KL-5056E Microstepping Driver

1. Introduction

The KL-5056E is a high performance microstepping driver using pure-sinusoidal current control technology. It is particularly suitable for the applications desired with extremely low noise and low heating, compared with microstepping drivers which apply pseudo-sinusoidal current control technology. Because pseudo-sinusoidal current control technology may make the output current to be a distorted sine wave or generates larger current ripple, and both of them may cause the motor working in a higher noise, bigger vibration and higher temperature condition. If the motor works in that condition for a long time, that may decrease motor torque, accelerate motor aging and short motor's operating life. However the pseudo-sine precise current control technology applied by the KL-5056E can solve above problems very well and make it can offer servo-like performances.

2. Features

- Pure-sinusoidal precise current control technology
- Extremely low motor noise
- Both driver and motor are low heating
- High performance, low cost
- Supply voltage up to +50VDC
- peak current up to 5.6A (4.0A RMS)
- Optically isolated differential inputs
- Pulse frequency up to 400 KHz
- Automatic idle-current reduction
- 15 selectable resolutions in decimal and binary
- Suitable for 2-phase and 4-phase motors
- DIP switch current setting with 8 different values
- Over-voltage and short-circuit protection
- Small size (118x75.5x33mm)

3. Applications

Suitable for medium and small-sized automatic equipments and devices, such as carving machines, laser cutters, laser phototypesetting systems, plotting instruments, NC machines, pick-place devices, and etc. It is specially adapted to extremely low noise, low vibration and high precision equipments.

4. Specifications

Electrical Specifications ($T_j = 25^\circ\text{C}$)

Parameters	MD556			
	Min	Typical	Max	Unit
Output Current	1.4 (1.0A RMS)	-	5.6 (4.0A RMS)	A
Supply voltage	20	36	50	VDC
Logic signal current	7	10	16	mA
Pulse input frequency	0	-	400	KHz
Isolation resistance	500			MΩ

Mechanical Specifications (unit: mm, 1 inch = 25.4 mm)
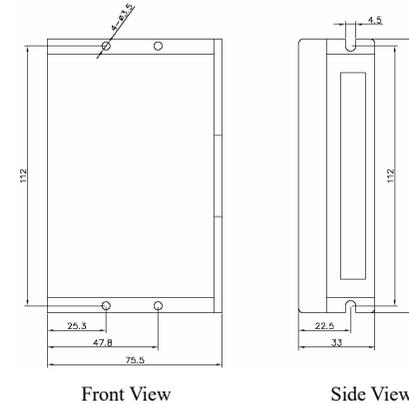

Front View   Side View

Figure 1: Mechanical dimensions

*Recommend use side mounting for better heat dissipation

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	70℃ Max
	Vibration	5.9m/s² Max
Storage Temperature	-20℃ － 65℃	
Weight	Approx. 280 gram (9.9 oz)	

5. Pin Assignment and Description

The KL-5056E 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 of the KL-5056E.

Connector P1 Configurations

Pin Function	Details
PUL + (+5V) PUL- (PUL)	Pulse signal: This input represents pulse signal, effective for each rising edge; 4-5V when PUL-HIGH, 0-0.5V when PUL-LOW. For reliable response, pulse width should be longer than 1.2μs. Series connect resistors for current-limiting when +12V or +24V used.
DIR+ (+5V) DIR- (DIR)	Direction signal: HIGH/LOW level signal, correlative to motor rotation direction. For reliable response, DIR must be ahead of PUL by 5μs at least. 4-5V when DIR- HIGH, 0-0.5V when DIR-LOW. Please note that motor rotation direction also depends upon the connection of the motor windings, exchange any motor phase can reverse motor rotation direction.
ENA+ (+5V) ENA- (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)**.

Connector P2 Configurations

Pin Function	Details
GND	DC power ground.
+V	DC power supply, 20~50VDC, Including voltage fluctuation and EMF voltage.
A+, A-	Motor Phase A
B+, B-	Motor Phase B

6. Selecting Microstep Resolution and Driver Output Current

The KL-5056E uses an 8-bit DIP switch to set microstep resolution, and motor operating current, as shown in the following figure:

Dynamic Current   Microstep Resolution

1 2 3 4 5 6 7 8

Standstill Current (half/full)
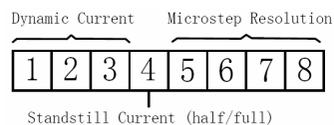
Current Settings

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 (A)	RMS (A)	SW1	SW2	SW3
1.4	1.0	OFF	OFF	OFF
2.1	1.5	ON	OFF	OFF
2.7	1.9	OFF	ON	OFF
3.2	2.3	ON	ON	OFF
3.8	2.7	OFF	OFF	ON
4.3	3.1	ON	OFF	ON
4.9	3.5	OFF	ON	ON
5.6	4.0	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 be reduced to 60% of the selected dynamic current one second after the last pulse. Theoretically, this will reduce motor heating to 36% (due to $P=I^2*R$) of the original value. If the application needs a different standstill current, please contact Leadshine.

Microstep Resolution Selection

Microstep resolution is set by SW5, 6, 7, 8 of the DIP switch as shown in the following table:

Microstep	Steps/rev.(for 1.8°motor)	SW5	SW6	SW7	SW8
2	400	OFF	ON	ON	ON
4	800	ON	OFF	ON	ON
8	1600	OFF	OFF	ON	ON
16	3200	ON	ON	OFF	ON
32	6400	OFF	ON	OFF	ON
64	12800	ON	OFF	OFF	ON
128	25600	OFF	OFF	OFF	ON

5	1000	ON	ON	ON	OFF
10	2000	OFF	ON	ON	OFF
20	4000	ON	OFF	ON	OFF
25	5000	OFF	OFF	ON	OFF
40	8000	ON	ON	OFF	OFF
50	10000	OFF	ON	OFF	OFF
100	20000	ON	OFF	OFF	OFF
125	25000	OFF	OFF	OFF	OFF

7. Typical Connection

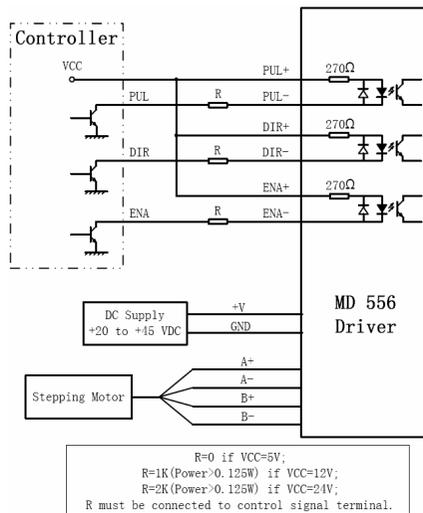A complete stepping system should include stepping motor, stepping driver, power supply and controller (pulse generator). A typical connection is shown as figure 2.

Figure 2: Typical connection