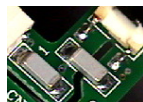
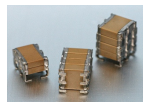
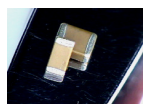


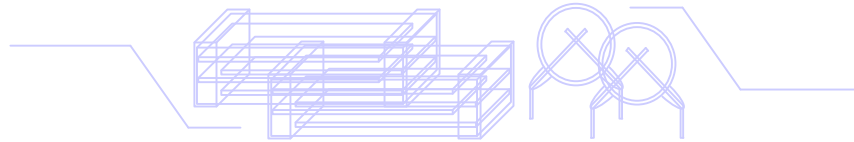


Holy Stone
Enterprise Co.,Ltd.

CERAMIC CAPACITOR CATALOG 2008-2009



www.holystone.com.tw
www.holystonecaps.com



▪ 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 in Holy Stone's phenomenal growth (2007 revenues of US\$439 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 TS-16949.



▪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 opens Singapore office to service Southeast Asia. Holy Stone also has a network of independent Representatives, Distributors and Agents throughout the world.

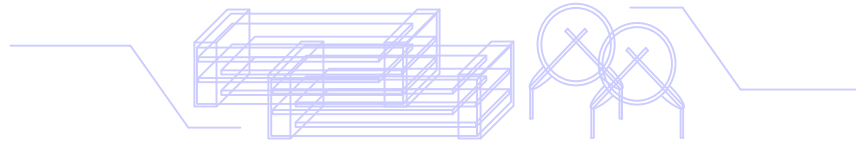
▪The Environment

Holy Stone is committed to the cause of achieving and maintaining a healthy environment. Holy Stone is also among the first suppliers of halogen free epoxy coated capacitors. 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.

You should know 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 ignition
- 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

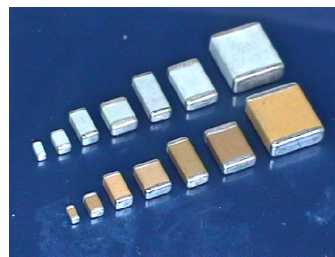
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Product Series		Application	Page
	HVC series -- High Voltage Capacitors	For Power Circuits (Backlight Inverter, DC to DC,...)	3-12
	SCC series -- Safety Capacitors	For Isolation and Protection Circuits (UL,EN132400 Class X2/Y3,X1/Y2)	13-16
	TCX series -- Trigger Capacitors	For DSC Strobe Circuits	17-20
	LDC series -- Low Distortion Capacitors	For Oscillation and Filter Circuits	21-24
	NCC series -- Normal Chip Capacitors	For Decoupling Circuits	25-30
	HCC series -- High Capacitance MLCC-More than 1uF	For Smoothing (DC to DC) and Decoupling Circuits	31-36
	VAC series -- Low Profile Capacitors- X7R/X5R/Y5V	For small and tin size electronic equipment (for FDP,LCD,HDD,CD-RW...etc.)	37-40
	HCN series -- Hi-Cap NPO	For ADSL/XDSL (Replacement for Film Capacitor)	41-44
	HCX series -- Hi-Cap X7R	For Input, Output Filters (DC to DC)	45-48
	HCY series -- Y5U Characteristic MLCC	For Noise suppressor and by pass or decoupling (for DC to DC, DC Fan...etc.)	49-52
	RFC series -- Radio Frequency Capacitors	For High Q & High Frequency Circuits (for Matching Resonant and Coupling Circuit)	53-56
	MCA series -- Multilayer Capacitor Arrays	For High Density Placement Requirement (for Cellular Phone,Pager, Mother Board...)	57-62
	SAC series -- Tip & Ring Capacitors	For telephone line ringer circuits	63-66
	LMC series -- Leaded configuration MLCC	For Power Circuits (Backlight Inverter, DC to DC,...)	67-68
	SMC series -- Stacked Capacitors	For Power Circuits (Backlight Inverter, DC to DC, Surge protection ...)	69-70
	FTC series -- Feed Thru' EMI Filter	For high speed digital integration circuit and decoupling of CPU power lines	71-74
	HTC series -- High Temperature Capacitors	For high operation temperature up to 200°C	75-78
	LCC series -- Large Size MLCC (1515 to 7565)	For Voltage Multipliers, Power circuit(DC-DC, Ballast, Snubbe), Surge protection, Industrial control, ...	79-80
	HDC series -- High Voltage Ceramic Disc Capacitors	For xDSL, Power Circuits (Backlight Inverter, Power Supplier,...)	81-86
	HDC series -- Low Loss/Low DF Ceramic Capacitors	For 1KV to 3KV Application (Power Supplier, Adaptor...)	87-90
	HDC series -- Ultra High Voltage Ceramic Capacitors	For 10KV to 20KV Application (Pump, Hybrid engine ,Power Supplier,...)	91-92
	SDC series -- Safety Ceramic Disc Capacitors	For xDSL,Set Top Box, VOIP , Power Supplier (UL,CSA,EN132400 Class X1/Y2,X1/Y1)	93-98
	RDC series -- Radial Dipped Ceramic Capacitors	For Car Electronic , Inverter and Converter, Power Supplier	99-102
	RDH series -- Ultra High Voltage Radial Dipped Cap	For Fuel pump, Water pump, Hybrid engine ,Power Supplier	103-106
	AXC series -- Axial Leader Ceramic Capacitors	For General Electronic, Power supplier...	107-110

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.

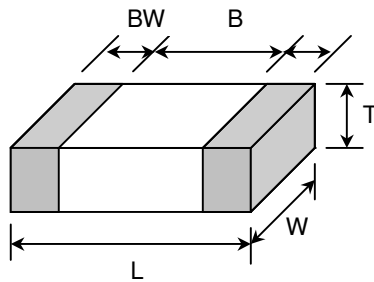
◆ Summary of Specification

Operation Temperature	-55~+125 °C
Rated Voltage	100Vdc to 1000Vdc
Temperature Coefficient	NPO : $\pm 30\text{ppm}/^{\circ}\text{C}$, -55~+125 °C (EIA Class I)
	X7R : $\pm 15\%$, -55~+125 °C (EIA Class II)
Capacitance Range	NPO :2pF to 100nF ; X7R :150pF to 2.2uF
Dissipation Factor :	NPO : $Q \geq 1000$; X7R : D.F. $\leq 2.5\%$
Insulation Resistance	10G Ω or 500/C Ω whichever is smaller
Aging	NPO:0% ; X7R: 2.5 % per decade of time
Dielectric Strength	100V $\leq V < 500V$: 200% Rated Voltage
	500V $\leq V < 1000V$: 150% Rated Voltage
	1000V $\leq V$: 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 : 1.6×0.80mm 0805 : 2.0×1.25mm 1206 : 3.2×1.60mm 1210 : 3.2×2.50mm 1808 : 4.6×2.00mm 1812: 4.6×3.20mm 2220 : 5.7×5.00mm	Dielectric Ex.: N: NPO X: X7R	Capacitance Unit : pF Ex.: 2R0:2.0pF 100:10×10 ⁰ 471:47×10 ¹ 102:10×10 ²	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



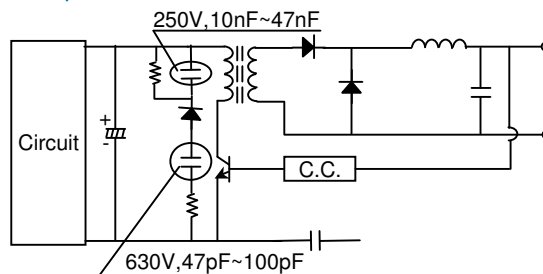
Unit : mm [inches]

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)																					
			2R0	3R3	3R9	5R0	8R2	100	120	150	180	220	270	330	390	470	560	680	820	101	121	151	181	221
NPO	0603	100V																						
		200V																						
	0805	100V																						
		200V																						
		250V																						
	1206	200V																						
		250V																						
		500V																						
	1210	200V																						
		250V																						
		500V																						
	1808	1KV																						
		1KV																						
	1812	1KV																						
		1KV																						
	2220	1KV																						
		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.

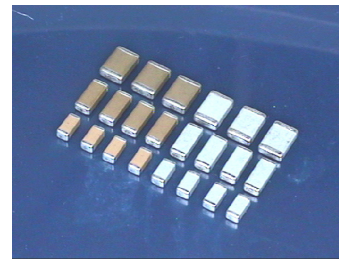
◆ Capacitance Range

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	125	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	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B

■ 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), SL and X7R temperature characteristic in sizes 1206 to 2220 and pass DWV or 1500VAC and 2250VDC Hi-Pot test available to prevent arcing.

◆ Features

- ☐ Standard for telecommunication devices (IEEE802.3) in LAN interface.
- ☐ Available with proprietary coating to prevent arcing and pass Hi-Pot test
- ☐ Suitable for surface mounting using wave or reflow soldering processes
- ☐ Special internal electrode design offers the highest voltage rating
- ☐ RoHS compliant

◆ Application

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

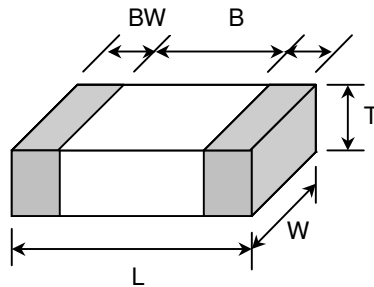
◆ Summary of Specification

Operation Temperature	-55~+125 °C
Rated Voltage	2KVdc
Temperature Coefficient	NPO : $\leq \pm 30\text{ppm}/^\circ\text{C}$, -55~+125 °C (EIA Class I)
	SL : $\leq +350/-1000\text{ ppm}/^\circ\text{C}$, -25~+85 °C (EIA Class I)
	X7R : $\leq \pm 15\%$, -55~+125 °C (EIA Class II)
Capacitance Range	NPO :2pF to 470pF ; SL : 220pF to 1000pF ; X7R :150pF to 10nF
Dissipation Factor :	NPO : $Q \geq 1000$; X7R : D.F. $\leq 2.5\%$
Insulation Resistance	10G Ω or 500/C Ω whichever is smaller
Aging	NPO: 0% per decade of time
	SL: 1.5 % per decade of time
	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 : 3.2×1.6mm 1808 : 4.6×2.0mm 1812 : 4.6×3.2mm 2220 : 5.7×5.0mm	Dielectric Ex.: N: NPO L: SL X: X7R	Capacitance Unit : pF Ex.: 2R0:2.0pF 100:10×10 ⁰ 471:47×10 ¹ 102:10×10 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

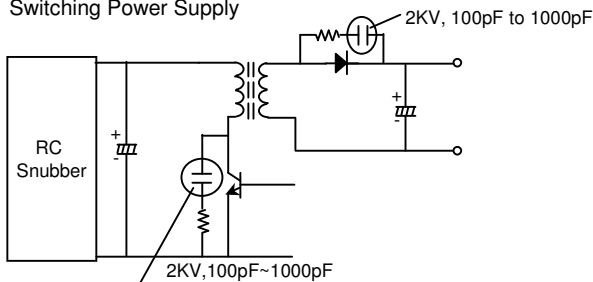


Unit : mm [inches]

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



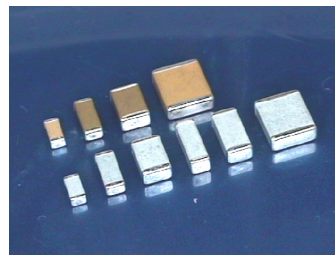
◆ Capacitance Range

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	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D

■ 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)



◆ Features

- ❑ Polymer termination (Superterm) to inhibit mechanical cracking
- ❑ Special internal electrode design offers the highest voltage rating
- ❑ Surface mount suited for wave and reflow soldering
- ❑ High reliability
- ❑ RoHS compliant

◆ Applications

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

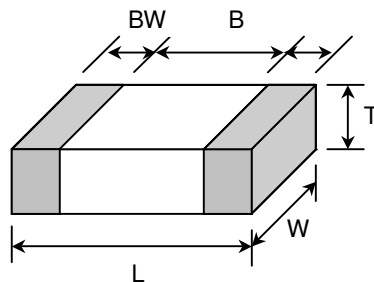
◆ Summary of Specification

Operation Temperature	-55~+125 °C
Rated Voltage	3KVdc to 5KVdc
Temperature Coefficient	NPO : $\leq \pm 30\text{ppm}/^\circ\text{C}$, -55~+125 °C (EIA Class I)
	SL : $\leq +350/-1000\text{ ppm}/^\circ\text{C}$, -25~+85 °C (EIA Class I)
	X7R : $\leq \pm 15\%$, -55~+125 °C (EIA Class II)
Capacitance Range	NPO :2pF to 1.0nF ; SL : 220pF to 1000pF ; X7R :150pF to 2.7nF
Dissipation Factor :	NPO : $Q \geq 1000$; X7R : D.F. $\leq 2.5\%$
Insulation Resistance	10G Ω or 500/C Ω whichever is smaller
Aging	NPO: 0% per decade of time
	SL: 1.5 % per decade of time
	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 : 3.2×1.6mm 1808 : 4.6×2.0mm 1812 : 4.6×3.2mm 2208 : 5.7×2.0mm 2211 : 5.7×2.8mm 2220 : 5.7×5.0mm	Dielectric Ex.: N: NPO L: SL X: X7R	Capacitance Unit : pF Ex.: 2R0:2.0pF 100:10×10 ⁰ 471:47×10 ¹ 102:10×10 ²	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)

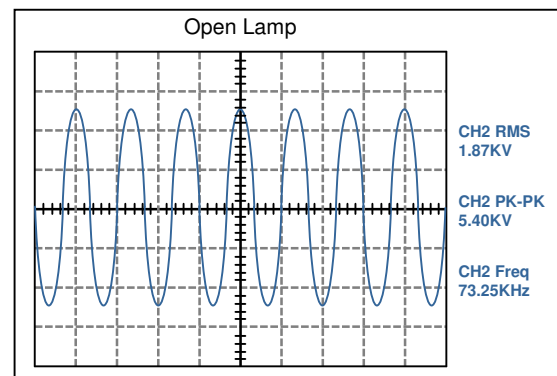
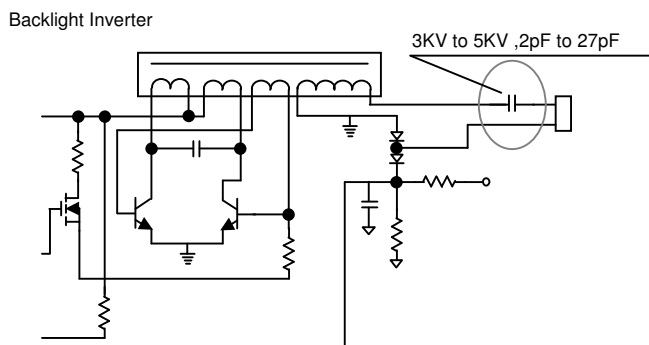
◆ Dimension



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



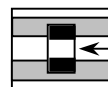
◆ Capacitance Range

[illegible]

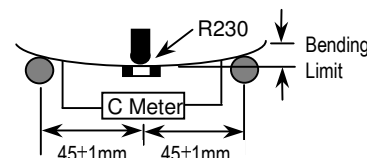
■ **Other dimensions, capacitance values and voltages rating are available. Please contact HEC.**

HVC Series Specification & Test Condition

Item	Specification	Test Condition
Operation Temperature	-55 to +125°C	
Visual	No abnormal exterior appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	Class Frequency Voltage
Quality Factor	Class I (NPO/SL): More Than 30pF : $Q \geq 1000$ 30pF & Below: $Q \geq 400+20C$ (C:Cap., pF)	NPO/SL $C \leq 100\text{pF}$ 1MHz $\pm 10\%$ 1.0 $\pm 0.2V_{rms}$ $C > 100\text{pF}$ 1KHz $\pm 10\%$
		X7R 1KHz $\pm 10\%$ 1.0 $\pm 0.2V_{rms}$
Dissipation Factor	Class II (X7R): Maximum 0.025	Perform a heat treatment at 150 $\pm 5^\circ\text{C}$ for 30min. then place room temp. for 24 ± 2 hr.
Insulation Resistance	10,000M Ω or 500/C Ω whichever is smaller. (C in Farad)	$V \leq 500V$, 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 $500V \leq V < 1000V$: 150% Rated Voltage $1000 \leq V$: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
	NPO(N)	-55°C ~ +125°C
	SL (L)	-25°C ~ +85°C
	X7R (X)	-55°C ~ +125°C
	Cap. Change	
	NPO(N)	$\pm 30\text{ppm}/^\circ\text{C}$
	SL (L)	+350/-1000ppm / $^\circ\text{C}$
	X7R (X)	$\pm 15\%$
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.	
Resistance to Flexure of Substrate	No mechanical damage or capacitance change more than the following table.	
Solderability	More than 90% of the terminal surface is to be soldered newly, so metal part does not come out or dissolve .	



A 5N-f($\approx 0.5\text{Kg-f}$) pull force shall be applied for 10 ± 1 sec.



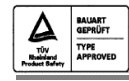
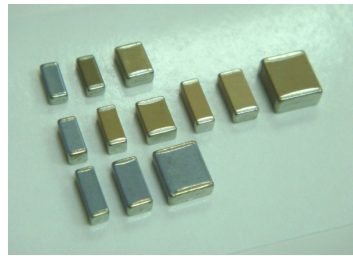
HVC Series Specification & Test Condition

Item	Specification	Test Condition														
Resistance to Soldering Heat	Appearance	No mechanical damage shall occur														
	Capacitance	Class I (NPO/SL): Within 2.5% or $\pm 0.25\text{pF}$ whichever is larger of initial value Class II (X7R): Within $\pm 10\%$ of initial value														
	Q / 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 $150 \pm 0/-10^\circ\text{C}$ before initial measure. Preheat : at $150 \pm 10^\circ\text{C}$ for 60~120sec. Dip : solder temperature of $260 \pm 5^\circ\text{C}$ Dip Time : 10 ± 1 sec. Immersing Speed : $25 \pm 10\%$ mm/s Solder : H63A Flux : Rosin														
Temperature Cycle	Appearance	No mechanical damage shall occur														
	Capacitance	Class I (NPO/SL): Within 2.5% or $\pm 0.25\text{pF}$ whichever is larger of initial value Class II (X7R): Within $\pm 7.5\%$ of initial value														
	Q / 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 $150 \pm 0/-10^\circ\text{C}$ before initial measure. Capacitor shall be subjected to five cycles of the temperature cycle as following: <table border="1"> <thead> <tr> <th>Step</th><th>Temp.($^\circ\text{C}$)</th><th>Time(min)</th></tr> </thead> <tbody> <tr> <td>1</td><td>Min Rated Temp.+0/-3 (-55)</td><td>30</td></tr> <tr> <td>2</td><td>25</td><td>3</td></tr> <tr> <td>3</td><td>Max Rated Temp.+3/-0 (125)</td><td>30</td></tr> <tr> <td>4</td><td>25</td><td>3</td></tr> </tbody> </table>	Step	Temp.($^\circ\text{C}$)	Time(min)	1	Min Rated Temp.+0/-3 (-55)	30	2	25	3	3	Max Rated Temp.+3/-0 (125)	30	4	25
Step	Temp.($^\circ\text{C}$)	Time(min)														
1	Min Rated Temp.+0/-3 (-55)	30														
2	25	3														
3	Max Rated Temp.+3/-0 (125)	30														
4	25	3														
Humidity	Appearance	No mechanical damage shall occur														
	Capacitance	Class I (NPO/SL): Within 5% or $\pm 0.5\text{pF}$ whichever is larger of initial value Class II (X7R): Within $\pm 15\%$ of initial value														
	Q / Tan δ	Class I (NPO/SL): More Than 30pF : $Q \geq 350$ 30pF & Below: $Q \geq 275 + 2.5C$ Class II (X7R): Maximum 5.0%														
	Insulation Resistance	1,000M Ω or 50/C Ω whichever is smaller. (C in Farad)														
		Class II capacitor shall be set for 48 ± 4 hours at room temperature after one hour heat treatment at $150 \pm 0/-10^\circ\text{C}$ before initial measure. Temperature : $40 \pm 2^\circ\text{C}$ Relative Humidity : 90 ~95%RH Test Time : $500 \pm 12/-0$ hr														

HVC Series Specification & Test Condition

Item	Specification		Test Condition								
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 $\pm 3^{\circ}\text{C}$ 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>$V \leq 250\text{Vdc}$</td><td>150% Rated Voltage</td></tr><tr><td>$250\text{Vdc} < V < 1\text{KVdc}$</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. Measure at room temperature after cooling for Class I : 24 $\pm$ 2 Hours Class II : 48 $\pm$ 4 Hours	Rated Voltage	Applied Voltage	$V \leq 250\text{Vdc}$	150% Rated Voltage	$250\text{Vdc} < V < 1\text{KVdc}$	120% Rated Voltage	More Than 1KVdc(include 1KV)	100% Rated Voltage
	Rated Voltage	Applied Voltage									
	$V \leq 250\text{Vdc}$	150% Rated Voltage									
	$250\text{Vdc} < V < 1\text{KVdc}$	120% Rated Voltage									
	More Than 1KVdc(include 1KV)	100% Rated Voltage									
Capacitance	Class I (NPO/SL): Within 3% or $\pm 0.3\text{pF}$ whichever is larger of initial value Class II (X7R): Within $\pm 15\%$ of initial value										
Q / Tan δ	Class I (NPO/SL): More Than 30pF : $Q \geq 350$ 30pF & Below: $Q \geq 275 + 2.5C$ Class II (X7R): Maximum 5%										
Insulation Resistance	1,000M Ω or 50/C Ω whichever is smaller. (C in Farad)										
Vibration	Appearance	No mechanical damage shall occur	Solder the capacitor on P.C. board.								
	Capacitance	Within the specified tolerance	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.								
	Q / Tan δ	To satisfy the specified initial value	Repeat this for 2 hours each in 3 perpendicular directions.								

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



The SCC series **X2**, **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
- ☐ Certified to:
TUV R50005234 & UL E229738
- ☐ RoHS compliant

◆ Application

- ☐ The **X2**, **X2/Y3** & **X1/Y2** specially designed for use in Modem, Facsimile, Telephone and other telecommunication equipment, electronic equipment for lightning and surge protection, EMI filtering 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

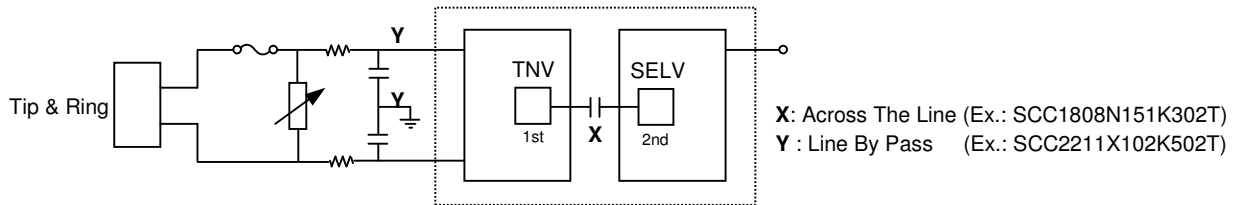
◆ How To Order

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 : 4.6×2.0mm 1812 : 4.6×3.2mm 2208 : 5.7×2.0mm 2211 : 5.7×2.8mm 2220 : 5.7×5.0mm 2825 : 6.8×6.3mm	Ex.: N: NPO X: X7R	Ex.: 100:10×10 ⁰ 471:47×10 ¹ 182:18×10 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)

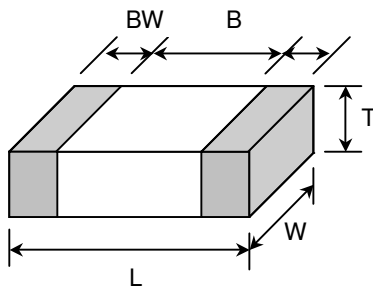
Summary of Specification

Rated Voltage	AC 250Vrms
Temperature Coefficient	NPO : < 30ppm/ °C , -55~+125 °C (EIA Class I) X7R : < ± 15% , -55~+125 °C (EIA Class II)
Capacitance Range	X2/Y3 :2.0pF ~ 2700pF ; X1/Y2 :2.0pF ~ 4700pF X2 : 47nF,56nF
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



Dimension



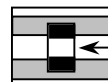
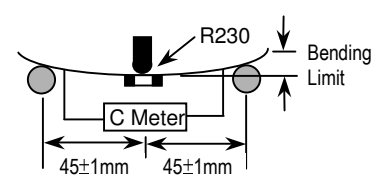
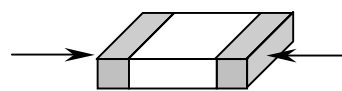
Unit : mm [inches]

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]

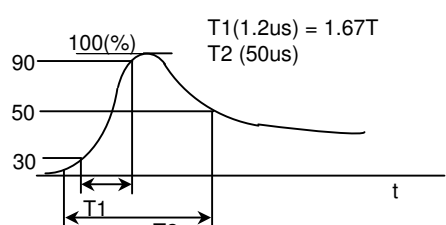
Capacitance Range

Class	Size	Temperature Characteristic	Rated Voltage	Certificated	Capacitance Range (pF)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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X2/Y3	1808	NPO	250Vrms	TUV/UL	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	

SCC Series Specification & Test Condition

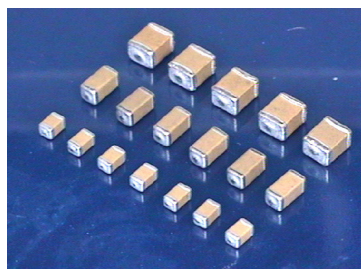
Item	Specification	Test Condition
Operation Temperature	-55 to +125℃	
Visual	No Abnormalities	Visual Inspection
Capacitance	Within The Specified Tolerance	Char. Frequency Voltage
Quality and Dissipation Factor	Class I (NPO): More Than 30pF : Q ≥ 1000 30pF & Below: Q ≥ 400 + 20C (C:Cap., pF) Class II (X7R): Maximum 2.5% (0.025)	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.
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 5N·f 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	A minimum of 90% the termination surface shall be wetted with no sign of termination leaching. 	Solder Temperature : 245 ± 5℃ Dip Time : 5 ± 0.5 sec. Immersing Speed : 25 ± 10% mm/s Solder : H63A Flux : Rosin Preheat : At 80 ~ 120 °C 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℃ 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°C before initial measure. Test Condition : Temperature : 40 ± 2(°C) 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 $\leq \pm 15\%$ of initial value	
		X7R $\leq \pm 20\%$ of initial value	
	Q (NPO) Class I	More Than 30pF:Q $\geq$ 350 30pF& Below:Q $\geq$ 275+2.5C	
	Tan δ (X7R) Class II	Maximum 5% (0.05)	
	Insulation Resistance	More than 1,000M Ω	
	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°C 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 $\leq \pm 20\%$ of initial value	
		X7R $\leq \pm 25\%$ of initial value	
	Q Class I	More Than 30pF:Q $\geq$ 350 30pF& Below:Q $\geq$ 275+2.5C	
	Tan δ Class II	Maximum 5% (0.05)	
	Insulation Resistance	More than 1,000M Ω	
	Voltage Proof	To satisfy the specified initial value	
Passive Flammability	Capacitor shall not ignite or burn		Volume Sample : 21.56mm³ Flame exposure time : 5 sec.Max.
Active Flammability	Cheese cloth shall not ignite		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 in which a minimum change in capacitance over temperature(T/C) is 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.

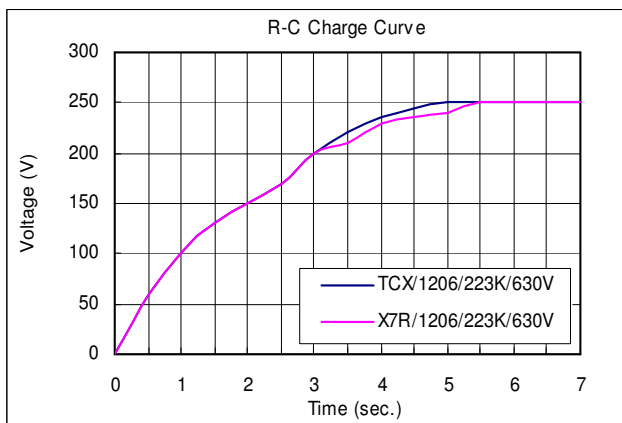
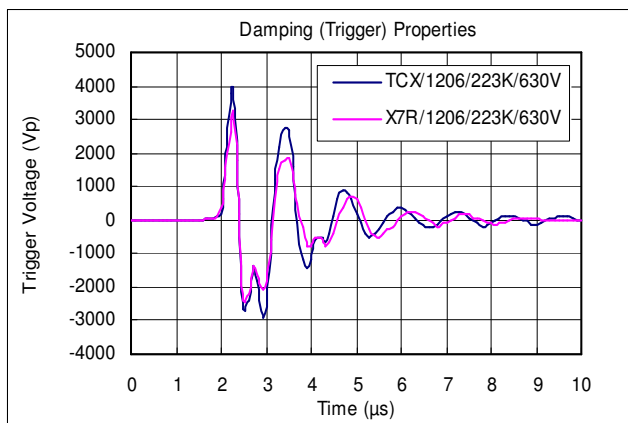
◆ Summary of Specification

Operation Temperature	-55~+125 °C
Rated Voltage	350Vdc and 630Vdc
Temperature Coefficient	X7E : $\leq \pm 4.7\%$, -55~+125 °C (EIA Class II)
Capacitance Range	1.0nF to 100nF
Dissipation Factor :	1.0% max. at 1KHz 25°C
Insulation Resistance	10G Ω or 500/C Ω whichever is smaller (C in Farad)
Dielectric Strength	250V $\leq$ V < 500V : 200% Rated Voltage
	500V $\leq$ V < 1000V : 150% Rated Voltage
Capacitance Tolerance	$\pm 5\%$, $\pm 10\%$, $\pm 20\%$
Aging	1.0% per decade hr, Typical

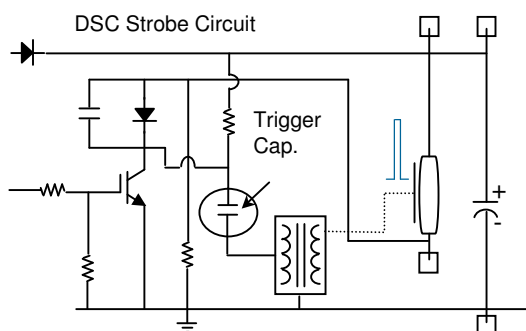
◆ How To Order

TCX	1206	C	223	K	631	T
Product Code	Chip Size	Dielectric	Capacitance Unit : pF	Tolerance	Rated Voltage	Packaging
TCX: Trigger Capacitor	Ex.: 0805 : 2.0×1.25 mm 1206 : 3.2×1.6 mm 1210 : 3.2×2.5 mm	C: X7E	Ex.: 102:10×10 ² 473:47×10 ³	Ex.: J : +/- 5% K: +/- 10% M: +/- 20%	Ex.: 351:350Vdc 631:630Vdc	T: Taping & Reel B: Bulk

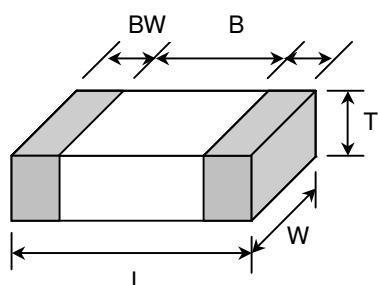
◆ Characteristic



◆ 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]

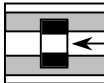
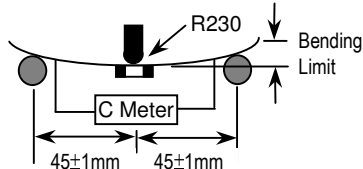
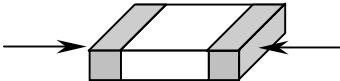
◆ Capacitance Range

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	C	C	C	C	C	C	C	C	C	C	C
	1206	350V																											
		630V																											
	1210	350V																											
		630V																											

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

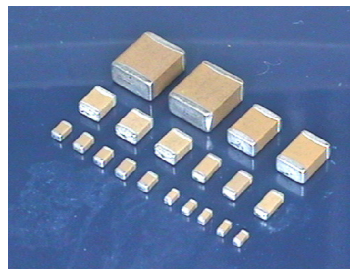
Item	Specification		Test Condition	
Operation Temperature	-55 to +125°C			
Visual	No Abnormal Exterior Appearance		Visual Inspection	
Capacitance	Within The Specified Tolerance		Frequency	Voltage
Dissipation Factor	Maximum 1.0% (0.01)		1KHz±10%	1.0±0.2Vrms
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller. (C in Farad)		$V \leq 500V$, Rated Voltage $V > 500V$, Applied 500Vdc Charge Time : 60sec. Current is limited to less than 50mA.	
Dielectric Strength	No dielectric breakdown or mechanical breakdown		$250V \leq V < 500V$: 200% Rated Voltage $500V \leq V < 1000V$: 150% Rated Voltage for 1~5 sec. Current is limited to less than 50mA.	
Temperature Capacitance Coefficient	Temperature Range -55°C ~ +125°C	Cap. Change ± 4.7%	$(C2-C1)/C1 \times 100\%$ C1:Capacitance at standard temperature(25°C) 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 5N.f 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°C Dip Time : 5 ± 0.5 sec. Immersing Speed : 25±10% mm/s Solder : H63A Flux : Rosin Preheat : At 80~120 °C For 10~30sec.	
Resistance To Soldering Heat	Appearance	No mechanical damage shall occur	Preheat : at 150±10°C for 60~120sec. Dip : solder temperature of 260±5°C 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	Cap. change within ±7.5% of initial value		
	Tanδ(D.F.)	To satisfy the specified initial value		
	Insulation Resistance	To satisfy the specified initial value		
	Dielectric Strength	To satisfy the specified initial value		

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 °C before initial measure. Capacitor shall be subjected to five cycles of the temperature cycle as following: <table><tr><th>Step</th><th>Temp.(°C)</th><th>Time(min)</th></tr><tr><td>1</td><td>Min Rated Temp.(-55)+0/-3</td><td>30</td></tr><tr><td>2</td><td>25</td><td>3</td></tr><tr><td>3</td><td>Max Rated Temp.(+125)+3/-0</td><td>30</td></tr><tr><td>4</td><td>25</td><td>3</td></tr></table> Measure at room temperature after cooling for 48 ±4 Hours	Step	Temp.(°C)	Time(min)	1	Min Rated Temp.(-55)+0/-3	30	2	25	3	3	Max Rated Temp.(+125)+3/-0	30	4	25	3
	Step	Temp.(°C)		Time(min)														
	1	Min Rated Temp.(-55)+0/-3		30														
	2	25		3														
	3	Max Rated Temp.(+125)+3/-0		30														
4	25	3																
Capacitance	Cap. change within ±7.5% of initial value																	
Tanδ(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 °C before initial measure. Temperature : 40± 2 °C 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																	
Tanδ(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°C 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°C) 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																	
Tanδ(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																	
Tanδ (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

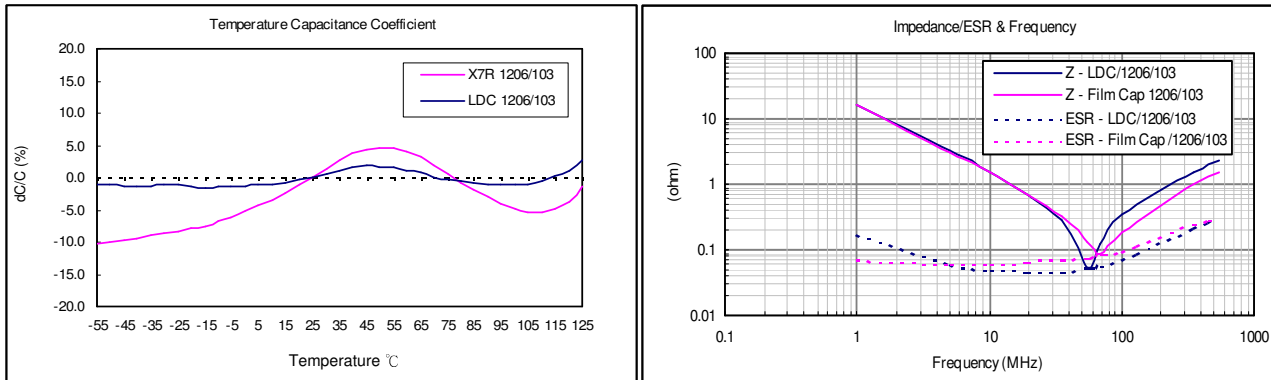
◆ Summary of Specification

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

◆ How To Order

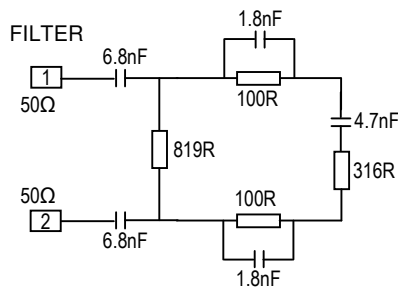
LDC	1206	C	103	K	025	T
Product Code LDC: Low Distortion Capacitor	Chip Size Ex.: 0603 : 1.6×0.80 mm 0805 : 2.0×1.25 mm 1206 : 3.2×1.60 mm 1210 : 3.2×2.50 mm 1812 : 4.6×3.20 mm 2220 : 5.7×5.00 mm	Dielectric C: X7E	Capacitance Unit : pF Ex.: 102:10×10 ² 224:22×10 ⁴	Tolerance Ex.: J : +/- 5% K: +/- 10% M: +/- 20%	Rated Voltage Ex.: 025:25Vdc 050:50Vdc	Packaging T: Taping & Reel B: Bulk

◆ Characteristic

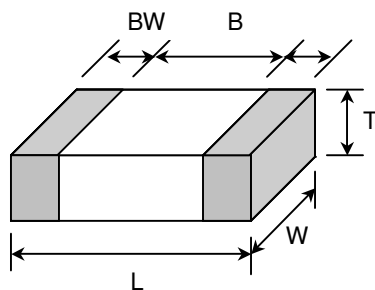


◆ Application

Example Circuit



◆ Dimension



Unit : mm [inches]

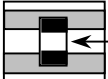
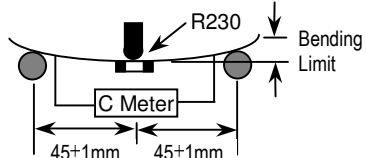
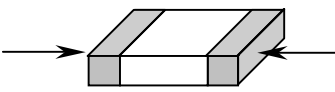
TYPE	L	W	T (max)	B (min)	BW (min)
0603	1.60±0.1 [.063±.004]	0.80±0.1 [.031±.004]	0.90 [.035]	0.40 [.016]	0.15 [.006]
0805	2.00±0.2 [.079±.012]	1.25±0.2 [.049±.008]	1.45 [.057]	0.70 [.028]	0.20 [.008]
1206	3.20±0.3 [.126±.012]	1.60±0.2 [.126±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.3 [.126±.012]	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
X7E	0603	50V	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	0805	50V														
	1206	25V														
	1206	50V														
	1210	50V														
	1812	50V														
	2220	50V														
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

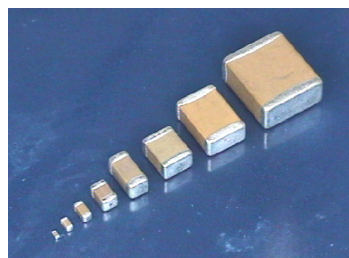
Item	Specification		Test Condition
Operation Temperature	-55 to +125°C		
Visual	No Abnormal Exterior Appearance		Visual Inspection
Capacitance	Within The Specified Tolerance		Frequency Voltage
Dissipation Factor	Rated Voltage	50V 25V	1KHz±10% 1.0±0.2Vrms
	D.F. (max.)	1.2% 2.0%	Perform a heat temperature at 150±5°C 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	Cap. Change	(C2-C1)/C1 × 100% C1:Capacitance At Standard Temperature(25°C) C2:Capacitance At Test Temperature
	-55°C ~ +125°C	≤ ± 4.7%	
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.		 5N-f 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°C Dip Time : 5± 0.5 sec. Immersing Speed : 25±10% mm/s Solder : H63A Flux : Rosin Preheat : At 80~120 °C For 10~30sec.
Resistance To Soldering Heat	Appearance	No mechanical damage shall occur	Preheat : at 150±10°C for 60~120sec. Dip : solder temperature of 260±5°C 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	Cap. change within ±7.5% of initial value	
	Tanδ(D.F.)	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	
	Dielectric Strength	To satisfy the specified initial value	

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 °C before initial measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following: <table><tr><th>Step</th><th>Temp.(°C)</th><th>Time(min)</th></tr><tr><td>1</td><td>Min Rated Temp.(-55)+0/-3</td><td>30</td></tr><tr><td>2</td><td>25</td><td>3</td></tr><tr><td>3</td><td>Max Rated Temp.(+125)+3/-0</td><td>30</td></tr><tr><td>4</td><td>25</td><td>3</td></tr></table> Measure at room temperature after cooling for 48 ±4 Hours	Step	Temp.(°C)	Time(min)	1	Min Rated Temp.(-55)+0/-3	30	2	25	3	3	Max Rated Temp.(+125)+3/-0	30	4	25	3
	Step	Temp.(°C)		Time(min)														
	1	Min Rated Temp.(-55)+0/-3		30														
	2	25		3														
	3	Max Rated Temp.(+125)+3/-0		30														
4	25	3																
Capacitance	Cap. change within ±7.5% of initial value																	
Tanδ(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 °C before initial measure. Temperature : 40± 2 °C 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																	
Tanδ(D.F.)	<table><tr><td>50V</td><td>25V</td></tr><tr><td>max. 3.5%</td><td>max. 5.0%</td></tr></table>	50V		25V	max. 3.5%	max. 5.0%												
50V	25V																	
max. 3.5%	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																
Humidity Loading	Capacitance	Cap. change within ±12.5% of initial value	Capacitors applied DC voltage of the rated voltage is applied for one hour at maximum operation temperature±3°C 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°C 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															
	Tanδ(D.F.)	<table><tr><td>50V</td><td>25V</td></tr><tr><td>max. 3.5%</td><td>max. 5.0%</td></tr></table>		50V	25V	max. 3.5%	max. 5.0%											
	50V	25V																
	max. 3.5%	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																
High Temperature Load (Life Test)	Capacitance	Cap. change within ±15% of initial value	Capacitors applied DC voltage of 200% the rated voltage is applied for one hour at maximum operation temperature±3°C 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															
	Tanδ(D.F.)	<table><tr><td>50V</td><td>25V</td></tr><tr><td>max. 3.5%</td><td>max. 5.0%</td></tr></table>		50V	25V	max. 3.5%	max. 5.0%											
	50V	25V																
	max. 3.5%	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

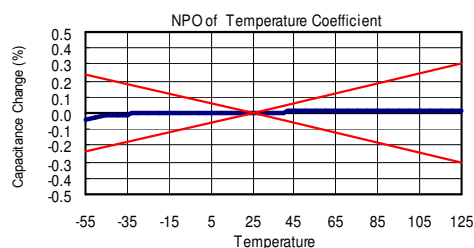
◆ Application

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

◆ Summary of Specification

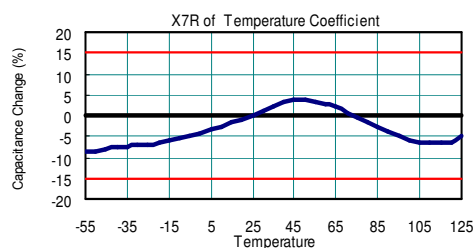
NPO Dielectric Characteristic

Operation Temperature : -55~+125 °C
 Temperature Coefficient : ± 30 ppm/°C , -55~+125 °C (EIA Class I)
 Capacitance Range : 0.5pF to 820pF
 Dissipation Factor : more than 30pF: $Q \geq 1000$ (0.001)
 30pF & below : $Q \geq 400+20C$ C:pF
 Insulation Resistance : 10G Ω or 500/C Ω whichever is smaller
 Aging : 0 % per decade of time, typical
 Dielectric Strength : 250% Rated Voltage



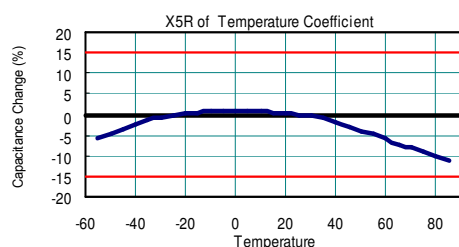
X7R Dielectric Characteristic

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



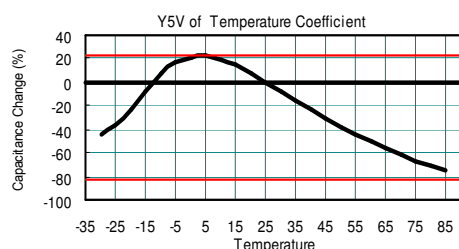
X5R Dielectric Characteristic

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



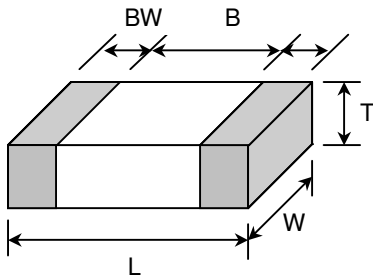
Y5V Dielectric Characteristic

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



Dimension

Unit : mm [inches]

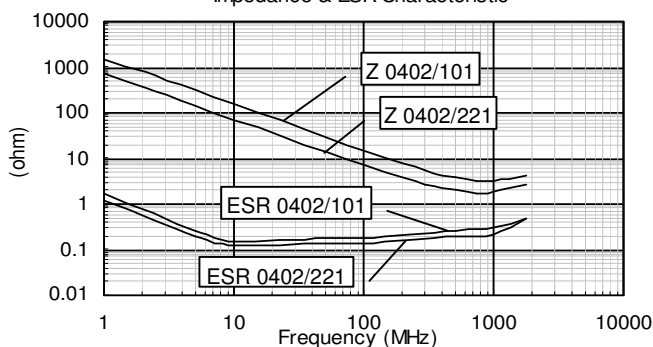


TYPE	L	W	T (max)	B (min)	BW (min)
0201	0.60±0.03 [.024±.001]	0.30±0.03 [.011±.001]	0.33 [.013]	0.20 [.008]	0.10 [.004]
0402	1.00±0.05 [.039±.002]	0.50±0.05 [.020±.002]	0.55 [.022]	0.30 [.012]	0.15 [.006]
0603	1.60±0.10 [.063±.004]	0.80±0.10 [.031±.004]	0.90 [.035]	0.40 [.016]	0.15 [.006]
0805	2.00±0.20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

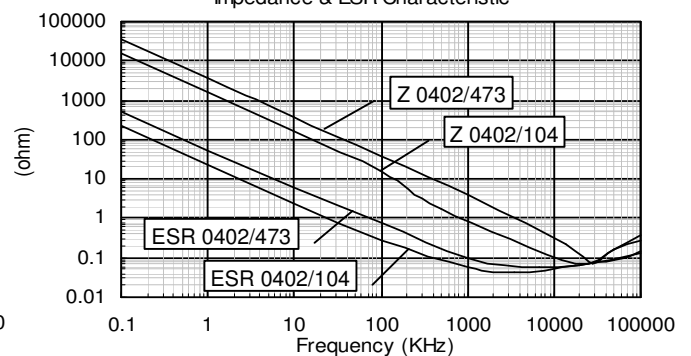
NPO(N) Series

Impedance & ESR Characteristic



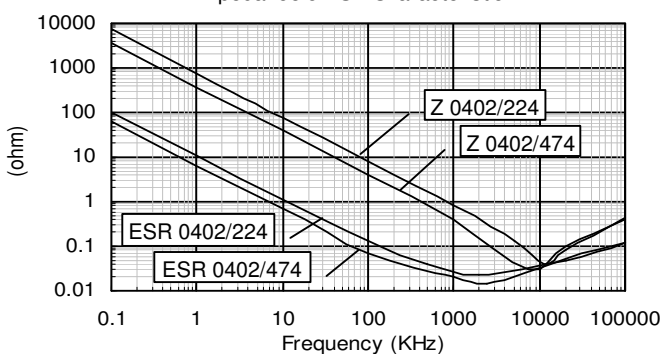
X7R(X) Series

Impedance & ESR Characteristic



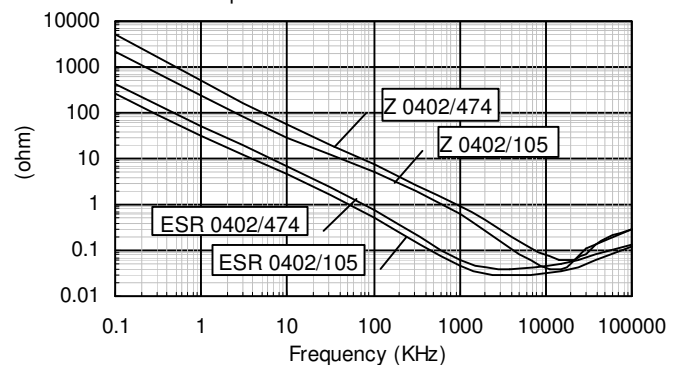
X5R(B) Series

Impedance & ESR Characteristic



Y5V(Y) Series

Impedance & ESR Characteristic



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 : 0.6×0.30 mm 0402 : 1.0×0.50 mm 0603 : 1.6×0.80 mm 0805 : 2.0×1.25 mm 1206 : 3.2×1.60 mm	Ex.: N: NPO X: X7R B: X5R Y: Y5V	Ex.: 102: 10×10 ² 473: 47×10 ³ 104: 10×10 ⁴	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

[illegible][illegible]

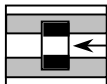
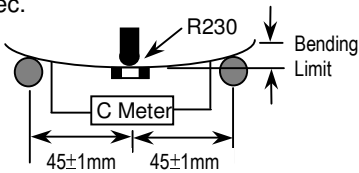
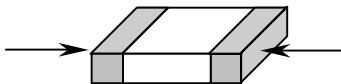
Dielectric Characteristic		Size	Rated Voltage	Capacitance Range							
				102	222	472	103	223	473	104	224
Y5V	0201	6.3V							S		
	0402	10V								OO	OO
		16V						OO	OO		
		25V	OO	OO	OO	OO			O		
		50V	OO	OO	O						
	0603	16V							BB	BB	BB
		25V								BB	BB
		50V				BB	BB	B			
	0805	16V							BB	BB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

Dielectric Characteristic		Size	Rated Voltage	Capacitance Range (pF)																		
				332	392	472	562	682	822	103	153	223	273	333	473	683	823	104	154	224	334	474
X5R	0201	6.3V		S	S	S	S	S	S								S		S			
	0402	10V	S	S	S	S	S	S	S								S					
		6.3V																	O	O	O	O
		10V										O	O	O	O	O	O	O		O	O	O
		16V										O	O	O	O	O	O	O				
	0603	25V																O				
		10V																		B	B	
		16V																	B	B	B	B
		25V																	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
Quality Factor	Class I (NPO): More Than 30pF : Q ≥ 1000 30pF & Below: Q ≥ 400 + 20C (C:Cap., pF)			NPO		
				C≤100pF	1MHz±10%	1.0±0.2Vrms
				C>100pF	1KHz±10%	
Dissipation Factor	Class II (X7R/X5R/Y5V): Please see HEC specification data sheet for details			X7R/X5R/Y5V	1KHz±10%	1.0±0.2Vrms
				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	Class I :		
	NPO(N)	-55℃ ~ +125℃	± 30ppm/℃	[C2-C1/C1(T2-T1)] × 100%		
	X7R (X)	-55℃ ~ +125℃	± 15%	Class II :		
	X5R (B)	-55℃ ~ +85℃	± 15%	(C2-C1)/C1 × 100%		
	Y5V (Y)	-30℃ ~ +85℃	+22/-82%	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.			The board shall be bend 1.0mm with a rate of 1.0 mm/sec.		
	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				
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

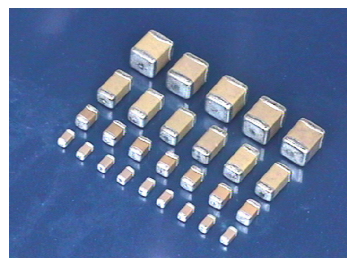
Item	Specification	Test Condition														
Resistance to Soldering Heat	Appearance	No mechanical damage shall occur														
	Capacitance	Class I (NPO): Within 2.5% or $\pm 0.25\text{pF}$ whichever is larger of initial value Class II : Char. Cap. change <u>X7R(X)</u> $\leq \pm 7.5\%$ of initial value <u>X5R(B)</u> $\leq \pm 7.5\%$ of initial value <u>Y5V(Y)</u> $\leq \pm 20\%$ of initial value														
	Q / 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 $150 \pm 0/-10^\circ\text{C}$ before initial measure. Preheat : at $150 \pm 10^\circ\text{C}$ for 60~120sec. Dip : solder temperature of $260 \pm 5^\circ\text{C}$ Dip Time : 10 ± 1 sec. Immersing Speed : $25 \pm 10\%$ mm/s Solder : H63A Flux : Rosin														
Temperature Cycle	Appearance	No mechanical damage shall occur														
	Capacitance	Class I (NPO): Within 2.5% or $\pm 0.25\text{pF}$ whichever is larger of initial value Class II : Char. Cap. change <u>X7R(X)</u> $\leq \pm 7.5\%$ of initial value <u>X5R(B)</u> $\leq \pm 7.5\%$ of initial value <u>Y5V(Y)</u> $\leq \pm 20\%$ of initial value														
	Q / 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 $150 \pm 0/-10^\circ\text{C}$ before initial measure. Capacitor shall be subjected to five cycles of the temperature cycle as following: <table border="1"> <thead> <tr> <th>Step</th><th>Temp.($^\circ\text{C}$)</th><th>Time(min)</th></tr> </thead> <tbody> <tr> <td>1</td><td>Min Rated Temp.+0/-3</td><td>30</td></tr> <tr> <td>2</td><td>25</td><td>3</td></tr> <tr> <td>3</td><td>Max Rated Temp.+3/-0</td><td>30</td></tr> <tr> <td>4</td><td>25</td><td>3</td></tr> </tbody> </table>	Step	Temp.($^\circ\text{C}$)	Time(min)	1	Min Rated Temp.+0/-3	30	2	25	3	3	Max Rated Temp.+3/-0	30	4	25
Step	Temp.($^\circ\text{C}$)	Time(min)														
1	Min Rated Temp.+0/-3	30														
2	25	3														
3	Max Rated Temp.+3/-0	30														
4	25	3														
Humidity	Appearance	No mechanical damage shall occur														
	Capacitance	Class I (NPO): Within 5.0% or $\pm 0.5\text{pF}$ whichever is larger of initial value Class II : Char. Cap. change <u>X7R(X)</u> $\leq \pm 12.5\%$ of initial value <u>X5R(B)</u> $\leq \pm 12.5\%$ of initial value <u>Y5V(Y)</u> $\leq \pm 30\%$ of initial value														
	Q	30pF & Over : $Q \geq 350$ 10 to 30pF : $Q \geq 275 + 2.5C$ 30pF & Below: $Q \geq 200 + 10C$														
	Tan δ Class II	Please see HEC specification data sheet for details														
	Insulation Resistance	1,000M Ω or 50/C Ω whichever is smaller for rated voltage $> 10\text{V}$ and greater 10/C Ω for rated voltage $\leq 10\text{V}$. (C in Farad)														
		Class II capacitor shall be set for 48 ± 4 hours at room temperature after one hour heat treatment at $150 \pm 0/-10^\circ\text{C}$ before initial measure. Temperature : $40 \pm 2^\circ\text{C}$ Relative Humidity : 90 ~95%RH Test Time : $500 \pm 12/-0$ hr Measure at room temperature after cooling for Class I : 24 ± 2 Hours Class II : 48 ± 4 Hours														

NCC Series Specification & Test Condition

Item	Specification	Test Condition
Humidity Loading	Appearance	No mechanical damage shall occur
	Capacitance	Class I (NPO): Within 7.5% or $\pm 0.75\text{pF}$ whichever is larger of initial value Class II : Char. Cap. change <u>X7R(X)</u> $\leq \pm 12.5\%$ of initial value <u>X5R(B)</u> $\leq \pm 12.5\%$ of initial value <u>Y5V(Y)</u> $\leq \pm 30\%$ of initial value
	Q Class I	30pF & Over : $Q \geq 350$ 10 to 30pF : $Q \geq 275+2.5C$ 30pF & Below: $Q \geq 200+10C$
	Tan δ Class II	Please see HEC specification data sheet for details
	Insulation Resistance	500M Ω or 25/C Ω whichever is smaller for rated voltage $>10\text{V}$ and greater 5/C Ω for rated voltage $\leq 10\text{V}$. (C in Farad)
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur
	Capacitance	Class I (NPO): Within 5.0% or $\pm 0.5\text{pF}$ whichever is larger of initial value Class II : Char. Cap. change <u>X7R(X)</u> $\leq \pm 12.5\%$ of initial value <u>X5R(B)</u> $\leq \pm 12.5\%$ of initial value <u>Y5V(Y)</u> $\leq \pm 30\%$ of initial value
	Q Class I	30pF & Over : $Q \geq 350$ 10 to 30pF : $Q \geq 275+2.5C$ 30pF & Below: $Q \geq 200+10C$
	Tan δ Class II	Please see HEC specification data sheet for details
	Insulation Resistance	1,000M Ω or 50/C Ω whichever is smaller for rated voltage $>10\text{V}$ and greater 10/C Ω for rated voltage $\leq 10\text{V}$. (C in Farad)
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.

Multilayer Ceramic Chip Capacitors [High Capacitance MLCC—More Than 1.0uF]

HCC Series – X7R,X6S,X5R,Y5V



◆ 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

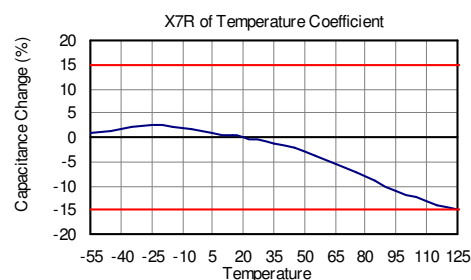
◆ Application

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

◆ Summary of Specification

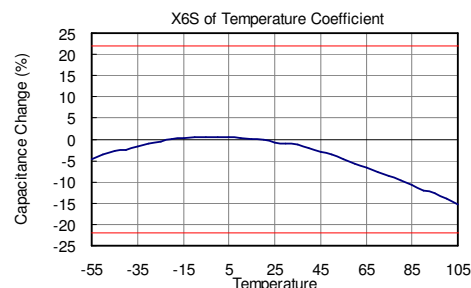
X7R Dielectric Characteristic

Operation Temperature : -55~+125 °C
 Temperature Coefficient : $\pm 15\%$ under -55~+125 °C (EIA Class II)
 Capacitance Range : 1.0uF to 22uF
 Dissipation Factor : Please see HEC specification data sheet
 Insulation Resistance : $10G\Omega$ or $500/C\ \Omega$ whichever is smaller
 Aging : $\leq 2.5\%$ per decade hr , typical
 Dielectric Strength : 250% Rated Voltage



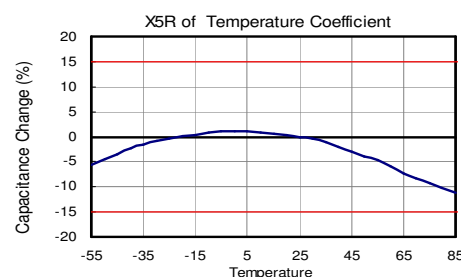
X6S Dielectric Characteristic

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



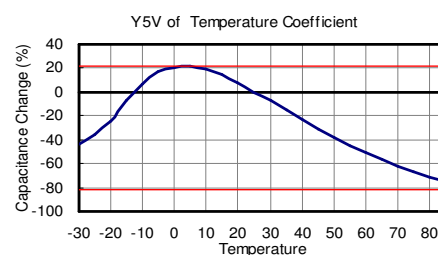
X5R Dielectric Characteristic

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



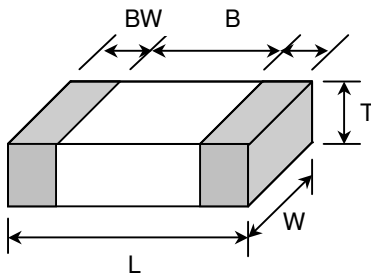
Y5V Dielectric Characteristic

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



◆ Dimension

Unit : mm [inches]

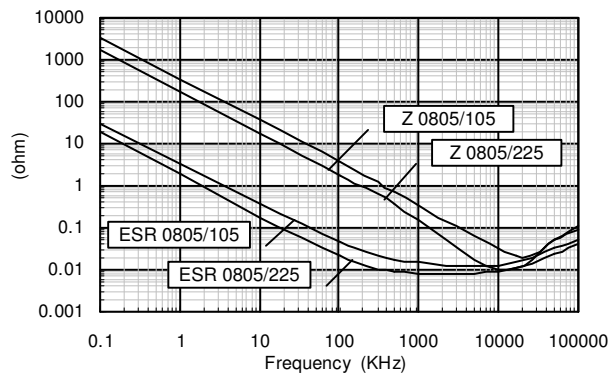


TYPE	L	W	T (max)	B (min)	BW (min)
0402	1.00±0.05 [.039±.002]	0.50±0.05 [.020±.002]	0.55 [.022]	0.30 [.012]	0.15 [.006]
0603	1.60±0.10 [.063±.004]	0.80±0.10 [.031±.004]	0.90 [.035]	0.40 [.016]	0.15 [.006]
0805	2.00±0.20 [.079±.012]	1.25±0.20 [.049±.008]	1.45 [.057]	0.70 [.028]	0.20 [.008]
1206	3.20±0.30 [.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

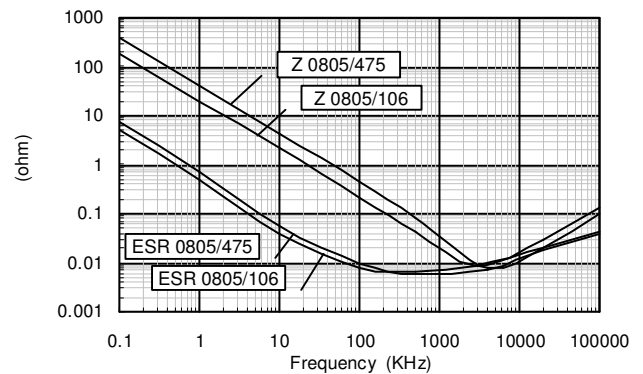
X7R(X) Series

Impedance & ESR Characteristic



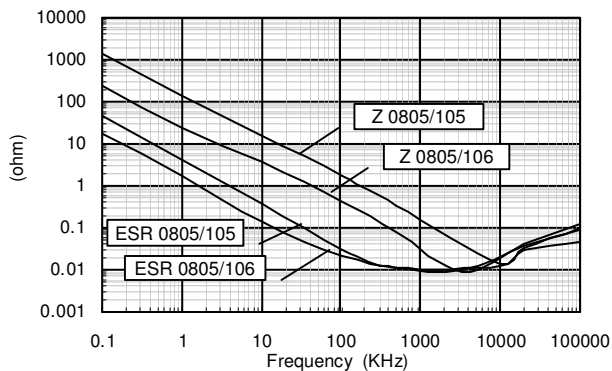
X5R(B) Series

Impedance & ESR Characteristic



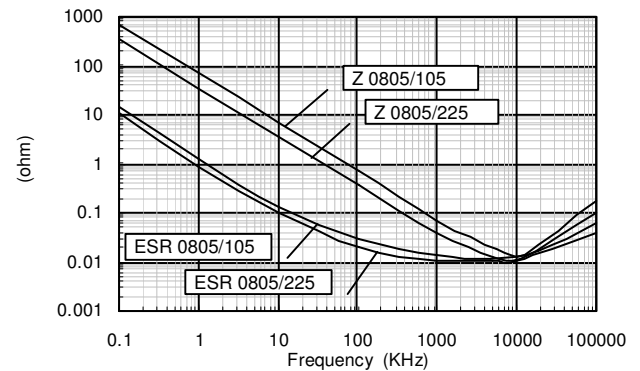
Y5V(Y) Series

Impedance & ESR Characteristic



X6S(S) Series

Impedance/ESR & Frequency



◆ 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 : 1.0×0.50 mm 0603 : 1.6×0.80 mm 0805 : 2.0×1.25 mm 1206 : 3.2×1.6 mm 1210 : 3.2×2.5 mm	Ex.: X:X7R S:X6S B:X5R Y:Y5V	Ex.: 105:10×10 ⁵ 106:10×10 ⁶ 226:22×10 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		D	D	D		E	E	E				E	E/F	F	F	F
335				D	D			E	E								F	F
475				D	D	D		E	E	E				E	F	F		F
106				D				E	E				E	E	F			G
226														G				

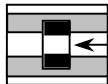
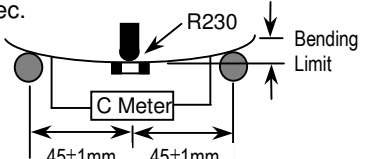
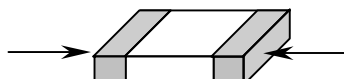
X6S (S) Series																			
Size	0402	0603				0805				1206						1210			
Code	6.3V	6.3V	10V	16V	25V	6.3V	10V	16V	25V	6.3V	10V	16V	25V	35V	50V	10V	16V	25V	50V
105	O	B	B	B	B			D	D					E	E				F
225		B	B				D	D	D			E	E					F	F
475		B					D	D	D		E	E	E				F	F	
106							D	D			E	E	E			F	F	G	
226							D				E					G	G		

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		E	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
106			B	B						D	D	D		E	E	E	E				F	F	F/G
226								D	D					E	E	E				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	D						F	F	F	F	F
106							D	D	D			D	D/E	D/E					E	F	F	F	F	F
226							D					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
Dissipation Factor	Please see HEC specification data sheet for details			$C \leq 10\mu\text{F}$ 1KHz $\pm 10\%$ 1.0 $\pm 0.2\text{Vrms}$
				$C > 10\mu\text{F}$ 120Hz $\pm 20\%$ 0.5 $\pm 0.2\text{Vrms}$
Perform a heat temperature at 150 $\pm 5^\circ\text{C}$ for 30min. then place at room temp. for 24 ± 2 hr.				
Insulation Resistance	10,000M Ω or 500/C Ω whichever is smaller for rated voltage $>10\text{V}$ and greater 100/C Ω for rated voltage $\leq 10\text{V}$.			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	(C2-C1)/C1 $\times 100\%$ C1:Capacitance At Standard Temperature (25℃) C2:Capacitance At Test Temperature The detail condition please see HEC specification data sheet.
	X7R (X)	-55℃ ~ +125℃	$\pm 15\%$	
	X6S (S)	-55℃ ~ +105℃	$\pm 22\%$	
	X5R (B)	-55℃ ~ +85℃	$\pm 15\%$	
	Y5V (Y)	-30℃ ~ +85℃	+22/-82%	
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.			 A 5N-f ($\approx 0.5\text{Kg-f}$) 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.			The board shall be bend 1.0mm with a rate of 1.0 mm/sec. 
	Char.	Capacitance Change		
	X7R(X)	$\leq \pm 12.5\%$ of initial value		
	X6S(S)	$\leq \pm 12.5\%$ of initial value		
	X5R(B)	$\leq \pm 12.5\%$ of initial value		
	Y5V(Y)	$\leq \pm 30.0\%$ of initial value		
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 $\pm 5^\circ\text{C}$ Dip Time : 5 $\pm$ 0.5 sec. Immersing Speed : 25 $\pm 10\%$ mm/s Solder : H63A Flux : Rosin Preheat : At 80~120 $^\circ\text{C}$ For 10~30sec.

HCC Series Specification & Test Condition

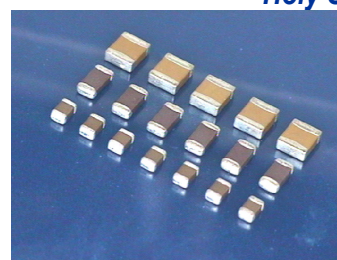
Item	Specification		Test Condition		
Resistance to Soldering Heat	Appearance	No mechanical damage shall occur	Class II capacitor shall be set for 48± 4 hours at room temperature after one hour heat treatment at 150 +0/-10℃ before initial measure.		
	Capacitance	Char.		Cap. change	
		X7R(X)	≤ ±7.5% of initial value	Preheat : at 150 ± 10℃ for 60~120sec. Dip : solder temperature of 260±5℃ Dip Time : 10 ± 1sec. Immersing Speed : 25±10% mm/s Solder : H63A Flux : Rosin	
		X6S(S)	≤ ±7.5% of initial value		
		X5R(B)	≤ ±7.5% of initial value		
	Y5V(Y)	≤ ±20% of initial value			
Tanδ	To satisfy the specified initial value	Measure at room temperature after cooling for 48 ± 4 Hours			
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.		
	Capacitance	Char.		Cap. change	Capacitor shall be subjected to five cycles of the temperature cycle as following:
		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		
	Tanδ	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
Insulation Resistance	To satisfy the specified initial value	4	25	3	
		Measure at room temperature after cooling for 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 measure.		
	Capacitance	Char.		Cap. change	
		X7R(X)	≤ ±12.5% of initial value	Temperature : 40 ± 2 ℃ Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0 hr	
		X6S(S)	≤ ±12.5% of initial value		
		X5R(B)	≤ ±12.5% of initial value		
		Y5V(Y)	≤ ±30% of initial value		
Tanδ	Please see HEC specification data sheet for details	Measure at room temperature after cooling for 48 ± 4 Hours			
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 $\pm 3^{\circ}\text{C}$ then shall be set for 48 $\pm$ 4 hours at room temperature and the initial measurement shall be conducted. Applied Voltage :Rated Voltage Temperature : 40 $\pm$ 2 $^{\circ}\text{C}$ Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 48 $\pm$ 4 Hours	
	Capacitance	Char.		Cap. change
		X7R(X)		$\leq \pm 12.5\%$ of initial value
		X6S(S)		$\leq \pm 12.5\%$ of initial value
		X5R(B)		$\leq \pm 12.5\%$ of initial value
		Y5V(Y)		$\leq \pm 30\%$ of initial value
Tan δ	Please see HEC specification data sheet for details			
Insulation Resistance	500M Ω or 25/C Ω whichever is smaller for rated voltage>10V and greater 5/C Ω for rated voltage $\leq$ 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 $\pm 3^{\circ}\text{C}$ then shall be set for 48 $\pm$ 4 hours at room temperature and the initial measurement shall be conducted. Applied Voltage : please see HEC specification data sheet. Temperature : max. operation temperature Test Time : 1000 +48/-0Hr Current Applied : 50 mA Max. Measure at room temperature after cooling for 48 $\pm$ 4 Hours	
	Capacitance	Char.		Cap. change
		X7R(X)		$\leq \pm 12.5\%$ of initial value
		X6S(S)		$\leq \pm 12.5\%$ of initial value
		X5R(B)		$\leq \pm 12.5\%$ of initial value
		Y5V(Y)		$\leq \pm 30\%$ of initial value
Tan δ	Please see HEC specification data sheet for details			
Insulation Resistance	1,000M Ω or 50/C Ω whichever is smaller for rated voltage>10V and greater 10/C Ω for rated voltage $\leq$ 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

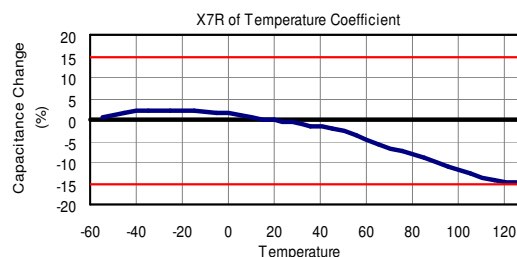
◆ Application

- ❑ 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

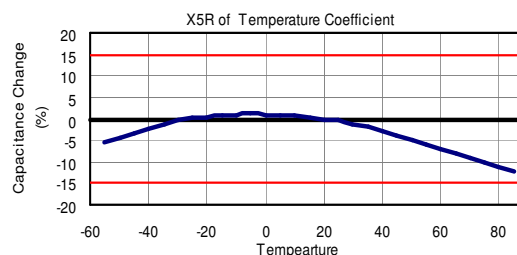
X7R Dielectric Characteristic

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



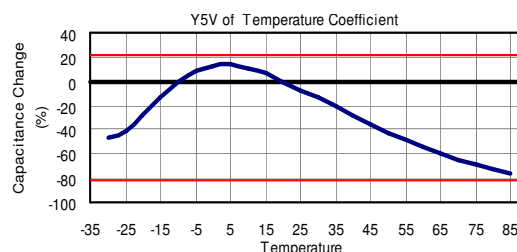
X5R Dielectric Characteristic

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



Y5V Dielectric Characteristic

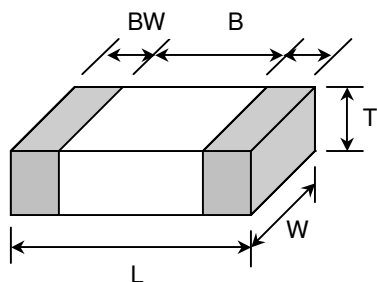
Operation Temperature : -30~+85 °C
 Temperature Coefficient : +22/ -82 % , -30~+85 °C (EIA Class II)
 Capacitance Range : 1uF to 10uF
 Dissipation Factor : See Spec.
 Insulation Resistance : 10G Ω or 500/C Ω whichever is smaller
 Aging : $\leq 7.0\%$ per decade hr , typical
 Dielectric Strength : 250%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



◆ How To Order

VAC	1206	B	106	M	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



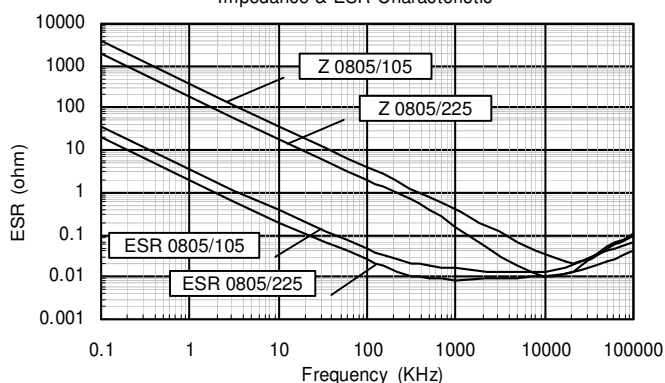
Unit : mm [inches]

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

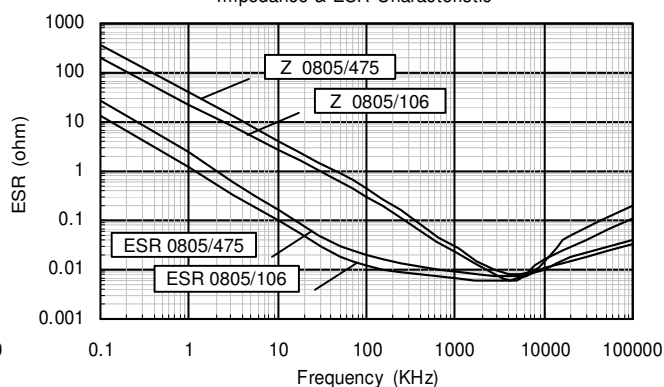
X7R(X) Series

Impedance & ESR Characteristic



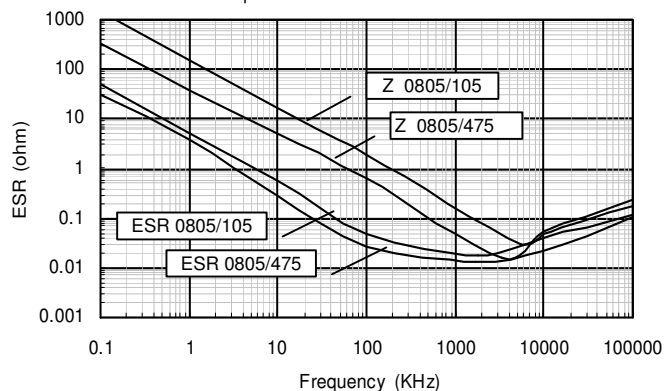
X5R(B) Series

Impedance & ESR Characteristic



Y5V(Y) Series

Impedance & ESR Characteristic

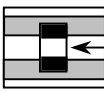
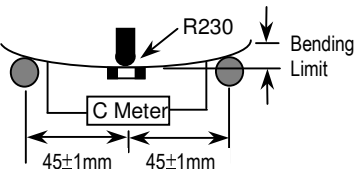
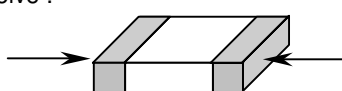


◆ Capacitance Range

X7R (X) Series					X5R (B) Series												Y5V (Y) Series								
Size	0805		1206		Size	0603			0805				1206				Size	0805				1206			
Code	16V	25V	16V	25V	Code	6.3V	10V	16V	6.3V	10V	16V	25V	6.3V	10V	16V	25V	Code	6.3V	10V	16V	25V	6.3V	10V	16V	25V
105	B	B		B	105	T	T	T			B	B				B	105		B	B	B				
155	B		B	B	155				B		B					B	155			B	B				
225	B	B	B	B	225	T	T			B	B	B			B	B	225		B	B	B				B
335					335				B						B		335								
475					475				B	B				B	B		475	B	B	B	B		B		
106					106				B	B				B	B		106					B			
226					226								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

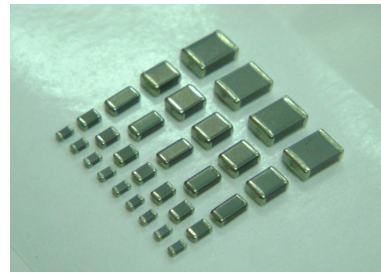
Item	Specification					Test Condition			
Operation Temperature	Char.	Operation Temp.							
	X7R (X)	-55℃ ~ +125℃							
	X5R (B)	-55℃ ~ +85℃							
	Y5V (Y)	-30℃ ~ +85℃							
Visual	No abnormal exterior appearance					Visual Inspection			
Capacitance	Within The Specified Tolerance					Capacitance	Frequency	Voltage	
Dissipation Factor	Char.	25V	16V	10V	6.3V max.	$C \leq 10\mu F$	$1\text{KHz} \pm 10\%$	$1.0 \pm 0.2\text{Vrms}$	
	X7R/X5R	5%	7.5%	15%	15%	$C > 10\mu F$	$120\text{Hz} \pm 20\%$	$0.5 \pm 0.2\text{Vrms}$	
	Y5V	10%	12.5%	20%	20%	Perform a heat treatment at $150 \pm 5^\circ\text{C}$ for 30min. then place at room temp. for $24 \pm 2\text{hr}$.			
Insulation Resistance	10,000MΩ or $500/C \Omega$ whichever is smaller for rated voltage $> 10\text{V}$ and greater $100/C \Omega$ for rated voltage $\leq 10\text{V}$. (C in Farad)					Applied Voltage : Rated Voltage Charge Time : $60 \pm 5 \text{ sec}$. 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		$(C2-C1)/C1 \times 100\%$			
	X7R(X)	$-55^\circ\text{C} \sim +125^\circ\text{C}$		$\pm 15\%$		C1:Capacitance at Standard Temperature (25°C)			
	X5R(B)	$-55^\circ\text{C} \sim +85^\circ\text{C}$		$\pm 15\%$		C2:Capacitance at Test Temperature.			
	Y5V(Y)	$-30^\circ\text{C} \sim +85^\circ\text{C}$		$+22/-82\%$		The detail condition please see HEC specification data sheet.			
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.					 5N·f A 5N·f ($\approx 0.5\text{Kg}\cdot\text{f}$) pull force shall be applied for $10 \pm 1 \text{ sec}$.			
Resistance to Flexure of Substrate	No mechanical damage or capacitance change more than the following table.					The board shall be bent 1.0mm with a rate of 1.0 mm/sec.			
	Char.	Capacitance Change							
	X7R(X)	$\leq \pm 12.5\%$ of initial value							
	X5R(B)	$\leq \pm 12.5\%$ of initial value							
	Y5V (Y)	$\leq \pm 30.0\%$ of initial value							
Solderability	More than 90% of the terminal surface is to be soldered newly, so metal part does not come out or dissolve .					Solder Temperature : $245 \pm 5^\circ\text{C}$ Dip Time : $5 \pm 0.5 \text{ sec}$. Immersing Speed : $25 \pm 10\%$ mm/s Solder : H63A Flux : Rosin Preheat : At $80 \sim 120^\circ\text{C}$ For $10 \sim 30\text{sec}$.			
									
Resistance to Soldering Heat	Appearance	No mechanical damage shall occur					Capacitor shall be set for 48 ± 4 hours at room temperature after one hour heat treatment at $150 +0/-10^\circ\text{C}$ before initial measure.		
	Capacitance	Char.	Cap. change				Preheat : at $150 \pm 10^\circ\text{C}$ for $60 \sim 120\text{sec}$.		
		X7R(X)	$\leq \pm 7.5\%$ of initial value				Dip : solder temperature of $260 \pm 5^\circ\text{C}$		
		X5R(B)	$\leq \pm 7.5\%$ of initial value				Dip Time : $10 \pm 1 \text{ sec}$.		
		Y5V(Y)	$\leq \pm 20\%$ of initial value				Immersing Speed : $25 \pm 10\%$ mm/s		
	Tanδ	To satisfy the specified initial value					Solder : H63A		
	Insulation Resistance	To satisfy the specified initial value					Flux : Rosin		
						Measure at room temperature after cooling for $48 \pm 4 \text{ Hours}$			

VAC 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 °C before initial measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following: <table><tr><th>Step</th><th>Temp.(°C)</th><th>Time(min)</th></tr><tr><td>1</td><td>Min Rated Temp.+0/-3</td><td>30</td></tr><tr><td>2</td><td>25</td><td>3</td></tr><tr><td>3</td><td>Max Rated Temp.+3/-0</td><td>30</td></tr><tr><td>4</td><td>25</td><td>3</td></tr></table> Measure at room temperature after cooling for 48 ± 4 Hours	Step	Temp.(°C)	Time(min)	1	Min Rated Temp.+0/-3	30	2	25	3	3	Max Rated Temp.+3/-0	30	4	25	3
	Step	Temp.(°C)		Time(min)														
	1	Min Rated Temp.+0/-3		30														
	2	25		3														
	3	Max Rated Temp.+3/-0		30														
	4	25		3														
Capacitance	<table><tr><th>Char.</th><th>Cap. change</th></tr><tr><td>X7R(X)</td><td>≤±7.5% of initial value</td></tr><tr><td>X5R(B)</td><td>≤±7.5% of initial value</td></tr><tr><td>Y5V(Y)</td><td>≤±20% of initial value</td></tr></table>	Char.	Cap. change	X7R(X)	≤±7.5% of initial value	X5R(B)	≤±7.5% of initial value	Y5V(Y)	≤±20% of initial value									
Char.	Cap. change																	
X7R(X)	≤±7.5% of initial value																	
X5R(B)	≤±7.5% of initial value																	
Y5V(Y)	≤±20% of initial value																	
Tanδ	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 °C before initial measurement. Temperature : 40 ± 2 °C Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0 hr Measure at room temperature after cooling for 48 ± 4 Hours															
	Capacitance	<table><tr><th>Char.</th><th>Cap. change</th></tr><tr><td>X7R(X)</td><td>≤±12.5% of initial value</td></tr><tr><td>X5R(B)</td><td>≤±12.5% of initial value</td></tr><tr><td>Y5V(Y)</td><td>≤±30% of initial value</td></tr></table>		Char.	Cap. change	X7R(X)	≤±12.5% of initial value	X5R(B)	≤±12.5% of initial value	Y5V(Y)	≤±30% of initial value							
	Char.	Cap. change																
	X7R(X)	≤±12.5% of initial value																
	X5R(B)	≤±12.5% of initial value																
	Y5V(Y)	≤±30% of initial value																
Tanδ	<table><tr><th>Type</th><th>25V</th><th>16V</th><th>10V</th><th>6.3V</th></tr><tr><td>X7R/X5R</td><td>7.5%</td><td>12.5%</td><td>25%</td><td>25%</td></tr><tr><td>Y5V</td><td>13.5%</td><td>15%</td><td>30%</td><td>30%</td></tr></table>	Type	25V	16V	10V	6.3V	X7R/X5R	7.5%	12.5%	25%	25%	Y5V	13.5%	15%	30%	30%		
Type	25V	16V	10V	6.3V														
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)																	
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°C 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°C 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	<table><tr><th>Char.</th><th>Cap. change</th></tr><tr><td>X7R(X)</td><td>≤±15% of initial value</td></tr><tr><td>X5R(B)</td><td>≤±15% of initial value</td></tr><tr><td>Y5V(Y)</td><td>≤±30% of initial value</td></tr></table>		Char.	Cap. change	X7R(X)	≤±15% of initial value	X5R(B)	≤±15% of initial value	Y5V(Y)	≤±30% of initial value							
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Tanδ	<table><tr><th>Type</th><th>25V</th><th>16V</th><th>10V</th><th>6.3V</th></tr><tr><td>X7R/X5R</td><td>7.5%</td><td>12.5%</td><td>25%</td><td>25%</td></tr><tr><td>Y5V</td><td>13.5%</td><td>15%</td><td>30%</td><td>30%</td></tr></table>	Type	25V	16V	10V	6.3V	X7R/X5R	7.5%	12.5%	25%	25%	Y5V	13.5%	15%	30%	30%		
Type	25V	16V	10V	6.3V														
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)																	
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Capacitors applied DC testing rated voltage is applied for one hour at maximum operation temperature ±3°C 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															
	Capacitance	<table><tr><th>Char.</th><th>Cap. change</th></tr><tr><td>X7R(X)</td><td>≤±15% of initial value</td></tr><tr><td>X5R(B)</td><td>≤±15% of initial value</td></tr><tr><td>Y5V(Y)</td><td>≤±30% of initial value</td></tr></table>		Char.	Cap. change	X7R(X)	≤±15% of initial value	X5R(B)	≤±15% of initial value	Y5V(Y)	≤±30% of initial value							
	Char.	Cap. change																
	X7R(X)	≤±15% of initial value																
	X5R(B)	≤±15% of initial value																
	Y5V(Y)	≤±30% of initial value																
Tanδ	<table><tr><th>Type</th><th>25V</th><th>16V</th><th>10V</th><th>6.3V</th></tr><tr><td>X7R/X5R</td><td>7.5%</td><td>12.5%</td><td>25%</td><td>25%</td></tr><tr><td>Y5V</td><td>13.5%</td><td>15%</td><td>30%</td><td>30%</td></tr></table>	Type	25V	16V	10V	6.3V	X7R/X5R	7.5%	12.5%	25%	25%	Y5V	13.5%	15%	30%	30%		
Type	25V	16V	10V	6.3V														
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)																	

Multilayer Ceramic Chip Capacitors [High Cap. NPO – More Than 1.0nF]

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

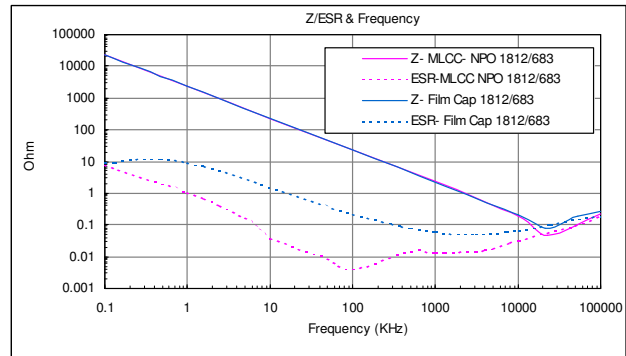
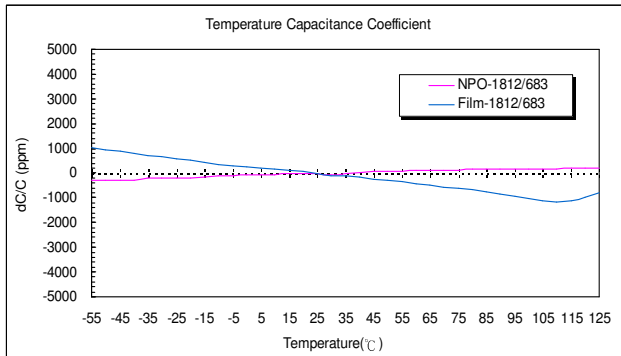
◆ Summary of Specification

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

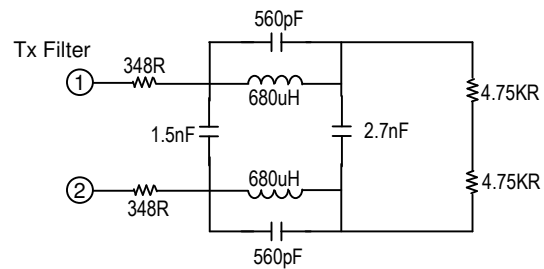
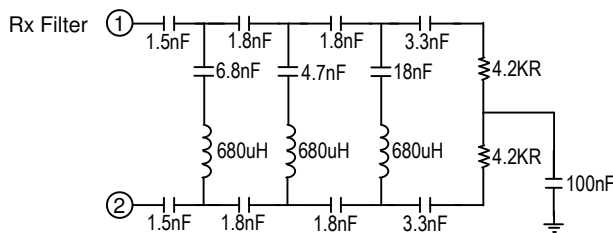
◆ How To Order

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 : 1.6×0.80 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	N: NPO	Ex.: 102:10×10 ² 103:10×10 ³ 124:12×10 ⁴	Ex.: F : +/- 1% G : +/- 2% J : +/- 5%	Ex.: 016:16Vdc 025:25Vdc 050:50Vdc	T: Taping & Reel B: Bulk

Characteristic

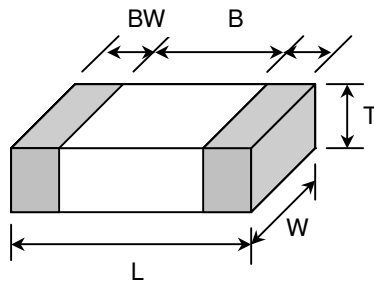


Application Example Circuit



Dimension

Unit : mm [inches]



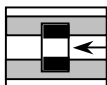
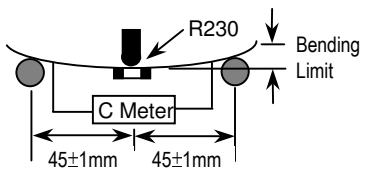
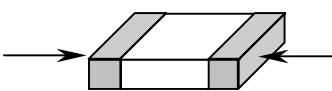
TYPE	L	W	T (max)	B (min)	BW (min)
0603	1.60+/-0.1 [.063+/-0.004]	0.80+/-0.1 [.031+/-0.004]	0.90 [.039]	0.40 [.016]	0.15 [.006]
0805	2.00±0.2 [.079±0.12]	1.25±0.2 [.049 ±0.08]	1.40 [.055]	0.70 [.028]	0.20 [.008]
1206	3.20±0.3 [.126±0.12]	1.60±0.2 [.126±0.12]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.3 [.126±0.12]	2.50±0.2 [.098±0.08]	2.20 [.087]	1.60 [.063]	0.30 [.012]
1812	4.60±0.3 [.181±0.12]	3.20±0.3 [.126±0.12]	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	B																							
		25V	B	B	B	B	B	B	B	B																							
		50V	B	B	B	B	B	B	B	B																							
	0805	16V	B	B	B	B	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D												
		25V	B	B	B	B	C	D	D	D	D	D	D	D	D	D	D	D	D	D													
		50V	B	B	B	B	C	D	D	D	D	D	D	D	D	D																	
	1206	16V	B	B	B	B	B	B	B	B	B	B	C	D	D	D	C	D	C	D	D	E	E	E	E	E	E	E	E	E	E		
		25V	B	B	B	B	B	B	B	B	B	B	B	C	D	D	D	C	D	C	D	D	E	E	E	E	E	E	E	E	E		
		50V	B	B	B	B	B	B	B	B	B	B	B	C	D	D	D	E	C	D	C	D	D	E	E	E	E	E	E	E	E		
	1210	16V																			D	E	E	E	E	E	E	E	F	F			
		25V	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	D	E	E	E	F	F	F	F	F	F	F	F	F		
		50V	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	D	E	E	E	F	F	F	F	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	D	D	D	E	E	E	E	E	E	E	E	E	F	F	
		50V	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	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

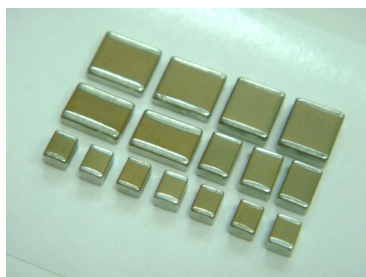
Item	Specification		Test Condition	
Operation Temperature	-55℃ ~ +125℃			
Visual	No Abnormal Exterior Appearance		Visual Inspection	
Capacitance	Within The Specified Tolerance		Frequency	Voltage
Quality Factor	Q ≥1000		1KHz±10%	1.0±0.2Vrms
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller. (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 °C For 10~30sec.	
Resistance To Soldering Heat	Appearance	No mechanical damage shall occur	Preheat : at 150±10℃ 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	
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			

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	<table><tr><th>Step</th><th>Temp.(°C)</th><th>Time(min)</th></tr><tr><td>1</td><td>Min Rated Temp.(-55)+0/-3</td><td>30</td></tr><tr><td>2</td><td>25</td><td>3</td></tr><tr><td>3</td><td>Max Rated Temp.(+125)+3/-0</td><td>30</td></tr><tr><td>4</td><td>25</td><td>3</td></tr></table>	Step	Temp.(°C)	Time(min)	1	Min Rated Temp.(-55)+0/-3	30	2	25	3	3	Max Rated Temp.(+125)+3/-0	30	4	25	3
	Step	Temp.(°C)	Time(min)															
	1	Min Rated Temp.(-55)+0/-3	30															
	2	25	3															
3	Max Rated Temp.(+125)+3/-0	30																
4	25	3																
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 °C Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0 hr															
	Capacitance	Cap. change within ±5.0% of initial value																
	Q Factor	Q ≥350	Measure at room temperature after cooling for 24 ± 2 Hours															
	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°C Relative Humidity : 90 ~ 95%RH Test Time : 500 +12/- 0Hr Current Applied : 50 mA Max.															
	Capacitance	Cap. change within ±5.0% of initial value																
	Q Factor	Q ≥350	Measure at room temperature after cooling for 24 ± 2 Hours															
	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.															
	Capacitance	Cap. change within ±3.0% of initial value																
	Q Factor	Q ≥350	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.															
	Capacitance	Within the specified tolerance																
	Tanδ	To satisfy the specified initial value	Repeat this for 2 hours each in 3 perpendicular directions.															

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

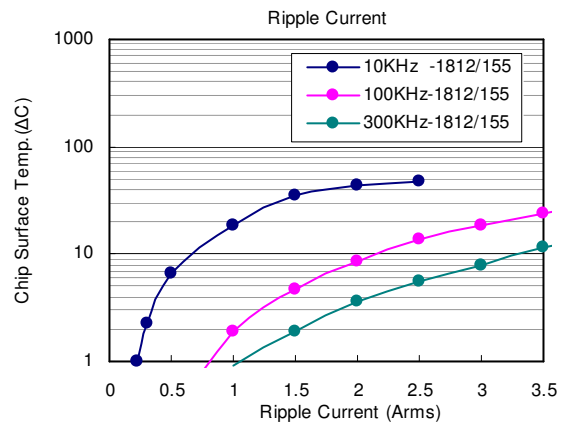
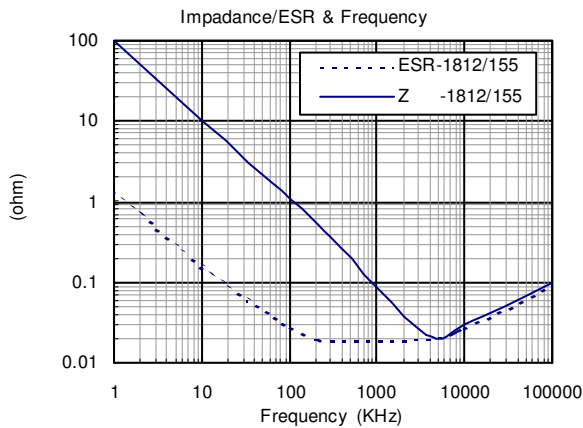
◆ Summary of Specification

Operation Temperature	-55~+125 °C
Rated Voltage	50V to 100Vdc
Temperature Coefficient	X7R : $\leq \pm 15\%$ at -55~+125 °C (EIA Class II)
Capacitance Range	100nF ~ 10uF
Dissipation Factor :	2.5% max. at 1KHz 25°C
Insulation Resistance	10G Ω 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	$\pm 10\%$, $\pm 20\%$
Aging	2.5% per decade hr , typical

◆ How To Order

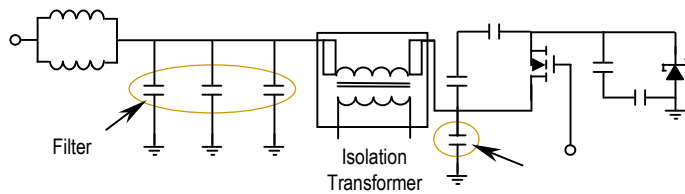
C	1210	X	225	K	101	T	X
Product Code	Chip Size	Dielectric	Capacitance Unit : pF	Tolerance	Rated Voltage	Packaging	Special Requirement
C:MLCC (Multilayer Ceramic Chip of Capacitor)	Ex.: 1210 : 3.2×2.5 mm 1812 : 4.6×3.2 mm 1825 : 4.6×6.35 mm 2220 : 5.7×5.0 mm 2225 : 5.7×6.35 mm	X: X7R	Ex.: 102:10×10 ² 224:22×10 ⁴ 105:10×10 ⁵	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

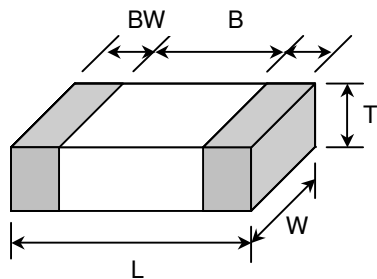


◆ Application Example Circuit

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]

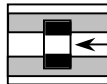
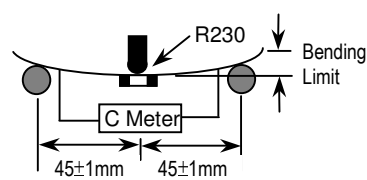
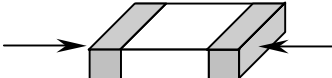
◆ Capacitance Range

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	C	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

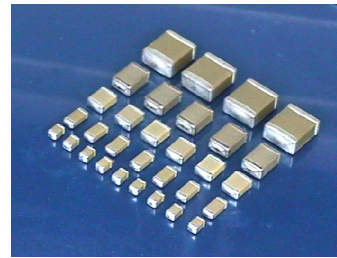
Item	Specification	Test Condition								
Operation Temperature	-55℃ ~ +125℃									
Visual	No Abnormal Exterior Appearance	Visual Inspection								
Capacitance	Within The Specified Tolerance	Frequency Voltage								
Dissipation Factor	0.025 max.	1KHz±10% 1.0±0.2Vrms								
		Perform a heat treatment 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)	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	<table><tr><td>Temp. Range</td><td>Cap. Change</td></tr><tr><td>-55℃ ~ +125℃</td><td>± 15%</td></tr></table>	Temp. Range	Cap. Change	-55℃ ~ +125℃	± 15%	(C2-C1)/C1 × 100% C1:Capacitance at Standard Temperature(25℃) C2:Capacitance at Test Temperature				
Temp. Range	Cap. Change									
-55℃ ~ +125℃	± 15%									
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.	 5N·f 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.	The board shall be bent 1.0mm with a rate of 1.0 mm/sec.								
	<table><tr><td>Char.</td><td>Capacitance Change</td></tr><tr><td>X7R (X)</td><td>≤ ± 12.5% of initial Value</td></tr></table>	Char.	Capacitance Change	X7R (X)	≤ ± 12.5% of initial Value					
Char.	Capacitance Change									
X7R (X)	≤ ± 12.5% of initial Value									
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 °C For 10~30sec.								
										
Resistance to Soldering Heat	<table><tr><td>Appearance</td><td>No mechanical damage shall occur</td></tr><tr><td>Capacitance</td><td>within ±7.5% of initial Value</td></tr><tr><td>Tanδ</td><td>To satisfy the specified initial value</td></tr><tr><td>Insulation Resistance</td><td>To satisfy the specified initial value</td></tr></table>	Appearance	No mechanical damage shall occur	Capacitance	within ±7.5% of initial Value	Tanδ	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℃ 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
Appearance	No mechanical damage shall occur									
Capacitance	within ±7.5% of initial Value									
Tanδ	To satisfy the specified initial value									
Insulation Resistance	To satisfy the specified initial value									

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 °C before initial measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following:
	Capacitance	Within ±7.5% of initial value	
	Tanδ	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	
	Step	Temp.(°C)	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	Class II capacitor shall be set for 48 ± 4 hours at room temperature after one hour heat treatment at 150 +0/-10 °C before initial measurement.
	Capacitance	Within ±12.5% of initial value	
	Tanδ	0.05 max.	Temperature : 40± 2 °C Relative Humidity : 90 ~95%RH
	Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)	Test Time : 500 +12/-0 hr
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°C then shall set for 48±4 hours at room temperature and the initial measurement shall be conducted.
	Capacitance	Within ±15% of initial value	
	Tanδ	0.05 max.	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.
	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.
	Capacitance	Within the specified tolerance	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.
	Tanδ	To satisfy the specified initial value	Repeat this for 2 hours each in 3 perpendicular directions.

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 °C to +85 °C
Rated Voltage	10V to 100Vdc
Temperature Coefficient	Y5U : $\leq +22 / -56 \%$, -30~+85 °C (EIA Class II)
Capacitance Range	10nF ~ 22uF
Dissipation Factor :	Y5U : D.F. $\leq 4.0\%$ at 1KHz 20 °C
Insulation Resistance	10G Ω or 500/C Ω whichever is smaller (C in Farad)
Dielectric Strength	V $\leq$ 50V; 250% Rated Voltage for 5 seconds @ 50mA max. current
	V =100V ; 200% 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: 1.6×0.80 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	Dielectric Ex.: E: Y5U	Capacitance Unit : pF Ex.: 102:10×10 ² 473:47×10 ³ 106:10×10 ⁶	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

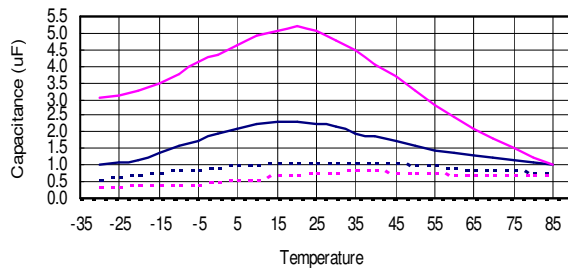
E Series (Y5U) 2.2uF/25V

— Bias 0 V
- - - Bias 12V

Barium Titante (Y5V) 4.7uF/16V

— Bias 0 V
- - - Bias 12V

Y5U & Y5V Characteristic Comparison



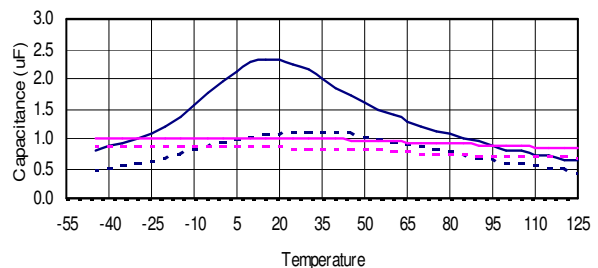
E Series (Y5U) 2.2uF/25V

— Bias 0 V
- - - Bias 12V

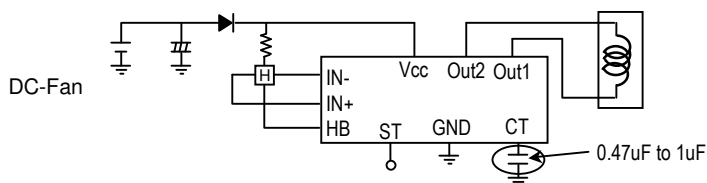
Barium Titante (X5R) 1.0uF/16V

— Bias 0 V
- - - Bias 12V

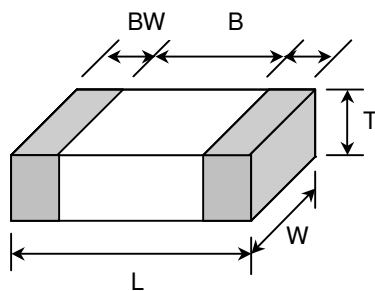
Y5U & X5R Characteristic Comparison



Application Example Circuit



Dimension



Unit : mm [inches]

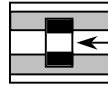
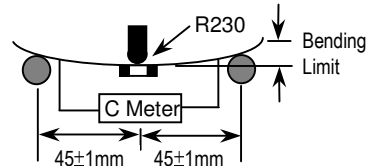
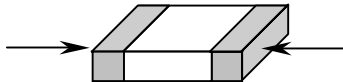
TYPE	L	W	T (max)	B (min)	BW (min)
0603	1.60±0.1 [.063±.004]	0.80±0.1 [.031±.004]	0.90 [.035]	0.40 [.016]	0.15 [.006]
0805	2.00±0.2 [.079±.012]	1.25±0.2 [.049±.008]	1.45 [.057]	0.70 [.028]	0.20 [.008]
1206	3.20±0.3 [.126±.012]	1.60±0.2 [.126±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.3 [.126±.012]	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

Size		0603			0805			1206			1210			1812			2220				
Code	WVDC	10V	25V	50V	10V	25V	50V	10V	25V	50V	10V	25V	50V	100V	25V	50V	100V	25V	50V	100V	
103	10nF		B	B		B	B		B	B		C	C	E	E	F	F	F	F	F	
153	15nF		B	B		B	B		B	B		C	C	E	E	F	F	F	F	F	
223	22nF		B	B		B	B		B	B		C	C	E	E	F	F	F	F	F	
333	33nF		B	B		B	B		B	B		C	C	E	E	F	F	F	F	F	
473	47nF		B	B		B	B		B	B		C	C	E	E	F	F	F	F	F	
683	68nF		B			B	B		B	B		C	C	E	E	F	F	F	F	F	
104	100nF		B			B	B		B	B		C	C	E	E	F	F	F	F	F	
154	150nF		B			B	B		B	B		C	C	E	E	F	F	F	F	F	
224	220nF		B			B	B		B	B		C	C	E	E	F	F	F	F	F	
334	330nF					B			B	C		C	C	E	E	F	F	F	F	F	
474	470nF					B			B	C		C	C	E	E	F	F	F	F	F	
684	680nF					B			B	D		C	C		E	F	F	F	F	F	
105	1uF	B				B			B	E		C	C		E	F	F	F	F	F	
155	1.5uF								C			D	D		E	F	F	F	F	F	
225	2.2uF								D			D			E	F		F	F	F	
335	3.3uF											D			E	F		F	F	G	
475	4.7uF				D							E			E	F		F	F		
685	6.8uF											E			F			F	F		
106	10uF				D			D			F				F			F	F		
226	22uF																	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

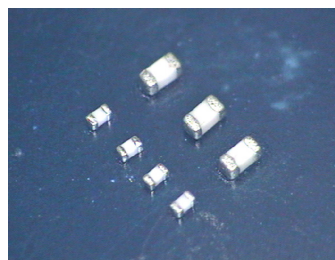
Item	Specification		Test Condition	
Operation Temperature	-30°C ~ +85°C			
Visual	No abnormal exterior appearance		Visual Inspection	
Capacitance	Within the specified tolerance		Frequency	Voltage
Dissipation Factor	4.0% Maximum		1KHz±10%	1.0±0.2Vrms
Insulation Resistance	10,000MΩ or 500/C Ω whichever is smaller. (C in Farad)		Perform a heat treatment at 150±5°C for 30min. then place at room temp. for 24±2hr.	
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°C ~ +85°C	Cap. Change +22/-56%	(C2-C1)/C1 × 100% C1:Capacitance at Standard Temperature(25°C) 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°C Dip Time : 5 ± 0.5 sec. Immersing Speed : 25±10% mm/s Solder : H63A Flux : Rosin Preheat : At 80~120 °C For 10~30sec.	
Resistance to Soldering Heat	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°C before initial measurement.	
	Capacitance	Cap. change within ±20% of initial value	Preheat : at 150 ± 10°C for 60~120sec.	
	Tanδ	To satisfy the specified initial value	Dip : solder temperature of 260 ± 5°C Dip Time : 10 ± 1sec.	
	Insulation Resistance	To satisfy the specified initial value	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 °C before initial measurement. Capacitor shall be subjected to five cycles of the temperature cycle as follow: <table><tr><th>Step</th><th>Temp.(°C)</th><th>Time(min)</th></tr><tr><td>1</td><td>Min Rated Temp.(-30)+0/-3</td><td>30</td></tr><tr><td>2</td><td>25</td><td>3</td></tr><tr><td>3</td><td>Max Rated Temp.(+85)+3/-0</td><td>30</td></tr><tr><td>4</td><td>25</td><td>3</td></tr></table> Measure at room temperature after cooling for 48 ± 4 Hours	Step	Temp.(°C)	Time(min)	1	Min Rated Temp.(-30)+0/-3	30	2	25	3	3	Max Rated Temp.(+85)+3/-0	30	4	25	3
	Step	Temp.(°C)		Time(min)														
	1	Min Rated Temp.(-30)+0/-3		30														
	2	25		3														
	3	Max Rated Temp.(+85)+3/-0		30														
4	25	3																
Capacitance	Cap. change within ±20% of initial value																	
Tanδ	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 °C before initial measurement. Temperature : 40 ± 2 °C 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																
	Tanδ	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°C 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°C 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																
	Tanδ	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°C then shall be set for 48±4 hours at room temperature and the initial measurement shall be conducted. Applied Voltage :200% Rated Voltage However: V ≥ 100V:applied voltage of 150% rated voltage V ≤ 10V :applied voltage of 100% 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																
	Tanδ	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 0201 to 1111
- ❑ 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

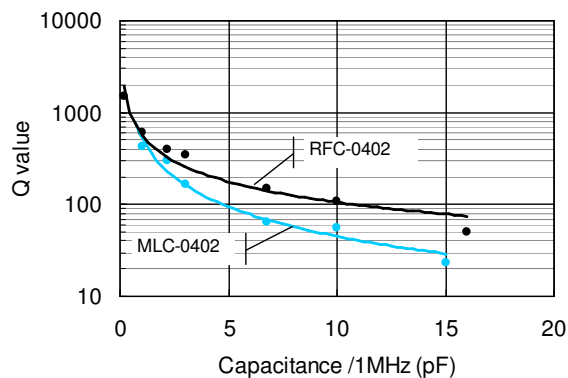
Operation Temperature	-55 to +125℃
Rated Voltage	25Vdc to 500Vdc
Size	0201, 0402, 0603, 0505, 0805 and 1111
Temperature Coefficient	C0G < ± 30ppm/℃ , -55~+125 ℃ (EIA Class I)
Capacitance Range	0.1pF ~ 1000pF
Q Value :	$Q \geq 1000$ at 1MHz & ≥ 500 at 1GHz / 1pF
Insulation Resistance	10GΩ
Dielectric Strength	$V \leq 50V$: 300% Rated Voltage for 5 second @ 50mA max. current
	$100 \leq V < 500V$: 200% rated voltage for 5 second @ 50mA max. current
	$V \geq 500V$: 150% 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

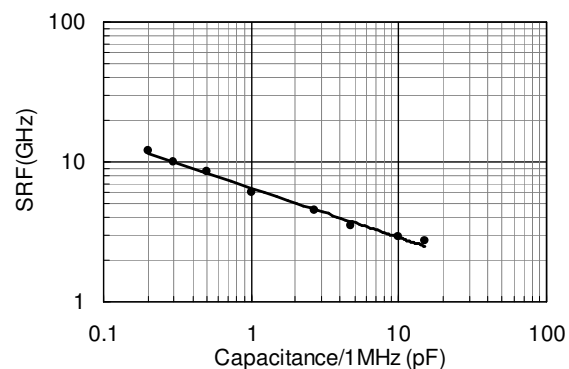
RFC	0402	G	R30	B	025	T
Product Code	Chip Size	Dielectric	Capacitance Unit : pF	Tolerance	Rated Voltage	Packaging
RFC: Radio Frequency of MLCC	Ex.: 0201 : 0.60×0.30 mm 0402 : 1.00×0.50 mm 0603 : 1.60×0.80 mm 0505 : 1.40×1.40 mm 0805 : 2.00×1.25 mm 1111 : 2.80×2.80 mm	Ex.: G : C0G	Ex.: R10: 0.1pF 5R0: 5.0pF 120: 12×10 ⁰ 102: 10×10 ²	Ex.: L : ±0.050pF A: ±0.075pF B: ±0.10pF C: ±0.25pF J : ± 5.0 %	Ex.: 025:25Vdc 050:50Vdc 101:100Vdc 151:150Vdc 201:200Vdc 251:250Vdc 501:500Vdc	T: Taping & Reel B: Bulk

◆ Characteristic

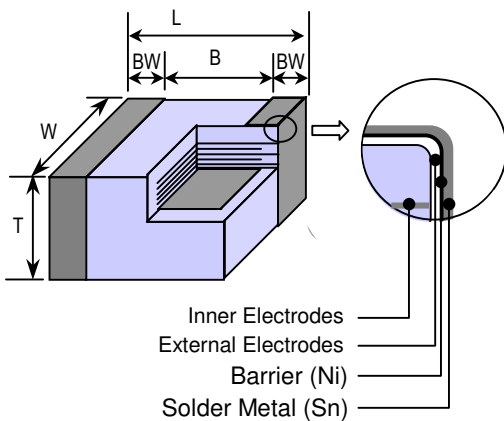
Q v.s. Capacitance at 1GHz



Self Resonant Frequency

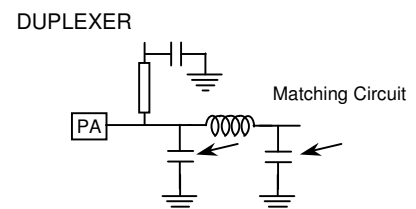
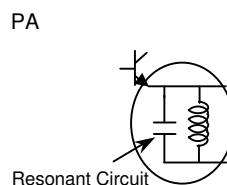
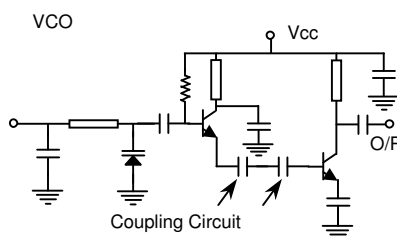


◆ Structure & Dimension



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]
0603	1.60±0.1 [.063±.004]	0.80±0.1 [.031 ±.004]	0.90 [.035]	0.40 [.016]	0.15 [.006]
0505	1.40±0.25 [.055±.010]	1.40±0.25 [.055±.010]	1.40 [.055]	0.35 [.014]	0.20 [.008]
0805	2.00±0.2 [.079±.012]	1.25±0.2 [.049±.008]	1.45 [.057]	0.70 [.028]	0.20 [.008]
1111	2.80±0.4 [.110±.016]	2.80±0.4 [.110±.016]	2.60 [.102]	1.40 [.055]	0.30 [.012]

◆ **Application** Example Circuit

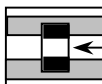
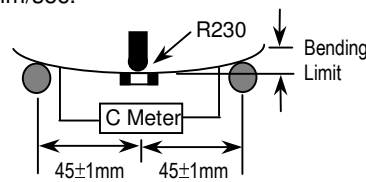
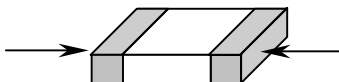


◆ Capacitance Range

[illegible]

■ **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	Voltage
Q Value	≥ 1000		1MHz±10%	1.0±0.2Vrms
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		V≤50V : 300% Rated Voltage 100≤V<500V : 200% Rated Voltage V≥500V : 150% 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(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 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 °C For 10~30sec.	
Resistance to Soldering Heat	Appearance	No mechanical damage shall occur		Preheat : at 150±10℃ for 60~120sec. Dip : solder temperature of 260±5℃ Dip Time : 10 ± 1sec. Immersing Speed : 25±10% mm/s Solder : H63A Flux : Rosin
	Capacitance	Cap. change within ±7.5% or ±0.02pF of initial value, whichever is large.		
	Insulation Resistance	≥ 1000MΩ		

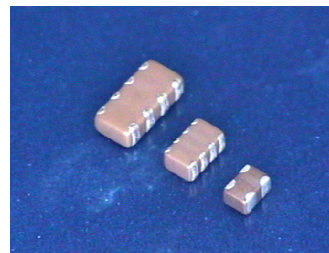
RFC Series Specification & Test Condition

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:															
	Capacitance	Cap. change within $\pm 7.5\%$ or $\pm 0.02\text{pF}$ of initial value, whichever is larger.	<table><tr><th>Step</th><th>Temp.($^{\circ}\text{C}$)</th><th>Time(min)</th></tr><tr><td>1</td><td>Min Rated Temp.(-55)+0/-3</td><td>30</td></tr><tr><td>2</td><td>25</td><td>3</td></tr><tr><td>3</td><td>Max Rated Temp.(+125)+3/-0</td><td>30</td></tr><tr><td>4</td><td>25</td><td>3</td></tr></table>	Step	Temp.($^{\circ}\text{C}$)	Time(min)	1	Min Rated Temp.(-55)+0/-3	30	2	25	3	3	Max Rated Temp.(+125)+3/-0	30	4	25	3
	Step	Temp.($^{\circ}\text{C}$)	Time(min)															
	1	Min Rated Temp.(-55)+0/-3	30															
	2	25	3															
3	Max Rated Temp.(+125)+3/-0	30																
4	25	3																
Insulation Resistance	$\geq 1,000\text{M}\Omega$																	
		Measure at room temperature after cooling for 24 ± 2 Hours																
Humidity	Appearance	No mechanical damage shall occur	Temperature : $40 \pm 2^{\circ}\text{C}$ Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0 hr															
	Capacitance	Cap. change Within 7.5% or $\pm 0.02\text{pF}$ of initial value, Whichever is larger	Measure at room temperature after cooling for 24 ± 2 Hours															
	Q	≥ 200																
	Insulation Resistance	$\geq 1,000\text{M}\Omega$																
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Applied Voltage : $V \leq 50\text{V}$:200%Rated Voltage $50\text{V} < V \leq 250\text{V}$: 150%Rated Voltage $V > 250\text{V}$: 120%Rated Voltage Temperature : max. operating temperature Test Time : 1000 +48/-0Hr Current Applied : 50 mA Max.															
	Insulation Resistance	$\geq 1,000\text{M}\Omega$	Measure at room temperature after cooling for 24 ± 2 Hours															

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 2xMLCC & 4xMLCC.



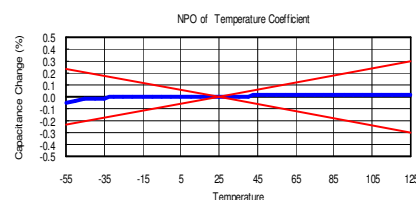
◆ Features

- ❑ Small size with 2xMLCC & 4xMLCC 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

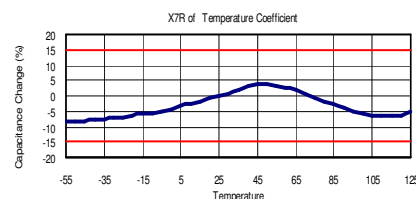
NPO Dielectric Characteristic

Temperature Coefficient : $\pm 30\text{ppm}/^{\circ}\text{C}$, $-55\sim+125^{\circ}\text{C}$
 Capacitance Range : 10pF to 470pF
 Dissipation Factor : more than 30pF: $Q \geq 1000$ (0.001)
 30pF & below : $Q \geq 400+20C$ C:pF
 Insulation Resistance : $10G\Omega$ or $500/C\Omega$ whichever is smaller
 Dielectric Strength : 250% Rated Voltage



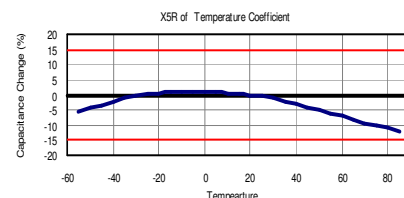
X7R Dielectric Characteristic

Temperature Coefficient : $\pm 15\%$, $-55\sim+125^{\circ}\text{C}$
 Capacitance Range : 180pF to 1.0uF
 Dissipation Factor : See table 1.
 Insulation Resistance : $10G\Omega$ or $500/C\Omega$ whichever is smaller
 Dielectric Strength : 250% Rated Voltage



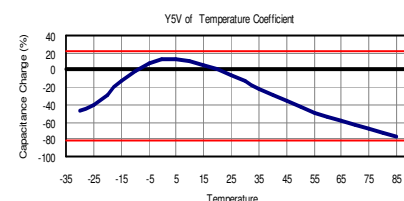
X5R Dielectric Characteristic

Temperature Coefficient : $\pm 15\%$, $-55\sim+85^{\circ}\text{C}$
 Capacitance Range : 100nF to 2.2uF
 Dissipation Factor : See table 1.
 Insulation Resistance : $10G\Omega$ or $500/C\Omega$ whichever is smaller
 Dielectric Strength : 250% Rated Voltage



Y5V Dielectric Characteristic

Temperature Coefficient : $+22/-82\%$, $-30\sim+85^{\circ}\text{C}$
 Capacitance Range : 10nF to 1.0uF
 Dissipation Factor : See table 2.
 Insulation Resistance : $10G\Omega$ or $500/C\Omega$ whichever is smaller
 Dielectric Strength : 250% Rated Voltage



◆ How To Order

CA

4

B

1C

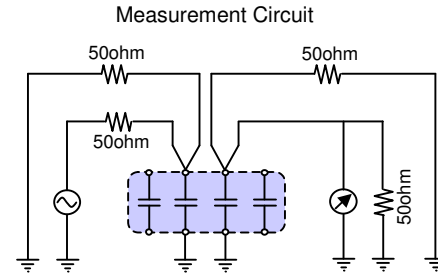
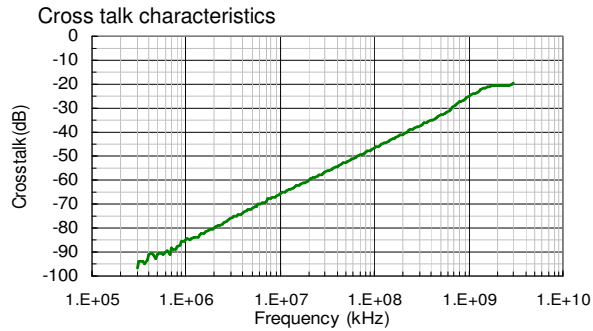
105

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: 10×10 ² 473: 47×10 ³ 104: 10×10 ⁴	Ex.: K : +/- 10% M: +/- 20% Z : +80/-20 %	T: Taping & Reel B: Bulk

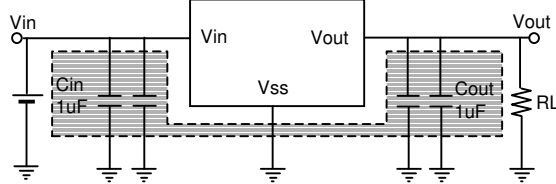
Characteristic



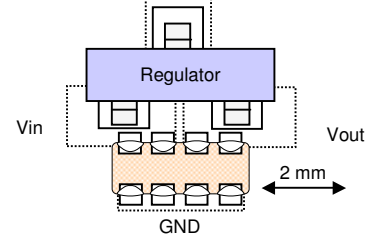
Application

Example Circuit

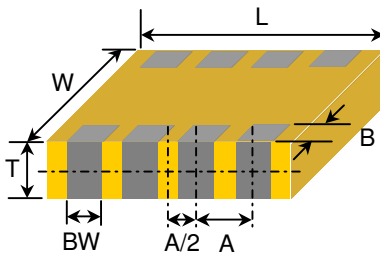
Regulator circuit(Cellular phone, PC card)



Lay out



Dimension



Unit : mm [inches]

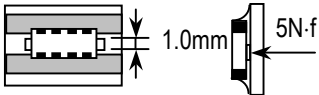
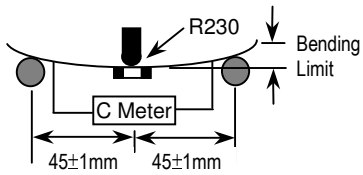
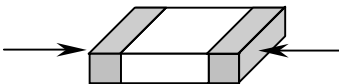
Type	L	W	T (max.)	B (min.)	BW	A
0504	1.37±0.15 [.054±.006]	1.00±0.10 [.039±.004]	0.90 [.035]	0.10 [.004]	0.36± 0.10 [.014±.004]	0.64± 0.10 [.025±.004]
0805	2.00±0.15 [.079±.006]	1.25±0.15 [.049±.006]	0.95 [.037]	0.10 [.004]	0.25± 0.10 [.010±.004]	0.50± 0.10 [.020±.004]
1206	3.20±0.20 [.126±.008]	1.60±0.20 [.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
NPO	0805 4xCap	50V	B				B	B	B	B					B									
	1206 4xCap	50V	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
X7R	0805 4xCap	10V																						
		16V																						
		25V																						
		50V																						
		6.3V																						
	1206 4xCap	16V																						
		25V																						
		50V																						
		10V																						
		16V																						
Y5V	0805 4xCap	16V																						
		10V																						
		16V																						
		25V																						
X5R	0805 4xCap	6.3V																						
		10V																						
		6.3V																						
	0504 2xCap	10V																						
		16V																						
		10V																						

■ 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
Quality Factor	Class I (NPO): More Than 30pF : Q ≥ 1000 30pF & Below: Q ≥ 400+20C (C:Cap., pF)		NPO	1MHz±10%	1.0±0.2Vrms
			X7R/X5R/Y5V	1KHz±10%	1.0±0.2Vrms
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	Class I :	
	NPO(N)	-55℃ ~ +125℃	± 30ppm/℃	[C2-C1/C1(T2-T1)] × 100%	
	X7R (X)	-55℃ ~ +125℃	± 15%	Class II :	
	X5R (B)	-55℃ ~ +85℃	± 15%	(C2-C1)/C1 × 100%	
	Y5V(Y)	-30℃ ~ +85℃	+22/-82%	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.		The board shall be bent 1.0mm with a rate of 1.0 mm/sec.		
	Char.	Capacitance Change			
	NPO(N)	≤ ± 5.0%			
	X7R (X)	≤ ± 12.5%			
	X5R (B)	≤ ± 12.5%			
	Y5V (Y)	≤ ± 30.0%			
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														
	Capacitance	Class I (NPO): Within 2.5% or $\pm 0.25\text{pF}$ whichever is larger of initial value Class II : Char. Cap. change <u>X7R(X)</u> $\leq \pm 7.5\%$ of initial value <u>X5R(B)</u> $\leq \pm 7.5\%$ of initial value <u>Y5V(Y)</u> $\leq \pm 20\%$ of initial value														
	Q / 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 $150 \pm 10^\circ\text{C}$ before initial measure. Preheat : at $150 \pm 10^\circ\text{C}$ for 60~120sec. Dip : solder temperature of $260 \pm 5^\circ\text{C}$ Dip Time : $10 \pm 1\text{sec}$. Immersing Speed : $25 \pm 10\%$ mm/s Solder : H63A Flux : Rosin														
Temperature Cycle	Appearance	No mechanical damage shall occur														
	Capacitance	Class I (NPO): Within 2.5% or $\pm 0.25\text{pF}$ whichever is larger of initial value Class II : Char. Cap. change <u>X7R(X)</u> $\leq \pm 7.5\%$ of initial value <u>X5R(B)</u> $\leq \pm 7.5\%$ of initial value <u>Y5V(Y)</u> $\leq \pm 20\%$ of initial value														
	Q / 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 $150 \pm 10^\circ\text{C}$ before initial measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following: <table border="1"> <thead> <tr> <th>Step</th><th>Temp.($^\circ\text{C}$)</th><th>Time(min)</th></tr> </thead> <tbody> <tr> <td>1</td><td>Min Rated Temp.+0/-3</td><td>30</td></tr> <tr> <td>2</td><td>25</td><td>3</td></tr> <tr> <td>3</td><td>Max Rated Temp.+3/-0</td><td>30</td></tr> <tr> <td>4</td><td>25</td><td>3</td></tr> </tbody> </table>	Step	Temp.($^\circ\text{C}$)	Time(min)	1	Min Rated Temp.+0/-3	30	2	25	3	3	Max Rated Temp.+3/-0	30	4	25
Step	Temp.($^\circ\text{C}$)	Time(min)														
1	Min Rated Temp.+0/-3	30														
2	25	3														
3	Max Rated Temp.+3/-0	30														
4	25	3														
Humidity	Appearance	No mechanical damage shall occur														
	Capacitance	Class I (NPO): Within 5.0% or $\pm 0.5\text{pF}$ whichever is larger of initial value Class II : Char. Cap. change <u>X7R(X)</u> $\leq \pm 12.5\%$ of initial value <u>X5R(B)</u> $\leq \pm 12.5\%$ of initial value <u>Y5V(Y)</u> $\leq \pm 30\%$ of initial value														
	Q	30pF & Over : $Q \geq 350$ 10 to 30pF : $Q \geq 275 + 2.5C$ 30pF & Below: $Q \geq 200 + 10C$														
	Tan δ Class II	Shall meet the value in Table 1, Table 2														
	Insulation Resistance	1,000M Ω or 50/C Ω whichever is smaller for rated voltage $> 10\text{V}$ and greater 10/C Ω for rated voltage $\leq 10\text{V}$. (C in Farad)														
		Class II capacitor shall be set for 48 ± 4 hours at room temperature after one hour heat treatment at $150 \pm 10^\circ\text{C}$ before initial measurement. Temperature : $40 \pm 2^\circ\text{C}$ Relative Humidity : 90 ~95%RH Test Time : $500 \pm 12/0$ hr Measure at room temperature after cooling for Class I : 24 ± 2 Hours Class II : 48 ± 4 Hours														

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 $\pm 3^{\circ}\text{C}$ then shall be set for 48 ± 4 hours at room temperature and the initial measurement shall be conducted. Applied Voltage :Rated Voltage Temperature : $40 \pm 2^{\circ}\text{C}$ 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 $\pm 0.75\text{pF}$ whichever is larger of initial value Class II : <table><tr><td>Char.</td><td>Cap. change</td></tr><tr><td>X7R(X)</td><td>$\leq \pm 12.5\%$ of initial value</td></tr><tr><td>X5R(B)</td><td>$\leq \pm 12.5\%$ of initial value</td></tr><tr><td>Y5V(Y)</td><td>$\leq \pm 30\%$ of initial value</td></tr></table>		Char.	Cap. change	X7R(X)	$\leq \pm 12.5\%$ of initial value	X5R(B)	$\leq \pm 12.5\%$ of initial value	Y5V(Y)	$\leq \pm 30\%$ of initial value
	Char.	Cap. change									
	X7R(X)	$\leq \pm 12.5\%$ of initial value									
	X5R(B)	$\leq \pm 12.5\%$ of initial value									
	Y5V(Y)	$\leq \pm 30\%$ of initial value									
	Q	30pF & Over : $Q \geq 350$									
Class I	10 to 30pF : $Q \geq 275+2.5C$ 30pF & Below: $Q \geq 200+10C$										
Tan δ	Shall meet the value in Table 1, Table 2										
Insulation Resistance	500M Ω or 25/C Ω whichever is smaller for rated voltage>10V and greater 5/C Ω for rated voltage $\leq 10\text{V}$. (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 $\pm 3^{\circ}\text{C}$ 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 $\pm 0.5\text{pF}$ whichever is larger of initial value Class II : <table><tr><td>Char.</td><td>Cap. change</td></tr><tr><td>X7R(X)</td><td>$\leq \pm 12.5\%$ of initial value</td></tr><tr><td>X5R(B)</td><td>$\leq \pm 12.5\%$ of initial value</td></tr><tr><td>Y5V(Y)</td><td>$\leq \pm 30\%$ of initial value</td></tr></table>		Char.	Cap. change	X7R(X)	$\leq \pm 12.5\%$ of initial value	X5R(B)	$\leq \pm 12.5\%$ of initial value	Y5V(Y)	$\leq \pm 30\%$ of initial value
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	Q	30pF & Over : $Q \geq 350$									
Class I	10 to 30pF : $Q \geq 275+2.5C$ 30pF & Below: $Q \geq 200+10C$										
Tan δ	Shall meet the value in Table 1, Table 2										
Insulation Resistance	1,000M Ω or 50/C Ω whichever is smaller for rated voltage>10V and greater 10/C Ω for rated voltage $\leq 10\text{V}$. (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.

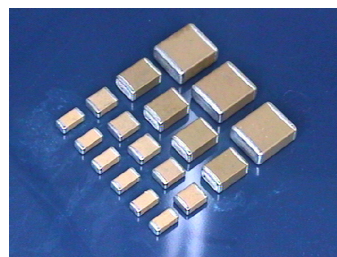
Size	Rated voltage	Capacitance Range	tan δ (D.F.)	
			Initial Vibration Resistance to solder heat Temperature cycle	Humidity Humidity loading High temperature loading
0504	DC 6.3V	All Capacitance	15.0 %	25.0 %
	DC 10V		15.0 %	25.0 %
	DC 16V		15.0 %	25.0 %
0805	DC 10V	All Capacitance	7.5 %	12.5 %
	DC 16V		3.5 %	7.5 %
	DC 25V		3.5 %	7.5 %
	DC 50V		2.5 %	5.0 %
1206	DC 6.3V	C=1 uf	7.5 %	12.5 %
	DC 16V	C<1 uf	3.5 %	7.5 %
	DC 25V	C<1 uf	3.5 %	7.5 %
	DC 50V	C<1 uf	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<1 uf	10.0 %	15.0 %
1206	DC 10V	C=1 uf	12.5 %	20.0 %
	DC 16V	C<1 uf	10.0 %	15.0 %
	DC 25V	C<1 uf	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

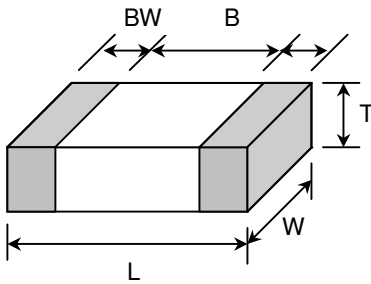
◆ Summary of Specification

Operation temperature	X7R : -55~+125 °C , Y5U : -30~+85 °C
Rated Voltage	250Vdc
Temperature Coefficient	Y5U : ≤ +22 /-56 % , -30~+85 °C (EIA Class II) X7R : ≤ ± 15% , -55~+125 °C (EIA Class II)
Capacitance Range	Y5U : 10nF ~ 1.0uF 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 : 2.0×1.25 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	Ex.: X : X7R E : Y5U	Ex.: 103:10×10 ³ 474:47×10 ⁴	Ex.: K: +/- 10% M: +/- 20%	Ex.: 251:250Vdc	T: Taping & Reel B: Bulk

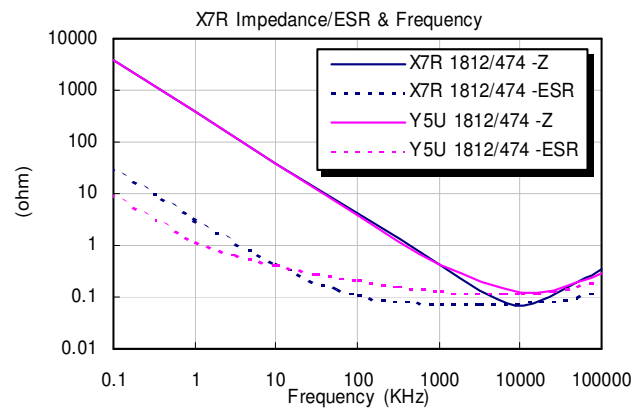
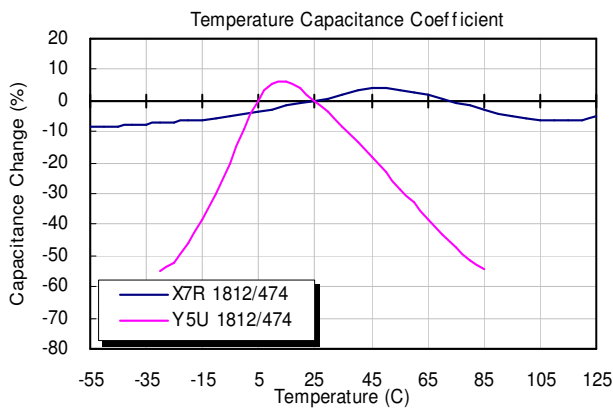
Dimension



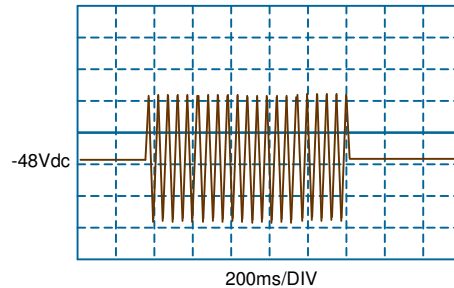
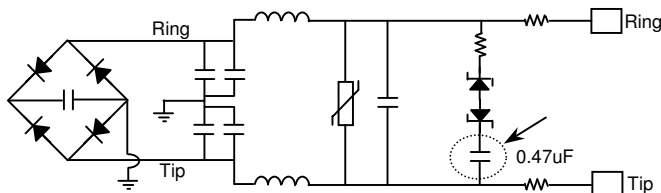
Unit : mm [inches]

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

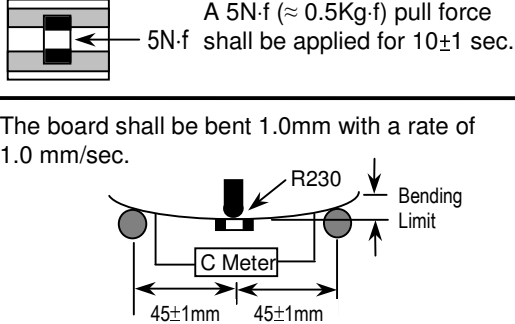


Capacitance Range

Dielectric Characteristic	Size	Voltage	Capacitance Range																	
			181	221	271	331	471	681	102	152	182	222	332	472	562	682	103	153	223	273
X7R	0805	250V																		
	1206	250V																		
	1210	250V																		
	1812	250V																		
	2220	250V																		
Y5U	1812	250V																		

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

SAC Series Specification & Test Condition

Item	Specification		Test Condition
Operation Temperature	Char. X7R(X) Y5U(E)	Operation Temp. -55°C ~ +125°C -30°C ~ +85°C	
Visual	No Abnormal Exterior Appearance		Visual Inspection
Capacitance	Within The Specified Tolerance		Frequency Voltage
Dissipation Factor	Char. X7R(X) Y5U(E)	D.F. (max.) 2.5% 4.0%	1KHz $\pm 10\%$ 1.0 ± 0.2 Vrms Perform a heat treatment at 150 $\pm 5^\circ\text{C}$ for 30min. then place room temp. for 24 ± 2 hr.
Insulation Resistance	10,000M Ω 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. X7R(X) Y5U(E)	Temp. Range -55°C ~ +125°C -30°C ~ +85°C	Cap. Change $\pm 15\%$ +22/-56%
Adhesive Strength of Termination	No indication of peeling shall occur on the terminal electrode.		(C2-C1)/C1 $\times 100\%$ C1:Capacitance at Standard Temperature(25°C) C2:Capacitance a Test Temperature
Resistance to Flexure of Substrate	No mechanical damage or change capacitance more than the following table.		The board shall be bent 1.0mm with a rate of 1.0 mm/sec.
	Char. X7R(X) Y5U(E)	Capacitance Change $\leq \pm 12.5\%$ of initial value $\leq \pm 30.0\%$ of initial value	
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 $\pm 5^\circ\text{C}$ Dip Time : 5 ± 0.5 sec. Immersing Speed : 25 $\pm 10\%$ mm/s Solder : H63A Flux : Rosin Preheat : At 80~120 $^\circ\text{C}$ For 10~30sec.
Resistance to Soldering Heat	Appearance	No mechanical damage shall occur	Capacitor shall be set for 48 ± 4 hours at room temperature after one hour heat treatment at 150 $\pm 0/-10^\circ\text{C}$ before initial measurement.
	Capacitance	Char. Cap. change X7R(X) $\leq \pm 7.5\%$ of initial value Y5U(E) $\leq \pm 20\%$ of initial value	Preheat : at 150 $\pm 10^\circ\text{C}$ for 60~120sec. Dip : solder temperature of 260 $\pm 5^\circ\text{C}$ Dip Time : 10 ± 1 sec. Immersing Speed : 25 $\pm 10\%$ mm/s Solder : H63A Flux : Rosin
	Tan δ	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	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 °C before initial measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following: <table><tr><td>Step</td><td>Temp.(°C)</td><td>Time(min)</td></tr><tr><td>1</td><td>Min Rated Temp.+0/-3</td><td>30</td></tr><tr><td>2</td><td>25</td><td>3</td></tr><tr><td>3</td><td>Max Rated Temp.+3/-0</td><td>30</td></tr><tr><td>4</td><td>25</td><td>3</td></tr></table> Measure at room temperature after cooling for 48 ± 4 Hours	Step	Temp.(°C)	Time(min)	1	Min Rated Temp.+0/-3	30	2	25	3	3	Max Rated Temp.+3/-0	30	4	25	3
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Tanδ	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 °C before initial measurement. Temperature : 40±2 °C Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0 hr Measure at room temperature after cooling for 48 ± 4 Hours															
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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 150% the rated voltage is applied for one hour at maximum operation temperature ±3°C then shall be set for 48±4 hours at room temperature and the initial measurement shall be conducted. Applied Voltage :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															
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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																
	Tanδ	To satisfy the specified initial value																

Multilayer Ceramic Chip Capacitors [Leaded Configuration MLCC]

LMC Series



Excellent Reliability due to leaded configuration

◆ Features

- ❑ High reliability: leaded package improves flexure strength characteristics
- ❑ Surface mount suited for reflow soldering
- ❑ Available with proprietary coating to prevent arcing and pass Hi-Pot test
- ❑ High temperature stability & low $\tan \delta$
- ❑ RoHS compliant

◆ Application

- ❑ Suitable for back-lighting inverter circuits, DC-DC converters, modems, and switching power supply snubber circuits
- ❑ Suitable for telecommunication devices in LAN interface

◆ Summary of Specification

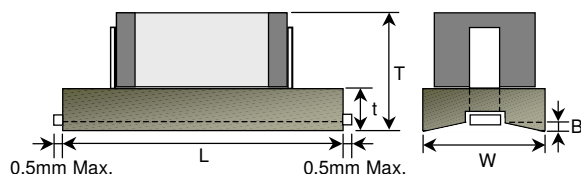
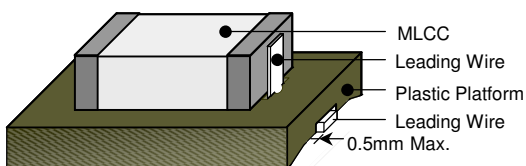
Operation Temperature	-55~+125 °C
Rated Voltage	2KVdc to 6KV
Temperature Coefficient	NPO : ± 30 ppm/ °C , -55~+125 °C (EIA Class I)
	SL : $\pm 350/-1000$ ppm/ °C , -25~+85 °C (EIA Class I)
	X7R : $\pm 15\%$, -55~+125 °C (EIA Class II)
Capacitance Range	NPO :2pF to 1.2nF ; SL :220pF to 1000pF ; X7R :150pF to 2.2nF
Dissipation Factor :	NPO/SL : $Q \geq 1000$; X7R : D.F. $\leq 2.5\%$
Insulation Resistance	10G Ω or 500/C Ω whichever is smaller
Aging	NPO:0%
	SL: 2.5 % per decade of time
	X7R: 1.5 % per decade of time
Dielectric Strength	120% Rated Voltage

◆ How To Order

LMC	C	N	150	J	602	T	L	--
Product Code	Case Size	Dielectric	Capacitance Unit : pF	Tolerance	Rated Voltage	Packaging	Lead Configuration	Optional Suffix
LMC: Leaded MLCC	Ex.: A : 5.8×2.25mm C: 7.1×2.65mm	Ex.: N: NPO L: SL X: X7R	Ex.: 2R0:2pF 100:10×10 ⁰ 151:15×10 ¹	Ex.: C: +/- 0.25pF D: +/- 0.5pF H: +/- 3% J: +/- 5% K: +/- 10% M: +/- 20%	Ex.: 202:2000Vdc 302:3000Vdc 402:4000Vdc 502:5000Vdc 602:6000Vdc	Ex.: T: Tape Reel B: Bulk	Ex.: L: L Lead	Ex.: O: Arc Prevention Coating

Dimension

L Type (Leading Style)

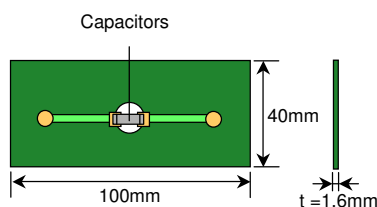


Unit : mm [inches]

Platform Type	L	W	T (max)	B(max.)	t
A	5.80±0.30 [.228±.012]	2.25±0.20 [.089±.008]	3.15 [.124]	0.35 [.059]	1.30±0.20 [.051±.008]
C	7.10±0.30 [.280±.012]	2.65±0.20 [.104±.008]	3.55 [.140]	0.35 [.098]	1.30±0.20 [.051±.008]

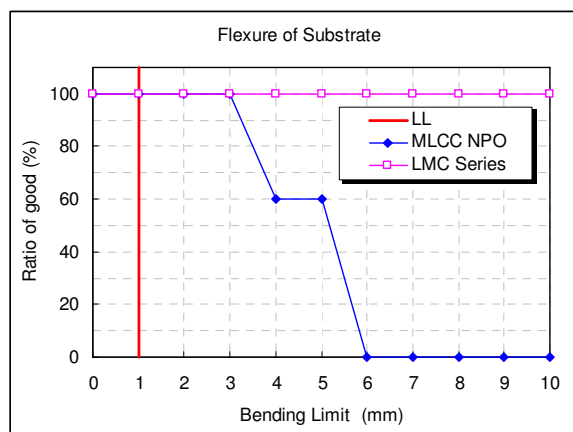
Performance

Bending Test



Refer to: JIS C 5102 & EIA 198

1808/NPOv.s. LMC Series



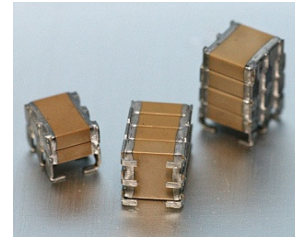
Capacitance Range

Temperature Characteristic	Platform & Lead Shape	Rated Voltage	Capacitance Range (pF)																	
			2F0	3F3	3F9	5F0	8F2	100	120	150	180	220	270	330	390	470	560	680	820	101
NPO	AL	2KV																		
		3KV																		
	CL	2KV																		
		3KV																		
		5KV																		
		6KV																		
SL	AL	2KV																		
	CL	3KV																		
Temperature Characteristic	Platform & Lead Shape	Rated Voltage	Capacitance Range (pF)																	
			151	181	221	271	331	391	471	561	681	821	102	122	152	182	222	272	332	392
X7R	AL	2KV																		
		2KV																		
	CL	3KV																		
		4KV																		

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

Multilayer Ceramic Chip Capacitors [Stacked Capacitors]

SMC Series



MLCC Design, Suitable for Switchmode Power Supply Filters

◆ Features

- ☐ Stacked design offers very high capacitance ranges combined with extremely low ESR.
- ☐ 'J', 'L' and 'N' lead configurations provides mechanical and thermal stress relief
- ☐ High capacitance range from 0.047uF to 27uF
- ☐ Voltages from 25V to 500V
- ☐ Available in NPO and X7R dielectrics
- ☐ Hi-Reliability testing available upon request
- ☐ RoHS compliant

◆ Application

- ☐ power supply
- ☐ DC-DC converters
- ☐ Surge protection
- ☐ Industrial control circuits
- ☐ snubber circuits
- ☐ Custom applications
- ☐ Hi-Reliability Application
- ☐ Filtering, Smoothing and decoupling applications

◆ Summary of Specification

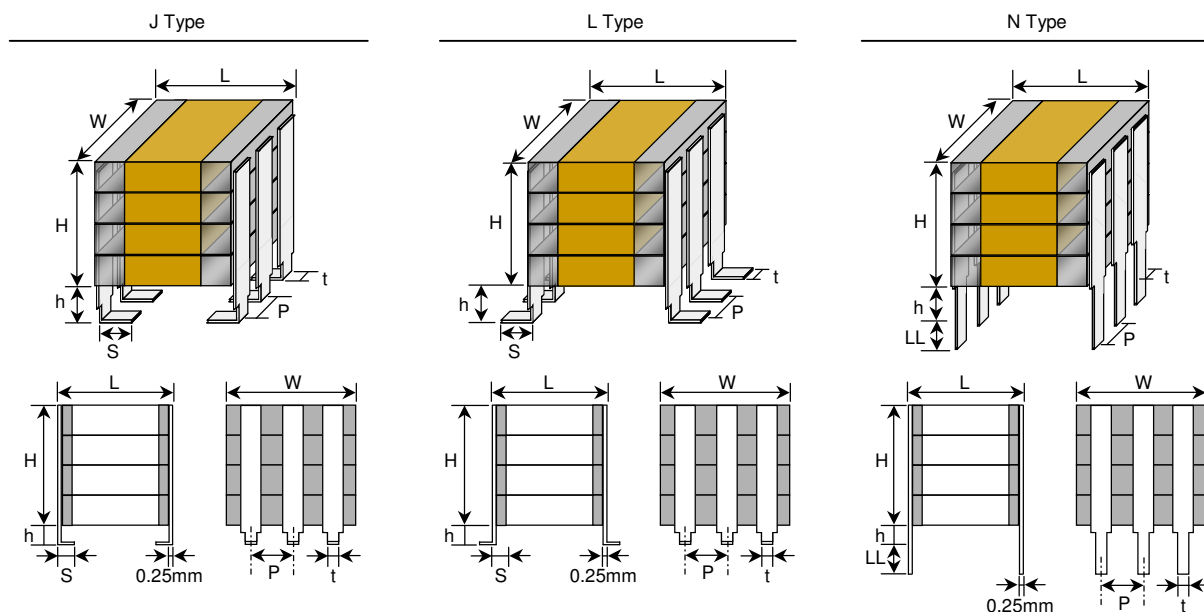
Operating Temperature	-55 to +125 °C
Rated Voltage	25Vdc to 500Vdc
Temperature Coefficient of Capacitance	NPO : $\pm 30\text{ppm}/^\circ\text{C}$, -55 to +125 °C (EIA Class I)
	X7R : $\pm 15\%$, -55 to +125 °C (EIA Class II)
Capacitance Range	NPO: 47nF to 560nF
	X7R : 470nF to 27.2uF
Dissipation Factor :	Please see HEC specification data sheet
Insulation Resistance	10G Ω or 500/C Ω whichever is smaller
Aging	NPO:0% ; X7R: 2.5 % per decade of time
Dielectric Withstanding Voltage	V $\leq$ 50V ; 250% Rated Voltage
	100V $\leq$ V < 500V ; 200% Rated Voltage
	500V $\leq$ V < 1KV ; 150% Rated Voltage
Tolerance	$\pm 1\%$ & $\pm 2\%$ tolerances are only available in NPO

◆ How To Order

SMC	49	J	X	224	K	501	T	N	--
-----	----	---	---	-----	---	-----	---	---	----

Product Code	Stack and Size	Lead Configuration	Tolerance	Capacitance (pF)	Tolerance	Rated Voltage	Packaging	Marking	Special Requirement
SMC: Commercial Size Switchmode Stack Capacitor	The first digit: # of chips in stack Second Digit: Chip Size 8: 1825 9: 2225	Ex.: J :J Lead L :L Lead N: Straight Lead	Ex.: N: NPO X: X7R	Ex.: 103:10x10 ³ 224:22x10 ⁴ 475:47x10 ⁵	Ex.: F: +/-1.0% G: +/-2.0% J: +/-5.0% K: +/- 10% M: +/- 20%	Ex.: 025: 25Vdc 050: 50Vdc 101: 100Vdc 201: 200Vdc 501: 500Vdc	B: Bulk T: Tape&Reel W: Waffle pack	Ex.: N: No Marking S: Special Marking M: Marked (cap & Tolerance)	Blank: Standard electrical test H: Hi-Reliability Testing

◆ Dimensions



Unit : mm [inches]

EIA Size Code	1825				2225			
Size Code	18	28	38	48	19	29	39	49
L	5.35±0.50 [.210±.020]	5.35±0.50 [.210±.020]	5.35±0.50 [.210±.020]	5.35±0.50 [.210±.020]	6.35±0.50 [.250±.020]	6.35±0.50 [.250±.020]	6.35±0.50 [.250±.020]	6.35±0.50 [.250±.020]
W (max.)	6.85 [.270]	6.85 [.270]	6.85 [.270]	6.85 [.270]	6.85 [.270]	6.85 [.270]	6.85 [.270]	6.85 [.270]
H(max.)	2.54 [.100]	5.08 [.200]	7.62 [.300]	10.16 [.400]	2.54 [.100]	5.08 [.200]	7.62 [.300]	10.16 [.400]
S	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]	1.65±0.50 [.065±.020]
P	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]	2.54±0.25 [.100±.010]
h (Typical)	1.78 [.070]	1.78 [.070]	1.78 [.070]	1.78 [.070]	1.78 [.070]	1.78 [.070]	1.78 [.070]	1.78 [.070]
LL (min.)	2.54 [.100]	2.54 [.100]	2.54 [.100]	2.54 [.100]	2.54 [.100]	2.54 [.100]	2.54 [.100]	2.54 [.100]
t	0.50±0.05 [.020±.002]	0.50±0.05 [.020±.002]	0.50±0.05 [.020±.002]	0.50±0.05 [.020±.002]	0.50±0.05 [.020±.002]	0.50±0.05 [.020±.002]	0.50±0.05 [.020±.002]	0.50±0.05 [.020±.002]
# of leads per side	3	3	3	3	3	3	3	3

- 'h' varies and dependent on the lead style. See lead configuration below
- "LL" applies only to straight (N) leads

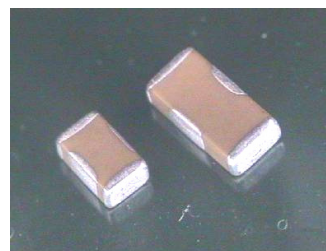
◆ Capacitance Range

EIA Chip Size	Size Code	NPO Maximum Capacitance (uF)						X7R Maximum Capacitance (uF)					
		25V	50V	100V	200V	250V	500V	25V	50V	100V	200V	250V	500V
1825	18 (1×Cap)	0.12	0.10	0.10	0.082	0.082	0.047	5.7	5.7	4.7	1.8	1.8	0.47
	28 (2×Cap)	0.22	0.22	0.22	0.15	0.15	0.10	11.4	11.4	9.4	3.6	3.6	0.94
	38 (3×Cap)	0.36	0.30	0.30	0.27	0.27	0.15	17.1	17.1	14.1	5.4	5.4	1.41
	48 (4×Cap)	0.47	0.39	0.39	0.33	0.33	0.18	22.8	22.8	18.8	7.2	7.2	1.88
2225	19 (1×Cap)	0.15	0.12	0.12	0.10	0.10	0.06	6.8	6.8	5.6	2.2	2.2	0.56
	29 (2×Cap)	0.30	0.22	0.22	0.22	0.22	0.12	13.6	13.6	11.2	4.4	4.4	1.12
	39 (3×Cap)	0.47	0.36	0.36	0.30	0.30	0.18	20.4	20.4	16.8	6.6	6.6	1.68
	49 (4×Cap)	0.56	0.47	0.47	0.39	0.39	0.22	27.2	27.2	22.4	8.8	8.8	2.24

- Other Stacked configuration on other sizes, capacitance values and voltages rating are available. Please contact HEC.

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.

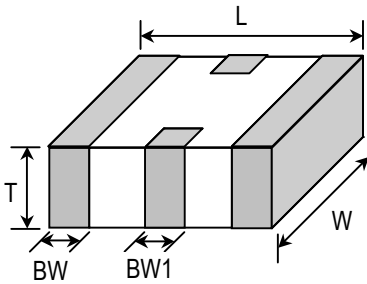
◆ Summary of Specification

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 : 2.0×1.25 mm 1206 : 3.2×1.6 mm	Ex.: N: NPO X: X7R	Ex.: 100:10×10 ⁰ 471:47×10 ¹ 182:18×10 ²	Ex.: M:±/-20%	Ex.: 050: 50VDC	T: Taping &Reel B: Bulk	Ex.: 10: 1A 20: 2A

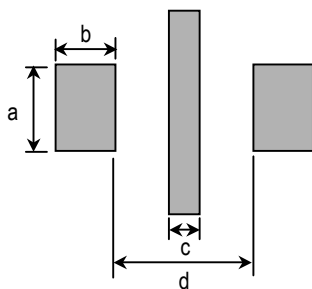
◆ Dimension



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]	1.00 [.039]	0.20 [.008]	0.95±0.3 [.037 ±.012]

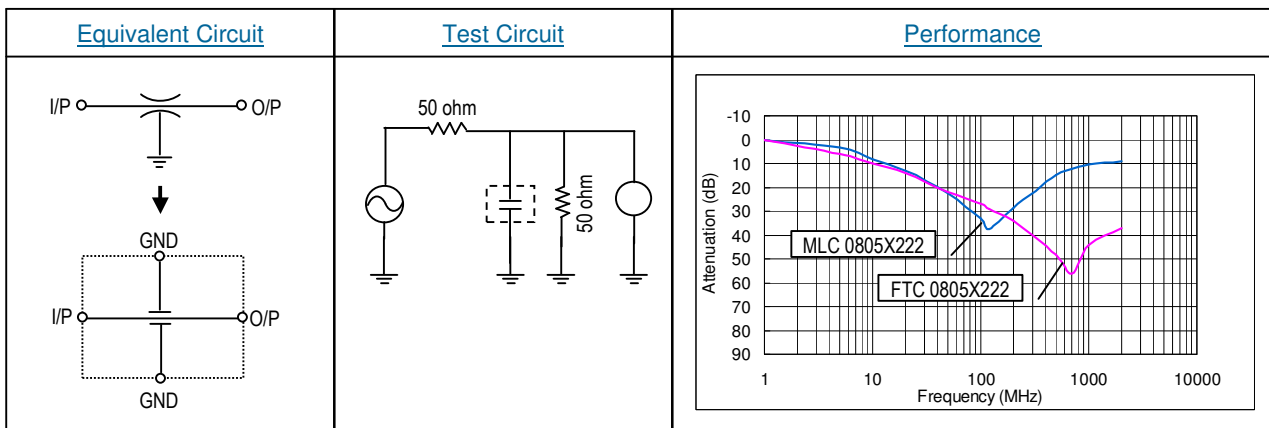
◆ Recommend Solder Lands



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

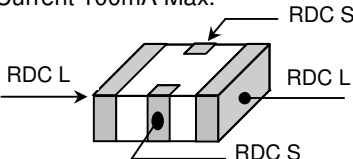
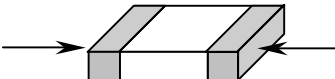


◆ Capacitance Range

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
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
	1206	50V	2A													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

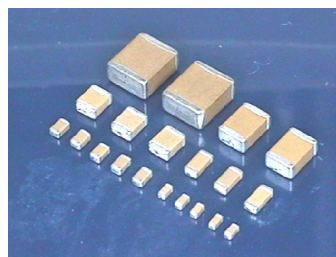
Item	Specification	Test Condition
Operation Temperature	-55 to +125°C	
Visual	No abnormal exterior appearance	Visual Inspection
Capacitance	Within The Specified Tolerance	Class Frequency Voltage
Quality Factor	Class I (NPO): More Than 30pF : $Q \geq 1000$ 30pF & Below: $Q \geq 400+20C$ (C:Cap., pF)	Class I (NPO) 1MHz $\pm 10\%$ 1.0 ± 0.2 Vrms
		Class II (X7R) 1KHz $\pm 10\%$
Dissipation Factor	Class II (X7R): Maximum 0.025	Perform a heat treatment at 150 $\pm 5^\circ\text{C}$ for 30min. then place room temp. for 24 ± 2 hr.
Insulation Resistance	1,000M Ω 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 $\geq$ 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	Class I :
	NPO(N) -55°C ~ +125°C $\pm 30\text{ppm}/^\circ\text{C}$	$[C2-C1/C1(T2-T1)] \times 100\%$
	X7R (X) -55°C ~ +125°C $\pm 15\%$	Class II :
		$(C2-C1)/C1 \times 100\%$
		T1:Standard Temperature(25°C)
		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 $\pm 5^\circ\text{C}$ Dip Time : 5 $\pm$ 0.5 sec. Immersing Speed : 25 $\pm 10\%$ mm/s Solder : H63A Flux : Rosin Preheat : At 80~120 °C 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 °C before initial measurement.															
	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		Capacitor shall be subjected to five cycles of the temperature cycle as following:														
	Q / Tanδ	To satisfy the specified initial value	<table><tr><th>Step</th><th>Temp.(°C)</th><th>Time(min)</th></tr><tr><td>1</td><td>Min Rated Temp.+0/-3 (-55)</td><td>30</td></tr><tr><td>2</td><td>25</td><td>3</td></tr><tr><td>3</td><td>Max Rated Temp.+3/-0 (125)</td><td>30</td></tr><tr><td>4</td><td>25</td><td>3</td></tr></table>		Step	Temp.(°C)	Time(min)	1	Min Rated Temp.+0/-3 (-55)	30	2	25	3	3	Max Rated Temp.+3/-0 (125)	30	4	25
	Step	Temp.(°C)	Time(min)															
	1	Min Rated Temp.+0/-3 (-55)	30															
	2	25	3															
	3	Max Rated Temp.+3/-0 (125)	30															
4	25	3																
Insulation Resistance	500MΩ or 50/C Ω whichever is smaller. (C in Farad)	Measure at room temperature after cooling for Class I : 24 ± 2 Hours Class II : 48 ± 4 Hours																
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 °C before initial measurement.															
	Capacitance	Class I (NPO): Within 5% or ± 0.5pF whichever is larger of initial value Class II (X7R): Within ±10% of initial value		Temperature : 40 ± 2 °C Relative Humidity : 90 ~95%RH Test Time : 500 +12/-0 hr														
	Q / Tanδ	Class I (NPO): More Than 30pF : Q ≥350 30pF & Below: Q ≥275+2.5C Class II (X7R): Maximum ± 5.0%	Measure at room temperature after cooling for Class I : 24 ± 2 Hours Class II : 48 ± 4 Hours															
	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°C then shall be set for 48±4 hours at room temperature and the initial measurement shall be conducted.														
		Capacitance	Class I (NPO): Within 5% or ±0.5pF whichever is larger of initial value Class II (X7R): Within ±15% of initial value		Applied Voltage :200% of rated voltage Applied Current : rated current Temperature : max. operating temperature Test Time : 1000 +12/-0Hr Current Applied : 50 mA Max.													
Q / Tanδ		Class I (NPO): More Than 30pF : Q ≥350 30pF & Below: Q ≥275+2.5C Class II (X7R): Maximum ±5%	Measure at room temperature after cooling for Class I : 24 ± 2 Hours Class II : 48 ± 4 Hours															
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 – up to 200°C]

HTC Series



◆ Features

- ☐ Rated working voltage of 25 to 50Vdc
- ☐ High operation temperature up to 200 °C
- ☐ 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 °C
Rated Voltage	25V and 50Vdc
Temperature Coefficient	Cap drop $\leq +4.7\% \sim -65\%$ at -55~+200 °C
Capacitance Range	1nF ~ 270nF
Dissipation Factor :	2.0% max. at 1KHz 25°C
Insulation Resistance	10G Ω or 500/C Ω whichever is smaller $\geq 1G \Omega$ or 10/C Ω at 200 °C Which is smaller
Dielectric Strength	250% Rated Voltage for 5 second @ 50mA max. current
Capacitance Tolerance	$\pm 10\%$, $\pm 20\%$
Aging	1.0% per decade hr , Typical

◆ How To Order

HTC

1812

X

104

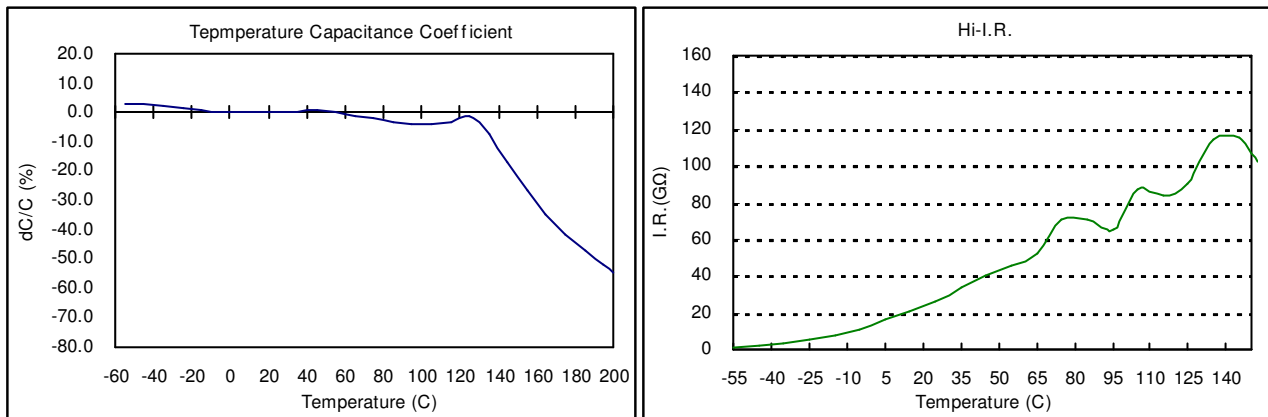
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050

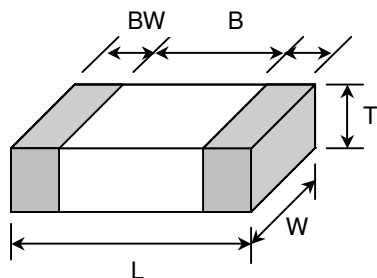
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Product Code	Chip Size	Dielectric	Capacitance Unit : pF	Tolerance	Rated Voltage	Packaging
HTC: High Temperature Capacitor	Ex.: 0603: 1.6×0.80 mm 0805 : 2.0×1.25 mm 1206: 3.2×1.60 mm 1210 : 3.2×2.50 mm 1812 : 4.6×3.20 mm 2220 : 5.7×5.00 mm	X: X7R	Ex.: 102:10×10 ² 224:22×10 ⁴	Ex.: K: +/- 10% M: +/- 20%	Ex.: 025:25Vdc 050:50Vdc	T: Taping & Reel B: Bulk

◆ Characteristic



◆ Dimension



Unit : mm [inches]

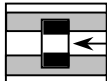
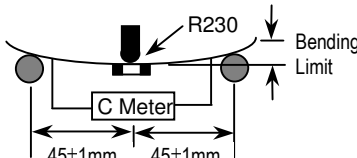
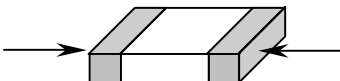
TYPE	L	W	T (max)	B (min)	BW (min)
0603	1.60±0.1 [.063±.004]	0.80±0.1 [.031±.004]	0.90 [.035]	0.40 [.016]	0.15 [.006]
0805	2.00±0.2 [.079±.012]	1.25±0.2 [.049±.008]	1.45 [.057]	0.70 [.028]	0.20 [.008]
1206	3.20±0.3 [.126±.012]	1.60±0.2 [.126±.012]	1.80 [.071]	1.50 [.059]	0.30 [.012]
1210	3.20±0.3 [.126±.012]	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
X7R	0603	50V	B	B	B	B	B	B	B	B	B	B	B	B	B											
	0805	50V																								
	1206	25V																								
		50V																								
	1210	50V																								
	1812	50V																								
	2220	50V																								
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	Voltage
Dissipation Factor	Rated Voltage	50V	25V	1KHz ±10%	1.0±0.2Vrms
	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		(C2-C1)/C1 × 100% C1:Capacitance at Standard Temperature(25℃) C2:Capacitance at Test Temperature	
	-55℃~ +125℃	≤ ± 15%			
	-55℃~ +200℃	≤ ± 60%			
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 °C For 10~30sec.	
Resistance To Soldering Heat	Appearance	No mechanical damage shall occur		Preheat : at 150±10℃ for 60~120sec.	
	Capacitance	Cap. change within ±7.5% of initial value		Dip : solder temperature of 260±5℃ Dip Time : 10 ± 1sec.	
	Tanδ(D.F.)	To satisfy the specified initial value		Immersing Speed : 25±10% mm/s Solder : H63A	
	Insulation Resistance	To satisfy the specified initial value		Flux :Rosin Measure at room temperature after cooling for 48 ± 4 Hours	
	Dielectric Strength	To satisfy the specified initial value			

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 °C before initial measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following: <table><tr><th>Step</th><th>Temp.(°C)</th><th>Time(min)</th></tr><tr><td>1</td><td>Min Rated Temp.(-55)+0/-3</td><td>30</td></tr><tr><td>2</td><td>25</td><td>3</td></tr><tr><td>3</td><td>Max Rated Temp.(+125)+3/-0</td><td>30</td></tr><tr><td>4</td><td>25</td><td>3</td></tr></table> Measure at room temperature after cooling for 48 ±4 Hours	Step	Temp.(°C)	Time(min)	1	Min Rated Temp.(-55)+0/-3	30	2	25	3	3	Max Rated Temp.(+125)+3/-0	30	4	25	3
	Step	Temp.(°C)		Time(min)														
	1	Min Rated Temp.(-55)+0/-3		30														
	2	25		3														
	3	Max Rated Temp.(+125)+3/-0		30														
4	25	3																
Capacitance	Cap. change within ±7.5% of initial value																	
Tanδ(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 °C before initial measure. Temperature : 40± 2 °C 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																
	Tanδ(D.F.)	<table><tr><td>50V</td><td>25V</td></tr><tr><td>max. 3.5%</td><td>max. 5.0%</td></tr></table>		50V	25V	max. 3.5%	max. 5.0%											
	50V	25V																
	max. 3.5%	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°C 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°C 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																
	Tanδ(D.F.)	<table><tr><td>50V</td><td>25V</td></tr><tr><td>max. 3.5%</td><td>max. 5.0%</td></tr></table>		50V	25V	max. 3.5%	max. 5.0%											
	50V	25V																
	max. 3.5%	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°C 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°C 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																
	Tanδ(D.F.)	<table><tr><td>50V</td><td>25V</td></tr><tr><td>max. 3.5%</td><td>max. 5.0%</td></tr></table>		50V	25V	max. 3.5%	max. 5.0%											
	50V	25V																
	max. 3.5%	max. 5.0%																
Insulation Resistance	1,000MΩ or 50/C Ω whichever is smaller. (C in Farad)																	

Multilayer Ceramic Chip Capacitors [Large Size Ceramic Chip Capacitor] LCC Series – NPO,X7R (50V-8KV)



◆ Features

- ☐ Optimized internal designs offer the highest voltage rating (up to 8KVdc)
- ☐ Capacitance range from 470 pF to 33 uF & Sizes from 1515 to 7565
- ☐ Available with proprietary surface coating for arc prevention
- ☐ Available with flexible termination (Superterm) to minimize effects of mechanical stress
- ☐ High reliability screening is available
- ☐ Pd/Ag, 100% Sn and optional 90/10 Sn/Pb termination
- ☐ RoHS compliant

◆ Applications.

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

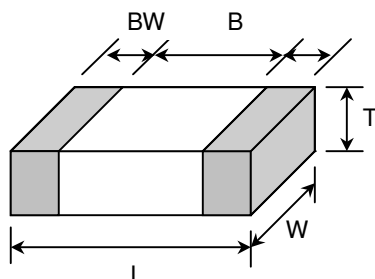
◆ Summary of Specification

Operation Temperature	-55~+125 °C
Rated Voltage	50Vdc to 8KVdc
Temperature Coefficient	NPO : $\leq \pm 30\text{ppm}/^\circ\text{C}$, -55~+125 °C (EIA Class I)
	X7R : $\leq \pm 15\%$, -55~+125 °C (EIA Class II)
Capacitance Range	NPO :470pF to 820nF ; X7R :1000pF to 33uF
Dissipation Factor :	NPO : $Q \geq 1000$; X7R : D.F. $\leq 2.5\%$
Insulation Resistance	10G Ω or 500/C Ω whichever is smaller
Aging	NPO:0% ; X7R: 2.5 % per decade of time
Dielectric Strength	$V \leq 500V$: 200% Rated Voltage
	$500V \leq V < 1000V$: 150% Rated Voltage
	$V \geq 1000V$: 120% Rated Voltage

◆ How To Order

C	2520	X	103	K	102	T	N	S	--
Product Code	Chip Size	Dielectric	Capacitance Unit : pF	Tolerance	Rated Voltage	Packaging	Termination	Testing Requirement	Special Requirement
C: MLCC (Multilayer Ceramic Chip of Capacitor)	EX.: 1515 : 3.80×3.80mm 2520 : 6.35×5.00mm 3530 : 8.90×7.60mm 3640 : 9.20×10.2mm 4540 : 11.5×10.2mm 5550: 14.0×12.7mm 6560 : 16.5×15.3mm 7565: 19.0×16.5mm	Ex.: N: NPO X: X7R	Ex.: 100:10×10 ⁰ 471:47×10 ¹ 102:10×10 ²	Ex.: C:±/-0.25pF D:±/-0.50pF J :±/- 5% K :±/-10% M:±/-20%	Ex.: 050:50Vdc 251:250Vdc 631:630Vdc 102:1000Vdc	Ex.: T: Taping & Reel W: Waffle Pack B: Bulk	Ex.: P: Pd/Ag N: 100% Sn Plated W: 90/10 Sn/Pb Plated S: Solderable Ag B: Bulk	Ex.: S: Standard Electrical H: Hi-Reliability Testing	Ex.: Blank: Standard O: Arc Prevention Coating X: Cushion Termination (Super Term)

◆ Dimension



Unit : mm [inches]

TYPE	L	W	T (max)	B (min)	BW (min)
1515	3.80±0.50 [.15±.020]	3.80±0.50 [.15±.020]	3.80 [.150]	1.60 [.059]	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]
2520	6.35±0.50 [.25±.020]	5.00±0.50 [.20±.020]	3.80 [.150]	3.50 [.137]	0.30 [.012]
3530	8.90±0.50 [.35±.020]	7.60±0.50 [.30±.020]	5.00 [.200]	4.00 [.157]	0.30 [.012]
3640	9.20±0.50 [.36±.020]	10.2±0.50 [.40±.020]	5.00 [.200]	4.00 [.157]	0.30 [.012]
4540	11.5±0.50 [.45±.020]	10.2±0.50 [.40±.020]	5.00 [.200]	4.00 [.157]	0.30 [.012]
5550	14.0±0.50 [.55±.020]	12.7±0.50 [.50±.020]	5.00 [.200]	4.00 [.157]	0.30 [.012]
6560	16.5±0.50 [.65±.020]	15.3±0.50 [.60±.020]	5.00 [.200]	4.50 [.177]	0.30 [.012]
7565	19.0±0.50 [.750±.020]	16.5±0.50 [.65±.020]	5.00 [.200]	4.50 [.177]	0.30 [.012]

◆ Capacitance Range

Size	Dielectric	Capacitance (pF) maximum									
		50V	100V	200V	500V	1KV	2KV	3KV	4KV	5KV	8KV
1515	NPO	473	393	363	103	222	821	--	--	--	--
	X7R	225	105	474	224	104	103	--	--	--	--
1825	NPO	563	473	393	363	103	682	222	--	--	--
	X7R	--	--	--	224	104	223	682	--	--	--
2220	NPO	823	683	563	473	183	822	392	152	471	--
	X7R	--	--	--	474	224	153	103	472	182	--
2225	NPO	104	823	683	563	223	103	682	222	561	--
	X7R	--	--	--	474	224	183	153	562	222	--
2520	NPO	823	683	563	473	183	822	392	152	471	--
	X7R	475	225	474	224	473	153	562	222	102	--
3530	NPO	224	184	104	823	473	103	472	332	102	471
	X7R	106	475	225	474	224	473	153	562	222	102
3640	NPO	224	184	104	823	473	123	562	362	122	561
	X7R	126	565	225	564	274	683	223	153	103	122
4540	NPO	274	224	124	823	563	223	103	472	152	621
	X7R	156	685	225	105	334	104	683	273	223	152
5550	NPO	334	274	154	104	683	333	223	562	182	681
	X7R	186	825	275	125	364	124	823	333	273	182
6560	NPO	684	564	474	334	333	273	103	682	332	821
	X7R	226	186	106	475	105	334	224	104	473	222
7565	NPO	824	684	564	474	473	333	223	103	472	102
	X7R	336	226	186	106	225	364	274	124	563	272

■ All value are capacitance EIA codes.

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

Soldering And Handling Precautions:

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

The recommended method for soldering large chips, is reflow soldering. Wave soldering and manual soldering with Iron is not recommended. Ceramic capacitors must be preheated with less than 3°C/sec rate to about 50°C below the reflow temperature. Sudden increase, or decrease in temperature more than the recommended rate, during soldering, may cause internal thermal cracks.

Available Options:

- HEC offers polymer termination (Superterm) for very large chips to minimize mechanical cracks due to board flexing.
- To minimize the potential for surface arcing in higher voltage applications, HEC offers the option of a proprietary surface coating.
- Pure Tin terminated/ROHS compliant products are offered as a standard, however, lead (Pb) content plated termination may be provided if required.
- Pd/Ag termination is also offered as an option for Hybrid circuits and other applications.

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
- Halogen Free available

◆ Applications

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

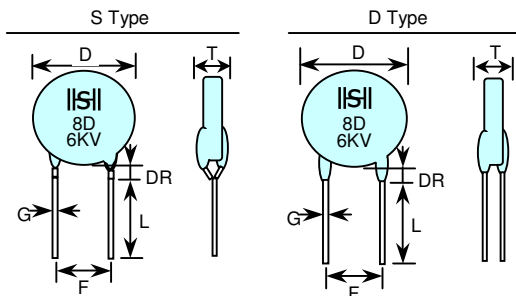
◆ Summary of Specification

Operation Temperature	NPO/SL : -55~+125 °C
	X7R/Y5P/Y5S : -55~+125°C
	Y5U/Y5V : -25~+105°C
Capacitance Range	2pF to 100nF
Rated Voltage	1KVdc to 6KVdc
Temperature Coefficient	NPO : $\leq \pm 30\text{ppm}/^\circ\text{C}$, -55~+125 °C (EIA Class I)
	SL : $+350 \sim -1000\text{ppm}/^\circ\text{C}$, -25~+85 °C (EIA Class I)
	Y5S : $\leq \pm 22\%$, -25~+85 °C
	X7R : $\leq \pm 15\%$, -55~+125 °C (EIA Class II)
	Y5P: $\leq \pm 10\%$;Y5U: $+22\%/-56\%$;Y5V: $+22\%/-82\%$, -25~+85 °C(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 $\leq$ 2KV : 200% Rated Voltage
	3KV : 175% Rated Voltage
	6KV : 150% Rated Voltage

◆ How To Order

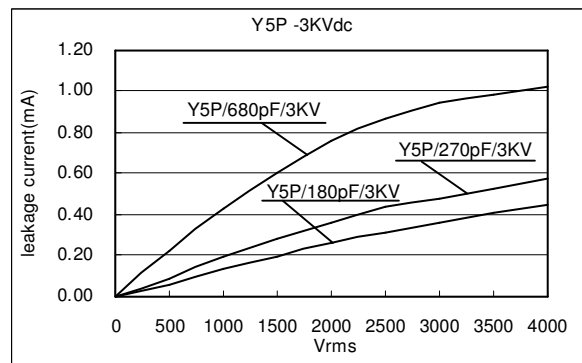
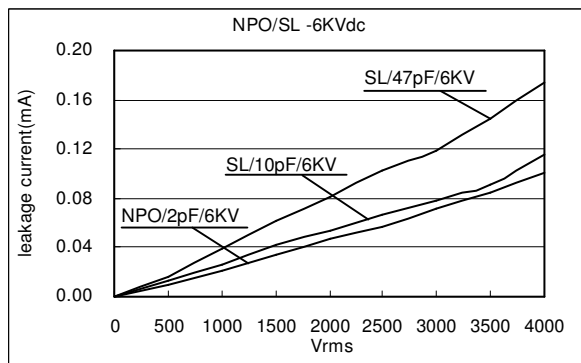
HDC	S	3R0	C	602	7	A	A	N
Product Code HDC: Ceramic Disc Capacitor	Dielectric Ex.: N:NPO S:SL L:Y5S X:X7R P:Y5P Y:Y5V E:Y5U	Capacitance Unit : pF Ex.: 2R0:2pF 100:10x10 ⁰ 151:15x10 ¹	Tolerance Ex.: C: +/-0.25pF D: +/-0.5pF H: +/- 3% J: +/- 5% K: +/- 10% M: +/- 20%	Rated Voltage Ex.: 102:1000Vdc 202:2000Vdc 302:3000Vdc 602:6000Vdc	Lead Space Ex.: 5 : 5.00mm 6 : 6.35mm 7 : 7.50mm A : 10.0mm B : 12.5mm	Lead Length & Packaging Ex.: H:3.1mm C:3.5mm S:5.0mm M:10.0mm L: 25mm min. T: Tape Reel A: Ammo Box	Lead Shape Style Ex.: S Type 1: $\phi=0.50\text{mm}$ 2: $\phi=0.60\text{mm}$ 3: $\phi=0.65\text{mm}$ 4: $\phi=0.80\text{mm}$ D Type 9: $\phi=0.50\text{mm}$ A: $\phi=0.60\text{mm}$ B: $\phi=0.65\text{mm}$ C: $\phi=0.80\text{mm}$	Optional Suffix Ex.: N :Halogen Free Indicator

◆ 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																	
		2R0	3R0	5R0	6R0	7R0	8R0	9R0	100	120	150	180	220	270	330	390	470	560	680
NPO	3KV	3.3n	5.6n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n									
	6KV	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n									
SL	1KV								3.3n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n
	2KV								3.3n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n
	3KV								3.3n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n
	6KV								3.3n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n	5.6n
Y5S	3KV																		

Dielectric Characteristic	Voltage	Capacitance Range																	
		101	121	151	181	221	271	331	391	471	561	681	821	102	122	152	182	222	272
X7R	2KV	6.8n	6.8n	6.8n	6.8n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n
	3KV	6.8n	6.8n	6.8n	6.8n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n	7.5n
Y5P	1KV	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n
	2KV	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n
	3KV	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n
Y5U	1KV								3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n
	2KV								3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n
	3KV								3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n	3.3n
Y5V	1KV																		
	2KV																		

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

■ 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	
Quality Factor	Class I (NPO/SL): More Than 30pF : $Q \geq 1000$ 30pF & Below : $Q \geq 400+20C$ (C:Capacitance)		NPO/SL	1MHz±10%	5.0Vrms max.	
			Y5S/X7R/Y5P	1KHz±10%		
			Y5U/Y5V	1KHz±10%		
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	Class I (NPO/SL):		
	NPO(N)	-55℃ ~ +125℃	0±30ppm/ ℃	[C2-C1/C1(T2-T1)] × 100%		
	SL(S)	-30℃ ~ +85℃	+350~ -1000 ppm	Class II (X7R/Y5S/Y5P/Y5U/Y5V):		
	Y5S(L)	-30℃ ~ +85℃	± 22%	(C2-C1)/C1 × 100%		
	X7R(X)	-55℃ ~ +125℃	± 15%	T1:Standard Temperature(25℃)		
	Y5P(P)	-30℃ ~ +85℃	± 10%	T2:Test Temperature		
	Y5U(E)	-30℃ ~ +85℃	+22 ~ -56%	C1:Capacitance at Standard Temperature		
	Y5V(Y)	-30℃ ~ +85℃	+22 ~ -82%	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

Item	Specification		Test Condition																											
Solderability of leads	More than 75% of the circumferential surface dipped into solder shall be covered with new solder.		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																											
Resistance to Soldering Heat	Appearance	No mechanical damage shall occur	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.																											
	Capacitance	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 <u>Y5S(L)</u> ≤±5% of initial value <u>X7R(X)</u> ≤±5% of initial value <u>Y5P(P)</u> ≤±5% of initial value <u>Y5U(E)</u> ≤±20% of initial value <u>Y5V(Y)</u> ≤±20% of initial value																												
	Withstand Voltage (Between Terminal)	No dielectric breakdown or abnormality																												
Temperature and Dipping Cycle	Appearance	No mechanical damage shall be occur	Capacitor shall be subjected to five cycles of the temperature cycle as following: <table><tr><th>Step</th><th>Temp.(℃)</th><th>Time(min)</th></tr><tr><td>1</td><td>Min Rated Temp.+0/-3 (-55)</td><td>30</td></tr><tr><td>2</td><td>25</td><td>3</td></tr><tr><td>3</td><td>Max Rated Temp.+3/-0 (125)</td><td>30</td></tr><tr><td>4</td><td>25</td><td>3</td></tr></table> After 5 temperature cycle then consecutively to 2 dipping cycles <table><tr><th>Step</th><th>Temp.(℃)</th><th>Time(min)</th><th>Dipping Liquid</th></tr><tr><td>1</td><td>65 +5/-0</td><td>15±2</td><td>Pure Water</td></tr><tr><td>2</td><td>0±3</td><td>15±2</td><td>Salt Water</td></tr></table> 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.	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	Step	Temp.(℃)	Time(min)	Dipping Liquid	1	65 +5/-0	15±2	Pure Water	2	0±3	15±2	Salt Water
	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																										
	Step	Temp.(℃)		Time(min)	Dipping Liquid																									
	1	65 +5/-0		15±2	Pure Water																									
	2	0±3		15±2	Salt Water																									
	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 <u>Y5S(L)</u> ≤±10% of initial value <u>X7R(X)</u> ≤±10% of initial value <u>Y5P(P)</u> ≤±10% of initial value <u>Y5U(E)</u> ≤±30% of initial value <u>Y5V(Y)</u> ≤±30% of initial value																												
Q / Tanδ	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)																													
Withstand Voltage (Between Terminal)	No dielectric breakdown or abnormality																													

HDC Series Specification & Test Condition

Item	Specification		Test Condition
Humidity (Under Steady State)	Appearance	No mechanical damage shall occur	Temperature : 40± 2 °C Relative Humidity : 90 ~95%RH Test Time : 500 +24/-0 hr
	Capacitance	Class I (NPO/SL): Within 5.0% or ±0.5pF whichever is larger of initial value	Class I : Measurement under room temperature after test for 1 to 2Hr Class II : The capacitor shall be pre-treatment stored at 85±2°C for 1hr, then placed at room temperature for 24±2hr before initial measurements. The capacitor shall stored for 24±2hr at room temperature
		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 / Tanδ	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 °C Relative Humidity : 90 ~95%RH Test Time : 500 +24/-0 hr Applied Voltage : 100% of Rated Voltage Is applied less than 50mA current.
	Capacitance	Class I (NPO/SL) : Within 7.5% or ±0.75pF whichever is larger of initial value	Class I : Measurement under room temperature after test for 1 to 2Hr Class II : The capacitor shall be pre-treatment stored at 85±2°C for 1hr, then placed at room temperature for 24±2hr before initial measurements. The capacitor shall stored for 24±2hr at room temperature
		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 / Tanδ	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:	
	Capacitance	Class I (NPO/SL) :	The rated voltage is more than 5KVDC, applied voltage of 120% rated voltage.	
		Within 5.0% or ±0.5pF whichever is larger of initial value	Temperature: max. operation temperature	
		Class II (Y5S/X7R/Y5P/Y5U/Y5V):	Test Time : 1000 +48/-0 Hr	
		Char.	Cap.Change	Is applied less than 50mA current.
		Y5S(L)	≤±20% of initial value	Class I :
X7R(X)		≤±20% of initial value	Measurement under room temperature after test for 1 to 2Hr.	
Y5P(P)	≤±20% of initial value	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..		
Y5U(E)	≤±30% of initial value			
Y5V(Y)	≤±30% of initial value			
Q / Tanδ	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%		The capacitor shall stored for 24±2hr at room temperature.	
Insulation Resistance	1000MΩ or 50/C whichever is smaller.			
Vibration	Appearance	No mechanical damage shall occur	The capacitor shall firmly be solder 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		

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.

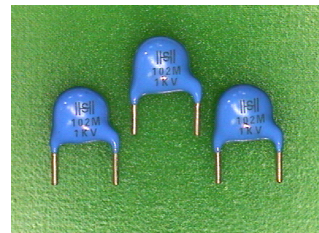
Class I :
Measurement under room temperature after test for 1 to 2Hr.

Class II :
The capacitor shall be pre-treatment stored at $85 \pm 2^\circ\text{C}$ for 1hr, then placed at room temperature for $24 \pm 2\text{hr}$ before initial measurements..
The capacitor shall stored for $24 \pm 2\text{hr}$ at room temperature.

The capacitor shall firmly be solder 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.

Ceramic Disc Capacitors [High Voltage Disc Capacitor]

HDC Series – Low Loss/ Low Dissipation



The series (R type) used in electronic product and the voltage ratings from 1KV to 3KV. Ideal for use on high frequency pulse circuits such as a horizontal resonance circuits for CTV and snubber circuits for switching power supplies.

◆ Features

- Wide operation temperature up to +125°C
- Ultra low dissipation factor
- Small size a special designed
- High reliability
- RoHS compliant
- Halogen Free available

◆ Applications

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

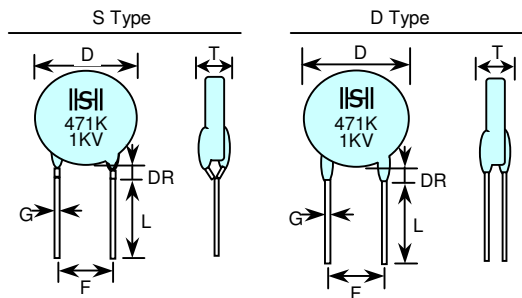
◆ Summary of Specification

Operation Temperature	-25~+125 °C
Capacitance Range	100pF to 47nF
Rated Voltage	1KVdc to 3KVdc
Temperature Coefficient	≤ +15/-30%, -25~+125 °C
Dissipation Factor	≤ 0.2%
Insulation Resistance	10GΩ or 500/C Ω whichever is smaller
Aging	3.5 % per decade of time
Dielectric Strength	V ≤ 2KV : 200% Rated Voltage
	3KV : 175% Rated Voltage

◆ How To Order

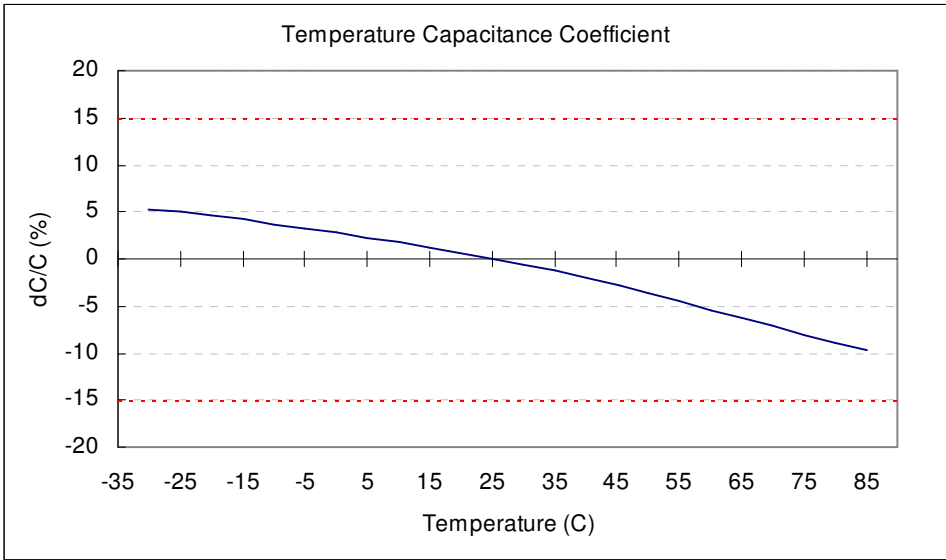
HDC	R	471	K	102	5	A	9	L
Product Code HDC: Ceramic Disc Capacitor	Dielectric Ex.: R:Y5R	Capacitance Unit : pF Ex.: 101:10x10 ¹ 472:47x10 ²	Tolerance Ex.: K: +/- 10% M: +/- 20%	Rated Voltage Ex.: 102:1000Vdc 202:2000Vdc 302:3000Vdc	Lead Space Ex.: 5 : 5.00mm 6 : 6.35mm 7 : 7.50mm A : 10.0mm B : 12.5mm	Lead Length & Packaging Ex.: H:3.1mm C:3.5mm S:5.0mm M:10.0mm L: 25mm min. T: Tape Reel A: Ammo Box	Lead Shape Style 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	Optional Suffix Ex.: L:Low Loss/ Low Dissipation R :Halogen Free Indicator

◆ 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.			

◆ Temperature Capacitance Coefficient (Typical Reference)



◆ Capacitance Range

Dielectric Characteristic	Voltage	Capacitance Range																	
		101	121	151	181	221	271	331	391	471	561	681	821	102	122	152	182	222	272
Y5R	1KV	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	2KV	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	3KV	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

■ Other capacitance and voltage rating are available. Please contact HEC.

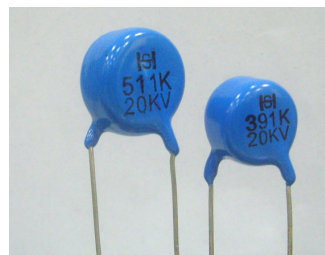
HDC Series Specification & Test Condition

Item	Specification		Test Condition			
Operating Temperature Range	-25℃ ~ +125℃					
Capacitance	Within specified tolerance.		Frequency	Voltage		
Dissipation Factor	0.2% Maximum		1KHz±10%	5.0Vrms max.		
Insulation Resistance	More than 10,000MΩ		The measurement at reference temperature 25 ℃.			
Dielectric Strength	Between Lead Wires	No Failure	Applied Voltage : 500±5Vdc Charge Time : 60±5sec. Is applied less than 50mA current.			
	Body Insulation	No Failure	V≤2KV:200% of Rated Voltage V≤3KV 175% of Rated Voltage For 1~5 sec. Current is limited to less than 50mA. 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 DC1.3KV is applied for1 to 5s. Between capacitor lead wires and small metals. Current is limited to less than 50mA.			
Temperature Capacitance Coefficient	Operation Temp. -25℃ ~+125℃	Cap.Change +15 ~ -30%	(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) 0.07-0.2 Over 0.2-0.5	Wire Diameter (mm) 0.3-0.5 over0.5-0.8	Tensile Force (N) 5 10	Holding Time (s) 10 ±1
	Bending Strength	Lead wire shall not be disconnected and capacitor shall not be damaged.	Nominal cross section area (mm) 0.07-0.2 Over 0.2-0.5	Wire Diameter (mm) 0.3-0.5 over0.5-0.8	Tensile Force (N) 2.5 5	Mass of Weight (Kg) 10 ±1
Solderability of leads	More than 75% of the circumferential surface dipped into solder shall be covered with new solder.		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			
Resistance to Soldering Heat	Appearance	No mechanical damage shall occur	Soldering Temperature	350±10 ℃	260 ±5℃	
	Capacitance	≤±5.0% of initial value	Dipping Time	3.5 ±0.5sec.	10 ±1sec.	
	Withstand Voltage (Between Terminal)	No dielectric breakdown or abnormality	The capacitor shall stored for 24±2hr at room temperature.			

HDC Series Specification & Test Condition

Item	Specification		Test Condition															
Temperature and Dipping Cycle	Appearance	No mechanical damage shall be occur	Capacitor shall be subjected to five cycles of the temperature cycle as following: <table><tr><th>Step</th><th>Temp.(°C)</th><th>Time(min)</th></tr><tr><td>1</td><td>Min Rated Temp.+0/-3 (-55)</td><td>30</td></tr><tr><td>2</td><td>25</td><td>3</td></tr><tr><td>3</td><td>Max Rated Temp.+3/-0 (125)</td><td>30</td></tr><tr><td>4</td><td>25</td><td>3</td></tr></table>	Step	Temp.(°C)	Time(min)	1	Min Rated Temp.+0/-3 (-55)	30	2	25	3	3	Max Rated Temp.+3/-0 (125)	30	4	25	3
	Step	Temp.(°C)		Time(min)														
	1	Min Rated Temp.+0/-3 (-55)		30														
	2	25		3														
	3	Max Rated Temp.+3/-0 (125)	30															
	4	25	3															
Capacitance	≤±10% of initial value																	
Tanδ	≤0.4%																	
Insulation Resistance	More than 1,000MΩ																	
Withstand Voltage (Between Terminal)	No dielectric breakdown or abnormality	After 5 temperature cycle then consecutively to 2 dipping cycles <table><tr><th>Step</th><th>Temp.(°C)</th><th>Time(min)</th><th>Dipping Liquid</th></tr><tr><td>1</td><td>65 +5/-0</td><td>15±2</td><td>Pure Water</td></tr><tr><td>2</td><td>0±3</td><td>15±2</td><td>Salt Water</td></tr></table>	Step	Temp.(°C)	Time(min)	Dipping Liquid	1	65 +5/-0	15±2	Pure Water	2	0±3	15±2	Salt Water				
Step	Temp.(°C)	Time(min)	Dipping Liquid															
1	65 +5/-0	15±2	Pure Water															
2	0±3	15±2	Salt Water															
			The capacitor shall stored for 24±2hr at room temperature.															
Humidity (Under Steady State)	Appearance	No mechanical damage shall occur	Temperature : 40± 2 °C Relative Humidity : 90 ~95%RH Test Time : 500 +24/-0 hr															
	Capacitance	≤±10% of initial value																
	Tanδ	≤0.4%	The capacitor shall stored for 24±2hr at room temperature															
	Insulation Resistance	More than 1,000MΩ																
Humidity Loading	Appearance	No mechanical damage shall occur	Temperature : 40± 2 °C Relative Humidity : 90 ~95%RH Test Time : 500 +24/-0 hr Applied Voltage : 100% of Rated Voltage Is applied less than 50mA current.															
	Capacitance	≤±10% of initial value																
	Tanδ	≤0.4%	The capacitor shall stored for 24±2hr at room temperature															
	Insulation Resistance	More than 500MΩ																
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur	Applied Voltage: 150% of rated voltage															
	Capacitance	≤±10% of initial value	Temperature: max. operation temperature Test Time : 1000 +48/-0 Hr Is applied less than 50mA current.															
	Tanδ	≤0.4%	The capacitor shall stored for 24±2hr at room temperature.															
	Insulation Resistance	More than 2000MΩ																
Vibration	Appearance	No mechanical damage shall occur	The capacitor shall firmly be solder 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 [Ultra 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
- ☐ Halogen Free available

◆ 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

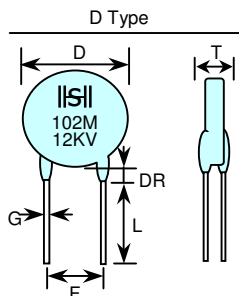
◆ Summary of Specification

Operation Temperature	NPO/SL : -55~+125 °C
	X7R/Y5P/Y5S : -55~+125°C
	Y5U/Y5V : -25~+105°C
Capacitance Range	10pF to 10,000pF
Capacitance	1KHz $\pm$ 20% /osc: 1 to 5Vrms ,and 20 °C
Rated Voltage	10KVdc to 20KVdc
Temperature Coefficient	NPO : $\leq \pm 30$ ppm/ °C , -55~+125 °C (EIA Class I)
	SL : +350 ~ -1000ppm/ °C , -25~+85 °C (EIA Class I)
	Y5S (N3300) $\pm 22\%$, -25~+85 °C
	X7R : $\leq \pm 15\%$, -55~+125 °C (EIA Class II)
	Y5P: $\pm 10\%$;Y5U: +22%/-56% ;Y5V: +22%/-82% , -25~+85 °C(EIA Class II)
Dissipation Factor	Please see HEC specification data sheet
Insulation Resistance	10G Ω 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

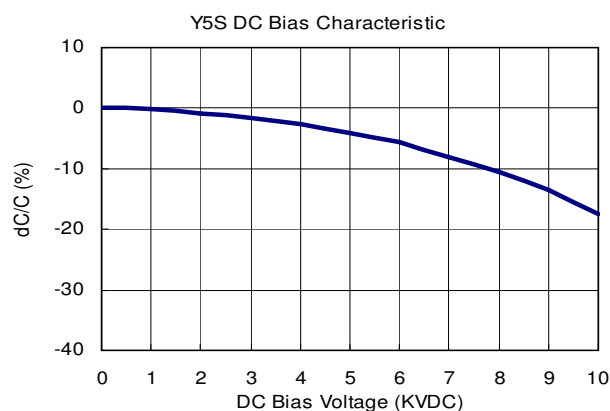
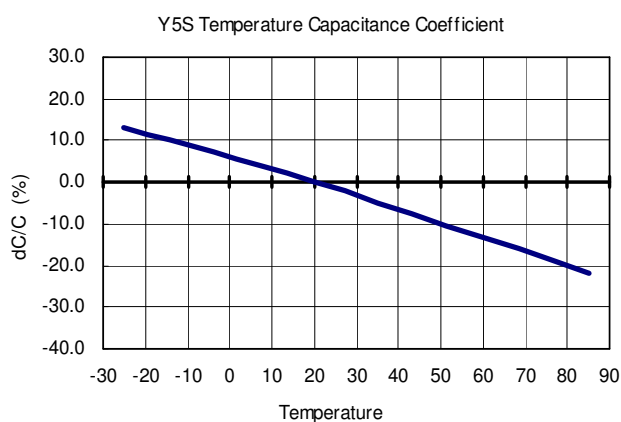
HDC	L	102	M	153	A	L	C	N
Product Code	Dielectric	Capacitance Unit : pF	Tolerance	Rated Voltage	Lead Space	Lead Length & Packaging	Lead Shape Style	Optional Suffix
HDC: Ceramic Disc Capacitor	Ex.: N:NPO S:SL L:Y5S X:X7R P:Y5P E:Y5U Y:Y5V	Ex.: 102:10x10 ² 103:10x10 ³	Ex.: C: ± 0.25 pF D: ± 0.5 pF J: $\pm 5\%$ K: $\pm 10\%$ M: $\pm 20\%$	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: 25mm min.	Ex.: D Type 9: $\phi = 0.50$ mm A: $\phi = 0.60$ mm B: $\phi = 0.65$ mm C: $\phi = 0.80$ mm	Ex.: N :Halogen Free Indicator

◆ 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)



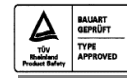
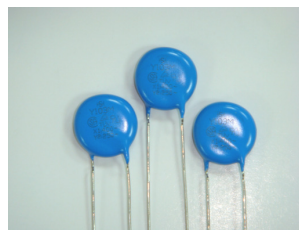
◆ Capacitance Range

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
NPO	10KV																								
	15KV																								
	20KV																								
SL	10KV																								
	15KV																								
	20KV																								
X7R	10KV																								
	12KV																								
	15KV																								
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.

◆ Features

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

◆ Application

- ❑ Safety capacitors specially designed for use in Modem, Facsimile, Telephone and other electronic equipment for lightning 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 (3 rd Edition) EN 60384-14 : 2005 EN 132400 : 1994+A2:1998+A3:1998+A4:2001	R50101887	X1:400 VAC Y2:250 VAC
			X1:440 VAC Y1:250 VAC
			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(3 rd Edition)	2792364	
CB Report	EN 60384-14 : 2005(3 rd Edition)	HU-455/A1	

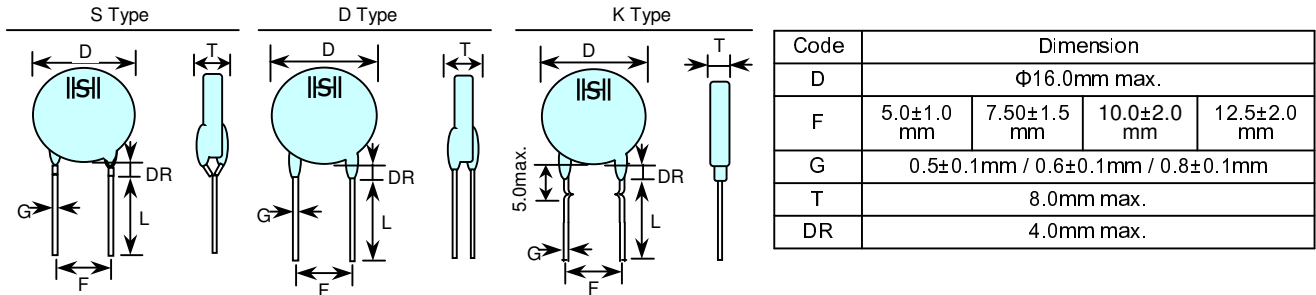
◆ How To Order

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
SDC: Safety Disc Ceramic Capacitor	Ex.: N : NPO S : SL X : X7R P : Y5P Y : Y5V E : Y5U	Ex.: 100 : 10x10 ⁰ 151 : 15x10 ¹	Ex.: J: +/-5.0% K: +/- 10% M: +/- 20%	Ex.: 10 : X1/Y1 50 : X1/Y2	Ex.: 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	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

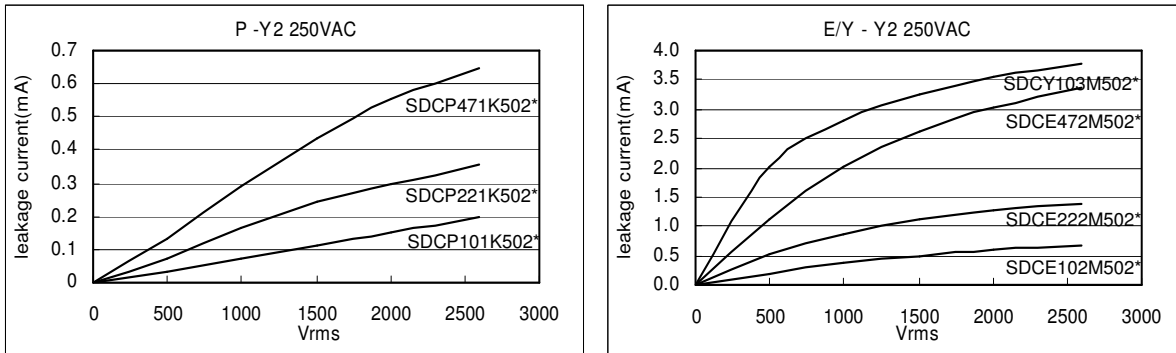
Summary of Specification

Operation Temperature	-25~+125 °C
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
Insulation Resistance	Class II , Y5P :DF ≤ 2.5% ; Y5U/Y5V :DF ≤ 5.0% at 1KHz/1Vrms
	10,000MΩ min. at 500VDC

Dimension



Leakage Current Characteristic (Typical Reference)



Capacitance Range

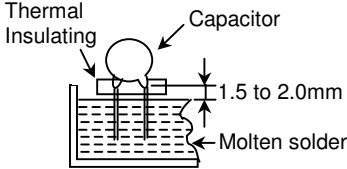
Class	TC	Capacitance Range																						
		2R0	3R0	5R0	8R0	100	150	220	330	390	470	680	101	121	151	181	221	271	331	391	471	561	681	102
X1: 400VAC Y2: 250VAC	NPO	0.5	0.5	0.5	0.5	0.5																		
	SL				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5												
	Y5P				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	10.7
	Y5U																							0.7
	Y5V																							0.7
X1: 440VAC Y1: 250VAC	NPO	0.5	0.5	0.5																				
	SL				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5												
	Y5P												0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	12.0
	Y5U																							0.5
X1: 440VAC Y1: 400VAC	NPO	0.5	0.5	0.5																				
	SL				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5												
	Y5P												0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	12.0
	Y5U																							0.5

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

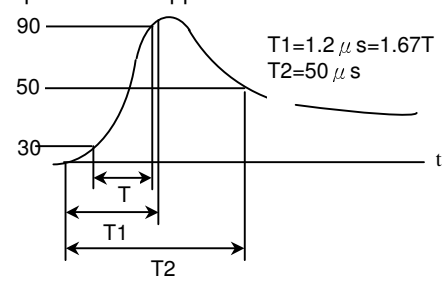
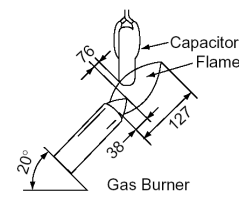
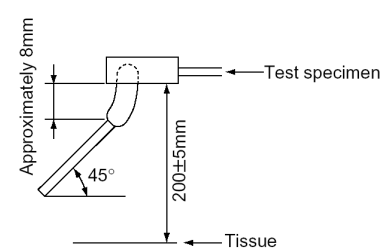
SDC Series Specification & Test Condition

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
Quality Fact/or & Dissipation Factor	Char.	Q / D.F.(max.)	NPO/SL	1MHz±10%	5.0Vrms max.
	NPO(N)/SL(S)	Q≥300	Y5P/Y5U/Y5V	1KHz±10%	
	Y5P(P)	D.F. ≤2.5%	The measurement at reference temperature 25 ℃.		
	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 AC4KV (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(2.6KV for Y2 and 4KV for Y1) 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	The capacitance measurement shall be made at each step specified as following..	
	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%		
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.		

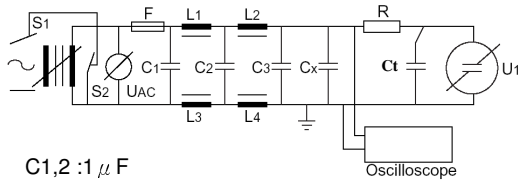
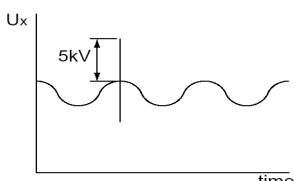
SDC Series Specification & Test Condition

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.	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. 
	Capacitance	Within±10%	
	I.R.	1000MΩ min.	
	Dielectric Strength	Per Item 5.	
Humidity (Under Steady State)	Appearance	No marked defect	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.
	Capacitance	Char. Cap. change 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 / Tanδ	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.	
Humidity Loading	Appearance	No marked defect	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.
	Capacitance	Char. Cap. change 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 / Tanδ	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.	

SDC Series Specification & Test Condition

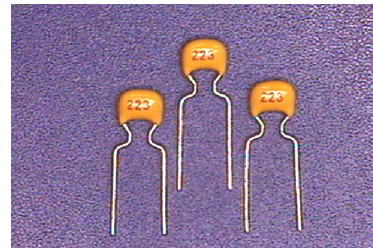
Item	Specification		Test Condition
Endurance (Life Test)	Appearance	No marked defect.	Impulse Voltage Each individual capacitor shall be subjected to 5KV(Y2) and 8KV(Y1) impulses for the times below. After impulse testing the capacitors are applied to life test.  $T1=1.2\mu s=1.67T$ $T2=50\mu s$ The 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 $125\pm 2^{\circ}\text{C}$. 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.
	Capacitance	Char. Cap. change NPO(N) $\leq \pm 5\%$ of initial value SL(S) $\leq \pm 20\%$ of initial value Y5P(P) $\leq \pm 20\%$ of initial value Y5U(E) $\leq \pm 20\%$ of initial value Y5V(Y) $\leq \pm 30\%$ of initial value	
	Insulation Resistance	3,000MΩ min.	
	Dielectric Strength	Pre Item 5.	
Flame Test	The capacitor flame discontinue as follows		The capacitor shall be subjected to the flame below for 15 sec. then removed for 15 sec, for 5 cycles. 
	Cycle	Time	
	1~ 4	30sec. Max.	
	5	60sec. max.	
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 : $12\pm 1\text{mm}$ Gas burner : Length 35mm min. Inside Dia. : $0.5\pm 0.1\text{mm}$ 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 U_{ac} shall be maintained for 2 min. after the last discharge.  $C_{1,2} : 1 \mu F$ $L_{1-4} : 1.5mH \pm 20\%$ 16A Rod core choke $R : 100 \Omega \pm 2\%$, $U_{ac} : U_r \pm 5\%$ C_x : Capacitor U_1 : Voltage applied to C_t $C_3 : 0.33 \mu F \pm 5\%$ 10KV $C_t : 3 \mu F \pm 5\%$ 10KV U_r : Rated working voltage F : Fuse, Rated 10A 
Vibration	Appearance	No mechanical damage shall occur
	Capacitance	Within the specified tolerance
	Q / Tanδ	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.

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

RDC 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
- ❑ Halogen free available

◆ Applications

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

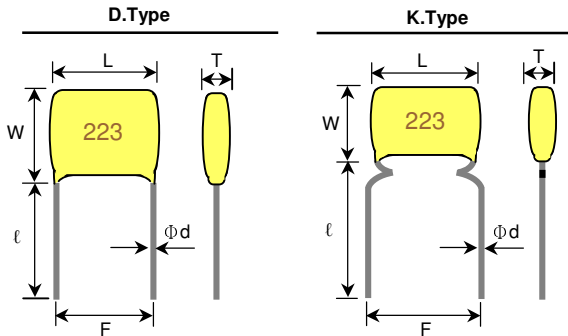
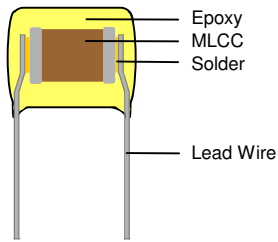
◆ Summary of Specification

Operation Temperature	NPO,X7R : -55~+125 °C ; X5R : -55~+85 °C ; Y5V : -30~+85 °C
Rated Voltage	6.3Vdc to 1KVdc
Temperature Coefficient	NPO : $\leq \pm 30\text{ppm}/^\circ\text{C}$, -55~+125 °C (EIA Class I)
	X7R : $\leq \pm 15\%$, -55~+125 °C (EIA Class II)
	X5R : $\leq \pm 15\%$, -55~+85 °C (EIA Class II)
	Y5V : $\leq +22\sim -82\%$, -30~+85 °C (EIA Class II)
Capacitance Range	NPO : 2pF to 220nF
	X7R : 150pF to 22uF
	X5R : 0.1uF to 100uF
	Y5V : 0.1uF to 100uF
Dissipation Factor	Please see RDC specification data sheet
Insulation Resistance	10G Ω or 500/C Ω whichever is smaller
Aging	NPO:0% ; X7R,X5R: 2.5 % Y5V: 6% per decade of time
Dielectric Strength	V $\leq$ 50 : 250% Rated Voltage
	V < 500V : 200% Rated Voltage
	500V $\leq$ V < 1000V: 150% Rated Voltage
	1000 $\leq$ V : 120% Rated Voltage

◆ How To Order

RDC	X	473	K	631	EK	A	N
Product Code RDC: Radial Ceramic Chip Capacitor	Dielectric Ex.: N: NPO X: X7R B: X5R Y: Y5V	Capacitance Unit : pF Ex.: 2R0:2.0pF 100:10 $\times 10^0$ 471:47 $\times 10^1$ 102:10 $\times 10^2$	Tolerance Ex.: C: $\pm 0.25\text{pF}$ D: $\pm 0.50\text{pF}$ J : $\pm 5\%$ K : $\pm 10\%$ M: $\pm 20\%$ Z: $\pm 80\sim 20\%$	Rated Voltage Ex.: 007:6.3Vdc 010:10Vdc 025:25Vdc 050:50Vdc 101:100Vdc 251:250Vdc 631:630Vdc 102:1000Vdc	Leader Style & Dimension Ex: D Type CD:4.5x5.5mm DD:4.5x5.5mm ED:5.5x7.0mm FD:7.5x8.0mm GD:7.6x9.4mm K Type CK:4.5x5.5mm DK:4.5x5.5mm EK:5.5x7.0mm FK:7.5x8.0mm	Lead Length & Packaging Ex.: S:5.0mm M:10.0mm L :25mm min. A: Ammo Box	Optional Suffix Ex.: N :Halogen Free Indicator

◆ Structure & Dimension



Unit : mm [inches]

TYPE	L (max)	W (max)	T (max)	F	ℓ	Φd
C□	4.5 [0.157]	5.5 [0.216]	2.5 [0.098]	5.0±1 [0.196]	25.0+3/-1 [0.984]	0.5±0.1 [0.196]
D□	4.5 [0.157]	5.5 [0.216]	2.5 [0.098]	5.0±1 [0.196]	25.0+3/-1 [0.984]	0.5±0.1 [0.196]
E□	5.5 [0.216]	7.0 [0.275]	4.0 [0.157]	5.0±1 [0.196]	25.0+3/-1 [0.984]	0.5±0.1 [0.196]
F□	7.5 [0.294]	8.0 [0.314]	4.0 [0.157]	5.0±1 [0.196]	25.0+3/-1 [0.984]	0.5±0.1 [0.196]
GD	7.6 [0.299]	9.4 [0.370]	6.9 [0.272]	--	25.0+3/-1 [0.984]	0.6±0.1 [0.196]

◆ Capacitance Range

NPO(N) Series

Type	C□			D□				E□						F□					GD
WVDC	50V	100V	250V	50V	100V	250V	500V	50V	100V	250V	500V	630V	1KV	50V	100V	250V	500V	630V	1KV
Cap Min.	5R0	5R0	2R0	100	101	101	100	153	392	332	101	101	100	104	473	223	822	822	101
Cap Max.	332	471	151	103	472	272	681	104	333	153	682	682	102	224	104	473	223	223	183

X7R(X) Series

Type	C□				D□						E□							
WVDC	16V	25V	50V	100V	16V	25V	50V	100V	250V	500V	16V	25V	50V	100V	250V	500V	630V	1KV
Cap Min.	151	151	151	151	224	154	102	102	102	102	335	684	474	333	153	102	102	102
Cap Max.	474	224	104	183	225	155	334	103	223	223	156	475	225	105	224	683	683	103

Type	F□								GD					
WVDC	16V	25V	50V	100V	250V	500V	630V	1KV	50V	100V	250V	500V	630V	1KV
Cap Min.	226	475	104	104	104	683	683	103	474	474	105	224	224	393
Cap Max.	226	156	475	225	105	224	104	683	106	475	225	474	474	224

X5R(B) Series

Type	C□				D□				E□				F□	
WVDC	6.3V	10V	16V	25V	6.3V	10V	16V	25V	6.3V	10V	16V	25V	6.3V	10V
Cap Min.	225	474	154	104	475	334	225	105	685	685	155	155	686	226
Cap Max.	106	475	225	105	106	475	475	475	226	156	106	106	107	476

Y5V(Y) Series

Type	C□				D□					E□					F□			
WVDC	6.3V	10V	16V	25V	6.3V	10V	16V	25V	50V	6.3V	10V	16V	25V	50V	10V	16V	25V	50V
Cap Min.	474	224	104	104	475	225	105	474	104	476	226	106	475	225	476	226	106	475
Cap Max.	475	475	225	105	226	106	475	225	105	107	476	226	106	475	107	476	226	106

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

RDC Series Specification & Test Condition

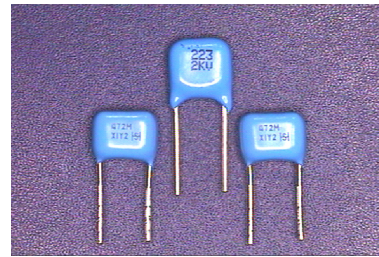
Item	Specification	Test Condition															
Operation Temperature	Please see HEC specification data sheet for details																
Visual	No abnormal exterior appearance	Visual Inspection															
Capacitance	Within The Specified Tolerance	Class Frequency Voltage															
Quality Factor	Class I (NPO): More Than 30pF : $Q \geq 1000$ 30pF & Below: $Q \geq 400 + 20C$ (C:Cap., pF)	NPO C≤100pF 1MHz±10% 1.0±0.2Vrms C>100pF 1KHz±10%															
Dissipation Factor	Class II (X7R,X5R,Y5V): Please see HEC specification data sheet for details	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°C 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	<table border="1"> <thead> <tr> <th>Char.</th><th>Temp. Range</th><th>Cap. Change</th></tr> </thead> <tbody> <tr> <td>NPO (N)</td><td>-55°C ~ +125°C</td><td>± 30ppm/°C</td></tr> <tr> <td>X7R (X)</td><td>-55°C ~ +125°C</td><td>± 15%</td></tr> <tr> <td>X5R (B)</td><td>-55°C ~ +85°C</td><td>± 15%</td></tr> <tr> <td>Y5V (Y)</td><td>-30°C ~ +85°C</td><td>+22% ~ -82%</td></tr> </tbody> </table>	Char.	Temp. Range	Cap. Change	NPO (N)	-55°C ~ +125°C	± 30ppm/°C	X7R (X)	-55°C ~ +125°C	± 15%	X5R (B)	-55°C ~ +85°C	± 15%	Y5V (Y)	-30°C ~ +85°C	+22% ~ -82%	Class I : $[C2-C1/C1(T2-T1)] \times 100\%$ Class II : $(C2-C1)/C1 \times 100\%$ T1:Standard Temperature(25°C) T2:Test Temperature C1:Capacitance at Standard Temperature C2:Capacitance a Test Temperature
Char.	Temp. Range	Cap. Change															
NPO (N)	-55°C ~ +125°C	± 30ppm/°C															
X7R (X)	-55°C ~ +125°C	± 15%															
X5R (B)	-55°C ~ +85°C	± 15%															
Y5V (Y)	-30°C ~ +85°C	+22% ~ -82%															
Lead Strength	Tensile Strength No mechanical damage such as lead breakage and loosening. Bending Strength No mechanical damage such as lead breakage or loosening.	Pulling strength: 5N Holding time: 10±1s 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°C for 2±0.5s Solder : H63A Flux :Rosin Dipping :By 1.5~2.0mm from 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 : ≤ ±10% of initial value Y5V : ≤ ±20% of initial value Q / Tanδ To satisfy the specified initial value Insulation Resistance To satisfy the specified initial value	Completely soak both terminations in solder at 250± 5°C for 5±1s Solder : H63A Flux :Rosin Dipping :By 1.5~2.0mm from the root of lead															

RDC Series Specification & Test Condition

Item	Specification	Test Condition														
Temperature Cycle	Appearance	No mechanical damage shall occur														
	Capacitance	Class I (NPO): Within 2.5% or $\pm 0.25\text{pF}$ whichever is larger of initial value Class II X7R, X5R : $\leq \pm 7.5\%$ of initial value Y5V : $\leq \pm 20\%$ of initial value														
	Q / Tan δ	see RDC specification data sheet														
	Insulation Resistance	To satisfy the specified initial value														
		Class II capacitor shall be set for 48 $\pm$ 4 hours at room temperature after one hour heat treatment at 150 $\pm$ 0/-10 $^{\circ}\text{C}$ before initial measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following: <table border="1"> <thead> <tr> <th>Step</th><th>Temp.($^{\circ}\text{C}$)</th><th>Time(min)</th></tr> </thead> <tbody> <tr> <td>1</td><td>Min Rated Temp.+0/-3 (-55)</td><td>30</td></tr> <tr> <td>2</td><td>25</td><td>3</td></tr> <tr> <td>3</td><td>Max Rated Temp.+3/-0 (125)</td><td>30</td></tr> <tr> <td>4</td><td>25</td><td>3</td></tr> </tbody> </table> Measure at room temperature after cooling for Class I : 24 $\pm$ 2 Hours Class II : 48 $\pm$ 4 Hours	Step	Temp.($^{\circ}\text{C}$)	Time(min)	1	Min Rated Temp.+0/-3 (-55)	30	2	25	3	3	Max Rated Temp.+3/-0 (125)	30	4	25
Step	Temp.($^{\circ}\text{C}$)	Time(min)														
1	Min Rated Temp.+0/-3 (-55)	30														
2	25	3														
3	Max Rated Temp.+3/-0 (125)	30														
4	25	3														
Humidity	Appearance	No mechanical damage shall occur														
	Capacitance	Class I (NPO): Within 5% or $\pm 0.5\text{pF}$ whichever is larger of initial value Class II X7R, X5R : $\leq \pm 15\%$ of initial value Y5V : $\leq \pm 30\%$ of initial value														
	Q / Tan δ	see RDC specification data sheet														
	Insulation Resistance	1,000M Ω or 50/C Ω whichever is smaller for rated voltage $>10\text{V}$ and greater 10/C Ω for rated voltage $\leq 10\text{V}$														
		Class II capacitor shall be set for 48 $\pm$ 4 hours at room temperature after one hour heat treatment at 150 $\pm$ 0/-10 $^{\circ}\text{C}$ before initial measurement. Temperature : 40 $\pm$ 2 $^{\circ}\text{C}$ Relative Humidity : 90 ~95%RH Test Time : 500 $\pm$ 12/-0 hr Measure at room temperature after cooling for Class I : 24 $\pm$ 2 Hours Class II : 48 $\pm$ 4 Hours														
High Temperature Load (Life Test)	Appearance	No mechanical damage shall occur														
	Capacitance	Class I (NPO): Within 5% or $\pm 0.5\text{pF}$ whichever is larger of initial value Class II X7R, X5R : $\leq \pm 15\%$ of initial value Y5V : $\leq \pm 30\%$ of initial value														
	Q / Tan δ	Class I (NPO): More Than 30pF : Q $\geq$ 350 30pF & Below: Q $\geq$ 275+2.5C Class II (X7R, X5R, Y5V): see RDC specification data sheet														
	Insulation Resistance	1,000M Ω or 50/C Ω whichever is smaller for rated voltage $>10\text{V}$ and greater 10/C Ω for rated voltage $\leq 10\text{V}$														
		Class II capacitors applied DC testing voltage is applied for one hour at maximum operation temperature $\pm 3^{\circ}\text{C}$ then shall be set for 48 $\pm$ 4 hours at room temperature and the initial measurement shall be conducted. Applied Voltage: please see HEC specification data sheet. Temperature: max. operating temperature Test Time : 1000 $\pm$ 48/-0 Hr Current Applied : 50mA Max Measure at room temperature after cooling for Class I : 24 $\pm$ 2 Hours Class II : 48 $\pm$ 4 Hours														
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 1min. Repeat this for 2 hours each in 3perpendicular directions.														

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
- ❑ Halogen free available

◆ Applications

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

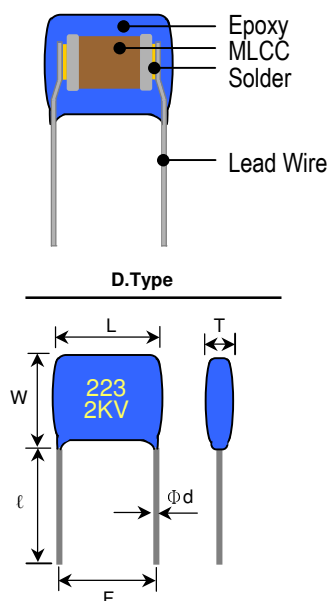
◆ Summary of Specification

Operation Temperature	-55~+125 °C
Rated Voltage	2KV to 5KV
Temperature Coefficient	NPO : $\leq \pm 30\text{ppm}/^\circ\text{C}$, -55~+125 °C (EIA Class I)
	X7R : $\leq \pm 15\%$, -55~+125 °C (EIA Class II)
Capacitance Range	NPO :2pF to 56nF
	X7R :100pF to 390nF
Dissipation Factor :	NPO : $Q \geq 1000$
	X7R : D.F. $\leq 2.5\%$
Insulation Resistance	10G Ω or 500/C Ω whichever is smaller
Aging	NPO:0% ; X7R: 2.5 %
Dielectric Strength	1000 $\leq V$:120% Rated Voltage

◆ How To Order

RDH	X	102	K	202	HK	T	N
Product Code RDH: Radial Dipped Ultra High Voltage Capacitor	Dielectric Ex.: N: NPO X: X7R	Capacitance Unit : pF Ex.: 100:10 $\times 10^0$ 471:47 $\times 10^1$ 102:10 $\times 10^2$	Tolerance Ex.: C: $\pm 0.25\text{pF}$ D: $\pm 0.50\text{pF}$ J : $\pm 5\%$ K : $\pm 10\%$ M: $\pm 20\%$	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	Packaging T: Taping & Reel B: Bulk	Optional Suffix Ex.: N :Halogen Free Indicator

◆ Structure & Dimension



Unit : mm [inches]

TYPE	L (max)	W (max)	T (max)	F (Max.)	ℓ	Φd
ED	5.5 [0.216]	7.0 [0.275]	4.0 [0.157]	5.0±1 [0.196]	25.0+3/-1 [0.984]	0.6±0.1 [0.196]
FD	7.5 [0.294]	8.0 [0.314]	4.0 [0.157]	5.0±1 [0.196]	25.0+3/-1 [0.984]	0.6±0.1 [0.196]
GD	7.6 [0.299]	9.4 [0.370]	6.9 [0.272]	6.54 [0.257]	25.0+3/-1 [0.984]	0.6±0.1 [0.196]
HD	9.40 [0.370]	7.62 [0.300]	6.86 [0.270]	7.55 [0.296]	25.0+3/-1 [0.984]	0.6±0.1 [0.196]
I D	12.0 [0.470]	10.2 [0.400]	8.13 [0.320]	10.2 [0.400]	25.0+3/-1 [0.984]	0.6±0.1 [0.196]
J D	14.5 [0.570]	12.7 [0.500]	8.13 [0.320]	12.8 [0.503]	25.0+3/-1 [0.984]	0.6±0.1 [0.196]
KD	17.0 [0.670]	15.2 [0.600]	8.13 [0.320]	15.36 [0.603]	25.0+3/-1 [0.984]	0.6±0.1 [0.196]
LD	19.6 [0.770]	18.3 [0.720]	8.13 [0.320]	17.86 [0.701]	25.0+3/-1 [0.984]	0.6±0.1 [0.196]
MD	22.1 [0.870]	19.1 [0.750]	8.13 [0.320]	20.46 [0.804]	25.0+3/-1 [0.984]	0.6±0.1 [0.196]

◆ Capacitance Range

NPO(N) Series

Type	ED		FD				GD				HD				I D			
WVDC	2KV	3KV	2KV	3KV	4KV	5KV	2KV	3KV	4KV	5KV	2KV	3KV	4KV	5KV	2KV	3KV	4KV	5KV
Cap Min.	100	2R0	2R0	2R0	2R0	2R0	100	100	100	2R0	100	100	100	100	100	100	100	100
Cap Max.	391	390	102	102	151	101	681	331	221	151	152	681	331	221	332	152	102	471

Type	JD				KD				LD				MD			
WVDC	2KV	3KV	4KV	5KV	2KV	3KV	4KV	5KV	2KV	3KV	4KV	5KV	2KV	3KV	4KV	5KV
Cap Min.	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Cap Max.	682	332	222	102	103	472	393	182	153	682	472	332	563	333	223	682

X7R(R) Series

Type	ED	FD			GD				HD				I D			
WVDC	2KV	2KV	3KV	4KV	2KV	3KV	4KV	5KV	2KV	3KV	4KV	5KV	2KV	3KV	4KV	5KV
Cap Min.	101	101	101	101	151	151	151	151	221	221	221	221	221	221	221	221
Cap Max.	152	472	272	102	103	332	272	102	153	682	222	102	473	333	103	682

Type	JD				KD				LD				MD			
WVDC	2KV	3KV	4KV	5KV	2KV	3KV	4KV	5KV	2KV	3KV	4KV	5KV	2KV	3KV	4KV	5KV
Cap Min.	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331	331
Cap Max.	104	683	223	103	154	683	223	103	224	154	473	333	394	184	563	393

■ 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°C				
Visual	No abnormal exterior appearance		Visual Inspection		
Capacitance	Within The Specified Tolerance		Class	Frequency	Voltage
Quality Factor	Class I (NPO): More Than 30pF : $Q \geq 1000$ 30pF & Below: $Q \geq 400+20C$ (C:Cap., pF)		NPO $C \leq 100\text{pF}$ $C > 100\text{pF}$	1MHz $\pm 10\%$ 1KHz $\pm 10\%$	1.0 $\pm 0.2V_{rms}$
			X7R	1KHz $\pm 10\%$	1.0 $\pm 0.2V_{rms}$
Dissipation Factor	Class II (X7R): Maximum 0.025		Perform a heat treatment at 150 $\pm 5^\circ\text{C}$ for 30min. then place room temp. for 24 ± 2 hr.		
Insulation Resistance	10,000M Ω or 500/C Ω whichever is smaller. (C in Farad)		V> 500V, Applied 500Vdc Charge Time : 60sec. Is applied less than 50mA current.		
Withstanding Voltage	No dielectric breakdown or mechanical breakdown		1000 $\leq V$:120% Rated Voltage for 1~5 sec. Current is limited to less than 50mA.		
Temperature Capacitance Coefficient	Char.	Temp. Range	Class I :		
	NPO(N)	-55 $^\circ\text{C}$ ~ +125 $^\circ\text{C}$	[C2-C1/C1(T2-T1)] $\times 100\%$		
	X7R (X)	-55 $^\circ\text{C}$ ~ +125 $^\circ\text{C}$	Class II :		
			(C2-C1)/C1 $\times 100\%$		
			T1:Standard Temperature(25 $^\circ\text{C}$)		
			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 losing.	Holding the body of the part, apply the pulling force to the lead as indicated below. Pulling strength: 5N Holding time: 10 ± 1 s		
	Bending Strength	No mechanical damage such as lead breakage and losing.	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 $\pm 5^\circ\text{C}$ for 2 ± 0.5 s Solder : H63A Flux :Rosin Dipping :By 1.5~2.0mm from the root of lead		
Resistance to Soldering Heat	Appearance	No mechanical damage shall occur	Completely immerse both terminations in solder at 250 $\pm 5^\circ\text{C}$ for 5 ± 1 s		
	Capacitance	Class I (NPO): Within 2.5% or $\pm 0.25\text{pF}$ whichever is larger of initial value Class II (X7R): Within $\pm 10\%$ of initial value	Solder : H63A Flux :Rosin Dipping :By 1.5~2.0mm from the root of lead		
	Q / Tan δ	To satisfy the specified initial value			
	Insulation Resistance	To satisfy the specified initial value			

RDH 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 °C before initial measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following: <table><tr><th>Step</th><th>Temp.(°C)</th><th>Time(min)</th></tr><tr><td>1</td><td>Min Rated Temp.+0/-3 (-55)</td><td>30</td></tr><tr><td>2</td><td>25</td><td>3</td></tr><tr><td>3</td><td>Max Rated Temp.+3/-0 (125)</td><td>30</td></tr><tr><td>4</td><td>25</td><td>3</td></tr></table> Measure at room temperature after cooling for Class I : 24 ± 2 Hours Class II : 48 ± 4 Hours	Step	Temp.(°C)	Time(min)	1	Min Rated Temp.+0/-3 (-55)	30	2	25	3	3	Max Rated Temp.+3/-0 (125)	30	4	25	3
	Step	Temp.(°C)		Time(min)														
	1	Min Rated Temp.+0/-3 (-55)		30														
	2	25		3														
	3	Max Rated Temp.+3/-0 (125)		30														
4	25	3																
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 / Tanδ	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 °C before initial measurement. Temperature : 40 ± 2 °C 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 / Tanδ	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)																
	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 1000 +48/-0h 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. 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	Rated Voltage	Applied Voltage	V≤250Vdc	150%Rated Voltage	250Vdc < V< 1KVdc	120%Rated Voltage	More Than 1KVdc(include 1KV)	100%Rated Voltage					
Rated Voltage		Applied Voltage																
V≤250Vdc		150%Rated Voltage																
250Vdc < V< 1KVdc		120%Rated Voltage																
More Than 1KVdc(include 1KV)		100%Rated 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 / Tanδ	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)																	
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 / Tanδ	To satisfy the specified initial value																

Axial Coated Multilayer Ceramic Chip 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
- ❑ Halogen free available

◆ Applications

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

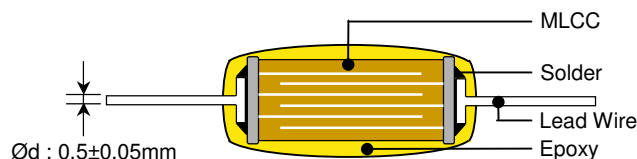
◆ Summary of Specification

Operation Temperature	NPO,X7R : -55~+125 °C
	X5R : -55~+85 °C
	Y5V : -30~+85 °C
Rated Voltage	6.3Vdc to 50Vdc
Temperature Coefficient	NPO : $\leq \pm 30\text{ppm}/^\circ\text{C}$, -55~+125 °C (EIA Class I)
	X7R : $\leq \pm 15\%$, -55~+125 °C (EIA Class II)
	X5R : $\leq \pm 15\%$, -55~+85 °C (EIA Class II)
	Y5V : $\leq \pm 22\sim 82\%$, -30~+82 °C (EIA Class II)
Capacitance Range	NPO :0.5pF to 33nF
	X7R :150pF to 1.5uF
	X5R : 10nF to 22uF
	Y5V :10nF to 22uF
Dissipation Factor :	NPO : $Q \geq 1000$;
	X7R,X5R,Y5V : Please see AXC specification data sheet
Insulation Resistance	10G Ω 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

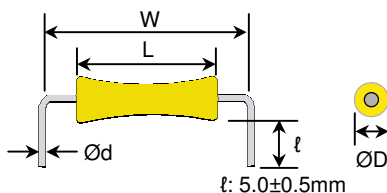
◆ How To Order

AXC	X	103	K	050	D	L	N
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 $\times 10^0$ 471:47 $\times 10^1$ 102:10 $\times 10^2$ 105:10 $\times 10^5$	Tolerance Ex.: C: $\pm 0.25\text{pF}$ D: $\pm 0.50\text{pF}$ J : $\pm 5\%$ K : $\pm 10\%$ M: $\pm 20\%$ Z: $\pm 80\sim 20\%$	Rated Voltage Ex.: 007:6.3Vdc 016:16Vdc 025:25Vdc 050:50Vdc	Dimension (max.) EX: Size C:3.07x2.12mm D:3.81x2.54mm E:5.08x3.81mm	Lead Spacing & Packaging EX: 5: 5.00mm 6: 6.35mm 7: 7.50mm 8: 8.90mm L: 52mm Lead Tape & Reel (Standard) S: 26mm Lead Tape & Reel	Optional Suffix Ex.: N :Halogen Free Indicator

◆ Dimension



H,C,A. type (Bulk)

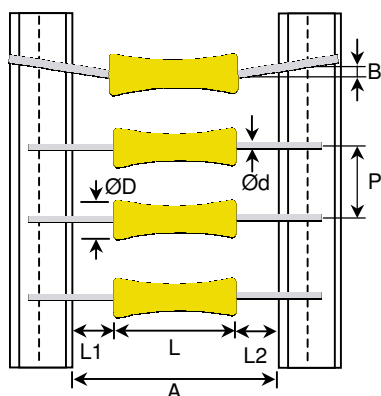


Lead Spacing

Unit:mm [inches]

Type	Dimensions(mm)					
	ØD	L	W			
C	2.12max [.083max.]	3.07max [.121max.]	5.00±0.8 [.197±.0314]	6.35±0.8 [.250±.0314]	7.50±0.8 [.295±.0314]	8.90±0.8 [.350±.0314]
D	2.54max [.100max.]	3.81max [.150max.]	5.00±0.8 [.197±.0314]	6.35±0.8 [.250±.0314]	7.50±0.8 [.295±.0314]	8.90±0.8 [.350±.0314]
E	3.81max [.150max.]	5.08max [.200max.]	--	6.35±0.8 [.250±.0314]	7.50±0.8 [.295±.0314]	8.90±0.8 [.350±.0314]

L,S. Type (Tapping)



L(Lead Space 52mm) Packing

Unit:mm [inches]

Type	Dimension					
	ØD	L	A	B	L1-L2	P
C	2.12max [.083max.]	3.07max [.121max.]	52.0±0.5 [2.047±.0197]	1.2 max [.0472max.]	1.0 max [.0393max.]	5.0±0.5 [.197±.0197]
D	2.54max [.100max.]	3.81max [.150max.]				
E	3.81max [.150max.]	5.08max [.200max.]				

S(Lead Space 26mm) Packing

Type	Dimension					
	ØD	L	A	B	L1-L2	P
C	2.12max [.083max.]	3.07max [.121max.]	26.0±0.5 [1.024±.0197]	0.8 max [.0315max.]	0.5 max [.0197max.]	5.0±0.5 [.197±.0197]
D	2.54max [.100max.]	3.81max [.150max.]				
E	3.81max [.150max.]	5.08max [.200max.]				

Unit:mm [inches]

◆ Capacitance Range

NPO(N) Series

Type	C				D		E	
WVDC	16V	25V	50V	100V	50V	100V	50V	100V
Cap Min.	R50	R50	R50	5R0	5R0	100	100	100
Cap Max.	332	332	332	471	103	102	333	472

X7R(X) Series

Type	C				D				E			
WVDC	16V	25V	50V	100V	16V	25V	50V	100V	16V	25V	50V	100V
Cap Min.	151	151	151	151	151	151	151	151	102	102	102	102
Cap Max.	105	224	104	183	105	224	334	104	156	475	155	474

X5R(B) Series

Type	C				D				E				
WVDC	6.3V	10V	16V	25V	6.3V	10V	16V	25V	6.3V	10V	16V	25V	50V
Cap Min.	474	334	154	104	105	334	225	224	475	155	105	103	103
Cap Max.	106	475	225	105	226	106	475	475	476	226	106	106	105

Y5V(Y) Series

Type	C				D					E			
WVDC	6.3V	10V	16V	25V	6.3V	10V	16V	25V	50V	10V	16V	25V	50V
Cap Min.	103	103	103	103	103	103	103	103	103	103	103	103	103
Cap Max.	475	475	225	105	226	106	475	225	105	226	226	106	105

■ Other dimensions, 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°C ~ +125°C	
	X7R (X)	-55°C ~ +125°C	
	X5R (B)	-55°C ~ +85°C	
	Y5V (Y)	-30°C ~ +85°C	
Visual	No abnormal exterior appearance		Visual Inspection
Capacitance	Within The Specified Tolerance		Class Frequency Voltage
Quality Factor	Class I (NPO):		NPO
	More Than 30pF : $Q \geq 1000$		$C \leq 100\text{pF}$ 1MHz $\pm 10\%$ 1.0 $\pm 0.2\text{Vrms}$
	30pF & Below: $Q \geq 400 + 20C$ (C:Cap., pF)		$C > 100\text{pF}$ 1KHz $\pm 10\%$
			X7R,X5R,Y5V
			$C \leq 10\text{uF}$ 1KHz $\pm 10\%$ 1.0 $\pm 0.2\text{Vrms}$
Dissipation Factor	Class II (X7R,X5R,Y5V):		$C > 10\text{uF}$ 120Hz $\pm 20\%$ 0.5 $\pm 0.2\text{Vrms}$
	Please see AXC specification data sheet		Perform a heat treatment at 150 $\pm 5^\circ\text{C}$ for 30min. then place room temp. for 24 ± 2 hr.
Insulation Resistance	10,000M Ω or 500/C Ω whichever is smaller for rated voltage $>10\text{V}$ and greater 100/C Ω for rated voltage $\leq 10\text{V}$		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°C ~ +125°C	$\pm 30\text{ppm}/^\circ\text{C}$
	X7R (X)	-55°C ~ +125°C	$\pm 15\%$
	X5R (B)	-55°C ~ +85°C	$\pm 15\%$
	Y5V (Y)	-30°C ~ +85°C	+22% ~ -82%
Lead Strength	Tensile Strength	No mechanical damage such as lead breakage and loosening.	
	Bending Strength	No mechanical damage such as lead breakage and loosening.	
Solderability	Leads shall be covered by new solder more than 75% of its surface		Class I : [C2-C1/C1(T2-T1)] $\times 100\%$ Class II : (C2-C1)/C1 $\times 100\%$ T1:Standard Temperature(25°C) T2:Test Temperature C1:Capacitance At Standard Temperature C2:Capacitance At Test Temperature
			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
Resistance to Soldering Heat	Leads shall be covered by new solder more than 75% of its surface		Completely soak both terminations in solder at 235 $\pm 5^\circ\text{C}$ for 2 ± 0.5 s Solder : H63A Flux : Rosin Dipping : By 1.5~2.0mm from the root of lead
	Appearance	No mechanical damage shall occur	
	Capacitance	Class I (NPO): Within 2.5% or $\pm 0.25\text{pF}$ whichever is larger of initial value Class II (X7R,X5R,Y5V) see AXC specification data sheet	Completely soak both terminations in solder at 250 $\pm 5^\circ\text{C}$ for 5 ± 1 s Solder : H63A Flux : Rosin Dipping : By 1.5~2.0mm from the root of lead
	Q / Tan δ	To satisfy the specified initial value	
	Insulation Resistance	To satisfy the specified initial value	

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 °C before initial measurement. Capacitor shall be subjected to five cycles of the temperature cycle as following: <table><tr><th>Step</th><th>Temp.(°C)</th><th>Time(min)</th></tr><tr><td>1</td><td>Min Rated Temp.+0/-3 (-55)</td><td>30</td></tr><tr><td>2</td><td>25</td><td>3</td></tr><tr><td>3</td><td>Max Rated Temp.+3/-0 (125)</td><td>30</td></tr><tr><td>4</td><td>25</td><td>3</td></tr></table>	Step	Temp.(°C)	Time(min)	1	Min Rated Temp.+0/-3 (-55)	30	2	25	3	3	Max Rated Temp.+3/-0 (125)	30	4	25	3
	Step	Temp.(°C)		Time(min)														
	1	Min Rated Temp.+0/-3 (-55)		30														
	2	25		3														
	3	Max Rated Temp.+3/-0 (125)	30															
	4	25	3															
	Capacitance	Class I (NPO): Within 2.5% or ±0.25pF whichever is larger of initial value Class II (X7R,X5R,Y5V): <table><tr><th>Char.</th><th>Cap. change</th></tr><tr><td>X7R(X)</td><td>≤ ±7.5% of initial value</td></tr><tr><td>X5R(B)</td><td>≤ ±7.5% of initial value</td></tr><tr><td>Y5V(Y)</td><td>≤ ±20% of initial value</td></tr></table>	Char.	Cap. change	X7R(X)	≤ ±7.5% of initial value	X5R(B)	≤ ±7.5% of initial value	Y5V(Y)	≤ ±20% of initial value								
Char.	Cap. change																	
X7R(X)	≤ ±7.5% of initial value																	
X5R(B)	≤ ±7.5% of initial value																	
Y5V(Y)	≤ ±20% of initial value																	
Q / Tanδ	To satisfy the specified initial value																	
Insulation Resistance	To satisfy the specified initial value	Measure at room temperature after cooling for Class I : 24 ± 2 Hours Class II : 48 ± 4 Hours																
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 °C before initial measurement. Temperature : 40±2 °C 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): <table><tr><th>Char.</th><th>Cap. change</th></tr><tr><td>X7R(X)</td><td>≤ ±15% of initial value</td></tr><tr><td>X5R(B)</td><td>≤ ±15% of initial value</td></tr><tr><td>Y5V(Y)</td><td>≤ ±30% of initial value</td></tr></table>		Char.	Cap. change	X7R(X)	≤ ±15% of initial value	X5R(B)	≤ ±15% of initial value	Y5V(Y)	≤ ±30% of initial value							
	Char.	Cap. change																
	X7R(X)	≤ ±15% of initial value																
	X5R(B)	≤ ±15% of initial value																
	Y5V(Y)	≤ ±30% of initial value																
	Q / Tanδ	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°C then shall be set for 48±4 hours at room temperature and the initial measurement shall be conducted. Applied Voltage:please see HEC specification data sheet. 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): <table><tr><th>Char.</th><th>Cap. change</th></tr><tr><td>X7R(X)</td><td>≤ ±15% of initial value</td></tr><tr><td>X5R(B)</td><td>≤ ±15% of initial value</td></tr><tr><td>Y5V(Y)</td><td>≤ ±30% of initial value</td></tr></table>		Char.	Cap. change	X7R(X)	≤ ±15% of initial value	X5R(B)	≤ ±15% of initial value	Y5V(Y)	≤ ±30% of initial value							
	Char.	Cap. change																
	X7R(X)	≤ ±15% of initial value																
	X5R(B)	≤ ±15% of initial value																
	Y5V(Y)	≤ ±30% of initial value																
	Q / Tanδ	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 / Tanδ	To satisfy the specified initial value																

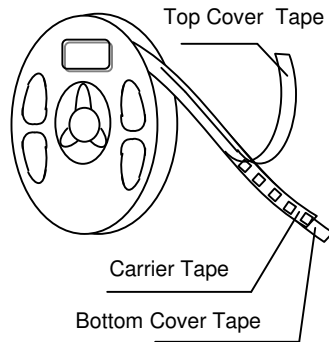
◆ Multilayer Ceramic Chip Capacitor

● Bulk Packing

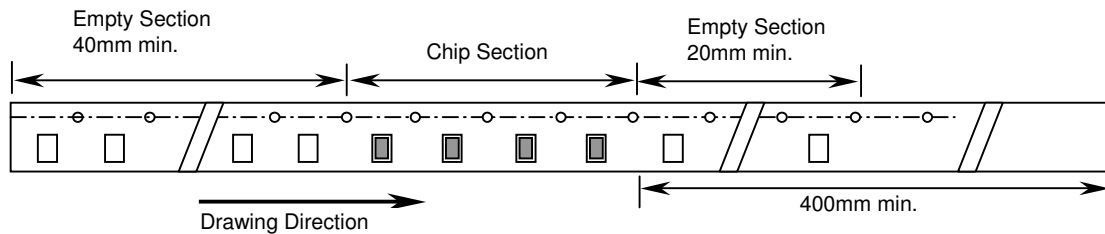
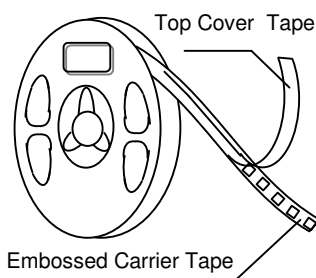
Standard packing 10Kpcs/pack, others according to customers' request.

● Tape Packing

Paper Tape



Embossed Tape



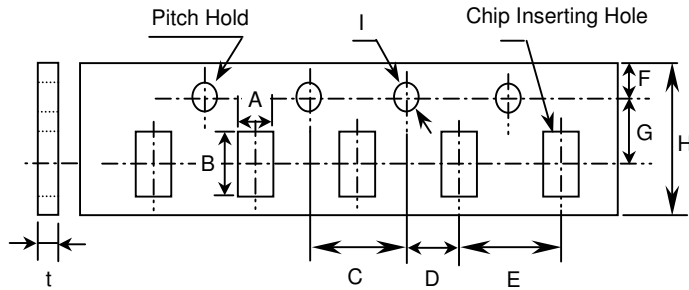
Material And Quantity (ø180mm)

Chip Size (EIA Code)	Dimension (mm)			ø180mm reel	
	L	W	T	Paper Tape	Plastic Tape
0201	0.6	0.3	$T \leq 0.33$	15,000 pcs/reel	N/A
0402	1.0	0.5	$T \leq 0.55$	10,000 pcs/reel	N/A
0603	1.6	0.8	$T \leq 0.90$	4,000 pcs/reel	N/A
0805	2.0	1.25	$T \leq 0.90$	4,000 pcs/reel	N/A
			$0.9 < T \leq 1.25$	N/A	3,000 pcs/reel
1206	3.2	1.6	$T \leq 0.90$	4,000 pcs/reel	N/A
			$0.9 < T \leq 1.25$	N/A	3,000 pcs/reel
			$T > 1.25$	N/A	2,000 pcs/reel
1210	3.2	2.5	$T \leq 1.25$	N/A	3,000 pcs/reel
			$T > 1.25$	N/A	2,000 pcs/reel
1808	4.6	2.0	$T \leq 1.25$	N/A	3,000 pcs/reel
			$T > 1.25$	N/A	2,000 pcs/reel
1812	4.6	3.2	$T \leq 2.20$	N/A	1,000 pcs/reel
			$T > 2.20$	N/A	700 pcs/reel
1825	4.6	6.35	$T \leq 2.20$	N/A	700 pcs/reel
			$T > 2.20$	N/A	400 pcs/reel
2208	5.7	2.0	$T \leq 2.20$	N/A	1,000 pcs/reel
2211	5.7	2.8	$T \leq 2.20$	N/A	1,000 pcs/reel
			$T > 2.20$	N/A	700 pcs/reel
2220	5.7	5.0	$T \leq 2.20$	N/A	1,000 pcs/reel
			$T > 2.20$	N/A	700 pcs/reel
2225	5.7	6.35	$T \leq 2.20$	N/A	700 pcs/reel
			$T > 2.20$	N/A	400 pcs/reel

NA : Not Available

• Dimension of Tape Specification

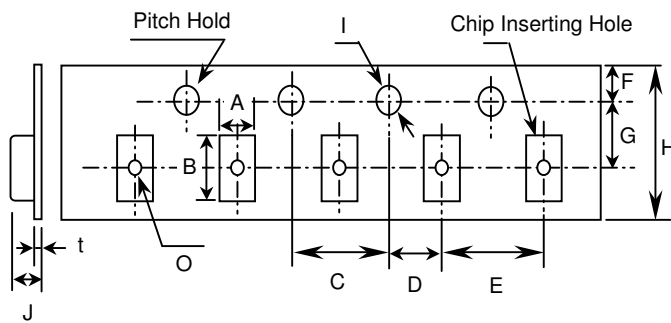
Paper Tape



	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	φ1.5+0.1/-0	---	---	---	---	---
t	1.1 max.	---	---	---	---	---

Unit : mm

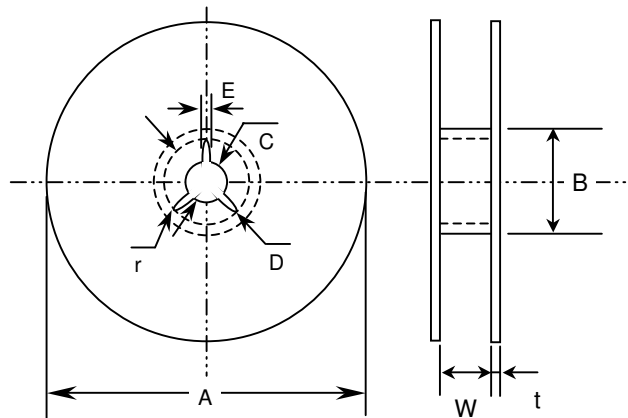
Embossed Tape



	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	φ1.5+0.1/-0	→	---	---	---	---	---	---	---	---
J	3.0 max.	→	---	4.0 max.	→	---	---	---	---	---
t	0.3 max.	→	---	---	---	---	---	---	---	---
O	0.15 min.	→	---	---	---	---	---	---	---	---

Unit : mm

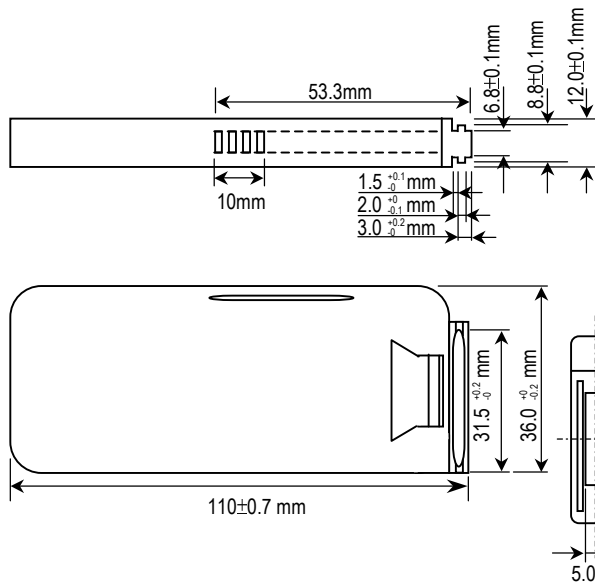
Reel Dimension



Unit : mm

	0402 to 1210	1808 to 2220
A	ϕ 382 max.	ϕ 178±0.2
B	ϕ 50 min.	ϕ 60±0.2
C	ϕ 13±0.5	ϕ 13±0.5
D	ϕ 21±0.8	ϕ 21±0.8
E	ϕ 2.0±0.5	ϕ 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



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.

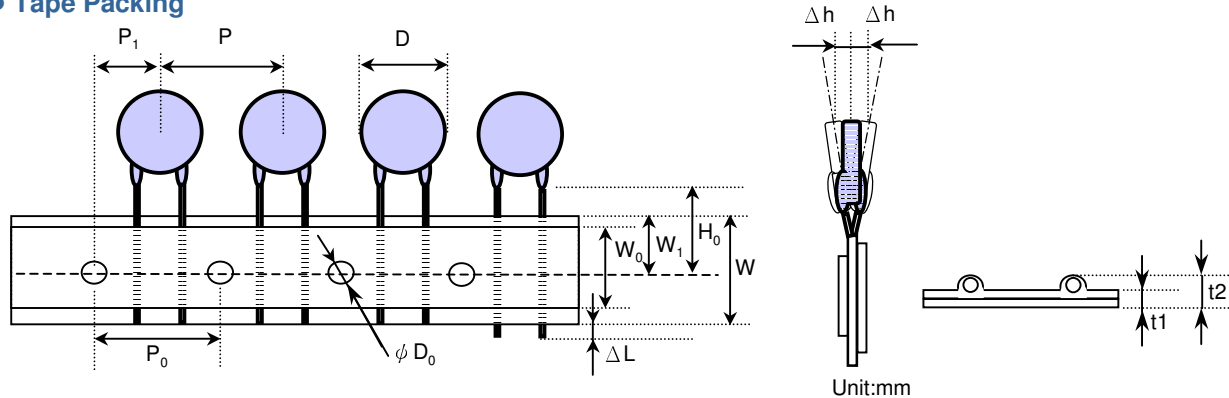
◆ Ceramic Disc Capacitors Packing Information (SDC,HDC Series)

● Bulk Packing

Standard packing 300pcs,500pcs&1,000pcs/pack, others according to customers' request.

Bulk Package	Lead Code	Qt'y/One Pack
HDC Series	H,C,S,M / L	1,000 / 500 pcs
SDC Series	H,C,S,M / L	500 / 250 pcs

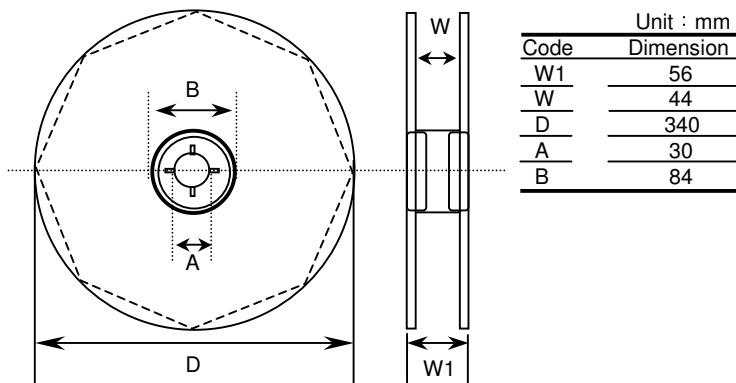
● Tape Packing



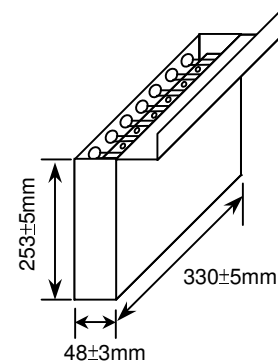
	Symbol	Lead Space		
		5.00mm	6.35mm	7.50mm
Pitch of component	P	12.7±1.0		
Feed Hole Pitch	P_0	12.7±0.3		
Hole center to component center	P_1	6.35±1.3		
Body diameter	D	11.0 max		
Hold position	W_1	8+1.0-0.5		
Hold tape width	W_0	10 min		
Hold position	W_1	9±0.5		
Lead wire clinch	H_0	16+1.5-0.5		
Total tape thickness	t_1	0.6±0.3		
Total thickness, tape& lead wire	t_2	1.5 max		
Feed hole diameter	ϕD_0	4.0±0.2		
Deviation across tape	Δh	2.0 max		
Protrusion Length	ΔL	1.0 max		

● Packing Dimension

Reel Dimension:



Ammo Dimension:



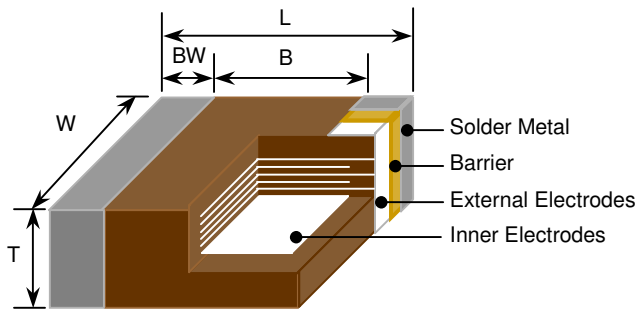
● Packing Quantity

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

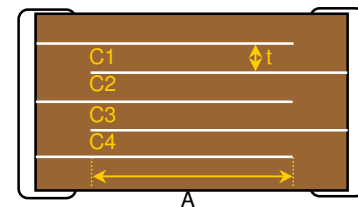
The Multilayer Ceramic Chip of Capacitors supplied in bulk, cassette or taped & reel package are ideally suitable for thick-film Hybrid circuits and automatic surface mounting on printed circuit boards.

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±0.20 [.049±.008]	1.45 [.057]	0.20 [.008]	0.70 [.028]
1206	3.20±0.30 [.126±.012]	1.60±0.20 [.063±.008]	1.80 [.071]	0.30 [.012]	1.50 [.059]
1210	3.20±0.30 [.126±.012]	2.50±0.20 [.098±.008]	2.60 [.102]	0.30 [.012]	1.60 [.063]
1808	4.60±0.30 [.181±.012]	2.00±0.20 [.079±.008]	2.20 [.087]	0.30 [.012]	2.50 [.098]
1812	4.60±0.30 [.181±.012]	3.20±0.30 [.126±.012]	3.00 [.118]	0.30 [.012]	2.50 [.098]
1825	4.60±0.30 [.181±.012]	6.35±0.40 [.250±.016]	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]

$$C = \epsilon_0 \cdot \epsilon \frac{A \cdot N}{t}$$

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

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

For Class II Dielectrics

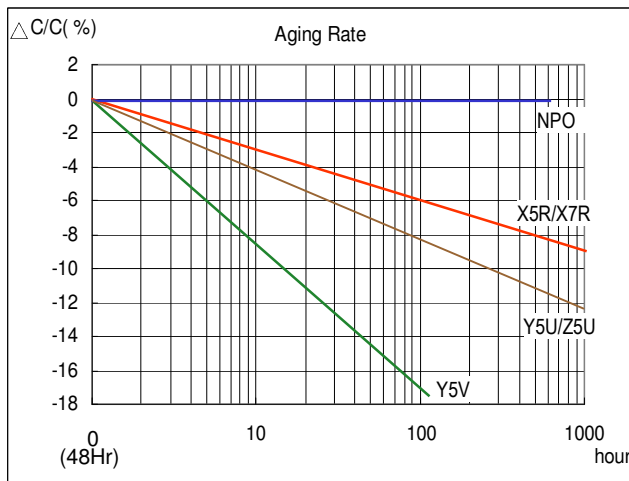
Low Temp. Symbol	High Temp. Symbol	Max. %ΔC Symbol
-55°C X	+45°C 3	±1.0% A
-30°C Y	+65°C 4	±1.2% B
+10°C Z	+85°C 5	±2.2% C
	+105°C 6	±3.3% D
	+125°C 7	±4.7% E
	+150 °C 8	±7.5% F
	+200 °C 9	±10.0% P
		±15.0% R
		±22.0% S
		+22% /-33% T
		+22% /-56% U
		+22% /-82% V

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

◆ Operation Temperature Range

Class	EIA Symbol	Dielectric Code	Temperature Range(°C)	Capacitance Change	Reference Temperature
I	NPO	N	-55°C ~ +125 °C	0±30 ppm/°C	25°C
	SL	L	-25°C ~ +85 °C	+350/-1000 ppm/°C	25°C
II	X7R	X	-55°C ~ +125°C	±15%	25°C
	X7E	C	-55°C ~ +125°C	±4.7%	25°C
	X5R	B	-55°C ~ +85°C	±15%	25°C
	Y5V	Y	-30°C ~ +85°C	+22/-82 %	25°C
	Y5U	E	-30°C ~ +85°C	+22/-56 %	25°C
	Z5U	Z	+10°C ~ +85°C	+22/-56 %	25°C

◆ Dielectric Material – Aging Rate



Aging Rate

NPO: 0

X7R/X5R : 2 ~ 4 % /decade

Y5U/Z5U : 4~6% / decade

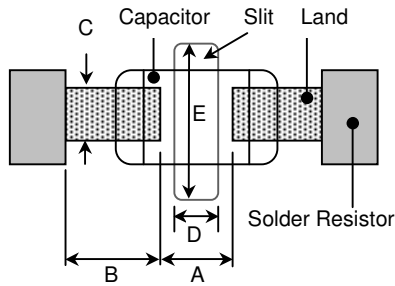
Y5V : 6~10 % /decade

After performing De-Aging at 150±5 °C 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:

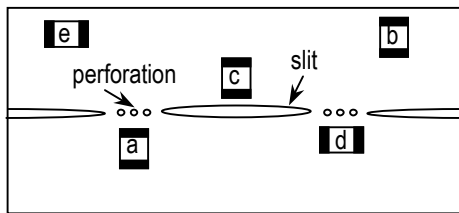
1. Size and recommend land dimensions for reflow soldering



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.

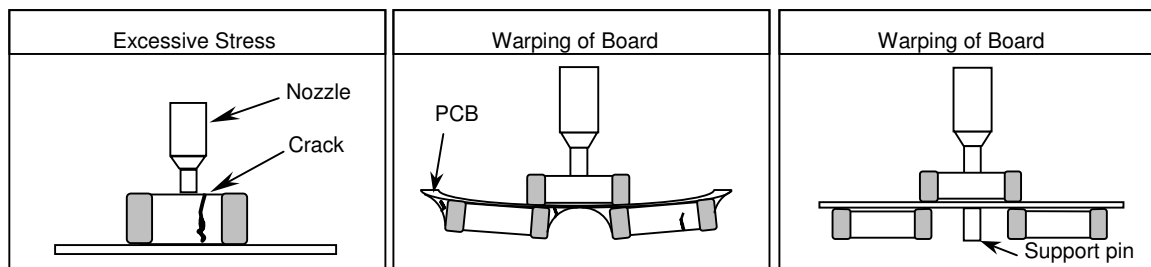


Component layout close to the edge of the board or the "depanelization line" is not recommended.
Susceptibility to stress is in the order of: $a > b > c$ and $d > e$

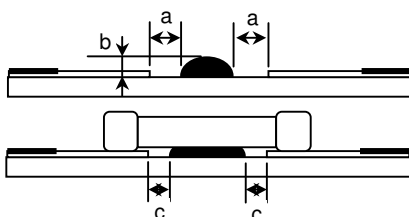
◆ Mounting

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

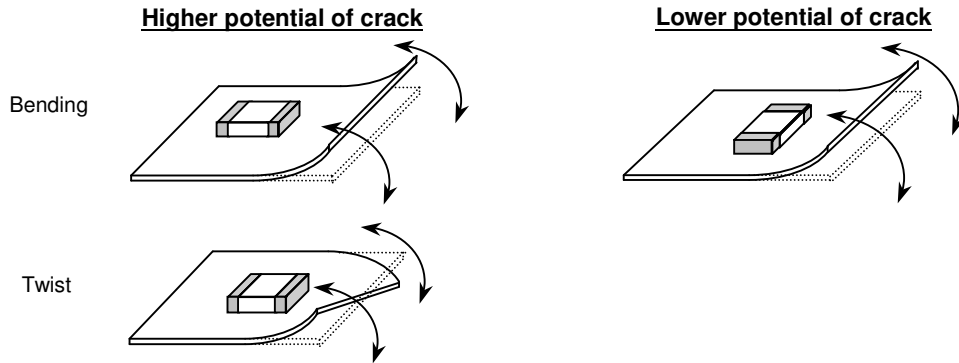


Example : 0805 & 1206

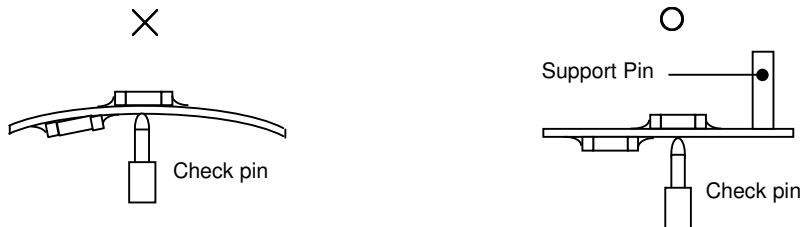
a	0.2mm min.
b	70 ~ 100 μ m
c	Do not touch the solder land

◆ 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.

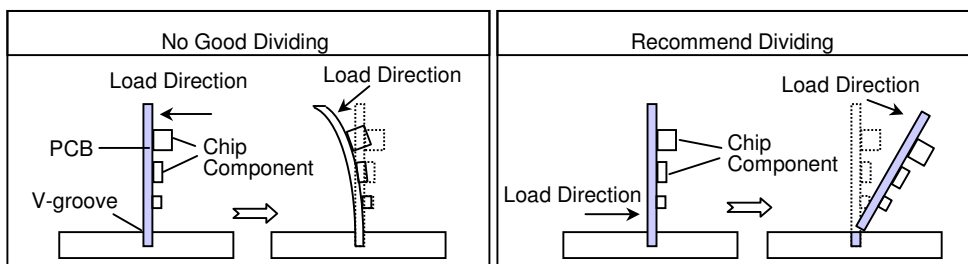
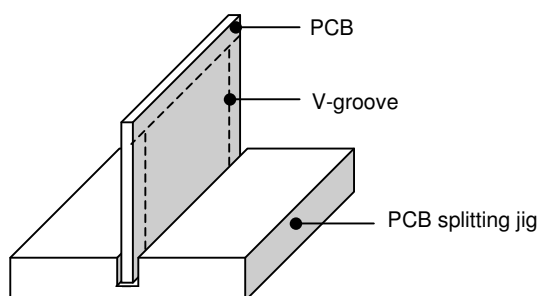


2. There is a potential of crack if board is warped due to excessive load by check pin



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.

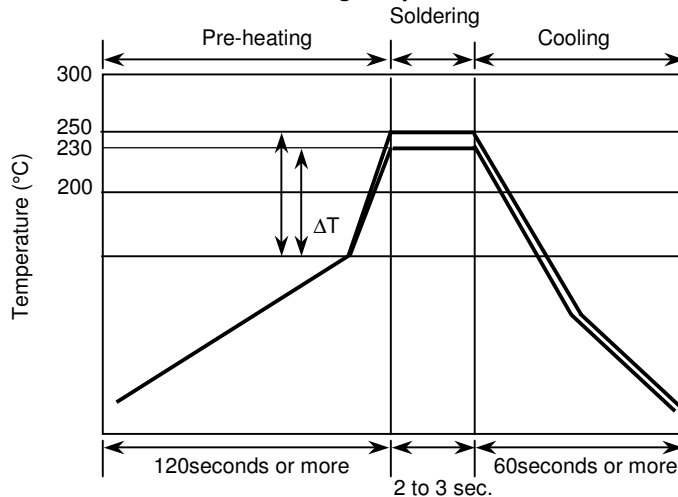


◆Soldering

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.(°C)
1206 and Under	$\Delta T \leq 100 \sim 130^{\circ}\text{C max.}$

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

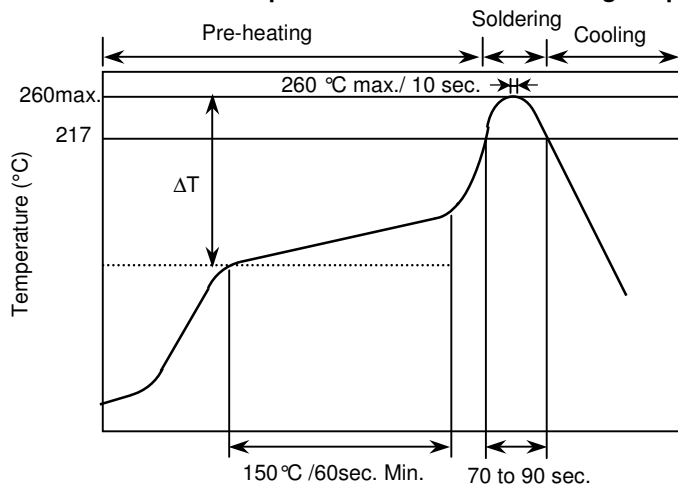
Cooling Condition:

Natural cooling using air is recommended. If the chips are dipped into a solvent for cleaning, the temperature difference (ΔT) between the solvent and the chips must be less than 100°C.

2. Reflow Soldering

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

Recommend reflow profile for Lead-Free soldering temperature Profile (MIL-STD-202G #210F)

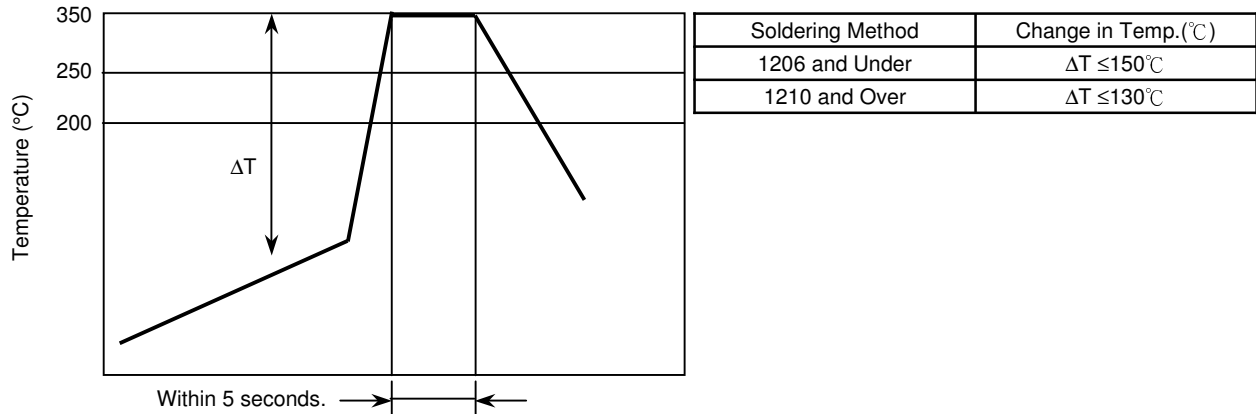


Soldering Method	Change in Temp.(°C)
1206 and Under	$\Delta T \leq 190^{\circ}\text{C}$
1210 and Over	$\Delta T \leq 130^{\circ}\text{C}$

※ 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.



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.

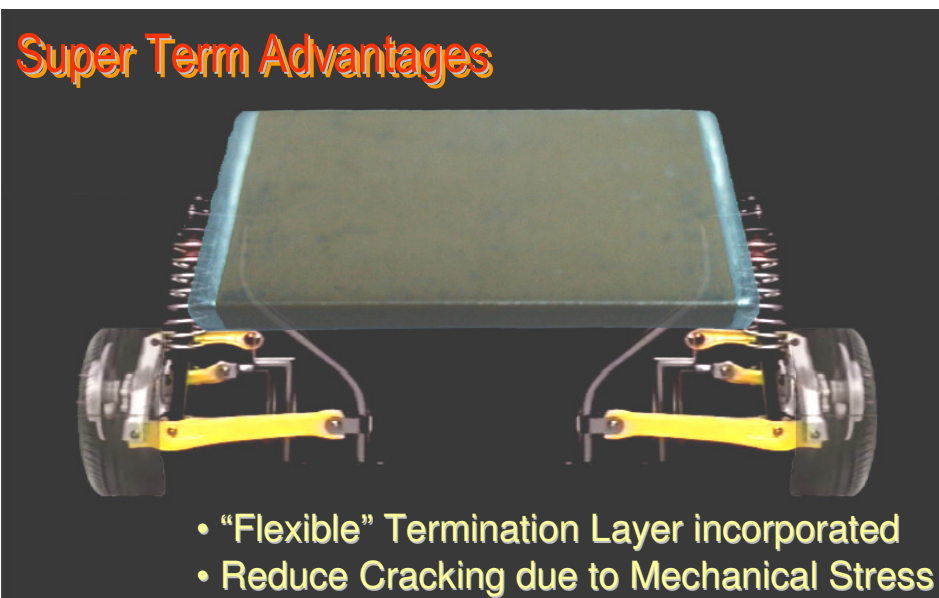
2) recommended solder iron condition

- 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)
- Soldering iron power shall not exceed 30 W.
- Soldering iron tip diameter shall not exceed 3mm.
- 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)**
- 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.
- After soldering operation, let the products cool down gradually in the room temperature.

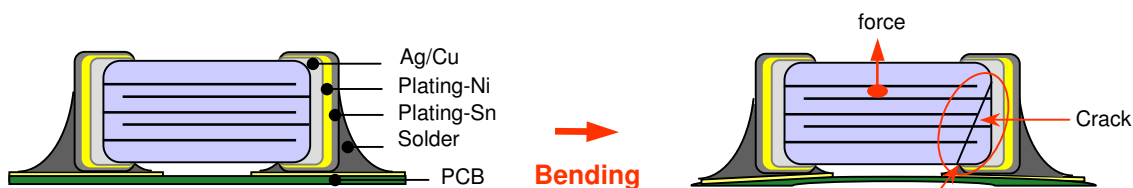
◆Storage

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.

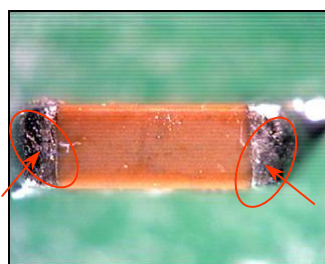


Typical Applications are power circuit input and output filtering, smoothing...

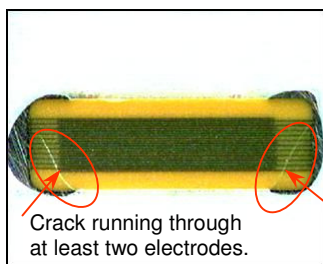


Actual Examples:

Failure Mode Type 1



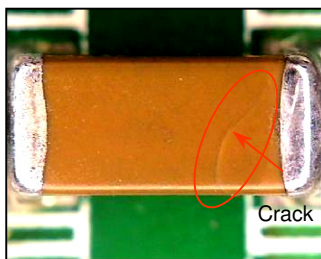
Surface View



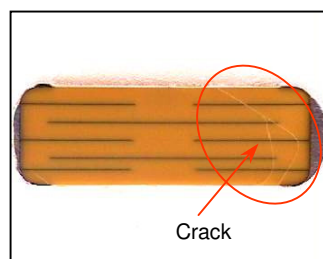
Cross Section View

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

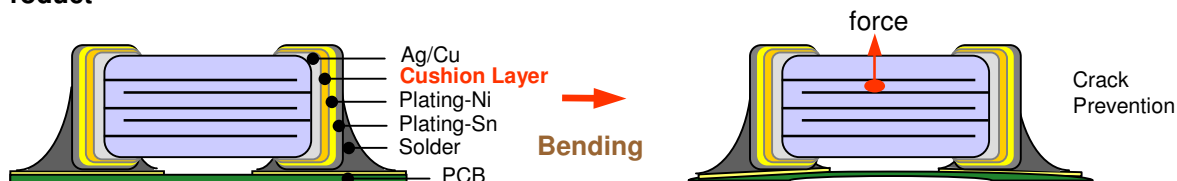


Cross Section View

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

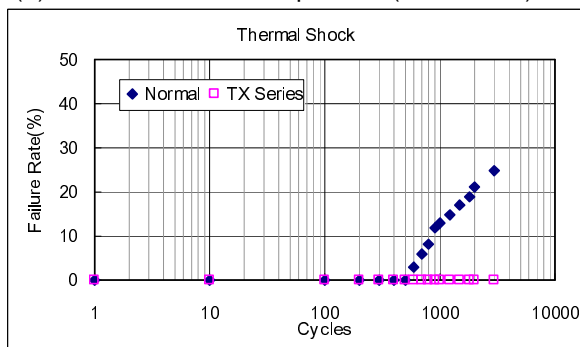
Holy Stone has developed the “**Super Term**” Series (TX suffix in the part number), which incorporates a “cushion layer” in the termination structure. This construction effectively absorbs external forces, reduces the incidence of cracking and improve overall product reliability. SuperTerm product applications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

TX Product



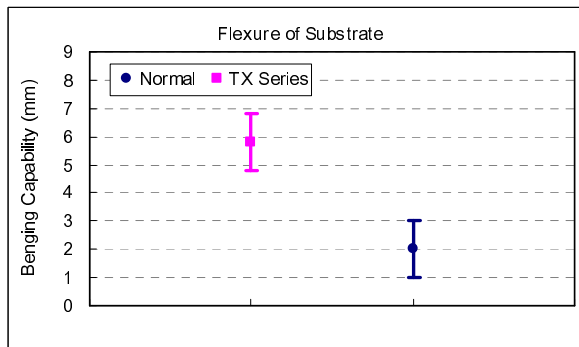
Reliability/Durability Comparison

(a) Thermal Shock Comparison (0805/X7R)

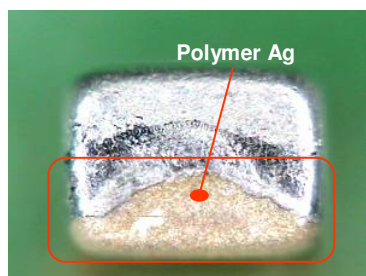


Thermal shock test on standard termination results of inception of failure at 500 cycles. SuperTermTX Series reliability improves to over 3000 cycles.

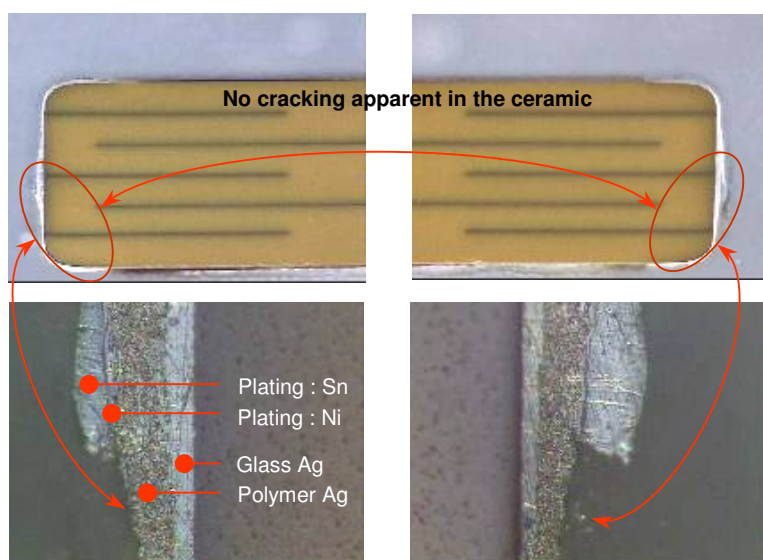
(b) Substrate Flexure Comparison (0805/X7R)



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.

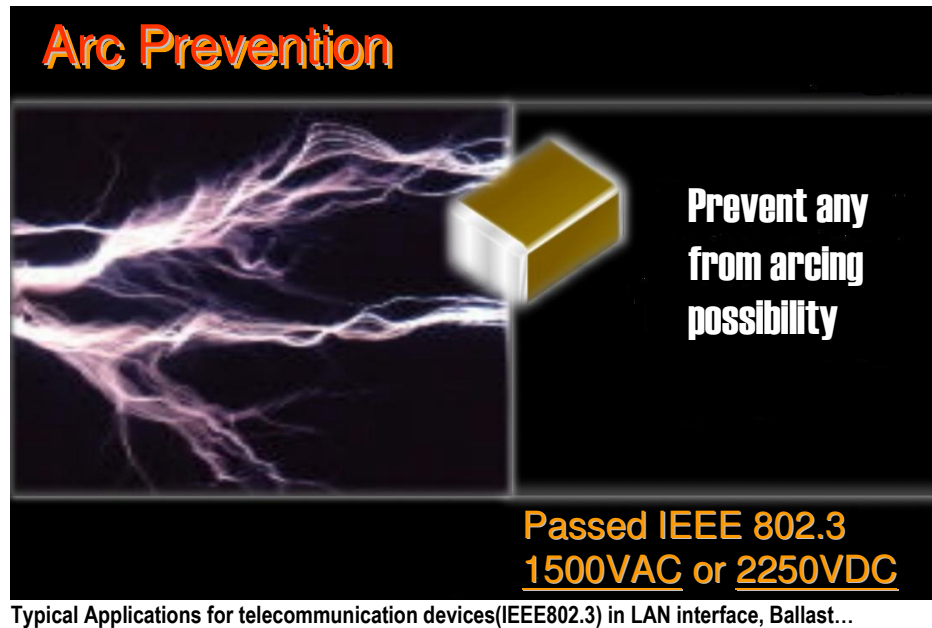


SuperTerm failures resulting from destructive bending test occur in the OPEN mode and not the short circuit mode typical of standard termination failures. The SuperTerm cushion layer material is a “polymer silver” material and can be seen in the above photo.

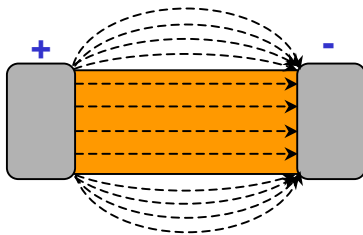
MLCC Arc Prevention – for Hi-Pot Testing

Base on the ceramic material a relatively 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...).

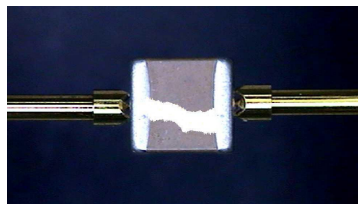
Holy stone developed to possess arc prevention solution on the MLCC product and to meet application and enactment criteria.



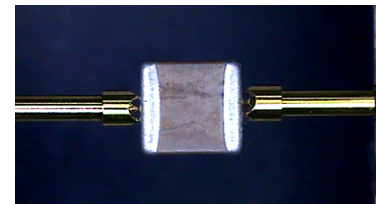
Surface arcing a phenomenon



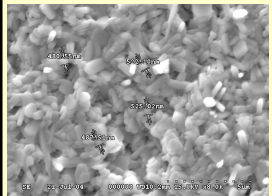
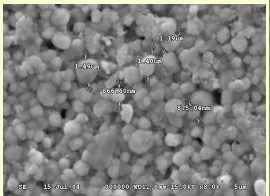
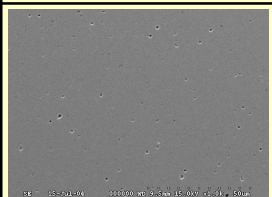
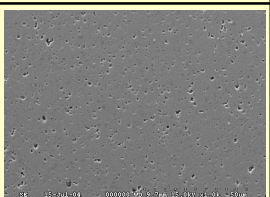
Dielectric flux is generated upon applying voltage to the capacitor as show Fig.



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

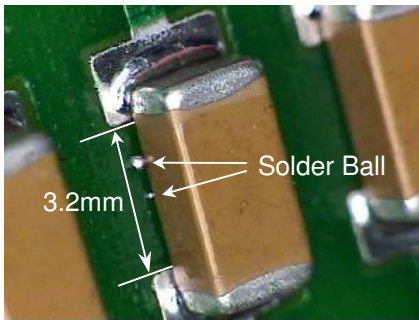


NPO & X7R Material Content & Characteristic Comparison

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)		

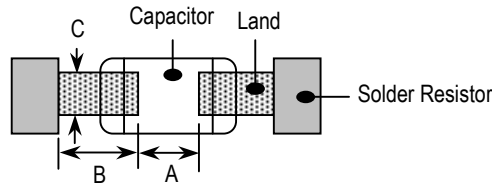
- The different grain sharp will lead to different grain density after sintering
- Because the NPO thinner & longer grain, so grow more tight & dense grain structure than X7R. Especially cause the porosity different between NPO & X7R.
- Much surface porosity will trap more dust & moisture.
- When add 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



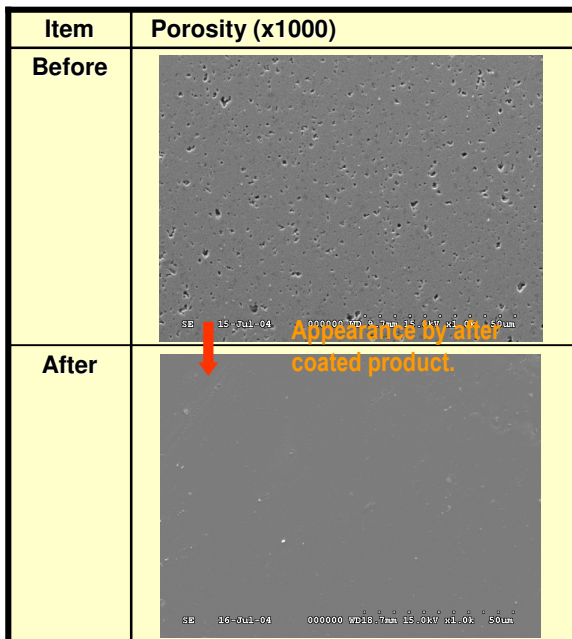
EIA Code	Chip (mm)		Land (mm)		
	L	W	A	B	C
1808	4.6±0.3	2.0±0.2	3.2~3.6	1.2~2.4	1.5~1.8
1812	4.6±0.3	3.2±0.2	3.2~3.6	1.2~2.4	2.3~3.0
2208	5.7±0.4	2.0±0.2	4.0~4.6	1.2~2.4	1.5~1.8
2211	5.7±0.4	2.0±0.3	4.0~4.6	1.2~2.4	2.0~2.6
2220	5.7±0.4	5.0±0.4	4.0~4.6	1.2~2.4	3.5~4.8

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.

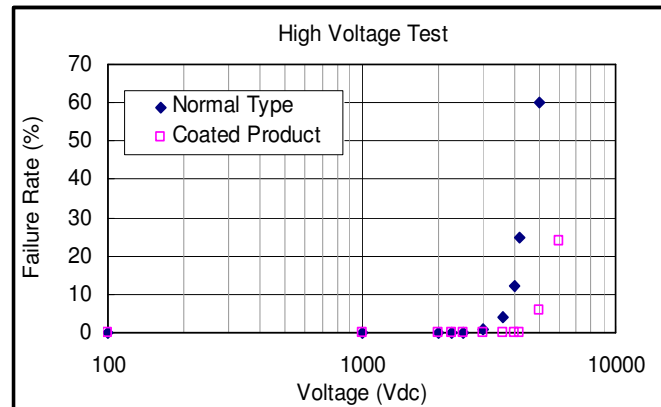
Coated for arcing prevent solution.

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



High Voltage Testing Comparison



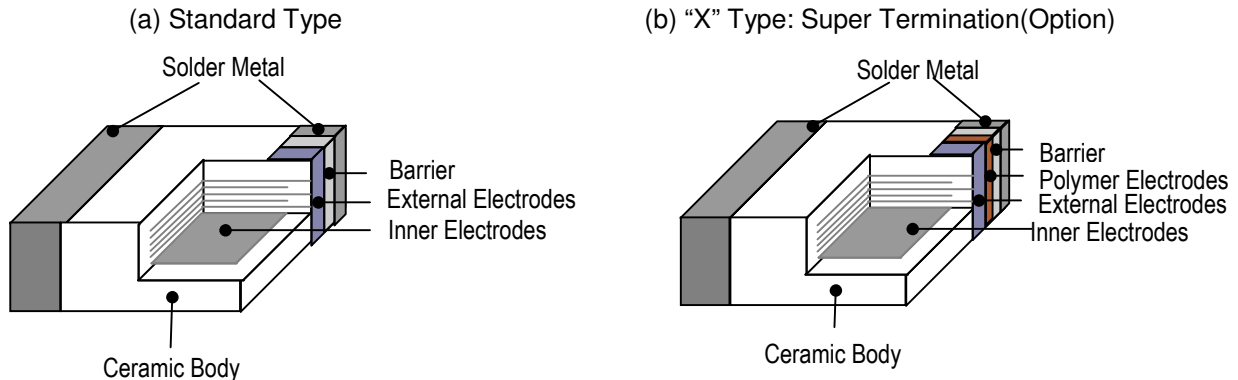
- The coating will filling the porosity of the X7R surface and provide a smooth surface to against hi-voltage charge.
- The Hi-pot endurance level will increase about 1000Vdc after coating in single & on-board hi-pot test.

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:

MLCC , Ceramic Disc Capacitors, Radial & Axial Coated Capacitors: NPO 、X7R 、X5R 、X6S 、X7E 、Y5V 、Y5U & Z5U dielectrics.

• Basic Construction/Homogenous Material :



- 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,AXC	Available	√	√	√	√	√	√

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

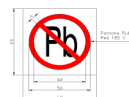
RoHS Status	Lead-Free Status / MSL level
※ External plating : 100% Matte Sn as Standard.	※ Pb-free Reflow & Wave Solder compliant, MSL=1 • Reflow : 260℃ max recommended. • Wave : 260℃ max recommended, Wave & Reflow profile refer to HEC recommended solder profile.

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



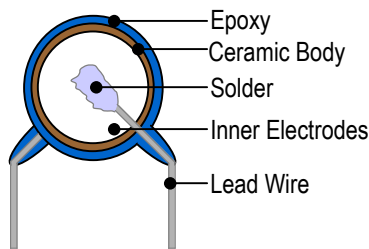
refer to JEDEC&IPC Std.

● Description:

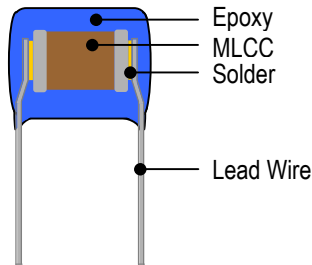
Ceramic Disc Capacitors(SDC,HDC) & Radial(RDC), Axial(AXC) Coated Capacitors by Halogen free compliant

● Basic Construction/Homogenous Material :

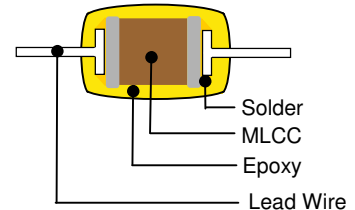
(a) Ceramic Disc Capacitors



(b) Radial Coated Capacitors



(c) Axial Coated Capacitors



Group	Series	Halogen Free Status	Chlorine (Cl)	Fluorine (F)	Bromine (Br)	Iodine (I)
		Limit	<0.09%	<0.09%	<0.09%	<0.09%
Family Products	SDC	Available	√/√	√/√	X/√	√/√
	HDC	Available	√/√	√/√	X/√	√/√
	RDC,RDH	Available	√/√	√/√	X/√	√/√
	AXC	Available	√/√	√/√	X/√	√/√
• Non-Halogen Free Products/ Halogen Free Products • Total Concentration of Chlorine (Cl) + Bromine (Br) less than 1500ppm (0.15%) • A homogeneous material has uniform composition throughout and cannot be mechanically disjointed into different materials • Available on July-2008 by Halogen Free Products						

Part Number Designation:

a) SDC Series(Safety Ceramic Disc Cap) no change P/N.

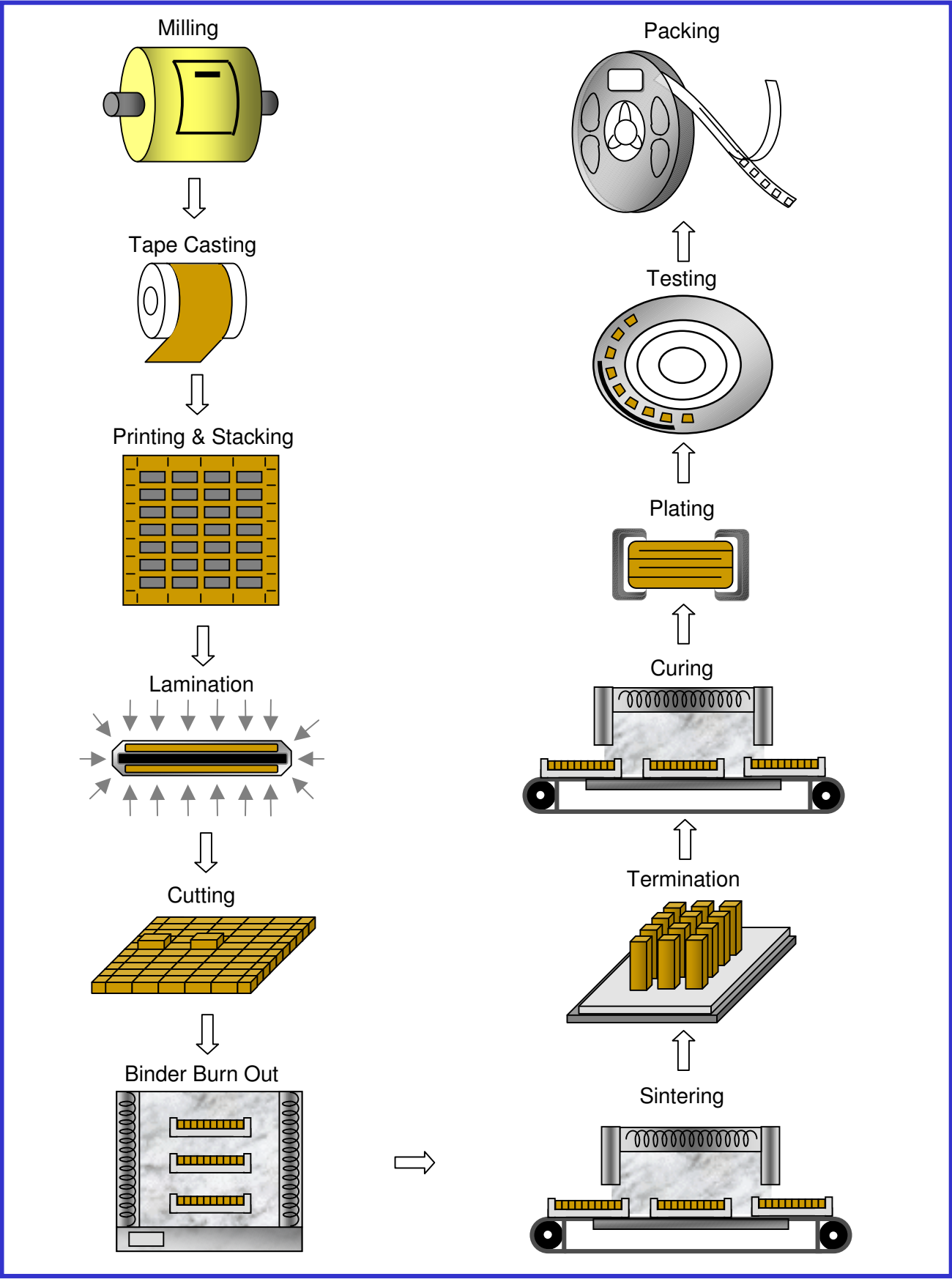
b) HDC, RDC, RDH, AXC Series need to change P/N. (additional Optional Suffix Code : N)

Product Marking :

Marked on pack label and carton label -- RoHS/HF

For Example: (available at customer request)





ISO Certification

Plant	Certificated	Date	Organization	Registration No.
Taipei HQ/Lung Tan Factory	ISO 9001:2000	20,Mar.,2002	BVQI	TW08098Q
Taipei HQ/Lung Tan Factory	ISO 14001:1996	29,May,2003	BVQI	131145
Dongguan Manufacturing	ISO 9001:2000	16.Dec.,2003	BVQI	TW08098Q
Taipei HQ/Lung Tan Factory	QS 9000 : 1998	04.Oct.,2004	BVQI	162522

ISO 9001:2000



ISO 14001:1996



QS 9000:2004



Location in Taiwan

• Taipei HQ/台北總公司

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