



CERAMIC RESONATOR (CERALOCK®)

CERAMIC
RESONATOR
(CERALOCK®)



Murata

*Innovator
in Electronics*

Murata
Manufacturing Co., Ltd.

CONTENTS

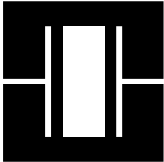
Types	Series	With Built-in Capacitors	Frequency Range	Page
■ Chip 3 Terminals	CSTC□MG	○	2M~3.5MHz	2 ~ 3
	CSTCC□MG	○	3.51M~8.0MHz	2 ~ 3
	CSTCS□MT/MX	○	8.0M~60MHz	2 ~ 3
■ Chip 2 Terminals	CSAC□MGC/MGCM	—	1.8M~6MHz	4 ~ 5
	CSACS□MT/MX	—	6.01M~60MHz	4 ~ 5
■ SMD, kHz range	CSBF□J	—	430k~500kHz	6 ~ 7
			700k~1250kHz	6 ~ 7
■ 2 Terminals, leaded	CSB□P/E/D/J	—	190k~1250kHz	8 ~10
	CSA□MK/MG/MTZ/MXZ	—	1.26M~60MHz	8 ~10
■ 3 Terminals, leaded	CSU□P	○	450k~500kHz	11~12
	CST□MG/MGW/MTW/MXW	○	1.8M~60MHz	11~12

■ Application Circuits 13~15

* Available in several standard frequencies

NOTICE

- Unstable oscillation or oscillation stoppage might happen when CERALOCK® is used in improper way in conjunction with ICs. We are happy to evaluate the application circuit to avoid this for you.
- Oscillation frequency of our standard CERALOCK is adjusted with our standard measuring circuit. There could be slight shift is frequency if other types of IC are used. When you require exact oscillation frequency in your application, we can adjust it with your specified circuit.
- Please consult with us regarding ultrasonic cleaning conditions to avoid possible damage during ultrasonic cleaning.



CERAMIC RESONATOR (CERALOCK®)



Chip Ceramic Resonator CSTC/CSTCC/CSTCS Series (CERALOCK®)

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 capacitance.

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.



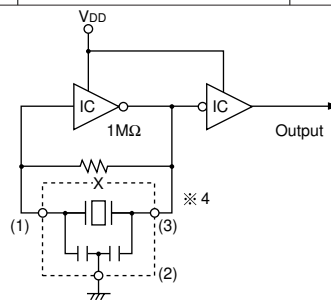
APPLICATIONS

1. Clock oscillators for microprocessors.
2. Electronic control circuits for small electronic equipment such as hand held movie
3. Automotive electronics
4. Dual Tone Multi Frequency (DTMF) generator for cordless telephones

SPECIFICATIONS

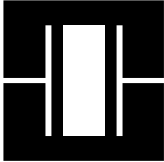
Item \ Type	CSTC Series	CSTCC Series	CSTCS Series	
	CSTC□MG	CSTCC□MG	CSTCS□MT	CSTCS□MX040
Frequency Range	2.00–3.5MHz	3.51–8.00MHz	8.01–13.0MHz	14.00–60.00MHz
Oscillation Frequency Initial Tolerance	±0.5%	±0.5%	±0.5%	±0.5%
Oscillation Frequency Temperature Stability ^{※1}	±0.3%	±0.3%	±0.4%	±0.3%
Aging ^{※2}	±0.3%	±0.3%	±0.3%	±0.3%

Oscillation Frequency Measuring Circuit



IC :1/6CD4069UBE×2^{※3}
 V_{DD} :5V (MT Series:12V)
 X :Chip CERALOCK®

※1 At -20 to +80°C
 ※2 For 10 years at room temperature
 ※3 TC74HCU04 is used as the standard circuit for the MX040 series.
 ※4 If connected with incorrect orientation, the above specification may not be guaranteed.



CERAMIC RESONATOR (CERALOCK®)



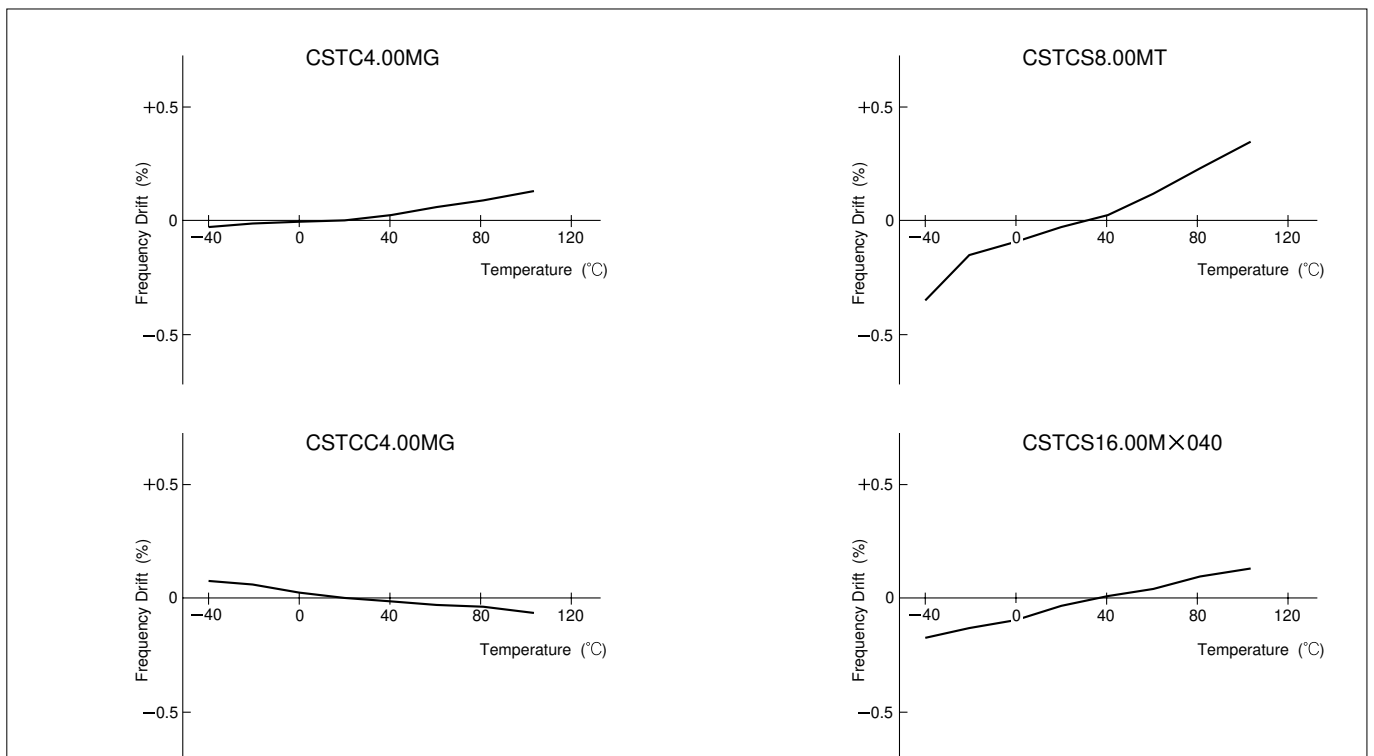
Chip Ceramic Resonator CSTC/CSTCC/CSTCS Series (CERALOCK®)

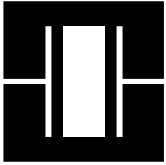
■ DIMENSIONS/STANDARD LAND PATTERN (in mm tol.:±0.3mm)

Frequency	2.00—3.50MHz	3.51—8.00MHz	8.01—13.0MHz	14.00—60MHz
Type	CSTC□MG	CSTCC□MG	CSTCS□MT	CSTCS□MX040
Dimensions				
Standard Land Pattern				

※ Thickness varies with frequencies.
 ※ The electrode pattern varies with built-in load capacitance value.

■ THE STABILITY OF OSCILLATION FREQUENCY WITH TEMPERATURE VARIATION





CERAMIC RESONATOR (CERALOCK®)



Chip Ceramic Resonator CSAC/CSACS Series (CERALOCK®)

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 (CSACS 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
4. DTMF generators for cordless telephones.



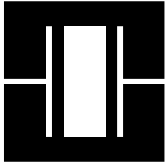
■SPECIFICATIONS

Type Item	CSAC Series		CSACS Series	
	CSAC□MGC/MGCM	CSACS□MT	CSACS□MX040	
Frequency Range	1.80–6.00MHz	6.01–13.0MHz	14.00–60.00MHz	
Oscillation Frequency Initial Tolerance	±0.5%	±0.5%	±0.5%	
Oscillation Frequency Temperature Stability※1	±0.3%	±0.5%	±0.3%	
Aging※2	±0.3%	±0.5%	±0.3%	
Oscillation Frequency Measuring Circuit				IC :1/6CD4069UBE×2※3 V _{DD} :5V (MT Series:12V) X :Chip CERALOCK®

※1 At –20 to +80°C

※2 For 10 years at room temperature

※3 TC74HCU04 is used as the standard circuit for the MX040 series.



CERAMIC RESONATOR (CERALOCK®)

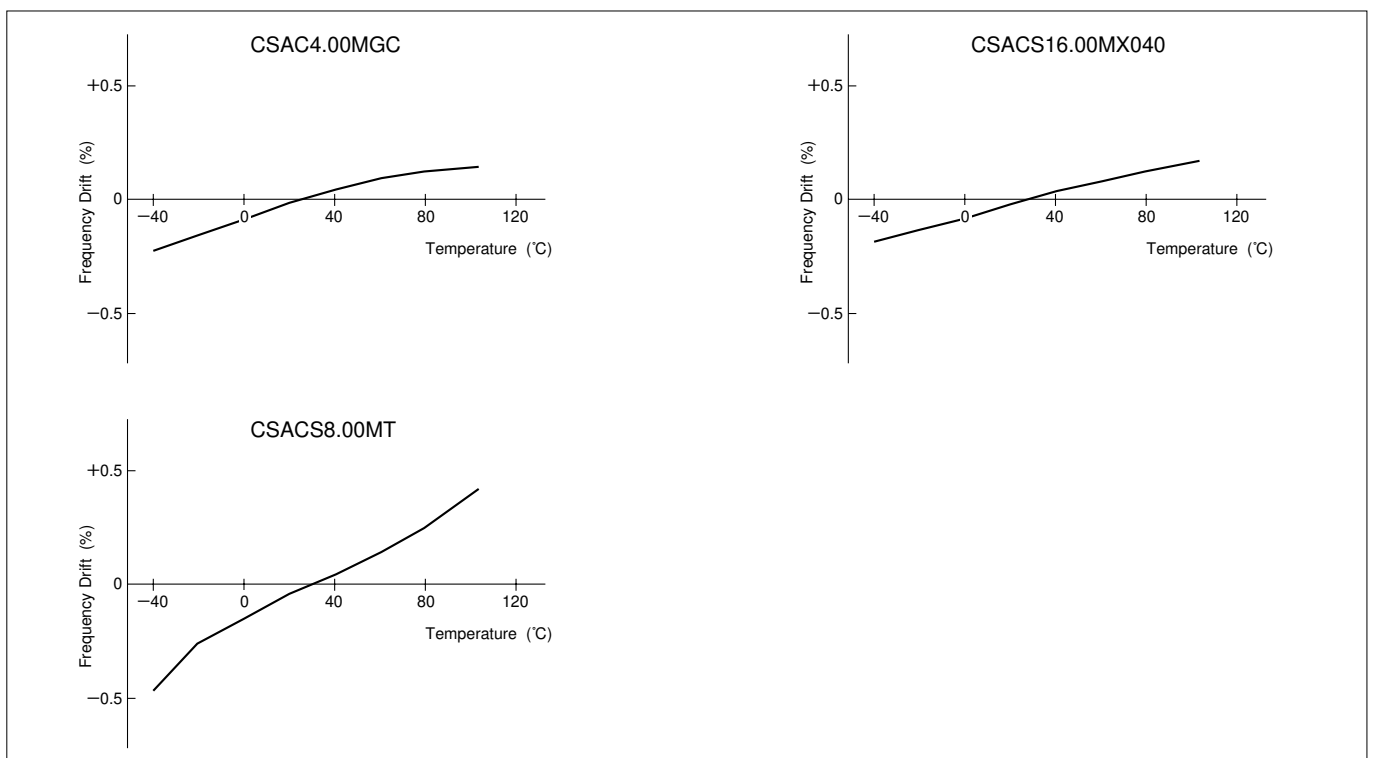


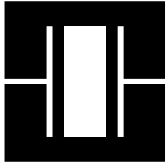
Chip Ceramic Resonator CSAC/CSACS Series (CERALOCK®)

■ DIMENSIONS/STANDARD LAND PATTERN (in mm tol.:±0.3mm)

Frequency	1.80—6.00MHz	6.01—13.0MHz	14.00—60.00MHz
Type	CSAC □ MGC/MGCM	CSACS □ MT	CSACS □ MX040
Dimensions	<p>(MGCM)</p> <p>(MGC)</p>		<p>※Thickness varies with frequency.</p>
Standard Land Pattern			

■ THE STABILITY OF OSCILLATION FREQUENCY WITH TEMPERATURE VARIATION





CERAMIC RESONATOR (CERALOCK®)



KHz Band SMD Ceramic Resonator CSBF Series (CERALOCK®)

Can be reflow soldered and mounted by automatic placers.

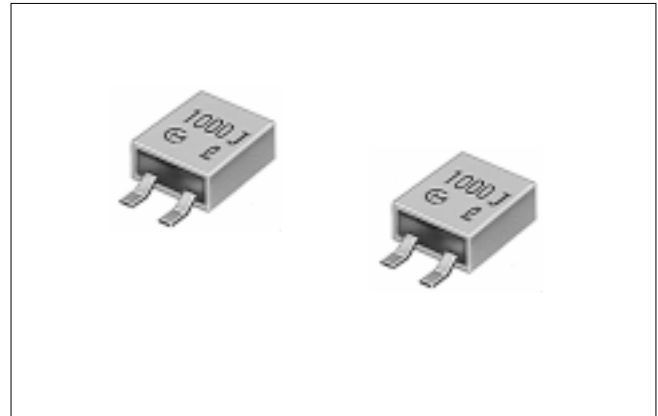
MURATA's original package technologies have enabled the development of the KHz band CERALOCK®. The series is perfect in miniature remote control units and A. V. modules.

FEATURES

1. The series withstands reflow soldering.
2. The series is mountable by automatic placers.
3. Its high performance provides stable oscillation.

APPLICATIONS

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



SPECIFICATIONS

Item	Type	CSBF Series	
		CSBF□J	CSBF□J※1
Frequency Range		430–519kHz	700–1250kHz
Oscillation Frequency Initial Tolerance		±0.5%	±0.5%
Oscillation Frequency Temperature Stability※2		±0.3%	±0.3%
Aging※3		±0.3%	±0.3%
Oscillation Frequency Measuring Circuit			IC :1/6CD4069UBE×2 V _{DD} :5V (MT Series:12V) X :CERALOCK® C1,C2 :100pF Rd :5.6KΩ※4

※1 Available in several standard frequencies (ex. 700, 800, 820, 910, 983, 1000, 1200KHz)

※2 At -20°C to +80°C

※3 For 10 years at room temperature.

※4 This resistance value applies to the 700–1250 KHz range.



CERAMIC RESONATOR (CERALOCK®)



KHz Band SMD Ceramic Resonator CSBF Series (CERALOCK®)

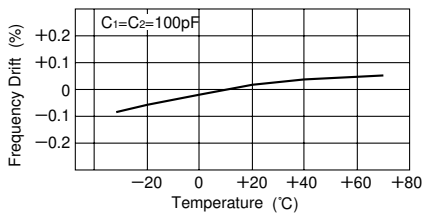
■ DIMENSIONS/STANDARD LAND PATTERN (in mm tol.:±0.3mm)

Frequency	430—519kHz	700—1250kHz
Type	CSBF□J	CSBF□J※1
Dimensions	<p>CSB 455J</p>	<p>1000J</p>
Standard Land Pattern		

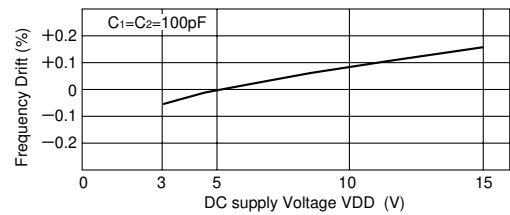
※1 Available in several standard frequencies.

■ TECHNICAL DATA

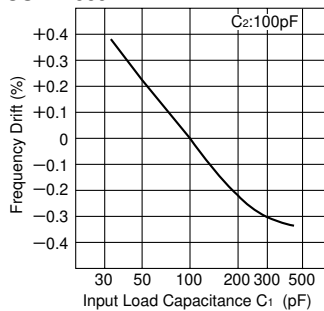
Temperature characteristics
CSBF455J



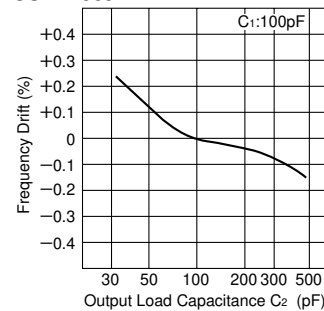
Supply voltage characteristics
CSBF455J

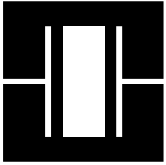


Input load capacitance (C₁) characteristics
CSBF455J



Output load capacitance (C₂) characteristics
CSBF455J





CERAMIC RESONATOR (CERALOCK®)



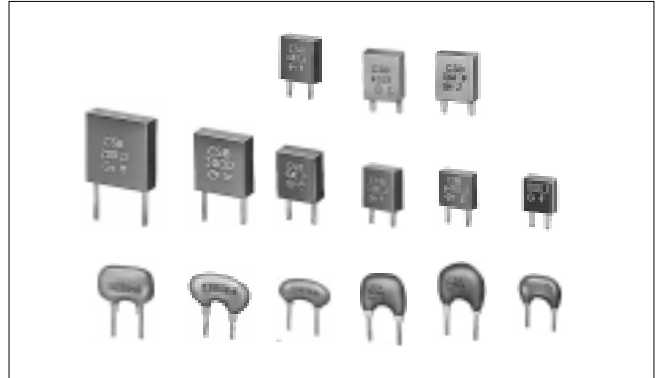
Ceramic Resonator CSA/CSB Series (CERALOCK®)

CERALOCK® with two leaded terminals.

The CSA and CSB series ceramic resonator 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, both the CSA and CSB series are ideally suited to microprocessor and remote control unit applications.

The CSA series is available in two types: one for MOS technology and the other for LS-TTL technology. The CSB series includes the thin and compact J type which is ideal in high-speed 4-bit microprocessor 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.

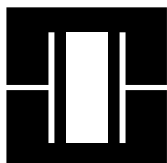


■FEATURES

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. Tone Dialers and Pulse Dialers for telephone.
4. Remote control systems.
5. Automotive electronics (engine control, digital speed meters, etc.)



CERAMIC RESONATOR (CERALOCK®)



Ceramic Resonator CSA/CSB Series (CERALOCK®)

SPECIFICATIONS

Item	Type	CSA Series (for MOS)				CSA Series (for LS-TTL)				CSB Series		
		CSA□MK	CSA□MG	CSA□MTZ	CSA□MXZ040	CSA□MK011	CSA□MG011	CSA□MTZ011	CSA□MXZ011	Not Washable	Washable*7	
Frequency Range		1.26— 1.79MHz	1.80— 6.30MHz	6.31— 13.0MHz	13.01— 60.0MHz	1.26— 1.79MHz	1.80— 6.30MHz	6.31— 11.9MHz	12.0— 30MHz	375— 699kHz	190— 374kHz	375— 1250kHz
Oscillation Frequency Initial Tolerance		±0.5%				±0.5%				±2KHz	±1KHz	±0.5%
Oscillation Frequency Temperature Stability*1		±0.3%		±0.5%	±0.3%	±0.3%		±0.5%	±0.3%	±0.3%		
Aging*2		±0.3%		±0.5%	±0.3%	±0.3%		±0.5%	±0.3%	±0.5%		
Oscillation Frequency Measuring Circuit		<p>IC :1/6CD4069UBE×2*5 V_{DD} :5V (MTZ Series:12V) X :CERALOCK® C1,C2 :30pF*6</p>				<p>IC :1/6SN74LS04×2 V_{CC} :5V X :CERALOCK® C1,C2 :Load Capacitors*3 Rt :2.2—4.7Ω Rb :2.2—22kΩ</p>				<p>IC :1/6CD4069UBE×2 V_{DD} :5V X :CERALOCK® C1,C2 :Load Capacitors*3 Rd :5.6kΩ*4</p>		

- *1 At -20°C to +80°C
- *2 For 10 years at room temperature
- *3 Values vary according to frequency. Please contact us for details.
- *4 700—1250KHz (J Type) only.
- *5 TC74HCU04 is used as the standard circuit for the MXZ040 series. Please contact us for details.

- *6 For the MXZ040 series, the value changes according to frequency.
- *7 Washing the resonator is allowed. However, temperature, time and other washing conditions should be evaluated to confirm that stable electrical characteristics are maintained.

DIMENSIONS

Standard Products	Frequency	Not Washable		Standard Products		Washable	
		Part Number	Dimensions (in mm)	Part Number	Dimensions (in mm)	Part Number	Dimensions (in mm)
	375—429kHz	CSB□P		375—429kHz	CSB□J*		
	430—509kHz	CSB□E		430—519kHz	CSB□J*		
	510—699kHz	CSB□P		520—699kHz	CSB□J*		
	190—249kHz	CSB□D		700—1250kHz	CSB□J*		
	250—374kHz	CSB□D					
		NOT ALLOWED	NOT ALLOWED	ALLOWED	ALLOWED	ALLOWED	ALLOWED

*: Please consult MURATA regarding ultrasonic cleaning conditions to avoid possible damage during ultrasonic cleaning.



CERAMIC RESONATOR (CERALOCK®)

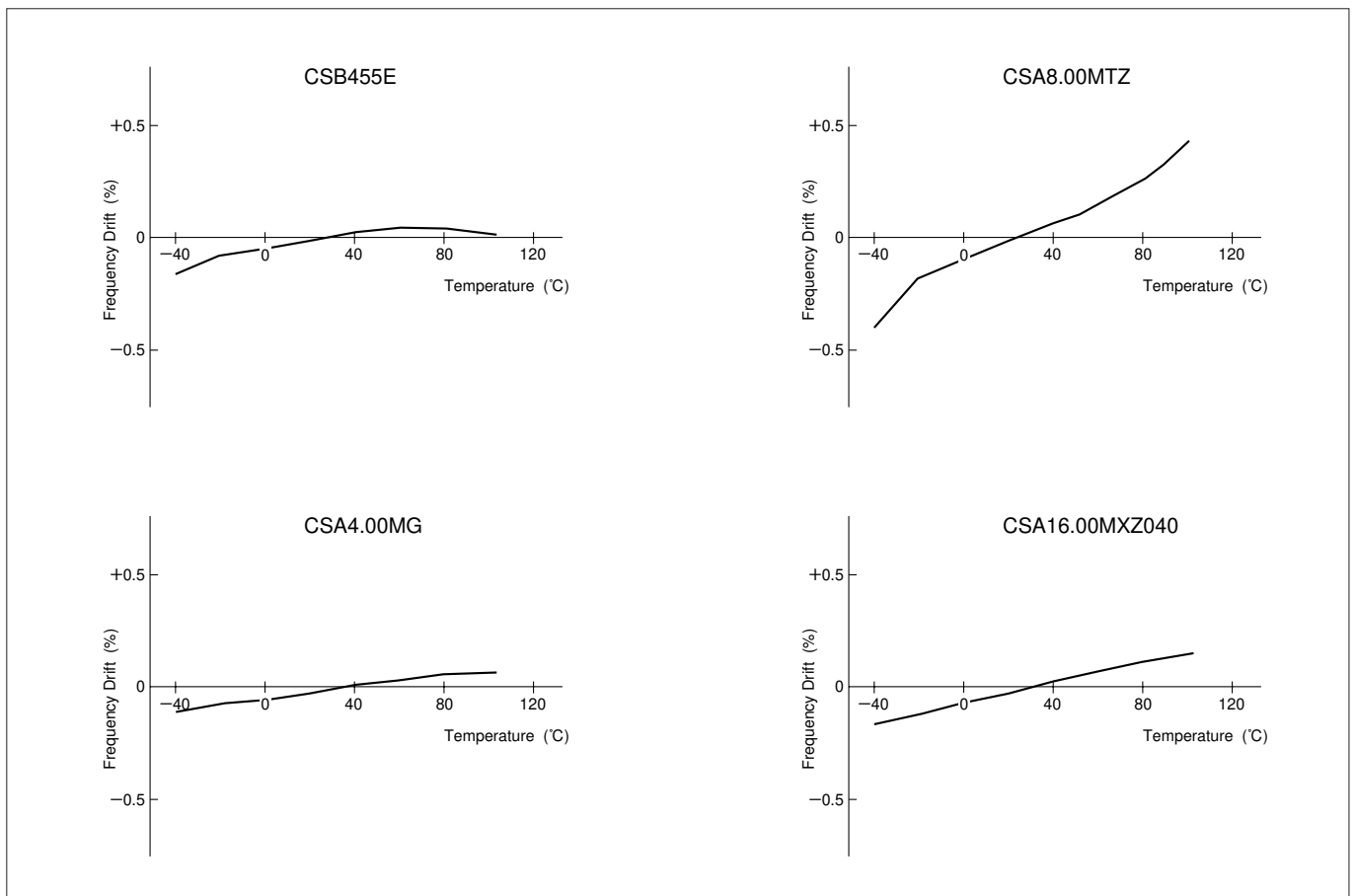


Ceramic Resonator CSA/CSB Series (CERALOCK®)

Frequency	1.26—1.79MHz	1.80—2.44MHz	2.45—6.30kHz	6.31—13.00MHz	12.00—32.00kHz	32.01—60.00MHz
Part Number	CSA□MK*	CSA□MG	CSA□MG	CSA□MTZ	CSA□MXZ	CSA□MXZ
Oscillation Mode*	Shear Vibration	Thickness Shear Vibration	Thickness Shear Vibration	Thickness Longitudinal Vibration	Thickness Longitudinal Vibration (3rd OVERTONE)	Thickness Longitudinal Vibration (3rd OVERTONE)
Dimensions (in mm)						

*The CSA□MK type is not washable.

THE STABILITY OF OSCILLATION FREQUENCY WITH TEMPERATURE VARIATION





CERAMIC RESONATOR (CERALOCK®)



Ceramic Resonator CSU/CST Series (CERALOCK®)

CERALOCK® with built in loading 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 CSU series (KHz band) and CST series (MHz band) 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 are some variation of built-in capacitance value to apply various of IC.



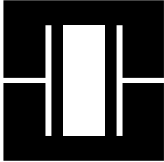
APPLICATIONS

1. DTMF generators • Remote control units
2. Clock oscillators for microcomputers
3. Automated office equipment
 - Automotive electronics (Suffixed “-A” ex. CST□MGWA)

SPECIFICATIONS

Item	Type	CST Series			
	CSU Series	CST□MG	CST□MGW	CST□MTW	CST□MXW040
Frequency Range	450–500kHz	1.80–2.44MHz	2.45–6.30MHz	6.31–13.0MHz	13.01–60.0MHz
Oscillation Frequency Initial Tolerance	±2kHz	±0.5%	±0.5%	±0.5%	±0.5%
Oscillation Frequency Temperature Stability※1	±0.3%	±0.3%	±0.3%	±0.4%	±0.3%
Aging※2	±0.5%	±0.3%	±0.3%	±0.3%	±0.3%
Oscillation Frequency Test Circuit	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>IC :1/6CD4069UBE×2 V_{DD} :5V X :Chip CERALOCK®</p> </div> <div style="text-align: center;"> <p>IC :1/6CD4069UBE×2※3 V_{DD} :5V (MTW Series:12V) X :CERALOCK®</p> </div> </div>				

※1 At -20 to +80°C (Temperature Condition)
 ※2 Room Temperature 10Years.
 ※3 MXW040 Series are used with the TC74HCU04IC.
 ※4 Input terminal (1) should be connected to the input of an inverter.
 ※5 If connected with incorrect orientation, the above specification may not be guaranteed.



CERAMIC RESONATOR (CERALOCK®)



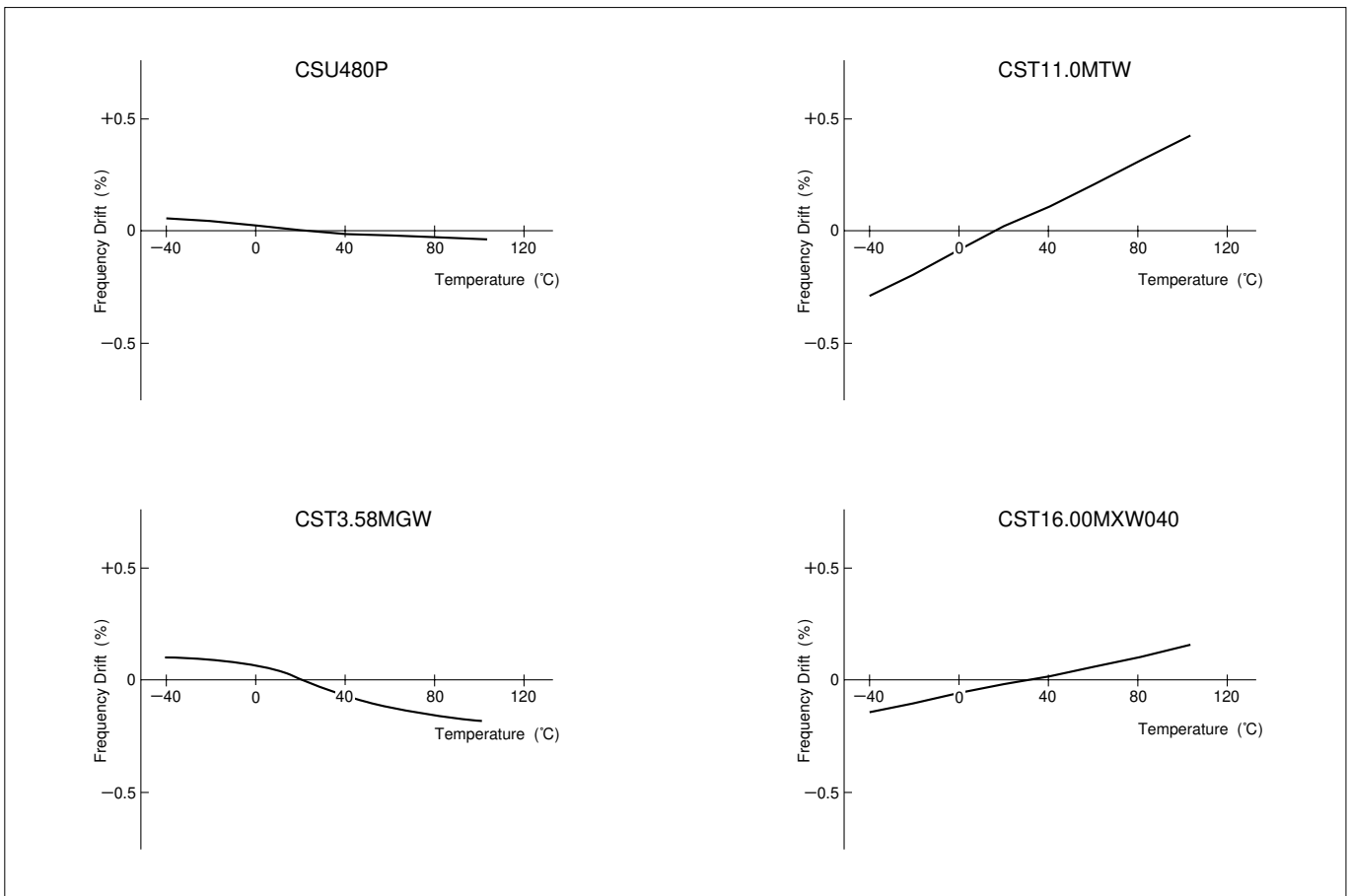
Ceramic Resonator CSU/CST Series (CERALOCK®)

■ DIMENSIONS

Frequency	450—500MHz	1.80—2.44MHz	2.45—6.30MHz	6.31—13.0MHz	13.01—60.00MHz
Part number	CSU□P	CST□MG	CST□MGW	CST□MXW	CST□MXW
Dimensions (Unit : mm)					

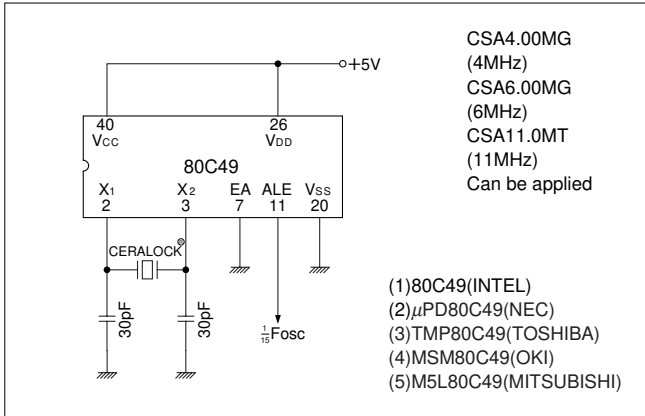
- ※1 6.01—7.99MHz: 9.0mm max.
- ※2 13.01—14.99MHz: 9.0mm max., 33.00—60.00MHz:7.0mm max.
- ※3 Terminals have directionality : (1)Input (2)Ground (3)Output
- ※4 The CSU□P is not washable.

■ THE STABILITY OF OSCILLATION FREQUENCY WITH TEMPERATURE VARIATION

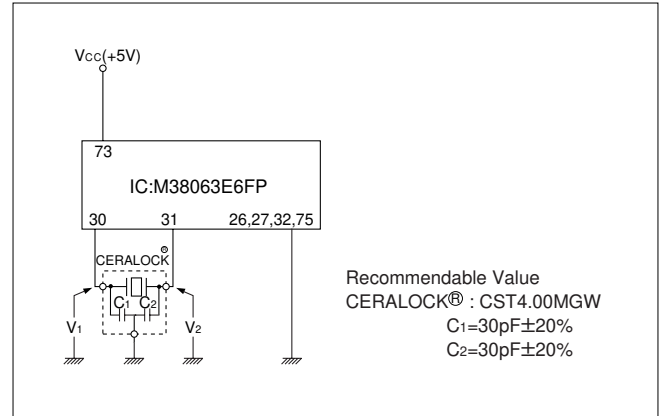


■APPLICATION CIRCUITS UTILIZING THE CERALOCK®

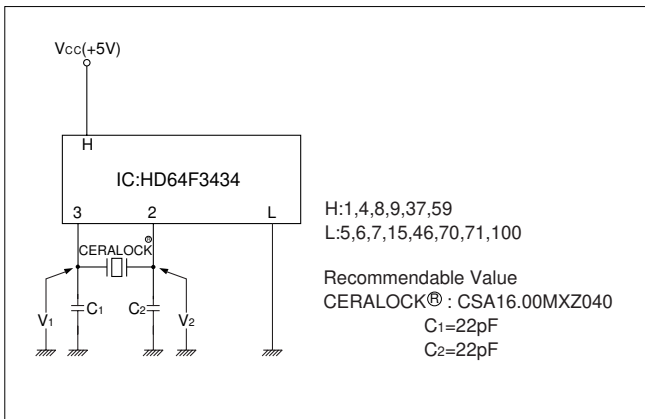
Application to 80C49 (8-bit Microcomputer)



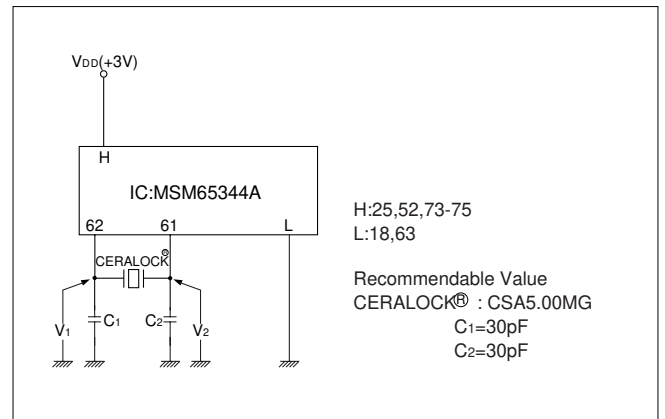
Application to M38063E6FP (MITSUBISHI) (8-bit Microcomputer)



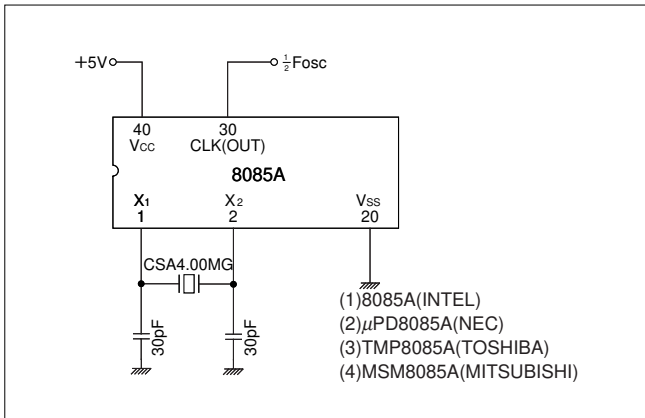
Application to HD64F3434 (HITACHI) (8-bit Microcomputer)



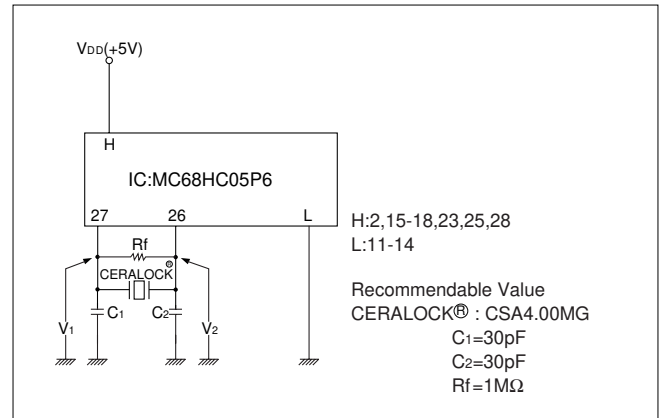
Application to MSM65344A (8-bit Microcomputer)



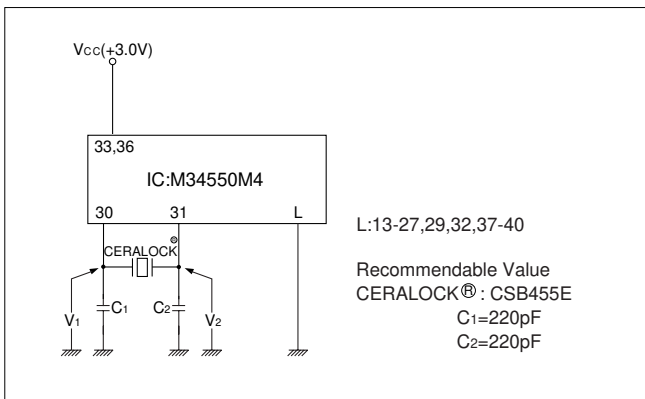
Application to 8085 (8-bit Microcomputer)



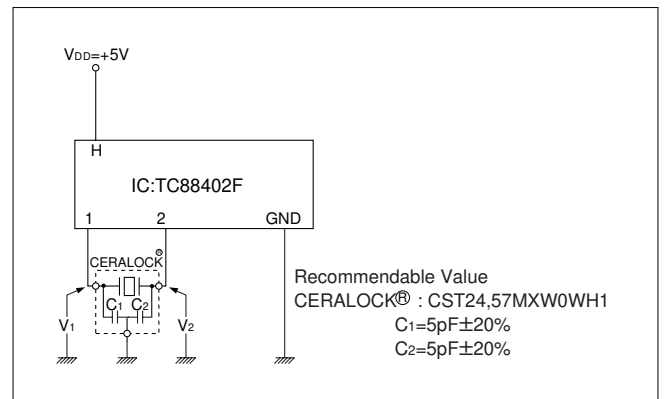
Application to MC68HC05P6 (MOTOROLA) (8-bit Microcomputer)



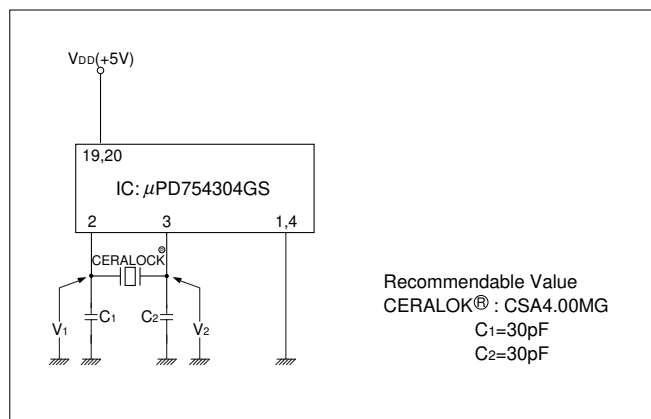
Application to M34550M4 (MITSUBISHI) (Remote Control Unit)



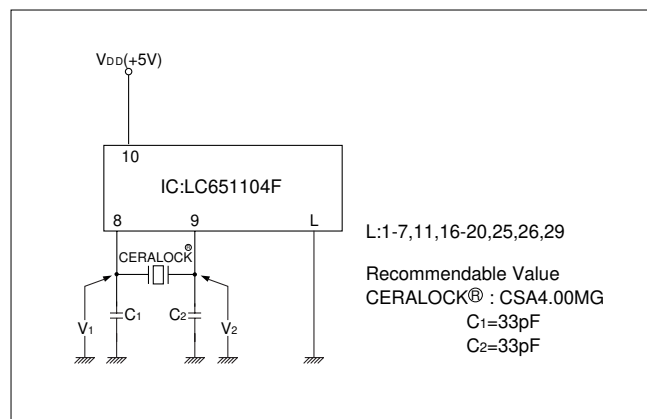
Application to TC88402F (TOSHIBA) (Speech Synthesizer)



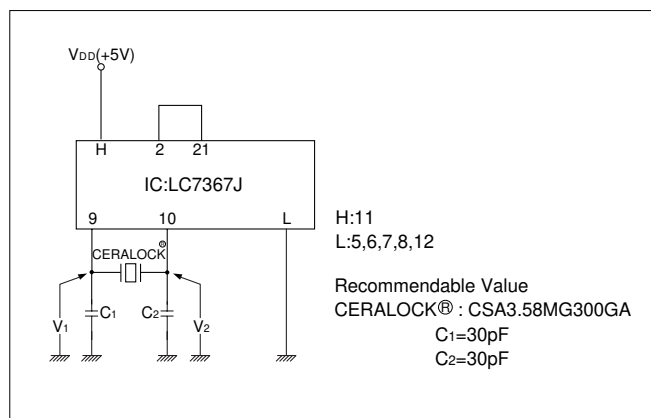
Application to μ PD754304GS (4-bit Microcomputer)



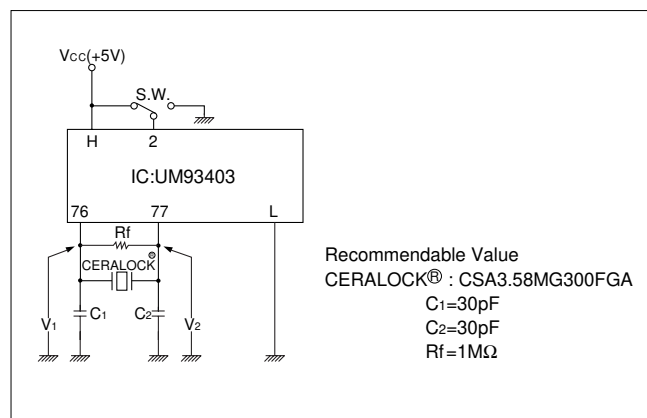
Application to 651104F (SANYO) (4-bit Microcomputer)



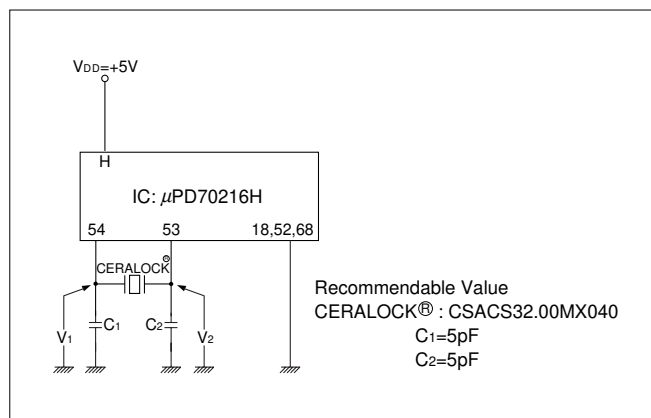
Application to LC7367J (SANYO) (Ton / Pulse Diater)



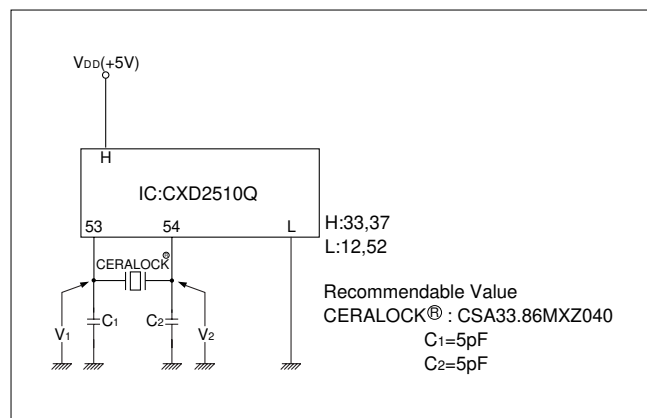
Application to UM93403 (UMC) (Tone / Pulse Diater)



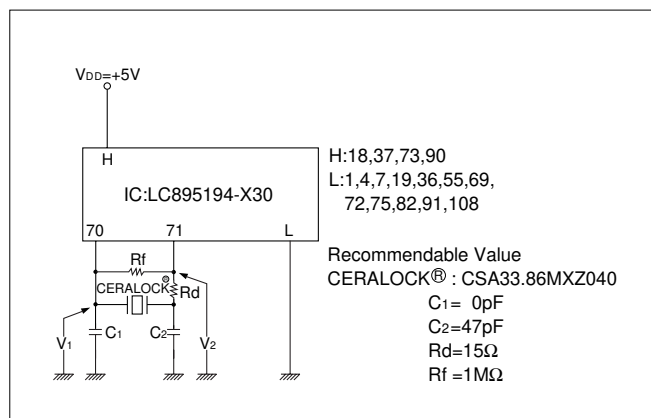
Application to μ PD70216H (NEC) (16-bit Microcomputer)



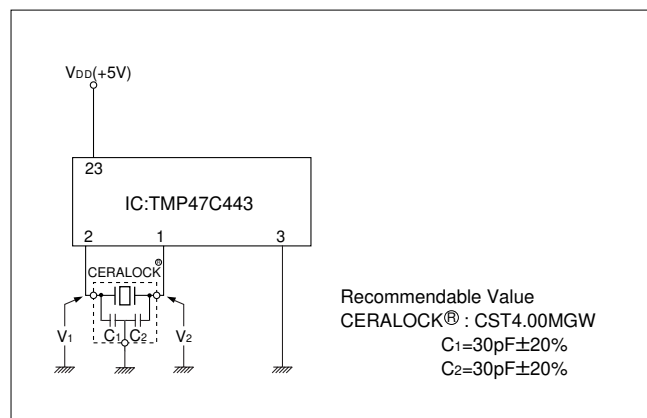
Application to CXD2510Q (SONY) (Digital Signal Processing IC for CD)



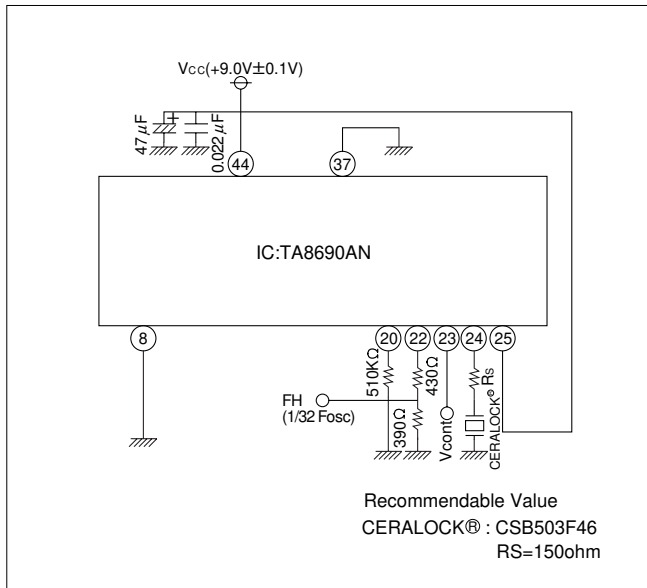
Application to LC895194-X30 (SANYO)



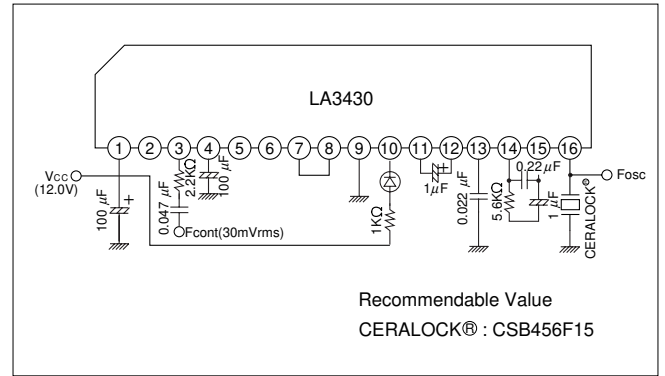
Application to TMP47C443 (TOSHIBA) (4-bit Microcomputer)



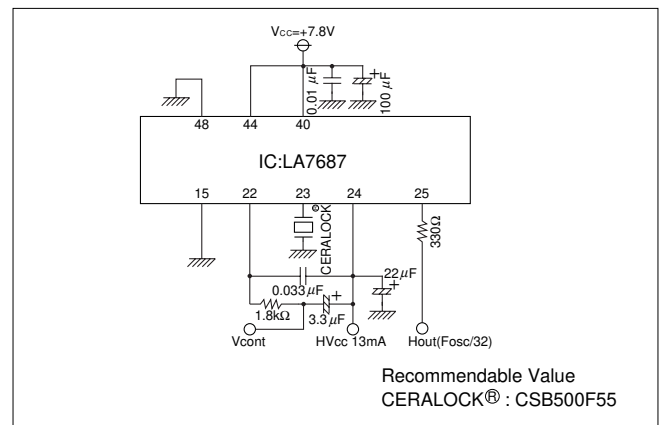
Application to TA8690AN (TOSHIBA)
(TV Horizontal / Vertical Synthesizer Circuit)



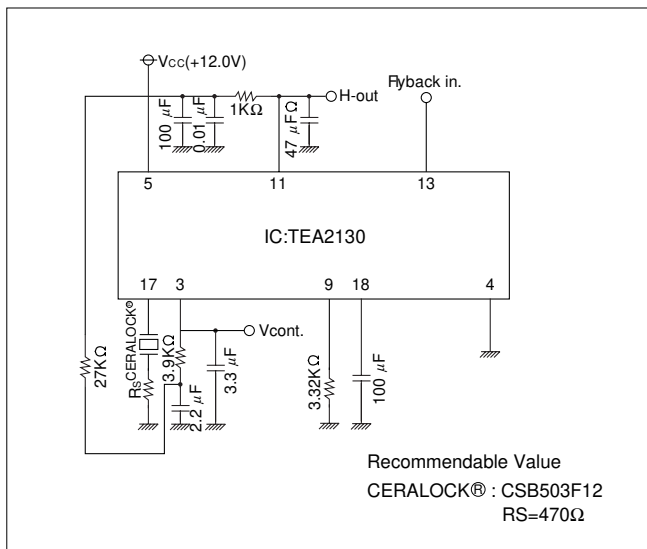
Application to LA3430 (SANYO) (FM Stereo MPX)



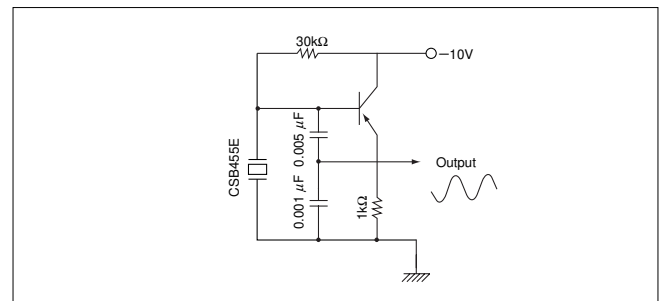
Application to LA7687 (SANYO)
(TV Horizontal Synthesizer Circuit)



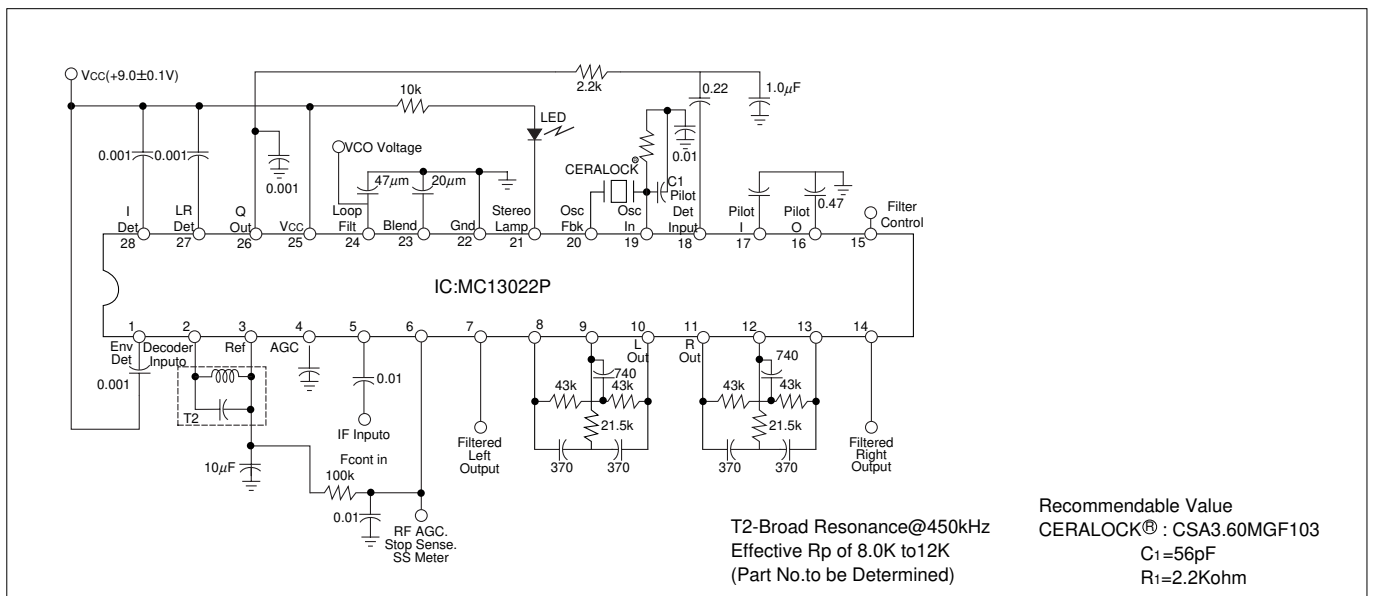
Application to TEA2130 (THOMSON)
(TV Horizontal / Compatible with synthesizer Circuit)



Oscillation Circuit incorporating Transistor



Application to MC13022P (MOTOROLA) (AM Stereo Decoder)



**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 Control Law" of Japan, the export license specified by the law is required for export.

2. Please contact our sales representatives or engineers before using our products listed in this catalog for the applications requiring especially high reliability what defects might directly cause damage to other party's life, body or property (listed below) or for other applications not specified in this catalog.

- ① Aircraft equipment
- ② Aerospace equipment
- ③ Undersea equipment
- ④ Medical equipment
- ⑤ Transportation equipment (automobiles, trains, ships, etc.)
- ⑥ Traffic signal equipment
- ⑦ Disaster prevention / crime prevention equipment
- ⑧ Data-processing equipment
- ⑨ Applications of similar complexity or with reliability requirements comparable to the applications listed in the above

3. Product specifications in this catalog are as of September 1997, and are subject to change or stop the supply without notice. Please confirm the specifications before ordering any product. If there are any questions, please contact our sales representatives or engineers.

4. The categories and specifications listed in this catalog are for information only. Please confirm detailed specifications by checking the product specification document or requesting for the approval sheet for product specification, before ordering.

5. 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 third party's intellectual property rights and other related rights in consideration of your using 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.

6. None of ozone depleting substances (ODS) under the Montreal Protocol is used in manufacturing process of us.


Murata Manufacturing Co., Ltd.
<http://www.murata.co.jp/>**Headquarters**

2-26-10, Tenjin Nagaokakyo-shi, Kyoto 617, Japan Phone:81-75-951-9111

International Division1-18-1 Hakusan, Midori-ku, Yokohama-shi, Kanagawa 226, Japan
Phone:81-45-931-7111 Fax:81-45-931-7105

<U.S.A.>

Murata Electronics North America, Inc.
2200 Lake Park Drive Smyrna, GA 30080-7604, U.S.A.
Phone:1-770-436-1300 Fax:1-770-436-3030

<BRAZIL>

Murata Amazônia Indústria e Comércio Ltda.
Alameda Santos, 1.893-6^o andar-conj. 62-São Paulo-SP
CEP 01419-910
Phone:55-11-287-7188 Fax:55-11-289-8310

Murata World Comercial Ltda.
Rua Fortaleza, 221-Bairro Adrianópolis-Manaus-AM CEP 69053-510
Phone:55-92-234-4351 Fax:55-92-234-5878

<GERMANY>

Murata Elektronik Handels GmbH
Holbeinstrasse 21-23.90441 Nürnberg, Germany
Phone:49-911-66870 Fax:49-911-6687411

<FRANCE>

Murata Electronique S.A.
18, 22, Avenue Edouard Herriot Copernic 6 92356 Le Plessis Robinson
Cedex, France
Phone:33-1-4094-8300 Fax:33-1-4094-0154

<ITALY>

Murata Elettronica S.p.A.
Via San Carlo, 1 20040 Caponago, Milano, Italy
Phone:39-2-95743000 Fax:39-2-95740168/95742292

<ENGLAND>

Murata Electronics(UK)Ltd.
Oak House, Ancells Road, Ancells Business Park, Fleet, Aldershot
Hampshire, GU13 8UN U.K.
Phone:44-1252-811666 Fax:44-1252-811777

<NETHERLANDS>

Murata Electronics(Netherlands)B.V.
Daalmeesterstraat 4 2131 HC Hoofddorp, The Netherlands
Phone:31-23-5698410 Fax:31-23-5698411

<SWITZERLAND>

Murata Ageltro Electronics AG
Isenrietstrasse 19, CH-8617 Mönchaltorf Switzerland
Phone:41-1-948-1314 Fax:41-1-948-1769

<SINGAPORE>

Murata Electronics Singapore(Pte.)Ltd.
547 Yishun Industrial Park A. 7 Singapore 768766 Republic of
Singapore Phone:65-758-4233 Fax:65-758-2026

<MALAYSIA>

Murata Trading(Malaysia)Sdn.Bhd.
Suite 1510, Plaza Pengkalan, Batu 3 Jalan Ipoh, 51200 Kuala Lumpur
Malaysia
Phone:60-3-442-5227 Fax:60-3-443-8018

Murata Trading(Malaysia)Sdn.Bhd. Penang Office
9.06 Wisma Tahwa No.39 Jalan Sultan Ahmad Shah 10050 Pulau
Penang Malaysia
Phone:60-4-229-4258 Fax:60-4-229-4257

<TAIWAN>

Murata Electronics North America, Inc. Taiwan Branch
Room 1403, Chia Hsin Building 96, Chung-Shan N. Rd., Sec. 2, Taipei
Taiwan
Phone:886-2-562-4218 Fax:886-2-536-6721

<THAILAND>

Murata Electronics(Thailand)Ltd.
No.62, Thaniya Building, 3rd Floor Silom Road, Bangkok, 10500
Kingdom of Thailand
Phone:66-2-236-3512/3491 Fax:66-2-238-4873
Thai Murata Electronics Trading,Ltd.
Phone:66-2-266-0750 Fax:66-2-266-0752

<HONG KONG>

Murata Co.,Ltd.
Room 709-712, Miramar Tower, 1-23 Kimberly Road, Tsimshatsui,
Kowloon, Hong Kong
Phone:852-2376-3898 Fax:852-2375-5655

<KOREA>

Murata Mfg.Co.,Ltd. Seoul Branch
14th Floor Haesung 2 Bldg., 942-10, Taechi-Dong, Kangnam-Ku,
Seoul, Korea
Phone:82-2-561-2347 Fax:82-2-561-2722

<CHINA>

Beijing Murata Electronics Co.,Ltd.
No.11 Tianzhu Road Tianzhu Airport Industry Zone Shunyi County,
Beijing 101312 the People's Republic of China
Phone:86-10-6456-8822 Fax:86-10-6456-9945

Murata Electronics Trading(Shanghai)Co.,Ltd.
Room No.506, West Tower Sun Plaza 88 Xianxia Road, Changning
District Shanghai, 200335 P.R.C.
Phone:86-21-6270-0611/2/3 Fax:86-21-6270-0614