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

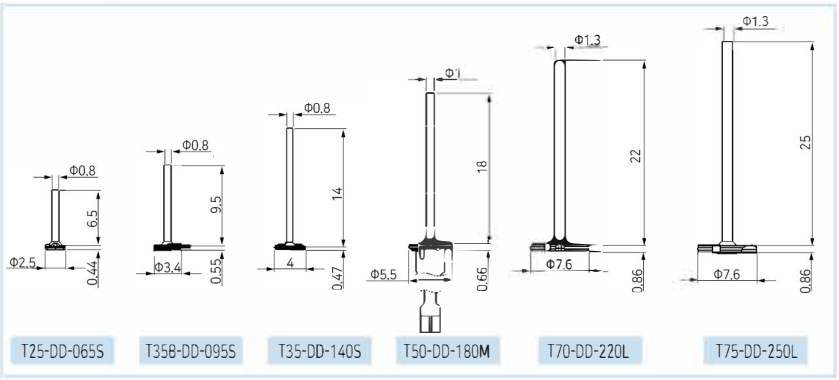
Features

- 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)	Φ 0.8	Φ 0.8	Φ 0.8	Φ 1.3	Φ 1.0	Φ 1.3	Φ 1.3
	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.

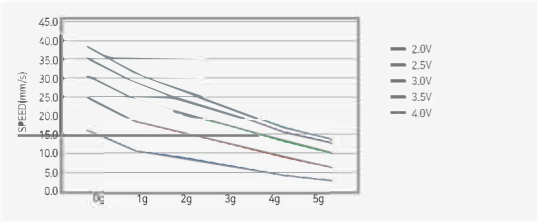
3 BB : layer of ceramics.

Specification

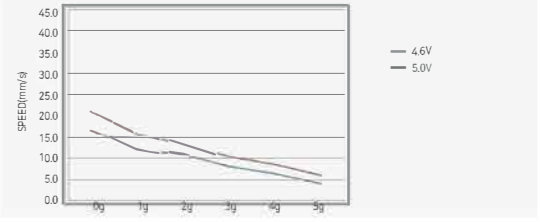
	SPECIFICATIONS	TM3507
Mechanical Characteristics	SPEED(NO LOAD)(㎜/S)	> 10
	MAX-THRUST(GF)	> 7
	HOLDING-FORCE(GF)	40 ~ 70
	STROKE(㎜)	< 8
	SHAFT LENGTH(㎜)	< 19
Electrical Characteristics	DRIVING FREQUENCY(KHZ)	100 ~ 120
	DRIVING VOLTAGE(V)	2 ~ 6
	POWER CONSUMPTION(MW)	<450 @ 2.5V
Enviroment Condition	OPERATION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

ST GRAPH

TMH ST GRAPH



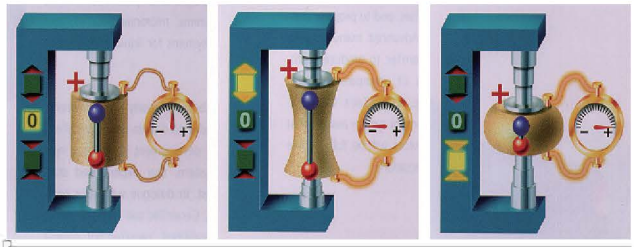
TML ST GRAPH



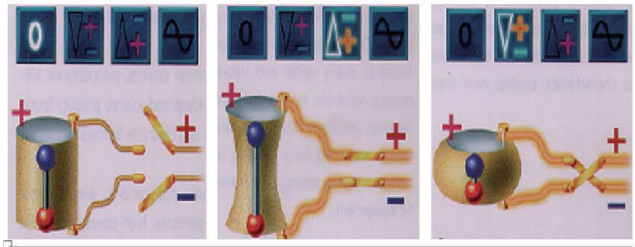
Piezoelectric Actuator Technology

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

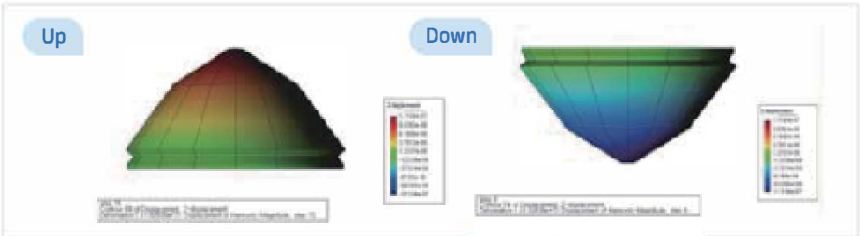


Inverse piezoelectric effect Sij = dkijEk

Operating Principle

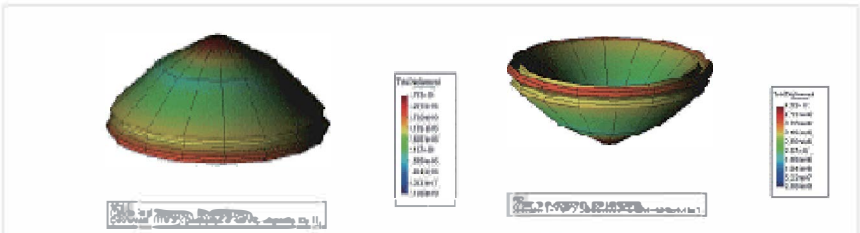
The operating principle of the TULA is explained by the characteristics of the piezoelectricity and Newton's first law. In other words, the TULA exploits the vibration modes of the piezoelectric ceramics, the inertia principle and the contact force of the friction.

Elastic material
Piezoelement



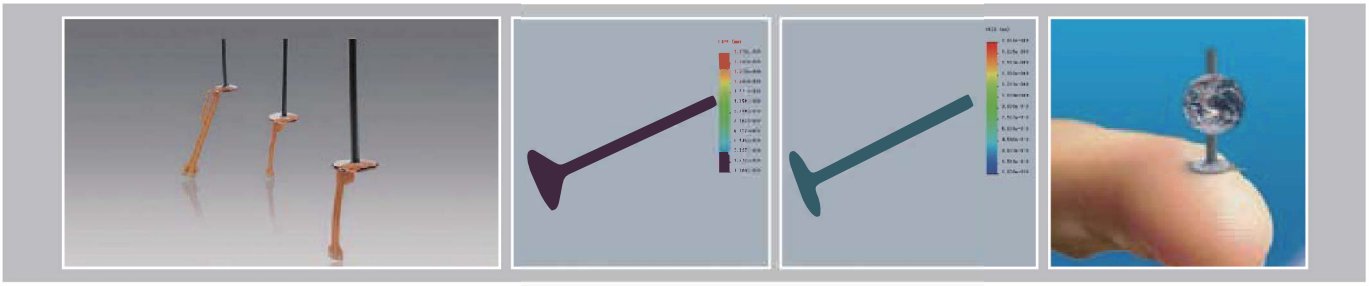
f_r : 114kHz Coupling coefficient : 24% Uni-morph type

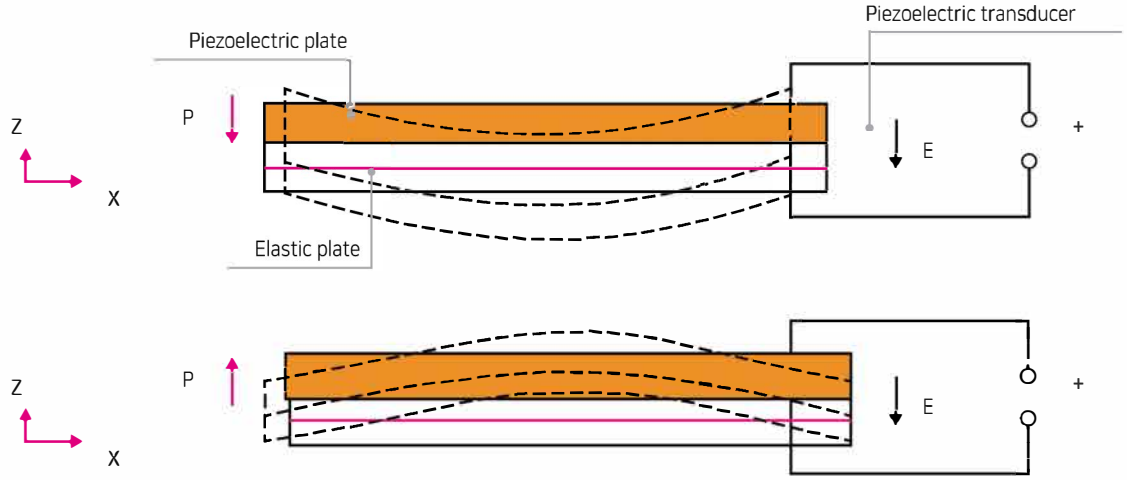
Piezoelement
Elastic material
Piezoelement

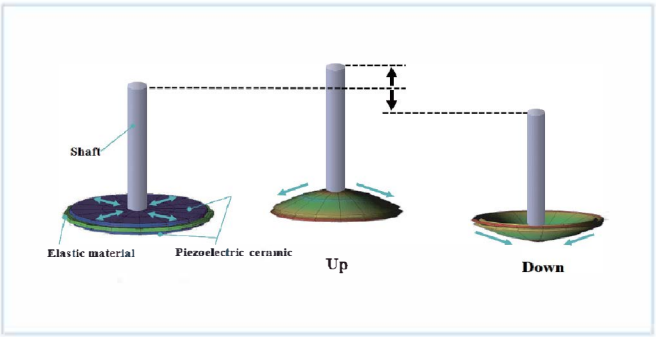


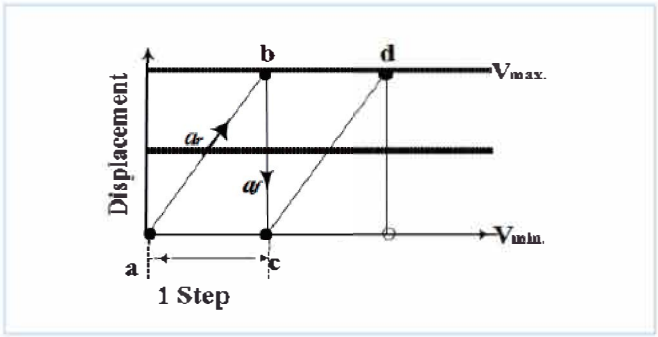
f_r : 128kHz Coupling coefficient : 43% Bl-morph type

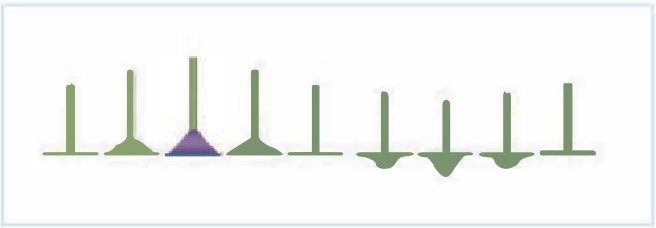
Piezoelectric Linear Actuator









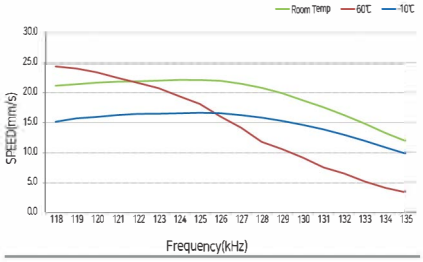


Forward Motion
⇒ Slow forward motion & quick return

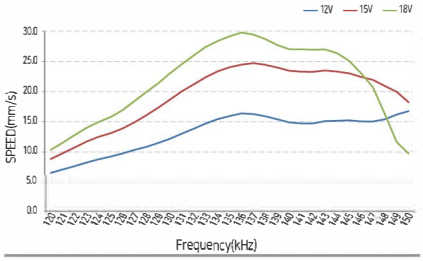
Backward Motion
⇒ Quick forward motion & slow retum

Typical Charateristics of TULA

Frequency Speed Graph



Volt Graph



ST Graph