

# **WISOL 制品介绍**

**Ceramic Actuator Module & Ceramic Touch Sensor**

**WISOL., Co. Ltd.**

2018. 10.

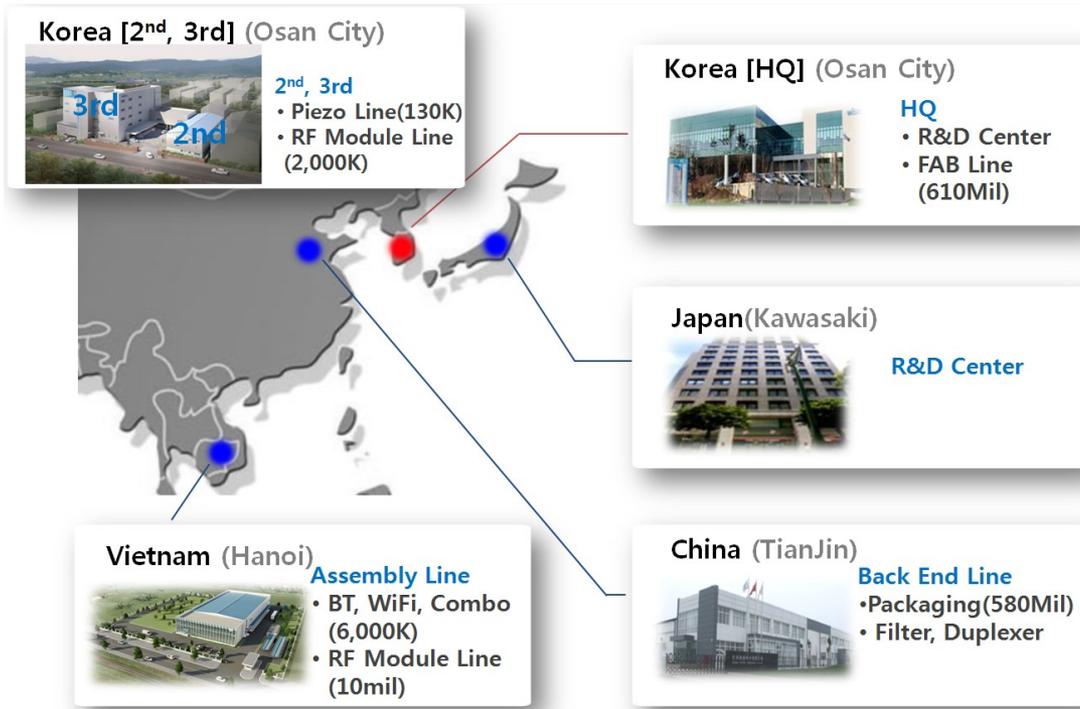
1. **WISOL** 介绍
2. **Ceramic Actuator Module** 介绍
3. **Ceramic Touch Sensor** 介绍

{另附}

- **RCV** 制作 工程
- **Reliability Item**{可靠性验证}
- **WISOL Piezoelectric Business Roadmap**{压电行业应用}



|             |   |
|-------------|---|
| CEO         | 金知浩(JI-HO, KIM )                          |
| Established | 2008年 06月 20日                             |
| Location    | 京畿道烏山市佳长产业东路 28-40                        |
| Employee    | 1,545( KOREA 619, CHINA 633,VIETNAM 293 ) |
| Home page   | www.wisol.co.kr                           |
| 卖出额 (2017年) | 4,450亿KRW                                 |



**RF Module**

**SAW Filter**  
 Essential RF component selectively transmits certain frequency required for mobile communication system.

**Duplexer**  
 RF Component locating near of antenna of mobile phone dividing Receiving signal and sending signal. It enables receiving and sending in one antenna

**Diversity FEM, GLM, SLM, FEMiD**  
 RF component making a packaging RF switch and various SAW filters into one embedded plate with electronic cells.

**Connectivity = IoT**

**WiFi Module**

**Bluetooth Module**

**ZigBee Module**

**Piezo Ceramic**

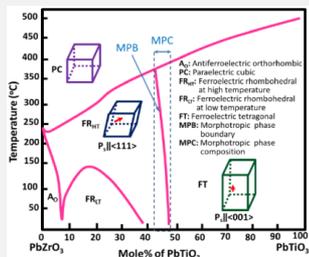
**Ceramic Actuator Module**

- Ultra thin size
- Low directivity, and high responsibility
- No sound hole
- Localized haptic feedback

**Ceramic Touch Sensor**

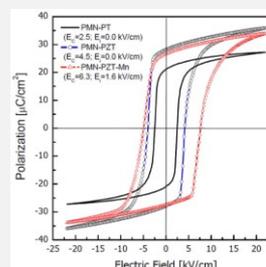
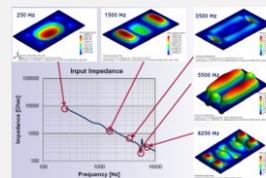
- Realize local haptic feedback
- Applicability for slim digital machinery.
- Light, very thin, Freedom of shape.
- Invisible design

## PZT Material



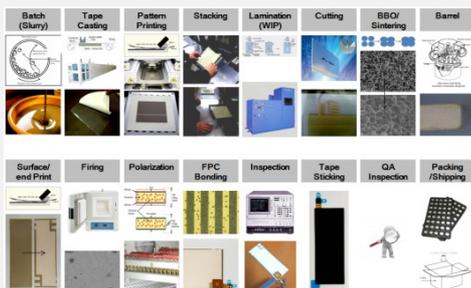
- √. 自体 PZT Powder 保有
- √. Material 设计/改善技术

## Design



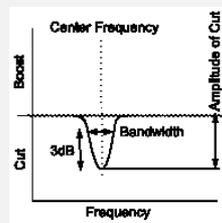
- √. 性能 最优化 Simulation
- √. 性能/信赖性 最优化 构造 设计

## Process



- √. Thick Film Process 技术 (国内最好)
- √. Ceramic/电极 Matching, 大面积烧成技术

## EQ 音质最优化

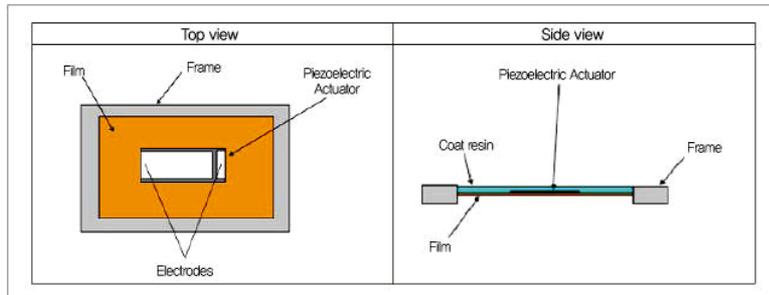
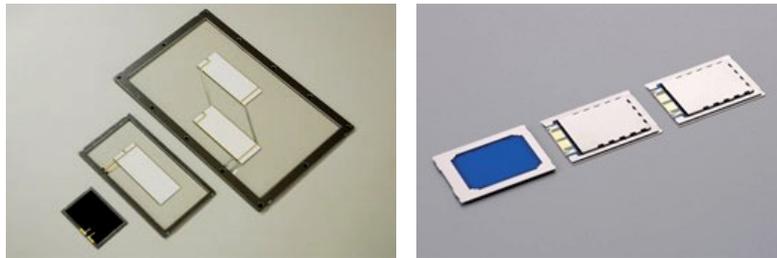


- √. 通过 EQ 音频性能最优化



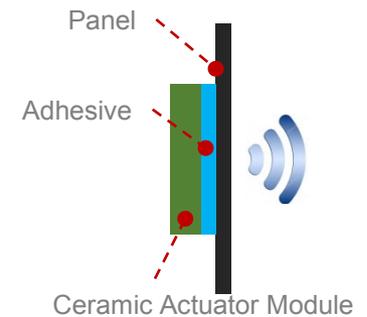
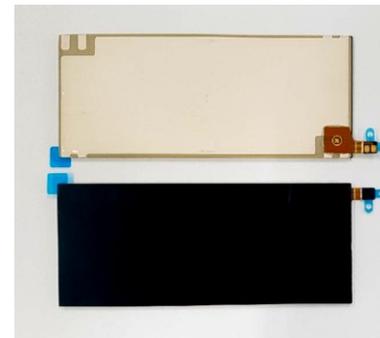
## 压电 Speaker 种类

### Piezoelectric Speaker Module



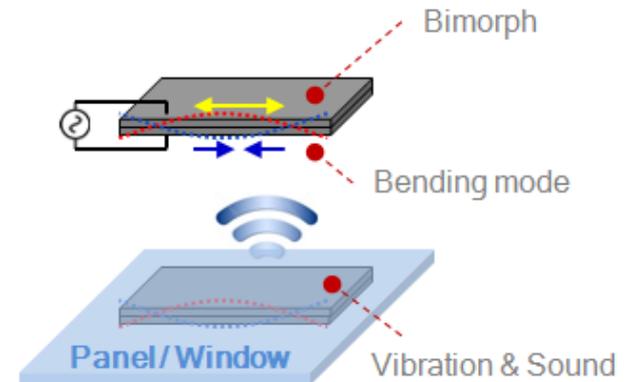
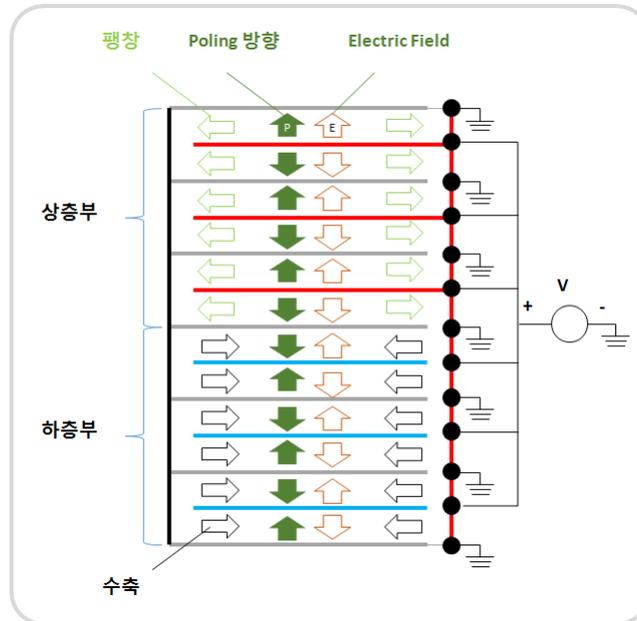
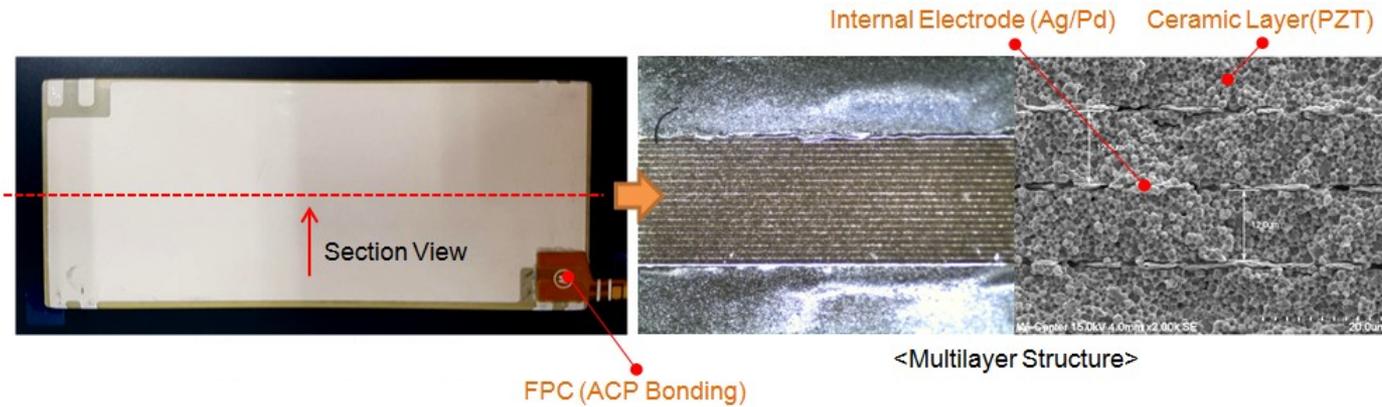
- 需要振动盘及 Frame 的构造
- 需要额外的 Sound Hole
- 根据SET构造条件不同 音响特性影响 少

### Piezoelectric Actuator Module (WISOL)



- 不需要振动盘及 Frame的构造
- OLED 等 Display Panel 起到振动盘的作用
- 不需要 Sound Hole 的构造
- 根据SET 构造条件不同音响特性影响 大

## Ceramic Actuator Module 驱动原理

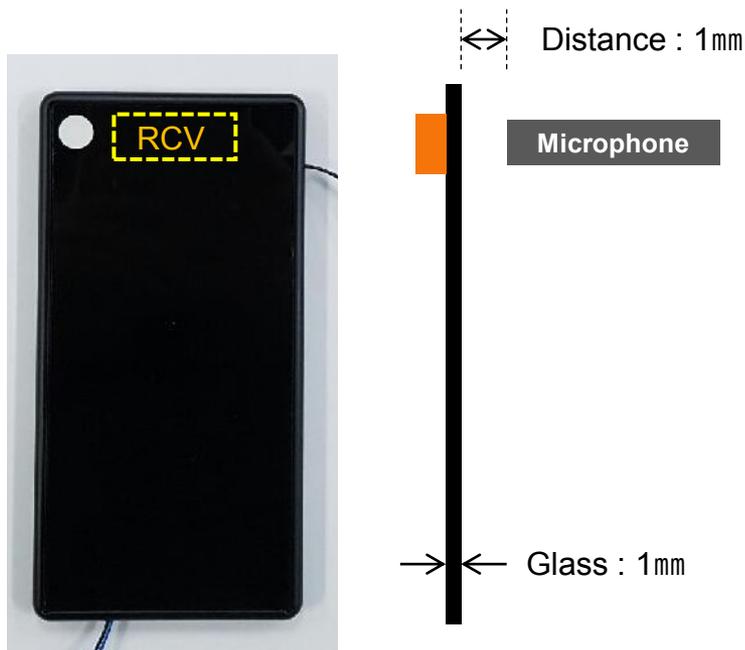




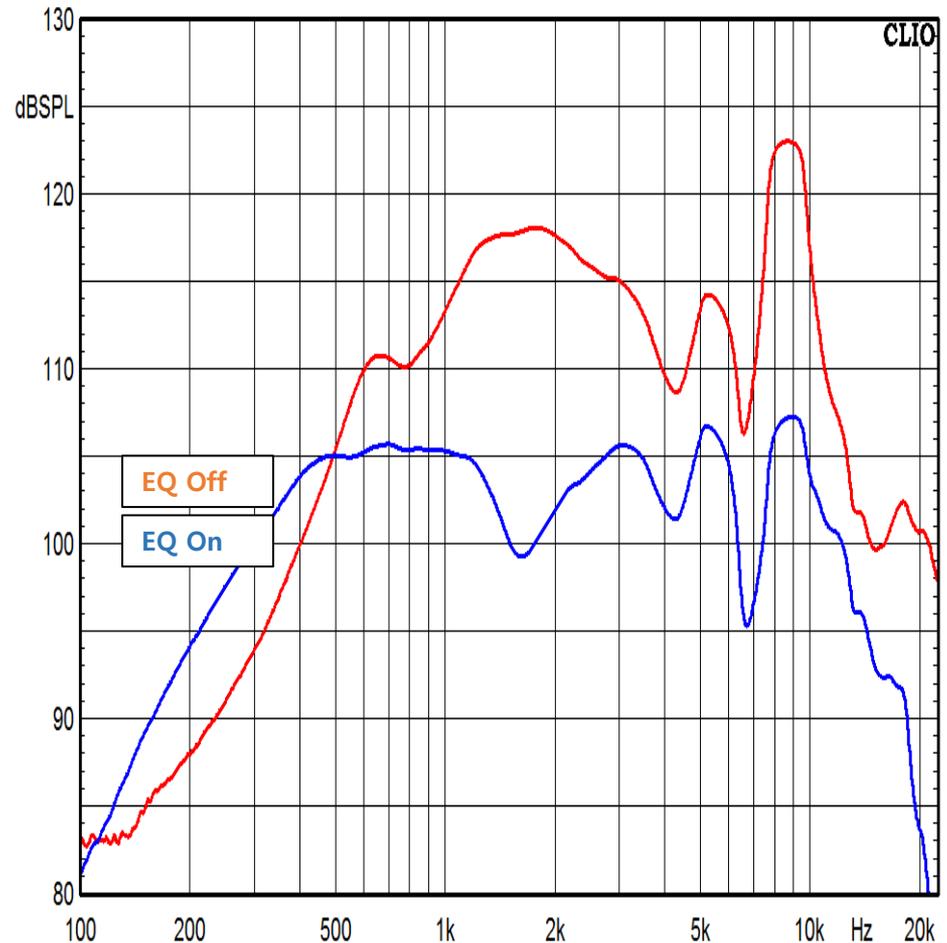
## RCV用 Ceramic Actuator Module 性能

### ◆ RCV 结构 及 测定环境

- √. Size : 18.0x4.0x0.8mm
- √. Capacitance :  $1.8\mu\text{F} \pm 20\%$  ( $1V_{\text{RMS}}$  at 1kHz)
- √. Driver IC : TI社 LM48560
- √. CLIO acoustic measurement system



<Measurement Condition>



<Sound Pressure Level of RCV>

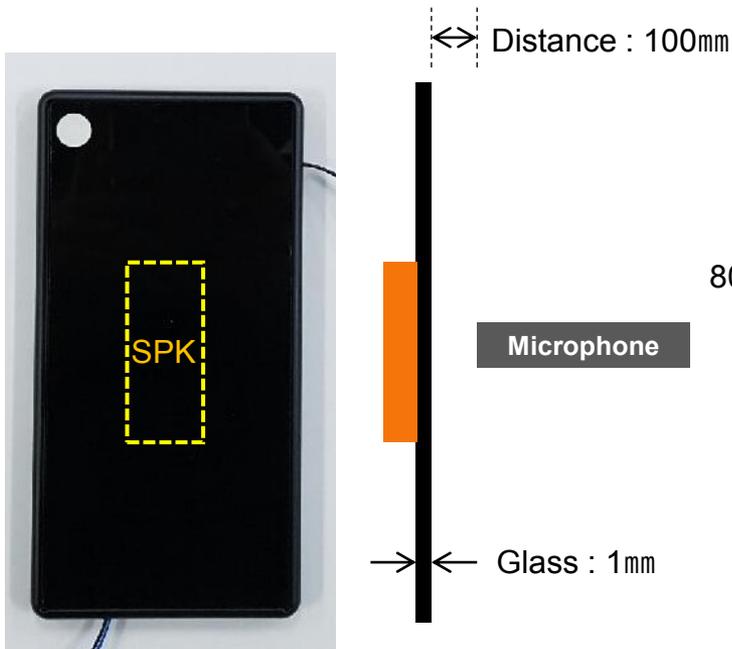




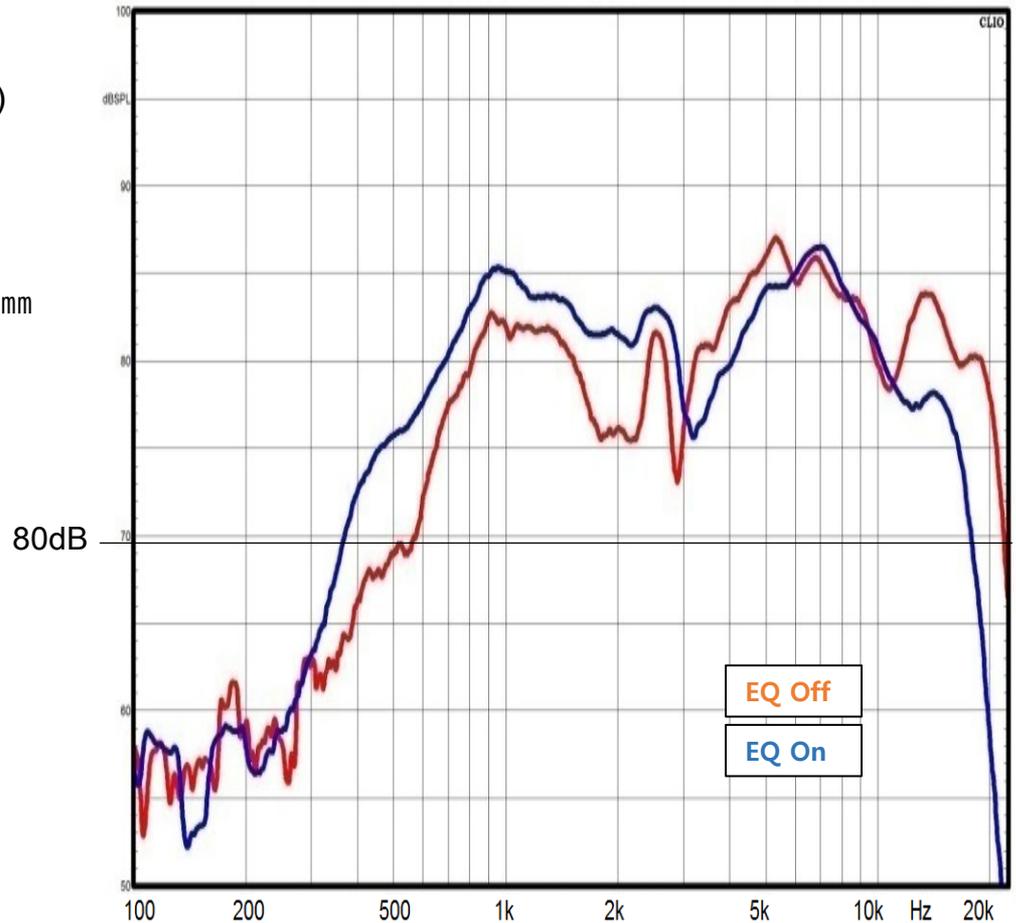
## Speaker用 Ceramic Actuator Module 性能

### ◆ SPK 结构 及 测定环境

- √. Size : 46x17x0.45mm
- √. Capacitance :  $3.2\mu\text{F} \pm 20\%$  ( $1V_{\text{RMS}}$  at 1kHz)
- √. Driver IC : TI社 LM48560
- √. CLIO acoustic measurement system



<Measurement Condition>

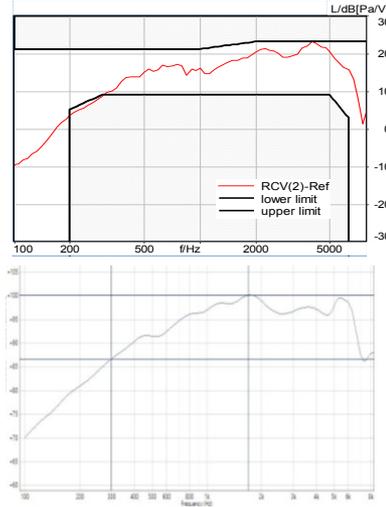


<Sound Pressure Level of Speaker>



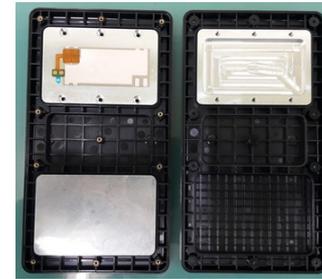
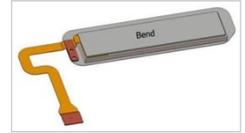
## Performance (性能)

3GPP Wideband 性能确保  
↓  
一般 RCV 同等性能



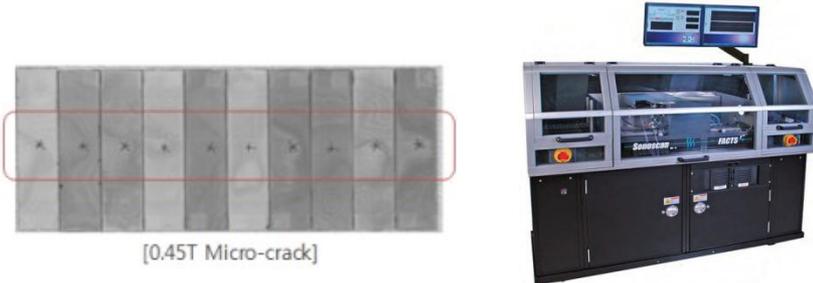
## Drop (机械性 信赖性)

落下, 多重冲击, Drop 信赖性确保  
↓  
保护 强化 构造



## Crack (细微 裂纹)

内部 Defect 完美检出 (SAT 超音波全数检查)  
↓  
细微裂纹, De-lamination, Void 检出



## Rework (再作业性)

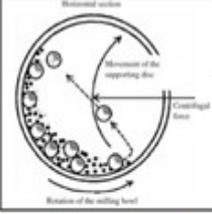
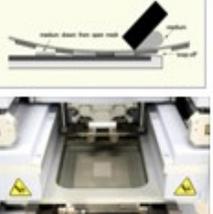
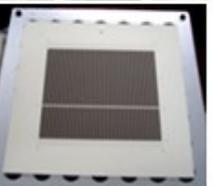
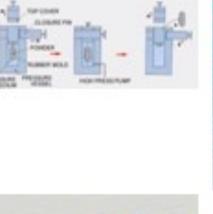
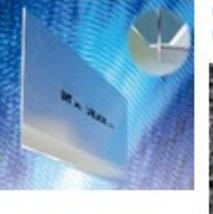
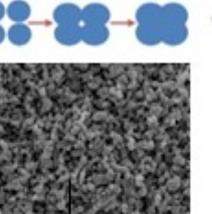
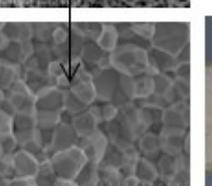
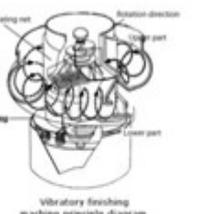
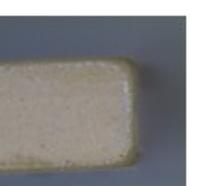
容易修理 (Rework 双面 Tape 适用)  
↓  
显示屏无损伤情况下可修复的构造



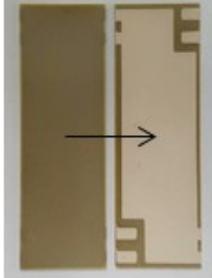
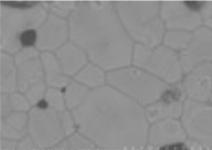
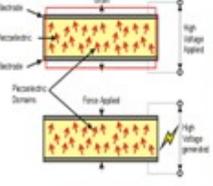
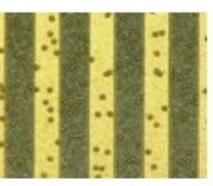
# 另附) 制作工程 PROCESS

Confidential

→

| Batch (Slurry)  | Tape Casting  | Pattern Printing  | Stacking  | Lamination (WIP)  | Cutting   | BBO/Sintering   | Barrel  |
|---|---|---|---|---|---|---|---|
|   |   |   |   |   |   |   |   |

→

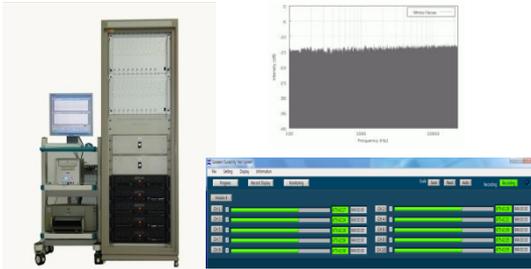
| Surface/end Print  | Firing   | Polarization   | FPC Bonding  | Inspection   | Tape Sticking  | QA Inspection   | Packing /Shipping  |
|--|--|--|--|--|--|---|--|
|   |   |   |   |   |  |  |   |

→



## 启动作业信赖性

1,000Hr, 存粹噪音信号



## 环境 信赖性

温度, 湿度, 静电, 盐水



## 机械性 信赖性

落下, 破坏 加强, 弯曲



|      | 细部项目                             | 评价项目            | 实验条件 / 设备  | Spec    | 结果 |
|------|----------------------------------|-----------------|--|---------|----|
| 启动作业 | Continuous Load Test             | 连续 负荷 试验        | EIA 2:1 Filter, White Noise  | 96Hr    | ●  |
|      |                                  |                 | EIA 2:1 Filter, White Noise  | 1000Hr  | ●  |
|      | HTOL (High Temp. Operating Life) | 高温启动作业信赖性评价     | 85°C EIA 2:1 Filter, White Noise   | 96Hr    | ●  |
|      | THB or THS (Temp. Humidity Bias) | 高温/高湿启动作业信赖性评价  | 50°C / 90~95% EIA 2:1 Filter, White Noise                                  | 96Hr    | ●  |
|      | LTOL (Low Temp. Operating Life)  | 低温启动作业信赖性评价     | -30°C EIA 2:1 Filter, White Noise  | 96Hr    | ●  |
| 环境   | 耐久性                              | 启动作业信赖性评价       | Sine wave, 1kHz  | 5min    | ●  |
|      | TC (Temp. Cycle)                 | 高温/低温环境信赖性评价    | -40°C (60min) ↔ +85°C (60min)  | 30cycle | ●  |
|      | PCB (Pressure Cooker Test)       | 高温/高湿环境信赖性评价    | 60°C / 90~95%  | 240Hr   | ●  |
|      | HBM (Human Body Model)           | 模拟带电人员的模型静电评价   | ESD Zapping设备  | ± 2000V | ●  |
|      | MM (Machine Model)               | 模拟机器带电的金属模型静电评价 |  | ± 200V  | ●  |
|      | CDM (Charged Device Model)       | 模拟电荷的量 静电评价     |  | ± 700V  | ●  |
| 机械性  | 盐水喷雾                             | 盐水环境信赖性评价       | 35°C / 5% (Salt)   | 48Hr    | ●  |
|      | 压缩 强度                            | 承受强度评价          | φ 2.0mm, 0.08mm/sec. with plastic plates<br>Center ≥ 90N, Outer ≥ 78.4N    | -       | ●  |
|      | Jig 落下                           | 落下(坠落)评价        | 152cm on steel plate, 13times<br>(6faces, 2cycle + Front 1time / Drop JIG) | -       | ●  |

## Long-term Reliability \_ Driving test of the mounted Piezo-RCV on OLED Display

Test Condition

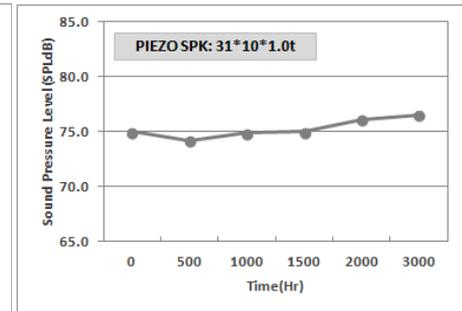
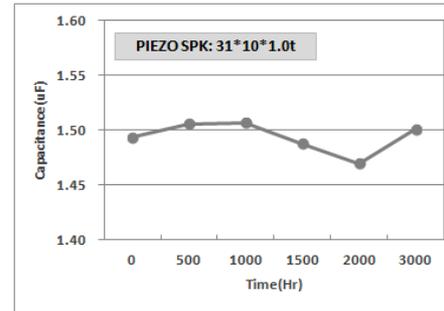


[Test environment]

|               |                        |
|---------------|------------------------|
| Piezo-element | 31*10*1.0t             |
| Display       | Total: 1.6T            |
|               | Glass: 0.7T            |
|               | OLED + Cu: 0.9T        |
| Bonding       | 0.15T adhesive tape    |
| Application   | Phone                  |
| Voltage(Max)  | 10Vrms                 |
| Signal        | EIA Filter+White Noise |
| Frequency     | 20~20KHz               |

Acoustic Performance (After 4,000Hr)

|                   |                   |
|-------------------|-------------------|
|                   | 31*10*1.0t        |
| $\Delta C_p$      | Total $\pm 3\% <$ |
| $\Delta SPL@1KHz$ | Total $\pm 1\% <$ |
| Power(W)          | 2.9               |



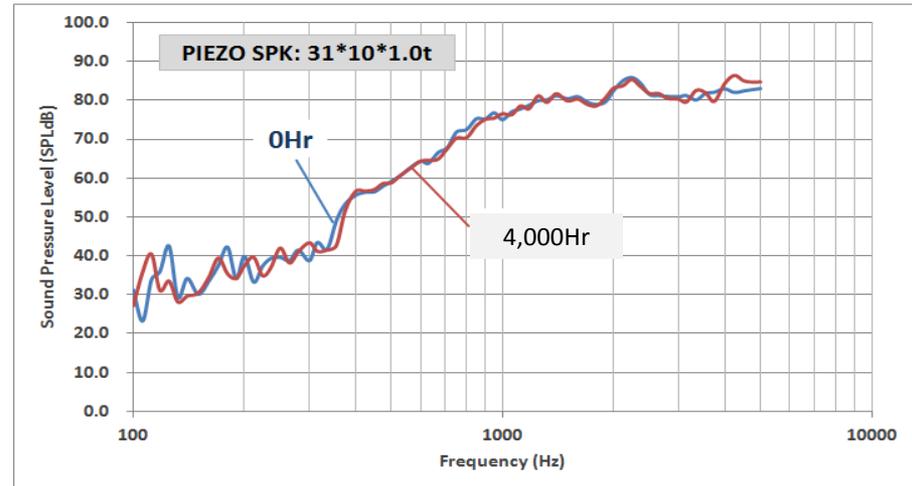
Display Inspection (After 4,000Hr)



No Noise signal



4,000Hr Driving



# 另附) WISOL Piezo Roadmap

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~ '2017

'2018

'2019

'2020

PZT Material



Low Temp. Material 确保  
(Cost 竞争力确保)

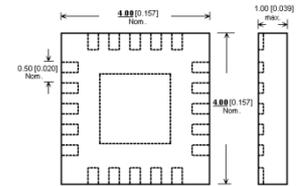


Silver

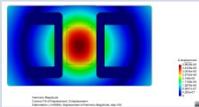


Palladium

驱动 Chip 及 Software 确保  
Acoustic/Haptic/Sensor  
(提供 Total Solution)



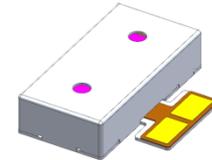
CTS Module



CTS Module 普及化



Acoustic + Haptic  
综合 Module 开发/普及化



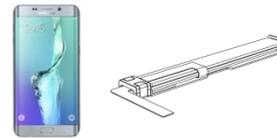
CAM Module



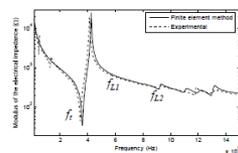
CAM Module 普及化  
(SPEAKER用)



CAM Module 普及化  
(MOBILE用)



Sensor用 Piezo 最优化



- Resonant Impedance 最优化
- Wide Bandwidth
- Multilayer → Single Layer
- 实现超薄型 及 Ass'y 最优化

Flexible Piezo Module 开发

