

Examples of MEMS Industrialization by Tohoku Univ. – industry Collaboration

Application of catheter tip S.F.E. T. for continuous in vivo measurement. Med. & Biol. Eng. & Comput. Vol. 18, No. 11, pp.741-745(1980)

| Type | Application | No. | Catheter (cm) | Length | Diameter | Monitor | Note |
|-------|--|-----------------|---------------|--------|----------|------------------------------|------|
| PH-21 | pH measurement in muscle etc | PH-2135 | 310 | 1.1 | KR-5000 | With reference | |
| PH-31 | pH measurement in esophagus and stomach | PH-3118 (Adult) | 1000 | 2.4 | KR-5000 | With reference and feed port | |
| PH-69 | pH measurement in mouth | PH-6918 | 100 | 1.8 | KR-5000 | Without reference | |
| PH-89 | Reference electrode for PH-60 | PH-8905 | 50 | 1.1 | KR-5000 | | |
| CP-19 | PCO ₂ measurement in muscle etc | CP-1935 | 250 | 2.8 | KR-5000 | With reference | |

Catheter pH, PCO₂ monitor (Kurare, Nihon Kohden)

半導体センサーのpH計 新電元pH BOYシリーズ
KS701 KS723
簡単・高安定・生活防水！
寿命が見える交換可能な電極

Portable pH sensor (Shindengen)

Helicotac
ピロリ菌クレンジング装置 ヘルコタック PYL-1100
NIPPON KOKDEN

Instrument to detect H. pylori (Nihon Kohden)

KEIKI
Chip 4.3mm X 4.3mm
Rotor diameter 1.5mm 74,000rpm
Control electrode
Rotor
150mm
1.5mm

Electrostatically levitated rotational (Tokyo Keiki)

TOYOTA
半導体MEMSセンサーを搭載したクラウン(2000年現在発売)
Drive monitor
Drive
Servo control
Resonant
Freq. control
Sensor
1992-1997
Two researchers from Toyota stayed in Tohoku University for collaborative development of vibrating gyroscope
Yaw rate sensor has been produced in Toyota since 2003 and used in more than 1 million cars.

Yaw rate-Accelerometer (Toyota)

Time of flight
Detector
Pulse laser
2D scanner
Ebisu station (platform doors using the ranging imager)
Ranging imager for safety systems and other applications
3D imager (LIDAR) for autonomous drive

2-axes optical scanner (Nippon signal)

Monolithic capacitive pressure sensor
CS7000
Toyota Machine Works, LTD.

Integrated capacitive pressure sensor (JTEKT)

The getter absorbs oxygen gas generated by an electrochemical decomposition of glass during anodic bonding process.
Reference capacitor electrode
Sensor capacitor electrode
Vacuum cavity
Non evaporable getter
Vacuum packaging
Pyrex glass
Diaphragm
Pressure
Canon Anelva Inc.

Diaphragm vacuum gauge (Canon ANELVA)

The MEMS microphone has been used for TV program as swimming in Beijing Olympic game
13mm
Sound
Membrane (Si)
Spacer (SiO₂)
Gap
Back plate (Si)
Pressure vessel
Sound signal output

Silicon microphone (NHK, Panasonic)

1. Green sheet
2. Punching
3. Plugging holes with Au paste
4. Laminating
5. Sintering
6. Anodic bonding
LTCC (Low Temperature Cofired Ceramic) with electrical feedthrough for MEMS packaging (Nikko)
Nano-porous gold bump by etching out of Sn from Au-Sn (Collaboration with FHG ENAS)

LTCC with electrical feedthrough for MEMS packaging (Nikko)

タービン
軸受
発電機磁石
圧縮器
燃焼器
発電機コイル
空気
870,000 rpm
Turbine
Dummy magnet
Compressor
Thrust plate
(S. Tanaka, K. Isomura (IHI), M. Esashi et al., Power MEMS 2007, Freiburg, pp.359-362)

Palm-top silent gas turbine engine power generator for robot (IHI)

アドバンテスト社
半導体試験装置
T2000シリーズ
アドバンテスト社
コンチニュームスイッチ
半導体試験装置を支える
キーデバイスを提供
ADVANTEST
Immune to electrostatic discharge up to 1000V
Dummies frequency range (DC-10GHz)
MEMS switch factory (Advantest components (Sendai))

MEMS switch for LSI tester (Advantest)