February, 2025

High Precision CMOS Oscillator MT-Series

MTO / MTG / DTT / MTT

九州電通株式会社

KYUSHU DENTSU COMPANY LIMITED (KDK)

http://www.kdk-group.co.jp

Overview / Applications

■ Developed new products meeting market needs

* Increased demand for higher precision clock signals as digital devices become more sophisticated.

CMOS, **High Frequency**, **High Precision**, **Low Noise**, and **Miniaturized** Oscillator = **MT Series**

■ Example of Applications

- Data Center
- Wi-Fi
- Drone
- Network Equipments (Rooter, Server, etc.)

Application

What's great！！

① Improved frequency-temperature characteristics ：

- Previously unthinkable Frequency Stability by innovative method ！
  50MHz or less ： possible ±2.5ppm in -10～+70℃
  10 ～ 160MHz ： ±5.0ppm -40～+85℃

② High Frequency： possible 160MHz from 10MHz

- Conventional TCXO： upper limit 60MHz
  MT Series ：up to 160MHz by unique Plasma thinning technology！

③ C-MOS OUTPUT ：

- Conventional TCXO：Clipped Sine wave
  MT Series ：High Frequency C-MOS output ！

④ Lo Noise・Low Jitter：

- Superior phase noise characteristics achieved because all frequency bands are fundamental design ！

⑤ 5 sizes package available ： smallest 2520 to 7050

- MTO(2520), MTG(3225), DTT(5032), MTT(7050)

Features

- **High Precision CMOS Output Oscillator**

RoHS

- **Size** ：2520 / 3225 / 5032 / 7050　4 types
- **Frequency Range** ：10MHz to 160MHz
- **Output** ：CMOS
- **Supply Voltage** ：+1.8V / +2.5V / +3.3V
- **Operating Temp Range** ：-40 to +125℃
- **Frequency Stability** ：±2.5ppm / -10～+70℃ (*≦50.000MHz, Custom options)
  ±5.0ppm / -40～+85℃
  ±15ppm / -40～+105℃
  ±25ppm / -40～+125℃
- **Phase Jitter** ：0.3ps typ. (@100.000MHz)

MTO
(2.5x2.0x1.0mm)

MTG
(3.2x2.5x1.1mm)

DTT
(5.0x3.2x1.0mm)

MTT
(7.0x5.0x1.4mm)

Products

Electrical Characteristics

All Sizes

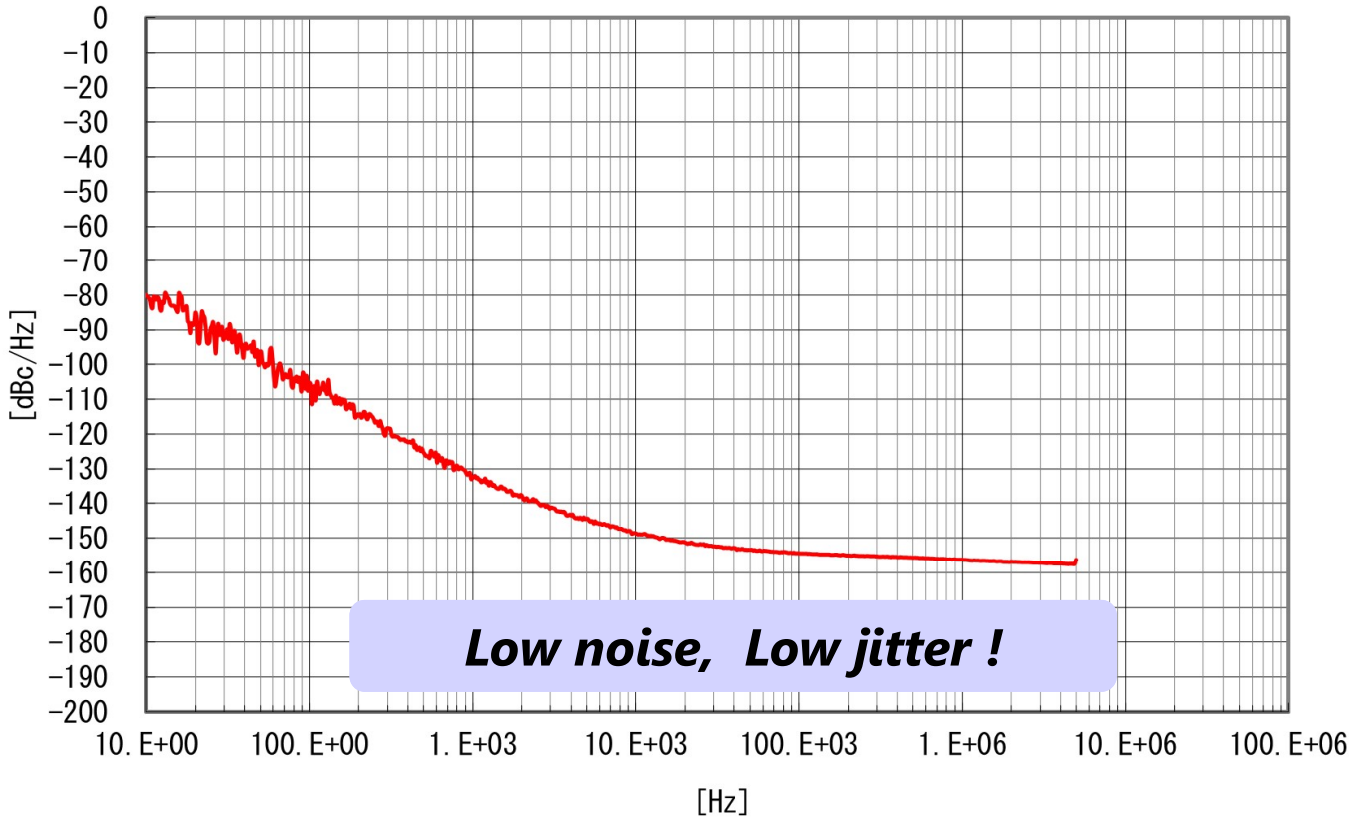
特性項目	Parameters	Conditions 条件	Specifications 仕様
供給電圧	Supply Voltage		+1.8V±5% +2.5V±5% +3.3V±5%
動作温度範囲	Operating Temperature Range		-40～+125℃ -40～+105℃ -40～+85℃ -10～+70℃
消費電流(max.)	Input Current	10 ～ 80MHz 80+ ～160MHz	11mA 20mA
周波数範囲	Frequency Range		10～160MHz
周波数安定性(max.)	Frequency Stability	≦50MHz(-10～+70℃)	±2.5ppm, ±5ppm, ±10ppm
		>50MHz(-10～+70℃)	±5ppm, ±10ppm, ±15ppm
		All Frequency(-40～+85℃)	±5ppm, ±10ppm, ±15ppm
		All Frequency(-40～+105℃)	±15ppm, ±20ppm, ±25ppm
		All Frequency(-40～+125℃)	±25ppm
波形対称性(max.)	Symmetry	At 0.5Vdd	45/55%
出力電圧	Output Voltage	"0" Level(max.) "1" Level(min.)	0.1Vdd 0.9Vdd
立上り/立下り時間(max.)	Rise/ Fall Time	At 0.1Vdd ～ 0.9Vdd	≦40MHz 6ns >40MHz 3ns
ドライブ能力(max.)	Driving Ability	CMOS Load	15pF
スタートアップ時間(max.)	Start-up Time		5ms
E/D機能	E/D Function	#1 Open #1 ≧0.7Vdd #1 ≦0.3Vdd	#3 Active #3 Active #3 High-Z
位相ジッタ(max.)	Phase jitter	Offset Frequency	1ps (12kHz～20MHz)

Frequency Stability（○：including、---：Not including ）

Freq. Stability (ppm)	Tolerance	vs. Temperature	Load Change	Volt Change	First Year Aging
± 2.5	○	○	---	---	---
± 5.0	○	○	---	---	---
± 10	○	○	○	○	○
± 15	○	○	○	○	○
± 20	○	○	○	○	○
± 25	○	○	○	○	○

Phase Noise Data (typical)

Ex) 25.000MHz, +3.3V, CMOS

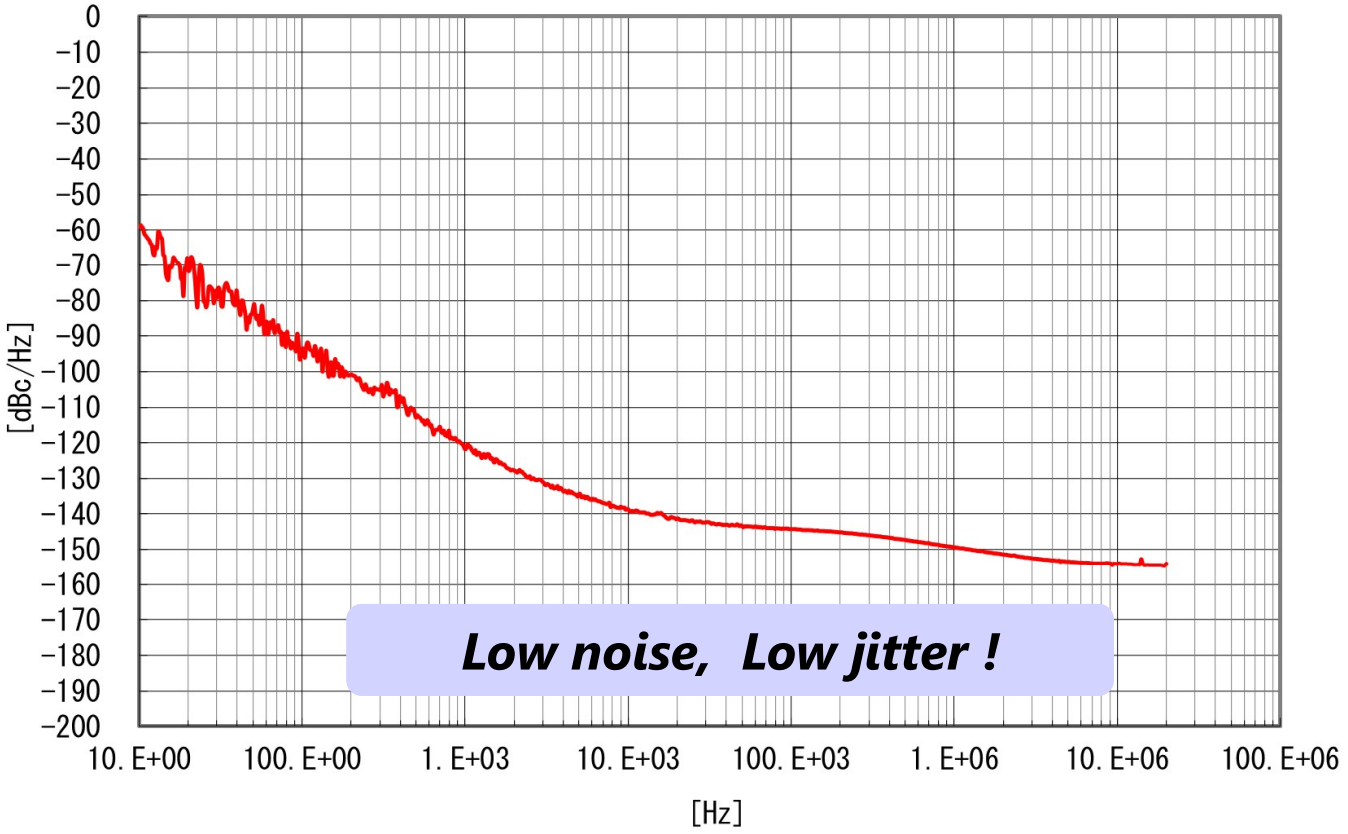


	10Hz	100Hz	1kHz	10kHz	100kHz	1MHz	10MHz	PHASE JITTER(ps)
Ave.	-80	-105	-133	-149	-154	-156	-156	0.294

Measured By "Agilent E5052B Signal Source Analyzer"

Phase Noise Data (typical)

Ex) 100.000MHz, +3.3V, CMOS



	10Hz	100Hz	1kHz	10kHz	100kHz	1MHz	10MHz	PHASE JITTER(ps)
Ave.	-59	-93	-122	-139	-144	-149	-154	0.228

Measured By "Agilent E5052B Signal Source Analyzer"

Freq. Temp. Characteristics (typical)

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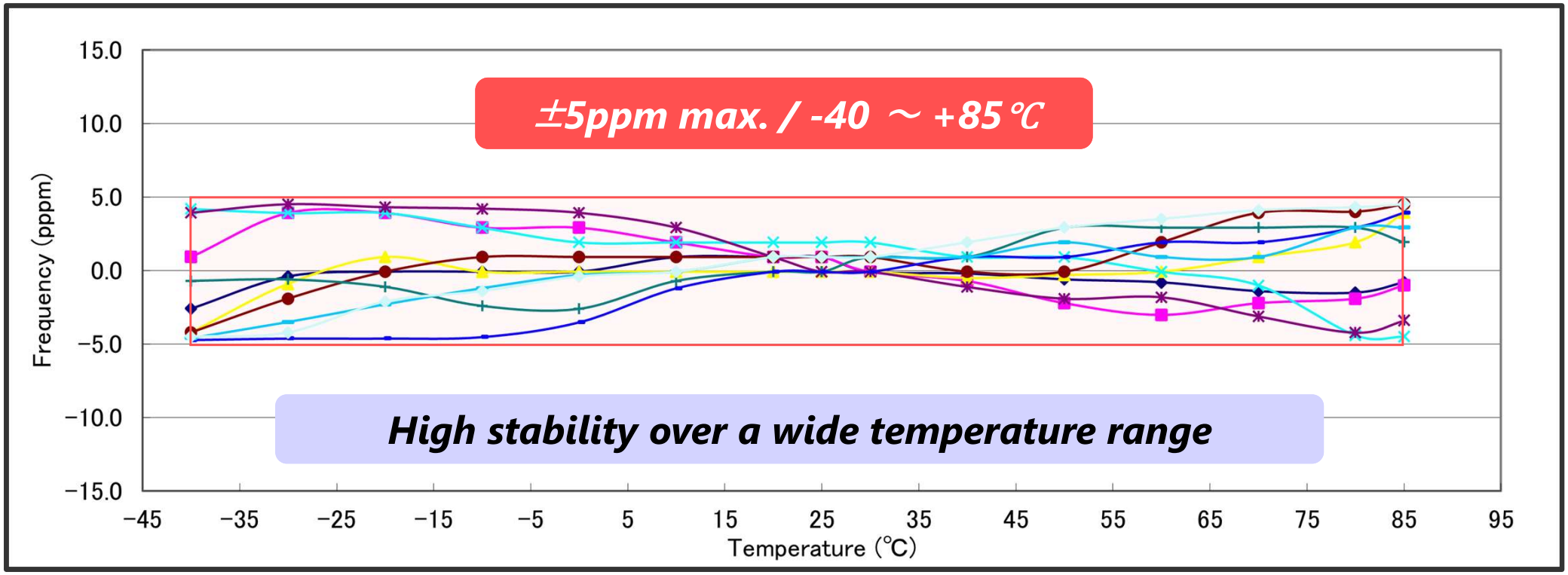
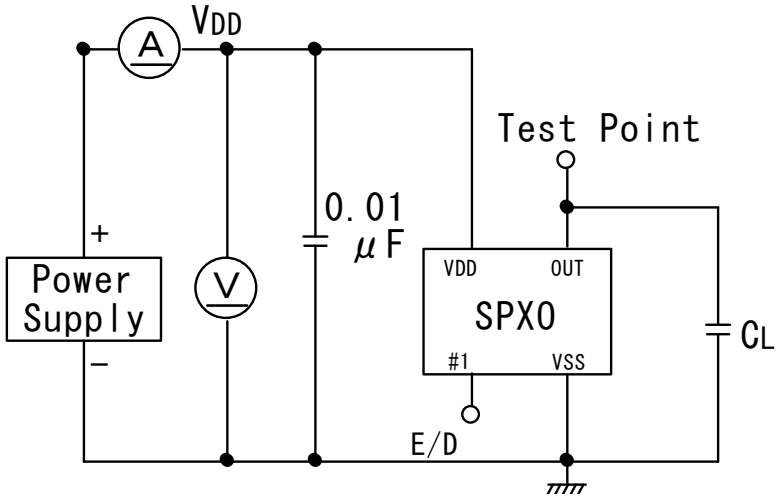
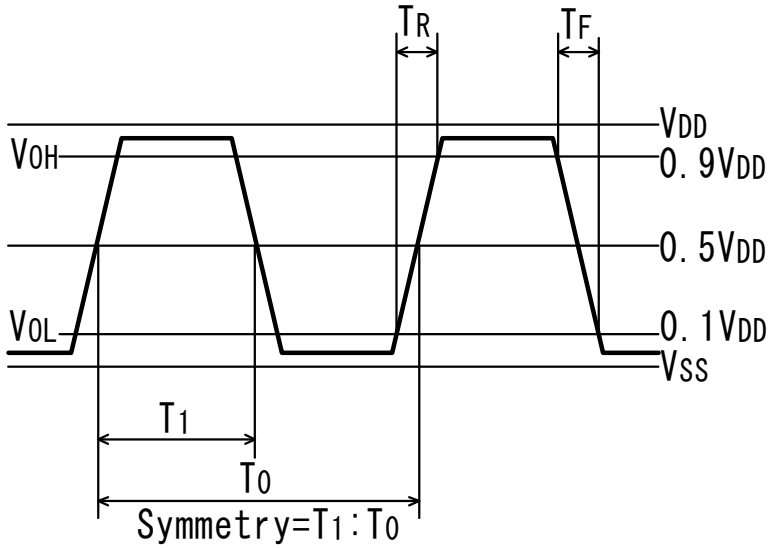
Ex) 100.000MHz, +3.3V, CMOS



℃	-40	-30	-20	-10	0	10	20	25	30	40	50	60	70	80	85
MAX	4.2	4.5	4.3	4.2	3.9	2.9	1.9	1.9	1.9	1.9	2.9	3.5	4.1	4.3	4.5
MIN	-4.6	-4.6	-4.6	-4.5	-3.5	-1.2	-0.1	-0.1	-0.1	-1.1	-2.2	-3.0	-3.1	-4.4	-4.5
AVE	-1.6	-0.4	0.3	0.1	0.3	0.6	0.7	0.6	0.5	0.3	0.5	0.5	0.7	0.7	1.2

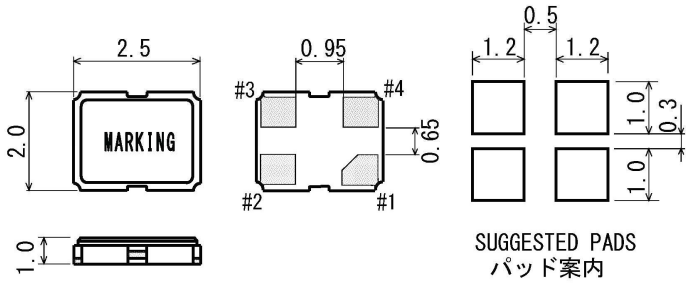
Test Circuit & Output Waveforms

Test Circuit (CMOS)	Output Waveforms (CMOS)
	

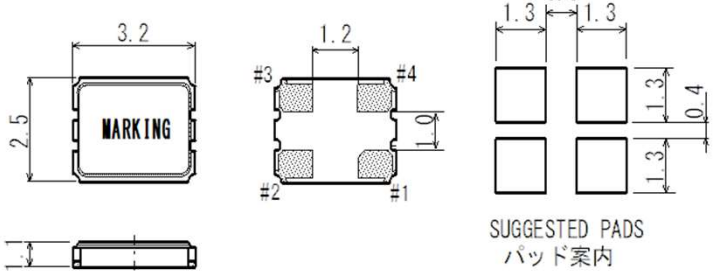
＊When using, a bypass capacitor of about 0.01 µF or 0.1 µF should be placed between power supply (Vdd) and ground (Vss).

Dimensions / Pad connections

MTO
2.5x2.0mm



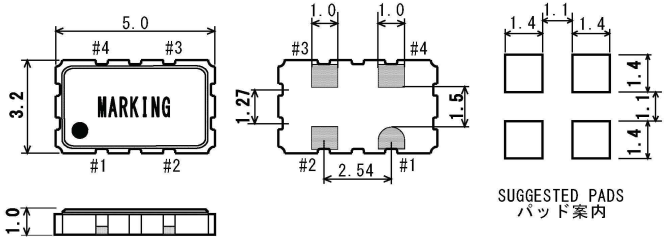
MTG
3.2x2.5mm



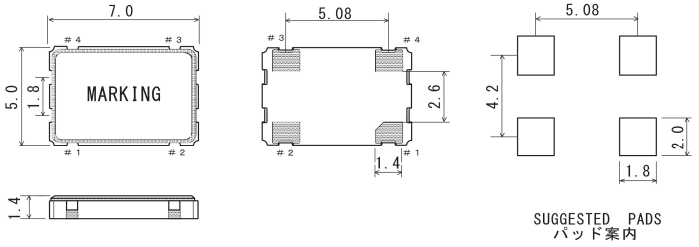
PAD Connections
All Sizes

#1	E/D
#2	NC
#3	GND
#4	OUT1

DTT
5.0x3.2mm



MTT
7.0x5.0mm



Nomenclature

Ex) Size : 2.5㎜×2.0㎜
Supply Voltage : +3.3V
Frequency Stability : ±5ppm max.
Temperature Range : -40℃ ～ +85℃

MTO 3 K F T _ 100.000000MHz

Code→ ① ② ③ ④ ② Frequency

Table1. MODEL

Code①	
MTO	2.5x2.0mm
MTG	3.2x2.5mm
DTT	5.0x3.2mm
MTT	7.0x5.0mm

Table2. Supply Voltage

Code②⑤		Supply Voltage
4	8	+1.8 V
2	5	+ 2.5 V
3	Blank	+3.3 V

Table3. Frequency Stability

Code③	Freq. Stability
H	±2.5 ppm max.
K	±5.0 ppm max.
1	±10 ppm max.
Z	±15 ppm max.
Y	±20 ppm max.

Table4. Temperature Range

Code④	Temp. Range
Z	-40℃ ～ +125℃
U	-40℃ ～ +105℃
F	- 40℃ ～ + 85℃
A	- 10℃ ～ + 70℃

Contact

■ Japanese market：Tokyo Office

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TEL ：042-367-8010

FAX ：042-367-8014

■ Overseas market：Nagasaki HQ

Add.：340 Fukushige-cho, Omura-city, Nagasaki Pref. 856-0006

TEL ：0957-55-1313

FAX ：0957-27-4018

Unique plasma processing technology 1

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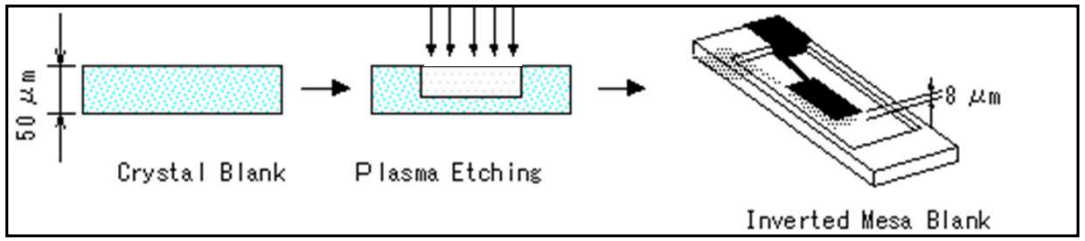
●Dry etching technology applied to crystal processing

Faster Signals → Higher frequency of crystal → Machining Limitations

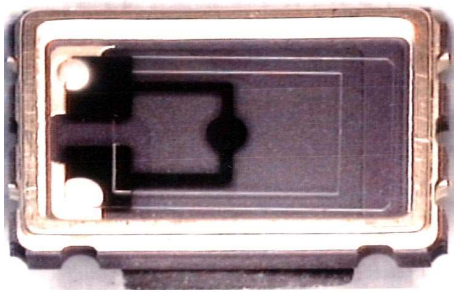
Thin quartz crystal sheets is achieved using proprietary plasma etching equipment

＊Patent No. 3492933

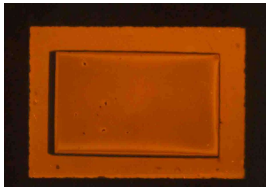


F0 = 1.67 x N ／T (AT-Cut)
F0 = Frequency (MHz)
N = 1,3,5,7 (Osc. mode)
T = thickness (mm)

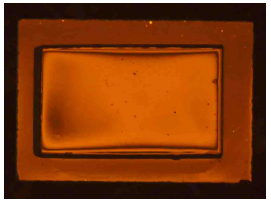
※Thinner Crystal = Higher Frequency



High frequency is realized by thinning only center of crystal plate.
Thickness remains on the periphery, thus preserving strength of the crystal plate.



70MHzRange (t=22.3μm)



200MHzRange (t=8.3μm)

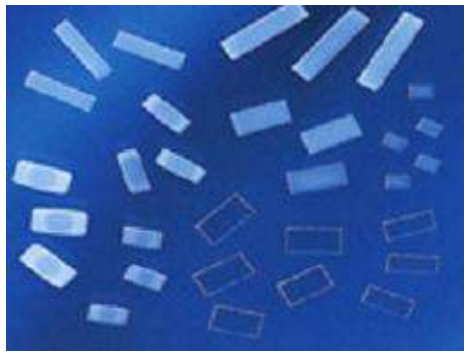
Only center can be processed to a few μm level.

KDK's unique thin plate processing technology overcomes the limitations of conventional mechanical polishing.

Unique plasma processing technology 2

● High-frequency fundamental process using plasma equipment

blank

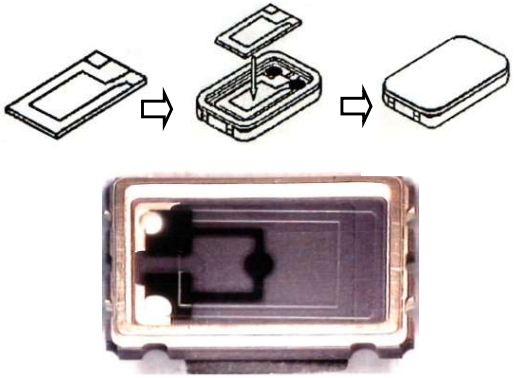


Crystal blank

MESA blank process

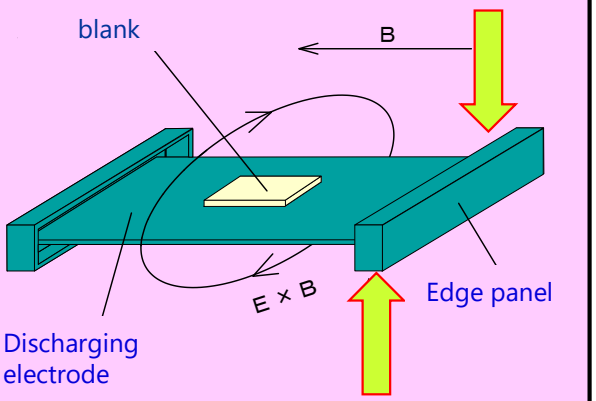
Plasma etching equipment

assembling



Oscillator, VCXO, Crystal

Vacuumed chamber



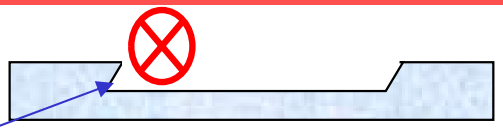
Introduce etching gas (CF4) and additive gases (Ar, O2) into the chamber to generate high-density uniform plasma to plane away quartz substrate (SiO2) thinly.

◂ Left : Image of dry etching with magnetron plasma

Unique plasma processing technology 3

● Advantages of Dry Etching Process with Plasma

Wet Processes by other company

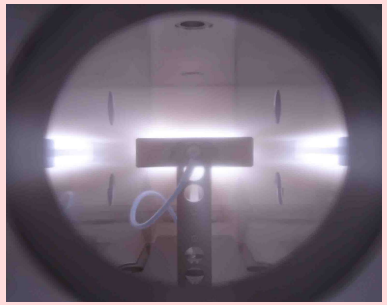


Chemical Mesa Blank

Risk of breakage of electrode at the side = risk of oscillation stoppage

KDK Dry Process

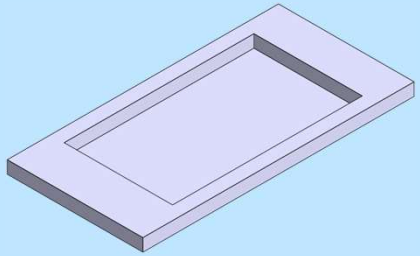
KDK Mesa Blank
real straight



Fundamental up to 500MHz available

High frequencies that were not possible with conventional wet etching can be produced using KDK plasma dry etching.

＊MT series up to 160MHz



Superior Microfabrication

Wet etching is processed in the crystal direction, so the edge is not vertical.
Plasma dry etching allows vertical processing, resulting in a good aspect ratio.

Environmentally friendly

Wet etching uses chemicals and requires waste liquid treatment.
Dry etching is an environ-mentally friendly process that does not produce waste liquid.