Specification

Drawing No.	TNY1T-H1-17462-00 [1/8]
Issued Date.	May-12-2017

TO: KCST

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

Product Name	Crystal Oscillator
Product Model	————————
Frequency	48 MHz
Customer Part Number	————————
Customer Specification Number	————————
KYOCERA Part Number	MC2016K48.0000C1XESK
Remarks RoHS Compliant / MSL 1 / AEC-Q200 Certified	

Customer Acceptance

Accept Signature	Accept Date	
	Department	
	Person in charge	

KYOCERA Corporation

Head Office

6 Takeda Tobadono-cho, Fushimi-ku, Kyoto
612-8501 Japan

TEL. No. (+81)75-604-3500
FAX. No. (+81)75-604-3501

Sales Division

6 Takeda Tobadono-cho, Fushimi-ku, Kyoto
612-8501 Japan

TEL. No. (+81)75-604-3500
FAX. No. (+81)75-604-3501

Design Department	Quality Assurance	Approved by	Checked by	Issued by
KYOCERA Corporation Crystal Components Division	**M.Morimoto**	**T.Koyanagi**	**K.Jikuhara**	**M.Ishibashi**

Revision History

Rev. No.	Description of revise	Date	Approved by	Checked by	Issued by
00	**First Edition**	**May-12-2017**	T.Koyanagi	K.Jikuhara	M.Ishibashi

1. Scope

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

2. Customer Part Number

3. KYOCERA Part Number

MC2016K48.0000C1XESK

4. Electrical Characteristics

4-1. Absolute Maximum Rating

Item	Symbol	Rated Value	Units
Power Supply Voltage	V_{CC}	-0.3 to +4.0	V
Input Voltage	V_{IN}	-0.3 to V_{CC} +0.3	V
Storage Temperature	T_{STG}	-55 to +125	°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}	1.6	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	---	48	---	MHz	
Frequency Tolerance*	F_{tol}	-50	---	+50	ppm	OP Temp. @-40 to +105°C
		-100	---	+100		OP Temp. @+105 to +125°C
Current Consumption (Loaded/ $1.6 \le V_{CC} \le 2.25V$)	I_{CC}	---	---	5.0	mA	
Current Consumption (Loaded/ $2.25 < V_{CC} \le 2.8V$)		---	---	5.5		
Current Consumption (Loaded/ $2.8 < V_{CC} \le 3.63V$)		---	---	6.0		
Standby Current	I_{ST}	---	---	5	µA	
Symmetry (Duty Ratio)	SYM	45	50	55	%	@ 50% V_{CC}
Rise Time/ Fall Time (10% V_{CC} to 90% V_{CC})	Tr/ Tf	---	---	6.0	ns	$1.6 \le V_{CC} \le 2.25V$
		---	---	5.0		$2.25 < V_{CC} \le 2.8V$
		---	---	4.5		$2.8 < V_{CC} \le 3.63V$
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	---	---	---	1	ps	BW:12kHz to 20MHz

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

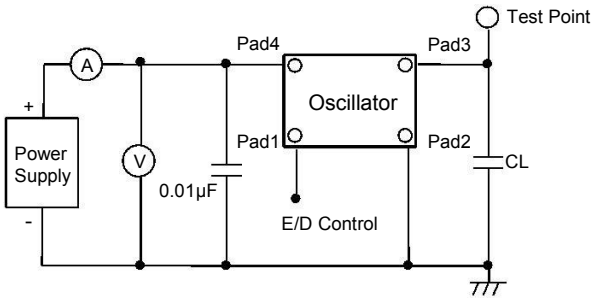
The reference temperature shall be +25±2ºC. The measurement shall be performed at the temperature range of +5 ºC to +35 ºC unless otherwise the result is doubtful.

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

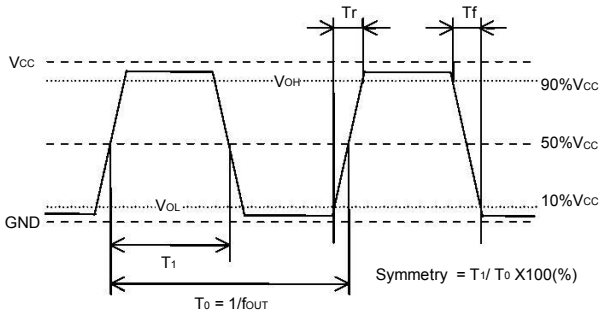
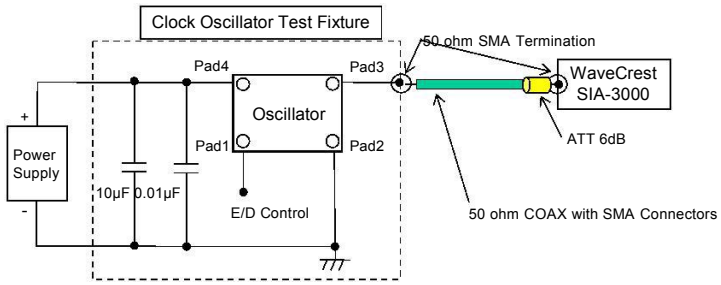


Fig.2 Clock Timing Chart (C-MOS Output)

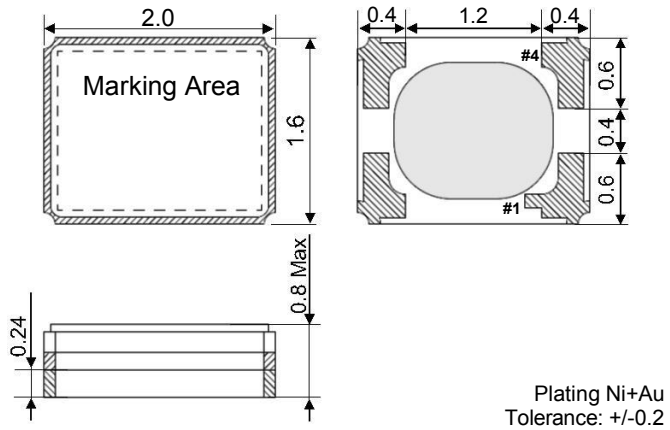


<Measurement Conditions>

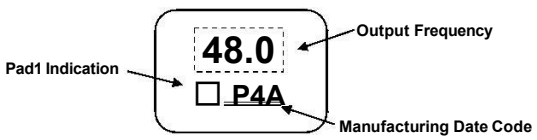
- Time Interval Analyzer
  - WaveCrest SIA-3000
- DTS timer calibration
  - Over 30 minutes warm-up
  - Extend 30 minutes calibration
- Jitter histogram conditions (Tail-fit)
  - More than 50,000cyc Hits
  - Bit Error Ratio (BER) –12 (14sigma)

Fig.3 Jitter Test Circuits

5. Dimensions and Marking



Plating Ni+Au
Tolerance: +/-0.2
Unit:(mm)



Output Frequency

The output frequency is three-digit without a decimal point. The frequency greater than the number of digits have rounded down.

(E.g. 14.31818MHz ➔ "14.3")

Manufacturing Date Code

Year	Code	Year	Code
2001	A	2011	L
2002	B	2012	M
2003	C	2013	N
2004	D	2014	P
2005	E	2015	Q
2006	F	2016	R
2007	G	2017	S
2008	H	2018	T
2009	J	2019	V
2010	K	2020	W
It repeats from A in 2021 and afterw ards.			

Month	Code
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B
12	C

Day	Code	Day	Code	Day	Code
1	1	11	B	21	M
2	2	12	C	22	N
3	3	13	D	23	P
4	4	14	E	24	Q
5	5	15	F	25	R
6	6	16	G	26	S
7	7	17	H	27	T
8	8	18	J	28	V
9	9	19	K	29	W
10	A	20	L	30	X
				31	Y

e.g. :"P4A" means "Apr-10-2014"

Table 2

Pad arrangement	
1	Enable/Disable
2	Case GND
3	Output
4	V_{CC}

Enable/Disable Function	
Pad1	Pad3 (Output)
OPEN	Active
"H" Level	Active
"L" Level	High Z (No-Oscillation)

6. Parts Numbering Guide

MC2016K48.0000 C 1 X E SK
A B C D E F G

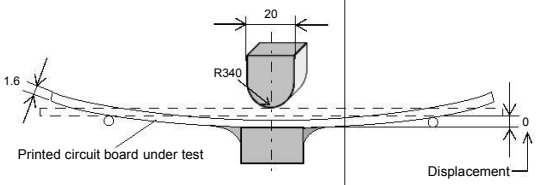
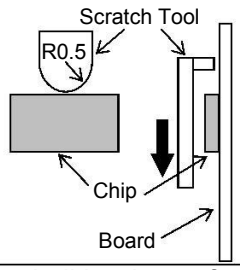
A. Series (SMD Oscillator)
B. Output Frequency
C. Output
C: C-MOS
D. Supply Voltage
1: 1.8V/ 2.5V/ 3.3V Compatible
E. Frequency Tolerance*

F. Symmetry (Duty Ratio) and Enable/Disable Function
E: Symmetry: 45% to 55% with Stand-by Function
G. For Automotive
Frequency Tolerance: +-50ppm @-40 to +105°C
+-100ppm @+105 to +125°C

Packing (Tape & Reel 2,000pcs/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)

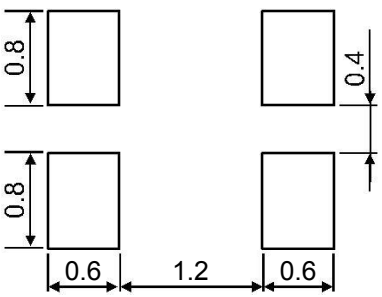
AEC-Q200 No	Items	Conditions	Reference	Criteria of Acceptance	Sample Size [PCS]
3	High Temperature Exposure (Storage)	+125°C 1000 hrs. Unpowered.	MIL-STD-202 Method 108	Satisfy Electrical Characteristics.	77
4	Temperature Cycling	1000cycles (-55 to +125°C)	JESD22 Method JA-104	Satisfy Electrical Characteristics.	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_{CC}=3.63V, CL=15pF	MIL-STD-202 Method 103	Satisfy Electrical Characteristics.	77
8	Operational Life	+125°C, 1000 hrs. V_{CC}=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_i)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	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. 	AEC-Q200-005	Satisfy Electrical Characteristics. Without looseness or crack etc.	30
22	Terminal Strength (SMD)	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. 	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.

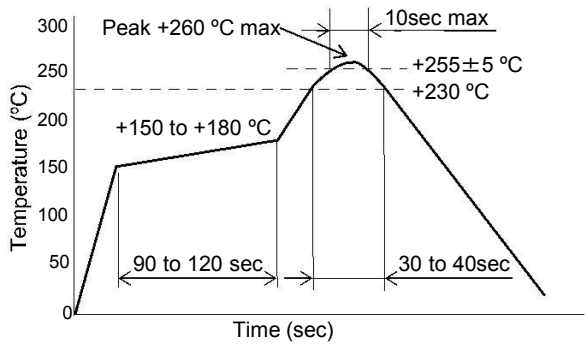
Table 3

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 0.01μF to the nearest position of oscillator.

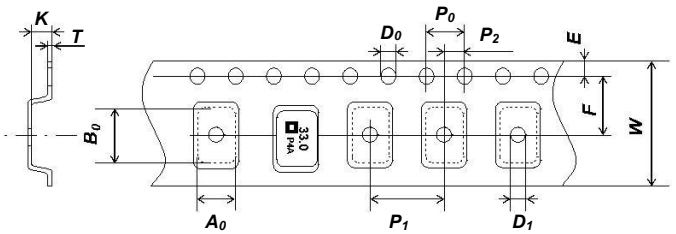
Fig.4 Land pattern



- Available Reflow times: Maximum twice

Fig.5 Reflow profile (Lead Free Available)

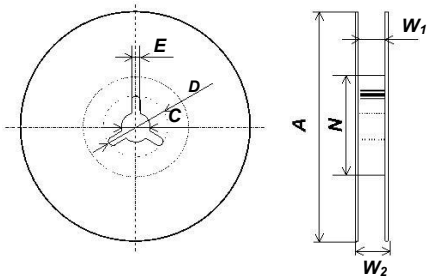
9. **Taping Specifications**



Unit: (mm)

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

Fig.6 Emboss Carrier Tape



Unit: (mm)

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

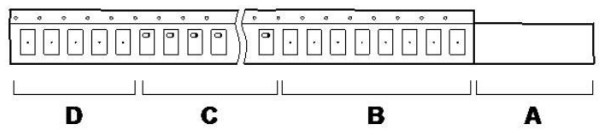
Fig.7 Reel

9-1. Taping Quantities

- The taping of per reel shall be packed 2,000 pcs.
- 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 0.7N(70gf) 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

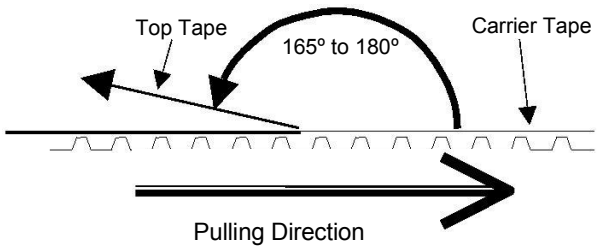


Fig.9 Peeling Strength

9-3. Reel Label

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

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

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

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.

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.

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.