

Ceramic Resonators (CERALOCK®)



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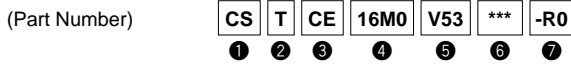
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● Part Numbering

CERALOCK® (MHz)



① Product ID

Product ID	
CS	Ceramic Resonators

② Frequency/Capacitance

Code	Frequency/Capacitance
A	MHz No capacitance built-in
T	MHz Built-in Capacitance

③ Structure/Size

Code	Structure/Size
LS	Round Lead Type
CC	Cap Chip Type
CR/CE/CG	Small-cap Chip Type
CV	Monolithic Chip Type
CW	Small Monolithic Chip Type

④ Nominal Center Frequency

Expressed by four-digit alphanumerics. The unit is in hertz (Hz). Decimal point is expressed by capital letter "M".

⑤ Design

Code	Design
G□□	Thickness Shear mode
T/V□□	Thickness Expander mode
X□□	Thickness Expander mode (3rd overtone)

□□ indicates initial frequency tolerance and load capacity.

⑥ Individual Specification

Code	Individual Specification
***	Three-digit alphanumerics express "Individual Specification".

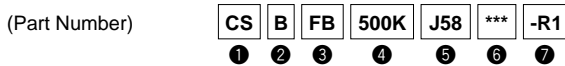
With standard products, "⑥ Individual Specification" is omitted, and "⑦ Package" is carried up.

⑦ Packaging

Code	Packaging
-B0	Bulk
-A0	Radial Taping H ₀ =18mm
-R0	Plastic Taping ø=180mm
-R1	Plastic Taping ø=330mm

Radial taping is applied to lead type and plastic taping to chip type.

CERALOCK® (kHz)



① Product ID

Product ID	
CS	Ceramic Resonators

② Frequency/Capacitance

Code	Frequency/Capacitance
B	kHz No capacitance built-in

③ Structure/Size

Code	Structure/Size
LA	Two-Terminal Lead Type
FB	SMD Type

④ Nominal Center Frequency

Expressed by four-digit alphanumerics. The unit is in hertz (Hz). Capital letter "K" following three figures expresses the unit of "kHz". In case of 1.0MHz (1000kHz) or above, expressed by three figures and capital letter "M" for decimal point.

⑤ Design

Code	Design
E□□	Area Expansion mode
J□□	Area Expansion mode (Closed Type)

□□ indicates initial frequency tolerance and load capacitance.

⑥ Individual Specification

Code	Individual Specification
***	Three-digit alphanumerics express "Individual Specification".

With standard products, "⑥ Individual Specification" is omitted, and "⑦ Package" is carried up.

⑦ Packaging

Code	Packaging
-B0	Bulk
-R1	Plastic Taping ø=330mm

Ceramic Resonators (CERALOCK®)



Chip Type Three Terminals CSTCC/R/E/G/V/W Series

Chip "CERALOCK" with built-in load capacitance in an extremely small package.
 MURATA's package technology expertise has enabled the development of the Chip "CERALOCK" with built-in load capacitors.
 High-density mounting can be realized because of the small package and the elimination of the need for an external load capacitor.

■ Features

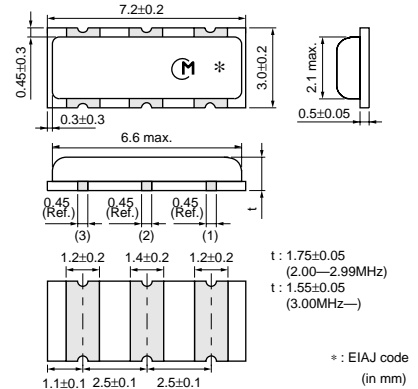
1. Oscillation circuits do not require external load capacitors.
2. The series is available in a wide frequency range.
3. The resonators are extremely small and have a low profile.
4. No adjustment is necessary for oscillation circuits.

■ Applicatons

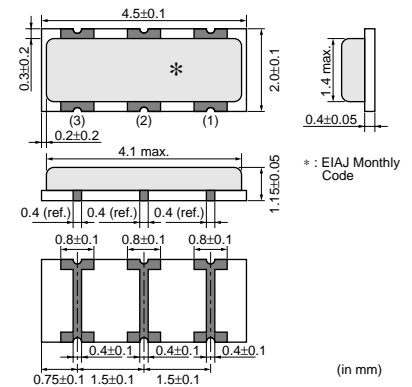
1. Clock oscillators for microprocessors
2. Electronic control circuits for small electronic equipment such as hand held video camera
3. Audio-visual applications (Camcorder, Remote Controller, etc.)
4. Office automation equipments (DVD, CD-ROM, HDD, FDD, etc.)
5. Automotive electronics (CSTCC_G_A series, CSTCR_G_B series, CSTCE_G_A series, CSTCE_V_A series, CSTCV_X_Q series)
6. Dual Tone Multi Frequency (DTMF) generator for cordless telephones



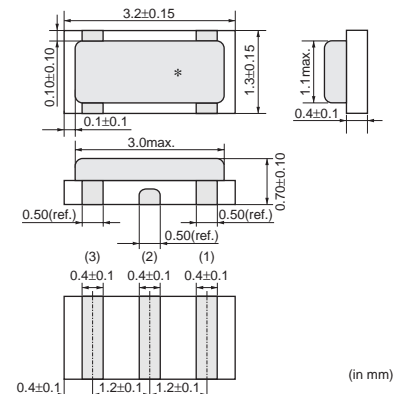
CSTCC_G(A)
2.00-3.99MHz



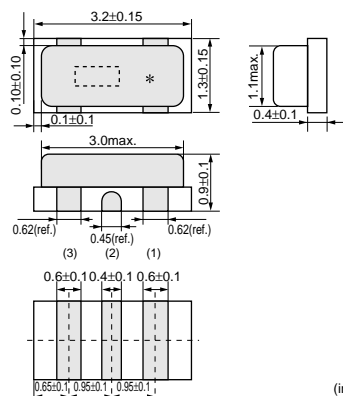
CSTCR_G(B)
4.00-7.99MHz



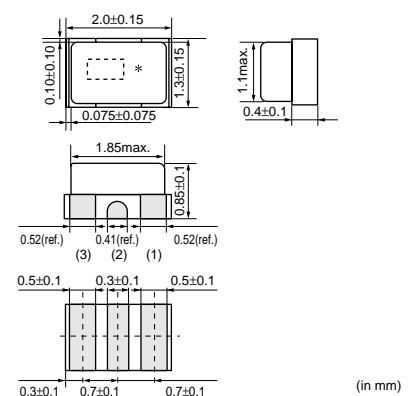
CSTCE_G(A)
8.00-13.99MHz



CSTCE_V(A)
14.00-20.00MHz

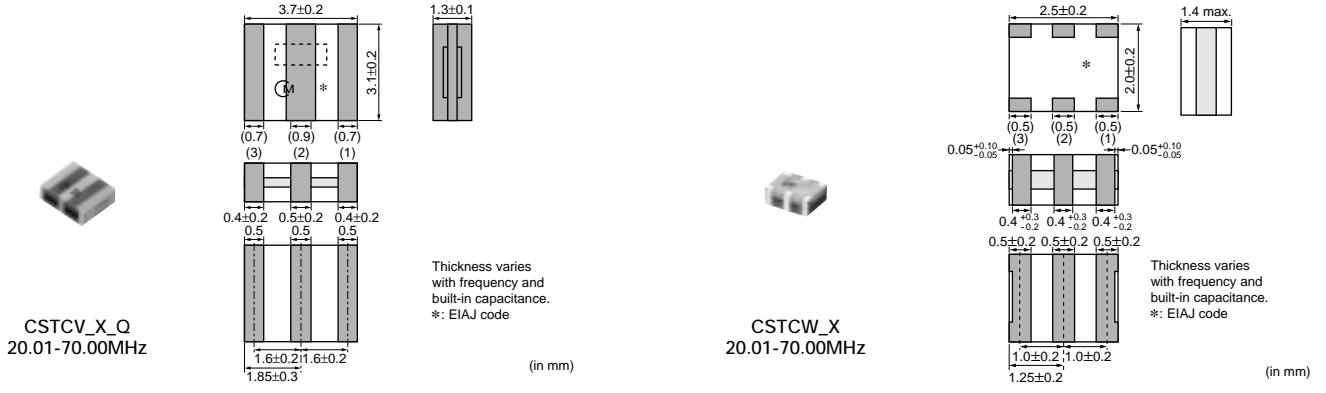


CSTCG_V
20.00-33.86MHz
(Ultra small)



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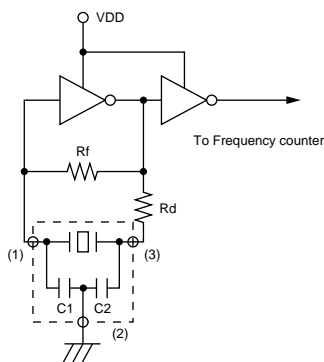
Continued from the preceding page.



Part Number	Oscillating Frequency (MHz)	Initial Tolerance (%)	Temp. Stability (%)	Temperature Range (°C)	Use
CSTCC_G	2.00 to 3.99	±0.5	±0.3 [±0.4%:Built-in Capacitance 47pF type within Freq.2.00 to 3.49MHz]	-20 to +80	For consumer electronics
CSTCC_G_A	2.00 to 3.99	±0.5	±0.4 [-0.6% to +0.3%:Built-in Capacitance 47pF type within Freq.2.00 to 3.49MHz]	-40 to +125	For automotive electronics
CSTCR_G	4.00 to 7.99	±0.5	±0.2	-20 to +80	For consumer electronics
CSTCR_G_B	4.00 to 7.99	±0.5	±0.15	-40 to +125	For automotive electronics
CSTCE_G	8.00 to 13.99	±0.5	±0.2	-20 to +80	For consumer electronics
CSTCE_G_A	8.00 to 13.99	±0.5	±0.2	-40 to +125	For automotive electronics
CSTCE_V	14.00 to 20.00	±0.5	±0.3	-20 to +80	For consumer electronics
CSTCE_V_A	14.00 to 20.00	±0.5	±0.3	-40 to +125	For automotive electronics
CSTCG_V	20.00 to 33.86	±0.5	±0.3	-20 to +80	For consumer electronics
CSTCV_X_Q	20.01 to 70.00	±0.5	±0.3	-40 to +125	For automotive electronics
CSTCW_X	20.01 to 70.00	±0.5	±0.2	-20 to +80	For consumer electronics

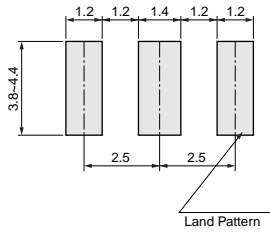
Irregular or stop oscillation may occur under unmatched circuit conditions. Please check the actual conditions prior to use.

■ Oscillation Frequency Measuring Circuit



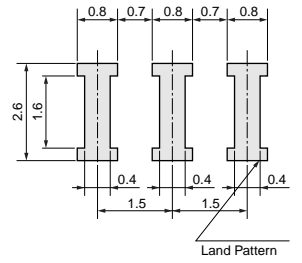
■ Standard Land Pattern Dimensions

CSTCC_G(A)



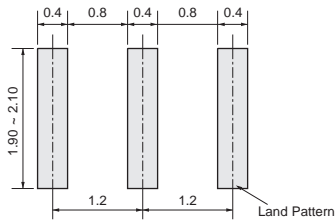
(in mm)

CSTCR_G(B)



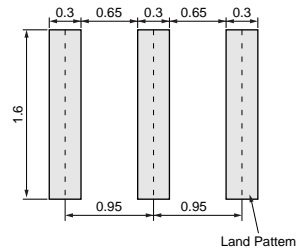
(in mm)

CSTCE_G(A)



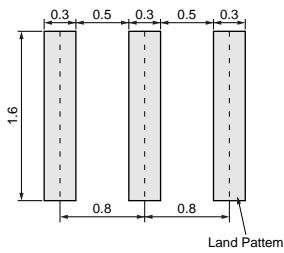
(in mm)

CSTCE_V(A)



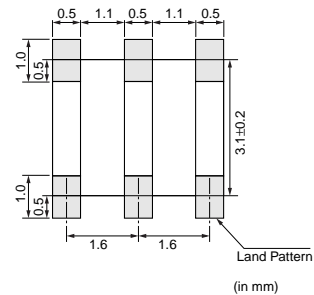
(in mm)

CSTCG_V



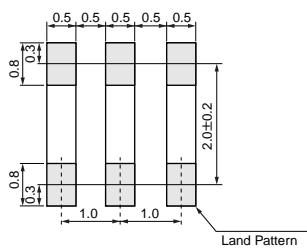
(in mm)

CSTCV_X(Q)



(in mm)

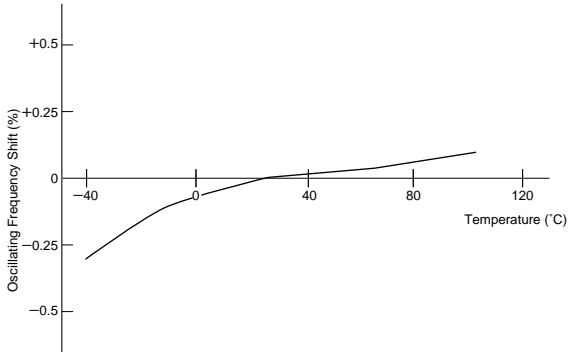
CSTCW_X



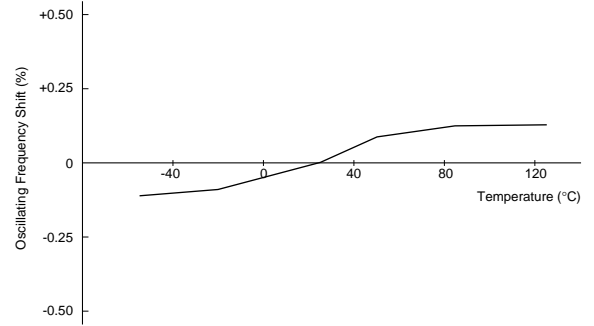
(in mm)

■ Oscillation Frequency Temperature Stability

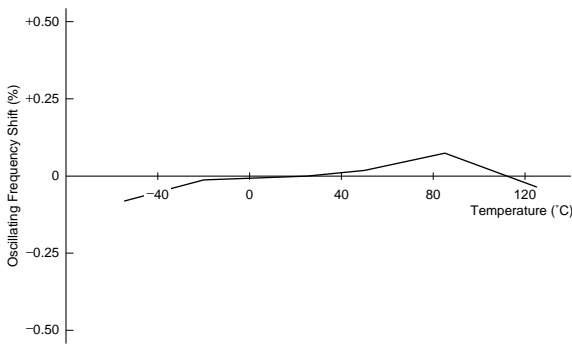
CSTCC_G



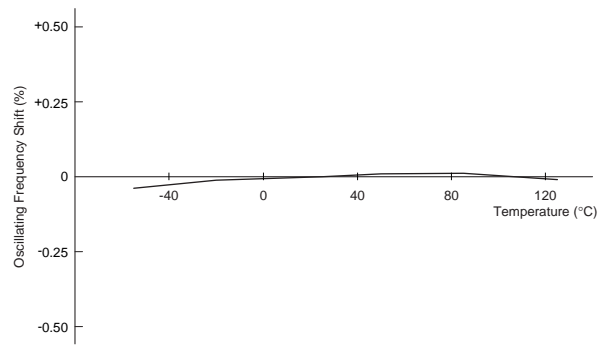
CSTCC_G_A



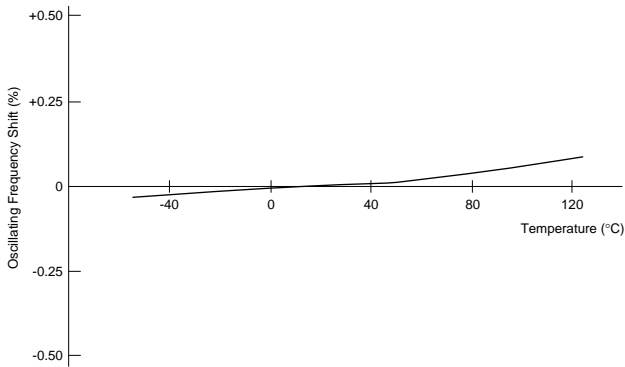
CSTCR_G(B)



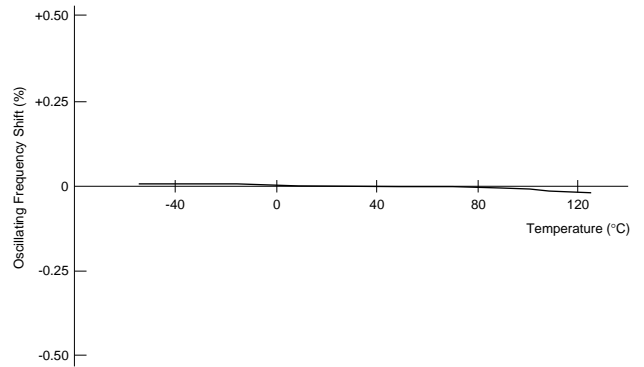
CSTCE_G(A)



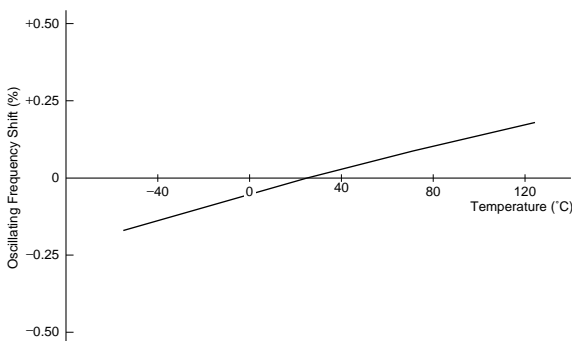
CSTCE_V(A)



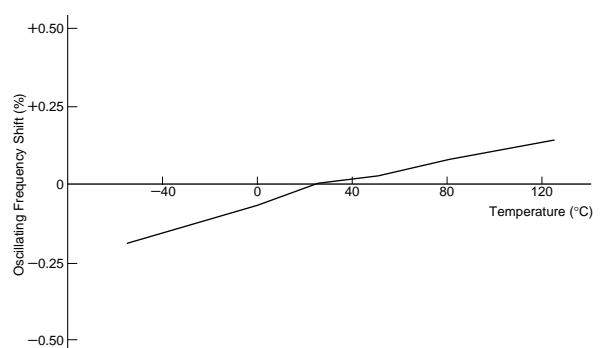
CSTCG_V



CSTCV_X(Q)



CSTCW_X



Ceramic Resonators (CERALOCK®)



Chip Type Two Terminals CSACV/W Series

A wide range of chip "CERALOCK" is now available. This diverse series owes its development to MURATA's package technology expertise and original mass production techniques. It enables high-density mounting and further miniaturization of electronic equipment.

■ Features

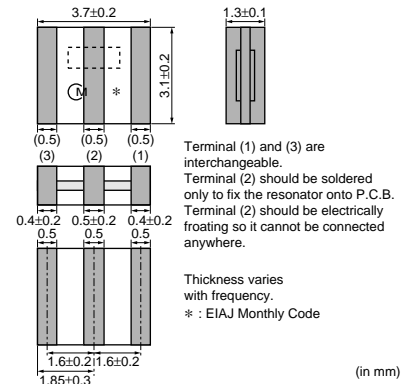
1. The series is available in a wide frequency range.
2. The resonators are extremely small and have a low profile (CSACW series).
3. No adjustment is necessary for oscillation circuits.

■ Applications

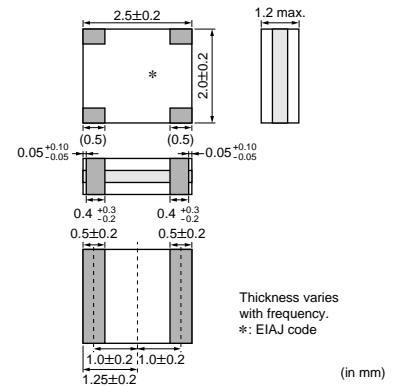
1. Clock oscillators for microprocessors
2. Electronic control circuits for small electronic equipment
3. Automotive electronics (CSACV_X_Q series)



CSACV_X_Q
20.01-70.00MHz



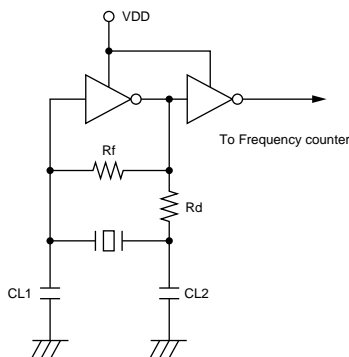
CSACW_X
20.01-70.00MHz



Part Number	Oscillating Frequency (MHz)	Initial Tolerance (%)	Temp. Stability (%)	Temperature Range (°C)	Use
CSACV_X_Q	20.01 to 70.00	±0.5	±0.3	-40 to +125	For automotive electronics
CSACW_X	20.01 to 70.00	±0.5	±0.2	-20 to +80	For consumer electronics

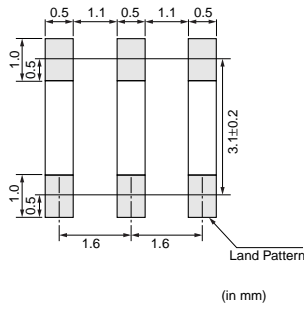
Irregular or stop oscillation may occur under unmatched circuit conditions. Please check the actual conditions prior to use.

■ Oscillation Frequency Measuring Circuit

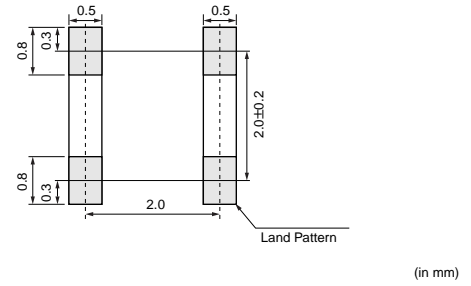


Standard Land Pattern Dimensions

CSACV_X_Q

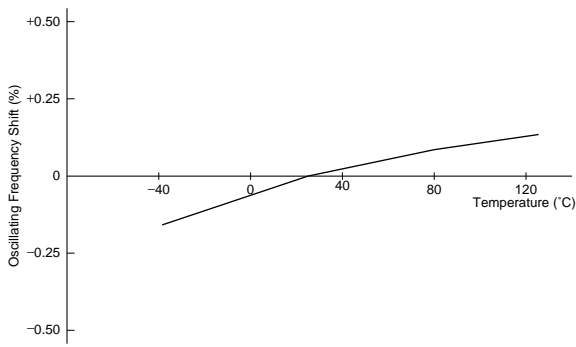


CSACW_X

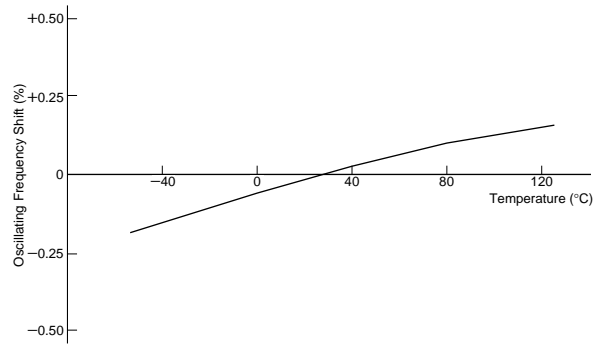


Oscillation Frequency Temperature Stability

CSACV_X_Q



CSACW_X



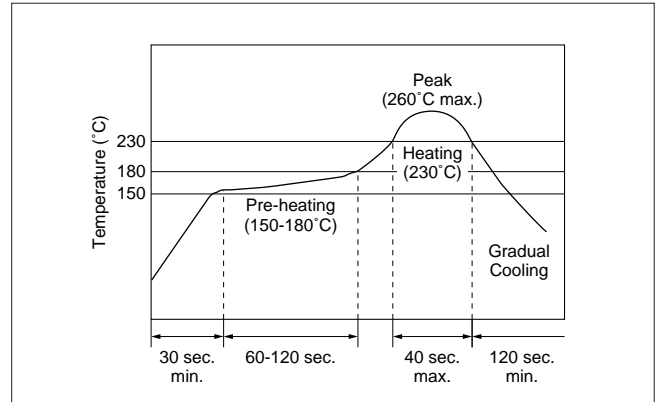
CSTCC Series Notice (Soldering and Mounting)

1. Soldering Conditions

(1) Reflow

One heat stress, shown in the profile at right, is applied to resonator; then, after being placed in natural conditions for 1 hour, the resonator is measured.

1. Pre-heating conditions should be +150 to +180°C for 60 to 120 seconds. Ascending time up to +150°C should be longer than 30 seconds.
2. Heating conditions should be within 40 seconds at +230°C min., but peak temperature should be lower than +260°C.



(2) Soldering Iron

Soldering iron of +300±5°C should be placed 0.5mm above electrode of resonator. Melting solder through soldering iron should be applied to electrode for 3±1 seconds; then, after being placed in natural conditions for 24 hours, the resonator should be measured.

2. Wash

Some series do not withstand washing.
Please check the list at right before use.

Series	Wash
CSTCC (Except 2.00 - 3.49MHz)	Available
CSTCC (Only 2.00 - 3.49MHz)	Not Available

*All automotive types are available.

(1) Cleaning Solvents

HCFC, Isopropanol, Tap water, Demineralized water, Cleanthrough750H, Pine alpha 100S, Techno care FRW

(2) Temperature Difference : dT *1

$dT \leq 60^\circ\text{C}$ ($dT = \text{Component} - \text{solvent}$)

*1 ex. In case the component at +90°C immerses into cleaning solvent at +60°C, then $dT = 30^\circ\text{C}$.

(3) Conditions

1. Ultrasonic Wash

1 minute max. in above solvent at +60°C max.
(Frequency : 28kHz, Output : 20W/L)

2. Immersion Wash

5 minutes max. in above solvent at +60°C max.

3. Shower or Rinse Wash

5 minutes max. in above solvent at +60°C max.

(4) Drying

5 minutes max. by air blow at +80°C max.

(5) Others

1. Total washing time should be within 10 minutes.
2. The component may be damaged if it is washed with chlorine, petroleum, or alkali cleaning solvent.

3. Notice for Mounting

1. The component is recommended for use with placement machines which employ optical placement capabilities. The component might be in damaged by excessive mechanical force. Please make sure to evaluate by using placement machines before going into mass production. Do not use placement machines which utilize mechanical positioning. Please contact Murata for details beforehand.

2. Please insure the component is thoroughly evaluated in your application circuit.

3. Please do not apply excess mechanical stress to the component and terminals during soldering.

CSTCR/CSTCE_V/CSTCG Series Notice (Soldering and Mounting)

1. Soldering Conditions

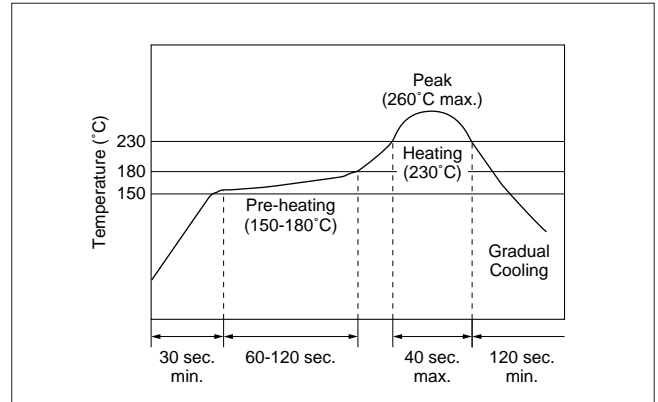
(1) Reflow

One heat stress, shown in the profile at right, is applied to resonator; then, after being placed in natural conditions for 1 hour, the resonator is measured.

1. Pre-heating conditions should be +150 to +180°C for 60 to 120 seconds. Ascending time up to +150°C should be longer than 30 seconds.
2. Heating conditions should be within 40 seconds at +230°C min., but peak temperature should be lower than +260°C.

(2) Soldering Iron

Soldering iron of +350±5°C should be placed 0.5mm above electrode of resonator. Melting solder through soldering iron should be applied to electrode for 3±1 seconds; then, after being placed in natural conditions for 24 hours, the resonator should be measured.



2. Wash (Automotive types)

Some series do not withstand washing.
Please check the list at right before use.

(1) Cleaning Solvents

HCFC, Isopropanol, Tap water, Demineralized water, Cleanthrough750H, Pine alpha 100S, Techno care FRW

(2) Temperature Difference : dT *1

$dT \leq 60^\circ\text{C}$ ($dT = \text{Component} - \text{solvent}$)

*1 ex. In case the component at +90°C immerses into cleaning solvent at +60°C, then $dT = 30^\circ\text{C}$.

(3) Conditions

1. Ultrasonic Wash

1 minute max. in above solvent at +60°C max.
(Frequency : 28kHz, Output : 20W/L)

2. Immersion Wash

5 minutes max. in above solvent at +60°C max.

3. Shower or Rinse Wash

5 minutes max. in above solvent at +60°C max.

(4) Drying

5 minutes max. by air blow at +80°C max.

(5) Others

1. Total washing time should be within 10 minutes.
2. The component may be damaged if it is washed with chlorine, petroleum, or alkali cleaning solvent.

3. Notice for Mounting

1. The component is recommended for use with placement machines which employ optical placement capabilities. The component might be damaged by excessive mechanical force. Please make sure to evaluate by using placement machines before going into mass production. Do not use placement machines which utilize mechanical positioning. Please contact Murata for details beforehand.

Series	Wash
CSTCR	Not Available
CSTCE_V	Not Available
CSTCG	Not Available

*All automotive types are available.

2. Please insure the component is thoroughly evaluated in your application circuit.

3. Please do not apply excess mechanical stress to the component and terminals during soldering.

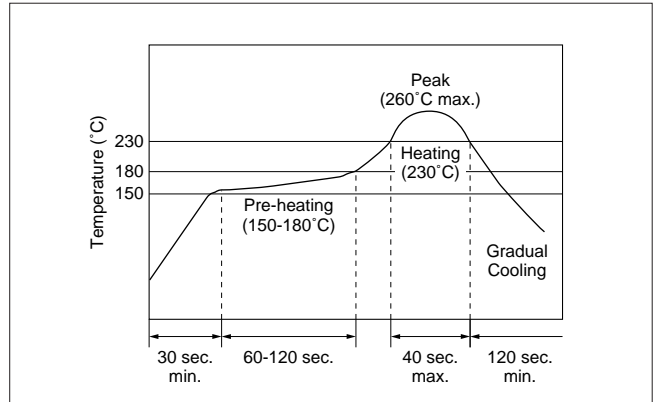
CSTCE_G Series Notice (Soldering and Mounting)

1. Soldering Conditions

(1) Reflow

One heat stress, shown in the profile at right, is applied to resonator; then, after being placed in natural conditions for 1 hour, the resonator is measured.

1. Pre-heating conditions should be +150 to +180°C for 60 to 120 seconds. Ascending time up to +150°C should be longer than 30 seconds.
2. Heating conditions should be within 40 seconds at +230°C min., but peak temperature should be lower than +260°C.



(2) Soldering Iron

Soldering iron of +330±5°C should be placed 0.5mm above electrode of resonator. Melting solder through soldering iron should be applied to electrode for 3±1 seconds; then, after being placed in natural conditions for 24 hours, the resonator should be measured.

2. Wash (Automotive types)

Some series do not withstand washing.
Please check the list at right before use.

Series	Wash
CSTCE_G	Not Available

*Automotive types are available.

(1) Cleaning Solvents

HCFC, Isopropanol, Tap water, Demineralized water, Cleanthrough750H, Pine alpha 100S, Techno care FRW

(2) Temperature Difference : dT *1

$dT \leq 60^\circ\text{C}$ ($dT = \text{Component} - \text{solvent}$)

*1 ex. In case the component at +90°C immerses into cleaning solvent at +60°C, then $dT = 30^\circ\text{C}$.

(3) Conditions

1. Ultrasonic Wash

1 minute max. in above solvent at +60°C max.
(Frequency : 28kHz, Output : 20W/L)

2. Immersion Wash

5 minutes max. in above solvent at +60°C max.

3. Shower or Rinse Wash

5 minutes max. in above solvent at +60°C max.

(4) Drying

5 minutes max. by air blow at +80°C max.

(5) Others

1. Total washing time should be within 10 minutes.
2. The component may be damaged if it is washed with chlorine, petroleum, or alkali cleaning solvent.

3. Notice for Mounting

1. The component is recommended for use with placement machines which employ optical placement capabilities. The component might be damaged by excessive mechanical force. Please make sure to evaluate by using placement machines before going into mass production. Do not use placement machines which utilize mechanical positioning. Please contact Murata for details beforehand.

2. Please insure the component is thoroughly evaluated in your application circuit.

3. Please do not apply excess mechanical stress to the component and terminals during soldering.

CSTCV/CSACV Series Notice (Soldering and Mounting)

1. Soldering Conditions

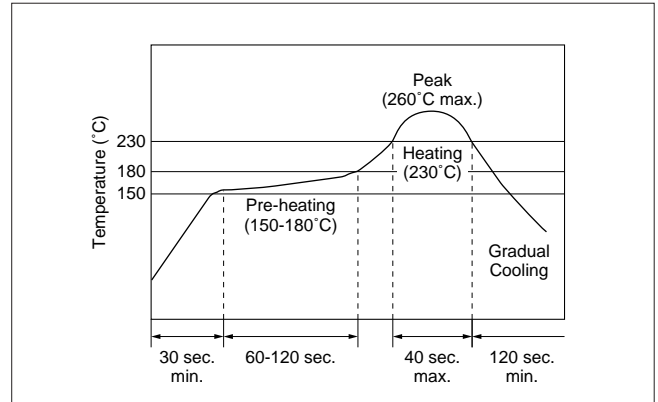
(1) Reflow

One heat stress, shown in the profile at right, is applied to resonator; then, after being placed in natural conditions for 1 hour, the resonator is measured.

1. Pre-heating conditions should be +150 to +180°C for 60 to 120 seconds. Ascending time up to +150°C should be longer than 30 seconds.
2. Heating conditions should be within 40 seconds at +230°C min., but peak temperature should be lower than +260°C.

(2) Soldering Iron

Soldering iron of +350±5°C should be placed 0.5mm above electrode of resonator. Melting solder through soldering iron should be applied to electrode for 3±1 seconds; then, after being placed in natural conditions for 24 hours, the resonator should be measured.



2. Wash

(1) Cleaning Solvents

HCFC, Isopropanol, Tap water, Demineralized water, Cleanthrough750H, Pine alpha 100S, Techno care FRW

(2) Temperature Difference : dT *1

$dT \leq 60^\circ\text{C}$ (dT=Component-solvent)

*1 ex. In case the component at +90°C immerses into cleaning solvent at +60°C, then dT=30°C.

(3) Conditions

1. Ultrasonic Wash

1 minute max. in above solvent at +60°C max.
(Frequency : 28kHz, Output : 20W/L)

2. Immersion Wash

5 minutes max. in above solvent at +60°C max.

3. Shower or Rinse Wash

5 minutes max. in above solvent at +60°C max.

(4) Drying

5 minutes max. by air blow at +80°C max.

(5) Others

1. Total washing time should be within 10 minutes.
2. The component may be damaged if it is washed with chlorine, petroleum, or alkali cleaning solvent.

3. Notice for Mounting

1. The component is recommended for use with placement machines which employ optical placement capabilities. In some cases, placement machines which utilize mechanical positioning may apply excessive mechanical force which might result in damage to the ceramic resonator. Please contact Murata before mounting this product using placement machines which use mechanical positioning.

2. Please insure the component is thoroughly evaluated in your application circuit.
3. Please do not apply excess mechanical stress to the component and terminals during soldering.

CSTCW/CSACW Series Notice (Soldering and Mounting)

1. Soldering Conditions

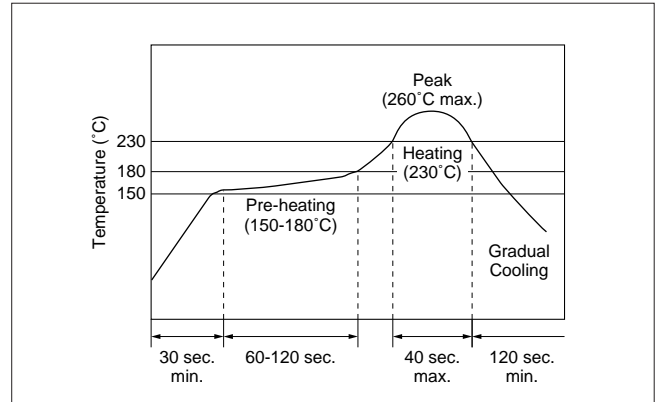
(1) Reflow

One heat stress, shown in the profile at right, is applied to resonator; then, after being placed in natural conditions for 1 hour, the resonator is measured.

1. Pre-heating conditions should be +150 to +180°C for 60 to 120 seconds. Ascending time up to +150°C should be longer than 30 seconds.
2. Heating conditions should be within 40 seconds at +230°C min., but peak temperature should be lower than +260°C.

(2) Soldering Iron

Soldering iron of +330±5°C should be placed 0.5mm above electrode of resonator. Melting solder through soldering iron should be applied to electrode for 3±1 seconds; then, after being placed in natural conditions for 24 hours, the resonator should be measured.



2. Wash

The component cannot withstand washing.

3. Notice for Mounting

1. Please insure the component is thoroughly evaluated in your application circuit.
2. Please do not apply excess mechanical stress to the component and terminals during soldering.

MHz Chip Type Notice

■ Notice (Storage and Operating Conditions)

CSTCR_G/CSTCE_G/CSTCE_V/CSTCG_V/CSTCC_G (2.00MHz-3.49MHz)/CSTCW_X/CSACW_X

1. Product Storage Condition

Please store the products in room where the temperature/humidity is stable. And avoid such places where there are large temperature changes. Please store the products under the following conditions:

Temperature: -10 to + 40 degree C

Humidity: 15 to 85% R.H.

2. Expire Date on Storage

Expire date (Shelf life) of the products is six months after delivery under the conditions of a sealed and an unopened package. Please use the products within six months after delivery. If you store the products for a long time (more than six months), use carefully because the products may be degraded in the solderability and/or rusty. Please confirm solderability and characteristics for the products regularly.

3. Notice on Product Storage

- (1) Please do not store the products in a chemical atmosphere (Acids, Alkali, Bases, Organic gas, Sulfides and so on), because the characteristics

may be reduced in quality, and/or be degraded in the solderability due to the storage in a chemical atmosphere.

- (2) Please do not put the products directly on the floor without anything under them to avoid damp places and/or dusty places.
- (3) Please do not store the products in the places such as: in a damp heated place, in a place where direct sunlight comes in, in place applying vibrations.
- (4) Please use the products immediately after the package is opened, because the characteristics may be reduced in quality, and/or be degraded in the solderability due to storage under the poor condition.
- (5) Please do not drop the products to avoid cracking of ceramic element.

4. Others

Conformal coating or washing of the component is not acceptable because it is not hermetically sealed. Please be sure to consult with our sales representative or engineer whenever and prior tousing the products.

■ Notice (Storage and Operating Conditions)

CSTCC_G_A/CSTCR_G_B/CSTCE_G_A/CSTCE_V_A/CSTCC_G (3.50MHz-10.0MHz)/CSTCV_X_Q/CSACV_X_Q

1. Product Storage Condition

Please store the products in room where the temperature/humidity is stable. And avoid such places where there are large temperature changes. Please store the products under the following conditions:

Temperature: -10 to + 40 degree C

Humidity: 15 to 85% R.H.

2. Expire Date on Storage

Expire date (Shelf life) of the products is six months after delivery under the conditions of a sealed and an unopened package. Please use the products within six months after delivery. If you store the products for a long time (more than six months), use carefully because the products may be degraded in the solderability and/or rusty. Please confirm solderability and characteristics for the products regularly.

3. Notice on Product Storage

- (1) Please do not store the products in a chemical atmosphere (Acids, Alkali, Bases, Organic gas, Sulfides and so on), because the characteristics may be reduced in quality, and/or be degraded in the solderability due to the storage in a chemical atmosphere.

- (2) Please do not put the products directly on the floor without anything under them to avoid damp places and/or dusty places.
- (3) Please do not store the products in the places such as: in a damp heated place, in a place where direct sunlight comes in, in place applying vibrations.
- (4) Please use the products immediately after the package is opened, because the characteristics may be reduced in quality, and/or be degraded in the solderability due to storage under the poor condition.
- (5) Please do not drop the products to avoid cracking of ceramic element.

4. Others

Conformal coating of the component is acceptable. However, the resin material, curing temperature, and other process conditions should be evaluated to confirm that stable electrical characteristics are maintained. Please be sure to consult with our sales representative or engineer whenever and prior tousing the products.

■ Notice (Rating)

The component may be damaged if excess mechanical stress is applied.

■ Notice (Handling)

"CERALOCK" may stop oscillating or oscillate irregularly under improper circuit conditions.

MHz Chip Type CSTC Series Packaging

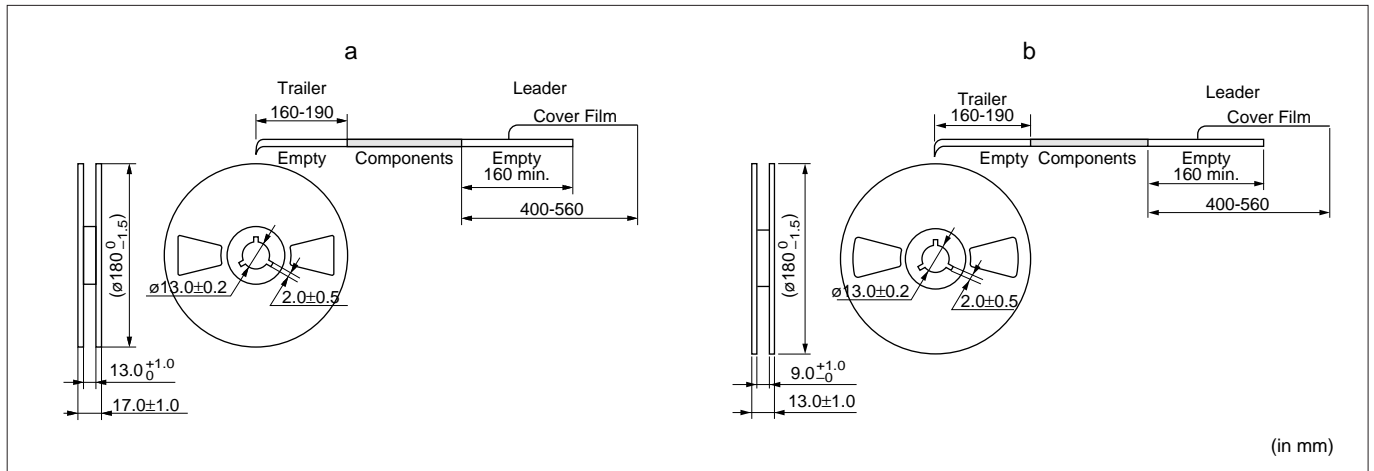
Minimum Quantity

Part Number	Plastic Tape ø180mm	Plastic Tape ø330mm	Bulk	Dimensions
CSTCC_G	2,000	6,000	500	a
CSTCC_G_A	2,000	6,000	500	a
CSTCR_G	3,000	9,000	500	a
CSTCR_G_B	3,000	9,000	500	a
CSTCE_G	3,000	9,000	500	b
CSTCE_G_A	3,000	9,000	500	b
CSTCE_V	3,000	9,000	500	b
CSTCE_V_A	3,000	9,000	500	b
CSTCV_X_Q	2,000	6,000	500	a
CSTCW_X	3,000	9,000	500	b
CSTCG_V	3,000	9,000	500	b

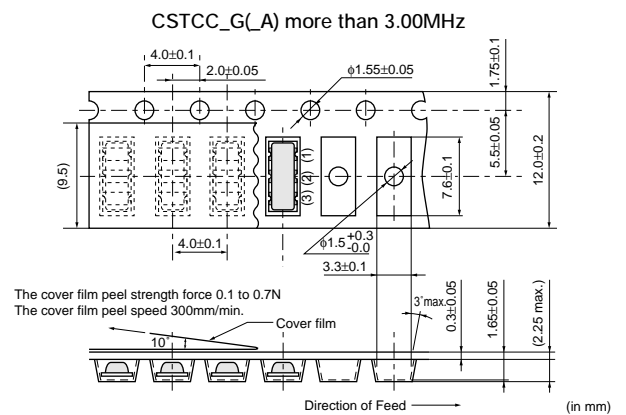
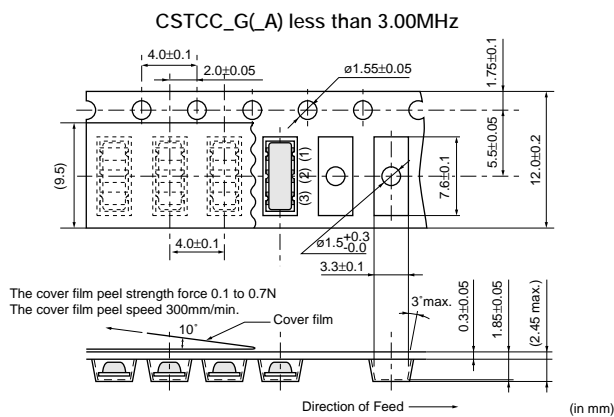
The order quantity should be an integral multiple of the "Minimum Quantity" shown above.

(pcs.)

Dimensions of Reel



Dimensions of Taping

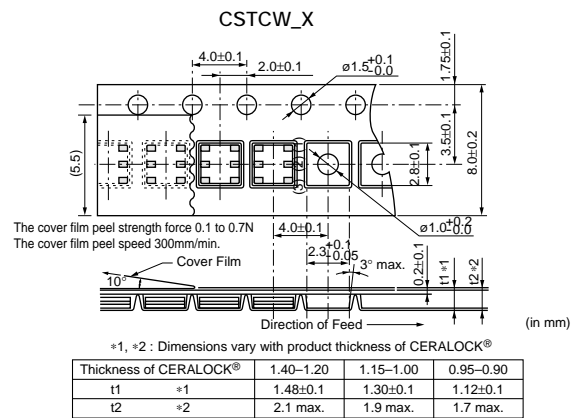
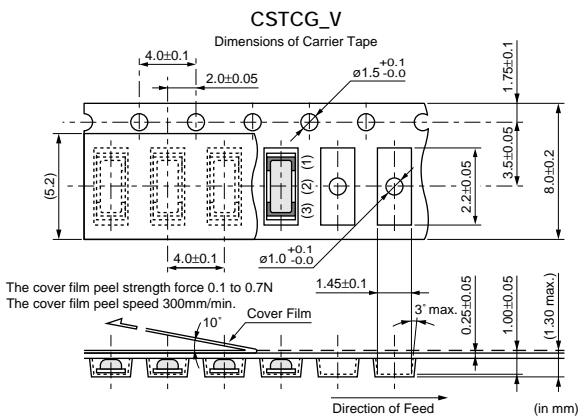
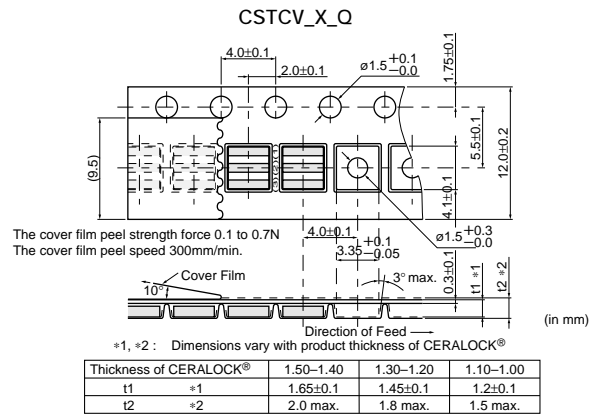
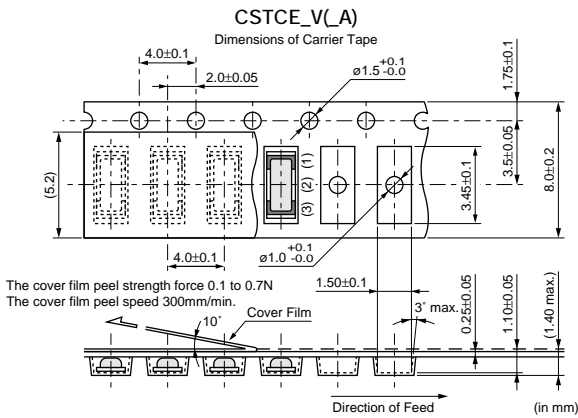
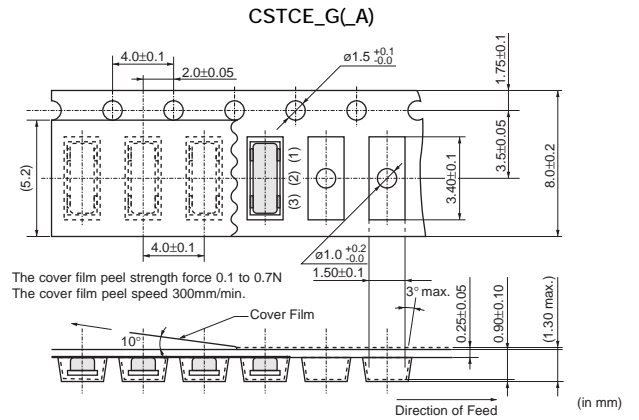
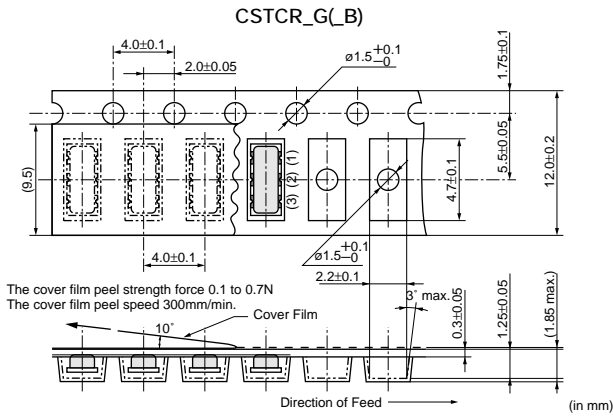


Continued on the following page.

MHz Chip Type CSTC Series Packaging

Continued from the preceding page.

Dimensions of Taping



MHz Chip Type CSAC Series Packaging

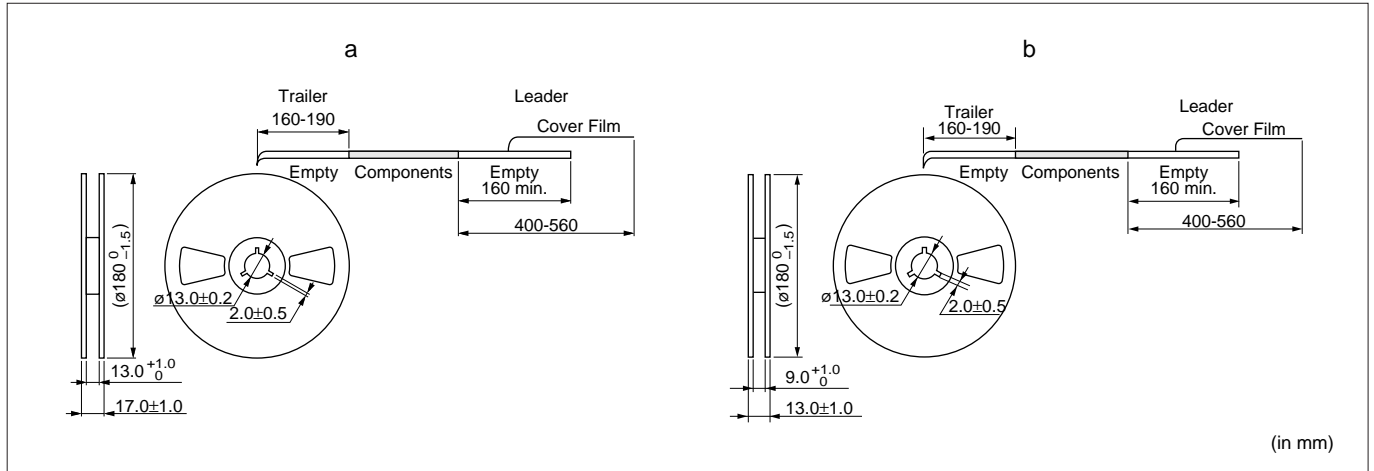
Minimum Quantity

Part Number	Plastic Tape ø180mm	Plastic Tape ø330mm	Bulk	Dimensions
CSACV_X_Q	2,000	6,000	500	a
CSACW_X	3,000	9,000	500	b

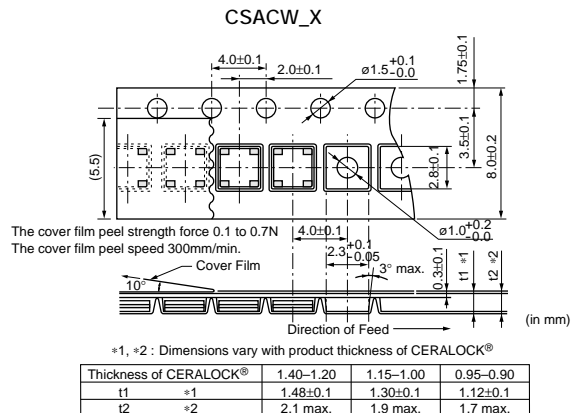
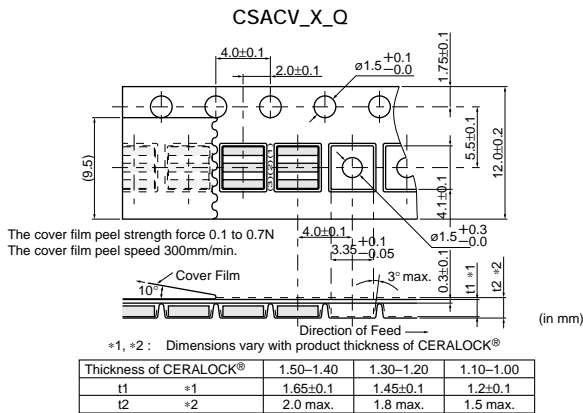
The order quantity should be an integral multiple of the "Minimum Quantity" shown above.

(pcs.)

Dimensions of Reel



Dimensions of Taping



Ceramic Resonators (CERALOCK®)



Lead Type Three Terminals CSTLS Series

3

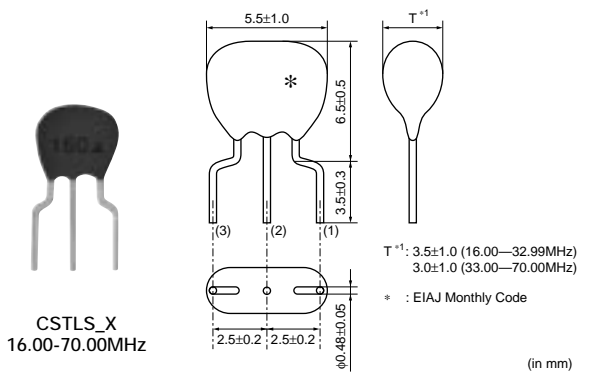
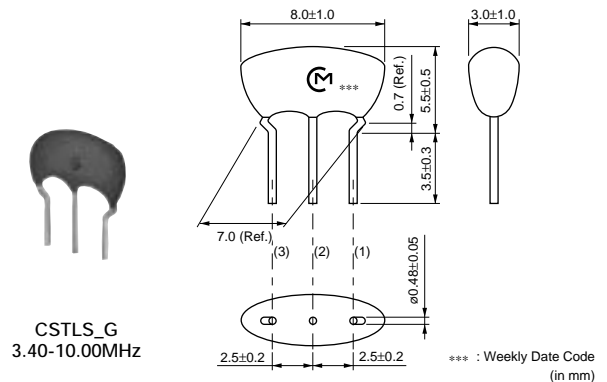
"CERALOCK" with built-in load capacitors.
 MURATA's ceramic resonator, "CERALOCK", has been widely applied as the most suitable component for clock oscillators in a broad range of microprocessors. The CSTLS series can be used in the design of oscillation circuits not requiring external load capacitors, enabling both high-density mounting and cost reduction.

■ Features

1. Oscillation circuits do not require external load capacitors.
2. The series is stable over a wide temperature range.
3. The resonators are compact, light weight and exhibit superior shock resistance performance.
4. They enable the design of oscillator circuits requiring no adjustment.
5. The series is inexpensive and available in stable supply.
6. There is some variation in built-in capacitance values applicable to various of IC.

■ Applications

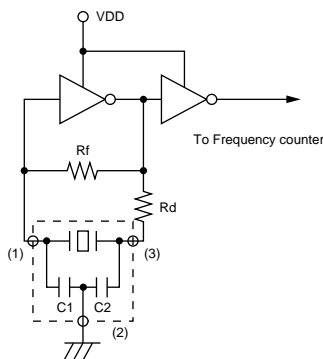
1. DTMF generators
2. Clock oscillators for microcomputers
3. Remote control units
4. Automated office equipment



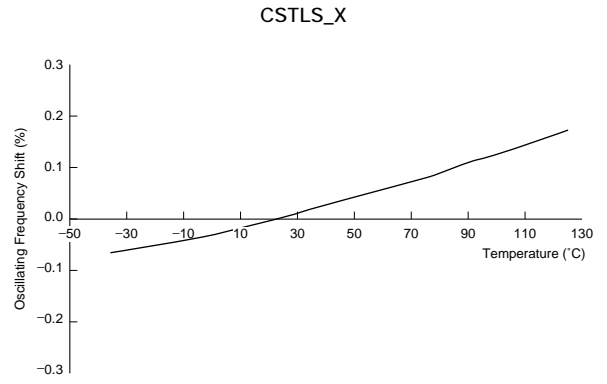
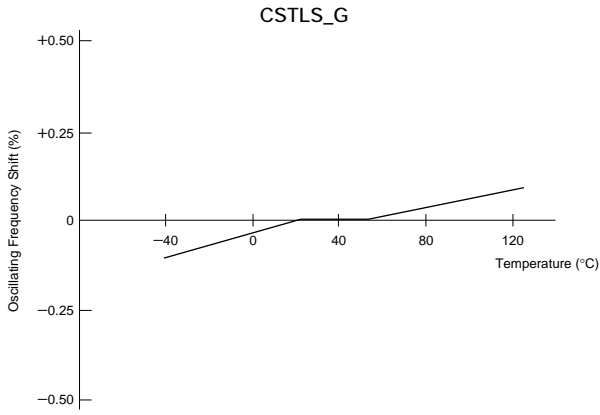
Part Number	Oscillating Frequency (MHz)	Initial Tolerance (%)	Temp. Stability (%)	Temperature Range (°C)	Use
CSTLS_G	3.40 to 10.00	±0.5	±0.2 [-0.4% to +0.2%:Built-in Capacitance 47pF type]	-20 to +80	For consumer electronics
CSTLS_X	16.00 to 70.00	±0.5	±0.2	-20 to +80	For consumer electronics

Irregular or stop oscillation may occur under unmatched circuit conditions. Please check the actual conditions prior to use.
 The order quantity should be an integral multiple of the "Minimum Quantity" shown in the packaging page.

■ Oscillation Frequency Measuring Circuit



■ Oscillation Frequency Temperature Stability



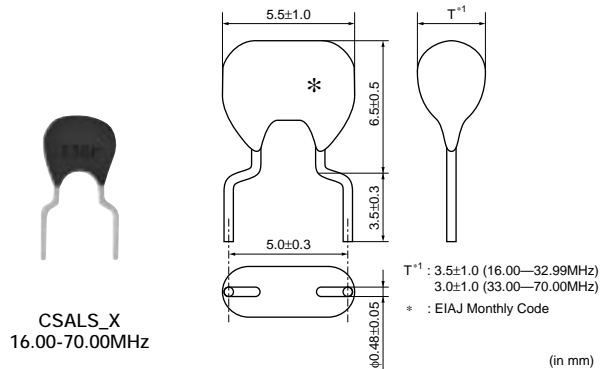
3

Ceramic Resonators (CERALOCK®)



Lead Type Two Terminals CSALS Series

"CERALOCK" with two leaded terminals.
 The CSALS series ceramic resonators owe their development to MURATA's innovative expert technologies and the application of mass production techniques typically utilized in the manufacture of piezoelectric ceramic components. Because of their high mechanical Q and consistent high quality, CSALS series are ideally suited to microprocessor and remote control unit applications.
 In addition, MURATA offers a special "CERALOCK" version suitable for automatic insertion utilizing tape and reel and other packaging forms. For further information, please contact your local MURATA representative office or authorized distributor.



4

■ Features

1. The series is stable over a wide temperature range and with respect to long-term aging.
2. The series comprises fixed, tuned, solid-state devices.
3. The resonators are miniature and light weight.
4. They exhibit excellent shock resistance performance.
5. Oscillating circuits requiring no adjustment can be designed by utilizing these resonators in conjunction with transistors or appropriate ICs.

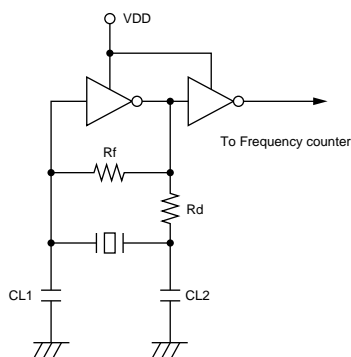
■ Applications

1. Square-wave and sine-wave oscillator
2. Clock generator for microprocessors
3. Remote control systems

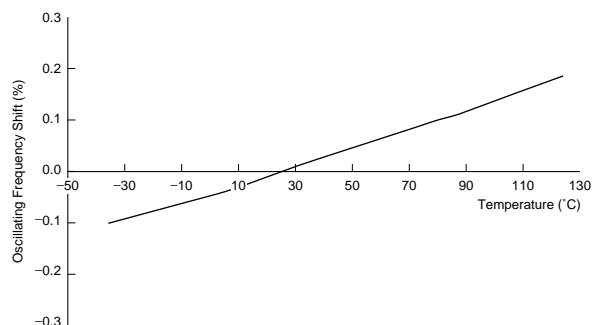
Part Number	Oscillating Frequency (MHz)	Initial Tolerance (%)	Temp. Stability (%)	Temperature Range (°C)	Use
CSALS_X	16.00 to 70.00	±0.5	±0.2	-20 to +80	For consumer electronics

Irregular or stop oscillation may occur under unmatched circuit conditions. Please check the actual conditions prior to use.
 The order quantity should be an integral multiple of the "Minimum Quantity" shown in the packaging page.

■ Oscillation Frequency Measuring Circuit



■ Oscillation Frequency Temperature Stability



MHz Lead Type Notice

■ Notice (Soldering and Mounting)

The component cannot withstand washing.

Please do not apply excessive mechanical stress to the component and lead terminals during soldering.

■ Notice (Storage and Operating Conditions)

1. Product Storage Condition

Please store the products in room where the temperature/humidity is stable. And avoid such places where there are large temperature changes. Please store the products under the following conditions:

Temperature: -10 to + 40 degree C

Humidity: 15 to 85% R.H.

2. Expire Date on Storage

Expire date (Shelf life) of the products is six months after delivery under the conditions of a sealed and an unopened package. Please use the products within six months after delivery. If you store the products for a long time (more than six months), use carefully because the products may be degraded in the solderability and/or rusty. Please confirm solderability and characteristics for the products regularly.

3. Notice on Product Storage

- (1) Please do not store the products in a chemical atmosphere (Acids, Alkali, Bases, Organic gas, Sulfides and so on), because the characteristics may be reduced in quality, and/or be degraded in the solderability due to the storage in a chemical atmosphere.

- (2) Please do not put the products directly on the floor without anything under them to avoid damp places and/or dusty places.
- (3) Please do not store the products in the places such as: in a damp heated place, in a place where direct sunlight comes in, in place applying vibrations.
- (4) Please use the products immediately after the package is opened, because the characteristics may be reduced in quality, and/or be degraded in the solderability due to storage under the poor condition.
- (5) Please do not drop the products to avoid cracking of ceramic element.

4. Others

Conformal coating or washing of the component is not acceptable because it is not hermetically sealed. Please be sure to consult with our sales representative or engineer whenever and prior tousing the products.

■ Notice (Rating)

The component may be damaged if excess mechanical stress is applied.

■ Notice (Handling)

"CERALOCK" may stop oscillating or oscillate irregularly under improper circuit conditions.

MHz Lead Type CSTLS Series Packaging

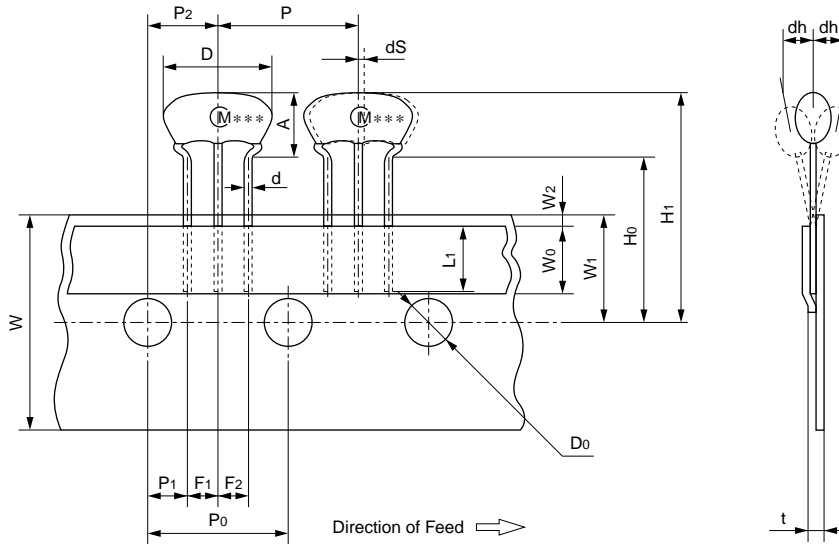
■ Minimum Quantity

Part Number	Ammo Pack	Bulk
CSTLS_G (3.40 to 10.0MHz)	2,000	500
CSTLS_X (16.00 to 70.00MHz)	2,000	500

The order quantity should be an integral multiple of the "Minimum Quantity" shown above.

(pcs.)

■ Tape Dimensions of CSTLS_G



Item	Code	Dimensions	Tolerance	Remarks
Width of diameter	D	8.0	±1.0	
Height of resonator	A	5.5	±0.5	
Dimensions of terminal	d	ø0.48	±0.05	
Lead length under the hold down tape	L ₁	5.0 min.	—	
Pitch of component	P	12.7	±0.5	Tolerance for Pitches 10xP ₀ =127±1
Pitch of sprocket hole	P ₀	12.7	±0.2	
Length from sprocket hole center to lead	P ₁	3.85	±0.5	
Length from sprocket hole center to component center	P ₂	6.35	±0.5	
Lead spacing (I)	F ₁	2.5	±0.2	
Lead spacing (II)	F ₂	2.5	±0.2	
Slant forward or backward	dh	0	±1.0	1mm max.
Width of carrier tape	W	18.0	±0.5	
Width of hold down tape	W ₀	6.0 min.	—	Hold down tape does not exceed the carrier tape.
Position of sprocket hole	W ₁	9.0	±0.5	
Gap of hold down tape and carrier tape	W ₂	0	+0.5 -0	
Distance between the center of sprocket hole and lead stopper	H ₀	18.0	±0.5	
Total height of resonator	H ₁	23.5	±1.0	
Diameter of sprocket hole	D ₀	ø4.0	±0.2	
Total tape thickness	t	0.6	±0.2	
Body tilt	dS	0	±1.0	

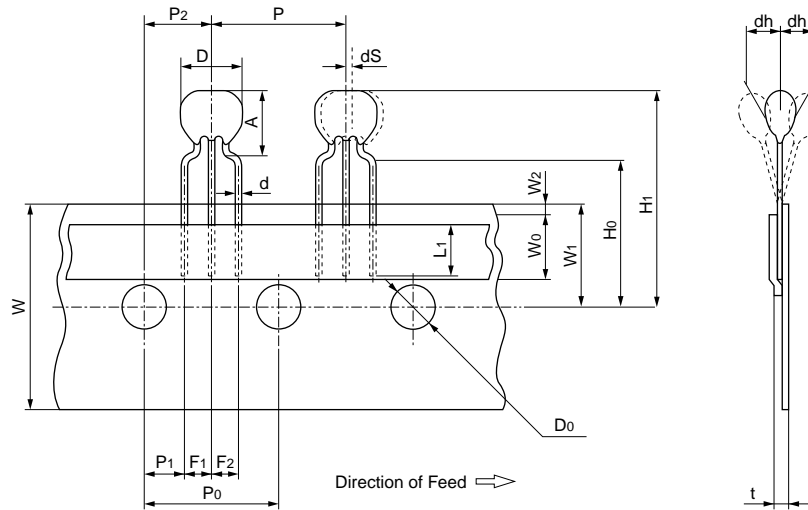
(in mm)

Continued on the following page. ↗

MHz Lead Type CSTLS Series Packaging

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■ Tape Dimensions of CSTLS_X



Item	Code	Dimensions	Tolerance	Remarks
Width of diameter	D	5.5	±1.0	
Height of resonator	A	6.5	±0.5	
Dimensions of terminal	d	ø0.48	±0.05	
Lead length under the hold down tape	L ₁	5.0 min.	—	
Pitch of component	P	12.7	±0.5	Tolerance for Pitches 10xP ₀ =127±1
Pitch of sprocket hole	P ₀	12.7	±0.2	
Length from sprocket hole center to lead	P ₁	3.85	±0.5	
Length from sprocket hole center to component center	P ₂	6.35	±0.5	
Lead spacing (I)	F ₁	2.5	±0.2	
Lead spacing (II)	F ₂	2.5	±0.2	
Slant forward or backward	dh	0	±1.0	1mm max.
Width of carrier tape	W	18.0	±0.5	
Width of hold down tape	W ₀	6.0 min.	—	Hold down tape doesn't exceed the carrier tape.
Position of sprocket hole	W ₁	9.0	±0.5	
Gap of hold down tape and carrier tape	W ₂	0	+0.5 -0.0	
Distance between the center of sprocket hole and lead stopper	H ₀	18.0	±0.5	
Total height of resonator	H ₁	24.5	±0.1	
Diameter of sprocket hole	D ₀	ø4.0	±0.2	
Total tape thickness	t	0.6	±0.2	
Body tilt	dS	0	±1.0	

(in mm)

MHz Lead Type CSALS Series Packaging

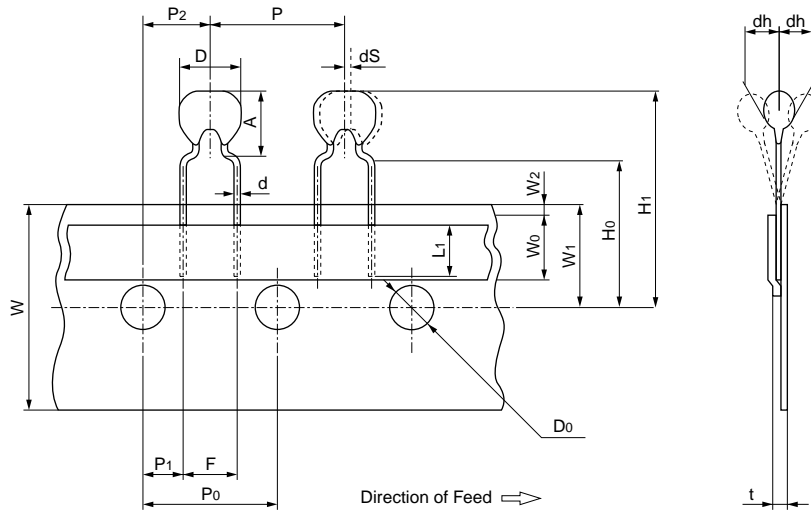
■ Minimum Quantity

Part Number	Ammo Pack	Bulk
CSALS_X (16.00 to 70.00MHz)	2,000	500

The order quantity should be an integral multiple of the "Minimum Quantity" shown above.

(pcs.)

■ Tape Dimensions of CSALS



Item	Code	Dimensions	Tolerance	Remarks
Width of diameter	D	5.5	±1.0	
Height of resonator	A	6.5	±0.5	
Dimensions of terminal	d	ø0.48	±0.05	
Lead length under the hold down tape	L1	5.0 min.	—	
Pitch of component	P	12.7	±0.5	Tolerance for Pitches 10xP0=127±1
Pitch of sprocket hole	P0	12.7	±0.2	
Length from sprocket hole center to lead	P1	3.85	±0.5	
Length from sprocket hole center to component center	P2	6.35	±0.5	
Lead spacing	F	5.0	±0.3	
Slant forward or backward	dh	0	±1.0	1mm max.
Width of carrier tape	W	18.0	±0.5	
Width of hold down tape	W0	6.0 min.	—	Hold down tape doesn't exceed the carrier tape.
Position of sprocket hole	W1	9.0	±0.5	
Gap of hold down tape and carrier tape	W2	0	+0.5 -0	
Distance between the center of sprocket hole and lead stopper	H0	18.0	±0.5	
Total height of resonator	H1	24.5	±1.0	
Diameter of sprocket hole	Do	ø4.0	±0.2	
Total tape thickness	t	0.6	±0.2	
Body tilt	dS	0	±1.0	

(in mm)

Ceramic Resonators (CERALOCK®)



Chip Type Two Terminals CSBFB Series

Can be reflow soldered and mounted by automatic placers. MURATA's original package technologies have enabled the development of the kHz band "CERALOCK". The series is perfect in miniature remote control units and AV modules.

■ Features

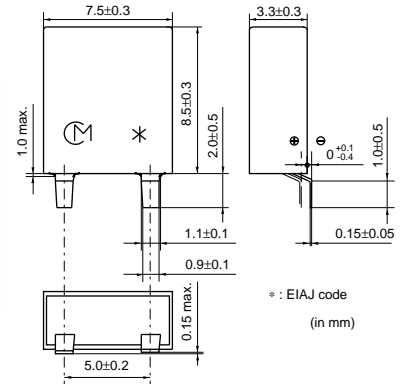
1. The series withstands reflow soldering.
2. The series is mountable by automatic placers.
3. No adjustment is necessary for oscillation circuits.

■ Applications

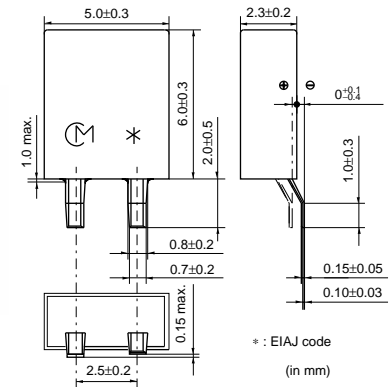
1. Clock oscillators for microprocessors
2. OA equipment
3. AV modules



CSBFB_J
430-519kHz



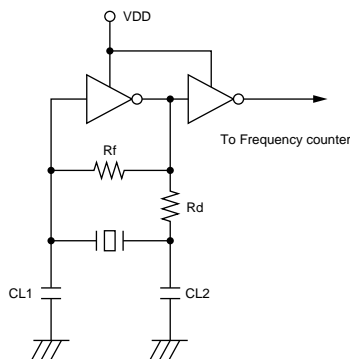
CSBFB_J
700-1250kHz



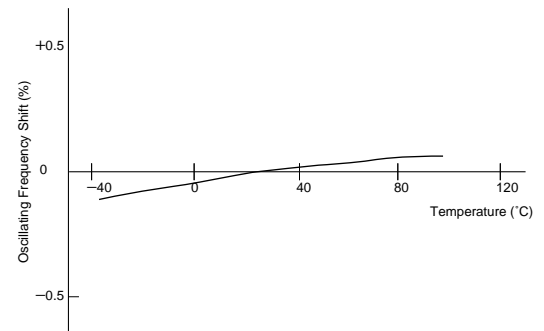
Part Number	Oscillating Frequency (kHz)	Initial Tolerance	Temp. Stability (%)	Temperature Range (°C)
CSBFB_J	430 to 519, 700 to 1250	$\pm 0.5\%$	± 0.3	-20 to +80

Irregular or stop oscillation may occur under unmatched circuit conditions. Please check the actual conditions prior to use.

■ Oscillation Frequency Measuring Circuit



■ Oscillation Frequency Temperature Stability

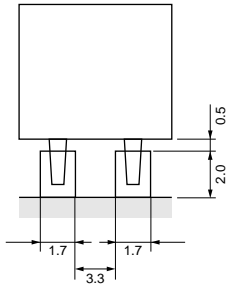


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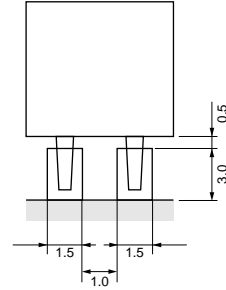
■ Standard Land Pattern Dimensions

CSBFB_J (430-519kHz)



(in mm)

CSBFB_J (700-1250kHz)



(in mm)

Ceramic Resonators (CERALOCK®)



Lead Type Two Terminals CSBLA Series

"CERALOCK" with two leaded terminals.

The CSBLA series ceramic resonators owe their development to MURATA's innovative expert technologies and the application of mass production techniques typically utilized in the manufacture of piezoelectric ceramic components. Because of their high mechanical Q and consistent high quality, the CSBLA series are ideally suited to microprocessor and remote control unit applications.

■ Features

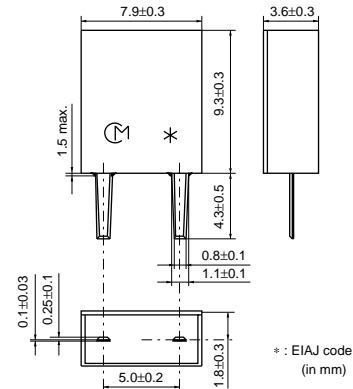
1. The series is stable over a wide temperature range and with respect to long-term aging.
2. The series comprises fixed, tuned, solid-state devices.
3. The resonators are miniature and light weight.
4. They exhibit excellent shock resistance performance.
5. Oscillating circuits requiring no adjustment can be designed by utilizing these resonators in conjunction with transistors or appropriate ICs.

■ Applications

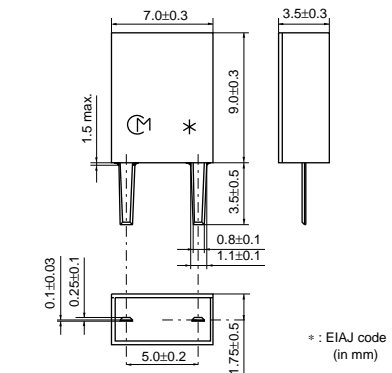
1. Square-wave and sine-wave oscillators
2. Clock generator for microprocessors
3. Remote control systems



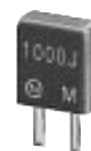
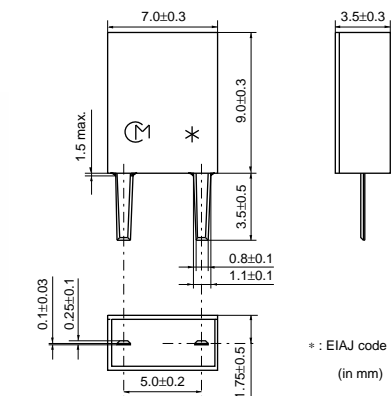
CSBLA_E
375-429kHz



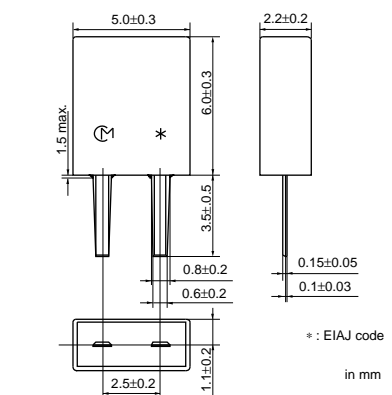
CSBLA_E
430-509kHz



CSBLA_E
510-699kHz



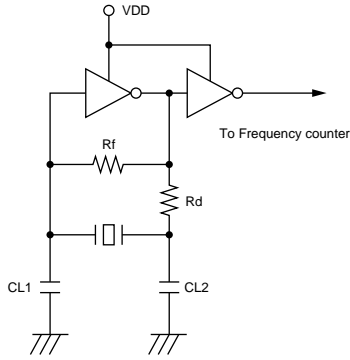
CSBLA_J
700-1250kHz



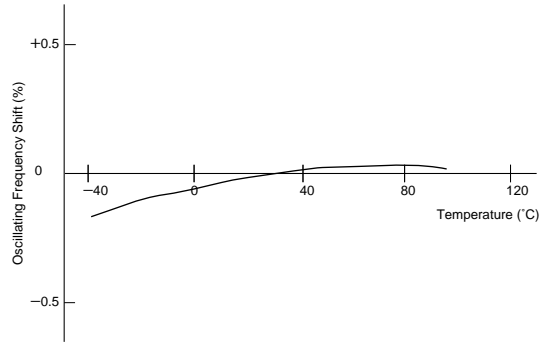
Part Number	Oscillating Frequency (kHz)	Initial Tolerance	Temp. Stability (%)	Temperature Range (°C)
CSBLA_E	375 to 699	±2kHz	±0.3	-20 to +80
CSBLA_J	700 to 1250	±0.5%	±0.3	-20 to +80

Irregular or stop oscillation may occur under unmatched circuit conditions. Please check the actual conditions prior to use.
 The order quantity should be an integral multiple of the "Minimum Quantity" shown in the packaging page.

■ Oscillation Frequency Measuring Circuit



■ Oscillation Frequency Temperature Stability



kHz Type Notice

■ Notice (Soldering and Mounting)

CSBFB_J 430-519kHz

1. Soldering Conditions

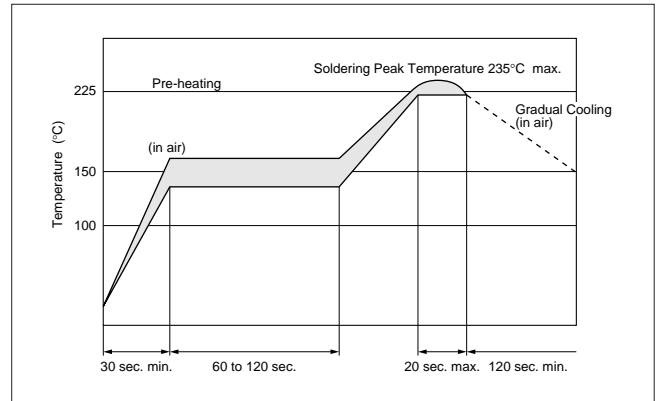
(1) Reflow

One heat stress, shown in the profile at right, is applied to resonator; then, after being placed in natural conditions for 1 hour, the resonator is measured.

1. Pre-heating conditions should be +140 to +160°C for 60 to 120 seconds. Ascending time up to +150°C should be longer than 30 seconds.
2. Heating conditions should be within 20 seconds at +225°C min., but peak temperature should be lower than +235°C.

(2) Soldering Iron

Soldering iron of +270±5°C should be placed 0.5mm above electrode of resonator. Melting solder through soldering iron should be applied to electrode for 3±1 seconds; then, after being placed in natural conditions for 24 hours, the resonator should be measured.



2. Wash

(1) Cleaning Solvents

HCFC, Isopropanol, Tap water, Demineralized water, Cleanthrough750H, Pine alpha 100S, Techno care FRW

(2) Temperature Difference : dT *1

$dT \leq 60^\circ\text{C}$ ($dT = \text{Component} - \text{solvent}$)

*1 ex. In case the component at +90°C immerses into cleaning solvent at +60°C, then $dT = 30^\circ\text{C}$.

(3) Conditions

1. Ultrasonic Wash

1 minute max. in above solvent at +60°C max.
(Frequency : 28kHz, Output : 20W/L)

2. Immersion Wash

5 minutes max. in above solvent at +60°C max.

3. Shower or Rinse Wash

5 minutes max. in above solvent at +60°C max.

(4) Drying

5 minutes max. by air blow at +80°C max.

(5) Others

1. Total washing time should be within 10 minutes.
2. The component may be damaged if it is washed with chlorine, petroleum, or alkali cleaning solvent.

3. Ultrasonic cleaning of the component is acceptable. However, the size of bath, size and thickness of PBC should be evaluated to confirm stable electrical characteristics are maintained.

3. Notice for Mounting

1. Please insure the component is thoroughly evaluated in your application circuit.
2. Please do not apply excess mechanical stress to the component and lead terminals during soldering.

3. In the case of the bulk component, dry heating treatment (130°C. for 5 hours min.) is required before reflow soldering. Then, the component should be soldered within 48 hours after dry heating treatment.

kHz Type Notice

■ Notice (Soldering and Mounting)

CSBFB_J 700-1250kHz

1. Soldering Condition

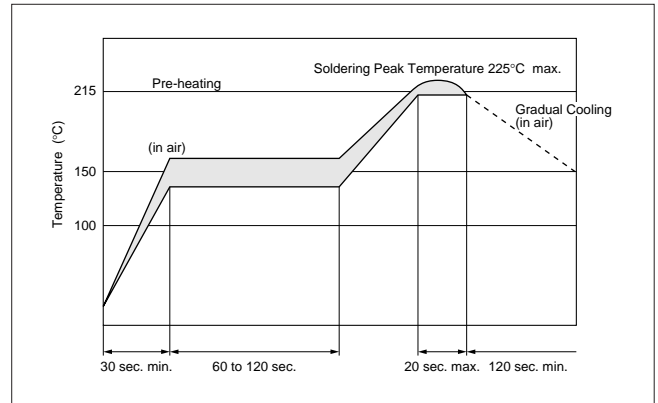
(1) Reflow

One heat stress, shown in the profile at right, is applied to resonator; then, after being placed in natural conditions for 1 hour, the resonator is measured.

1. Pre-heating conditions should be +140 to +160°C for 60 to 120 seconds. Ascending time up to +150°C should be longer than 30 seconds.
2. Heating conditions should be within 20 seconds at +215°C min., but peak temperature should be lower than +225°C.

(2) Soldering Iron

Soldering iron of +270±5°C should be placed 0.5mm above electrode of resonator. Melting solder through soldering iron should be applied to electrode for 3±1 seconds; then, after being placed in natural conditions for 24 hours, the resonator should be measured.



2. Wash

(1) Cleaning Solvents

HCFC, Isopropanol, Tap water, Demineralized water, Cleanthrough750H, Pine alpha 100S, Techno care FRW

(2) Temperature Difference : dT *1

$dT \leq 60^\circ\text{C}$ ($dT = \text{Component} - \text{solvent}$)

*1 ex. In case the component at +90°C immerses into cleaning solvent at +60°C, then $dT = 30^\circ\text{C}$.

(3) Conditions

1. Ultrasonic Wash

1 minute max. in above solvent at +60°C max.
(Frequency : 28kHz, Output : 20W/L)

2. Immersion Wash

5 minutes max. in above solvent at +60°C max.

3. Shower or Rinse Wash

5 minutes max. in above solvent at +60°C max.

(4) Drying

5 minutes max. by air blow at +80°C max.

(5) Others

1. Total washing time should be within 10 minutes.
2. The component may be damaged if it is washed with chlorine, petroleum, or alkali cleaning solvent.

3. Ultrasonic cleaning of the component is acceptable. However, the size of bath, size and thickness of PBC should be evaluated to confirm stable electrical characteristics are maintained.

3. Notice for Mounting

1. Please insure the component is thoroughly evaluated in your application circuit.
2. Please do not apply excess mechanical stress to the component and lead terminals during soldering.

3. In the case of the bulk component, dry heating treatment (130°C. for 5 hours min.) is required before reflow soldering. Then, the component should be soldered within 48 hours after dry heating treatment.

kHz Type Notice

■ Notice (Soldering and Mounting)

CSBLA_E

The component cannot withstand washing.

Please do not apply excessive mechanical stress to the component and lead terminals during soldering.

■ Notice (Soldering and Mounting)

CSBLA_J

(1) Cleaning Solvents

HCFC, Isopropanol, Tap water, Demineralized water, Cleanthrough 750H, Pine alpha 100S, Techno care FRW.

(2) Temperature Difference: dT *1

$dT \leq 30$ degree C (dT=Component-solvent)

*1 ex. In case the component at +90 degree C immerses into cleaning solvent at +60 degree C, then $dT=30$ degree C.

(3) Conditions

1. Ultrasonic Wash

1 minute max. in above solvent at +60 degree C max.
(Frequency: 28kHz, Output: 20W/L)

2. Immersion Wash

5 minutes max. in above solvent at +60 degree C max.

3. Shower or Rinse Wash

5 minutes max. in above solvent at +60 degree C max.

(4) Drying

5 minutes max. by air blow at +80 degree C max.

(5) Others

1. Total washing time should be within 10 minutes.

2. Please insure the component is thoroughly evaluated in your application circuit.

3. The component may be damaged if it is washed with alkali cleaning solvent.

4. Please do not apply excess mechanical stress to the component and lead terminals during soldering.

5. Ultrasonic cleaning of the component is acceptable. However, the size of bath, size and thickness of PBC should be evaluated to confirm stable electrical characteristics are maintained.

kHz Type Notice

■ Notice (Storage and Operating Condition)

CSBFB_J/CSBLA_J

1. Product Storage Condition

Please store the products in room where the temperature/humidity is stable. And avoid such places where there are large temperature changes. Please store the products under the following conditions:

Temperature: -10 to + 40 degree C

Humidity: 15 to 85% R.H.

2. Expire Date on Storage

Expire date (Shelf life) of the products is six months after delivery under the conditions of a sealed and an unopened package. Please use the products within six months after delivery. If you store the products for a long time (more than six months), use carefully because the products may be degraded in the solderability and/or rusty. Please confirm solderability and characteristics for the products regularly.

3. Notice on Product Storage

- (1) Please do not store the products in a chemical atmosphere (Acids, Alkali, Bases, Organic gas, Sulfides and so on), because the characteristics may be reduced in quality, and/or be degraded in the solderability due to the storage in a chemical atmosphere.

- (2) Please do not put the products directly on the floor without anything under them to avoid damp places and/or dusty places.

- (3) Please do not store the products in the places such as: in a damp heated place, in a place where direct sunlight comes in, in place applying vibrations.

- (4) Please use the products immediately after the package is opened, because the characteristics may be reduced in quality, and/or be degraded in the solderability due to storage under the poor condition.

- (5) Please do not drop the products to avoid cracking of ceramic element.

4. Others

Conformal coating of the component is acceptable. However, the resin material, curing temperature, and other process conditions should be evaluated to confirm that stable electrical characteristics are maintained.

Please be sure to consult with our sales representative or engineer whenever and prior tousing the products.

■ Notice (Storage and Operating Condition)

CSBLA_E

1. Product Storage Condition

Please store the products in room where the temperature/humidity is stable. And avoid such places where there are large temperature changes. Please store the products under the following conditions:

Temperature: -10 to + 40 degree C

Humidity: 15 to 85% R.H.

2. Expire Date on Storage

Expire date (Shelf life) of the products is six months after delivery under the conditions of a sealed and an unopened package. Please use the products within six months after delivery. If you store the products for a long time (more than six months), use carefully because the products may be degraded in the solderability and/or rusty. Please confirm solderability and characteristics for the products regularly.

3. Notice on Product Storage

- (1) Please do not store the products in a chemical atmosphere (Acids, Alkali, Bases, Organic gas, Sulfides and so on), because the characteristics

may be reduced in quality, and/or be degraded in the solderability due to the storage in a chemical atmosphere.

- (2) Please do not put the products directly on the floor without anything under them to avoid damp places and/or dusty places.

- (3) Please do not store the products in the places such as: in a damp heated place, in a place where direct sunlight comes in, in place applying vibrations.

- (4) Please use the products immediately after the package is opened, because the characteristics may be reduced in quality, and/or be degraded in the solderability due to storage under the poor condition.

- (5) Please do not drop the products to avoid cracking of ceramic element.

4. Others

Conformal coating or washing of the component is not acceptable because it is not hermetically sealed.

Please be sure to consult with our sales representative or engineer whenever and prior tousing the products.

■ Notice (Rating)

The component may be damaged if excess mechanical stress is applied.

■ Notice (Handling)

"CERALOCK" may stop oscillating or oscillate irregularly under improper circuit conditions.

kHz Type Packaging

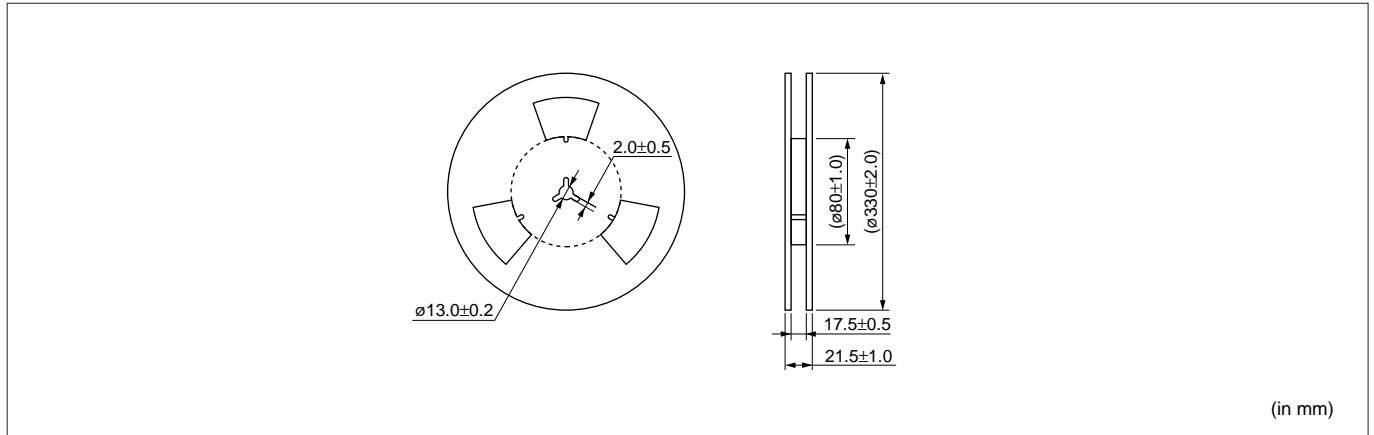
■ CSBFB Series Minimum Quantity

Part Number	Plastic Tape ø330mm	Bulk
CSBFB_J (430 to 519kHz)	1,500	500
CSBFB_J (700 to 1250kHz)	3,000	1,000

The order quantity should be an integral multiple of the "Minimum Quantity" shown above.

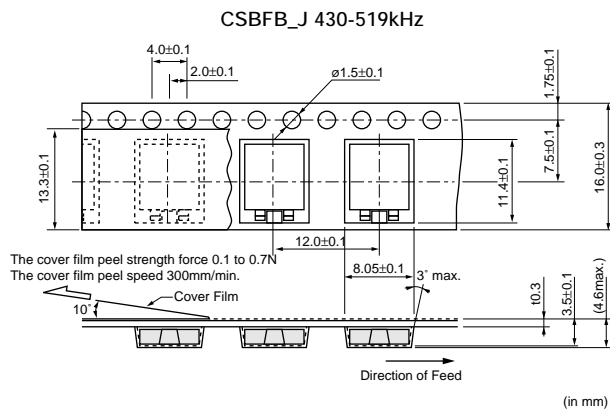
(pcs.)

■ Dimensions of Reel

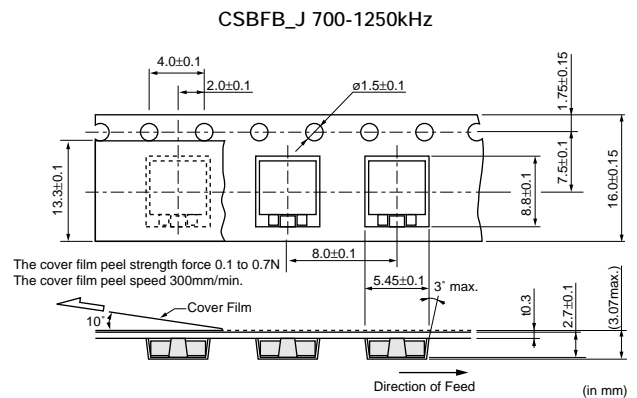


(in mm)

■ Dimensions of Taping



(in mm)



(in mm)

■ CSBLA Series Minimum Quantity

Part Number	Magazine	Bulk
CSBLA_E	50	500
CSBLA_J	100	1,000

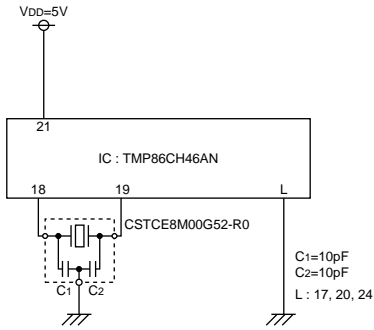
The order quantity should be an integral multiple of the "Minimum Quantity" shown above.

(pcs.)

Application Circuits Utilizing

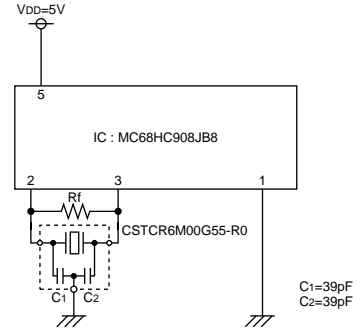
■ TMP86CH46AN(TOSHIBA)

8-bit Microcomputer



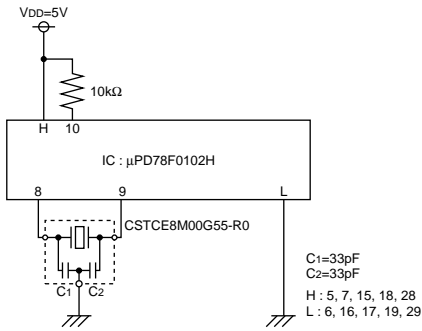
■ MC68HC908JB8(MOTOROLA)

8-bit Microcomputer



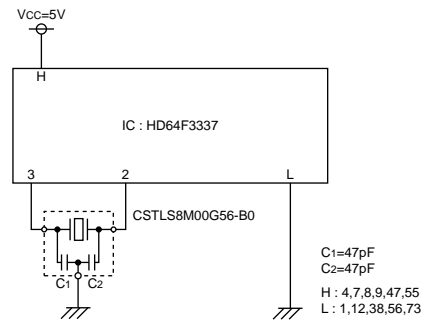
■ μPD78F0102H(NEC)

8-bit Microcomputer



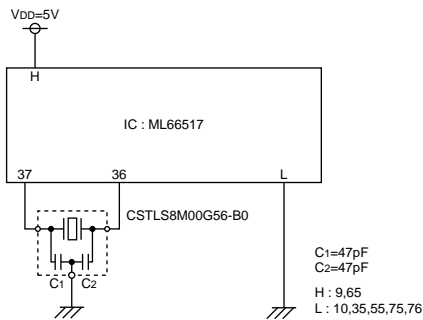
■ HD64F3337(RENESAS)

8-bit Microcomputer



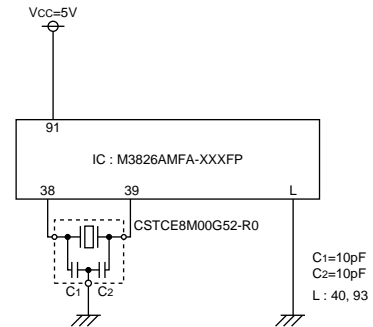
■ ML66517(OKI)

8-bit Microcomputer



■ M3826AMFA-XXXFP(RENESAS)

8-bit Microcomputer



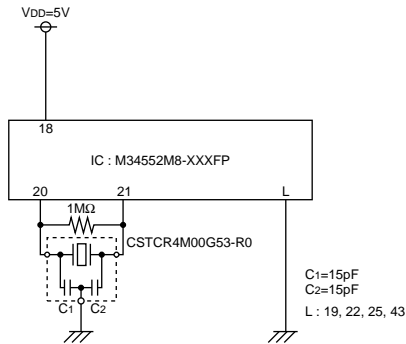
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Application Circuits Utilizing

Continued from the preceding page.

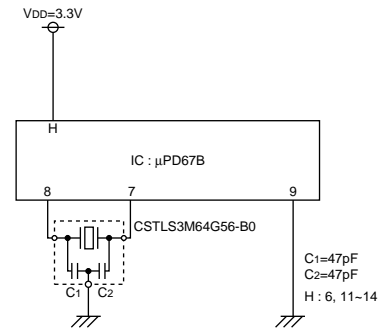
■ M34552M8-XXXFP(RENESAS)

Remote Control Unit



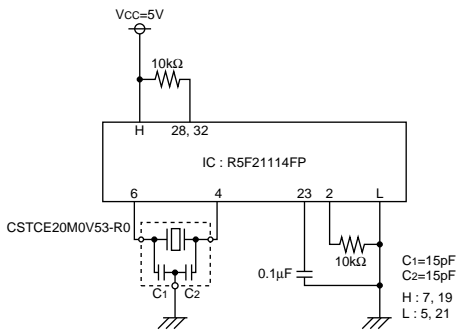
■ μPD67B(NEC)

Remote Control Unit



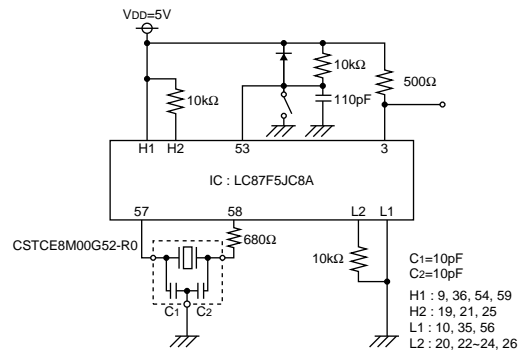
■ R5F2114FP(RENESAS)

16-bit Microcomputer



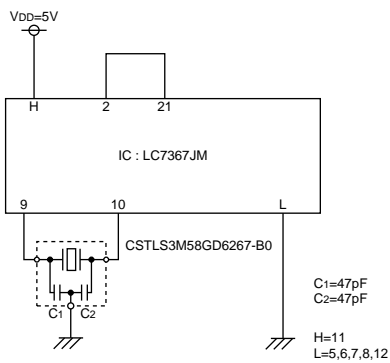
■ LC87F5JC8A(SANYO)

8-bit Microcomputer



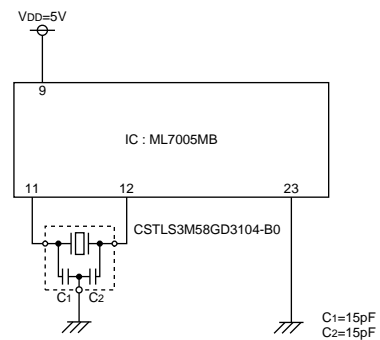
■ LC7367JM(SANYO)

Tone/Pulse Dialer



■ ML7005MB(OKI)

Tone/Pulse Dialer



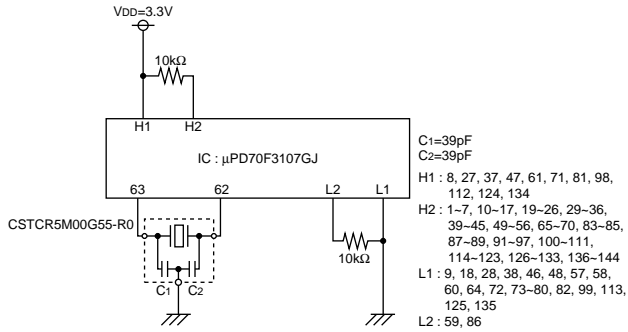
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Application Circuits Utilizing

Continued from the preceding page.

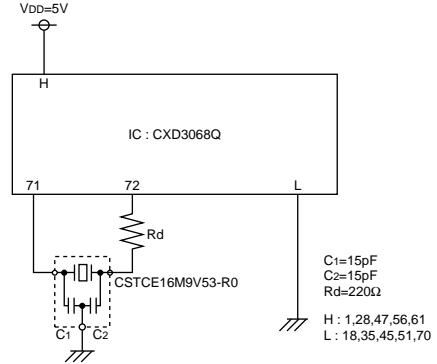
■ μPD70F3107GJ(NEC)

32-bit Microcomputer



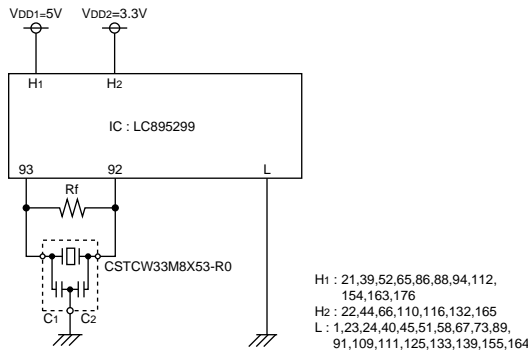
■ CXD3068Q(SONY)

Digital Signal Processing IC for CD



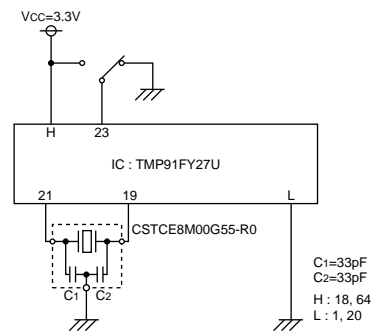
■ LC895299(SANYO)

Error Correction of CD-ROM LSI



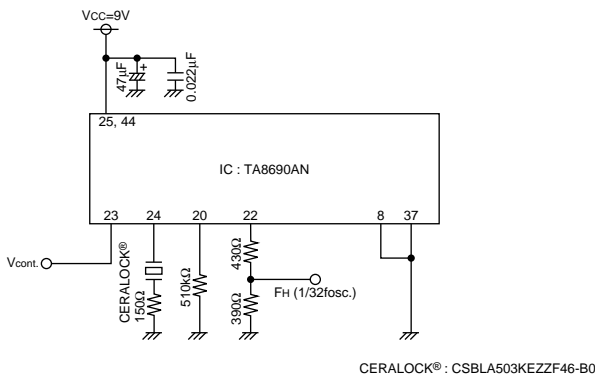
■ TMP91FY27U(TOSHIBA)

16-bit Microcomputer



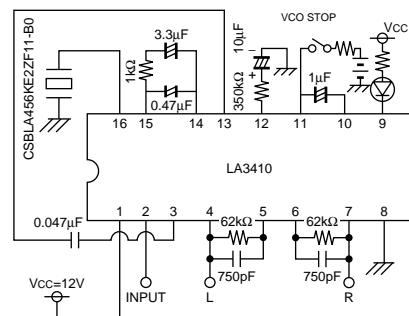
■ TA8690AN (TOSHIBA)

TV Horizontal/Compatible with Synthesizer Circuit



■ LA3410 (SANYO)

FM Stereo MPX



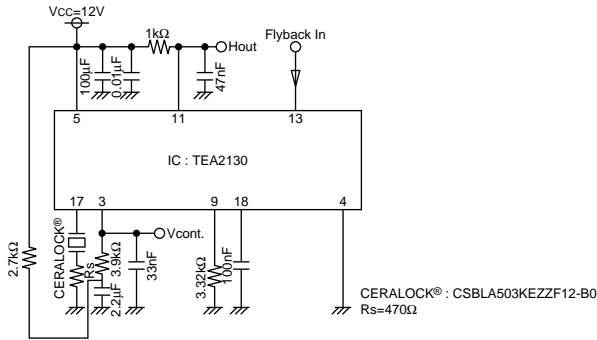
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Application Circuits Utilizing

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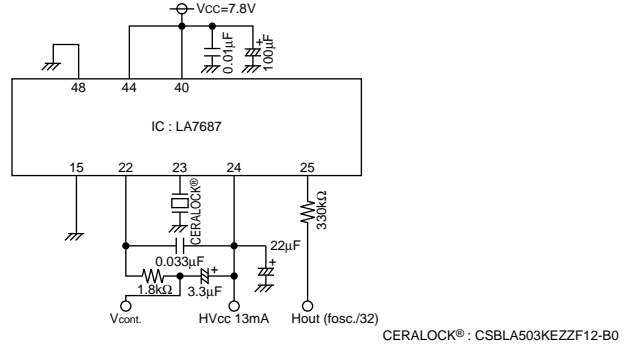
■ TEA2130 (THOMSON)

TV Horizontal/Compatible with Synthesizer Circuit

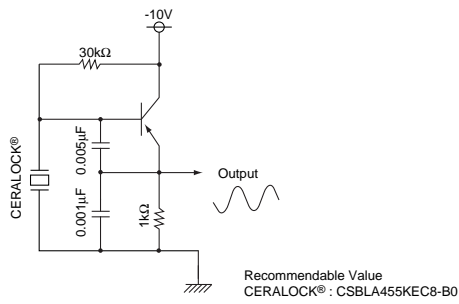


■ LA7687 (SANYO)

TV Horizontal/Compatible with Synthesizer Circuit



■ Oscillation Circuit Incorporating Transistor



△ Note:

1. Export Control

〈For customers outside Japan〉

Murata products should not be used or sold for use in the development, production, stockpiling or utilization of any conventional weapons or mass-destructive weapons (nuclear weapons, chemical or biological weapons, or missiles), or any other weapons.

〈For customers in Japan〉

For products which are controlled items subject to the "Foreign Exchange and Foreign Trade Law" of Japan, the export license specified by the law is required for export.

2. Please contact our sales representatives or product engineers before using the products in this catalog for the applications listed below, which require especially high reliability for the prevention of defects which might directly damage to a third party's life, body or property, or when one of our products is intended for use in applications other than those specified in this catalog.

- | | |
|-----------------------------|---|
| ① Aircraft equipment | ② Aerospace equipment |
| ③ Undersea equipment | ④ Power plant equipment |
| ⑤ Medical equipment | ⑥ Transportation equipment (vehicles, trains, ships, etc.) |
| ⑦ Traffic signal equipment | ⑧ Disaster prevention / crime prevention equipment |
| ⑨ Data-processing equipment | ⑩ Application of similar complexity and/or reliability requirements to the applications listed in the above |

3. Product specifications in this catalog are as of July 2005. They are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering. If there are any questions, please contact our sales representatives or product engineers.

4. Please read rating and △CAUTION (for storage, operating, rating, soldering, mounting and handling) in this catalog to prevent smoking and/or burning, etc.

5. This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

6. Please note that unless otherwise specified, we shall assume no responsibility whatsoever for any conflict or dispute that may occur in connection with the effect of our and/or a third party's intellectual property rights and other related rights in consideration of your use of our products and/or information described or contained in our catalogs. In this connection, no representation shall be made to the effect that any third parties are authorized to use the rights mentioned above under licenses without our consent.

7. No ozone depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.