



Transforming the Timing Industry

March 2016



The Smart Timing Choice™

Rich Timing Content in All Electronics

Only SiTime can Provide Higher Performance, Smaller Size, Lower Power



8 – 15 pieces
\$6 – \$200 value



4 – 20 pieces
\$2 – \$50 value



3 – 13 pieces
\$1.5 – \$11.5 value



20 – 40 pieces
\$3 – \$10 value



6 – 8 pieces
\$3.5 – \$5 value



3 – 5 pieces
\$0.5 – \$1.5 value



3 – 7 pieces
\$0.5 – \$1.5 value



3 – 7 pieces
\$0.3 – \$1.0 value

SiTime – The Timing Leader



\$6B Timing Market

Market CAGR – 5%
MEMS CAGR – 65%



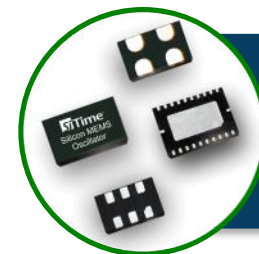
Technology Leader

100 Patents – MEMS, Analog, Systems
90% Share of MEMS Timing



Market Leader

400MU Shipped by 2015
1000 Design Wins in 5 market segments

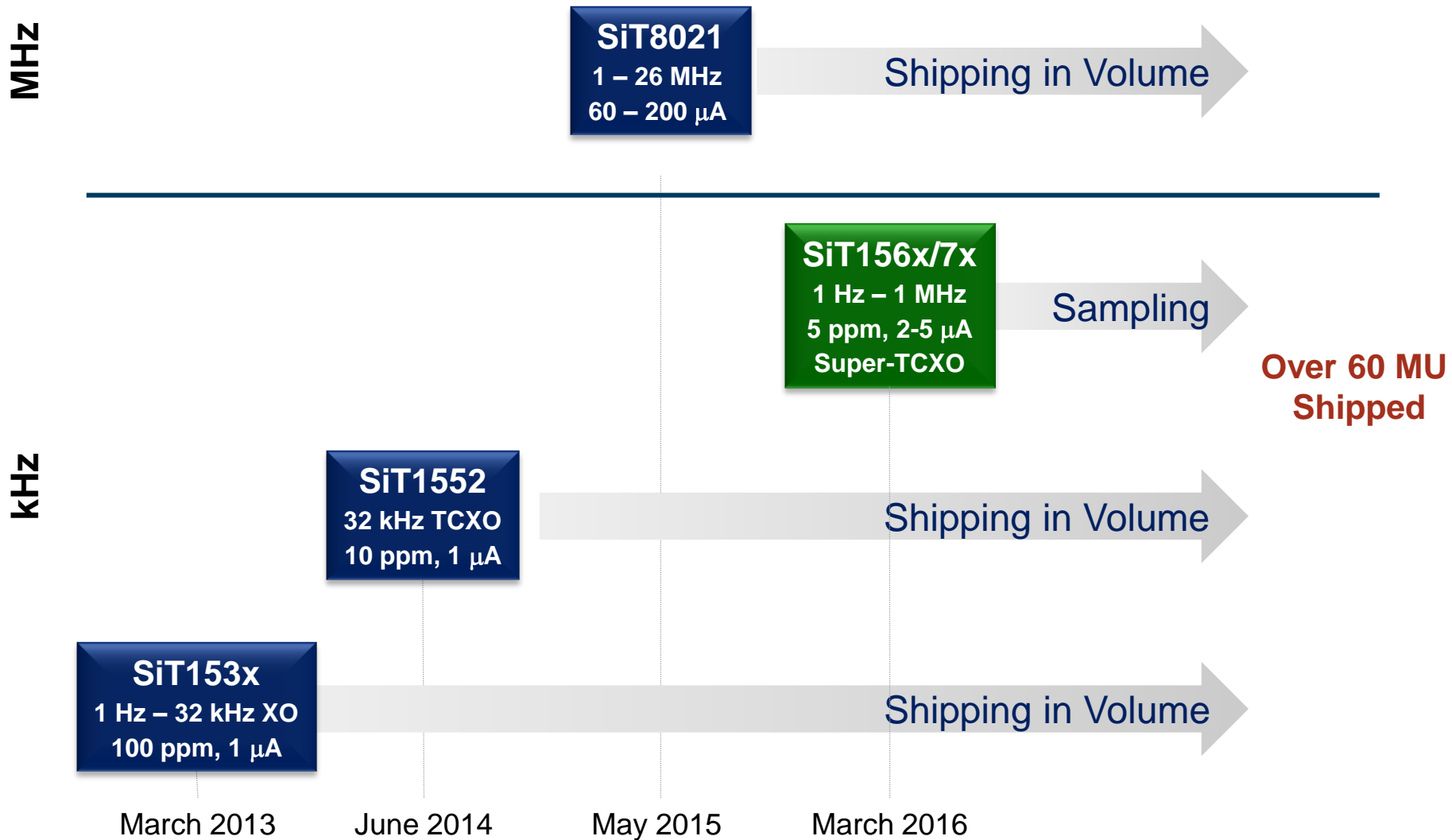


Product Leader

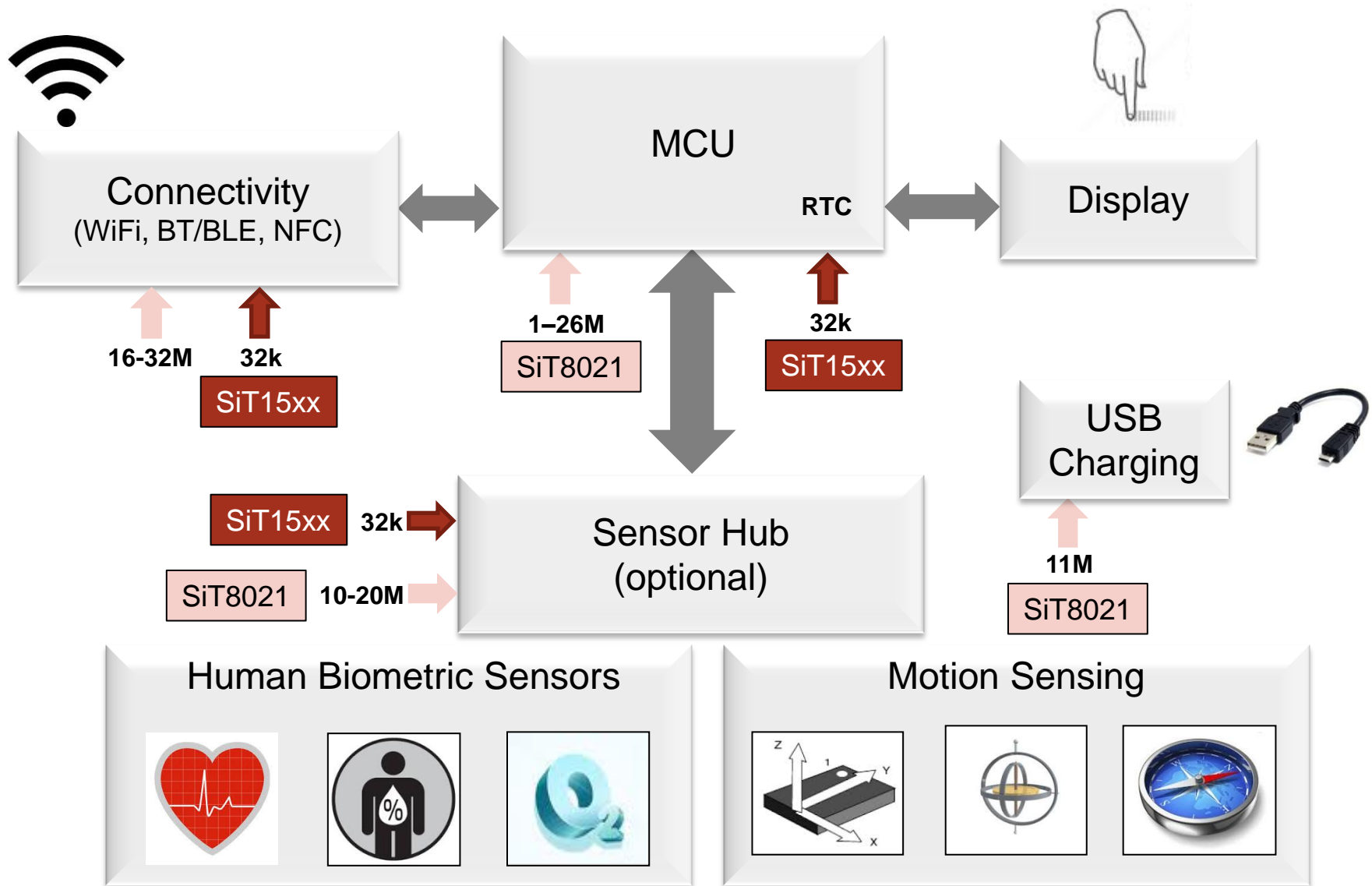
Programmable – 200K part numbers
Fabless advantage



SiTime – Big Success in IoT and Wearables



A SiTime Oscillator for Every Block in Wearables and IoT



SiT1566, SiT1568 & SiT1576

Super-TCXO
for Wearables, IoT, Mobile

Smallest
Most Accurate
Longest Battery Life
In-System Auto-calibration

SiT156x/7x Super-TCXO Family



Wearable & IoT Requirements	SiT1566 32 kHz	SiT1568 32 kHz	SiT1576 1 Hz to 1 MHz
Best Frequency Accuracy Best Timekeeping, Longest Battery Life All inclusive ± 5 PPM Stability	✓	✓	✓
Auto-Calibration after Overmolding ± 5 PPM Stability after Assembly Stress	-	✓	-
Factory Programmable Frequency ± 5 PPM Stability, 1 Hz to 1 MHz	-	-	✓

Target Applications for Super-TCXO



Wearables



Industrial, IoT



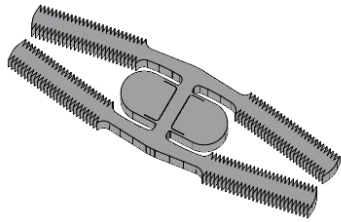
Consumer



Mobile

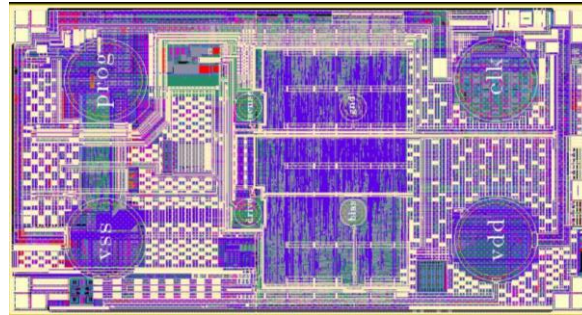
Solutions - Best MEMS, Analog, Systems **SiTime**[™]

Low Power MEMS



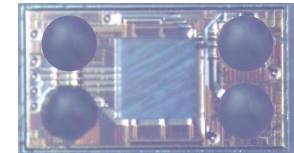
- 0.4 x 0.4 mm
- Vacuum sealed die

Programmable Analog



- High performance
- Low power – 2-5 μ A

MEMS Super-TCXO



- 1.5 x 0.8 mm
- CSP

SiT156x / 7x Super-TCXO

Smallest Size

SiTime – Smallest Timing Solutions



kHz

4 mm²

Smallest Quartz XTAL or XO
1.6x1.0 mm
Up to 3 devices

**65%
Smaller**

**1.2
mm²**

SiTime SiT15xx
1.5x0.8 mm
1 chip

MHz

**2
mm²**

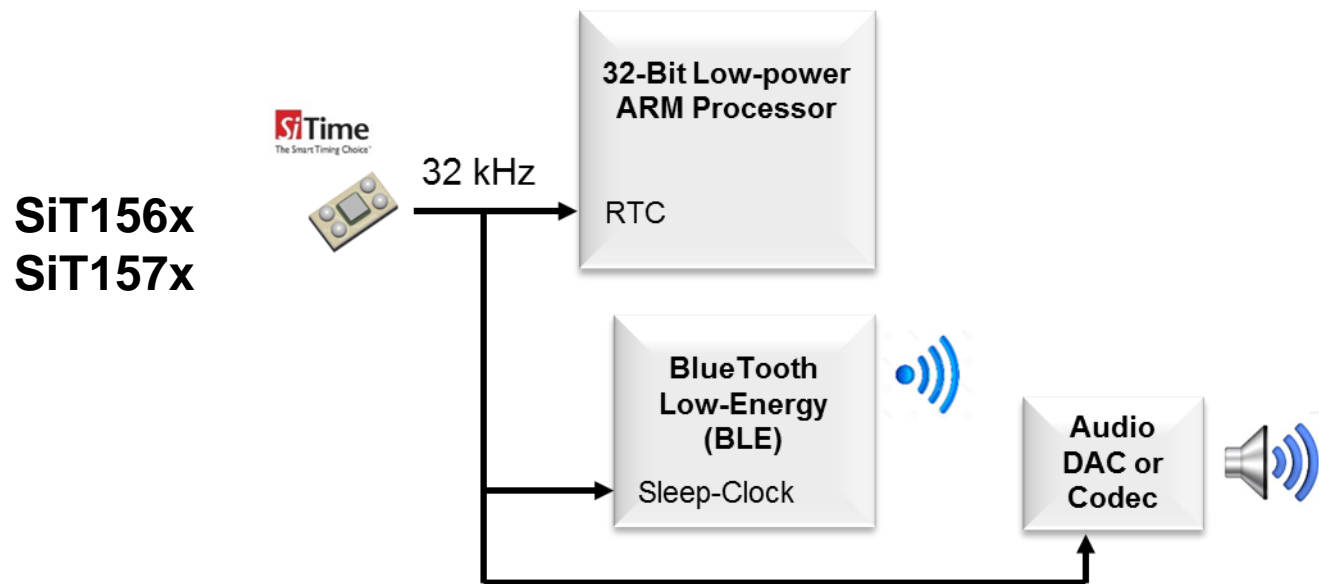
Smallest Quartz XTAL or XO
1.6x1.2 mm
Up to 3 devices

**40%
Smaller**

**1.2
mm²**

SiTime SiT8021
1.5x0.8 mm
1 chip

SiT156x/7x Drives Multiple Loads and Reduces BOM Space and Cost



- SiTime's SiT156x/7x drive multiple loads, eliminates components
- Saves space, cost
- Provides flexibility of placement in a space-constrained board
- XTAL resonators – passive, no drive capability

SiT156x / 7x Super-TCXO

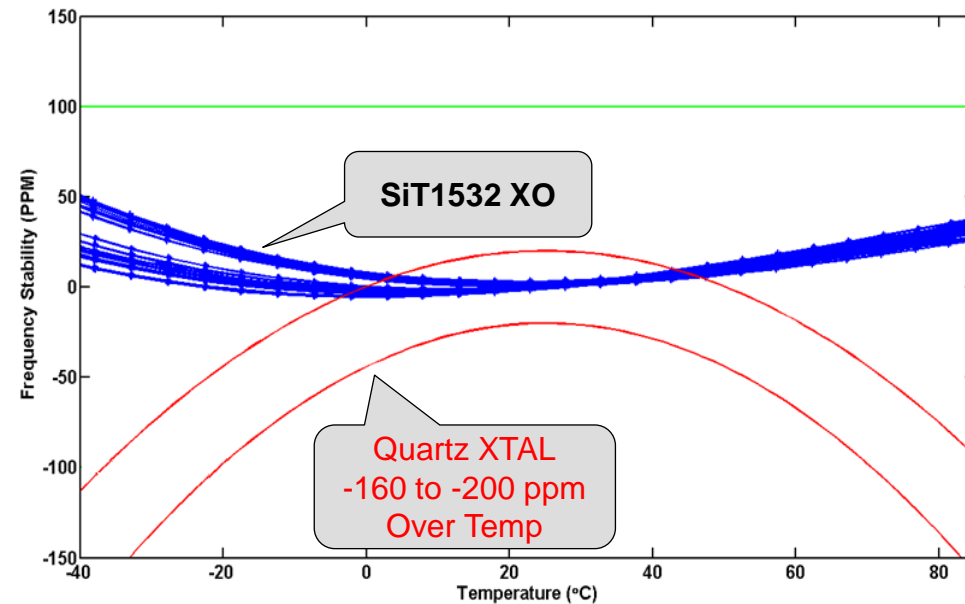
Most Accurate

Most Accurate Super-TCXO



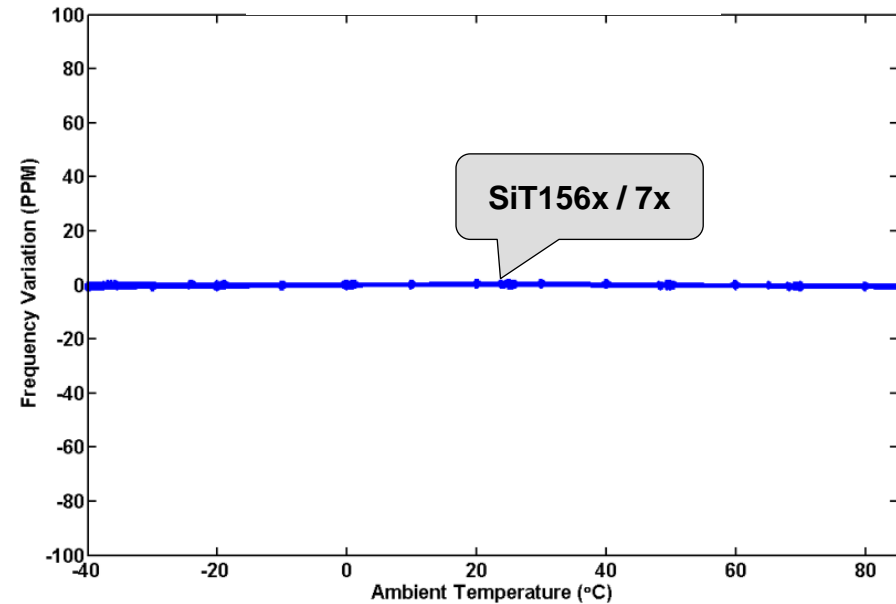
SiT1532 XO (March 2013) 100 ppm over Industrial Temp

2x More accurate than quartz XTAL



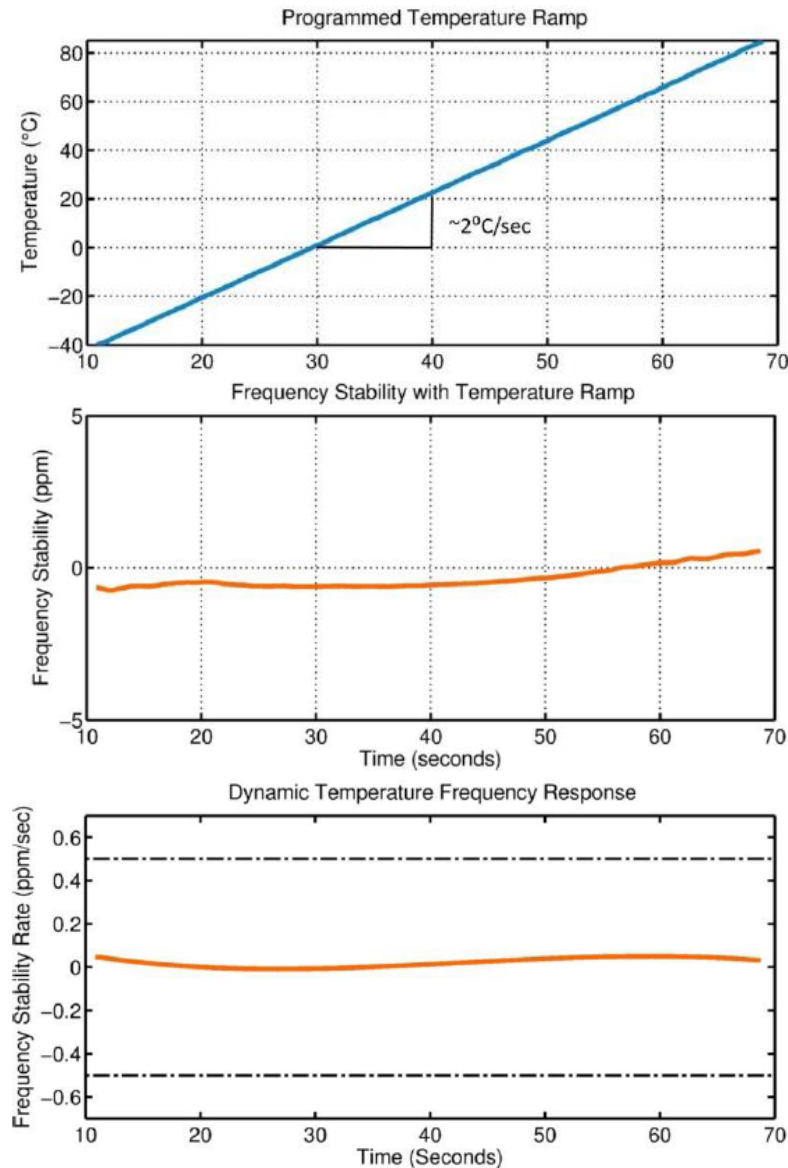
SiT156x/7x Super-TCXO ±5 ppm over Industrial Temp

30x – 40x more accurate than quartz XTAL



PPM – Lower is Better

SiT156x/7x **Uniquely** Maintains ± 5 ppm Stability Even In Presence of Temperature Ramp



PPM – Flatter is Better

SiT1568 – 66% Better Timekeeping than Swiss Chronometer Standard



COSC Standards for Mechanical and Quartz

Specification	Mechanical	Quartz	Silicon MEMS
Average Daily Rate	-4/+6 seconds	± 1 ppm ± 0.07 seconds (@ 23°C)	± 0.3 ppm ± 0.02 seconds <i>70% Better</i>
Greatest Variation between 2 days	5 seconds	± 3 ppm ± 0.2 seconds (@ 38°C)	± 1 ppm ± 0.07 seconds <i>66% Better</i>

COSC: Controle Officiel Suisse des Chronometres. Official Swiss chronometer testing institute

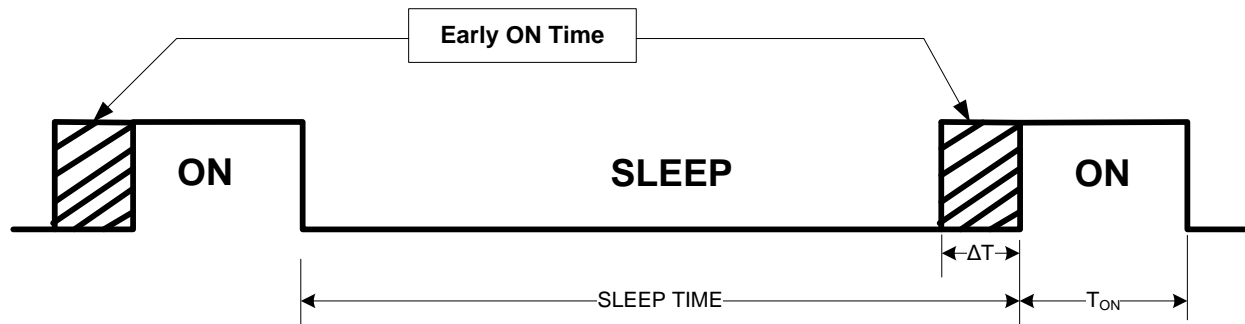
SiT156x / 7x Super-TCXO

Longest Battery Life

BLE Power Saving from Accurate 32 kHz Sleep Clock



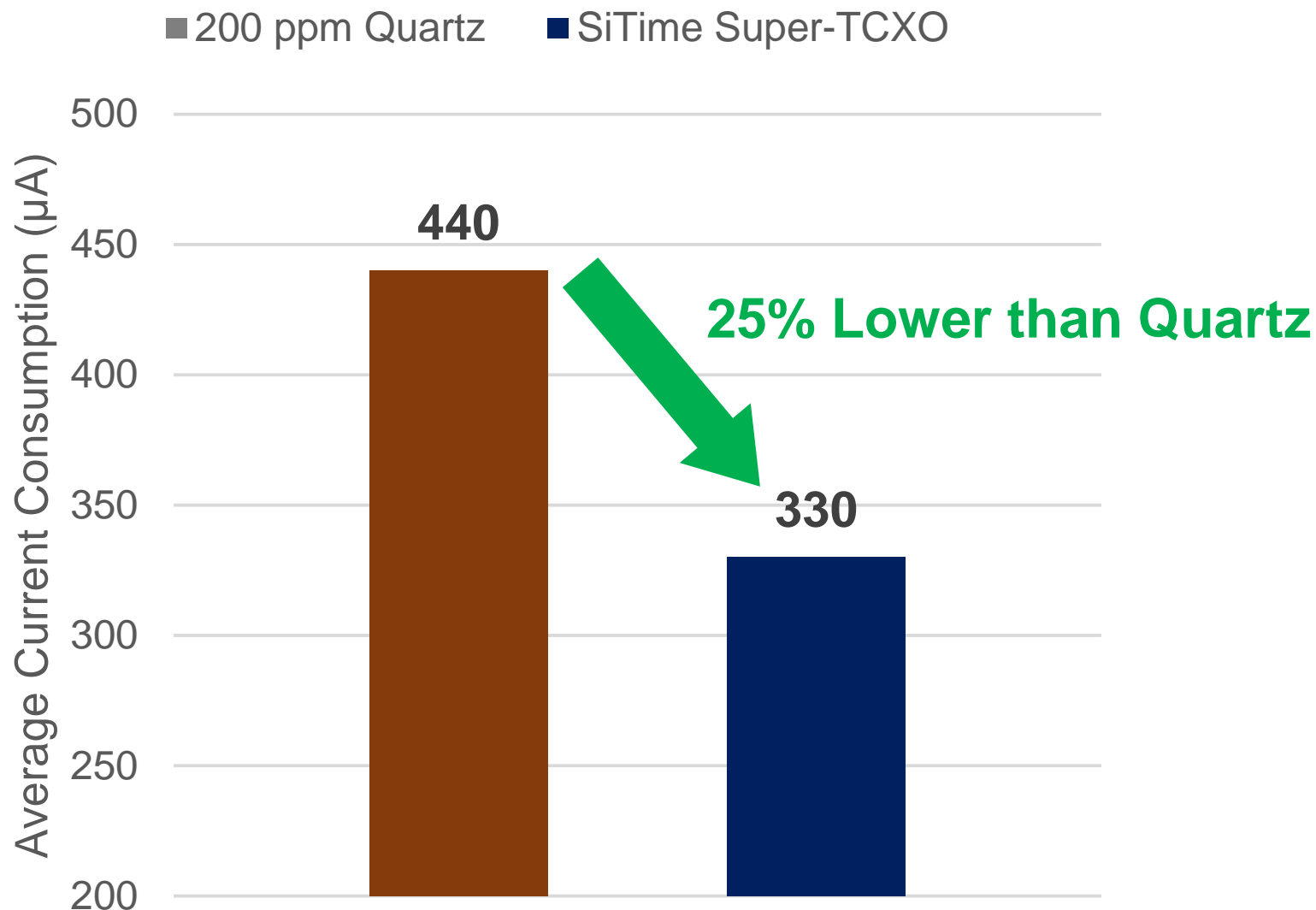
- Average Power is proportional to the ratio of “ON” time to “Sleep” time



- 32.768 kHz Sleep Clock inaccuracy (PPM) causes Early ON (ΔT)
 - $\Delta T = (\text{SLEEP CLOCK ACCURACY}) * (\text{SLEEP TIME})$
- Early ON time (ΔT) causes power penalty

32 kHz Sleep Clock Accuracy Over Temp	2 second Sleep Time	20 second Sleep Time	50 second Sleep Time
	ON-Time Error Budget (ΔT)		
SiT156x Super-TCXO 5 ppm	0.01 ms	0.1 ms	0.25 ms
32 kHz XTAL 200 ppm	0.4 ms	4.0 ms	10.0 ms

25% Lower Power with 5 PPM TCXO

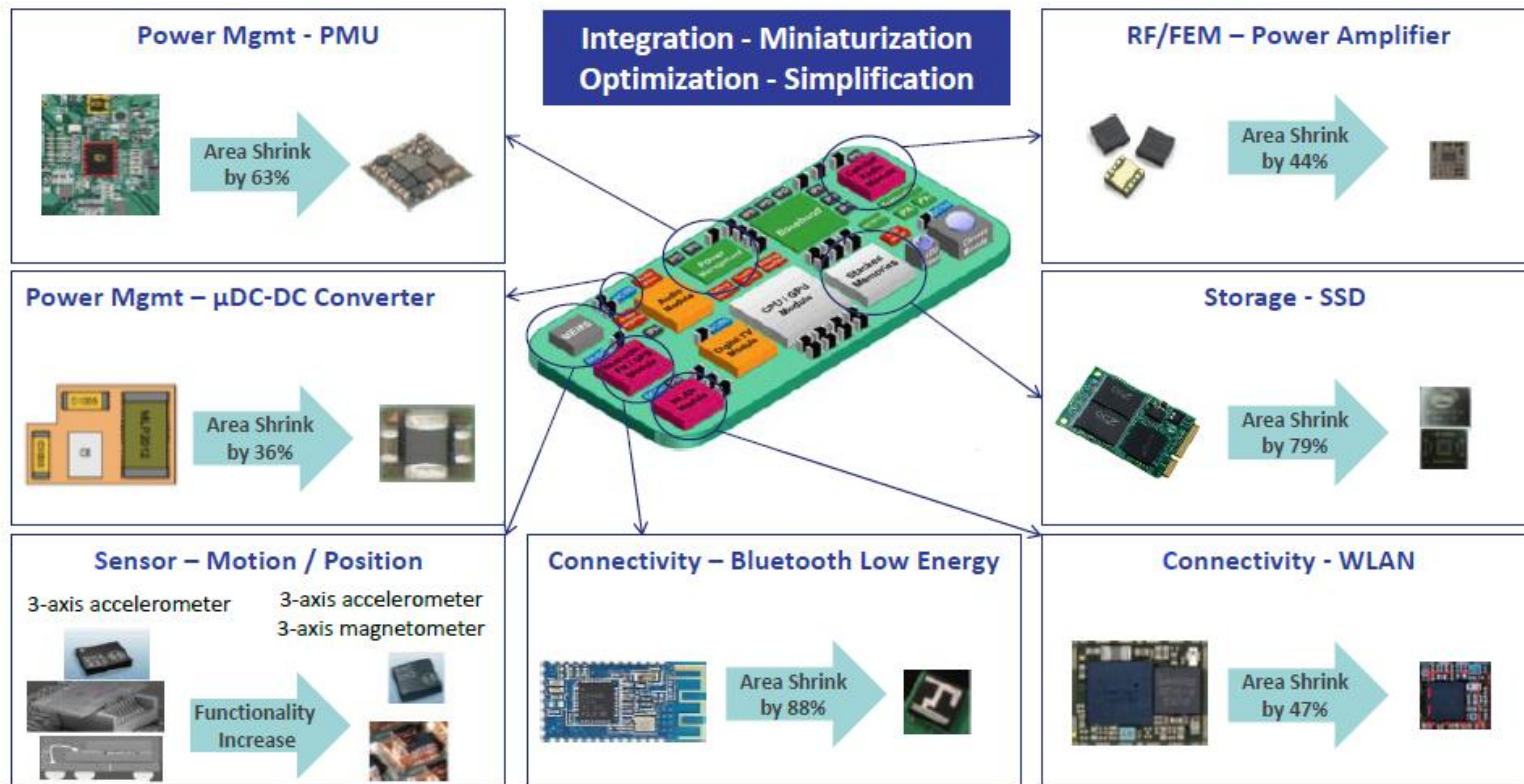


SiT156x / 7x Super-TCXO

In-System Autocalibration

Wearables, IoT Drive Miniaturization Modules, SiP May be Overmolded or Coated

Examples of Miniaturization

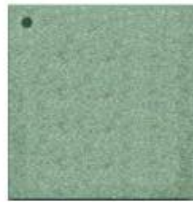


Overmolding, Coating are Stressors, Reduce Timing Accuracy

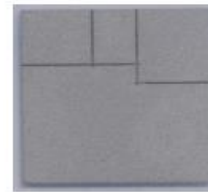
Key Timing Devices Remain Outside Overmolded Module / SiP

Package Shielding Solution

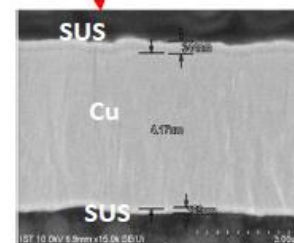
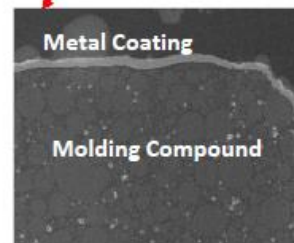
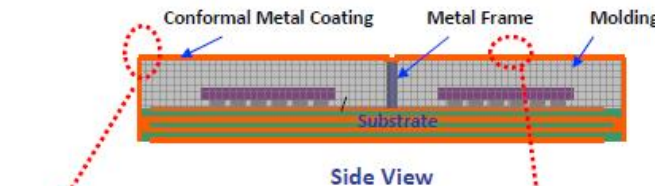
Conformal Shielding
Dual Band WiFi/BT Module



Compartment Shielding
LGA-type HSPA Module

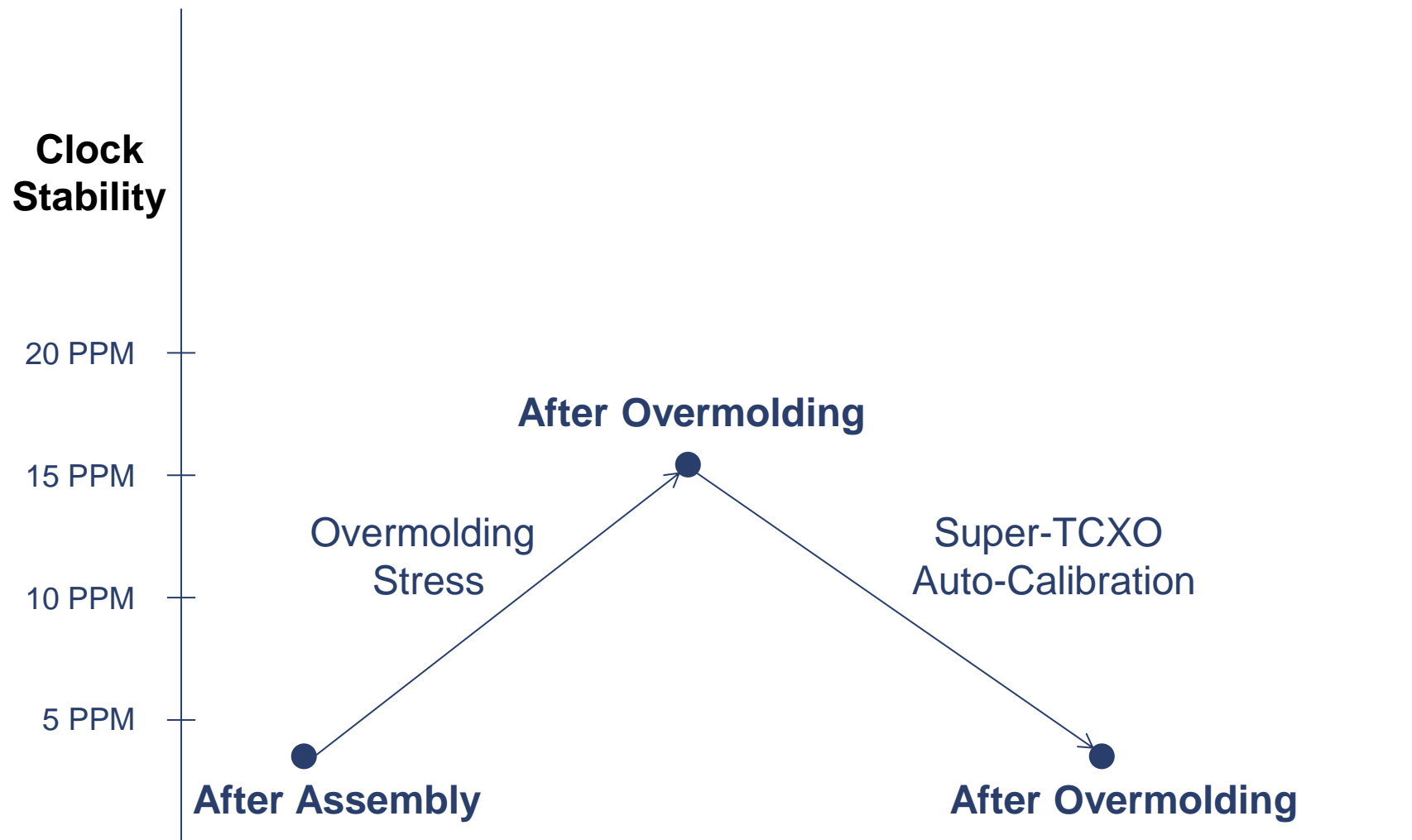


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Auto-Calibration Uniquely Improves Super-TCXO Accuracy after Assembly, Overmolding



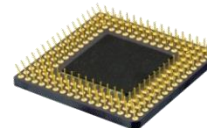
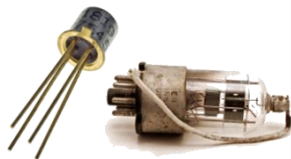
Smallest, Lowest Power, Most Accurate Super-TCXO



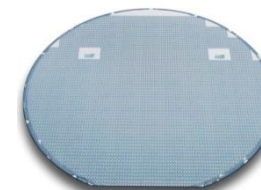
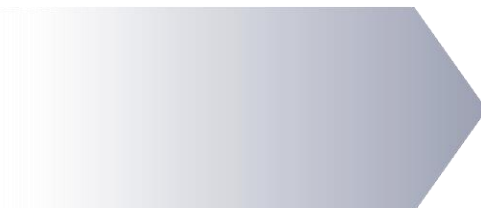
Specification	Quartz A	Quartz B	Quartz C	MEMS SiT156x SiT157x	SiTime Advantages
All-Inclusive Max Frequency Stability (ppm)	8	7.5	5	5	Up to 40% better
1 st year Max Aging (ppm)	3	3	NA	1.5	2x better
Max pk.-pk. Period Jitter (ns)	NA	NA	NA	35	Ideal for audio applications
Package (Footprint)	3225 SMD (8mm ²)	3225 SMD (8mm ²)	2520 SMD (5mm ²)	1508 CSP (1.2mm ²)	Up to 85% smaller
Max Package Height	1 mm	1.3 mm	1.0 mm	0.6 mm	Up to 55% less height

Silicon Always Wins

Highest Performance, Best Reliability, Smallest, Lowest Cost



Quartz

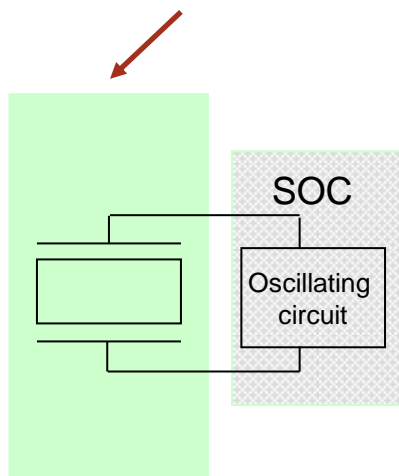


SiTimeTM
MEMS

Additional Information

Resonator, Oscillator and Clock Generator

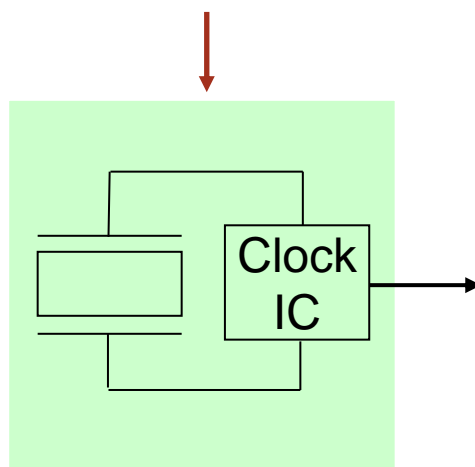
Resonator or Crystal (X, XTAL)



Passive device
Need ext. oscillating circuit
2 terminals used



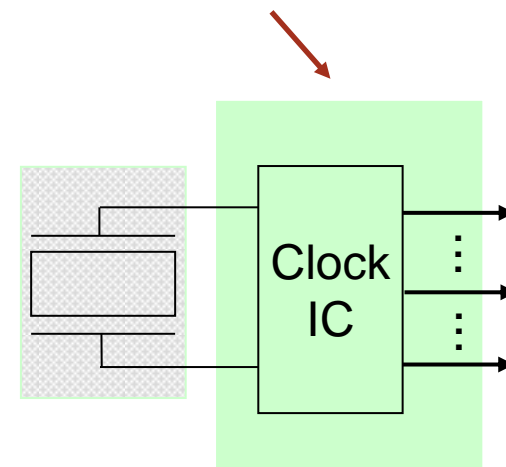
Oscillator (XO, TCXO, VCXO,)



Active device
2 chips in pkg.
4, 6, 10 terminals



Clock Generator (CG)



Active IC
Need ext. clock reference
Many terminals / outputs

