep, active level, current loop parameters and anti-resonance parameters.

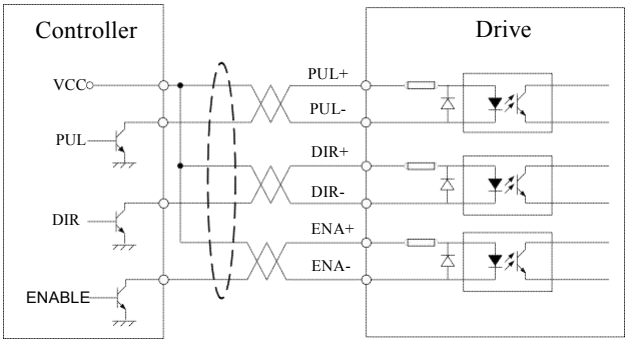
RS232 Communication Port – RJ11

Pin	Name	I/O	Description
1	**NC**	-	Not connected.
2	**+5V**	O	+5V power output.
3	**TxD**	O	RS232 transmit.
4	**GND**	GND	Ground.
5	**RxD**	I	RS232 receive.
6	**NC**	-	Not connected.



4. Control Signal Connector (P1) Interface

The 3DM2283T can accept differential and single-ended inputs (including open-collector and PNP output). The 3DM2283T has 3 optically isolated logic inputs which are located on connector P1 to accept line drive control signals. These inputs are isolated to minimize or eliminate electrical noises coupled onto the drive control signals. Recommend use line drive control signals to increase noise immunity of the drive in interference environments. In the following figures, connections to open-collector and PNP signals are illustrated.



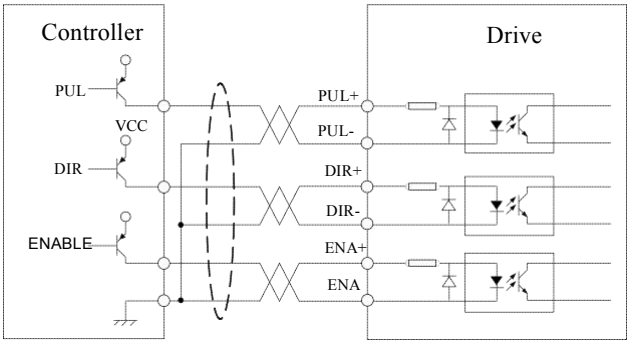


Figure 3: Connections to open-collector signal (common-anode)

Figure 4: Connection to PNP signal (common-cathode)

5. Connecting the Motor

The DM2282T can drive 3-phase hybrid stepping motors with 3-wires or 6-wires,1.2° step-angle.

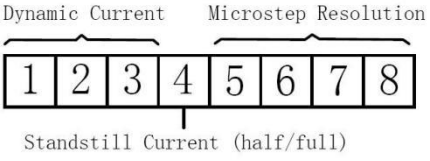
6. Power Supply Selection

The power supply voltage can work normally between the voltage range specified by the driver. The 3DM2283T is directly powered by AC. It is recommended that the user use the highest voltage lower than the driver's specified voltage to avoid the grid fluctuation exceeding the driver voltage operating range.

To reduce costs, two or three drivers can share a single power supply, but the power of power supply should be large enough.

7. Selecting Microstep Resolution and Drive Output Current

This drive 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 SW5, 6, 7, 8 of the DIP switch as shown in the following table:

Steps/rev.	SW5	SW6	SW7	SW8
200	ON	ON	ON	ON
400	OFF	ON	ON	ON
1600	ON	OFF	ON	ON
3200	OFF	OFF	ON	ON
6400	ON	ON	OFF	ON
12800	OFF	ON	OFF	ON
25600	ON	OFF	OFF	ON
500	OFF	OFF	OFF	ON
1000	ON	ON	ON	OFF
1200	OFF	ON	ON	OFF
2000	ON	OFF	ON	OFF
4000	OFF	OFF	ON	OFF
5000	ON	ON	OFF	OFF
6000	OFF	ON	OFF	OFF
8000	ON	OFF	OFF	OFF

10000	OFF	OFF	OFF	OFF

Current Settings

For a given motor, higher drive current will make the motor to output more torque, but at the same time causes more heating in the motor and drive. 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 drive output current depending on motor phase current, motor leads and connection methods. Phase current rating supplied by motor manufacturer is important in selecting drive current, however the selection also depends on leads and connections.

The first three bits (SW1, 2, 3) of the DIP switch are used to set the dynamic current. Select a setting closest to your motor's required current.

Dynamic Current Setting

Peak Current	RMS Current	SW1	SW2	SW3
Default	Default	OFF	OFF	OFF
3.1A	2.2A	ON	OFF	OFF
4.5A	3.2A	OFF	ON	OFF
5.9A	4.2A	ON	ON	OFF
7.3A	5.2A	OFF	OFF	ON
8.9A	6.3A	ON	OFF	ON
10.1A	7.2A	OFF	ON	ON
11.7A	8.3A	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

SW4 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 50% of the selected dynamic current one second after the last pulse.

Motor auto-identification and parameter auto-configuration

The drive will operate the function of motor auto-identification and parameter auto-configuration when power on, and calculate the optimal parameter using for current control after this processing,, then the stepper motor can output optimal torque.

8. Wiring Notes

- In order to improve anti-interference performance of the drive, it is recommended to use twisted pair shield cable.
- To prevent noise incurred in PUL/DIR signal, pulse/direction signal wires and motor wires should not be tied

up together. It is better to separate them by at least 10 cm, otherwise the disturbing signals generated by motor will easily disturb pulse direction signals, causing motor position error, system instability and other failures.

- If a power supply serves several drives, separately connecting the drives is recommended instead of daisy-chaining.
- It is prohibited to pull and plug connector P2 while the drive is powered ON, because there is high current flowing through motor coils (even when motor is at standstill). Pulling or plugging connector P2 with power on will cause extremely high back-EMF voltage surge, which may damage the drive.

9. Typical Connection

A complete stepping system should include stepping motor, stepping drive, power supply and controller (pulse generator). A typical connection is shown as figure 10.

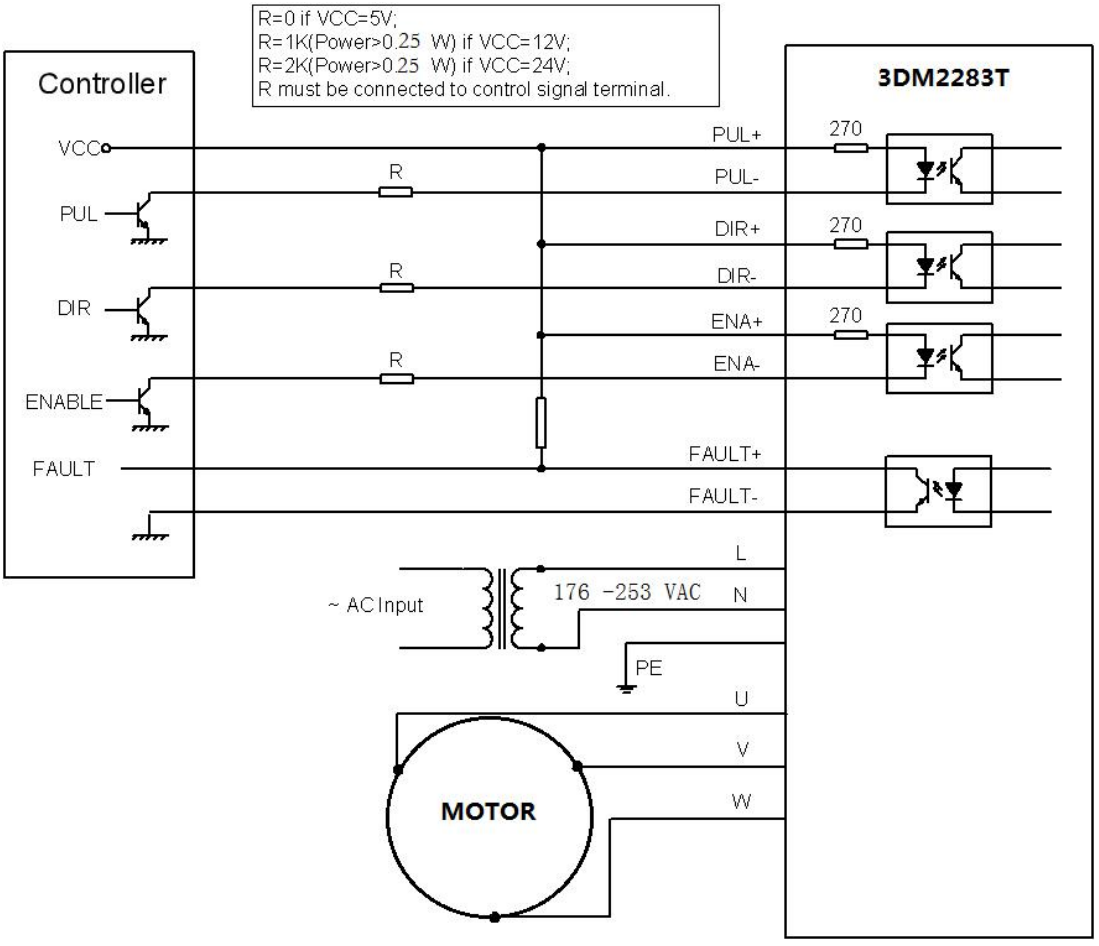


Figure 10: Typical connection

10. Sequence Chart of Control Signals

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

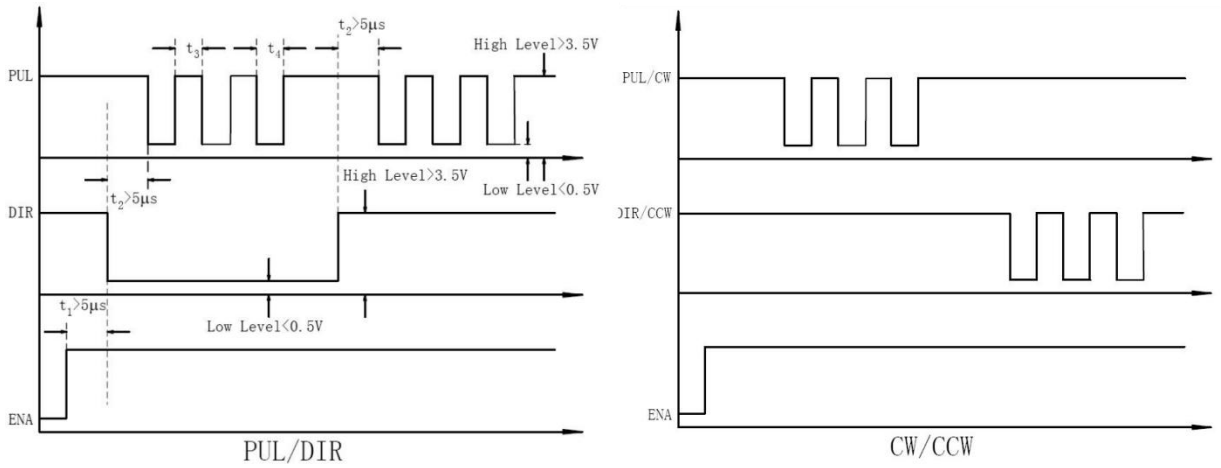


Figure 11: Sequence chart of control signals

Remark :

a)t1: ENA must be ahead of DIR by at least 5μs. Usually, ENA+ and ENA- are NC (not connected). See "Connector P1 Configurations" for more information.

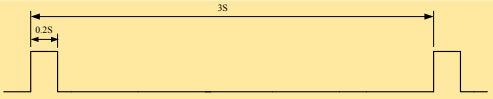
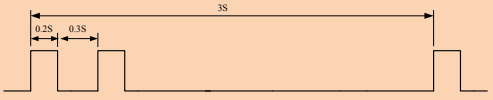
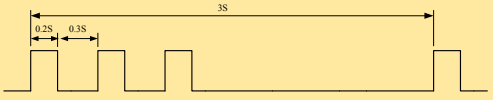
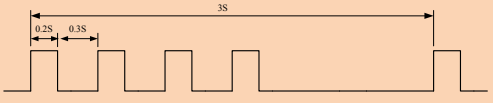
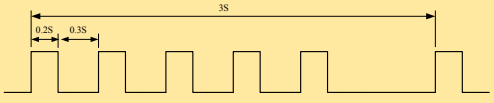
b)t2: DIR must be ahead of PUL effective edge by 5μs to ensure correct direction;

c)t3: Pulse width not less than 2.5μs;

d)t4: Low level width not less than 2.5μs.

11. Protection Functions

To improve reliability, the drive incorporates some built-in protections features.

Priority	Time(s) of Blink	Sequence wave of RED LED	Description
1st	1		Over-current Protection
2nd	2		Over-voltage Protection
3rd	3		Low-voltage Protection
4th	4		Phase Error Protection
5th	5		Over Temperature Protection

When above protections are active, the motor shaft will be free or the red LED blinks. Reset the drive by repowering

it to make it function properly after removing above problems.

12. Frequently Asked Questions

In the event that your drive doesn't operate properly, the first step is to identify whether the problem is electrical or mechanical in nature. The next step is to isolate the system component that is causing the problem. As part of this process you may have to disconnect the individual components that make up your system and verify that they operate independently. It is important to document each step in the troubleshooting process. You may need this documentation to refer back to at a later date, and these details will greatly assist our Technical Support staff in determining the problem should you need assistance.

Many of the problems that affect motion control systems can be traced to electrical noise, controller software errors, or mistake in wiring.

Problem Symptoms and Possible Causes

Symptoms	Possible Problems
Motor is not rotating	No power
	Microstep resolution setting is wrong
	DIP switch current setting is wrong
	Fault condition exists
	The drive is disabled
Motor rotates in the wrong direction	Motor phases may be connected in reverse
The drive in fault	DIP switch current setting is wrong
	Something wrong with motor coil
Erratic motor motion	Control signal is too weak
	Control signal is interfered
	Wrong motor connection
	Something wrong with motor coil
Motor stalls during acceleration	Current setting is too small, losing steps
	Current setting is too small
	Motor is undersized for the application
	Acceleration is set too high
	Power supply voltage too low
Excessive motor and drive heating	Inadequate heat sinking / cooling
	Automatic current reduction function not being utilized
	Current is set too high