CERAMIC CAPACITOR Catalog

2022

2023

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IHHEC

Holy Stone Enterprise Co., Ltd.

You Should Know Holy Stone.

The Company

Holy Stone Enterprise Company Co., Ltd. (Holy Stone) is headquartered in the Nei Hu District of Taipei, Taiwan. The company was founded in June of 1981 by three engineers as a technology focused distributor of electronic components.

In 1999, with technology and cooperation from a Japanese partner, Holy Stone began manufacturing Multi-layer Ceramic Capacitors. Today, Holy Stone is recognized as an industry leader in application specific ceramic capacitors.

Holy Stone integrates active and passive component distribution with state-of-the-art Ceramic Capacitor manufacturing capabilities. Holy Stone's unique business model combines the service and inventory management strengths of a broad line distributor with the technical knowledge and world class pricing of a manufacturer.

Holy Stone maintains a focus on and a commitment to providing customers with innovative products and exceptional service. That unwavering commitment is evident in Holy Stone's phenomenal growth.

Holy Stone maintains a high profile on the Taiwan Stock Exchange, is ranked in the top 100 companies and is recognized as a leader among its peers.

Manufacturing Facilities

Holy Stone ceramic capacitors are produced in two modern factories located in Lungtan and Yilan, Taiwan. Holy Stone advanced materials research laboratory is located in Japan. The factory operating systems are certified to ISO-9001, IATF16949 and ISO-14001.

Sales and Support Locations

Holy Stone Headquarter and Corporate Sales are located in Taipei, Taiwan. Holy Stone also maintains sales and support offices in Shenzhen, Suzhou and Shanghai, China. Holy Stone Enterprise Company Co., Ltd. has subsidiary companies in North America and in Europe. "HolyStone International", located in Diamond Bar, California, U.S.A. covers sales and technical support in the America. "Holystone (Europe) Ltd.", located in Norwich, England is responsible for sales and technical support throughout Europe. "Holy Stone Holdings Pte., Ltd." located in Singapore provides sales and support in South and Southeast Asia. Holy Stone also has a global network of independent representatives, agents and distributors.

The Environment

Holy Stone is committed to achieving and maintaining a healthy environment. The factories are certified to ISO-14001 and all standard products are designed and produced in compliance to RoHS.

Our Employees

Holy Stone's success is measured by the satisfaction of our customers and share holders. Achieving that satisfaction is the result of the sum contribution of our employees. Holy Stone strives to maintain a work environment that stimulates creativity, encourages enthusiasm, recognizes and rewards results.

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Capacitance Availability Guide

Vdc	Dielectric	0201	0402	0603	0805	1206	1210	1808	1812	1825	2220	2225
6.3V	NP0				22nF	100nF						
	X7R	100nF	1uF	4.7uF	10uF	22uF						
	X5R	4.7uF	22uF	47uF	100uF	100uF	220uF					
10V	NP0				22nF	100nF						
	X7R		100nF	4.7uF	10uF	22uF	47uF					
	X5R	1uF	22uF	22uF	47uF	47uF	100uF					
16V	NP0	100pF		3.9nF	22nF	100nF	100nF		220nF	100nF		
	X7R	3.9nF	470nF	1uF	10uF	10uF	22uF					
	X5R		4.7uF	10uF	22uF	47uF	100uF					
25V	NP0	100pF		3.9nF	22nF	100nF	100nF		220nF	100nF		
	X7R	2.2nF	220nF	1uF	4.7uF	10uF	22uF		10uF		10uF	4.7uF
	X5R		2.2uF	10uF	22uF	22uF	22uF					
35V	NP0				22nF	100nF						
	X7R				2.2uF	10uF	10uF					
	X5R		2.2uF	10uF	10uF							
50V	NP0		1nF	3.9nF	22nF	100nF	100nF		220nF	100nF	27nF	82nF
	X7R	10nF	100nF	1uF	2.2uF	4.7uF	10uF		10uF	2.2uF	10uF	4.7uF
	X5R			2.2uF	10uF	10uF	10uF					
100V	NP0			3.9nF	12nF	100nF	100nF		100nF	100nF	27nF	82nF
	X7R	1nF	10nF	220nF	1uF	3.3uF	4.7uF		2.2uF	1uF	10uF	4.7uF
	X5R					2.2uF						
200V	NP0			560pF	4.7nF	22nF	47nF		100nF	100nF	33nF	33nF
	X7R			10nF	100nF	220nF	680nF	560nF	1uF	1uF	2.2uF	2.2uF
	X5R											
250V	NP0			560pF	4.7nF	22nF	47nF		100nF	100nF	33nF	33nF
	X7R		100pF	47nF	100nF	220nF	560nF	560nF	1uF	1uF	2.2uF	2.2uF
	X5R											
500V	NP0				1.5nF	10nF	33nF	2.2nF	33nF	100nF	27nF	15nF
	X7R				22nF	68nF	120nF	47nF	470nF	470nF	1uF	470nF
	X5R											
630V	NP0				3.9nF	10nF	33nF	2.2nF	33nF	47nF	22nF	15nF
	X7R				10nF	47nF	100nF	47nF	220nF	330nF	470nF	100nF
	X5R											
1KV	NP0				1.5nF	3.3nF	15nF	2.2nF	2.2nF	12nF	33nF	15nF
	X7R				2.2nF	22nF	47nF	33nF	100nF	150nF	220nF	100nF
	X5R											
2KV	NP0					390pF	100pF	1nF	1.5nF		6.8nF	10nF
	X7R					4.7nF	4.7nF	10nF	33nF	22nF	39nF	47nF
	X5R											
3KV	NP0					47pF		1nF	1.2nF		2.2nF	3.3nF
	X7R					1nF	2.7nF	5.6nF	10nF	18nF	10nF	22nF
	X5R											
4KV	NP0							220pF				
	X7R							1nF			10nF	4.7nF
	X5R											
5KV	NP0										150pF	56pF
	X7R							1nF			4.7nF	
	X5R											

Safety Certified SMD Capacitors								
Class	Vac	Dielectric	1808	1812	2208	2211	2220	2825
X1/Y2	250Vrms	NPO	2.0pF - 330pF	2.0pF - 680pF	2.0pF - 330pF	2.0pF - 1nF	2.0pF - 1.2nF	N/A
	250Vrms	X7R	150pF - 1nF	130pF - 1nF	36pF - 1nF	68pF - 2.7nF	100pF - 4.7nF	N/A
X2	250Vrms	NPO	2.0pF -1nF	N/A	N/A	N/A	N/A	N/A
	250Vrms	X7R	150pF - 2.2nF	330pF - 4.7nF	N/A	N/A	150pF - 68nF	47nF - 56nF
	305Vrms	X7R	N/A	N/A	N/A	N/A	150pF - 33nF	N/A

◆ All ranges are Lead (Pb) free

ISO Certification

Plant	Certificated	Date	Organization	Registration No.
Taipei HQ/Lung Tan Factory	ISO 9001:2015	20 March, 2002	BVC	TWN4523166Q
Taipei HQ/Lung Tan Factory	ISO 14001:2015	29 May, 2003	BVC	TW005163
Taipei HQ/Lung Tan Factory	IATF16949:2016	27 September, 2016	BVC	41453
Taipei HQ/Lung Tan Factory	IECQ QC080000:2017	14 May, 2020	BVC	IECQ-H LCIE 20.0011

ISO 9001:2015


BUREAU VERITAS Certification

HOLY STONE ENTERPRISE CO., LTD.

ISO 9001:2015

THE DESIGN, DEVELOPMENT, PRODUCTION, SALES AND SUPPLY OF MULTILAYER CERAMIC CAPACITOR, ELECTRONIC DEVICE, SUBSTRATE; THE DISTRIBUTION OF SEMICONDUCTOR, PASSIVE AND ACTIVE ELECTRONIC COMPONENT AND COMPUTER PERIPHERAL.

ISO 14001:2015


Bureau Veritas Certification

HOLY STONE ENTERPRISE CO., LTD

ISO 14001:2015

IECQ QC 080000:2017


IEC QUALITY ASSESSMENT SYSTEM (IECQ)
covering Electronic Components, Assemblies, Related Materials and Processes

IECQ Certificate of Conformity
Hazardous Substance Process Management

Holy Stone Enterprise Co., Ltd.
No.56, 61, 61-1, Ln. 90, Gong 5th Rd., Wu Lin Vil., Longtan Dist., 32559, Taoyuan City
Taiwan

Issued by the Certification Body: LCIE Bureau Veritas

IATF16949: 2016


Bureau Veritas Certification

Certificate of Approval

HOLY STONE ENTERPRISE CO., LTD.

IATF 16949 – First Edition

Multilayer Ceramic Capacitors

[Middle Voltage Capacitors – NPO,X7R,100Vdc to 630Vdc]

MVC Series

Holy Stone high voltage products are designed and manufactured to meet the general requirements of international standards. The product offering is well suited for commercial and industrial applications and includes NP0 (C0G) and X7R characteristics in sizes 0402 to 2225 and with working voltages up to 630Vdc.

◆ Features

- ❑ Special internal electrode design offers the highest voltage rating
- ❑ Surface mount suitable for wave and reflow soldering
- ❑ High reliability
- ❑ RoHS compliant

◆ Applications

- ❑ Suitable for LAN/WLAN interface, Back-Lighting Inverter, DC-DC Converters, Ballast, Modems and Power Supplies.
- ❑ SiC & GaN systems, Snubber, Resonant Circuit (LLC, Wireless Charging, etc.)

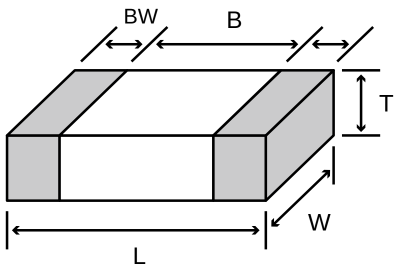
◆ Summary of Specifications

Operation Temperature	-55 ℃ to +125 ℃
Rated Voltage	100Vdc to 630Vdc
Temperature Coefficient	NP0 : ≤ ± 30ppm/ ℃ , -55 ℃ to +125 ℃ (EIA Class Ⅰ)
	X7R : ≤ ± 15% , -55 ℃ to +125 ℃ (EIA Class Ⅱ)
Dissipation Factor	NP0 : More than 30pF : Q ≧1000 30pF & Below : Q≧400+20C (C : Capacitance , pF) X7R : 100V : 5% (C≧0.1uF) 100V : 2.5% (C＜0.1uF) Other Voltage : 2.5% max
Insulation Resistance	10GΩ or 500/CΩ, whichever is smaller
Aging	NP0 : 0% , X7R : Typically 1.0% per decade of time
Dielectric Strength	100V ≦ V ＜ 500V : 200% Rated Voltage
	500V ≦ V ＜ 1000V : 150% Rated Voltage
	1000V≦ V : 120% Rated Voltage

◆ How To Order

C	1206	N	103	J	631	T	E	X	Y
Product Code	**Chip Size**	**Dielectric**	**Capacitance Unit : pF**	**Tolerance**	**Rated Voltage**	**Packaging**	**Thickness (mm) (Optional)**	**Special Requirement (Optional)**	**Suffix Code**
C: MLCC (Multilayer Ceramic Capacitor)	Ex.: 0402 0603 0805 1206 1210 1808 1812 1825 2220 2225	Ex.: N: NP0 X: X7R	Ex.: 2R0:2.0pF 100:10x10^0 471:47x10^1 102:10x10^2	Ex.: C:+/-0.25pF D:+/-0.50pF J :+/- 5% K :+/-10% M:+/-20%	Ex.: 101: 100Vdc 251: 250Vdc 501: 500Vdc 631: 630Vdc	Ex. : T: T&R 7" R: T&R 13" B: Bulk	Ex: E:1.60±0.20 F:2.0±0.20	Ex.: O: Arc Prevention Coating X: Polymer Termination (Super Term) Z: Coating & Polymer Termination	Y

◆ Dimensions



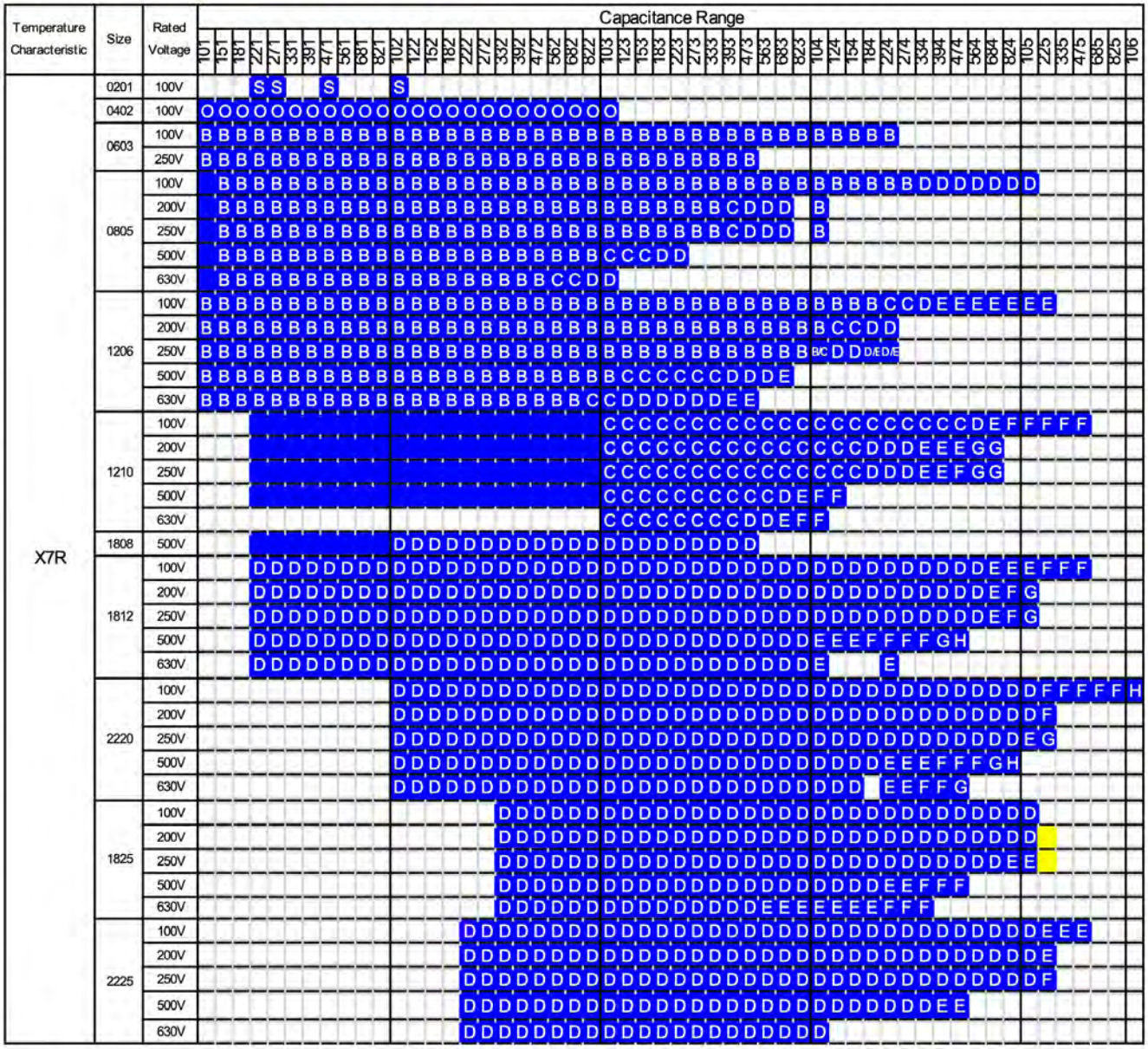
Unit : mm [inches]

SIZE	L	W	T (max)	B (min)	BW (min)
0402	1.00±0.05 [.039±0.02]	0.5±0.05 [.020 ±0.02]	0.55 [.022]	0.30 [.012]	0.15 [.006]
0603	1.60±0.10 [.063±.004]	0.80±0.10 [.031 ±.004]	1.00 [.039]	0.40 [.016]	0.15 [.006]
0805	2.00±0.20 [.079±.012]	1.25±0.20 [.049±.012]	1.45 [.057]	0.70 [.028]	0.20 [.008]
1206	3.20±0.30 [.126±.012]	1.60±0.20 [.063±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.30 [.126±.012]	2.50±0.20 [.098±.012]	2.60 [.102]	1.60 [.059]	0.30 [.012]
1808	4.60±0.30 [.181±.012]	2.00±0.20 [.079±.008]	2.20 [.087]	2.50 [.098]	0.30 [.012]
1812	4.60±0.30 [.181±.012]	3.20±0.30 [.126±.012]	3.00 [.118]	2.50 [.098]	0.30 [.012]
1825	4.60±0.30 [.181±.012]	6.35±0.40 [.250±.016]	3.40 [.118]	2.50 [.098]	0.30 [.012]
2220	5.70±0.40 [.220±.016]	5.00±0.40 [.197±.016]	3.00 [.118]	3.50 [.137]	0.30 [.012]
2225	5.70±0.40 [.220±.016]	6.35±0.40 [.250±.016]	3.00 [.118]	3.50 [.137]	0.30 [.012]

◆ Capacitance Range – NP0 / 100Vdc to 630Vdc

Temperature Characteristic	Size	Rated Voltage	Capacitance Range																																																	
			2R0	3R3	3R9	5R0	8R2	100	120	150	180	220	270	330	390	470	560	680	820	101	121	151	181	221	271	331	391	471	561	681	821	102	122	152	182	222	272	332	392	472	562	682	822	103	123	153	183	223	273	333	393	473	563	683	104
NP0	0402	250V	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O																															
	0603	100V	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B																
		200V	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B																										
		250V	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B																										
	0805	100V	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	D	D	D	D	D	D	D	D										
		200V	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	D	D																
		250V	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	D	D	D															
		500V	B	B	B	B	B	A	A	A	A	A	A	A	A	A	A	A	B	B	B	B	B	B	B	B	B	B	B	C	C	D	D	D	D																				
	1206	100V	C	C	C	C	C	C	C	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	D	D	D	E	E	E	E	E	E	E
		200V	C	C	C	C	C	C	C	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	C	D	D	E	E	E	E	E	E								
		250V	C	C	C	C	C	C	C	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	C	D	D	E	E	E	E	E	E								
		500V						C	C	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	D	E	E	E	E	E	E	E											
		630V						C	C	C	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	D	E	E	E	E	E	E	E											
	1210	100V						C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	D	D	D	E	E	F	F	F
		200V						C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	D	D	E	E	E	F	F			
		250V						C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	D	D	E	E	E	F	F			
		500V						C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	D	D	D	E	E	F	F	G	G	G	G	G	G					
		630V						C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	D	D	D	E	E	F	F	G	G	G	G	G	G					
	1808	500V	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E																			
		630V	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E																			
	1812	100V																D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E
		200V																D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E	E	E	E	E	E
		250V																D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E	E	E	E	E	E
		500V																D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E					
		630V																D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E					
	1825	250V																																					D	D	D	D	D	E	E	E	E	E	F	F	F	F	F	F	G
		500V																																									D	E	E	E	E	F	F	F	F	G	G	G	G
		630V																																									D	E	E	E	E	F	F	G	G	G			
	2220	100V																																									D	D	D	D	D	D	D						
		250V																																														D	E	E					
		500V																														D	D	D	D	D	D	D	D	D	D	D	E	E	E	E	E	F	F						
		630V																																														F							
	2225	100V																																					D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	
		250V																																					D	D	D	D	D	D	D	D	D	D	D						
		500V																																										E	E	F									

◆ Capacitance Range – X7R / 100Vdc to 630Vdc



- ***The yellow indication denotes values that are under development. Please contact Holy Stone office for further details***
- ***Other dimensions, capacitance values and voltages ratings are available on request. Please contact Holy Stone.***

◆ Thickness Specification

Symbol Code	S	O	A	B	C	D	E	F	G	H	I
Thickness(mm)	0.3±0.03	0.5±0.05	0.6±0.1	0.85±0.15	1.0+0.1/-0.05	1.25±0.20	1.6±0.2	2.0±0.2	2.4±0.2	2.8±0.2	3.2±0.2

Multilayer Ceramic Capacitors

[High Voltage Capacitors – NPO, X7R 1KVdc to 5KVdc]

HVC Series

Holy Stone high voltage products are designed and manufactured to meet the general requirements of international standards. The product offering is well suited for commercial and industrial applications and includes NP0 (C0G) and X7R characteristics in sizes 0805 to 2225 and with working voltages from 1KV up to 5KV.

◆ Features

- ❑ Special internal electrode design offers the highest voltage rating
- ❑ Surface mount suitable for wave and reflow soldering
- ❑ High reliability
- ❑ RoHS compliant

◆ Applications

- ❑ Suitable for LAN/WLAN interface, Back-Lighting Inverter, DC-DC Converters, Ballast, Modems and Power Supplies.
- ❑ SiC & GaN systems, Snubber, Resonant Circuit (LLC, Wireless Charging, etc.)

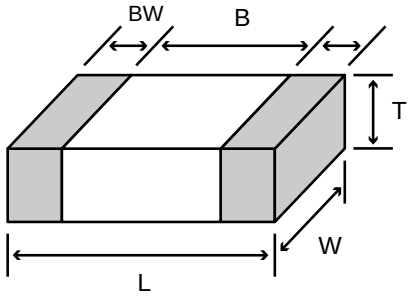
◆ Summary of Specifications

Operation Temperature	-55 ℃ to +125 ℃
Rated Voltage	1KVdc to 5KVdc
Temperature Coefficient	NP0 : ≤ ± 30ppm/ ℃ , -55 ℃ to +125 ℃ (EIA Class Ⅰ)
	X7R : ≤ ± 15% , -55 ℃ to +125 ℃ (EIA Class Ⅱ)
Dissipation Factor	NP0 : More than 30pF : Q ≧1000 30pF & below : Q≧400+20C (C : Capacitance , pF) X7R : D.F.≦ 2.5%
Insulation Resistance	10GΩ or 500/CΩ, whichever is smaller
Aging	NP0: 0% , X7R : Typically 1.0% per decade of time
Dielectric Strength	100V ≦ V < 500V : 200% Rated Voltage
	500V ≦ V < 1000V : 150% Rated Voltage
	1000V≦ V : 120% Rated Voltage

◆ How To Order

C	2220	N	333	J	102	T	I	X	Y
Product Code C: MLCC (Multilayer Ceramic Capacitor)	**Chip Size** Ex.: 0805 1206 1210 1808 1812 1825 2220 2225	**Dielectric** Ex.: N: NP0 X: X7R	**Capacitance Unit : pF** Ex.: 2R0:2.0pF 100:10x10⁰ 471:47x10¹ 102:10x10²	**Tolerance** Ex.: C: +/-0.25pF D: +/-0.50pF J: +/- 5% K: +/-10% M: +/-20%	**Rated Voltage** Ex.: 102: 1000Vdc 202: 2000Vdc 302: 3000Vdc 402: 4000Vdc 502: 5000Vdc	**Packaging** Ex.: T: T&R 7" R: T&R 13" B: Bulk	**Thickness (mm) (Optional)** Ex: E:1.60±0.20 F:2.0±0.20 I :3.2±0.20	**Special Requirement (Optional)** Ex.: O: Arc Prevention Coating X: Polymer Termination (Super Term) Z: Coating & Polymer Termination	**Suffix Code** Y

◆ Dimensions



Unit : mm [inches]

SIZE	L	W	T (max)	B (min)	BW (min)
0805	2.00±0.20 [.079±.012]	1.25±0.20 [.049±.012]	1.45 [.057]	0.70 [.028]	0.20 [.008]
1206	3.20±0.30 [.126±.012]	1.60±0.20 [.063±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.30 [.126±.012]	2.50±0.20 [.098±.012]	2.60 [.102]	1.60 [.059]	0.30 [.012]
1808	4.60±0.30 [.181±.012]	2.00±0.20 [.079±.008]	2.20 [.087]	2.50 [.098]	0.30 [.012]
1812	4.60±0.30 [.181±.012]	3.20±0.30 [.126±.012]	3.00 [.118]	2.50 [.098]	0.30 [.012]
1825	4.60±0.30 [.181±.012]	6.35±0.40 [.250±.016]	3.00 [.118]	2.50 [.098]	0.30 [.012]
2220	5.70±0.40 [.220±.016]	5.00±0.40 [.197±.016]	3.40 [.118]	3.50 [.137]	0.30 [.012]
2225	5.70±0.40 [.220±.016]	6.35±0.40 [.250±.016]	3.40 [.118]	3.50 [.137]	0.30 [.012]

◆ Capacitance Range – NP0 / 1KVdc to 2KVdc

Temperature Characteristic	Size	Rated Voltage	Capacitance Range (2R0 3R3 3R9 5R0 8R2 100 120 150 180 220 270 330 390 470 560 680 820 101 121 151 181 221 271 331 391 471 561 681 821 102 122 152 182 222 272 332 392 472 562 682 822 103 123 153 183 223 273 333 393 473 563 683 104)
NP0	0805	1KV	B B B B B B B B B C C C C C C C C C C C C C C C C C D D
	1206	1KV	C C C B B B B B B B B B B B B B B B B B B C D D D D E E B B C D D D
		2KV	D D D D D D D D D D D D D D D D D D D D D D D D D D E E
	1210	1KV	D D D D D D D D D D D D D D D D D D D D D D D D D D D E E E E F G D D E E F F G G G
		2KV	D D D D D D D D D
	1808	1KV	D D D D D D D D D D D D D D D D D D D D D D D D D D D D D D D E E
		2KV	D D D D D D D D D D D D D D D D D D D D D D D D D D D E E F F F
	1812	1KV	D D D D D D D D D D D D D D D D D D D D D D D D D D D D E E F F F F F F F F G G G G G G G
		2KV	D D D D D D D D D D D D D D D D D D D D D D D D E E E F F F F F
	2220	1KV	D D D D D D D D D D D D D D D D D E E F G G G I I
		2KV	D D D D D D D D D D D E E E F F G
	2225	1KV	F F F
		2KV	D D D D D D D D D D D E E E G G G H I

◆ Capacitance Range – NP0 / 3KVdc to 5KVdc

Temperature Characteristic	Size	Rated Voltage	Capacitance Range (2R0 3R3 3R9 5R0 8R0 8R2 100 120 150 180 220 270 330 390 470 560 680 820 101 121 151 181 221 271 331 391 471 561 681 821 102 122 152 182 222)
NP0	1206	3KV	D D D D D D D D D D D E E E E
	1808	3KV	D D D D D D D D D D D D D D D D D D D D D E E F F F F F F F F F F
		5KV	F F F F F F F F F F F F F F F
	1812	3KV	D D D D D D D D D D D D D D D D D D D D E E E E E E E E E E F F G H
		4KV	D D D D D D D D D D D D D E E E F G
	2208	3KV	F F F F F F F F F F F F F F F
	2211	3KV	F F F F F F F F F F F F F F F F F
	2220	3KV	D D D D D D D D D D D E E E E E E E E E E E E E E E E E F F F F F
		5KV	D D D D D D D D D D D E E E E E E E E E E
	2225	5KV	D

- ***The yellow indication denotes values that are under development. Please contact Holy Stone office for further details***
- ***Other dimensions, capacitance values and voltages ratings are available on request. Please contact Holy Stone.***

◆ Thickness Specification

Symbol Code	B	C	D	E	F	G	H	I
Thickness(mm)	0.85±0.15	1.0+0.1/-0.05	1.25±0.20	1.6±0.2	2.0±0.2	2.4±0.2	2.8±0.2	3.2±0.2

◆ Capacitance Range – X7R / 1KVdc

Temperature Characteristic	Size	Rated Voltage	Capacitance Range
X7R	0805	1KV	B B B B B B B B B B B B B B B
	1206	1KV	B B B B B B B B B B B B B B B B B B B B B C C D E E E
	1210	1KV	C C C D D D D D E F F G
	1808	1KV	D D D D D D D D D D D D D D D D D D D D
	1812	1KV	D D D D D D D D D D D D D D D D D D D D D D D D D E F F G G
	2220	1KV	D D D D D D D D D D D D D D D D D D D D D D D D D E E F F F
	1825	1KV	D D D D D D D D D D D D D D D D D D D E E E E G G
	2225	1KV	D D D D D D D D D D D D D D D D D D D D D D D D D

◆ Capacitance Range – X7R / 1.5KV to 2.5KV

Temperature Characteristic	Size	Rated Voltage	Capacitance Range
X7R	1206	1.5KV	B B B B B B B B B B B C C C C C C C C D
		2KV	B B B D D D D D D D B C D D D D D E E
		2.5KV	B B B B B B B B B B B C C C D D E E E
	1210	2KV	C C C C C C C C C C C C C D D E E E E E F F G
	1808	2KV	D D D D D D D D D D D D D D D D D D D D D D D E E
	1812	2KV	D D D D D D D D D D D D D D D D D D D D D D D E E E F F G H
	1825	2KV	D D D D D D D D D E E E E E F F G G
	2220	2KV	D D D D D D D D D D D D D D D D D D D D D E E E E F F G
	2225	2KV	D D D D D D D D D D D D D D D D D D D D D D E E E E

◆ Capacitance Range – X7R / 3KVdc to 5KVdc

Temperature Characteristic	Size	Rated Voltage	Capacitance Range
X7R	1206	3KV	B B B B B C C C D D D
	1808	3KV	D D D D D D D D D D D D D D D D D D E E E F F
		4KV	D D D D D E E E E F F F
	1812	3KV	D D D D D D D D D D D D D D D D D D E E E E F F
	1825	3KV	D D D D D D D D D D D D D D D D D D D E E E F G
	2220	3KV	D D D D D D D D D D D D D D D D D D D E E
	2220	4KV	D D D D E E E E F F G H
	2220	5KV	D D D D D D D D D D D D E E E F F F
	2225	3KV	D D D D D D D D D D E E E E
	2225	4KV	D D E E E

◆ Thickness Specification

Symbol Code	B	C	D	E	F	G	H	I
Thickness(mm)	0.85±0.15	1.0+0.1/-0.05	1.25±0.20	1.6±0.2	2.0±0.2	2.4±0.2	2.8±0.2	3.2±0.2

▪ Specifications & Test Conditions please see P47~P50

Multilayer Ceramic Capacitors

[Normal Chip Capacitors – less than 1uF]

NCC Series

Standard Multilayer Ceramic Capacitors are available in a full range of sizes and temperature coefficients, with voltage ratings from 6.3V to 50V.

◆ Features

- ❑ Surface mount suitable for wave and reflow soldering
- ❑ Small size and high reliability
- ❑ Excellent in high frequency characteristics
- ❑ RoHS compliant

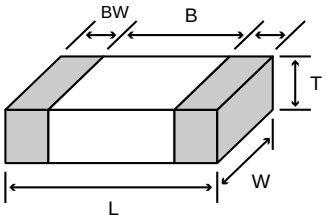
◆ Applications

- ❑ Suitable for general electronics circuit, telecomm2unication, personal computers and peripheral, power circuit, mobile application, etc.

◆ Summary of Specifications

Operation Temperature	NP0/X7R/X7S : -55 ℃ to +125 ℃ , X6R : -55 ℃ to +105 ℃, X5R : -55 ℃ to +85 ℃
Rated Voltage	6.3Vdc to 50Vdc
Temperature Coefficient	NP0 : ≤ ± 30ppm/ ℃ , -55 ℃ to +125 ℃ (EIA Class I)
	X7R : ≤ ± 15% , -55 ℃ to +125 ℃ (EIA Class Ⅱ)
	X7S : ≤ ± 22% , -55 ℃ to +125 ℃ (EIA Class Ⅱ)
	X6S : ≤ ± 22% , -55 ℃ to +105 ℃ (EIA Class Ⅱ)
	X5R : ≤ ± 15% , -55 ℃ to +85 ℃ (EIA Class Ⅱ)
Dissipation Factor	NP0 : More than 30pF : Q ≧1000 30pF & below : Q≧400+20C (C : Capacitance , pF)
	X7R/X7S/X6S/X5R : 10% max
Insulation Resistance	10,000mΩ or 500/CΩ, whichever is smaller for rated voltage>10V and greater than 100/CΩ for rated voltage≤10V.
Aging	NP0 : 0% , X7R/X7S/X6S/X5R: typically 1.0%
Dielectric Strength	250% Rated Voltage

◆ Dimension



Unit : mm [inches]

SIZE	L	W	T (max)	B (min)	BW (min)
0201	0.60±0.09 [.024±.003]	0.30±0.09 [.011 ±.003]	0.39 [.015]	0.20 [.008]	0.10 [.004]
0402	1.00±0.05 [.039±.002]	0.50±0.05 [.020 ±.002]	0.55 [.022]	0.30 [.012]	0.15 [.006]
0603	1.60±0.10 [.063±.004]	0.80±0.10 [.031 ±.004]	1.00 [.039]	0.40 [.016]	0.15 [.006]
0805	2.00±0.20 [.079±.012]	1.25±0.20 [.049 ±.008]	1.45 [.057]	0.70 [.028]	0.20 [.008]
1206	3.20±0.30 [.126±.012]	1.60±0.20 [.063±.008]	1.80 [.071]	1.50 [.059]	0.30 [.012]

◆ How To Order

C	0201	R	104	K	010	T	S	Y
Product Code C: MLCC (Multilayer Ceramic Capacitor)	**Chip Size** Ex.: 0201 0402 0603 0805 1206	**Dielectric** Ex.: N : NP0 X : X7R R : X7S S : X6S B : X5R	**Capacitance Unit : pF** Ex.: 102 : $10x10^2$ 103 : $10x10^3$	**Tolerance** Ex.: F : +/- 1% G : +/- 2% J : +/- 5% K : +/- 10% M : +/- 20%	**Rated Voltage** Ex.: 004 : 4Vdc 007 :6.3Vdc 010 :10Vdc 016 :16Vdc 025 :25Vdc 035 :35Vdc 050 :50Vdc	**Packaging** Ex.: T: T&R 7" R: T&R 13" B: Bulk	**Thickness (mm) (Optional)** Ex: E:1.6±0.20 F:2.0±0.20 S:0.3±0.03	**Suffix Code** Y

◆ Capacitance Range

Dielectric Characteristic	Size	Rated Voltage	Capacitance Range																																									
			0R5	1R0	1R5	2R0	3R0	4R0	5R0	6R0	7R0	8R0	9R0	100	120	150	180	220	270	330	390	470	560	680	820	101	121	151	181	221	271	331	391	471	561	681	821	102	222	332	472	562	682	103	102
NPO	0201	16V	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S																			
NPO	0201	25V	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S																			
NPO	0402	50V	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O								O
NPO	0603	50V							B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B								B
NPO	0805	50V												B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B								B

Dielectric Characteristic	Size	Rated Voltage	Capacitance Range																																								
			101	121	151	181	221	271	331	391	471	561	681	102	122	152	182	222	272	332	392	472	562	682	822	103	123	153	183	223	273	333	393	473	563	683	823	104	154	224	334	474	684	824
X7R	0201	6.3V																																				S						
X7R	0201	16V														S	S	S	S	S	S																							
X7R	0201	25V			S	S	S	S	S	S	S	S	S	S	S	S	S	S																										
X7R	0201	50V					S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S																		
X7R	0402	10V																																				O				T		
X7R	0402	16V																								O	O	O	O	O	O	O	O	O	O	O	O	O						
X7R	0402	25V																			O	O	O	O	O	O	O	O	O	O	O	O	O	O						O				
X7R	0402	50V	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O								O						
X7R	0603	10V																																				B	B	B	B	B	B	
X7R	0603	16V			B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	
X7R	0603	25V			B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		
X7R	0603	50V			B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B		B	B	B		
X7R	0805	16V									B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D	
X7R	0805	25V									B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D	
X7R	0805	35V									B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	D	D	D	D	
X7R	0805	50V									B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	D	D	
X7R	1206	16V																																				B	B	B	B	B	B	
X7R	1206	25V																																				B	B	B	C	D	D	
X7R	1206	50V																																				B	B	B	C	D	D	E

Dielectric Characteristic	Size	Rated Voltage	Capacitance Range												
			273	333	393	473	563	683	823	104	154	224	334	474	684
X7S	0201	6.3V								S		S2			
X7S	0201	10V								S					
X7S	0201	16V								S					

Dielectric Characteristic	Size	Rated Voltage	Capacitance Range												
			273	333	393	473	563	683	823	104	154	224	334	474	684
X6S	0201	6.3V								S		S2	S2		
X6S	0201	10V								S		S2	S2		
X6S	0201	16V								S					
X6S	0201	25V								S					

Dielectric Characteristic	Size	Rated Voltage	Capacitance Range												
			273	333	393	473	563	683	823	104	154	224	334	474	684
X5R	0201	6.3V								S		S	S2	S2	
X5R	0201	10V								S		S2	S2	S2	
X5R	0201	16V								S		S2	S2		
X5R	0201	25V								S		S2	S2		
X5R	0402	6.3V										O		O	
X5R	0402	10V								O		O		O	
X5R	0402	16V	O	O	O	O	O	O	O	O				O	
X5R	0402	25V	O	O	O	O	O	O	O	O				O	
X5R	0603	6.3V												B	B
X5R	0603	10V								B	B	B	B	B	B
X5R	0603	16V								B	B	B	B	B	B
X5R	0603	25V								B	B	B	B	B	

- ***The yellow indication denotes values that are under development. Please contact Holy Stone office for further details***
- ***Other dimensions, capacitance values and voltages ratings are available on request. Please contact Holy Stone.***

◆ Thickness Specification

- **Specifications & Test Conditions please see P51~P55**

Symbol Code	S	S2	O	T	A	B	C	D	E
Thickness(mm)	0.3±0.03	0.3±0.09	0.5±0.05	0.5±0.1	0.6±0.1	0.85±0.15	1.0+0.1/-0.05	1.25±0.20	1.6±0.2

Multilayer Ceramic Capacitors

[High Capacitance MLCCs – 1.0uF and above]

HCC Series

◆ Features

- ❑ Surface mount suitable for wave and reflow soldering
- ❑ High reliability
- ❑ Small size and high capacitance value
- ❑ Excellent high frequency characteristics
- ❑ RoHS compliant

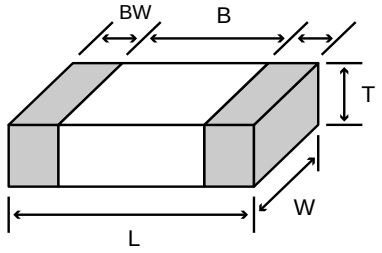
◆ Applications

- ❑ Ideal for smoothing and decoupling circuits
- ❑ Suitable for DC-DC converter, personal computer and peripherals, telecommunication and general electronic equipment

◆ Summary of Specifications

Operation Temperature	X7R / X7S : -55 ℃ to +125 ℃ , X6S : -55 ℃ to +105 ℃; X5R : -55 ℃ to +85 ℃
Rated Voltage	4.0Vdc to 50Vdc
Temperature Coefficient	X7R : ≤ ± 15% , -55 ℃ to +125 ℃ (EIA Class Ⅱ)
	X7S : ≤ ± 22% , -55 ℃ to +125 ℃ (EIA Class Ⅱ)
	X6S : ≤ ± 22% , -55 ℃ to +105 ℃ (EIA Class Ⅱ)
	X5R : ≤ ± 15% , -55 ℃ to +85 ℃ (EIA Class Ⅱ)
Dissipation Factor	X7R, X5R, X6S, X7S : 15% max
Insulation Resistance	10,000mΩ or 500/CΩ, whichever is smaller for rated voltage>10V and greater than 100/CΩ for rated voltage≤10V
Aging	X7S/X7R/X6S/X5R : typically 1.0%
Dielectric Strength	250% Rated Voltage

◆ Dimension



Unit : mm [inches]

SIZE	L	W	T (max)	B (min)	BW (min)
0201	0.60±0.09 [.024±.003]	0.30±0.09 [.011 ±.003]	0.55 [.022]	0.20 [.008]	0.10 [.004]
0402	1.00±0.05 [.039±.002]	0.50±0.05 [.020 ±.002]	0.95 [.037]	0.30 [.012]	0.15 [.006]
0603	1.60±0.10 [.063±.004]	0.80±0.10 [.031 ±.004]	1.00 [.039]	0.40 [.016]	0.15 [.006]
0805	2.00±0.20 [.079±.012]	1.25±0.20 [.049 ±.008]	1.45 [.057]	0.70 [.028]	0.20 [.008]
1206	3.20±0.30 [.126±.012]	1.60±0.20 [.126±.012]	1.90 [.074]	1.50 [.059]	0.30 [.012]
1210	3.20±0.30 [.126±.012]	2.50±0.20 [.098±.008]	2.80 [.110]	1.60 [.063]	0.30 [.012]

◆ How To Order

C	0402	B	105	K	025	T	O	Y

Product Code	Chip Size	Dielectric	Capacitance Unit : pF	Tolerance	Rated Voltage	Packaging	Thickness (mm) (Optional)	Suffix Code
C: MLCC (Multilayer Ceramic Capacitor)	Ex.: 0201 0402 0603 0805 1206 1210	Ex.: N : NP0 X : X7R R : X7S S : X6S B : X5R	Ex.: 105 : 10x10^5 225 : 22x10^5 475 : 47x10^5 106 : 10x10^6 226 : 22x10^6	Ex.: F : +/- 1% G : +/- 2% J : +/- 5%	Ex.: 004 : 4Vdc 007 :6.3Vdc 010 :10Vdc 016 :16Vdc 025 :25Vdc 035 :35Vdc 050 :50Vdc	Ex.: T: T&R 7" R: T&R 13" B: Bulk	Ex: E:1.6±0.20 F:2.0±0.20 O:0.5±0.05	Y

◆ Capacitance Range

X7R (X) Series

Size	0402		0603						0805						1206						1210				
Code	4V	6.3V	6.3V	10V	16V	25V	35V	50V	6.3V	10V	16V	25V	35V	50V	6.3V	10V	16V	25V	35V	50V	10V	16V	25V	35V	50V
105	O	O	B	B5	B5	B5	B5	B4	D	D	D	D	D	D	D	D	D/E	E5	D/E	E5	D	D	D	D	E
225			B5	B5					D	D	D	D	D	D	E	E5	E5	E5	E5	E5	F	F	F	F	F
475			B3	B3					D	D	D	D			E	E5	E5	E5	E5	E5	F	F	F	F	F
106									D	D	D				E5	E5	E5	E5	E5		F	F1	F1	F1/M	F1/M
226															E5	E5					M	M	M		
476																					G				

X7S (R) Series

Size	0402		0603			0805			1206	1210
Code	6.3V	10V	10V	16V	25V	16V	25V	50V	16V	6.3V
105		O1								
225	O2	O2		B	B					
475			B4	B3				D		
106						D	D			
226									E4	
476										
107										N

X6S (S) Series

Size	0201		0402					0603						0805							1206							1210					
Code	4V	6.3V	4V	6.3V	10V	16V	25V	4V	6.3V	10V	16V	25V	50V	2.5V	4V	6.3V	10V	16V	25V	35V	50V	4V	6.3V	10V	16V	25V	35V	50V	6.3V	10V	16V	25V	35V	50V
105	S	S2		O	O	O	O3		B	B	B	B	B					D	D	D	D					E	E						
225				O	O3	O2	O2		B	B	B	B					D	D	D	D	D				E	E5	E	E				F	F	F
475				O1					B5	B5	B4	B3				D	D	D	D	D	D			E	E	E	E	E			F	F	F	F
106			O2	O2				B3	B3	B3	B3					D	D	D	D	D			E	E	E5	E5	E5		F	F1	F	F1/M	F1/M	F/G
226			O4					B	B3						D	D	D	D					E5	E5	E	E				G	G			
476								B3						D	D							E	E5						G	G	G			
107																						E4	E4						N					
227																													G					

X5R (B) Series

Size	0201			0402					0603						0805							1206						1210					
Code	4V	6.3V	10V	6.3V	10V	16V	25V	35V	6.3V	10V	16V	25V	35V	50V	4V	6.3V	10V	16V	25V	35V	50V	6.3V	10V	16V	25V	35V	50V	6.3V	10V	16V	25V	35V	50V
105	S1	S1	S2	O	O	O	O	O3	B5	B5	B5	B5	B5	B5		D	D	D	D	D	D			E	E		E	F	F	F	F		F
225	S	S2		O	O	O2	O2	O	B5	B5	B5	B5	B5	B3		D	D	D	D	D	D		E	E	E5		E	F	F	F	F		F
475	S3	S3		O1	O1	O			B5	B5	B4	B4	B3			D	D	D	D	D	D	E5	E5	E5	E5		E	F	F	F	F		F
106				O2	O2				B5	B4	B4	B3	B			D	D	D	D	D	D	E5	E5	E5	E5	E5	E5	F	F1	F1	F1	F1/M	F1/M
226				O4	O4				B3	B3						D	D	D	D			E5	E5	E5	E5			M	M	M	M		
476									B3						D	D	D					E5	E5	E4				M	M	M	N		
107															D	D						E4						N	N	N			
227																												G					

▪ ***Other dimensions, capacitance values and voltages ratings are available on request. Please contact Holy Stone.***

◆ Thickness Dimensions

Symbol Code	S	S1	S2	S3	O	O1	O2	O3	O4
Thickness (mm)	0.3±0.03	0.3±0.05	0.3±0.09	0.5±0.05	0.5±0.05	0.5±0.15	0.5±0.20	0.5±0.10	0.8+0/-0.15

Symbol Code	B	B3	B4	B5	C	D	E	E4	E5
Thickness (mm)	0.85±0.15	0.8±0.20	0.8±0.15	0.8±0.1	1.0+0.1/-0.05	1.25±0.2	1.6±0.2	1.6±0.3	1.6±0.2

Symbol Code	F	F1	G	M	N
Thickness (mm)	2.0±0.2	2.0±0.2	2.4±0.2	2.5±0.2	2.5±0.3

Multilayer Ceramic Capacitors
6.3V ~ 100V High Capacitance(2.2uF and above)
HCD Series

Holy Stone high capacitance products are designed and manufactured to meet the general requirements of international standards. The HCD product offering is ideally suited for server power, USB PD charger, micro PV inverter, Power over Ethernet, and power tools applications where effective capacitance at working voltage is critical to circuit design.

◆ Features

- ❑ ±15% Temperature Coefficient from -55° C to +125° C
- ❑ Low Bias characteristics
- ❑ Small Size & Large Capacity Capacitor

◆ Applications

- ❑ Server Power (12V and 48V)
- ❑ USB 3.1 PD Chargers (20V, 28V, 36V and 48V)
- ❑ Micro PV Inverter
- ❑ Power Supplies
- ❑ General Telecommunications Equipment / PoE (48V)
- ❑ Power Tools (12V, 18V, 24V, 28V and 48V)

◆ Summary of Specifications

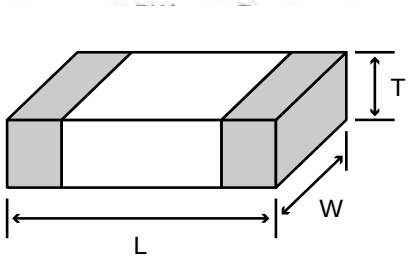
Operation Temperature	-55 ℃ to +125 ℃
Rated Voltage	6.3Vdc to 100Vdc
Temperature Coefficient	X7R : ±15% at -55 ℃ to +125 ℃
Capacitance Range	2.2uF~22uF ,other capacitance values available upon request
Dissipation Factor	2.5% max. at 1KHz 25 ℃
Insulation Resistance	V≤10V 100/CΩ ; V>10V 500/CΩ (C in Farads)
Dielectric Withstanding	150%-200% of the rated voltage from 1 to 5 seconds. (Rated voltage ≤ 100V)
Capacitance Tolerance	± 10% , ± 20%
Aging	typically 1%

◆ How To Order

HCD	1206	X	106	K	025	T	X	Y

Product Code	Chip Size	Dielectric	Capacitance Unit : pF	Tolerance	Rated Voltage	Packaging	Special Requirement	Suffix Code
HCD: Low Bias MLCC	Ex.: 1206 1210	Ex.: X : X7R	Ex.: 225 : 22x10⁵ 335 : 33x10⁵ 475 : 47x10⁵ 106 : 10x10⁶	Ex.: K :+/-10% M:+/-20%	Ex.: 016 : 16Vdc 025 : 25Vdc 035 : 35Vdc 050 : 50Vdc 101: 100Vdc	Ex.: T: T&R 7" R: T&R 13"	Ex.: X: Polymer Termination (Super Term)	Y

◆ Dimensions



Unit : mm

SIZE	L	W	T	Dimension Code
1206	3.20± 0.30	1.60± 0.20	1.60± 0.20	E2
1206	3.20± 0.40	1.60± 0.30	1.60± 0.30	E4
1210	3.20± 0.30	2.50± 0.20	2.00± 0.20	F
1210	3.20± 0.40	2.50± 0.30	2.50± 0.30	G2

◆ Capacitance Range (preferred values)

Temperature Characteristic	Size	Rated Voltage	Capacitance Range (pF)										
			104	224	334	474	684	105	225	335	475	106	226
X7R	1206	10V										E4	
		16V										E4	
		25V										E4	
		35V										E4	
		50V									E2		
		100V							E2	E2			
	1210	25V											G2
		50V										G2	
		100V									F		

Multilayer Ceramic Capacitors
16V ~ 100V High Capacitance
HCE Series

Holy Stone high capacitance products are designed and manufactured to meet the general requirements of international standards. The HCE product offering is ideally suited for LED driver, lighting, power adapter and USB PD charger applications where effective capacitance at working voltage is critical to circuit design.

◆ Features

- ❑ +/-15% Temperature Coefficient from -55° C to +125° C
- ❑ Excellent DC Bias characteristics
- ❑ Small Size & Large Capacity Capacitor

◆ Applications

- ❑ LED Drivers
- ❑ Power Adapters/USB PD Chargers
- ❑ Lighting
- ❑ Power Supplies
- ❑ General telecommunications equipment

◆ Summary of Specifications

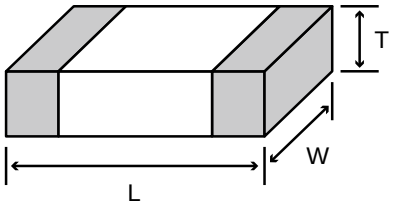
Operation Temperature	-55 ℃ to +125 ℃
Rated Voltage	16Vdc to 100Vdc
Temperature Coefficient	X7R : ±15% at -55 ℃ to +125 ℃
Capacitance Range	1.0uF~22uF ,other capacitance values available upon request
Dissipation Factor	5% when V=100V ; 10% when V=6.3V-50V (at 1KHz 25 ℃)
Insulation Resistance	V≤10V 100/CΩ ; V>10V 500/CΩ (C in Farads)
Dielectric Withstanding	200% of the rated voltage from 1 to 5 seconds. (Rated voltage ≤ 100V)
Capacitance Tolerance	± 10% , ± 20%
Aging	typically 1%

◆ How To Order

HCE	1206	X	475	K	050	T	X	Y

Product Code	Chip Size	Dielectric	Capacitance Unit : pF	Tolerance	Rated Voltage	Packaging	Special Requirement	Suffix Code
HCE: Excellent DC Bias MLCC	Ex.: 0603 0805 1206 1210	Ex.: X : X7R	Ex.: 105 : 10x10^5 106 : 10x10^6 226 : 22x10^6	Ex.: K :+/-10% M:+/-20%	Ex.: 016 : 16Vdc 025 : 25Vdc 035 : 35Vdc 050 : 50Vdc 101: 100Vdc	Ex.: T: T&R 7" R: T&R 13"	Ex.: X: Polymer Termination (Super Term)	Y

◆ Dimensions



Unit : mm

SIZE	L	W	T	Dimension Code
0603	1.60±0.15	0.80±0.15	0.85±0.15	B1
0805	2.00±0.20	1.25±0.20	1.25±0.20	D
0805	2.00+0.45/-0.02	1.25±0.25	1.25±0.25	D1
1206	3.20±0.30	1.60±0.20	1.60±0.20	E1
1210	3.20±0.30	2.50±0.20	2.00±0.20	F
1210	3.20±0.40	2.50±0.30	2.50±0.30	G2

◆ Capacitance Range (preferred values)

Temperature Characteristic	Size	Rated Voltage	Capacitance Range (pF)										
			104	224	334	474	684	105	225	335	475	106	226
X7R	0603	16V						B1					
		25V						B1					
		35V						B1					
	0805	16V									D1		
		25V									D1		
		35V									D1		
		50V						D	D				
		100V						D					
	1206	50V									E1		
		100V						E1	E1				
	1210	16V											G2
		25V											G2
		50V										G2	
		100V							F		F		

Multilayer Ceramic Capacitors
6.3V ~ 25V High Capacitance (0.1uF and above)
HCH Series

Holy Stone offer high capacitance product line ranging from compact (0.6x0.3mm) to large (3.2x1.6mm) for a variety of temperature characteristics, packages and rated voltages.

◆ Features
- ❑ Materials with general purpose dielectric for Ceramic Capacitors
- ❑ Small size & high capacitance values
- ❑ 125℃ max, special temperature characteristics

◆ Applications
- ❑ General and specialized applications
- ❑ 5G Base Station

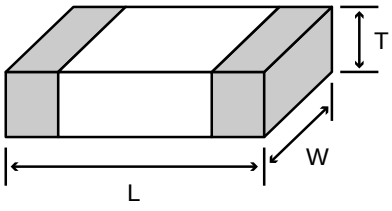
◆ Summary of Specifications

Operation Temperature	X7R : -55 ℃ to +125 ℃
Rated Voltage	6.3Vdc to 25Vdc
Temperature Coefficient	X7R : ±15% at -55 ℃ to +125 ℃ (Not EIA) Range of capacitance change rate is specified with 50% of rated voltage.
Dissipation Factor	10% max. at 1KHz 25℃
Insulation Resistance	V≤10V 100/CΩ ; V>10V 500/CΩ (C in Farads)
Dielectric Withstanding	250% of the rated voltage from 1 to 5 seconds. (Rated voltage ≤ 25V)
Capacitance Tolerance	± 10% , ± 20%
Aging	typically 1%

◆ How To Order

HCH	0201	X	104	K	016	T	X	Y
Product Code	**Chip Size**	**Dielectric**	**Capacitance Unit : pF**	**Tolerance**	**Rated Voltage**	**Packaging**	**Special Requirement**	**Suffix Code**
HCH: High Capacitance MLCC	Ex.: 0201 0402 0603 0805 1206	Ex.: X : X7R	Ex.: 104 : 10x10^4 105 : 10x10^5 106 : 10x10^6 226 : 22x10^6	Ex.: K :+/-10% M:+/-20%	Ex.: 007 : 6.3Vdc 010 : 10Vdc 016 : 16Vdc 025 : 25Vdc	Ex.: T: T&R 7" R: T&R 13"	Ex.: X: Polymer Termination (Super Term)	Y

◆ Dimensions



Unit : mm

SIZE	L	W	T	Dimension Code
0201	0.60± 0.05	0.60± 0.05	0.30± 0.05	S1
0201	0.60± 0.09	0.60± 0.09	0.30± 0.09	S2
0402	1.00± 0.20	0.50± 0.20	0.50± 0.20	W
0603	1.60± 0.15	0.80± 0.15	0.85± 0.15	B1
0805	2.00± 0.20	1.25± 0.20	1.25± 0.20	D
0805	2.00+0.45/-0.20	1.25± 0.25	1.25± 0.25	D1
1206	3.20± 0.30	1.60± 0.20	1.60± 0.20	E1
1206	3.20± 0.40	1.60± 0.30	1.60± 0.30	E4

◆ Capacitance Range (preferred values)

Temperature Characteristic	Size	Rated Voltage	Capacitance Range (pF)										
			104	224	334	474	684	105	225	335	475	106	226
X7R ※	0201	6.3V	S1										
		10V	S2										
		16V											
	0402	6.3V						W					
		10V						W					
		16V											
	0603	10V			B1	B1					C		
		16V											
		25V		B1				B1	B1				
	0805	6.3V										D	
		10V										D	
		16V									D1		
		25V									D1		
	1206	6.3V											E4
		10V										E1	
		16V										E1	
		25V										E1	

※(Range of capacitance change rate is specified with 50% of rated voltage)

Multilayer Ceramic Chip Capacitors

[High Capacitance NP0]

HCN Series

Replacement for Film Capacitor

◆ Features

- ❑ Small size & high Capacitance
- ❑ Suitable for wave and reflow soldering
- ❑ Excellent characteristics and tight tolerances
- ❑ Excellent Bias, high temperature stability & low Tan δ
- ❑ Replace Film Capacitors
- ❑ RoHS compliant

◆ Applications

- ❑ Suitable for ADSL filter circuits, cable Modem and coupling circuits, general Telecommunication use, power (Inverter for oscillation circuit), wireless charger and audio circuit

◆ Summary of Specifications

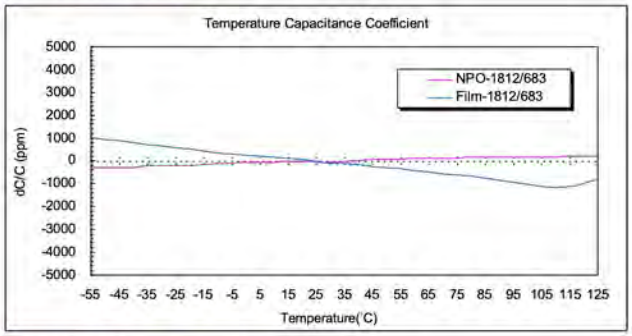
Operation Temperature	-55 ℃ to +125 ℃
Rated Voltage	16Vdc to 50Vdc
Temperature Coefficient	NP0 : ≤ ±30ppm/ ℃ , -55 ℃ to +125 ℃ (EIA Class I)
Capacitance Range	1nF ~ 220nF
Dissipation Factor	Q ≥1000 at 1KHz 20 ℃
Insulation Resistance	10GΩ or 500/C Ω, whichever is smaller (C in Farad)
Dielectric Strength	250% Rated Voltage for 1~ 5 seconds @ 50mA max. current
Aging	0% per decade hr.

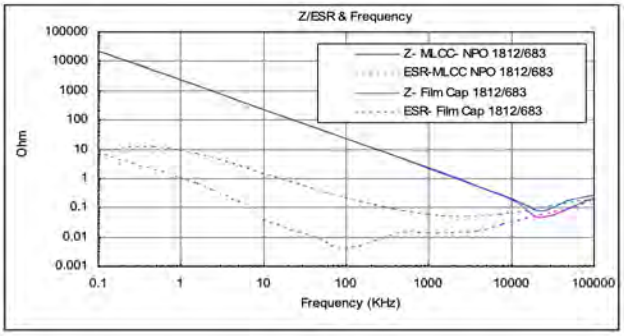
◆ How To Order

C	1206	N	103	J	025	T	C	Y

Product Code	Chip Size	Dielectric	Capacitance Unit : pF	Tolerance	Rated Voltage	Packaging	Thickness (mm) (Optional)	Suffix Code
C: MLCC (Multilayer Ceramic Capacitor)	Ex.: 0603 0805 1206 1210 1812	Ex.: N: NP0	Ex.: 102 : 10×10^2 103 : 10×10^3 124 : 12×10^4	Ex.: F : +/- 1% G : +/- 2% J : +/- 5%	Ex.: 016:16Vdc 025:25Vdc 050:50Vdc	Ex.: T: T&R 7" R: T&R 13" B: Bulk	Ex: C:1.0+0.1/ -0.05 E:1.6±0.20 F:2.0±0.20	Y

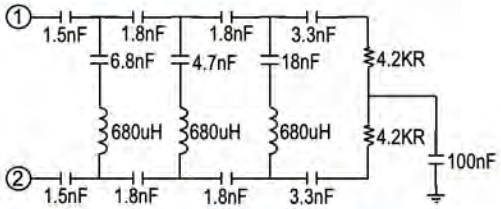
◆ Characteristics



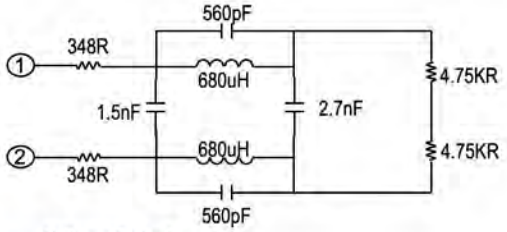


◆ Application Example Circuits

Rx Filter

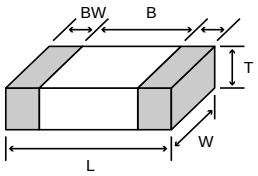


Tx Filter



◆ Dimensions

Unit : mm [inches]



SIZE	L	W	T (max)	B (min)	BW (min)
0402	1.00±0.1 [.039±0.02]	0.5±0.05 [.020±0.02]	0.55 [.022]	0.30 [.012]	0.15 [.006]
0603	1.60±0.10 [.063±.004]	0.80±0.10 [.031 ±.004]	1.00 [.039]	0.40 [.016]	0.15 [.006]
0805	2.00±0.20 [.079±.012]	1.25±0.20 [.049±.012]	1.45 [.057]	0.70 [.028]	0.20 [.008]
1206	3.20±0.30 [.126±.012]	1.60±0.20 [.063±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.30 [.126±.012]	2.50±0.20 [.098±.012]	2.60 [.102]	1.60 [.059]	0.30 [.012]
1812	4.60±0.30 [.181±.012]	3.20±0.30 [.126±.012]	3.00 [.118]	2.50 [.098]	0.30 [.012]
1825	4.60±0.30 [.181±.012]	6.35±0.40 [.250±.016]	3.00 [.118]	2.50 [.098]	0.30 [.012]
2220	5.70±0.40 [.220±.016]	5.00±0.40 [.197±.016]	3.00 [.118]	3.50 [.137]	0.30 [.012]
2225	5.70±0.40 [.220±.016]	6.35±0.40 [.250±.016]	3.00 [.118]	3.50 [.137]	0.30 [.012]

◆ Capacitance Range

Dielectric Characteristic	Size	Voltage	Capacitance Range 102	122	152	182	222	272	332	392	472	562	682	822	103	123	153	183	223	273	333	393	473	563	683	823	104	124	154	224
NPO	0402	50V	O																											
	0603	16V	B	B	B	B	B	B	B	B	B																			
		25V	B	B	B	B	B	B	B	B	B																			
		50V	B	B	B	B	B	B	B	B	B																			
	0805	16V	B	B	B	B	C	D	D	D	D	D	D	D	D	D	D	D	D											
		25V	B	B	B	B	C	D	D	D	D	D	D	D	D	D	D	D	D											
		50V	B	B	B	B	C	D	D	D	D	D	D	D	D	D	D	D	D											
	1206	16V	B	B	B	B	B	B	B	B	B	B	B	B	C	D	D	D	D	E	E	E	E							
		25V	B	B	B	B	B	B	B	B	B	B	B	B	C	D	D	D	D	E	E	E	E							
		50V	B	B	B	B	B	B	B	B	B	B	B	B	C	D	D	D	D	E	E	E	E							
	1210	16V	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	D	D	D	E	E	F	F	F	F			
		25V	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	D	D	D	E	E	F	F	F	F			
		50V	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	D	D	D	E	E	F	F	F	F			
	1812	16V	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E	F	F	F
		25V	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E	F	F	F
		50V	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E	F	F	F
	2220	16V	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D		
		25V	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D		
		50V	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D		
	1825	16V	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E	E	E	E	E	E	E	E			
		25V	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E	E	E	E	E	E	E	E			
		50V	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E	E	E	E	E	E	E	E			
	2225	16V	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D		
		25V	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D		
		50V	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D		

■ ***Other dimensions, capacitance values and voltages ratings are available on request. Please contact Holy Stone.***

Symbol Code	O	A	B	C	D	E	F	G	H	I
Thickness(mm)	0.5±0.05	0.6±0.1	0.85±0.15	1.0+0.1/-0.05	1.25±0.20	1.6±0.2	2.0±0.2	2.4±0.2	2.8±0.2	3.2±0.2

Multilayer Ceramic Capacitors

[X2 and X1/Y2 Safety Certified Capacitors]

SCC Series Rated up to 305Vac

The SCC series X2 and X1/Y2 rated at 250Vrms and X2 rated at 305Vrms safety capacitors are designed specifically for use in modem, facsimile, telephone and other electronic equipment. These parts are compliant to IEC60384-14 , UL60950-1 and UL60384-14 standards. These capacitors are available in NP0 (C0G) and X7R dielectrics.

◆ Features

- ❑ Small size & high capacitance
- ❑ Suitable for reflow soldering
- ❑ Surface mount
- ❑ Safety standard approval by IEC60384-14 , UL 60950-1 and UL60384-14
- ❑ RoHS compliant and Lead(Pb) free option
- ❑ Certified to:
  TUV R50005234, R50103496 & UL E229738
  TUV R50162550 & UL E300818
  & UL E229738 for Lead(Pb) free

◆ Applications

- ❑ The X2 and X1/Y2 (250Vrms) and X2- (305Vrms) are specially designed for use in Modem, Facsimile, Telephone and other telecommunication equipment, electronic equipment for lighting and surge protection, EMI filtering and Isolation.

◆ Safety Details of Specifications

IEC 60384-14:2013+AMD1:2016 EN 60384-14:2013+AMD1:2016	Meets the electrical requirements and certification for equipment requiring Class X1/Y2 and X2 devices.
UL 60384-14 : 2014, 2nd Edition	Component certified for equipment requiring UL-60384-14 compliance
UL 60950-1 : 2007, 2nd Edition	TNV/SELV isolation capacitors certified To UL 60950-1

◆ How To Order

SCC	1808	X	102	K	502	T	S

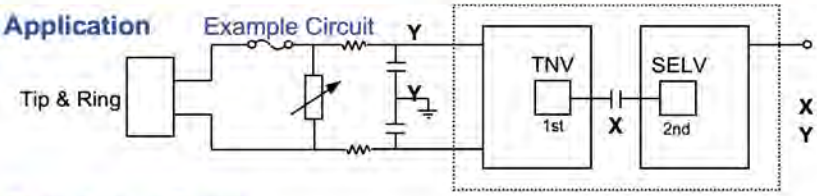
Product Code	Chip Size	Dielectric	Capacitance Unit : pF	Tolerance	Class	Packaging	Special Requirement
SCC: Safety Certified MLCC	Ex.: 1808 1812 2208 2211 2220 2825	Ex.: N: NP0 X: X7R	Ex.: 2R0:2.0pF 100:10x10^0 471:47x10^1 182:18x10^2	Ex.: J :+/-5% K :+/-10% M :+/-20%	Ex.: 202: X2 252 :X2 (305Vrms) 502: X1/Y2 602: X1/Y2 for SCC2208N, SCC2211N, SCC2220N	Ex.: T: T&R 7" R: T&R 13" B: Bulk	Ex.: S: Arc Prevention Coating X: Polymer Termination (Super Term) Z: Arc Prevention Coating & Polymer Termination (Super Term) G: Lead (Pb) Free

◆ Summary of Specifications

Rated Voltage	AC 250Vrms and AC 305Vrms
Temperature Coefficient	NP0 : < ±30ppm/ ℃ , -55 ℃ to +125 ℃ (EIA Class I)
	X7R : < ±15% , -55 ℃ to +125 ℃ (EIA Class II)
Capacitance Range	X1/Y2 : 2.0pF ~ 4700pF
	X2 – 250Vrms : 2pF ~ 56nF X2 – 305Vrms : 150pF ~ 33nF
Quality and Dissipation Factor	NP0 : Q≧1000 , X7R : D.F.≦2.5%
Climatic Category	55/125/21
Insulation Resistance	10GΩ
Voltage Proof	X Capacitor : Applied Voltage 1075Vdc(4.3Ur),1312Vdc(4.3Ur) Y Capacitor : Applied Voltage 1500Vac
Impulse	X2 : 2.5KV , Y2 : 5KV for three times
Aging	NP0: 0 % , X7R: 1.0 % per decade hr., typically

◆ Application

Example Circuit



X : Across the line (Ex.: SCC1808N151K202TG)
Y : Line by pass (Ex.: SCC2211X102K502TS)

◆ Capacitance Range

250Vrms

Class	Size	Temperature Characteristic	Rated Voltage	Certificate	Capacitance Range
X2	1808	NP0	250Vrms	TUV/UL	
	1808	X7R	250Vrms	TUV/UL	
	1812	X7R	250Vrms	TUV/UL	
X1/Y2	1808	NP0	250Vrms	TUV/UL	
	1808	X7R	250Vrms	TUV/UL	
	1812	NP0	250Vrms	TUV/UL	
	1812	X7R	250Vrms	TUV/UL	
	2208	NP0	250Vrms	TUV/UL	
	2208	X7R	250Vrms	TUV/UL	
	2211	NP0	250Vrms	TUV/UL	
	2211	X7R	250Vrms	TUV/UL	
	2220	NP0	250Vrms	TUV/UL	
	2220	X7R	250Vrms	TUV/UL	

Capacitance Range: 2R0, 5R0, 6R8, 8R2, 100, 120, 150, 180, 220, 270, 330, 360, 390, 470, 560, 680, 820, 101, 121, 131, 151, 181, 221, 271, 331, 391, 471, 561, 681, 821, 102, 122, 152, 182, 222, 272, 332, 472

Class	Size	Temperature Characteristic	Rated Voltage	Certificated	Capacitance Range
X2	2220	X7R	250Vrms	TUV/UL	
	2825	X7R	250Vrms	UL	

Capacitance Range: 101, 121, 131, 151, 181, 221, 271, 331, 391, 471, 561, 681, 821, 102, 122, 152, 182, 222, 272, 332, 472, 562, 682, 822, 103, 123, 153, 183, 223, 273, 333, 393, 473, 563, 683, 823, 104, 124

'X' denotes values that have been tested to a rated voltage of 305Vac. TUV test report number 28208004 dated on May 27th, 2010.

305Vrms

Class	Size	Temperature Characteristic	Rated Voltage	Certificated	Capacitance Range
X2	2220	X7R	305Vrms	TUV/UL	

Capacitance Range: 180, 220, 270, 330, 360, 390, 470, 560, 680, 820, 101, 121, 131, 151, 181, 221, 271, 331, 391, 471, 561, 681, 821, 102, 122, 152, 182, 222, 272, 332, 472, 562, 682, 822, 103, 153, 223, 333, 473, 563

Multilayer Ceramic Capacitors

[Low-Loss, High Frequency Capacitors]

HBC Series

◆ Features

- ❑ Low stable ESR at high frequency
- ❑ Ultra stable NP0 performance
- ❑ Suitable for solder wave and reflow soldering
- ❑ RoHS compliant
- ❑ High peak to peak voltage capability

◆ Applications

- ❑ High frequency pulse circuits
- ❑ Lighting ballast snubber circuits
- ❑ DC-DC converters
- ❑ High dv/dt rating

◆ Summary of Specifications

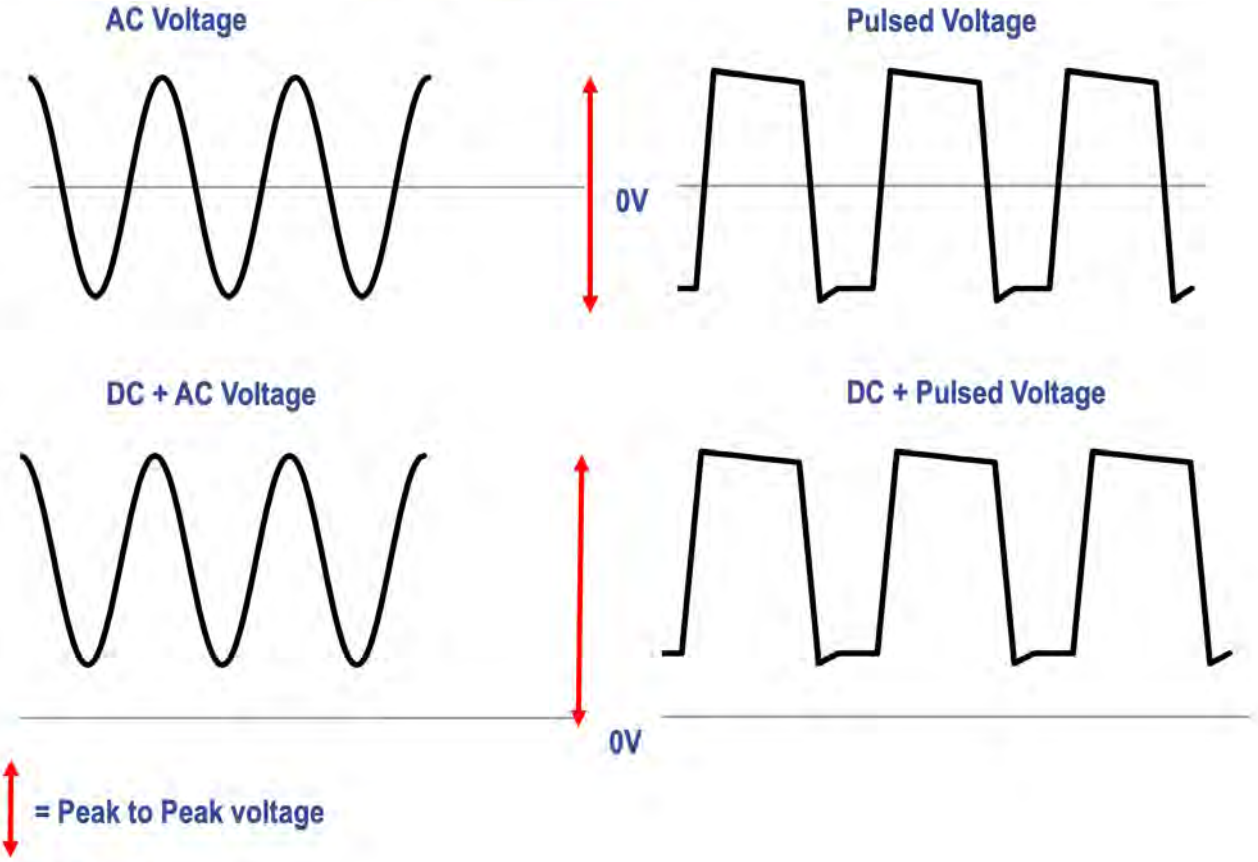
Operation Temperature	-55 ℃ to +125 ℃
Rated Voltage	500Vdc, 630Vdc and 1000Vdc
Temperature Coefficient	≤ ± 30ppm at -55 ℃ to +125 ℃
Capacitance Range	10pF ~ 2700pF
Dissipation Factor	0.1% max. at 1MHz 25 ℃
Insulation Resistance	10GΩ
Dielectric Withstanding	1.5 x WVDC for 5 sec
Capacitance Tolerance	±1%, ±2%, ±5%, ±10%
Ageing	None
Piezo Effects	None
dv/dt Rating	>8KV/μ second

◆ How To Order

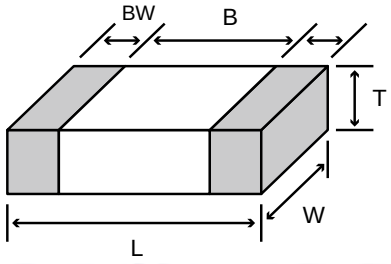
HBC	1206	N	102	J	631	T	E	Y
Product Code HBC: Low-Loss High Frequency Capacitor	**Chip Size** Ex.: 1206 1210	**Dielectric** Ex.: N: NP0	**Capacitance Unit : pF** Ex.: 100 : 10×10^0 101 : 10×10^1 102 : 10×10^2	**Tolerance** Ex.: F : ± 1% G : ± 2% J : ± 5% K : ± 10%	**Rated Voltage** Ex.: 501 : 500Vdc 631 : 630Vdc 102 : 1000Vdc	**Packaging** Ex.: T: T&R 7" R: T&R 13" B: Bulk	**Thickness (mm) (Optional)** Ex: E:1.60±0.20 F:2.0±0.20	**Suffix Code** Y

◆ Characteristics Peak to Peak Voltage

The maximum Peak to Peak voltage, as defined below, should not exceed the DC voltage rating of the capacitor



◆ Dimension



Unit : mm [inch]

SIZE	L	W	T (max)	B (min)	BW (min)
1206	3.20±0.30 [.126±.012]	1.60 ± 0.2 [.063±.008]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.30 [.126±.012]	2.50 ± 0.2 [.098±.008]	2.60 [.102]	1.60 [.063]	0.30 [.012]

◆ Capacitance Range

Size	Voltage	Capacitance Range: 100 120 150 180 220 270 330 390 470 560 680 820 101 121 151 181 221 271 331 391 471 561 681 821 102 122 152 182 222 272
1206	500V	■ □ □ □
1206	630V	■ □ □ □
1206	1000V	■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ □ □ □ □ □ □ □ □ □ □ □ □
1210	500V	■ ■
1210	630V	■ ■
1210	1000V	■ ■

■ ***Other dimensions, capacitance values and voltages rating are available. Please contact Holy Stone.***

IHHEC

Multilayer Ceramic Capacitors

[Automotive Grade MLCCs]

ACC Series

◆ Features

- ❑ AEC-Q200 & IATF16949 qualified.
- ❑ Suitable for harsh Automotive environments without additional qualification testing
- ❑ Available with Polymer Termination (Super Term) to prevent mechanical cracking
- ❑ High Reliability
- ❑ RoHS compliant
- ❑ 250Vac, X1/Y2 Safety capacitors available

◆ Applications

- ❑ Power supplies
- ❑ Lighting
- ❑ Isolation
- ❑ Powertrain
- ❑ Safety equipment
- ❑ Custom applications , BMS ,On board charger

◆ Summary of Specifications

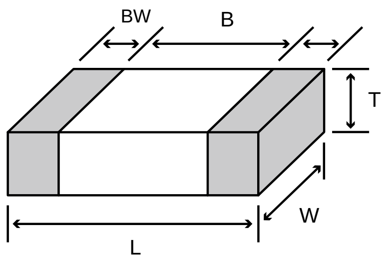
Operation Temperature	-55 ℃ to +125 ℃	
Rated Voltage	16Vdc ~ 1000Vdc , 250Vac X1/Y2 Safety capacitors	
Temperature Coefficient	NP0 : ≤ ± 30ppm/ ℃	-55 ℃ to +125 ℃ (EIA Class Ⅰ)
	X7R : ± 15%	-55 ℃ to +125 ℃ (EIA Class Ⅱ)
Capacitance Range	NP0 : 10pF ~ 47nF ; X7R : 330pF ~ 4.7uF	
Dissipation Factor	NP0 : More than 30pF Q≧1000 ; 30pF & below Q≧400+20C X7R : Range 2.5% to 10%	
Insulation Resistance	10GΩ or 500/C Ω, whichever is smaller (C in Farad)	
Aging	NP0 : 0% ; X7R : 2.5% per decade of time	
Dielectric Withstanding	V ＜100V	250% rated voltage
	100V ≤ V ＜ 500V	200% rated voltage
	500V ≤ V ＜ 1000V	150% rated voltage
	1000V ≤ V	120% rated voltage

◆ How To Order

ACC	2220	N	333	K	102	T	I	X	Y
Product Code ACC : Automotive Grade Capacitors	**Chip Size** EX : 0805 1206 1210 1812 1825 2222	**Dielectric** EX : N : NP0 X : X7R	**Capacitance Unit : pF** EX : 100 : 10 x 10^0 221 : 22 x 10^1 332 : 33 x 10^2 473 : 47 x 10^3 684 : 68 x 10^4	**Tolerance** Ex: J: +/- 5% K: +/-10% M: +/-20%	**Rated Voltage** EX : 025 : 25Vdc 050 : 50Vdc 101 : 100Vdc 251 : 250Vdc 501 : 500Vdc 102 : 1000Vdc 202 : 2000Vdc	**Packaging** EX : T : T&R 7" R : T&R 13" B : Bulk	**Thickness (mm) (Optional)** Ex: D: 1.25±0.20 E: 1.60±0.20 I : 3.2±0.20	**Special Requirement** EX: X: Polymer Termination (Super Term) O: Arc Prevention Coating Z: Coating & Polymer Termination	**Suffix Code** Y

◆ Dimensions

Unit : mm



SIZE	L	W	T (max)	B (min)	BW (min)
0402	1.00±0.05	0.5±0.05	0.55	0.30	0.15
0805	2.00 +0.45/-0.20	1.25 +0.25/-0.20	1.25±0.25	0.70	0.20
1206	3.20.±0.30	1.60±0.20	1.6±0.30	1.50	0.30
1210	3.20±0.30	2.50±0.20	2.60	1.60	0.30
1812	4.60±0.30	3.20±0.30	3.00	2.50	0.30
1825	4.60±0.30	6.35±0.40	3.00	2.50	0.30
2220	5.70±0.40	5.00±0.40	3.00	3.50	0.30

◆ Capacitance Range: X7R 16V~3000V

Size	Voltage (v)	Capacitance Range (pF) - ACC Series - X7R																																																		
		151	221	331	391	471	561	681	821	102	122	152	182	222	272	332	392	472	562	682	822	103	123	153	183	223	273	333	393	473	563	683	823	104	124	154	184	224	274	334	394	474	564	684	824	105	155	225	335	475	685	106
0402	50V																																	O																		
0805	16V			B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	C	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D				
	25V			B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	C	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D				
	50V			B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	C	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D	D						
	100V			B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	C	C	C	C	C	C	C	D	D	D	D	D	D	D	D	D	D	D	D						
	250V			B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D																									
1206	25V			B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	C	D	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E		
	50V			B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	C	D	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E				
	100V			B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	C	D	D	E	E	E	E	E	E	E	E	E	E	E	E	E						
	250V			B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	C	D	D	E																		
	630V									C	C	C	C	C	C	C	C	C	C	C	D	D																														
	1KV									D	D	D	D	D	E	E	E	E																																		
1210	25V																																													F	F	F	F	F	F	G
	50V																																													F	F	F	F	F		
	1KV									C	C	C	C	C	D	D	D	D	D	D	E	E																														
	2KV		C	C	C	C	C	C	C	D	D	E	E	E																																						
1812	1KV			D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E	E	E																														
	2KV		D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E	E	F	F	F																													
2220	2KV									F	F	F	F	F	F	F	F	F	F	F	F	F	G	G	G	G																										
2220	3KV	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E	E	E	F	F	F	F																														

Note : ■ Only Polymer Termination (Super Term) Available

■ Unavailable for Polymer Termination (Super Term)

■ Capacitors must be coated.

◆ Thickness Dimensions

Symbol Code	B	C	D	E	F	G	H	I
Thickness(mm)	0.85±0.15	1.0+0.1/-0.05	1.25±0.20	1.6±0.2	2.0±0.2	2.4±0.2	2.8±0.2	3.2±0.2

◆ Capacitance Range: NPO 25V~1000KV

Size	Voltage (v)	Capacitance Range (pF) - ACC Series-NP0																																																	
		100	120	150	180	200	220	270	300	330	390	470	560	680	820	101	121	151	181	221	271	331	391	471	561	681	821	102	122	152	182	222	272	332	392	472	562	682	822	103	123	153	183	223	333	393	473	563	683	823	104
0805	25	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	D	D	D	D														
	50	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	D	D	D	D														
	100	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	D	D	D	D														
	250	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	D	D																
1206	25				B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	D	D	D	E	E					
	50				B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	D	D	D	D	E	E					
	100				B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	C	D	D	E	E											
	250				B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	C	D	D	E	E											
	500				B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	C	C	D	D	E	E																							
	630				B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	C	C	D	D	E	E																							
	1000				B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	C	C	C	D	D	E	E																							
1210	1000																					D	D	D																											
1812	1000																											E	E	F	F	F	F	F	F	F	G	G													
1825	500																																							D	E	E	E	F	F	F	G				
2220	500																					D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E	F	F	G	G	I						
	630																					D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E	F	F	G	G	I						
	1000																					D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E	F	F	G	G	I						
	2000																						D	D	D	D	D	D	D	D	D	D	E	E	E	F	F	G													

Note : □ Available with Standard or Polymer Termination (Super Term)

■ Only Polymer Termination (Super Term) Available

◆ Thickness Dimensions

Symbol Code	B	C	D	E	F	G	H	I
Thickness(mm)	0.85±0.15	1.0+0.1/-0.05	1.25±0.20	1.6±0.2	2.0±0.2	2.4±0.2	2.8±0.2	3.2±0.2

- *Other dimensions, capacitance values and voltage ratings are available on request. Please contact Holy Stone.*
- *Specifications & Test Conditions for 0603 and larger sizes, please see P56~P60.*
- *Specifications & Test Conditions for 0402, please contact Holy Stone.*

Multilayer Ceramic Capacitors

[Automotive Grade - X1/Y2 and X2 Safety Certified Capacitors]
Rated Voltage 250Vac

◆ Features

- ❑ Suitable for harsh Automotive environments without additional qualification testing
- ❑ Available with Polymer Termination (Super Term) to prevent mechanical cracking
- ❑ High Reliability
- ❑ IATF16949 & AEC-Q200 qualified
- ❑ RoHS compliant
- ❑ 250Vac, X1/Y2 and X2 Safety Capacitors available

◆ Applications

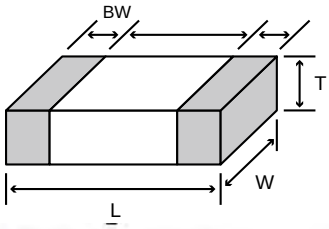
- ❑ CAN-Bus Isolation, On Board Charger
- ❑ Safety equipment
- ❑ Customized application

◆ Safety Details of Specifications

◆ How To Order :

SCC	2220	X	472	K	502	T	X	A
Product Code SCC: Safety Approved MLCC	**Chip Size** Ex.: 1808 2208 2220	**Dielectric** Ex.: X: X7R	**Capacitance Unit : pF** Ex.: 100 : 10 x 10^0 221 : 22 x 10^1 332 : 33 x 10^2	**Tolerance** Ex.: J :+/-5% K :+/-10% M :+/-20%	**Class** Ex.: 202: X2 502: X1/Y2	**Packaging** Ex.: T: T&R 7" R: T&R 13" B: Bulk	**Special Requirement** Ex.: X: Polymer Termination (Super Term)	**Suffix Code** EX: A : Automotive Grade

◆ Dimension



Unit : mm

SIZE	L	W	T (max)	BW (min)
1808	4.70±0.30	2.00±0.20	2.2	0.2
2208	5.80±0.50	2.00±0.20	2.2	0.3
2220	5.80±0.50	5.00±0.40	3	0.3

◆ Capacitance Range

Size	Voltage (v)	Capacitance Range (pF) - ACC Series - X7R 100 120 150 180 220 330 360 390 400 420 470 560 680 820 101 121 131 151 181 201 221 271 301 331 361 391 431 471 511 561 621 681 751 821 102 122 152 182 202 222 272 332 472 562 682 822 103 153 223
1808	X2	D D D D D D D D D D D
2208	X1/Y2	E E E E E E E F F F F F F F F F F F F F F
2220	X1/Y2	F F F F F F F F F F F F F F G H

Symbol Code	D	E	F	G	H	I
Thickness(mm)	1.25±0.20	1.6±0.2	2.0±0.2	2.4±0.2	2.8±0.2	3.2±0.2

■ *Other dimensions, capacitance values and voltage ratings are available on request. Please contact Holy Stone.*

Multilayer Ceramic Capacitors

[250V to 630V High Voltage & Low DC Bias]

HCP Series

Holy Stone high voltage products are designed and manufactured to meet the general requirements of international standards. The X7P product offering is ideally suited for LED driver, lighting, power adapter and USB charger applications where effective capacitance at working voltage is critical to circuit design.

◆ Features

- ❑ +/-10% Temperature Coefficient from -55° C to +125° C
- ❑ Low DC Bias characteristics
- ❑ Competitive price compared to X7T dielectric
- ❑ 1206, 1210, 1812, 2220 sizes. Other sizes and dielectric available upon request

◆ Applications

- ❑ LED Drivers
- ❑ Power Adapters/USB Chargers
- ❑ Lighting
- ❑ Power Supplies
- ❑ General telecommunications equipment

◆ Summary of Specifications

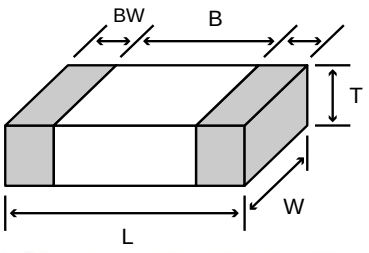
Operation Temperature	-55 ℃ ~ +125 ℃
Rated Voltage	250Vdc, 400Vdc , 450Vdc and 630Vdc
Temperature Coefficient	± 10% at -55 ℃ ~ +125 ℃
Capacitance Range	10nF ~0.68uF, other capacitance values available upon request
Dissipation Factor	0.8% max. at 1KHz 25 ℃
Insulation Resistance	10GΩ or 500/CΩ, whichever is smaller
Dielectric Withstanding	1.5 x WVDC for 5 sec
Capacitance Tolerance	5% , 10% , 20%

◆ How To Order

C	1206	P	104	K	401	T	E	X	Y
Product Code C: MLCC (Multilayer Ceramic Capacitor)	**Chip Size** Ex: 1206 1210 1812 2220	**Dielectric** Ex: P: X7P	**Capacitance Unit : pF** Ex: 103: 10 x 10^3 104: 10 x 10^4 224: 22 x 10^4	**Tolerance** Ex: J :+/- 5% K :+/-10% M:+/-20%	**Rated Voltage** Ex: 251: 250Vdc 401: 400Vdc 451: 450Vdc 631: 630Vdc	**Packaging** Ex: T: T&R 7" R: T&R 13" B: Bulk	**Thickness (mm) (Optional)** Ex: D: 1.25±0.20 E: 1.60±0.20	**Special Requirement** Ex: O: Arc Prevention Coating X: Polymer Termination (Super Term) Z: Arc coating and Polymer Termination	**Suffix Code** Y

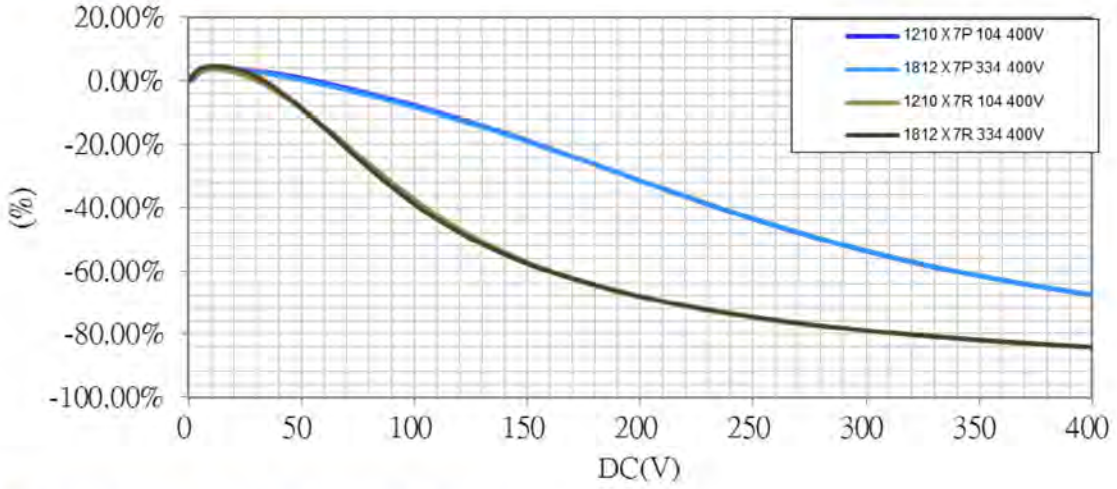
◆ Dimensions

Unit : mm [inches]



SIZE	L	W	T (max)	B (min)	BW (min)
1206	3.20±0.30 [.126±.012]	1.60±0.20 [.126±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.30 [.126±.012]	2.50±0.20 [.126±.012]	2.60 [.102]	1.60 [.059]	0.30 [.012]
1812	4.60±0.30 [.181±.012]	3.20±0.30 [.126±.012]	3.00 [.118]	2.50 [.098]	0.30 [.012]
2220	5.7±0.40 [.220±.016]	5.00±0.40 [.197±.016]	3.00 [.118]	3.50 [.137]	0.30 [.012]

◆ DC Bias Comparison

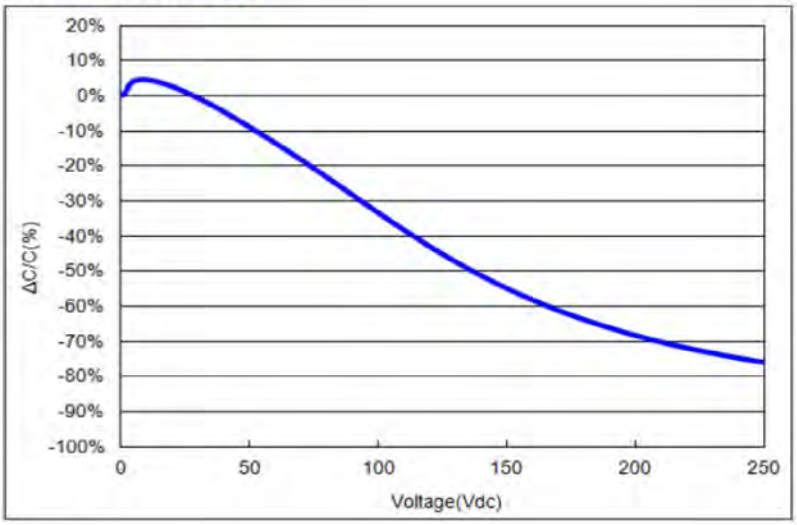


◆ Capacitance Range (preferred values)

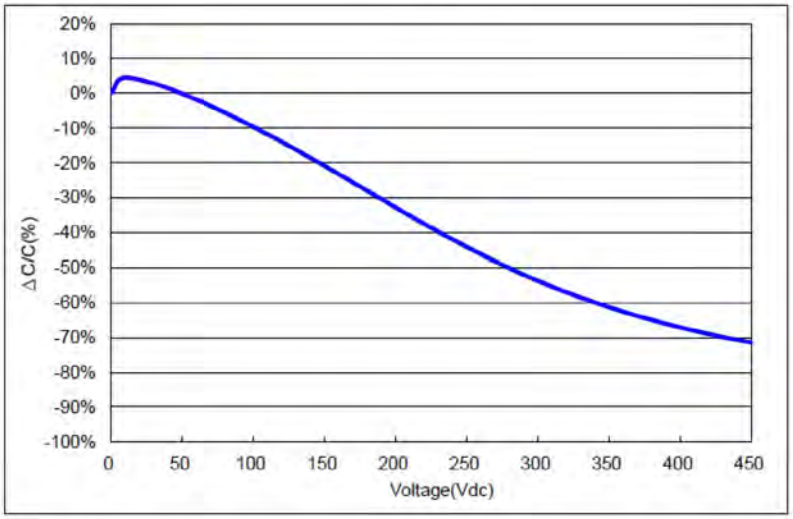
Temperature Characteristic	Voltage (V)	Size	Capacitance Range																		
			103	123	153	183	223	273	333	393	473	563	683	823	104	154	224	334	394	474	684
X7P	250V	1206	B		B		B		B	B	C		C		D		E				
		1210							C		C		C		C		F	F	F		
	400V	1206	B		B		C		D	D	E		E		E						
		1210							C		D		D		E	F		F			
		1812															F	F			
		2220																		F	F
	450V	1206											E		E						
		1210															F				
		1812															F	F		G	
	630V	1206	B		B		C		D	D	E		E								
		1210							C		D		D		E/F	F/G					

■ *Other dimensions, capacitance values and voltage ratings are available on request. Please contact Holy Stone.*

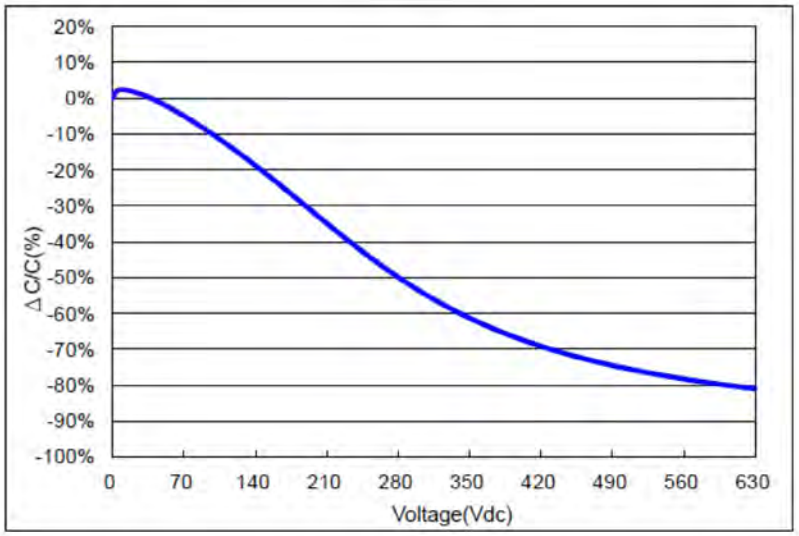
◆ DC Bias Characteristics



C1206P224K251T
DC Bias Characteristics
(typical)



C1206P473K451T
DC Bias Characteristics
(typical)



C1210P104K631T
DC Bias Characteristics
(typical)

Multilayer Ceramic Capacitors

[250V to 630V High Voltage & Low DC Bias]

HCT Series

Holy Stone high voltage products are designed and manufactured to meet the general requirements of international standards. The X7T product offering is ideally suited for LED driver, lighting, power adapter and USB charger applications where effective capacitance at working voltage is critical to circuit design.

◆ Features

- ❑ +22/-33% Temperature Coefficient from -55° C to +125° C
- ❑ Low DC Bias characteristics
- ❑ 1206, 1210, 1812, 2220 sizes. Other sizes and dielectric available upon request

◆ Applications

- ❑ LED Drivers
- ❑ Power Adapters/USB Chargers
- ❑ Lighting
- ❑ Power Supplies
- ❑ General telecommunications equipment

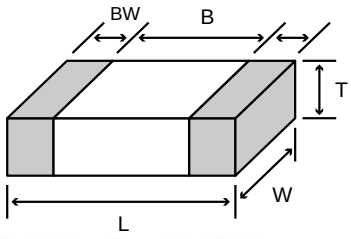
◆ Summary of Specifications

Operation Temperature	-55 ℃ ~ +125 ℃
Rated Voltage	250Vdc, 400Vdc, 450Vdc and 630Vdc
Temperature Coefficient	+22/-33% at -55 ℃ ~ +125 ℃
Capacitance Range	10nF ~ 0.68uF, other capacitance values available upon request
Dissipation Factor	2.5% max. at 1KHz 25 ℃
Insulation Resistance	10GΩ or 500/CΩ, whichever is smaller
Dielectric Withstanding	1.5 x WVDC for 5 sec.
Capacitance Tolerance	10% , 20%

◆ How To Order

C	1206	T	104	K	401	T	E	X	Y
Product Code C: MLCC (Multilayer Ceramic Capacitor)	**Chip Size** Ex: 1206 1210 1812 2220	**Dielectric** Ex: T: X7T	**Capacitance Unit : pF** Ex: 103: 10 x 10^3 104: 10 x 10^4 224: 22 x 10^4	**Tolerance** Ex: J :+/- 5% K :+/-10% M:+/-20%	**Rated Voltage** Ex: 251: 250Vdc 401: 400Vdc 451: 450Vdc 631: 630Vdc	**Packaging** Ex: T: T&R 7" R: T&R 13" B: Bulk	**Thickness (mm) (Optional)** Ex: D: 1.25±0.20 E: 1.60±0.20	**Special Requirement** Ex: O: Arc Prevention Coating X: Polymer Termination (Super Term) Z: Arc coating and Polymer Termination	**Suffix Code** Y

◆ Dimensions



Unit : mm [inches]

SIZE	L	W	T (max)	B (min)	BW (min)
1206	3.20±0.30 [.126±.012]	1.60±0.20 [.126±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.30 [.126±.012]	2.50±0.20 [.126±.012]	2.60 [.102]	1.60 [.059]	0.30 [.012]
1812	4.60±0.30 [.181±.012]	3.20±0.30 [.126±.012]	3.00 [.118]	2.50 [.098]	0.30 [.012]
2220	5.7±0.40 [.220±.016]	5.00±0.40 [.197±.016]	3.00 [.118]	3.50 [.137]	0.30 [.012]

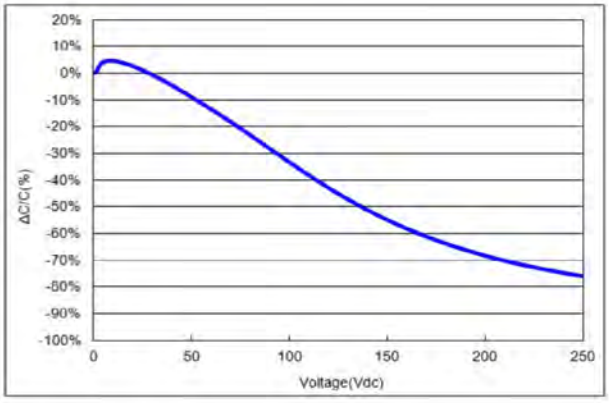
◆ Capacitance Range (preferred values)

Temperature Characteristic	Voltage (V)	Size	Capacitance Range																		
			103	123	153	183	223	273	333	393	473	563	683	823	104	154	224	334	394	474	684
X7T	250V	1206	B		B		B		B	B	C		C		D		E				
		1210							C		C		C		C		F	F	F		
	400V	1206	B		B		C		D	D	E		E		E						
		1210							C		D		D		E	F		F			
		1812															F	F			
		2220																		F	F
	450V	1206											E		E						
		1210															F				
		1812															F	F		G	
	630V	1206	B		B		C		D	D	E		E								
		1210							C		D		D		E/F	F/G					

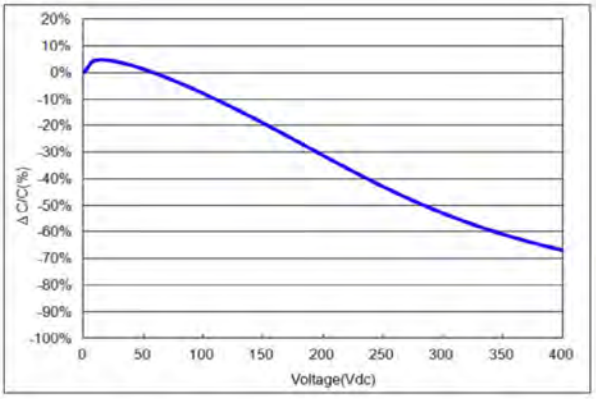
■ *Other dimensions, capacitance values and voltage ratings are available on request. Please contact Holy Stone.*

Symbol Code	O	A	B	C	D	E	F	G	H	I
Thickness(mm)	0.5±0.05	0.6±0.1	0.85±0.15	1.0+0.1/-0.05	1.25±0.20	1.6±0.2	2.0±0.2	2.4±0.2	2.8±0.2	3.2±0.2

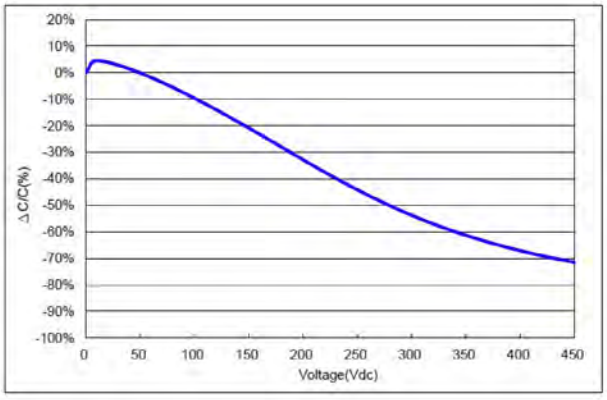
◆ DC Bias Characteristics



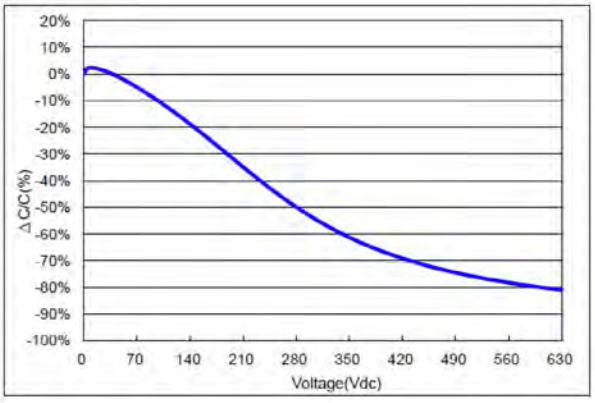
C1206T224K251T
DC Bias Characteristics
(typical)



C1206T104K401T
DC Bias Characteristics
(typical)



C1206T473K451T
DC Bias Characteristics
(typical)



C1210T104K631T
DC Bias Characteristics
(typical)

Multilayer Ceramic Capacitors

[Large Size Capacitors]

LCC Series

◆ Features

- ❑ Optimized internal designs offers the highest voltage rating (up to 8KVdc)
- ❑ Capacitance range from 100pF to 18uF and sizes from 2520 to 3640
- ❑ Available with proprietary surface coating for arc prevention
- ❑ Available with flexible termination (Super Term) to minimize the effects of mechanical stress
- ❑ RoHS compliant

◆ Applications

- ❑ Voltage Multipliers
- ❑ Power Supplies
- ❑ DC-DC Converters
- ❑ Surge protection
- ❑ Industrial control circuits
- ❑ Isolation
- ❑ Ballast
- ❑ Snubber
- ❑ Custom applications

◆ Summary of Specifications

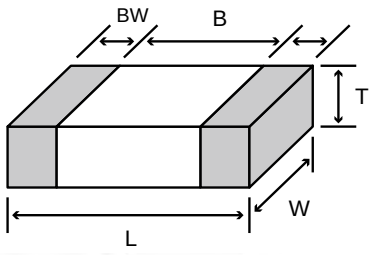
Operation Temperature	-55 ℃ ~ +125 ℃
Rated Voltage	50Vdc ~ 8KVdc
Temperature Coefficient	NP0 : ≤ ± 30ppm/ ℃ , -55 ~ +125 ℃ (EIA Class I)
	X7R : ≤ ± 15% , -55 ~ +125 ℃ (EIA Class Ⅱ)
Capacitance Range	NP0 : 68pF ~ 220nF , X7R : 1000pF ~ 18uF
Dissipation Factor	NP0 : Q≧1000 , X7R : 2.5% max.
Insulation Resistance	10GΩ or 500/CΩ, whichever is smaller (C in Farad)
Aging	NP0 : 0% , X7R : 2.5 % per decade of time
Dielectric Strength	V ≤ 500V : 200% Rated Voltage
	500V ≤ V < 1000V : 150% Rated Voltage
	V ≥1000V : 120% Rated Voltage

◆ How To Order

C	2520	X	103	K	102	T	N	S	X	Y
Product Code	**Chip Size**	**Dielectric**	**Capacitance Unit : pF**	**Tolerance**	**Rated Voltage**	**Packaging**	**Termination**	**Testing Requirement**	**Special Requirement**	**Suffix Code**
C: MLCC (Multilayer Ceramic Capacitor)	Ex.: 2520 3530 3640	Ex.: N : NP0 X : X7R	Ex.: 100 : $10x10^0$ 471 : $47x10^1$ 102 : $10x10^2$	Ex.: J : +/- 5% K : +/-10% M : +/-20%	Ex.: 050:50Vdc 251:250Vdc 102:1000Vdc 202:2000Vdc	Ex.: T : T&R W : Waffle B : Bulk	Ex: N: Ni Barrier / Sn Plate	Ex.: S: Standard Electrical	Ex.: O: Arc Prevention Coating X: Polymer Termination (Super Term) Z: Coating & Polymer Termination	Y

Dimension

Unit : mm [inches]



SIZE	L	W	T (max)	B (min)	BW (min)
2520	6.35±0.50 [.25±.020]	5.00±0.50 [.20±.020]	3.2 [.126]	4.0 [.157]	0.3 [.012]
3330	8.4±0.50 [0.33±0.2]	7.6 ±0.50 [0.30±0.2]	4.0 [.157]	4.0 [.157]	0.3 [.012]
3530	8.90±0.50 [.35±.020]	7.60±0.50 [.30±.020]	5.0 [.200]	5.5 [.217]	0.3 [.012]
3640	9.20±0.50 [.36±.020]	10.20±0.50 [.40±.020]	5.0 [.200]	6.0 [.236]	0.3 [.012]

Capacitance Range

Size	Dielectric	Capacitance (pF) maximum									
		50V	100V	250V	500V	1KV	2KV	3KV	4KV	5KV	8KV
2520	NP0	823	683	563	473	103	392	222	102	471	101
	X7R	685	685	395	474	334	563	473	822	822	152
3330	NP0	224	184	104	683	333	823	392	292	821	251
	X7R	126	126	825	105	824	124	823	183	183	332
3530	NP0	224	184	104	823	473	103	472	332	102	251
	X7R	126	126	825	105	824	124	823	183	183	332
3640	NP0	224	184	104	823	473	123	562	392	122	561
	X7R	186	186	106	125	105	184	104	273	273	392

- ***All values are capacitance EIA codes.***
- ***Other dimensions, capacitance values and voltages rating are available. Please contact Holy Stone.***

Soldering And Handling Precautions:

Large ceramic capacitors are more prone to thermal and mechanical cracks. To minimize mechanical cracks, capacitors have to be handled carefully in the original waffle pack container, carrier tape or other suitable container. Care must be taken that these capacitors do not come into contact with each other which can cause chip outs, cracks or other mechanical damage.

The recommended method for soldering large chips is reflow soldering. Wave soldering and manual soldering with Iron is not recommended. Ceramic capacitors must be preheated with less than 2°C/second rate to about 50°C below the reflow temperature. Any sudden increase or decrease in temperature more than the recommended rate, during soldering, may cause internal thermal cracks.

Options:

- Holy Stone offers polymer termination (Super Term) for very large chips to minimize mechanical cracks due to board flexing.
- To minimize the potential for surface arcing in higher voltage applications, IHHEC offers the option of a proprietary surface coating.

Multilayer Ceramic Capacitors [Stacked Capacitors]

SMC Series

MLCC Design, Suitable for Switchmode Power Supply Filters

◆ Features

- ❑ Stacked design offers the high capacitance similar to Tantalum but with extremely low ESR advantage.
- ❑ 'J', 'L' and 'N' Leaded configuration provide mechanical and thermal stress relief.
- ❑ Capacitance values up to 44μF. Voltage from 50V to 1KV.
- ❑ Available in NP0 and X7R dielectrics .
- ❑ HIREL screening available.
- ❑ RoHS compliant.

◆ Applications

- ❑ Power supplies
- ❑ DC-DC converters
- ❑ Surge protection
- ❑ Industrial control circuits
- ❑ Snubbers
- ❑ Filtering, smoothing, and decoupling application
- ❑ HIREL applications
- ❑ Custom applications

◆ Summary of Specifications

Operating Temperature	-55 to +125 ℃
Rated Voltage	50Vdc to 1000Vdc
Temperature Coefficient of Capacitance	NPO : ≤ ± 30ppm/ ℃ , -55 to +125 ℃ (EIA Class Ⅰ)
	X7R : ≤ ± 15% , -55 to +125 ℃ (EIA Class Ⅱ)
Capacitance Range	NPO: 2.2 nF to 550nF / X7R : 20.0nF to 44uF
Dissipation Factor	NPO : Q≧ 1000 at 1KHz / X7R : 2.5%max. at 1KHz
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller
Aging	NPO : 0% , X7R : 1.0% per decade of time typical
Dielectric Withstanding Voltage	V ≤50V ; 200% Rated Voltage
	100V ≤ V <500V ; 200% Rated Voltage
	500V ≤ V <1KV ; 150% Rated Voltage
	1000V = 120% Rated Voltage
Tolerance	± 2% tolerances are only available in NPO
Patent Number	M505047

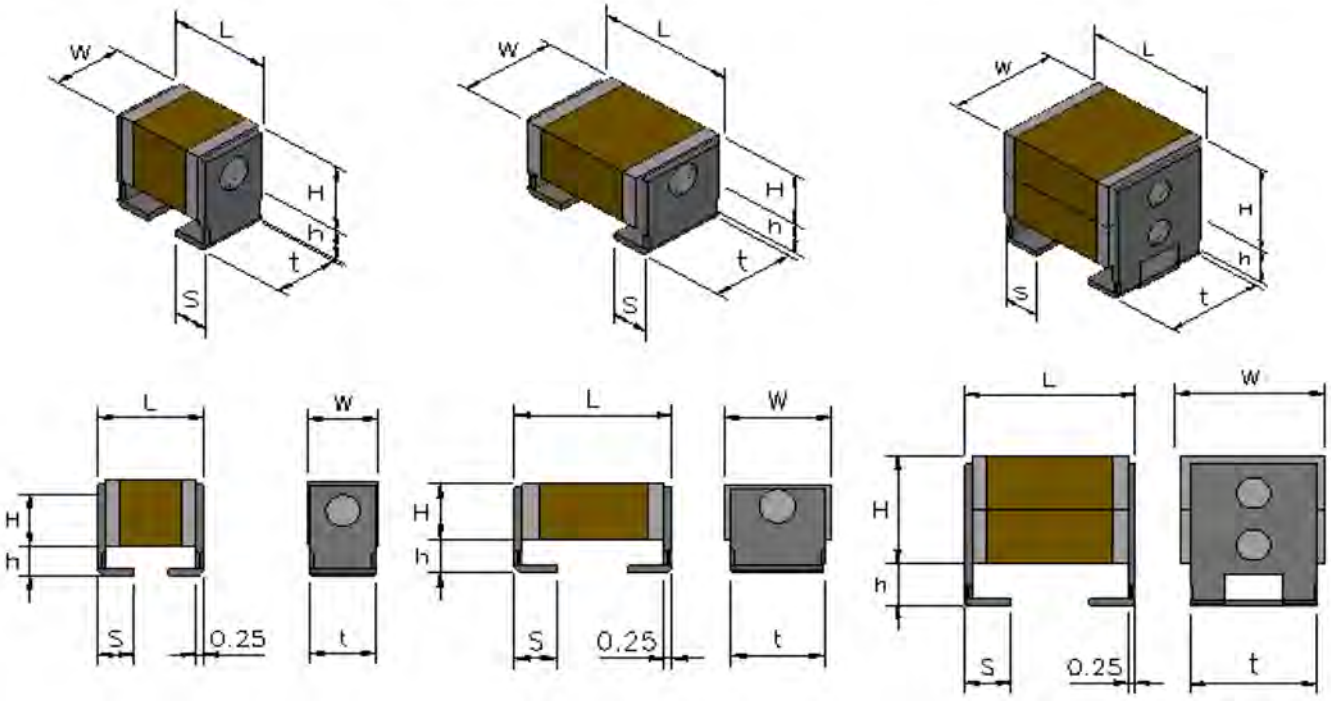
◆ How To Order

SMC	49	J	X	224	K	501	T	H	01

Product Code	Stack and Size	Lead Configuration	Material	Capacitance (pF)	Tolerance	Rated Voltage	Packaging	Special test Requirement	Special Requirement
SMC: Commercial Size Switchmode Stacked Capacitor	The first digit: # of chips in stack Second Digit: Chip Size 5: 1210 6: 1812 7: 2220 8: 1825 9: 2225	Ex.: J : J Lead for h=0.070" L: L Lead for h=0.070" N: Straight Lead P :J Lead for h=0.045" S : L Lead for h=0.045" A: Flat type Lead X: No lead frame	Ex.: N: NP0 X: X7R B: X5R	Ex.: 103:10x10^3 224:22x10^4 475:47x10^5	Ex.: G: +/-2.0% J: +/-5.0% K: +/- 10% M: +/- 20%	Ex.: 050: 50Vdc 101: 100Vdc 201: 200Vdc 501: 500Vdc 102:1000Vdc	Ex.: B: Bulk T:Tape&Reel W: Waffle pack	Ex.: Blank: Standard electrical test H: Hi-Rel Testing	Ex.: Blank: No special requirement 01~99: Customer special requirement

◆ Dimensional Shape

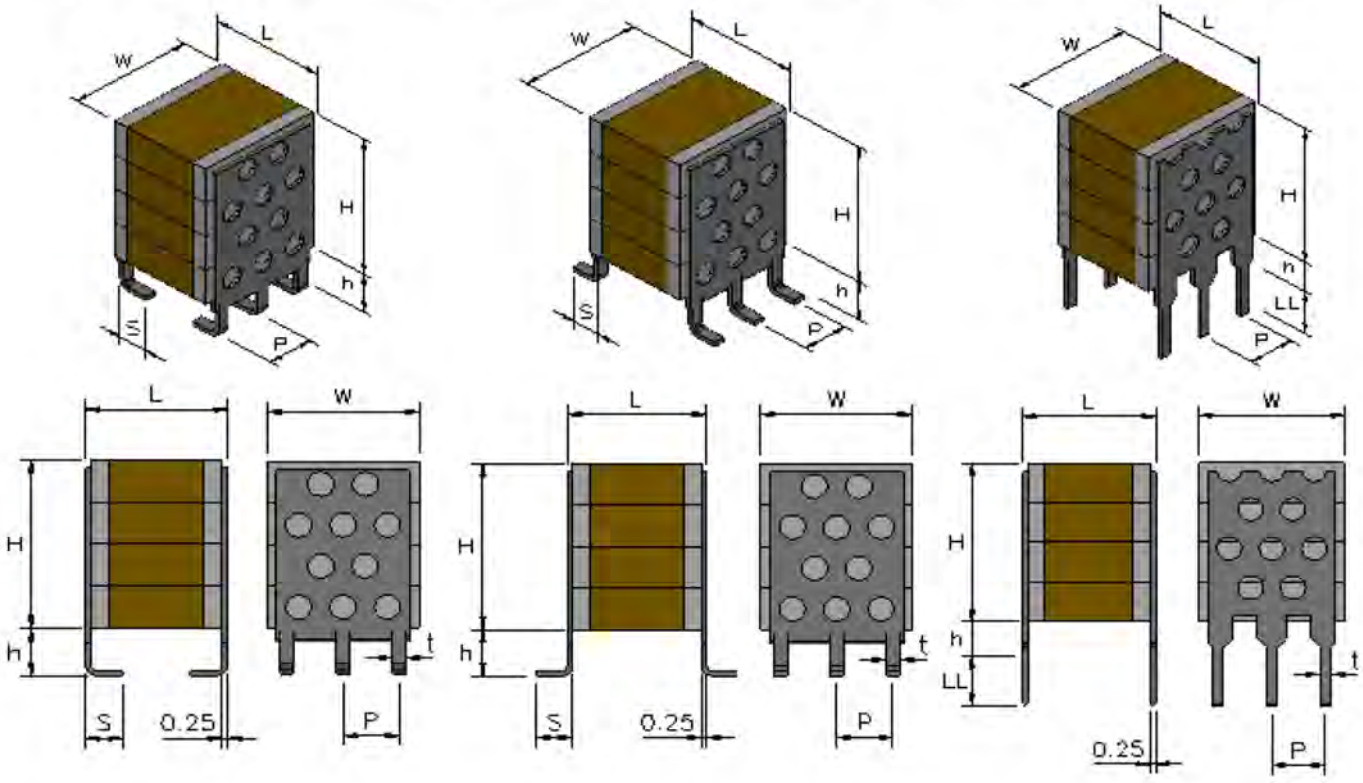
1210 Size



1812 Size

2220 Size

1825/2225 J Type

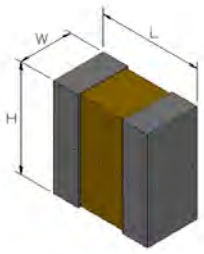


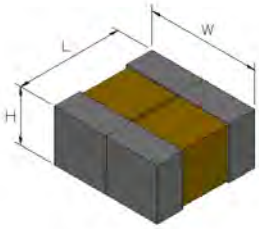
1825/2225 L Type

1825/2225 N Type

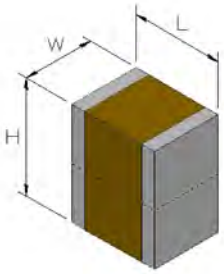
◆ Dimensional Shape

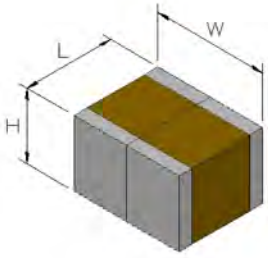
1206 X Type



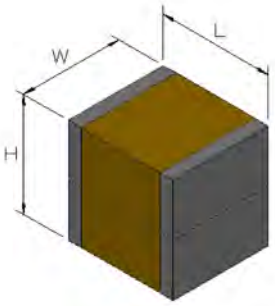


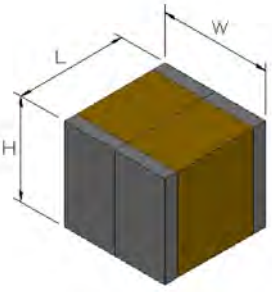
1210 X Type



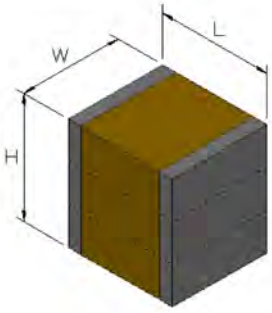


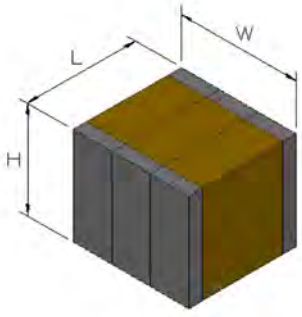
2220 X Type



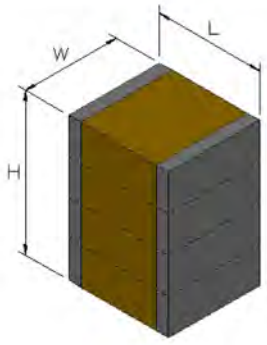


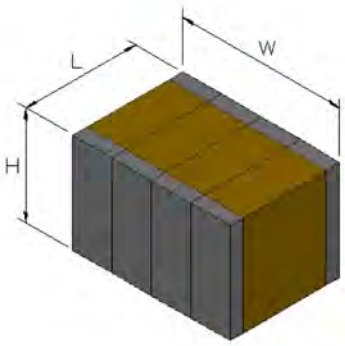
2220 X Type



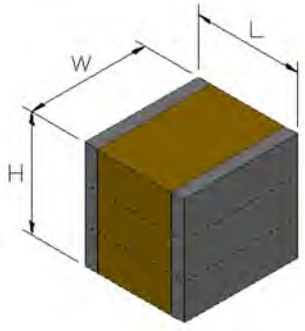


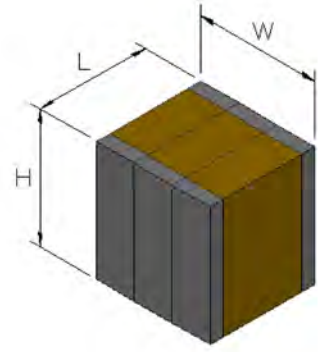
2220 X Type





1825/2225 X Type





◆ Dimensions

Unit : mm [inches]

EIA Size Code	1210		1812		2220		1825	
Size Code	15	25	16	26	17	27	18	28
L	3.80 Max [.150 Max]	3.80 Max [.150 Max]	5.50 Max [.217 Max]	5.50 Max [.217 Max]	6.50 Max [.256 Max]	6.50 Max [.256 Max]	5.35±0.50 [.210±.020]	5.35±0.50 [.210±.020]
W (max.)	2.90 [.114]	2.90 [.114]	4.00 [.157]	4.00 [.157]	5.50 [.217]	5.50 [.217]	6.85 [.270]	6.85 [.270]
H(max.)	2.20 [.087]	4.40 [.173]	2.60 [.102]	5.20 [.205]	3.00 [.118]	6.00 [.236]	3.00 [.118]	6.00 [.236]
S	1.00±0.10 [.040±.004]	1.00±0.10 [.040±.004]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]
P			2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]
h* (Typical)	1.30 [.051]	1.30 [.051]	1.30 [.051]	1.30 [.051]	1.30 [.051]	1.30 [.051]	1.78 [.070]	1.78 [.070]
h* (P/S Type)							1.14 [.045]	1.14 [.045]
LL** (min.)					2.54 [.100]	2.54 [.100]	2.54 [.100]	2.54 [.100]
t	2.25±0.1 [.089±.004]	2.25±0.1 [.089±.004]	3.08±0.1 [.121±.004]	3.08±0.1 [.121±.004]	4.50±0.10 [.177±.004]	4.50±0.10 [.177±.004]	0.60±0.10 [.024±.004]	0.60±0.10 [.024±.004]
# of leads per side	1	1	1	1	1	1	3	3

EIA Size Code	1825			2225				
Size Code	38	48	58	19	29	39	49	59
L	5.35±0.50 [.210±.020]	5.35±0.50 [.210±.020]	5.35±0.50 [.210±.020]	6.35±0.50 [.250±.020]	6.35±0.50 [.250±.020]	6.35±0.50 [.250±.020]	6.35±0.50 [.250±.020]	6.35±0.50 [.250±.020]
W (max.)	6.85 [.270]	6.85 [.270]	6.85 [.270]	6.85 [.270]	6.85 [.270]	6.85 [.270]	6.85 [.270]	6.85 [.270]
H(max.)	9.00 [.354]	10.85 [.427]	10.85 [.427]	3.00 [.118]	6.00 [.236]	9.00 [.354]	10.85 [.427]	10.85 [.427]
S	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]
P	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]
h* (Typical)	1.78 [.070]	1.78 [.070]	1.78 [.070]	1.78 [.070]	1.78 [.070]	1.78 [.070]	1.78 [.070]	1.78 [.070]
h* (P/S Type)	1.14 [.045]	1.14 [.045]	1.14 [.045]	1.14 [.045]	1.14 [.045]	1.14 [.045]	1.14 [.045]	1.14 [.045]
LL** (min.)	2.54 [.100]	2.54 [.100]	2.54 [.100]	2.54 [.100]	2.54 [.100]	2.54 [.100]	2.54 [.100]	2.54 [.100]
t	0.60±0.10 [.024±.004]	0.60±0.10 [.024±.004]	0.60±0.10 [.024±.004]	0.60±0.10 [.024±.004]	0.60±0.10 [.024±.004]	0.60±0.10 [.024±.004]	0.60±0.10 [.024±.004]	0.60±0.10 [.024±.004]
# of leads per side	3	3	3	3	3	3	3	3

- * 'h' varies depends on the lead style. See lead configuration above
- ** "LL" Applies only to Straight (N) leads

◆ X Type-Horizontal Dimensions

Unit : mm [inches]

EIA Size Code	1206	1210	1812			2220		
Size Code	22	25	26	36	46	27	37	47
L (max.)	3.60 [.142]	3.50 [.138]	4.90 [.193]	4.90 [.193]	4.90 [.193]	6.20 [.244]	6.10 [.240]	6.10 [.240]
W (max.)	2.00 [.079]	2.70 [.106]	3.50 [.138]	3.50 [.138]	3.50 [.138]	5.40 [.213]	5.40 [.213]	5.40 [.213]
H(max.)	3.90 [.154]	5.40 [.213]	5.40 [.213]	6.80 [.268]	9.00 [.354]	6.20 [.244]	8.00 [.315]	10.60 [.417]

EIA Size Code	1825				2225			
Size Code	28	38	48	58	29	39	49	59
L (max.)	4.9 [.193]	4.9 [.193]	4.9 [.193]	4.9 [.193]	6.10 [.240]	6.10 [.240]	6.10 [.240]	6.10 [.240]
W (max.)	6.75 [.266]	6.75 [.266]	6.75 [.266]	6.75 [.266]	6.75 [.266]	6.75 [.266]	6.75 [.266]	6.75 [.266]
H(max.)	5.40 [.213]	6.80 [.268]	9.00 [.354]	11.2 [.441]	6.20 [.244]	6.80 [.268]	9.00 [.354]	11.20 [.441]

◆ X Type-Vertical Dimensions

Unit : mm [inches]

EIA Size Code	1206	1210	1812			2220		
Size Code	22	25	26	36	46	27	37	47
L (max.)	3.60 [.142]	3.50 [.138]	4.90 [.193]	4.90 [.193]	4.90 [.193]	6.20 [.244]	6.10 [.240]	6.10 [.240]
W (max.)	3.90 [.154]	5.40 [.081]	5.40 [.213]	6.80 [.268]	9.00 [.354]	6.20 [.244]	8.00 [.315]	10.60 [.417]
H(max.)	2.00 [.079]	2.70 [.106]	3.50 [.138]	3.50 [.138]	3.50 [.138]	5.40 [.213]	5.40 [.213]	5.40 [.213]

EIA Size Code	1825				2225			
Size Code	28	38	48	58	29	39	49	59
L (max.)	4.9 [.193]	4.9 [.193]	4.9 [.193]	4.9 [.193]	6.10 [.240]	6.10 [.240]	6.10 [.240]	6.10 [.240]
W (max.)	5.40 [.213]	6.80 [.268]	9.00 [.354]	11.20 [.441]	6.20 [.244]	6.80 [.268]	9.00 [.354]	11.20 [.441]
H(max.)	6.75 [.266]	6.75 [.266]	6.75 [.266]	6.75 [.266]	6.75 [.266]	6.75 [.266]	6.75 [.266]	6.75 [.266]

◆ Capacitance Range

EIA Chip Size	Size Code	NPO Maximum Capacitance					X7R Maximum Capacitance				
		50V	100V	200V/250V	500V	1000V	50V	100V	200V/250V	500V	1000V
1206	12 (1×Cap)	104	104	223	472	332	475	335	564	683	223
	22 (2×Cap)	204	204	223	472	662	945	665	115	134	443
1210	15 (1×Cap)	104	104	473	123	153	106	475	564	124	473
	25 (2×Cap)	204	204	943	243	304	206	945	115	244	943
1812	16 (1×Cap)	224	104	104	223	223	106	475	105	474	104
	26 (2×Cap)	444	204	204	443	443	206	945	205	944	204
2220	17 (1×Cap)	273	273	333	273	333	106	106	225	105	224
	27 (2×Cap)	543	543	663	543	663	206	206	445	205	444
1825	18 (1×Cap)	104	104	104	104	123	225	105	105	474	154
	28 (2×Cap)	204	204	204	204	243	445	205	205	944	304
	38 (3×Cap)	304	304	304	304	363	665	305	305	145	454
	48 (4×Cap)	404	404	404	404	483	885	405	405	185	604
	58 (5×Cap)	504	504	504	504	603	116	505	505	235	754
2225	19 (1×Cap)	823	823	333	153	153	475	475	225	474	104
	29 (2×Cap)	164	164	663	303	303	945	945	445	944	204
	39 (3×Cap)	244	244	993	453	453	146	146	665	145	304
	49 (4×Cap)	334	334	134	603	603	186	186	885	185	404
	59 (5×Cap)	414	414	164	753	753	236	236	116	235	504

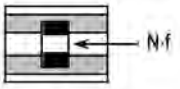
▪ ***Other Stacked configuration on other sizes, capacitance values and voltages rating are available. Please contact Holy Stone.***

◆ Soldering and Handling Precautions

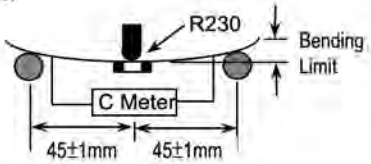
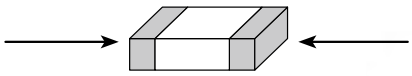
The recommended method for soldering large SMC capacitor, is reflow soldering. Wave soldering and manual soldering with Iron is not recommended.

Ceramic capacitors must be preheated with less than 2ºC/sec rate to about 50ºC below the reflow temperature. Sudden increase, or decrease in temperature more than the recommended rate, during soldering, may cause internal thermal cracks.

HVC Series Specifications & Test Conditions

Item	Specification		Test Conditions
Visual	No abnormal exterior appearance		Visual Inspection
Dimension	See HVC Series		Visual Inspection
Insulation Resistance	10,000MΩ or 500/C Ω, whichever is smaller		V≦500V, Rated Voltage V>500V, Applied 500Vdc Charge Time : 60 sec. Current : Less than 50mA
Electrical Characterization	**Capacitance**	Class Ⅰ (NP0) : Within the specified tolerance. Class Ⅱ (X7R) : Within the specified tolerance.	Class Ⅰ (NP0) : Capacitance / Frequency / Voltage C≦ 1000pF / 1MHz±10% / 1.0±0.2Vrms C>1000pF / 1KHz±10% / 1.0±0.2Vrms Class Ⅱ : Frequency / Voltage X7R / 1KHz±10% / 1.0±0.2Vrms Perform a heat temperature at 150±5℃ for 30min, then place room temp. for 24±2 hours.
	Q / D.F.	Class Ⅰ (NP0) : More Than 30pF : Q ≧ 1000 30pF & Below : Q ≧ 400+20C (C : Capacitance , pF) Class Ⅱ (X7R) : 100V : 5.0% (C≧0.1uF) 100V : 2.5% (C<0.1uF) Other Voltage : 2.5% max	
Withstanding Voltage	No dielectric breakdown or mechanical breakdown.		V<500V : 200% Rated Voltage 500V≦V<1000V : 150% Rated Voltage 1000≦V : 120% Rated Voltage 2.5KV : 100% Rated Voltage Voltage ramp up rate≦500V/sec for 1~5 sec. Charge/discharge current : less than 50mA ※ Withstanding voltage testing requires immersion of the element in an isolation fluid prevent arcing on the chip surface, at voltage over 1000Vdc.
Temperature Capacitance Coefficient	Char. / Temp. Range / Cap. Change NP0(N) / -55℃ ~ +125℃ / ±30ppm/℃ X7R (X) / -55℃ ~ +125℃ / ±15%		Class Ⅰ : [C2-C1/C1(T2-T1)] x 100% Class Ⅱ : (C2-C1)/C1 x 100% T1:Standard temperature(25℃) T2:Test temperature C1:Capacitance at standard temperature C2:Capacitance at test temperature
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.		≦ 0603 size : 5N(≒ 0.5 Kg·f) > 0603 size : 10N(≒1.0 Kg·f) Pull force shall be applied for 10±1 sec. 

HVC Series Specifications & Test Conditions

Item	Specification	Test Conditions
Resistance to Flexure of Substrate	Appearance: No mechanical damage shall occur. Capacitance: Char. / Cap. Change NP0(N) ≤ ± 5.0% X7R(X) ≤ ± 12.5%	The board should bend 1.0mm with a rate of 1.0 mm/sec. 
Solderability	More than 90% of the termination surface should be soldered so the metal part does not come out or dissolve . 	Solder Temperature : 245±5℃ Dip Time : 5 ± 0.5 sec. Immersing Speed : 25±10% mm/s Solder : Lead Free Solder Flux : Rosin Preheat : At 80~120 ℃ For 10~30 sec.
Resistance to Soldering Heat	Appearance: No mechanical damage shall occur. Capacitance: Class Ⅰ(NP0): Within ± 2.5% or ± 0.25pF, whichever is larger of initial value Class Ⅱ: Char. / Cap. change X7R(X) Within ± 10% Q (Class Ⅰ) To satisfy the specified initial value. D.F. (Class Ⅱ) To satisfy the specified initial value. Insulation Resistance To satisfy the specified initial value. Withstand Voltage To satisfy the specified initial value.	Class Ⅱ capacitor shall be set for 48± 4 hours at room temperature after one hour heat treatment at 150 +0/-10℃ before initial measuring. Preheat : at 150±10°C for 60~120sec. Dip : solder temperature of 260±5℃ Dip Time : 10 ± 1sec. Immersing Speed : 25±10% mm/s Flux : Rosin Measure at room temperature after cooling for Class Ⅰ: 24 ± 2 Hours Class Ⅱ: 48 ± 4 Hours
Temperature Cycle	Appearance: No mechanical damage shall occur Capacitance: Class Ⅰ(NP0) : Within 2.5% or ±0.25pF, whichever is larger of initial value Class Ⅱ: Char. / Cap. change X7R(X) Within ± 7.5% Q (Class Ⅰ) To satisfy the specified initial value. D.F. (Class Ⅱ) To satisfy the specified initial value. Insulation Resistance To satisfy the specified initial value.	Class Ⅱ capacitor shall be set for 48±4 hours at room temperature after one hour heat treatment at 150 +0/-10 ℃ before initial measuring. Capacitor shall be subjected to five cycles of the temperature cycle as following: Step / Temp.(℃) / Time(min) 1 / Min. Rated Temp. +0/-3 / 30 2 / 25 / 3 3 / Min. Rated Temp. +0/-3 / 30 4 / 25 / 3 Measure at room temperature after cooling for Class Ⅰ: 24 ± 2 Hours Class Ⅱ: 48 ± 4 Hours

HVC Series Specifications & Test Conditions

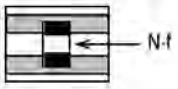
Item		Specification	Test Conditions
Humidity	Appearance	No mechanical damage shall occur.	Class Ⅱ capacitor shall be set for 48±4 hours at room temperature after one hour heat treatment at 150 +0/-10 ℃before initial measure. Temperature : 40± 2 ℃ Relative humidity : 90 ~95%RH Test Time : 500 +12/-0 hr Measure at room temperature after cooling for Class Ⅰ: 24 ± 2 Hours Class Ⅱ: 48 ± 4 Hours
	Capacitance	Char. Cap. Change NP0(N) Within ± 5.0% or ± 0.5pF, whichever is larger of initial value X7R(X) Within ± 15.0%	
	Q / D.F.	Class Ⅰ (NP0) : More Than 30pF : Q ≧ 350 30pF & Below : Q ≧ 275+2.5xC (C : Capacitance , pF) ClassⅡ(X7R) : 100V : 10.0% max. (C≧0.1uF) 100V : 5.0% max. (C<0.1uF) Other Voltage : 5.0% max.	
	Insulation Resistance	1000MΩ or 50/CΩ, whichever Is Smaller. (C in Farad)	
High Temperature Load (Life Test) (100V-1KV)	Appearance	No mechanical damage shall occur.	ClassⅡ capacitors applied DC voltage (following table) is applied for one hour at maximum operation temperature ±3℃ then shall be set for 48±4 hours at room temperature and the initial measurement shall be conducted. Applied Voltage : Test Temperature : max. operating temp. Test Time : 1000 +12/-0 hours Current Applied : 50 mA Max. Measure at room temperature after cooling for Class Ⅰ: 24 ± 2 Hours Class Ⅱ: 48 ± 4 Hours
	Capacitance	Char. Cap. Change NP0(N) Within ± 3.0% or ± 0.3pF, whichever is larger of initial value X7R(X) Within ± 15%	
	Q / D.F.	Class Ⅰ (NP0) : More Than 30pF : Q ≧ 350 30pF & Below : Q ≧ 275+2.5xC (C : Capacitance , pF) ClassⅡ(X7R) : 100V : 10.0% max. (C≧0.1uF) 100V : 5.0% max. (C<0.1uF) Other Voltage : 5.0% max.	
	Insulation Resistance	1000MΩ or 50/CΩ, whichever Is Smaller	

Rated Voltage	Applied Voltage
V<250Vdc<1.0uF	150%Rated Voltage
V≦250Vdc≧1.0 uF	100%Rated Voltage
250Vdc≦V≦500Vdc<0.1 uF	120%Rated Voltage
250Vdc≦V≦500Vdc≧0.1 uF	100%Rated Voltage
Less Than 1KVdc	120%Rated Voltage
More Than 1KVdc (include 1KV)	100%Rated Voltage

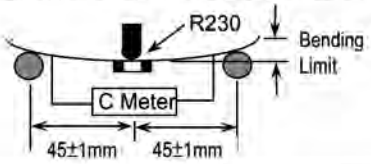
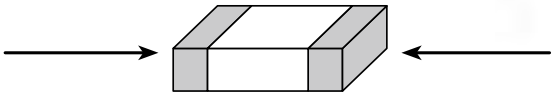
HVC Series Specifications & Test Conditions

Item		Specification	Test Conditions
High Temperature Load (Life Test) (1.5V-5KV)	Appearance	No mechanical damage shall occur.	Class Ⅱ capacitors applied DC voltage (following table) is applied for one hour at maximum operation temperature ±3℃ then shall be set for 48±4 hours at room temperature and the initial measurement shall be conducted. Voltage Conditioning : 100% Rated Voltage meet MIL-PRF-49467(Group A/B) Current Applied : 50 mA Max. Measure at room temperature after cooling for Class Ⅰ: 24 ± 2 Hours Class Ⅱ: 48 ± 4 Hours
	Capacitance	Char. — Cap. Change NP0(N) Within ± 3.0% or ± 0.3pF, whichever is larger of initial value X7R(X) Within ± 15%	
	Q / D.F.	Class Ⅰ (NP0) : More Than 30pF : Q ≧ 350 30pF & Below : Q ≧ 275 + 2.5xC (C : Capacitance , pF) ClassⅡ(X7R) : 5.0% max.	
	Insulation Resistance	1000MΩ or 50/CΩ, whichever Is Smaller. (C in Farad)	
Vibration	Appearance	No mechanical damage shall occur	Solder the capacitor on P.C. Board shown in Fig 2. before testing. Vibrate the capacitor with amplitude of 1.5mm P-P changing the frequencies from 10Hz to 55Hz and back to 10Hz in about 1 min. Repeat this for 2 hours each in 3 perpendicular directions.
	Capacitance	Class Ⅰ (NP0) : Within 2.5% or ±0.25pF, whichever is larger of initial value Class Ⅱ: Char. — Cap. Change X7R(X) Within ± 7.5%	
	Q (Class Ⅰ)	To satisfy the specified initial value.	
	D.F. (Class Ⅱ)	To satisfy the specified initial value.	
	Insulation Resistance	To satisfy the specified initial value.	

NCC Series Specifications & Test Conditions

Item	Specification	Test Conditions
Visual	No abnormal exterior appearance	Visual Inspection
Dimension	See NCC Series	Visual Inspection
Insulation Resistance	10,000MΩ or 500/C Ω, whichever is smaller for rated voltage>10V and greater than 100/C Ω for rated voltage≤10V	Applied Voltage: Rated Voltage Charge Time : 60±5 sec. Charge-Discharge current shall be less than 50mA current.
Electrical Characterization	**Capacitance** Class Ⅰ (NP0) : Within the specified tolerance. Class Ⅱ (X7R/X7S/X6S/X5R) : Within the specified tolerance. **Q / D.F.** Class Ⅰ (NP0) : More Than 30pF : Q ≧ 1000 30pF & Below : Q ≧ 400+20C (C : Capacitance , pF) Class Ⅱ (X7R/X7S/X6S/X5R) : Shell meet the value in Table 1.	Class Ⅰ (NP0) : Capacitance / Frequency / Voltage C≦ 1000pF / 1MHz±10% / 1.0±0.2Vrms C>1000pF / 1KHz±10% / 1.0±0.2Vrms Class Ⅱ : Capacitance / Frequency / Voltage C≦10uF / 1KHz±10% / *1.0±0.2Vrm or 0.5±0.2Vrms C>10uF / 120Hz±20% / 0.5±0.2Vrms Perform a heat temperature at 150±5℃ for 30 minutes, then place room temp. for 24±2 hours. * Depend on the individual parts.
Withstanding Voltage	No dielectric breakdown or mechanical breakdown.	250% of the rated voltage for 1~5 sec. charge / discharge current : less than 50mA
Temperature Capacitance Coefficient	Char. / Temp. Range / Cap. Change NP0(N) / -55°C ~ +125°C / ±30ppm/°C X7R (X) / -55°C ~ +125°C / ±15% X7S (R) / -55°C ~ +125°C / ±22% X6S (S) / -55°C ~ +105°C / ±22% X5R (B) / -55°C ~ +85°C / ±15%	Class Ⅰ : [C2-C1/C1(T2-T1)] x 100% Class Ⅱ : (C2-C1)/C1 x 100% T1:Standard temperature (25℃) T2:Test temperature C1:Capacitance at standard temperature (25℃) C2:Capacitance at test temperature (T2) Under 1.0Vrms.
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.	0201 : 2N (≒ 0.2 Kg·f) 0402/0603 : 5N (≒ 0.5 Kg·f) ≧0805- : 10N (≒1.0 Kg·f) Pull force shall be applied for 10±1 sec. 

NCC Series Specifications & Test Conditions

Item		Specification	Test Conditions
Resistance to Flexure of Substrate	Appearance	No mechanical damage shall occur.	The board should bend 1.0mm with a rate of 1.0 mm per sec. The duration of the applied forces shall be 5 ± 1 sec.
	Capacitance	Char. / Cap. Change NP0(N) ≤ ± 5.0% X7R(X) ≤ ± 12.5% X7S(R) ≤ ± 12.5% X6S(S) ≤ ± 12.5% X5R(B) ≤ ± 12.5%	
Solderability		More than 90% of the termination surface should be soldered so the metal part does not come out or dissolve . 	Solder Temperature : 245±5℃ Dip Time : 5 ± 0.5 sec. Immersing Speed : 25±10% mm/s Solder : Lead Free Solder Flux : Rosin Preheat : At 80~120 ℃ For 10~30 sec.
Resistance to Soldering Heat	Appearance	No mechanical damage shall occur.	Class Ⅱ capacitor shall be set for 48± 4 hours at room temperature after one hour heat treatment at 150 +0/-10℃ before initial measuring.
	Capacitance	Class Ⅰ(NP0): Within ± 2.5% or ± 0.25pF, whichever is larger of initial value Class Ⅱ (X7R/X7S/X6S/X5R) : ≤ ±7.5% of initial value	Preheat : at 150±10°C for 60~120sec. Dip ; solder temperature of 260±5℃ Dip Time : 10 ± 1sec. Immersing Speed : 25±10% mm/s Flux : Rosin
	Q (Class Ⅰ)	To satisfy the specified initial value.	Measure at room temperature after cooling for Class Ⅰ : 24 ± 2 Hours Class Ⅱ: 48 ± 4 Hours
	D.F. (Class Ⅱ)	Shell meet the value in Table 1.	
	Insulation Resistance	To satisfy the specified initial value.	
Temperature Cycle	Appearance	No mechanical damage shall occur	Class Ⅱ capacitor shall be set for 48±4 hours at room temperature after one hour heat treatment at 150 +0/-10 ℃ before initial measuring.
	Capacitance	Class Ⅰ(NP0): Within ± 2.5% or ± 0.25pF, whichever is larger of initial value Class Ⅱ (X7R/X7S/X6S/X5R) : ≤ ±7.5% of initial value	Capacitor shall be subjected to five cycles of the temperature cycle as following: Step / Temp.(℃) / Time(min) 1 / Min. Rated Temp. +0/-3 / 30 2 / 25 / 3 3 / Min. Rated Temp. +0/-3 / 30 4 / 25 / 3
	Q (Class Ⅰ)	To satisfy the specified initial value.	
	D.F. (Class Ⅱ)	Shell meet the value in Table 1.	
	Insulation Resistance	To satisfy the specified initial value.	Measure at room temperature after cooling for Class Ⅰ : 24 ± 2 Hours Class Ⅱ: 48 ± 4 Hours

NCC Series Specifications & Test Conditions

Item		Specification	Test Conditions
Humidity	Appearance	No mechanical damage shall occur.	Class Ⅱ capacitor shall be set for 48±4 hours at room temperature after one hour heat treatment at 150 +0/-10 ℃before initial measure. Temperature : 40± 2 ℃ Relative humidity : 90 ~95%RH Test Time : Max. 500 hours Measure at room temperature after cooling for Class Ⅰ: 24 ± 2 Hours Class Ⅱ: 48 ± 4 Hours
	Capacitance	Char. — Cap. Change NP0(N) Within ± 5.0% or ± 0.5pF, whichever is larger of initial value X7R(X) ≤ ± 12.5% X7S(R) ≤ ± 12.5% X6S(S) ≤ ± 12.5% X5R(B) ≤ ± 12.5%	
	Q / D.F.	Class Ⅰ (NP0) : 30pF & Over : Q ≧350 10 to 30pF : Q ≧275+2.5C 30pF & Below: Q ≧200+10C ClassⅡ (X7R/X7S/X6S/X5R) : Shell meet the value in Table 1.	
	Insulation Resistance	1000MΩ or 50/C Ω, whichever is smaller for rated voltage>10V and greater than 10/C Ω for rated voltage≤10V (C in Farad)	
Humidity Load	Appearance	No mechanical damage shall occur.	Class Ⅱ capacitors applied DC voltage of the rated voltage is applied for one hour at maximum operation temperature then shall be set for 48± 4 hours at room temperature and the initial measurement shall be conducted. Applied Voltage :Rated Voltage Temperature : 40± 2℃ Relative Humidity : 90 ~ 95%RH Test Time : 500 Hrs Max. Current Applied : 50 mA Max. Measure at room temperature after cooling for Class Ⅰ: 24 ± 2 Hours Class Ⅱ capacitor for Cap≧103(10nF) shall be set for 24±2 hours at room temperature after one hour heat treatment at 150 +0/-10℃ before final measure. Class Ⅱ capacitor for Cap＜103(10nF) Measure at room temperature after cooling for 48 ± 4 Hours.
	Capacitance	Char. — Cap. Change NP0(N) Within ± 7.5% or ± 0.75pF, whichever is larger of initial value X7R(X) ≤ ± 12.5% X7S(R) ≤ ± 12.5% X6S(S) ≤ ± 12.5% X5R(B) ≤ ± 12.5%	
	Q / D.F.	Class Ⅰ (NP0) : 30pF & Over : Q ≧350 10 to 30pF : Q ≧275+2.5C 30pF & Below: Q ≧200+10C ClassⅡ (X7R/X7S/X6S/X5R) : Shell meet the value in Table 1.	
	Insulation Resistance	500MΩ or 25/C Ω, whichever is smaller for rated voltage>10V and greater 5/C Ω for rated voltage≤10V (C in Farad)	

NCC Series Specifications & Test Conditions

Item		Specification	Test Conditions
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur.	The capacitors applied DC testing voltage is applied for one hour at maximum operation temperature then shell be set for 48± 4 hours at room temperature and the initial measurement shall be conducted. Applied Voltage : Rated Voltage The class Ⅰ applied voltage 200% of rated voltage. Temperature : max. operation temperature Test Time : Max 1000 hours. Current Applied : 50mA Max Measure at room temperature after cooling for Class Ⅰ: 24 ± 2 Hours Class Ⅱ capacitor for Cap≧103(10nF) shall be set for 24±2 hours at room temperature after one hour heat treatment at 150 +0/-10℃ before final measure. Class Ⅱ capacitor for Cap＜103(10nF) Measure at room temperature after cooling for 48 ± 4 Hours.
	Capacitance	Char. Cap. Change NP0(N) Within ± 5.0% or ± 0.5pF, whichever is larger of initial value X7R(X) ≤ ± 12.5% X7S(R) ≤ ± 12.5% X6S(S) ≤ ± 12.5% X5R(B) ≤ ± 12.5%	
	Q / D.F.	Class Ⅰ (NP0) : 30pF & Over : Q ≧350 10 to 30pF : Q ≧275+2.5C 30pF & Below: Q ≧200+10C ClassⅡ (X7R/X7S/X6S/X5R) : Shell meet the value in Table 1.	
	Insulation Resistance	1000MΩ or 50/C Ω, whichever is smaller for rated voltage>10V and greater than 10/C Ω for rated voltage≤10V (C in Farad)	

Vibration	Appearance	No mechanical damage shall occur.	Solder the capacitor on P.C. board. Vibrate the capacitor with amplitude of 1.5mm P-P changing the frequencies from 10Hz to 55Hz and back to 10Hz in about 1 min. Repeat this for 2 hours each in 3 perpendicular directions.
	Capacitance	Within the specified tolerance.	
	Q (Class Ⅰ)	To satisfy the specified initial value.	
	D.F. (Class Ⅱ)	Shell meet the value in Table 1.	

NCC Series Specifications & Test Conditions

Table 1

Temp char : X7R, X7S, X6S, X5R

Size	Rated Voltage	Capacitance Range	D.F.(MAX)	
			Initial Vibration Resistance to solder heat Temperature cycle	Humidity Humidity loading High temperature loading
0201	DC 4V	All Capacitance	10.0%	20.0%
	DC 6.3V		10.0%	20.0%
	DC 10V		10.0%	20.0%
	DC 16V		10.0%	20.0%
	DC 25V		10.0%	20.0%
	DC 50V		10.0%	20.0%
0402	DC 4V	All Capacitance	10.0%	20.0%
	DC 6.3V	C＜22uF	10.0%	20.0%
		C=22uF	20.0%	30.0%
	DC 10V	All Capacitance	10.0%	20.0%
	DC 16V		10.0%	20.0%
	DC 25V		10.0%	20.0%
	DC 35V		10.0%	20.0%
	DC 50V		10.0%	20.0%
0603	DC 6.3V	All Capacitance	10.0%	20.0%
	DC 10V		10.0%	20.0%
	DC 16V		10.0%	20.0%
	DC 25V		10.0%	20.0%
	DC 35V		10.0%	20.0%
	DC 50V		10.0%	20.0%
0805	DC 4V	All Capacitance	10.0%	20.0%
	DC 6.3V		10.0%	20.0%
	DC 10V		10.0%	20.0%
	DC 16V		10.0%	20.0%
	DC 25V		10.0%	20.0%
	DC 35V		10.0%	20.0%
	DC 50V		10.0%	20.0%
1206	DC 4V	C=22uF	15.0%	25.0%
	DC 6.3V	C＜10uF	10.0%	20.0%
		C≦100uF	15.0%	25.0%
	DC 10V	C＜10uF	10.0%	20.0%
		C≦100uF	15.0%	25.0%
	DC 16V	All Capacitance	10.0%	20.0%
	DC 25V		10.0%	20.0%
	DC 35V		10.0%	20.0%
	DC 50V		10.0%	20.0%
1210	DC 4V	All Capacitance	10.0%	20.0%
	DC 6.3V		10.0%	20.0%
	DC 10V		10.0%	20.0%
	DC 16V		10.0%	20.0%
	DC 25V		10.0%	20.0%
	DC 35V		10.0%	20.0%
	DC 50V		10.0%	20.0%
1812	DC 6.3V	All Capacitance	10.0%	20.0%
	DC 10V		10.0%	20.0%
	DC 16V		10.0%	20.0%
	DC 25V		10.0%	20.0%
	DC 35V		10.0%	20.0%
	DC 50V		10.0%	20.0%
2220	DC 63V	All Capacitance	10.0%	20.0%

ACC Series Specifications & Test Conditions

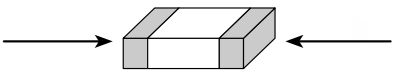
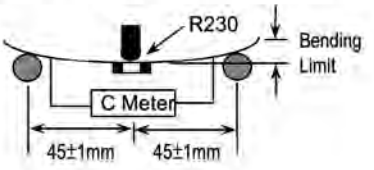
Item		Specification	AEC-Q200 Test Conditions
Pre- and Post-Stress Electrical Test		—	—
High Temperature Exposure (Storage)	**Appearance**	No mechanical damage shall occur.	Test Temperature : max. rated temperature. Test Time : 1000+12/-0 hours Measure at room temperature after cooling for 24±2 hours.
	Capacitance	Char. Cap. Change NP0(N) Within 2.5% or ±0.25pF, whichever is larger of initial value X7R(X) ≤ ±10% of initial value	
	Q / D.F.	Class Ⅰ(NP0) : To satisfy the specified initial value Class Ⅱ(X7R) : Shell meet the value in Table 1.	
	Insulation Resistance	To satisfy the specified initial value	
Temperature Cycle	**Appearance**	No mechanical damage shall occur.	Class Ⅱ capacitor shall be set for 24± 2 hours at room temperature after one hour heat treatment at 150 +0/-10 ℃ before initial measure. Capacitor shall be subjected to 1000 cycles of the temperature cycle as following: Step / Temp.(℃) / Time(min) 1 / -55+0/-3 / 15±3 2 / Room Temp. / 1 3 / 125+3/-0 / 15±3 4 / Room Temp. / 1 Measure at room temperature after cooling for 24±2 hours. Solder the capacitor on P.C. board shown in Fig 2. before testing.
	Capacitance	Char. Cap. Change NP0(N) Within 2.5% or ±0.25pF, whichever is larger of initial value X7R(X) ≤ ±10% of initial value	
	Q / D.F.	Class Ⅰ(NP0) : To satisfy the specified initial value Class Ⅱ(X7R) : Shell meet the value in Table 1.	
	Insulation Resistance	To satisfy the specified initial value	
Destructive Physical Analysis		No defects or abnormalities.	Per EIA-469
Biased Humidity	**Appearance**	No mechanical damage shall occur.	Class Ⅱ capacitors applied DC voltage of the rated voltage is applied for one hour at maximum operation temperature ± 3℃, then shall be set for 24± 2 hours at room temperature and the initial measurement shall be conducted. Applied Voltage : Rated voltage(500Vdc max.) and DC 1.3 to 1.5V. Add 100Kohm resistor. Temperature : 85±3℃ Relative Humidity : 80 to 85 %RH Test Time : 1000 +12/-0 hours Current Applied : 50 mA Max. Measure at room temperature after cooling for 24±2 hours.
	Capacitance	Char. Cap. Change NP0(N) Within ± 7.5% or ±0.75pF, whichever is larger of initial value X7R(X) ≤ ±12.5% of initial value	
	Q / D.F.	Class Ⅰ(NP0) : More Than 30pF : Q ≧ 350 30pF & Below : Q ≧ 275 + 2.5xC (C : Capacitance , pF) Class Ⅱ(X7R) : Shell meet the value in Table 1.	
	Insulation Resistance	500MΩ or 25/CΩ, whichever Is Smaller	

ACC Series Specifications & Test Conditions

Item		Specification	AEC-Q200 Test Conditions
Operational Life	**Appearance**	No mechanical damage shall occur.	Class Ⅱ capacitors applied DC voltage (following table) is applied for one hour at maximum operation temperature ±3℃ then shall be set for 24±2 hours at room temperature and the initial measurement shall be conducted. Applied Voltage : (C : Capacitance) Test Temperature : 125±3℃ Test Time : 1000 +12/-0 hours Current Applied : 50 mA Max. Measure at room temperature after cooling for 24±2 hours.
	Capacitance	Char. Cap. Change NP0(N) Within ± 5% or ±0.5pF, whichever is larger of initial value X7R(X) ≤ ±15% of initial value	
	Q / D.F.	Class Ⅰ (NP0) : More Than 30pF : Q ≧ 350 30pF & Below:Q ≧ 275 + 2.5xC (C : Capacitance , pF) Class Ⅱ (X7R) : Shell meet the value in Table 1.	
	Insulation Resistance	1000MΩ or 50/CΩ, whichever Is Smaller	
External Visual		No defects or abnormalities.	Visual Inspection
Physical Dimension		Within The Specified Dimensions	Using Calipers
Resistance to Solvents	**Appearance**	No marking defects.	It is applicable to marked and/or coated components. Per MIL-STD-202 Method 215. Solvent 1: 1 part (by volume) of isopropyl alcohol 3 parts (by volume) of mineral spirits, or three parts (by volume) of a mixture of 80% (by volume) of kerosene and 20%(by volume) ethylbenzene. Solvent 4: 42 parts (by volume) of water 1 part (by volume) of propylene glycol monomethyl ether 1 part (by volume) of monoethanolamine
	Capacitance	Within The Specified Tolerance	
	Q / D.F.	Class Ⅰ (NP0) : To satisfy the specified initial value. Class Ⅱ (X7R) : Shell meet the value in Table 1.	
	Insulation Resistance	To satisfy the specified initial value	
Mechanical Shock	**Appearance**	No mechanical damage shall occur.	Solder the capacitor on P.C. Board shown in Fig 2. before testing. Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks). The specified test pulse should be Half-sine and should have a duration: 0.5ms, peak value: 1500g and velocity change: 15.4 ft/sec.
	Capacitance	Within The Specified Tolerance	
	Q / D.F.	Class Ⅰ (NP0) : To satisfy the specified initial value. Class Ⅱ (X7R) : Shell meet the value in Table 1.	
	Insulation Resistance	To satisfy the specified initial value	

Rated Voltage	Applied Voltage
V<100Vdc, Class Ⅰ	200%Rated Voltage
V<100Vdc, Class Ⅱ	100%Rated Voltage
V＜250Vdc＜1.0uF	150%Rated Voltage
V≦250Vdc≧1.0 uF	100%Rated Voltage
250Vdc≦V≦500Vdc＜0.1 uF	120%Rated Voltage
250Vdc≦V≦500Vdc≧0.1 uF	100%Rated Voltage
Less Than 1KVdc	120%Rated Voltage
More Than 1KVdc (include 1KV)	100%Rated Voltage

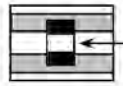
ACC Series Specifications & Test Conditions

Item		Specification	AEC-Q200 Test Conditions
Vibration	**Appearance**	No mechanical damage shall occur.	Solder the capacitor on P.C. Board shown in Fig 2. before testing.
	Capacitance	Within The Specified Tolerance	
	Q / D.F.	Class Ⅰ (NP0) : To satisfy the specified initial value. ClassⅡ(X7R) : Shell meet the value in Table 1.	Perform 12 cycles in each of the 3 mutually perpendicular axes of the capacitor (in total 36 cycles). Subject the capacitor to a simple harmonic motion varying the frequency logarithmically between 10 and 2000 Hz and return to 10 Hz (duration approx. 20 min) with an amplitude of 1.5 mm
	Insulation Resistance	To satisfy the specified initial value	
Resistance to Soldering Heat	**Appearance**	No mechanical damage shall occur.	ClassⅡ capacitor shall be set for 24±2 hours at room temperature after one hour heat treatment at 150 +0/-10℃ before initial measure.
	Capacitance	Char. Cap. Change NP0(N) Within 2.5% or ±0.25pF, whichever is larger of initial value X7R(X) ≤ ±10% of initial value	Preheat : At 150± 10℃ For 60~120sec Dip : Solder Temperature of 260± 5℃ Dip Time : 10 ± 1sec.
	Q / D.F.	Class Ⅰ (NP0) : To satisfy the specified initial value. ClassⅡ(X7R) : Shell meet the value in Table 1.	Measure at room temperature after cooling for 24±2 hours.
	Insulation Resistance	To satisfy the specified initial value	
ESD	**Appearance**	No mechanical damage shall occur.	Per AEC-Q200-002
	Capacitance	Within The Specified Tolerance	
	Q / D.F.	Class Ⅰ (NP0) : To satisfy the specified initial value. ClassⅡ(X7R) : Shell meet the value in Table 1.	
	Insulation Resistance	To satisfy the specified initial value	
Solderability	More than 95% of the termination surface should be soldered so the metal part does not come out or dissolve. 		(a)Preheat at 155℃ for 4 hours, immerse the capacitor in flux. Immerse in solder bath for 5+0/-0.5 sec. at 245±5℃ (b)Should be placed into steam aging for 8 hours 15 minutes. After preheating, immerse the capacitor in flux. Immerse in solder bath for 5+0/-0.5 sec. at 245±5℃ (c) Should be placed into steam aging for 8 hours 15 minutes. After preheating, immerse the capacitor in flux. Immerse in solder bath for 120±5 sec. at 260±5℃
Board Flex	**Appearance**	No mechanical damage shall occur.	Bending shall be applied to the 3.0 mm for X7R and 3mm for NP0 with rate of 1.0mm/sec. The duration of the applied forces shall be 60 sec.
	Capacitance	Char. Cap. Change NP0(N) ≤ ±5% of initial value X7R(X) ≤ ±12.5% of initial value	

ACC Series Specifications & Test Conditions

Item		Specification	AEC-Q200 Test Conditions
Electrical Characterization	**Appearance**	No mechanical damage shall occur.	Visual Inspection
	Capacitance	Within The Specified Tolerance	Class Ⅰ (NP0) :
	Q / D.F.	Class Ⅰ (NP0) : More Than 30pF : Q ≧ 1000 30pF & Below : Q ≧ 400+20C (C : Capacitance , pF) Class Ⅱ (X7R) : Shell meet the value in Table 1.	Class Ⅱ (X7R) :
	Insulation Resistance	1000MΩ or 50/CΩ, whichever Is Smaller	V≦500V, Rated Voltage V>500V, Applied 500Vdc Charge Time : 120sec. Is applied less than 50mA current.
	Withstanding Voltage	No dielectric breakdown or mechanical breakdown	V<100V : 250% Rated Voltage 100V≦V<500V: 200% Rated Voltage 500V≦V<1000V: 150% Rated Voltage 1000V≦V: 120% Rated Voltage for 1~5 sec. Current is limited to less than 50mA.
Terminal Strength	**Appearance**	No mechanical damage shall occur.	Apply a 18N force in parallel with the test jig for 60 sec. Chip Size 0603 Apply a 10N force in parallel with the test jig for 10 sec.
	Capacitance	Within The Specified Tolerance	
	Q / D.F.	Class Ⅰ (NP0) : To satisfy the specified initial value. Class Ⅱ (X7R) : Shell meet the value in Table 1.	
	Insulation Resistance	To satisfy the specified initial value	
Beam Load Test	The chip endures following force :		Place the capacitor in the beam load fixture. Apply a force.

Chip Length	Chip Thickness	Force Min.
≦2.5mm	>0.5mm	20N
≧3.2mm	<1.25mm	15N
	≧1.25mm	54.5N



Speed supplied the Stress Load: 2.5mm / sec.

ACC Series Specifications & Test Conditions

Table 1

Temp char : X7R

Size	Rated Voltage	Capacitance Range	D.F.(MAX)	
			High Temperature Exposure Temperature cycle Resistance to Solvents Mechanical Shock Vibration Resistance to solder heat ESD Initial Terminal Strength	Biased Humidity Operational Life
0603	DC 16V	All Capacitance	10.0%	20.0%
	DC 25V	All Capacitance	10.0%	20.0%
	DC 50V	All Capacitance	10.0%	20.0%
0805	DC 16V	All Capacitance	10.0%	20.0%
	DC 25V	All Capacitance	10.0%	20.0%
	DC 50V	All Capacitance	10.0%	20.0%
	DC 100V	C≧0.1uF	5.0%	10.0%
		C＜0.1uF	2.5%	5.0%
	>DC 100V	All Capacitance	2.5%	5.0%
1206	DC 25V	All Capacitance	10.0%	20.0%
	DC 50V	All Capacitance	10.0%	20.0%
	DC 100V	C≧0.1uF	5.0%	10.0%
		C＜0.1uF	2.5%	5.0%
	>DC 100V	All Capacitance	2.5%	5.0%
1210	DC 50V	All Capacitance	10.0%	20.0%
	DC 100V	C≧0.1uF	5.0%	10.0%
		C＜0.1uF	2.5%	5.0%
	>DC 100V	All Capacitance	2.5%	5.0%
1812	DC 50V	All Capacitance	10.0%	20.0%
	DC 100V	C≧0.1uF	5.0%	10.0%
		C＜0.1uF	2.5%	5.0%
	>DC 100V	All Capacitance	2.5%	5.0%
2220	DC 50V	All Capacitance	10.0%	20.0%
	DC 100V	C≧0.1uF	5.0%	10.0%
		C＜0.1uF	2.5%	5.0%
	>DC 100V	All Capacitance	2.5%	5.0%

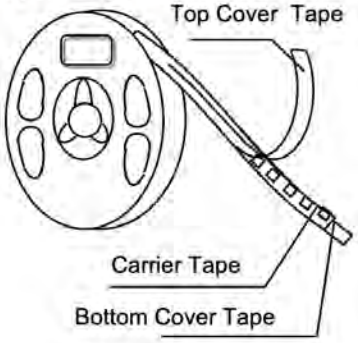
◆ Multilayer Ceramic Chip Capacitor

• Bulk Packing

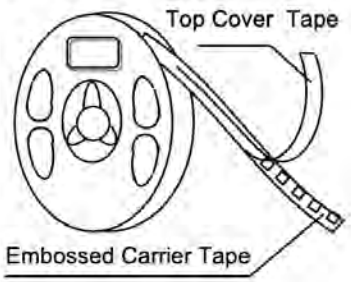
Standard packing 10Kpcs/pack, others according to customers' request.

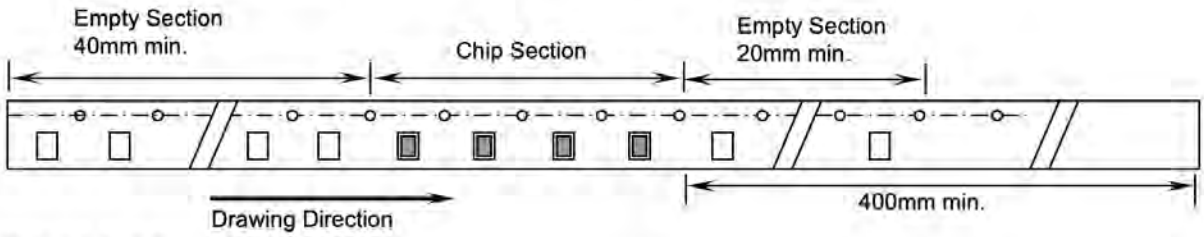
• Tape Packing

Paper Tape



Embossed Tape



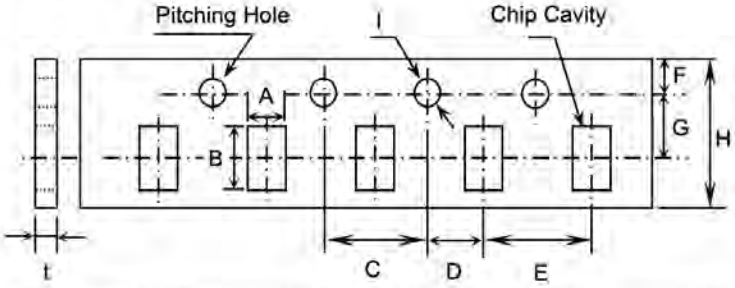


Material And Quantity (¢180mm)

Chip Size (EIA Code)	Dimension (mm) L	W	T	¢180mm reel Paper Tape	Plastic Tape
0201	0.6	0.3	T≤0.39	15,000 pcs/reel	N/A
0402	1	0.5	T≤0.70	10,000 pcs/reel	N/A
0603	1.6	0.8	T≤1.00	4,000 pcs/reel	N/A
0805	2	1.25	T≤1.00	4,000 pcs/reel	N/A
			T>1.00	N/A	3,000 pcs/reel
1206	3.2	1.6	T≤1.00	4,000 pcs/reel	N/A
			1.00<T≤1.25	N/A	3,000 pcs/reel
			T>1.25	N/A	2,000 pcs/reel
1210	3.2	2.5	T≤1.25	N/A	3,000 pcs/reel , 2,000 pcs/reel
			1.25<T≤2.40	N/A	2,000 pcs/reel , 1,000 pcs/reel
			T>2.40	N/A	500 pcs/reel , 1,000 pcs/reel
1808	4.6	2	T≤1.25	N/A	3,000 pcs/reel , 2,000 pcs/reel
			1.25<T≤2.40	N/A	2,000 pcs/reel , 1,000 pcs/reel
			T>2.40	N/A	500 pcs/reel , 1,000 pcs/reel
1812	4.6	3.2	T≤2.20	N/A	1,000 pcs/reel
			T>2.20	N/A	700 pcs/reel
1825	4.6	6.35	T≤2.20	N/A	700 pcs/reel
			T>2.20	N/A	400 pcs/reel
2208	5.7	2	T≤2.20	N/A	1,000 pcs/reel
2211	5.7	2.8	T≤2.20	N/A	1,000 pcs/reel
			T>2.20	N/A	700 pcs/reel
2220	5.7	5	T≤2.20	N/A	1,000 pcs/reel
			T>2.20	N/A	700 pcs/reel
2225	5.7	6.35	T≤2.20	N/A	700 pcs/reel
			T>2.20	N/A	400 pcs/reel

Tape Dimensions and Specifications

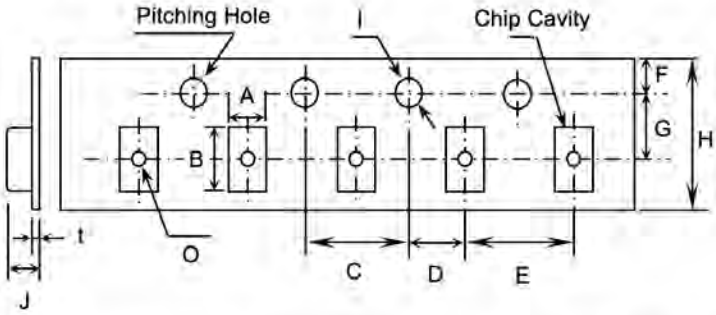
Paper Tape



Unit : mm

	0201	0402	0603	0805	1206	1210
A	0.37±0.1	0.61±0.1	1.10±0.2	1.50±0.2	1.90±0.2	2.90±0.2
B	0.67±0.1	1.20±0.1	1.90±0.2	2.30±0.2	3.50±0.2	3.60±0.2
C	4.00±0.1	-->				
D	2.0±0.05	-->				
E	2.00±0.1	-->	4.00±0.1	-->		
F	1.75±0.1	-->				
G	3.5±0.05	-->				
H	8.00±0.3	-->				
I	¢1.5+0.1/-0	-->				
t	1.1 max.	-->				

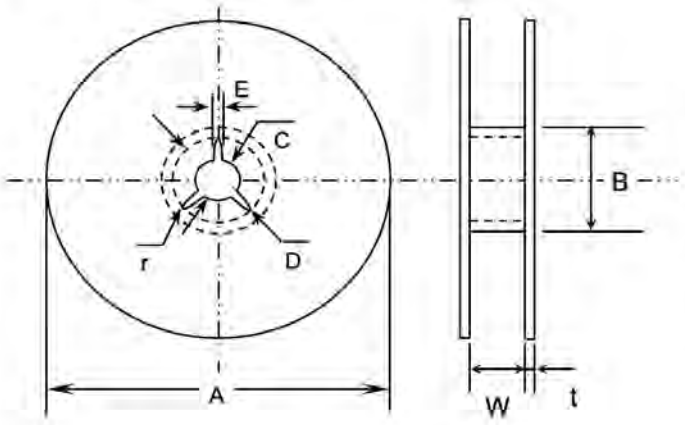
Embossed Tape



Unit : mm

	0805	1206	1210	1808	2208	1812	1825	2211	2220	2225
A	1.5±0.2	1.9±0.2	2.9±0.2	2.5±0.2	2.5±0.2	3.6±0.2	6.9±0.2	3.2±0.2	5.4±0.2	6.9±0.2
B	2.3±0.2	3.5±0.2	3.6±0.2	4.9±0.2	6.1±0.2	4.9±0.2	4.9±0.2	6.1±0.2	6.1±0.2	6.1±0.2
C	4.0±0.1	→								
D	2.0±0.05.	→								
E	4.0±0.1	→				8.0±0.1	→			
F	1.75±0.1	→								
G	3.5±0.05.	→		5.5±0.05	→					
H	8.0±0.3	→		12.0±0.3	→					
I	¢1.5+0.1/-0	→								
J	3.0 max.	→		4.0 max.	→					
t	0.3 max.	→								
O	1.0±0.1	→		1.5±0.1	→					

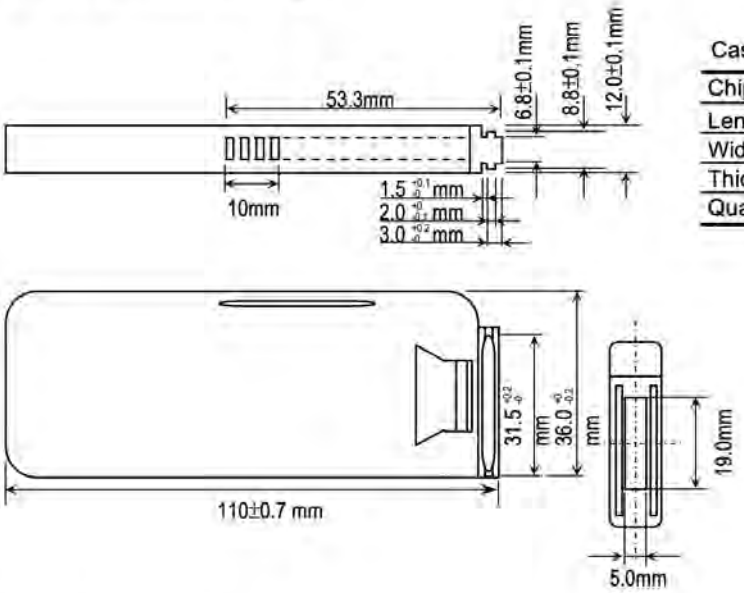
Reel Dimensions



Unit : mm

	0402 to 1210	1808 to 2220
A	¢ 382 max.	¢ 178±2.0
B	¢ 50 min.	¢ 60±0.2
C	¢ 13±0.5	¢ 13±0.5
D	¢ 21±0.8	¢ 21±0.8
E	¢ 2.0±0.5	¢ 2.0±0.5
W	10±0.15	13±0.3
t	2.0±0.5	17±1.4
r	1.0	1.0

Bulk Cassette Packing



Cassette Packing — Unit : mm

Chip Size	0402	0603	2012
Length	1.00±0.05	1.60±0.10	2.00±0.20
Width	0.50±0.05	0.80±0.10	1.25±0.20
Thickness	0.50±0.05	0.80±0.10	0.60±0.10
Quantity	50,000pcs	15,000pcs	10,000pcs

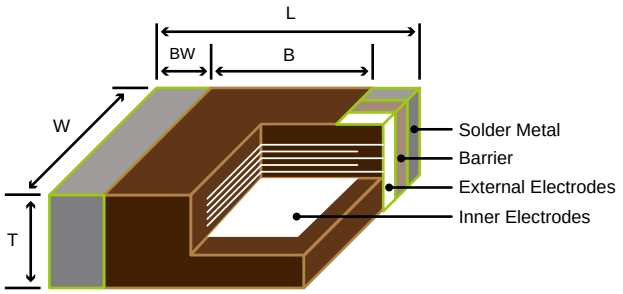
● Cover Tape Peel Force

The peel force of cover tape is 5 to 70 grams in the direction of arrow.

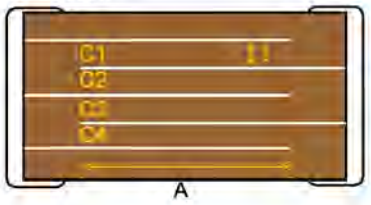
The Multilayer Ceramic Chip Capacitors supplied in bulk, cassette or taped & reel package are ideally suitable for thick-film Hybrid circuits and automatic surface mounting on printed circuit boards.

Mainly used in electric circuit for by-pass, filtering and smoothing circuit.

◆ Shapes and Dimensions



Cross Section



Dimension (mm) [inches]

EIA style	L	W	Tmax.	BWmin	Bmin.
0201	0.60±0.03 [.024±.002]	0.30±0.03 [.011±.002]	0.33 [.013]	0.10 [.004]	0.20 [.008]
0402	1.00±0.05 [.039±.002]	0.50±0.05 [.020±.002]	0.55 [.022]	0.15 [.006]	0.30 [.012]
0603	1.60±0.10 [.063±.004]	0.80±0.10 [.031±.004]	1.00 [.039]	0.15 [.006]	0.40 [.016]
0805	2.00±0.20 [.079±.008]	1.25±0.20 [.049±.008]	1.45 [.057]	0.20 [.008]	0.70 [.028]
1206	3.20±0.30 [.126±.012]	1.60±0.20 [.063±.008]	1.80 [.071]	0.30 [.012]	1.50 [.059]
1210	3.20±0.30 [.126±.012]	2.50±0.20 [.098±.008]	2.60 [.102]	0.30 [.012]	1.60 [.063]
1808	4.60±0.30 [.181±.012]	2.00±0.20 [.079±.008]	2.20 [.087]	0.30 [.012]	2.50 [.098]
1812	4.60±0.30 [.181±.012]	3.20±0.30 [.126±.012]	3.00 [.118]	0.30 [.012]	2.50 [.098]
1825	4.60±0.30 [.181±.012]	6.35±0.40 [.250±.016]	3.40 [.118]	0.30 [.012]	2.50 [.098]
2208	5.70±0.40 [.220±.016]	2.00±0.20 [.197±.008]	2.20 [.087]	0.30 [.012]	3.50 [.137]
2211	5.70±0.40 [.220±.016]	2.80±0.40 [.110±.016]	3.00 [.118]	0.30 [.012]	3.50 [.137]
2220	5.70±0.40 [.220±.016]	5.00±0.40 [.197±.016]	3.40 [.133]	0.30 [.012]	3.50 [.137]
2225	5.70±0.40 [.220±.016]	6.35±0.40 [.250±.016]	3.40 [.133]	0.30 [.012]	3.50 [.137]

$$C = \varepsilon_0 \cdot \varepsilon \frac{A \cdot N}{t}$$

C : Capacitance
ε_0 : Dielectric constant in the air
ε : Proportional dielectric constant
A : Overlap Area
t : Dielectric Thickness
N : Layers

◆ Nominal Capacitance and Tolerance

1. Standard Combination of Nominal Capacitance and Tolerance

Class	EIA Symbol	Tolerance	Nominal Capacitor
I	NP0	J (±5%),K (±10%)	E-12
Π	X7R	K(±10%), M(±20%)	E-3,E-6 E-12 Series
	X7T	K(±10%), M(±20%)	E-3,E-6 Series
	X7P	K(±10%), M(±20%)	E-3,E-6 Series
	X6S	K(±10%), M(±20%)	E-3,E-6 Series
	X5R	K(±10%), M(±20%)	E-3,E-6 Series

2. E Series (Standard Number)

E-Series	Application Capacitance											
E-3	1.0				2.2				4.7			
E-6	1.0		1.5		2.2		3.3		4.7		6.8	
E12	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2

◆EIA Designations

For Class I Dielectrics

Coefficient of capacitance (ppm/ °C)		Multiplier applicable to column		Tolerance of temp. coeff.(ppm/ °C)	
0.0	C	-1.0	0	30	G
1.0	M	-10	1	60	H
1.5	P	-100	2	120	J
2.2	R	-1000	3	250	K
3.3	S	-10000	4	500	L
4.7	T	+1	5	1000	M
7.5	U	+10	6	2500	N
		+100	7		
		+1000	8		
		+10000	9		

Ex.: C0G Negative 0±30ppm/ °C
U2J Negative 750±120ppm/ °C

For Class Π Dielectrics

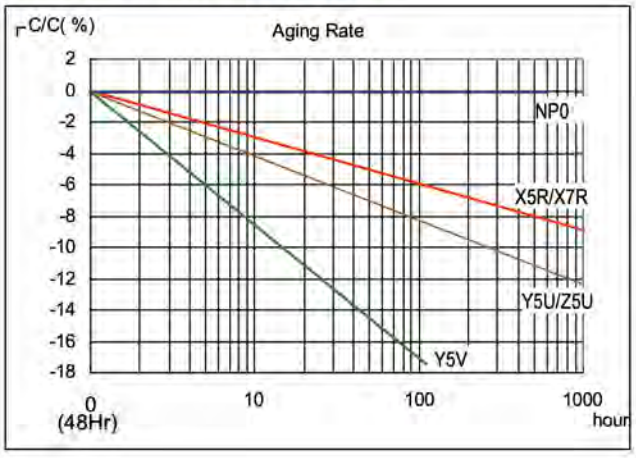
Low Temp. Symbol		High Temp. Symbol		Max. %△C Symbol	
-55°C	X	+45°C	3	±1.0%	A
-30°C	Y	+65°C	4	±1.2%	B
+10°C	Z	+85°C	5	±2.2%	C
		+105°C	6	±3.3%	D
		+125°C	7	±4.7%	E
		+150 °C	8	±7.5%	F
		+200 °C	9	±10.0%	P
				±15.0%	R
				±22.0%	S
				+22% /-33%	T
				+22% /-56%	U
				+22% /-82%	V

Ex.: X7R -55 ~ +125 °C ±15%
Y5V -30 ~ +85 °C +22%/-82%

◆Operating Temperature Range

Class	EIA Symbol	Dielectric Code	Temperature Range(°C)	Capacitance Change	Reference Temperature
I	NP0	N	-55°C ~ +125 °C	0±30 ppm/°C	25°C
	SL	L	-25°C ~ +85 °C	+350/-1000 ppm/°C	25°C
Π	X7R	X	-55°C ~ +125°C	±15%	25°C
	X6S	S	-55°C ~ +105°C	±22%	25°C
	X7P	P	-55°C ~ +125°C	±10%	25°C
	X7T	T	-55°C ~ +125°C	+22% /-33%	25°C
	X7S	R	-55°C ~ +125°C	±22%	25°C
	X5R	B	-55°C ~ +85°C	±15%	25°C

◆ Dielectric Material – Aging Rate

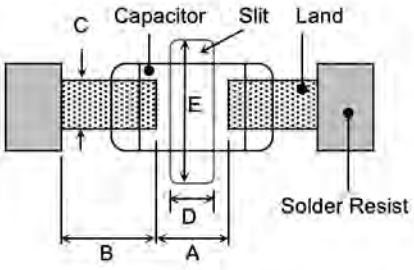


Aging Rate
NP0: 0
X7R/X5R : 1 ~ 4 % / decade
Y5U/Z5U : 4~6% / decade
Y5V : 6~10 % / decade
After performing De-Aging at 150±5 °C for 30 minutes and Placement at room temperature for 48 hours.

◆ Construction of Board Pattern

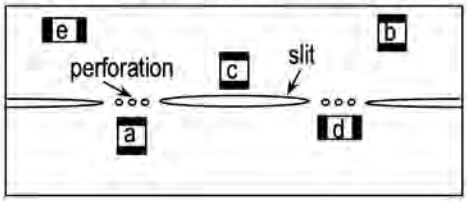
Improper circuit layout and pad/land size may cause poor solder joints between the component and the PC board. Insufficient solder may create a weak joint, and excessive solder may increase the potential for mechanical or thermal cracks in the ceramic capacitor. Therefore we recommend the solder pad/land size to be as shown in the following table:

1. Size and recommend land dimensions for reflow soldering



EIA Code	Chip (mm)		Land (mm)				
	L	W	A	B	C	D	E
0201	0.60	0.30	0.2~0.3	0.2~0.4	0.2~0.4	--	--
0402	1.00	0.50	0.3~0.5	0.3~0.5	0.4~0.6	--	--
0603	1.60	0.80	0.4~0.6	0.6~0.7	0.6~0.8	--	--
0805	2.00	1.25	0.7~0.9	0.6~0.8	0.8~1.1	--	--
1206	3.20	1.60	2.2~2.4	0.8~0.9	1.0~1.4	1.0~2.0	3.2~3.7
1210	3.20	2.50	2.2~2.4	1.0~1.2	1.8~2.3	1.0~2.0	4.1~4.6
1808	4.60	2.00	2.8~3.4	1.8~2.0	1.5~1.8	1.0~2.8	3.6~4.1
1812	4.60	3.20	2.8~3.4	1.8~2.0	2.3~3.0	1.0~2.8	4.8~5.3
1825	4.60	6.35	2.8~3.4	1.8~2.0	5.1~5.8	1.0~4.0	7.1~8.3
2208	5.70	2.00	4.0~4.6	2.0~2.2	1.5~1.8	1.0~4.0	3.6~4.1
2211	5.70	2.80	4.0~4.6	2.0~2.2	2.0~2.6	1.0~4.0	4.4~4.9
2220	5.70	5.00	4.0~4.6	2.0~2.2	3.5~4.8	1.0~4.0	6.6~7.1
2225	5.70	6.35	4.0~4.6	2.0~2.2	5.1~5.8	1.0~4.0	7.1~8.3

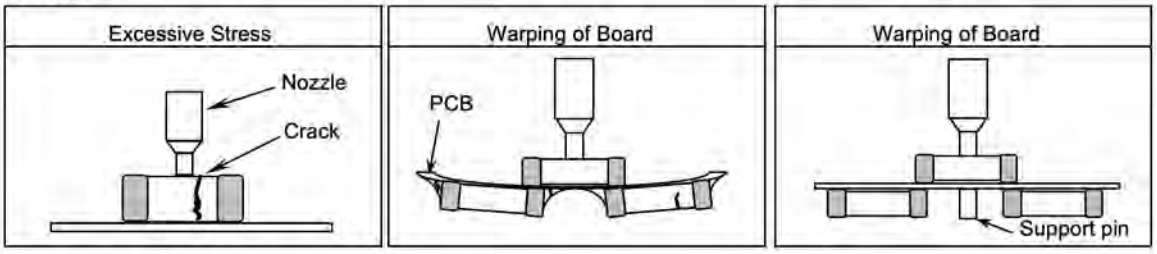
2. Mechanical strength varies according to location of chip capacitors on the P.C. board.
Design the layout of components on the PC board in such a way to minimize the stress imposed on the components, upon flexure of the boards in depanelization or other processes.



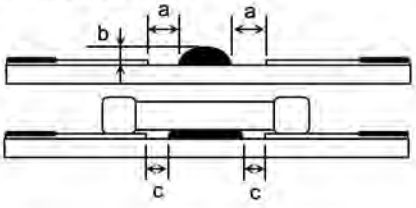
Component layout close to the edge of the board or the "depanelization line" is not recommended.
Susceptibility to stress is in the order of: a>b>c and d>e

◆ Mounting

1. Sometimes cracking can be caused by the impact load of the pick and place nozzle.
In the pick and place operation, if the low dead point is too low, excessive stress is applied to component. This may cause cracks in the ceramic capacitor, therefore it is required to move the low dead point of the nozzle to the higher level to minimize the board warpage and stress on the components. Nozzle pressure should be adjusted to 1N to 3N (static load) during the pick and place operation.



2. Amount of Adhesive

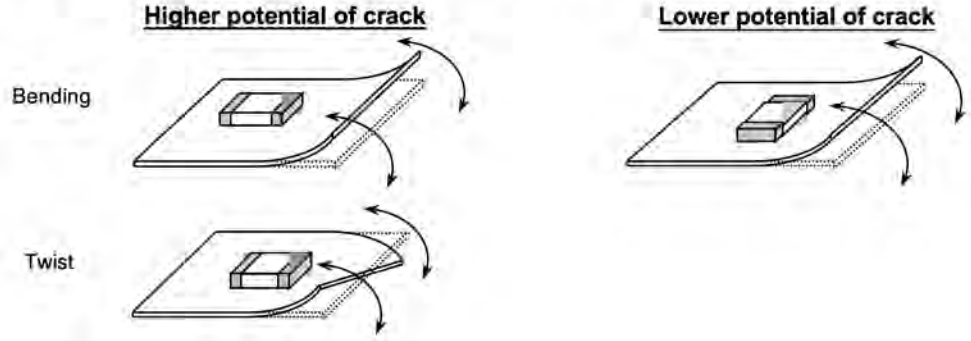


Example : 0805 & 1206

a	0.2mm min.
b	70 ~ 100 μm
c	Do not touch the solder land

◆ Handling after chip mounted

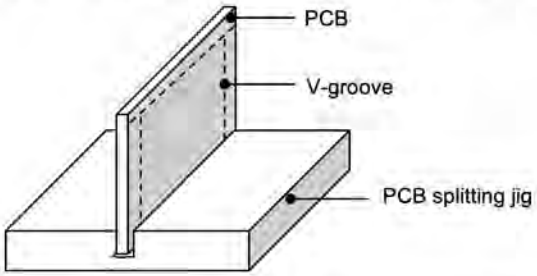
1. Proper handling of the PCB is recommended since excessive bending and twisting of the PC board may induce mechanical stress and cause internal cracking of the capacitor.

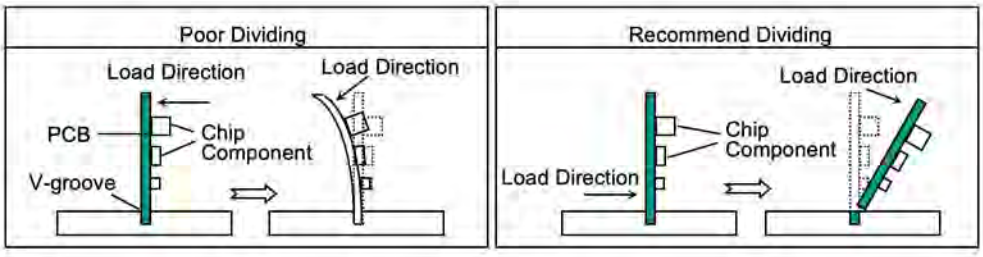


2. There is a potential of cracking if board is warped due to excessive load from the check pin.

3. Examples of PCB de-panelization jigs:

The outline of PCB breaking jig is shown below. It is recommended when dividing or breaking PCB that they are held near the jig where no bending will occur, this way there will be no compressive stress is applied to the capacitors on the PCB. Do not hold the PCB at a position which is far away from the jig, tensile stress to the capacitors may cause them to crack.

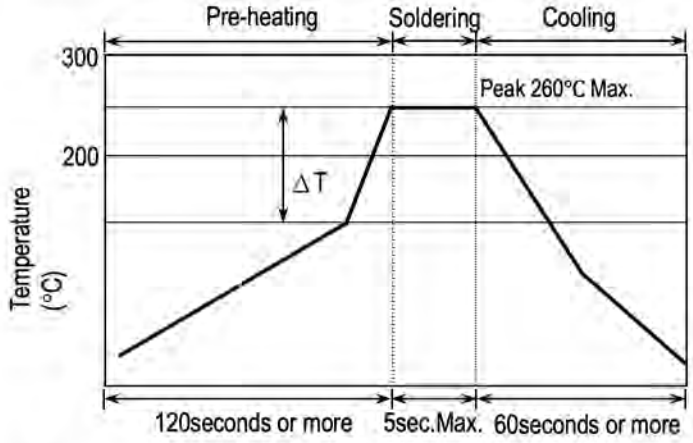




◆Soldering

1. Wave Soldering

Most of components are wave soldered with solder at Peak Temperature. Adequate care must be taken to prevent the potential of thermal cracks on the ceramic capacitors. Refer to the soldering methods below for optimum soldering benefits.



Soldering Method	Peak Temp.(°C) / Duration (sec)
1206/0805/0603	ΔT ≤ 100~150°C max.
Pb-Sn Solder	250°C(max.) / 3sec(max.)
Lead Free Solder	260°C(max.) / 5sec(max.)

Recommended solder compositions
Sn-37Pb (Pb - Sn Solder)
Sn-3.0Ag-0.5Cu (Lead Free Solder)

To optimize the result of soldering, proper preheating is essential:

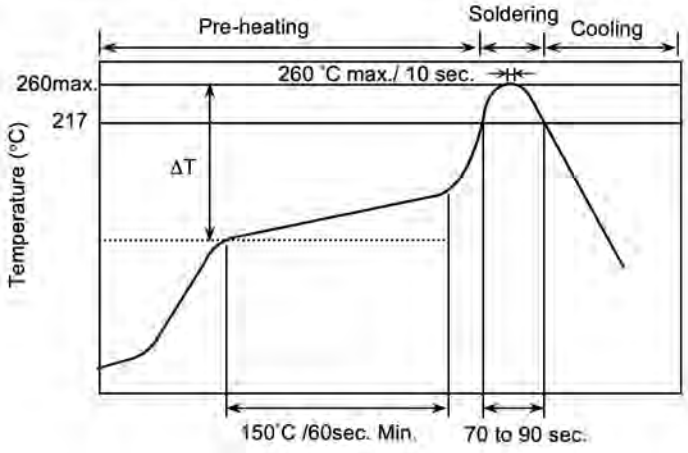
1) Preheat temperature is too low
   a. Flux flows to easily
   b. Possibility of thermal cracks
2) Preheat temperature is too high
   a. Flux deteriorates even when oxide film is removed
   b. Causes warping of circuit board
   c. Loss of reliability in chip and other components

Cooling Condition:
Natural cooling in air is recommended. Forced cooling should be avoided, however if the chips are dipped into a solvent for cleaning, the temperature difference (ΔT) between the solvent and the chips must be less than 100˚C.

2. Reflow Soldering

Preheat and gradual increase in temperature to the reflow temperature is recommended to decrease the potential of thermal crack on the components. The recommended heating rate depends on the size of component, however it should not exceed 3˚C/Sec.

Recommend reflow profile for Lead-Free soldering temperature Profile (J-STD-020D)

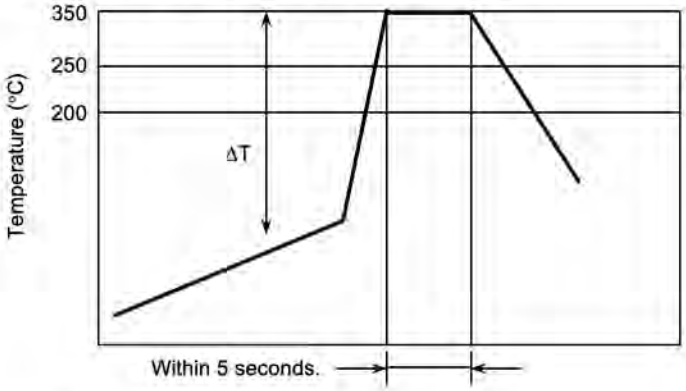


Soldering Method	Change in Temp.(°C)
1206 and Under	ΔT ≤190°C
1210 and Over	ΔT ≤130°C

※ The cycles of soldering : Twice (Max.)

3. Hand Soldering

Sudden temperature changes in ceramic capacitors will result in a temperature gradient within the component and therefore may cause internal thermal cracking. In general a hand soldering method is not recommended unless proper preheating and handling practices have been taken. Care must also be taken not to touch the ceramic body of the capacitor with the tip of solder Iron. The soldering iron tip should always be placed on to the solder pad.



Soldering Method	Change in Temp.(°C)
1206 and Under	ΔT ≤150°C
1210 and Over	ΔT ≤130°C

How to Solder Repair by Solder Iron

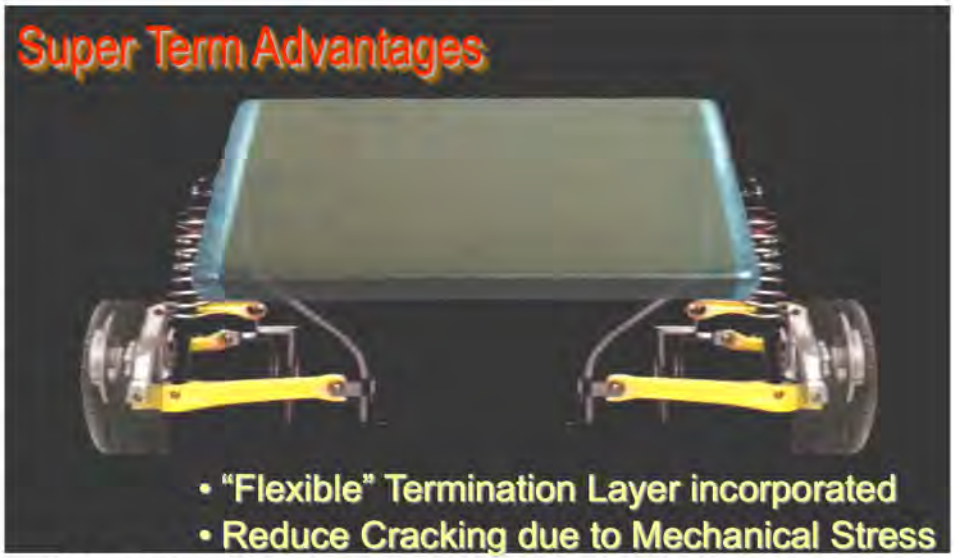
1) Selection of the soldering iron tip
The required temperature of soldering iron for any type of repair depends on the type of the tip, the substrate material, and the solder land size.

2) recommended solder iron condition
a.) Preheating Condition : Board and components should be preheated sufficiently at 150°C or over, and soldering should be conducted with soldering iron as boards and components are maintained at sufficient temperatures
b.) Soldering iron power shall not exceed 30 W.
c.) Soldering iron tip diameter shall not exceed 3mm.
d.) Temperature of the iron tip shall not exceed 350°C, and the process should be finished within 5 seconds. **(refer to MIL-STD-202G)**
e.) Do not touch the ceramic body with the tip of solder iron. Direct contact of the soldering iron tip to ceramic body may cause thermal cracks.
f.) After soldering operation, let the products should be allowed to cool down naturally in air.

◆Storage

Store the capacitors where the temperature and relative humidity do not exceed 40°C and 70%RH. We recommend that the capacitors be used within 12 months from the date of manufacturing. Store the products in the original package and do not open the outer polyethylene bag until just before usage. If it is open, seal it as soon as possible or keep it in a desiccant with a desiccation agent.

Internal MLCC cracking can result in serious failure modes. If ceramic capacitors are subjected to severe mechanical stress, a bending crack may occur. This crack can run through two or more electrodes of opposing polarity and result in a short circuit. Typical bending cracks are shown below. In the worst-case scenario, these short circuits may lead to the MLCC overheating and catastrophic failure.

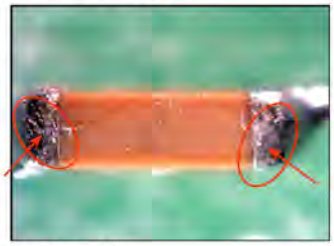


Typical Applications are power circuit input and output filtering, smoothing...

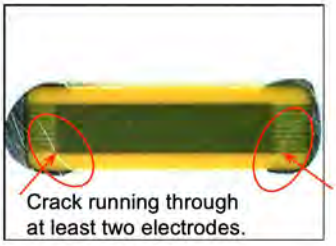
Standard termination construction may result in cracking during PCB bending, vibration, Depanelizing, etc.

Actual Examples:

Failure Mode Type 1



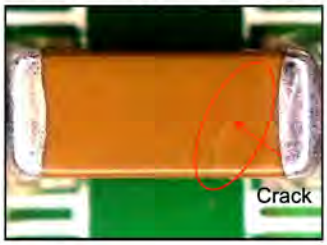
Surface View



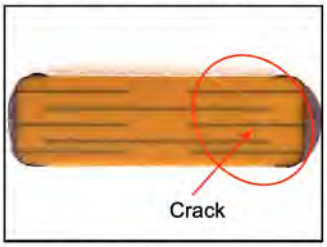
Cross Section View

The failure mode results from PCB bending forces. These cracks may not be visible on the MLCC surface. Cross sectional analysis is required to determine these internal cracks.

Failure Mode Type 2 (wetting greater than 2/3 of thickness)



Top View

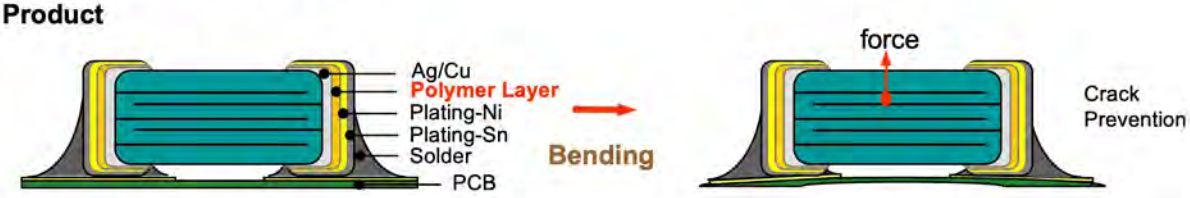


Cross Section View

MLCC cracking frequently occurs during the circuit board depanelizing process. The root cause is knife (blade) vibration during the process.

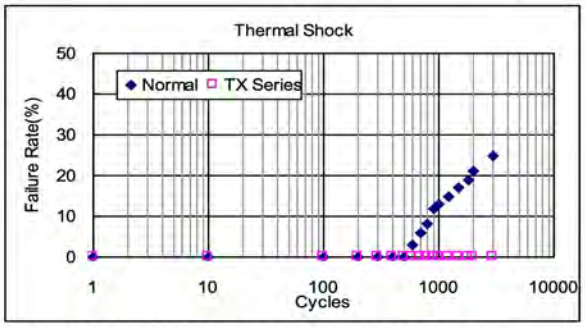
Holy Stone has developed the **"Super Term" Series (TX suffix in the part number),** which incorporates a "polymer layer" in the termination structure. This construction effectively absorbs external forces, reduces the incidence of cracking and improves overall product reliability. The Super Term product design is suitable for the applications including: high temperature automotive, power circuits and other critical end products with extreme processing conditions.

TX Product



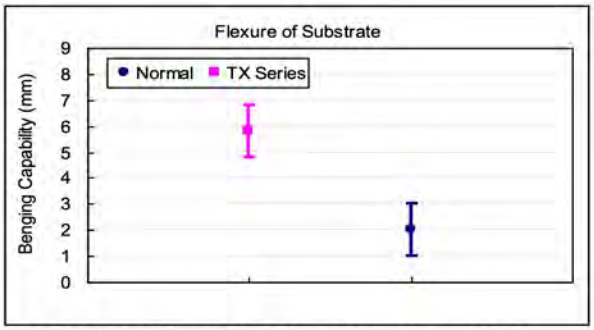
Reliability/Durability Comparison

(a) Thermal Shock Comparison (0805/X7R)

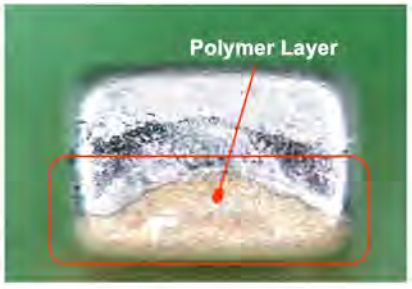


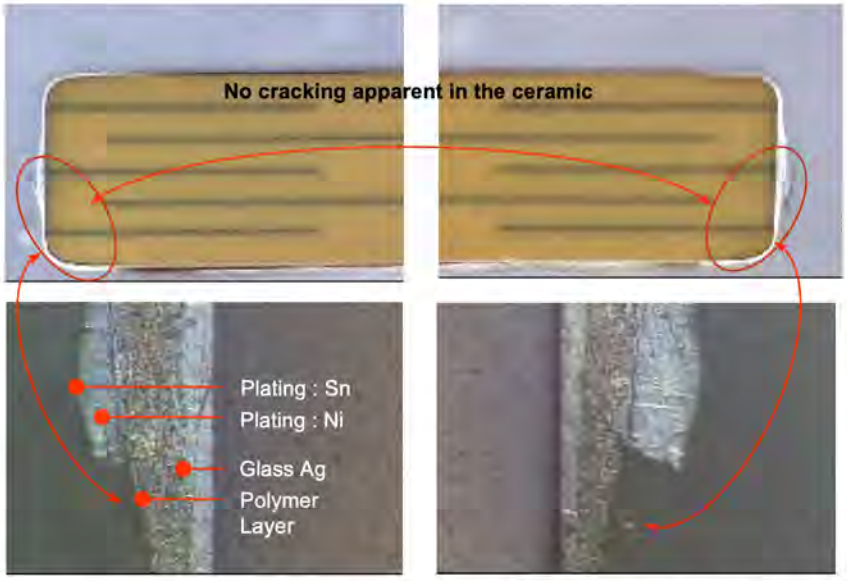
Thermal shock test on standard termination results in inception of failure at 500 cycles. Super Term TX Series reliability improves to over 3000 cycles.

(b) Substrate Flexure Comparison (0805/X7R)



Bending test on Super Term shows an improvement of about 5.0 mm bend vs. an average of about 2.0 mm. for standard termination.



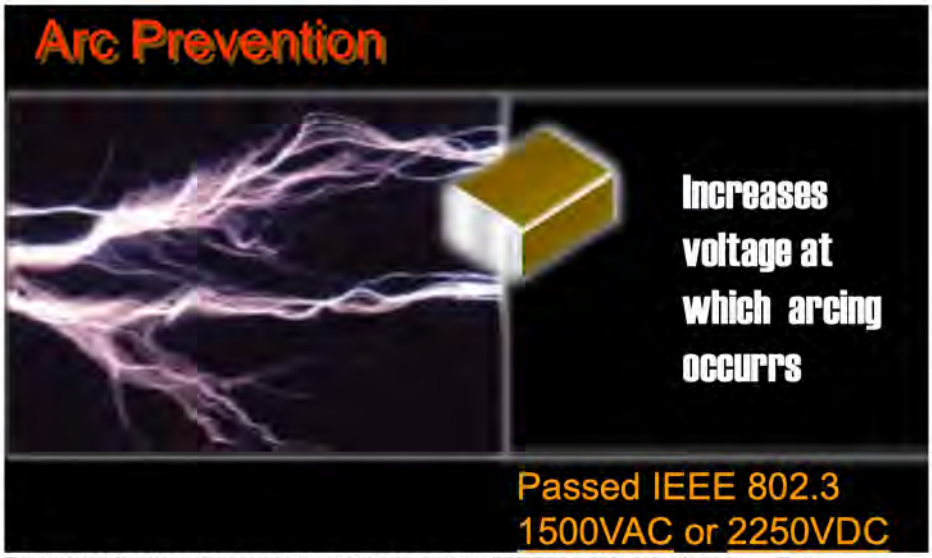


During destructive bending test, the PCB is subjected to bending until capacitor failure. With Super Term there is no cracking damage in the ceramic. Super Term effectively prevents ceramic body cracking during extreme mechanical stress as simulated by this test.

Super Term failures resulting from destructive bending test tend to occur in the OPEN mode and not short circuit mode typical of standard termination failures. The Super Term (polymer layer) design is a polymer material and can be seen in the above photo.

MLCC Arc Prevention – for Hi-Pot Testing

Due to the open and porous nature of the surface of the X7R dielectric, moisture and/or dirt which will have a lower resistance than the dielectric grains, can become entrapped in the surface. Dirt can also include any flux residues as a result of the soldering process. This dirt/flux as well as becoming entrapped into the surface will, in itself, attract additional moisture onto the surface thus reducing the surface resistance and the voltage at which arcing occurs. Surface arcing or flashover at worst can cause equipment failure during isolation testing and, in addition, will leave a carbon track on the surface which can lead to eventual failure of the capacitor.



Typical Applications for telecommunication devices(IEEE802.3) in LAN interface, Ballast…

Holy Stone has developed an Arc Prevention coating process that coats the surface of the dielectric without encroaching onto the termination material. This coating makes the surface of the dielectric non porous and prevents moisture and dirt becoming trapped thus reducing the surface resistance and the arcing voltage of the capacitor. It has been shown that the arcing voltage can be increased by up to 65% on soldered parts by using the **Holy Stone** Arc Prevention Coating.

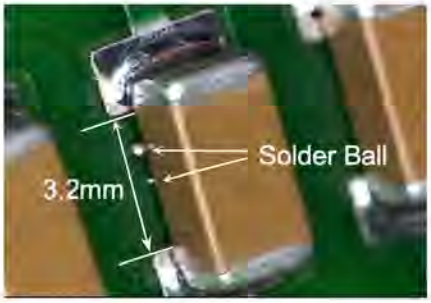
Typical surface arcing on X7R MLCC is from termination-to-termination (shown in polarized light)

NP0 & X7R Material Characteristic Comparison

Item	NP0	X7R
Dielectric Constant	30 ~ 100	2000 ~ 4000
I. Resistance	>10^{13} Ω	>10^{11} Ω
B.D. Voltage	70~80 Vdc/um	40~50 Vdc/um
Grain Size	< 500nm	900nm ~ 1500nm
Grain Size (x8000)		
Porosity (x1000)		

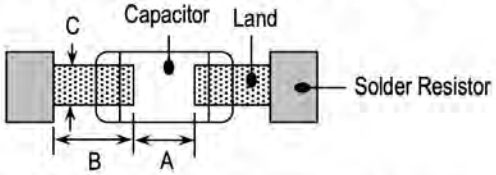
- The different grain shape and size will lead to different grain density after sintering.
- The grain size of NP0 dielectric is smaller than that of X7R resulting a denser and less porous structure.
- Surface porosity will trap dirt, flux and moisture causing the surface resistance to dramatically decrease.
- Low surface resistance will cause the arcing voltage to reduce, possibly leading to failure of the capacitor or equipment during isolation testing.
- Using the **Holy Stone** Arc Prevention coating effectively makes the surface of X7R dielectric similar to that of NP0.

Creepage distance v.s. Arcing Voltage



Solder balls reduce the creepage distance between terminations and thus reduce the arcing voltage

Recommended Solder Pad Design



EIA Code	Chip (mm)		Land (mm)		
	L	W	A	B	C
1808	4.6±0.3	2.0 ±0.2	3.2~3.6	1.2~2.4	1.5~1.8
1812	4.6±0.3	3.2 ±0.2	3.2~3.6	1.2~2.4	2.3~3.0
2208	5.7±0.4	2.0 ±0.2	4.0~4.6	1.2~2.4	1.5~1.8
2211	5.7±0.4	2.0 ±0.3	4.0~4.6	1.2~2.4	2.0~2.6
2220	5.7±0.4	5.0 ±0.4	4.0~4.6	1.2~2.4	3.5~4.8

The distance between terminations also has a direct effect on the arcing voltage. The greater the distance (chip size) the higher this voltage will be. Solder pad design will have a significant effect on the arcing of high voltage capacitors. Above is our recommended solder pad land design or each chip size.

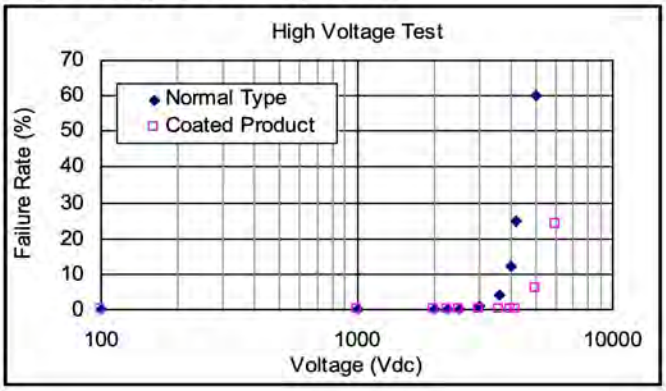
Arc Prevention Coating

The application of the Arc Prevention coating, which is a high insulation resistance material, coats the surface of the dielectric with a smooth and non porous layer that prevents moisture entering the surface pours and also aids cleaning post soldering. The following diagrams show the difference between coated and non coated X7R components.

Surface Comparison

Item	Porosity (x1000)
Before	
After	

High Voltage Test Comparison



- The coating reduces the porosity of the X7R surface and provides a smooth surface which help prevent surface arcing.
- The maximum Hi-pot test level will be increased by >1000Vdc after coating with both unsoldered and soldered components.

Using the Holy Stone Arc Prevention coating increases the surface arcing voltage of X7R capacitors to almost that of an equivalent NP0 part. However, the higher dielectric constant of X7R allows for higher capacitance values to be achieved in any given case size.

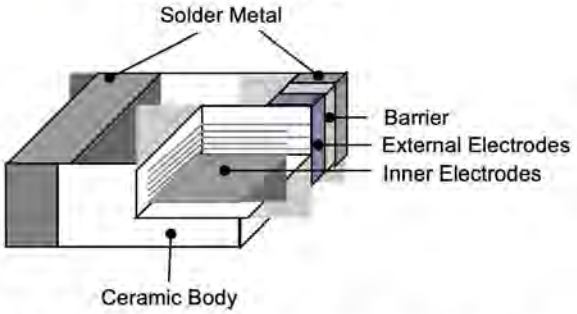
The Holy Stone Arc Prevention coating provides a total solution to the harmful effects of surface arcing.

Description:

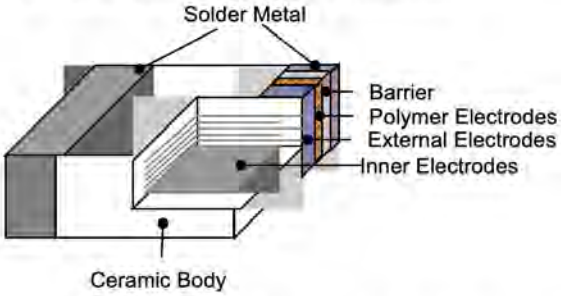
MLCC : NP0, X7R, X7S, X5R, X7P, X7T, X6S dielectrics.

Basic Construction/Homogenous Material :

(a) Standard Type



(b) "X" Type: Super Termination (Option)



- Multi-layer Ceramic Chip capacitors are Homogenous devices manufactured from materials that cannot be mechanically disjointed into different materials.
- Multi-layer Ceramic Chip products : Standard sizes are fully RoHS compliant.

RoHS Status	Lead-Free Status / MSL level
※ External plating : 100% Matte Sn as Standard	※ Pb-free Reflow & Wave Solder compliant, MSL=1 Reflow : 260℃ max recommended Wave : 260℃ max recommended Wave & Reflow profile refer to IHHEC recommended solder profile.

Part Number Designation:
(Generally no change to P/N, but available as P/N prefix at customer request)

RoHS Compliant : No Change to P/N
Pb-Free : No Change to P/N

Product Marking :
(available at customer request, highlighted or marked on reel and container)

Pb free : Pb free

refer to JEDEC&IPC Std.

禾伸堂
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Edition_2022.01

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