

Development background

CO-SCH5032/SCC5032

■ In-house environment

□ Maturity of TCXO technologies for GPS

■ Improved accuracy of frequency temperature characteristics adjusting system

■ Hysteresis characteristics improvement

■ Advanced method of evaluation of heat traceability

□ Reviewed method of TAS processing

■ Improved aging characteristics

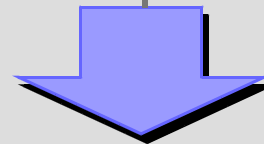
■ Market circumstances

□ Improved accuracy of TCXO IC

■ 2.0ppm ⇒ 0.5ppm ⇒ 0.28ppm

□ Enlarged Femtocell market

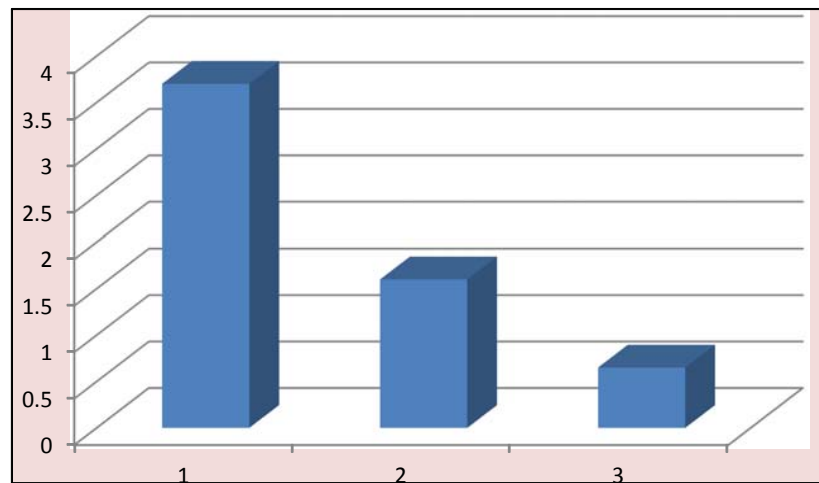
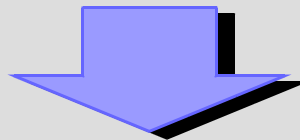
■ TCXO advance into OCXO market



Target market

CO-SCH5032/SCC5032

- *Standard signal source for wireless base station and femtocell.*
- *Oscillator that satisfies temperature characteristic of $\pm 0.28\text{ppm}$*



$\pm 0.5\text{ppm TCXO}$

CO-SCH5032

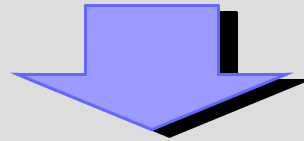
OCXO

	$\pm 0.5\text{ppm TCXO}$	CO-SCH5032	OCXO
Tolerance (at 25°C)	$\pm 1.0\text{ppm}$	$\pm 0.5\text{ppm}$	-
Reflow characteristics	$\pm 1.0\text{ppm}$	$\pm 0.5\text{ppm}$	-
Temp. Characteristics	$\pm 0.5\text{ppm}$	$\pm 0.28\text{ppm}/-40\text{ to }+85^\circ\text{C}$ $\pm 0.05\text{ppm}/-10\text{ to }+70^\circ\text{C}$	$\pm 0.1\text{ppm}/-10\text{ to }+60^\circ\text{C}$
Voltage coefficient	$\pm 0.1\text{ppm}$	$\pm 0.05\text{ppm}$	$\pm 0.05\text{ppm}$
Load coefficient	$\pm 0.1\text{ppm}$	$\pm 0.05\text{ppm}$	-
Aging	$\pm 1.0\text{ppm}$	$\pm 0.5\text{ppm}$	$\pm 0.5\text{ppm}$
Total	$\pm 3.7\text{ppm}$	$\pm 1.83\text{ppm}/-40\text{ to }+85^\circ\text{C}$ $\pm 1.60\text{ppm}/-40\text{ to }+85^\circ\text{C}$	$\pm 0.65\text{ppm}$

Improvement to high stabilization

CO-SCH5032/SCC5032

- *Integrated stability level is improved by making TCXO IC highly accurate*
 - *Integrated stability level = Frequency Temperature characteristics + Voltage coefficient + Load coefficient + Frequency tolerance + Reflow characteristics*



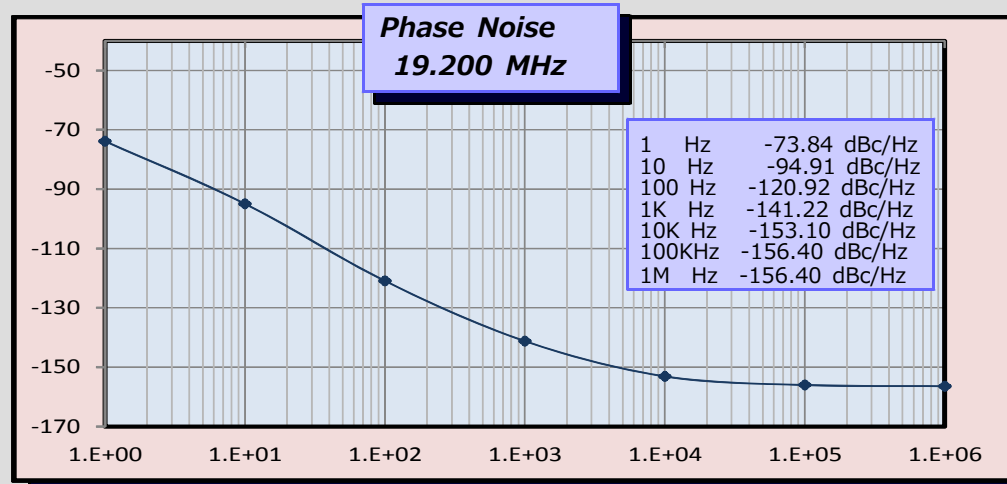
- *CO-SCH5032/SCC5032*
 - *Remarkably improved aging characteristics of the new TCXOs*
 - *Improved thermal hysteresis*

The main specifications

CO-SCH5032/SCC5032

■ Specifications

Item	Symbol	Specifications		Conditions
		CO-SCH5032/V	CO-SCC5032/V	
Output Frequency	F_{out}	10.0MHz to 52.0MHz		
Developed Frequency		10M/16.8M/19.2M/19.44M/20M/26M/36M		10Kohm//10pF No Load
Supply Voltage	V_{cc}	2.7V to 5.5V		$V_{cc}=+3.3V$
Current Consumption	I_{cc}	2.4mA max.	4.0mA max.	
Output Voltage	$V_{pp}/V_{oH}, V_{oL}$	0.8Vp-p min	$V_{cc} \times 90\% \text{ min} / V_{cc} \times 10\% \text{ max}$	
Load	Load	10Kohm//10pF	15pF	
Frequency Stability				
/Frequency Tolerance	F_o	$\pm 0.5\text{ppm max}$		
/Temperature Characteristics	F_{tc}	$\pm 0.28\text{ppm max} / \pm 0.05\text{ppm max}$	$\pm 0.5\text{ppm max}$	$-40+85^\circ\text{C} / -10+70^\circ\text{C}$
/Voltage Coefficient	F_{vcc}	$\pm 0.05\text{ppm max}$	TBD	at $V_{cc} \pm 5\%$, TBD
/Load Coefficient	F_{load}	$\pm 0.05\text{ppm max}$	TBD	Load $\pm 10\%$ TBD
/Frequency Aging	F_{age}	$\pm 0.5\text{ppm max}$		1year at $+25^\circ\text{C}$
Frequency Controlled Range	F_{cont}	$\pm 3.0\text{ppm to } \pm 15\text{ppm}$		$V_c = 1.5 \pm 1.0V$



Technical improvement #1

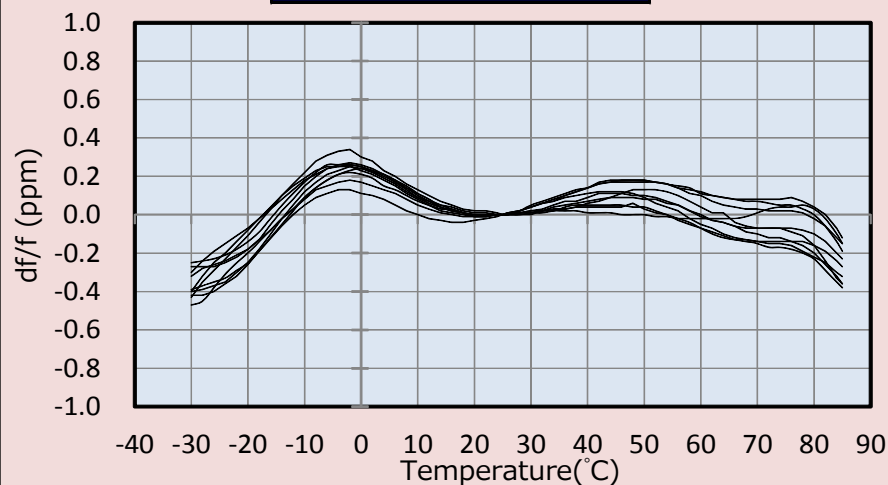
CO-SCH5032/SCC5032

■ Improvement of frequency temperature behavior

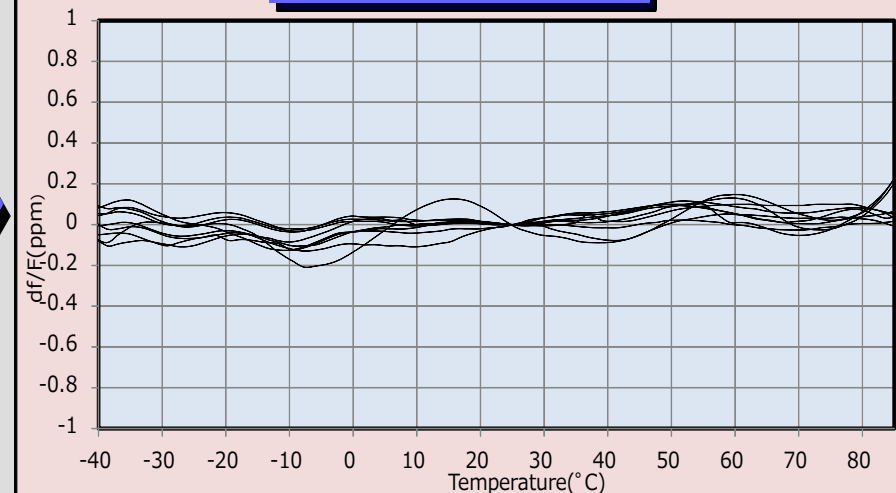
- Achieved with highly accurate IC
- Improvement of frequency temperature characteristics of the crystal cultivated in GPS requirements has contributed

Already achieved $\pm 0.2\text{ppm}$ @ $-30\sim 85^\circ\text{C}$

$\pm 0.5\text{ppm}$ @ $-30\sim 80^\circ\text{C}$



$\pm 0.28\text{ppm}$ @ $-40\sim 85^\circ\text{C}$



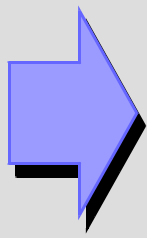
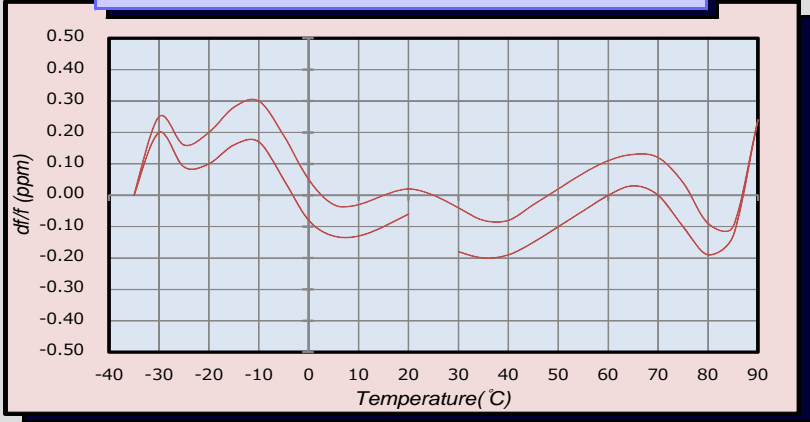
Technical improvement #2

CO-SCH5032/SCC5032

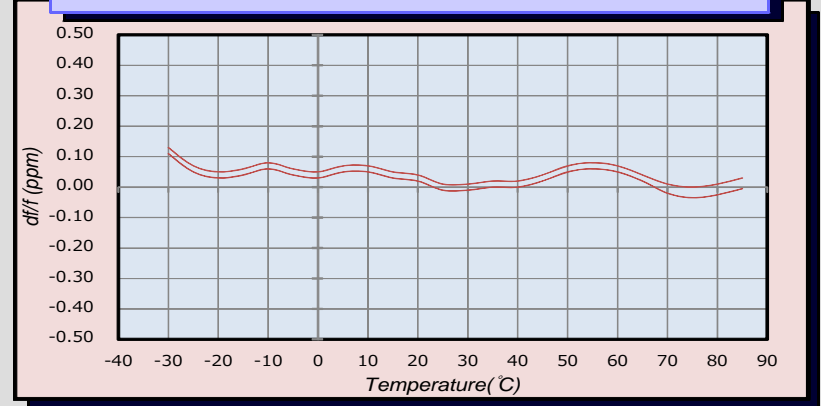
Improvement of thermal hysteresis

Improved over wide temperature range \Rightarrow Achieved by the characteristic improvement etc. of the crystal strip

General hysteresis characteristic

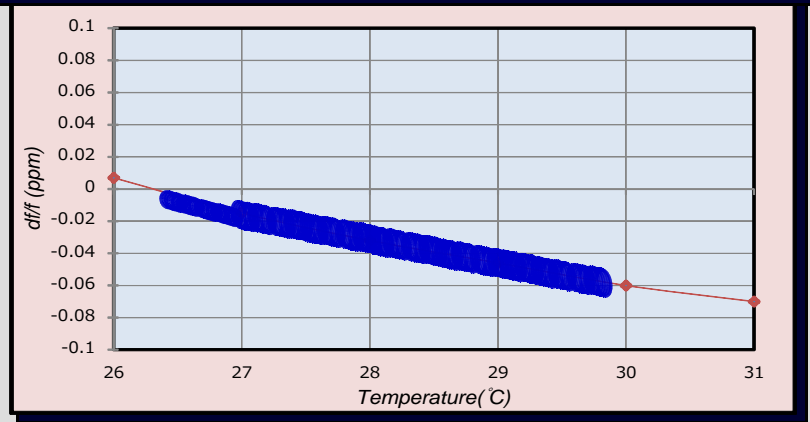


CO-SCH5032/SCC5032 hysteresis characteristic

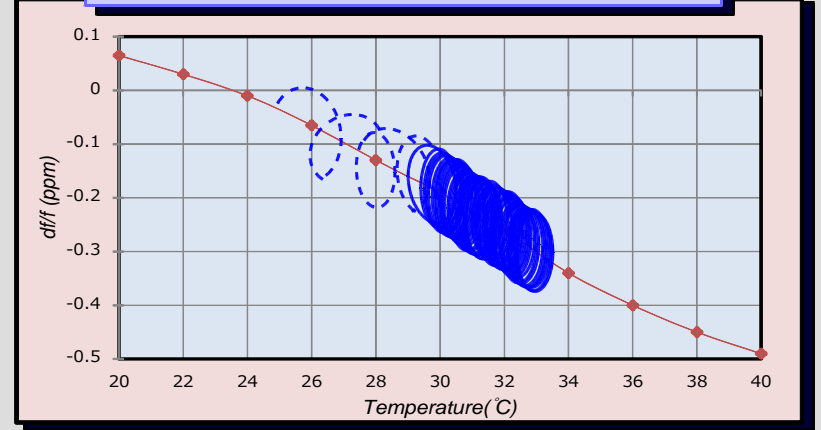


Improvement in narrow temperature range (Heat traceability) \Rightarrow Achieved by the product structure improvement

Heat traceability characteristics (Temperature characteristics with a small amount of heat changes)



Frequency deviation at 2C° Up/Down (15sec/cycle)



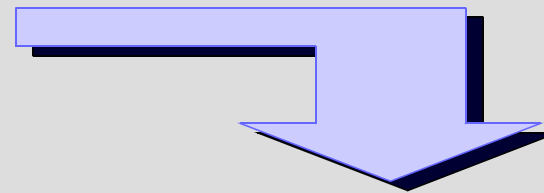
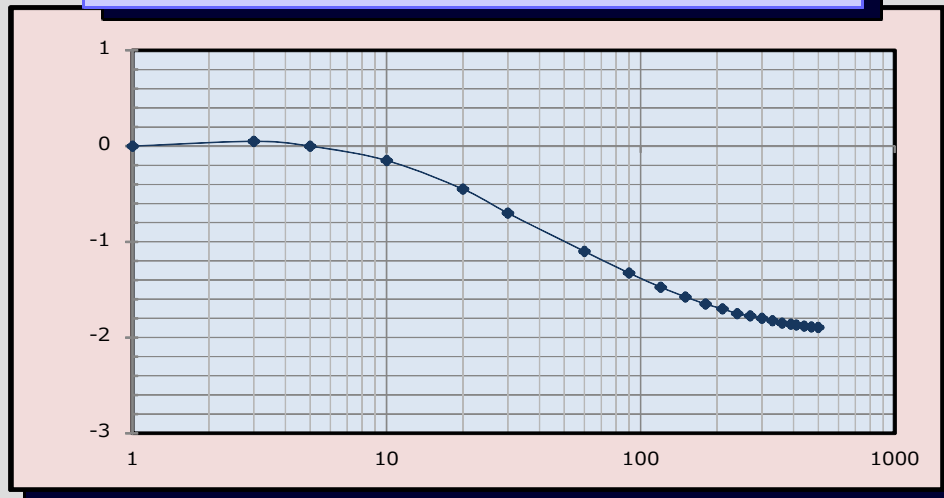
Technical improvement #3

CO-SCH5032/SCC5032

■ Improvement of aging characteristics

□ Review of crystal manufacturing process

Current TCXO (Acceleration test exposed in 85°C)
19.200 MHz



CO-SCH5032/SCC5032 (Acceleration test exposed in 85°C)
19.200 MHz

