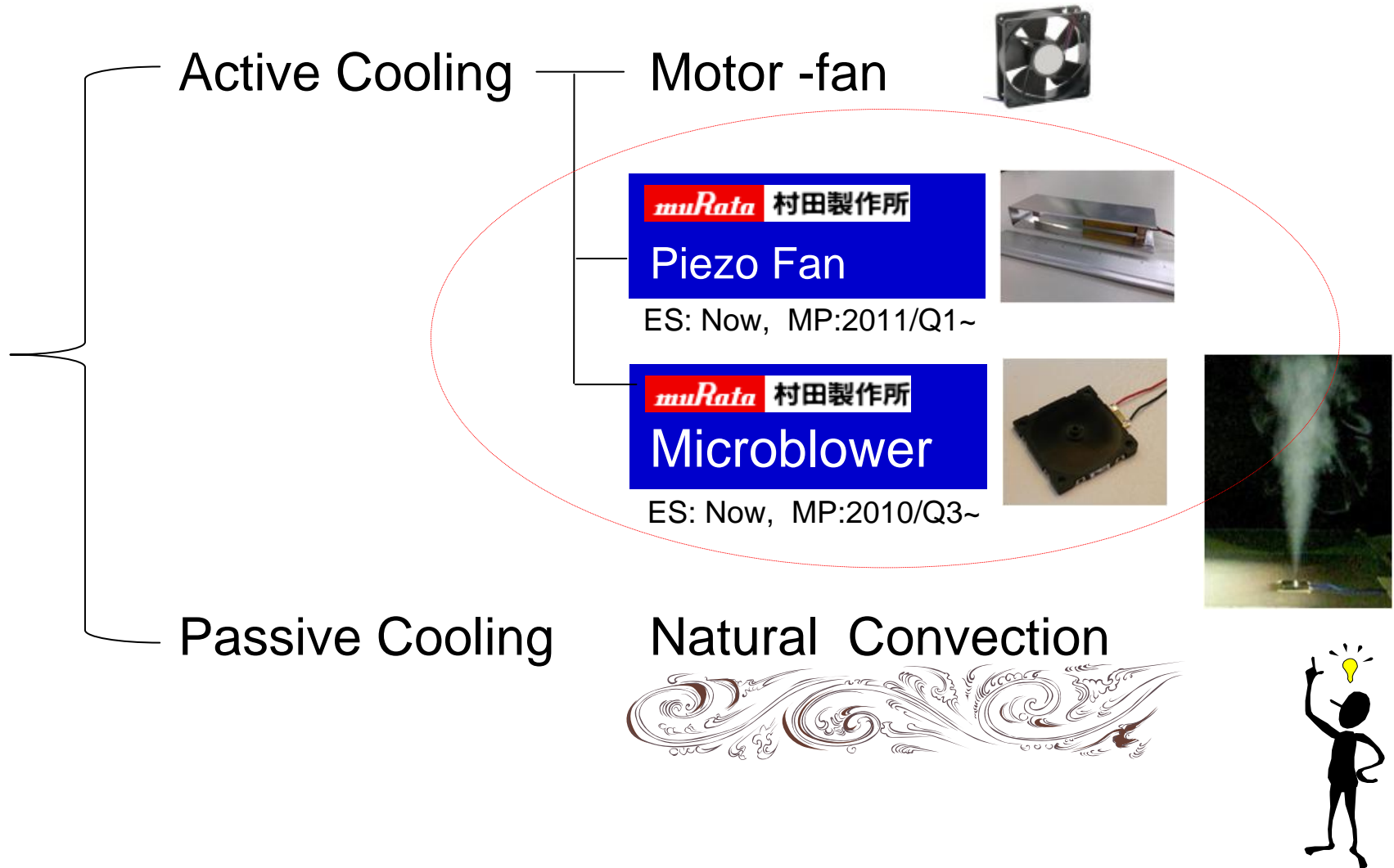


# Micromechatronics products



# Cooling Solution



# Application of Micromechatronics Products

Next Generation Energy System

**Fuel Cell**



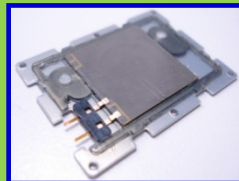
DMFC

(Direct methanol Fuel Cell)

**Microvalve**



**Micropump**



**Microblower**



**Air Pump application**

Air Fresh



Toys/Game, etc



**Air Cooling Device**

Small/Mobile Equipment



Micro Projector



Security Camera



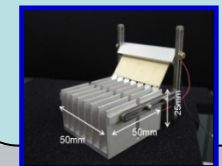
LED Lightning

CPU



NETTOP PC  
NETBOOK

**Piezo Fan**



# Profile of Microblower



P/N: MZB1001T\*\*

## ◆ Feature

- Small and thin (20 × 20 × 1.8mm)
- High output pressure ( $\geq 1\text{kPa}$ )
- Low power consumption

## ◆ Application

- **Air cooler** for compact equipments such as DVC, DSC, and UMPC, etc
- **Air pump** for Fuel Cell, Gas Sensor, Ionizer, Fragrance, etc.

## <Market trend and needs>

**Thermal technology is increasing its importance, especially in small/compact electronic equipments. Customers are looking for a smaller cooling device than DC fan.**



Gas Sensor

(ex. Reflow Checker)



LED Cooling

(ex. Micro-projector)



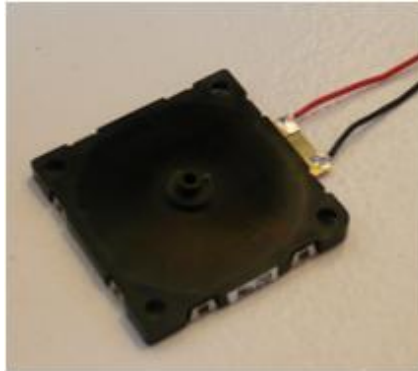
PC Cooling

(ex. Net Top Book)

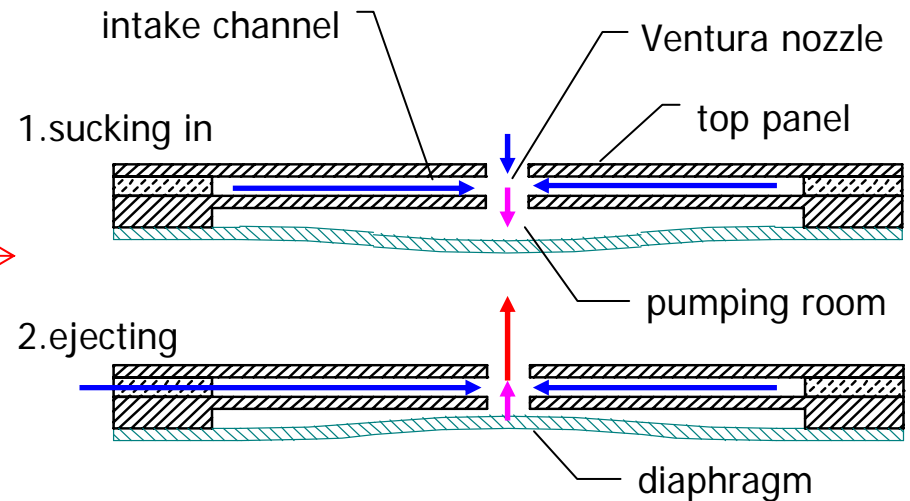
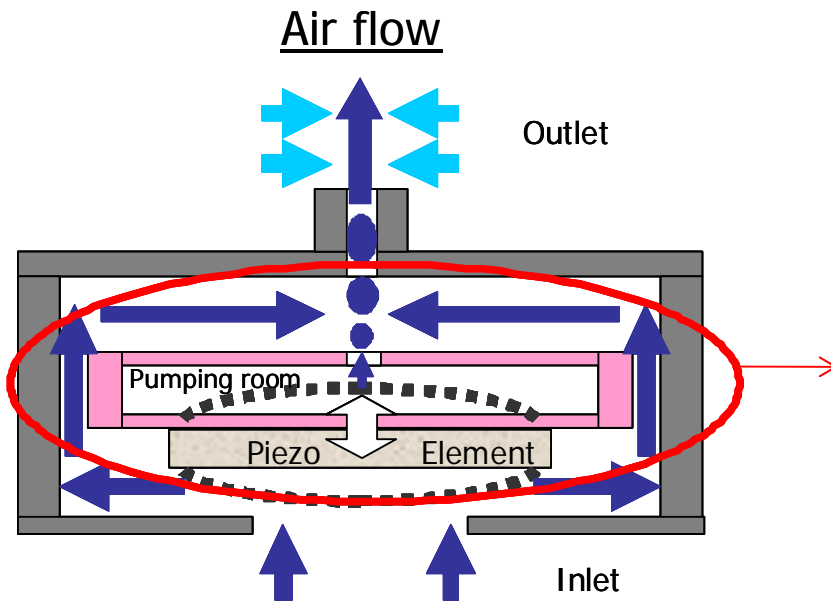
Air Cooling & Air pump  
**Microblower Technology**



# Feature of Microblower

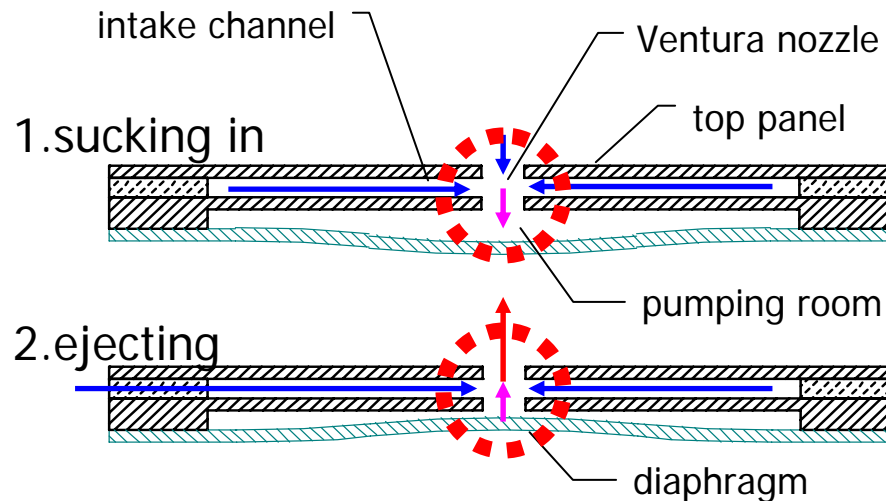


Item	Specification
Driving Frequency	25KHz
Air flow	0.8l/min(@15Vpp)
Static pressure	<b>1.5kPa</b>
Size (Excl Nozzle Height)	<b>20x20x1.85mm</b> <b>(Nozzle Height 1.6mm)</b>



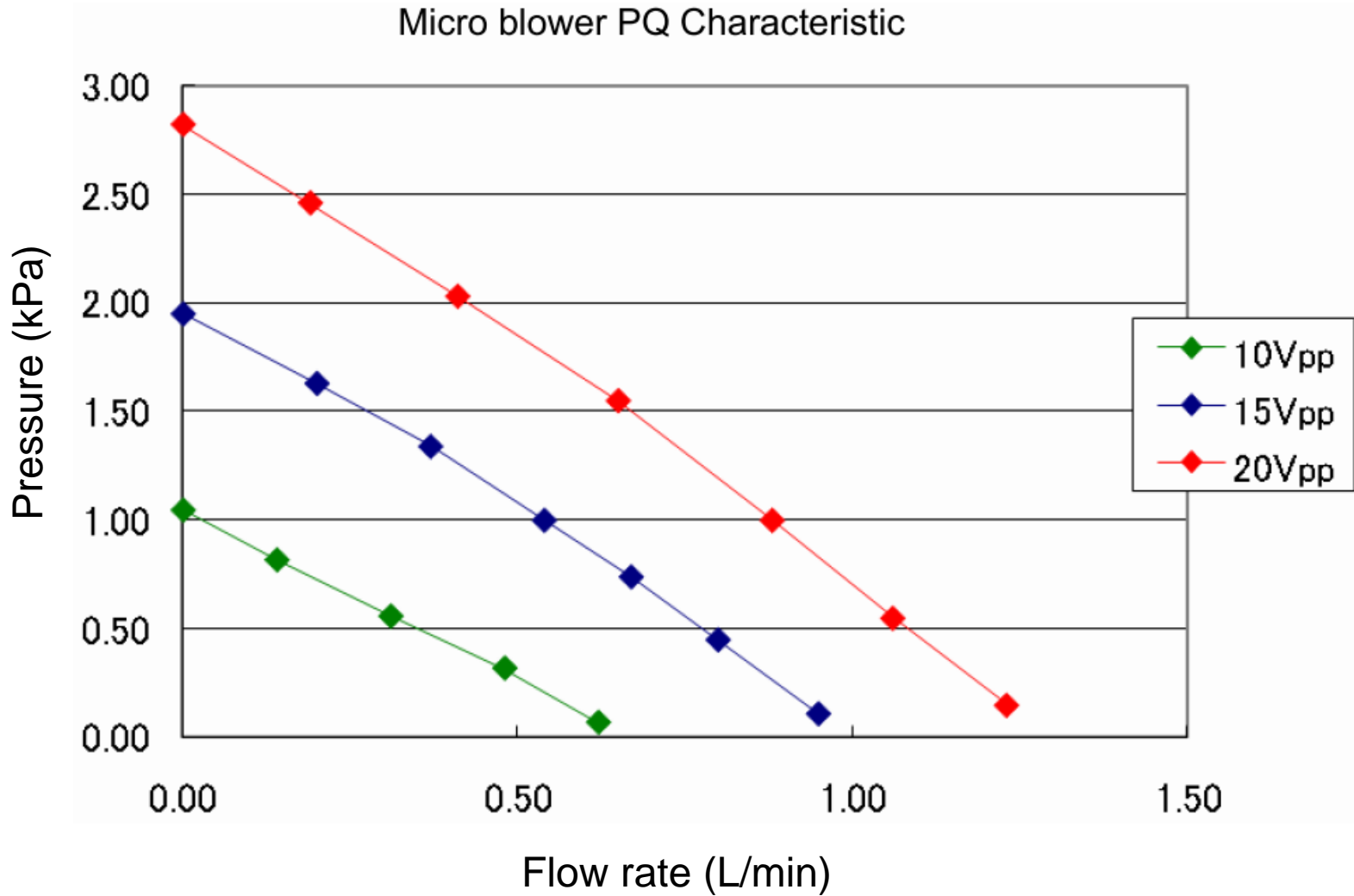
# Principle of operation

Air flow with high velocity generates lower pressure to suck air around, which makes real net flow ( Bernoulli's theorem )



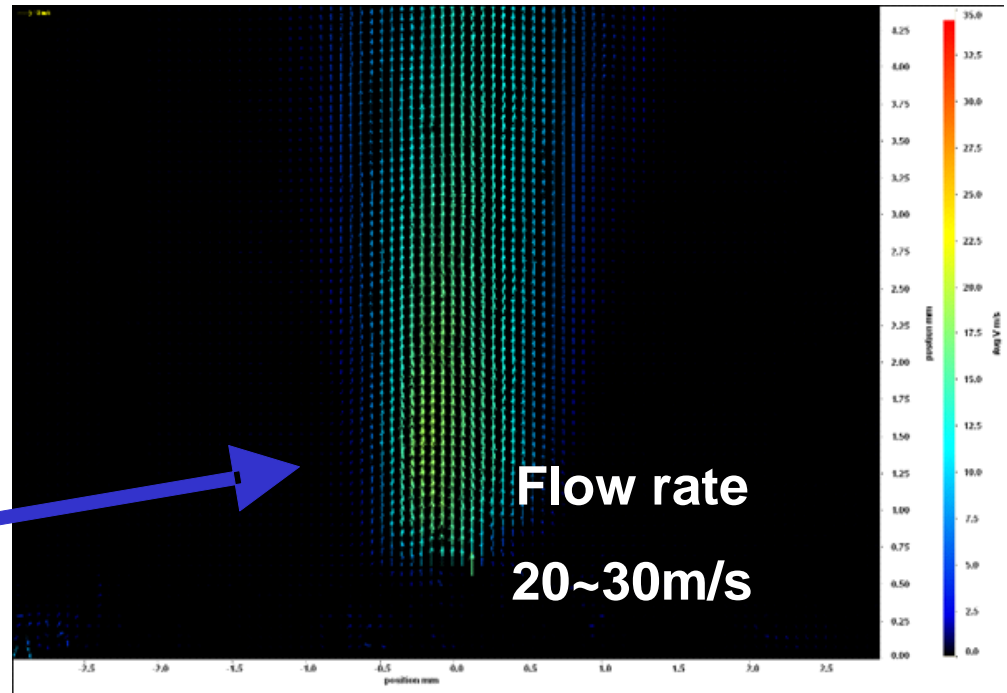
High velocity -> Low pressure -> Suck air around -> Push out to outlet

# P-Q Characteristics





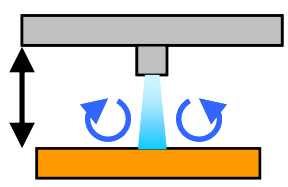
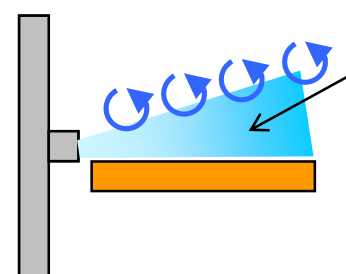
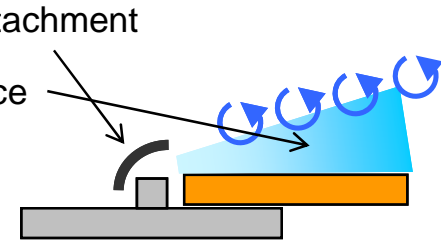
# Features



**High Pressure** : Air Pump, Cooling Narrow pitch Mounting

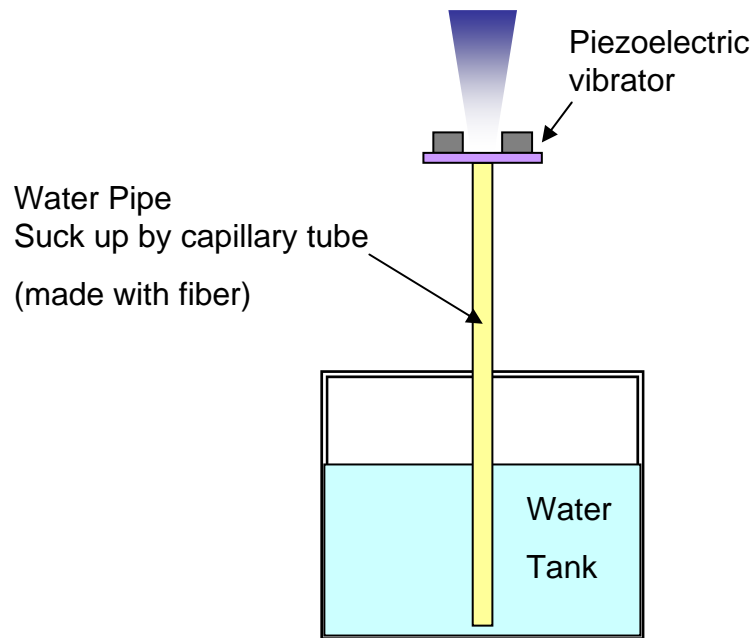
**High Flow Rate** : Local cooling, Diffusion

# Cooling methods

Vertical	Horizontal -1	Horizontal -2
		
<ul style="list-style-type: none"> <li>- Minimizing mounting area</li> <li>- Certain distance is necessary to enhance cooling performance.</li> </ul> <p>(Cooling only by the amount of flowing from the blower if the distance is too close)</p>	<ul style="list-style-type: none"> <li>- Cooling effect is enhanced if there is some space above a material.</li> <li>- Effect of increasing Net amount of flowing.</li> <li>- Making thermal boundary thinner owing to flowing speed.</li> <li>- Not so adequate for low profile mounting.</li> </ul>	<ul style="list-style-type: none"> <li>- Cooling effect is enhanced if there is some space above a material.</li> <li>- Lower profile mounting is possible.</li> <li>- Attachment is necessary.</li> </ul>

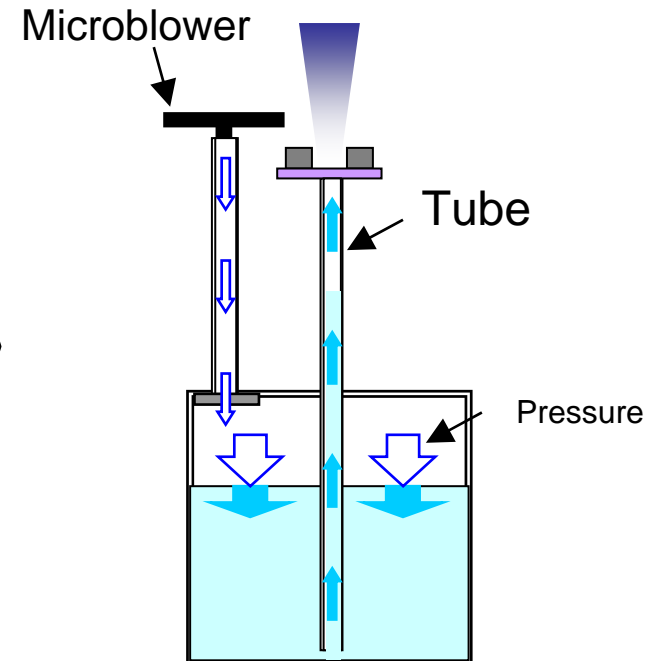
# Application of Microblower

## Current



Water supply is not stable  
due to capillary effect

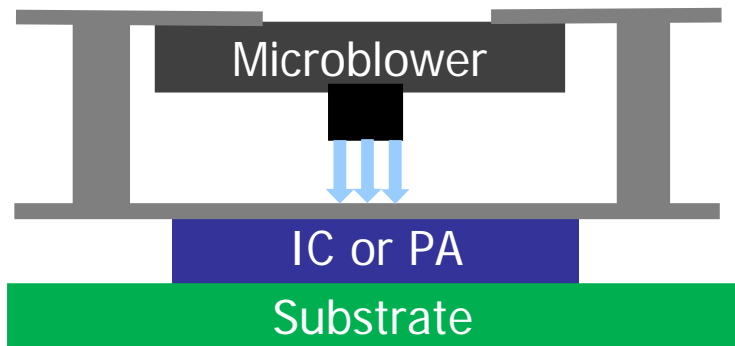
## New Method w/ Microblower



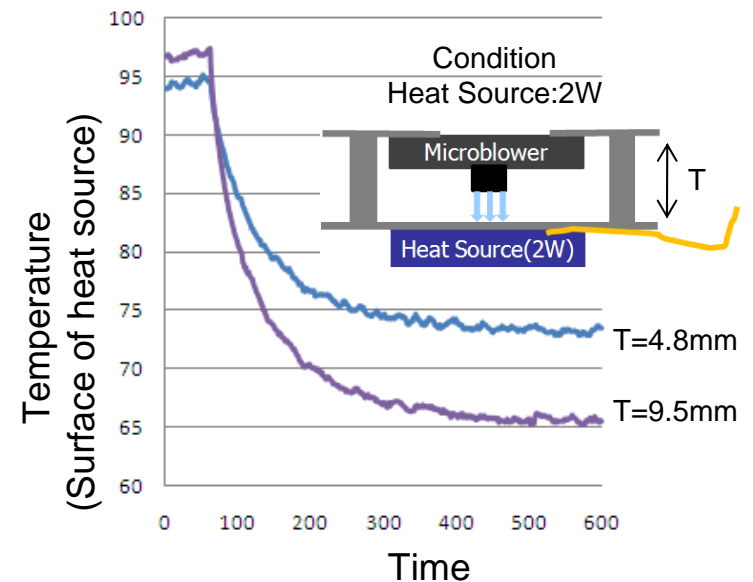
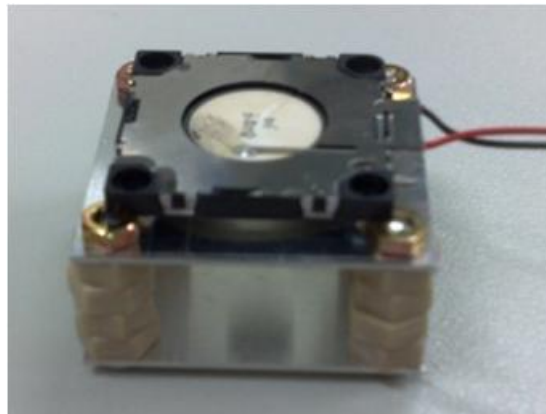
Water supply is stable and  
quick start can be achieved.

# Spot Cooling for PA/IC with Microblower

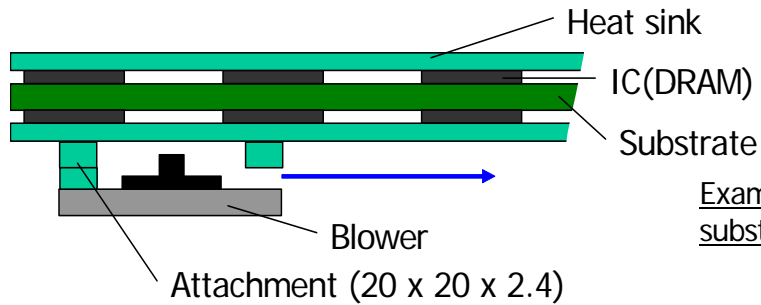
## •Piezo Microblower



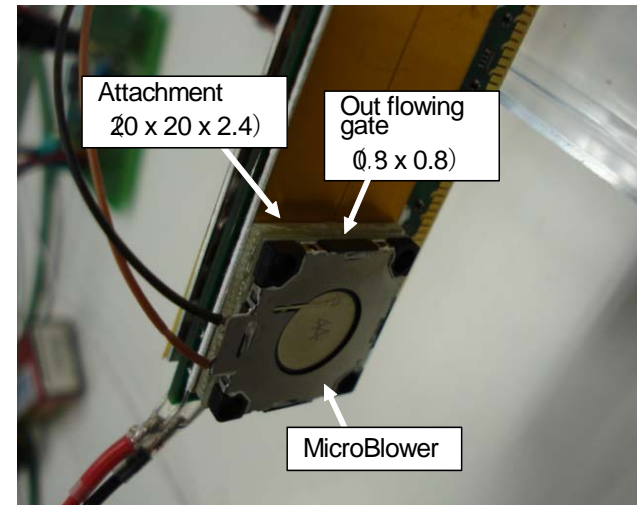
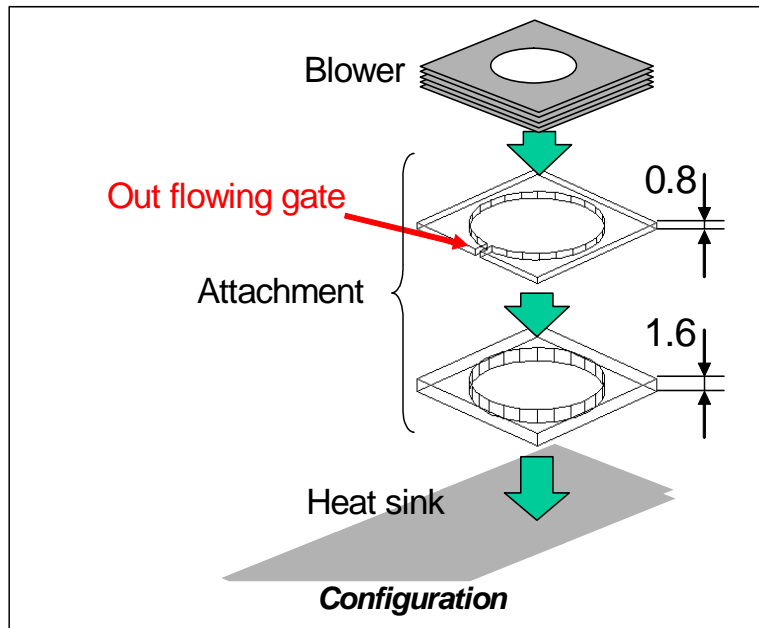
20.0x20.0x1.65mm



# Example of (Cooling Memory Module)



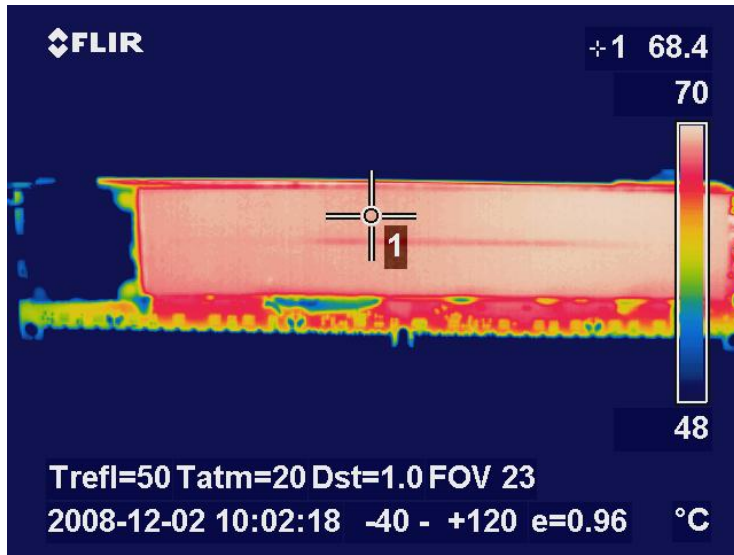
Example of the method to make flowing direction toward a substrate using minimum thickness of attachment.



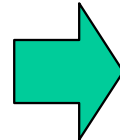
*Blower and attachment*

# Test Result

Power: 6.8W



Thermal temp. of surface of Heat sink  
(Before blower operation)



-17K  
lower



Thermal temp. of surface of heat sink  
(Blower is under operation)

Thermal resistance

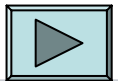
$R_{hs} = 6.3 [K/W]$

↓

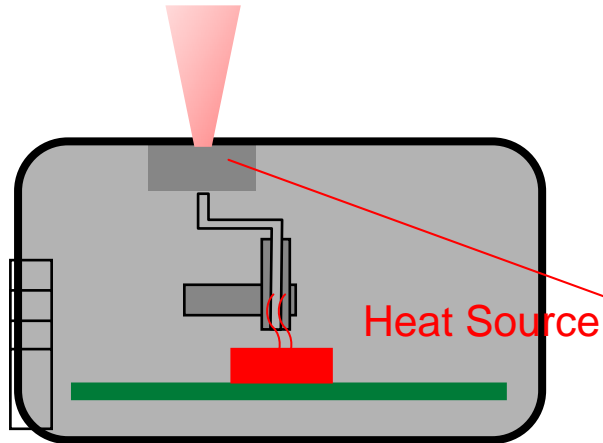
$R_{hs} = 3.8 [K/W]$

40% lower

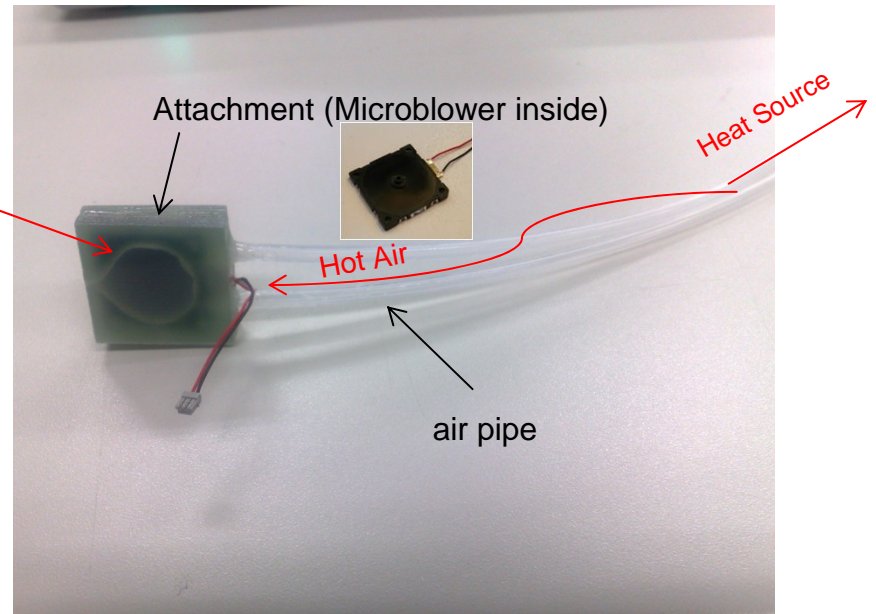
We can see around 17k temp. lower in open space



# Aspiration of hot air

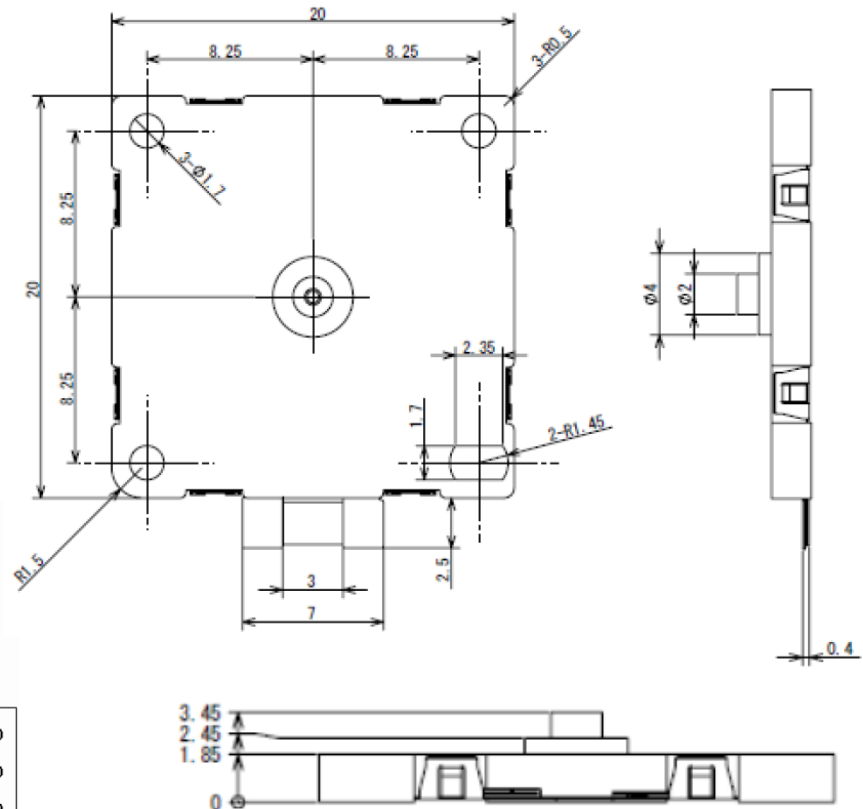
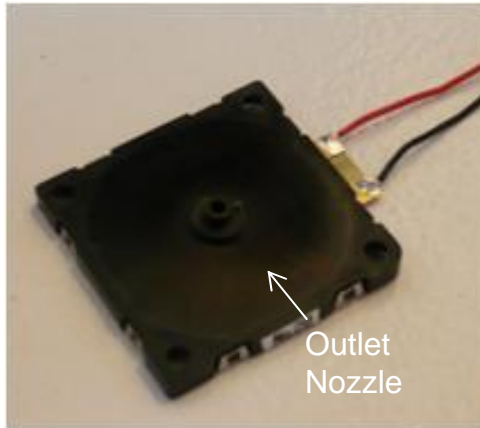


Aspiration of hot air from deep area to cool down

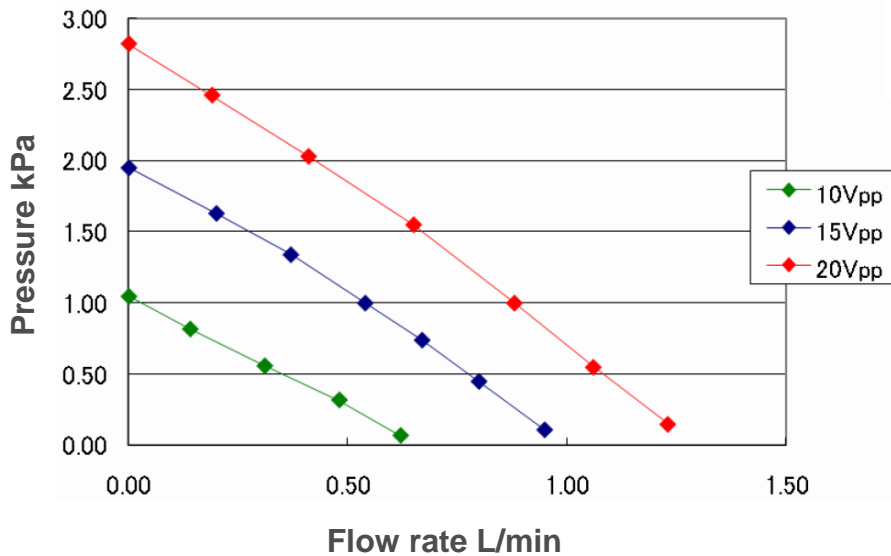


Example : handmade attachment  
(Microblower +air pipe)

# Appearance of Microblower

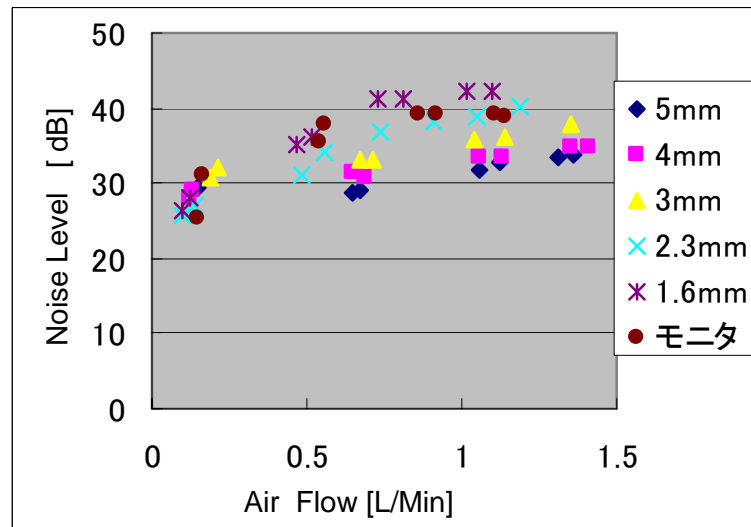
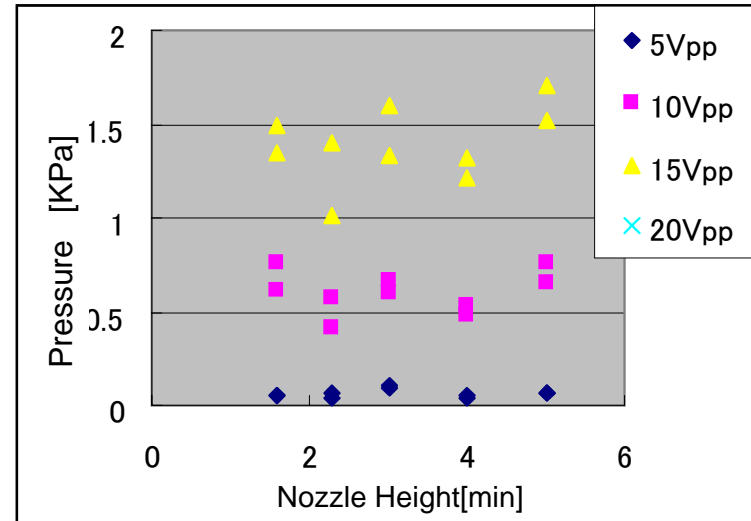
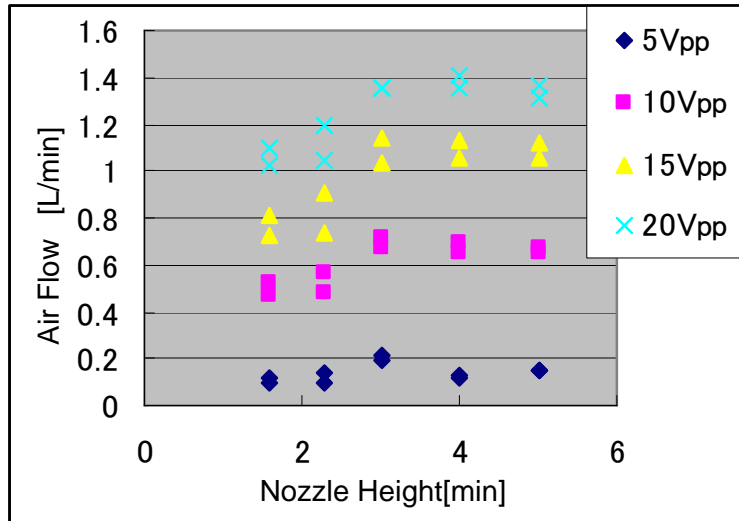


Micro blower PQ Characteristic





# Test Result



# MICROBLOWER Driver

# MICROBLOWER's Driver Board

Control Board Type1

Control Board Type2(USB Type)

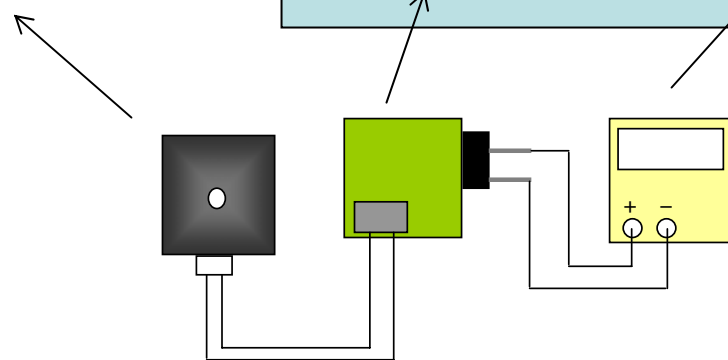
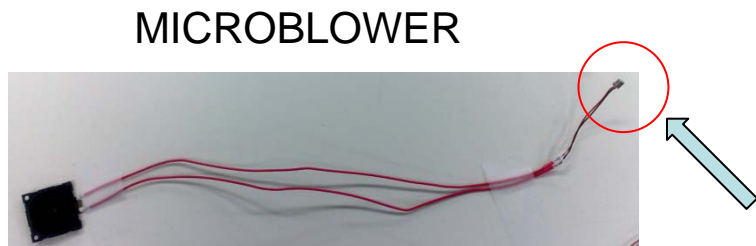
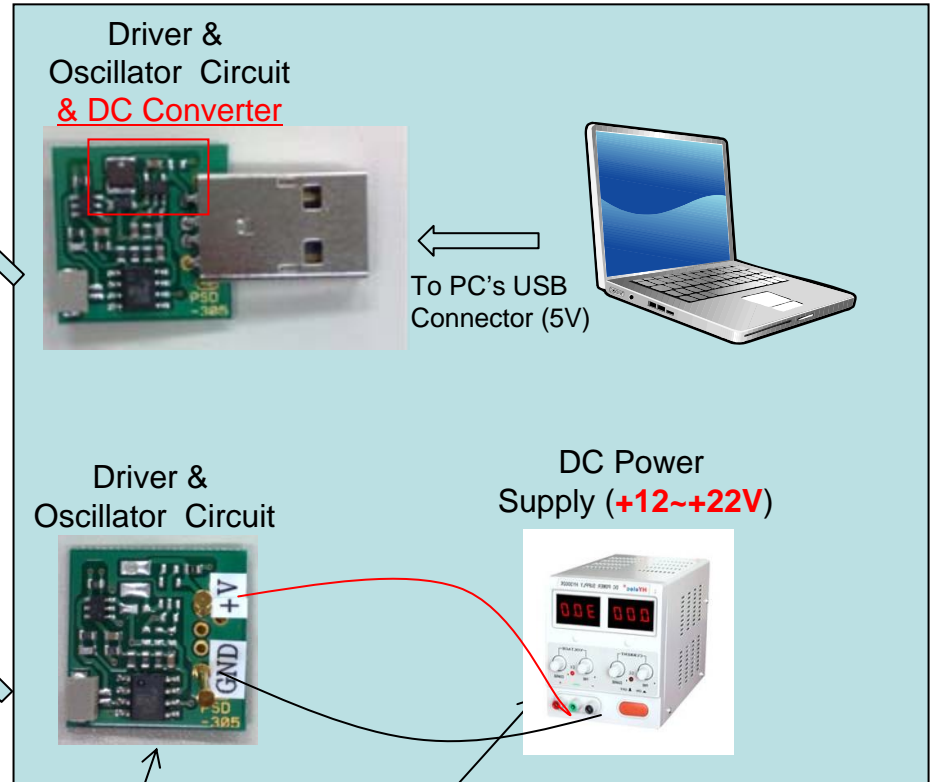
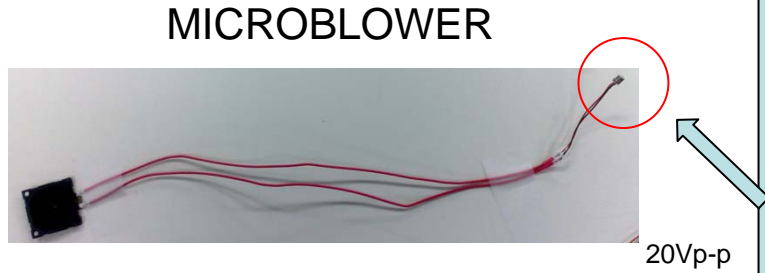


P/N:MZBD001

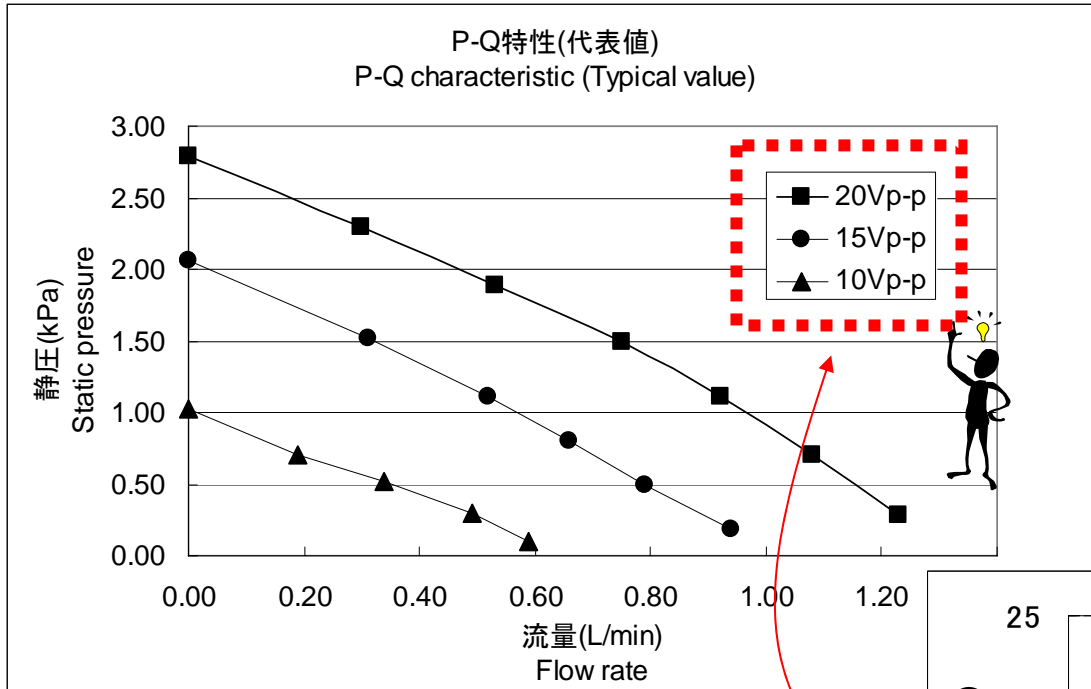
Note: only for evaluation purpose

(we don't have this product in mass-production.)

# MICROBLOWER Sample (How to connect)



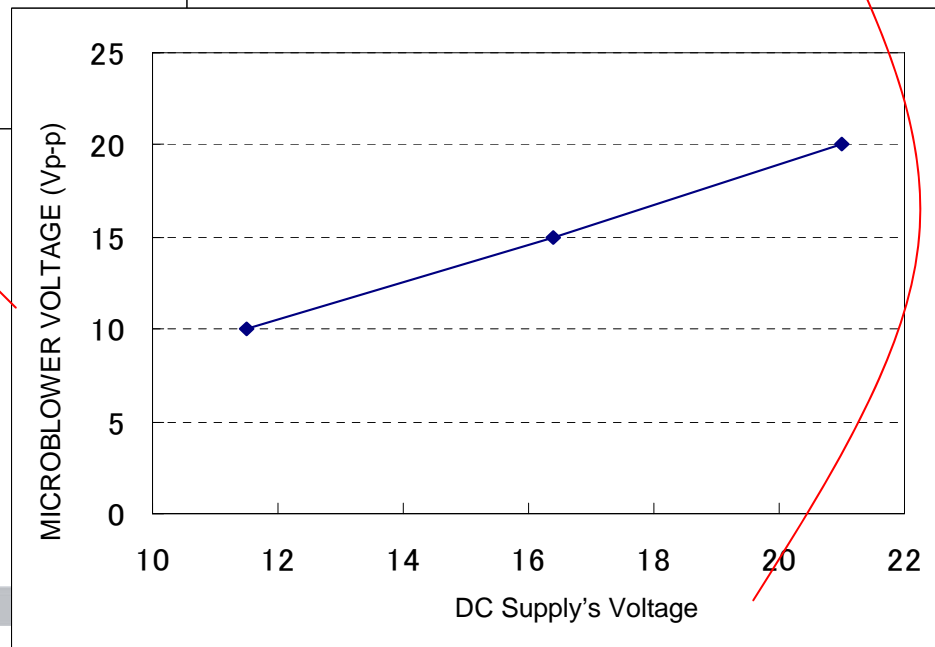
# MICROBLOWER Sample (How to apply voltage)



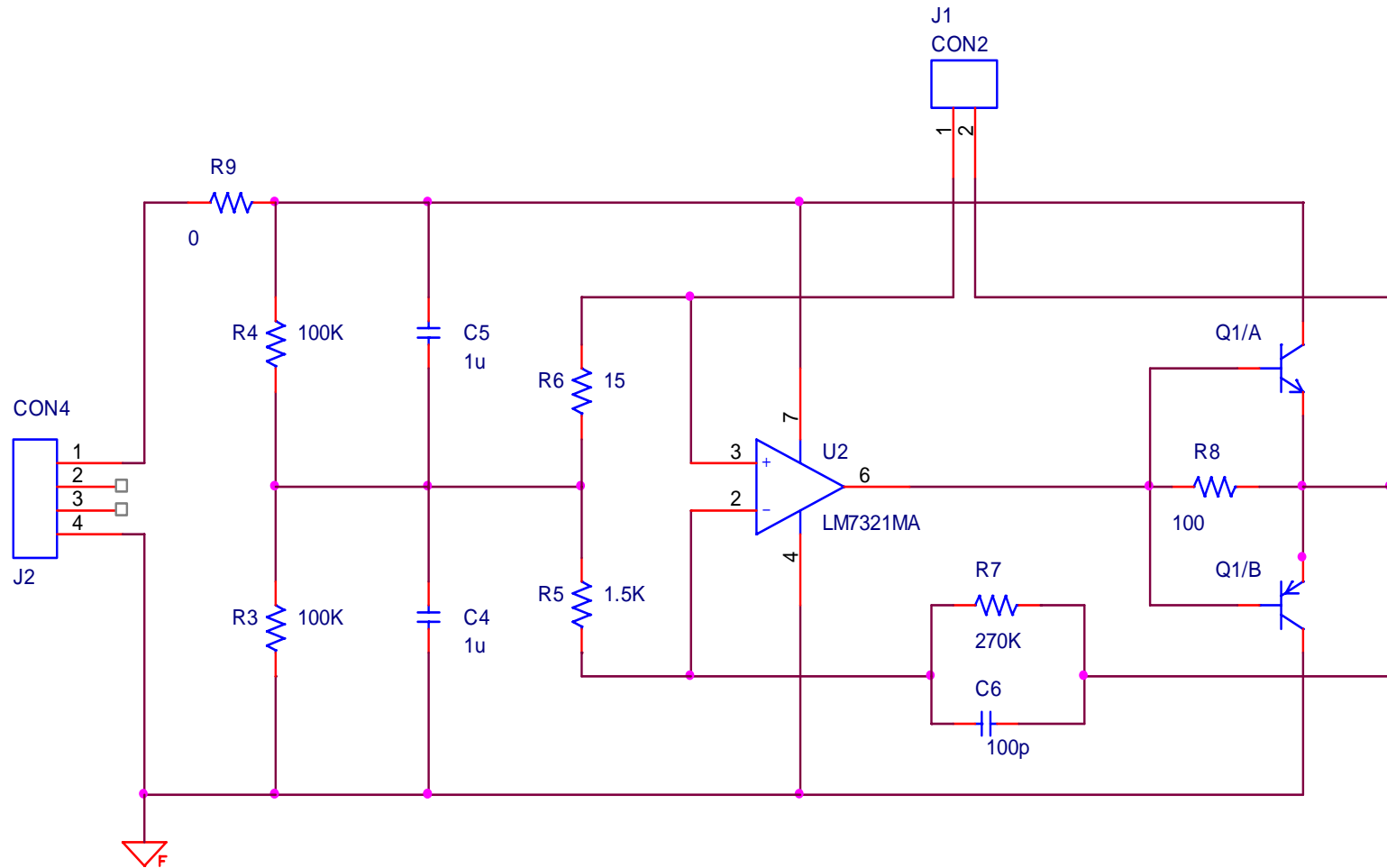
Driver & Oscillator Circuit



DC Power Supply (12~22V)



# Driver Circuit (Type1)



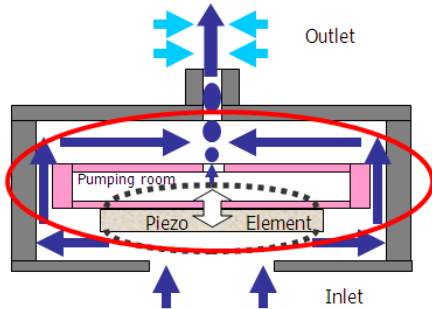
# Driver Part List

U2	Op Amp	LM7321 MA	National Semiconductor	GBW=20MHz RailtoRail IN/OUT
Q1	Transister(PNP/NPN)	HNI B04F	Toshiba Semiconductor	I <sub>c</sub> =500mA
R3,R4	Chip Resistor 100k $\Omega$	RK73B1 JTTD1 04J	KOA	0.1W
R5	Chip Resistor 1.5k $\Omega$	RK73B1 JTTD1 52J	KOA	0.1W
R6	Chip Resistor 15 $\Omega$	RK73B1 JTTD1 50J	KOA	0.1W
R7	Chip Resistor 270K $\Omega$	RK73B1 JTTD274J	KOA	0.1W
R8	Chip Resistor 100 $\Omega$	RK73B1 JTTD1 01 J	KOA	0.1W
R9	Short Chip	RK73Z1 JTTD	KOA	
C4,C5	Chip Capacitor 1 $\mu$ F	GRM1 88R71 E1 05KA1 2D	MURATA	25V X7R
C6	Chip Capacitor 100p	GRM1 882C1 H1 01 JA01 D	MURATA	50Vdc CH
J1	Connector	SM02B-SSR-H-TB	JST	
J2	USB Connector	317A	Chant Sincere	

# Microblower Reliability Testing



# On-going reliability



Amplitude  $\rightleftharpoons$  Apply Voltage



=> 15000hr by now

試験項目 Examination item	条件 Condition	結果 Result	試験状態 Status
高温放置 Dry heat (storage)	85°C	6000hr/G	継続中 Continue
高温駆動 (CR内) Dry heat operating (in CR)	85°C20Vp-p	10000hr/G	継続中 Continue
湿中放置 High temperature and humidity	85°C85%	3000hr/G	5000時間で劣化 Degradation at 5000h
湿中駆動 High temperature and humidity operating	60°C93%20Vp-p	3000hr/G	完了 Finished
HCT Heat cycle test	-40°C $\rightleftharpoons$ 85°C	6000cyc/G	継続中 Continue
低温放置 Low temperature	-40°C	7000hr/G	継続中 Continue
圧力負荷試験 High temperature pressure driving test	85°C/20V	2000hr/G	完了 Finished
落下試験 Drop test	To 1.5m concrete 6directionx 3times	G	完了 Finished
衝撃試験 Shock test	1500G	G	完了 Finished
振動試験 Vibration test	98m/s <sup>2</sup> (10G)、max amplitude 1.5mm 10~2kHz、Log sweep、 3dir•20min、12cycles	G	完了 Finished

※判定基準: 初期値 $\pm$ 10% G/NG judge : initial value  $\pm$ 10%

Dec.2010

Expected failure mode: Crack of piezo-element (Fatigue breakdown)

END