

# Specification

Drawing No.	TKY1T-H1-23015-00[45]
Issued Date.	January 27, 2023

**TO: Digi-Key**

Note: In case of specification change, KYOCERA Part Number also will be changed.

Product Name	Crystal Oscillator
Product Model	_____
Frequency	24.0000 MHz
Customer Part Number	_____
Customer Specification Number	_____
KYOCERA Part Number	MC2016Z24.0000C19YSX
Remarks	RoHS Compliant / MSL 1 / AEC-Q200 Certified





## Customer Acceptance

Accept Signature	Accept Date	
	Department	
	Person in charge	

## Seller

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**KYOCERA Corporation**



**1. Scope**

This specification shall be defined of the Clock Oscillator for the integrated circuits (ICs).

**2. Customer Part Number**

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**3. KYOCERA Part Number****MC2016Z24.0000C19YSX****4. Electrical Characteristics****4-1. Absolute Maximum Rating**

Item	Symbol	Rated Value	Units
Power Supply Voltage	$V_{CC}$	-0.3 to +4.5	V
Input Voltage	$V_{IN}$	-0.3 to $V_{CC} + 0.3$	V
Storage Temperature	$T_{STG}$	-55 to +150	°C

Note:

If the part is used beyond absolute maximum ratings, it may cause internal destruction. The part should be used under the recommended operating conditions the reliability of this part may be damaged if those conditions are exceeded.

**4-2. Recommended Operating Conditions**

Item	Symbol	Min	Typ	Max	Units	Remarks
Power Supply Voltage	$V_{CC}$	1.71	3.3	3.63	V	
Input Voltage	$V_{IN}$	0	---	$V_{CC}$	V	
Operating Temperature	$T_{OPR}$	-40	+25	+125	°C	

**4-3. Electrical Characteristics**

Item	Symbol	Min	Typ	Max	Units	Remarks
Output Frequency	$F_O$	---	24	---	MHz	
Frequency Tolerance*	$F_{tol}$	-35	---	+35	ppm	
Current Consumption (NoLoad/ $1.71 \leq V_{CC} \leq 2.25V$ )	$I_{CC}$	---	---	2.7	mA	
Current Consumption (NoLoad/ $2.25 < V_{CC} \leq 2.8V$ )		---	---	3.5		
Current Consumption (NoLoad/ $2.8 < V_{CC} \leq 3.63V$ )		---	---	4.0		
Standby Current	$I_{ST}$	---	---	5	μA	
Symmetry (Duty Ratio)	SYM	45	50	55	%	@ 50% $V_{CC}$
Rise Time/ Fall Time (20% $V_{CC}$ to 80% $V_{CC}$ )Loaded	$T_r / T_f$	--	--	4.0	ns	$1.71 \leq V_{CC} \leq 2.25V$
		--	--	3.2		$2.25 < V_{CC} \leq 2.8V$
		--	--	2.7		$2.8 < V_{CC} \leq 3.63V$
Output Voltage-"L"	$V_{OL}$	---	---	10% $V_{CC}$	V	$I_{OL} = 4mA$
Output Voltage-"H"	$V_{OH}$	90% $V_{CC}$	---	---		$I_{OH} = -4mA$
Output Load	CL	---	---	15	pF	CMOS
Input Voltage-"L"	$V_{IL}$	---	---	30% $V_{CC}$	V	
Input Voltage-"H"	$V_{IH}$	70% $V_{CC}$	---	---		
Output Disable Time	$t_{dis}$	---	---	200	ns	
Output Enable Time	$t_{ena}$	---	---	5	ms	
Start-up Time	$t_{sta}$	---	---	5	ms	@ Minimum operating voltage to be 0sec
1 Sigma Jitter**	$J_{Sigma}$	---	---	5	ps	
Peak to Peak Jitter**	$J_{PK-PK}$	---	---	50		
Phase Jitter (BW: 12kHz to 20MHz)	---	---	---	1	ps	$V_{CC} = 1.8V$
	---	---	---	1		$V_{CC} = 2.5V$
	---	---	---	1		$V_{CC} = 3.3V$

Note: All electrical characteristics have defined on the maximum loaded and recommended operating conditions.

\* Over All Conditions: Include initial tolerance, operating temperature range, rated power supply voltage change, load change, aging (1year @ +25°C), shock and vibration

\*\*Based on Time Interval Analyzer "Wavecrest SIA-3000".

**Table 1**

## 4-4. Measurement Condition

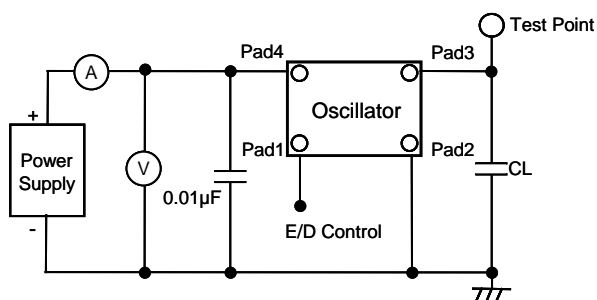
The reference temperature shall be  $+25\pm 2^{\circ}\text{C}$ . The measurement shall be performed at the temperature range of  $+5^{\circ}\text{C}$  to  $+35^{\circ}\text{C}$  unless otherwise the result is doubtful.

## 4-5. Measurement Circuit

The electrical characteristics shall be measured by test circuit "Fig. 1". Also jitter shall be measured by test circuit "Fig. 3".

## 4-6. Clock Timing Chart

The clock timing chart is "Fig. 2".



Note: CL includes probe and test fixture capacitance

Fig.1 Test Circuits

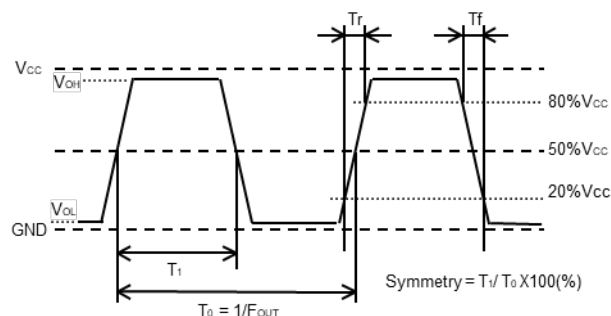
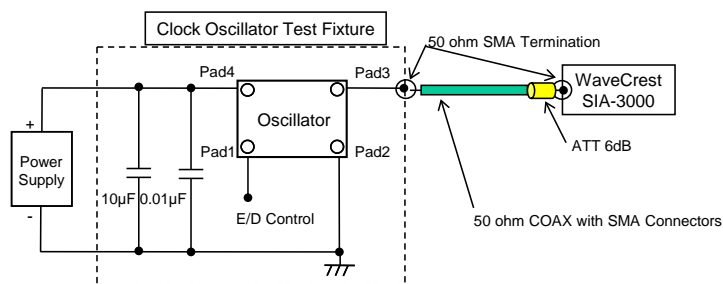


Fig.2 Clock Timing Chart (C-MOS Output)

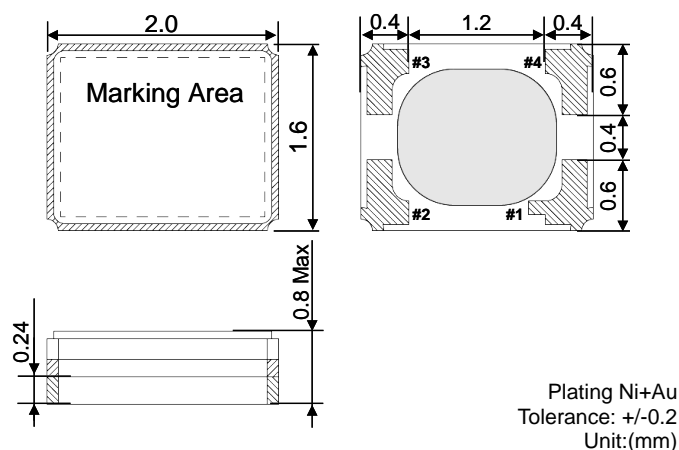


## &lt;Measurement Conditions&gt;

- Time Interval Analyzer
  - WaveCrest SIA-3000
- DTS timer calibration
  - Over 30 minutes warm-up
  - Extend 30 minutes calibration
- Jitter histogram conditions (Tail-fit)
  - More than 50,000cyc Hits
  - Bit Error Ratio (BER)  $-12$  (14sigma)

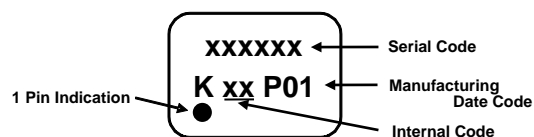
Fig.3 Jitter Test Circuits

## 5. Dimensions and Marking



Pad arrangement	
1	Stand-by Function
2	Case GND
3	Output
4	V <sub>CC</sub>

Stand-by Function	
Pad1	Pad3 (Output)
OPEN	Active
"H" Level	Active
"L" Level	High Z (No-Oscillation)



## Manufacturing Date Code

- Year Code (2020: "W", 2021: "A", 2022: "B" ....)
- Weekly Code

Year	Code	Year	Code
2020	W	2031	L
2021	A	2032	M
2022	B	2033	N
2023	C	2034	P
2024	D	2035	Q
2025	E	2036	R
2026	F	2037	S
2027	G	2038	T
2028	H	2039	V
2029	J	2040	W
2030	K	2041	A

It repeats from A in 2041 and after wards.

Table 2

## 6. Parts Numbering Guide

**MC2016Z 24.0000 C 1 9 Y SX**  
**A B C D E F G**

- A. Series (SMD Oscillator)  
 B. Output Frequency  
 C. Output  
   C: C-MOS  
 D. Supply Voltage  
   1: 1.8V/ 2.5V/ 3.3V Compatible  
 E. Frequency Tolerance\*

- F. Symmetry (Duty Ratio) and Stand-by Function  
   Y: Symmetry: 40% to 55% with Stand-by Function  
 G. For Automotive,  
   Frequency Tolerance: +/-35ppm @-40 to +125°C

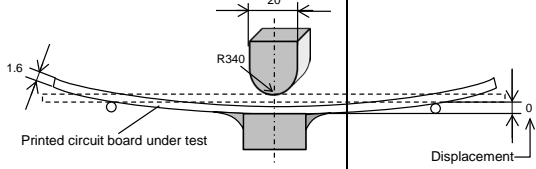
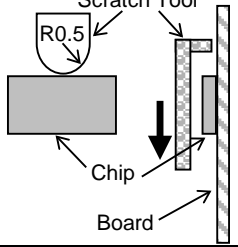
Packing (Tape & Reel 2,000pcs/Reel or 15,000pcs/Reel)

\*Over All Conditions:

Include initial tolerance, operating temperature range,  
 rated power supply voltage change, load change,  
 aging (1year @+25°C), shock and vibration.

## 7. Environmental Characteristics (Based on AEC-Q200 Rev. D)

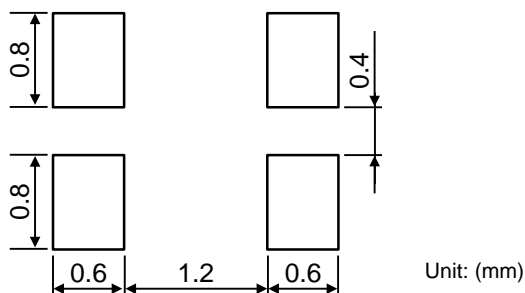
AEC-Q200 No	Items	Conditions	Reference	Criteria of Acceptance	Sample Size [PCS]
3	High Temperature Exposure (Storage)	+125°C 1000 hrs. Unpowered.	MIL-STD-202 Method 108	Satisfy Electrical Characteristics.	77
4	Temperature Cycling	1000cycles (-55 to +125°C)	JESD22 Method JA-104	Satisfy Electrical Characteristics.	77
6	Moisture Resistance	+25°C, +65°C 90%RH 10cycles 24 hrs/1cycle. Unpowered. Steps 7a & 7b not required.	MIL-STD-202 Method 106	Satisfy Electrical Characteristics. Clause 13 shall be also satisfied.	77
7	Biased Humidity	+85°C, 85%RH, 1000 hrs. V <sub>CC</sub> =3.63V, CL=15pF	MIL-STD-202 Method 103	Satisfy Electrical Characteristics.	77
8	Operational Life	+125°C, 1000 hrs. V <sub>CC</sub> =3.63V, CL=15pF	MIL-STD-202 Method 108	Satisfy Electrical Characteristics.	77
9	External Visual	Magnification 10x	MIL-STD-883 Method 2009	Thing that abnormality is not found in externals. (Inspect device construction, marking and workmanship. Electrical Test not required.)	30
10	Physical Dimension	-	JESD22 Method JB-100	Satisfy Approval Sheet	30
12	Resistance to Solvents	Magnification 10x	MIL-STD-202 Method 215	Thing that abnormality is not found in externals.	5
13	Mechanical Shock	100G/6ms/Half-sine Velocity change 12.3 (V)/ft/sec	MIL-STD-202 Method 213	Satisfy Electrical Characteristics.	30
14	Vibration	10 to 2000Hz. 5g's for 20 minutes 12 cycles each of 3 orientations.	MIL-STD-202 Method 204	Satisfy Electrical Characteristics.	30
15	Resistance to Soldering Heat	Soaking:+260±5°C, 10±1sec	MIL-STD-202 Method 210	Satisfy Electrical Characteristics.	30
16	Thermal Shock	-55°C/+125°C. 300Cycles, Max. transfer time 20 sec. Dwell time 5 min. Air-Air.	MIL-STD-202 Method 107	Satisfy Electrical Characteristics.	30
17	ESD	Human Body Model: 100pF/1500ohm/500~2000V 5 pulses	AEC-Q200-002	Satisfy Electrical Characteristics.	15
18	Solderability	8 hrs. steam age +215°C solder temperature 5 second dwell	J-STD-002	Dipped potion: Minimum 95% coverage	15
19	Electrical Characterization	-	Approval Sheet	Satisfy Approval Sheet	30 x 3Lot

AEC-Q200 No	Items	Conditions	Reference	Criteria of Acceptance	Sample Size [PCS]
21	Board Flex	<p>It pressurizes in the direction of the arrow, it pressurizes at the speed of 2mm in bend width about 0.5mm/sec, and it maintains it for 60 seconds.</p>  <p>Printed circuit board under test</p> <p>Displacement</p>	AEC-Q200-005	Satisfy Electrical Characteristics. Without looseness or crack etc.	30
22	Terminal Strength (SMD)	<p>The static load of 1.8Kg is added in the direction of the arrow and it maintains it in the prime fields of parts for 60 sec with a scratch treatment device of R0.5.</p>  <p>Scratch Tool</p> <p>R0.5</p> <p>Chip</p> <p>Board</p>	AEC-Q200-006	Satisfy Electrical Characteristics. Without looseness or crack etc.	30

After above test, measurement shall be done after leaving sample in room temperature for 2 hours.

Table 3

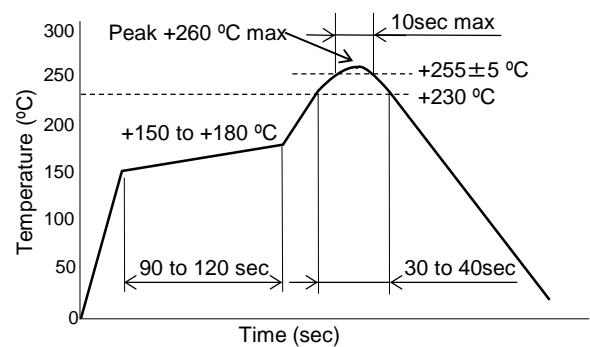
## 8. Recommended Land pattern and Soldering Guide



Note:

Since the part doesn't have Bypass Capacitor between  $V_{cc}$  and GND, Please mount high frequency type capacitor 0.01 $\mu$ F to the nearest position of oscillator.

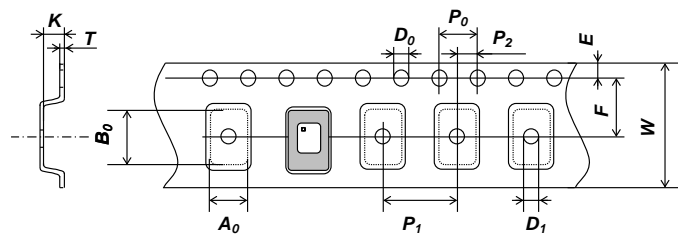
Fig.4 Land pattern



- Available Reflow times: Maximum twice

Fig.5 Reflow profile (Lead Free Available)

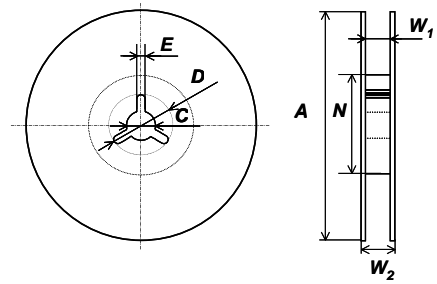
## 9. Taping Specifications



Unit: (mm)

Symbol	$A_0$	$B_0$	$W$	$F$	$E$
Dimensions	$1.8 \pm 0.05$	$2.25 \pm 0.05$	$8.0 \pm 0.2$	$3.5 \pm 0.05$	$1.75 \pm 0.1$
Symbol	$P_1$	$P_2$	$P_0$	$D_0$	$T$
Dimensions	$4.0 \pm 0.1$	$2.0 \pm 0.05$	$4.0 \pm 0.1$	$1.5 \pm 0.1/-0$	$0.2 \pm 0.05$
Symbol	$K$	$D_1$			
Dimensions	$0.9 \pm 0.1$	$1.1 \pm 0.1$			

Fig.6 Emboss Carrier Tape



Unit: (mm)

Std. Max 2,000pcs/Reel

Symbol	$A$	$N$	$W_1$
Dimensions	$180 \pm 0/-1.5$	$60 \pm 1/-0$	$9.0 \pm 0.3/-0$
Symbol	$W_2$	$C$	$D$
Dimensions	$11.4 \pm 1.0$	$13.0 \pm 0.2$	$21.0 \pm 0.8$
Symbol	$E$		
Dimensions	$2.0 \pm 0.5$		

Option Max 15,000pcs/Reel Unit: (mm)

Symbol	$A$	$N$	$W_1$
Dimensions	$330 \pm 0/-2$	$100 \pm 1/-1$	$9.4 \pm 1/-0.5$
Symbol	$W_2$	$C$	$D$
Dimensions	---	$13.0 \pm 0.2$	$21.0 \pm 0.8$
Symbol	$E$		
Dimensions	$2.0 \pm 0.5$		

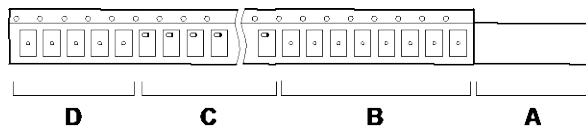
Fig.7 Reel

### 9-1. Taping Quantities

- The taping of per reel shall be packed 2,000 pcs (Std) or 15,000 pcs (Option).
- The parts shall be contained continuously in the pocket.

### 9-2. Leader and Blank Pockets

- The package shall be consisted of leader, blank pockets and loaded pocket as follows "Fig. 8".
- The power of peeling strength between top tape and carrier tape shall be 0.1N(10gf) to 1.0N(100gf) as follows "Fig. 9".



- A) Leader  
 B) Blank Pocket (40mm to 320mm)  
 A+B: 400mm to 560mm  
 C) Load Pocket  
 D) Blank Pocket (160mm minimum)

Fig.8 Packing Method

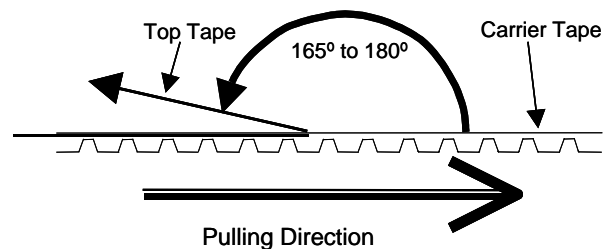


Fig.9 Peeling Strength

**9-3. Reel Label**

The reel label shall be consisted as below. (Based on EIAJ C-3 format)

- |                         |                  |
|-------------------------|------------------|
| A) Customer Part Number | D) Shipping Date |
| B) Lot No.              | E) Vender Name   |
| C) Quantities           |                  |

**9-4. Exterior Package Label**

The oscillator shall be packed properly to avoid defect in transportation. The exterior package label shall be consisted as below.

- |                         |                  |
|-------------------------|------------------|
| A) Name of Customer     | E) Quantities    |
| B) P/O No.              | F) Shipping Date |
| C) Customer Part Number | G) Vender Name   |
| D) Lot No.              |                  |

**10. The agreement of this specifications**

In case there is any obscure point or doubt concerning the contents of the specification, it shall be settled through consultation of both parties.

**11. Remarks on Usages****A) Storage Conditions**

The parts shall be stored in temperature range of -5 to +40°C, humidity 40 to 60% RH, and avoid direct sunlight. Then the parts shall be used within 6 months.

**B) Handling Conditions**

Although the part has protection circuit against static electricity, when excess static electricity is applied, the inside IC may get damaged.

Before mounting on the PCB, please make sure the direction of the part is correct. Otherwise the part of temperature will increase. And also the part will have some damages.

Please do not use the parts under the unfavorable condition such as beyond specified range in this specification.

Please do not use the parts under the condition, in the water or in the salt water also environment of dew or harmful gas.

Frequency drift may occur as a result of application of light such as direct sunlight or LED light etc when operating this oscillator.

Please use in a design and environment that consider light shielding.

Note the frequency drift will not occur if used in a light-shielded environment.

Please make sure the condition of pick and place following pick up nozzle guideline.

Picking Method: Case of Head Unit 1.6 x 1.2mm (Inside Diameter)

The proper condition of pick and place will be different each equipment. Therefore, please check before testing.

This product can be used for general electronic equipment (information equipment, communication equipment, audiovisual equipment, measuring equipment, home appliances, etc.) Intended to be used. Equipment and systems (traffic equipment, safety equipment, aviation / space control, nuclear power control, life support equipment) that require special quality and reliability and whose failure or malfunction may endanger human life or harm the human body. (Including medical devices, etc.), basic driving functions (running, turning, stopping) and collision safety in traffic equipment, applications related directly or indirectly to collision safety, and applications that are expected to have a significant impact on property, etc. It is not intended to be used. In the unlikely event that this product is used for any of these purposes, we will not be liable for any damages resulting from such use.



- C) Rework Condition  
Please do not pick up Head Unit. We can't guaranty electrical performance and reliability.
- D) Soldering Conditions  
This product can respond to the general Pb-free reflow profile. The wave soldering cannot be supported.
- E) Soldering in Mounting  
In case of Solder paste and conductive glue contact product lid or product side face exception for product terminal it's possible to influence product characteristics.  
Please be careful above contents.
- F) Washing Conditions  
Ultra sonic cleaning is available. However there is a possibility that Crystal in the part may cause damaged under certain condition. Therefore please test before using.  
After washing, please dry the parts completely. Otherwise water drops between the parts and PCB may cause migration.

In case of using this part without above precaution, Kyocera is unable to guarantee the specific characteristics

## 12. Quality guarantee

In case when Kyocera Corporation rooted failure occurred within 1year after its delivery, substitute product will be arranged based on discussion. Quality guarantee of product after 1year of its delivery is waived.