AXTAL ADVANCED XTAL PRODUCTS

High Temperature Products

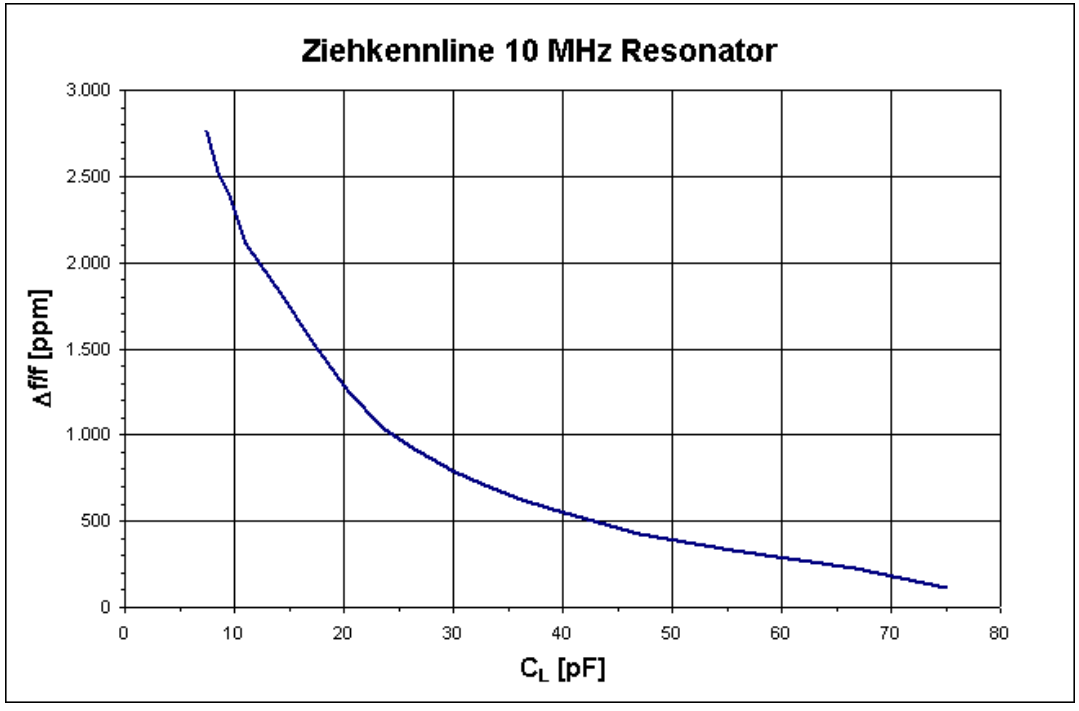
Resonators

- Quartz crystal units have $\alpha \rightarrow \beta$ phase transition (Curie point) at +573°C, with twinning starting already at lower temperatures, if applied over longer time.
- Langasite (LGS) and Gallium Phosphate ($GaPO_4$) show no phase transition up to +1450°C (LGS) or +950°C ($GaPO_4$)

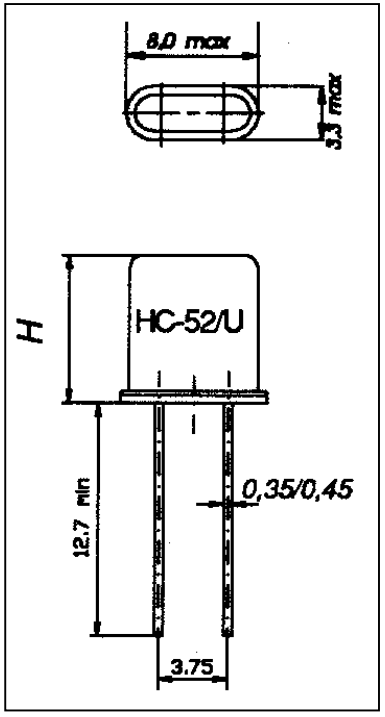
Comparison

	Quartz	LGS	$GaPO_4$
Phase transition	+573°C	None (>1450°C)	None (>950°C)
Q-factor	High (100%)	Good (70%)	Good (80%)
Pullability f(C_L)	Low (100%)	High (>500%)	High (>500%)
Stability f(T)	Good (3rd order)	Fair (2nd order)	Fair (2nd order)
Material growth	Hydrothermal (4 weeks)	Czrochalski (3~4 weeks)	Hydrothermal (1 year)
Max. wafer size	4″ (100 mm)	4″ (100 mm)	Blanks (15 mm)
Material availability	High volume, many suppliers	Good, industrial manufacturing, 2 suppliers	Fair, small scale production, 1 supplier
Material cost	Low	Moderate	High

Pulling Range & Size

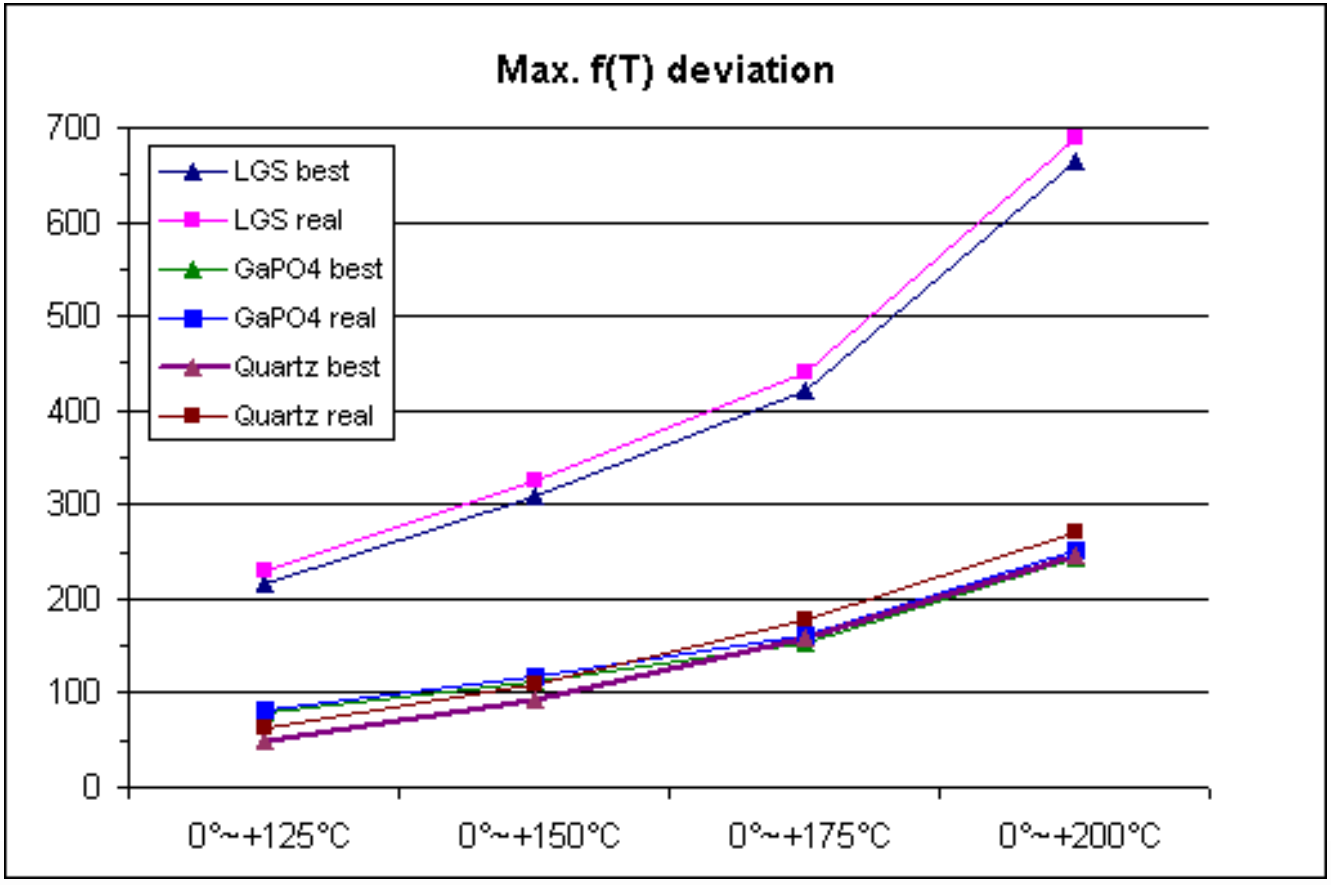


Typical Pulling Characteristics $f(C_L)$ of a 10 MHz LGS resonator in HC-52/U



Package HC-52/U
(H = 8.0mm)

Temperature stability

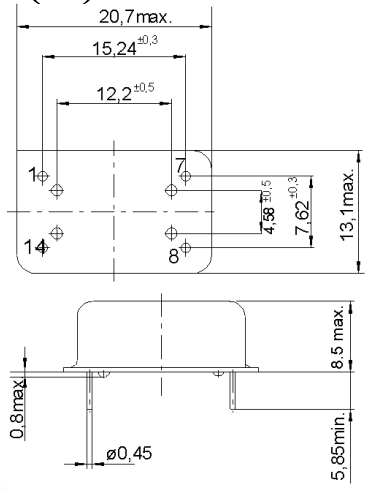


Piezo Sensors

- Sensors for High Temperature environment based on Langasite (LGS) and Gallium Phosphate ($GaPO_4$)
- Direct sensors, transducers or actors:
  Pressure, force, mass, temperature, viscosity, flow, chemical/biological processes
- Indirect sensors: transform capacitance change into frequency change

Hi-Temp Oscillators

- Types:
  - Clocks / PXO (Packaged Crystal Oscillators)
  - VCXO (Voltage Controlled Crystal Oscillators
    Wide pulling range larger than f(T) deviation
- Enclosure:
  - metal 4 pin DIP14 package
  - hermetically sealed
  - Nitrogen backfilled



Technology

- Packaging:
  - Al_2O_3 Hybrid thick film substrate
  - Au or Al wire bonding
  - Hi-Temp glues, unfilled and Ag filled
- Resonator:
  - LGS or $GaPO_4$ resonator in HC-52/U
  - optional: mounting for high shock resistance

Technology II

- Components:
  - two choices of Oscillator IC:
    -- HCMOS, qualified for 175°C continuous operation for MTBF > 500 h
    -- HTMOS SOI (Silicon On Isolator), high reliability up to 200°C. Disadvantages: cost, availability
  - Discrete Semiconductors (if used):
    bare die, die attach & wire bonded
  - Resistors: thick film printed
  - Capacitors: Hi-Temp Chip capacitors (0805)

Quality

Quality assurance:

- 100% Screening including
  - -- temp cycling –30°C~+150°C, 10 cycles
  - -- constant acceleration 100g/min
  - -- active burn-in 160h @+175°C
  - -- leak test (gross & fine leak)
  - -- electrical test @ RT
- Qualification including
  - -- temp cycling –30°C~+150°C, 1000 cycles
  - -- intermediate and final electrical tests @ RT

Example: Hi-Temp VCXO

Parameter	Min.	Typ.	Max.	Unit	Condition
Frequency Range	10		25	MHz	
Frequency stability in temperature range 0°C~175°C			±100 ±280	ppm ppm	$GaPO_4$ LGS
Electronic Frequency Control (EFC) range	±170 ±350	±200 ±400		ppm ppm	$GaPO_4$ LGS
EFC Voltage	0,25		4,75	V	Positive slope
Absolute pull range (APR)	±60			ppm	0°C~175°C
RF Output signal	HC	MOS	15 pF		
Supply Voltage	4,75	5,0	5,25	V	
Current consumption			30	mA	
Package 4pin DIP14 size	20,7x	13,1x	8,5	mm	Hermetically sealed

AXTAL Website

For latest updates:
Visit our Website
www.axtal.com

AXTAL ADVANCED XTAL PRODUCTS

Buchfinkenweg 8
D-74931 Lobbach / Germany
fon: +49(6226)9719689
fax: +49(6226)970133
E-Mail: info@axtal.com
Web: www.AXTAL.com