A Company of Wellgain Group

VID23 Series Transparent Shaft Stepper Motor

Description

VID23-xx series

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

VID23-XX series

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.

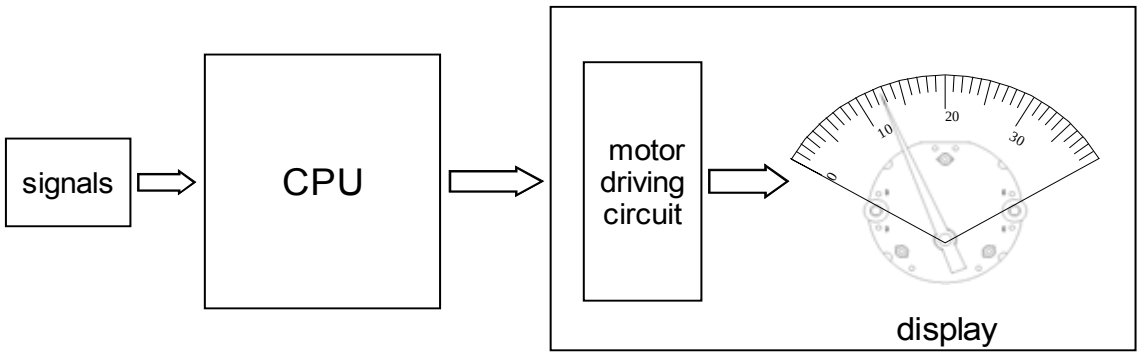
VID23-XX series

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 μ-step resolution: 1/12°.
- Wide working temperature: -40~105℃.
- Low current consumption: less than20mA, 5V, 2X100mW.
- Extremely robust construction: Φ30mm X 7.6mm.
- Long lifetime: in 200Hz, constant working up to 5000Hrs.
- Directly driven by a μ-controller.

Typical application:

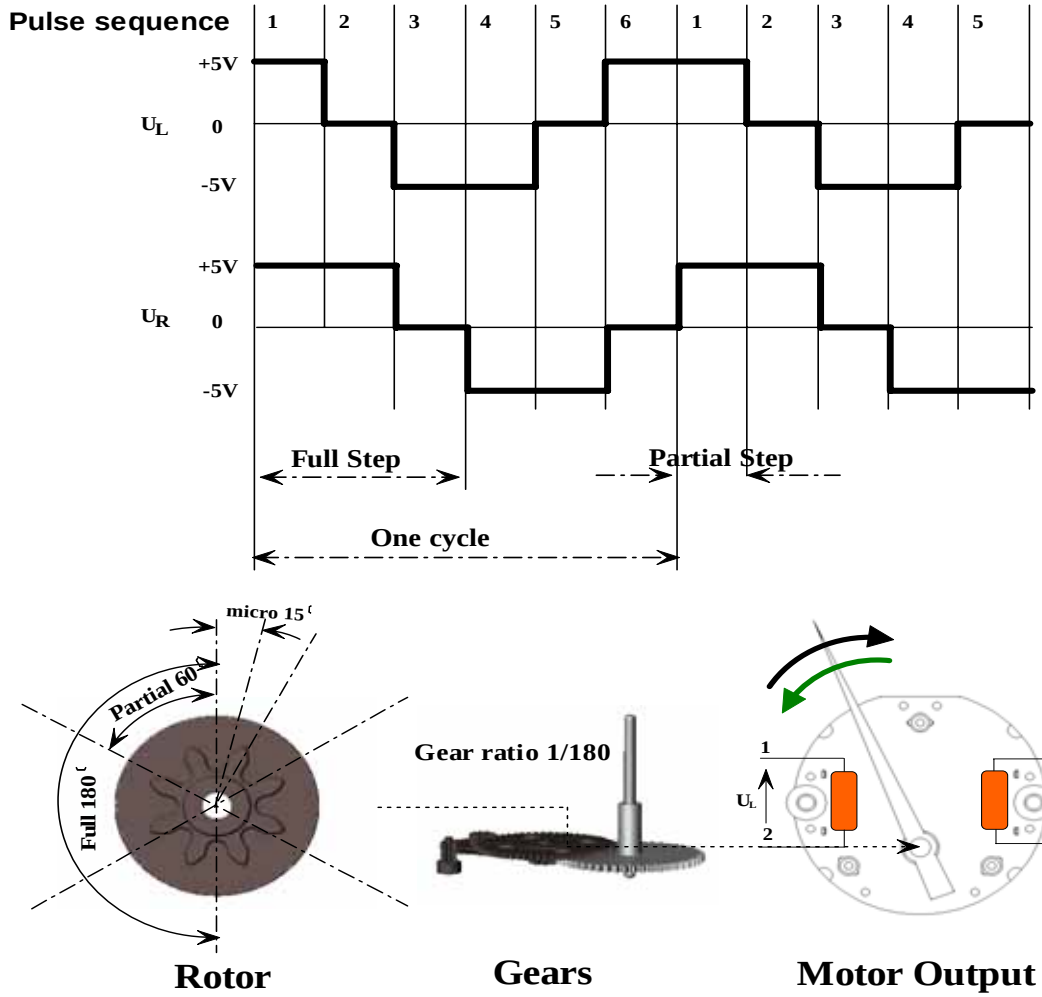


perfect combination of digital accuracy and analog facility

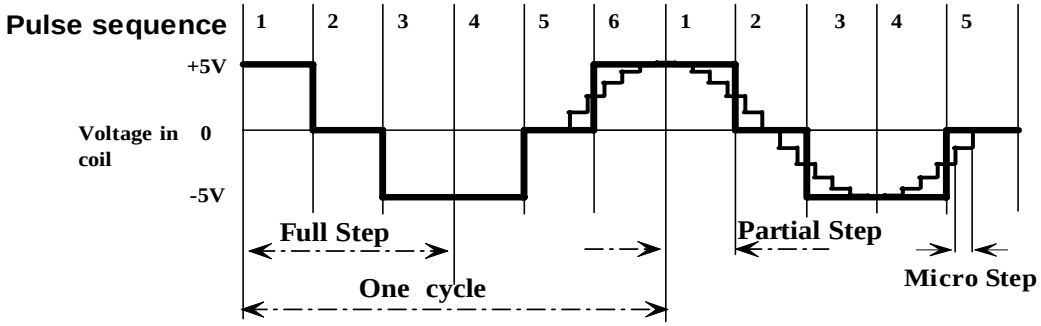
Email: vid.info@wellgain-telecom.com | Website: www.vid.wellgain.com

Step Definition and Rotor Movement

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



In order to make the motor run more stablely 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° micro step of the pointer. The diagram is as following:



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

Email: vid.info@wellgain-telecom.com | Website: www.vid.wellgain.com

Absolute Maximum Ratings

Driving voltage (Ub) 10V
EMI tolerance (1 kHz;AM 80%; 100 kHz - 2 GHz) …….. 80 V/m
Soldering temperature (≤ 5 sec) 380ºC

Electrical and Mechanical Characteristics

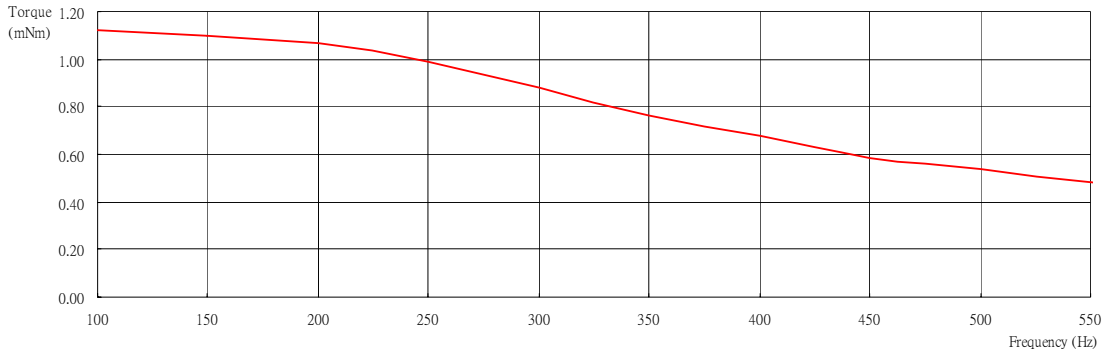
Symbol Definition : f_a – testing frequency, J_L – testing pointer inertia, Ub – Driving Voltage
Testing Conditions : T_{amb}=25ºC, In micro step mode @ Max. voltage 4.2V, unless other specified.

Parameter	Symbol	Test Conditions	Min.	Typ.	Max	Units
Electrical Characteristics						
Operating Temperature	T_a		-40		105	ºC
Coil Resistance	R_b		260	280	300	Ω
Operating Current	I_m	f_a=200Hz		15	20	mA
Start-Stop Frequency	f_{ss}	$J_L=0.2x10^{-6}kgm^2$	125			Hz
Maximum Driving Frequency	f_{mm}	$J_L=0.2x10^{-6}kgm^2$	400			Hz
Mechanical Characteristics						
Dynamic Torque	M200 M400	f_a=200Hz f_a=400Hz		1.0 0.7		MNm mNm
Static Torque	Ms	U_b=5V	3.5	4.0		mNm
Equivalent Motor Inertia @ Output	Jm			4.225 E-7		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_l	Motors with internal Stop			315	Degree
Noise						
Noise Level	SPL	@ 100 °/sec @ 200 °/sec @ 400 °/sec		35 38 47		dBA dBA dBA

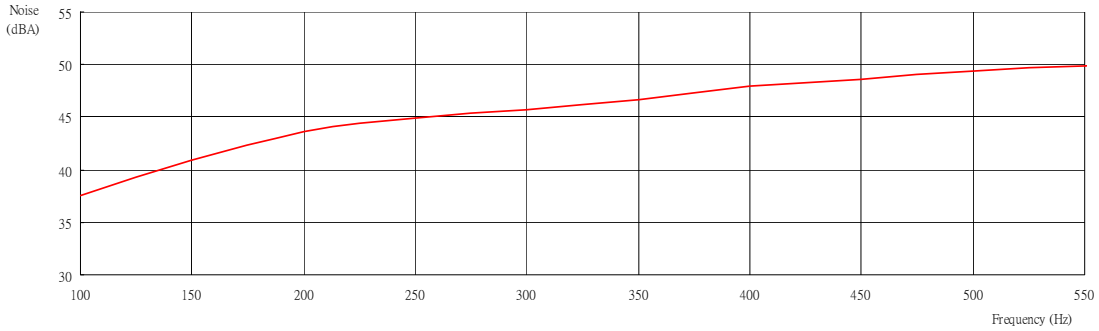
Email: vid.info@wellgain-telecom.com | Website: www.vid.wellgain.com

Typical torque and noise

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

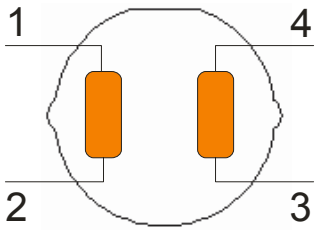


Noise - testing in micro step driving mode, @ Max voltage U_b= 4.2V

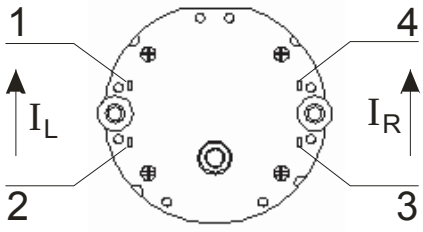


Pin Connection

VID23 Series Pin Connection



Schematic

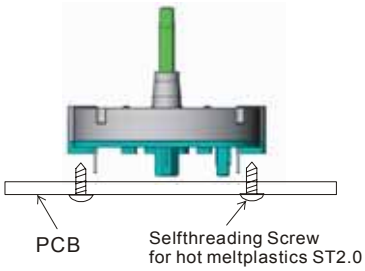


Front Mount

Email: vid.info@wellgain-telecom.com | Website: www.vid.wellgain.com

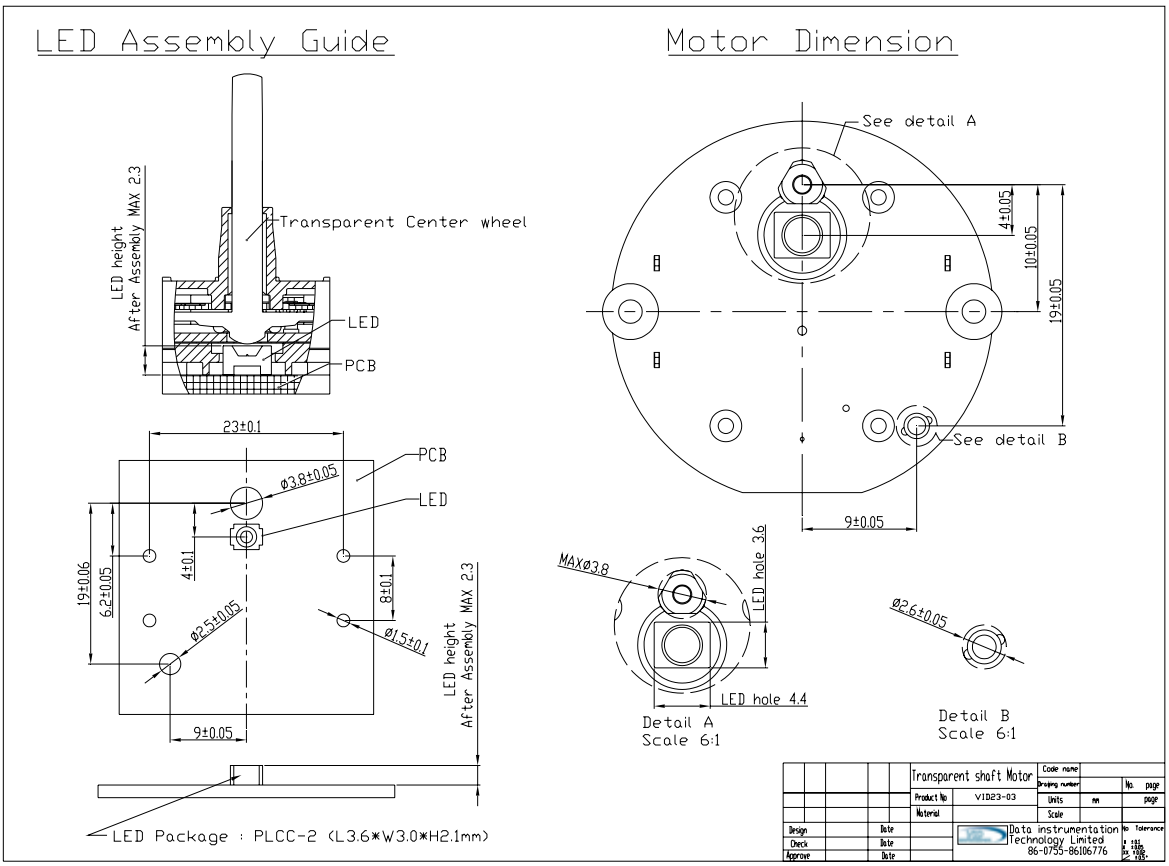
Suggested Installation

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 capactured by the lower lens of transparent shaft. VID23 motor and LED corresponding position is recommended on the following LED Assembly Guide.



Email: vid.info@wellgain-telecom.com | Website: www.vid.wellgain.com

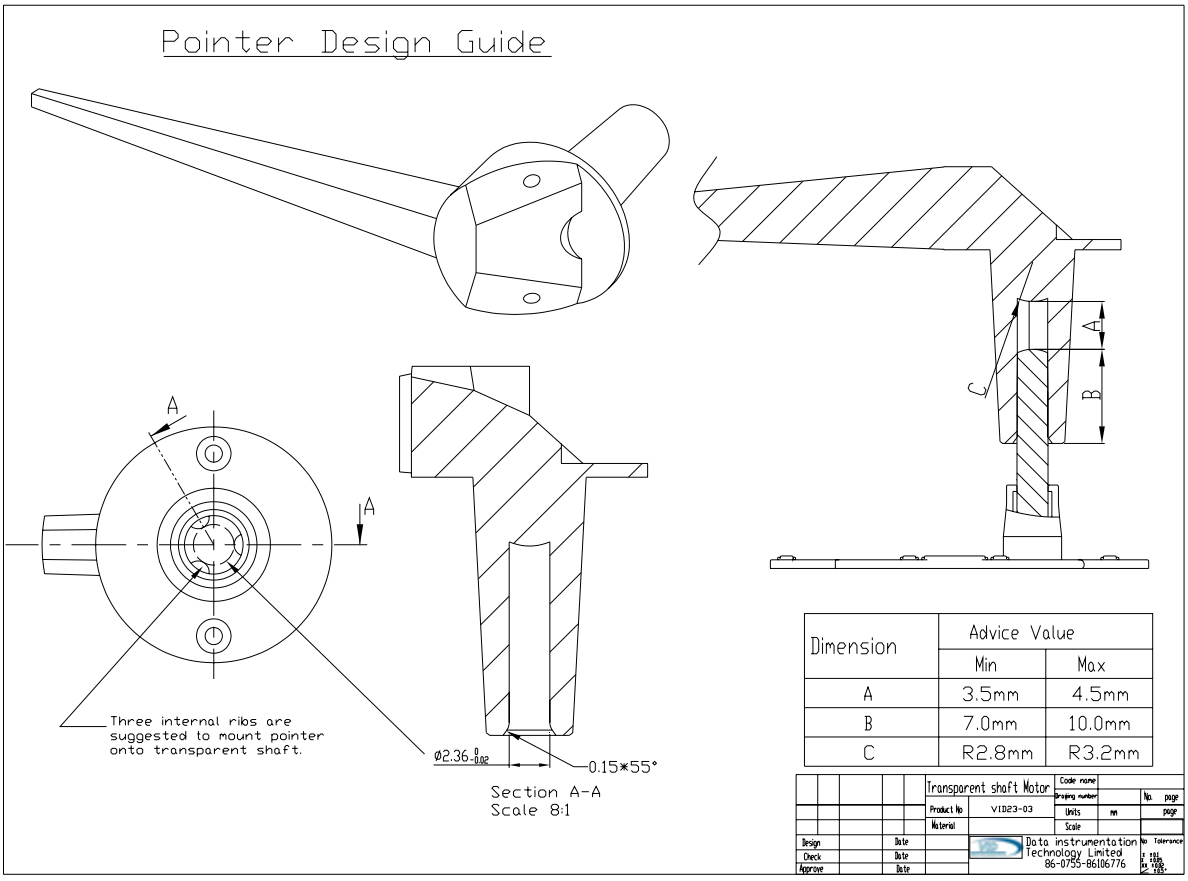
Pointer Design Reference

The parameter of the pointer

	Min	Typical	Suggested MaxValue(*)
Size:		50mm	80mm
Weight:		2.5g	10g
Inertia moment:		$2\times10^{-7}kgm^2$	$20\times10^{-7}kgm^2$
Unbalance:		0.01mNm	0.025mNm

Structure Design

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

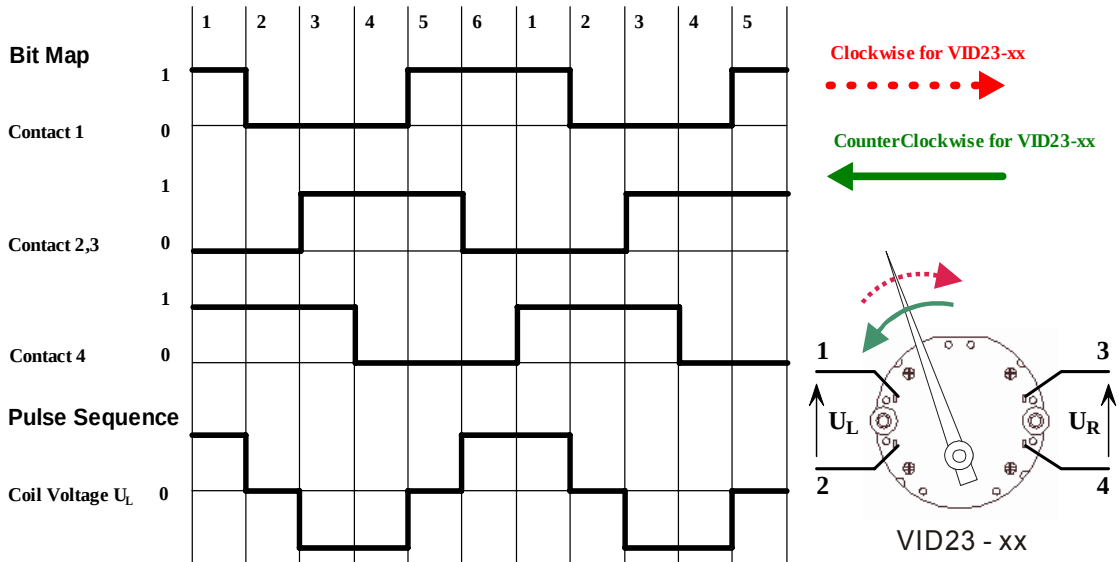


Driving Pulse and Control Circuit

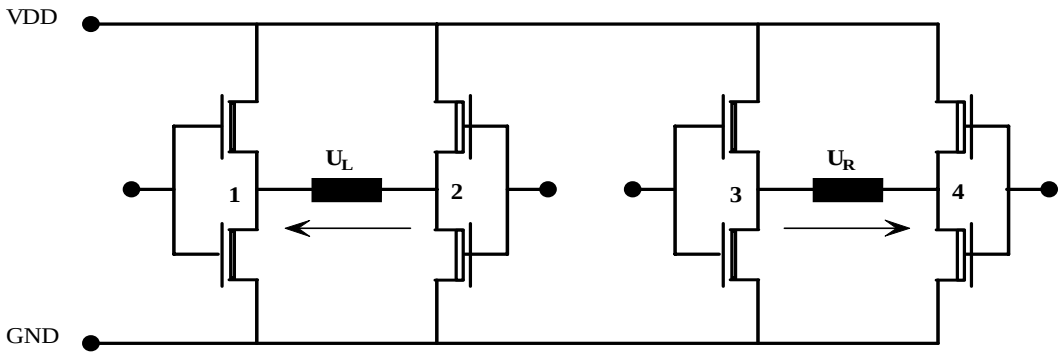
1. Partial-Step Driving Mode

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



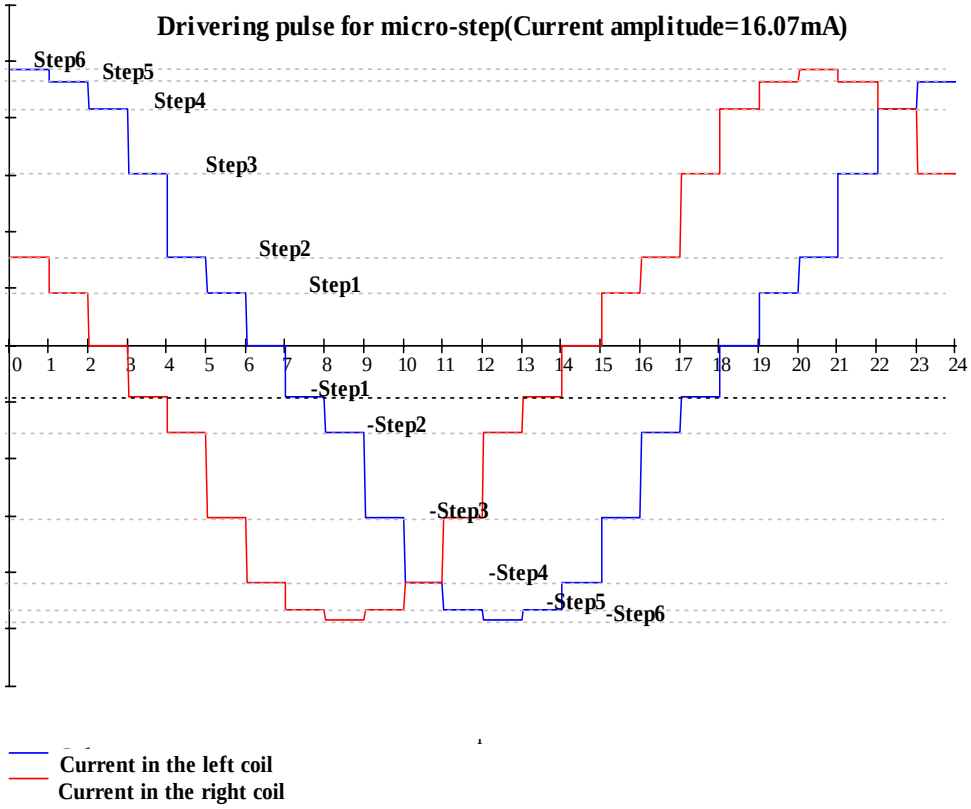
Driving Diagram in Partial Mode



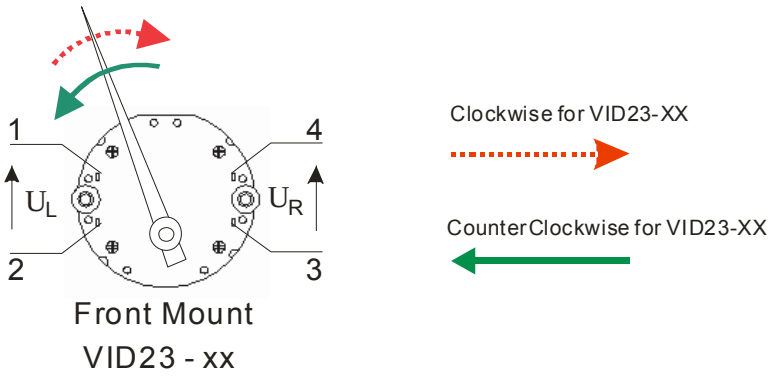
2. μ-Step Driving Mode

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

Example of driving Pulses in μ-step Mode



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

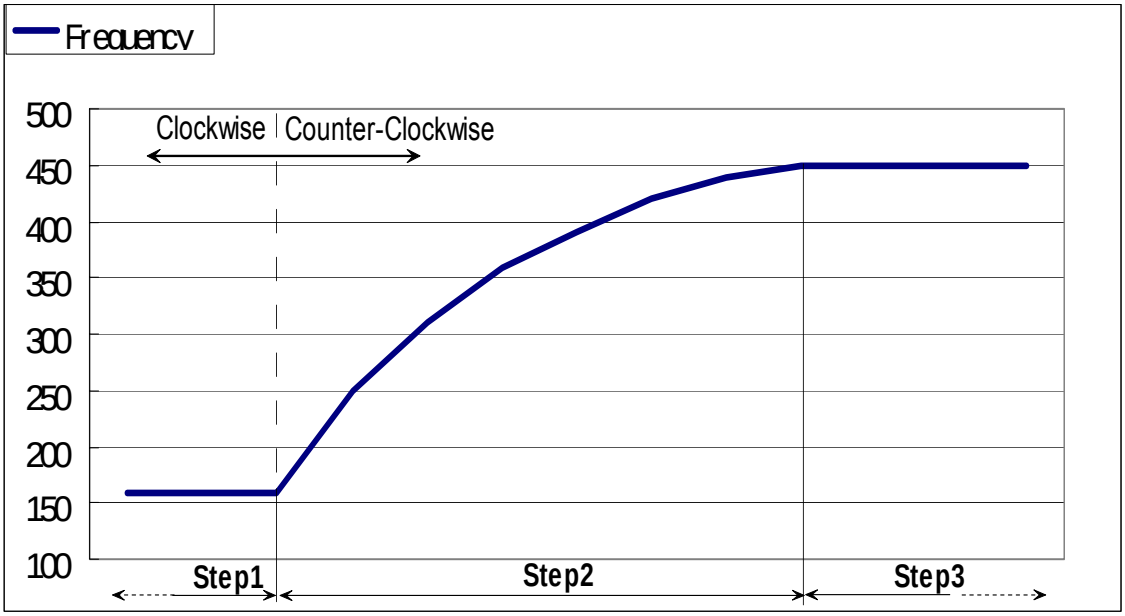


Email: vid.info@wellgain-telecom.com | Website: www.vid.wellgain.com

Suggested Reseting Process

In most of the VID23-XX 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:



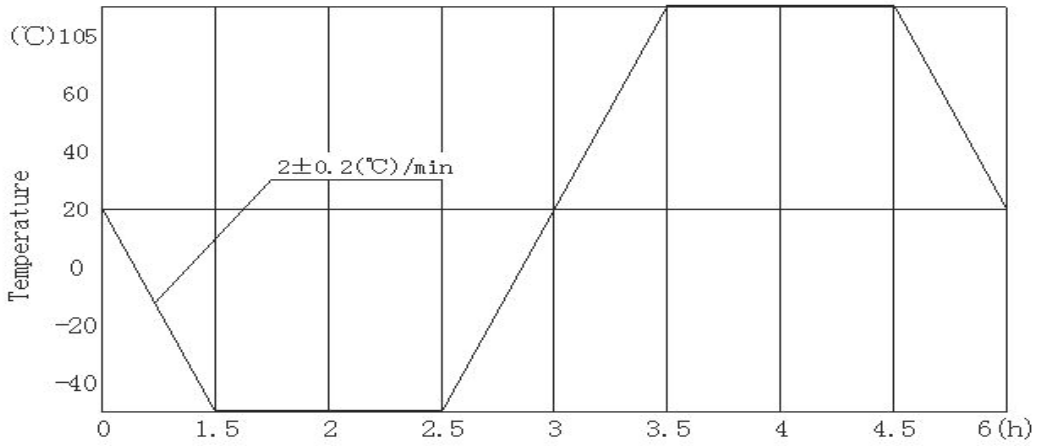
Email: vid.info@wellgain-telecom.com | Website: www.vid.wellgain.com

Reliability Test (stepper motor)

Temperature Cycle Test

- Low Temperature:-40°C±2°C
- High Temperature:+105°C±2°C
- Dwell time:1 Hrs/each
- Transfer Time:1.5 hrs
- Cycle:50 Cycles
- Motor Status : running
- The test was carried out according to IEC68-2-14 and PF-9688(DaimlerChrysler)

Temperature change like the following curve



Thermal Shock Test

- Low Temperature:-40°C±2°C
- High Temperature:+85°C±2°C
- Dwell time:30 Minutes/each
- Transfer Time:within 30 seconds
- Cycle:100 Cycles
- Motor Status: non-running
- The test was carried out according to IEC68-2-14 and PF-9688(DaimlerChrysler)

Humidity Test

- Temperature:+50°C±2°C
- Humidity:94±2％RH
- Duration:144 Hrs
- Motor Status: non-running
- The test was carried out according to IEC68-2-3 and PF-9688(DaimlerChrysler)

Email: vid.info@wellgain-telecom.com | Website: www.vid.wellgain.com

High Temperature Test

- Temperature:+105°C±2°C
- Duration:168 Hrs
- Motor Status : running
- The test was carried out according to IEC68-2-2 and PF-9688(DaimlerChrysler)

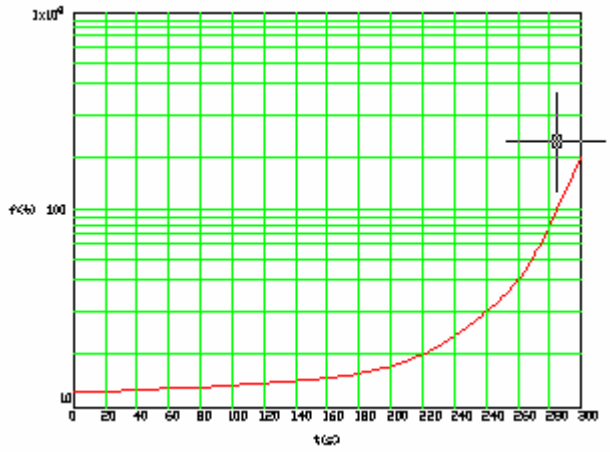
Low Temperature Test

- Temperature:-40°C±2°C
- Duration:48 Hrs
- Motor Status : running
- The test was carried out according to IEC68-2-1 and PF-9688(DaimlerChrysler)

Mechanical Vibration Test

- Pulse shape:sine pulse form
- Range of frequency:5Hz～200Hz(logarithm sweep)
- Sweep cycle: 315 sec.
- Direction:X,Y axis
- Duration:8 hrs /each Direction
- Acceleration : 6 g
- Motor Status : running
- The test was carried out according to IEC68-2-6

Frequency change with time :

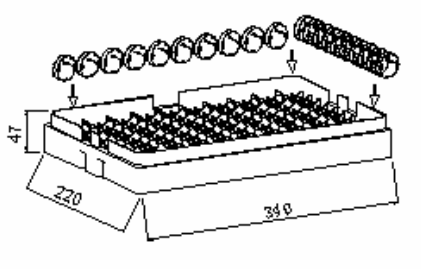
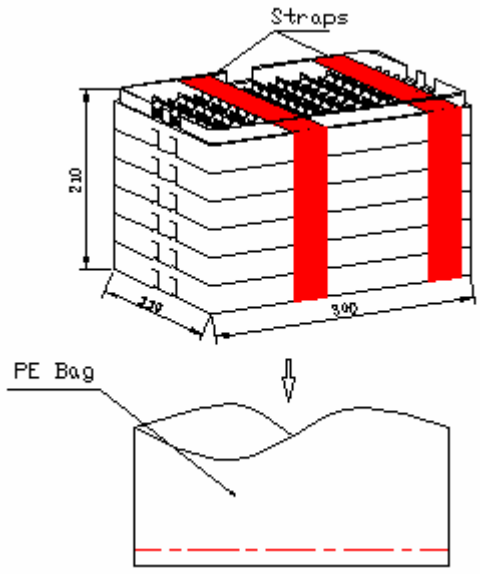
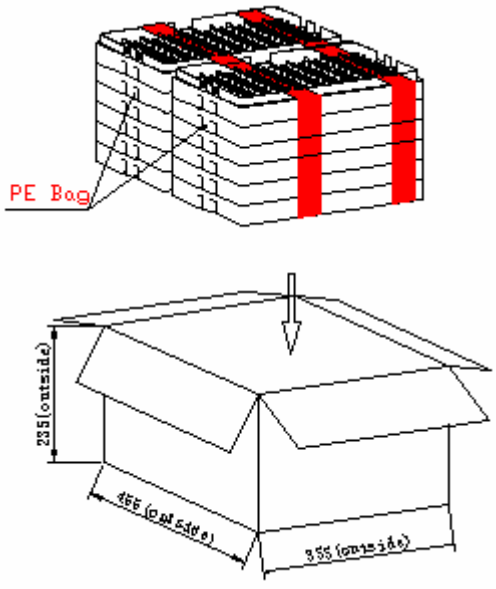


Mechanical Shock Test

- Height: 1 m
- Direction:X/Y/Z
- Motor Status : non-running
- The test was carried out according to IEC68-2-62 and ISO 1413

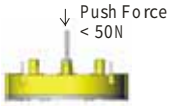
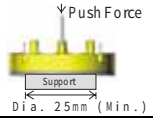
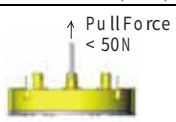
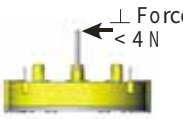
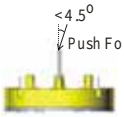
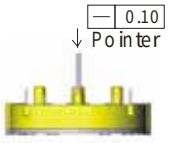
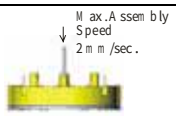
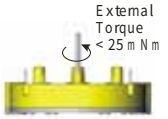
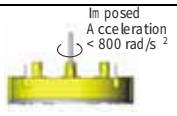
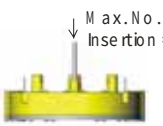
Email: vid.info@wellgain-telecom.com | Website: www.vid.wellgain.com

Packing Sketch Map

Tray for 100 stepper motor VID23-xx : Material : PP Weight : Tray 1x210g=210g Motors 100x7g=700g Total = 910g	
Stack for 500 motors VID23-xx : Material : 6 Trays (including Cover) strapped together with plastic band Weight : Trays 5x910g=4550g Cover tray 1x210g=210g Plastic strap 2x15g=30g Total = 4790g	
Master-carton for 1000 motors VID23-xx : Material : cardboard 710g/m2 Weight : Master-carton 1x820g=820g PE bag 2x50g=100g Stacks 2x4790g=9580g Total = 10500g	

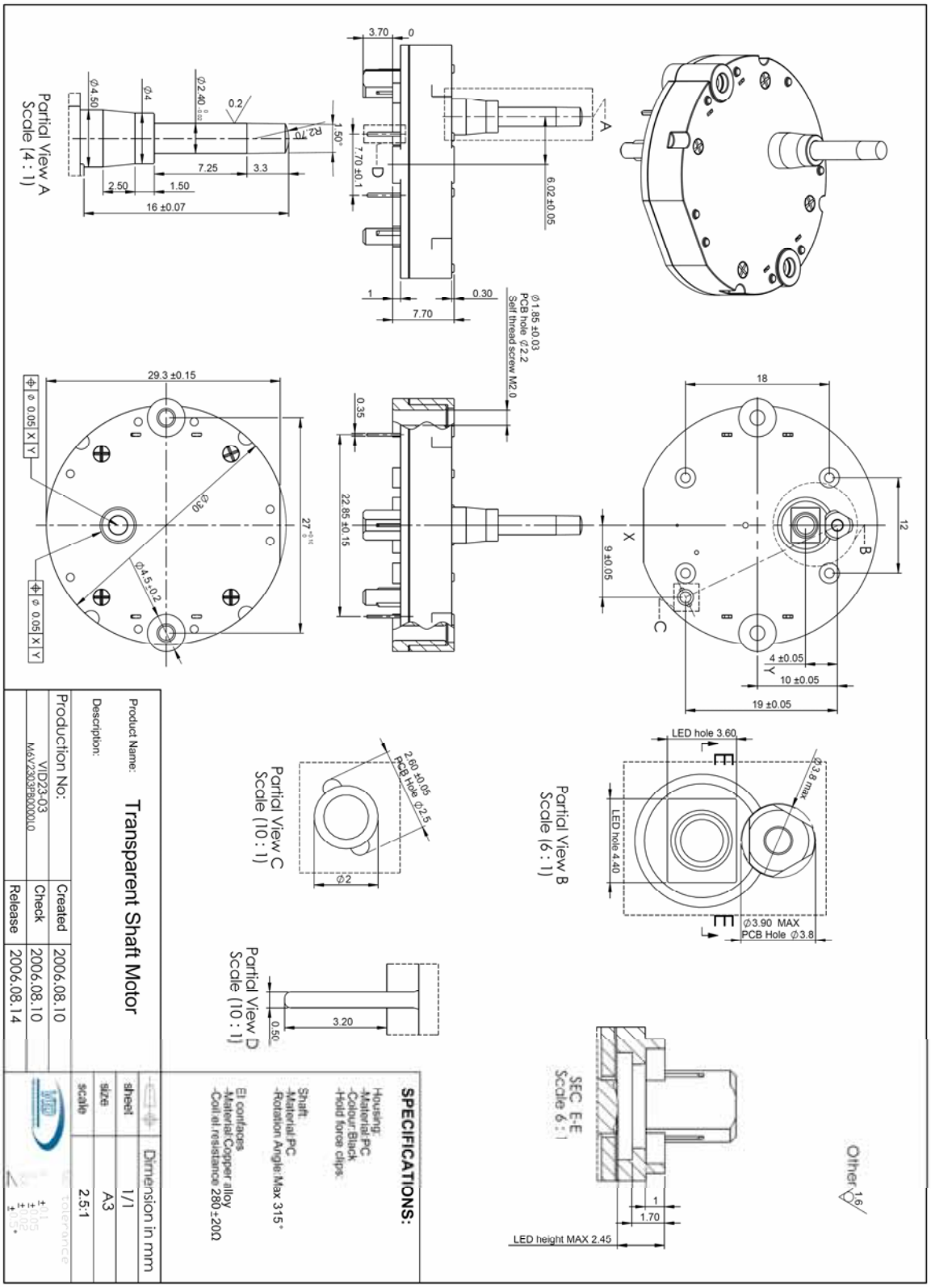
Email: vid.info@wellgain-telecom.com | Website: www.vid.wellgain.com

VID23 Limits and Precaution of Pointer Assembly

Description 描述	Diagram 图解	Specification 标准		Possible problems when over limit 超标后可能引起的问题	Remarks 备注
		Limit 極限	Unit 单		
Maximum Push On Force 最大壓力		50 max.	N	Wire damaged/ Wire broken/ Gear damage/ Abnormal Noise 断线\ 线伤\ 齿伤\ 杂音	Proper fixing motor on PCB. Proper supporting during assembly. 电机需正确装上 PCB； 电机装配时需合适的支持；
Minimum Assembly Support 最小裝配支持		Dia. 25 min.	mm	Wire damaged/ Wire broken/ Gear damage/ Abnormal Noise 断线\ 线伤\ 齿伤\ 杂音	Concrete base support should be located within +/- 1.0mm concentricity to the motor. 支持台需與電機保持+/-1.0mm 同心.
Maximum Pull Out Force 最大撥出力		50 max.	N	Wire damaged/ Wire broken/ Gear damage/ Abnormal Noise/ 断线\ 线伤\ 齿伤\ 杂音\	Repetivitive push & pull force should also be avoided. This could deform gear and shaf. 避免重复的推/拉力，因齿轮和轴變形.
Maximum Perpendicular Force 最大橫向力		4 max.	N	Output shaft bend/ Non-concentric rotation 轴弯\ 转动晃动	Excess perpendicular force should be avoided to bend the shaft. 需避免过大横向力，防止轴弯.
Maximum Force Inclination 最大力傾斜度		4.5 max.	degree	Output shaft bend/ Non-concentric rotation 轴弯\ 转动晃动	Excess inclination of applied force should be avoided to bend the shaft. 施加外力時,需避免外力过大傾斜，防止轴弯.
Maximum Pointer Straightness Deviation 最大指針 垂直度偏差		0.10 max.	mm	Output shaft bend/ Non-concentric rotation of output shaft. 轴弯\ 转动晃动	Pointer straightness should be maintained within 0.1mm during assembly. Excess inclination could induce excess perpendicular force and bend the shaft. 當裝配時指針需保持直度 0.1mm 垂直，过量傾斜会引起过量横力，引至轴弯.
Maximum Assembly Speed 最高裝配速度		2 max.	mm/sec	Gear damage/ Gear & shaft deform 齿伤\ 齿轮与指针變形	Excess assembly speed could induce excess force on gears. 装配速度太快会令齿轮受力过大.
Maximum External Torque 最大外加扭力		25 max.	mNm	Gear damage/ Gear & shaft deform / Stopper damage (360 Degree Rotate) 齿伤\ 齿轮与指针轴變形\ 限位受伤	Excess external torque (>25 mNm) applied on shaft would damage stopper , gear and shaft. 过量外加扭力，限位,齿轮和指针轴会被弄伤. Repetivtive external torque, even less than 25mNm, could also induce gears and shaft deformation, it should be avoided. 避免重复的外加扭力， 即使小于 25mNm，因齿轮和指针轴可能被變形.必須避免. Zero reset should be done before assembly, then pointer is assembled while pointing to zero. Zero reset manually should be avoided. 装配前需先回零，指针对零位装上.需避免手动回零.
Maximum Imposed Acceleration 最高外加加速率		800 max.	rad/s²	Gear damage 齿伤	Excessive imposed acceleration would induce excessive force on gears, it must be avoided. 过高外加加速率, 能引起齿轮上產生过大應力，必須避免.
Maximum Number of Pointer Insertion 最多指針裝配次數		1 max.	time	Pointer loose out from pointer shaft / Pointer loose out from pointer shaft when temperature changes 指針由指針軸脫落/ 指針在温度改變時由指針軸脫落	Repetivitive assembly and disassembly pointer would cause pointer shaft surface wearing. It induce loose matching between pointer and pointer shaft. 重覆裝配指針於指針軸上,會引致指針軸表面磨損. 這引致指針與指針軸配合鬆.

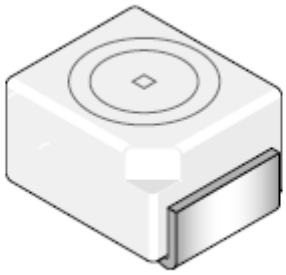
Email: vid.info@wellgain-telecom.com | Website: www.vid.wellgain.com

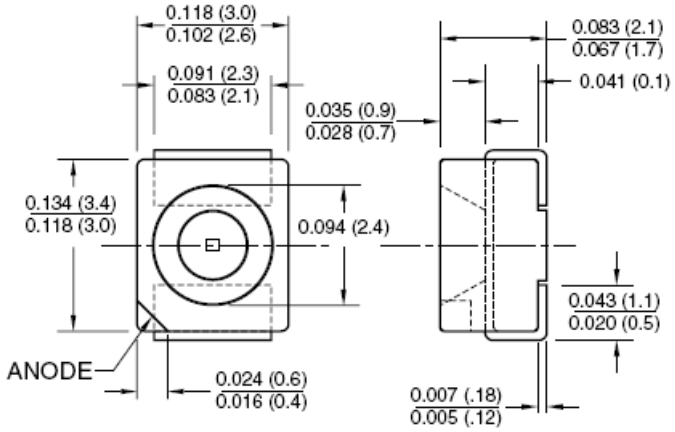
VID23 –XX Outside Dimension



Email: vid.info@wellgain-telecom.com | Website: www.vid.wellgain.com

LED PLCC-2 Package Reference





Email: vid.info@wellgain-telecom.com | Website: www.vid.wellgain.com