

Specification

| | |
|--------------|--------------------------|
| Drawing No. | TNY1T-H1-16552-00 [1/10] |
| Issued Date. | Jul-27-2016 |

TO: AVX Corporation

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

| | |
|-------------------------------|--|
| Product Name | Crystal Oscillator |
| Product Model | _____ |
| Frequency | 20 MHz |
| Customer Part Number | _____ |
| Customer Specification Number | _____ |
| KYOCERA Part Number | MC2016K20.0000C16ESH |
| Remarks | RoHS Compliant / MSL 1 / AEC-Q200 & Q100 Certified |

Customer Acceptance

| | | |
|------------------|------------------|--|
| Accept Signature | Accept Date | |
| | Department | |
| | Person in charge | |

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| | | | | |
|---|-------------------|--------------------|---------------------|------------------|
| Design Department | Quality Assurance | Approved by | Checked by | Issued by |
| KYOCERA Crystal Device Corporation Oscillator Division | M. Fukawa | H.Yotsuzuka | M. Ishibashi | K.Shimura |

Revision History

| Rev. No. | Description of revise | Date | Approved by | Checked by | Issued by |
|----------|-----------------------|-------------|-------------|--------------|-----------|
| 00 | First Edition | Jul-27-2016 | H.Yotsuzuka | M. Ishibashi | K.Shimura |
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Preliminary

1. Scope

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

2. Customer Part Number

3. KYOCERA Part Number

MC2016K20.0000C16ESH

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 | +105 | °C | |

4-3. Electrical Characteristics

| Item | Symbol | Min | Typ | Max | Units | Remarks |
|--|-------------|--------------|-----|--------------|---------|--|
| Output Frequency | F_O | --- | 20 | --- | MHz | |
| Frequency Tolerance* | F_{tol} | -50 | --- | +50 | ppm | |
| Current Consumption (Loaded/ $1.6 \leq V_{CC} \leq 2.25V$) | I_{CC} | --- | --- | 2.5 | mA | |
| Current Consumption (Loaded/ $2.25 < V_{CC} \leq 2.8V$) | | --- | --- | 3.0 | | |
| Current Consumption (Loaded/ $2.8 < V_{CC} \leq 3.63V$) | | --- | --- | 3.5 | | |
| 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}) | T_r / T_f | --- | --- | 6.0 | ns | $1.6 \leq V_{CC} \leq 2.25V$ |
| | | --- | --- | 5.0 | | $2.25 < V_{CC} \leq 2.8V$ |
| | | --- | --- | 4.5 | | $2.8 < V_{CC} \leq 3.63V$ |
| Output Voltage-"L" | V_{OL} | --- | --- | 10% V_{CC} | V | $I_{OL} = 4mA$ |
| Output Voltage-"H" | V_{OH} | 90% V_{CC} | --- | --- | V | $I_{OH} = -4mA$ |
| 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

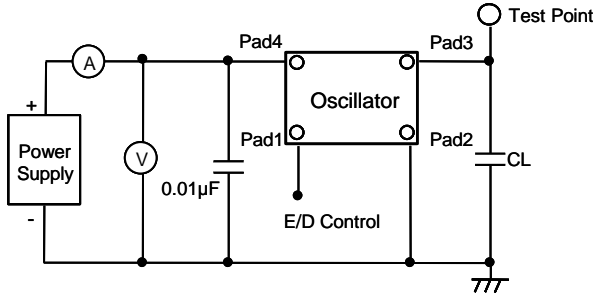
The reference temperature shall be $+25\pm 2^{\circ}\text{C}$. The measurement shall be performed at the temperature range of $+5^{\circ}\text{C}$ to $+35^{\circ}\text{C}$ unless otherwise the result is doubtful.

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

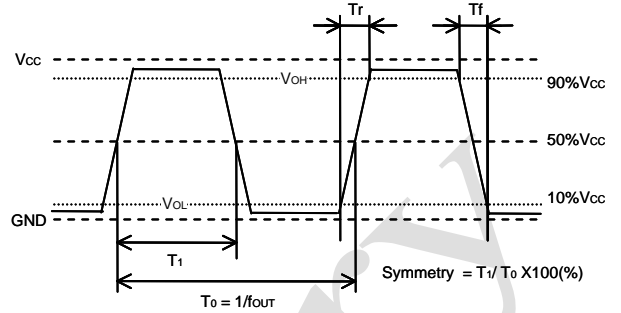
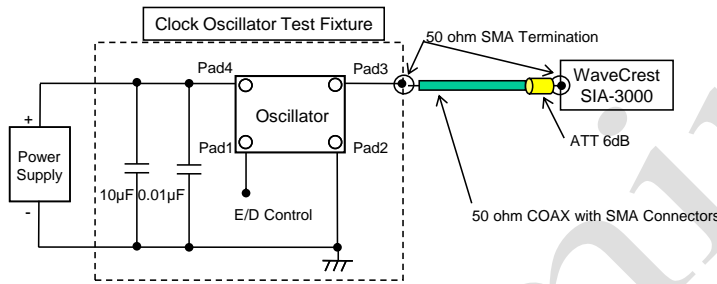


Fig.2 Clock Timing Chart (C-MOS Output)

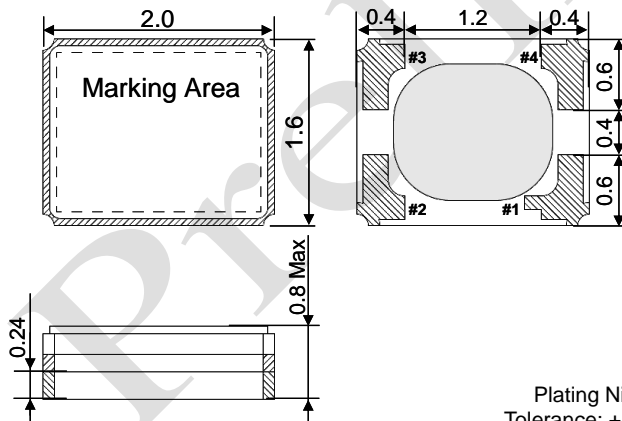


<Measurement Conditions>

- 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

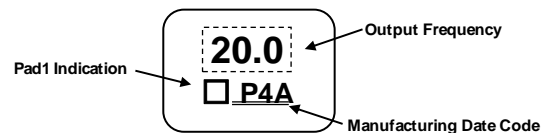
5. Dimensions and Marking



Plating Ni+Au
Tolerance: ± 0.2
Unit: (mm)

| Pad arrangement | |
|-----------------|----------------|
| 1 | Enable/Disable |
| 2 | Case GND |
| 3 | Output |
| 4 | Vcc |

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



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 \rightarrow "14.3")

Manufacturing Date Code

| Year | Code | Year | Code | Month | Code | Day | Code | Day | Code | Day | Code |
|------|------|------|------|-------|------|-----|------|-----|------|-----|------|
| 2001 | A | 2011 | L | 1 | 1 | 1 | 1 | 11 | B | 21 | M |
| 2002 | B | 2012 | M | 2 | 2 | 2 | 2 | 12 | C | 22 | N |
| 2003 | C | 2013 | N | 3 | 3 | 3 | 3 | 13 | D | 23 | P |
| 2004 | D | 2014 | P | 4 | 4 | 4 | 4 | 14 | E | 24 | Q |
| 2005 | E | 2015 | Q | 5 | 5 | 5 | 5 | 15 | F | 25 | R |
| 2006 | F | 2016 | R | 6 | 6 | 6 | 6 | 16 | G | 26 | S |
| 2007 | G | 2017 | S | 7 | 7 | 7 | 7 | 17 | H | 27 | T |
| 2008 | H | 2018 | T | 8 | 8 | 8 | 8 | 18 | J | 28 | V |
| 2009 | J | 2019 | V | 9 | 9 | 9 | 9 | 19 | K | 29 | W |
| 2010 | K | 2020 | W | 10 | A | 10 | A | 20 | L | 30 | X |
| | | | | 11 | B | | | | | 31 | Y |
| | | | | 12 | C | | | | | | |

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

Table 2

6. Parts Numbering Guide

MC2016K20.0000 C 1 6 E SH
 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*
 6: ± 50 ppm

- F. Symmetry (Duty Ratio) and Enable/Disable Function
 E: Symmetry: 45% to 55% with Stand-by Function
 G. For Automotive

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

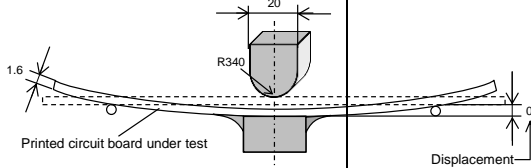
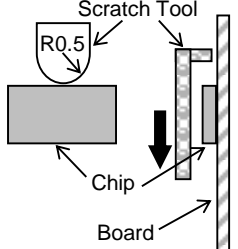
*Over All Conditions:

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

7. Environmental Characteristics

7-1. 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 \pm 5°C, 10 \pm 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>  | 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>  | 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

7-2 Based on AEC-Q100 Rev. G
TEST GROUP A

| AEC-Q100 ABV | Stress | Reference | Criteria of Acceptance | Sample Size [PCS] |
|------------------|---|----------------------------------|---------------------------------------|-------------------|
| PC | Preconditioning | JESD22 A113 J-STD-020 | Satisfy Electrical Characteristics. | 77 |
| THB or HAST | Temperature-Humidity-Bias or Biased HAST | JESD22-A101 or 110 | AEC-Q200 Biased Humidity | 77 |
| AC or UHST or TH | Autoclave or Unbiased HAST or Temperature-Humidity (without Bias) | JEDEC JESD22-A102,118 or A101 | AEC-Q200 Biased Humidity Test | 77 |
| TC | Temperature Cycling | JESD22-A104 | AEC-Q200 Temperature Cycling | 77 |
| PTC | Power Temperature Cycle | JESD22-A105 | N/A Max rated power is under 0.1W. | - |
| HTSL | High Temperature Storage Life | JESD22-A103 | Satisfy Electrical Characteristics. | 45 |

Table 4

| | |
|-------------|--------------------------|
| Drawing No. | TNY1T-H1-16552-00 [7/10] |
|-------------|--------------------------|

TEST GROUP B

| AEC-Q100 ABV | Stress | Reference | Criteria of Acceptance | Sample Size [PCS] |
|--------------|---|--------------|---|-------------------|
| HTOL | High Temperature Operating Life | JESD22- A108 | AEC-Q200 Operational Life | 77 |
| ELFR | Early Life Failure Rate | AEC Q100-008 | Satisfy Electrical Characteristics | 800 |
| EDR | NVM Endurance, Data Retention, and Operational Life | AEC Q100-005 | NA IC without memory, not applicable | --- |

Table 5

TEST GROUP C

| AEC-Q100 ABV | Stress | Reference | Criteria of Acceptance | Sample Size [PCS] |
|--------------|--------|-----------|------------------------|-------------------|
| ALL GROUP C | --- | --- | NA Not Wire Bonding | --- |

Table 6

TEST GROUP D (Compatible IC MAKER DATA)

| AEC-Q100 ABV | Stress | Reference | Criteria of Acceptance | Sample Size [PCS] |
|--------------|---------------------------------------|-----------------|------------------------|-------------------|
| EM | Electromigration | JESD61 | Process Data | --- |
| TDDDB | Time Dependent Dielectric Breakdown | JESD35 | Process Data | --- |
| HCI | Hot Carrier Injection | JESD60 & 28 | Process Data | --- |
| NBTI | Negative Bias Temperature Instability | JESD90 | N/A | --- |
| SM | Stress Migration | JESD61,87 & 202 | Process Data | --- |

Table 7

TEST GROUP E

| AEC-Q100 ABV | Stress | Reference | Criteria of Acceptance | Sample Size [PCS] |
|--------------|--|---------------------------------------|--|-------------------|
| TEST | Pre- and Post-Stress Function/Parameter | Specification | 0 fails | ALL |
| HBM / MM | Electrostatic Discharge Human Body Model / Machine Model | AEC Q100-002 Q100-003 | HBM Over 2KV MM Over 200V | 18 |
| CDM | Electrostatic Discharge Charged Device Model | AECQ100-011 | 0 Fails 750V corner pins, 500V all other pins | 6 |
| LU | Latch-Up | AECQ100-004 | 0 fails | 6 |
| ED | Electrical Distributions | AECQ100-009 | Satisfy Electrical Characteristics | 30 |
| FG | Fault Grading | AECQ100-007 | NA | --- |
| CHAR | Characterization | AEC Q003 | AEC-Q200 acceptable | --- |
| GL | Electrothermally-Induced Gate Leakage | AECQ100-006 | NA | --- |
| EMC | Electromagnetic Compatibility | SAE J1752/3 | For Information only | 6 |
| SC | Short Circuit Characterization | AEC Q100-012 | N/A | --- |
| SER | Soft Error Rate | JESD89-1 or JESD89-2 & JESD89-3 | NA Non Volatile Memory IC | -- |

Table 8

TEST GROUP F

| AEC-Q100 ABV | Stress | Reference | Criteria of Acceptance | Sample Size [PCS] |
|--------------|--------------------------------|-----------|------------------------|-------------------|
| PAT | Process Average Testing | AEC Q001 | For Information only | ALL |
| SBA | Statistical Bin/Yield Analysis | AEC Q002 | For Information only | ALL |

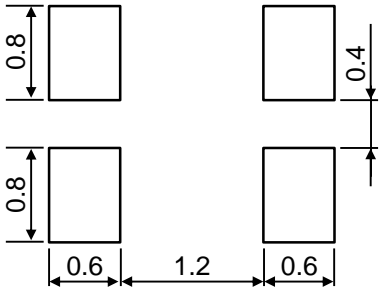
Table 9

TEST GROUP G

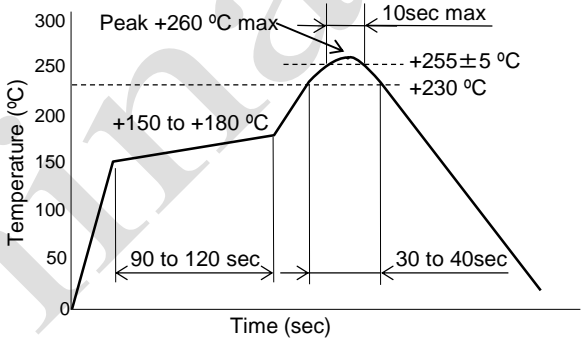
| AEC-Q100 ABV | Stress | Reference | Criteria of Acceptance | Sample Size [PCS] |
|--------------|------------------------------|-------------------------|------------------------------------|-------------------|
| MS | Mechanical Shock | JESD22-B104 | AEC-Q200 Mechanical Shock | 39 |
| VFV | Variable Frequency Vibration | JESD22-B103 | AEC-Q200 Vibration | 39 |
| CA | Constant Acceleration | MIL-STD-883 Method 2001 | Satisfy Electrical Characteristics | 39 |
| GFL | Gross/Fine Leak | MIL-STD-883 Method 1014 | Satisfy Electrical Characteristics | 39 |
| DROP | Package Drop | --- | NA NOT MEMS | --- |
| LT | Lid Torque | MIL-STD-883 Method 2024 | Over 0.5N-m | 5 |
| DS | Die Shear | MIL-STD-883 Method 2019 | For Information only | 5 |
| IWV | Internal Water Vapor | MIL-STD-883 Method 1018 | Satisfy Electrical Characteristics | 3 |

Table 10

8. Recommended Land pattern and Soldering Guide



Unit: (mm)



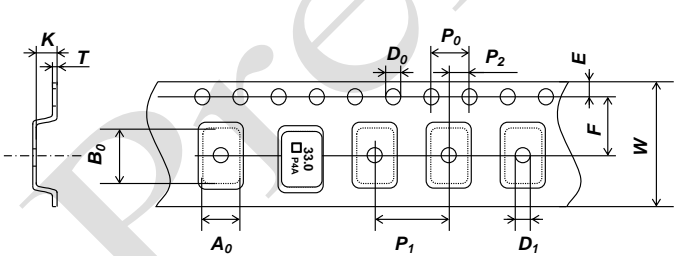
Note:
Since the part doesn't have Bypass Capacitor between V_{cc} and GND, Please mount high frequency type capacitor 0.01μF to the nearest position of oscillator.

- Available Reflow times: Maximum twice

Fig.4 Land pattern

Fig.5 Reflow profile (Lead Free Available)

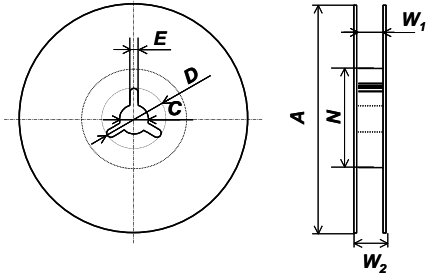
9. Taping Specifications



Unit: (mm)

| | | | | | |
|------------|----------------------|----------------------|----------------------|----------------------|----------|
| Symbol | A₀ | B₀ | 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 | P₁ | P₂ | P₀ | D₀ | 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 | D₁ | | | |
| Dimensions | 0.9±0.1 | 1.1±0.1 | | | |

Fig.6 Emboss Carrier Tape



Unit: (mm)

| | | | |
|------------|----------------------|----------|----------------------|
| Symbol | A | N | W₁ |
| Dimensions | 180 +0/-1.5 | 60+1/-0 | 9.0+0.3/-0 |
| Symbol | W₂ | C | D |
| Dimensions | 11.4±1.0 | 13.0±0.2 | 21.0±0.8 |
| Symbol | E | | |
| Dimensions | 2.0±0.5 | | |

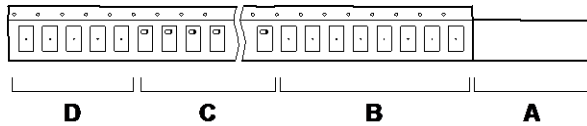
Fig.7 Reel

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

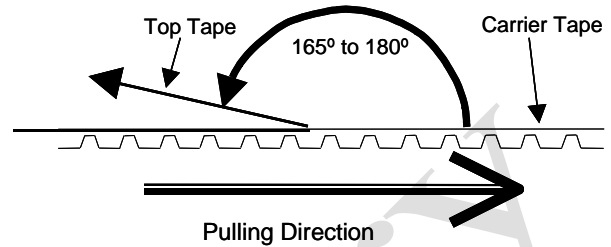


Fig.9 Peeling Strength

9-3. Reel Label

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

- | | |
|-------------------------|------------------|
| A) Customer Part Number | 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.

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.

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[601251](#) [EP16E7E2H26.000MTR](#) [SIT8918AA-11-33S-16.000000G](#) [XO3003](#) [9120AC-2D2-33E212.500000](#) [9102AI-243N25E100.00000](#)
[8208AC-82-18E-25.00000](#) [ASDK2-32.768KHZ-LR-T3](#) [8008AI-72-XXE-24.545454E](#) [8004AC-13-33E-133.33000X](#) [AS-4.9152-16-SMD-TR](#)
[ASFL1-48.000MHZ-LC-T](#) [SIT8920AM-31-33E-25.0000](#) [DSC1028DI2-019.2000](#) [9121AC-2C3-25E100.00000](#) [9102AI-233N33E100.00000X](#)
[9102AI-233N25E200.00000](#) [9102AI-232H25S125.00000](#) [9102AI-133N25E200.00000](#) [9102AC-283N25E200.00000](#) [9001AC-33-33E1-30.000](#)
[3921AI-2CF-33NZ125.000000](#) [5730-1SF](#) [PXA000010](#) [8003AI-12-33S-40.00000Y](#) [1602BI-13-33S-19.200000E](#) [8208AI-2F-18E-25.000000X](#)