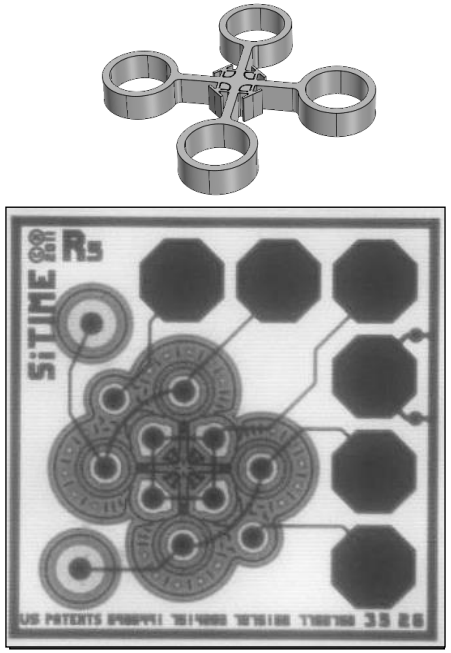
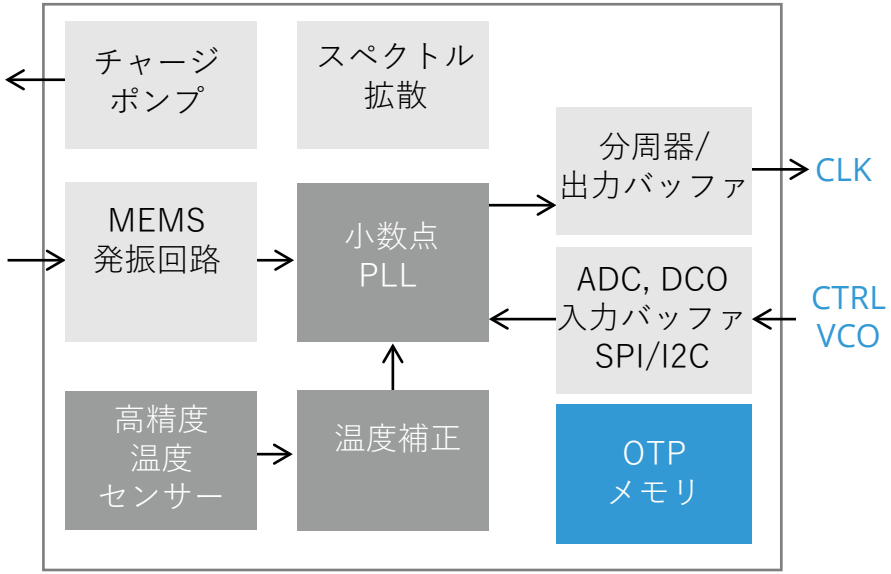
製品アーキテクチャ

MEMS振動子ダイ



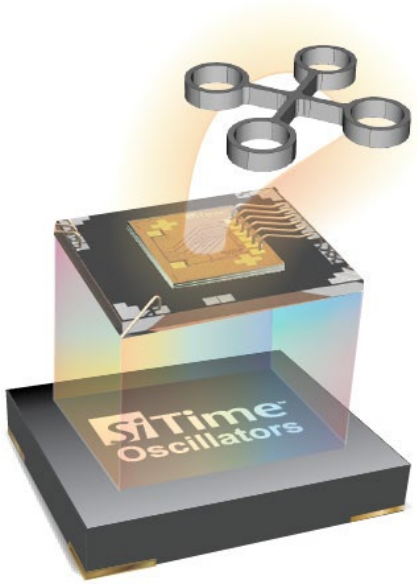
- 0.4 mm x 0.4 mm
- 歩留り99%
- 高真空封止構造ダイ
- 標準CMOSプロセスで製造

プログラマブル CMOS IC



- Jitter - 70 fs
- 周波数安定度 - 5 ppb (TCXO)
- 低消費電力 <350 nA @32kHz
- 180nm CMOS – fab TSMC

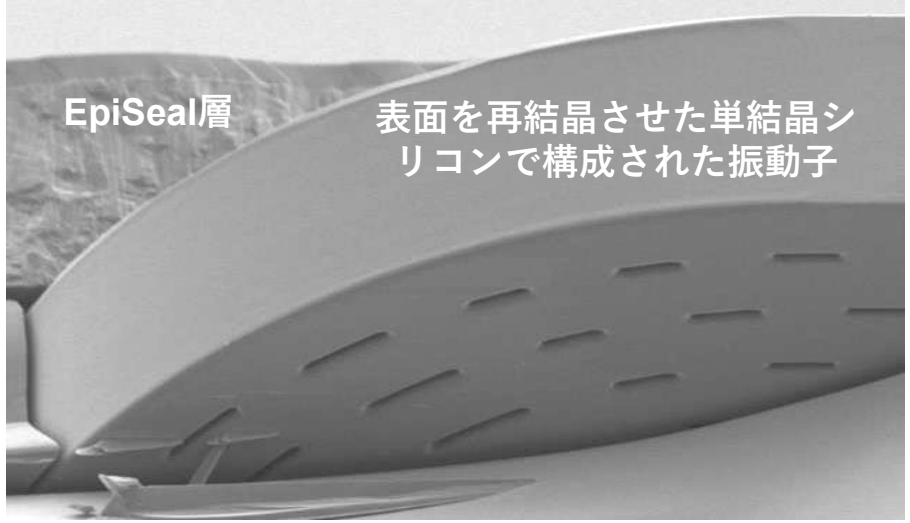
MEMS 発振器



- プラスチックパッケージ
- 丈夫で取り扱い容易 - MSL1
- 高歩留り(99%)
- 0.10DPPM, 2Fit

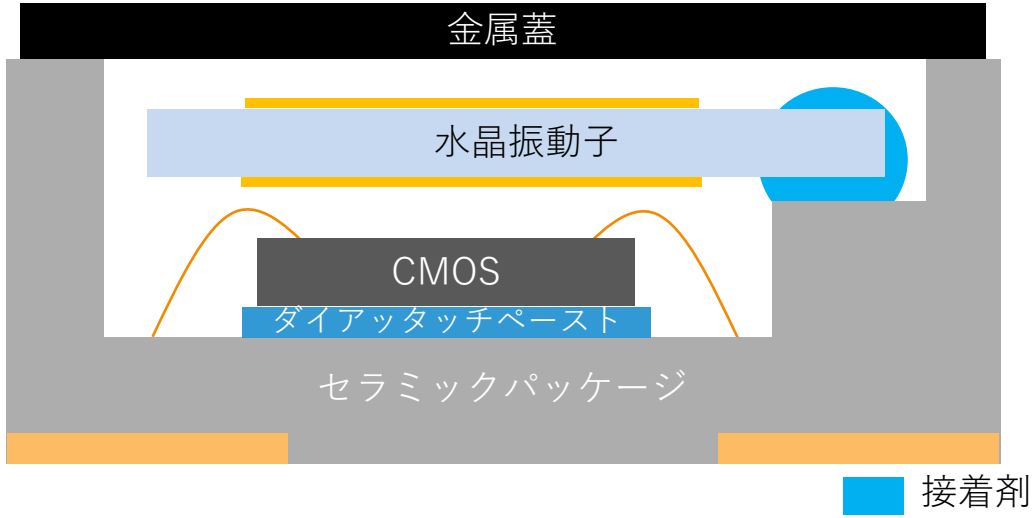
SiTime MEMS振動子の特長 - EpiSeal®プロセス

半導体プロセスを使ったMEMS振動子



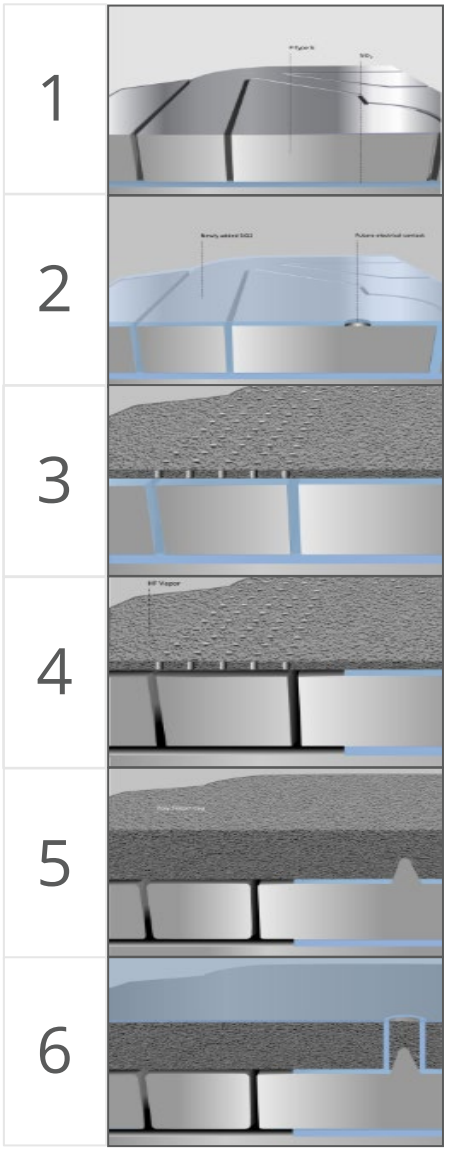
- 完全なクリーン真空封止 10uBar
- 高純度でppbレベルまで制御された完全な材料
- EpiSealプロセスの1100°Cの工程で表面を再結晶させた単結晶シリコンの振動子はAgingがなく、金属疲労も無い
- MEMS振動子の不良は 0

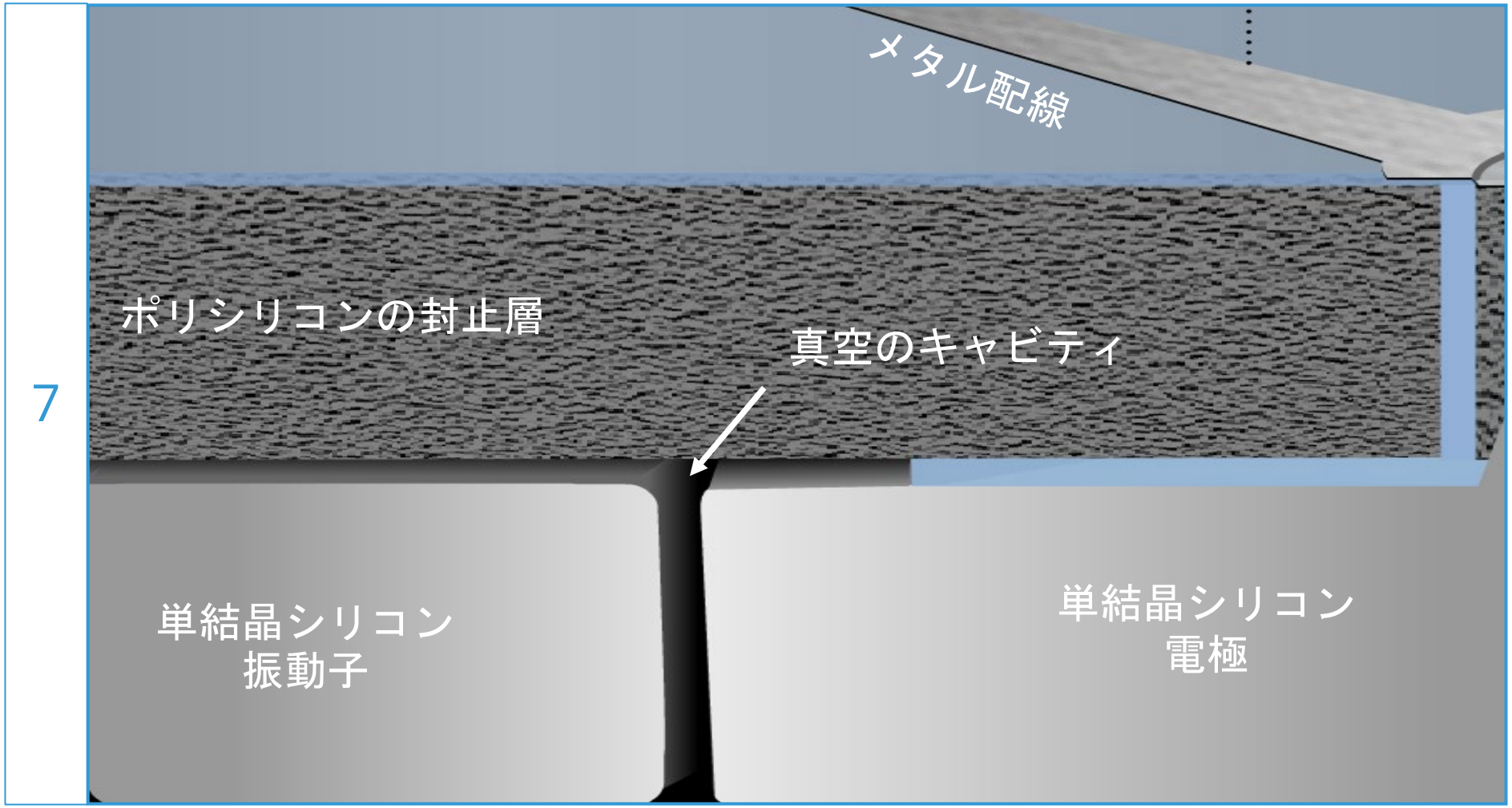
機械加工による水晶振動子



- 低真空封止あるいは窒素封止
- 接着剤から出る有機ガスや接着剤劣化が大きなAgingの原因となる
- スプリアス、ドリフト、ヒステリシスの存在
- 複雑な機械加工工程が多くの不良の原因なる

MEMS振動子製造プロセス

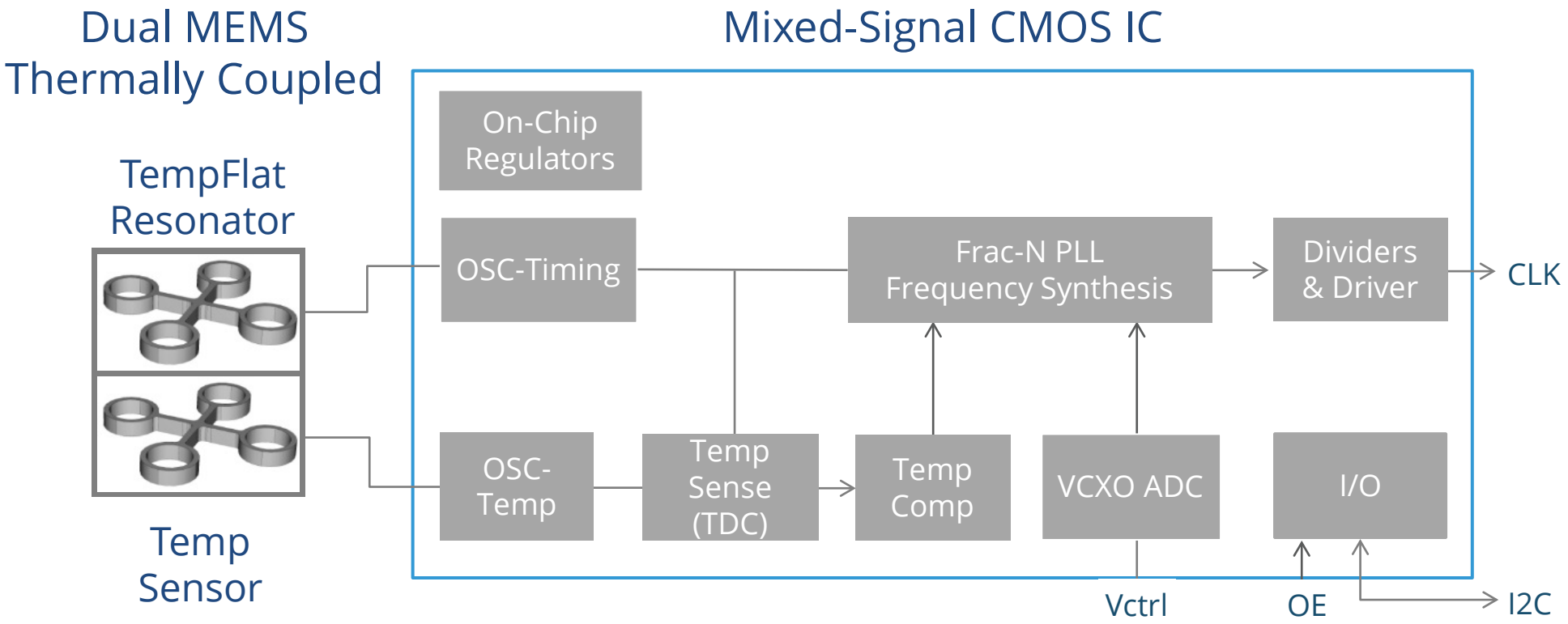




20 µm

- クリーンな半導体プロセスで製造
- 振動子は超高純度の単結晶シリコン製

Elite TCXO Architecture, Optimized for Dynamic Performance



TempFlat™ MEMS Resonator

- No aging
- No activity dips
- 30x better vibration immunity

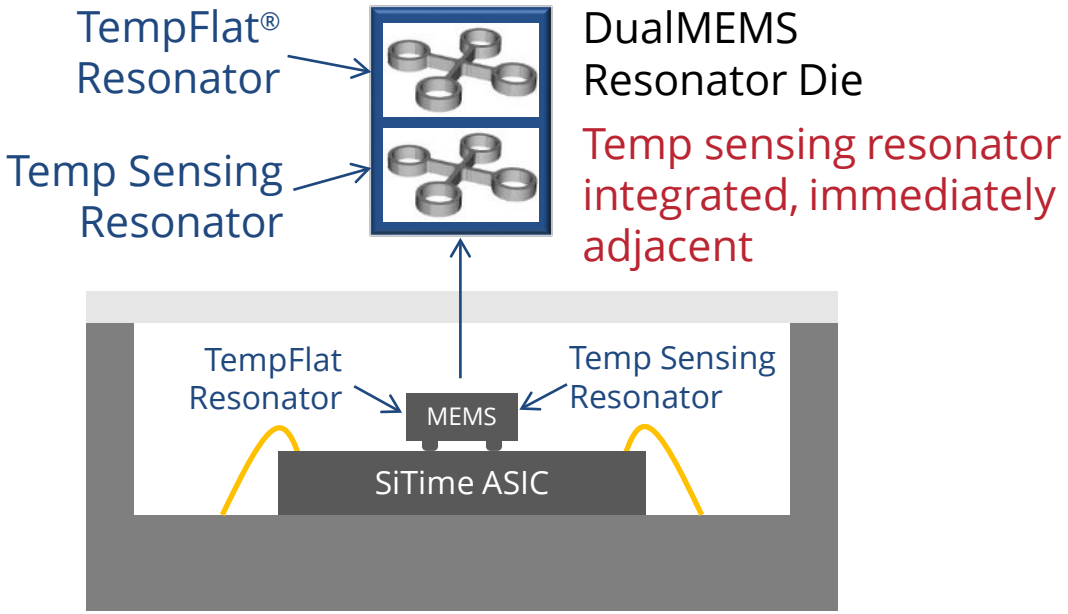
DualMEMS™ Temp Sensing 100% Thermal Coupling

- 30 µK, 10x more accurate
- 350 Hz tracking, 40x faster
- Airflow, temp ramp resistant

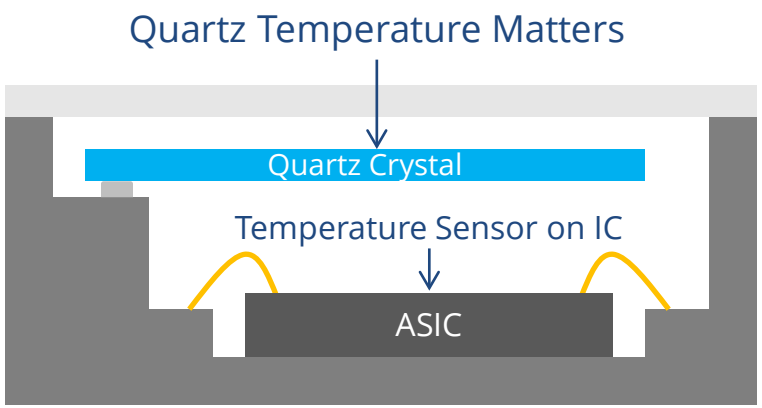
Low Noise CMOS Enabling Frequency Agility

- 1 to 220 MHz, steps in mHz
- 0.2 ps/mv PSNR, 5x better
- In-system programmability

MEMS Temperature Sensor Advantage



Temperature sensor measures IC temperature, physically separated from quartz



Elite DualMEMS Temperature Sensor

- Tight thermal coupling between two MEMS resonators on the same die
- Digital low-noise, high-bandwidth TDC
- Enables fast tracking and compensation of fast temp changes
- Higher-order compensation enables smallest dF/dT residue

Quartz TCXO

- Limited thermal coupling between the Quartz and ASIC
- Analog noisy temp sensor
- Limited compensation of slow temperature changes only
- Higher-order large dF/dT residues