

## VID23 Series Transparent Shaft Stepper Motor

### Description

#### VID23

Is a precise stepping motor of patent design. It is specially designed with transparent pointer shaft, pointer lamination intensity is superior to traditional way. It also bring cost reduction in saving number of LEDs.



#### VID23

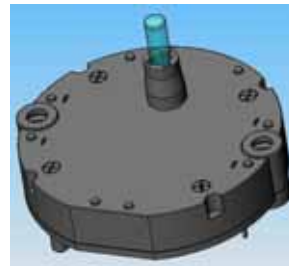
with a gear reduction ratio of 1/180. It's mainly used in dashboard instrumentation or other digital indicator equipments, to transfer digital signals directly and accurately to analog display output.

#### VID23

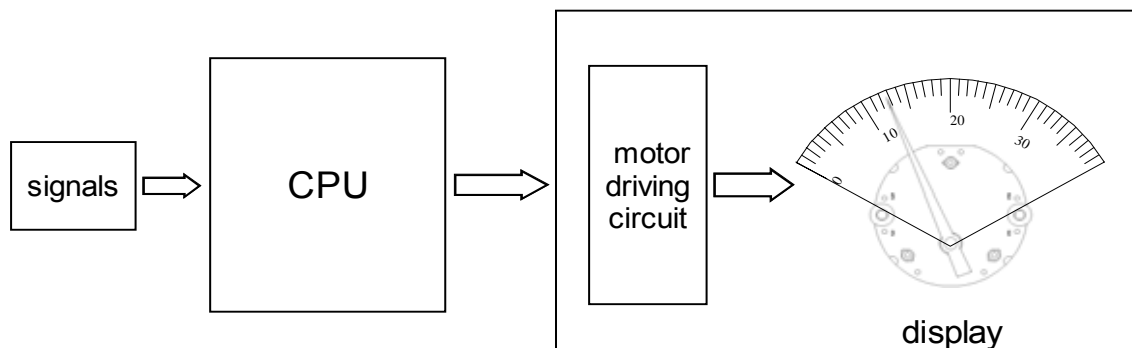
Is driven by 2 sequent logic pulse signals. It can be driven in 5V ~ 10V providing shaft stepping angle resolution 1/12°. The pointer can move with a speed more than 400Hz.

#### The main features are:

- Transparent Pointer Shaft
- Superior illumination intensity
- Compatible with LED PLCC-2 Package
- High speed rotation: 400Hz.
- High  $\mu$ -step resolution: 1/12°.
- Wide working temperature: - 40 ~ 105 .
- Low current consumption: less than 20mA, 5V, 2X100mW.
- Extremely robust construction:  $\Phi$ 30mm X 7.6mm.
- Long lifetime: in 200Hz, constant working up to 5000Hrs.
- Directly driven by a  $\mu$ -controller.



#### Typical application:

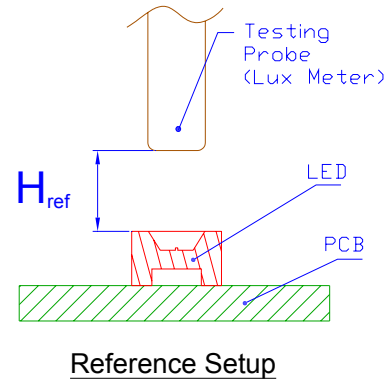


perfect combination of digital accuracy and analog facility

## Illumination

### Reference Setup

| Parameters                                      | Red LED                   | White LED   |
|---|---------------------------|-------------|
| H <sub>ref</sub> (Probe apart from LED surface) | 1mm                       | 1mm         |
| Chromaticity Coordinates (x,y)                  | (0.7,0.27)<br>(630~635nm) | (0.35,0.35) |
| Luminous Intensity                              | 46,000 Lux                | 55,000 Lux  |
| Forward voltage                                 | 2 V                       | 3.3 V       |
| Forward Current                                 | 20mA                      | 20mA        |
| View Angle                                      | 120 °                     | 120 °       |
| Package   | PLCC-2                    | PLCC-2      |



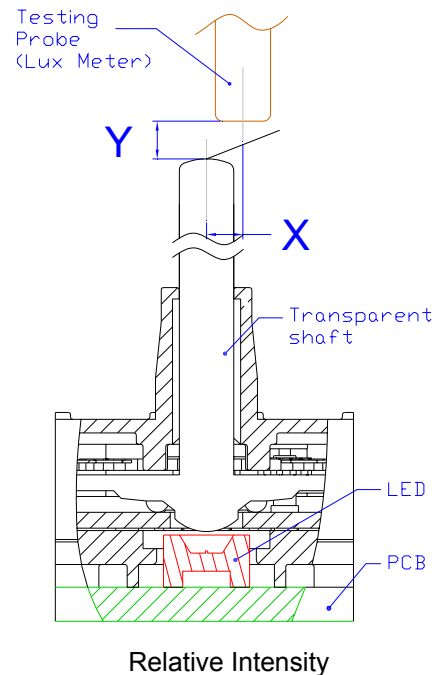
### Relative Intensity

#### Red LED Relative Intensity

| Y (mm) | X (mm) |      |      |      |
|--------|--------|------|------|------|
|        | 0.00   | 0.25 | 0.50 | 0.75 |
| 1.40   | 118%   | 114% | 84%  | 46%  |
| 1.00   | 146%   | 134% | 94%  | 48%  |
| 0.60   | 138%   | 151% | 101% | 53%  |

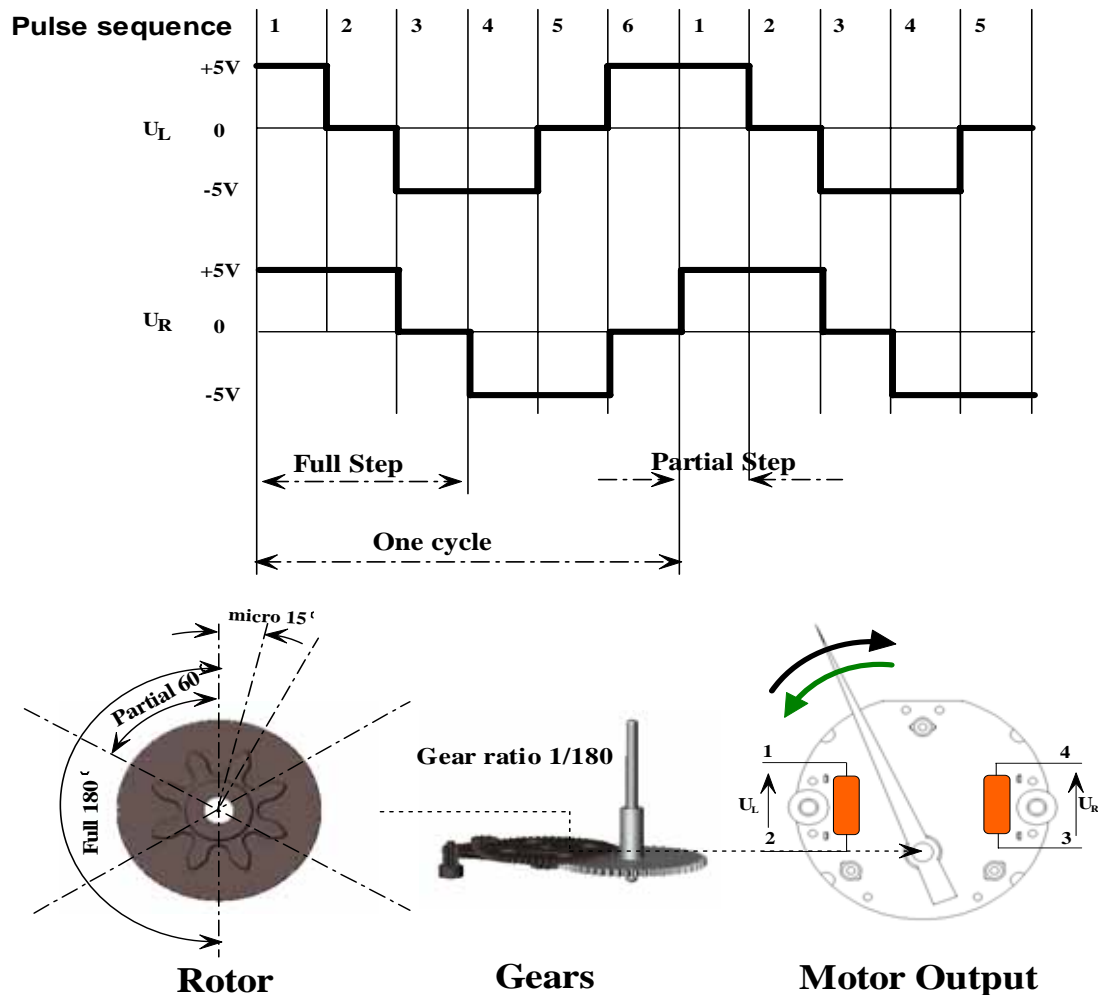
#### White LED Relative Intensity

| Y (mm) | X (mm) |      |      |      |
|--------|--------|------|------|------|
|        | 0.00   | 0.25 | 0.50 | 0.75 |
| 1.40   | 94%    | 93%  | 78%  | 54%  |
| 1.00   | 100%   | 98%  | 79%  | 59%  |
| 0.60   | 92%    | 93%  | 82%  | 63%  |

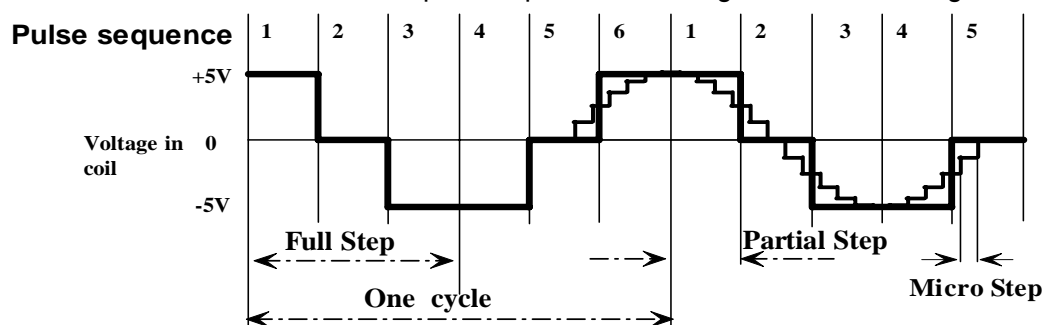


## Step Definition and Rotor Movement

VID23 - 03 series is driven by 2 sequent logic pulse signals and has 4 gears design to construct high efficiency. Its work diagram is as following:



In order to make the motor run more stably and reduce its noise, micro stepping technology is recommended. The micro pulse sequence which is more precise and near to sine wave, which could drive motor with  $1/12^\circ$  micro step of the pointer. The diagram is as following:



For more details about the micro stepping driving signals, please see specified files.



## Absolute Maximum Ratings

Driving voltage (Ub) ..... 10V  
 EMI tolerance (1 kHz;AM 80%; 100 kHz - 2 GHz) ..... 80 V/m  
 Soldering temperature ( $\leq 10$  sec) ..... 260°C

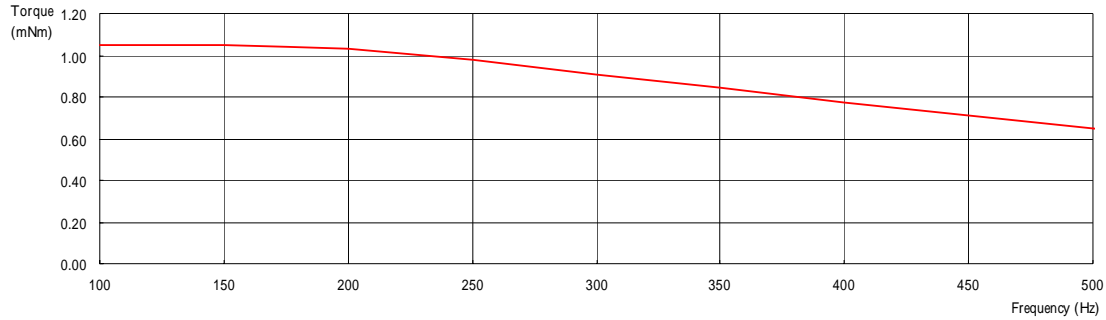
## Electrical and Mechanical Characteristics

Symbol Definition :  $f_a$  – testing frequency,  $J_L$  – testing pointer inertia,  $U_b$  – Driving Voltage  
 Testing Conditions :  $T_{amb}=25^\circ\text{C}$ , In micro step mode @ Max. voltage 4.2V, unless other specified.

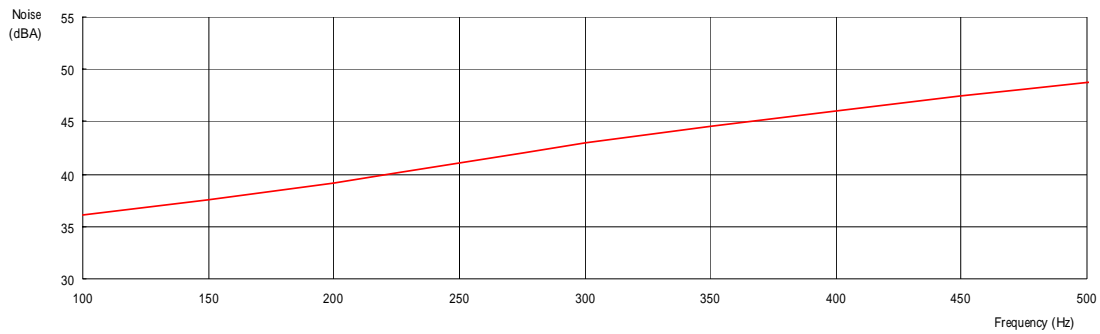
| Parameter                         | Symbol       | Test Conditions                          | Min. | Typ.         | Max | Units          |
|-----------------------------------|--------------|--|------|--------------|-----|----------------|
| <b>Electrical Characteristics</b> |              |  |      |              |     |                |
| Operating Temperature             | $T_a$        |  | -40  |              | 105 | °C             |
| Coil Resistance                   | $R_b$        |  | 260  | 280          | 300 | $\Omega$       |
| Operating Current                 | $I_m$        | $f_a=200\text{Hz}$                       |      | 15           | 20  | mA             |
| Start-Stop Frequency              | $f_{ss}$     | $J_L=0.2 \times 10^{-6} \text{kgm}^2$    | 125  |              |     | Hz             |
| Maximum Driving Frequency         | $f_{mm}$     | $J_L=0.2 \times 10^{-6} \text{kgm}^2$    | 400  |              |     | Hz             |
| <b>Mechanical Characteristics</b> |              |  |      |              |     |                |
| Dynamic Torque                    | M200<br>M400 | $f_a=200\text{Hz}$<br>$f_a=400\text{Hz}$ |      | 1.0<br>0.7   |     | MNm<br>mNm     |
| Static Torque                     | $M_s$        | $U_b=5\text{V}$                          | 3.5  | 4.0          |     | mNm            |
| Equivalent Motor Inertia @ Output | $J_m$        |  |      | 4.225<br>E-7 |     | $\text{Kgm}^2$ |
| Gear ratio                        |              |  |      | 1:180        |     |                |
| Step size in full step mode       |              |  |      | 1            |     | Degree         |
| Step size in partial step mode    |              |  |      | 1/3          |     | Degree         |
| Step size in micro step mode      |              |  |      | 1/12         |     | Degree         |
| Backlash                          |              |  |      | 0.5          | 1   | Degree         |
| Angle of Rotation                 | $f_i$        | Motors with internal Stop                |      |              | 315 | Degree         |
| <b>Noise</b>                      |              |  |      |              |     |                |
| Noise Level                       | SPL          | @ 100 °/sec<br>@ 200 °/sec               |      | 34<br>41     |     | dBA<br>dBA     |

## Typical torque and noise

**Dynamic Torque** - testing in micro step driving mode, @ Max voltage  $U_b = 4.2V$

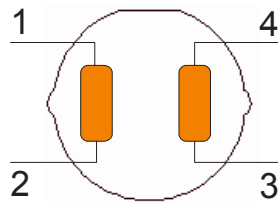


**Noise** - testing in micro step driving mode, @ Max voltage  $U_b = 4.2V$

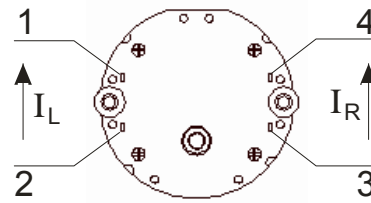


## Pin Connection

### VID23 Series Pin Connection



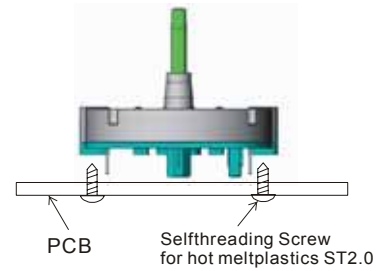
Schematic



Front Mount

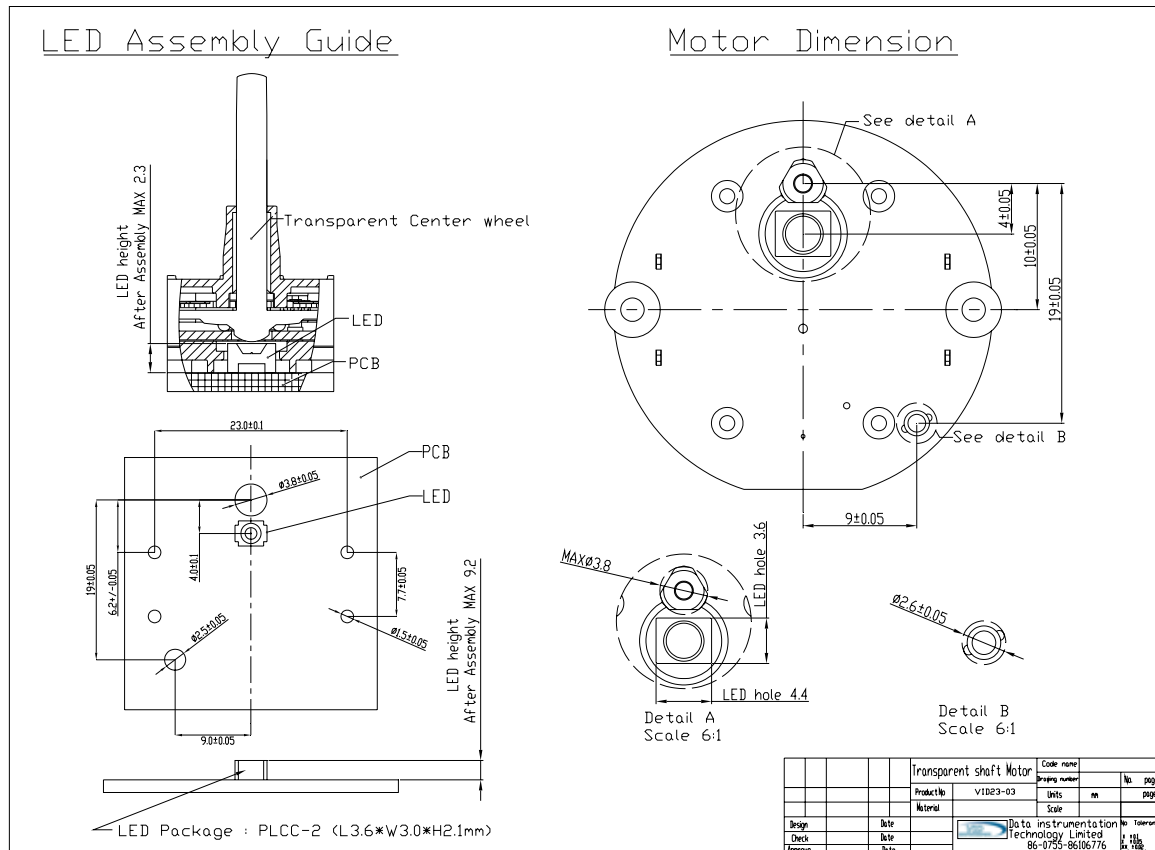
## Suggested Installation

The VID23 can be easily installed. The four contact pins can be soldered on PCB circuits. If the application is subject in very strong vibrations, screws might be necessary.



## Compatible with LED PLCC-2 Package

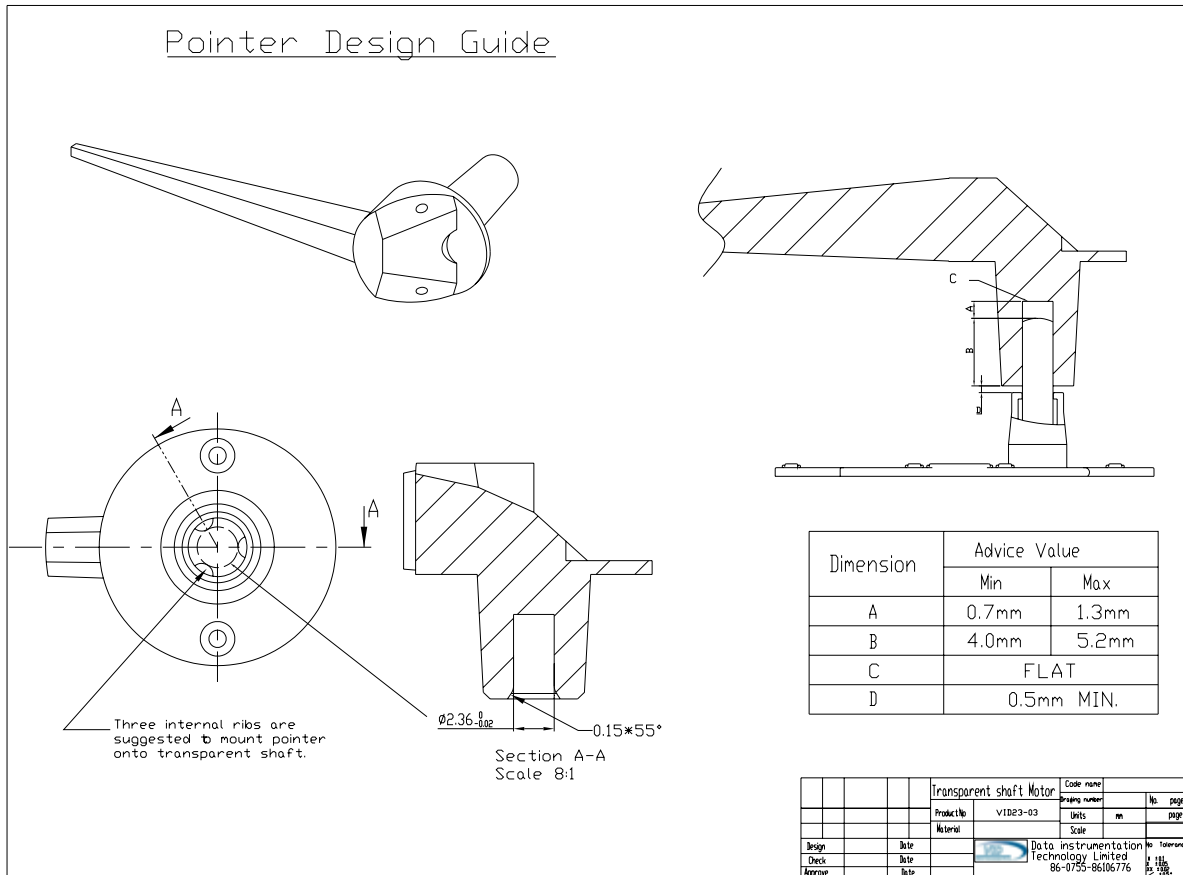
The VID23 is designed compatible with LED PLCC-2 Package to obtain the optimum light intensity. Light is captured by the lower lens of transparent shaft. VID23 motor and LED corresponding position is recommended on the following LED Assembly Guide.



## Pointer Design Reference

### Structure Design

Pointer design can influence the final illumination result of VID23. Following Pointer Design Guide is recommended to obtain the optimum illumination result.

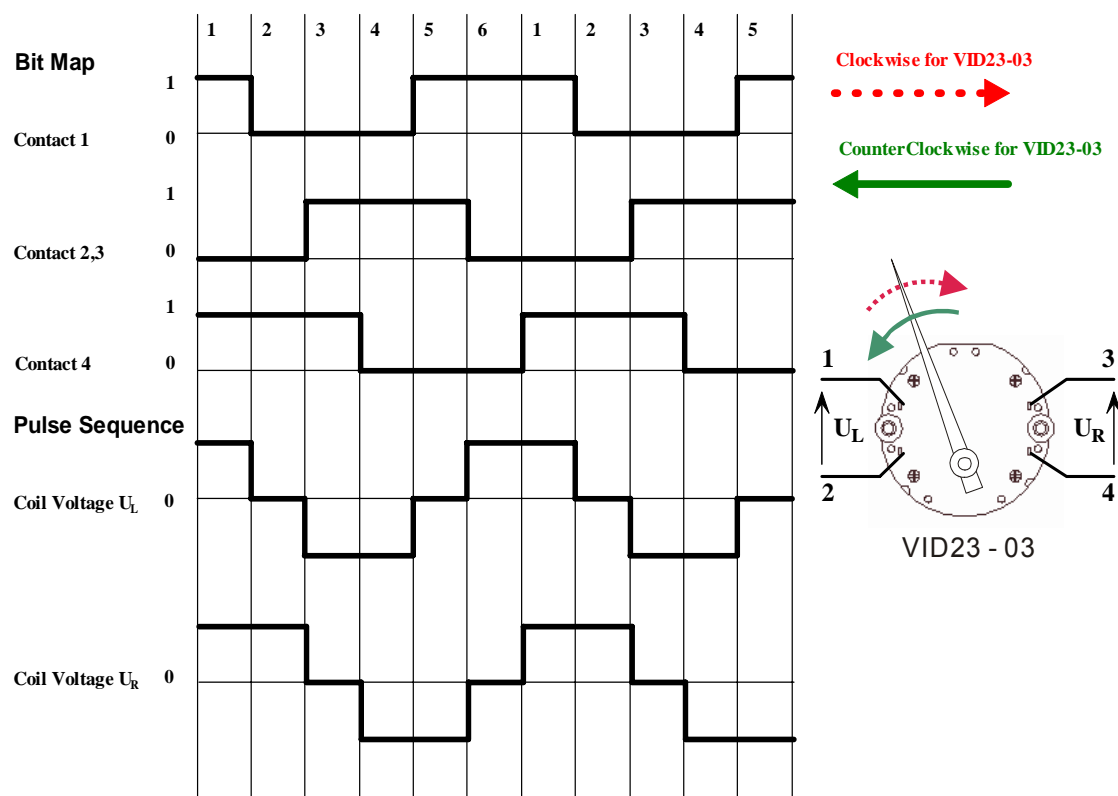


## Driving Pulse and Control Circuit

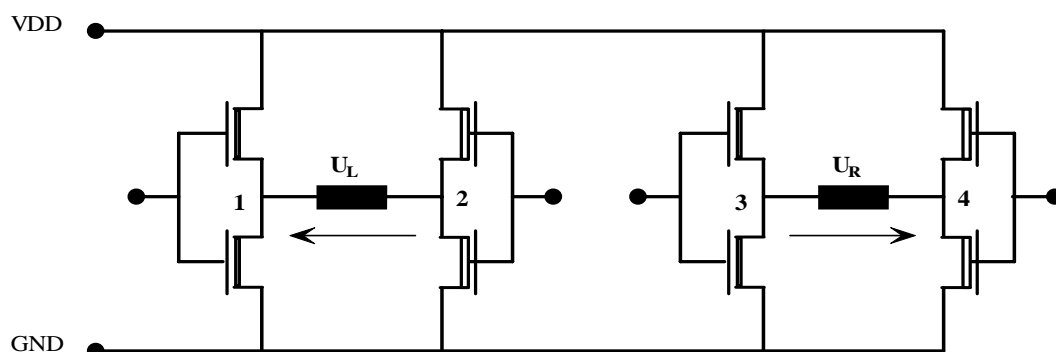
### 1. Partial-Step Driving Mode

In partial-step driving mode, the motor can be directly driven by a standard logic voltage level with less than 20mA current consumption. The bit-time sequence determines the turning direction of the motor. The time sequence diagram is as following:

#### Driving Pulse in Partial Mode



#### Driving Diagram in Partial Mode

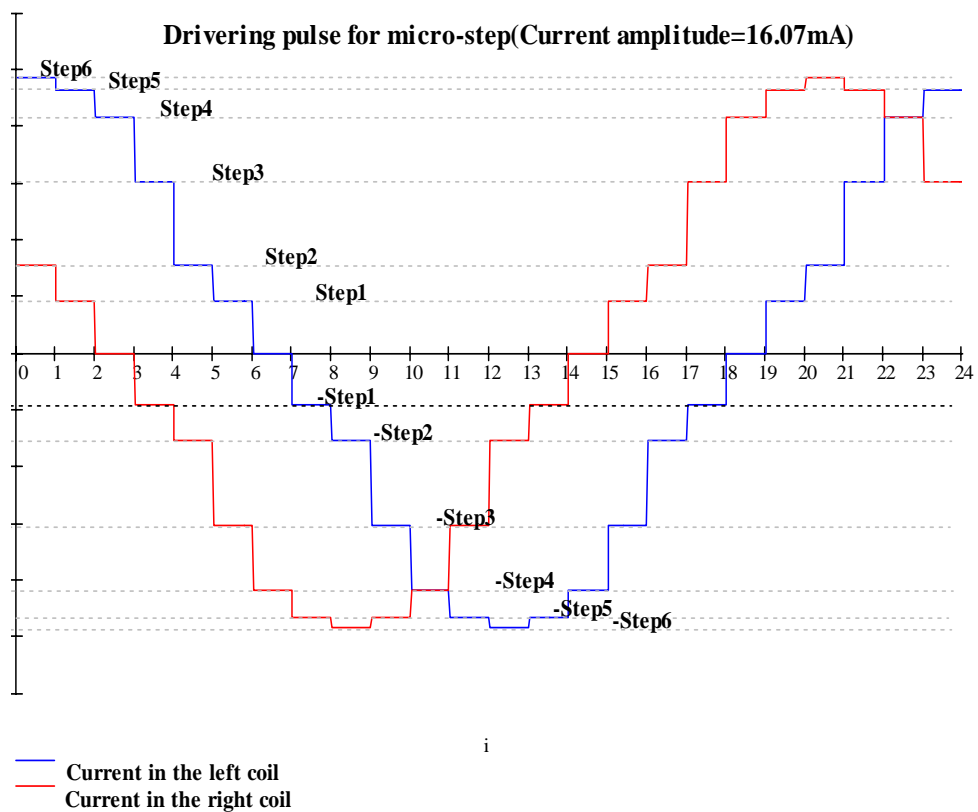




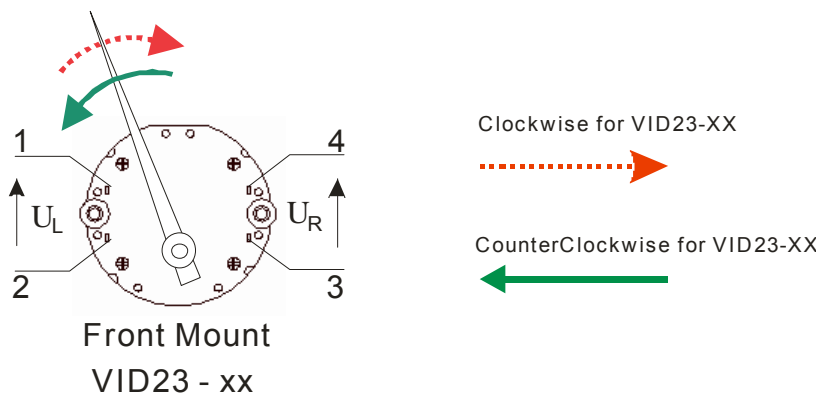
## 2. $\mu$ -Step Driving Mode

In  $\mu$ -step driving mode, the motor can be driven by a current-level sequence. A  $\mu$ -step is a  $0.083^\circ$  of pointer. The driving pulses consist of many different current level pulse sequences. The  $\mu$ -step provides the pointer shaft continuous, smooth movement.

### Example of driving Pulses in $\mu$ -step Mode



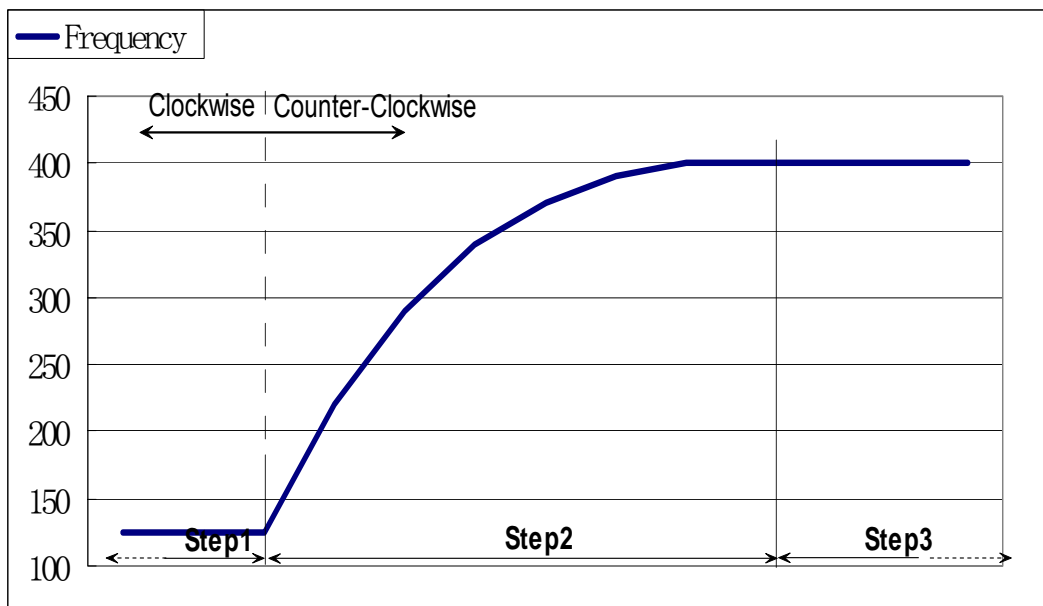
In general, the *peak amplitude* should be between  $12.9\text{mA} \geq I_{\text{max.}} \geq 16.07\text{mA}$ .



## Suggested Reseting Process

In most of the VID23 applications, the angular range of the instrument dial is less than 300°. This allows use of a mechanical stop to define the zero position. Generally the pointer will be reset to the zero position at each power-up of the instrument.

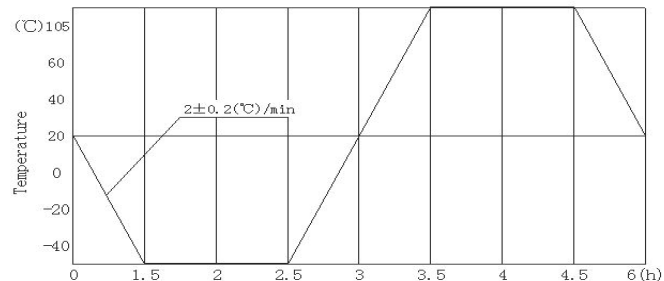
During the power-up of instrument, to bring the pointer at his initial stop position without creating any visible and audible jitter of the pointer, we suggest frequency acceleration process to speed up VID23 step motor till a high speed. Below is an example:



## Reliability Test

### Temperature Cycle Test

- Low Temperature:  $-40^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- High Temperature:  $+105^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- Dwell time: each for 1 Hrs
- Transfer Time: 1.5 hrs
- Cycle times: 50 cycles total 300hrs
- Cycle mode: see right graph..
- Motor Status: running
- Reference standard: IEC68-2-14.



### Thermal Shock Test

- Low Temperature:  $-40^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- High Temperature:  $+105^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- Dwell time: each for 0.5hrs
- Transfer Time: within 30s
- Cycle: 100 Cycles total 100hrs
- Motor Status: non-running
- Reference standard: IEC68-2-14.

### High Temperature Test

- Temperature:  $+105^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- Duration: 168 Hrs
- Motor Status: running
- Reference standard: IEC68-2-2.

### Humidity Test

- Temperature:  $+65^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- Humidity:  $95\pm 2\% \text{RH}$
- Duration: 144 Hrs
- Motor Status: non-running
- Reference standard: IEC68-2-3.

### Low Temperature Test

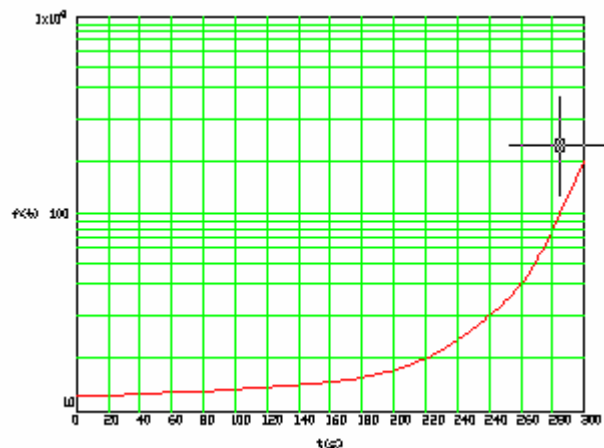
- Temperature:  $-40^{\circ}\text{C}\pm 2^{\circ}\text{C}$
- Duration: 48 Hrs
- Motor Status: running
- Reference standard: IEC68-2-1.

### Mechanical Shocking Test

- Height: 1.2 m
- Direction: X/Y
- Motor Status: non-running
- Reference standard: IEC68-2-62

### Mechanical Vibration Test

- Pulse shape: sine pulse form
- Range of frequency: 10Hz~200Hz(logarithm sweep)
- Sweep cycle: 300 sec.
- Direction: X,Y axis
- Duration: 8 hrs /each Direction
- Acceleration: 6 g
- Motor Status: running
- Reference standard: IEC68-2-6



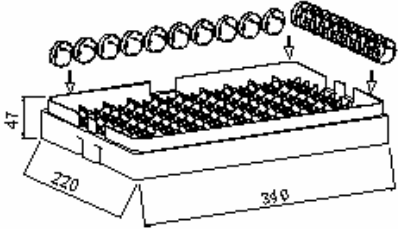
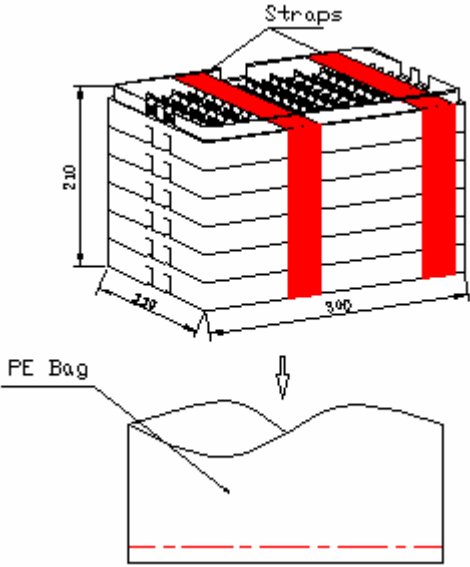
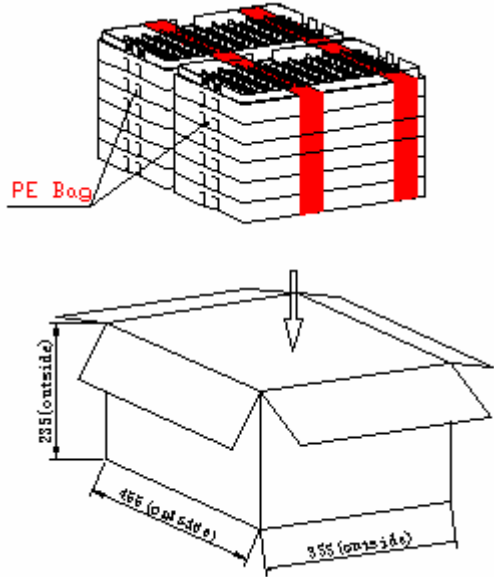


# VID23 Transparent Shaft Stepper Motor Specification

Type: VID23-XX  
Revision : 1  
Page: 1/13

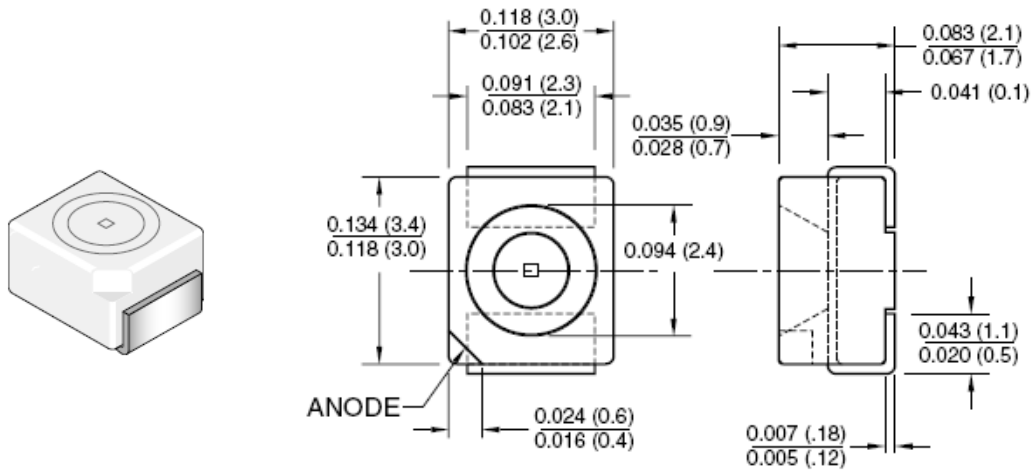
A Company of Wellgain Group

## Packing Sketch Map

|  |  |
|--|--|
| <p>Tray for 100 stepper motor VID23-01 :</p> <p>Material : PP</p> <p>Weight : Tray 1x210g=210g<br/>Motors 100x7g=700g<br/>Total = 910g</p>   |    |
| <p>Stack for 500 motors VID23-xx :</p> <p>Material : 6 Trays (including Cover) strapped together with plastic band</p> <p>Weight : Trays 5x910g=4550g<br/>Cover tray 1x210g=210g<br/>Plastic strap 2x15g=30g<br/>Total = 4790g</p> |   |
| <p>Master-carton for 1000 motors VID23-xx :</p> <p>Material : cardboard 710g/m<sup>2</sup></p> <p>Weight : Master-carton 1x820g=820g<br/>PE bag 2x50g=100g<br/>Stacks 2x4790g=9580g<br/>Total = 10500g</p>                         |  |



## LED PLCC-2 Package Reference



## Chromaticity Coordinates

