Since 2000

PIEZO TECH

PIEZOELECTRIC TECHNOLOGY CO.,LTD.

PIEZO ACTUATOR

TULA

Tiny Ultrasonic Linear Actuator

PIEZOELECTRIC TECHNOLOGY CO.,LTD.

Welcome to
PIEZOELECTRIC TECHNOLOGY CO.,LTD.!

Piezoelectric Technology Co.,Ltd. was established in Nov. 2000 in Korea where people are unfamiliar with ultrasonic motor, only with the confidence of our technology and passion of our ability.

Since established,we have continued a long journey for industrialization.
We have been industrializing the piezo actuator called "TULA" over the world for a long time, overcoming a lot of difficulities even if we were in trouble. We keep going our way.

Piezoelectric Technology Co.,Ltd. was feeble at first, but we will be a leading company moving forward
We do our best for our future from CEO to all employees. With quality and technique of the best in the world, we pursue investment of positive R&D field to lead rather than the profit which is visible immediately in close at hand, and will return customer's favor. Please keep an eye on our growth.

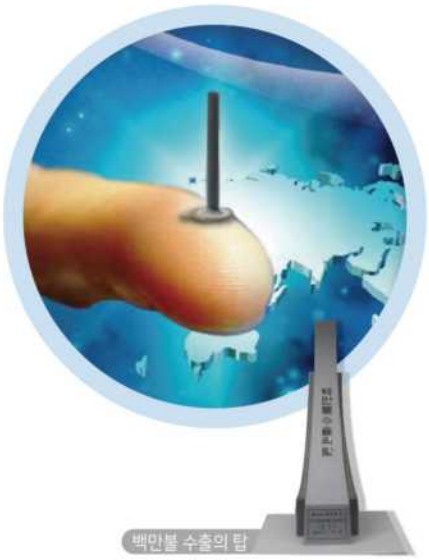
Seong iL Yoon/CEO

PIEZOELECTRIC TECHNOLOGY CO.,LTD.

Piezoelectric Technology History

2000-2005
Basic Technology Development Stage

2000.11 **Piezoelectric Technology Co.,Ltd was established**
2001.07 Certified " Venture company" (SMBA, 2001112571-6881)
2001.08 Selected " "INNO -BIZ" enterprise by SMBA of Government
2001.10 Awarded the Minister's prize of Ministry of commerce, Industry and Energy, Korea for Piezoelectric Ultrasonic Motors as the very best product
2002.04 Laboratory(R&D center)established, and certified by the government
2002.12 Acquired "NT"(New Technology) mark from KITA
2003.07 Selected "Export promising enterprise" by SMBA
2004.05 Developed TULA(Tiny Ultrasonic Linear Actuator)
2004.05 Designated as "Professional enterprise in parts and material industry" by Ministry of Commerce, Industry and Energy.
2005.05 Acquired "QS9000" Mark (Product quality management system) from KOTRIC
2005.06 Selected as a accomplishment enterprise in "Korea Materials and Components in dustry developing project" by Ministry of Commerce, Industry and Energy



2006-2010
Advanced technology and Module development stage

2006.03 Registered for "Foreign Direct Investment Company" by Woori bank (registration No:22218)
2006.06 Launched TULA50-165 Mass-production for DSC (Digital Still Camera of Samsung)
2007.04 Developed "Linear Actuator of Butterfly Type"
2007.06 Registered as a S-Partner certified supplier from Samsung Techwin (KSTW07-1061)
2007.08 Acquired a certificate of ISO9001 Quality Management System
2007.08 Acquired a certificate of ISO14001 Environmental Management System
2007.10 Awarded "Most Excellent Prize" with TULA in the 12th Contest of Excellent Development of Electronic Parts
2008.10 **US Patent for TULA(No.14-240758)**
2008.10 Acquired CE Certificate for "10W Ultrasonic Cutter" (PUC 10W)
2008.12 Selected as TULA
- "30 Excellent Successful Cases of Technology Development" by Korea Institute of Industrial Technology Evaluation and Planning
2009.10 Launched OIS module for Hybrid DSLR camera to Samsung Electronic (Model : NX10)
2010.04 Developed AF module for barcode with INTERMEC(U.S.A) as strategic business partner
2010.08 **Registered European Patent for TULA (No. EP 1,721,382B1)**
2008.12 Selected as TULA
- "30 Excellent Successful Cases of Technology Development" by Korea Institute of Industrial Technology Evaluation and Planning
2009.10 Launched OIS module for Hybrid DSLR camera to Samsung Electronic (Model : NX10)
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2010.08 **Registered European Patent for TULA (No. EP 1,721,382B1)**

2011-2020
Growth stage Strengthening the market

2011.06 **Registered Chinese Patent for TULA (No. 200580001317.6)**
2012.07 Developed TULA of Rectangular type
2012.11 Won an award for exporting tower of USD 1 Million from the Korea Trade Association
2013.07 Launched AF module for a digital medical camera (Finland)
2014.05 Developed Bio Maldi system (Italia)
2014.06 Contracted with USA company for AF module of smart camera
2014.09 Acquired permission of the medical device from KFDA
2015.12 Registered Military service exception Firm from Defense Minister
2016.11 Excellent company in technology assessment certificate from NICE credit
2017.01 **Acquired ISO9001 certification and ISO14001 certification**
2017.04 Selection of small but strong company from Korean government division
2017.10 Developed TULA25 (size : 2.5mm *0.5t, it is the smallest motor in the world)
2018.10 Selected high growth company exporting from Korean government
2019.01 **Developed the standard AF module based on TULA**
2020.10 Established Joint Venture Company in Germany : Piezolution GmbH

2021~NOW
Globalization

2021.03 Digi-Key registered stage modules in Digi-Key network as global sales network site
2021.06 Developed Multilayered TULA for low voltage (2~5V)

Basic Product

TULA (Tiny Ultrasonic Linear Actuators)

Next generation actuator driven by linear motion of unimorph or bimorph piezoelectric body.

TULAXX- □□□
- The diameter of piezoeletric ceramic
- The length of the rod

Product LIne

- TULA Series

Tiny Ultrasonic Linear Actuators

TULA 25 | TULA 50 | TULA 35B | TULA 70 | TULA 35 | TULA 75

- Hollow type Piezo Motor
- Mutilayer Piezo Actuator for smart device

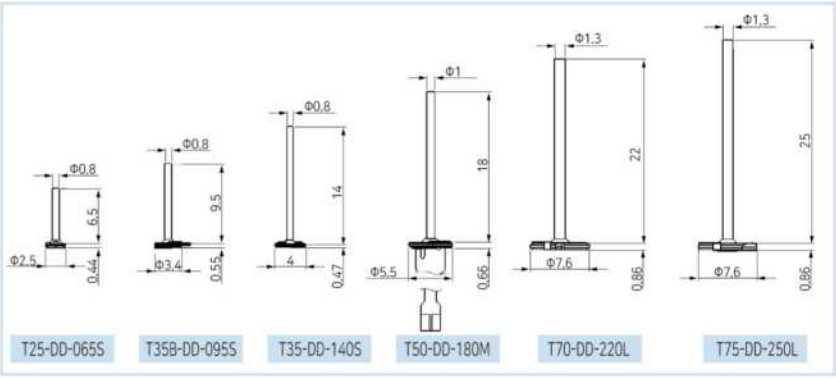
Features

- Very small size, light weight and simple structure
- Variable stroke
- Quick response
- Intrinsic holding force
- Excellent cotrollability
- Fine positioning / High resolution
- Quiet operation
- No EMI

	SPECIFICATIONS	TULA25	TULA35B	TULA35	TULA50		TULA70	TULA75
Mechanical Characteristics	Speed(No load)(㎜/s)	> 3	> 7	> 10	> 10	> 10	> 15	> 20
	Max-Thrust(gf)	> 3	> 5	> 10	> 40	> 20	> 50	> 70
	Holding-Force(gf)	30 ~ 50	40 ~ 70	50 ~ 80	100 ~ 150	100 ~ 150	120 ~ 160	120 ~ 160
	Stroke(㎜)	< 3	< 6	< 8	< 8	< 10	< 15	< 18
	Shaft Diameter(mm)	Φ0.8	Φ0.8	Φ0.8	Φ1.3	Φ1.0	Φ1.3	Φ1.3
	Shaft length(㎜)	< 9	< 14	< 19	< 20	< 22	< 28	< 30
	Reference Mobile	M308	M308	M308	M813	M510	M813	M813
Electrical Characteristics	Driving Frequency(kHz)	170 ~ 250	110 ~ 140	80 ~ 100	60 ~ 80	60 ~ 80	40 ~ 55	35 ~ 50
	Driving Voltage(V)	12 ~ 16	12 ~ 18	14 ~ 20	20 ~ 35	20 ~ 35	20 ~ 35	20 ~ 35
	Power Consumption(mW)	<150@12V	<180@12V	<250@14V	<350@20V	<350@20V	<500@20V	<500@20V
Enviroment Condition	Operation Temperature(℃)	-10 ~ 60						
	Storage Temperature(℃)	-30 ~ 80						

Applications

- ZOOM, AF of camera and mobile phone
- Optical Image Stabilizer (OIS) of DSC or Smartphone
- Stage module
- ICR(infrared cut removal) of CCTV
- Medical equipments, MEMS, Optical equipments
- Micro gripper / Manipulator
- Pan/Tilt module



Multilayered TULA (TM-AA-BB)

1 x : sintering temperature of ceramics
H : high temperature.
L : low temperature.

2 AA : size of ceramic.

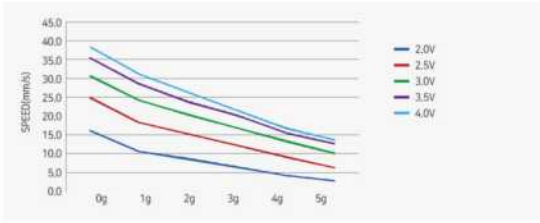
3 BB : layer of ceramics.

Specification

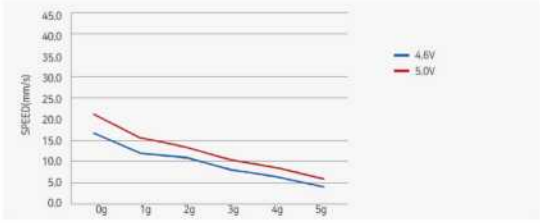
	SPECIFICATIONS	TM3507
Mechanical Characteristics	SPEED(NO LOAD)(㎜/S)	> 10
	MAX-THRUST(GF)	> 7
	HOLDING-FORCE(GF)	40 ~ 70
	STROKE(㎜)	< 8
	SHAFT LENGTH(㎜)	< 19
Electrical Characteristics	DRIVING FREQUENCY(KHZ)	100 ~ 120
	DRIVING VOLTAGE(V)	2 ~ 6
	POWER CONSUMPTION(MW)	<450 @ 2.5V
Enviroment Condition	OPERATION TEMPERATURE(°C)	-10 ~ 60
	STORAGE TEMPERATURE(°C)	-30 ~ 80

ST GRAPH

TMH ST GRAPH



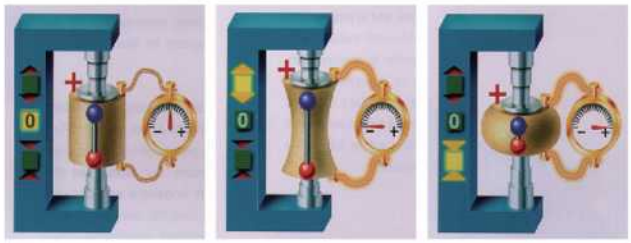
TML ST GRAPH



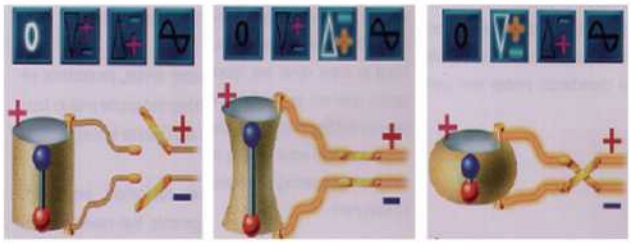
Piezoelectric Actuator Technology

Piezoelectric Effect

Piezoelectic effect is appearance of an electric potential across certain faces of piezoceramics when it is subjected to mechanical pressure. The word originates from the Greek word "piezein", which means "to press". A piezoelectric substance is one that produces an electric charge when a mechanical stress is applied (the substance is squeezed or stretched). Conversely, a mechanical deformation (the substance shrinks or expands) is produced when an electric field is applied.



Direct piezoelectric effect | Pi = dijkTjk

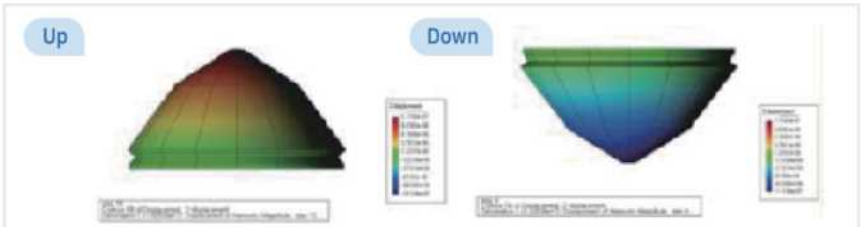


Inverse piezoelectric effect | Sij = dkijEk

Operating Principle

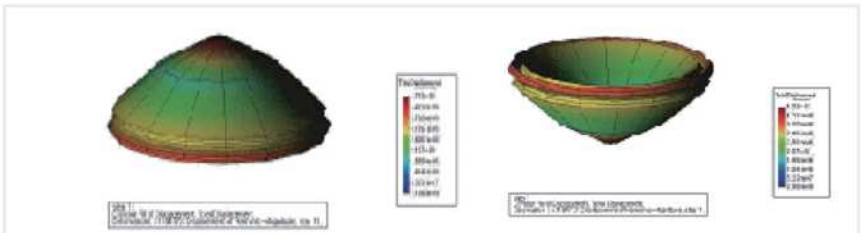
The operating principle of the TULA is explained by the characteristics of the piezoelectricity and Newton's first law. In other words, the TULA exploits the vibration modes of the piezoelectric ceramics, the inertia principle and the contact force of the friction.

Elastic material
Piezoelement



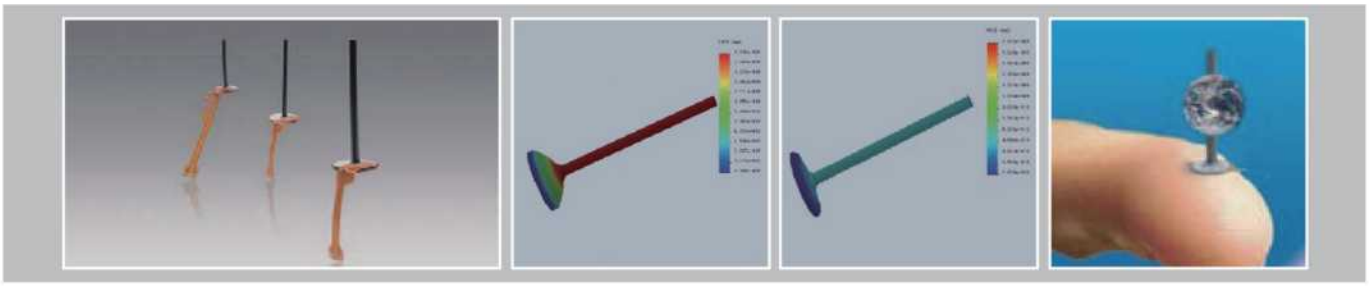
f_r : 114kHz Coupling coefficient : 24% Uni-morph type

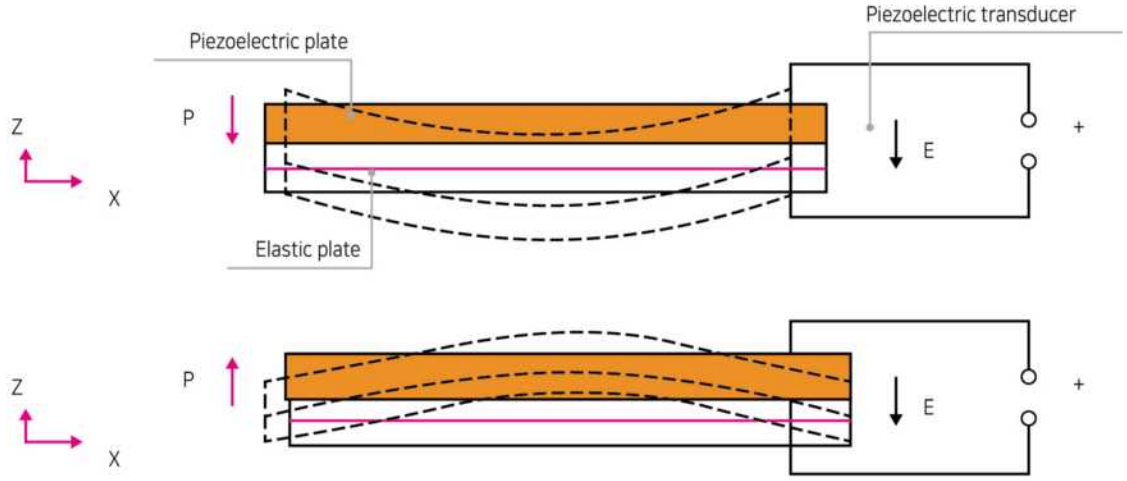
Piezoelement
Elastic material
Piezoelement

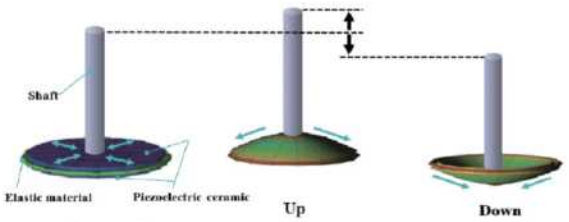


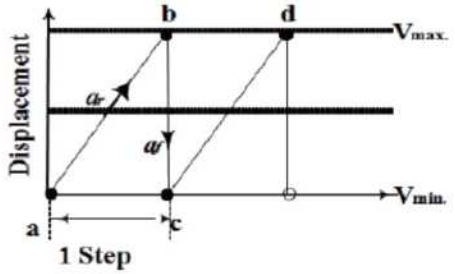
f_r : 128kHz Coupling coefficient : 43% Bl-morph type

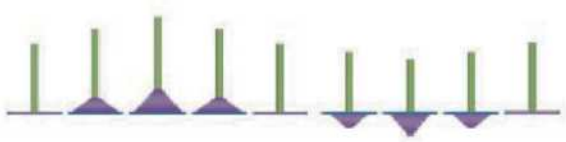
Piezoelectric Linear Actuator











Forward Motion

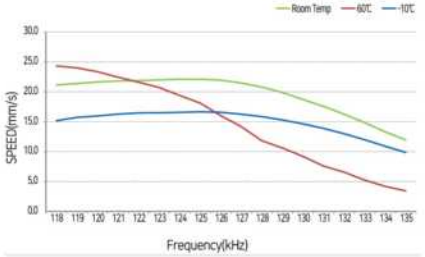
⇒ Slow forward motion & quick return

Backward Motion

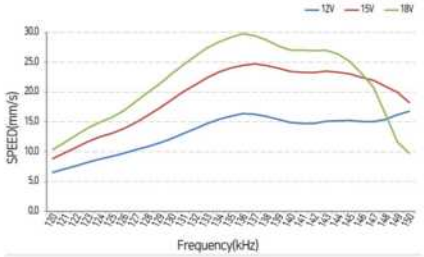
⇒ Quick forward motion & slow retum

Typical Charateristics of TULA

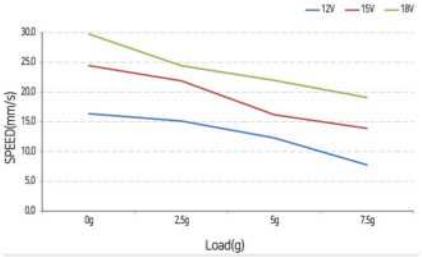
Frequency Speed Graph



Volt Graph



ST Graph



TULA's Applications

Standard Product

Built in type Auto Focus Module(Built in type)

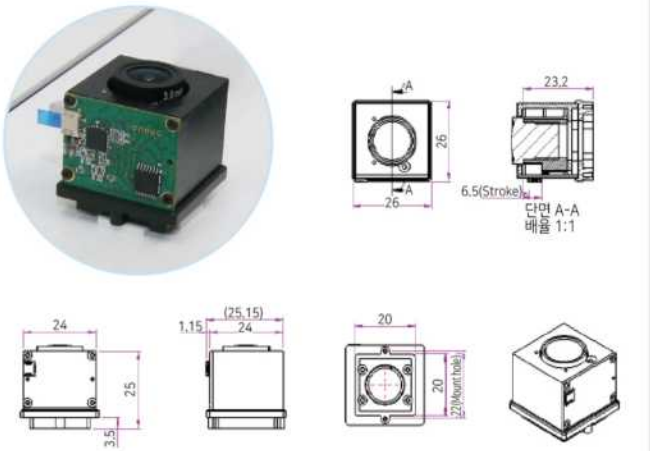
- PZT AF standard series help you to create your costomized AF module quickly and easily

Dear Mr.Choi,

good news, we won this project.
Delivery schedule of series is not clear yet, but we know the plan was 10k for coming two years. .....

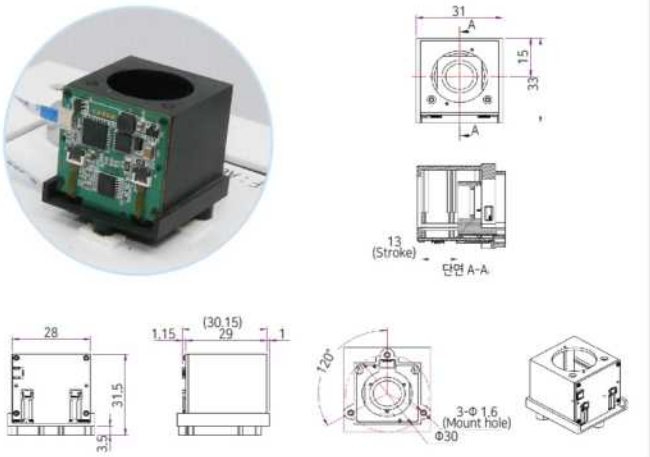
PT-AF06-M12

Stroke	6.5mm
Resolution	1μm
Repeatability	±3μm
Lens Weight	<5g
Moving Speed	10mm/sec
Driver	Built in
Input Power	<2.5W
Input Voltage	DC5V
Mean Time Before Failure	>300K Cycles
Digital Interface	UART
Actuator	TULA50



PT-AF13-M12

Stroke	13mm
Resolution	1μm
Repeatability	±3μm
Lens Weight	<30g
Moving Speed	10mm/sec
Driver	Built in
Input Power	<2.5W
Input Voltage	DC5V
Mean Time Before Failure	>300K Cycles
Digital Interface	UART
Actuator	TULA70 X 2



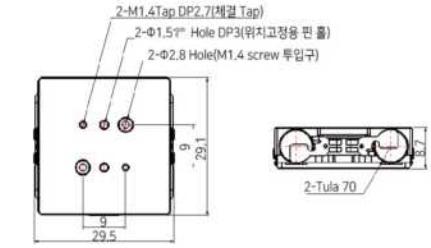
PIEZO TECH **TULA** Tiny Ultrasonic Linear Actuator

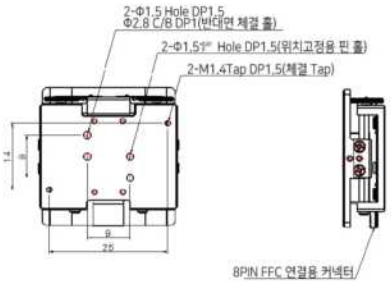
Hi Seong-iL,

We tested 10 stages moving between2 points 1.5mm apart.
They first completed 10km of travel at 20mm/s speed and then another 10km of travel at 35mm/s
Additionally 1 stage completed 100km at 35mm/s.
There were no failures. .....

Stage Module

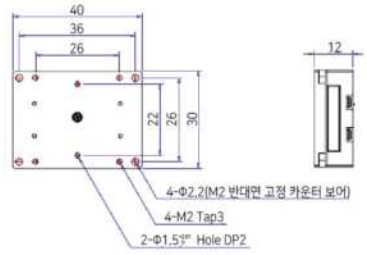
Pin Guide Type

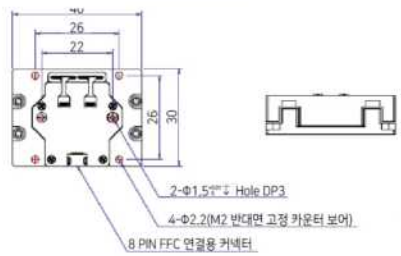




Specification				
Model name		PT-XDT50-S05C	PT-XDT70-S10C	PT-XDT70-S15C
General Spec	Full Stroke	5.1 ± 0.1 ㎜	10.1 ± 0.1 ㎜	15.1 ± 0.1 ㎜
	Real Stroke	5 ㎜	10 ㎜	15 ㎜
	Dimensions	29 x 22.2 x 7.5 ㎜	29.5 x 29.2 x 8.9 ㎜	29.5 x 34 x 8.9 ㎜
	Weight	< 10 g	< 12 g	< 14 g
	Vertical Load	≤ 15 g	≤ 20 g	≤ 20 g
	Horizontal Load	≤ 30 g	≤ 50 g	≤ 50 g
	Holding Force	> 250 gf	> 250 gf	> 250 gf
	Speed(at Real stroke)	> 10 ㎜/s		
Closed Loop Performance	Resolution	0.1㎛ with Incremental Encoding		
	Repeatability	± 2㎛		
	Accuracy	± 10㎛		
Mechanical	Static parallelism	≤ 10'		
	Pitch and Yaw	≤ 10'		
Environment	Relative Humidity	≤ 70%		
	Operation Temperature	0 ° C to +50 ° C		
	Storage Temperature	-30 ° C to +80 ° C		
	Life time	1kk Cycles (at real Stroke)		
Electrical	Controller	one channel Drive board (PMC2001,PMC2002,PMC2109)		
	Host Interface	USB Adapter from PC		
	Input Power	5V DC (3W max.)		

Cross Roller Guide Type



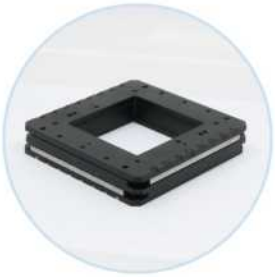


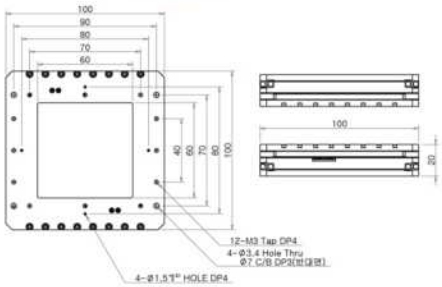
Specification				
Model name		PT-XDT75-C10C	PT-XDT75-C15C	PT-XDT75-C20C
General Spec	Full Stroke	10.1 ± 0.1 ㎜	15.1 ± 0.1 ㎜	20.1 ± 0.1 ㎜
	Real Stroke	10 ㎜	15 ㎜	20 ㎜
	Dimensions	40 x 30 x 12 ㎜	40 x 40 x 12 ㎜	40 x 50 x 12 ㎜
	Weight	< 32 g	<44 g	<53 g
	Horizontal Load	≤ 400 g		
	Holding Force	> 250 gf		
	Speed(at Real stroke)	> 10 ㎜/s		
Closed Loop Performance	Resolution	0.1㎛ with Incremental Encoding		
	Repeatability	± 2㎛		
	Accuracy	±10㎛		
Mechanical	Static parallelism	≤10'		
	Pitch and Yaw	≤10'		
Environment	Relative Humidity	≤ 70%		
	Operation Temperature	0 ° C to +50 ° C		
	Storage Temperature	-30 ° C to +80 ° C		
	Life time	1kk Cycles (at real Stroke)		
Electrical	Controller	one channel Drive board (PMC2001,PMC2002,PMC2109)		
	Host Interface	USB Adapter from PC		
	Input Power	5V DC (3W max.)		

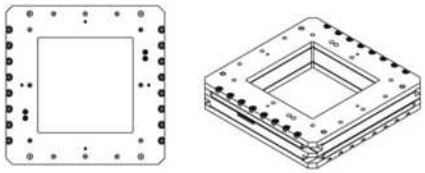
Hi Seong-iL,

We have not fully completed outgas testing but it looks good so far and good enough to move to Pilot phase. ·····

Micro Scopy Stage

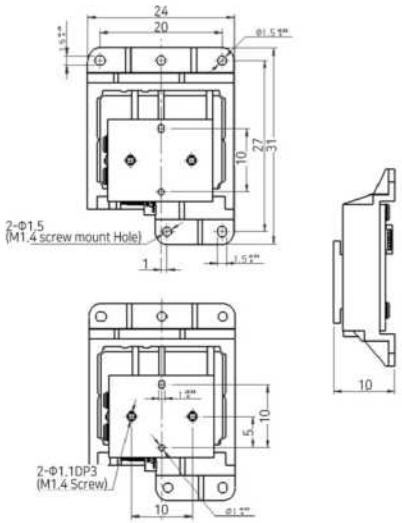






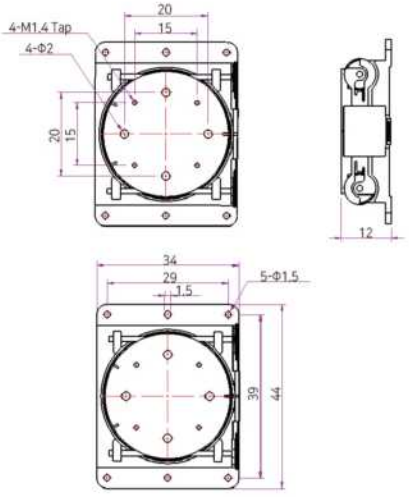
Specification		
Model name		PT-HQT75-C20C
General Spec	Full Stroke	20.1~± 0.1㎜
	Real Stroke	20㎜
	Dimensions	100 x 100 x 20㎜
	Weight	<280 g
	Horizontal Load	≤ 400 g
	Holding Force	> 250 gf
	Speed(at Real stroke)	> 10 ㎜/s
Closed Loop Performance	Resolution	0.1㎛ with Incremental Encoding
	Repeatability	± 2㎛
	Accuracy	±10㎛
Mechanical	Static parallelism	≤10′
	Pitch and Yaw	≤10′
Environment	Relative Humidity	≤ 70%
	Operation Temperature	0 ˚ C to +50 ˚ C
	Storage Temperature	-30 ˚ C to +80 ˚ C
	Life time	1kk Cycles(at real Stroke)
Electrical	Controller	one channel Drive board (PMC2001,PMC2002,PMC2109)
	Host Interface	USB Adapter from PC
	Input Power	5V DC (3W max)

Popular Standard Stage



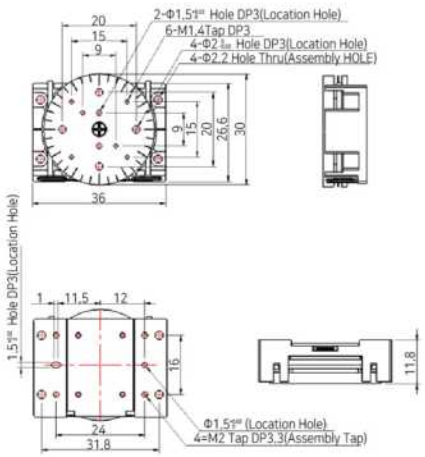
Specification		
Model name		PT-XST50-S06C
General Spec	Full Stroke	6.5 ± 0.2㎜
	Real Stroke	6㎜
	Dimensions	31 x 24 x 10㎜
	Weight	< 5 g
	Vertical Load	≤ 10 g
	Horizontal Load	≤ 20 g
	Holding Force	> 120gf
	Speed(at Real stroke)	> 10㎜/s
Closed Loop Performance	Resolution	0.1㎛ with Incremental Encoding
	Repeatability	± 2㎛
	Accuracy	± 10㎛
Environment	Relative Humidity	≤ 70%
	Operation Temperature	0 ˚ C to +50 ˚ C
	Storage Temperature	-30 ˚ C to +80 ˚ C
	Life time	1kk Cycles (at real Stroke)
Electrical	Controller	Embedded
	Host Interface	UART of TTL level
	Input Power	5V DC (3W max)

Theta Stage



Specification		
Model name		PT-THDT70-A300C
General Spec	Full Angle	300° ± 1°
	Real Angle	295°
	Dimensions	34 x 44 x 12㎜
	Weight	< 27g
	Vertical Load	N/A
	Horizontal Load	N/A
	Torque	> 50 gf cm
	Holding Force	> 250 gf cm
	Angle Speed(at Real angle span)	> 90°/s
Closed Loop Performance	Resolution	0.0004°
	Repeatability	0.1°
	Accuracy	TBD
Mechanical	Radial run-out	50㎛ at Radian 13mm
	Axial run-out	50㎛ at Radian 15mm
Environment	Relative HumidityF	≤ 70%
	Operation Temperature	0 ° C to +50 ° C
	Storage Temperature	-30 ° C to +80 ° C
	Life time	1kk Cycles (at real Stroke)
Electrical	Controller	one channel Drive board (PMC2001,PMC2002,PMC2109)
	Host Interface	USB Adapter from PC
	Input Power	5V DC (3W max)

Rotation Stage



Specification		
Model name		PT-RDT70-A360C
General Spec	Full Angle	360°
	Dimensions	36 x 30 x 11.8㎜
	Weight	< 27g
	Vertical Load	N/A
	Horizontal Load	N/A
	Torque	> 50 gf cm
	Holding Force	> 300 gf cm
	Angle Speed(at Real angle span)	> 60°/s
Closed Loop Performance	Resolution	0.022°
	Repeatability	0.2°
	Accuracy	TBD
Mechanical	Radial run-out	50㎛ at Radian 13mm
	Axial run-out	50㎛ at Radian 15mm
Environment	Relative Humidity	≤ 70%
	Operation Temperature	0 ° C to +50 ° C
	Storage Temperature	-30 ° C to +80 ° C
	Life time	1kk Cycles (at real Stroke)
Electrical	Controller	one channel Drive board (PMC2001,PMC2002,PMC2109)
	Host Interface	USB Adapter from PC
	Input Power	5V DC (3W max)

Customization

Business Field

Logistic Device Medical Device Cosmetic Device Surveillance Device Semiconductor Device

Logistic Device : AF Module

PT-AF50

Speed	10mm/sec
Thrust Force	10gf
Stroke	5mm
Resolution	2μm(MR Sensor)
Power Consumption	<400mW
Size	15.5mm x 15.8mm x 12mm
Actuator	TULA50×1

PT-AF35

Speed	8mm/sec
Thrust Force	20gf
Stroke	5mm
Resolution	2μm(MR Sensor)
Power Consumption	<300mW
Size	15.5mm×15.8mm×13mm
Actuator	TULA35×1

Medical Device : AF Module

PT-AF50SD

Speed	10mm/sec
Thrust Force	20gf
Stroke	5mm
Resolution	1μm(Magnetic Encoder)
Lens size	Φ16
Power Consumption	<600mW
Actuator	TULA50×2

PT-AF70O

Speed	10mm/sec
Thrust Force	40gf
Stroke	8mm
Resolution	1μm(Magnetic Encoder)
Lens size	Φ19
Power Consumption	<500mW
Actuator	TULA70×1

Cosmetic Device : Moving Module

- Zooming module for Motorized Hand Piece

Items	Contents
Application	**Moving module**
Actuator	TULA70 X 1
Stroke	6mm
Size	Φ40 X 29mm
Resolution	1um
Communication	RS232
Temperature	0~60℃
Power	DC5V

- Piezo motor for HIFU Device with Pieze Motor

Items	Contents
Application	**HIFU Device**
Actuator	TULA70 X 1
Stroke	10~15mm
Speed	>15mm/sec

Ultrasonic HiFu Lifting

It is a device using the principle of regeneration when the skin is injured.It gives high-intensity ultrasonic stimulation to the skin,but only damages the inside of the targeted skin without damaging the skin surface,changing it to a new skin using the human body's regenerative ability

Surveillance Device : AF Module

IRIS Recognition

	AF35B-IR1	AF35-IR2	MR50-IR3
Max Speed	≥ 8mm/s	≥ 8mm/s	≥ 100°/s
Resolution	1um ± 3	1um ± 3	0.01°
Driving Frequency	110~130kHz	90~110kHz	60 ~ 70kHz
Power Consumption	≤ 120mW	≤ 120mW	≤ 750mW
Operating Temperature	-20°C ~ 75°C	-20°C ~ 75°C	-20°C ~ 75°C
Dimension(W×L×H)	15.6mm x 10mm x 11.2mm	15.5mm x 21.5mm x 12.25mm	63.7mm x 34.5mm x 45.9mm
Actuator	TULA35B (1EA)	TULA35 (1EA)	TULA50 (1EA)
Lens Weight	0.5g	2.0g	N/A
Mirror Weight	N/A	N/A	4.0g
Angle	N/A	N/A	±11°
Stroke	0.6mm	0.8mm	N/A

IR Filter Change for Day and Night

ICR50-A	
Max Speed	>10mm/s
Resolution	On-Off System
Driving Frequency	70±10%kHz
Power Consumption	< 500mW
Operating Temperature	-15°C~70°C
Dimension(W×L×H)	33.6 × 33 x 5.3mm
Actuator	TULA50×1
Filter Size	10.6×9.4mm
Stroke	10.0mm

ICR70-B	
Max Speed	>20mm/s
Resolution	On-Off System
Driving Frequency	50±10%kHz
Power Consumption	< 700mW
Operating Temperature	-15°C~70°C
Dimension(W×L×H)	45.1 × 37.3 x 8.9mm
Actuator	TULA70×1
Filter Size	18.1×12.8mm
Stroke	13.5mm

Semiconductor Device : Moving Module

Max Speed	>10mm/s
Resolution	On-Off system
Driving Frequency	70 ±10% kHz
Power Consumption	< 500mW @21V
Operating Temperature	-15℃ ~ 70℃
Dimension(W×L×H)	38mm X 27mm X 6.7mm
Actuator	TULA50
Stroke	13mm

Others

OIS(Optical Image Stabilizer) Module

PT-OIS50-14

Speed	20mm/sec
Thrust Force	20gf
Stroke	2mm
Resolution	5μm (Hall Sensor)
Power Consumption	<1000mW
Size	43mm×43mm×9.2mm
Actuator	TULA50×2
Usage	Tele Zoom Lends

PT-OIS50-17

Speed	15mm/sec
Thrust Force	20gf
Stroke	2mm
Resolution	5μm (Hall Sensor)
Power Consumption	<1000mW
Size	Φ43mm×14.2mm
Actuator	TULA50×2
Usage	Super Zoom Lends

Pan / Tilt / Zoom Module

Stroke	Pan ±10 ° , Tilt ±10 ° , Zoom 15mm
Resolution	Pan 0.1 ° , Tilt 0.1 ° , Zoom 0.5μm
Repeatability	Pan ±0.3 ° , Tilt ±0.3 ° , Zoom ±2
Lens size	Φ23
Actuator	TULA70

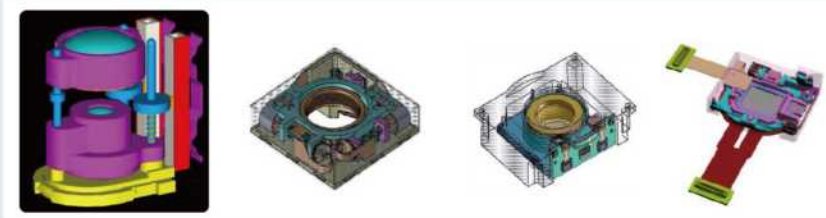
Braille/Haptic Module

- Bralle terminal
- It's applicable to bank ATM
- Customizing
- 3D Display image
- Actuator : TULA25

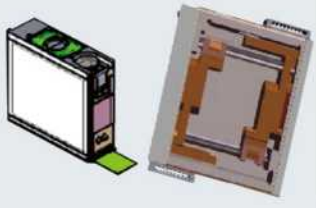
Smart Application(Future Market)

AF and OIS

TULA25



AF and Zoom



	LENS1	LENS2	LENS3
Type	Object	Zoom	AF
Dimension	20mmX20mmX5.5mm		
Stroke	Fix	< 5mm	< 5mm
Speed	Fix	< 15mm/sec	< 10mm/sec
Repeatability	Fix	±3μm	±3μm
Interface	UART		

Piezo Driver

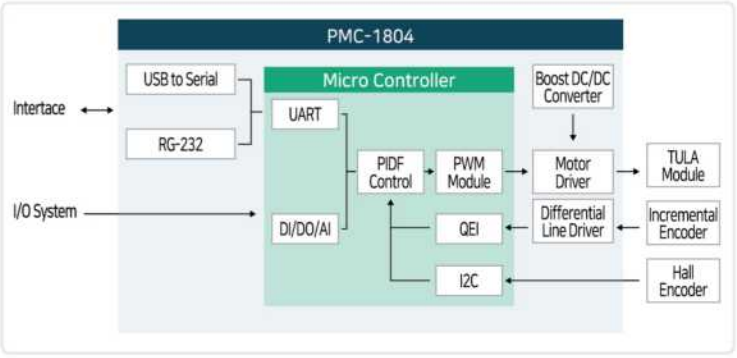
TULA EV-Kit

PMC-1804

Features

- Industry's smallest TULA controller solution
- PID Control and IIR filter Algorithm
- USB (Serial over USB) or RS-232 Interface
- DI/DO/AI System
- Data Recording
- Single Axis configuration

Block Diagram



Specification

- Driver for TULA series.
- Single Axis configuration
- USB (Serial over USB) or RS-232 Interface
- Data Recording

MODEL	PMC-1804
Power	
Operating Voltage	5V [±10%]
Electrical power	1.5W
Power consumption	0.3A
Communication	USB (Serial over USB) / RS-232
Baud rate	115200 bps
Transmission code	ASC II
Data length	8 bit
Stop bit length	1 bit
Parity check	Nil
User software	TULA Controller PC Manager
Environmental	
Ambient operating temperature	0 to +50℃
Storage temperature	-20℃ to +70℃
Operating humidity	0 to 80%
Dimensions	25 mm x 61 mm x 8 mm
Weight	8g

Multi Channel Driver

PMC-2001_Master

PMC-2002_Slave

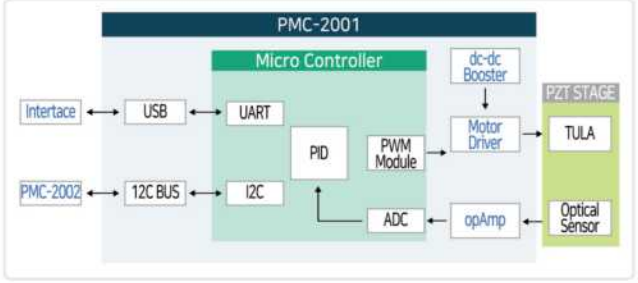
Features

- Industry's smallest TULA controller solution
- PID Control and IIR filter Algorithm
- USB (Serial over USB) or I2C interface
- Data Recording
- Multi Axis Configuration

Specification

MODEL	PMC-2001
Power	
Operating Voltage	5V [±10%]
Electrical power	1.5W
Power consumption	0.3A
Communication	USB (Serial over USB)
Baud rate	115200 bps
Transmission code	ASC II
Data length	8 bit
Stop bit length	1 bit
Parity check	Nil
User software	TULA Controller PC Manager
Environmental	
Ambient operating temperature	0 to +50℃
Storage temperature	-20℃ to +70℃
Operating humidity	0 to 80%
Dimensions	72 mm x 25 mm x 18 mm
Weight	12g

Block Diagram



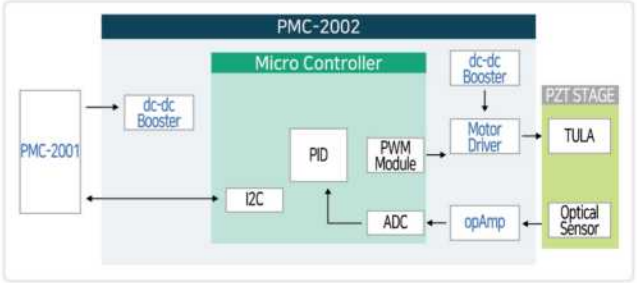
Features

- Industry's smallest TULA controller solution
- PID Control and IIR filter Algorithm
- I2C interface
- Data Recording
- Single Axis Configuration

Specification

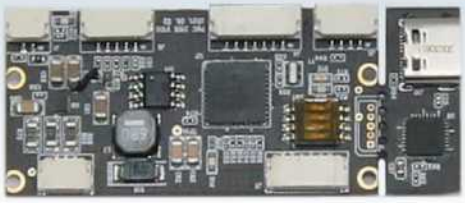
MODEL	PMC-2002
Power	
Operating Voltage	5V [±10%]
Electrical power	1.5W
Power consumption	0.3A
Communication	I2C with PMC-2001
User software	TULA Controller PC Manager
Environmental	
Ambient operating temperature	0 to +50℃
Storage temperature	-20℃ to +70℃
Operating humidity	0 to 80%
Dimensions	33 mm x 25 mm x 10 mm
Weight	5g

Block Diagram



Low Voltage TULA Driver

PMC-2108



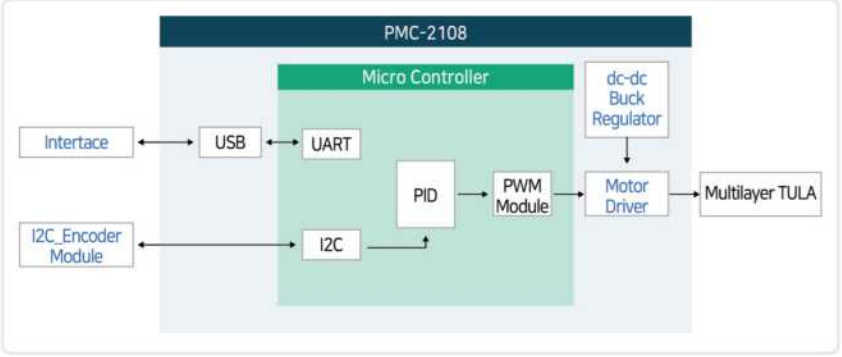
Features

- Industry's smallest TULA controller solution
- PID Control and IIR filter Algorithm
- USB (Serial over USB) or RS-232 Interface
- Open Loop
- DI/DO/AI System
- Data Recording
- Single Axis configuration

Specification

MODEL	PMC-2108
Power	
Operating Voltage	8V ~ 12V [±10%]
Electrical Power	1.5W
Power Consumption	0.5A
Communication	USB (Serial over USB) / RS-232
Baud Rate	115200 bps
Transmission Code	ASC II
Data length	8 bit
Stop bit length	1 bit
Parity Check	Nil
User Software	TULA PC Manager
Environmental	
Ambient operating temperature	0 to +50℃
Storage temperature	-20℃ to +70℃
Operating humidity	0 to 80%
Dimensions	25 mm x 61 mm x 8 mm
Weight	8g

Block Diagram



Built -in Type Device

PMC-1901

Specification

MODEL	PMC-1901
Power	
Operating Voltage	5V [±10%]
Electrical Power	2.5W
Power Consumption	0.5A
Communication	UART (TTL-level)
Baud Rate	115200 bps
Transmission Code	ASC II
Data length	8 bit
Stop bit length	1 bit
Parity Check	None
User Software	TULA control PC Manager
Environmental	
Ambient operating temperature	0 to +50℃
Storage temperature	-20℃ to +70℃
Operating humidity	0 to 80%

Features

- Industry's smallest TULA controller solution
- PID Control Algorithm
- UART Interface
- Open Loop Direction
- Data Recording
- Single Axis configuration

Encoder Module

PMC-1802

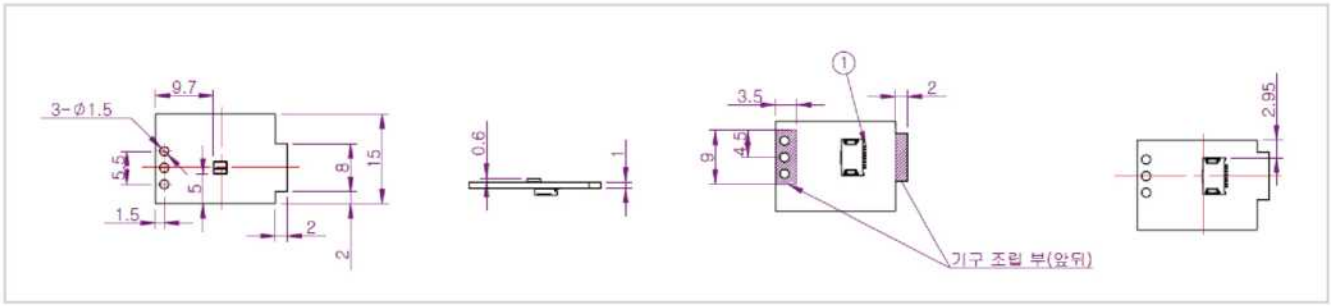
Features

- I2C speed up to 400kHz
- Motor speed up to 100mm/s
- Travel length up to 10mm
- Position resolution is 100nm

Specification

SPECIFICATIONS	PMC-1802
Size (W x H)	14 x 22 mm
Input power	DC 5V / 30mA
Operating temperature	-20℃ ~ +75℃
Resolution	100nm
Accuracy	+- 5um (@25℃)
Repeatability	+- 2um (@25℃)

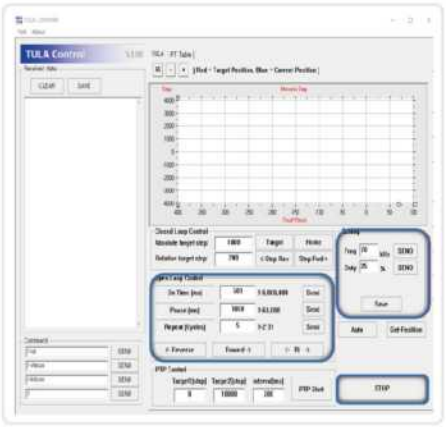
Dimension



TULA Monitor PC Program

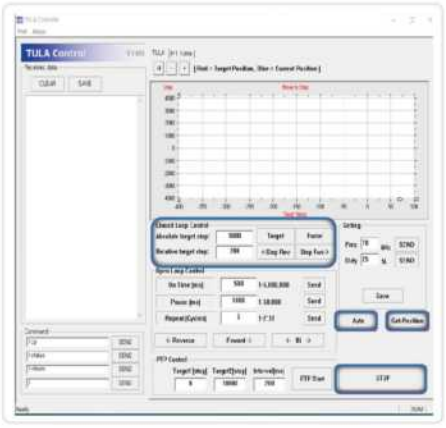
Open Loop Control & Configuration

[Freq]	Define the driving frequency (20~300kHz)
[Duty]	Define the duty(1~48%)
[Duration]	The moving on-time.
[Pause]	The time between the start of each step.
[Repeat]	The optional number of run.
[<Reverse]	Motor runs in reverse.
[Forward>]	Motor runs forward.
[<Bi>]	Move to both direction.
[Stop]	Aborts the motion immediately



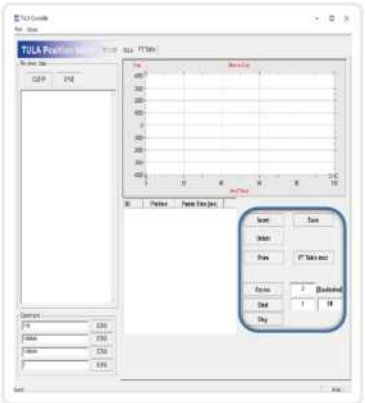
Closed Loop Control

[Display]	During motion, the motion status can be continuously monitored. Red = Target Step. Blue = Current Step.
[+]	Zoom in
[-]	Zoom out
[R]	Reset to the scale
[Auto]	Calibration of the Sensor
[Get-Position]	Reports the actual controller position.(Encoder value)
[Home]	Move to the home position.
[Target]	Move to the absolute target position. The target position can be specified absolute position, using the absolute position parameter.
[<Step Rev],[Step Fwd>]	Move to the relative target position. The target position can be specified relatively to the current desired position, using the relative position parameter.
[STOP]	Aborts the motion immediately



PT TABLE

[Insert]	set the target position and pause time on the ID of PT.
[Delete]	delete the selected ID of PT.
[Draw]	Draw PT position on Graph.
[PT Table read]	read of saved PT Tables.
[Cycles]	The optional number of run.
[Start]	execute to set range of PT ID(1~50).
[STOP]	Aborts the motion immediately.



Communication Data Format (Command)

Type	STX	COMMAND	SPACE1	PARAMETER1	SAPCE2	PARAMETER2	ETX
Send to controller	'>'		0x20	Optional	0x20	Optional	'₩r'
Receive from controller	'<'		0x20	Optional	0x20	Optional	'₩r'

STX	The code showing the head of transmit data ('>' =0x3e).
COMMAND	Selects from the column of command on the command list to set.
SPACE1	Shows the separation between Command and Parameter1.
PARAMETER1	Selests from the column of command on the command list to set.
SAPCE2	Shows the separation between Parameter1 and Parameter2
PARAMETER2	Selects from the column of command on the command on the command list to set.
ETX	The code showing the completion of transmit data ('₩r'= 0x0d).

Command List

Command	Parameter1	Parameter2	Description
ma	-2,147,000,000 ~ +2,147,000,000		Move to the absolute target position, [counts]. The target position can be specified absolute position, using the absolute position parameter. 1) Parameter1 : Assigning an absolute target position, [counts] 2)printf(">ma 1000₩r");
ma	-2,147,000,000 ~ +2,147,000,000		Move to the relative target position, [counts]. The target position can be specified relatively to the current desired position, using the relative position parameter. 1) Parameter1 : Assigning an relative target position, [counts] 2)printf(">ma 10000₩r");
home	N/A		Move to the home sensor. 1)printf(">home₩r");
monitor	0 ~ 1		During motion, the motion status can be continuously monitored. 1) Parameter1 : Reports the current actual motor position and the target position, [counts]. [1:ON, 0:OFF, default+0] 2)printf(">monitor 0₩r");
auto	N/A		Automatic tuning. 1)printf(">auto₩r");
stop	N/A		Aborts the motion immediately. 1)printf(">stop₩r");
duration	1 ~ 600,000		Define the moving on-time 1)printf(">duration 1000₩r");
interval	1 ~ 600,000		Define the time between the start of each step 1) Parameter1 : step interval (unit:ms) 2)printf(">interval 1000₩r");
cycle	1 ~ +2,147,000,000		Define the optional number of run. 1)printf(">cycle 10₩r"); 2) Receive from controller : printf(">cycle 10₩r");

TULA Drive IC

NJW4814 (Dual H-Bridge Driver with Boost Converter)

FEATURES

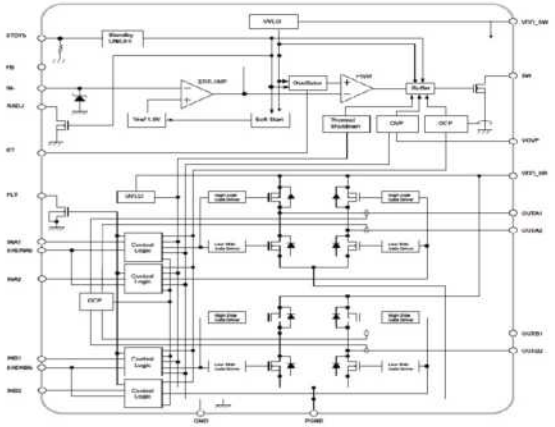
Boost Converter Block

- Output Switch Voltage ⇒ 40V max.
- Switching Current ⇒ 1.5A min.
- PWM Control
- Operating Voltage Range ⇒ 2.7 to 5.5V
- Oscillation Frequency Range ⇒ 380k to 1MHz
- Soft Start Function ⇒ 48ms typ.
- Over Current Protection
- Over Voltage Protection

H-Bridge Driver Block

- Internal 2 Channel H-Bridge
- Each Channel Operates Individually
- Over Current Protection ⇒ ±300mA typ.
- Operating Voltage Range ⇒ 7.0 to 35V
- Switching Frequency ⇒ 300kHz max.
- Output Shut Down Control
- Fault Indicator Output

BLOCK DIAGRAM

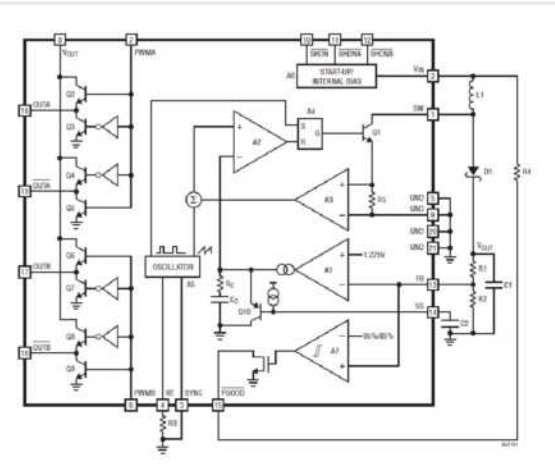


LT3572 (Dual Full-Bridge Piezo Driver with 900mA Boost Converter)

FEATURES

- 2.7V to 10V Input Voltage Range
- 900mA Boost Converter
- Dual Full-Bridge Piezo Drivers
- Programmable Switching Frequency from 500kHz to 2.25MHz
- Synchronizable Up to 2.5MHz
- Soft-Start
- Separate Enable for Each Piezo Driver and Boost Converter
- Available in a 4mm × 4mm 20-Pin QFN Package

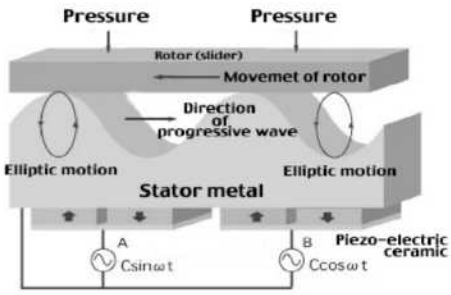
BLOCK DIAGRAM



Rotary Type Ultrasonic Motor(Non-Magnetic Type)

FEATURES

- Low speed with high torque without a gear reduction
- No heat is generated when paused with high positioning control
- Simple, slim and lightweight design
- High responsiveness and quiet operation
- Actuator for surveillance cameras



FEATURES

- Micro actuator and manipulators for medical systems, robot, camera and process engineering
- Stage for precise position controlling of semiconductor and weapon system
- Actuators for intelligent FA, OA and HA

SPECIFICATIONS

	UMR40	UMR60
Shaft Dia.(mm)	Φ6	Φ8
Dimensions(mm)	44 × 44 × 19	65 × 65 × 22
Weight(g)	91	270
Drive Frequency(kHz)	34~37	40~44
Drive Voltage (Vrms)	120	120
Rated Speed(rpm)	80	100
Rated Torque(kgf·cm)	0.8	2.5
Max. Torque(kgf·cm)	>1.8	>7
Holding Toque(kgf·cm)	>2	>10
Encoder(p/r)	1,000	
Allowable temperature rising (℃)	(On surface of the motor) 55 ℃	
Operating temperature rising (℃)	-10 ~ 50	
Storage temperature rising (℃)	-20 ~ 60	
Life time (hrs)	3,000	

Nothing Is Better Than This Piezo Actuator : TULA

World Best
Ultra-high Precision PIEZO ACTUATOR
Since established in 2000 Nov.

Customer Satisfaction !
Customization !
Optimization !

AF(Auto Focus) Module
Know-how through many kinds of market

Surveillance

Logistics fields

CCTV, Security

Medical fields

Smart phone fields

PT-XDT50-S05C

PT-XDT70-S10F

Customer Satisfaction !
Price Competitiveness !
Optimization !

STAGE series

Full strokes	5mm ~ 15mm
Dimensions	29X22.2X7.5mm, 31X24X10mm, etc.
Vertical load	<10g ~ <20g
Speed	>10mm/sec.
Application Fields	All devices that needs Automation, Semiconductor equipment CCTV, Medical equipment, Beam shutter, Laser beam, Inspection device, Mini robot, Braille module

PT-XDT70-S10C

PT-HQT50-S04C

PT-XDT70-S15C

XST50-S06C
Popular Standard Stage

Standard Product

AF Module
Stage Module

Customization

Logistic Device
Medical Device
Cosmetic Device
Surveillance Device
Semiconductor Device
⋮

Others

OIS(Optical Image Stabilizer) Module
Pan/ Tilt/ Zoom Module
Braille / Haptic Module
Camera Module
⋮

Nothing Is Better Than This Piezo Actuator : TULA

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PIEZO TECH

PIEZOELECTRIC TECHNOLOGY CO.,LTD.

2301

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