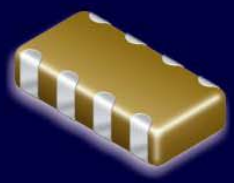
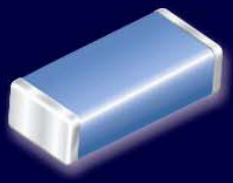
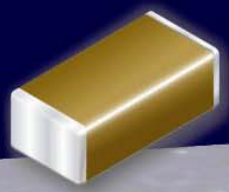
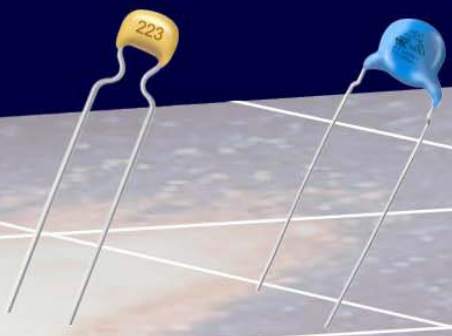
CERAMIC CAPACITOR

2007-2008









HEC

禾伸堂企業股份有限公司

Holy Stone Enterprise Co., Ltd.

▪ Introduction

▪The Company

Holy Stone Enterprise Company Ltd. (Holy Stone) was established in June of 1981 as an agent and distributor of electronic components. In 1994, 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 significant 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 was founded by five engineers in 1981. Since this point Holy Stone has maintained a focus and commitment to providing customers with innovative products and exceptional service. The result of that unwavering commitment is evident is Holy Stone's phenomenal growth (2006 revenues of US$360 million). Holy Stone also maintains a high profile on the Taiwan Stock Exchange, ranked in the top 100 companies and the leader among its peers.

▪Manufacturing Facilities

Holy Stone capacitors are produced in a modern 40,000 square meter factory located in Lungtan, Taiwan. In addition to the Lungtan factory, Holy Stone has facilities in Dongguan and Wujiang China. The advanced materials research laboratory is located in Japan. The factory operating systems are certified to ISO-9001,ISO-14000 and QS-9000.

▪Sales and Support Locations

Holy Stone administrative Headquarters are located in Taipei, Taiwan.
Holy Stone maintains sales and support offices in Kaohsiung, Taiwan, Dongguan, China and Shanghai, China.

Holy Stone Enterprise Company Ltd has subsidiary companies in North America and in Europe. " HolyStone International", located in Murrieta, California, U.S.A. is responsible for sales and technical support in the Americas. "HolyStone (Europe) Ltd.", located in Norwich, England is responsible for sales and technical service for Europe. Holy Stone also has a network of independent Representatives, Distributors and Agents throughout the world.

▪The Environment

Holy Stone is committed to the cause of achieving and maintaining a healthy environment. The factory is Certified to ISO-14000 and all standard products are designed and produced conforming to full RoHS compliance.

▪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. Those contributions come from all of our employees, whether they are engaged in administrative functions, manufacturing our goods or servicing our customers. Holy Stone strives to maintain a work environment that stimulates creativity, encourages enthusiasm and rewards results.

Our employees are Holy Stone, and you should know Holy Stone.

Holy Stone

Holy Stone … a leader in ceramic capacitors!

- High capacitance NPO MLCC's to replace Film Capacitors for xDSL
- High C/V MLCC's for DC/DC Converters and Power Supplies
- High Voltage MLCC's for Inverter and Data Communication
- Trigger MLCC's for High Energy Discharge for Strobe
- Low Profile Capacitors – Thin Type X7R, X5R, Y5V
- Hi-Q Value and Low ESL at High Frequency
- X2Y3 and X1Y2 Safety Certified MLCC's
- X1Y2 and X1Y1 Safety Certified Disc Capacitors
- High Voltage Disc Capacitors for Inverter and Power Supplies
- Large Size High Voltage/High Capacitance for Power Applications
- Polymer Terminations (Superterm) for crack prevention
- Coated Products for surface arc prevention

A partner you can trust

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Product Series		Application	Page
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	SCC series -- Safety Capacitors	For Isolation and Protection Circuits (UL,EN132400 Class X2/Y3,X1/Y2)	13-16
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	NCC series -- Normal Chip Capacitors	For Decoupling Circuits	25-32
	HCC series -- High Capacitance MLCC	For Smoothing (DC to DC) and Decoupling Circuits	33-38
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	MCA series -- Multilayer Capacitor Arrays	For High Density Placement Requirement (for Cellular Phone,Pagers, Mother Board...)	59-64
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	MMC series -- Molding Style Capacitors	For Power Circuits (Backlight Inverter, DC to DC,...)	69-72
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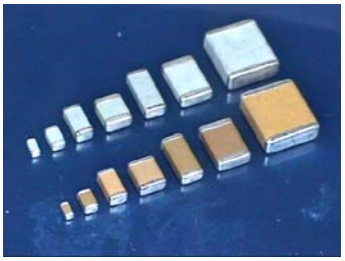
	HDC series -- High Voltage Ceramic Disc Capacitors	For xDSL, Power Circuits (Backlight Inverter, Power Supplier,...)	81-86
	HDC series -- Ultra High Voltage Ceramic Capacitors	For 10KV to 20KV Application (Pump, Hybrid engine ,Power Supplier,...)	87-88
	SDC series -- Safety Ceramic Disc Capacitors	For xDSL,Set Top Box, VOIP , Power Supplier (UL,CSA,EN132400 Class X1/Y2,X1/Y1)	89-94
	RDC series -- Radial Dipped Ceramic Capacitors	For Car Electronic , Inverter and Converter, Power Supplier	95-98
	RDH series – Ultra High Voltage Radial Dipped Cap	For Fuel pump, Water pump, Hybrid engine ,Power Supplier	99-104
	AXC series – Axial Leader Ceramic Capacitors	For General Electronic, Power supplier...	105-108

Multilayer Ceramic Chip Capacitors
[High Voltage Capacitor]
HVC Series – Middle Voltage (100V-1KV)



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 C0G (NPO) and X7R characteristics in 0603 to 2225 sizes with working voltages up to 1KV.

◆ Features

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

◆ Applications.

- ❑ Suitable for LAN/WLAN interface, Back-Lighting Inverter ,DC-DC Converters, Ballast, Modems & Power Supplies.

◆ Summary of Specification

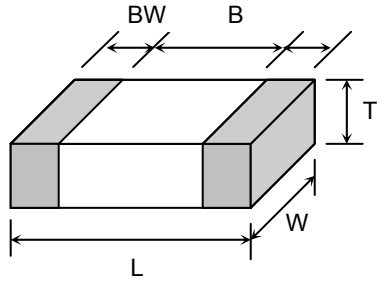
Operation Temperature	-55~+125 ℃
Rated Voltage	100Vdc to 1000Vdc
Temperature Coefficient	NPO : ≤ ± 30ppm/ ℃ , -55~+125 ℃ (EIA Class Ⅰ)
	X7R : ≤ ± 15% , -55~+125 ℃ (EIA Class Ⅱ)
Capacitance Range	NPO :2pF to 100nF ; X7R :150pF to 2.2uF
Dissipation Factor :	NPO : Q≧1000 ; X7R : D.F.≦2.5%
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller
Aging	NPO:0% ; X7R: 2.5 % 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	1210	X	103	K	102	T	X
Product Code C: MLCC (Multilayer Ceramic Chip of Capacitor)	**Chip Size** EX.: 0603 : 1.6x0.80mm 0805 : 2.0x1.25mm 1206 : 3.2x1.60mm 1210 : 3.2x2.50mm 1808 : 4.6x2.00mm 1812: 4.6x3.20mm 2220 : 5.7x5.00mm	**Dielectric** Ex.: N: NPO 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.: 251:250Vdc 631:630Vdc 102:1000Vdc	**Packaging** T: Taping &Reel B: Bulk	**Special Requirement** Ex.: O: Arc Prevention Coating X: Cushion Termination (Super Term)

◆ Dimension

Unit : mm [inches]

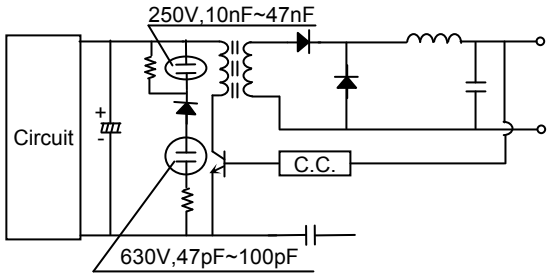


TYPE	L	W	T (max)	B (min)	BW (min)
0603	1.60±0.1 [.063±.004]	0.80±0.1 [.031 ±.004]	0.90 [.039]	0.40 [.016]	0.15 [.006]
0805	2.00±0.20 [.126±.012]	1.25±0.20 [.126±.012]	1.45 [.057]	0.70 [.059]	0.20 [.012]
1206	3.20±0.30 [.126±.012]	1.60±0.20 [.126±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.30 [.126±.012]	2.50±0.20 [.126±.012]	2.60 [.102]	1.60 [.059]	0.30 [.012]
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	4.6±0.30 [.220±.012]	6.35±0.40 [.250±.016]	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]
2225	5.7±0.40 [.220±.016]	6.35±0.40 [.250±.016]	3.00 [.118]	3.50 [.137]	0.30 [.012]

◆ Application

Example Circuit

DC-DC Converter



◆ Capacitance Range

Temperature Characteristic	Size	Rated Voltage	Capacitance Range (pF)
NPO	0603	100V	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
		200V	
	0805	100V	
		200V	
		250V	
		500V	
	1206	200V	
		250V	
		500V	
		1KV	
	1210	200V	
		250V	
		500V	
	1808	1KV	
	1812	1KV	
	2220	1KV	
	1825	250V	
		500V	
		1KV	
	2225	250V	
		500V	
		1KV	

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

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

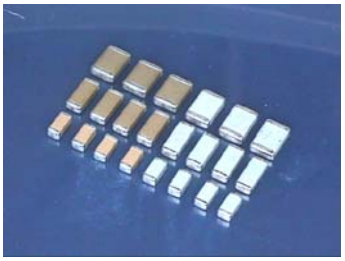
◆ Capacitance Range

Temperature Characteristic	Size	Rated Voltage	Capacitance Range (pF) 151 181 221 271 331 391 471 561 681 821 102 122 152 182 222 272 332 392 472 562 682 822 103 123 153 183 223 273 333 393 473 563 683 823 104 124 154 184 224 274 334 394 474 564 684 824 105 155 225
X7R	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
	0805	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 C
		200V	B/C B/C B/C B/C B/C B/C B/C B/C B/C B/C B/C B/C B/C B/C B/C B/C B/C B/C B/C B/C B/C B/C B/C D D D D
		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 D D D D
		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 C C C C
	1206	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 B/C B/C B/C B/C C C C C D E E E E E E E
		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 D D D
		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 D D D
		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 C C C C D
		630V	D D D D D D D D D E E E E
		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
	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 D E E E E 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
		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
		500V	D D E E E F F
		1KV	D D D D D E F F
	1808	500V	D D D D D D D D D D D D D E E F
		1KV	D D D D E E E F F F F
	1812	200V	D D D D D D D D D/E D/E D/E D/E D/E D/E D/E D/E D/E D/E D/E D/E D/E E E E E E/F
		250V	D D D D D D D D D/E D/E D/E D/E D/E D/E D/E D/E D/E D/E D/E D/E D/E E E E F G
		500V	D D D D D D D D D E E E E E F G H H
		1KV	D D D D D D D D D D D D D D D D E E E E E E F F F F F G G H H
	2220	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 E E E E F F G
		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 E E E E E F F F F G G H
		1KV	D D D D D D D D D D D D D D D E E E E E E E E F F F F F G G H H
	1825	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
		500V	D E E E E E E E E E F F F F F F G
		1KV	D E E E E E E F F F F F G
	2225	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 E E E E F F G
		500V	D D D D D D E E E E E E E F F F F F F F G
		1KV	D E E E E E E E E F F F F F F G H

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

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

Multilayer Ceramic Chip Capacitors
[High Voltage Capacitor]
HVC Series – High Voltage Capacitors (2KV)



This series is offered in C0G(NPO) and X7R temperature characteristic in sizes from 1206 to 2220. This series can passed 1500VAC or 2250VDC Hi-Pot.

◆ Features

- ❑ Standard for telecommunication devices (IEEE802.3) in LAN interface.
- ❑ Available with proprietary coating to prevent arcing and pass Hi-Pot test
- ❑ Surface mount suited for wave and reflow soldering
- ❑ Special internal electrode design offers the highest voltage rating
- ❑ RoHS compliant

◆ Application

- ❑ Suitable for telecommunication devices in LAN interface
- ❑ Ballast capacitor for back light inverter applications

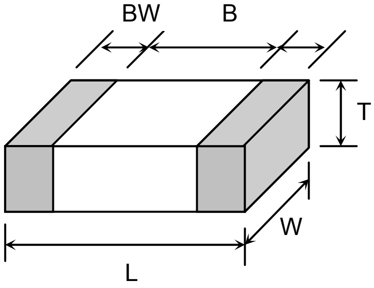
◆ Summary of Specification

Operation Temperature	-55~+125 ℃
Rated Voltage	2KVdc
Temperature Coefficient	NPO : ≤ ± 30ppm/ ℃ , -55~+125 ℃ (EIA Class Ⅰ)
	X7R : ≤ ± 15% , -55~+125 ℃ (EIA Class Ⅱ)
Capacitance Range	NPO :2pF to 470pF ; X7R :150pF to 10nF
Dissipation Factor :	NPO : Q≧1000 ; X7R : D.F.≦2.5%
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller
Aging	NPO:0% ; X7R: 2.5 % per decade of time
Dielectric Strength	120% Rated Voltage

◆ How To Order

C	1206	X	102	K	202	T	O
Product Code C: MLCC (Multilayer Ceramic Chip of Capacitor)	**Chip Size** Ex.: 1206 : 3.2x1.6mm 1808 : 4.6x2.0mm 1812 : 4.6x3.2mm 2220 : 5.7x5.0mm	**Dielectric** Ex.: N: NPO X: X7R	**Capacitance Unit : pF** Ex.: 2R0:2.0pF 100:10x10^0 471:47x10^1 102:10x10^2	**Tolerance** Ex.: C:+/-0.25pF D:+/-0.50pF J :+/- 5% K :+/-10% M:+/-20%	**Rated Voltage** Ex.: 202:2000Vdc	**Packaging** T: Taping &Reel B: Bulk	**Special Requirement** Ex.: O: Arc Prevention Coating X: Cushion Termination (Super Term)

Dimension



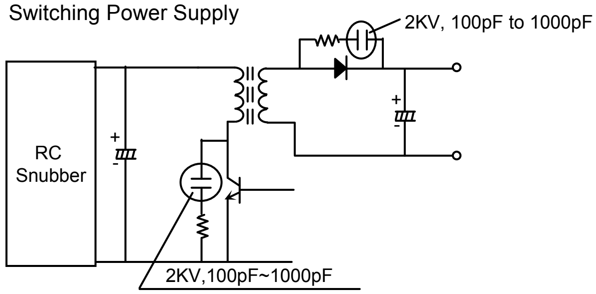
Unit : mm [inches]

TYPE	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]
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]
2220	5.7±0.40 [.220±.016]	5.00±0.40 [.197±.016]	3.00 [.118]	3.50 [.137]	0.30 [.012]

Application

Example Circuit

Switching Power Supply



Capacitance Range

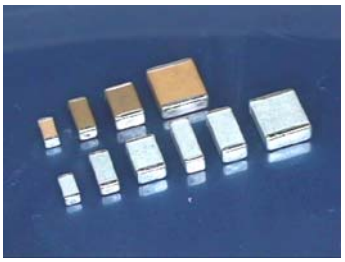
Temperature Characteristic	Size	Rated Voltage	Capacitance Range (pF)																																		
			2R0	3R3	3R9	5R0	8R2	100	120	150	180	220	270	330	390	470	560	680	820	101	121	151	181	221	271	331	391	471	561	681	821	102	122	152	182	222	272
NPO	1206	2KV						D	D	D	D	D	D	D	D	D	D	D	D	D	D	D/E	D/E	D/E	D/E	D/E	D/E										
	1808	2KV	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E/F	E/F	E/F	E/F	E/F	E/F											
	1812	2KV																D	D	D	D	D	D	D	E	E	F	F									

Temperature Characteristic	Size	Rated Voltage	Capacitance Range (pF)																																		
			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	823	104
X7R	1206	2KV			D	D	D	D	D	D	D	D	D/E	E	E																						
	1808	2KV	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D																				
	1812	2KV				D	D	D	D	D	D	D	D	D	D	E	E	F	F	F	F			G	H												
	2220	2KV											D	D	D	D	D	D	E	E	F	F	F	F	F												

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

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

Multilayer Ceramic Chip Capacitors
[High Voltage Capacitor]
HVC Series – Ultra High Voltage (3KV-5KV)



Capacitors with voltage ratings or 3KV to 5KV are ideally suited for LCD back light inverter circuits.

◆ Features

- ❑ Super term termination prevents cracking solution mechanical stress
- ❑ Special internal electrode design offers the highest voltage rating
- ❑ Surface mount suited for wave and reflow soldering
- ❑ High reliability
- ❑ RoHS compliant

◆ Applications

- ❑ Suitable for back-lighting inverter ,DC-DC converters, modems and power supplies

◆ Summary of Specification

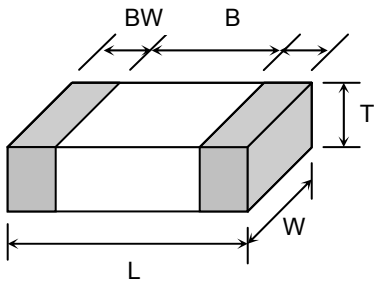
Operation Temperature	-55~+125 ℃
Rated Voltage	3KVdc to 5KVdc
Temperature Coefficient	NPO : ≤ ± 30ppm/ ℃ , -55~+125 ℃ (EIA Class Ⅰ)
	X7R : ≤ ± 15% , -55~+125 ℃ (EIA Class Ⅱ)
Capacitance Range	NPO :2pF to 1.0nF ; X7R :150pF to 2.7nF
Dissipation Factor :	NPO : Q≧1000 ; X7R : D.F.≦2.5%
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller
Aging	NPO:0% ; X7R: 2.5 % per decade of time
Dielectric Strength	120% Rated Voltage

◆ How To Order

C	1808	N	5R0	C	302	T	X
Product Code C: MLCC (Multilayer Ceramic Chip of Capacitor)	**Chip Size** Ex.: 1206 : 3.2x1.6mm 1808 : 4.6x2.0mm 1812 : 4.6x3.2mm 2208 : 5.7x2.0mm 2211 : 5.7x2.8mm 2220 : 5.7x5.0mm	**Dielectric** Ex.: N: NPO 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.: 302:3000Vdc 502:5000Vdc	**Packaging** T: Taping &Reel B: Bulk	**Special Requirement** Ex.: O: Arc Prevention Coating X: Cushion Termination (Super Term)

◆ Dimension

Unit : mm [inches]

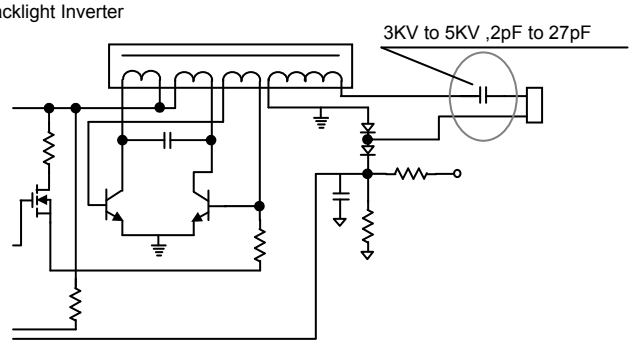


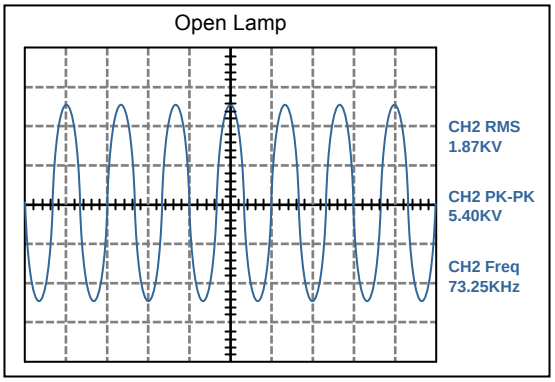
TYPE	L	W	T (max)	B (min)	BW (min)
1206	3.20±0.30 [.126±.012]	1.60±0.20 [.126±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.30 [.126±.012]	2.50±0.20 [.126±.012]	2.60 [.102]	1.60 [.059]	0.30 [.012]
1808	4.60±0.30 [.181±.012]	2.00±0.20 [.079±.008]	2.20 [.087]	2.50 [.098]	0.30 [.012]
1812	4.60±0.30 [.181±.012]	3.20±0.30 [.126±.012]	3.00 [.118]	2.50 [.098]	0.30 [.012]
2208	5.7±0.40 [.220±.016]	2.00±0.20 [.079±.008]	2.20 [.087]	3.50 [.137]	0.30 [.012]
2211	5.7±0.40 [.220±.016]	2.80±0.40 [.110±.016]	3.00 [.118]	3.50 [.137]	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]

◆ Application

Example Circuit

Backlight Inverter





◆ Capacitance Range

Temperature Characteristic	Size	Rated Voltage	Capacitance Range (pF)
NPO	1206	3KV	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
	1808	3KV	D D D D D D D D D D D D D D D D D D D E E E/F E/F E/F E/F E/F F F F F F
		5KV	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 F F F F F F F F F F F F
	2208	5KV	F F F F F F F F F F F F F F
	2211	5KV	F F F F F F F F F F F F F F F F
	2220	5KV	F F F F F F F F F F F F F F F F F F F

Temperature Characteristic	Size	Rated Voltage	Capacitance Range (pF)
X7R	1808	3KV	151 181 221 271 331 391 471 561 681 821 102 122 152 182 222 272 332 392 472 562 682 822 103 123 153 183 223 273 333 393 473 563 683 823 104
		3KV	D D D D D D D D D D D F F F
		4KV	D D D D D/E D/E D/E D/F D/F D/F D/F
	1812	3KV	D D D E E F F F

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

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

HVC Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	-55 to +125℃	
Visual	No abnormal exterior appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	
Quality Factor	Class Ⅰ(NPO): More Than 30pF : Q ≧1000 30pF & Below: Q≧400+20C (C:Cap., pF)	
Dissipation Factor	Class Ⅱ(X7R): Maximum 0.025	

Class	Frequency	Voltage
NPO		
C≤100pF	1MHz±10%	1.0±0.2Vrms
C>100pF	1KHz±10%	
X7R	1KHz±10%	1.0±0.2Vrms

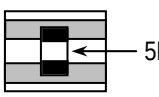
Perform a heat treatment at 150±5℃ for 30min. then place room temp. for 24±2hr.

Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller. (C in Farad)	V≦500V, Rated Voltage V> 500V, Applied 500Vdc Charge Time : 60sec. Is applied less than 50mA current.
Withstanding Voltage	No dielectric breakdown or mechanical breakdown	V＜500V : 200% Rated Voltage 500V≦V＜1000V: 150% Rated Voltage 1000≦V :120% Rated Voltage for 1~5 sec. Current is limited to less than 50mA. Withstanding voltage testing requires immersion of the element in a isolation fluid prevent arcing on the chip surface, at voltage over 1000Vdc.

Temperature Capacitance Coefficient

Char.	Temp. Range	Cap. Change
NPO(N)	-55℃~ +125℃	± 30ppm/℃
X7R (X)	-55℃~ +125℃	± 15%

Class Ⅰ :
[C2-C1/C1(T2-T1)] × 100%
Class Ⅱ :
(C2-C1)/C1 × 100%
T1:Standard Temperature(25℃)
T2:Test Temperature
C1:Capacitance At Standard Temperature
C2:Capacitance At Test Temperature

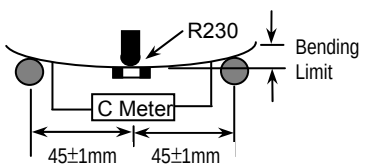
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.	 A 5N·f(≈0.5Kg·f) pull force shall be applied for 10±1 sec.

Resistance to Flexure of Substrate

No mechanical damage or capacitance change more than the following table.

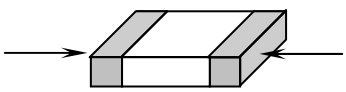
Char.	Capacitance Change
NPO(N)	≦ ± 5.0% of initial value
X7R (X)	≦ ± 12.5% of initial value

The board shall be bent 1.0mm with a rate of 1.0 mm/sec.



Solderability

More than 90% of the terminal surface is to be soldered newly, so 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 : H63A
Flux :Rosin
Preheat : At 80~120 ℃ For 10~30sec.

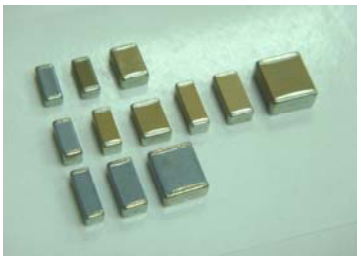
HVC Series Specification & Test Condition

Item		Specification	Test Condition
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 measure. Preheat : at 150±10°C for 60~120sec. Dip : solder temperature of 260±5℃ Dip Time : 10 ± 1sec. Immersing Speed : 25±10% mm/s Solder : H63A Flux : Rosin Measure at room temperature after cooling for Class Ⅰ : 24 ± 2 Hours Class Ⅱ : 48 ± 4 Hours
	Capacitance	Class Ⅰ (NPO): Within 2.5% or ±0.25pF whichever is larger of initial value Class Ⅱ (X7R): Within ±10% of initial value	
	Q / Tan δ	To satisfy the specified initial value	
	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 measure. Capacitor shall be subjected to five cycles of the temperature cycle as following: Step / Temp.(℃) / Time(min) 1 / Min Rated Temp.+0/-3 (-55) / 30 2 / 25 / 3 3 / Max Rated Temp.+3/-0 (125) / 30 4 / 25 / 3 Measure at room temperature after cooling for Class Ⅰ : 24 ± 2 Hours Class Ⅱ : 48 ± 4 Hours
	Capacitance	Class Ⅰ (NPO): Within 2.5% or ±0.25pF whichever is larger of initial value Class Ⅱ (X7R): Within ±7.5% of initial value	
	Q / Tan δ	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	
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	Class Ⅰ (NPO): Within 5% or ±0.5pF whichever is larger of initial value Class Ⅱ (X7R): Within ±15% of initial value	
	Q / Tan δ	Class Ⅰ (NPO): More Than 30pF : Q ≧350 30pF & Below: Q≧275＋2.5C Class Ⅱ (X7R): Maximum ±5.0%	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)	

HVC Series Specification & Test Condition

<table>
<tr><th>Item</th><th></th><th>Specification</th><th>Test Condition</th></tr>
<tr><td rowspan="4">High Temperature Load
(Life Test)</td><td>Appearance</td><td>No mechanical damage shall occur</td><td rowspan="4">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.
Applied Voltage :
<table><tr><th>Rated Voltage</th><th>Applied Voltage</th></tr><tr><td>V≤250Vdc</td><td>150%Rated Voltage</td></tr><tr><td>250Vdc < V< 1KVdc</td><td>120%Rated Voltage</td></tr><tr><td>More Than 1KVdc(include 1KV)</td><td>100%Rated Voltage</td></tr></table>Temperature : max. operation temperature
Test Time : 1000 +12/-0Hr
Current Applied : 50 mA Max.</td></tr>
<tr><td>Capacitance</td><td>Class Ⅰ (NPO):
Within 3% or ±0.3pF whichever is larger of initial value
Class Ⅱ (X7R):
Within ±15% of initial value</td></tr>
<tr><td>Q / Tan δ</td><td>Class Ⅰ (NPO):
More Than 30pF : Q ≧350
30pF & Below: Q≧275＋2.5C
Class Ⅱ (X7R):
Maximum ±5%</td></tr>
<tr><td>Insulation Resistance</td><td>1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)</td><td>Measure at room temperature after cooling for
Class Ⅰ : 24 ± 2 Hours
Class Ⅱ : 48 ± 4 Hours</td></tr>
<tr><td rowspan="3">Vibration</td><td>Appearance</td><td>No mechanical damage shall occur</td><td rowspan="3">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.</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>Q / Tan δ</td><td>To satisfy the specified initial value</td></tr>
</table>

Multilayer Ceramic Chip Capacitors
[Safety Capacitor – X2Y3 & X1Y2]
SCC Series



The SCC series **X2/Y3** & **X1/Y2** safety capacitors are designed specifically for use in modem, facsimile, telephone and other electronic equipment.

These parts are compliant to EN132400,IEC60384-14 and UL60950 standards. These capacitors are available in C0G(NPO) and X7R dielectrics.

◆ Features

- ❑ Small size & high capacitance
- ❑ Suitable for reflow soldering
- ❑ Surface mount
- ❑ Safety standard approval by EN 132400+A4:01 and UL 60950
- ❑ Certificate Number : by TUV R50005234 & UL E229738
- ❑ RoHS compliant

◆ Application

- ❑ The **X2/Y3** & **X1/Y2** specially designed for use in Modem, Facsimile, Telephone and other electronic equipment for lighting and surge protection, EMI Filter and Isolation.

◆ Safety Detail of Specification

EN132400: 1994 A2: 1998 +A3: 1998 +A4: 2001	Meets The Electrical Requirements and certification for Equipment requiring Class X1/Y2 and X2/Y3 devices.
IEC 60950 : 2000	Component Certified for Equipment requiring IEC 60950 compliance
IEC 384-14: 1993 A1: 1995	Component Certified for Equipment requiring IEC-384 compliance
UL 60950 : 2002 Third Edition	TNV/SELV Isolation Capacitors Certified To UL 60950

◆ How To Order

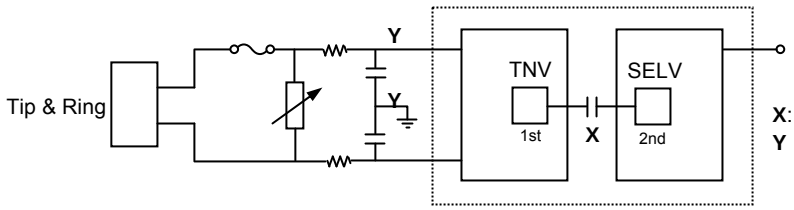
SCC	1808	X	102	K	502	T	S

Product Code	**Chip Size**	**Dielectric**	**Capacitance Unit : pF**	**Tolerance**	**Class**	**Packaging**	**Special Requirement**
SCC: Safety Approved of MLCC Product	Ex.: 1808 : 4.6x2.0mm 1812 : 4.6x3.2mm 2208 : 5.7x2.0mm 2211 : 5.7x2.8mm 2220 : 5.7x5.0mm 2825 : 6.8x6.3mm	Ex.: N: NPO X: X7R	Ex.: 100:10x10^0 471:47x10^1 182:18x10^2	Ex.: J :+/- 5% K :+/-10% M:+/-20%	Ex.: 202: X2 302: X2/Y3 502: X1/Y2 602: X1/Y2 for SCC2208N, SCC2211N, SCC2220N	T: Taping &Reel B: Bulk	Ex.: S: Arc Prevention Coating X: Cushion Termination (Super Term)

◆ Summary of Specification

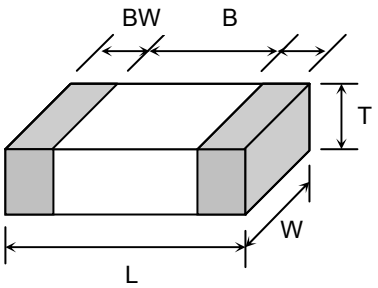
Rated Voltage	AC 250Vrms
Temperature Coefficient	NPO : < 30ppm/℃ , -55~+125℃ (EIA Class Ⅰ)
	X7R : < ± 15% , -55~+125℃ (EIA Class Ⅱ)
Capacitance Range	X2/Y3 :2.0pF ~ 2700pF ; X1/Y2 :2.0pF ~ 4700pF
	X2 : 4700pF,5600pF
Quality and Dissipation Factor	NPO : Q≧1000 ; X7R : D.F.≦2.5%
Climatic Category	-55/125/21
Insulation Resistance	10GΩ
Voltage Proof	X Capacitor :Applied Voltage 1075Vdc(4.3Ur) Y Capacitor :Applied Voltage 1500Vac
Impulse	Y3 : 2.5KV (Compliant to IEC 60950) ; X2:2.5KV / Y2:5KV for three times
Aging	NPO: 0 % ; X7R: 2.5 % per decade hr, Typical

◆ Application Example Circuit



X: Across The Line (Ex.: SCC1808N151K302T)
Y : Line By Pass (Ex.: SCC2211X102K502T)

◆ Dimension



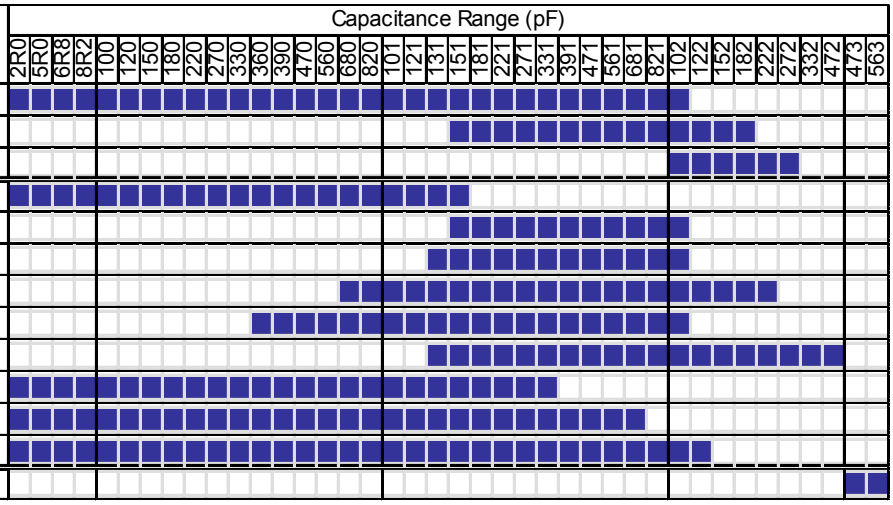
Unit : mm [inches]

TYPE	L	W	T (max)	B (min)	BW (min)
1808	4.60±0.3 [.181±.012]	2.00±0.2 [.079 ±.008]	2.20 [.087]	2.50 [.157]	0.20 [.008]
1812	4.60±0.3 [.181±.012]	3.20±0.3 [.126±.012]	2.60 [.102]	2.50 [.157]	0.20 [.008]
2208	5.70±0.4 [.220±.016]	2.00±0.2 [.079±.008]	2.20 [.087]	4.00 [.157]	0.30 [.012]
2211	5.70±0.4 [.220±.016]	2.80±0.3 [.110±.012]	3.00 [.118]	4.00 [.157]	0.30 [.012]
2220	5.70±0.4 [.220±.016]	5.00±0.4 [.197±.016]	3.00 [.118]	4.00 [.157]	0.30 [.012]
2825	6.80±0.4 [.220±.016]	6.35±0.4 [.197±.016]	4.00 [.118]	4.00 [.157]	0.30 [.012]

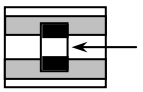
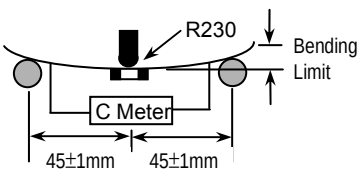
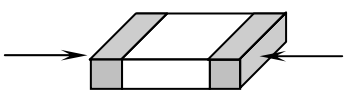
◆ Capacitance Range

Class	Size	Temperature Characteristic	Rated Voltage	Certificated
X2/Y3	1808	NPO	250Vrms	TUV/UL
	1808	X7R	250Vrms	TUV/UL
	1812	X7R	250Vrms	TUV/UL
X1/Y2	1808	NPO	250Vrms	TUV/UL
	1808	X7R	250Vrms	TUV/UL
	1812	X7R	250Vrms	TUV/UL
	2211	X7R	250Vrms	TUV/UL
	2208	X7R	250Vrms	TUV/UL
	2220	X7R	250Vrms	TUV/UL
	2208	NPO	250Vrms	TUV/UL
	2211	NPO	250Vrms	TUV/UL
	2220	NPO	250Vrms	TUV/UL
X2	2825	X7R	250Vrms	TUV

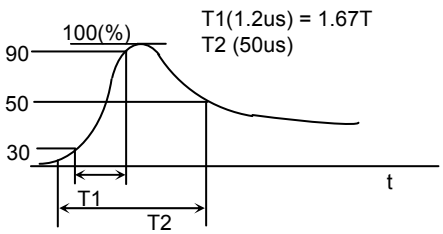
Capacitance Range (pF)



SCC Series Specification & Test Condition

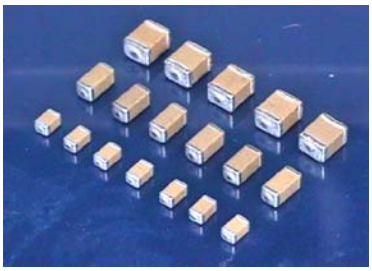
Item	Specification	Test Condition
Operation Temperature	-55 to +125℃	
Visual	No Abnormal Exterior Appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	Char. / Frequency / Voltage NPO C≤100pF: 1MHz±10%, 1.0±0.2Vrms C>100pF: 1KHz±10% X7R: 1KHz±10%, 1.0±0.2Vrms Perform a heat treatment at 150±5℃ for 30min. then place at room temp. for 24±2hr.
Quality and Dissipation Factor	Class Ⅰ(NPO): More Than 30pF : Q ≧1000 30pF & Below: Q≧400+20C (C:Cap., pF) Class Ⅱ(X7R): Maximum 2.5% (0.025)	
Insulation Resistance	Minimum 10,000MΩ	Applied Voltage: Applied Voltage:500V Charge Time : 60sec.
Voltage Proof	No dielectric breakdown or mechanical breakdown	Applied Voltage: X Capacitor :Applied Voltage 1075Vdc(4.3Ur) Y Capacitor :Applied Voltage 1500Vac For 1min. Current is limited to less than 50mA.
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.	 A 5N·f (≈ 0.5Kg·f) pull force shall be applied for 10±1 sec.
Resistance to Flexure of Substrate	No mechanical damage or change C more than the following table. Capacitance Change : Class Ⅰ(NPO) ≦ ± 5% of initial value Class Ⅱ(X7R) ≦ ±12.5% of initial value	The board shall be bent 1.0mm with a rate of 1.0 mm/sec. 
Solderability	More than 90% of the terminal surface is to be soldered newly, so 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 : H63A Flux :Rosin Preheat : At 80~120 ℃ For 10~30sec.
Resistance To Soldering Heat	Appearance: No mechanical damage shall occur Capacitance / Cap. Change Class Ⅰ(NPO): ≦ ±10% of initial value Class Ⅱ(X7R): ≦ ±20% of initial value Insulation Resistance: More than 1,000MΩ Voltage Proof: To satisfy the specified 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 Solder : H63A Flux :Rosin Measure at room temp. after cooling for: Class Ⅰ: 24 ± 2 Hours Class Ⅱ: 48 ± 4 Hours

SCC Series Specification & Test Condition

Item	Specification		Test Condition
Damp Heat / Steady State	Appearance	No mechanical damage shall occur	Class Ⅱ capacitor shall be set for 48±4 hours at room temperature after one hour deage treatment at 150 +0/-10℃ before initial measure. Test Condition : Temperature : 40± 2(℃) Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0 hr (21days) The capacitors with rated voltage(250Vac) applied. Measure at room temp. after cooling for: Class Ⅰ : 24 ± 2 Hours Class Ⅱ : 48 ± 4 Hours
	Capacitance	Cap. Change NPO ≦ ± 15% of initial value X7R ≦ ± 20% of initial value	
	Q (NPO) Class Ⅰ	More Than 30pF:Q≧350 30pF& Below:Q≧275＋2.5C	
	Tan δ (X7R) Class Ⅱ	Maximum 5% (0.05)	
	Insulation Resistance	More than 1,000MΩ	
	Voltage Proof	To satisfy the specified initial value	
Endurance	Appearance	No mechanical damage shall occur	Impulse Voltage Each individual capacitor shall be subjected to a 2.5KV(X2) and 5.0KV(X1/Y2) impulse for three times. Then the capacitors are applied to life test. Additional impulse 2.5KV of Y3 compliant to EN60950 standard.  Temperature : 125℃ Test Time : 1000hrs Applied Voltage : Class X Capacitors :1.25Ur (312.5Vac) Class Y Capacitors :1.70Ur (425Vac) Except that once every hour the voltage shall be increased to 1000Vrms for 0.1s.
	Capacitance	Cap. Change NPO ≦ ±20% of initial value X7R ≦ ±25% of initial value	
	Q Class Ⅰ	More Than 30pF:Q≧350 30pF& Below:Q≧275＋2.5C	
	Tan δ Class Ⅱ	Maximum 5% (0.05)	
	Insulation Resistance	More than 1,000MΩ	
	Voltage Proof	To satisfy the specified initial value	
Passive Flammability	Capacitor didn't burn at all		Volume Sample : 21.56mm3 Flame exposure time : 5 sec.Max.
Active Flammability	The cheese cloth shall not burn with a flame		The capacitors of class X2/Y3 & X1/Y2 each test capacitors applied Ur(250Vac). Then each sample shall be subjected to 20 discharges from a tank capacitor, charge to a voltage that, when discharged, places Ui(Y3:2.5KV,Y2:5KV) across the capacitor under test. The interval between successive discharges shall be 5s.

Multilayer Ceramic Chip Capacitors [Trigger Capacitors for Strobe]

TCX Series



TCX series are specifically designed with a proprietary material for discharge applications such as strobe circuit applications.The unique properties of the X7E material, and the design of TCX, makes them suitable for any discharge application which requires the capacitor to have a good damping characteristic.

TCX series are also suitable for applications where a significant change of capacitance value with temperature is not desired. TCX series is offered in 0805, 1206 and 1210 sizes at 350 and 630 voltages.

◆ Features

- ❑ Excellent Trigger Characteristics
- ❑ Low ESR & Low Tan δ
- ❑ Excellent DC Bias
- ❑ Provide Good Damping Characteristics Results in More Light.
- ❑ RoHS compliant

◆ Applications

- ❑ Suitable for strobe trigger circuit in digital and electric cameras.

◆ Summary of Specification

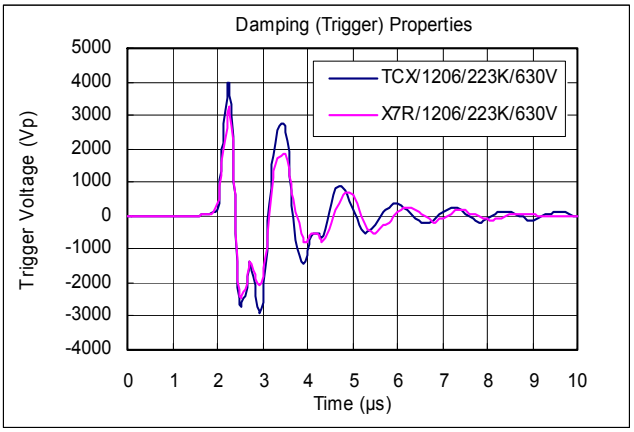
Operation Temperature	-55~+125 ℃
Rated Voltage	350Vdc and 630Vdc
Temperature Coefficient	X7E : ≤ ± 4.7% , -55~+125 ℃ (EIA Class II)
Capacitance Range	1.0nF to 68nF
Dissipation Factor :	1.0% max. at 1KHz 25℃
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller (C in Farad)
Dielectric Strength	250V ≦ V < 500V : 200% Rated Voltage
	500V ≦ V < 1000V : 150% Rated Voltage
Capacitance Tolerance	± 5% , ± 10% , ± 20%
Aging	1.0% per decade hr, Typical

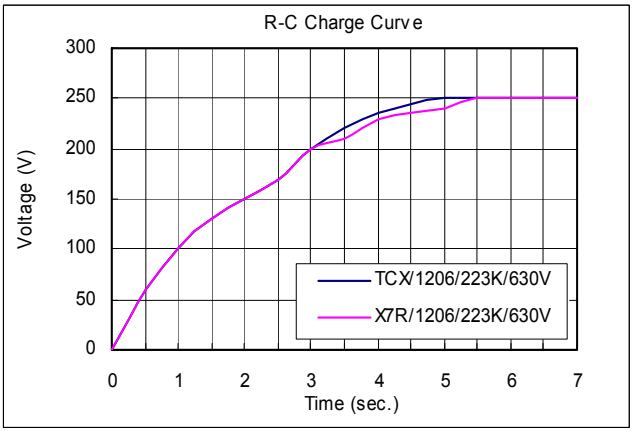
◆ How To Order

TCX	1206	C	223	K	631	T

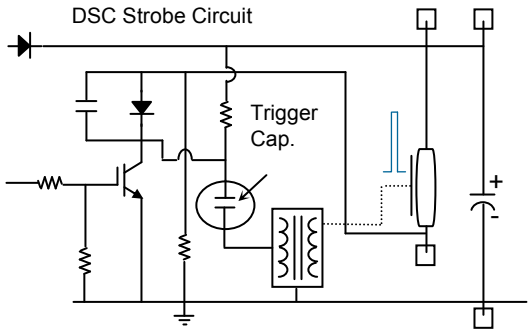
Product Code	**Chip Size**	**Dielectric**	**Capacitance Unit : pF**	**Tolerance**	**Rated Voltage**	**Packaging**
TCX: Trigger Capacitor	Ex.: 0805 : 2.0x1.25 mm 1206 : 3.2x1.6 mm 1210 : 3.2x2.5 mm	C: X7E	Ex.: 102:10x10² 473:47x10³	Ex.: J : +/- 5% K: +/- 10% M: +/- 20%	Ex.: 351:350Vdc 631:630Vdc	T: Taping & Reel B: Bulk

◆ Characteristic

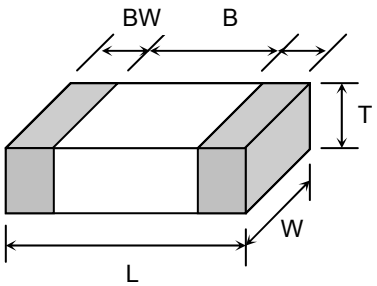




◆ Application Example Circuit



◆ Dimension



Unit : mm [inches]

TYPE	L	W	T (max)	B (min)	BW (min)
0805	2.00±0.2 [.079±.012]	1.25±0.2 [.049 ±.008]	1.45 [.057]	0.70 [.028]	0.20 [.008]
1206	3.20±0.3 [.126±.012]	1.60±0.2 [.126±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.3 [.126±.012]	2.50±0.2 [.098±.008]	1.80 [.071]	1.60 [.063]	0.30 [.012]

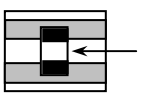
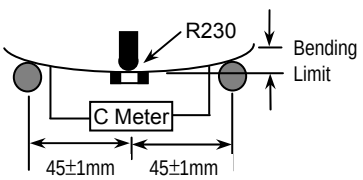
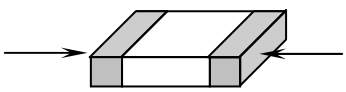
◆ Capacitance Range

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	154	224
X7E	0805	350V	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	D	D	D								
	1206	350V													C	C	C	C	C	C	D	E	E						
		630V								D	D	D	D	D	D	D	E	E	E	E									
	1210	350V													D	D	D	D	D	D	D	D	D	E	E				
		630V													D	D	D	D	D	D	D	E	E						

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

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

TCX Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	-55 to +125℃	
Visual	No Abnormal Exterior Appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	Frequency: 1KHz±10%; Voltage: 1.0±0.2Vrms
Dissipation Factor	Maximum 1.0% (0.01)	
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller. (C in Farad)	V≦500V, Rated Voltage V> 500V, Applied 500Vdc Charge Time : 60sec. Current is limited to less than 50mA.
Dielectric Strength	No dielectric breakdown or mechanical breakdown	250V≦V＜500V : 200% Rated Voltage 500V≦V＜1000V: 150% Rated Voltage for 1~5 sec. Current is limited to less than 50mA.
Temperature Capacitance Coefficient	Temperature Range: -55℃~ +125℃; Cap. Change: ± 4.7%	(C2-C1)/C1 × 100% C1:Capacitance at standard temperature(25℃) C2:Capacitance at test temperature
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.	 A 5N·f (≈ 0.5Kg·f) pull force shall be applied for 10±1 sec.
Resistance to Flexure of Substrate	No mechanical damage or change C more than the following table. Capacitance Change : ≦ ±12.5% of initial value	The board shall be bent 1.0mm with a rate of 1.0 mm/sec. 
Solderability	More than 90% of the terminal surface is to be soldered newly, so 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 : H63A Flux :Rosin Preheat : At 80~120 ℃ For 10~30sec.
Resistance To Soldering Heat	Appearance: No mechanical damage shall occur Capacitance: Cap. change within ±7.5% of initial value Tan δ (D.F.): To satisfy the specified initial value Insulation Resistance: To satisfy the specified initial value Dielectric Strength: To satisfy the specified 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 Solder : H63A Flux :Rosin Measure at room temperature after cooling for 48 ± 4 Hours

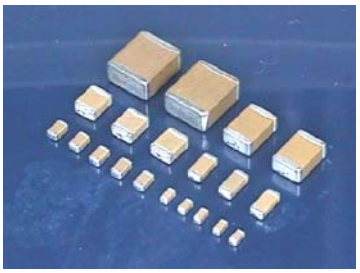
TCX Series Specification & Test Condition

Item		Specification	Test Condition
Temperature Cycle	Appearance	No mechanical damage shall occur	Capacitor shall be set for 48±4 hours at room temperature after one hour heat treatment at 150 +0/-10 ℃ before initial measure. Capacitor shall be subjected to five cycles of the temperature cycle as following:
	Capacitance	Cap. change within ±7.5% of initial value	
	Tan δ (D.F.)	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	

Step	Temp.(℃)	Time(min)
1	Min Rated Temp.(-55)+0/-3	30
2	25	3
3	Max Rated Temp.(+125)+3/-0	30
4	25	3

Measure at room temperature after cooling for 48 ±4 Hours

Humidity	Appearance	No mechanical damage shall occur	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 48 ± 4 Hours
	Capacitance	Cap. change within ±12.5%of initial value	
	Tan δ (D.F.)	Maximum 3.5% (0.035)	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)	
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Capacitors applied DC voltage of 120% the rated voltage 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 :120% of rated voltage Temperature : max. operation temperature (125℃) Test Time : 1000 +12/-0Hr Current Applied : current is limited to less than 50mA. Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Cap. change within ±15% of initial value	
	Tan δ (D.F.)	Maximum 3.5% (0.035)	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (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	
	Tan δ (D.F.)	To satisfy the specified initial value	



Multilayer Ceramic Chip Capacitors
[Low Distortion Capacitor]
LDC Series

Low Distortion Capacitor (NPO/X7R Hybrid)

◆ Features

- ❑ Small Size & High Capacitance
- ❑ Ultra Stable T/C for a Class II
- ❑ Excellent Bias,High Temperature Stability & Low Tan δ
- ❑ High Breakdown Voltage
- ❑ Replacement for Film Capacitors
- ❑ RoHS compliant

◆ Application

- ❑ Suitable for Telecommunication (ADSL、Modem…),Power (Inverter for oscillation Circuit) & Audio Circuit

◆ Summary of Specification

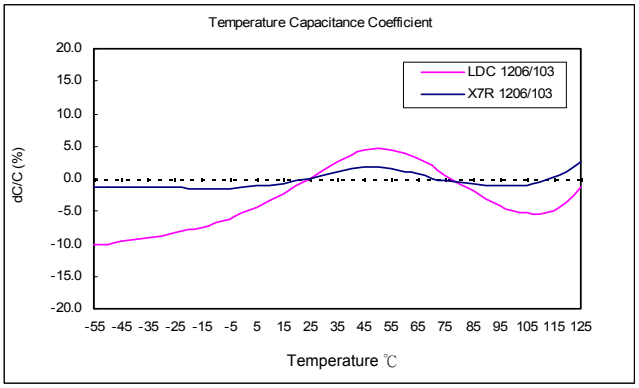
Operation Temperature	-55~+125 ℃
Rated Voltage	25V and 50Vdc
Temperature Coefficient	X7E ：≤ ±4.7% , -55~+125 ℃ (EIA Class II)
Capacitance Range	1nF ~ 270nF
Dissipation Factor :	For 50V : 1.2% max. at 1KHz 25℃
	For 25V : 2.0% max. at 1KHz 25℃
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller
Dielectric Strength	250% Rated Voltage for 5 second @ 50mA max. current
Capacitance Tolerance	± 5% , ± 10% , ± 20%
Aging	1.0% per decade hr , Typical

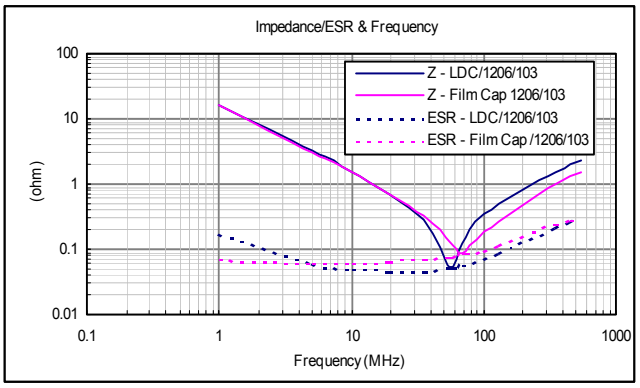
◆ How To Order

LDC	1206	C	103	K	025	T

Product Code	**Chip Size**	**Dielectric**	**Capacitance Unit : pF**	**Tolerance**	**Rated Voltage**	**Packaging**
LDC: Low Distortion Capacitor	Ex.: 0603 : 1.6×0.80 mm 0805 : 2.0×1.25 mm 1206 : 3.2×1.60 mm 1210 : 3.2×2.50 mm 1812 : 4.6×3.20 mm 2220 : 5.7×5.00 mm	C: X7E	Ex.: 102:10×10² 224:22×10⁴	Ex.: J : +/- 5% K: +/- 10% M: +/- 20%	Ex.: 025:25Vdc 050:50Vdc	T: Taping & Reel B: Bulk

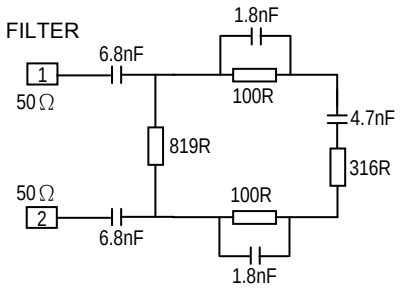
◆ Characteristic





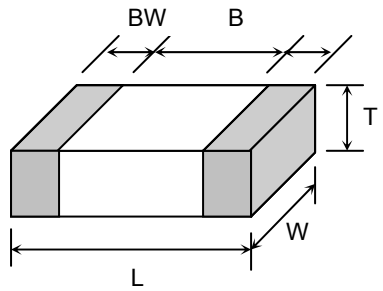
◆ Application

Example Circuit



◆ Dimension

Unit : mm [inches]



TYPE	L	W	T (max)	B (min)	BW (min)
0603	1.60±0.1 [.063±.004]	0.80±0.1 [.031 ±.004]	0.90 [.035]	0.40 [.016]	0.15 [.006]
0805	2.00±0.2 [.079±.012]	1.25±0.2 [.049 ±.008]	1.45 [.057]	0.70 [.028]	0.20 [.008]
1206	3.20±0.3 [.126±.012]	1.60±0.2 [.126±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.3 [.126±.012]	2.50±0.2 [.098±.008]	1.80 [.071]	1.60 [.063]	0.30 [.012]
1812	4.60±0.3 [.181±.012]	3.20±0.3 [.126±.012]	2.20 [.087]	2.50 [.098]	0.30 [.012]
2220	5.70±0.4 [.220±.016]	5.00±0.4 [.197±.016]	2.20 [.087]	3.50 [.137]	0.30 [.012]

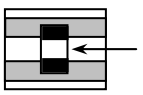
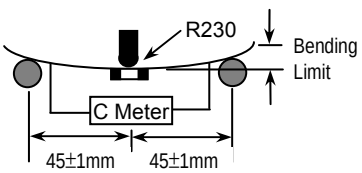
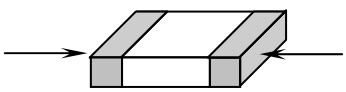
◆ Capacitance Range

Dielectric Characteristic	Size	Rated Voltage	Capacitance Range: 102 122 152 182 222 272 332 392 472 562 682 822 103 123 153 183 223 273 333 393 473 563 683 823 104 154 224 274
X7E	0603	50V	B B B B B B B B B B B B B
	0805	50V	C C C C C C C C C C C C
	1206	25V	C C C C C C C C C C C C C
		50V	C C C C C C C C C C C C C
	1210	50V	C C C C C C
	1812	50V	D D D D D D
	2220	50V	D

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

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

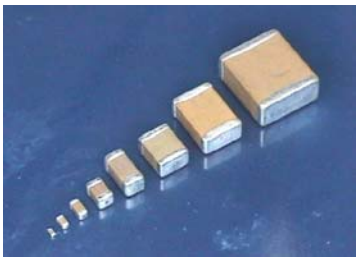
LDC Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	-55 to +125℃	
Visual	No Abnormal Exterior Appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	Frequency: 1KHz±10%; Voltage: 1.0±0.2Vrms
Dissipation Factor	Rated Voltage: 50V, 25V D.F. (max.): 1.2%, 2.0%	Perform a heat temperature at 150±5℃ for 30min. then place at room temp. for 24±2hr.
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller. (C in Farad)	Applied Voltage : Rated Voltage Charge Time : 60sec. Current is limited to less than 50mA
Dielectric Strength	No dielectric breakdown or mechanical breakdown	250% of the rated voltage for 1 to 5 sec. Current is limited to less than 50mA.
Temperature Capacitance Coefficient	Temperature Range: -55℃~ +125℃ Cap. Change: ≦ ± 4.7%	(C2-C1)/C1 × 100% C1:Capacitance At Standard Temperature(25℃) C2:Capacitance At Test Temperature
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.	 A 5N·f (≈ 0.5Kg·f) pull force shall be applied for 10±1 sec.
Resistance to Flexure of Substrate	No mechanical damage or change capacitance more than the following table. Capacitance Change : ≦ ±12.5% of initial value	The board shall be bend 1.0mm with a rate of 1.0 mm/sec. 
Solderability	More than 90% of the terminal surface is to be soldered newly, so 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 : H63A Flux :Rosin Preheat : At 80~120 ℃ For 10~30sec.
Resistance To Soldering Heat	Appearance: No mechanical damage shall occur Capacitance: Cap. change within ±7.5% of initial value Tan δ (D.F.): To satisfy the specified initial value Insulation Resistance: To satisfy the specified initial value Dielectric Strength: To satisfy the specified 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 Solder : H63A Flux :Rosin Measure at room temperature after cooling for 48 ± 4 Hours

LDC Series Specification & Test Condition

Item		Specification	Test Condition
Temperature Cycle	Appearance	No mechanical damage shall occur	Capacitor shall be set for 48±4 hours at room temperature after one hour deage at 150 +0/-10 ℃ before initial measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following: Step / Temp.(℃) / Time(min) 1 / Min Rated Temp.(-55)+0/-3 / 30 2 / 25 / 3 3 / Max Rated Temp.(+125)+3/-0 / 30 4 / 25 / 3 Measure at room temperature after cooling for 48 ±4 Hours
	Capacitance	Cap. change within ±7.5% of initial value	
	Tan δ (D.F.)	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	
Humidity	Appearance	No mechanical damage shall occur	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 48 ± 4 Hours
	Capacitance	Cap. change within ±12.5% of initial value	
	Tan δ (D.F.)	50V: max. 3.5%; 25V: max. 5.0%	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)	
Humidity Loading	Appearance	No mechanical damage shall occur	Capacitors applied DC voltage of the rated voltage 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 :Rated Voltage Temperature : 40±2℃ Relative Humidity : 90 ~ 95%RH Test Time : 500 ＋12/－0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Cap. change within ±12.5% of initial value	
	Tan δ (D.F.)	50V: max. 3.5%; 25V: max. 5.0%	
	Insulation Resistance	500MΩ or 25/C Ω whichever is smaller. (C in Farad)	
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Capacitors applied DC voltage of 200% the rated voltage 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 :200% of Rated Voltage Temperature : max. operation temperature Test Time : 1000 +48/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Cap. change within ±15% of initial value	
	Tan δ (D.F.)	50V: max. 3.5%; 25V: max. 5.0%	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)	

Multilayer Ceramic Chip Capacitors
[Normal Chip Capacitor – NPO,X7R,X5R,Y5V]
NCC Series



Standard Multilayer Ceramic Chip Capacitors (MLCC's) are available in a full line of sizes and temperature coefficients, with voltage ratings from 6.3V to 50V.

◆ Features

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

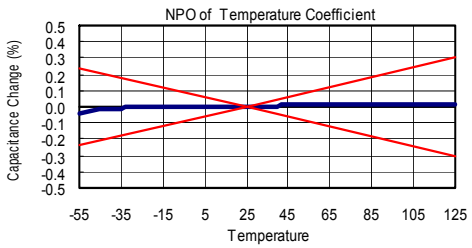
◆ Application

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

◆ Summary of Specification

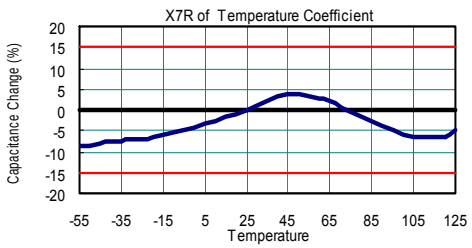
NPO Dielectric Characteristic

Operation Temperature :	-55~+125 ℃
Temperature Coefficient :	± 30ppm/℃ , -55~+125 ℃(EIA Class Ⅰ)
Capacitance Range	0.5pF to 1nF
Dissipation Factor :	more than 30pF: Q≧1000 (0.001)
	30pF& below : Q≧400+20C C:pF
Insulation Resistance :	10GΩ or 500/C Ω whichever is smaller
Aging :	0 % per decade of time, typical
Dielectric Strength :	250% Rated Voltage



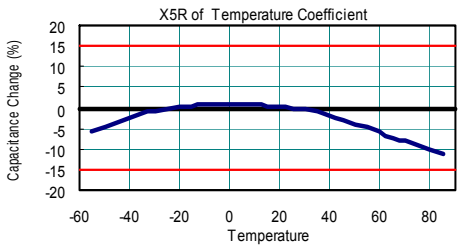
X7R Dielectric Characteristic

Operation Temperature :	-55~+125 ℃
Temperature Coefficient :	± 15% , -55~+125 ℃(EIA Class Ⅱ)
Capacitance Range	100pF to 680nF
Dissipation Factor :	Please see HEC specification data sheet
Insulation Resistance :	10GΩ or 500/C Ω whichever is smaller
Aging :	≦ 2.5 % per decade hr, typical
Dielectric Strength :	250% Rated Voltage



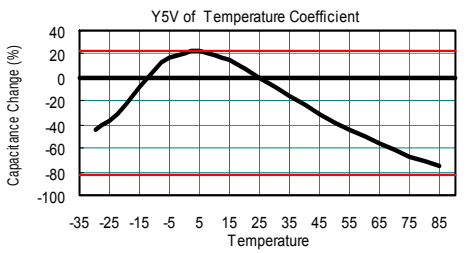
X5R Dielectric Characteristic

Operation Temperature :	-55~+85 ℃
Temperature Coefficient :	± 15% , -55~+85 ℃(EIA Class Ⅱ)
Capacitance Range	3.3nF to 680nF
Dissipation Factor :	Please see HEC specification data sheet
Insulation Resistance :	10GΩ or 500/C Ω whichever is smaller
Aging :	≦ 2.5 % per decade hr , typical
Dielectric Strength :	250% Rated Voltage

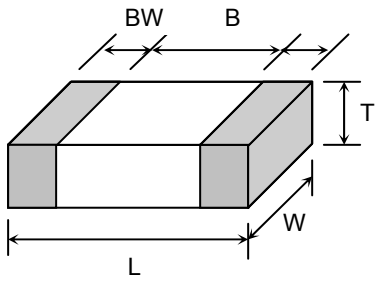


Y5V Dielectric Characteristic

Operation Temperature :	-30~+85 ℃
Temperature Coefficient :	+22/ -82 %, -30~+85 ℃ (EIA Class Ⅱ)
Capacitance Range	1nF to 470nF
Dissipation Factor :	Please see HEC specification data sheet
Insulation Resistance :	10GΩ or 500/C Ω whichever is smaller
Aging :	≦ 7.0 % per decade hr , typical
Dielectric Strength :	250% Rated Voltage



◆ Dimension

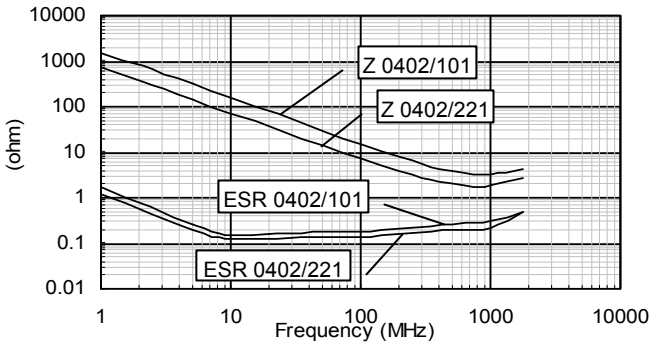


Unit : mm [inches]

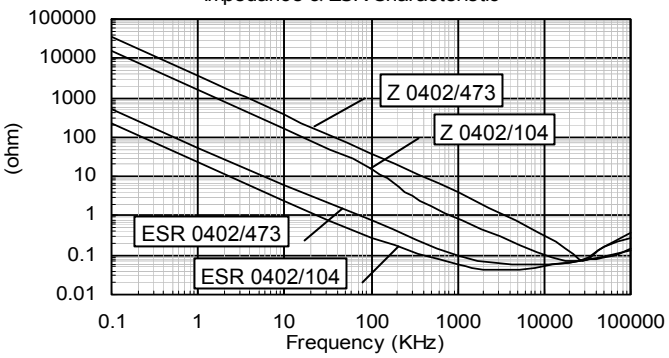
TYPE	L	W	T (max)	B (min)	BW (min)
0201	0.60±0.03 [.024±.001]	0.30±0.03 [.011 ±.001]	0.33 [.013]	0.20 [.008]	0.10 [.004]
0402	1.00±0.05 [.039±.002]	0.50±0.05 [.020 ±.002]	0.55 [.022]	0.30 [.012]	0.15 [.006]
0603	1.60±0.10 [.063±.004]	0.80±0.10 [.031 ±.004]	0.90 [.035]	0.40 [.016]	0.15 [.006]
0805	2.00±0.20 [.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]	1.80 [.071]	1.50 [.059]	0.30 [.012]

◆ Characteristic

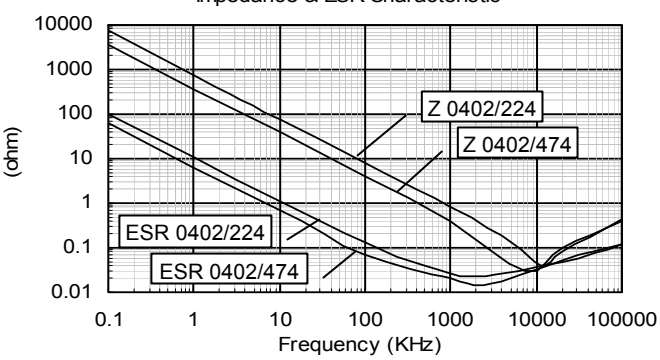
NPO(N) Series



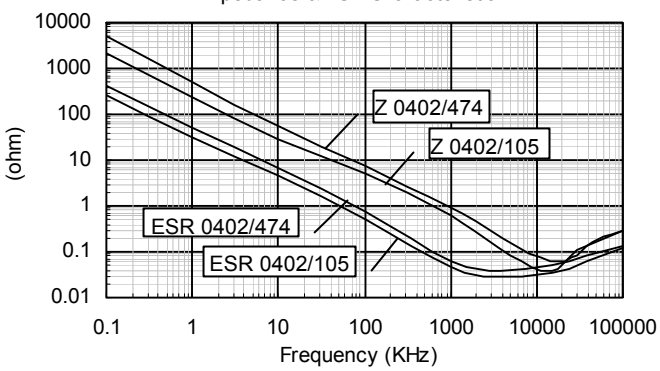
X7R(X) Series



X5R(B) Series



Y5V(Y) Series



◆ How To Order

C	0402	B	104	M	010	T

Product Code	**Chip Size**	**Dielectric**	**Capacitance Unit : pF**	**Tolerance**	**Rated Voltage**	**Packaging**
C: MLCC (Multilayer Ceramic Chip of Capacitor)	Ex.: 0201 : 0.6x0.30 mm 0402 : 1.0x0.50 mm 0603 : 1.6x0.80 mm 0805: 2.0x1.25 mm 1206 : 3.2x1.60 mm	Ex.: N: NPO X: X7R B:X5R Y:Y5V	Ex.: 102:10x10² 473:47x10³ 104:10x10⁴	Ex.: C:+/- 0.25pF D:+/- 0.50pF F: +/- 1% G: +/- 2% J : +/- 5% K: +/- 10% M:+/- 20% Z :+80/-20%	Ex.: 007: 6.3Vdc 010: 10Vdc 016: 16Vdc 025: 25Vdc 050: 50Vdc	T: Taping & Reel B: Bulk

◆ Capacitance Range

Dielectric Characteristic	Size	Rated Voltage	Capacitance Range (pF) 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	122	152	182	222	272	332
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																		
		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																		
	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											
	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	B
	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	B	B

Dielectric Characteristic	Size	Rated Voltage	Capacitance Range (pF) 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	105
X7R	0201	6.3V																																			S						
		16V														S	S	S	S	S	S																							
		25V			S	S	S	S	S	S	S	S	S	S	S	S	S	S																										
	0402	10V																																O				O						
		16V																								O	O	O	O	O	O	O	O	O				O						
		25V																				O	O	O	O	O																		
		50V	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O																			
	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	B	B
		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				
		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							
	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	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	B	B	B	B	B	B	B	D	D	D	D		
		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		
		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			
	1206	16V																																			B	B	B	B	B	B			
		25V																																			B	B	B	E	E	E			
		50V																																			B	B	B	C	D	D			

Dielectric Characteristic	Size	Rated Voltage	Capacitance Range (pF) 332	392	472	562	682	822	103	123	153	183	223	273	333	393	473	563	683	823	104	154	224	334	474	684	105
X5R	0201	6.3V			S	S	S	S	S												S						
		10V	S	S	S	S	S	S	S																		
	0402	6.3V																					O	O	O	O	
		10V												O	O	O	O	O	O	O	O		O	O	O		
		16V												O	O	O	O	O	O	O	O						
	0603	10V																							B	B	
		16V																				B	B	B	B	B	

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

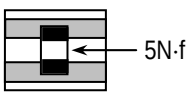
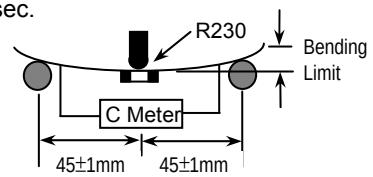
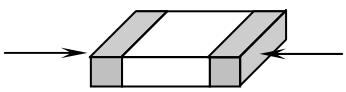
▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

Dielectric Characteristic	Size	Rated Voltage	Capacitance Range									
			102	222	472	103	223	473	104	224	474	105
Y5V	0201	6.3V							S			
	0402	10V								O	O	
		16V					O	O	O			
		25V	O	O	O	O	O		O			
		50V	O	O	O	O						
	0603	16V							B	B	B	
		25V							B	B	B	
		50V				B	B	B	B			
	0805	16V							B	B	B	
		25V							B	B	B	
		50V							B	B	B	
	1206	16V				B	B	B	B	B	B	
		25V				B	B	B	B	B	B	
		50V				B	B	B	B	B	B	

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

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

NCC Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	Char. / Operation Temp. NPO(N) -55℃~ +125℃ X7R (X) -55℃~ +125℃ X5R (B) -55℃~ +85℃ Y5V (Y) -30℃~ +85℃	
Visual	No abnormal exterior appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	Char. / Frequency / Voltage NPO C≤100pF 1MHz±10% 1.0±0.2Vrms C>100pF 1KHz±10% X7R/X5R/Y5V 1KHz±10% 1.0±0.2Vrms
Quality Factor	Class Ⅰ (NPO): More Than 30pF : Q ≧1000 30pF & Below: Q≧400+20C (C:Cap., pF)	
Dissipation Factor	Class Ⅱ (X7R/X5R/Y5V): Shall meet the value in Table 1,Tble 2	Perform a heat temperature at 150±5℃ for 30min. then place at room temp. for 24±2hr.
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller for rated voltage>10V and greater 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.
Withstanding Voltage	No dielectric breakdown or mechanical breakdown	250% of the rated voltage for 1~5 sec. Current is limited to less than 50mA
Temperature Capacitance Coefficient	Char. / Temp. Range / Cap. Change NPO(N) -55℃~ +125℃ ± 30ppm/℃ X7R (X) -55℃~ +125℃ ± 15% X5R (B) -55℃~ +85℃ ± 15% Y5V (Y) -30℃~ +85℃ +22/-82%	Class Ⅰ : [C2-C1/C1(T2-T1)] × 100% Class Ⅱ : (C2-C1)/C1 × 100% T1:Standard Temperature(20℃) 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.	 A 5N·f (≈ 0.5Kg·f) pull force shall be applied for 10±1 sec.
Resistance to Flexure of Substrate	No mechanical damage or capacitance change more than the following table. Char. / Capacitance Change NPO(N) ≦ ± 5.0% of initial value X7R (X) ≦ ± 12.5% of initial value X5R (B) ≦ ± 12.5% of initial value Y5V (Y) ≦ ± 30.0% of initial value	The board shall be bend 1.0mm with a rate of 1.0 mm/sec. 
Solderability	More than 90% of the terminal surface is to be soldered newly, so 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 : H63A Flux :Rosin Preheat : At 80~120 ℃ For 10~30sec.

NCC Series Specification & Test Condition

Item		Specification	Test Condition
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 measure. Preheat : at 150±10°C for 60~120sec. Dip : solder temperature of 260±5℃ Dip Time : 10 ± 1sec. Immersing Speed : 25±10% mm/s Solder : H63A Flux : Rosin Measure at room temperature after cooling for Class Ⅰ : 24 ± 2 Hours Class Ⅱ : 48 ± 4 Hours
	Capacitance	Class Ⅰ (NPO): Within 2.5% or ±0.25pF whichever is larger of initial value Class Ⅱ : Char. — Cap. change X7R(X) — ≤ ±7.5% of initial value X5R(B) — ≤ ±7.5% of initial value Y5V(Y) — ≤ ±20% of initial value	
	Q / Tan δ	To satisfy the specified initial value	
	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 ℃ befor initial measure. 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 — Max Rated Temp.+3/-0 — 30 4 — 25 — 3 Measure at room temperature after cooling for Class Ⅰ : 24 ± 2 Hours Class Ⅱ : 48 ± 4 Hours
	Capacitance	Class Ⅰ (NPO): Within 2.5% or ±0.25pF whichever is larger of initial value Class Ⅱ : Char. — Cap. change X7R(X) — ≤ ±7.5% of initial value X5R(B) — ≤ ±7.5% of initial value Y5V(Y) — ≤ ±20% of initial value	
	Q / Tan δ	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	
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	Class Ⅰ (NPO): Within 5.0% or ±0.5pF whichever is larger of initial value Class Ⅱ : Char. — Cap. change X7R(X) — ≤ ±12.5% of initial value X5R(B) — ≤ ±12.5% of initial value Y5V(Y) — ≤ ±30% of initial value	
	Q Class Ⅰ	30pF & Over : Q ≧350 10 to 30pF : Q≧275+2.5C 30pF & Below: Q≧200+10C	
	Tan δ Class Ⅱ	Shall meet the value in Table 1, Table 2	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller for rated voltage>10V and greater 10/C Ω for rated voltage≦10V. (C in Farad)	

NCC Series Specification & Test Condition

Item		Specification	Test Condition
Humidity Loading	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 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 +12/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for Class Ⅰ : 24 ± 2 Hours Class Ⅱ : 48 ± 4 Hours
	Capacitance	Class Ⅰ (NPO): Within 7.5% or ±0.75pF whichever is larger of initial value Class Ⅱ : Char. / Cap. change X7R(X) ≤ ±12.5% of initial value X5R(B) ≤ ±12.5% of initial value Y5V(Y) ≤ ±30% of initial value	
	Q Class Ⅰ	30pF & Over : Q ≧350 10 to 30pF : Q≧275+2.5C 30pF & Below: Q≧200+10C	
	Tan δ Class Ⅱ	Shall meet the value in Table 1, Table 2	
	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)	
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Class Ⅱ capacitors applied DC testing voltages 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 :200%Rated Voltage However: 0201/X5R/104/6.3V and 0402/X5R/474,684/6.3V,10V ,applied voltage of 100%rated voltage Temperature : max. operation temperature Test Time : 1000 +48/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for Class Ⅰ : 24 ± 2 Hours Class Ⅱ : 48 ± 4 Hours
	Capacitance	Class Ⅰ (NPO): Within 5.0% or ±0.5pF whichever is larger of initial value Class Ⅱ : Char. / Cap. change X7R(X) ≤ ±12.5% of initial value X5R(B) ≤ ±12.5% of initial value Y5V(Y) ≤ ±30% of initial value	
	Q Class Ⅰ	30pF & Over : Q ≧350 10 to 30pF : Q≧275+2.5C 30pF & Below: Q≧200+10C	
	Tan δ Class Ⅱ	Shall meet the value in Table 1, Table 2	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller for rated voltage>10V and greater 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 / Tan δ	To satisfy the specified initial value	

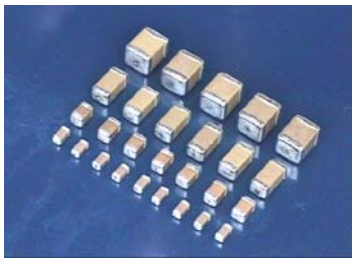
NCC Series Specification & Test Condition

X7R(X)/X5R(B) Table 1.

Size	Rated voltage	Capacitance Range	tan δ (D.F.)	
			Initial Vibration Resistance to solder heat Temperature cycle	Humidity Humidity loading High temperature loading
0201	DC 6.3V	C≦0.01uF	5.0 %	7.5 %
		C=0.1uF	15.0 %	25.0 %
	DC 10V	C≦0.01uF	5.0 %	7.5 %
	DC 16V	C≦2.2nF	2.5 %	5.0 %
		2.2nF <C≦3.3nF	5.0 %	7.5 %
	DC 25V	C≦2.2nF	2.5 %	5.0 %
0402	DC 6.3V	C≦0.22uF	10.0 %	15.0 %
		C≦0.68uF	15.0 %	25.0 %
	DC 10V	C≦0.1uF	5.0 %	7.5 %
		C≦0.47uF	15.0 %	25.0 %
	DC 16V	C≦0.22uF	2.5 %	5.0 %
	DC 25V	C≦0.01uF	2.5 %	5.0 %
	DC 50V	C≦3.9nF	2.5 %	5.0 %
0603	DC 6.3V	All Capacitance	5.0 %	7.5 %
	DC 10V	All Capacitance	5.0 %	7.5 %
	DC 16V	C≦0.1uF	2.5 %	5.0 %
		C≦1uF	5.0 %	7.5 %
	DC 25V	All Capacitance	3.5 %	7.0 %
	DC 50V		2.5 %	5.0 %
0805	DC 16V	C≦0.47uF	2.5 %	5.0 %
		C≦1uF	5.0 %	7.5 %
	DC 25V	C≦0.47uF	2.5 %	5.0 %
	DC 50V	All Capacitance	2.5 %	5.0 %
1206	DC 16V	All Capacitance	2.5 %	5.0 %
	DC 25V		2.5 %	5.0 %
	DC 50V		2.5 %	5.0 %

Y5V(Y) Table 2.

Size	Rated voltage	Capacitance Range	tan δ (D.F.)	
			Initial Vibration Resistance to solder heat Temperature cycle	Humidity Humidity loading High temperature loading
0201	DC 6.3V	All Capacitance	20.0 %	30.0 %
0402	DC 10V	All Capacitance	12.5 %	15.0 %
	DC 16V		9.0 %	11.0 %
	DC 25V		5.0 %	7.5 %
	DC 50V		5.0 %	7.5 %
0603	DC 16V	All Capacitance	7.0 %	10.5 %
	DC 25V		7.0 %	10.5 %
	DC 50V		5.0 %	7.5 %
0805	DC 16V	All Capacitance	7.0 %	10.5 %
	DC 25V		7.0 %	10.5 %
	DC 50V		5.0 %	7.5 %
1206	DC 16V	All Capacitance	7.0 %	10.5 %
	DC 25V		7.0 %	10.5 %
	DC 50V		5.0 %	7.5 %



Multilayer Ceramic Chip Capacitors
[High Capacitance MLCC–X7R,X6S,X5R,Y5V]
HCC Series

◆ Features.

- ❑ Surface mount suited for wave and reflow soldering
- ❑ High reliability and no polarity
- ❑ Small size and high capacitance value
- ❑ Excellent in high frequency characteristic
- ❑ RoHS compliant

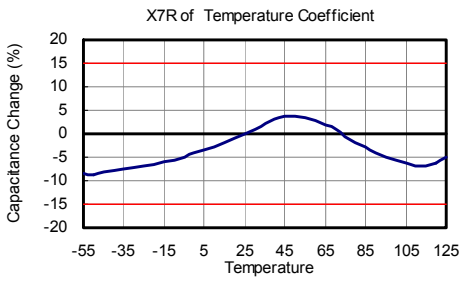
◆ Application

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

◆ Summary of Specification

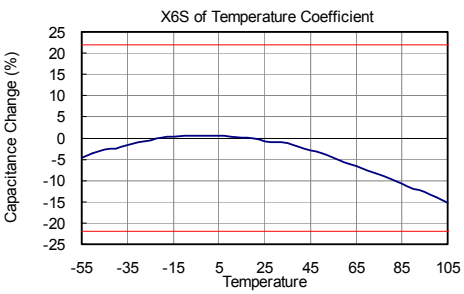
X7R Dielectric Characteristic

Operation Temperature :	-55~+125 ℃
Temperature Coefficient :	± 15% under -55~+125 ℃(EIA Class Ⅱ)
Capacitance Range	1.0uF to 10uF
Dissipation Factor :	Please see HEC specification data sheet
Insulation Resistance :	10GΩ or 500/C Ω whichever is smaller
Aging :	≦ 2.5 % per decade hr , typical
Dielectric Strength :	250% Rated Voltage



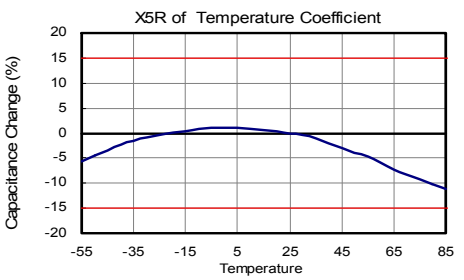
X6S Dielectric Characteristic

Operation Temperature :	-55~+105 ℃
Temperature Coefficient :	± 22% under -55~+105 ℃(EIA Class Ⅱ)
Capacitance Range	1.0uF to 22uF
Dissipation Factor :	Please see HEC specification data sheet
Insulation Resistance :	10GΩ or 500/C Ω whichever is smaller
Aging :	≦ 2.5 % per decade hr , typical
Dielectric Strength :	250% Rated Voltage



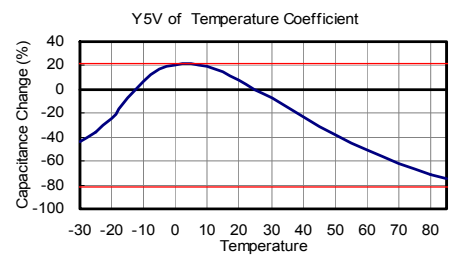
X5R Dielectric Characteristic

Operation Temperature :	-55~+85 ℃
Temperature Coefficient :	± 15% under -55~+85 ℃(EIA Class Ⅱ)
Capacitance Range	1.0uF to 100uF
Dissipation Factor :	Please see HEC specification data sheet
Insulation Resistance :	10GΩ or 500/C Ω whichever is smaller
Aging :	≦ 2.5 % per decade hr , typical
Dielectric Strength :	250% Rated Voltage

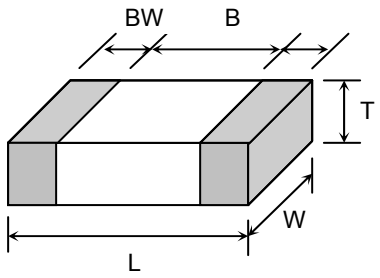


Y5V Dielectric Characteristic

Operation Temperature :	-30~+85 ℃
Temperature Coefficient :	+22/ -82 %, -30~+85 ℃(EIA Class Ⅱ)
Capacitance Range	1.0uF to 47uF
Dissipation Factor :	Please see HEC specification data sheet.
Insulation Resistance :	10GΩ or 500/C Ω whichever is smaller
Aging :	≦ 7.0 % per decade hr , typical
Dielectric Strength :	250% Rated Voltage



◆ Dimension

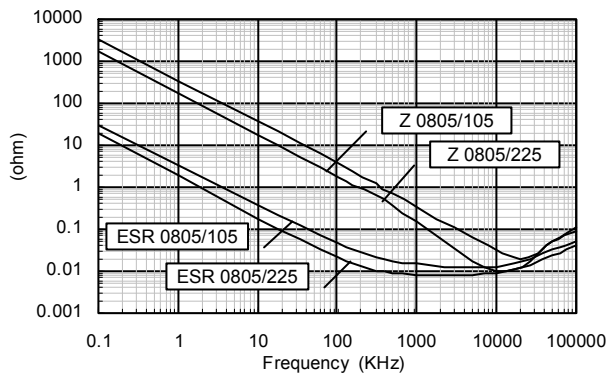


Unit : mm [inches]

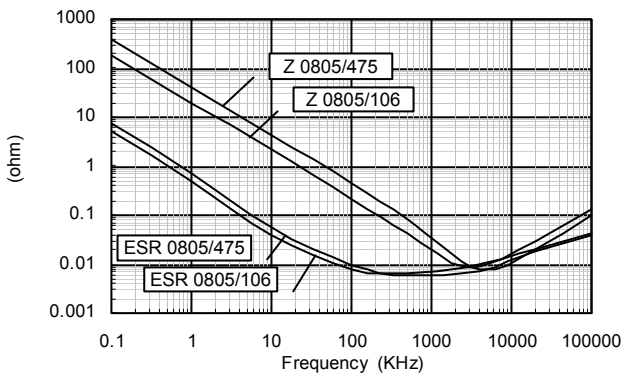
TYPE	L	W	T (max)	B (min)	BW (min)
0402	1.00±0.05 [.039±.002]	0.50±0.05 [.020 ±.002]	0.55 [.022]	0.30 [.012]	0.15 [.006]
0603	1.60±0.10 [.063±.004]	0.80±0.10 [.031 ±.004]	0.90 [.035]	0.40 [.016]	0.15 [.006]
0805	2.00±0.20 [.079±.012]	1.25±0.20 [.049 ±.008]	1.45 [.057]	0.70 [.028]	0.20 [.008]
1206	3.20±0.30 [.126±.012]	1.60±0.20 [.126±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.30 [.126±.012]	2.50±0.20 [.098±.008]	2.60 [.102]	1.60 [.063]	0.30 [.012]
1812	4.60±0.3 [.181±.012]	3.20±0.3 [.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]

◆ Characteristic

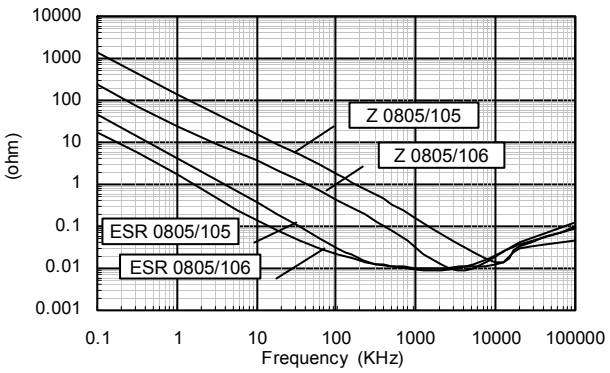
X7R(X) Series



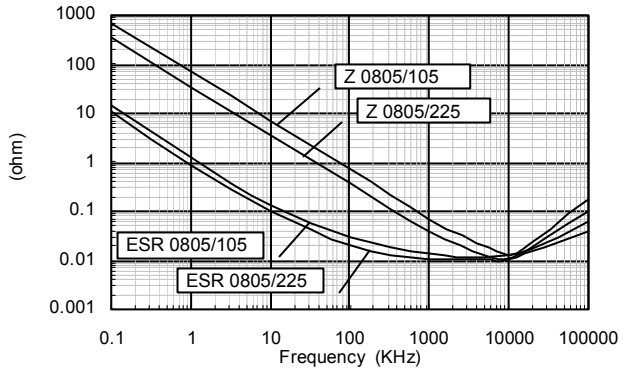
X5R(B) Series



Y5V(Y) Series



X6S(S) Series



◆ How To Order

C	0805	B	106	M	010	T

Product Code	Chip Size	Dielectric	Capacitance Unit : pF	Tolerance	Rated Voltage	Packaging
C: MLCC (Multilayer Ceramic Chip of Capacitor)	0402 : 1.0x0.50 mm 0603 : 1.6x0.80 mm 0805 : 2.0x1.25 mm 1206 : 3.2x1.6 mm 1210 : 3.2x2.5 mm	Ex.: X:X7R S:X6S B:X5R Y:Y5V	Ex.: 105:10x10^5 106:10x10^6 226:22x10^6	Ex.: J : +/- 5% K: +/- 10% M:+/- 20% Z :+80/-20%	Ex.: 004: 4Vdc 007: 6.3Vdc 010: 10Vdc 016: 16Vdc 025: 25Vdc 035: 35Vdc 050: 50Vdc	T: Taping & Reel B: Bulk

◆ Capacitance Range

X7R (X) Series

Size	0603			0805				1206					1210				1812	2220
Code	6.3V	10V	16V	6.3V	10V	16V	25V	10V	16V	25V	35V	50V	10V	16V	25V	35V	35V	35V
105	B	B	B		D	D	D		E	E	E	E		E	E	E	F	F
155																	F	F
225	B	B	B	D	D	D		E	E	E				E	E/F	F	F	F
335				D	D			E	E									F
475				D	D			E	E					E	F	F		F
685																		
106								E					E	E	F	G		G

X6S (S) Series

Size	0402	0603		0805			1206				1210			
Code	6.3V	10V	25V	10V	16V	25V	16V	25V	35V	50V	10V	16V	25V	50V
105	B		B			D			E	E				F
225				D	D	D							F	
475					D	D	E	E				F	F	
106		B		D			E	E			F	F	G	
226											G	G	G	
476														

X5R (B) Series

Size	0402		0603					0805					1206					1210				
Code	6.3V	10V	4V	6.3V	10V	16V	25V	4V	6.3V	10V	16V	25V	6.3V	10V	16V	25V	35V	50V	6.3V	10V	16V	25V	35V
105	O	O		B	B	B	B			D	D	D			E	E	E	E					F
155														E									
225	O			B	B	B			D	D	D	D		E	E	E					E	E/F	F
335									D	D	D	D		E	E	E							
475				B	B				D	D	D	D	E	E	E	E				F	F	F	F
106			B	B					D	D	D		E	E	E	E				F	F	G	G
226								D	D				E	E	E				G	G	G	G	
476													E	E					G	G			
107																			G				

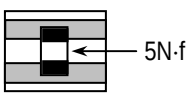
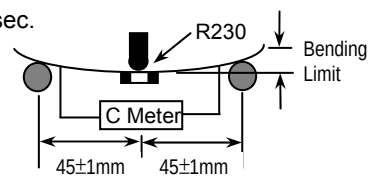
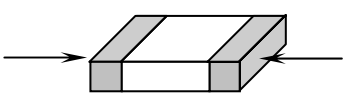
Y5V (Y) Series

Size	0402		0603				0805					1206					1210						1812	
Code	6.3V	10V	6.3	10V	16V	25V	6.3V	10V	16V	25V	50V	10V	16V	25V	35V	50V	6.3V	10V	16V	25V	35V	50V	35V	50V
105	O	O		B	B	B			B	B	D		B	D	D	D								
225			B	B	B			D	D	D			B	D	D									
475			B	B			D	D	D				D	D						F	F	F		F
106							D	D	D			D	D/E	D/E					E	F	F	F	F	F
226							D					D	E					F	F	F			F	
476																	F	F						
107																	G							

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

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

HCC Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	Char. / Operation Temp. X7R (X) -55℃~ +125℃ X6S (S) -55℃~ +105℃ X5R (B) -55℃~ +85℃ Y5V (Y) -30℃~ +85℃	
Visual	No abnormal exterior appearance	Visual Inspection
Capacitance	Within the specified tolerance	Capacitance / Frequency / Voltage C≦10uF 1KHz±10% 1.0±0.2Vrms C>10uF 120Hz±20% 0.5±0.2Vrms
Dissipation Factor	Please see HEC specification data sheet for details	Perform a heat temperature at 150±5℃ for 30min. then place at room temp. for 24±2hr.
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller for rated voltage>10V and greater 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.
Withstanding Voltage	No dielectric breakdown or mechanical breakdown	250% of the rated voltage for 1~5 sec. Current is limited to less than 50mA
Temperature Capacitance Coefficient	Char. / Temp. Range / Cap. Change X7R (X) -55℃~ +125℃ ± 15% X6S (S) -55℃~ +105℃ ± 22% X5R (B) -55℃~ +85℃ ± 15% Y5V (Y) -30℃~ +85℃ +22/-82%	(C2-C1)/C1 × 100% C1:Capacitance At Standard Temperature (20℃) C2:Capacitance At Test Temperature
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.	 A 5N·f (≈ 0.5Kg·f) pull force shall be applied for 10±1 sec.
Resistance to Flexure of Substrate	No mechanical damage or capacitance change more than the following table. Char. / Capacitance Change X7R(X) ≦ ± 12.5% of initial value X6S(S) ≦ ± 12.5% of initial value X5R(B) ≦ ± 12.5% of initial value Y5V(Y) ≦ ± 30.0% of initial value	The board shall be bend 1.0mm with a rate of 1.0 mm/sec. 
Solderability	More than 90% of the terminal surface is to be soldered newly, so 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 : H63A Flux :Rosin Preheat : At 80~120 ℃ For 10~30sec.

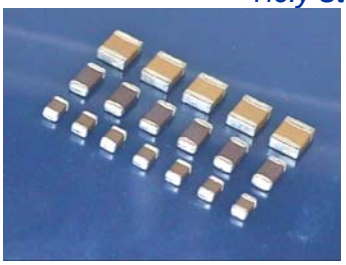
HCC Series Specification & Test Condition

Item	Specification		Test Condition
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 measure. Preheat : at 150±10°C for 60~120sec. Dip : solder temperature of 260±5℃ Dip Time : 10 ± 1sec. Immersing Speed : 25±10% mm/s Solder : H63A Flux : Rosin Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Char. / Cap. change X7R(X) ≤ ±7.5% of initial value X6S(S) ≤ ±7.5% of initial value X5R(B) ≤ ±7.5% of initial value Y5V(Y) ≤ ±20% of initial value	
	Tan δ	To satisfy the specified initial value	
	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 ℃ befor initial measure. 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 / Max Rated Temp.+3/-0 / 30 4 / 25 / 3 Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Char. / Cap. change X7R(X) ≤ ±7.5% of initial value X6S(S) ≤ ±7.5% of initial value X5R(B) ≤ ±7.5% of initial value Y5V(Y) ≤ ±20% of initial value	
	Tan δ	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	
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 48 ± 4 Hours
	Capacitance	Char. / Cap. change X7R(X) ≤ ±12.5% of initial value X6S(S) ≤ ±12.5% of initial value X5R(B) ≤ ±12.5% of initial value Y5V(Y) ≤ ±30% of initial value	
	Tan δ	Please see HEC specification data sheet for details	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller for rated voltage>10V and greater 10/C Ω for rated voltage≦10V. (C in Farad)	

HCC Series Specification & Test Condition

Item	Specification		Test Condition
Humidity Loading	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 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 +12/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Char. Cap. change X7R(X) ≤±12.5% of initial value X6S(S) ≤±12.5% of initial value X5R(B) ≤±12.5% of initial value Y5V(Y) ≤±30% of initial value	
	Tan δ	Please see HEC specification data sheet for details	
	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)	
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Class Ⅱ capacitors applied DC testing voltage 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 :150%Rated Voltage However: The rated voltage is 4V/6.3V/10V, applied voltage of 100% rated voltage. Temperature : max. operation temperature Test Time : 1000 +48/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Char. Cap. change X7R(X) ≤±12.5% of initial value X6S(S) ≤±12.5% of initial value X5R(B) ≤±12.5% of initial value Y5V(Y) ≤±30% of initial value	
	Tan δ	Please see HEC specification data sheet for details	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller for rated voltage>10V and greater 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	
	Tan δ	To satisfy the specified initial value	

Multilayer Ceramic Chip Capacitors
[Low Profile Capacitor – Thin Type X7R,X5R,Y5V]
VAC Series



Low profile high capacitance MLCC's ideally suited for height restricted needs

◆ Features

- ❑ High capacitance & rated voltage with maximum height of 0.5mm(size 0603) & 0.95 mm
- ❑ Surface mount suited for Wave and Reflow soldering
- ❑ RoHS compliant

◆ Application

- ❑ For small and height restricted electronic equipment and applications
- ❑ Suitable for FPD device, HDD, CD-RW, LCD device, cellular phone modules and portable devices…etc.

◆ Summary of Specification

X7R Dielectric Characteristic

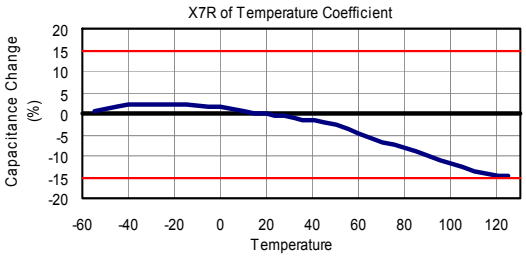
Operation Temperature :	-55~+125 ℃
Temperature Coefficient :	± 15% , -55~+85 ℃ (EIA Class Ⅱ)
Capacitance Range	1uF to 2.2uF
Dissipation Factor :	See Spec.
Insulation Resistance :	10GΩ or 500/C Ω whichever is smaller
Aging :	≦ 2.5 % per decade hr , typical
Dielectric Strength :	250% Rated Voltage

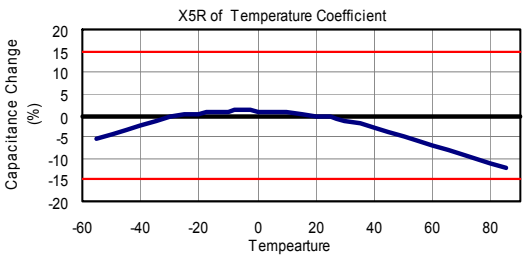
X5R Dielectric Characteristic

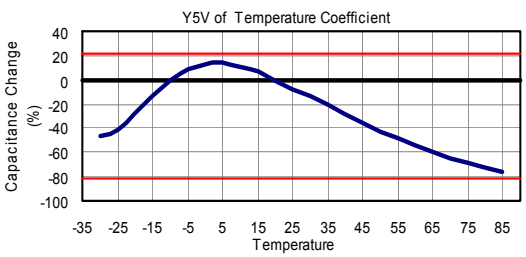
Operation Temperature :	-55~+85 ℃
Temperature Coefficient :	± 15% , -55~+85 ℃ (EIA Class Ⅱ)
Capacitance Range	1uF to 22uF
Dissipation Factor :	See Spec.
Insulation Resistance :	10GΩ or 500/C Ω whichever is smaller
Aging :	≦ 2.5 % per decade hr , typical
Dielectric Strength :	250% Rated Voltage

Y5V Dielectric Characteristic

Operation Temperature :	-30~+85 ℃
Temperature Coefficient :	+22/ -82 %, -30~+85 ℃ (EIA Class Ⅱ)
Capacitance Range	1uF to 10uF
Dissipation Factor :	See Spec.
Insulation Resistance :	10GΩ or 500/C Ω whichever is smaller
Aging :	≦ 7.0 % per decade hr , typical
Dielectric Strength :	250% Rated Voltage





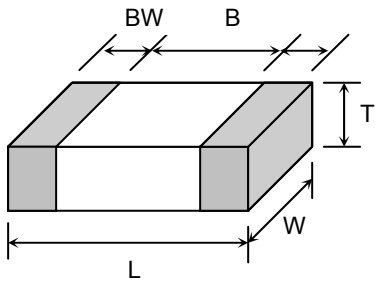


◆ How To Order

VAC	1206	B	106	K	007	T

Product Code	Chip Size	Dielectric	Capacitance Unit : pF	Tolerance	Rated Voltage	Packaging
VAC: Low Profile capacitor (Thin Type)	0603 : 1.6×0.80 mm 0805 : 2.0×1.25 mm 1206 : 3.2×1.60 mm	Ex.: X:X7R B:X5R Y:Y5V	Ex.: 475:47×10^5 106:10×10^6	Ex.: K: +/- 10% M:+/- 20% Z :+80/-20%	Ex.: 007: 6.3Vdc 010: 10Vdc 016: 16Vdc 025: 25Vdc	T: Taping & Reel B: Bulk

◆ Dimension

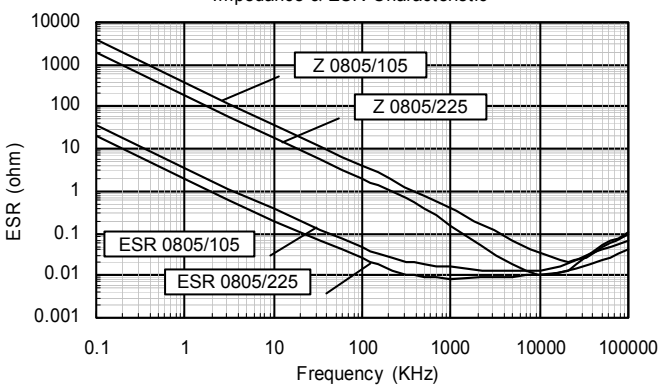


Unit : mm [inches]

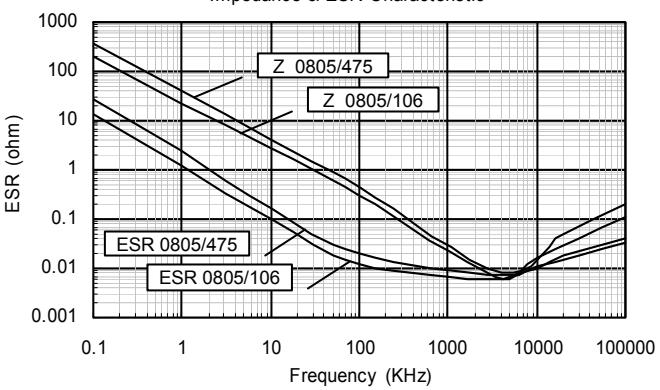
TYPE	L	W	T (max)	B (min)	BW (min)
0603	1.60±0.10 [.063±.004]	0.80±0.10 [.031±.004]	0.50 [.020]	0.40 [.016]	0.15 [.006]
0805	2.00±0.2 [.079±.012]	1.25±0.2 [.049±.008]	0.95 [.037]	0.70 [.028]	0.20 [.008]
1206	3.20±0.3 [.126±.012]	1.60±0.2 [.063±.008]	0.95 [.037]	1.50 [.059]	0.30 [.012]

◆ Characteristic

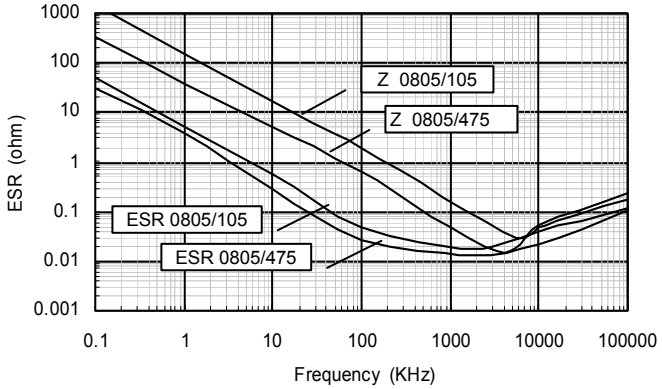
X7R(X) Series



X5R(B) Series



Y5V(Y) Series



◆ Capacitance Range

X7R (X) Series				
Size	0805		1206	
Code	16V	25V	16V	25V
105	B	B		B
155	B		B	B
225	B	B	B	B
335				
475				
106				
226				

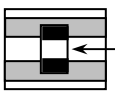
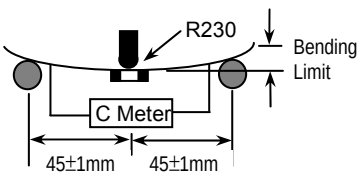
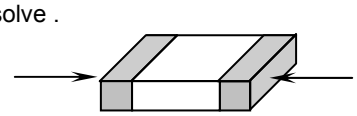
X5R (B) Series												
Size	0603			0805				1206				
Code	6.3V	10V	16V	6.3V	10V	16V	25V	6.3V	10V	16V	25V	
105	T	T	T			B	B				B	
155				B		B				B		
225	T	T		B	B	B	B		B	B	B	
335				B					B			
475				B	B			B	B			
106				B	B			B	B			
226								B				

Y5V (Y) Series							
Size	0805				1206		
Code	6.3V	10V	16V	25V	6.3V	10V	16V
105		B	B	B			
155							
225		B	B	B			B
335							
475	B	B	B	B		B	
106					B		
226							

Symbol Code	T	B
Thickness(mm)	0.45±0.05	0.85±0.1

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

VAC Series Specification & Test Condition

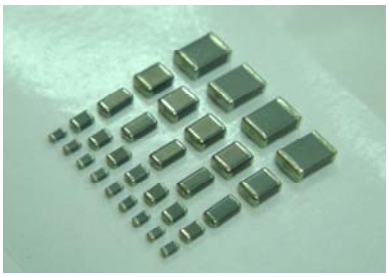
Item	Specification	Test Condition
Operation Temperature	Char. / Operation Temp. X7R (X) / -55℃~ +125℃ X5R (B) / -55℃~ +85℃ Y5V (Y) / -30℃~ +85℃	
Visual	No abnormal exterior appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	Capacitance / Frequency / Voltage C≦10uF / 1KHz±10% / 1.0±0.2Vrms C>10uF / 120Hz±20% / 0.5±0.2Vrms
Dissipation Factor	Char. / 25V / 16V / 10V / 6.3V max. X7R/X5R / 5% / 7.5% / 15% / 15% Y5V / 10% / 12.5% / 20% / 20%	Perform a heat treatment at 150±5℃ for 30min. then place at room temp. for 24±2hr.
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller for rated voltage>10V and greater 100/C Ω for rated voltage≦10V. (C in Farad)	Applied Voltage : Rated Voltage Charge Time : 60±5 sec. Charge-Discharge current shall be less than 50mA current.
Withstanding Voltage	No dielectric breakdown or mechanical breakdown	250% of the rated voltage for 1~5 sec. Current is limited to less than 50mA
Temperature Capacitance Coefficient	Char. / Temp. Range / Cap. Change X7R(X) / -55℃~ +125℃ / ± 15% X5R(B) / -55℃~ +85℃ / ± 15% Y5V(Y) / -30℃~ +85℃ / +22/-82%	(C2-C1)/C1 × 100% C1:Capacitance at Standard Temperature (20℃) C2:Capacitance at Test Temperature
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.	 A 5N·f (≈ 0.5Kg·f) pull force shall be applied for 10±1 sec.
Resistance to Flexure of Substrate	No mechanical damage or capacitance change more than the following table. Char. / Capacitance Change X7R(X) / ≦ ± 12.5% of initial value X5R(B) / ≦ ± 12.5% of initial value Y5V (Y) / ≦ ± 30.0% of initial value	The board shall be bent 1.0mm with a rate of 1.0 mm/sec. 
Solderability	More than 90% of the terminal surface is to be soldered newly, so 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 : H63A Flux :Rosin Preheat : At 80~120 ℃ For 10~30sec.
Resistance to Soldering Heat	Appearance / No mechanical damage shall occur Capacitance / Char. / Cap. change X7R(X) / ≦±7.5% of initial value X5R(B) / ≦±7.5% of initial value Y5V(Y) / ≦±20% of initial value Tan δ / To satisfy the specified initial value Insulation Resistance / To satisfy the specified initial value	Capacitor shall be set for 48± 4 hours at room temperature after one hour heat treatment at 150 +0/-10℃ before initial measure. Preheat : at 150±10°C for 60~120sec. Dip : solder temperature of 260±5℃ Dip Time : 10 ± 1sec. Immersing Speed : 25±10% mm/s Solder : H63A Flux : Rosin Measure at room temperature after cooling for 48 ± 4 Hours

VAC Series Specification & Test Condition

Item	Specification	Test Condition
Temperature Cycle	Appearance: No mechanical damage shall occur Capacitance: X7R(X) ≦±7.5% of initial value; X5R(B) ≦±7.5% of initial value; Y5V(Y) ≦±20% of initial value Tan δ: To satisfy the specified initial value Insulation Resistance: To satisfy the specified initial value	Capacitor shall be set for 48±4 hours at room temperature after one hour heat treatment at 150 +0/-10 ℃ before initial measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following: Step 1: Min Rated Temp.+0/-3, 30 Step 2: 25, 3 Step 3: Max Rated Temp.+3/-0, 30 Step 4: 25, 3 Measure at room temperature after cooling for 48 ± 4 Hours
Humidity	Appearance: No mechanical damage shall occur Capacitance: X7R(X) ≦±12.5% of initial value; X5R(B) ≦±12.5% of initial value; Y5V(Y) ≦±30% of initial value Tan δ: X7R/X5R 7.5% 12.5% 25% 25%; Y5V 13.5% 15% 30% 30% Insulation Resistance: 1,000MΩ or 50/C Ω whichever is smaller for rated voltage>10V and greater 10/C Ω for rated voltage≦10V. (C in Farad)	Capacitor shall be set for 48±4 hours at room temperature after one hour heat treatment at 150 +0/-10 ℃before initial measurement. Temperature : 40± 2 ℃ Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0 hr Measure at room temperature after cooling for 48 ± 4 Hours
Humidity Loading	Appearance: No mechanical damage shall occur Capacitance: X7R(X) ≦±15% of initial value; X5R(B) ≦±15% of initial value; Y5V(Y) ≦±30% of initial value Tan δ: X7R/X5R 7.5% 12.5% 25% 25%; Y5V 13.5% 15% 30% 30% 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)	Capacitors applied DC voltage of the rated voltage 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 :Rated Voltage Temperature : 40±2℃ Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 48 ± 4 Hours
High Temperature Load (Life Test)	Appearance: No mechanical damage shall occur Capacitance: X7R(X) ≦±15% of initial value; X5R(B) ≦±15% of initial value; Y5V(Y) ≦±30% of initial value Tan δ: X7R/X5R 7.5% 12.5% 25% 25%; Y5V 13.5% 15% 30% 30% Insulation Resistance: 1,000MΩ or 50/C Ω whichever is smaller for rated voltage>10V and greater 10/C Ω for rated voltage≦10V. (C in Farad)	Capacitors applied DC testing rated voltage 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 :Rated Voltage Temperature : max. operating temperature Test Time : 1000 +48/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 48 ± 4 Hours

Multilayer Ceramic Chip Capacitors [High Cap. NPO]

HCN Series



Replacement for Film Capacitor

◆ Features

- ❑ Small Size & High Capacitance
- ❑ Suitable for Wave and Reflow Soldering
- ❑ Excellent Characteristics and Tight Tolerance
- ❑ Excellent Bias,High Temperature Stability & Low Tan δ
- ❑ Replace Film Capacitor
- ❑ RoHS compliant

◆ Application

- ❑ Suitable for ADSL Filter Circuits, Cable Modem and Coupling Circuits, general Telecommunications use, Power (Inverter for oscillation Circuit) and Audio Circuits

◆ Summary of Specification

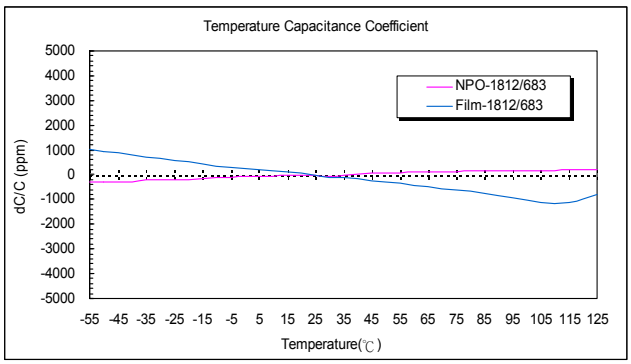
Operation Temperature	-55~+125 ℃
Rated Voltage	16V to 50Vdc
Temperature Coefficient	NPO : ≤ 60ppm/℃, -55~+125 ℃ (EIA Class Ⅰ)
Capacitance Range	1nF ~ 220nF
Dissipation Factor :	Q ≥1000 at 1KHz 20℃
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller (C in Farad)
Dielectric Strength	250% Rated Voltage for 5 second @ 50mA max. current
Capacitance Tolerance	± 5% (±1% ,±2% also available)
Aging	0% per decade hr , Typical

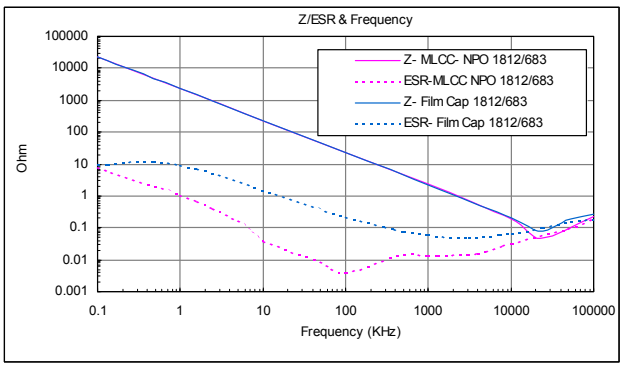
◆ How To Order

C	1206	N	103	J	025	T

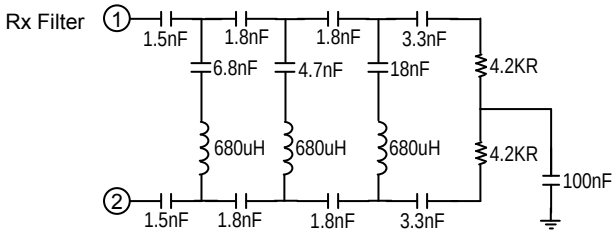
Product Code	Chip Size	Dielectric	Capacitance Unit : pF	Tolerance	Rated Voltage	Packaging
C: MLCC (Multilayer Ceramic Chip of Capacitor)	0603 : 1.6x0.80 mm 0805 : 2.0x1.25 mm 1206 : 3.2x1.60 mm 1210 : 3.2x2.50 mm 1812 : 4.6x3.20 mm	N: NPO	Ex.: 102:10x10^2 103:10x10^3 124:12x10^4	Ex.: F : +/- 1% G : +/- 2% J : +/- 5%	Ex.: 016:16Vdc 025:25Vdc 050:50Vdc	T: Taping & Reel B: Bulk

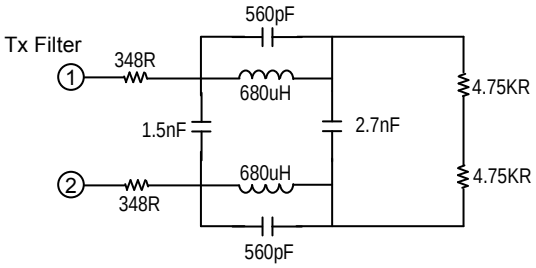
◆ Characteristic





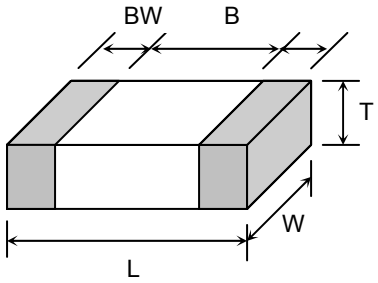
◆ Application Example Circuit





◆ Dimension

Unit : mm [inches]



TYPE	L	W	T (max)	B (min)	BW (min)
0603	1.60+/-0.1 [.063+/-.004]	0.80+/-0.1 [.031+/-.004]	0.90 [.039]	0.40 [.016]	0.15 [.006]
0805	2.00±0.2 [.079±.012]	1.25±0.2 [.049 ±.008]	1.40 [.055]	0.70 [.028]	0.20 [.008]
1206	3.20±0.3 [.126±.012]	1.60±0.2 [.126±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.3 [.126±.012]	2.50±0.2 [.098±.008]	2.20 [.087]	1.60 [.063]	0.30 [.012]
1812	4.60±0.3 [.181±.012]	3.20±0.3 [.126±.012]	2.20 [.087]	4.00 [.157]	0.20 [.008]

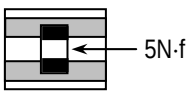
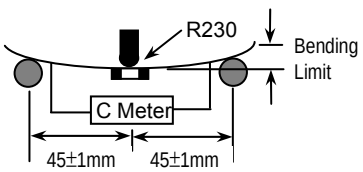
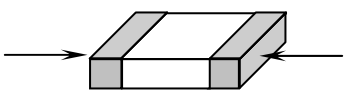
◆ Capacitance Range

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	0603	16V	B	B	B	B	B	B	B																					
		25V	B	B	B	B	B	B	B																					
		50V	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	D										
		25V	B	B	B	B	C	D	D	D	D	D	D	D	D	D	D													
		50V	B	B	B	B	C	D	D	D	D	D	D	D	D															
	1206	16V	B	B	B	B	B	B	B	B	B	C	D	D	D	C/D	C/D	D	D	E	E	E	E	E	E					
		25V	B	B	B	B	B	B	B	B	B	C	D	D	D	C/D	C/D	D	D	E	E	E	E							
		50V	B	B	B	B	B	B	B	B	B	C	D	D	D	C/D	C/D	D	D	E	E									
	1210	16V																		D	E	E	E	E	E	F	F			
		25V	C	C	C	C	C	C	C	C	C	C	C	C	C	D	E	E	F	F	F	F	F	F	F					
		50V	C	C	C	C	C	C	C	C	C	C	C	C	C	D	E	E	F	F	F	F	F							
	1812	16V																						F	F	F	F	F	F	F
		25V	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E	E	E	F	F	F	F	F	F		
		50V	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	E	E	E	E	F	F	F	F	F			

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

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

HCN Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	-55℃~ +125℃	
Visual	No Abnormal Exterior Appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	Frequency: 1KHz±10%; Voltage: 1.0±0.2Vrms
Quality Factor	Q ≧1000	
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller. (C in Farad)	Applied Voltage : Rated Voltage Charge Time : 60±5 sec. Current is limited to less than 50mA
Withstanding Voltage	No dielectric breakdown or mechanical breakdown	250% of the rated voltage for 1~5 sec. Current is limited to less than 50mA.
Temperature Capacitance Coefficient	Temperature Range: -55℃~ +125℃; Cap. Change: ± 60ppm/℃	[C2-C1/C1(T2-T1)] × 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.	 A 5N·f (≈ 0.5Kg·f) pull force shall be applied for 10±1 sec.
Resistance to Flexure of Substrate	No mechanical damage or change capacitance more than the following table. Capacitance Change : ≦ ±5.0% of initial value	The board shall be bent 1.0mm with a rate of 1.0 mm/sec. 
Solderability	More than 90% of the terminal surface is to be soldered newly, so 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 : H63A Flux :Rosin Preheat : At 80~120 ℃ For 10~30sec.
Resistance To Soldering Heat	Appearance: No mechanical damage shall occur Capacitance: Cap. change within ±2.5% of initial value Q Factor: To satisfy the specified initial value Insulation Resistance: To satisfy the specified initial value Dielectric Strength: To satisfy the specified 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 Solder : H63A Flux :Rosin Measure at room temperature after cooling for 24 ± 2 Hours

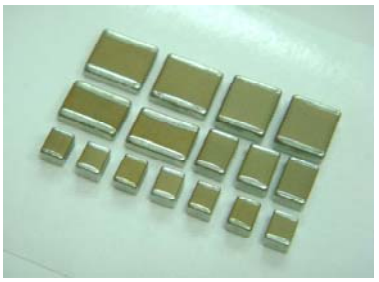
HCN Series Specification & Test Condition

Item	Specification		Test Condition
Temperature Cycle	Appearance	No mechanical damage shall occur	Capacitor shall be subjected to five cycles of the temperature cycle as following:
	Capacitance	Cap. change within ±2.5% of initial value	
	Q Factor	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	Measure at room temperature after cooling for 24 ±2 Hours
Humidity	Appearance	No mechanical damage shall occur	Temperature : 40± 2 ℃ Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0 hr Measure at room temperature after cooling for 24 ± 2 Hours
	Capacitance	Cap. change within ±5.0% of initial value	
	Q Factor	Q ≧350	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)	
Humidity Loading	Appearance	No mechanical damage shall occur	Applied Voltage :Rated Voltage Temperature : 40±2℃ Relative Humidity : 90 ~ 95%RH Test Time : 500 ＋12/－0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 24 ± 2 Hours
	Capacitance	Cap. change within ±5.0% of initial value	
	Q Factor	Q ≧350	
	Insulation Resistance	500MΩ or 25/C Ω whichever is smaller. (C in Farad)	
High Temperature Load **(Life Test)**	Appearance	No mechanical damage shall occur	Applied Voltage :200% of Rated Voltage Temperature : max. operation temperature Test Time : 1000 +48/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 24 ± 2 Hours
	Capacitance	Cap. change within ±3.0% of initial value	
	Q Factor	Q ≧350	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (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	
	Tan δ	To satisfy the specified initial value	

Step	Temp.(℃)	Time(min)
1	Min Rated Temp.(-55)+0/-3	30
2	25	3
3	Max Rated Temp.(+125)+3/-0	30
4	25	3

Multilayer Ceramic Chip Capacitors [High Cap. X7R]

HCX Series



◆ Features

- ❑ Rated working voltage of 50 to 100Vdc
- ❑ Small size & high capacitance
- ❑ Excellent bias,high temperature stability & low Tan δ
- ❑ Low ESR and excellent ripple current characteristics
- ❑ RoHS compliant

◆ Application

- ❑ DC-DC Converters (filter)
- ❑ Industrial Controls
- ❑ Power Supplies
- ❑ Surge Protection

◆ Summary of Specification

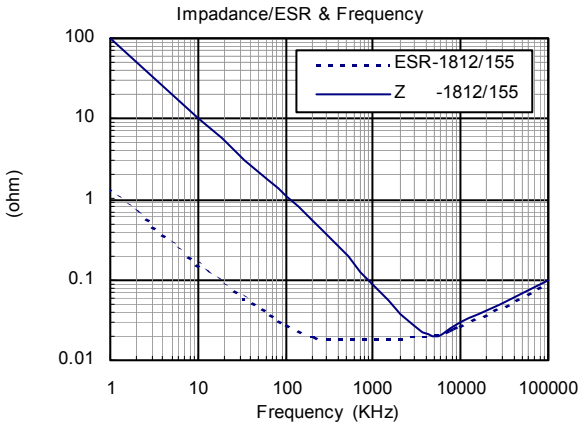
Operation Temperature	-55~+125 ℃
Rated Voltage	50V to 100Vdc
Temperature Coefficient	X7R : ≤ ± 15% at -55~+125 ℃ (EIA Class II)
Capacitance Range	100nF ~ 10uF
Dissipation Factor :	2.5% max. at 1KHz 25℃
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller (C in Farad)
Dielectric Strength	50V : 250% rated voltage for 5 second @ 50mA max. current
	100V :200% rated voltage for 5 second @ 50mA max. current
Capacitance Tolerance	± 10% , ± 20%
Aging	2.5% per decade hr , typical

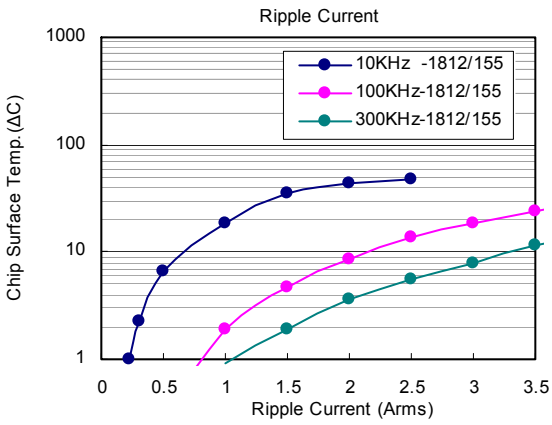
◆ How To Order

C	1210	X	225	K	101	T	X

Product Code	**Chip Size**	**Dielectric**	**Capacitance Unit : pF**	**Tolerance**	**Rated Voltage**	**Packaging**	**Special Requirement**
C:MLCC (Multilayer Ceramic Chip of Capacitor)	Ex.: 1210 : 3.2x2.5 mm 1812 : 4.6x3.2 mm 1825 : 4.6x6.35 mm 2220 : 5.7x5.0 mm 2225 : 5.7x6.35 mm	X: X7R	Ex.: 102:10x10² 224:22x10⁴ 105:10x10⁵	Ex.: K: +/- 10% M: +/- 20%	Ex.: 050:50Vdc 101:100Vdc	T: Taping & Reel B: Bulk	Ex.: O: Arc Prevention Coating X: Cushion Termination (Super Term)

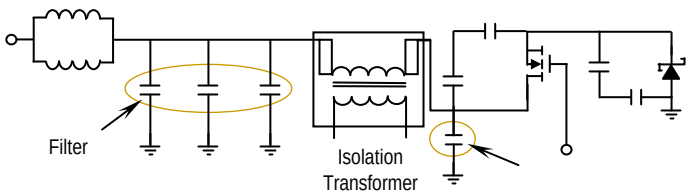
◆ Characteristic



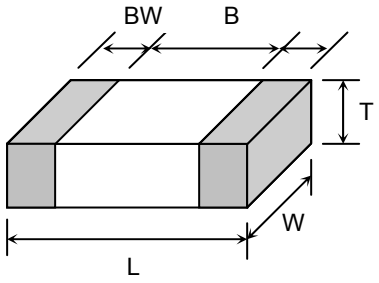


◆ Application Example Circuit

DC-DC Converter



◆ Dimension



Unit : mm [inches]

TYPE	L	W	T (max)	B (min)	BW (min)
1210	3.20±0.3 [.126±.012]	2.50±0.2 [.098±.008]	2.60 [.102]	1.60 [.063]	0.30 [.012]
1812	4.60±0.3 [.181±.012]	3.20±0.3 [.126±.012]	3.00 [.118]	2.50 [.098]	0.30 [.012]
1825	4.60±0.3 [. 181±.012]	6.35±0.4 [.250±.016]	3.00 [.118]	2.50 [.137]	0.30 [.012]
2220	5.70±0.4 [.220±.016]	5.00±0.4 [.197±.016]	3.00 [.118]	3.50 [.137]	0.30 [.012]
2225	5.70±0.4 [.220±.016]	6.35±0.4 [.250±.016]	3.00 [.118]	3.50 [.137]	0.30 [.012]

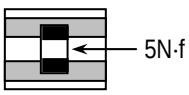
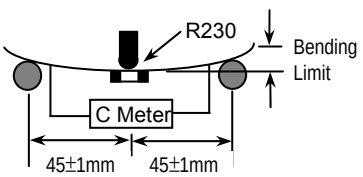
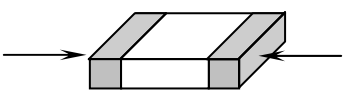
◆ Capacitance Range

Size		1210		1812		1825		2220		2225	
Code	WVDC	50V	100V	50V	100V	50V	100V	50V	100V	50V	100V
104	100nF	C	C	D	D/E	D	D				
154	150nF	C	C	D	D/E	D	D				
224	220nF	C	C	D	D/E	D	D				
334	330nF	C	C	D	D/E	D	D				
474	470nF	D	C	D	E	D	D	E	E	D	D
564	560nF	D	D	D	E	D	D	E	E	D	D
684	680nF	D	E	D	E	D	E	E	E	D	D
105	1uF	E	F	D	E	D	E	F	F	D	E
155	1.5uF	F	G	E	F	E	F	F	F	E	F
225	2.2uF	G	G	F	F	F	F	F	F	F	F
335	3.3uF			F		F		F	F	F	F
475	4.7uF			F		F		F	F	F	F
685	6.8uF							G		F	
106	10uF							H		G	

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

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

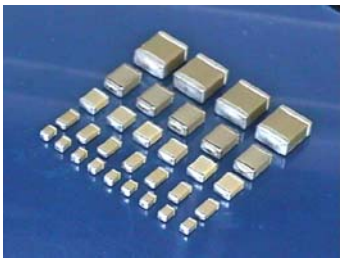
HCX Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	-55℃~ +125℃	
Visual	No Abnormal Exterior Appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	Frequency: 1KHz±10%; Voltage: 1.0±0.2Vrms
Dissipation Factor	0.025 max.	Perform a heat treatment at 150±5℃ for 30min. then place room temp. for 24±2hr.
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller. (C in Farad)	Applied Voltage : Rated Voltage Charge Time : 60±5 sec. Charge-Discharge current shall be less than 50mA current.
Withstanding Voltage	No dielectric breakdown or mechanical breakdown	50V: 250% Rated Voltage 100V: 200% Rated Voltage for 1~5 sec. Current is limited to less than 50mA.
Temperature Capacitance Coefficient	Temp. Range: -55℃~ +125℃; Cap. Change: ± 15%	(C2-C1)/C1 × 100% C1:Capacitance at Standard Temperature(25℃) C2:Capacitance at Test Temperature
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.	 A 5N·f (≈ 0.5Kg·f) pull force shall be applied for 10±1 sec.
Resistance to Flexure of Substrate	No mechanical damage or capacitance change more than the following table. Char. X7R (X): Capacitance Change ≦ ± 12.5% of initial Value	The board shall be bent 1.0mm with a rate of 1.0 mm/sec. 
Solderability	More than 90% of the terminal surface is to be soldered newly, so 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 : H63A Flux :Rosin Preheat : At 80~120 ℃ For 10~30sec.
Resistance to Soldering Heat	Appearance: No mechanical damage shall occur Capacitance: within ±7.5% of initial Value Tan δ: 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 measurement. Preheat : at 150±10°C for 60~120sec. Dip : solder temperature of 260±5℃ Dip Time : 10 ± 1sec. Immersing Speed : 25±10% mm/s Solder : H63A Flux : Rosin Measure at room temperayure after cooling for Class Ⅰ : 24 ± 2 Hours Class Ⅱ : 48 ± 4 Hours

HCX Series Specification & Test Condition

Item	Specification		Test Condition
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 measurement. 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 / Max Rated Temp.+3/-0 / 30 4 / 25 / 3 Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Within ±7.5% of initial value	
	Tan δ	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	
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 measurement. Temperature : 40± 2 ℃ Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0 hr Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Within ±12.5% of initial value	
	Tan δ	0.05 max.	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)	
High Temperature Loading (Life Test)	Appearance	No mechanical damage shall occur	For Class Ⅱ capacitors, DC testing voltage is applied for one hour at maximum operation temperature ±3℃ then shall set for 48±4 hours at room temperature and the initial measurement shall be conducted. Load/Life Conditions: Caps rated <100V 200% Rated Voltage Caps rated ≥100V 150% Rated Voltage 1210/100V ≥1.0uF 120% Rated Voltage Temperature : max.operating temperature Test Time : 1000 +48/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Within ±15% of initial value	
	Tan δ	0.05 max.	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (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	
	Tan δ	To satisfy the specified initial value	

Multilayer Ceramic Chip Capacitors
[Y5U Characteristic Capacitors]
HCY Series



◆ Features

- ❑ Small size & high capacitance
- ❑ Excellent high frequency characteristics due to low ESR
- ❑ Improved temperature stability over Y5V
- ❑ Excellent bias and high rated ripple current.
- ❑ Suitable for Wave and Reflow soldering
- ❑ RoHS compliant

◆ Application

- ❑ DC-DC converter for smoothing circuit.
- ❑ Switching power supplies, DC Fans…etc.
- ❑ Noise suppression, by pass and decoupling circuits.
- ❑ Other applications requiring very high capacitance values.

◆ Summary of Specification

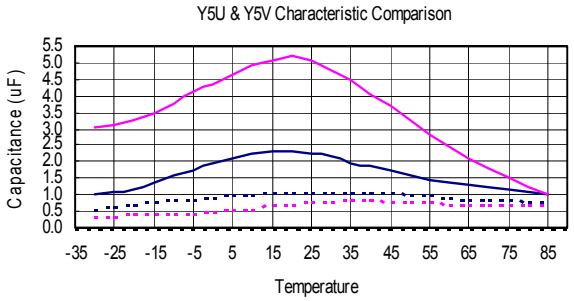
Operation Temperature	-30 ℃ to +85 ℃
Rated Voltage	25V to 100Vdc
Temperature Coefficient	Y5U : ≤ +22 /-56 % , -30~+85 ℃ (EIA Class II)
Capacitance Range	10nF ~ 22uF
Dissipation Factor :	Y5U : D.F.≦4.0% at 1KHz 20 ℃
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller (C in Farad)
Dielectric Strength	250% Rated Voltage for 5 seconds @ 50mA max. current
Aging	Y5U: 4.0 % per decade hr, Typical

◆ How To Order

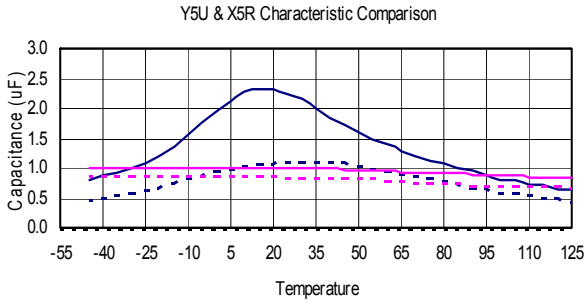
C	1206	E	106	M	025	T
Product Code C: MLCC (Multilayer Ceramic Chip of Capacitor)	**Chip Size** Ex.: 0603: 1.6x0.80 mm 0805: 2.0x1.25 mm 1206 : 3.2x1.60 mm 1210 : 3.2x2.50 mm 1812 : 4.6x3.20 mm 2220 : 5.7x5.00 mm	**Dielectric** Ex.: E: Y5U	**Capacitance** **Unit : pF** Ex.: 102:10x10² 473:47x10³ 106:10x10⁶	**Tolerance** Ex.: M: +/- 20% Z:+80/-20%	**Rated Voltage** Ex.: 010:10Vdc 025:25Vdc 050:50Vdc 101:100Vdc	**Packaging** T: Taping & Reel B: Bulk

◆ Characteristic

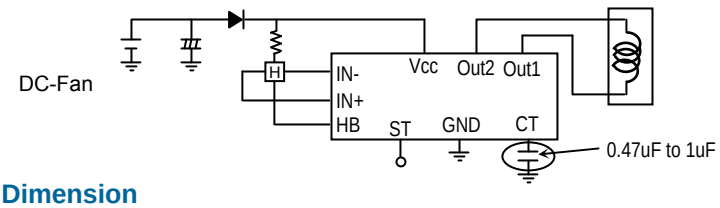
E Series (Y5U) 2.2uF/25V — Bias 0 V; Bias 12V
Barium Titante (Y5V) 4.7uF/16V — Bias 0 V; Bias 12V



E Series (Y5U) 2.2uF/25V — Bias 0 V; Bias 12V
Barium Titante (X5R) 1.0uF/16V — Bias 0 V; Bias 12V

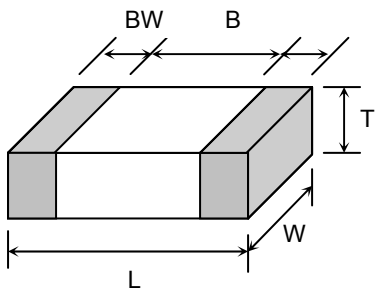


◆ Application Example Circuit



◆ Dimension

Unit : mm [inches]



TYPE	L	W	T (max)	B (min)	BW (min)
0603	1.60±0.1 [.063±.004]	0.80±0.1 [.031 ±.004]	0.90 [.035]	0.40 [.016]	0.15 [.006]
0805	2.00±0.2 [.079±.012]	1.25±0.2 [.049 ±.008]	1.45 [.057]	0.70 [.028]	0.20 [.008]
1206	3.20±0.3 [.126±.012]	1.60±0.2 [.126±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.3 [.126±.012]	2.50±0.2 [.098±.008]	2.60 [.102]	1.60 [.063]	0.30 [.012]
1812	4.60±0.3 [.181±.012]	3.20±0.3 [.126±.012]	3.00 [.118]	2.50 [.098]	0.30 [.012]
2220	5.70±0.4 [.220±.016]	5.00±0.4 [.197±.016]	3.00 [.118]	3.50 [.137]	0.30 [.012]

◆ Capacitance Range

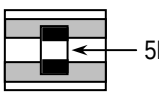
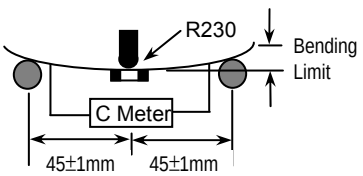
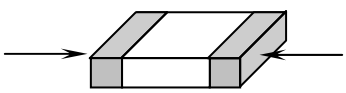
Y5U (E) Series

Size	0603			0805			1206			1210				1812			2220		
Code	10V	25V	50V	10V	25V	50V	10V	25V	50V	10V	25V	50V	100V	25V	50V	100V	25V	50V	100V
103		B	B		B	B		B	B		C	C	E	E	F	F	F	F	F
153		B	B		B	B		B	B		C	C	E	E	F	F	F	F	F
223		B	B		B	B		B	B		C	C	E	E	F	F	F	F	F
333		B	B		B	B		B	B		C	C	E	E	F	F	F	F	F
473		B	B		B	B		B	B		C	C	E	E	F	F	F	F	F
683		B			B	B		B	B		C	C	E	E	F	F	F	F	F
104		B			B	B		B	B		C	C	E	E	F	F	F	F	F
154		B			B	B		B	B		C	C	E	E	F	F	F	F	F
224		B			B	B		B	B		C	C	E	E	F	F	F	F	F
334					B			B	C		C	C	E	E	F	F	F	F	F
474					B			B	C		C	C	E	E	F	F	F	F	F
564					B			B	D		C	C	F	E	F	F	F	F	F
684					B			B	D		C	C		E	F	F	F	F	F
105	B				B			B	E		C	C		E	F	F	F	F	F
155								C			D	D		E	F	F	F	F	F
225								D			D			E	F		F	F	F
335											D			E	F		F	F	G
475				D							E			E	F		F	F	
685											E			F			F	F	
106				D			D			F				F			F	F	
226																	G		

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

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

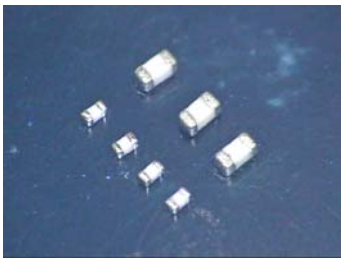
HCY Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	-30℃~ +85℃	
Visual	No abnormal exterior appearance	Visual Inspection
Capacitance	Within the specified tolerance	Frequency: 1KHz±10%; Voltage: 1.0±0.2Vrms
Dissipation Factor	4.0% (0.04) Maximum	Perform a heat treatment at 150±5℃ for 30min. then place at room temp. for 24±2hr.
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller. (C in Farad)	Applied Voltage : Rated Voltage Charge Time : 60±5 sec. Charge-Discharge current shall be less than 50mA.
Withstanding Voltage	No dielectric breakdown or mechanical breakdown	250% of the rated voltage for 1~5 sec. Current is limited to less than 50mA
Temperature Capacitance Coefficient	Char. Y5U(E); Temp. Range -30℃~ +85℃; Cap. Change +22/-56%	(C2-C1)/C1 × 100% C1:Capacitance at Standard Temperature C2:Capacitance at Test Temperature
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.	 A 5N·f (≈ 0.5Kg·f) pull force shall be applied for 10±1 second.
Resistance to Flexure of Substrate	No mechanical damage or change capacitance more than the following table. Capacitance Change : ≦ ±30% of initial value	The board shall be bent 1.0mm with a rate of 1.0 mm/sec. 
Solderability	More than 90% of the terminal surface is to be soldered newly, so 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 : H63A Flux :Rosin Preheat : At 80~120 ℃ For 10~30sec.
Resistance to Soldering Heat	Appearance: No mechanical damage shall occur Capacitance: Cap. change within ±20% of initial value Tan δ: To satisfy the specified initial value Insulation Resistance: To satisfy the specified initial value	Capacitor shall be set for 48± 4 hours at room temperature after one hour heat treatment at 150 +0/-10℃ before initial measurement. Preheat : at 150±10°C for 60~120sec. Dip : solder temperature of 260±5℃ Dip Time : 10 ± 1sec. Immersion Speed : 25±10% mm/s Solder : H63A Flux : Rosin Measure at room temperature after cooling for 48 ± 4 Hours

HCY Series Specification & Test Condition

Item	Specification		Test Condition
Temperature Cycle	Appearance	No mechanical damage shall occur	Capacitor shall be set for 48±4 hours at room temperature after one hour heat treatment at 150 +0/-10 ℃ before initial measurement. Capacitor shall be subjected to five cycles of the temperature cycle as follow: Step / Temp.(℃) / Time(min) 1 / Min Rated Temp.(-30)+0/-3 / 30 2 / 25 / 3 3 / Max Rated Temp.(+85)+3/-0 / 30 4 / 25 / 3 Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Cap. change within ±20% of initial value	
	Tan δ	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	
Humidity	Appearance	No mechanical damage shall occur	Capacitor shall be set for 48±4 hours at room temperature after one hour heat treatment at 150 +0/-10 ℃before initial measurement. Temperature : 40± 2 ℃ Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0 hr Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Cap. change within ±30% of initial value	
	Tan δ	6.0% Maximum	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)	
Humidity Loading	Appearance	No mechanical damage shall occur	Capacitors applied DC voltage of the rated voltage 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 :Rated Voltage Temperature : 40±2℃ Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Cap. change within ±30% of initial value	
	Tan δ	6.0% Maximum	
	Insulation Resistance	500MΩ or 25/C Ω whichever is smaller. (C in Farad)	
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Capacitors applied DC testing voltage 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 :200% Rated Voltage However: For rated voltage ≥ 100V, applied voltage of 150% rated voltage. Temperature : max. operating temperature Test Time : 1000 +48/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Cap. change within ±30% of initial value	
	Tan δ	6.0% Maximum	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)	

Multilayer Ceramic Chip Capacitors
[Radio Frequency Capacitors]
RFC Series



◆ Features

- ❑ High Q value & Low ESL at high frequency
- ❑ Ultra stable C0G performance
- ❑ Ultra miniature size 0402 and 0201
- ❑ Low capacitance with tight tolerance
- ❑ RoHS compliant

◆ Application

- ❑ Radio Frequency
  - ▪ Impedance Matching Circuit
  - ▪ Resonant Circuit
  - ▪ Coupling Circuit
    - ◆RF Modules, VCO, BPF, DUP, PA, etc.
    - ◆ Cellular Phone, Bluetooth, Wireless LAN etc.

◆ Summary of Specification

Operation Temperature	-55 to +125℃
Rated Voltage	25Vdc
Size	0201 and 0402
Temperature Coefficient	C0G < ± 30ppm/℃ , -55~+125 ℃ (EIA Class Ⅰ)
Capacitance Range	0.1pF ~ 15pF
Q Value :	Q ≧1000 at 1MHz & ≧ 500. at 1GHz / 1pF
Insulation Resistance	10GΩ
Dielectric Strength	300% Rated Voltage for 5 second @ 50mA max. current
Tolerance	± 0.05pF to ± 0.1pF, C , J
Aging	0 % per decade of time , Typical

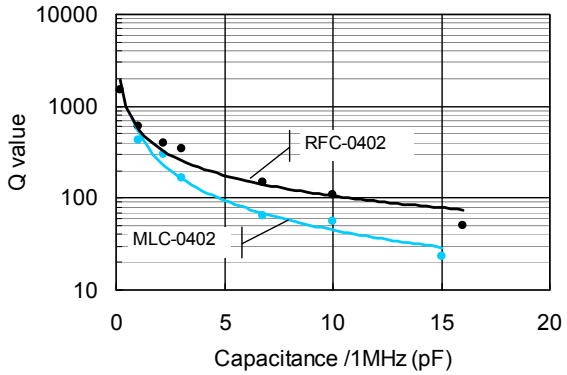
◆ How To Order

RFC	0402	G	R30	B	025	T

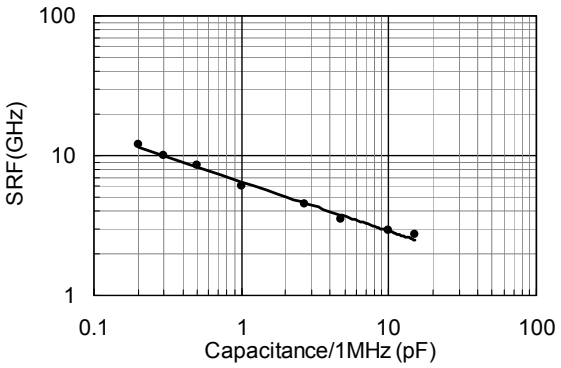
Product Code	**Chip Size**	**Dielectric**	**Capacitance Unit : pF**	**Tolerance**	**Rated Voltage**	**Packaging**
RFC: Radio Frequency of MLCC	Ex.: 0201 : 0.6x0.3 mm 0402 : 1.0x0.5 mm	Ex.: G : C0G	Ex.: R10: 0.1pF 5R0: 5.0pF 120: 12x10⁰	Ex.: L : ±0.050pF A: ±0.075pF B: ±0.10pF C: ±0.25pF J : ± 5.0 %	Ex.: 025:25Vdc	T: Taping & Reel B: Bulk

◆ Characteristic

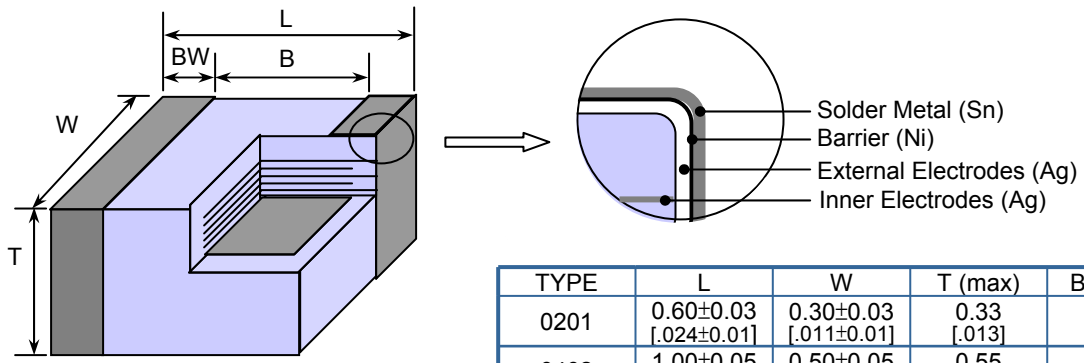
Q v.s. Capacitance at 1GHz



Self Resonant Frequency



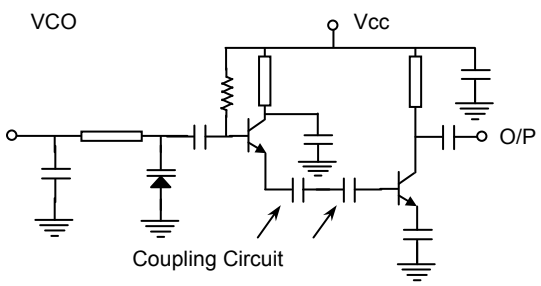
◆ Structure & Dimension

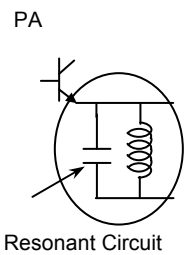


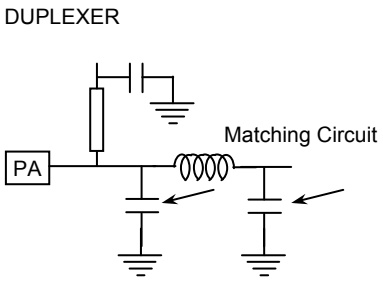
Unit : mm [inches]

TYPE	L	W	T (max)	B (min)	BW (min)
0201	0.60±0.03 [.024±0.01]	0.30±0.03 [.011±0.01]	0.33 [.013]	0.20 [.008]	0.10 [.004]
0402	1.00±0.05 [.039±0.02]	0.50±0.05 [.020±0.02]	0.55 [.022]	0.30 [.012]	0.15 [.006]

◆ Application Example Circuit







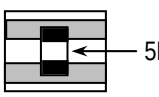
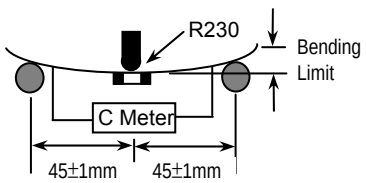
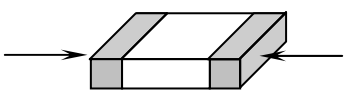
◆ Capacitance Range

Dielectric Characteristic	Size	Voltage	Capacitange Range																														
			R10	R20	R30	R40	R50	R60	R70	R80	R90	1R0	1R1	1R2	1R3	1R5	1R6	1R8	2R0	2R2	2R4	2R7	3R0	3R3	3R9	4R7	5R6	6R8	8R2	100	120	150
C0G	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							
C0G	0402	25V	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
Tolerance			± 0.05pF					±0.075pF				±0.1pF												± 0.25pF								±5%	

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

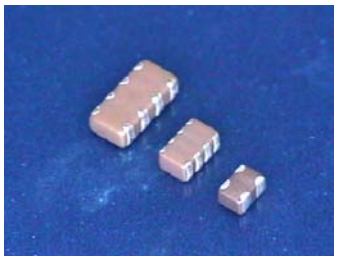
▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

RFC Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	-55℃~ +125℃	
Visual	No abnormal exterior appearance	Visual Inspection
Capacitance	Within the specified tolerance	Frequency: 1MHz±10% / Voltage: 1.0±0.2Vrms
Q Value	≧1000	
Insulation Resistance	More than 10,000MΩ	Applied Voltage : Rated Voltage Charge Time : 60±5 sec. Charge-Discharge current shall be less than 50mA current.
Withstanding Voltage	No dielectric breakdown or mechanical breakdown	300% of the rated voltage for 1~5 sec. Current is limited to less than 50mA
Temperature Capacitance Coefficient	Char. C0G(G) / Temp. Range -55℃~ +125℃ / Cap. Change ± 30ppm/℃	[C2-C1/C1(T2-T1)] × 100% T1:Standard Temperature(20℃) 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.	 A 5N·f (≈ 0.5Kg·f) pull force shall be applied for 10±1 second.
Resistance to Flexure of Substrate	No mechanical damage shall occur.	The board shall be bent 1.0mm with a rate of 1.0 mm/sec. 
Solderability	More than 90% of the terminal surface is to be soldered newly, so metal part does not come out or dissolve . 	Solder Temperature : 245±5℃ Dip Time : 2 ± 0.5 sec. Immersion Speed : 25±10% mm/s Solder : H63A Flux :Rosin Preheat : At 80~120 ℃ For 10~30sec.
Resistance to Soldering Heat	Appearance: No mechanical damage shall occur Capacitance: Cap. change within ±7.5% or ±0.02pF of initial value, whichever is large. Insulation Resistance: ≧1000MΩ	Preheat : at 150±10°C for 60~120sec. Dip : solder temperature of 260±5℃ Dip Time : 10 ± 1sec. Immersing Speed : 25±10% mm/s Solder : H63A Flux : Rosin

RFC Series Specification & Test Condition

Item		Specification	Test Condition
Temperature Cycle	Appearance	No mechanical damage shall occur	Capacitor shall be subjected to five cycles of the temperature cycle as follow: Step / Temp.(℃) / Time(min) 1 / Min Rated Temp.(-55)+0/-3 / 30 2 / 25 / 3 3 / Max Rated Temp.(+125)+3/-0 / 30 4 / 25 / 3 Measure at room temperature after cooling for 24 ± 2 Hours
	Capacitance	Cap. change within ±7.5% or ±0.02pF of initial value, whichever is larger.	
	Insulation Resistance	≧1,000MΩ	
Humidity	Appearance	No mechanical damage shall occur	Temperature : 40± 2 ℃ Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0 hr Measure at room temperature after cooling for 24 ± 2 Hours
	Capacitance	Cap. change Within 7.5% or ±0.02pF of initial value, Whichever is larger	
	Q	≧200	
	Insulation Resistance	≧1,000MΩ	
Humidity Loading	Appearance	No mechanical damage shall occur	Applied Voltage :Rated Voltage Temperature : 40±2℃ Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 24 ± 2 Hours
	Insulation Resistance	≧1,000MΩ	
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Applied Voltage :200%Rated Voltage Temperature : max. operating temperature Test Time : 1000 +48/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 24 ± 2 Hours
	Insulation Resistance	≧1,000MΩ	



Multilayer Ceramic Chip Capacitors
[Multilayer Capacitor Arrays]
MCA Series

The capacitor array combines four separate multilayer ceramic capacitors. It's can reduce PCB space and improve placement efficiency compared to 2×MLCC & 4×MLCC.

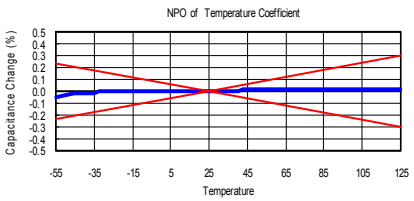
◆ Features

- ❑ Small size with 2×MLCC & 4×MLCC capacitor
- ❑ Space saving for high density placing requirement
- ❑ Improve placement efficiency
- ❑ Suitable for Cellular, Pagers, I/O Port, Mother Boards and General Electronic Equipment.
- ❑ RoHS compliant

◆ Summary of Specification

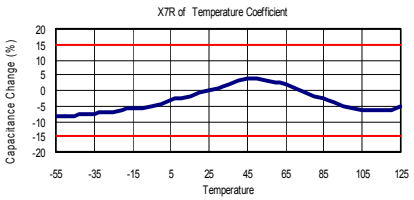
NPO Dielectric Characteristic

Temperature Coefficient :	±30ppm/℃ , -55~+125℃
Capacitance Range	10pF to 470pF
Dissipation Factor :	more than 30pF: Q≧1000 (0.001)
	30pF& below : Q≧400+20C C:pF
Insulation Resistance :	10GΩ or 500/C Ω whichever is smaller
Dielectric Strength :	250% Rated Voltage



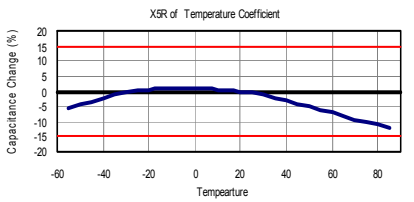
X7R Dielectric Characteristic

Temperature Coefficient :	±15% , -55~+125℃
Capacitance Range	180pF to 1.0uF
Dissipation Factor :	See table 1.
Insulation Resistance :	10GΩ or 500/C Ω whichever is smaller
Dielectric Strength :	250% Rated Voltage



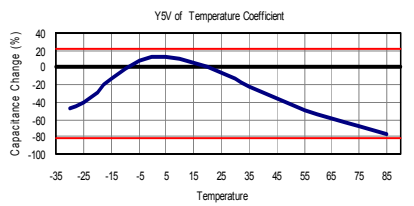
X5R Dielectric Characteristic

Temperature Coefficient :	±15% , -55~+85℃
Capacitance Range	100nF to 2.2uF
Dissipation Factor :	See table 1.
Insulation Resistance :	10GΩ or 500/C Ω whichever is smaller
Dielectric Strength :	250% Rated Voltage



Y5V Dielectric Characteristic

Temperature Coefficient :	+22/ -82 %, -30~+85℃
Capacitance Range	10nF to 1.0uF
Dissipation Factor :	See table 2.
Insulation Resistance :	10GΩ or 500/C Ω whichever is smaller
Dielectric Strength :	250% Rated Voltage

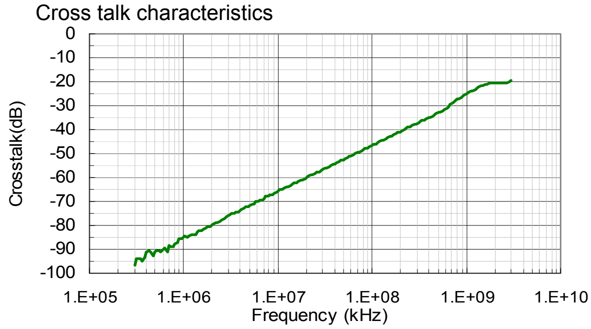


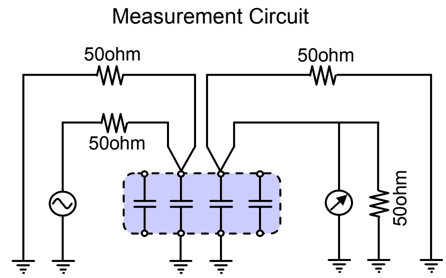
◆ How To Order

CA	4	B	1C	105	M	T

Product Code	Chip Size	Dielectric	Rated Voltage	Capacitance Unit : pF	Tolerance	Packaging
CA: MLCC Array	6 : 1206 3.2×1.6 mm 5 : 0805 2.0×1.25 mm 4 : 0504 1.37×1.0 mm	Ex.: N: NPO X: X7R B:X5R Y: Y5V	Ex.: 1J : 6.3Vdc 1A: 10Vdc 1C: 16Vdc 1E: 25Vdc 1H:50Vdc	Ex.: 102:10×10² 473:47×10³ 104:10×10⁴	Ex.: K : +/- 10% M: +/- 20% Z :+80/-20 %	T: Taping & Reel B: Bulk

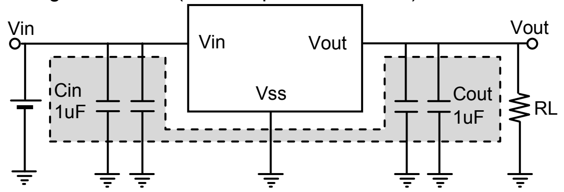
◆ Characteristic

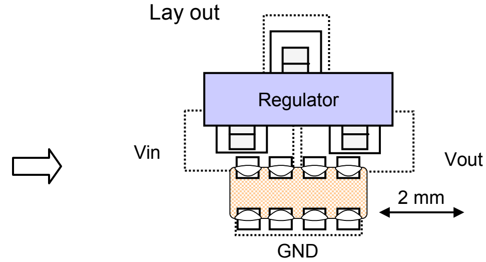




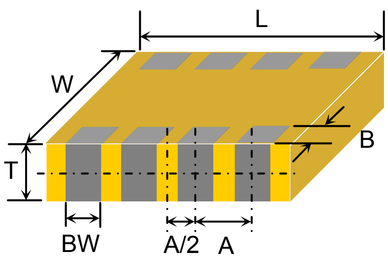
◆ Application

Example Circuit





◆ Dimension



Unit : mm [inches]

Type	L	W	T (max.)	B (min.)	BW	A
0504	1.37±0.15 [.054±.006]	1.00±0.10 [.039±.004]	0.90 [.035]	0.10 [.004]	0.36± 0.10 [.014±.004]	0.64± 0.10 [.025±.004]
0805	2.00±0.15 [.079±.006]	1.25±0.15 [.049±.006]	0.95 [.037]	0.10 [.004]	0.25± 0.10 [.010±.004]	0.50± 0.10 [.020±.004]
1206	3.20±0.20 [.126±.008]	1.60±0.20 [.063±.008]	0.90 [.035]	0.10 [.004]	0.40± 0.10 [.016±.004]	0.80± 0.10 [.031±.004]

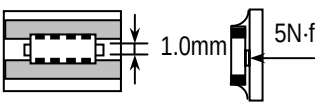
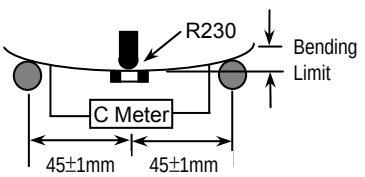
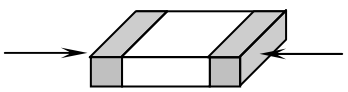
◆ Capacitance Range

Temperature Characteristic	Size	Rated Voltage	Capacitance Range																																			
			100	120	150	180	220	270	330	390	470	560	680	820	101	121	151	181	221	271	331	391	471	681	102	152	222	272	332	472	103	223	473	104	224	105	125	225
NPO	0805 4×Cap	50V	B				B		B		B				B				B																			
	1206 4×Cap	50V	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B															
X7R	0805 4×Cap	10V																															B	B				
		16V																													B			B				
		25V																												B								
		50V																				B		B		B												
	1206 4×Cap	6.3V																																		B		
		16V															B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B				
		25V															B	B	B	B	B	B	B	B	B	B	B	B	B	B							
		50V															B	B	B	B	B	B	B	B	B	B	B	B	B	B							
	0504 2×Cap	10V																																A				
		16V																																A				
Y5V	0805 4×Cap	16V																																B				
	1206 4×Cap	10V																																		B		
		16V																													B	B	B	B				
		25V																													B	B	B	B	B			
		50V																													B			B				
X5R	0805 4×Cap	6.3V																																		B		
		10V																																B				
	0504 2×Cap	6.3V																																			B	B
		10V																																A		B		
		16V																																A		B		

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

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

MCA Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	Char. / Operation Temp. NPO(N): -55℃~ +125℃ X7R (X): -55℃~ +125℃ X5R (B): -55℃~ +85℃ Y5V (Y): -30℃~ +85℃	
Visual	No abnormal exterior appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	Char. / Frequency / Voltage NPO: 1MHz±10% / 1.0±0.2Vrms X7R/X5R/Y5V: 1KHz±10% / 1.0±0.2Vrms
Quality Factor	Class Ⅰ(NPO): More Than 30pF : Q ≧1000 30pF & Below: Q≧400+20C (C:Cap., pF)	
Dissipation Factor	Class Ⅱ(X7R/X5R/Y5V): Shall meet the value in Table 1,Table 2	Perform a heat treatment at 150±5℃ for 30min. then place at room temp. for 24±2hr.
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller for rated voltage>10V and greater 100/C Ω for rated voltage≤10V. (C in Farad)	Applied Voltage : Rated Voltage Charge Time : 60±5 sec. Charge-Discharge current shall be less than 50mA current.
Withstanding Voltage	No dielectric breakdown or mechanical breakdown	250% of the rated voltage for 1~5 sec. Current is limited to less than 50mA
Temperature Capacitance Coefficient	Char. / Temp. Range / Cap. Change NPO(N): -55℃~ +125℃ / ± 30ppm/℃ X7R (X): -55℃~ +125℃ / ± 15% X5R (B): -55℃~ +85℃ / ± 15% Y5V(Y): -30℃~ +85℃ / +22/-82%	Class Ⅰ: [C2-C1/C1(T2-T1)] × 100% Class Ⅱ: (C2-C1)/C1 × 100% T1:Standard Temperature(20℃) 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.	 A 5N·f (≈ 0.5Kg·f) pull force shall be applied for 10±1 sec.
Resistance to Flexure of Substrate	No mechanical damage or capacitance change more than the following table. Char. / Capacitance Change NPO(N): ≦ ± 5.0% X7R (X): ≦ ± 12.5% X5R (B): ≦ ± 12.5% Y5V (Y): ≦ ± 30.0%	The board shall be bent 1.0mm with a rate of 1.0 mm/sec. 
Solderability	More than 90% of the terminal surface is to be soldered newly, so metal part does not come out or dissolve . 	Solder Temperature : 245±5℃ Dip Time : 5 ± 1 sec. Immersing Speed : 25±10% mm/s Solder : H63A Flux :Rosin Preheat : At 80~120 ℃ For 10~30sec.

MCA Series Specification & Test Condition

Item		Specification	Test Condition
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 measure. Preheat : at 150±10°C for 60~120sec. Dip : solder temperature of 260±5℃ Dip Time : 10 ± 1sec. Immersing Speed : 25±10% mm/s Solder : H63A Flux : Rosin Measure at room temperature after cooling for Class Ⅰ : 24 ± 2 Hours Class Ⅱ : 48 ± 4 Hours
	Capacitance	Class Ⅰ (NPO): Within 2.5% or ±0.25pF whichever is larger of initial value Class Ⅱ : Char. — Cap. change X7R(X) — ≦ ±7.5% of initial value X5R(B) — ≦ ±7.5% of initial value Y5V(Y) — ≦ ±20% of initial value	
	Q / Tan δ	To satisfy the specified initial value	
	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 measurement. 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 — Max Rated Temp.+3/-0 — 30 4 — 25 — 3 Measure at room temperature after cooling for Class Ⅰ : 24 ± 2 Hours Class Ⅱ : 48 ± 4 Hours
	Capacitance	Class Ⅰ (NPO): Within 2.5% or ±0.25pF whichever is larger of initial value Class Ⅱ : Char. — Cap. change X7R(X) — ≦ ±7.5% of initial value X5R(B) — ≦ ±7.5% of initial value Y5V(Y) — ≦ ±20% of initial value	
	Q / Tan δ	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	
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 measurement. 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	Class Ⅰ (NPO): Within 5.0% or ±0.5pF whichever is larger of initial value Class Ⅱ : Char. — Cap. change X7R(X) — ≦ ±12.5% of initial value X5R(B) — ≦ ±12.5% of initial value Y5V(Y) — ≦ ±30% of initial value	
	Q Class Ⅰ	30pF & Over : Q ≧350 10 to 30pF : Q≧275+2.5C 30pF & Below: Q≧200+10C	
	Tan δ Class Ⅱ	Shall meet the value in Table 1, Table 2	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller for rated voltage>10V and greater 10/C Ω for rated voltage ≤ 10V. (C in Farad)	

MCA Series Specification & Test Condition

Item	Specification		Test Condition
Humidity Loading	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 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 +12/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for Class Ⅰ : 24 ± 2 Hours Class Ⅱ : 48 ± 4 Hours
	Capacitance	Class Ⅰ (NPO): Within 7.5% or ±0.75pF whichever is larger of initial value Class Ⅱ : Char. — Cap. change X7R(X) — ≦ ±12.5% of initial value X5R(B) — ≦ ±12.5% of initial value Y5V(Y) — ≦ ±30% of initial value	
	Q Class Ⅰ	30pF & Over : Q ≧350 10 to 30pF : Q≧275+2.5C 30pF & Below: Q≧200+10C	
	Tan δ Class Ⅱ	Shall meet the value in Table 1, Table 2	
	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)	
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Class Ⅱ capacitors applied DC testing voltage 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 :200%Rated Voltage However: The size 0504,applied voltage of 100% rated voltage Temperature : max. operation temperature Test Time : 1000 +48/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for Class Ⅰ : 24 ± 2 Hours Class Ⅱ : 48 ± 4 Hours
	Capacitance	Class Ⅰ (NPO): Within 5.0% or ±0.5pF whichever is larger of initial value Class Ⅱ : Char. — Cap. change X7R(X) — ≦ ±12.5% of initial value X5R(B) — ≦ ±12.5% of initial value Y5V(Y) — ≦ ±30% of initial value	
	Q Class Ⅰ	30pF & Over : Q ≧350 10 to 30pF : Q≧275+2.5C 30pF & Below: Q≧200+10C	
	Tan δ Class Ⅱ	Shall meet the value in Table 1, Table 2	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller for rated voltage>10V and greater 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 / Tan δ	To satisfy the specified initial value	

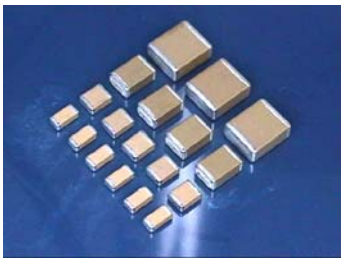
X7R/X5R Table 1.

Size	Rated voltage	Capacitance Range	tan δ (D.F.)	
			Initial Vibration Resistance to solder heat Temperature cycle	Humidity Humidity loading High temperature loading
0504	DC 6.3V	All Capacitance	15.0 %	25.0 %
	DC 10V		15.0 %	25.0 %
	DC 16V		15.0 %	25.0 %
0805	DC 10V	All Capacitance	7.5 %	12.5 %
	DC 16V		3.5 %	7.5 %
	DC 25V		3.5 %	7.5 %
	DC 50V		2.5 %	5.0 %
1206	DC 6.3V	C=1uf	7.5 %	12.5 %
	DC 16V	C<1uf	3.5 %	7.5 %
	DC 25V	C<1uf	3.5 %	7.5 %
	DC 50V	C<1uf	2.5 %	5.0 %

Y5V Table 2.

Size	Rated voltage	Capacitance Range	tan δ	
			Initial Vibration Resistance to solder heat Temperature cycle	Humidity Humidity loading High temperature loading
0805	DC 16V	C<1uf	10.0 %	15.0 %
1206	DC 10V	C=1uf	12.5 %	20.0 %
	DC 16V	C<1uf	10.0 %	15.0 %
	DC 25V	C<1uf	7.0 %	10.5 %

Multilayer Ceramic Chip Capacitors
[Tip & Ring Capacitors]
SAC Series



In telephone lines the DC voltage is 48 volts and pass the subscriber's AC signal pulse(15 to 25Hz, 70 to 90Vrms).

These MLCC ringer capacitors replace bulk leaded film capacitors and offer excellent frequency response, low ESR, and improved temperature characteristics. Ideal for telecommunication/modem applications.

◆ Features

- ❑ Small Size & High Capacitance
- ❑ Suitable for Wave and Reflow Soldering
- ❑ Surface Mount
- ❑ Low ESR characteristics & improved temperature performance
- ❑ RoHS compliant

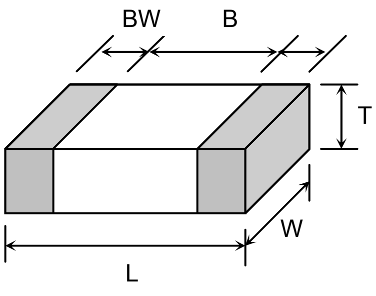
◆ Summary of Specification

Operation temperature	X7R : -55~+125 ℃ , Y5U : -30~+85 ℃
Rated Voltage	250Vdc
Temperature Coefficient	Y5U : ≤ +22 /-56 % , -30~+85 ℃ (EIA Class II)
	X7R : ≤ ± 15% , -55~+125 ℃ (EIA Class II)
Capacitance Range	Y5U :10nF ~ 2.2uF
	X7R :180pF ~ 2.2uF
Dissipation Factor :	Y5U : D.F.≦4.0% ; X7R : D.F.≦2.5%
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller
Dielectric Strength	200% Rated Voltage for 5 second @ 50mA max. current
Aging	Y5U: 4.0 % ; X7R: 2.5 % per decade hr , Typical

◆ How To Order

C	1812	X	474	M	251	T
Product Code	**Chip Size**	**Dielectric**	**Capacitance Unit : pF**	**Tolerance**	**Rated Voltage**	**Packaging**
C: MLCC (Multilayer Ceramic Chip of Capacitor)	Ex.: 0805 : 2.0x1.25 mm 1206 : 3.2x1.60 mm 1210 : 3.2x2.50 mm 1812 : 4.6x3.20 mm 2220 : 5.7x5.00 mm	Ex.: X : X7R E : Y5U	Ex.: 103:10x10³ 474:47x10⁴	Ex.: K: +/- 10% M: +/- 20%	Ex.: 251:250Vdc	T: Taping & Reel B: Bulk

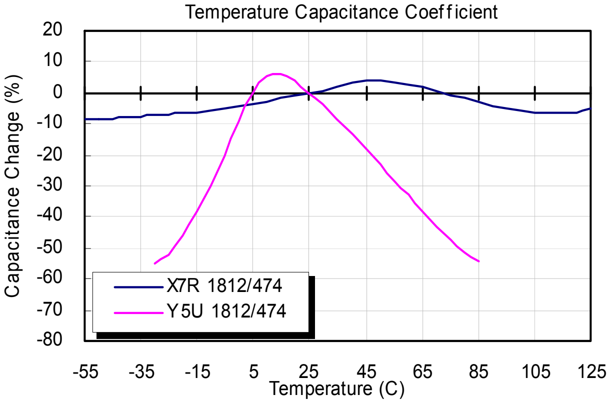
◆ Dimension

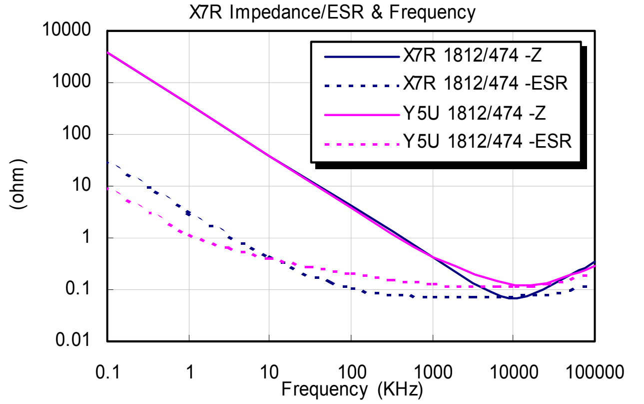


Unit : mm [inches]

TYPE	L	W	T (max)	B (min)	BW (min)
0805	2.00±0.2 [.079±.012]	1.25±0.2 [.049 ±.008]	1.45 [.043]	0.70 [.028]	0.20 [.008]
1206	3.20±0.3 [.126±.012]	1.60±0.2 [.126±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.3 [.126±.012]	2.50±0.2 [.098±.008]	2.60 [.102]	1.60 [.063]	0.30 [.012]
1812	4.60±0.3 [.181±.012]	3.20±0.3 [.126±.012]	3.00 [.118]	2.50 [.098]	0.30 [.012]
2220	5.70±0.4 [.220±.016]	5.00±0.4 [.197±.016]	3.00 [.118]	3.50 [.137]	0.30 [.012]

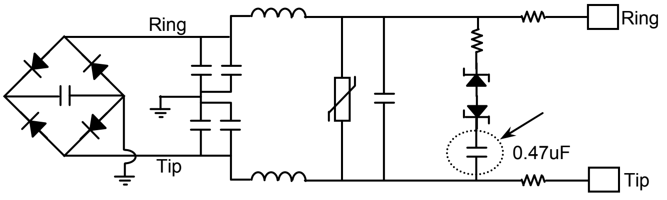
◆ Characteristic

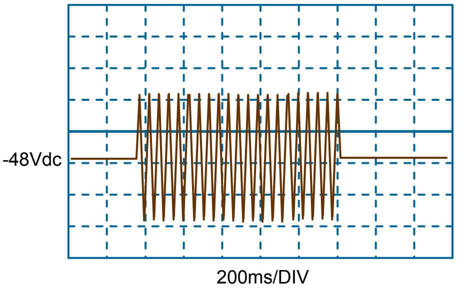




◆ Application

Example Circuit





200ms/DIV

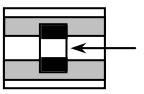
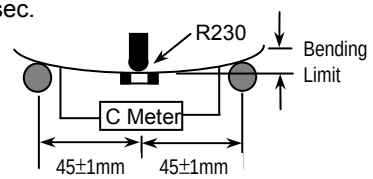
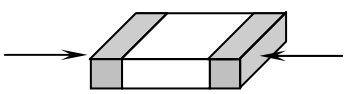
◆ Capacitance Range

Dielectric Characteristic	Size	Voltage	Capacitance Range																																	
			181	221	271	331	471	681	102	152	182	222	332	472	562	682	103	153	223	273	333	393	473	563	683	823	104	154	224	334	474	564	684	824	105	155	225
X7R	0805	250V			C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	D	D	D	D														
	1206	250V	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	D/E	D/E										
	1210	250V															D	D	D	D	D	D	D	D	D	D	D	D	D								
	1812	250V															D	D	D	D	D	D	E	E	E	E	E	E	E	E	E	E	E	F	G		
	2220	250V																									E	E	E	E	E	E	E	E	F	F	G
Y5U	1812	250V															E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	F	F		

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

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

SAC Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	Char. / Operation Temp. X7R(X) / -55℃~ +125℃ Y5U(E) / -30℃~ +85℃	
Visual	No Abnormal Exterior Appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	Frequency / Voltage 1KHz±10% / 1.0±0.2Vrms
Dissipation Factor	Char. / D.F. (max.) X7R(X) / 2.5% Y5U(E) / 4.0%	Perform a heat treatment at 150±5℃ for 30min. then place room temp. for 24±2hr.
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller. (C in Farad)	Applied Voltage : Rated Voltage Charge Time : 60±5 sec. Charge-Discharge current shall be less than 50mA current.
Withstanding Voltage	No dielectric breakdown or mechanical breakdown	200% of the rated voltage for 1~5 sec. Current is limited to less than 50mA.
Temperature Capacitance Coefficient	Char. / Temp. Range / Cap. Change X7R(X) / -55℃~ +125℃ / ± 15% Y5U(E) / -30℃~ +85℃ / +22/-56%	(C2-C1)/C1 × 100% C1:Capacitance at Standard Temperature C2:Capacitance a Test Temperature
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.	 A 5N·f (≈ 0.5Kg·f) pull force shall be applied for 10±1 sec.
Resistance to Flexure of Substrate	No mechanical damage or change capacitance more than the following table. Char. / Capacitance Change X7R(X) / ≤ ± 12.5% of initial value Y5U(E) / ≤ ± 30.0% of initial value	The board shall be bent 1.0mm with a rate of 1.0 mm/sec. 
Solderability	More than 90% of the terminal surface is to be soldered newly, so 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 : H63A Flux :Rosin Preheat : At 80~120 ℃ For 10~30sec.
Resistance to Soldering Heat	Appearance: No mechanical damage shall occur Capacitance: Char. / Cap. change X7R(X) / ≤ ±7.5% of initial value Y5U(E) / ≤ ±20% of initial value Tan δ: To satisfy the specified initial value Insulation Resistance: To satisfy the specified initial value	Capacitor shall be set for 48± 4 hours at room temperature after one hour heat treatment at 150 +0/-10℃ before initial measurement. Preheat : at 150±10°C for 60~120sec. Dip : solder temperature of 260±5℃ Dip Time : 10 ± 1sec. Immersing Speed : 25±10% mm/s Solder : H63A Flux : Rosin Measure at room temperature after cooling for 48 ± 4 Hours

SAC Series Specification & Test Condition

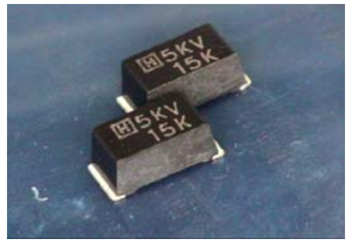
Item		Specification	Test Condition
Temperature Cycle	Appearance	No mechanical damage shall occur	Capacitor shall be set for 48±4 hours at room temperature after one hour heat treatment at 150 +0/-10 ℃ before initial measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following:
	Capacitance	Char. / Cap. change X7R(X) / ≤±7.5% of initial value Y5U(E) / ≤±20% of initial value	
	Tan δ	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	

Step	Temp.(℃)	Time(min)
1	Min Rated Temp.+0/-3	30
2	25	3
3	Max Rated Temp.+3/-0	30
4	25	3

Measure at room temperature after cooling for 48 ± 4 Hours

Humidity	Appearance	No mechanical damage shall occur	Capacitor shall be set for 48±4 hours at room temperature after one hour heat treatment at 150 +0/-10 ℃before initial measurement. Temperature : 40± 2 ℃ Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0 hr Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Char. / Cap. change X7R(X) / ≤±15% of initial value Y5V(E) / ≤±30% of initial value	
	Tan δ	Char. / D.F. (max.) X7R(X) / 5.0% Y5U(E) / 5.0%	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)	
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Capacitors applied DC voltage of 120% the rated voltage 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 :120%Rated Voltage Temperature : max. operating temperature Test Time : 1000 +48/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Char. / Cap. change X7R(X) / ≤±15% of initial value Y5V(E) / ≤±30% of initial value	
	Tan δ	Char. / D.F. (max.) X7R(X) / 5.0% Y5U(E) / 5.0%	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (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	
	Tan δ	To satisfy the specified initial value	

Molding Style Capacitors
[High Voltage Capacitors]
MMC Series



Excellent Reliability: Bending and Arcing Prevention

◆ Features

- ❑ High reliability: molded package improves arc over and flexure strength characteristics
- ❑ Surface mount suited for reflow soldering
- ❑ High temperature stability & low tan δ
- ❑ RoHS compliant

◆ Application

- ❑ Suitable for ballast circuit of back-lighting Inverter , DC-DC converters, modems & snubber circuits of switching power supply

◆ Summary of Specification

Operation Temperature	-55~+125 ℃
Rated Voltage	3KVdc and 5KVdc
Temperature Coefficient	NPO : ≤ ± 30ppm/ ℃ , -55~+125 ℃ (EIA Class Ⅰ)
Capacitance Range	2pF to 150pF
Dissipation Factor :	NPO : Q≧1000
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller
Aging	0%
Dielectric Strength	120% Rated Voltage; is applied less than 50mA current.

◆ How To Order

MMC	C	N	150	K	502	T
Product Code MMC: Molding Style Capacitors	**Style & Size** Ex.: A: 1810 4.9x2.6x2.6 C: 2816 7.0x3.2x3.2	**Dielectric** Ex.: N: NPO	**Capacitance Unit : pF** Ex.: 5R0:5.0pF 100:10x10⁰ 101:10x10¹	**Tolerance** Ex.: C : +/- 0.25pF D : +/- 0.5pF J : +/- 5% K: +/- 10% M:+/- 20%	**Rated Voltage** Ex.: 302: 3KVdc 502: 5KVdc	**Packaging** T: Taping & Reel B: Bulk

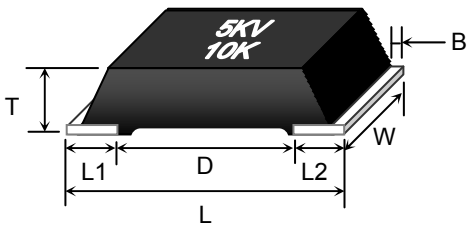
◆ Capacitance Range

Temperature Characteristic	Size	Rated Voltage	Capacitance Range (pF)																																		
			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
NPO	A	3KV	■	■	■	■	■	■	■	■	■	■	■	■	■	■																					
	C	3KV	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
		5KV	■	■	■	■	■	■	■	■	■	■	■	■																							

▪ ***Other capacitance values and voltages rating are available. Please contact HEC.***

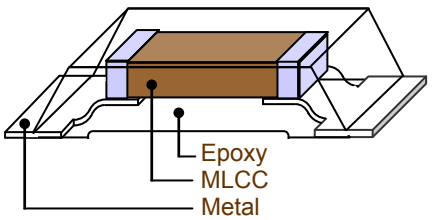
◆ Sharp & Dimension

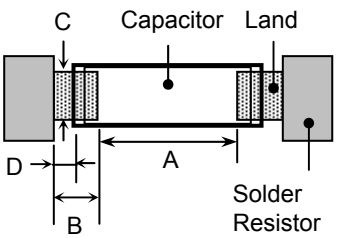
Unit : mm [inches]



Style	SMA-L	SMC-L
L	4.90±0.2 [.193±.008]	7.00±0.2 [.276±.008]
W	2.60±0.2 [.102±.008]	3.20±0.2 [.126±.008]
T	2.60±0.2 [.102±.008]	3.20±0.2 [.126±.008]
L1=L2	0.45±0.2 [.018±.008]	0.75±0.2 [.030±.008]
B	0.30±0.2 [.012±.008]	0.30±0.3 [.012±.008]
D	4.0 +0.2/-0 [.157 +.008/-0]	5.5 +0.2/-0 [.216 +.008/-0]

◆ Construction & Recommend Land Dimension



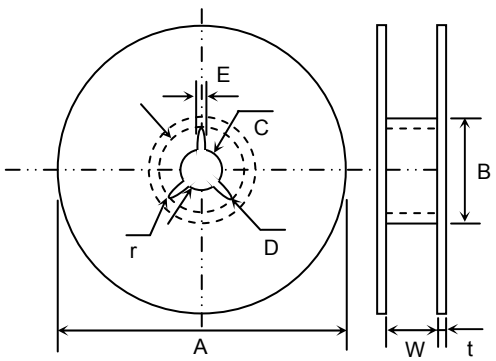


Unit :mm

Style	SMA-L	SMC-L
A	3.2~3.4	5.1~5.3
B	1.4~1.6	1.4~1.6
C	2.6~2.8	3.2~3.4
D	0.4~0.6	0.4~0.6

◆ Packing Specification

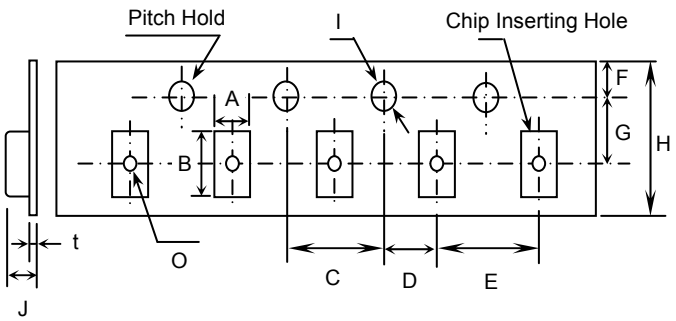
Reel Dimension



Unit : mm

	SMA-L / SMC-L
A	¢ 178±0.2
B	¢ 60±0.2
C	¢ 13±0.5
D	¢ 21±0.8
E	¢ 2.0±0.5
W	13±0.3
t	17±1.4
r	1.0

Embossed Tape



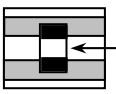
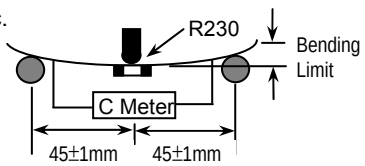
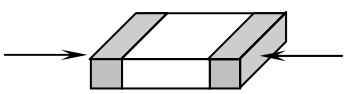
Unit : mm

	SMA-L	SMC-L
A	2.85±0.1	3.45±0.1
B	5.20±0.1	7.30±0.1
C	4.00±0.1	4.00±0.1
D	2.0±0.05	2.0±0.05
E	4.0±0.10	8.0±0.10
F	1.75±0.1	1.75±0.1
G	5.50±0.1	5.50±0.1
H	12.0±0.1	12.0±0.1
I	¢1.55±0.05	¢1.55±0.05
J	2.80±0.1	3.40±0.1
t	0.3 max.	0.3 max.
O	1.55±0.05	1.55±0.05

Material And Quantity (¢180mm)

Style	¢180mm reel
SMA-L	1000pcs/reel
SMC-L	700pcs/reel

MMC Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	-55 to +125℃	
Visual	No abnormal exterior appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	Cap. / Frequency / Voltage
Quality Factor	More Than 30pF : Q ≧1000 30pF & Below: Q≧400 + 20C (C:Cap., pF)	C≤100pF 1MHz±10% 1.0±0.2Vrms C>100pF 1KHz±10%
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller. (C in Farad)	Applied 500Vdc Charge Time : 60sec. Is applied less than 50mA current.
Withstanding Voltage	No dielectric breakdown or mechanical breakdown	Applied Voltage:120% Rated Voltage for 1~5 sec. Current is limited to less than 50mA.
Temperature Capacitance Coefficient	Char. / Temp. Range / Cap. Change NPO(N) -55℃~ +125℃ ± 30ppm/℃	[C2-C1/C1(T2-T1)] × 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.	 A 5N·f(≈0.5Kg·f) pull force shall be applied for 10±1 sec.
Resistance to Flexure of Substrate	No mechanical damage or capacitance change more than the following table. Char. / Capacitance Change NPO(N) ≦ ± 5.0% of initial value	The board shall be bent 1.0mm with a rate of 1.0 mm/sec. 
Solderability	More than 90% of the terminal surface is to be soldered newly, so 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 : H63A Flux :Rosin Preheat : At 80~120 ℃ For 10~30sec.
Resistance to Soldering Heat	Appearance: No mechanical damage shall occur Capacitance: Within 2.5% or ±0.25pF whichever is larger of initial value Q: To satisfy the specified initial value Insulation Resistance: To satisfy the specified 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 Solder : H63A Flux : Rosin Measure at room temperature after cooling for 24 ± 2 Hours

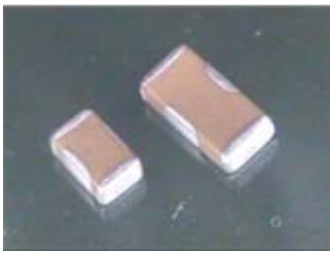
MMC Series Specification & Test Condition

Item	Specification		Test Condition
Temperature Cycle	Appearance	No mechanical damage shall occur	Capacitor shall be subjected to five cycles of the temperature cycle as following:
	Capacitance	Within 2.5% or ±0.25pF whichever is larger of initial value	
	Q	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	Measure at room temperature after cooling for 24 ± 2 Hours
Humidity	Appearance	No mechanical damage shall occur	Capacitor shall be set for 24±4 hours at room temperature after one hour heat treatment at 150 +0/-10 ℃before initial measurement.
	Capacitance	Within 5% or ±0.5pF whichever is larger of initial value	Temperature : 40± 2 ℃ Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0 hr
	Q	More Than 30pF : Q ≧350 30pF & Below: Q≧275＋2.5C	Measure at room temperature after cooling for 24 ± 2 Hours
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)	
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Capacitors applied DC voltage of 100% the rated voltage 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.
	Capacitance	Within 3% or ±0.3pF whichever is larger of initial value	Applied Voltage : 100%Rated Voltage Temperature : max. operating temperature Test Time : 1000 +12/-0Hr Current Applied : 50 mA Max.
	Q	More Than 30pF : Q ≧350 30pF & Below: Q≧275＋2.5C	Measure at room temperature after cooling for 24 ± 2 Hours
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (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	To satisfy the specified initial value	

Step	Temp.(℃)	Time(min)
1	Min Rated Temp.+0/-3 (-55)	30
2	25	3
3	Max Rated Temp.+3/-0 (125)	30
4	25	3

Multilayer Ceramic Chip Capacitors [Feed Thru' EMI Filters]

FTC Series



The FTC series is a three terminal structure component. This product is capable of handling currents up to 2A and is suitable for use on DC power lines, preventing noise suppression from high speed signal lines and IC's.

◆ Features

- ❑ Suitable for power line ripple voltage stabilization
- ❑ Ultra low inductance
- ❑ Supply in MEC function
- ❑ RoHS compliant

◆ Application

- ❑ For high speed digital integration circuit and decoupling of CPU power lines.

◆ Summary of Specification

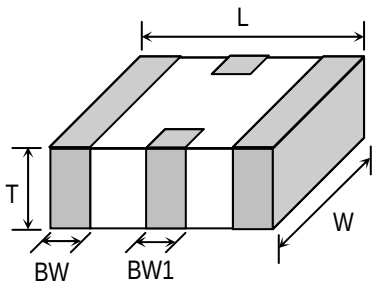
Operation Temperature	-55 to +125℃
Rated Voltage	50Vdc
Current Rating	2A
Size	0805 and 1206
Temperature Coefficient	C0G < ± 30ppm/℃ , -55~+125 ℃ (EIA Class Ⅰ)
	X7R < ± 15%, , -55~+125 ℃ (EIA Class Ⅱ)
Capacitance Range	NPO : 22pF ~1.0nF
	X7R : 1.0nF ~100nF
Tolerance	± 20%
DC Resistance	600mΩ max.
Insulation Resistance	10GΩ or 500/C whichever is smaller
Dielectric Strength	250% Rated Voltage for 5 second @ 50mA max. current

◆ How To Order

FTC	1206	X	332	M	050	T	20

Product Code	**Chip Size**	**Dielectric**	**Capacitance Unit : pF**	**Tolerance**	**Rated Voltage**	**Packaging**	**Rated Current**
FTC: Feed Thru' EMI Filter	Ex.: 0805 : 2.0x1.25 mm 1206 : 3.2x1.6 mm	Ex.: N: NPO X: X7R	Ex.: 100:10x10⁰ 471:47x10¹ 182:18x10²	Ex.: M:+/-20%	Ex.: 050: 50VDC	T: Taping &Reel B: Bulk	Ex.: 10: 1A 20: 2A

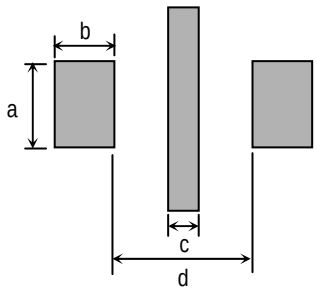
◆ Dimension



Unit : mm [inches]

TYPE	L	W	T (max)	B W(min)	BW1
0805	2.00 ±0.2 [.079±.008]	1.25±0.2 [.049±.008]	1.00 [.039]	0.20 [.008]	0.50±0.2 [.020±.008]
1206	3.20±0.02 [.126±.008]	1.60±0.2 [.063±.008]	1.25 [.049]	0.20 [.008]	0.95±0.3 [.037 ±.012]

◆ Recommend Solder Lands

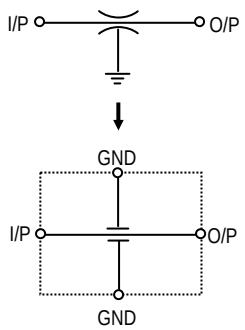


Unit : mm

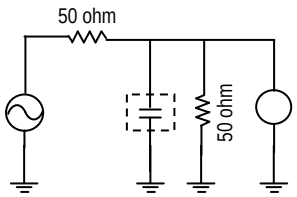
TYPE	0805	1206
a	0.9~1.0	1.2~1.3
b	0.9~1.0	0.9~1.0
c	0.4~0.5	0.8~0.9
d	1.5	1.5

◆ Characteristic

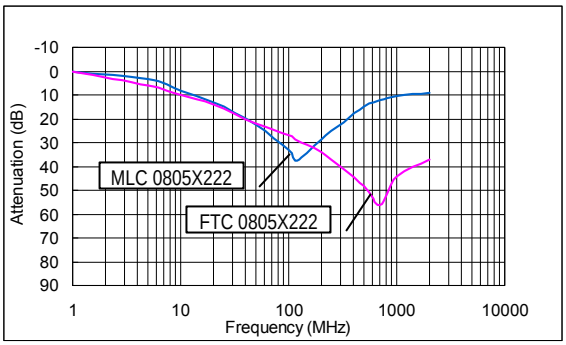
Equivalent Circuit



Test Circuit



Performance



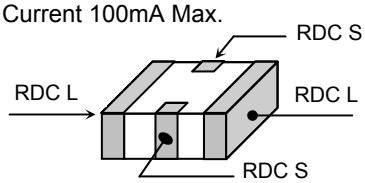
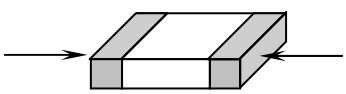
◆ Capacitance Range

Dielectric Characteristic	Size	Rated Voltage	Rated Current	Capacitance Range 100	150	220	330	470	680	101	151	221	331	471	681	102	152	222	332	472	682	103	153	223	333	473	563	104	154	224	334
NPO	0805	50V	2A	B	B	B	B	B	B	B	B	B	B	B	B																
	1206	50V	2A	B	B	B	B	B	B	B	B	B	B	B	B	B															
X7R	0805	50V	2A													B	B	B	B	B	B	B									
	1206	50V	2A													B	B	B	B	B	B	B	B	B	B	B	B	B			

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

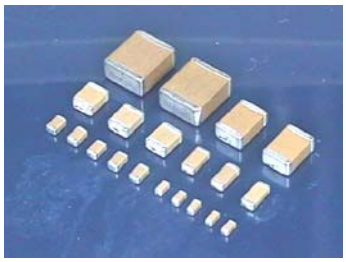
▪ ***Other dimensions,capacitance values and voltages rating are available. Please contact HEC.***

FTC Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	-55 to +125℃	
Visual	No abnormal exterior appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	Class / Frequency / Voltage Class Ⅰ (NPO) 1MHz±10% 1.0±0.2Vrms Class Ⅱ (X7R) 1KHz±10% Perform a heat treatment at 150±5℃ for 30min. then place room temp. for 24±2hr.
Quality Factor	Class Ⅰ (NPO): More Than 30pF : Q ≧1000 30pF & Below: Q≧400+20C (C:Cap., pF)	
Dissipation Factor	Class Ⅱ (X7R): Maximum 0.025	
Insulation Resistance	1,000MΩ or 100/C Ω whichever is smaller. (C in Farad)	Rated Voltage Charge Time : 60sec. Current is limited to less than 50mA.
RDC (L,S)	C< 10,000pF : 600m Ω max. C≥ 10,000pF : 300m Ω max.	Rated Current 100mA Max. 
Withstanding Voltage	No dielectric breakdown or mechanical breakdown	Applied Voltage : 250% Rated Voltage for 1~5 sec. Current is limited to less than 50mA.
Temperature Capacitance Coefficient	Char. / Temp. Range / Cap. Change NPO(N) -55℃~ +125℃ ± 30ppm/℃ X7R (X) -55℃~ +125℃ ± 15%	Class Ⅰ : [C2-C1/C1(T2-T1)] × 100% Class Ⅱ : (C2-C1)/C1 × 100% T1:Standard Temperature(25℃) T2:Test Temperature C1:Capacitance at Standard Temperature C2:Capacitance at Test Temperature
Solderability	More than 90% of the terminal surface is to be soldered newly, so 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 : H63A Flux :Rosin Preheat : At 80~120 ℃ For 10~30sec.

FTC Series Specification & Test Condition

Item		Specification	Test Condition
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 measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following: Step / Temp.(℃) / Time(min) 1 / Min Rated Temp.+0/-3 (-55) / 30 2 / 25 / 3 3 / Max Rated Temp.+3/-0 (125) / 30 4 / 25 / 3 Measure at room temperature after cooling for Class Ⅰ: 24 ± 2 Hours Class Ⅱ: 48 ± 4 Hours
	Capacitance	Class Ⅰ (NPO): Within 2.5% or ±0.25pF whichever is larger of initial value Class Ⅱ (X7R): Within ±7.5% of initial value	
	Q / Tan δ	To satisfy the specified initial value	
	Insulation Resistance	500MΩ or 50/C Ω whichever is smaller. (C in Farad)	
	DCR(L,S)	1.0Ω Maximum	
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 measurement. 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	Class Ⅰ (NPO): Within 5% or ±0.5pF whichever is larger of initial value Class Ⅱ (X7R): Within ±10% of initial value	
	Q / Tan δ	Class Ⅰ (NPO): More Than 30pF : Q ≧350 30pF & Below: Q≧275＋2.5C Class Ⅱ (X7R): Maximum ±5.0%	
	Insulation Resistance	500MΩ or 50/C Ω whichever is smaller. (C in Farad)	
	DCR(L,S)	1.0Ω Maximum	
High Temperature Load (Life Test)	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. Applied Voltage :200% of rated voltage Applied Current : rated current Temperature : max. operating temperature Test Time : 1000 +12/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for Class Ⅰ: 24 ± 2 Hours Class Ⅱ: 48 ± 4 Hours
	Capacitance	Class Ⅰ (NPO): Within 5% or ±0.5pF whichever is larger of initial value Class Ⅱ (X7R): Within ±15% of initial value	
	Q / Tan δ	Class Ⅰ (NPO): More Than 30pF : Q ≧350 30pF & Below: Q≧275＋2.5C Class Ⅱ (X7R): Maximum ±5%	
	Insulation Resistance	500MΩ or 50/C Ω whichever is smaller. (C in Farad)	
	DCR(L,S)	1.0Ω Maximum	



Multilayer Ceramic Chip Capacitors
[High Temperature Capacitor]
HTC Series

◆ Features

- ❑ Rated working voltage of 25 to 50Vdc
- ❑ High operation temperature up to 200 ℃
- ❑ Excellent bias,high temperature stability & low Tan δ
- ❑ RoHS compliant

◆ Application

- ❑ Suitable for oil exploration, automotive and avionics engine, and other harsh environments.
- ❑ Other high temperature circuit design

◆ Summary of Specification

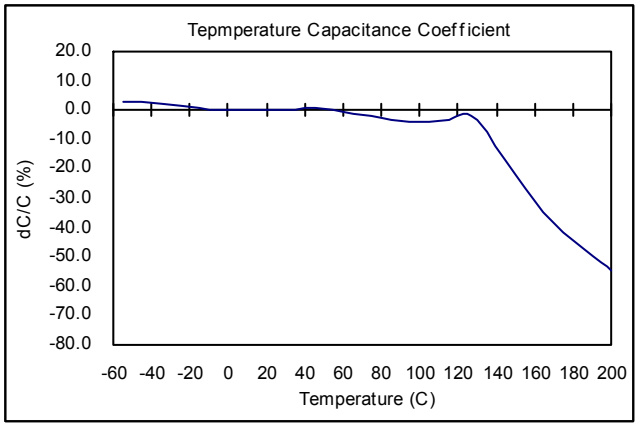
Operation Temperature	-55~+200 ℃
Rated Voltage	25V and 50Vdc
Temperature Coefficient	Cap drop ≤ + 4.7%~ -65% at -55~+200 ℃
Capacitance Range	1nF ~ 270nF
Dissipation Factor :	2.0% max. at 1KHz 25℃
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller
	≧1G Ω or 10/C Ω at 200 ℃ Which is smaller
Dielectric Strength	250% Rated Voltage for 5 second @ 50mA max. current
Capacitance Tolerance	± 10% , ± 20%
Aging	1.0% per decade hr , Typical

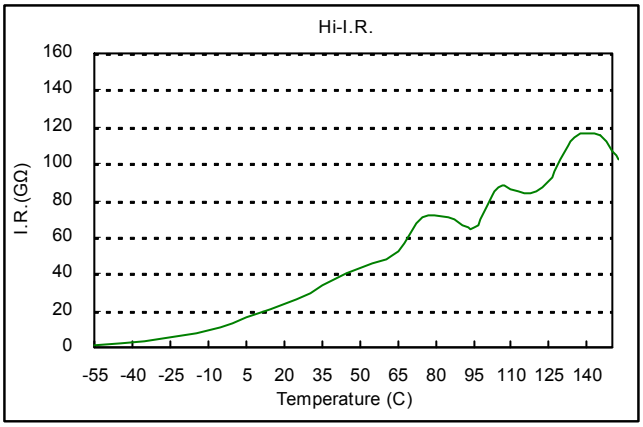
◆ How To Order

HTC	1812	X	104	K	050	T

Product Code	**Chip Size**	**Dielectric**	**Capacitance Unit : pF**	**Tolerance**	**Rated Voltage**	**Packaging**
HTC: High Temperature Capacitor	Ex.: 0603: 1.6x0.80 mm 0805 : 2.0x1.25 mm 1206: 3.2x1.60 mm 1210 : 3.2x2.50 mm 1812 : 4.6x3.20 mm 2220 : 5.7x5.00 mm	X: X7R	Ex.: 102:10x10² 224:22x10⁴	Ex.: K: +/- 10% M: +/- 20%	Ex.: 025:25Vdc 050:50Vdc	T: Taping & Reel B: Bulk

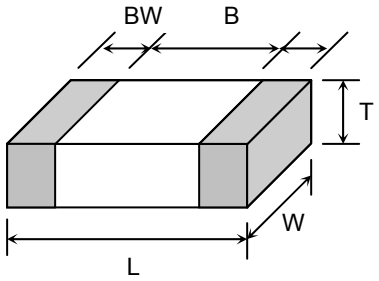
◆ Characteristic





◆ Dimension

Unit : mm [inches]



TYPE	L	W	T (max)	B (min)	BW (min)
0603	1.60±0.1 [.063±.004]	0.80±0.1 [.031 ±.004]	0.90 [.035]	0.40 [.016]	0.15 [.006]
0805	2.00±0.2 [.079±.012]	1.25±0.2 [.049 ±.008]	1.45 [.057]	0.70 [.028]	0.20 [.008]
1206	3.20±0.3 [.126±.012]	1.60±0.2 [.126±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.3 [.126±.012]	2.50±0.2 [.098±.008]	1.80 [.071]	1.60 [.063]	0.30 [.012]
1812	4.60±0.3 [.181±.012]	3.20±0.3 [.126±.012]	2.20 [.087]	2.50 [.098]	0.30 [.012]
2220	5.70±0.4 [.220±.016]	5.00±0.4 [.197±.016]	2.20 [.087]	3.50 [.137]	0.30 [.012]

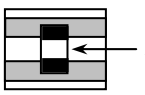
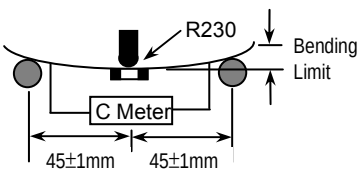
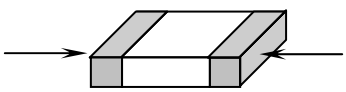
◆ Capacitance Range

Dielectric Characteristic	Size	Rated Voltage	Capacitance Range: 102 122 152 182 222 272 332 392 472 562 682 822 103 123 153 183 223 273 333 393 473 563 683 823 104 154 224 274
X7R	0603	50V	B B B B B B B B B B B B B
	0805	50V	C C C C C C C C C C C
	1206	25V	C C C C C C C C C C C C C
		50V	C C C C C C C C C C C C C
	1210	50V	C C C C C C
	1812	50V	D D D D D D
	2220	50V	D

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

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

HTC Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	-55 to +125℃	
Visual	No Abnormal Exterior Appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	Frequency: 1KHz±10%; Voltage: 1.0±0.2Vrms
Dissipation Factor	Rated Voltage: 50V, 25V D.F. (max.): 1.2%, 2.0%	
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller. (C in Farad)	Applied Voltage : Rated Voltage Charge Time : 60sec. Current is limited to less than 50mA
Dielectric Strength	No dielectric breakdown or mechanical breakdown	250% of the rated voltage for 1 to 5 sec. Current is limited to less than 50mA.
Temperature Capacitance Coefficient	Temperature Range / Cap. Change: -55℃~ +125℃ : ≦ ± 15% -55℃~ +200℃ : ≦ ± 60%	(C2-C1)/C1 × 100% C1:Capacitance at Standard Temperature(25℃) C2:Capacitance at Test Temperature
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.	 A 5N·f (≈ 0.5Kg·f) pull force shall be applied for 10±1 sec.
Resistance to Flexure of Substrate	No mechanical damage or change capacitance more than the following table. Capacitance Change : ≦ ±12.5% of initial value	The board shall be bent 1.0mm with a rate of 1.0 mm/sec. 
Solderability	More than 90% of the terminal surface is to be soldered newly, so 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 : H63A Flux :Rosin Preheat : At 80~120 ℃ For 10~30sec.
Resistance To Soldering Heat	Appearance: No mechanical damage shall occur Capacitance: Cap. change within ±7.5% of initial value Tan δ (D.F.): To satisfy the specified initial value Insulation Resistance: To satisfy the specified initial value Dielectric Strength: To satisfy the specified 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 Solder : H63A Flux :Rosin Measure at room temperature after cooling for 48 ± 4 Hours

HTC Series Specification & Test Condition

Item	Specification		Test Condition
Temperature Cycle	Appearance	No mechanical damage shall occur	Capacitor shall be set for 48±4 hours at room temperature after one hour deage at 150 +0/-10 ℃ before initial measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following: Step / Temp.(℃) / Time(min) 1 / Min Rated Temp.(-55)+0/-3 / 30 2 / 25 / 3 3 / Max Rated Temp.(+125)+3/-0 / 30 4 / 25 / 3 Measure at room temperature after cooling for 48 ±4 Hours
	Capacitance	Cap. change within ±7.5% of initial value	
	Tan δ (D.F.)	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	
Humidity	Appearance	No mechanical damage shall occur	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 48 ± 4 Hours
	Capacitance	Cap. change within ±12.5% of initial value	
	Tan δ (D.F.)	50V: max. 3.5%; 25V: max. 5.0%	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)	
Humidity Loading	Appearance	No mechanical damage shall occur	Capacitors applied DC voltage of the rated voltage 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 :Rated Voltage Temperature : 40±2℃ Relative Humidity : 90 ~ 95%RH Test Time : 500 +12/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Cap. change within ±12.5% of initial value	
	Tan δ (D.F.)	50V: max. 3.5%; 25V: max. 5.0%	
	Insulation Resistance	500MΩ or 25/C Ω whichever is smaller. (C in Farad)	
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Capacitors applied DC voltage of 200% the rated voltage 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 :200% of Rated Voltage Temperature : 125℃ Test Time : 1000 +48/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 48 ± 4 Hours
	Capacitance	Cap. change within ±15% of initial value	
	Tan δ (D.F.)	50V: max. 3.5%; 25V: max. 5.0%	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)	

Ceramic Disc Capacitors
[High Voltage Disc Capacitor]
HDC Series – 1KVdc to 6KVdc

HDC Series (ceramic disc capacitors) are ideal for use in general electronic products with voltage ratings from 1KV to 6KV.

◆ Features

- Wide operation temperature
- Low loss at wide range of frequency
- High reliability
- RoHS compliant

◆ Applications

- Suitable for LAN/WLAN interface
- Ballast circuit of back-lighting inverter
- DC-DC converters,
- Snubber circuit of switching power supplies
- Modems & communication

◆ Summary of Specification

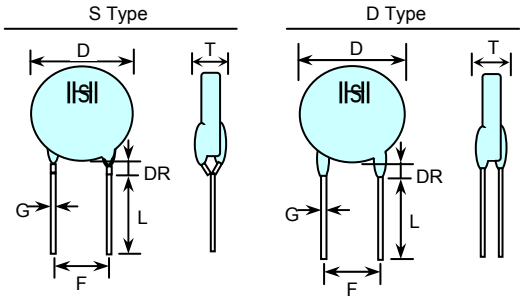
Operation Temperature	NPO/SL : -55~+125 ℃
	X7R/Y5P/Y5S : -55~+125℃
	Y5U/Y5V : -25~+105℃
Capacitance Range	2pF to 47nF
Rated Voltage	1KVdc to 6KVdc
Temperature Coefficient	NPO : ≤ ± 30ppm/ ℃ , -55~+125 ℃ (EIA Class I)
	SL : +350 ~ -1000ppm/ ℃ , -25~+85 ℃ (EIA Class I)
	Y5S :(N3300) ≤ ± 22% , -25~+85 ℃
	X7R : ≤ ± 15% , -55~+125 ℃ (EIA Class II)
	Y5P:≤ ± 10% ;Y5U:+22%/-56% ;Y5V:+22%/-82% ,-25~+85 ℃(EIA Class II)
Dissipation Factor :	Please see HEC specification data sheet
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller
Aging	NPO:0% ; SL :1.5% per decade of time
	X7R, Y5P, Y5S: 3.5 % per decade of time
	Y5U: 5.0 %; Y5V:7.5% per decade of time
Dielectric Strength	V≤ 2KV : 200% Rated Voltage
	3KV : 175% Rated Voltage
	6KV : 150% Rated Voltage

◆ How To Order

HDC	S	3R0	C	602	7	A	A

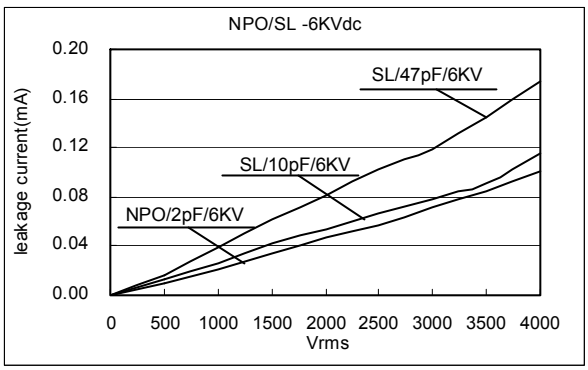
Product Code	**Dielectric**	**Capacitance Unit : pF**	**Tolerance**	**Rated Voltage**	**Lead Space**	**Packaging**	**Lead Shape Style**
HDC: Ceramic Disc Capacitor	Ex.: N:NPO S:SL L:Y5S X:X7R P:Y5P Y:Y5V E:Y5U	Ex.: 2R0:2pF 100:10x10^0 151:15x10^1	Ex.: C:+/-0.25pF D:+/-0.5pF H:+/- 3% J: +/- 5% K: +/- 10% M: +/- 20%	Ex.: 102:1000Vdc 202:2000Vdc 302:3000Vdc 602:6000Vdc	Ex.: 5：5.00mm 6：6.35mm 7：7.50mm A：10.0mm B：12.5mm	Ex.: H:3.1mm C:3.5mm S:5.0mm M:10.0mm L:25.0mm min. T: Taping Reel A: Ammo Box	Ex.: S Type 1: φ =0.50mm 2: φ =0.60mm 3: φ =0.65mm 4: φ =0.80mm D Type 9: φ =0.50mm A: φ =0.60mm B: φ =0.65mm C: φ =0.80mm

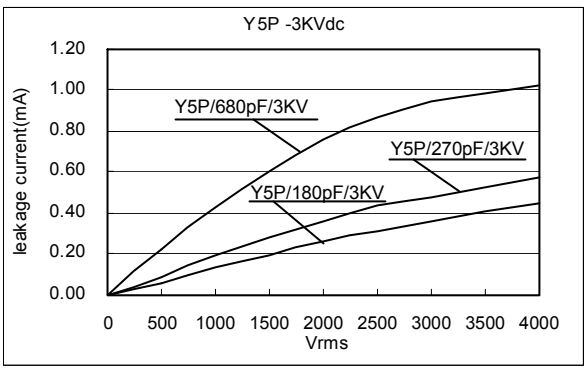
◆ Dimension



Code	Dimension			
D	Φ20.5mm max.			
F	5.0±1.0 mm	7.50±1.5 mm	10.0±2.0 mm	12.5±2.0 mm
G	0.5±0.1mm / 0.6±0.1mm / 0.8±0.1mm			
T	8.0mm max.			
DR	4.0mm max.			

◆ Leakage Current Characteristic (Typical Reference)





◆ Capacitance Range

Dielectric Characteristic	Voltage	Capacitance Range: 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
NPO	3KV	
	6KV	
SL	2KV	
	3KV	
	6KV	
Y5S	3KV	
	6KV	

Dielectric Characteristic	Voltage	Capacitance Range: 101 121 151 181 221 271 331 391 471 561 681 821 102 122 152 182 222 272 332 392 472 562 682 822 103 153 183 223 273 333 393 473
X7R	2KV	
	3KV	
Y5P	1KV	
	2KV	
	3KV	
Y5U	1KV	
	2KV	
	3KV	
Y5V	1KV	
	2KV	
	3KV	

▪ ***Other capacitance and voltage rating are available. Please contact HEC.***

HDC Series Specification & Test Condition

Item	Specification	Test Condition
Operating Temperature Range	Char. / Operation Temp. NPO(N) -55℃~ +125℃ SL(S) -55℃~ +125℃ Y5S(L) -55℃~ +125℃ X7R(X) -55℃~ +125℃ Y5P(P) -55℃~ +125℃ Y5U(E) -25℃~ +105℃ Y5V(Y) -25℃~ +105℃	
Capacitance	Within specified tolerance.	Char. / Frequency / Voltage NPO/SL 1MHz±10% 5.0Vrms max. Y5S/X7R/Y5P 1KHz±10% Y5U/Y5V 1KHz±10%
Quality Factor	Class Ⅰ(NPO/SL): More Than 30pF：Q≧1000 30pF & Below：Q≧400+20C (C:Capacitance)	
Dissipation Factor	Class Ⅱ: Y5S(L)/X7R(X)/Y5P(P)：D.F.≦2.5% Y5U(E)/Y5V(Y)：D.F.≦5.0%	The measurement at reference temperature 25 ℃.
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller (C: in Farad)	Applied Voltage：500±5Vdc Charge Time：60±5sec. Is applied less than 50mA current.
Dielectric Strength	Between Lead Wires: No Failure	V≤2KV:200% of Rated Voltage V≤3KV 175% of Rated Voltage V≤6KV 150% of Rated Voltage For 1~5 sec. Current is limited to less than 50mA.
	Body Insulation: No Failure	The capacitor is place in the container with metal balls of diameter 1mm so that each lead wire, short circuited is kept about 2mm off the ball and AC1250Vrms (NPO/SL) [DC1.3KV (Y5S/X7R/Y5P/Y5U/Y5V)] is applied for1 to 5s. between capacitor lead wires and small metals. Current is limited to less than 50mA.
Temperature Capacitance Coefficient	Char. / Operation Temp. / Cap.Change NPO(N) -55℃~+125℃ 0±30ppm/ ℃ SL(S) -30℃~+85℃ +350~ -1000 ppm Y5S(L) -30℃~+85℃ ± 22% X7R(X) -55℃~+125℃ ± 15% Y5P(P) -30℃~+85℃ ± 10% Y5U(E) -30℃~+85℃ +22 ~ -56% Y5V(Y) -30℃~+85℃ +22 ~ -82%	Class Ⅰ(NPO/SL): [C2-C1/C1(T2-T1)] × 100% Class Ⅱ(X7R/Y5P/Y5U/Y5V): (C2-C1)/C1 × 100% T1:Standard Temperature(25℃) T2:Test Temperature C1:Capacitance at Standard Temperature C2:Capacitance at Test Temperature
Strength of Terminal	Tensile Strength: Lead wire shall not be disconnected and capacitor shall not be damaged.	Nominal cross section area (mm) / Wire Diameter (mm) / Tensile Force (N) / Holding Time (s) 0.07-0.2 / 0.3-0.5 / 5 / 10 ±1 Over 0.2-0.5 / over0.5-0.8 / 10
	Bending Strength: Lead wire shall not be disconnected and capacitor shall not be damaged.	Nominal cross section area (mm) / Wire Diameter (mm) / Tensile Force (N) / Mass of Weight (Kg) 0.07-0.2 / 0.3-0.5 / 2.5 / 10 ±1 Over 0.2-0.5 / over0.5-0.8 / 5

HDC Series Specification & Test Condition

<table>
<tr><th>Item</th><th colspan="2">Specification</th><th>Test Condition</th></tr>
<tr><td>Solderability of leads</td><td colspan="2">More than 75% of the circumferential surface dipped into solder shall be covered with new solder.</td><td>Solder Temperature : 235±5℃
Dip Time : 2 ± 0.5 sec.
Solder: H60A or H63A
Flux: Ethanol solution of Rosin (25wt%)
Immersion depth: 1.5 to 2mm
Immersion speed: 25±2.5mm/s</td></tr>
<tr><td rowspan="3">Resistance to Soldering Heat</td><td>Appearance</td><td>No mechanical damage shall occur</td><td rowspan="3">The lead wire shall be immersed into the melted solder of 350±10℃ (body diameter 5.0mm max 260±5℃) up to about 1.5 to 2.0mm from the main body for 3.5 ±0.5 sec. (body diameter 5.0mm max 5±0.5sec.)
Class Ⅰ:
Measurement under room temperature after test for 1 to 2Hr
Class Ⅱ:
The capacitor shall be pre-treatment stored at 85±2℃ for 1hr, then placed at room temperature for 24±2hr before initial measurements.
The capacitor shall stored for 24±2hr at room temperature.</td></tr>
<tr><td>Capacitance</td><td>Class Ⅰ (NPO/SL):
Within±2.5% or ±0.25pF whichever is larger of initial value
Class Ⅱ (Y5S/X7R/Y5P/Y5U/Y5V):
Char. — Cap.Change
Y5S(L) — ≦±5% of initial value
X7R(X) — ≦±5% of initial value
Y5P(P) — ≦±5% of initial value
Y5U(E) — ≦±20% of initial value
Y5V(Y) — ≦±20% of initial value</td></tr>
<tr><td>Withstand Voltage (Between Terminal)</td><td>No dielectric breakdown or abnormality</td></tr>
<tr><td rowspan="5">Temperature and Dipping Cycle</td><td>Appearance</td><td>No mechanical damage shall be occur</td><td rowspan="5">Capacitor shall be subjected to five cycles of the temperature cycle as following:
Step — Temp.(℃) — Time(min)
1 — Min Rated Temp.+0/-3 (-55) — 30
2 — 25 — 3
3 — Max Rated Temp.+3/-0 (125) — 30
4 — 25 — 3
After 5 temperature cycle then consecutively to 2 dipping cycles
Step — Temp.(℃) — Time(min) — Dipping Liquid
1 — 65 +5/-0 — 15±2 — Pure Water
2 — 0±3 — 15±2 — Salt Water
Class Ⅰ:
Measurement under room temperature after test for 1 to 2Hr
Class Ⅱ:
The capacitor shall be pre-treatment stored at 85±2℃ for 1hr, then placed at room temperature for 24±2hr before initial measurements.
The capacitor shall stored for 24±2hr at room temperature.</td></tr>
<tr><td>Capacitance</td><td>Class Ⅰ (NPO/SL):
Within 5.0% or ±0.5pF whichever is larger of initial value
Class Ⅱ (Y5S/X7R/Y5P/Y5U/Y5V):
Char. — Cap.Change
Y5S(L) — ≦±10% of initial value
X7R(X) — ≦±10% of initial value
Y5P(P) — ≦±10% of initial value
Y5U(E) — ≦±30% of initial value
Y5V(Y) — ≦±30% of initial value</td></tr>
<tr><td>Q / Tan δ</td><td>Class Ⅰ (NPO/SL):
More Than 30pF：Q≧350
30pF & Below：Q≧275+2.5C
Class Ⅱ:
Y5S/X7R/Y5P：D.F.≦5.0%
Y5U/Y5V：D.F.≦7.5%</td></tr>
<tr><td>Insulation Resistance</td><td>1,000MΩ or 50/C Ω whichever is smaller. (C: in Farad)</td></tr>
<tr><td>Withstand Voltage (Between Terminal)</td><td>No dielectric breakdown or abnormality</td></tr>
</table>

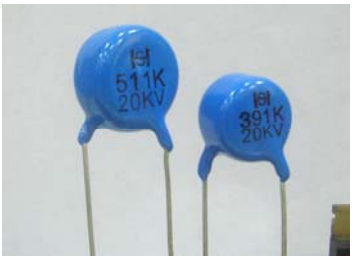
HDC Series Specification & Test Condition

Item		Specification	Test Condition
Humidity (Under Steady State)	Appearance	No mechanical damage shall occur	Temperature : 40± 2 ℃ Relative Humidity : 90 ~95%RH Test Time : 500 +24/-0 hr Class Ⅰ: Measurement under room temperature after test for 1 to 2Hr Class Ⅱ: The capacitor shall be pre-treatment stored at 85±2℃ for 1hr, then placed at room temperature for 24±2hr before initial measurements. The capacitor shall stored for 24±2hr at room temperature
	Capacitance	Class Ⅰ (NPO/SL): Within 5.0% or ±0.5pF whichever is larger of initial value Class Ⅱ (Y5S/X7R/Y5P/Y5U/Y5V): Char. — Cap.Change Y5S(L) — ≦±10% of initial value X7R(X) — ≦±10% of initial value Y5P(P) — ≦±10% of initial value Y5U(E) — ≦±30% of initial value Y5V(Y) — ≦±30% of initial value	
	Q / Tan δ	Class Ⅰ (NPO/SL): More Than 30pF：Q≧350 30pF & Below：Q≧275+2.5C Class Ⅱ: Y5S/X7R/Y5P：D.F.≦5.0% Y5U/Y5V：D.F.≦7.5%	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C: in Farad)	
Humidity Loading	Appearance	No mechanical damage shall occur	Temperature : 40± 2 ℃ Relative Humidity : 90 ~95%RH Test Time : 500 +24/-0 hr Applied Voltage : 100% of Rated Voltage Is applied less than 50mA current. Class Ⅰ: Measurement under room temperature after test for 1 to 2Hr Class Ⅱ: The capacitor shall be pre-treatment stored at 85±2℃ for 1hr, then placed at room temperature for 24±2hr before initial measurements. The capacitor shall stored for 24±2hr at room temperature
	Capacitance	Class Ⅰ (NPO/SL) : Within 7.5% or ±0.75pF whichever is larger of initial value Class Ⅱ (Y5S/X7R/Y5P/Y5U/Y5V): Char. — Cap.Change Y5S(L) — ≦±10% of initial value X7R(X) — ≦±10% of initial value Y5P(P) — ≦±10% of initial value Y5U(E) — ≦±30% of initial value Y5V(Y) — ≦±30% of initial value	
	Q / Tan δ	Class Ⅰ (NPO/SL): More Than 30pF：Q≧200 30pF & Below：Q≧100+(10/3)C Class Ⅱ: Y5S/X7R/Y5P：D.F.≦5.0% Y5U/Y5V：D.F.≦7.5%	
	Insulation Resistance	500MΩ or 25/C Ω whichever is smaller. (C: in Farad)	

HDC Series Specification & Test Condition

Item		Specification	Test Condition
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Applied Voltage: 150% of rated voltage However: The rated voltage is more than 5KVDC, applied voltage of 120% rated voltage. Temperature: max. operation temperature Test Time : 1000 +48/-0 Hr Is applied less than 50mA current. Class Ⅰ: Measurement under room temperature after test for 1 to 2Hr. Class Ⅱ: The capacitor shall be pre-treatment stored at 85±2℃ for 1hr, then placed at room temperature for 24±2hr before initial measurements.. The capacitor shall stored for 24±2hr at room temperature.
	Capacitance	Class Ⅰ(NPO/SL) : Within 5.0% or ±0.5pF whichever is larger of initial value Class Ⅱ(Y5S/X7R/Y5P/Y5U/Y5V): Char. — Cap.Change Y5S(L) — ≦±20% of initial value X7R(X) — ≦±20% of initial value Y5P(P) — ≦±20% of initial value Y5U(E) — ≦±30% of initial value Y5V(Y) — ≦±30% of initial value	
	Q / Tan δ	Class Ⅰ(NPO/SL): More Than 30pF：Q≧350 30pF & Below：Q≧275+2.5C Class Ⅱ: Y5S/X7R/Y5P：D.F.≦5.0% Y5U/Y5V：D.F.≦7.5%	
	Insulation Resistance	1000MΩ or 50/C whichever is smaller.	
Vibration	Appearance	No mechanical damage shall occur	The capacitor shall firmly be solded to the supporting terminal and vibration which is 10 to 55Hz in the vibration frequency range 1.5mm in total amplitude and about 1mm in the rate of vibration change from 10Hz to 55Hz and back to 10Hz is applied for a total of 6 hours ; 2 hours each in three mutually perpendicular directions.
	Capacitance	To satisfy the specified initial value	
	Q / Tan δ	To satisfy the specified initial value	

Ceramic Disc Capacitors
[High Voltage Disc Capacitor]
HDC Series – 10KVdc to 20KVdc



HDC Series (ceramic disc capacitors) are ideal for use in general electronic products with voltage ratings from 10KV to 20KV.

◆ Features

- ❑ Wide operation temperature
- ❑ Low loss at wide range of frequency
- ❑ High reliability
- ❑ RoHS compliant

◆ Applications

- ❑ Suitable for LAN/WLAN interface
- ❑ Ballast circuit of back-lighting inverter
- ❑ DC-DC converters,
- ❑ Snubber circuit of switching power supplies
- ❑ Modems & communication
- ❑ High voltage power supply

◆ Summary of Specification

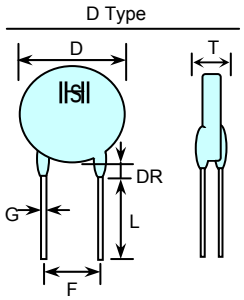
Operation Temperature	NPO/SL : -55~+125 ℃
	X7R/Y5P/Y5S : -55~+125℃
	Y5U/Y5V : -25~+105℃
Capacitance Range	10pF to 10,000pF
Capacitance	1KHz ± 20% /osc: 1 to 5Vrms ,and 20 ℃
Rated Voltage	10KVdc to 20KVdc
Temperature Coefficient	NPO : ≤ ± 30ppm/ ℃ , -55~+125 ℃ (EIA Class I)
	SL : +350 ~ -1000ppm/ ℃ , -25~+85 ℃ (EIA Class I)
	Y5S (N3300) ±22% , -25~+85 ℃
	X7R : ≤ ± 15% , -55~+125 ℃ (EIA Class II)
	Y5P:≤ ± 10% ;Y5U:+22%/-56% ;Y5V:+22%/-82% ,-25~+85 ℃(EIA Class II)
Dissipation Factor	Please see HEC specification data sheet
Insulation Resistance	10GΩ at 500VDC 1minute
Aging	NPO:0% ; SL :1.5% per decade of time
	X7R, Y5P, Y5S: 3.5 % per decade of time
	Y5U: 5.0 %; Y5V:7.5% per decade of time
Dielectric Strength	150% Rated Voltage

◆ How To Order

HDC	L	102	M	123	B	L	C

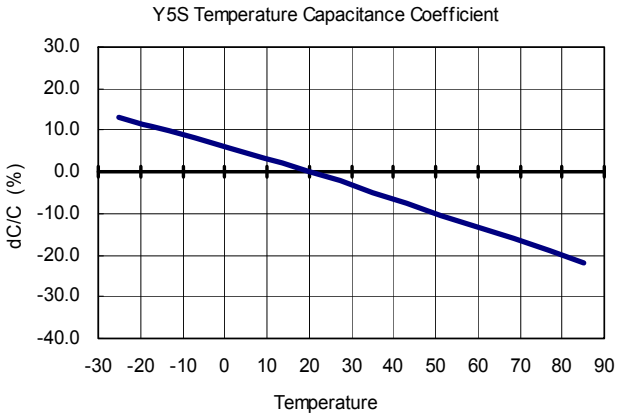
Product Code	**Dielectric**	**Capacitance Unit : pF**	**Tolerance**	**Rated Voltage**	**Lead Space**	**Packaging**	**Lead Shape Style**
HDC: Ceramic Disc Capacitor	Ex.: N:NPO S:SL L:Y5S X:X7R P:Y5P E:Y5U Y:Y5V	Ex.: 102:10x10^2 103:10x10^3	Ex.: C:+/-0.25pF D:+/-0.5pF J: +/- 5% K: +/- 10% M: +/- 20%	Ex.: 103:10KVdc 123:12KVdc 153:15KVdc 203:20KVdc	Ex.: A：10.0mm B：12.5mm	Ex.: H:3.1mm C:3.5mm S:5.0mm M:10.0mm L:25.0mm min.	Ex.: D Type 9: φ =0.50mm A: φ =0.60mm B: φ =0.65mm C: φ =0.80mm

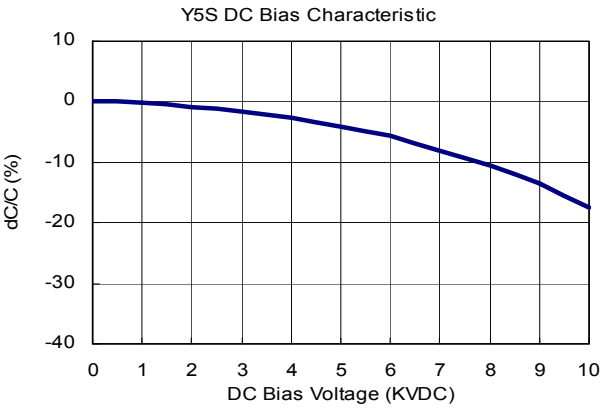
◆ Dimension



Code	Dimension		
	D Tape		
D	Φ20.5mm max.		
F	10.0±2 mm	12.5±2 mm	
G	0.6±0.1mm max.	0.65±0.1mm max.	0.8±0.1mm max.
T	10.0mm max.		
DR	5.0mm max.		

◆ Leakage Current Characteristic (Typical Reference)

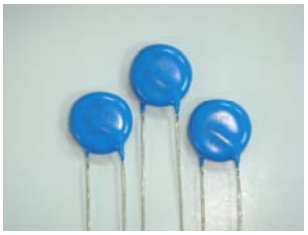




◆ Capacitance Range

Dielectric Characteristic	Voltage	Capacitance Range: 100 120 150 180 220 270 330 390 470 560 680 820 101 121 151 181 221 271 331 391 471 561 681 821 102 152 222 332 472 682 103 123
NPO	10KV	
	15KV	
	20KV	
SL	10KV	
	15KV	
	20KV	
Y5S	10KV	
	12KV	
	15KV	
Y5P	10KV	
	12KV	
	15KV	
Y5U	10KV	
	12KV	
	15KV	
Y5V	10KV	
	12KV	
	15KV	

▪ ***Other capacitance and voltage rating are available. Please contact HEC.***



Ceramic Disc Capacitors
[Safety Disc Capacitors – X1Y1& X1Y2]
SDC Series

This specification applies to the following Safety Standards that are recognized for Ceramic Capacitors used in Electronic Appliances.

These parts are compliant to EN60384-14, IEC60384-14, UL 1414, and C22.2 No.1 standards.

◆ Features

- ❑ Operating temperature range guaranteed up to 125℃(UL/CSA:85℃)
- ❑ Safety capacitors specially designed for use in Modem, Facsimile, Telephone and other electronic equipment for lighting and surge protection, EMI filter and isolation.
- ❑ The series is recognized by UL / CSA / TUV
- ❑ Coated with Flame-retardant epoxy resin (conforming to UL 94-0 standards)
- ❑ Suitable for automatic insertion
- ❑ RoHS compliant

◆ Application

- ❑ Safety capacitors specially designed for use in Modem, Facsimile, Telephone and other electronic equipment for lighting and surge protection, EMI filter and isolation.
- ❑ Interference suppressor for AC line of electronic equipment

◆ Related Standards and Certificate Numbers

Certificated Body	Relation Standard	Number	Rated Voltage
TUV	IEC 60384-14 : 2005 (3nd Edition) EN 60384-14 : 2005 EN 132400 : 1994+A2:1998+A3:1998+A4:2001	R50101887	X1:400 VAC Y2:250 VAC
		R50101887	X1:440 VAC Y1:250 VAC
		R50101887	X1:440 VAC Y2:400 VAC
UL	UL 1414 Edition 5	E300818	SDC-Y2 250 VAC
			SDC-Y1L 250 VAC
			SDC-Y1H 250 VAC
CUL/CSA	CSA :C22.2 NO.1	E300818/1686156	250 VAC
ENEC Report	EN 60384-14 : 2005	28203507 002	

◆ How To Order

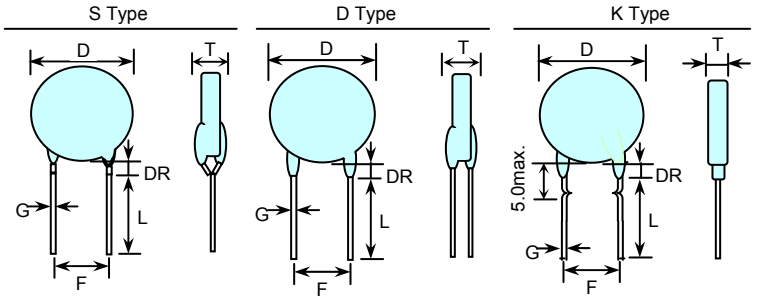
SDC	P	101	K	50	2	7	A	2

Product Code	**Dielectric**	**Capacitance Unit : pF**	**Tolerance**	**Class**	**Rated Voltage**	**Lead Space**	**Lead Length**	**Lead Shape Style**
SDC: Safety Disc Ceramic Capacitor	Ex.: N：NPO S： SL X：X7R P：Y5P Y：Y5V E：Y5U	Ex.: 100：10x10⁰ 151：15x10¹	Ex.: J: +/-5.0% K: +/- 10% M: +/- 20%	Ex.: 10：X1/Y1 50：X1/Y2	**2:** Y Cap:250V X Cap:400V **3:** Y Cap:250V X Cap:440V **4:** Y Cap:400V X Cap:440V	Ex.: 5：5.00mm 6：6.35mm 7：7.50mm A：10.0mm B：12.5mm	Ex.: H:3.1mm C:3.5mm S:5.0mm M:10mm L :25mm min T :Tape Reel A:Ammo Box	**S Type** 1: φ=0.50mm 2: φ=0.60mm 3: φ=0.65mm 4: φ=0.80mm **K Type** 5: φ=0.50mm 6: φ=0.60mm 7: φ=0.65mm 8: φ=0.80mm **D Type** 9: φ=0.50mm A: φ=0.60mm B: φ=0.65mm C: φ=0.80mm

◆ Summary of Specification

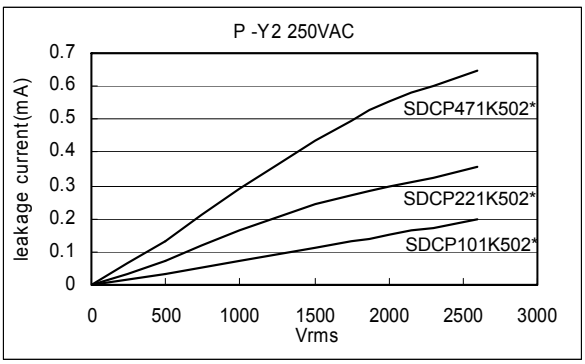
Operation Temperature	-25~+125 ℃
Dielectric Strength	X1:440 VAC / Y1:250 VAC : 4000VAC for 1 minute
	X1:440 VAC / Y1:400 VAC : 4000VAC for 1 minute
	X1:400 VAC / Y2:250 VAC : 2600VAC for 1 minute
Capacitance Range	X1:440 VAC / Y1:250 VAC : 2pF to 4700pF
	X1:440 VAC / Y1:400 VAC : 2pF to 4700pF
	X1:400 VAC / Y2:250 VAC : 2pF to 10,000pF
Dissipation Factor	Class I , NPO/SL : Q ≥ 300 at 1MHz/1Vrms
	Class II , Y5P :DF ≤ 2.5% ; Y5U/Y5V :DF ≤ 5.0% at 1KHz/1Vrms
Insulation Resistance	10,000MΩ min. at 500VDC

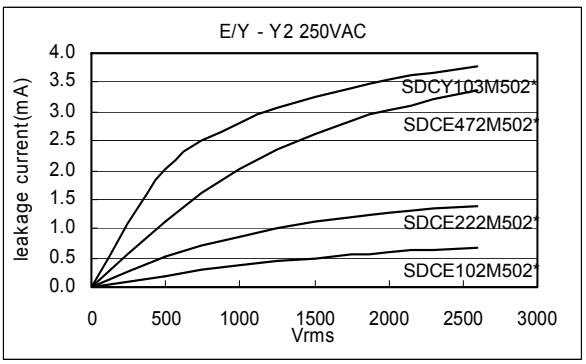
◆ Dimension



Code	Dimension			
D	Φ16.0mm max.			
F	5.0±1.0 mm	7.50±1.5 mm	10.0±2.0 mm	12.5±2.0 mm
G	0.5±0.1mm / 0.6±0.1mm / 0.8±0.1mm			
T	8.0mm max.			
DR	4.0mm max.			

◆ Leakage Current Characteristic (Typical Reference)





◆ Capacitance Range

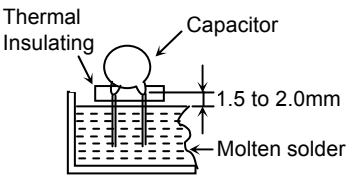
Class	TC	Capacitance Range																																
		2R0	3R0	5R0	8R0	100	150	220	330	470	680	101	121	151	181	221	271	331	391	471	561	681	102	152	182	202	222	332	392	472	682	822	103
X1: 400VAC Y2: 250VAC	NPO	8/5	8/5	8/5	9/5	10/5																												
	SL				8/5	8/5	8/5	8/5	8/5	8/5	8/5																								
	Y5P				8/5	8/5	8/5	8/5	8/5	8/5	8/5	8/7	8/7	8/7	8/7	8/7	8/7	8/7	8/7	8/7	9/7	9/7	10/7												
	Y5U																						8/7	9/7	10/7	10/7	10/7	12/7	13/7	14/7				
	Y5V																						8/7	8/7			9/7	10/7		12/7	14/7	15/7	16/7		
X1: 440VAC Y1: 250VAC	NPO	8/8	8/8	8/8																														
	SL				8/8	8/8	8/8	9/8	9/8	9/8	10/8																								
	Y5P											8/8		8/8		8/8		9/8	9/8	9/8		10/8	12/8												
	Y5U																						8/8	9/8	10/8	10/8	11/8	13.5/8	14.5/8	15.5/8				
X1: 440VAC Y1: 400VAC	NPO	8/8	8/8	8/8																														
	SL				8/8	8/8	8/8	9/8	9/8	9/8	10/8																								
	Y5P											8/8		8/8		8/8		9/8	9/8	9/8		10/8	12/8												
	Y5U																						8/8	9/8	10/8	10/8	11/8	13.5/8	14.5/8	15.5/8				

Body Diameter(max.) / Body Thickness (max.)

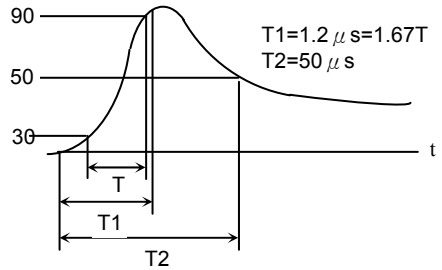
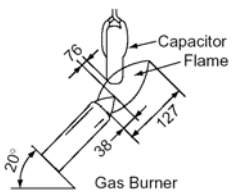
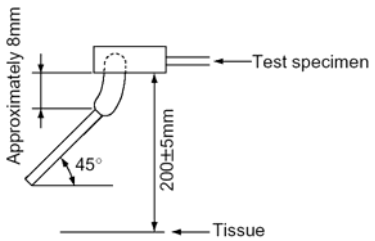
SDC Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	Char. / Operation Temp. NPO(N)/SL(S)/Y5P(P) / -25℃~ +125℃ Y5U(E)/Y5V(Y) / -25℃~ +105℃	
Capacitance	Within specified tolerance.	Char. / Frequency / Voltage NPO/SL / 1MHz±10% / 5.0Vrms max. Y5P/Y5U/Y5V / 1KHz±10% The measurement at reference temperature 25 ℃.
Quality Fact/or & Dissipation Factor	Char. / Q / D.F.(max.) NPO(N)/SL(S) / Q≧300 Y5P(P) / D.F. ≦2.5% Y5U(E) /Y5V(Y) / D.F. ≦5.0%	
Insulation Resistance(I.R.)	10,000MΩ min.	Applied Voltage：500±5Vdc Charge Time：60±5sec. Is applied less than 50mA current.
Dielectric Strength	Between lead wires: No failure	The capacitors shall not be damaged when AC2.6KV(for Y2 Class) and AC4000V (for Y1 Class) are applied between the lead wires for 60 sec. Is applied less than 50mA current.
	Body insulation: No failure	First the terminals of the capacitor shall be connected together. Then, as shown in the figure to the right, a metal foil shall be closely wrapped around the body of the capacitor to the distance of about 3 to 4mm from each terminal. Then, the capacitor shall be inserted into a container filled with metal balls of about 1mm diameter. Finally VAC 2600Vrms is applied for 60sec. between the capacitor lead wires and metal balls. Is applied less than 50mA current.
Temperature Characteristic	Char. / Temp. Range / Cap. Change NPO(N) / -55 ℃~+125 ℃ / 0±60ppm/℃ SL(S) / -55 ℃~+85 ℃ / +350~-1000% Y5P(P) / -25 ℃~+85 ℃ / ±10% Y5U(E) / -25 ℃~+85 ℃ / +22%~ -56% Y5V(Y) / -25 ℃~+85 ℃ / +22% ~ -82%	The capacitance measurement shall be made at each step specified as following.. Step. / Temperature(℃) (SL/Y5P/Y5U/Y5V) / (NPO) 1 / +25±2 / +25±2 2 / -25±2 / -55±2 3 / +25±2 / +25±2 4 / +85±2 / +125±2 5 / +25±2 / +25±2
Robustness of Termination	Tensile: Lead wire shall not separate from the capacitor and shall not be broken.	With the termination in its normal position the specimen is held by its body in such a manner that the axis of the termination is vertical the tensile force of 10N shall be applied to the termination in the direction of its axis and acting in a direction away from the body of the specimen.
	Bending: Lead wire shall not separate from the capacitor shall not be broken.	With the termination in its normal position the specimen is held by its body in such a manner that the axis of the termination is vertical : a mass applying a force of 5N is then suspended from the end of the termination. The body of the specimen is then inclined within a period of 2 to 3 sec., through an angle of a approximately 90 in the vertical plane and then returned to its initial position over the same period of time; this operation constitutes one bend. One bend immediately followed by a second bend in the opposite direction.

SDC Series Specification & Test Condition

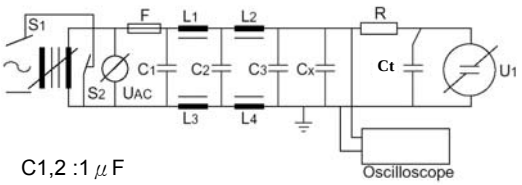
Item	Specification	Test Condition
Solderability of leads	Lead wire shall be soldered uniformly and coated on the axial direction over 3/4 of the circumference direction.	Solder temperature: 235 ± 5℃ Immersion time: 2 ± 0.5 sec The depth of immersion : 1.5~2.0mm
Soldering Effect	Appearance: No marked defect. Capacitance: Within±10% I.R.: 1000MΩ min. Dielectric Strength: Per Item 5.	Solder temperature: 350±10℃ or 260±5℃ Immersion time:3.5±0.5sec(10±1sec.for 260±5℃) The depth of immersion is up to about 1.5~2.0mm from the root of lead wires.  **Pre-treatment:** Capacitor shall be stored at 85±2℃ for 1 hour, then placed at room condition for 24±2 hours before initial measurements. **Post-treatment:** Capacitor shall be stored for 1 to 2 hours at room condition.
Humidity (Under Steady State)	Appearance: No marked defect Capacitance: NPO(N): ≦±5% of initial value SL(S): ≦±5% of initial value Y5P(P): ≦±10% of initial value Y5U(E): ≦±15% of initial value Y5V(Y): ≦±30% of initial value Q / Tan δ: Class Ⅰ (NPO/SL) Q≧135; Class Ⅱ Y5P：DF≦5.0% Y5U/Y5V：DF≦7.5% Insulation Resistance: 3,000MΩ min. Dielectric Strength: Pre Item 5.	Set the capacitor for 500±12 hours at 40±2℃, in 90 to 95% humidity. **Pre-treatment:** Capacitor shall be stored at 85±2℃ for 1 hour, then placed at room condition for 24±2 hours before initial measurements. **Post-treatment:** Capacitor shall be stored for 1 to 2 hours at room condition.
Humidity Loading	Appearance: No marked defect Capacitance: NPO(N): ≦±5% of initial value SL(S): ≦±5% of initial value Y5P(P): ≦±10% of initial value Y5U(E): ≦±15% of initial value Y5V(Y): ≦±30% of initial value Q / Tan δ: Class Ⅰ (NPO/SL) Q≧135; Class Ⅱ Y5P：DF≦5.0% Y5U/Y5V：DF≦7.5% Insulation Resistance: 3,000MΩ min. Dielectric Strength: Pre Item 5.	Apply the rated voltage for 500±12 hours at 40±2℃, in 90 to 95% humidity. **Pre-treatment:** Capacitor shall be stored at 85±2℃ for 1 hour, then placed at room condition for 24±2 hours before initial measurements. **Post-treatment:** Capacitor shall be stored for 1 to 2 hours at room condition.

SDC Series Specification & Test Condition

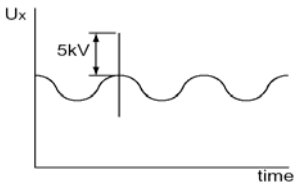
Item	Specification	Test Condition
Endurance (Life Test)	Appearance: No marked defect. Capacitance: NPO(N) ≦±5% of initial value; SL(S) ≦±20% of initial value; Y5P(P) ≦±20% of initial value; Y5U(E) ≦±20% of initial value; Y5V(Y) ≦±30% of initial value Insulation Resistance: 3,000MΩ min. Dielectric Strength: Pre Item 5.	Impulse Voltage Each individual capacitor shall be subjected to 5KV(Y2) and 8KV(Y1) impulses for the times below. After impulse testing the capacitors are applied to life test.  The specimen capacitor are placed in a circulating air oven for a period of 1000 hours. The air in the oven is maintained at a temperature of 125±2℃. Throughout the test the capacitors are subjected to 1.7Ur (rms) alternating voltage of mains frequency. In addition once per hour the voltage is increased to 1000Vrms for 0.1sec.
Flame Test	The capacitor flame discontinue as follows Cycle 1~4: Time 30sec. Max. Cycle 5: Time 60sec. max.	The capacitor shall be subjected to the flame below for 15 sec. then removed for 15 sec, for 5 cycles. 
Passive Flammability	The burning time shall not be exceeded the time 30sec. The tissue paper shall not ignite.	The capacitor under test shall be held in the flame in the position shown, which best promotes burning. Each specimen shall only be exposed once to the flame. Length of flame :12±1mm Gas burner : Length 35mm min. Inside Dia. : 0.5±0.1mm Outside Dia. : 0.9mm max. Gas : Butane gas Purity 95% min. Time of exposure to flame : 30 sec. 

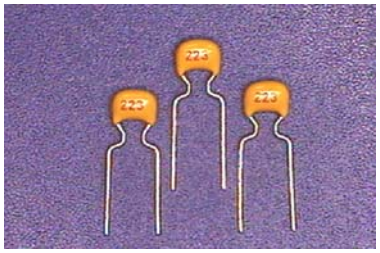
SDC Series Specification & Test Condition

Item	Specification	Test Condition
Active Flammability	The cheese-cloth shall not catch fire	The specimens shall be individually wrapped in at least one but not more than two complete layers of cheese-cloth The specimens shall be subjected to 20 discharges. The interval between successive discharges shall be 5 sec. The Uac shall be maintained for 2 min. after the last discharge.
Vibration	Appearance: No mechanical damage shall occur Capacitance: Within the specified tolerance Q / Tan δ: To satisfy the specified initial value	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.



C1,2 :1 μF
L1-4 :1.5mH±20%
16A Rod core choke
R : 100Ω±2%,
Uac : Ur±5%
Cx : Capacitor
U_1 : Voltage applied to Ct
C3 :0.33 μF±5% 10KV
Ct : 3 μF±5% 10KV
Ur : Rated working voltage
F : Fuse, Rated 10A





Radial Dipped Ceramic Capacitors [General Used Capacitor – 6.3V-1KV]

RDC Series

Capacitors with voltage ratings from 6.3V to 1KV

◆ Features

- ❑ Advanced process technology produces thinner layers of ceramic dielectric and offers higher voltage rating and capacitance values
- ❑ Provides good frequency response
- ❑ High reliability
- ❑ RoHS compliant

◆ Applications

- ❑ Suitable for Automotive Electronics, Power supplies
- ❑ Inverter and Converter
- ❑ Fuel pump , Water pump , Hybrid engine , Door lock , Wiper

◆ Summary of Specification

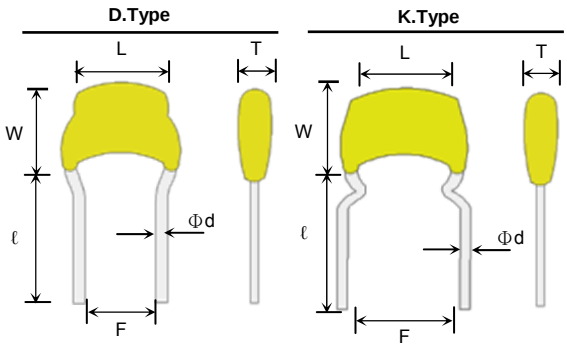
Operation Temperature	NPO,X7R : -55~+125 ℃ ; X5R : -55~+85 ℃ ; Y5V : -30~+85 ℃
Rated Voltage	6.3Vdc to 1KVdc
Temperature Coefficient	NPO : ≤ ± 30ppm/ ℃ , -55~+125 ℃ (EIA Class Ⅰ)
	X7R : ≤ ± 15% , -55~+125 ℃ (EIA Class Ⅱ)
	X5R : ≤ ± 15% , -55~+85 ℃ (EIA Class Ⅱ)
	Y5V : ≤ +22~ -82% , -30~+85 ℃ (EIA Class Ⅱ)
Capacitance Range	NPO : 10pF to 220nF
	X7R : 1000pF to 22uF
	X5R : 330nF to 100uF
	Y5V : 0.1uF to 100uF
Dissipation Factor	Please see RDC specification data sheet
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller
Aging	NPO:0% ; X7R,X5R: 2.5 % Y5V: 6% per decade of time
Dielectric Strength	V ≤ 50 : 250% Rated Voltage
	V＜500V :200% Rated Voltage
	500V ≤ V＜1000V: 150% Rated Voltage
	1000 ≤ V :120% Rated Voltage

◆ How To Order

RDC	X	103	K	631	EK	T

Product Code	**Dielectric**	**Capacitance Unit : pF**	**Tolerance**	**Rated Voltage**	**Leader Style**	**Packaging**
RDC: Radial Ceramic Chip Capacitor	Ex.: N: NPO X: X7R B: X5R Y: Y5V	Ex.: 2R0:2.0pF 100:10×10⁰ 471:47×10¹ 102:10×10²	Ex.: C:+/-0.25pF D:+/-0.50pF J :+/- 5% K :+/-10% M:+/-20%	Ex.: 007:6.3Vdc 010:10Vdc 025:25Vdc 050:50Vdc 101:100Vdc 251:250Vdc 631:630Vdc 102:1000Vdc	EX: Size DD:5.5x4.0 ED:5.5x4.5 FD:5.5x4.0 DK:5.5x4.0 EK:5.5x4.5 FK:5.5x4.0	T: Taping &Reel B: Bulk

◆ Dimension



Unit : mm [inches]

TYPE	L (max)	W (max)	T (max)	F		ℓ		Φd
D□	4.0 [0.157]	5.5 [0.216]	2.5 [0.098]	2.5±0.8 [0.098]	5.0±1 [0.196]	5.0 [0.196]	25 [0.982]	0.5±0.1 [0.196]
E□	5.5 [0.216]	7.0 [0.275]	4.0 [0.157]	2.5±0.8 [0.098]	5.0±1 [0.196]	5.0 [0.196]	25 [0.982]	0.5±0.1 [0.196]
F□	7.5 [0.294]	8.0 [0.314]	4.0 [0.157]	------	5.0±1 [0.196]	5.0 [0.196]	25 [0.982]	0.5±0.1 [0.196]

◆ Capacitance Range

Dielectric Characteristic	Type	Rated Voltage	Capacitance Range (pF)
NPO	D□	50V	100 120 150 180 220 270 330 390 470 560 680 820 101 121 151 181 221 271 331 391 471 561 681 821 102 122 152 182 222 272 332 392 472 562 682 822 103 153 223 333 473 683 104 154 224
	E□	50V	
	F□	50V	

Dielectric Characteristic	Type	Rated Voltage	Capacitance Range (pF)
X7R	D□	16V	102 152 222 332 472 682 103 153 223 333 473 683 104 154 224 334 474 684 105 155 255 335 475 685 106 156 226 336 476 686 107
		25V	
		50V	
	E□	16V	
		25V	
		50V	
	F□	16V	
		25V	
		50V	
X5R	D□	6.3V	
		10V	
	E□	6.3V	
		10V	
		16V	
	F□	6.3V	
		10V	
Y5V	D□	6.3V	
		10V	
		16V	
		25V	
		50V	
	E□	6.3V	
		10V	
		16V	
		25V	
		50V	
	F□	10V	
		16V	
		25V	
		50V	

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

RDC Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	Please see HEC specification data sheet for details	
Visual	No abnormal exterior appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	
Quality Factor	Class Ⅰ(NPO): More Than 30pF : Q ≧1000 30pF & Below: Q≧400+20C (C:Cap., pF)	
Dissipation Factor	Class Ⅱ(X7R,X5R,Y5V): Please see HEC specification data sheet for details	

Class	Frequency	Voltage
NPO		
C≦100pF	1MHz±10%	1.0±0.2Vrms
C>100pF	1KHz±10%	
X7R/X5R/Y5V		
C≦10uF	1KHz±10%	1.0±0.2Vrms
C＞10uF	120Hz±20%	0.5±0.2Vrms

Perform a heat treatment at 150±5℃ for 30min. then place room temp. for 24±2hr.

Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller for rated voltage>10V and greater 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..
Withstanding Voltage	No dielectric breakdown or mechanical breakdown	V≦50 : 250% Rated Voltage V＜500V : 200% Rated Voltage 500V≦V＜1000V: 150% Rated Voltage 1000≦V :120% Rated Voltage for 1~5 sec. Current is limited to less than 50mA.

Temperature Capacitance Coefficient	Char.	Temp. Range	Cap. Change	Class Ⅰ: [C2-C1/C1(T2-T1)] × 100% Class Ⅱ: (C2-C1)/C1 × 100% T1:Standard Temperature(25℃) T2:Test Temperature C1:Capacitance at Standard Temperature C2:Capacitance a Test Temperature
	NPO (N)	-55℃~ +125℃	± 30ppm/℃	
	X7R (X)	-55℃~ +125℃	± 15%	
	X5R (B)	-55℃~+85℃	± 15%	
	Y5V (Y)	-30℃~+85℃	+22% ~-82%	

Lead Strength			
	Tensile Strength	No mechanical damage such as lead breakage and loosing.	Pulling strength: 5N Holding time: 10±1s
	Bending Strength .	No mechanical damage such as lead breakage or loosening.	Hold the capacitors to keep the axis vertical, bend it 90 degrees as shown below and bend back to the original position. This operation shall be done for 2~3s. and repeated for the following times. Bending force: 5N(weight :0.51kg) Test time : 2 times

Solderability	Leads shall be covered by new solder more than 75% of its surface	Completely immerse both terminations in solder at 235± 5℃ for 2±0.5s Solder : H63A Flux :Rosin Dipping :By 1.5~2.0mm form the root of lead

Resistance to Soldering Heat			
	Appearance	No mechanical damage shall occur	Completely soak both terminations in solder at 250± 5℃ for 5±1s Solder : H63A Flux :Rosin Dipping :By 1.5~2.0mm from the root of lead
	Capacitance	Class Ⅰ(NPO): Within 2.5% or ±0.25pF whichever is larger of initial value Class Ⅱ X7R,X5R : ≤ ±10% of initial value Y5V : ≤ ±20% of initial value	
	Q / Tan δ	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	

RDC Series Specification & Test Condition

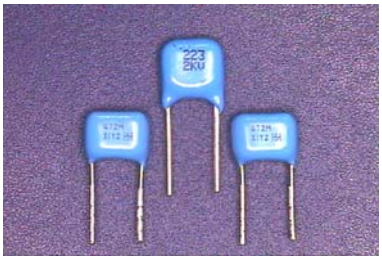
Item		Specification	Test Condition
Temperature Cycle	Appearance	No mechanical damage shall occur	Class Ⅱ capacitor shall be set for 48±4 hours at room temperature after one hour heat treatment at 150 +0/-10 ℃ before initial measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following:
	Capacitance	Class Ⅰ (NPO): Within 2.5% or ±0.25pF whichever is larger of initial value Class Ⅱ X7R,X5R : ≤ ±7.5% of initial value Y5V : ≤ ±20% of initial value	
	Q / Tan δ	see RDC specification data sheet	
	Insulation Resistance	To satisfy the specified initial value	

Step	Temp.(℃)	Time(min)
1	Min Rated Temp.+0/-3 (-55)	30
2	25	3
3	Max Rated Temp.+3/-0 (125)	30
4	25	3

Measure at room temperature after cooling for
Class Ⅰ : 24 ± 2 Hours
Class Ⅱ : 48 ± 4 Hours

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 measurement. 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	Class Ⅰ (NPO): Within 5% or ±0.5pF whichever is larger of initial value Class Ⅱ X7R,X5R : ≤ ±15% of initial value Y5V : ≤ ±30% of initial value	
	Q / Tan δ	see RDC specification data sheet	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller for rated voltage>10V and greater 10/C Ω for rated voltage ≤10V	
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Class Ⅱ capacitors applied DC testing voltage is applied for one hour at maximum operation temperature ±3℃ then shell be set for 48± 4 hours at room temperature and the initial measurement shall be conducted. Applied Voltage: V≤50Vdc 200%Rated Voltage V≤250Vdc 150%Rated Voltage V< 1KVdc 120%Rated Voltage V≥1KV 100%Rated Voltage However: The rated voltage is 6.3V/10V,applied voltage of 100% Rated voltage. 150% Rated Voltage for C≥1.0uF and 200% Rated Voltage for C < 1.0uF . Temperature: max. operating temperature Test Time : 1000 +48/-0 Hr Current Applied : 50mA Max Measure at room temperature after cooling for Class Ⅰ : 24 ± 2 Hours Class Ⅱ : 48 ± 4 Hours
	Capacitance	Class Ⅰ (NPO): Within 5% or ±0.5pF whichever is larger of initial value Class Ⅱ X7R,X5R : ≤ ±15% of initial value Y5V : ≤ ±30% of initial value	
	Q / Tan δ	Class Ⅰ (NPO): More Than 30pF : Q ≧350 30pF & Below: Q≧275＋2.5C Class Ⅱ (X7R,X5R,Y5V): see RDC specification data sheet	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller for rated voltage>10V and greater 10/C Ω for rated voltage ≤10V	
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 1min. Repeat this for 2 hours each in 3perpendicular directions.
	Capacitance	Within the specified tolerance	
	Q / Tan δ	To satisfy the specified initial value	

Radial Dipped Ceramic Capacitors
[Ultra High Voltage Radial Capacitor – 2KV-5KV]
RDH Series



◆ Features

- ❑ Advanced process technology produces thinner layers of ceramic dielectric and offers higher voltage rating and capacitance values
- ❑ Provides good frequency response
- ❑ High reliability
- ❑ RoHS compliant

◆ Applications

- ❑ Suitable for Power supplies , Surge protection Industrial control circuits , Voltage multipliers , Data isolation

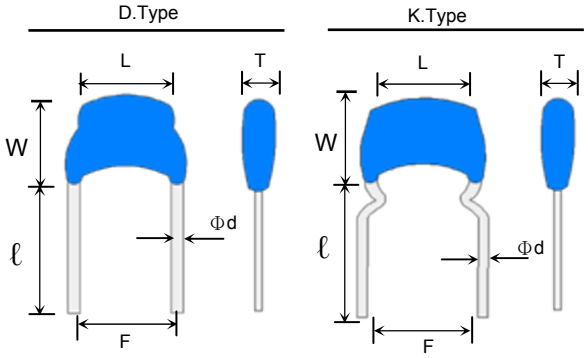
◆ Summary of Specification

Operation Temperature	-55~+125 ℃
Rated Voltage	2KV to 5KV
Temperature Coefficient	NPO : ≤ ± 30ppm/ ℃ , -55~+125 ℃ (EIA Class Ⅰ)
	X7R : ≤ ± 15% , -55~+125 ℃ (EIA Class Ⅱ)
Capacitance Range	NPO :10pF to 56nF ; X7R :330pF to 470nF
Dissipation Factor :	NPO : Q≧1000 ; X7R : D.F.≤2.5%
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller
Aging	NPO:0% ; X7R: 2.5 %
Dielectric Strength	1000≦V :120% Rated Voltage

◆ How To Order

RDH	X	102	K	202	HK	T
Product Code RDH: Radial Dipped Ultra High Voltage Capacitor	**Dielectric** Ex.: N: NPO X: X7R	**Capacitance Unit : pF** Ex.: 100:10×10⁰ 471:47×10¹ 102:10×10²	**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	**Leader Style** EX: Size GD:5.5x4.0 HD:5.5x4.5 I D:5.5x4.0 GK:5.5x4.0 HK:5.5x4.5 I K:5.5x4.0	**Packaging** T: Taping &Reel B: Bulk

◆ Dimension



Unit : mm [inches]

TYPE	L (max)	W (max)	T (max)	F		ℓ	
G□	6.35 [0.250]	5.59 [0.220]	6.86 [0.270]	5.08 [0.199]	5.0 [0.196]	25 [0.982]	0.5±0.1 [0.196]
H□	9.40 [0.370]	7.62 [0.300]	6.86 [0.270]	7.55 [0.296]	5.0 [0.196]	25 [0.982]	0.5±0.1 [0.196]
I □	12.0 [0.470]	10.2 [0.400]	8.13 [0.320]	10.2 [0.400]	5.0 [0.196]	25 [0.982]	0.5±0.1 [0.196]
J □	14.5 [0.570]	12.7 [0.500]	8.13 [0.320]	12.8 [0.503]	5.0 [0.196]	25 [0.982]	0.5±0.1 [0.196]
K□	17.0 [0.670]	15.2 [0.600]	8.13 [0.320]	15.36 [0.603]	5.0 [0.196]	25 [0.982]	0.5±0.1 [0.196]
L□	19.6 [0.770]	18.3 [0.720]	8.13 [0.320]	17.86 [0.701]	5.0 [0.196]	25 [0.982]	0.5±0.1 [0.196]
M□	22.1 [0.870]	19.1 [0.750]	8.13 [0.320]	20.46 [0.804]	5.0 [0.196]	25 [0.982]	0.5±0.1 [0.196]

◆ Capacitance Range

Dielectric Characteristic	Type	Rated Voltage	Capacitance Range (pF)
NPO	G □	2KV	
		3KV	
		4KV	
		5KV	
	H □	2KV	
		3KV	
		4KV	
		5KV	
	I □	2KV	
		3KV	
		4KV	
		5KV	
	J □	2KV	
		3KV	
		4KV	
		5KV	
	K □	2KV	
		3KV	
		4KV	
		5KV	
	L □	2KV	
		3KV	
		4KV	
		5KV	
	M □	2KV	
		3KV	
		4KV	
		5KV	
	N □	2KV	
		3KV	
		4KV	
		5KV	

100 120 150 180 220 270 330 390 470 560 680 820 101 121 151 181 221 271 331 391 471 561 681 821 102 122 152 182 222 272 332 392 472 562 682 822 103 153 223 333 473 563 683

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

Dielectric Characteristic	Type	Rated Voltage	Capacitance Range (pF)
X7R	G □	2KV	331 391 471 561 681 102 152 152 222 332 472 682 103 153 223 333 393 473 563 683 104 154 184 224 334 394 474 684
		3KV	
	H □	2KV	
		3KV	
		4KV	
		5KV	
	I □	2KV	
		3KV	
		4KV	
		5KV	
	J □	2KV	
		3KV	
		4KV	
		5KV	
	K □	2KV	
		3KV	
		4KV	
		5KV	
	L □	2KV	
		3KV	
		4KV	
		5KV	
	M □	2KV	
		3KV	
		4KV	
		5KV	
	N □	2KV	
		3KV	
		4KV	
		5KV	

▪ ***Other dimensions, capacitance values and voltages rating are available. Please contact HEC.***

RDH Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	-55 to +125℃	
Visual	No abnormal exterior appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	Class / Frequency / Voltage: NPO C≤100pF: 1MHz±10%, 1.0±0.2Vrms C>100pF: 1KHz±10% X7R: 1KHz±10%, 1.0±0.2Vrms
Quality Factor	Class Ⅰ(NPO): More Than 30pF : Q ≧1000 30pF & Below: Q≧400+20C (C:Cap., pF)	
Dissipation Factor	Class Ⅱ(X7R): Maximum 0.025	Perform a heat treatment at 150±5℃ for 30min. then place room temp. for 24±2hr.
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller. (C in Farad)	V≦500V, Rated Voltage V> 500V, Applied 500Vdc Charge Time : 60sec. Is applied less than 50mA current.
Withstanding Voltage	No dielectric breakdown or mechanical breakdown	1000≦V :120% Rated Voltage for 1~5 sec. Current is limited to less than 50mA. Withstand voltage testing requires immersion of the part in an isolation fluid prevent to arcing on the chip surface, at voltages over 1000Vdc.
Temperature Capacitance Coefficient	Char. / Temp. Range / Cap. Change NPO(N) / -55℃~ +125℃ / ± 30ppm/℃ X7R (X) / -55℃~ +125℃ / ± 15%	Class Ⅰ: [C2-C1/C1(T2-T1)] × 100% Class Ⅱ: (C2-C1)/C1 × 100% T1:Standard Temperature(25℃) T2:Test Temperature C1:Capacitance At Standard Temperature C2:Capacitance At Test Temperature
Lead Strength	Tensile Strength: No mechanical damage such as lead breakage and loosing.	Holding the body of the part, apply the pulling force to the lead as indicated below. Pulling strength: 5N Holding time: 10±1s
	Bending Strength: No mechanical damage such as lead breakage and loosing.	Hold the capacitors to keep the axis vertical, bend it 90 degrees as shown below and bend back to the original position. This operation shall be done for 2~3s. and repeated for the following times. Bending force: 5N(weight :0.51kg) Test time : 2 times
Solderability	Leads shall be covered by new solder more than 75% of its surface	Completely immerse both terminations in solder at 235± 5℃ for 2±0.5s Solder : H63A Flux :Rosin Dipping :By 1.5~2.0mm from the root of lead

RDH Series Specification & Test Condition

Item		Specification	Test Condition
Resistance to Soldering Heat	Appearance	No mechanical damage shall occur	Completely immerse both terminations in solder at 250± 5℃ for 5±1s Solder : H63A Flux :Rosin Dipping :By 1.5~2.0mm from the root of lead
	Capacitance	Class Ⅰ (NPO): Within 2.5% or ±0.25pF whichever is larger of initial value Class Ⅱ (X7R): Within ±10% of initial value	
	Q / Tan δ	To satisfy the specified initial value	
	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 measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following: Step / Temp.(℃) / Time(min) 1 / Min Rated Temp.+0/-3 (-55) / 30 2 / 25 / 3 3 / Max Rated Temp.+3/-0 (125) / 30 4 / 25 / 3 Measure at room temperature after cooling for Class Ⅰ : 24 ± 2 Hours Class Ⅱ : 48 ± 4 Hours
	Capacitance	Class Ⅰ (NPO): Within 2.5% or ±0.25pF whichever is larger of initial value Class Ⅱ (X7R): Within ±7.5% of initial value	
	Q / Tan δ	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	
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 measurement. 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	Class Ⅰ (NPO): Within 5% or ±0.5pF whichever is larger of initial value Class Ⅱ (X7R): Within ±15% of initial value	
	Q / Tan δ	Class Ⅰ (NPO): More Than 30pF : Q ≧350 30pF & Below: Q≧275＋2.5C Class Ⅱ (X7R): Maximum ±5.0%	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)	

RDH Series Specification & Test Condition

Item		Specification	Test Condition
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Solder the capacitor on P.C. board shown in Fig 2. before testing. Apply the voltage below at 125±2°C for 1,000 +48/-0h Applied Voltage :
	Capacitance	Class Ⅰ (NPO): Within 3% or ±0.3pF whichever is larger of initial value Class Ⅱ (X7R): Within ±15% of initial value	
	Q / Tan δ	Class Ⅰ (NPO): More Than 30pF : Q ≧350 30pF & Below: Q≧275＋2.5C Class Ⅱ (X7R): Maximum ±5%	
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)	

Rated Voltage	Applied Voltage
V≤250Vdc	150%Rated Voltage
250Vdc < V< 1KVdc	120%Rated Voltage
More Than 1KVdc(include 1KV)	100%Rated Voltage

Temperature : max. operating temperature
Test Time : 1000 +12/-0Hr
Current Applied : 50 mA Max.
Measure at room temperature after cooling for
Class Ⅰ : 24 ± 2 Hours
Class Ⅱ : 48 ± 4 Hours

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 3perpendicular directions.
	Capacitance	Within the specified tolerance	
	Q / Tan δ	To satisfy the specified initial value	

Axial Leader Ceramic Capacitors
[General Capacitor – NPO,X7R,X5R,Y5V]
AXC Series

◆ Features

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

◆ Applications

- ❑ For EIA Class Ⅰ can be used in stabilize frequency circuits
- ❑ For EIA Class Ⅱ can be used in by pass circuits

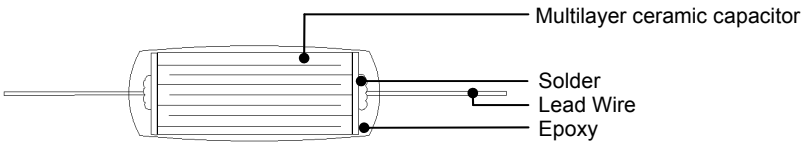
◆ Summary of Specification

Operation Temperature	NPO,X7R : -55~+125 ℃
	X5R : -55~+85 ℃
	Y5V : -30~+85 ℃
Rated Voltage	6.3Vdc to 50Vdc
Temperature Coefficient	NPO : ≤ ± 30ppm/ ℃ , -55~+125 ℃ (EIA Class Ⅰ)
	X7R : ≤ ± 15% , -55~+125 ℃ (EIA Class Ⅱ)
	X5R : ≤ ± 15% , -55~+85 ℃ (EIA Class Ⅱ)
	Y5V : ≤ ± 22~-82% , -30~+82 ℃ (EIA Class Ⅱ)
Capacitance Range	NPO :0.5pF to 1nF
	X7R :1.2nF to 6.8nF
	X5R : 1.2nF to 10uF
	Y5V :10nF to 1uF
Dissipation Factor :	NPO : Q≧1000 ;
	X7R,X5R,Y5V : Please see AXC specification data sheet
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller
Aging	NPO:0% ; X7R,X5R: 2.5 % Y5V: 6% per decade of time
Dielectric Strength	250% Rated Voltage

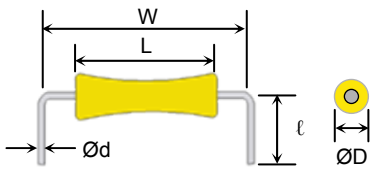
◆ How To Order

AXC	X	103	K	050	D	A
Product Code AXC: Axial Leader Ceramic Capacitors	**Dielectric** Ex.: N: NPO X: X7R B: X5R Y: Y5V	**Capacitance Unit : pF** Ex.: 2R0:2.0pF 100:10×10⁰ 471:47×10¹ 102:10×10² 105:10×10⁵	**Tolerance** Ex.: C:+/-0.25pF D:+/-0.50pF J :+/- 5% K :+/-10% M:+/-20% Z:+80/-20%	**Rated Voltage** Ex.: 007:6.3Vdc 016:16Vdc 025:25Vdc 050:50Vdc	**Dimension (max.)** EX: Size C : 5.5x4.0 mm D : 5.5x4.5 mm	**Packaging** EX: H: Pitch 5.0mm C: Pitch 7.5mm A: Pitch 10mm S: 26mm Lead Ammo L: 56mm Lead Ammo

◆ Dimension



H,C,A. type (Bulk)

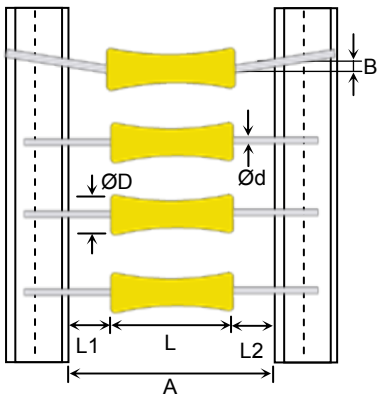


H,C,A

Unit:mm (inches)

Type	Dimensions(mm)						
	ØD	L	W			Ød	ℓ
C	2.0max (0.079)	2.3max (0.09)	5.0±0.5 (0.197±0.020)	7.5±0.5 (0.295±0.020)	10±0.5 (0.394±0.020)	0.45±0.05 (0.018±0.002)	20.0min (0.787)
D	2.2max (0.087)	3.2max (0.126)	5.0±0.5 (0.197±0.020)	7.5±0.5 (0.295±0.020)	10±0.5 (0.394±0.020)	0.45±0.05 (0.018±0.002)	20.0min (0.787)

S,L. type (Tapping)



S

Unit:mm (inches)

Type	Dimension						insertion pitch
	ØD	L	A	B	L1-L2	Ød	L
C	2.0max (0.079)	2.3max (0.09)	26±0.5 (1.024±0.02)	0.8 max (0.03max)	0.5 max (0.02max)	0.45±0.05 (0.018±0.002)	5.0 mm (0.197)
D	2.2max (0.087)	3.2max (0.126)				0.45±0.05 (0.018±0.002)	

L

Unit:mm (inches)

Type	Dimension						insertion pitch
	ØD	L	A	B	L1-L2	Ød	L
C	2.0max (0.079)	2.3max (0.09)	52±0.5 (2.047±0.02)	1.2 max (0.047 less)	1.0 max (0.03max)	0.45±0.05 (0.018±0.002)	5.0 mm (0.197) min
D	2.2max (0.087)	3.2max (0.126)				0.45±0.05 (0.018±0.002)	

◆ Capacitance Range

Dielectric Characteristic	Type	Rated Voltage	Capacitance Range (pF)
			0R5 1R0 1R5 2R0 3R0 4R0 5R0 6R0 7R0 8R0 9R0 100 120 150 180 220 270 330 390 470 560 680 820 101 121 151 181 221 271 331 391 471 561 681 821 102 122
NPO	C,D	50V	■

Dielectric Characteristic	Type	Rated Voltage	Capacitance Range (pF)
			102 122 152 182 222 272 332 392 472 562 682 822 103 123 153 183 223 273 333 393 473 563 683 823 104 154 224 334 474 684 105 225 335 475 685 106 226
X7R	C,D	16V	■
	C,D	25V	■
	C,D	50V	■
X5R	C,D	6.3V	■
		10V	■
		16V	■
		50V	■
Y5V	C,D	50V	■

▪ ***Other capacitance values and voltages rating are available. Please contact HEC.***

AXC Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	Char. / Operation Temp. NPO(N) -55℃~ +125℃ X7R (X) -55℃~ +125℃ X5R (B) -55℃~ +85℃ Y5V (Y) -30℃~ +85℃	
Visual	No abnormal exterior appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	Class / Frequency / Voltage NPO C≤100pF 1MHz±10% 1.0±0.2Vrms C>100pF 1KHz±10% X7R,X5R,Y5V C≦10uF 1KHz±10% 1.0±0.2Vrms C＞10uF 120Hz±20% 0.5±0.2Vrms
Quality Factor	Class Ⅰ(NPO): More Than 30pF : Q ≧1000 30pF & Below: Q≧400＋20C (C:Cap., pF)	
Dissipation Factor	Class Ⅱ(X7R,X5R,Y5V): Please see AXC specification data sheet	Perform a heat treatment at 150±5℃ for 30min. then place room temp. for 24±2hr.
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller for rated voltage>10V and greater 100/C Ω for rated voltage≤10V	Applied Voltage: Rated Voltage Charge Time : 60±5 sec. Current is limited to less than 50mA
Withstanding Voltage	No dielectric breakdown or mechanical breakdown	V≦50 : 250% Rated Voltage for 1~5 sec. Current is limited to less than 50mA.
Temperature Capacitance Coefficient	Char. / Temp. Range / Cap. Change NPO (N) -55℃~ +125℃ ± 30ppm/℃ X7R (X) -55℃~ +125℃ ± 15% X5R (B) -55℃~+85℃ ± 15% Y5V (Y) -30℃~+85℃ +22% ~-82%	Class Ⅰ: [C2-C1/C1(T2-T1)] × 100% Class Ⅱ: (C2-C1)/C1 × 100% T1:Standard Temperature(25℃) T2:Test Temperature C1:Capacitance At Standard Temperature C2:Capacitance At Test Temperature
Lead Strength	Tensile Strength: No mechanical damage such as lead breakage and loosing. Bending Strength . : No mechanical damage such as lead breakage and loosing.	With holding the parts, apply pulling force to lead drawing direction gradually. Pulling strength: 5N With holding the capacitors to keep the axis vertical, bend it 90 degrees with weighting and put it back to the original position. This operation shall be done for 2~3s. and repeat the following times. Bending forth: 5N(weight :0.51kg) / 2 times
Solderability	Leads shall be covered by new solder more than 75% of its surface	Completely soak both terminations in solder at 235± 5℃ for 2±0.5s Solder : H63A Flux :Rosin Dipping :By 1.5~2.0mm form the root of lead
Resistance to Soldering Heat	Appearance: No mechanical damage shall occur Capacitance: Class Ⅰ(NPO): Within 2.5% or ±0.25pF whichever is larger of initial value Class Ⅱ(X7R,X5R,Y5V) see AXC specification data sheet Q / Tan δ: To satisfy the specified initial value Insulation Resistance: To satisfy the specified initial value	Completely soak both terminations in solder at 250± 5℃ for 5±1s Solder : H63A Flux :Rosin Dipping :By 1.5~2.0mm form the root of lead

AXC Series Specification & Test Condition

Item		Specification	Test Condition
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 measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following: Step / Temp.(℃) / Time(min) 1 / Min Rated Temp.+0/-3 (-55) / 30 2 / 25 / 3 3 / Max Rated Temp.+3/-0 (125) / 30 4 / 25 / 3 Measure at room temperature after cooling for Class Ⅰ: 24 ± 2 Hours Class Ⅱ: 48 ± 4 Hours
	Capacitance	Class Ⅰ (NPO): Within 2.5% or ±0.25pF whichever is larger of initial value Class Ⅱ (X7R,X5R,Y5V): Char. / Cap. change X7R(X) / ≤ ±7.5% of initial value X5R(B) / ≤ ±7.5% of initial value Y5V(Y) / ≤ ±20% of initial value	
	Q / Tan δ	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	
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 measurement. 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	Class Ⅰ (NPO): Within 5% or ±0.5pF whichever is larger of initial value Class Ⅱ (X7R,X5R,Y5V): Char. / Cap. change X7R(X) / ≤ ±15% of initial value X5R(B) / ≤ ±15% of initial value Y5V(Y) / ≤ ±30% of initial value	
	Q / Tan δ	see AXC specification data sheet	
	Insulation Resistance	see AXC specification data sheet	
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Class Ⅱ capacitors applied DC testing voltage is applied for one hour at maximum operation temperature ±3℃ then shell be set for 48± 4 hours at room temperature and the initial measurement shall be conducted. Applied Voltage: 200% Rated Voltage for C < 1.0uF and 150% Rated Voltage for C≥1.0uF. However: The rated voltage is 6.3V/10V,applied voltage of 100% rated voltage. Temperature: max. operating temperature Test Time : 1000 +48/-0 Hr Current Applied : 50mA Max Measure at room temperature after cooling for Class Ⅰ: 24 ± 2 Hours Class Ⅱ: 48 ± 4 Hours
	Capacitance	Class Ⅰ (NPO): Within 5% or ±0.5pF whichever is larger of initial value Class Ⅱ (X7R,X5R,Y5V): Char. / Cap. change X7R(X) / ≤ ±15% of initial value X5R(B) / ≤ ±15% of initial value Y5V(Y) / ≤ ±30% of initial value	
	Q / Tan δ	see AXC specification data sheet	
	Insulation Resistance	see AXC specification data sheet	
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 3perpendicular directions.
	Capacitance	Within the specified tolerance	
	Q / Tan δ	To satisfy the specified initial value	

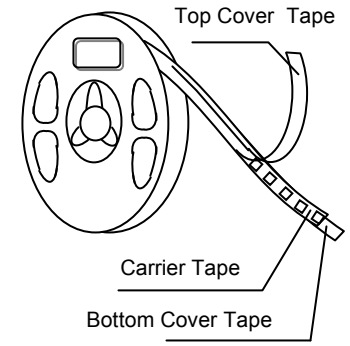
◆ Multilayer Ceramic Chip Capacitor

● Bulk Packing

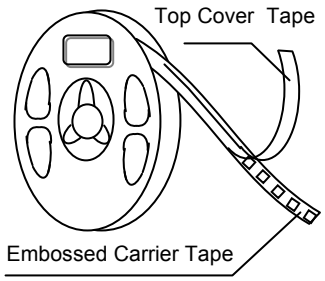
Standard packing 10Kpcs/pack, others according to customers' request.

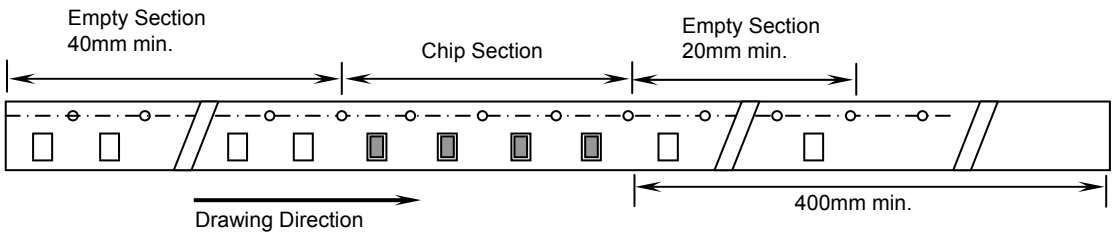
● Tape Packing

Paper Tape



Embossed Tape





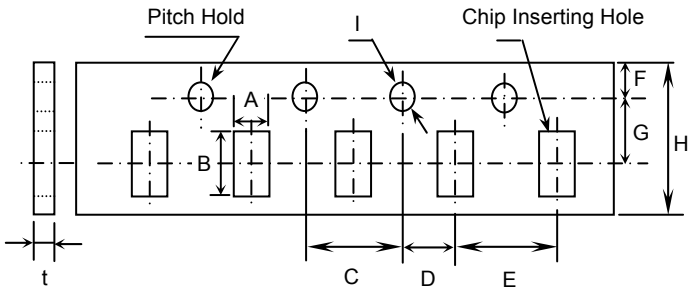
Material And Quantity (¢180mm)

Chip Size (EIA Code)	Dimension (mm) L	W	T	¢180mm reel Paper Tape	Plastic Tape
0201	0.6	0.3	T≤0.33	15,000 pcs/reel	N/A
0402	1.0	0.5	T≤0.55	10,000 pcs/reel	N/A
0603	1.6	0.8	T≤0.90	4,000 pcs/reel	N/A
0805	2.0	1.25	T≤0.90	4,000 pcs/reel	N/A
			0.9< T≤1.25	N/A	3,000 pcs/reel
1206	3.2	1.6	T≤0.90	4,000 pcs/reel	N/A
			0.9< 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
			T>1.25	N/A	2,000 pcs/reel
1808	4.6	2.0	T≤1.25	N/A	3,000 pcs/reel
			T>1.25	N/A	2,000 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	2.0	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	5.0	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

NA：Not Available

● Dimension of Tape Specification

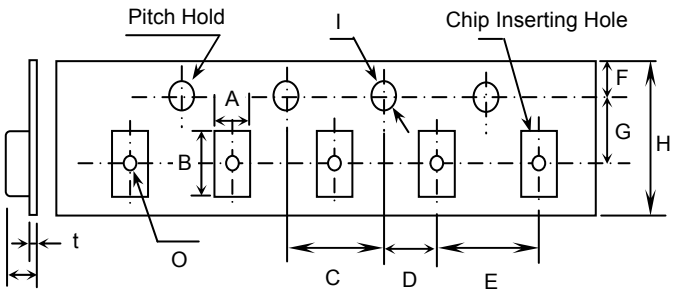
Paper Tape



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.	-- -->				

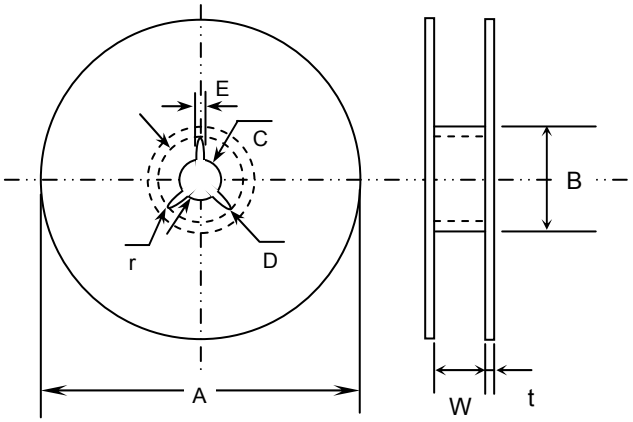
Embossed Tape



Unit：mm

	0805	1206	1210	1808	2208	1812	1825	2211	2220	2225
A	1.5±0.1	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 +3/-0	→					
I	¢1.5+0.1/-0	→								
J	3.0 max.	→		4.0 max.	→					
t	0.3 max.	→								
O	0.15 min.	→								

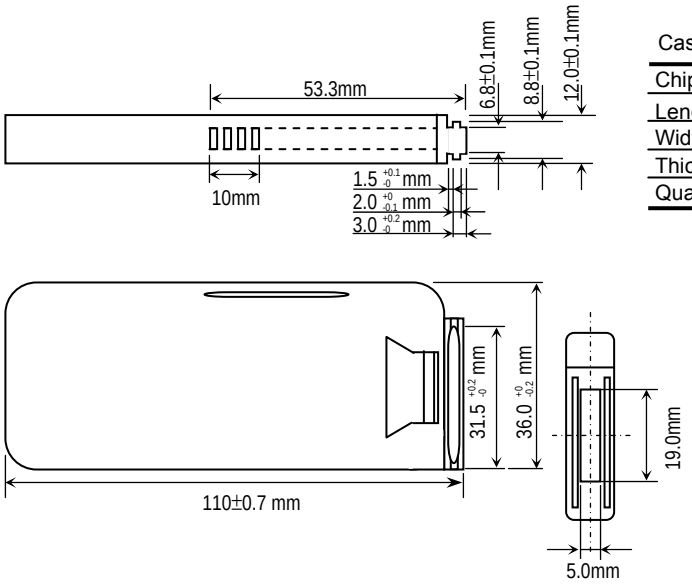
Reel Dimension



Unit：mm

	0402 to 1210	1808 to 2220
A	¢ 382 max.	¢ 178±0.2
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

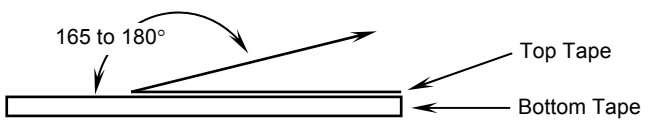


Cassette Packing

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 Off Force



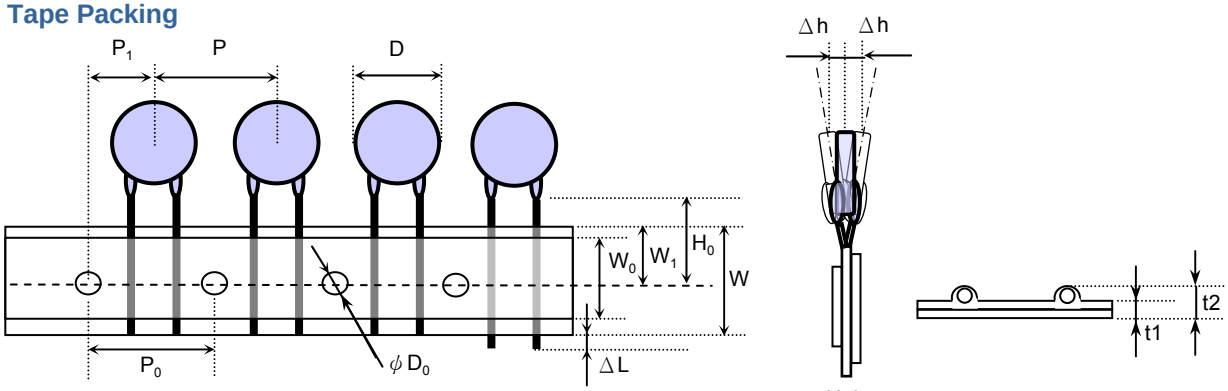
The peel off force of cover tape is 5 to 70 grams in the direction of arrow.

◆ Ceramic Disc Capacitors Packing Information (SDC,HDC Series)

● Bulk Packing

Standard packing 500pcs&1,000pcs/pack, others according to customers' request.

● Tape Packing

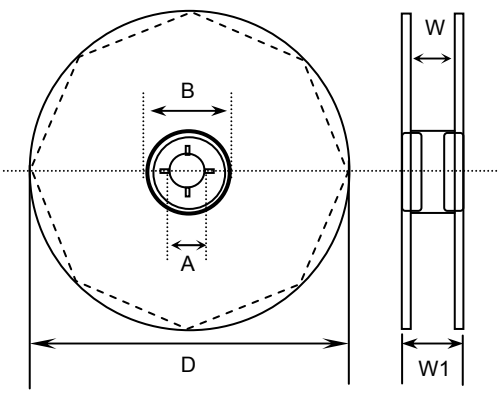


Unit:mm

	Symbol	Lead Space		
		5.00mm	6.35mm	7.50mm
Pitch of component	P	12.7±1.0		
Feed Hole Pitch	P_0	12.7±0.3		
Hole center to component center	P_1	6.35±1.3		
Body diameter	D	11.0 max		
Hold position	W1	8+1.0-0.5		
Hold tape width	W_0	10 min		
Hold position	W_1	9±0.5		
Lead wire clinch	H_0	16+1.5-0.5		
Total tape thickness	t1	0.6±0.3		
Total thickness, tape& lead wire	t2	1.5 max		
Feed hold diameter	ϕD_0	4.0±0.2		
Deviation across tape	△h	2.0 max		
Protrusion Length	△L	1.0 max		

● Packing Dimension

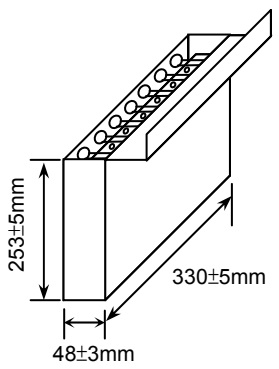
Reel Dimension:



Unit：mm

Code	Dimension
W1	56
W	44
D	340
A	30
B	84

Ammo Dimension:



● Packing Quantity

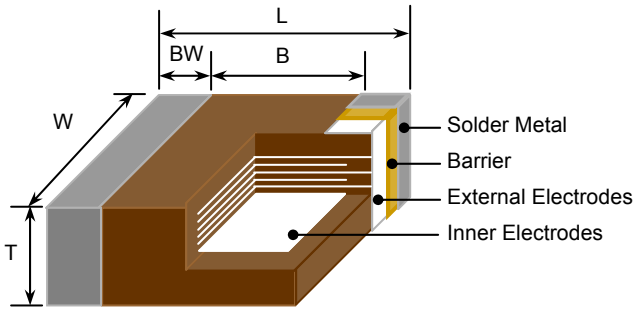
Unit:mm

Package	One Box / One Reel	Carton Box
Taping Reel Pack	1,500 / 2,000 pcs	15,000 / 20,000 pcs
Ammo Box Pack	1,000 / 1,500 pcs	10,000 / 15,000 pcs

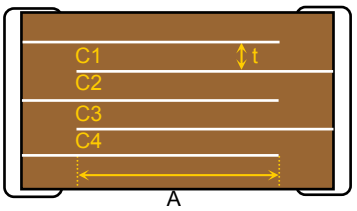
The Multilayer Ceramic Chip of Capacitors supplied in bulk, cassette or taped & reel package are ideally suitable for thick-film Hybrid circuits and automatic surface mounting on printed circuit boards.

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

◆ Shapes and Dimension



Cross Section



Dimensions(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]	0.90 [.035]	0.15 [.006]	0.40 [.016]
0805	2.00±0.20 [.079±.008]	1.25±0.25 [.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]	2.60 [.102]	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]	3.00 [.118]	0.30 [.012]	3.50 [.137]
2225	5.70±0.40 [.220±.016]	6.35±0.40 [.250±.016]	3.00 [.118]	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	NPO	J (±5%),K (±10%)	E-12 ,E-24 Series
II	X7R	K(±10%), M(±20%)	E-3,E-6 Series
	X7E	K(±10%), M(±20%)	E-3,E-6 Series
	X5R	K(±10%), M(±20%)	E-3,E-6 Series
	Y5U	M(±20%),Z(+80/-20 %)	E-3 Series
	Y5V	M(±20%),Z(+80/-20 %)	E-3 Series
	Z5U	M(±20%),Z(+80/-20 %)	E-3 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
E24	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2
	1.1	1.3	1.6	2.0	2.4	3.0	3.6	4.3	5.1	6.2	7.5	9.1

◆EIA Designations

For Class Ⅰ Dielectrics

Coefficient of capacitance (ppm/℃)		Multiplier applicable to column		Tolerance of temp. coeff.(ppm/℃)	
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/℃
U2J Negative 750±120ppm/℃

For Class Ⅱ Dielectrics

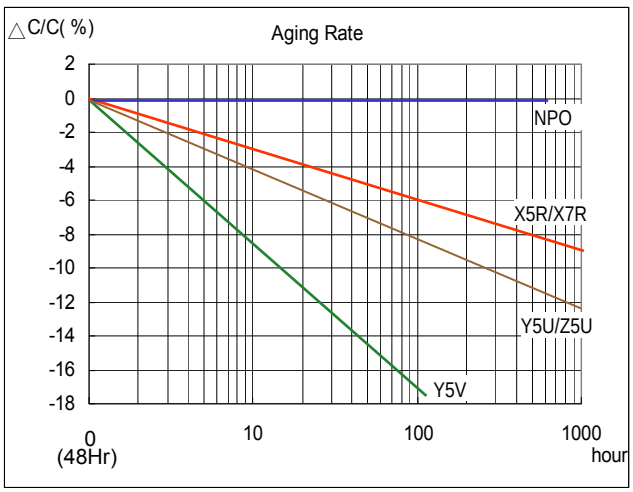
Low Temp. Symbol		High Temp. Symbol		Max. %△C Symbol	
-55℃	X	+45℃	3	±1.0%	A
-30℃	Y	+65℃	4	±1.2%	B
+10℃	Z	+85℃	5	±2.2%	C
		+105℃	6	±3.3%	D
		+125℃	7	±4.7%	E
		+150 ℃	8	±7.5%	F
		+200 ℃	9	±10.0%	P
				±15.0%	R
				±22.0%	S
				+22% /-33%	T
				+22% /-56%	U
				+22% /-82%	V

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

◆ Operation Temperature Range

Class	EIA Symbol	Dielectric Code	Temperature Range(℃)	Capacitance Change	Reference Temperature
Ⅰ	NPO	N	-55℃ ~ +125 ℃	0±30 ppm/℃	20℃
Ⅱ	X7R	X	-55℃ ~ +125℃	±15%	20℃
	X7E	C	-55℃ ~ +125℃	±4.7%	25℃
	X5R	B	-55℃ ~ +85℃	±15%	20℃
	Y5V	Y	-30℃ ~ +85℃	+22/-82 %	20℃
	Y5U	E	-30℃ ~ +85℃	+22/-56 %	25℃
	Z5U	Z	+10℃ ~ +85℃	+22/-56 %	25℃

◆ Dielectric Material – Aging Rate



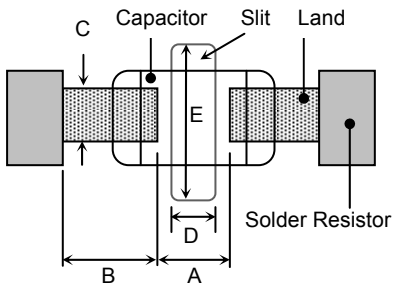
Aging Rate
NPO: 0
X7R/X5R : 2 ~ 4 % /decade
Y5U/Z5U : 4~6% / decate
Y5V : 6~10 % /decade

After performing De-Aging at 150±5 ℃ for 30 minutes and placement room temperature for 48 hours.

◆ Construction of Board Pattern

Improper circuit layout and pad/land size may cause excessive or not enough solder amount on the PC board. Not enough solder may create weak joint, and excessive solder may increase the potential of mechanical or thermal cracks on the ceramic capacitor. Therefore we recommend the land size to be as shown in the following table:

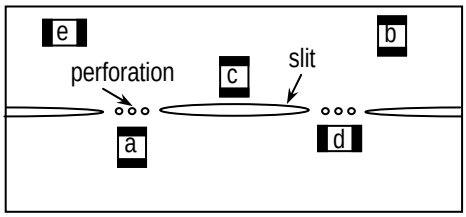
1. Size and recommend land dimensions for reflow soldering



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 the P.C. board.

Design layout of components on the PC board such a way to minimize the stress imposed on the components, upon flexure of the boards in depanelization or other processes.

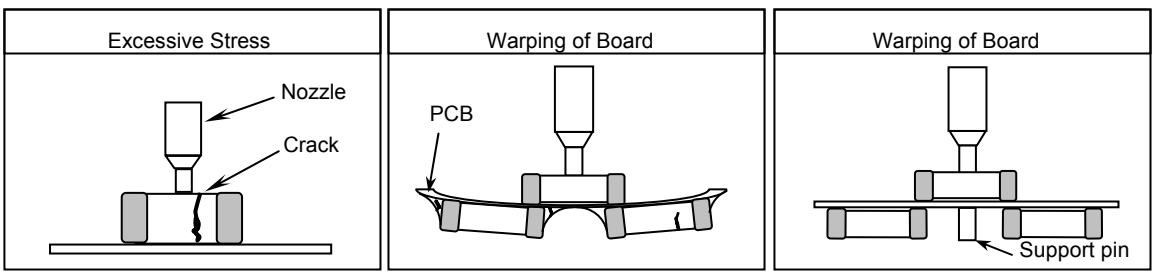


Component layout close to the edge of the board or the "depanelization line" is not recommended.
Susceptibility to stress is in the order of: a>b>c and d>e

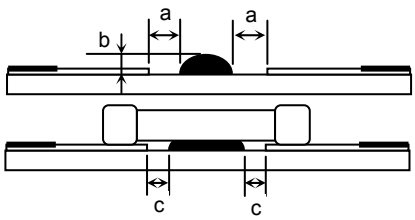
◆ Mounting

1. Sometimes crack is caused by the impact load due to suction nozzle in pick and place operation.

In 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 low dead point of a suction nozzle to the higher level to minimize the board warp age and stress on the components. Nozzle pressure is typically adjusted to 1N to 3N (static load) during the pick and place operation.



2. Amount of Adhesive

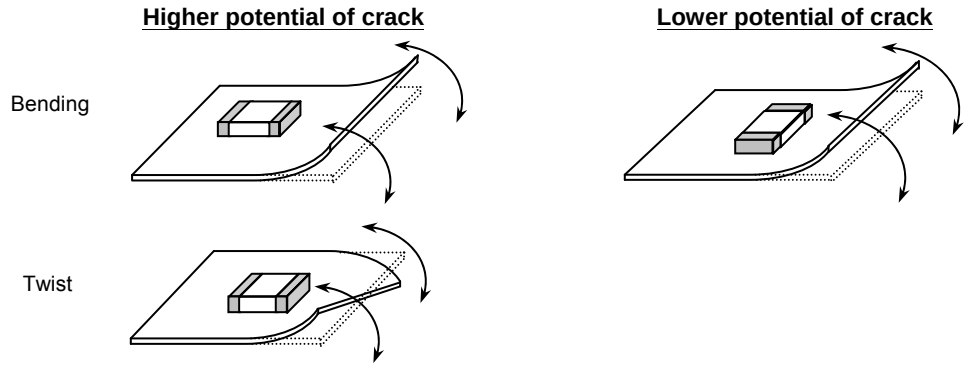


Example : 0805 & 1206

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

◆ Handling after chip mounted

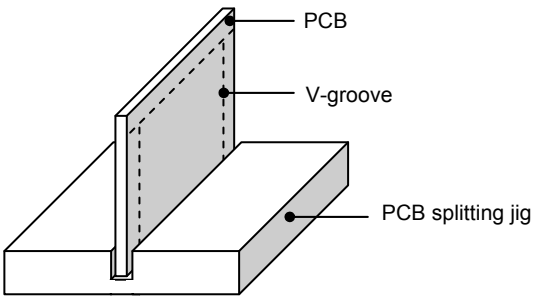
1. Proper handling is recommended, since excessive bending and twist of the board, depends on the orientation of the chip on the board, may induce mechanical stress and cause internal crack in the capacitor.

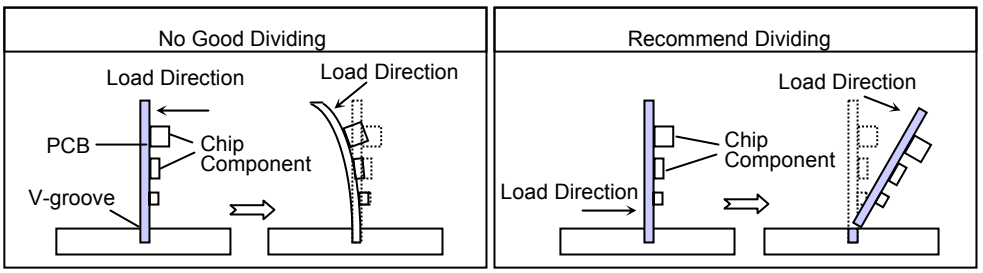


2. There is a potential of crack if board is warped due to excessive load by check pin

3. Examples of PCB dividing/breaking 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 applied to the components or varistors on the PCB. Do not hold the PCB at a position which is far away from the jig, tensile stress to the varistors may cause them to crack.



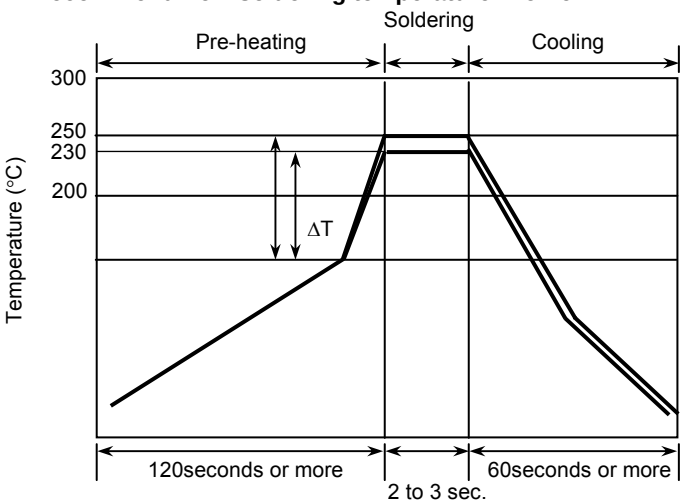


◆Soldering

1. Wave Soldering

Most of components are wave soldered with solder at 230 to 250˚C. 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.

Recommend flow soldering temperature Profile



Soldering Method	Change in Temp.(℃)
1206 and Under	ΔT ≤100~130℃max.

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

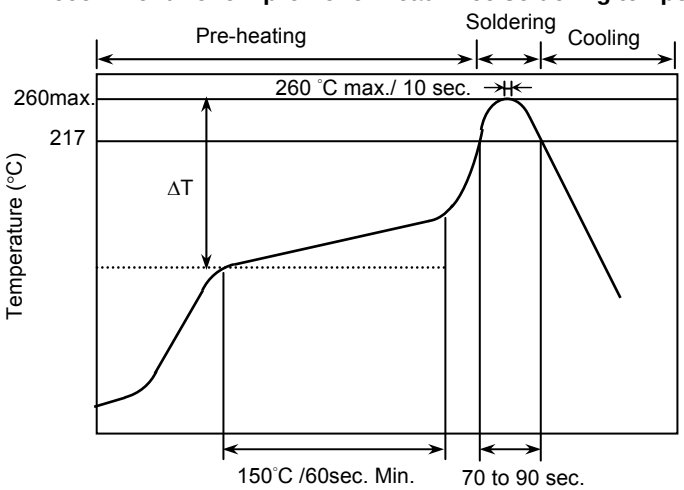
Cooling Condition:

Natural cooling using air is recommended. If the chips are dipped into a solvent for cleaning, the temperature difference (△T) 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 (MIL-STD-202G #210F)

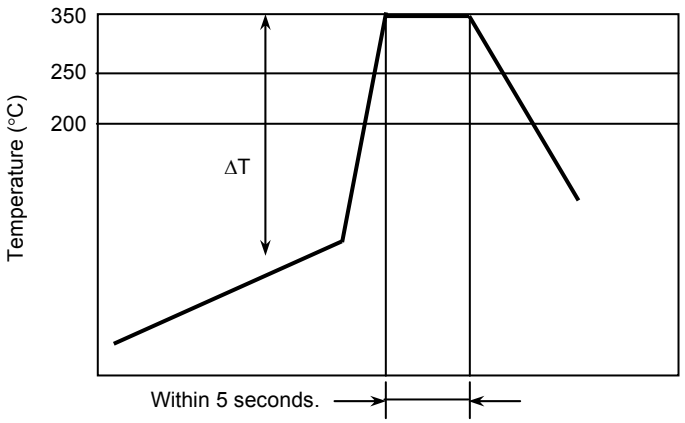


Soldering Method	Change in Temp.(℃)
1206 and Under	ΔT ≤190℃
1210 and Over	ΔT ≤130℃

※ The cycles of soldering : Twice (Max.)

3. Hand Soldering

Sudden temperature change in components, results in a temperature gradient recommended in the following table, and therefore may cause internal thermal cracks in the components. 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.



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

How to Solder Repair by Solder Iron

1) Selection of the soldering iron tip

The required temperature of solder 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.) Preheat the substrate to (60˚C to 120˚C) on a hot plate. Note that due to the heat loss, the actual setting of the hot plate may have to be higher. (For example 100˚C to 150˚C)

b.) Soldering iron power shall not exceed 30 W.

c.) Soldering iron tip diameter shall not exceed 3mm.

d.) Temperature of iron tip shall not exceed 350˚C of Value,and the process should be finished within 5 seconds. **(refer to MIL-STD-202G)**

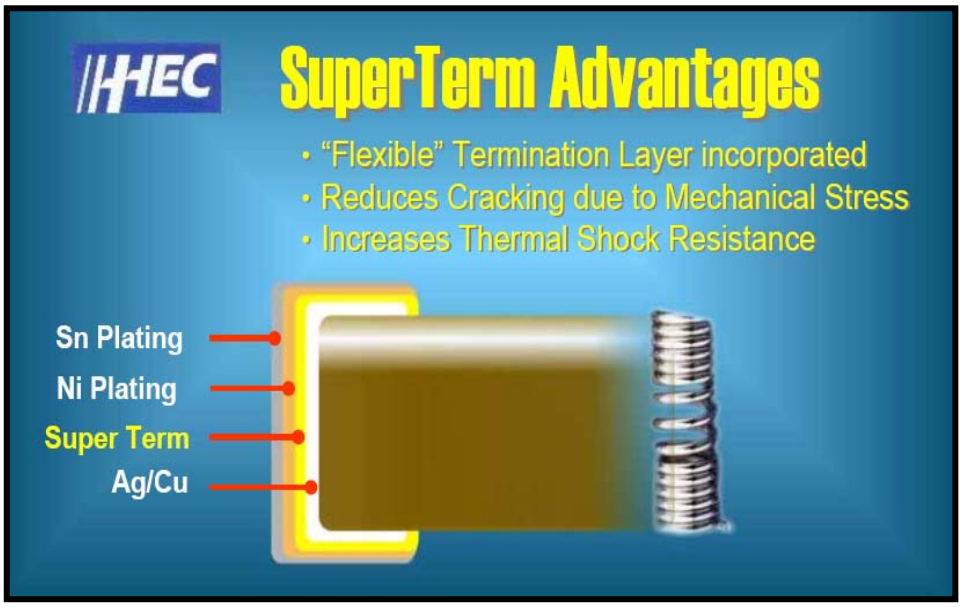
e.) Do not touch the ceramic body with the tip of solder iron. Direct contact of the soldering iron tip to ceramic body may cause thermal cracks.

f.) After soldering operation, let the products cool down gradually in the room temperature.

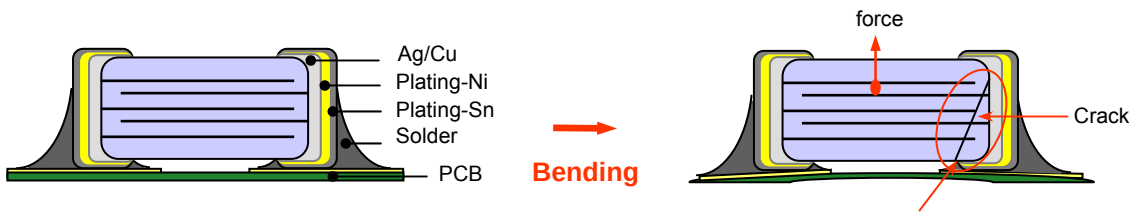
◆Storage

Store the capacitors where the temperature and relative humidity don't exceed 40˚C and 70%RH. We recommend that the capacitors be used within 6 months from the date of manufacturing. Store the products in the original package and do not open the outer wrapped, polyethylene bag, till 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.



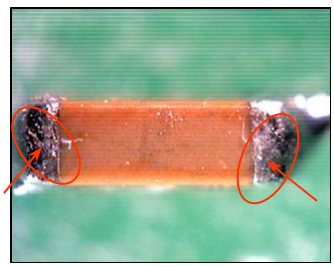
Typical Applications are power circuit input and output filtering, smoothing…



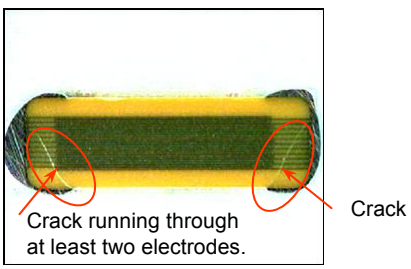
Standard termination construction may result in cracking during PCB bending, vibration, Depanelizing, etc.

Actual Examples:

Failure Mode Type 1



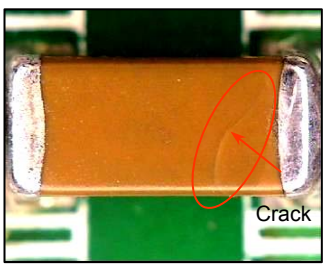
Surface View



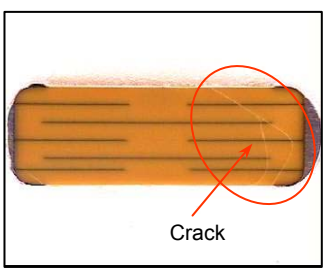
Cross Section View

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

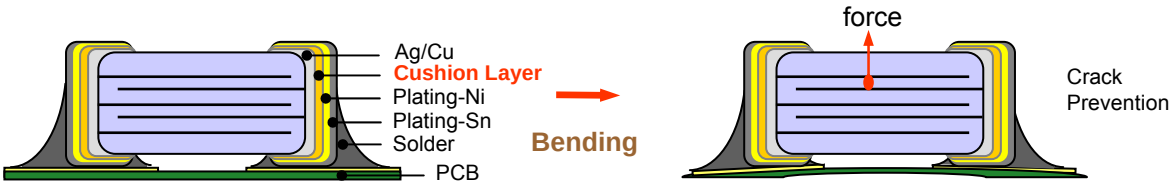


Cross Section View

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

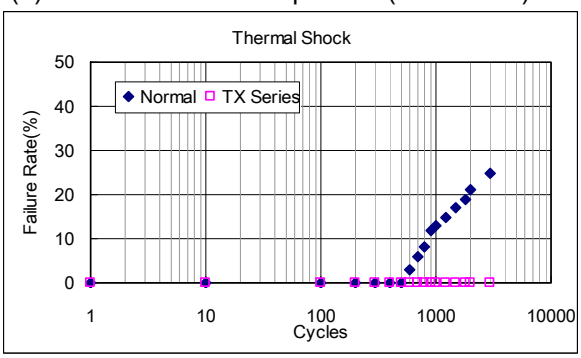
Holy Stone has developed the "**Super Term**" **Series (TX suffix in the part number),** which incorporates a "cushion layer" in the termination structure. This construction effectively absorbs external forces, reduces the incidence of cracking and improve overall product reliability. SuperTerm product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

TX Product



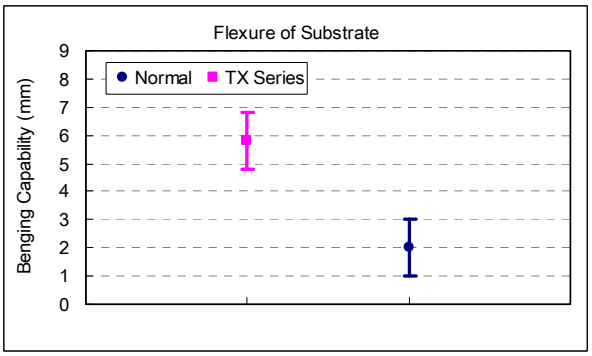
Reliability/Durability Comparison

(a) Thermal Shock Comparison (0805/X7R)

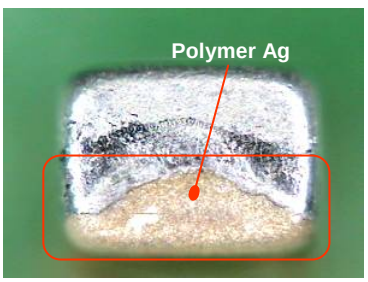


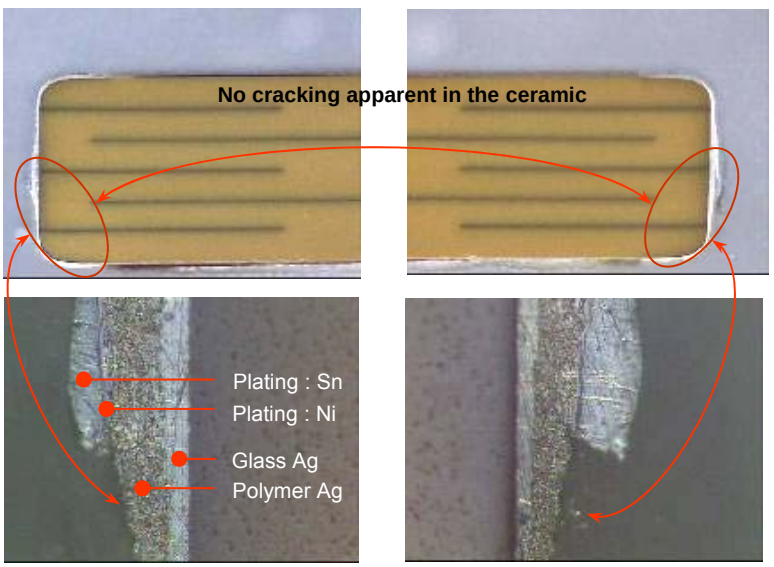
Thermal shock test on standard termination results of inception of failure at 500 cycles. SuperTermTX Series reliability improves to over 3000 cycles.

(b) Substrate Flexure Comparison (0805/X7R)



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



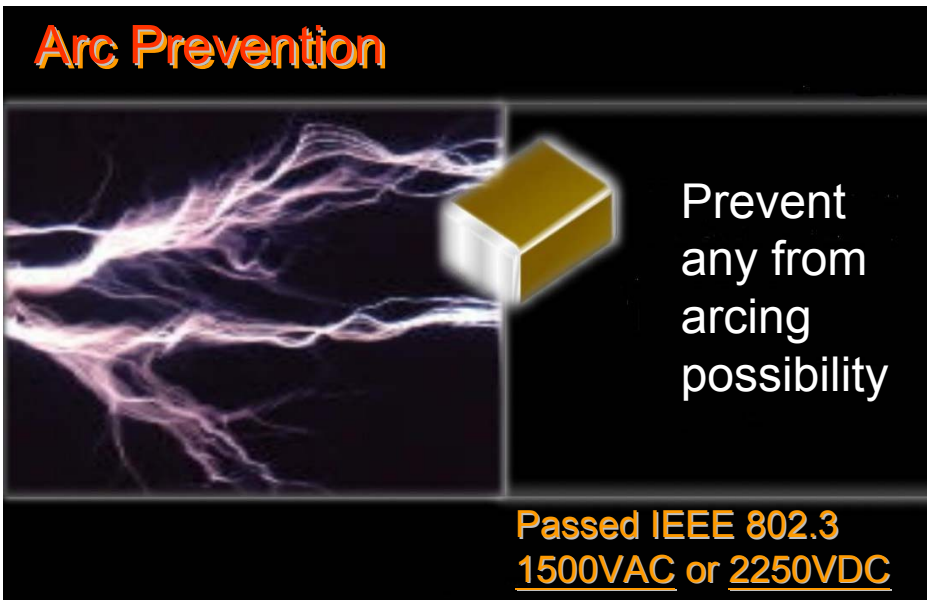


During destructive bending test, the PCB is subjected to bending until capacitor failure. With superterm there is no cracking damage in the ceramic. Superterm effectively prevents ceramic body cracking during extreme mechanical stress as simulated by this test.

Superterm failures resulting from destructive bending test occur in the OPEN mode and not the short circuit mode typical of standard termination failures. The SuperTerm cushion layer material is a "polymer silver" material and can be seen in the above photo.

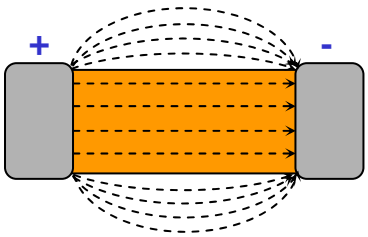
MLCC Arc Prevention – for Hi-Pot Testing

Base on the ceramic material a relativity air or vacuum that electric conductivity is higher. And are differences ambient environment as temperature, moisture, termination creep age distance, and PCB layout...etc. all to effective arcing when Hi-Pot tests. The especially is a high dielectric constant (ex. X7R, Y5V...).
Holy stone developed to possess arc prevention solution on the MLCC product and to meet application and enactment criteria.

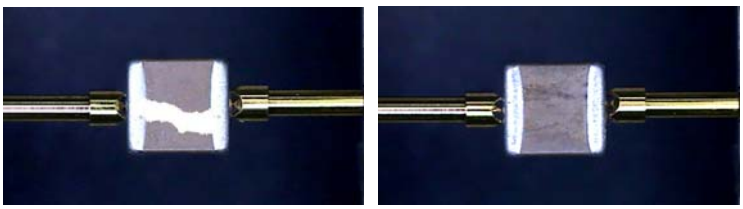


Typical Applications for telecommunication devices(IEEE802.3) in LAN interface, Ballast...

Surface arcing a phenomenon

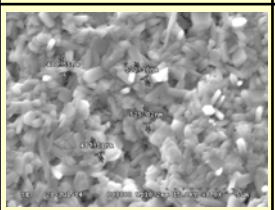
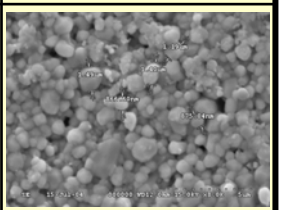
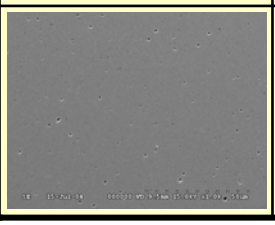
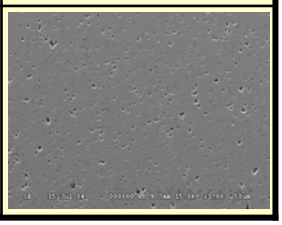


Dielectric flux is generated upon applying voltage to the capacitor as show Fig.



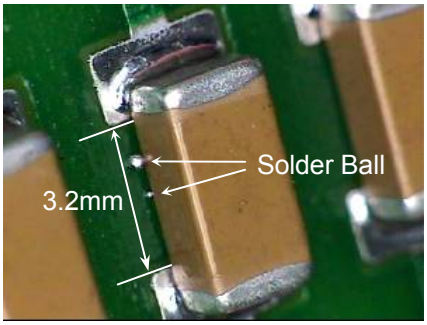
The typical surface arcing on MLCC that is termination-to-termination (show in polarized lighting)

NPO & X7R Material Content & Characteristic Comparison

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

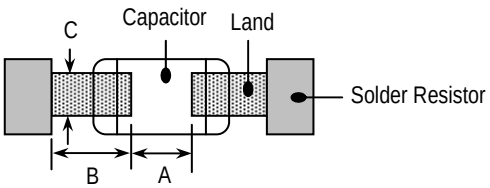
- The different grain sharp will lead to different grain density after sintering
- Because the NPO thinner & longer grain, so grow more tight & dense grain structure than X7R.Especially cause the porosity different between NPO & X7R.
- Much surface porosity will trap more dust & moisture.
- When add a voltage(especially high voltage), the porosity on the surface will gather the electric charge easily, and when the additional voltage reach the rouse voltage then the electric arc will occur.

Creepage distance v.s. Arc effect



Exist the residual solder will be reduce creepage distance and Insulation resistance.

Recommend Land Requirement



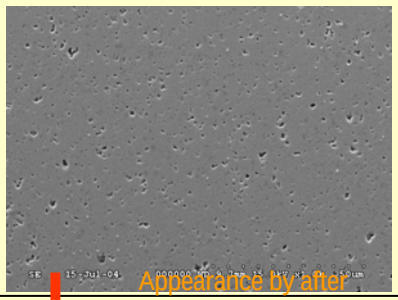
EIA Code	Chip (mm)		Land (mm)		
	L	W	A	B	C
1808	4.6±0.3	2.0 ±0.2	3.2~3.6	1.2~2.4	1.5~1.8
1812	4.6±0.3	3.2 ±0.2	3.2~3.6	1.2~2.4	2.3~3.0
2208	5.7±0.4	2.0 ±0.2	4.0~4.6	1.2~2.4	1.5~1.8
2211	5.7±0.4	2.0 ±0.3	4.0~4.6	1.2~2.4	2.0~2.6
2220	5.7±0.4	5.0 ±0.4	4.0~4.6	1.2~2.4	3.5~4.8

The metal-to-metal distance can to effect arcing too. It the more wide the more well. Therefore, we need to consideration by high voltage capacitors that pad-to-pad layout design. Above is a recommend land design.

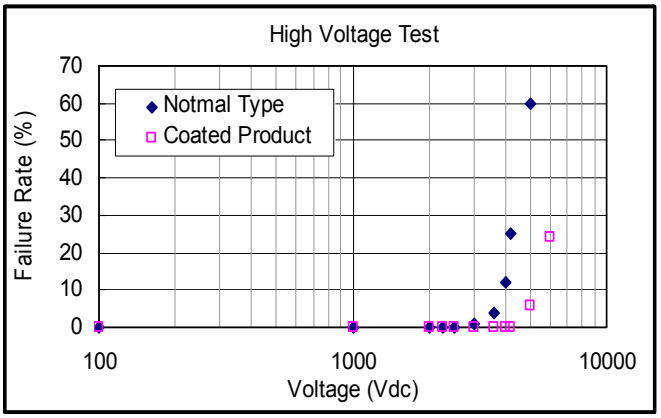
Coated for arcing prevent solution.

For preventing form arcing because of much surface porosity in X7R, the insulated gel(high insulated material) was used for filling the surface porosity and provide the smooth & less porosity surface.The following tests descript the different between coating & non-coating effect in X7R component.

Surface Handling Comparison

Item	Porosity (x1000)
Before	
After	

High Voltage Testing Comparison



- The coating will filling the porosity of the X7R surface and provide a smooth surface to against hi-voltage charge.
- The Hi-pot endurance level will increase about 1000Vdc after coating in single & on-board hi-pot test.

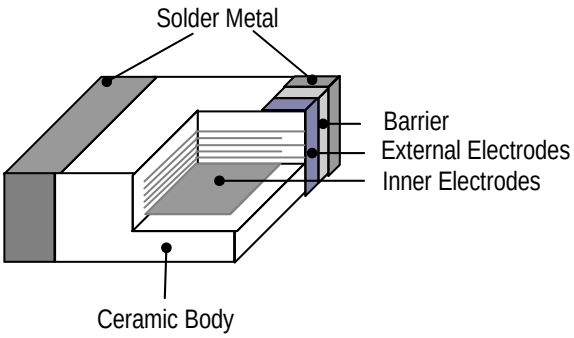
The against hi-pot ability will increase 1000Vdc after coating product. Although NPO could provide better against hi-pot arcing ability but the capacitance was limited lower because of material characteristic and the X7R could provide higher capacitance but much porosity surface will reduce the ability to against arcing. So HEC provide a coating process solution will be the total solution in X7R against hi-pot arcing issue.

Description:

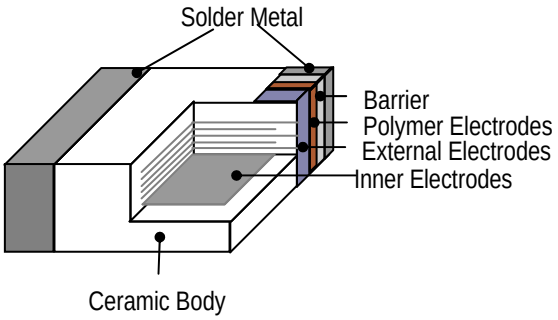
Multi-layer Ceramic Capacitor include: NPO、X7R、X5R、X6S、X7E、Y5V、Y5U & Z5U dielectrics.

Basic Construction/Homogenous Material :

(a) Standard Type



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



- **Multi-layer Ceramic Chip are Homogenous devices and a material that cannot be mechanically disjointed into different materials.**
- **Multi-layer Ceramic Chip products : Standard sizes are fully RoHs Compliant.**

Group	Series		RoHS Status	Cadmium	Hexavalent Chromium	Lead *	Mercury	PBBs	PBDE
			Limit	<0.01%	<0.01%	<0.1%	<0.01%	<0.01%	0.01%
MLC Family Surface mount Products	NCC,HCC, VAC,LSC RFC,MCA, HCX		Available	√	√	√	√	√	√
	TCX,LDC, HTC		Available	√	√	√	√	√	√
	HCN,HCY,SAC SCC,FTC		Available	√	√	√ *	√	√	√
	HVC MMC	NPO	Available	√	√	√ / √*	√	√	√
		X7R	Available	√	√	√ *	√	√	√
	HDC,SDC,RDC,RDH		Available	√	√	√	√	√	√

*** Pb in internal ceramic insert – exempt from RoHS annex 7 to Article 4.1**

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 HEC recommended solder profile.

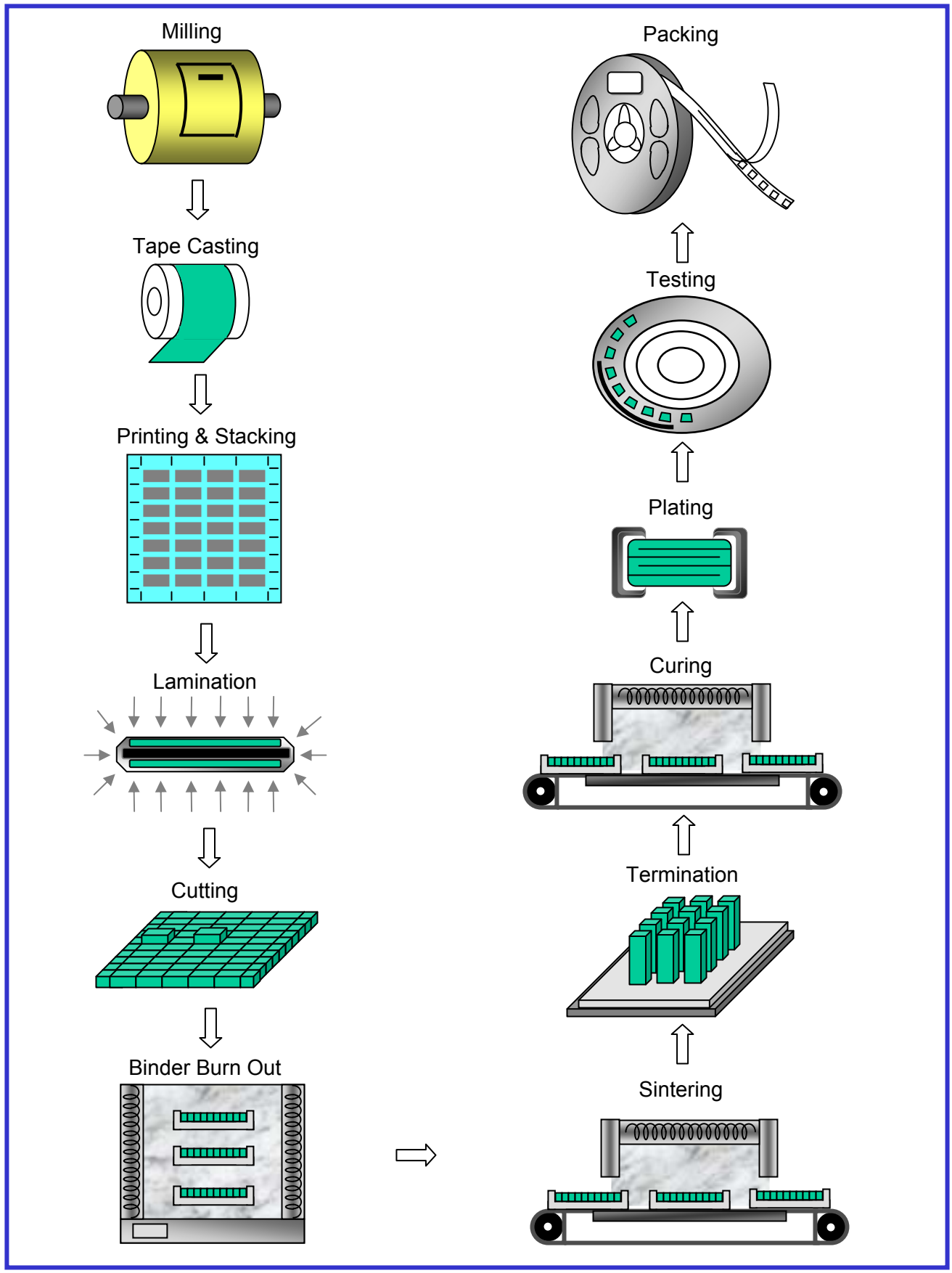
Part Number Designation:
(Generally no change to P/N, but available as P/N prefix at customer request)

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.


Milling
Tape Casting
Printing & Stacking
Lamination
Cutting
Binder Burn Out
Sintering
Termination
Curing
Plating
Testing
Packing

ISO Certification

Plant	Certificated	Date	Organization	Registration No.
Lung Tan Manufacturing	ISO 9001:1994	17, Jul.,2000	BSI	FM 38437
Lung Tan Manufacturing	ISO 9001:2000	20,May,2002	BVQI	107405
Lung Tan Manufacturing	ISO 14001:1996	29,May,2003	BVQI	131145
Dongguan Manufacturing	ISO 9001:2000	16.Dec.,2003	BVQI	107405
Lung Tan Manufacturing	QS 9000 : 1998	04.Oct.,2004	BVQI	162522

ISO 9001:2000

ISO 14001:1996

QS 9000:2004

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Fax: 886-2-27987181 Zip code: 114

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8FL-1, No.239, Yi-Hsin 1st. Road, Chien Chen Dist., Kaohsiung, Taiwan, R.O.C.

Tel:886-7-5366115

Fax:886-7-5366105 Zip code: 806

- Lungtan Plant/龍潭生產事業處

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Tel: 886-3-4995288

Fax:886-3-4995299 Zip code: 325

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- Shanghai Sales Office/上海分公司

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16F, Shouxinyindu Building, 1160 YanAn (W) Road, Shanghai, China.

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Fax: 86-21-62826722 Zip Code: 200052

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