PSA
華科事業群 PASSIVE SYSTEM ALLIANCE

信昌電子陶瓷

2012

MULTILAYER CERAMIC CHIP CAPACITORS

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ABOUT PDC

Introduction

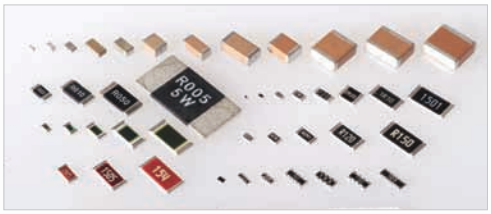
Prosperity Dielectrics Co., Ltd. (PDC) was founded in 1990 as the 1st local manufacturer and exporter in Taiwan for ceramic dielectric powders and multiple-layer ceramic chip capacitors (MLCCs). PDC joined to Walsin Technology Corporation (WTC) as an allied company in September 2005, and incorporated Frontier to create solid synergy in 2008. Our product lines expand to SMD magnetic chips, power chokes, coils, diode and transformers.

歷史沿革	1990 台泥集團購買美大美電子公司，信昌電子陶瓷正式成立。 1995 信昌電子陶瓷併購台灣精密材料公司。 2002 信昌電子陶瓷正式上櫃。 2005 與華新科技（股）公司策略聯盟。 2007 與弘電電子工業（股）公司策略聯盟，生產二極體與磁性材料元件。 2008 集團推動 PSA 被動系統聯盟企業識別，信昌電子陶瓷定位為特殊品及材料事業群。
關鍵技術	1988 生產製造圓板電容粉末、開發。 1990 生產製造積層陶瓷晶片電容。 1995 生產陶瓷晶片電阻、陶瓷晶片電感。 2001 臺灣第一家自行供給晶片電容器介電瓷粉之被動元件廠商。 自製半導性介電瓷粉，掌握由材料至製程的完整關鍵性技術。 2007 生產二極體與磁性材料元件。
品牌價值	2001 亞洲第一家獲得 SEMKO 安全規格認證之供應商。 2003 獲 ISO 9001 驗證通過。 2004 榮獲經濟部工業局工業精銳獎。 2004 獲 TS16949、ISO 14000 及 OHSAS 18000 驗證。 2008 獲 IECQ QC080000 HSF 驗證。 2007 天下雜誌 1000 大製造業排名第 705 名 2008 天下雜誌 1000 大製造業排名第 682 名 2009 天下雜誌 1000 大製造業排名第 677 名
市場表現	介電陶瓷粉末產品佔有率世界第三。 國內唯一可全數提供特殊電容、電感、電阻之被動元件供應商。 國內唯一打入日本供應鏈之廠商。

信昌電子陶瓷成立於 1990 年，為國內少數能自行供給瓷粉原料並同時銷售積層陶瓷電容的被動元件廠商，更是唯一有能力由上游初發原料，向下垂直整合至被動晶片元件的廠商。2005 年信昌電陶與華新集團進行策略聯盟、2008 年正式合併弘電電子，將銷售範圍從介電瓷粉、半導性陶瓷電容器瓷片、積層陶瓷電容、晶片電阻延伸到二極體與線圈。







Branding Performance

成為高階電子陶瓷產品的世界級廠商

Business Operation
經營模式分析

- Vertical integration of improve competitiveness
- Building strategic alliances to strengthen competitiveness
- Expanding Western and Japanese markets, cultivating high-end products
- Moving into Chinese market to expand market share
- 垂直整合發展，擺脫同業競爭
- 運用策略聯盟，產品水平延伸
- 拓展歐美日市場，深耕高階產品
- 跨足中國市場，擴大市佔率

Branding Strategy
品牌經營策略

- Developing specialized products market
- Enhancing brand value with continuing innovation and R&D ability
- Improving competitiveness through vertical integration
- Satisfying customer's need through extending product lines
- 深耕被動元件特殊品市場及其上游材料產業高階產品
- 持續創新研發能力，提升品牌競爭力
- 產品垂直整合，強化競爭優勢
- 產品齊全，滿足客戶一次購足

Keys to the Success
關鍵成功因素

- The only local manufacturer with vertical production capability from ceramic dielectric powder material to multiple-layer ceramic chip capacitors
- Differentiating marketing strategy with niche product
- Diversifying product lines to expand customer base
- Continuing innovation and R&D ability
- Focusing core competence with PSA group support
- 國內唯一有能力由上游初發原料，向下垂直整合至被動晶片元件的廠商，掌握材料與製程的完整關鍵性技術
- 利基產品差異化與行銷差異化策略
- 產品線多元發展，擴大客戶群
- 持續創新與研發，開發新產品與導入新製程
- 共享集團資源，聚焦核心競爭力

Characteristics
企業特色

- PDC is the domestic manufacturer devoting to ceramic dielectric materials.
- 為國內廠商對介電瓷粉材料研發投注最深者

Support You Forward

由於掌握關鍵性材料的技術利基，信昌電陶可配合市場需求，由材料的研發著手，向下整合開發客戶所需要的電子元件，縮短量產時效，並積極規劃各項產品朝高附加價值的零件功能領域邁進，如：中高壓、高精度、大尺寸之晶片電容器及高功率、高精度與低阻值之晶片電阻器等高附加價值產品。未來更將結合材料核心技術，進軍高頻及高容領域。

目前信昌電陶貴金屬製程及卑金屬製程（BME）使用的晶片電容器介電瓷粉已陸續開發完成，量產自用與對外銷售並行展開，提升國內高階積層電容瓷粉原料自主供應比率。藉由原料往下游整合至晶片電容器成品的延伸策略，發揮上下垂直整合的高度營運績效。

近年來，為了擴展磁性元件及半導體系列產品的產能，信昌電陶陸續在中國昆山廠增置半導體相關製造設備，在東莞廠、湖南廠、重慶廠增置電感、變壓器相關製造設備，藉由產能提升，大幅拉升業績。

上下游垂直整合，掌握完整關鍵性技術：
原料（介電瓷粉）
半成品（半導性陶瓷電容瓷片）
成品（晶片電容、晶片電阻、線圈、二極體）

MLCC Select Guide

Two significant digits followed by no. of zeros. And R is in place of decimal point.

eg.:

100=10x10^0 =10pF 106=10x10^6 =10μF

Rated Voltage	6.3V			10V				16V				25V				50V			100V			200V/250V			500V/630V		Rated Voltage
Dielectric	X7R	X5R	Y5V	NPO/ C0G	X7R	X5R	Y5V	NPO/ C0G	X7R	X5R	Y5V	NPO/ C0G	X7R	X5R	Y5V	NPO/ C0G	X7R	Y5V	NPO/ C0G	X7R	Y5V	NPO/ C0G	X7R	X5R	NPO/ C0G	X7R	Dielectric
0201	103	224	104	---	103	104		101	472	472	---	101	102	102	---	390	102	---									0201
0402	---	475	105	102	104	225	105	102	104	224	474	102	473	104	224	102	103	333	221			---			---		0402
0603	105	106	475	332	225	475	475	332	105	225	225	332	105	105	105	332	104	474	102	333		221	103	---	---	---	0603
0805	106	476	226	103	106	226	106	103	475	106	106	103	225	475	475	103	474	225	472	104	104	102	333	683	391	223	0805
1206	106	107	476	393	226	476	226	393	106	226	226	103	106	106	106	103	475	475	103	105	224	222	104	154	222	333	1206
1210	476	107	107	153	476	476	476	153	226	476	226	153	226	226	226	153	225	106	153	225	334	392	474	154	182	563	1210
1812	---	107	---	333	106	---	106	333	106	---	476	333	106	---	106	333	275	106	333	225	---	682	105	684	332	124	1812
1825	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	393	565	---	153	475	---	822	225	---	472	334	1825
2020	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	393	565	---	153	475	---	822	225	---	472	334	2020
2220	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	473	685	---	183	475	---	822	225	---	472	474	2220
2225	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	563	685	---	333	475	---	103	225	---	682	105	2225
3035	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	683	685	---	473	475	---	273	335	---	822	125	3035
3333	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	823	825	---	563	475	---	333	335	---	822	125	3333
3530	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	104	825	---	683	475	---	393	475	---	103	125	3530
3640	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	124	825	---	823	565	---	473	475	---	103	225	3640
3940	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	154	825	---	104	655	---	563	565	---	123	225	3940
4045	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	154	106	---	104	685	---	563	565	---	123	225	4045
4238	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	184	106	---	124	685	---	683	565	---	223	335	4238
4252	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	184	106	---	124	685	---	683	685	---	223	335	4252
4540	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	184	126	---	124	685	---	683	685	---	273	335	4540
4545	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	184	126	---	124	685	---	683	685	---	273	475	4545
5530	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	224	126	---	154	685	---	823	825	---	334	475	5530
5540	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	224	156	---	154	685	---	823	825	---	104	475	5540
5550	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	224	156	---	154	825	---	823	825	---	124	565	5550
5780	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	274	156	---	184	106	---	104	106	---	154	565	5780
5868	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	274	156	---	184	106	---	104	106	---	154	565	5868
6560	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	274	186	---	184	126	---	104	106	---	184	685	6560
7680	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	334	186	---	224	126	---	124	126	---	224	685	7680
7875	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	394	186	---	274	156	---	154	126	---	334	685	7875
7880	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	474	186	---	334	156	---	184	126	---	394	825	7880
8550	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	564	186	---	394	186	---	224	156	---	474	825	8550
8840	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	564	226	---	394	186	---	224	156	---	474	825	8840
42102	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	684	276	---	474	226	---	274	186	---	564	106	42102
10642	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	684	336	---	474	226	---	274	186	---	684	106	10642
10662	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	824	396	---	564	276	---	334	226	---	684	106	10662
13060	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	824	476	---	684	276	---	394	226	---	824	106	13060
Dielectric	X7R	X5R	Y5V	NPO/ C0G	X7R	X5R	Y5V	NPO/ C0G	X7R	X5R	Y5V	NPO/ C0G	X7R	X5R	Y5V	NPO/ C0G	X7R	Y5V	NPO/ C0G	X7R	Y5V	NPO/ C0G	X7R	X5R	NPO/ C0G	X7R	Dielectric
Rated Voltage	6.3V			10V				16V				25V				50V			100V			200V/250V			500V/630V		Rated Voltage

* For more information, please contact with PDC local representative.

MLCC Select Guide

Two significant digits followed by no. of zeros. And R is in place of decimal point.

eg.:

100=10x10^0=10pF 106=10x10^6=10μF

Rated Voltage	1KV		2KV		3KV		4KV		5KV		6KV		7KV		8KV		10KV		Rated Voltage
Dielectric	NPO/ C0G	X7R	NPO/ C0G	X7R	NPO/ C0G	X7R	NPO/ C0G	X7R	NPO/ C0G	X7R	NPO/ C0G	X7R	NPO/ C0G	X7R	NPO/ C0G	X7R	NPO/ C0G	X7R	Dielectric
1206	681	103	271	222	680	---	---	---	---	---	---	---	---	---	---	---	---	---	1206
1210	102	103	561	222	221	---	---	---	---	---	---	---	---	---	---	---	---	---	1210
1808	152	123	102	222	331	102	121	561	---	---	---	---	---	---	---	---	---	---	1808
1812	222	473	122	472	471	182	221	821	---	---	---	---	---	---	---	---	---	---	1812
1825	332	683	152	682	102	222	471	102	---	---	---	---	---	---	---	---	---	---	1825
2020	332	683	152	682	102	222	471	102	271	821	101	681	---	---	---	---	---	---	2020
2211	332	104	152	822	102	272	471	122	331	821	101	681	---	---	---	---	---	---	2211
2220	332	104	152	822	102	272	471	122	331	102	121	821	---	---	---	---	---	---	2220
2225	392	104	182	103	122	332	561	152	471	102	151	821	---	---	---	---	---	---	2225
3035	472	124	222	103	152	332	681	152	561	122	181	102	---	---	---	---	---	---	3035
3333	562	124	472	123	152	392	821	182	561	122	181	102	---	---	---	---	---	---	3333
3530	682	154	562	123	222	392	102	182	681	152	221	122	181	102	151	821	121	---	3530
3640	822	154	472	153	222	472	122	222	681	152	221	122	181	102	151	821	121	---	3640
3940	103	184	682	153	332	472	222	222	821	182	271	152	221	122	181	102	151	---	3940
4045	123	184	822	183	472	682	272	272	821	182	271	152	221	122	181	102	151	---	4045
4238	223	224	103	183	472	682	332	272	102	222	331	182	271	152	221	122	181	---	4238
4252	333	224	223	223	562	822	472	332	102	222	331	182	271	152	221	122	181	---	4252
4540	473	274	333	223	562	822	562	332	222	272	471	222	331	182	271	152	221	---	4540
4545	563	274	333	273	682	103	682	392	222	272	471	222	331	182	271	152	221	---	4545
5530	683	334	333	273	682	103	822	392	272	332	561	272	471	222	331	182	271	---	5530
5540	683	334	333	333	822	123	103	472	272	332	561	272	471	222	331	182	271	---	5540
5550	823	394	333	393	822	123	123	472	332	392	681	332	561	272	471	222	331	---	5550
5780	823	394	473	393	103	153	153	562	332	392	681	332	561	272	471	222	331	---	5780
5868	823	474	473	473	103	153	153	562	472	472	821	392	681	332	561	272	471	---	5868
6560	104	474	473	473	223	183	183	682	472	472	821	392	681	332	561	272	471	---	6560
7680	104	564	563	563	223	183	223	682	562	562	102	472	821	392	681	332	561	---	7680
7875	124	564	823	563	333	223	333	822	682	562	122	472	821	392	681	332	561	---	7875
7880	224	684	124	683	473	273	473	822	822	682	152	562	102	472	821	392	681	182	7880
8550	---	684	---	683	---	273	---	103	---	682	---	562	---	472	---	392	---	182	8550
8840	---	824	---	823	---	333	---	103	---	822	---	682	---	562	---	472	---	222	8840
42102	---	824	---	823	---	333	---	123	---	822	---	682	---	562	---	472	---	222	42102
10642	---	105	---	104	---	393	---	123	---	103	---	822	---	682	---	562	---	272	10642
10662	---	105	---	104	---	393	---	153	---	103	---	822	---	682	---	562	---	272	10662
13060	---	125	---	124	---	473	---	153	---	123	---	103	---	822	---	682	---	332	13060
Rated Voltage	1KV		2KV		3KV		4KV		5KV		6KV		7KV		8KV		10KV		Rated Voltage
Dielectric	NPO/ C0G	X7R	NPO/ C0G	X7R	NPO/ C0G	X7R	NPO/ C0G	X7R	NPO/ C0G	X7R	NPO/ C0G	X7R	NPO/ C0G	X7R	NPO/ C0G	X7R	NPO/ C0G	X7R	Dielectric

* For more information, please contact with PDC local representative.

Multilayer Ceramic Chip Capacitors

Introduction

The follwing information about PROSPERITY Multilayer Ceramic Capacitors provides all information necessary to select a particular part to fit your application.
PROSPERITY offers a versatile product line designed to meet the high standard of industrial applications.

For easy reference, this catalogue is divided into separate sections, as shown in the table of contents.

Each section has product specifications, dimensional drawings, and ordering information.

Once you have determined the proper part number for your application, you may use it for ordering, as a reference for further questions, or obtaining price information.
If modifications to standard capacitors would suit your application better, please contact a PROSPERITY representative for assistance. We'll be glad to help.

Technology

PROSPERITY Multilayer Ceramic Capacitors are constructed by depositing alternative layers of ceramic dielectric materials and internal metallic electrodes, by using advanced ceramic manufacturing technology, and co-firing into an indestructible homogeneous body, then completed with application of metal end terminations which are fired on to assure that permanent connection of individual internal electrodes are in parallel. The terminations can also be nickel plated and then solder plated to give the chip capacitors nickel-barrieer termination which have much better leaching resistance during soldering.

Reliable performances are built-in through exact formulation of dielectric powders, preparation of conductive paste, advanced automatic manufacturing, and strict quality control to assure excellent control in dielectric thickness, electrode integrity, and electrode-to-termination continuity.

Table Of Contents

Introduction

PROSPERITY's SAFETY CERTIFIED CAPACITORS are designed for surge or lightning immunity in modem facsimile and other equipments. The capacitors of series FK are class X1/Y2 compliant respectively.

The green type capacitors in FK and FH series are manufactured by using environmentally friendly materials without lead or cadmium.

The terminations are composed of plated nickel and pure tin to feature the superior leaching resistance during soldering.

Features

- » High reliability and stability.
- » Small size and high capacitance
- » RoHS compliant
- » Safety standard approval by EN132400:1994+A2+A3+A4, IEC60384-14, Third edition, 2005, EN60384-14:2005 and UL60950
- » Certificate number: R 50041666 and R 50118381 by TUV E231248 by UL
- » HALOGEN compliant

Applications

- » Modem.
- » Facsimile.
- » Telephone.
- » Other electronic equipment for lighting or surge protection and isolation.

TÜV Rheinland Product Safety | BAUART GEPRÜFT TYPE APPROVED

c UL us

How to order

FK	08	X	102	K	502	E	F	G
PDC Family	Size	Dielectric	Capacitance	Tolerance	Safety Class	Packaging	Thickness	Control Code
FK: X1/Y2 FH: X2/Y3	Inch (mm) 06: 1206(3216) 08: 1808(4520) 12: 1812(4532) 21: 2211(5728) 20: 2220(5750)	N: C0G(NPO) X: X7R	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: R47=0.47pF 0R5=0.5pF 1R0=1.0pF 100=10x10^0 =10pF	B= ± 0.1pF C= ± 0.25pF D= ± 0.5pF F= ± 1.0% G= ± 2.0% J= ± 5.0% K= ± 10% M= ± 20%	202: 2000 VDC 252: 2500 VDC 302: X2/Y3 (Impulse 2.5KV) 502: X1/Y2 (Impulse 5.0KV) 602: X1/Y2 (Impulse 6.0KV)	E: Tape and Reel, Embossed Tape B: Bulk	C: 1.25 ± 0.10mm D: 1.40 ± 0.15mm E: 1.60 ± 0.20 mm F: 2.00 ± 0.20 mm G: 2.50 ± 0.30 mm	G: RoHS compliant

General electrical data

Dielectric	C0G(NPO)		X7R		
Size	1808, 1812, 2211		1808, 1812, 2211, 2220		1206
Rated voltage	250Vac		250Vac		2KV, 2.5KV
Capacitance range*	X1/Y2 Class (Impulse 6KV)	4pF ~ 100pF	X1/Y2 Class	100pF ~ 4700pF	1000pF
	X1/Y2 Class (Impulse 5KV)	3pF ~ 720pF	X2/Y3 Class	150pF ~ 4700pF	
	X2/Y3 Class	3pF ~ 1000pF			
Capacitance tolerance	Cap ≤ 5pF : B (± 0.1pF), C (± 0.25pF) 5pF<Cap<10pF : C (± 0.25pF), D (± 0.5pF) Cap ≥ 10pF : F (± 1%), G (± 2%), J (± 5%), K (± 10%)		K (± 10%), M (± 20%)		J (± 5%), K (± 10%), M (± 20%)
Tan δ *(Tangent of loss angle)	Cap<30pF : D.F ≤ 1/(400+20C) Cap ≥ 30pF : D.F ≤ 0.10%		≤ 2.5%		
Insulation resistance at 500Vdc for 60 seconds	≥ 100G Ω or R·C ≥ 1000 whichever is smaller		≥ 10G Ω or R·C ≥ 500 Ω -F whichever is smaller		
Operating temperature	-55 to +125℃				
Capacitance characteristic	± 30ppm / ℃		± 15%		
Termination	Cu or Ag/Ni/Sn (lead-free termination)				

* C0G(NPO): Apply 1.0 ± 0.2Vrms, 1.0MHz ± 10%, at 25℃ ambient temperature
X7R: Apply 1.0 ± 0.2Vrms, 1.0kHz ± 10%, at 25℃ ambient temperature.

Capacitance range

6.1 X1Y2 (FK) Class

CLASS		X1/Y2(FK series)								X2/Y3(FH series)			
RATED VOLTAGE		250Vac											
DIELECTRIC		C0G(NPO)				X7R				C0G(NPO)		X7R	
CERTIFICATED		TUV / UL	TUV	TUV	TUV	TUV	TUV / UL	TUV / UL	TUV	TUV / UL	TUV	TUV / UL	TUV / UL
SIZE		1808	1812	2211	2211	1808	1812	2211	2220	1808	1812	1808	1812
Impulse		5KV			6KV	5KV				2.5KV			
Capacitance	3.0pF (3R0)												
	3.3pF (3R3)												
	4.0pF (4R0)												
	4.7pF (4R7)												
	5.0pF (5R0)												
	5.6pF (5R6)												
	6.8pF (6R8)												
	8.2pF (8R2)												
	10pF (100)												
	12pF (120)												
	15pF (150)												
	18pF (180)												
	22pF (220)												
	27pF (270)												
	33pF (330)												
	39pF (390)												
	47pF (470)												
	56pF (560)												
	68pF (680)												
	82pF (820)												
	100pF (101)												
	120pF (121)												
	130pF (131)												
	150pF (151)												
	160pF (161)												
	180pF (181)												
	220pF (221)												
	270pF (271)												
	330pF (331)												
	390pF (391)												
	470pF (471)												
	560pF (561)												
	680pF (681)												
	720pF (721)												
	820pF (821)												
	1,000pF (102)												
	1,200pF (122)												
	1,500pF (152)												
	1,800pF (182)												
	2,200pF (222)												
	2,700pF (272)												
	3,300pF (332)												
	3,900pF (392)												
	2,700pF (272)												
	4,700pF (472)												
	5,600pF (562)												

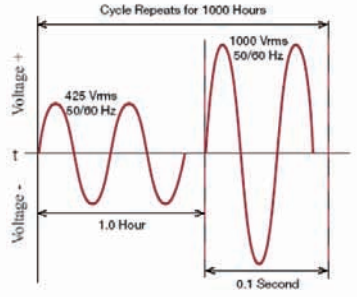
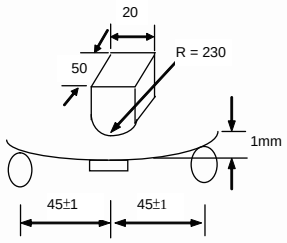
Reliability test conditions and requirements

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Visual examination and Dimensions</td><td>• ---</td><td>• No remarkable defect.
• Dimensions to confirm to individual specification sheet.</td></tr>
<tr><td>2.</td><td>Capacitance</td><td rowspan="2">• Class I (C0G/NPO): 1.0 ± 0.2Vrms,
1.0MHz ± 10% For Cap ≤ 1000pF
1.0KHz ± 10% For Cap > 1000pF
• Class II (X7R): 1.0 ± 0.2Vrms, 1.0KHz ± 10%</td><td>• Capacitance is within specified tolerance
• C_R means rated capacitance for conform to the E6 series of preferred values given in IEC 60063.</td></tr>
<tr><td>3.</td><td>D.F. (Dissipation Factor)
Tangent of loos angle</td><td>• Class I (C0G/NPO):
Cap ≥ 30pF, D.F ≤ 0.1%;
Cap<30pF, D.F ≤ 1/(400+20C)
• Class II (X7R): ≤ 2.5%</td></tr>
<tr><td>4.</td><td>Temperature Coefficient</td><td>• With no electrical load.
<table><tr><th>T.C.</th><th>Operating Temp</th></tr><tr><td>C0G(NPO)</td><td>-55~125℃ at 25℃</td></tr><tr><td>X7R</td><td>-55~125℃ at 25℃</td></tr></table></td><td>•
<table><tr><th>T.C.</th><th>Capacitance Cange</th></tr><tr><td>C0G(NPO)</td><td>Within ± 30ppm/℃</td></tr><tr><td>X7R</td><td>Within ± 15%</td></tr></table></td></tr>
<tr><td>5.</td><td>Insulation Resistance</td><td>• To apply voltage at 500VDC for 60 sec.
• The charge current shall not exceed 0.05A.</td><td>• Class I (NP0) : ≥ 10G Ω or RxC ≥ 100 Ω -F whichever is smaller.
• Class II (X7R) : ≥ 4G Ω or RxC ≥ 100 Ω -F whichever is smaller.</td></tr>
<tr><td>6.</td><td>Voltage proof (Dielectric Strength)</td><td>• To apply voltage:
X Capacitor: 1075Vdc (4.3U_R)
Y Capacitor: 1500Vac
• Duration: 60 sec.
• The charge current shall not exceed 0.05A.</td><td>• No evidence of damage or flashover during test.
• The voltage shall be raised from the near zero to the test voltage a rate not exceeding 150V(r.m.s.)/sec.</td></tr>
<tr><td>7.</td><td>Solderability</td><td>• Solder temperature: 245 ± 5℃
• Dipping time: 5 ± 0.2 sec.</td><td>• 75% min. coverage of all metalized area.</td></tr>
<tr><td>8.</td><td>Resistance to Soldering Heat</td><td>• Solder temperature: 260 ± 5℃
• Dipping time: 10 ± 1 sec
• Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder.
• Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) and 48 ± 4 hrs (Class II)</td><td>• No visible damage.
• Cap change:
NP0: within ± 2.5% or ± 0.25pF whichever is larger.
I.R: More than 1G Ω
X7R: within ± 10%
I.R: More than 1G Ω</td></tr>
<tr><td>9.</td><td>Humidity (Damp Heat) Steady State</td><td>• Test temp.: 40 ± 2℃
• Humidity: 90~95% RH
• Test time: 500+24/-0hrs.
• Applied Voltage:250Vac
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) and 48 ± 4 hrs (Class II)</td><td>• No remarkable damage.
• Cap change:
NP0 within ± 5% or ± 0.5pF whichever is larger
X7R within ± 15%
• D.F Value:
NP0 ≤ 0.25%
X7R: ≤ 5.0%
• I.R. ≥ 1G Ω
• Dielectric strength satisfies the specified initial value</td></tr>
</table>

* FH06X102K202ECG & FH06X102K252ECG reliability is follow UL60950 standard.

* Above 2 items is deferent with IEC60384-14. For more information, please contact with PDC local representative.

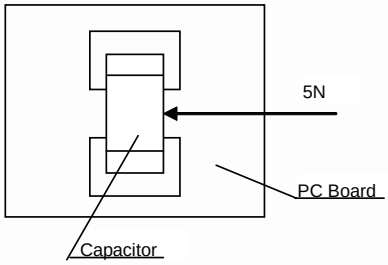
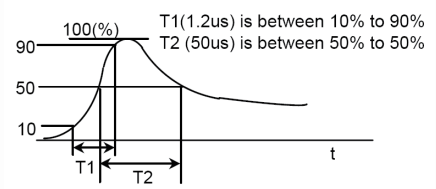
Reliability test conditions and requirements

No.	Item	Test Condition	Requirements
10.	Endurance	• Impulse Voltage: Each individual capacitor shall be subjected to a Vp = 5.0KV (X1Y2 Class Impulse 5KV) & Vp = 6.0KV (X1Y2 Class Impulse 6KV) impulse for three times before applied to endurance test. Additional pulse test 10/700μs before endurance test for Y3 class (IEC60950) • Test Temp.: 125 ± 3℃ • Test time: 1000+48/-0 hrs. • Applied Voltage: X capacitor: 1.25U_R (312.5Vac) Y capacitor: 1.70U_R (425Vac) Once every hour the voltage shall be increased to 1000Vrms for 0.1 sec. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) and 48 ± 4 hrs (Class II) 	• Appearance : No mechanical damage. • Cap change: NP0 within ± 5% or ± 0.5pF whichever is larger X7R within ± 20% • D.F Value: NP0 ≤ 0.25% X7R: ≤ 5.0% • I.R. ≥ 1G Ω • Dielectric strength satisfies the specified initial value
11.	Resistance to Flexure of Substrate	• Capacitors mounted on a substrate. The board shall be bent 1mm with a rate of 1mm/sec. 	• No remarkable damage. • Cap change is less than 10%. (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)

* FH06X102K202ECG & FH06X102K252ECG reliability is follow UL60950 standard.

* Above 2 items is deferent with IEC60384-14. For more information, please contact with PDC local representative.

Reliability test conditions and requirements

No.	Item	Test Condition	Requirements
12.	Robustness of terminations (Adhesive Strength of Termination)	• Capacitors mounted on a substrate. A force of 5N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 sec. 	• No remarkable damage or removal of the terminations.
13.	Passive Flammability	• Volume sample: 80mm^3 • Flame exposure time: 5 sec Max. • Category of flammability : C.	• Capacitor didn't burn at all
14.	Active Flammability	• The capacitors applied U_R (250Vac). Then each sample shall be subjected to 20 discharges from a tank capacitor, charge to a voltage that, when discharged, plase Ui 2500V for X2Y3, Ui 5000V for X1Y2 across the capacitor under test. The interval between successive discharges shall be 5 sec.	• The cheese cloth shall not burn with a flame.
15.	Impulse Voltage	• X1 : 4.0KV, X2 : 2.5KV. • Y2 : 5.0KV, Y3 : None. • Number of impulse : 24 max. • The rise time, tr, is defined as tr = (t90 – t30) × 1,67 according to 18.1.4 of IEC 60060-1. • For Y2 : T1/T2(Rise time/Fall time) = 1us/20us • Before use, the functioning of the circuit shall be checked using CX values of 0,01 µ F and 0,1 µ F and the values for the other circuit elements as given in Table A.1. The rise time tr and decay time td shall be within 0 % + 50 % of the values given in Table A.2. The capacitors CX used for this check should not be high-permittivity ceramic. • 	• There shall be no permanent breakdown or flashover.

* FH06X102K202ECG & FH06X102K252ECG reliability is follow UL60950 standard.
* Above 2 items is deferent with IEC60384-14. For more information, please contact with PDC local representative.

FV EXTRA HIGH VOLTAGE CAPACITOR SERIES

Introduction

PDC FV Series green type capacitors are manufactured by using environmental friendly material without lead or cadmium. These capacitors feature series connection of multi-layer capacitor units in a MLCC to realize high voltage performance. This special design can distribute voltage gradients throughout the entire capacitor, so as to prevent short circuit failure. It is a safety design for LCD back-lighting inverter application.

Features

- Special interior design offers high voltage rating in a given case size.
- High reliability and stability.
- RoHS compliant

Applications

- DC to DC converter.
- High voltage coupling/DC blocking.
- Back-lighting inverters.
- LAN/WLAN interface.
- Modem.
- Power supplies.

How to order

FV	21	X	102	K	402	E	F	G
PDC Family	Size Inch (mm) 21: 2211 (5728)	Dielectric N:C0G X: X7R	Capacitance Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: R47=0.47pF 0R5=0.5pF 1R0=1.0pF 100=10x10^0 =10pF	Tolerance B= ± 0.1pF C= ± 0.25pF D= ± 0.5pF F= ± 1% G= ± 2% J= ± 5% K= ± 10% M= ± 20%	Rated voltage Two significant digits followed by no. of zeros. And R is in place of decimal point. 402= 4000 VDC 602= 6000 VDC	Packaging E: Tape and Reel, Embossed Tape No Code: Bulk	Thickness E: 1.60 ± 0.20mm F: 2.00 ± 0.20mm G: 2.50 ± 0.20mm	Control Code G: RoHS compliant

General electrical data

Dielectric	C0G	X7R
Size	2211	2211
Rated voltage (WVDC)	6KV	4KV
Capacitance range*	4pF to 100pF	150pF to 2200pF
Capacitance tolerance	Cap ≤ 5pF : B (± 0.1pF), C (± 0.25pF) 5pF<Cap<10pF : C (± 0.25pF), D (± 0.5pF) Cap ≥ 10pF : F (± 1%), G (± 2%), : J (± 5%),K (± 10%)	J (± 5%), K (± 10%), M (± 20%)
Tan δ *	Cap<30pF : Q ≥ 400+20C Cap ≥ 30pF : Q ≥ 1000	≤ 2.5%
Insulation resistance at 500Vdc for 60 seconds	≥ 100G Ω or R·C ≥ 1000 Ω -F whichever is smaller	≥ 10G Ω or R·C ≥ 500 Ω -F whichever is smaller
Dielectric Strength	6000VDC	4400VDC
Operating temperature	-55~+125℃	-55~+125℃
Temperature coefficient	± 30ppm/℃	± 15%
Termination	Cu or Ag/Ni/Sn (Lead free termination)	

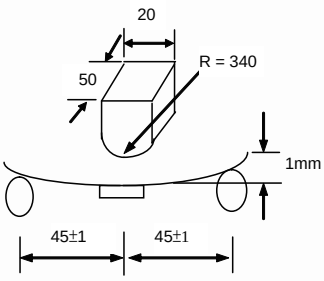
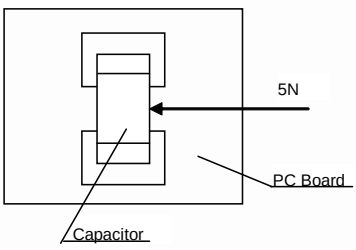
* Measured at the condition of 30~70% related humidity.
C0G: Apply 1.0 ± 0.2Vrms, 1.0MHz ± 10% for Cap ≤ 1000pF and 1.0 ± 0.2Vrms, 1.0kHz ± 10% for Cap>1000pF, 25℃ at ambient temperature
X7R: Apply 1.0 ± 0.2Vrms, 1.0kHz ± 10%, at 25℃ ambient temperature.

Capacitance range

DIELECTRIC		C0G (NP0)	X7R
SIZE		2211	2211
RATED VOLTAGE (VDC)		6000	4000
Capacitance	1.5pF (1R5)		
	1.8pF (1R8)		
	2.2pF (2R2)		
	2.7pF (2R7)		
	3.3pF (3R3)		
	3.9pF (3R9)		
	4.0pF (4R0)		
	4.7pF (4R7)		
	5.6pF (5R6)		
	6.8pF (6R8)		
	8.2pF (8R2)		
	10pF (100)		
	12pF (120)		
	15pF (150)		
	18pF (180)		
	22pF (220)		
	27pF (270)		
	33pF (330)		
	39pF (390)		
	47pF (470)		
	56pF (560)		
	68pF (680)		
	82pF (820)		
	100pF (101)		
	120pF (121)		
	150pF (151)		
	180pF (181)		
	220pF (221)		
	270pF (271)		
	330pF (331)		
	390pF (391)		
	470pF (471)		
	560pF (561)		
	680pF (681)		
	820pF (821)		
	1,000pF (102)		
	1,200pF (122)		
	1,500pF (152)		
	1,800pF (182)		
	2,200pF (222)		

Reliability test conditions and requirements

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Visual examination and Dimensions</td><td>• ---</td><td>• No remarkable defect.
• Dimensions to conform to individual specification sheet.</td></tr>
<tr><td>2.</td><td>Capacitance</td><td>• Class I: (C0G)</td><td>• Shall not exceed the limits given in the detailed spec.</td></tr>
<tr><td>3.</td><td>Q/ D.F. (Dissipation Factor)</td><td>• Cap ≤ 1000pF, 1.0 ± 0.2Vrms, 1MHz ± 10%
• Cap>1000pF, 1.0 ± 0.2Vrms, 1KHz ± 10%
• Class II: (X7R)
• 1.0 ± 0.2Vrms, 1kHz ± 10%</td><td>• C0G: Cap ≥ 30pF, Q ≥ 1000; Cap<30pF, Q ≥ 400+20C
• X7R: ≤ 2.5%</td></tr>
<tr><td>4.</td><td>Temperature Coefficient</td><td>• With no electrical load.<table><tr><th>T.C.</th><th>Operating Temp</th></tr><tr><td>C0G</td><td>-55~125℃ at 25℃</td></tr><tr><td>X7R</td><td>-55~125℃ at 25℃</td></tr></table></td><td>•<table><tr><th>T.C.</th><th>Capacitance Change</th></tr><tr><td>C0G</td><td>Within ± 30ppm/℃</td></tr><tr><td>X7R</td><td>Within ± 15%</td></tr></table></td></tr>
<tr><td>5.</td><td>Insulation Resistance</td><td>• * To apply voltage at 500VDC for 60 sec.</td><td>• Class I (C0G) : ≥ 100G Ω or RxC ≥ 1000 Ω -F whichever is smaller.
• Class II (X7R) : ≥ 10G Ω or RxC ≥ 500 Ω -F whichever is smaller.</td></tr>
<tr><td>6.</td><td>Voltage proof (Dielectric Strength)</td><td>• To apply voltage:
U_R ≤ 5KV : 1.1 times of U_R
U_R > 5KV : 1.0 time of U_R
• Duration: 1 to 5 sec.</td><td>• No evidence of damage or flashover during test.</td></tr>
<tr><td>7.</td><td>Solderability</td><td>• Solder temperature: 245 ± 5℃
• Dipping time: 5 ± 0.5 sec.</td><td>• 75% min. coverage of all metalized area.</td></tr>
<tr><td>8.</td><td>Resistance to Soldering Heat</td><td>• Solder temperature: 260 ± 5℃
• Dipping time: 10 ± 1 sec
• Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder.
• Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).</td><td>• No remarkable damage.
• Cap change:
C0G : within ± 2.5% or ± 0.25pF whichever is larger.
X7R : within ± 7.5%
• 25% max. leaching on each edge.</td></tr>
<tr><td>9.</td><td>Rapid change of temperature (Temperature Cycle)</td><td>• Conduct the five cycles according to the temperatures and time.<table><tr><th>Step</th><th>Temp. (℃)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30 ± 3</td></tr><tr><td>2</td><td>Room temp.</td><td>2~3</td></tr><tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30 ± 3</td></tr><tr><td>4</td><td>Room temp.</td><td>2~3</td></tr></table>• Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).</td><td>• No remarkable damage.
• Cap change :
C0G : within ± 2.5% or ± 0.25pF whichever is larger.
X7R : within ± 15%
• Q/D.F.:
C0G : ≤ 2.0 × Initial requirement
X7R : ≤ 1.5 × Initial requirement
• I.R. ≥ 0.25 × initial requirements.</td></tr>
</table>

No.	Item	Test Condition	Requirements
10.	Damp Heat Steady State	• Test temp.: 40 ± 2℃ • Humidity: 90~95% RH • Test time: 500+24/-0hrs. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).	• No remarkable damage. • Cap change: C0G :within ± 5% or ± 2pF whichever is larger X7R : within ± 15% • Q/D.F Value: C0G : Cap ≥ 30pF : Q ≥ 350; 10pF ≤ Cap < 30pF : Q ≥ 275+2.5C Cap < 10pF : Q ≥ 200+10C X7R : ≤ 7.0% • I.R.: ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.
11.	High Temperature Load (Endurance)	• Test temp.:125 ± 3℃ • To apply voltage:100% of rated voltage. • Test time: 1000+24/-0 hrs. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).	• No remarkable damage. • Cap change: C0G : within ± 3% or ± 3pF whichever is larger. X7R : within ± 20% • Q/D.F Value: C0G : Cap ≥ 30pF : Q ≥ 350; 10pF ≤ Cap < 30pF : Q ≥ 275+2.5C Cap < 10pF : Q ≥ 200+10C X7R : ≤ 7.0% • I.R.: ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.
12.	Substrate bending test (Resistance to Flexure of Substrate)	• The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm.  	• No remarkable damage. • Cap change: within ± 10% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)
13.	Robustness of terminations (Adhesive Strength of Termination)	• Capacitors mounted on a substrate. A force of 5N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 sec.  	• No remarkable damage or removal of the terminations.

MA HV HIGH VOLTAGE CAPACITORS SERIES

Introduction

MA Series green type capacitors are manufactured by using green materials without lead and cadmium. These capacitors feature series connection of multi-layer capacitor units in a MLCC to realize high voltage performance. Reliable performances are built-in through exact formulation of dielectric powders, preparation of conductive paste, advanced automatic manufacturing, and strict quality control to assure excellent control in dielectric thickness, electrode integrity, and electrode-to-termination continuity.

Features

- Special interior design offers high voltage rating in a given case size.
- High reliability and stability.
- RoHS compliant.
- HALOGEN compliant.

Applications

- DC to DC converter.
- High voltage coupling/DC blocking.
- Back-lighting inverters.
- LAN/WLAN interface.
- Modem.
- Power supplies.

How to order

MA	2225	XR	-	103	K	-	202	ER	G
PDC Family	Size	Dielectric		Capacitance	Tolerance		Rated voltage	Packaging	Control Code
	Inch (mm) 1206 (3216) 1210 (3225) 1808 (4520) 1812 (4532) 1825 (4563) 2220 (5750) 2225 (5763)	CG: C0G(NPO) XR: X7R YV: Y5V		Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: R47=0.47pF 0R5=0.5pF 1R0=1.0pF 100=10x10^0 =10pF	B= ± 0.1pF C= ± 0.25pF D= ± 0.5pF F= ± 1% G= ± 2% J= ± 5% K= ± 10% M= ± 20%		Two significant digits followed by no. of zeros. And R is in place of decimal point. 102= 1000 VDC 202= 2000 VDC 302= 3000 VDC	ER: Tape and Reel, Embossed Tape PR: Tape and Reel, Paper Tape No Code: Bulk	G: RoHS compliant P: Pb/Sn Plating (Tin/lead with min. 5% lead)*

* For more information, please contact with PDC local representative.

General electrical data

Dielectric	C0G(NPO)		X7R	
Size	1206, 1210, 1808, 1812		1206, 1210, 1812, 1808, 1825, 2220, 2225	
Rated voltage (WVDC)	1KV, 2KV, 3KV		1KV, 2KV, 3KV	
Capacitance range*	1KV	1.5pF ~ 2.2nF	1KV	100pF ~ 100nF
	2KV	1.5pF ~ 1.2nF	2KV	150pF ~ 47nF
	3KV	2.2pF ~ 470pF	3KV	150pF ~ 10nF
Capacitance tolerance	Cap ≤ 5pF: B (± 0.1pF), C (± 0.25pF) 5pF<Cap<10pF: C (± 0.25pF), D (± 0.5pF) Cap ≥ 10pF: F (± 1%), G (± 2%), J (± 5%),K (± 10%)		J (± 5%), K (± 10%), M (± 20%)	
Tan δ *	Cap<30pF: Q ≥ 400+20C Cap ≥ 30pF: Q ≥ 1000		≤ 2.5%	
Insulation resistance at 500Vdc for 60 seconds	≥ 100G Ω or R·C ≥ 1000 whichever is smaller		≥ 10G Ω or R·C ≥ 500 Ω -F whichever is smaller	
Operating temperature	-55 to +125℃			
Temperature coefficient	± 30ppm / ℃		± 15%	
Termination	Ag (or Cu)/Ni/Sn (lead-free termination)			

* Measured at the condition of 30~70% related humidity.
C0G(NPO): Apply 1.0 ± 0.2Vrms, 1.0MHz ± 10% for Cap ≤ 1000pF and 1.0 ± 0.2Vrms, 1.0kHz ± 10% for Cap>1000pF, 25℃ at ambient temperature
X7R: Apply 1.0 ± 0.2Vrms, 1.0kHz ± 10%, at 25℃ ambient temperature.

Capacitance range

DIELECTRIC		C0G(NP0)											
SIZE		1206			1210			1808			1812		
RATED VOLTAGE (VDC)		1000	2000	3000	1000	2000	3000	1000	2000	3000	1000	2000	3000
Capacitance	1.5pF (1R5)												
	1.8pF (1R8)												
	2.2pF (2R2)												
	2.7pF (2R7)												
	3.3pF (3R3)												
	3.9pF (3R9)												
	4.7pF (4R7)												
	5.6pF (5R6)												
	6.8pF (6R8)												
	8.2pF (8R2)												
	10pF (100)												
	12pF (120)												
	15pF (150)												
	18pF (180)												
	22pF (220)												
	27pF (270)												
	33pF (330)												
	39pF (390)												
	47pF (470)												
	56pF (560)												
	68pF (680)												
	82pF (820)												
	100pF (101)												
	120pF (121)												
	150pF (151)												
	180pF (181)												
	220pF (221)												
	270pF (271)												
	330pF (331)												
	390pF (391)												
	470pF (471)												
	560pF (561)												
	680pF (681)												
	820pF (821)												
	1,000pF (102)												
	1,200pF (122)												
	1,500pF (152)												
	1,800pF (182)												
	2,200pF (222)												
	2,700pF (272)												
	3,300pF (332)												
	3,900pF (392)												
	4,700pF (472)												
	5,600pF (562)												
	6,800pF (682)												
	8,200pF (822)												
	0.010μF (103)												

Capacitance range(Con.)

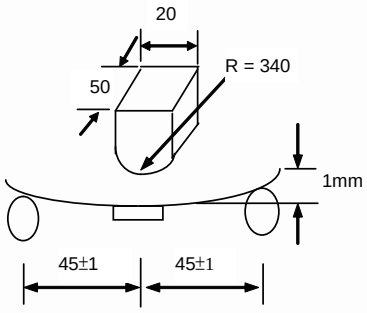
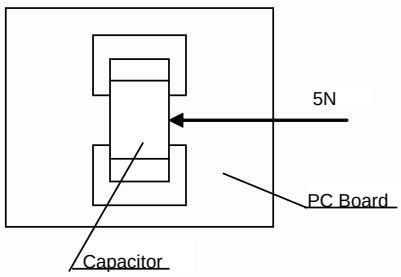
DIELECTRIC		X7R									
SIZE		1206		1210		1808			1812		
RATED VOLTAGE (VDC)		1000	2000	1000	2000	1000	2000	3000	1000	2000	3000
Capacitance	100pF (101)										
	120pF (121)										
	150pF (151)										
	180pF (181)										
	220pF (221)										
	270pF (271)										
	330pF (331)										
	390pF (391)										
	470pF (471)										
	560pF (561)										
	680pF (681)										
	820pF (821)										
	1,000pF (102)										
	1,200pF (122)										
	1,500pF (152)										
	1,800pF (182)										
	2,200pF (222)										
	2,700pF (272)										
	3,300pF (332)										
	3,900pF (392)										
	4,700pF (472)										
	5,600pF (562)										
	6,800pF (682)										
	8,200pF (822)										
	0.010μF (103)										
	0.012μF (123)										
	0.015μF (153)										
	0.018μF (183)										
	0.022μF (223)										
	0.027μF (273)										
	0.033μF (333)										
	0.039μF (393)										
	0.047μF (473)										

DIELECTRIC		X7R								
SIZE		1825			2220			2225		
RATED VOLTAGE (VDC)		1000	2000	3000	1000	2000	3000	1000	2000	3000
Capacitance	1,000pF (102)									
	1,200pF (122)									
	1,500pF (152)									
	1,800pF (182)									
	2,200pF (222)									
	2,700pF (272)									
	3,300pF (332)									
	3,900pF (392)									
	4,700pF (472)									
	5,600pF (562)									
	6,800pF (682)									
	8,200pF (822)									
	0.010μF (103)									
	0.012μF (123)									
	0.015μF (153)									
	0.018μF (183)									
	0.022μF (223)									
	0.027μF (273)									
	0.033μF (333)									
	0.039μF (393)									
	0.047μF (473)									
	0.056μF (563)									
	0.068μF (683)									
	0.082μF (823)									
	0.100μF (104)									

Reliability test conditions and requirements

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Visual examination and Dimensions</td><td>• ---</td><td>• No remarkable defect.
• Dimensions to conform to individual specification sheet.</td></tr>
<tr><td>2.</td><td>Capacitance</td><td>• Class I: C0G(NP0)
Cap ≤ 1000pF, 1.0 ± 0.2Vrms, 1MHz ± 10%
Cap>1000pF, 1.0 ± 0.2Vrms, 1KHz ± 10%
Class II: (X7R)
1.0 ± 0.2Vrms, 1kHz ± 10%</td><td>• Shall not exceed the limits given in the detailed spec.</td></tr>
<tr><td>3.</td><td>Q/ D.F. (Dissipation Factor)</td><td></td><td>• C0G(NP0): Cap ≥ 30pF, Q ≥ 1000;
Cap<30pF, Q ≥ 400+20C
• X7R: ≤ 2.5%</td></tr>
<tr><td>4.</td><td>Temperature Coefficient</td><td>• With no electrical load.
<table>
<tr><th>T.C.</th><th>Operating Temp</th></tr>
<tr><td>C0G(NP0)</td><td>-55~125℃ at 25℃</td></tr>
<tr><td>X7R</td><td>-55~125℃ at 25℃</td></tr>
</table></td><td>•
<table>
<tr><th>T.C.</th><th>Capacitance Change</th></tr>
<tr><td>C0G(NP0)</td><td>Within ± 30ppm/℃</td></tr>
<tr><td>X7R</td><td>Within ± 15%</td></tr>
</table></td></tr>
<tr><td>5.</td><td>Insulation Resistance</td><td>• To apply voltage at 500VDC for 60 sec.</td><td>• Class I C0G(NP0) : ≥ 100G Ω or RxC ≥ 1000 Ω -F whichever is smaller.
• Class II (X7R) : ≥ 10G Ω or RxC ≥ 500 Ω -F whichever is smaller.</td></tr>
<tr><td>6.</td><td>Voltage proof (Dielectric Strength)</td><td>• To apply voltage: 1.2 times of U_R
• The charge current shall not exceed 0.05A.
• Duration: 1 to 5 sec.</td><td>• No evidence of damage or flashover during test.</td></tr>
<tr><td>7.</td><td>Solderability</td><td>• Solder temperature: 235 ± 5℃
• Dipping time: 5 ± 0.5 sec.</td><td>• 75% min. coverage of all metalized area.</td></tr>
<tr><td>8.</td><td>Resistance to Soldering Heat</td><td>• Solder temperature: 260 ± 5℃
• Dipping time: 10 ± 1 sec
• Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder.
• Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 24 ± 2hrs (Class I) or 48 ± 4 hrs (Class II).</td><td>• No remarkable damage.
• Cap change:
C0G(NP0) : within ± 2.5% or ± 0.25pF whichever is larger.
X7R: within ± 7.5%
• 25% max. leaching on each edge.</td></tr>
<tr><td>9.</td><td>Rapid change of temperature (Temperature Cycle)</td><td>• Conduct the five cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th>Temp. (℃)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30 ± 3</td></tr>
<tr><td>2</td><td>Room temp.</td><td>2~3</td></tr>
<tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30 ± 3</td></tr>
<tr><td>4</td><td>Room temp.</td><td>2~3</td></tr>
</table>
• Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).</td><td>• No remarkable damage.
• Cap change :
C0G(NP0): within ± 2.5% or ± 0.25pF whichever is larger.
X7R: within ± 15%
• Q/D.F.:
C0G(NP0): ≤ 2.0 × Initial requirement
X7R: ≤ 1.5 × Initial requirement
I.R. ≥ 0.25 × initial requirement</td></tr>
</table>

Reliability test conditions and requirements

No.	Item	Test Condition	Requirements
10.	Damp Heat Steady State	• Test temp.: 40 ± 2℃ • Humidity: 90~95% RH • Test time: 500+24/-0hrs. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).	• No remarkable damage. • Cap change: C0G(NP0) within ± 5% or ± 2pF whichever is larger X7R within ± 15% • Q/D.F Value: C0G(NP0): Cap ≥ 30pF :Q ≥ 350 10pF ≤ Cap<30pF :Q ≥ 275+2.5C Cap<10pF :Q ≥ 200+10C X7R: ≤ 7.0% • I.R.: ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.
11.	High Temperature Load (Endurance)	• Test temp.: NP0, X7R: 125 ± 3℃ • To apply voltage: 120% of rated voltage. • Test time: 1000+24/-0 hrs. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).	• No remarkable damage. • Cap change: C0G(NP0): within ± 3% or ± 3pF whichever is larger.X7R: within ± 20% • Q/D.F value: C0G(NP0): Cap ≥ 30pF :Q ≥ 350 10pF ≤ Cap<30pF :Q ≥ 275+2.5C Cap<10pF :Q ≥ 200+10C X7R: ≤ 7.0% • I.R.: ≥ 10V, ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.
12.	Substrate bending test (Resistance to Flexure of Substrate)	• The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm. 	• No remarkable damage. • Cap change: within ± 10% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)
13.	Robustness of terminations (Adhesive Strength of Termination)	• Capacitors mounted on a substrate. A force of 5N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 sec. 	• No remarkable damage or removal of the terminations.

Introduction

MA Series green type capacitors are manufactured by using green materials without lead and cadmium. These capacitors feature series connection of multi-layer capacitor units in a MLCC to realize high voltage performance. Reliable performances are built-in through exact formulation of dielectric powders, preparation of conductive paste, advanced automatic manufacturing, and strict quality control to assure excellent control in dielectric thickness, electrode integrity, and electrode-to-termination continuity.

Features

- » High Voltage in a given case size.
- » High reliability and stability.
- » RoHS Compliant
- » HALOGEN compliant

Applications

- » DC to DC converter.
- » High voltage coupling/DC blocking.
- » Back-lighting inverters.
- » Sunbbers in high frequency power convertors.

How to order

MA	2220	XR	-	105	K	-	251	ER	G
PDC Family	Size	Dielectric		Capacitance	Tolerance		Rated voltage	Packaging	Control Code
	Inch (mm) 0402 (1005) 0603 (1608) 0805 (2012) 1206 (3216) 1210 (3225) 1808 (4520) 1812 (4532) 1825 (4563) 2220 (5750) 2225 (5763)	CG: C0G(NPO) XR: X7R YV: Y5V		Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: R47=0.47pF 0R5=0.5pF 1R0=1.0pF 100=10x10^0 =10pF	B= ± 0.1pF C= ± 0.25pF D= ± 0.5pF F= ± 1% G= ± 2% J= ± 5% K= ± 10% M= ± 20% Z=-20/+80%		Two significant digits followed by no. of zeros. And R is in place of decimal point. 101=100 VDC 201= 200 VDC 251=250 VDC 501=500 VDC 631=630 VDC	ER: Tape and Reel, Embossed Tape PR: Tape and Reel, Paper Tape No Code: Bulk	G: RoHS compliant P: Pb/Sn Plating (Tin/lead with min. 5% lead)*

* For more information, please contact with PDC local representative.

General electrical data

Dielectric	C0G(NPO)	X7R	Y5V
Size	0402, 0603, 0805, 1206, 1210, 1812	0603, 0805, 1206, 1210, 1808, 1812, 1825, 2220, 2225	0805, 1206, 1210, 1812
Capacitance range*	0.5pF to 33nF	100pF to 1.0μF	10nF to 1.0μF
Capacitance tolerance	Cap ≤ 5pF: B (± 0.1pF), C (± 0.25pF) 5pF<Cap<10pF: C (± 0.25pF), D (± 0.5pF) Cap ≥ 10pF: F (± 1%), G (± 2%), J (± 5%), K (± 10%)	J (± 5%), K (± 10%), M (± 20%)	Z (-20/+80%)
Rated voltage (WVDC)	100V, 200V, 250V, 500V, 630V	100V, 200V,250V, 500V, 630V	100V, 200V, 250V
Tan δ *	Cap<30pF: Q ≥ 400+20C Cap ≥ 30pF: Q ≥ 1000	≤ 2.5% (Apply 1.0 ± 0.2Vrms, 1.0KHz ± 10%)	≤ 5%
Insulation resistance at Ur**	≥ 100G Ω or R•C ≥ 1000 whichever is smaller	≥ 10G Ω or R•C ≥ 100 Ω -F whichever is smaller	
Operating temperature	-55 to +125℃		-25 to +85℃
Capacitance characteristic	± 30ppm / ℃	± 15%	+30/-80%
Termination	Cu (or Ag)/Ni/Sn (lead-free termination)		

* Measured at the condition of 30~70% related humidity.
C0G(NPO): Apply 1.0 ± 0.2Vrms, 1.0MHz ± 10% for Cap ≤ 1000pF and 1.0 ± 0.2Vrms, 1.0kHz ± 10% for Cap>1000pF, 25℃ at ambient temperature
X7R: Apply 1.0 ± 0.2Vrms, 1.0kHz ± 10%, at 25℃ ambient temperature.
Y5V: Apply 1.0 ± 0.2Vrms, 1.0kHz ± 10%, at 20℃ ambient temperature.

** Measured at 500VDC for 60 sec, for U_R >500VDC

Capacitance range

6-1. C0G(NPO) Dielectric

DIELECTRIC		C0G(NP0)													
SIZE		0402	0603			0805					1206				
RATED VOLTAGE (VDC)		100	100	200	250	100	200	250	500	630	100	200	250	500	630
Capacitance	0.5 pF (0R5)														
	1.0 pF (1R0)														
	1.2 pF (1R2)														
	1.5 pF (1R5)														
	3.9pF (3R9)														
	4.7pF (4R7)														
	5.6pF (5R6)														
	6.8pF (6R8)														
	8.2pF (8R2)														
	10pF (100)														
	12pF (120)														
	15pF (150)														
	18pF (180)														
	22pF (220)														
	27pF (270)														
	33pF (330)														
	39pF (390)														
	47pF (470)														
	56pF (560)														
	68pF (680)														
	82pF (820)														
	100pF (101)														
	120pF (121)														
	150pF (151)														
	180pF (181)														
	220pF (221)														
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	2,700pF (272)														
	3,300pF (332)														
	3,900pF (392)														
	4,700pF (472)														
	5,600pF (562)														
	6,800pF (682)														
	8,200pF (822)														
	0.010μF (103)														

Capacitance range

6-1. C0G(NPO) Dielectric

DIELECTRIC		C0G(NPO)									
SIZE		1210					1812				
RATED VOLTAGE (VDC)		100	200	250	500	630	100	200	250	500	630
Capacitance	1.0pF (1R0)										
	1.2pF (1R2)										
	1.5pF (1R5)										
	1.8pF (1R8)										
	2.2pF (2R2)										
	2.7pF (2R7)										
	3.3pF (3R3)										
	3.9pF (3R9)										
	4.7pF (4R7)										
	5.6pF (5R6)										
	6.8pF (6R8)										
	8.2pF (8R2)										
	10pF (100)										
	12pF (120)										
	15pF (150)										
	18pF (180)										
	22pF (220)										
	27pF (270)										
	33pF (330)										
	39pF (390)										
	47pF (470)										
	56pF (560)										
	68pF (680)										
	82pF (820)										
	100pF (101)										
	120pF (121)										
	150pF (151)										
	180pF (181)										
	220pF (221)										
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	330pF (331)										
	390pF (391)										
	470pF (471)										
	560pF (561)										
	680pF (681)										
	820pF (821)										
	1,000pF (102)										
	1,200pF (122)										
	1,500pF (152)										
	1,800pF (182)										
	2,200pF (222)										
	2,700pF (272)										
	3,300pF (332)										
	3,900pF (392)										
	4,700pF (472)										
	5,600pF (562)										
	6,800pF (682)										
	8,200pF (822)										
	0.010μF (103)										
	0.012μF (123)										
	0.015μF (153)										
	0.018μF (183)										
	0.022μF (223)										
	0.027μF (273)										
	0.033μF (333)										
	0.039μF (393)										

Capacitance range

6.2 X7R Dielectric

DIELECTRIC		X7R															
SIZE		0603			0805				1206					1210				
RATED VOLTAGE (VDC)		100	200	250	100	200	250	500	100	200	250	500	630	100	200	250	500	630
Capacitance	100pF (101)																	
	120pF (121)																	
	150pF (151)																	
	180pF (181)																	
	220pF (221)																	
	270pF (271)																	
	330pF (331)																	
	390pF (391)																	
	470pF (471)																	
	560pF (561)																	
	680pF (681)																	
	820pF (821)																	
	1,000pF (102)																	
	1,200pF (122)																	
	1,500pF (152)																	
	1,800pF (182)																	
	2,200pF (222)																	
	2,700pF (272)																	
	3,300pF (332)																	
	3,900pF (392)																	
	4,700pF (472)																	
	5,600pF (562)																	
	6,800pF (682)																	
	8,200pF (822)																	
	0.010µF (103)																	
	0.012µF (123)																	
	0.015µF (153)																	
	0.018µF (183)																	
	0.022µF (223)																	
	0.027µF (273)																	
	0.033µF (333)																	
	0.039µF (393)																	
	0.047µF (473)																	
	0.056µF (563)																	
	0.068µF (683)																	
	0.082µF (823)																	
	0.10µF (104)																	
	0.12µF (124)																	
	0.15µF (154)																	
	0.18µF (184)																	
	0.22µF (224)																	
	0.27µF (274)																	
	0.33µF (334)																	
	0.39µF (394)																	
	0.47µF (474)																	
	0.56µF (564)																	
	0.68µF (684)																	
	0.82µF (824)																	
	1.0µF (105)																	

Capacitance range

6.2 X7R Dielectric

DIELECTRIC		X7R													
SIZE		1808				1812					1825				
RATED VOLTAGE (VDC)		100	200	250	500	100	200	250	500	630	100	200	250	500	630
Capacitance	100pF (101)														
	120pF (121)														
	150pF (151)														
	180pF (181)														
	220pF (221)														
	270pF (271)														
	330pF (331)														
	390pF (391)														
	470pF (471)														
	560pF (561)														
	680pF (681)														
	820pF (821)														
	1,000pF (102)														
	1,200pF (122)														
	1,500pF (152)														
	1,800pF (182)														
	2,200pF (222)														
	2,700pF (272)														
	3,300pF (332)														
	3,900pF (392)														
	4,700pF (472)														
	5,600pF (562)														
	6,800pF (682)														
	8,200pF (822)														
	0.010μF (103)														
	0.012μF (123)														
	0.015μF (153)														
	0.018μF (183)														
	0.022μF (223)														
	0.027μF (273)														
	0.033μF (333)														
	0.039μF (393)														
	0.047μF (473)														
	0.056μF (563)														
	0.068μF (683)														
	0.082μF (823)														
	0.10μF (104)														
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	0.18μF (184)														
	0.22μF (224)														
	0.27μF (274)														
	0.33μF (334)														
	0.39μF (394)														
	0.47μF (474)														
	0.56μF (564)														
	0.68μF (684)														
	0.82μF (824)														
	1.0μF (105)														

Capacitance range

6.2 X7R Dielectric

DIELECTRIC		X7R									
SIZE		2220					2225				
RATED VOLTAGE (VDC)		100	200	250	500	630	100	200	250	500	630
Capacitance	100pF (101)										
	120pF (121)										
	150pF (151)										
	180pF (181)										
	220pF (221)										
	270pF (271)										
	330pF (331)										
	390pF (391)										
	470pF (471)										
	560pF (561)										
	680pF (681)										
	820pF (821)										
	1,000pF (102)										
	1,200pF (122)										
	1,500pF (152)										
	1,800pF (182)										
	2,200pF (222)										
	2,700pF (272)										
	3,300pF (332)										
	3,900pF (392)										
	4,700pF (472)										
	5,600pF (562)										
	6,800pF (682)										
	8,200pF (822)										
	0.010µF (103)										
	0.012µF (123)										
	0.015µF (153)										
	0.018µF (183)										
	0.022µF (223)										
	0.027µF (273)										
	0.033µF (333)										
	0.039µF (393)										
	0.047µF (473)										
	0.056µF (563)										
	0.068µF (683)										
	0.082µF (823)										
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	0.22µF (224)										
	0.27µF (274)										
	0.33µF (334)										
	0.39µF (394)										
	0.47µF (474)										
	0.56µF (564)										
	0.68µF (684)										
	0.82µF (824)										
	1.0µF (105)										

Capacitance range

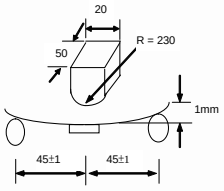
6.3 Y5V Dielectric

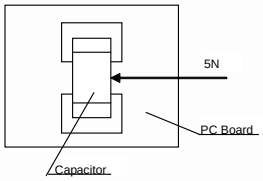
DIELECTRIC		Y5V											
SIZE		0805			1206			1210			1812		
RATED VOLTAGE(VDC)		100	200	250	100	200	250	100	200	250	100	200	250
Capacitance	0.010μF (103)												
	0.015μF (153)												
	0.022μF (223)												
	0.033μF (333)												
	0.047μF (473)												
	0.068μF (683)												
	0.10μF (104)												
	0.15μF (154)												
	0.18μF (184)												
	0.22μF (224)												
	0.33μF (334)												
	0.47μF (474)												
	0.68μF (684)												
	1.0μF (105)												

Reliability test conditions and requirements

No.	Item	Test Condition	Requirements
1.	Visual examination and Dimensions	• ---	• No remarkable defect. • Dimensions to conform to individual specification sheet.
2.	Capacitance	• Class I: C0G(NP0)	• Shall not exceed the limits given in the detailed spec.
3.	Q/ D.F. (Dissipation Factor)	• Cap ≤ 1000pF, 1.0 ± 0.2Vrms, 1MHz ± 10% • Cap>1000pF, 1.0 ± 0.2Vrms, 1KHz ± 10% • Class II: (X7R) • 1.0 ± 0.2Vrms, 1kHz ± 10%	• C0G(NP0): Cap ≥ 30pF, Q ≥ 1000; Cap<30pF, Q ≥ 400+20C • X7R: ≤ 2.5%
4.	Temperature Coefficient	• With no electrical load. T.C. / Operating Temp C0G(NP0) / -55~125℃ at 25℃ X7R / -55~125℃ at 25℃	• T.C. / Capacitance Change C0G(NP0) / Within ± 30ppm/℃ X7R / Within ± 15%
5.	Insulation Resistance	• U_R=100V: To apply voltage at U_R for max. 120 sec. • U_R >100V: To apply voltage at U_R (500V max.) for 60 sec.	• Class I (C0G/NPO) : ≥ 100G Ω or RxC ≥ 1000 Ω -F whichever is smaller. • Class II (X7R, Y5V) : ≥ 10G Ω or RxC ≥ 100 Ω -F whichever is smaller.
6.	Voltage proof (Dielectric Strength)	• To apply voltage: 100V =2.5 times of U_R 200V/250V =2 times of U_R 500V/630V =1.5 times of U_R • Duration: 1 to 5 sec.	• No evidence of damage or flashover during test.
7.	Solderability	• Solder temperature: 235 ± 5℃ • Dipping time: 5 ± 0.5 sec.	• 75% min. coverage of all metalized area.
8.	Resistance to Soldering Heat	• Solder temperature: 260 ± 5℃ • Dipping time: 10 ± 1 sec • Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder. • Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).	• No remarkable damage. • Cap change: C0G(NPO): within ± 2.5% or ± 0.25pF whichever is larger. X7R: within ± 7.5% Y5V: within ± 20% • 25% max. leaching on each edge.

Reliability test conditions and requirements

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>9.</td><td>Rapid change of temperature (Temperature Cycle)</td><td>
• Conduct the five cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th>Temp. (℃)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30 ± 3</td></tr>
<tr><td>2</td><td>Room temp.</td><td>2~3</td></tr>
<tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30 ± 3</td></tr>
<tr><td>4</td><td>Room temp.</td><td>2~3</td></tr>
</table>
• Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).
</td><td>
• No remarkable damage.
• Cap change :
C0G(NPO): within ± 2.5% or ± 0.25pF whichever is larger.
X7R: within ± 15%
Y5V: within ± 20%
• Q/D.F.:
C0G(NPO): ≤ 2.0 × Initial requirement
X7R: ≤ 1.5 × Initial requirement
Y5V: ≤ 1.5 × Initial requirement
• I.R. ≥ 0.25 × initial requirements.
</td></tr>
<tr><td>10.</td><td>Damp Heat Steady State</td><td>
• Test temp.: 40 ± 2℃
• Humidity: 90~95% RH
• Test time: 500+24/-0hrs.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).
</td><td>
• No remarkable damage.
• Cap change:
C0G(NPO) : within ± 5% or ± 2pF whichever is larger
X7R : within ± 15%
Y5V : within ± 30%
• Q/D.F Value:
C0G(NPO): Cap ≥ 30pF :Q ≥ 350;
10pF ≤ Cap<30pF :Q ≥ 275+2.5C;
Cap<10pF :Q ≥ 200+10C
X7R: ≤ 7.0%
Y5V: ≤ 7.5%
• I.R.: ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.
</td></tr>
<tr><td>11.</td><td>High Temperature Load (Endurance)</td><td>
• Test temp.:
C0G(NPO), X7R: 125 ± 3℃
Y5V: 85 ± 3℃
• To apply voltage:
(1) U_R ≤ 250V: 200% of rated voltage.
<table>
<tr><th>U_R</th><th>Size</th><th>Cap</th><th>Voltage</th></tr>
<tr><td>100V</td><td>1206
1210</td><td>> 474</td><td rowspan="5">1.5 times of U_R</td></tr>
<tr><td rowspan="4">200V and 250V</td><td>1210</td><td>> 224</td></tr>
<tr><td>1812</td><td>> 474</td></tr>
<tr><td>1825
2220
2225</td><td>≥ 105</td></tr>
</table>
(2) 250 < U_R ≤ 500V: 150% of rated voltage.
(3) U_R > 500V: 120% of rated voltage.
• Test time: 1000+24/-0 hrs.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).
</td><td>
• No remarkable damage.
• Cap change:
C0G(NPO) : within ± 5% or ± 2pF whichever is larger
X7R : within ± 15%
Y5V : within ± 30%
• Q/D.F Value:
C0G(NPO): Cap ≥ 30pF :Q ≥ 350;
10pF ≤ Cap<30pF :Q ≥ 275+2.5C;
Cap<10pF :Q ≥ 200+10C
X7R: ≤ 7.0%
Y5V: ≤ 7.5%
• I.R.: ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.
</td></tr>
<tr><td>12.</td><td>Substrate bending test (Resistance to Flexure of Substrate)</td><td>
• The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1mm per second until the deflection becomes 1mm.


</td><td>
• No remarkable damage.
• Cap change:
C0G(NPO): within ± 10%
X7R: within ± 12.5%
Y5V: within ± 30%
(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)
</td></tr>
<tr><td>13.</td><td>Robustness of terminations (Adhesive Strength of Termination)</td><td>
• Capacitors mounted on a substrate. A force of 5N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 sec.


</td><td>
• No remarkable damage or removal of the terminations.
</td></tr>
</table>

Introduction

PROSPERITY Multilayer Ceramic Chip Capacitors supplied in bulk or tape & reel package are ideally suitable for thick-film hybrid circuits and automatic surface mounting on any printed circuit boards. All of PROSPERITY's MLCC products meet RoHS directive.

FP series use a special material between nickel-barrier and ceramic body. It provides excellent performance to against bending stress occurred during process and provide more security for PCB process.

The nickel-barrier terminations are consisted of a nickel barrier layer over the silver metallization and then finished by electroplated solder layer to ensure the terminations have good solderability. The nickel barrier layer in terminations prevents the dissolution of termination when extended immersion in molten solder at elevated solder temperature.

Features

- » Withstanding 5mm of substrate bending.
- » High Voltage in a given case size.
- » High reliability and stability.
- » HALOGEN compliant
- » RoHS compliant

Applications

- » DC to DC converter.
- » High voltage coupling/DC blocking.
- » Back-lighting inverters.
- » Snubbers in high frequency power convertors.

How to order

FP	06	X	103	K	631	E	C	G
PDC Family	Size	Dielectric	Capacitance	Tolerance	Rated voltage	Packaging	Thickness	Control Code
	Code (inch) 03 (0603) 05 (0805) 06 (1206) 10 (1210) 12 (1812) 18 (1825) 20 (2220) 25 (2225)	X: X7R N: C0G(NPO)	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: $100=10x10^0$ =10pF $102=10x10^2$ =1000pF	B= ± 0.1pF C= ± 0.25pF D= ± 0.5pF F= ± 1% G= ± 2% J= ± 5% K= ± 10% M= ± 20%	Two significant digits followed by no. of zeros. And R is in place of decimal point. 100=10 VDC 160=16 VDC 250=25 VDC 500=50 VDC 101=100 VDC 201=200 VDC 251=250 VDC 501=500 VDC 631=630 VDC	E: Tape and Reel, Embossed Tape P: Tape and Reel, Paper Tape B: Bulk	B:0.80+0.15/-0.1mm C:1.25 ± 0.10mm D:1.40 ± 0.15mm E:1.60 ± 0.20mm F:2.00 ± 0.20mm G:2.50 ± 0.30mm P:1.60+0.30/-0.10mm J :1.15+-0.15 mm	G: RoHS compliant

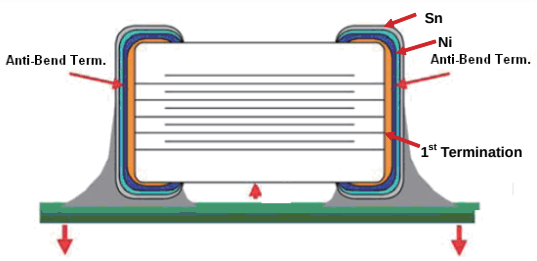
General electrical data

Dielectric	NP0		X7R
Size	1206, 1210, 1808, 1812		0603, 0805, 1206, 1210, 1812, 1808, 1825, 2220, 2225
Rated voltage (WVDC)	1KV, 2KV, 3KV		10V, 16V, 25V, 50V, 100V, 200V,250V, 500V, 630V, 1KV, 2KV, 3KV
Capacitance range*	1KV	1.5pF ~ 2.2nF	100pF to 10.0μF
	2KV	1.5pF ~ 1.2nF	
	3KV	2.2pF ~ 470pF	
Capacitance tolerance	Cap ≤ 5pF: B (± 0.1pF), C (± 0.25pF) 5pF<Cap<10pF: C (± 0.25pF), D (± 0.5pF) Cap ≥ 10pF: F (± 1%), G (± 2%), J (± 5%),K (± 10%)		J (± 5%), K (± 10%), M (± 20%)
Tan δ *	Cap<30pF: Q ≥ 400+20C Cap ≥ 30pF: Q ≥ 1000		50V ≤ 2.5%*** 25V, 16V ≤ 3.5% 10V ≤ 5.0% 100V ~ 3KV ≤ 2.5%
Insulation resistance at 500Vdc for 60 seconds	≥ 100G Ω or R·C ≥ 1000 whichever is smaller		≥ 10G Ω or R·C ≥ 500 Ω -F whichever is smaller
Operating temperature	-55 to +125℃		
Temperature coefficient	± 30ppm / ℃		± 15%
Termination	Ag (or Cu)/Ni/Sn (lead-free termination)		

* Measured at the condition of 30~70% related humidity.
X7R: Apply 1.0 ± 0.2Vrms, 1.0kHz ± 10%, at 25℃ ambient temperature.

* Measured at 500VDC for 60 sec, for U_R >500VDC
X7R:

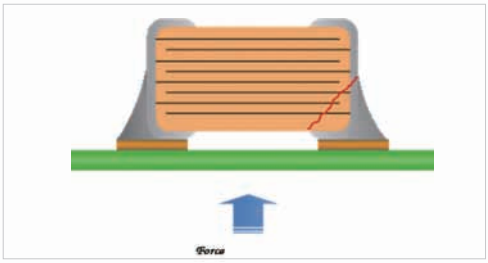
Rated vol.	D.F.	Exception of D.F.	
50V	≤ 2.5%	≤ 3%	0603 ≥ 0.047μF; 0805 ≥ 0.18μF, 1206 ≥ 0.47μF

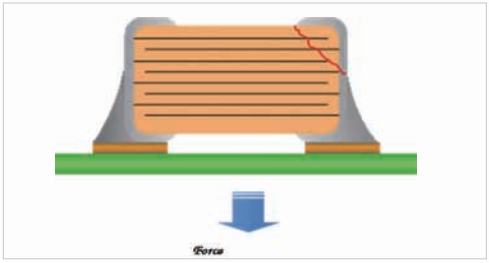


Typical Bending Cracks of MLCC

MLCC ceramic body is consisted of rigidity material. It will be suffered compressive and tensional stress when the carried board is bended. If the suffered stress is over ceramic body strength, the bending crack is occurred.

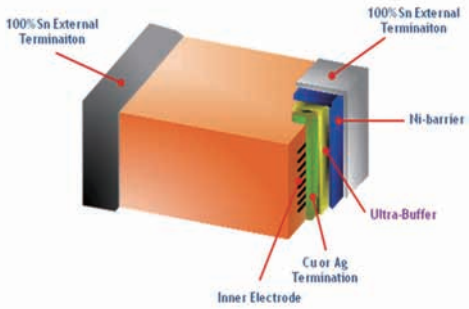
Therefore, the bending crack will be only occurred after soldering process.





Structure

PDC FP series is added a special termination material (Ultra-Buffer or Anti-Bend)between ceramic body and Ni-barrier that can absorb mechanical stress to prevent bending crack occurred.



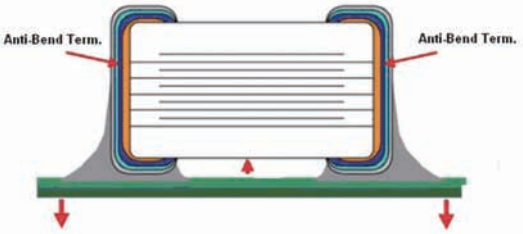
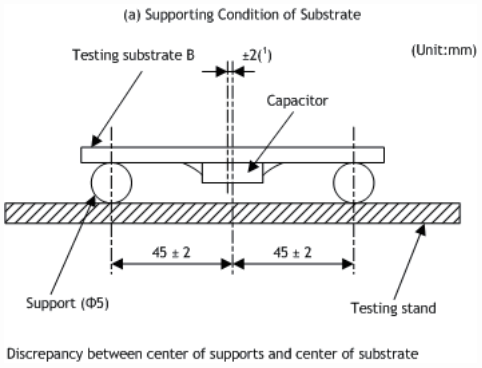
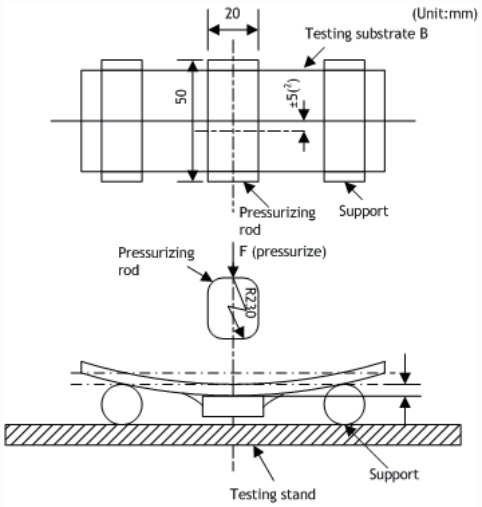


Illustration of Bending Test



Discrepancy between center of supports and center of substrate



Discrepancy between center of testing substrate A and center of pressurizing rod.

Comparison of Bending Test Result

PCB TEST RESULT				
Size	Dielectric	Mean Bend MA series(mm)	Mean Bend FP series.(mm)	Improvement with Ultra-buffer
0603	X7R	≥ 2	≥ 5	300%
0805	X7R	≥ 2	≥ 5	300%
1206	X7R	≥ 2	≥ 5	300%
1210	X7R	≥ 2	≥ 5	300%
1808	X7R	≥ 3	≥ 5	300%
1812	X7R	≥ 3	≥ 5	140%
1825	X7R	≥ 3	≥ 5	117%
2220	X7R	≥ 5	≥ 7	114%
2225	X7R	≥ 5	≥ 7	114%

Capacitance range

Rated Voltage ≤50V(0603~1210)

DIELECTRIC		X7R															
SIZE		0603				0805				1206				1210			
RATED VOLTAGE (VDC)		10	16	25	50	10	16	25	50	10	16	25	50	10	16	25	50
Capacitance	100pF (101)																
	120pF (121)																
	150pF (151)																
	180pF (181)																
	220pF (221)																
	270pF (271)																
	330pF (331)																
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	0.22μF (224)																
	0.27μF (274)																
	0.33μF (334)																
	0.39μF (394)																
	0.47μF (474)																
	0.56μF (564)																
	0.68μF (684)																
	0.82μF (824)																
	1.0μF (105)																
	1.2μF (125)																
	1.5μF (155)																
	1.8μF (185)																
	2.2μF (225)																

Capacitance range

Rated Voltage ≤50V(1812~2225)

DIELECTRIC		X7R															
SIZE		1812				1825				2220				2225			
RATED VOLTAGE (VDC)		10	16	25	50	10	16	25	50	10	16	25	50	10	16	25	50
Capacitance	100pF (101)																
	120pF (121)																
	150pF (151)																
	180pF (181)																
	220pF (221)																
	270pF (271)																
	330pF (331)																
	390pF (391)																
	470pF (471)																
	560pF (561)																
	680pF (681)																
	820pF (821)																
	1,000pF (102)																
	1,200pF (122)																
	1,500pF (152)																
	1,800pF (182)																
	2,200pF (222)																
	2,700pF (272)																
	3,300pF (332)																
	3,900pF (392)																
	4,700pF (472)																
	5,600pF (562)																
	6,800pF (682)																
	8,200pF (822)																
	0.010μF (103)																
	0.012μF (123)																
	0.015μF (153)																
	0.018μF (183)																
	0.022μF (223)																
	0.027μF (273)																
	0.033μF (333)																
	0.039μF (393)																
	0.047μF (473)																
	0.056μF (563)																
	0.068μF (683)																
	0.082μF (823)																
	0.10μF (104)																
	0.12μF (124)																
	0.15μF (154)																
	0.18μF (184)																
	0.22μF (224)																
	0.27μF (274)																
	0.33μF (334)																
	0.39μF (394)																
	0.47μF (474)																
	0.56μF (564)																
	0.68μF (684)																
	0.82μF (824)																
	1.0μF (105)																
	1.2μF (125)																
	1.5μF (155)																
	1.8μF (185)																
	2.2μF (225)																
	2.7μF (275)																
	3.3μF (335)																
	3.9μF (395)																
	4.7μF (475)																
	5.6μF (565)																
	6.8μF (685)																
	8.2μF (825)																
	10.0μF (106)																

Capacitance range

Rated Voltage ≤630V(0603~1210)

DIELECTRIC		X7R																
SIZE		0603			0805				1206					1210				
RATED VOLTAGE (VDC)		100	200	250	100	200	250	500 630	100	200	250	500	630	100	200	250	500	630
Capacitance	100pF (101)																	
	120pF (121)																	
	150pF (151)																	
	180pF (181)																	
	220pF (221)																	
	270pF (271)																	
	330pF (331)																	
	390pF (391)																	
	470pF (471)																	
	560pF (561)																	
	680pF (681)																	
	820pF (821)																	
	1,000pF (102)																	
	1,200pF (122)																	
	1,500pF (152)																	
	1,800pF (182)																	
	2,200pF (222)																	
	2,700pF (272)																	
	3,300pF (332)																	
	3,900pF (392)																	
	4,700pF (472)																	
	5,600pF (562)																	
	6,800pF (682)																	
	8,200pF (822)																	
	0.010μF (103)																	
	0.012μF (123)																	
	0.015μF (153)																	
	0.018μF (183)																	
	0.022μF (223)																	
	0.027μF (273)																	
	0.033μF (333)																	
	0.039μF (393)																	
	0.047μF (473)																	
	0.056μF (563)																	
	0.068μF (683)																	
	0.082μF (823)																	
	0.10μF (104)																	
	0.12μF (124)																	
	0.15μF (154)																	
	0.18μF (184)																	
	0.22μF (224)																	
	0.27μF (274)																	
	0.33μF (334)																	
	0.39μF (394)																	
	0.47μF (474)																	
	0.56μF (564)																	
	0.68μF (684)																	
	0.82μF (824)																	
	1.0μF (105)																	

Capacitance range

Rated Voltage ≤630V(1812~2225)

DIELECTRIC		X7R																			
SIZE		1812					1825					2220					2225				
RATED VOLTAGE (VDC)		100	200	250	500	630	100	200	250	500	630	100	200	250	500	630	100	200	250	500	630
Capacitance	100pF (101)																				
	120pF (121)																				
	150pF (151)																				
	180pF (181)																				
	220pF (221)																				
	270pF (271)																				
	330pF (331)																				
	390pF (391)																				
	470pF (471)																				
	560pF (561)																				
	680pF (681)																				
	820pF (821)																				
	1,000pF (102)																				
	1,200pF (122)																				
	1,500pF (152)																				
	1,800pF (182)																				
	2,200pF (222)																				
	2,700pF (272)																				
	3,300pF (332)																				
	3,900pF (392)																				
	4,700pF (472)																				
	5,600pF (562)																				
	6,800pF (682)																				
	8,200pF (822)																				
	0.010μF (103)																				
	0.012μF (123)																				
	0.015μF (153)																				
	0.018μF (183)																				
	0.022μF (223)																				
	0.027μF (273)																				
	0.033μF (333)																				
	0.039μF (393)																				
	0.047μF (473)																				
	0.056μF (563)																				
	0.068μF (683)																				
	0.082μF (823)																				
	0.10μF (104)																				
	0.12μF (124)																				
	0.15μF (154)																				
	0.18μF (184)																				
	0.22μF (224)																				
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	0.33μF (334)																				
	0.39μF (394)																				
	0.47μF (474)																				
	0.56μF (564)																				
	0.68μF (684)																				
	0.82μF (824)																				
	1.0μF (105)																				
	1.2μF (125)																				
	1.5μF (155)																				
	1.8μF (185)																				
	2.2μF (225)																				
	2.7μF (275)																				
	3.3μF (335)																				
	3.9μF (395)																				
	4.7μF (475)																				

Capacitance range

Rated Voltage ≤3KV(1206~1812)

DIELECTRIC		NP0 (C0G)											
SIZE		1206			1210			1808			1812		
RATED VOLTAGE (VDC)		1000	2000	3000	1000	2000	3000	1000	2000	3000	1000	2000	3000
Capacitance	1.5pF (1R5)												
	1.8pF (1R8)												
	2.2pF (2R2)												
	2.7pF (2R7)												
	3.3pF (3R3)												
	3.9pF (3R9)												
	4.7pF (4R7)												
	5.6pF (5R6)												
	6.8pF (6R8)												
	8.2pF (8R2)												
	10pF (100)												
	12pF (120)												
	15pF (150)												
	18pF (180)												
	22pF (220)												
	27pF (270)												
	33pF (330)												
	39pF (390)												
	47pF (470)												
	56pF (560)												
	68pF (680)												
	82pF (820)												
	100pF (101)												
	120pF (121)												
	150pF (151)												
	180pF (181)												
	220pF (221)												
	270pF (271)												
	330pF (331)												
	390pF (391)												
	470pF (471)												
	560pF (561)												
	680pF (681)												
	820pF (821)												
	1,000pF (102)												
	1,200pF (122)												
	1,500pF (152)												
	1,800pF (182)												
	2,200pF (222)												
	2,700pF (272)												
	3,300pF (332)												
	3,900pF (392)												
	4,700pF (472)												
	5,600pF (562)												
	6,800pF (682)												
	8,200pF (822)												
	0.010μF (103)												

Capacitance range

Rated Voltage ≤3KV(1206~1812)

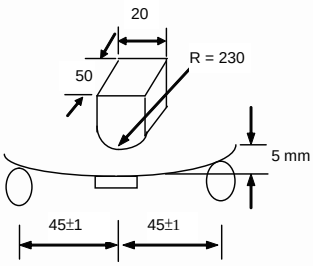
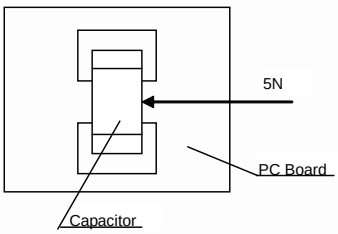
DIELECTRIC		X7R									
SIZE		1206		1210		1808			1812		
RATED VOLTAGE (VDC)		1000	2000	1000	2000	1000	2000	3000	1000	2000	3000
Capacitance	100pF (101)										
	120pF (121)										
	150pF (151)										
	180pF (181)										
	220pF (221)										
	270pF (271)										
	330pF (331)										
	390pF (391)										
	470pF (471)										
	560pF (561)										
	680pF (681)										
	820pF (821)										
	1,000pF (102)										
	1,200pF (122)										
	1,500pF (152)										
	1,800pF (182)										
	2,200pF (222)										
	2,700pF (272)										
	3,300pF (332)										
	3,900pF (392)										
	4,700pF (472)										
	5,600pF (562)										
	6,800pF (682)										
	8,200pF (822)										
	0.010μF (103)										
	0.012μF (123)										
	0.015μF (153)										
	0.018μF (183)										
	0.022μF (223)										
	0.027μF (273)										
	0.033μF (333)										

Rated Voltage ≤3KV(1825~2225)

DIELECTRIC		X7R								
SIZE		1825			2220			2225		
RATED VOLTAGE (VDC)		1000	2000	3000	1000	2000	3000	1000	2000	3000
Capacitance	1,000pF (102)									
	1,200pF (122)									
	1,500pF (152)									
	1,800pF (182)									
	2,200pF (222)									
	2,700pF (272)									
	3,300pF (332)									
	3,900pF (392)									
	4,700pF (472)									
	5,600pF (562)									
	6,800pF (682)									
	8,200pF (822)									
	0.010μF (103)									
	0.012μF (123)									
	0.015μF (153)									
	0.018μF (183)									
	0.022μF (223)									
	0.027μF (273)									
	0.033μF (333)									
	0.039μF (393)									
	0.047μF (473)									
	0.056μF (563)									
	0.068μF (683)									
	0.082μF (823)									
	0.100μF (104)									

Reliability test conditions and requirements

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Visual examination and Dimensions</td><td>• ---</td><td>• No remarkable defect.
• Dimensions to conform to individual specification sheet.</td></tr>
<tr><td>2.</td><td>Capacitance</td><td>• Class I: C0G(NP0)</td><td>• Shall not exceed the limits given in the detailed spec.</td></tr>
<tr><td>3.</td><td>Q/ D.F. (Dissipation Factor)</td><td>• Cap ≤ 1000pF, 1.0 ± 0.2Vrms, 1MHz ± 10%
• Cap>1000pF, 1.0 ± 0.2Vrms, 1KHz ± 10%
• Class II: (X7R)
• 1.0 ± 0.2Vrms, 1kHz ± 10%
• Cap ≤ 10μF, 1.0 ± 0.2Vrms, 1KHz ± 10%
• Cap>10μF, 0.5 ± 0.2Vrms, 120Hz ± 20%</td><td>• C0G(NP0): Cap ≥ 30pF, Q ≥ 1000;
Cap<30pF, Q ≥ 400+20C
• X7R: ≤ 2.5%
• U_R =50V, D.F. < 2.5%
<table>
<tr><th>Rated vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr>
<tr><td>50V</td><td>≤ 2.5%</td><td>≤ 3%</td><td>0603 ≥ 0.047μF;
0805 ≥ 0.18μF,
1206 ≥ 0.47μF</td></tr>
</table>
U_R < 50V, D.F. < 3.5%</td></tr>
<tr><td>4.</td><td>Temperature Coefficient</td><td>• With no electrical load.
<table>
<tr><th>T.C.</th><th>Operating Temp</th></tr>
<tr><td>C0G(NP0)</td><td>-55~125℃ at 25℃</td></tr>
<tr><td>X7R</td><td>-55~125℃ at 25℃</td></tr>
</table></td><td>•
<table>
<tr><th>T.C.</th><th>Capacitance Change</th></tr>
<tr><td>C0G(NP0)</td><td>Within ± 30ppm/℃</td></tr>
<tr><td>X7R</td><td>Within ± 15%</td></tr>
</table></td></tr>
<tr><td>5.</td><td>Insulation Resistance</td><td>• U_R =10~100V:
• To apply rated voltage for max. 120 sec.
• U_R >100V: To apply voltage at U_R (500V max.) for 60 sec.</td><td>• Class I (C0G/NPO) : ≥ 100G Ω or RxC ≥ 1000 Ω -F whichever is smaller.
• Class II (X7R) :
U_R =10~50V: ≥ 10G Ω or RxC ≥ 500 Ω -F whichever is smaller.
• U_R =100~3KV:
≥ 10G Ω or RxC ≥ 100 Ω -F whichever is smaller.</td></tr>
<tr><td>6.</td><td>Voltage proof (Dielectric Strength)</td><td>• To apply voltage:
≤ 100V =2.5 times of U_R
200V/250V =2 times of U_R
500V/630V =1.5 times of U_R
≥ 1kv =1.2 times of U_R
• Duration: 1 to 5 sec.</td><td>• No evidence of damage or flashover during test.</td></tr>
<tr><td>7.</td><td>Solderability</td><td>• Solder temperature: 235 ± 5℃
• Dipping time: 5 ± 0.5 sec.</td><td>• 75% min. coverage of all metalized area.</td></tr>
<tr><td>8.</td><td>Resistance to Soldering Heat</td><td>• Solder temperature: 260 ± 5℃
• Dipping time: 10 ± 1 sec
• Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder.
• Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).</td><td>• No remarkable damage.
• Cap change:
C0G(NPO):
within ± 2.5% or ± 0.25pF whichever is larger.
X7R:
within ± 15% For 10~630Vdc.
within ± 7.5% For 1K~3KVdc.
• 25% max. leaching on each edge.</td></tr>
<tr><td>9.</td><td>Rapid change of temperature (Temperature Cycle)</td><td>• Conduct the five cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th>Temp. (℃)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30 ± 3</td></tr>
<tr><td>2</td><td>Room temp.</td><td>2~3</td></tr>
<tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30 ± 3</td></tr>
<tr><td>4</td><td>Room temp.</td><td>2~3</td></tr>
</table>
Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).</td><td>• No remarkable damage.
• Cap change :
C0G(NPO): within ± 2.5% or ± 0.25pF whichever is larger.
X7R: within ± 15%
• Q/D.F.:
C0G(NPO): ≤ 2.0 × Initial requirement
X7R: ≤ 1.5 × Initial requirement
• I.R. ≥ 0.25 × initial requirements.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>10.</td><td>Damp Heat
Steady State</td><td>• Test temp.: 40 ± 2℃
• Humidity: 90~95% RH
• Test time: 500+24/-0hrs.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).</td><td>• No remarkable damage.
• Cap change:
C0G(NPO) : within ± 5% or ± 2pF whichever is larger
X7R : within ± 15%
Y5V : within ± 30%
• Q/D.F Value:
C0G(NPO): Cap ≥ 30pF :Q ≥ 350;
10pF ≤ Cap<30pF :Q ≥ 275+2.5C;
Cap<10pF :Q ≥ 200+10C
X7R: ≤ 7.0%
• I.R.: ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.</td></tr>
<tr><td>11.</td><td>High Temperature Load
(Endurance)</td><td>• Test temp.:
C0G(NPO), X7R: 125 ± 3℃
• To apply voltage:
(1) U_R ≤ 250V: 200% of rated voltage.
Exception item:<table><tr><th>U_R</th><th>Size</th><th>Cap</th><th>Voltage</th></tr><tr><td>100V</td><td>1206
1210</td><td>≥ 105</td><td rowspan="4">1.5 times of U_R</td></tr><tr><td rowspan="3">200V and 250V</td><td>1210</td><td>> 224</td></tr><tr><td>1812</td><td>> 474</td></tr><tr><td>1825
2220
2225</td><td>≥ 105</td></tr></table>(2) 250 < U_R ≤ 500V: 150% of rated voltage.
(3) U_R > 500V: 120% of rated voltage.
• Test time: 1000+24/-0 hrs.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).</td><td>• No remarkable damage.
• Cap change:
C0G(NPO) : within ± 3% or ± 3pF whichever is larger
X7R : within ± 15%
• Q/D.F Value:
C0G(NPO): Cap ≥ 30pF :Q ≥ 350;
10pF ≤ Cap<30pF :Q ≥ 275+2.5C;
Cap<10pF :Q ≥ 200+10C
X7R: ≤ 7.0%
• I.R.: ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.</td></tr>
<tr><td>12.</td><td>Substrate bending test
(Resistance to Flexure of Substrate)</td><td>• The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1mm per second until the deflection becomes 5 mm.
 
</td><td>• No remarkable damage.
• Cap change:
C0G(NPO): within ± 10%
X7R: within ± 12.5%
(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)
• Non split found in Anti-bend term.</td></tr>
<tr><td>13.</td><td>Robustness of terminations
(Adhesive Strength of Termination)</td><td>• Capacitors mounted on a substrate. A force of 5N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 sec.
 
</td><td>• No remarkable damage or removal of the terminations.</td></tr>
</table>

Introduction

POSPERITY open-mode series MLCC is designed by a special internal electrode pattern, which can reduce voltage concentrations by distributing voltage gradients throughout the entire capacitor. This special design also affords open-mode pattern to prevent circuit leakage when focused to failure in a board flex situation.

Features

- » High voltage in a given case size.
- » Circuit open during product cracking.
- » High stability and reliability.
- » HALOGEN compliant.
- » RoHS compliant.

Applications

- » High current applications.
- » Power supply and related industries
- » The other mechanical stress concerned products.

How to order

OP	31	B	223	K	501	L	T
Series	Size	Dielectric	Capacitance	Tolerance	Rated voltage	Termination	Packaging
OP=Open-mode	21=0805 (2012) 31=1206 (3216) 32=1210 (3225) 43=1812 (4532)	B=X7R	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: $102=10x10^2$ =1000pF	K= ± 10% M= ± 20%	Two significant digits followed by no. of zeros. And R is in place of decimal point. 101=100 VDC 201=200 VDC 251=250 VDC 501=500 VDC 631=630 VDC	C=Cu/Ni/Sn	T=7" reeled G=13" reeled

General electrical data

Dielectric	X7R
Size	0805, 1206, 1210, 1812
Capacitance*	100pF to 1μF
Capacitance tolerance	K (± 10%), M (± 20%)
Rated voltage (WVDC)	100V, 200V, 250V, 500V
Tan δ *	≤ 2.5%
Insulation resistance at Ur	≥ 10G Ω or RxC ≥ 500 Ω -F whichever is smaller
Dielectric strength	100V: ≥ 2.5 x WVDC 200V and 250V: ≥ 2 x WVDC 500V: ≥ 1.5 x WVDC
Operating temperature	-55 to +125℃
Capacitance characteristic	± 15%
Termination	Cu(or Ag)/Ni/Sn (lead-free termination)

* Measured at 25℃ ambient temperature and 30~70% related humidity. Apply 1.0 ± 0.2Vrms, 1.0kHz ± 10%.

Capacitance range

DIELECTRIC		X7R														
SIZE		0805				1206				1210				1812			
RATED VOLTAGE (VDC)		100	200	250	500 630	100	200	250	500 630	100	200	250	500 630	100	200	250	500 630
Capacitance	100pF (101)																
	120pF (121)																
	150pF (151)																
	180pF (181)																
	220pF (221)																
	270pF (271)																
	330pF (331)																
	390pF (391)																
	470pF (471)																
	560pF (561)																
	680pF (681)																
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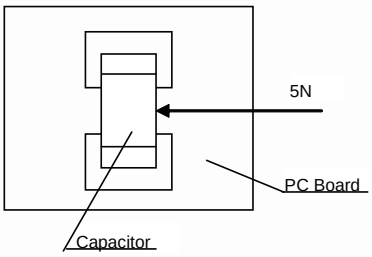
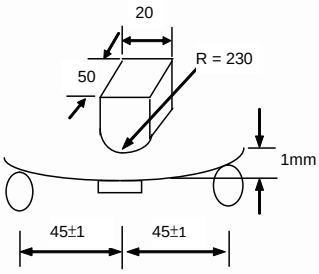
	2,700pF (272)																
	3,300pF (332)																
	3,900pF (392)																
	4,700pF (472)																
	5,600pF (562)																
	6,800pF (682)																
	8,200pF (822)																
	0.010μF (103)																
	0.012μF (123)																
	0.015μF (153)																
	0.018μF (183)																
	0.022μF (223)																
	0.027μF (273)																
	0.033μF (333)																
	0.039μF (393)																
	0.047μF (473)																
	0.056μF (563)																
	0.068μF (683)																
	0.082μF (823)																
	0.10μF (104)																
	0.12μF (124)																
	0.15μF (154)																
	0.18μF (184)																
	0.22μF (224)																
	0.27μF (274)																
	0.33μF (334)																
	0.39μF (394)																
	0.47μF (474)																
	0.56μF (564)																
	0.68μF (684)																
	0.82μF (824)																
	1.0μF (105)																

Reliability test conditions and requirements

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Visual examination and Dimensions</td><td>• ---</td><td>• No remarkable defect.
• Dimensions to conform to individual specification sheet.</td></tr>
<tr><td>2.</td><td>Capacitance</td><td>• Class II: (X7R)</td><td>• Shall not exceed the limits given in the detailed spec.</td></tr>
<tr><td>3.</td><td>Q/ D.F. (Dissipation Factor)</td><td>• 1.0 ± 0.2Vrms, 1kHz ± 10%</td><td>• X7R: ≤ 2.5%</td></tr>
<tr><td>4.</td><td>Temperature Coefficient</td><td>• With no electrical load.
<table><tr><th>T.C.</th><th>Operating Temp</th></tr><tr><td>X7R</td><td>-55~125℃ at 25℃</td></tr></table></td><td>•
<table><tr><th>T.C.</th><th>Capacitance Change</th></tr><tr><td>X7R</td><td>Within ± 15%</td></tr></table></td></tr>
<tr><td>5.</td><td>Insulation Resistance</td><td>• To apply voltage at U_R (500V max.) for 60 sec.</td><td>• ≥ 10G Ω or RxC ≥ 100 Ω -F whichever is smaller.</td></tr>
<tr><td>6.</td><td>Voltage proof (Dielectric Strength)</td><td>• To apply voltage:
≤ 100V =2.5 times of U_R
200V/250V =2 times of U_R
500V/630V =1.5 times of U_R
• Duration: 1 to 5 sec.
• To apply voltage (≤ 50V) 250%.
• Charge and discharge current less than 50mA.</td><td>• No evidence of damage or flashover during test.</td></tr>
<tr><td>7.</td><td>Solderability</td><td>• Solder temperature: 235 ± 5℃
• Dipping time: 5 ± 0.5 sec.</td><td>• 75% min. coverage of all metalized area.</td></tr>
<tr><td>8.</td><td>Resistance to Soldering Heat</td><td>• Solder temperature: 270 ± 5℃
• Dipping time: 10 ± 1 sec
• Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder.
• Before initial measurement (Class II only): Perform 150+0/ -10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).</td><td>• No remarkable damage.
• Cap change:
X7R: within ± 7.5%
• 25% max. leaching on each edge.</td></tr>
<tr><td>9.</td><td>Rapid change of temperature (Temperature Cycle)</td><td>• Conduct the five cycles according to the temperatures and time.
<table><tr><th>Step</th><th>Temp. (℃)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30 ± 3</td></tr><tr><td>2</td><td>Room temp.</td><td>2~3</td></tr><tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30 ± 3</td></tr><tr><td>4</td><td>Room temp.</td><td>2~3</td></tr></table>• Before initial measurement (Class II only): Perform 150+0/ -10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).</td><td>• No remarkable damage.
• Cap change :
X7R: within ± 15%
• Q/D.F.:
X7R: ≤ 1.5 × Initial requirement
• I.R. ≥ 0.25 × initial requirements.</td></tr>
</table>

Reliability test conditions and requirements

No.	Item	Test Condition	Requirements
10.	Robustness of terminations (Adhesive Strength of Termination)	• Capacitors mounted on a substrate. A force of 5N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 sec. • Pressurizing force : 5N (≤ 0603) and 10N (>0603) • Test time: 10 ± 1 sec. 	• No remarkable damage or removal of the terminations.
11.	Damp Heat Steady State	• Test temp.: 40 ± 2℃ • Humidity: 90~95% RH • Test time: 500+24/-0hrs. • Measurement to be made after keeping at room temp. for 48 ± 4 hrs. (Class II).	• No remarkable damage. • Cap change: X7R: within ± 15% • Q/D.F. value: X7R: D.F. ≤ 7.0% • I.R.: ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.
12.	High Temperature Load (Endurance)	• Test temp.: X7R: 125 ± 3℃ • To apply voltage: (1) <500V: 200% of rated voltage. (2) 500V: 150% of rated voltage. • Test time: 1000+24/-0 hrs. • Measurement to be made after keeping at room temp. for 48 ± 4 hrs.	• No remarkable damage. • Cap change: X7R: within ± 15% • Q/D.F. value: X7R: D.F. ≤ 7.0% • I.R.: ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.
13.	Substrate bending test (Resistance to Flexure of Substrate)	• The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1mm per second until the deflection becomes 5.0mm. 	• No remarkable damage. • Cap change: C0G(NPO): within ± 10% X7R: within ± 12.5% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.) • Non split found in Anti-bend term.
14.	Vibration Resistance	• Vibration frequency: 10~55 Hz/min. • Total amplitude: 1.5mm • Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)	• No remarkable damage. • Cap change and Q/D.F.: To meet initial spec.

ULTRA-SMALL 0201 SIZE SERIES

Introduction

MLCC consists of a conducting material and electrodes. To manufacture a chip-type SMT and achieve miniaturization, high density and high efficiency, ceramic condensers are used.
0201 MLCC is performed by high precision technology achieve high capacitance in unit size and ensure the stability and reliability of products.

Features

- » High capacitance in unit size.
- » High precision dimensional tolerances.
- » Suitable used in high-accuracy automatic mounting machine.
- » HALOGEN compliant.
- » RoHS compliant.

Applications

- » Miniature microwave module.
- » Portable equipments (ex. Mobile phone, PDA).
- » High frequency circuits.

How to order

MA	0201	CG	-	100	J	-	250	PR	G
PDC Family	Size	Dielectric		Capacitance	Tolerance		Rated voltage	Packaging	Control Code
	Inch (mm) 0201 (0603)	CG: C0G(NPO) XR: X7R or X5R YV: Y5V		Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: R47=0.47pF 0R5=0.5pF 1R0=1.0pF 100=10x10^0 =10pF	B= ± 0.1pF C= ± 0.25pF D= ± 0.5pF F= ± 1% G= ± 2% J= ± 5% K= ± 10% M= ± 20% Z=-20/+80%		Two significant digits followed by no. of zeros. And R is in place of decimal point. 6R3=6.3 VDC 100=10 VDC 160=16 VDC 250=25 VDC 500=50 VDC	PR: Tape and Reel, Paper Tape No Code: Bulk	G: RoHS compliant

General electrical data

Size	0201		
Dielectric	C0G(NPO)	X7R	X5R
Capacitance*	0.3pF to 100pF	100pF to 10nF	100pF to 0.22μF
Capacitance tolerance**	Cap ≤ 5pF: B (± 0.1pF), C (± 0.25pF) 5pF<Cap<10pF: C (± 0.25pF),D(± 0.5pF) Cap ≥ 10pF: F (± 1%), G (± 2%), J (± 5%), K (± 10%)	J (± 5%), K (± 10%), M (± 20%)	J (± 5%),K (± 10%), M (± 20%)
Rated voltage (WVDC)	16V, 25V, 50V	6.3V, 10V, 16V, 25V, 50V	6.3V,10V, 16V,25V,50V
Tan δ / Q*	Cap<30pF, Q ≥ 400+20C Cap ≥ 30pF, Q ≥ 1000	Ur=50V: ≤ 3.0% Ur=16V, 25V: ≤ 3.5% Ur=10V: ≤ 5.0% Ur=6.3V: ≤ 10%	Ur=50V: ≤ 3.0% Ur=16V, 25V: ≤ 3.5% Ur=10V: ≤ 5.0% Ur=6.3V: ≤ 10%
Insulation resistance at Ur	≥ 10G Ω	≥ 10G Ω or RxC ≥ 500 Ω xF whichever is less	
Operating temperature	-55 to +125℃		-55 to +85℃
Capacitance change	± 30ppm	± 15%	
Termination	Cu(or Ag)/Ni/Sn (lead-free termination)		

* Measured at 30~70% related humidity.
NP0: Apply 1.0 ± 0.2Vrms, 1.0MHz ± 10% at the condition of 25℃ ambient temperature.
X7R, X5R: Apply 1.0 ± 0.2Vrms, 1.0kHz ± 10% at the condition of 25℃ ambient temperature.

** Preconditioning for Class II MLCC: Perform a heat treatment at 150 ± 10℃ for 1 hour, then leave in ambient condition for 24 ± 2 hours before measurement

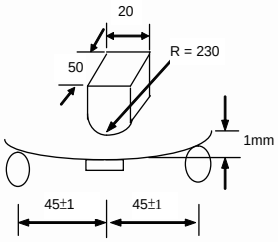
Capacitance Range

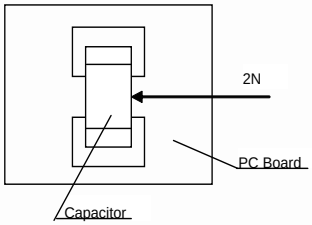
SIZE		0201												
DIELECTRIC		X7R					X5R					C0G		
RATED VOLTAGE (VDC)		6.3	10	16	25	50	6.3	10	16	25	50	16	25	50
Capacitance	100pF (101)													
	120pF (121)													
	150pF (151)													
	180pF (181)													
	220pF (221)													
	270pF (271)													
	330pF (331)													
	390pF (391)													
	470pF (471)													
	560pF (561)													
	680pF (681)													
	820pF (821)													
	1,000pF (102)													
	1,500pF (152)													
	2,200pF (222)													
	3,300pF (332)													
	4,700pF (472)													
	6,800pF (682)													
	0.010μF (103)													
	0.015μF (153)													
	0.022μF (223)													
	0.033μF (333)													
	0.047μF (473)													
	0.068μF (683)													
	0.10μF (104)													
	0.22μF (224)													
	0.3pF (0R3)													
	0.4pF (0R4)													
	0.5pF (0R5)													
	1.0pF (1R0)													
	1.2pF (1R2)													
	1.5pF (1R5)													
	1.8pF (1R8)													
	2.2pF (2R2)													
	2.7pF (2R7)													
	3.0pF (3R0)													
	3.3pF (3R3)													
	3.9pF (3R9)													
	4.0pF(4R0)													
	4.7pF (4R7)													
	5.6pF (5R6)													
	6.8pF (6R8)													
	8.2pF (8R2)													
	10pF (100)													
	12pF (120)													
	15pF (150)													
	18pF (180)													
	22pF (220)													
	27pF (270)													
	33pF (330)													
	39pF (390)													
	47pF (470)													
	56pF (560)													
	68pF (680)													
	82pF (820)													
	100pF (101)													

Reliability test conditions and requirements(Cont.)

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Visual examination and Dimensions</td><td>• ---</td><td>• No remarkable defect.
• Dimensions to conform to individual specification sheet.</td></tr>
<tr><td>2.</td><td>Capacitance</td><td>• Class I: NP0
• Cap ≤ 1000pF, 1.0 ± 0.2Vrms, 1MHz ± 10%</td><td>• Shall not exceed the limits given in the detailed spec.</td></tr>
<tr><td>3.</td><td>Q/ D.F. (Dissipation Factor)</td><td>• Cap>1000pF, 1.0 ± 0.2Vrms, 1KHz ± 10%
• Class II: X7R, X5R,Y5V
• Cap ≤ 10μF, 1.0 ± 0.2Vrms, 1kHz ± 10%
• Cap>10μF, 0.5 ± 0.2Vrms, 120Hz ± 20%</td><td>• NP0: Cap ≥ 30pF, Q ≥ 1000; Cap<30pF, Q ≥ 400+20C
• X7R, X5R:
<table>
<tr><th>Rated vol.</th><th>D.F.</th><th>Rated vol.</th><th>D.F.</th></tr>
<tr><td>≥ 50V</td><td>≤ 3%</td><td>10V</td><td>≤ 5.0%</td></tr>
<tr><td>25V</td><td>≤ 3.5%</td><td>6.3V</td><td>≤ 10%</td></tr>
<tr><td>16V</td><td>≤ 3.5%</td><td></td><td></td></tr>
</table></td></tr>
<tr><td>4.</td><td>Temperature Coefficient</td><td>• With no electrical load.
<table>
<tr><th>T.C.</th><th>Operating Temp</th></tr>
<tr><td>NP0 (C0G)</td><td>-55~125℃ at 25℃</td></tr>
<tr><td>X7R</td><td>-55~125℃ at 25℃</td></tr>
<tr><td>X5R</td><td>-55~85℃ at 25℃</td></tr>
</table></td><td>•
<table>
<tr><th>T.C.</th><th>Capacitance Change</th></tr>
<tr><td>NP0 (C0G)</td><td>Within ± 30ppm/℃</td></tr>
<tr><td>X7R</td><td>Within ± 15%</td></tr>
<tr><td>X5R</td><td>Within ± 15%</td></tr>
</table></td></tr>
<tr><td>5.</td><td>Insulation Resistance</td><td>• To apply rated voltage for max. 120 sec.</td><td>• ≥ 10G Ω or RxC ≥ 500 Ω -F whichever is smaller.
Class II (X5R, X6S, X7R, Y5V)
<table>
<tr><th>Rated voltage</th><th>Insulation resistance</th></tr>
<tr><td>6.3V</td><td>≥ 100 Ω-F</td></tr>
</table></td></tr>
<tr><td>6.</td><td>Voltage proof (Dielectric Strength)</td><td>• To apply voltage (≤ 50V) 250%.
• Duration: 1 to 5 sec.
• Charge and discharge current less than 50mA.</td><td>• No evidence of damage or flash over during test.</td></tr>
<tr><td>7.</td><td>Solderability</td><td>• Solder temperature: 235 ± 5℃
• Dipping time: 2 ± 0.5 sec.</td><td>• 95% min. coverage of all metalized area.</td></tr>
<tr><td>8.</td><td>Resistance to Soldering Heat</td><td>• Solder temperature: 270 ± 5℃
• Dipping time: 10 ± 1 sec
• Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder.
• Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs. (Class I) or 48 ± 4 hrs. (Class II).</td><td>• No remarkable damage.
• Cap change:
NP0: within ± 2.5% or ± 0.25pF whichever is larger.X7R, X5R: within ± 7.5%
• Q/D.F., I.R. and dielectric strength: To meet initial requirements.
• 25% max. leaching on each edge.</td></tr>
<tr><td>9.</td><td>Rapid change of temperature (Temperature Cycle)</td><td>• Conduct the five cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th>Temp. (℃)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30 ± 3</td></tr>
<tr><td>2</td><td>Room temp.</td><td>2~3</td></tr>
<tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30 ± 3</td></tr>
<tr><td>4</td><td>Room temp.</td><td>2~3</td></tr>
</table>
• Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs. (Class I) or 48 ± 4 hrs. (Class II).</td><td>• No remarkable damage.
• Cap change:
NP0: within ±2.5% or ±0.25pF whichever is larger.X7R, X5R: within ±7.5%
• Q/D.F., I.R. and dielectric strength: To meet initial requirements.</td></tr>
<tr><td>10.</td><td>Damp Heat Steady State</td><td>• Test temp.: 40 ± 2℃
• Humidity: 90~95% RH
• Test time: 500+24/-0hrs.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs. (Class I) or 48 ± 4 hrs. (Class II).</td><td>• No remarkable damage.
• Cap change: NP0: within ± 5.0% or ± 0.5pF whichever is larger.X7R, X5R: ≥ 10V, within ± 12.5% 6.3V, within ± 25%
• Q/D.F. value:
NP0: Cap ≥ 30pF, Q ≥ 350; 10pF ≤ Cap<30pF, Q ≥ 275+2.5C
Cap<10pF; Q ≥ 200+10C
X7R, X5R:
<table>
<tr><th>Rated vol.</th><th>D.F.</th><th>Rated vol.</th><th>D.F.</th></tr>
<tr><td>≥ 50V</td><td>≤ 6.0%</td><td>10V</td><td>≤ 7.5%</td></tr>
<tr><td>25V</td><td>≤ 5.0%</td><td>6.3V</td><td>≤ 15.0%</td></tr>
<tr><td>16V</td><td>≤ 5.0%</td><td></td><td></td></tr>
</table>
• I.R.: ≥ 10V, ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.
6.3V, RxC ≥ 10 Ω -F</td></tr>
</table>

Reliability test conditions and requirements(Cont.)

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>11.</td><td>Humidity Load
(Damp Heat)</td><td>• Test temp.: 40 ± 2℃
• Humidity: 90~95%RH
• Test time: 500+24/-0 hrs.
• To apply voltage : rated voltage.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs. (Class I) or 48 ± 4 hrs. (Class II).</td><td>• No remarkable damage.
• Cap change: NP0: within ± 5.0% or ± 0.5pF whichever is larger.X7R, X5R: ≥ 10V, within ± 12.5%
6.3V, within ± 25%
• Q/D.F. value:
NP0: Cap ≥ 30pF, Q ≥ 350; 10pF ≤ Cap<30pF, Q ≥ 275+2.5C
Cap<10pF; Q ≥ 200+10C
X7R, X5R:
<table><tr><th>Rated vol.</th><th>D.F.</th><th>Rated vol.</th><th>D.F.</th></tr><tr><td>≥ 50V</td><td>≤ 6.0%</td><td>10V</td><td>≤ 7.5%</td></tr><tr><td>25V</td><td>≤ 5.0%</td><td>6.3V</td><td>≤ 15.0%</td></tr><tr><td>16V</td><td>≤ 5.0%</td><td></td><td></td></tr></table>• I.R.: ≥ 10V, ≥ 1G Ω or RxC ≥ 25 Ω -F whichever is smaller.
6.3V, RxC ≥ 5 Ω -F</td></tr>
<tr><td>12.</td><td>High Temperature Load
(Endurance)</td><td>• Test temp.:
NP0, X7R: 125 ± 3℃
X5R,Y5V: 85 ± 3℃
• To apply voltage:
(1) 6.3V: 150% of rated voltage.
(2) >6.3V: 200% of rated voltage.
• Test time: 1000+24/-0 hrs.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs. (Class I) or 48 ± 4 hrs. (Class II).</td><td>• No remarkable damage.
• Cap change: NP0: within ± 5.0% or ± 0.5pF whichever is larger.X7R, X5R: ≥ 10V, within ± 12.5%
6.3V, within ± 25%
• Q/D.F. value:
NP0: Cap ≥ 30pF, Q ≥ 350; 10pF ≤ Cap<30pF, Q ≥ 275+2.5C
Cap<10pF; Q ≥ 200+10C
X7R, X5R:
<table><tr><th>Rated vol.</th><th>D.F.</th><th>Rated vol.</th><th>D.F.</th></tr><tr><td>≥ 50V</td><td>≤ 6.0%</td><td>10V</td><td>≤ 7.5%</td></tr><tr><td>25V</td><td>≤ 5.0%</td><td>6.3V</td><td>≤ 15.0%</td></tr><tr><td>16V</td><td>≤ 5.0%</td><td></td><td></td></tr></table>• I.R.: ≥ 10V, ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.
6.3V, RxC ≥ 10 Ω -F</td></tr>
<tr><td>13.</td><td>Substrate bending test
(Resistance to Flexure of Substrate)</td><td>• The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1mm per second until the deflection becomes 1 mm.
 
</td><td>• No remarkable damage.
• Cap change:
C0G(NPO): within ± 10%
X7R: within ± 12.5%

(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)
• Non split found in Anti-bend term.</td></tr>
<tr><td>14.</td><td>Robustness of terminations
(Adhesive Strength of Termination)</td><td>• Capacitors mounted on a substrate. A force of 2N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 sec.
 
</td><td>• No remarkable damage or removal of the terminations.</td></tr>
<tr><td>15.</td><td>Vibration Resistance</td><td>• Vibration frequency: 10~55 Hz/min
• Total amplitude: 1.5mm
• Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)</td><td>• No remarkable damage.
• Cap change and Q/D.F.: To meet initial spec.</td></tr>
</table>

Introduction

FL Series green type capacitors are manufactured by using green materials without lead and cadmium. These capacitors feature series connection of multi-layer capacitor units in a MLCC to realize high voltage performance. Reliable performances are built-in through exact formulation of dielectric powders, preparation of conductive paste, advanced automatic manufacturing, and strict quality control to assure excellent control in dielectric thickness, electrode integrity, and electrode-to-termination continuity.

Features

- Low ESR and Low Tan δ
- Excellent DC Bias
- Provide Good Ripple Characteristic.
- Excellent Temperature Coefficient
- HALOGEN compliant.
- RoHS compliant.

Applications

- Power supply.
- Strobe trigger circuit for digital cameras.
- Telecommunication (ADSL, Modem, Splitter)
- Audio circuit
- Lighting

How to order

FL	25	E	104	M	102	E	G	G
PDC Family	Size	Dielectric	Capacitance	Tolerance	Rated Voltage	Packaging	Thickness	Control Code
	Inch (mm) 05: 0805(2012) 06: 1206(3216) 10: 1210(3225) 12: 1812(4532) 18: 1825(4563) 20: 2220(5750) 25: 2225(5763)	E: X7E	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: R47=0.47pF 0R5=0.5pF 1R0=1.0pF 100=10x10^0 =10pF	J= ± 5% K= ± 10% M= ± 20%	Two significant digits followed by no. of zeros. And R is in place of decimal point. 101: 100V 201: 200V 251: 250V 351: 350V 501: 500V 631: 630V 102: 1000V 202: 2000V 302: 3000V	E: Tape and Reel, Embossed Tape P: Tape and Reel, Cardboard tape No Code: Bulk	B: 0.80 ± 0.10mm C: 1.25 ± 0.10mm D: 1.40 ± 0.15mm E: 1.60 ± 0.20 mm F: 2.00 ± 0.20 mm G: 2.50 ± 0.30 mm	G: RoHS compliant P: Pb/Sn Plating(Tin/lead with min. 5% lead)*

* For more information, please contact with PDC local representative.

General electrical data

Dielectric	X7E
Size	0805, 1206, 1210, 1812, 1825, 2220, 2225
Capacitance range*	100pF ~ 1.2μF
Capacitance tolerance	J (± 5%), K (± 10%), M(± 20%)
Rated voltage (WVDC)	100V, 200V, 250V, 350V, 500V, 630V, 1000, 2000V
Tan δ	U_R<200V: 1.4% max. ; U_R ≥ 200V: 1.0% max.
Insulation resistance at U_R**	≥ 10G Ω or R·C ≥ 500 Ω ·F whichever is smaller
Operating temperature	-55 to +125℃
Capacitance characteristic	± 4.7%
Termination	Ag / Ni / Sn

* Measured at the condition of 30~70% related humidity.
Apply 1.0 ± 0.2Vrms, 1.0kHz ± 10%, at 25℃ ambient temperature.

** Measured at 500VDC for 60 sec, for U_R>500VDC

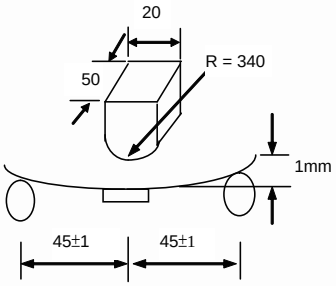
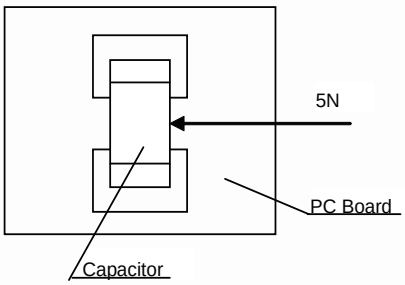
Reliability test conditions and requirements

7-1. 0805, 1206, 1210, 1812, 2220, 2225 Sizes.

DIELECTRIC		X7E																	
SIZE		0805			1206					1210				1812		1825	2220		2225
RATED VOLTAGE (VDC)		200	250	350	100	250	350	500	630	100	200	250	630	100	2000	100	100	250	1000
Capacitance	100pF (101)																		
	120pF (121)																		
	150pF (151)																		
	180pF (181)																		
	220pF (221)																		
	270pF (271)																		
	330pF (331)																		
	390pF (391)																		
	470pF (471)																		
	560pF (561)																		
	680pF (681)																		
	820pF (821)																		
	1,000pF (102)																		
	1,200pF (122)																		
	1,500pF (152)																		
	1,800pF (182)																		
	2,200pF (222)																		
	2,700pF (272)																		
	3,300pF (332)																		
	3,900pF (392)																		
	4,700pF (472)																		
	5,600pF (562)																		
	6,800pF (682)																		
	8,200pF (822)																		
	0.010μF (103)																		
	0.012μF (123)																		
	0.015μF (153)																		
	0.018μF (183)																		
	0.022μF (223)																		
	0.027μF (273)																		
	0.033μF (333)																		
	0.039μF (393)																		
	0.047μF (473)																		
	0.056μF (563)																		
	0.068μF (683)																		
	0.082μF (823)																		
	0.10μF (104)																		
	0.12μF (124)																		
	0.15μF (154)																		
	0.18μF (184)																		
	0.22μF (224)																		
	0.27μF (274)																		
	0.33μF (334)																		
	0.39μF (394)																		
	0.47μF (474)																		
	0.56μF (564)																		
	0.68μF (684)																		
	0.82μF (824)																		
	1.0μF (105)																		
	1.2μF (125)																		

Reliability test conditions and requirements

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Visual examination and Dimensions</td><td>• ---</td><td>• No remarkable defect.
• Dimensions to conform to individual specification sheet.</td></tr>
<tr><td>2.</td><td>Capacitance</td><td rowspan="2">• 1.0 ± 0.2Vrms, 1kHz ± 10%</td><td>• Shall not exceed the limits given in the detailed spec.</td></tr>
<tr><td>3.</td><td>Q/ D.F. (Dissipation Factor)</td><td>• U_R < 200V: D.F ≤ 1.40%
• U_R ≥ 200V: D.F ≤ 1.00%</td></tr>
<tr><td>4.</td><td>Temperature Coefficient</td><td>• With no electrical load.
<table><tr><th>T.C.</th><th>Operating Temp</th></tr><tr><td>X7E</td><td>-55~125℃ at 25℃</td></tr></table></td><td>•
<table><tr><th>T.C.</th><th>Capacitance Change</th></tr><tr><td>X7E</td><td>Within ± 4.7%</td></tr></table></td></tr>
<tr><td>5.</td><td>Insulation Resistance</td><td>• To apply voltage at U_R (500V max.) for 60 sec.</td><td>• ≥ 10G Ω or R·C ≥ 500 Ω -F whichever is smaller.</td></tr>
<tr><td>6.</td><td>Voltage proof (Dielectric Strength)</td><td>• To apply voltage:
• U_R= 100V=2.5 times of U_R
• U_R =200V/250V=2 times of U_R
• U_R =350/500V=1.5 times of U_R
• U_R >500V=1.2 times of U_R
• Duration: 1 to 5 sec.</td><td>• No evidence of damage or flashover during test.</td></tr>
<tr><td>7.</td><td>Solderability</td><td>• Solder temperature: 235 ± 5℃
• Dipping time: 2 ± 0.5 sec.</td><td>• 75% min. coverage of all metalized area.</td></tr>
<tr><td>8.</td><td>Resistance to Soldering Heat</td><td>• Solder temperature: 260 ± 5℃
• Dipping time: 10 ± 1 sec
• Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder.
• Before initial measurement: Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 48 ± 4 hrs.</td><td>• No remarkable damage.
• Cap change is within ± 7.5%
• 25% max. leaching on each edge.</td></tr>
<tr><td>9.</td><td>Rapid change of temperature (Temperature Cycle)</td><td>• Conduct the five cycles according to the temperatures and time.
<table><tr><th>Step</th><th>Temp. (℃)</th><th>Time (min.)</th></tr><tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30 ± 3</td></tr><tr><td>2</td><td>Room temp.</td><td>2~3</td></tr><tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30 ± 3</td></tr><tr><td>4</td><td>Room temp.</td><td>2~3</td></tr></table>• Before initial measurement: Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 48 ± 4 hrs.</td><td>• No remarkable damage.
• Cap change is within ± 15%
• Q/D.F. ≤ 1.5 × Initial requirement
• I.R. ≥ 0.25 × initial requirements.</td></tr>
<tr><td>10.</td><td>Humidity (Damp Heat) Steady State</td><td>• Test temp.: 40 ± 2℃
• Humidity: 90~95% RH
• Test time: 500+24/-0hrs.
• Measurement to be made after keeping at room temp. for 48 ± 4 hrs.</td><td>• No remarkable damage.
• Cap change is within ± 15%
• Q/D.F. ≤ 1.5 × Initial requirement
• I.R. ≥ 0.25 × initial requirements.</td></tr>
</table>

No.	Item	Test Condition	Requirements
11.	High Temperature Load (Endurance)	• Test temp.:125 ± 3℃ • To apply voltage: (1) 100V<U_R ≤ 250V: 200% of rated voltage. (2) 250<U_R ≤ 500V: 150% of rated voltage. (3) U_R ≥ 630V: 120% of rated voltage. • Test time: 1000+24/-0 hrs. • Measurement to be made after keeping at room temp. for 48 ± 4 hrs.	• No remarkable damage. • Cap change is within ± 20% • D.F value ≤ 7.0% • I.R.: ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.
12.	Substrate bending test (Resistance to Flexure of Substrate)	• The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm. 	• No remarkable damage. • Cap change: X7R: within ± 10.0% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)
13.	Robustness of terminations (Adhesive Strength of Termination)	• Capacitors mounted on a substrate. A force of 5N applied perpendicular to the place of substrate and parallel the line joining the center of terminations for 10 ± 1 sec. 	• No remarkable damage or removal of the terminations.

MA HC HIGH CAPACITANCE CAPACITOR SERIES

Description

MLCC consists of a conducting material and electrodes. To manufacture a chip-type SMT and achieve miniaturization, high density and high efficiency, ceramic condensers are used.
PDC high capacitance MLCC offers low ESR and excellent frequency characteristics to be suited for coupling and decoupling applications in circuit. The high dielectric constant material X7R, X5R and Y5V are used for this series product.

Features

- » Realize high capacitance in given sizes.
- » Capacitor with lead-free termination (pure Tin).
- » RoHS compliant.
- » HALOGEM compliant.

Applications

- » Digital circuit coupling or decoupling applications.
- » For bypassing.
- » For high frequency and high-density type power suppliers.

How to order

MA	0603	XR	-	105	K	-	160	PR	G
PDC Family	Size	Dielectric		Capacitance	Tolerance		Rated voltage	Packaging	Control Code
	Inch (mm) 0402 (1005) 0603 (1608) 0805 (2012) 1206 (3216) 1210 (3225) 1808 (4520) 1812 (4532) 1825 (4563) 2220 (5750) 2225 (5763)	XR: X7R or X5R YV: Y5V		Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: $106=10x10^6$ =10μF	K= ± 10% M= ± 20% Z=-20/+80%		Two significant digits followed by no. of zeros. And R is in place of decimal point. 6R3=6.3 VDC 100=10 VDC 160=16 VDC 250=25 VDC 500=50 VDC 101=100 VDC 251=250 VDC	ER:Tape and Reel, Embossed Tape PR: Tape and Reel, Paper Tape No Code: Bulk	G: RoHS compliant

General electrical data

Dielectric	X7R	X5R	Y5V
Size	0402, 0603, 0805, 1206, 1210, 1812, 1825, 2220, 2225		
Capacitance range*	1μF to 10μF	1μF to 100μF	1μF to 100μF
Capacitance tolerance**	K (± 10%), M (± 20%)		Z (-20/+80%)
Rated voltage (WVDC)	6.3V, 10V, 16V, 25V, 50V, 100V, 250V		
Tan δ *	Note 1		
Insulation resistance at Ur	RxC ≥ 500 Ω xF		
Operating temperature	-55 to +125℃	-55 to +85℃	-25 to +85℃
Capacitance characteristic	± 15%		+30/-80%
Termination	Cu/Ni/Sn (lead-free termination)		

* Measured at 1.0 ± 0.2Vrms, 1.0kHz ± 10% for C ≤ 10μF; 0.5 ± 0.2Vrms, 120Hz ± 20% for C>10μF, 30~70% related humidity, 25℃ ambient temperature for X7R, X5R and at 20℃ for Y5V.

** Preconditioning for Class II MLCC: Perform a heat treatment at 150 ± 10℃ for 1 hour, then leave in ambient condition for 24 ± 2 hours before measurement.

* X7R/X5R

Rated vol.	D.F.	Exception of D.F.	
≥ 50V	≤ 2.5%	≤ 3.0%	0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF
25V	≤ 3.5%	≤ 5.0%	0805 ≥ 1μF;1210 ≥ 10μF
		≤ 7.0%	0603 ≥ 0.33μF; 1206 ≥ 4.7μF
		≤ 10.0%	0402 ≥ 0.10μF; 0603 ≥ 0.47μF; 0805 ≥ 2.2μF; 1206 ≥ 6.8μF
16V	≤ 3.5%	≤ 5.0%	0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF; 1210 ≥ 4.7μF
		≤ 10.0%	0603 ≥ 0.68μF; 0805 ≥ 2.2μF; 1206 ≥ 4.7μF; 1210 ≥ 22μF
10V	≤ 5.0%	≤ 10.0%	0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF
		≤ 15.0%	0402 ≥ 1μF
6.3V	≤ 10.0%	≤ 15.0%	0603 ≥ 10μF; 0805 ≥ 4.7μF; 1210 ≥ 100μF
		≤ 20.0%	0402 ≥ 2.2μF

* Y5V

Rated vol.	D.F.	Exception of D.F.	
≥ 50V	≤ 5.0%	≤ 7.0%	0603 ≥ 0.1μF; 0805 ≥ 0.47μF
35V	≤ 7.0%	---	---
25V	≤ 5.0%	≤ 7.0%	0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF
		≤ 9.0%	0402 ≥ 0.068μF; 0603 ≥ 0.47μF 1206 ≥ 4.7μF;1210 ≥ 22uF
16V (C<1.0μF)	≤ 7.0%	≤ 9.0%	0402 ≥ 0.068μF; 0603 ≥ 0.68μF
		≤ 12.5%	0402 ≥ 0.22μF
16V (C ≥ 1.0μF)	≤ 9.0%	≤ 12.5%	0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF
10V	≤ 12.5%	---	--
6.3V	≤ 20.0%	---	--

Capacitance range

6-1 X7R Dielectric

DIELECTRIC		X7R																										
SIZE		0603				0805				1206					1210							1812						
RATED VOLTAGE (VDC)		6.3	10	16	25	6.3	10	16	25	6.3	10	16	25	50	6.3	10	16	25	35	50	100	10	16	25	50	100	250
Capacitance	1.0μF (105)																										
	1.5μF (155)																										
	2.2μF (225)																										
	3.3μF (335)																										
	4.7μF (475)																										
	6.8μF (685)																										
	10μF (106)																										
	22μF (226)																										
	47μF (476)																										

DIELECTRIC		X7R								
SIZE		1825			2220			2225		
RATED VOLTAGE (VDC)		50	100	250	50	100	250	50	100	250
Capacitance	1.0μF (105)									
	1.2μF (125)									
	1.5μF (155)									
	2.2μF (225)									
	3.3μF (335)									
	3.9μF (395)									
	4.7μF (475)									
	5.6μF (565)									
	6.8μF (685)									
	8.2μF (825)									
	10.0μF (106)									

Capacitance range

6-2 X5R Dielectric

DIELECTRIC		X5R																	
SIZE		0402		0603				0805				1206				1210				1812
RATED VOLTAGE (VDC)		6.3	10	6.3	10	16	25	6.3	10	16	25	6.3	10	16	25	6.3	10	16	25	6.3
Capacitance	1.0μF (105)	■	■	■	■	■	■		■		■									
	1.5μF (155)			■				■	■				■	■			■	■		
	2.2μF (225)	■	■	■	■	■		■	■	■	■		■	■			■	■		
	3.3μF (335)			■				■	■	■	■		■	■						
	4.7μF (475)	■		■	■			■	■	■	■	■	■	■			■	■	■	
	6.8μF (685)											■	■							
	10μF (106)			■				■	■	■		■	■	■	■	■	■	■	■	
	22μF (226)							■	■			■	■	■		■	■	■	■	
	47μF (476)							■				■	■			■	■	■		
	100μF (107)											■				■				■

6-3 Y5V Dielectric

DIELECTRIC		Y5V										
SIZE		0402		0603				0805				
RATED VOLTAGE (VDC)		6.3	10	6.3	10	16	25V	6.3	10	16	25	50
Capacitance	1.0μF (105)	■	■		■	■	■		■	■	■	■
	1.5μF (155)				■				■	■		
	2.2μF (225)			■	■	■			■	■	■	■
	3.3μF (335)								■	■		
	4.7μF (475)			■	■				■	■	■	
	6.8μF (685)								■			
	10μF (106)							■	■	■		
	22μF (226)							■				

DIELECTRIC		Y5V																
SIZE		1206						1210						1812				
RATED VOLTAGE (VDC)		6.3	10	16	25	35	50	6.3	10	16	25	35	50	10	16	25	50	100
Capacitance	1.0μF (105)		■	■	■		■		■	■	■		■	■	■	■	■	■
	1.5μF (155)		■	■	■				■	■	■			■	■	■	■	
	2.2μF (225)		■	■	■		■		■	■	■		■	■	■	■	■	
	3.3μF (335)		■	■	■				■	■	■			■	■	■	■	
	4.7μF (475)		■	■	■	■	■		■	■	■		■	■	■	■	■	
	6.8μF (685)		■	■					■	■	■			■	■	■	■	
	10μF (106)		■	■	■				■	■	■	■	■	■	■	■	■	
	22μF (226)		■	■					■	■	■							
	47μF (476)	■						■	■						■			
	100μF (107)							■										

Reliability test conditions and requirements

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Visual examination and Dimensions</td><td>• ---</td><td>• No remarkable defect.
• Dimensions to conform to individual specification sheet.</td></tr>
<tr><td>2.</td><td>Capacitance</td><td>• Cap ≤ 10μF, 1.0 ± 0.2Vrms, 1kHz ± 10%
• Cap>10μF, 0.5 ± 0.2Vrms, 120Hz ± 20%</td><td>• Shall not exceed the limits given in the detailed spec.</td></tr>
<tr><td>3.</td><td>Q/ D.F. (Dissipation Factor)</td><td></td><td>• X7R, X5R:
<table>
<tr><th>Rated vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr>
<tr><td>≥ 50V</td><td>≤ 2.5%</td><td>≤ 3.0%</td><td>0603 ≥ 0.047μF;0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td></tr>
<tr><td rowspan="3">25V</td><td rowspan="3">≤ 3.5%</td><td>≤ 5.0%</td><td>0805 ≥ 1μF; 1210 ≥ 10μF</td></tr>
<tr><td>≤ 7.0%</td><td>0603 ≥ 0.33μF; 1206 ≥ 4.7μF</td></tr>
<tr><td>≤ 10.0%</td><td>0402 ≥ 0.10μF;0603 ≥ 0.47μF; 0805 ≥ 2.2μF ;1206 ≥ 6.8μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤ 3.5%</td><td>≤ 5.0%</td><td>0402 ≥ 0.033μF;0603 ≥ 0.15μF; 0805 ≥ 0.68μF;1206 ≥ 2.2μF;1210 ≥ 4.7μF</td></tr>
<tr><td>≤ 10.0%</td><td>0603 ≥ 0.68μF;0805 ≥ 2.2μF; 1206 ≥ 4.7μF;1210 ≥ 22μF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≤ 5.0%</td><td>≤ 10.0%</td><td>0402 ≥ 0.33μF;0603 ≥ 0.33μF; 0805 ≥ 2.2μF;1206 ≥ 2.2μF; 1210 ≥ 22μF</td></tr>
<tr><td>≤ 15.0%</td><td>0402 ≥ 1μF</td></tr>
<tr><td rowspan="2">6.3V</td><td rowspan="2">≤ 10%</td><td>≤ 15%</td><td>0603 ≥ 10μF; 0805 ≥ 4.7μF; 1210 ≥ 100μF</td></tr>
<tr><td>≤ 20%</td><td>0402 ≥ 2.2μF</td></tr>
</table>
• Y5V:
<table>
<tr><th>Rated vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr>
<tr><td>≥ 50V</td><td>≤ 5.0%</td><td>≤ 7.0%</td><td>0603 ≥ 0.1μF; 0805 ≥ 0.47μF</td></tr>
<tr><td>35V</td><td>≤ 7.0%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≤ 5.0%</td><td>≤ 7.0%</td><td>0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF; 1210 ≥ 4.7μF</td></tr>
<tr><td>≤ 9.0%</td><td>0402 ≥ 0.068μF; 0603 ≥ 0.47μF 1206 ≥ 4.7μF;1210 ≥ 2uF</td></tr>
<tr><td rowspan="2">16V (C<1.0μF)</td><td rowspan="2">≤ 7.0%</td><td>≤ 9.0%</td><td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td></tr>
<tr><td>≤ 12.5%</td><td>0402 ≥ 0.22μF</td></tr>
<tr><td>16V (C ≥ 1.0μF)</td><td>≤ 9.0%</td><td>≤ 12.5%</td><td>0805 ≥ 3.3μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF</td></tr>
<tr><td>10V</td><td>≤ 12.5%</td><td>---</td><td>--</td></tr>
<tr><td>6.3V</td><td>≤ 20.0%</td><td>---</td><td>--</td></tr>
</table></td></tr>
<tr><td>4.</td><td>Temperature Coefficient</td><td>• With no electrical load.
<table>
<tr><th>T.C.</th><th>Operating Temp</th></tr>
<tr><td>X7R</td><td>-55~125℃ at 25℃</td></tr>
<tr><td>X5R</td><td>-55~85℃ at 25℃</td></tr>
<tr><td>Y5V</td><td>-25~85℃ at 20℃</td></tr>
</table></td><td>•
<table>
<tr><th>T.C.</th><th>Capacitance Change</th></tr>
<tr><td>X7R</td><td>Within ± 15%</td></tr>
<tr><td>X5R</td><td>Within ± 15%</td></tr>
<tr><td>Y5V</td><td>Within +30%/-80%</td></tr>
</table></td></tr>
<tr><td>5.</td><td>Insulation Resistance</td><td>• To apply rated voltage for max. 120 sec.</td><td>• ≥ 10G Ω or RxC ≥ 500 Ω -F whichever is smaller.
• Class II (X5R, X6S, X7R, Y5V)
<table>
<tr><th>Rated voltage</th><th>Insulation Resistance</th></tr>
<tr><td>16V:0402 ≥ 0.22uF</td><td rowspan="3">≧ 100 Ω-F</td></tr>
<tr><td>10V:0603 ≥ 0.47uF;0805 ≥ 2.2uF; 1206 ≥ 6.8uF</td></tr>
<tr><td>6.3V</td></tr>
</table></td></tr>
<tr><td>6.</td><td>Voltage proof (Dielectric Strength)</td><td>• To apply voltage:
≤ 100V =2.5 times of U_R
> 100V =2.0 times of U_R
• Duration: 1 to 5 sec.
• Charge and discharge current less than 50mA.</td><td>• No evidence of damage or flash over during test.</td></tr>
<tr><td>7.</td><td>Solderability</td><td>• Solder temperature: 235 ± 5℃
• Dipping time: 2 ± 0.5 sec.</td><td>• 75% min. coverage of all metalized area.</td></tr>
</table>

Reliability test conditions and requirements

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>8.</td><td>Resistance to Soldering Heat</td><td>• Solder temperature: 260 ± 5℃
• Dipping time: 10 ± 1 sec
• Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder.
• Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 48 ± 4 hrs.</td><td>• No remarkable damage.
• Cap change:
X7R, X5R: within ± 7.5%
Y5V: within ± 20%
• Q/D.F., I.R. and dielectric strength: To meet initial requirements.
• 25% max. leaching on each edge.</td></tr>
<tr><td>9.</td><td>Rapid change of temperature (Temperature Cycle)</td><td>• Conduct the five cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th>Temp. (℃)</th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30 ± 3</td></tr>
<tr><td>2</td><td>Room temp.</td><td>2~3</td></tr>
<tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30 ± 3</td></tr>
<tr><td>4</td><td>Room temp.</td><td>2~3</td></tr>
</table>
• Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 48 ± 4 hrs.</td><td>• No remarkable damage.
• Cap change :
X7R, X5R: within ± 15%
Y5V: within ± 20%
• Q/D.F., I.R. and dielectric strength: To meet initial requirements.</td></tr>
<tr><td>10.</td><td>Damp Heat Steady State</td><td>• Test temp.: 40 ± 2℃
• Humidity: 90~95% RH
• Test time: 500+24/-0hrs.
• Measurement to be made after keeping at room temp. for 48 ± 4 hrs.</td><td>• No remarkable damage.
• Cap change: X7R, X5R: ≥ 10V, within ± 15%; 6.3V, within ± 25%
Y5V: ≥ 10V, within ± 30%; 6.3V, within +30/-40%
• Q/D.F. value:
X7R, X5R:
<table>
<tr><th>Rated vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr>
<tr><td>≥ 50V</td><td>≤ 3.0%</td><td>≤ 6.0%</td><td>0603 ≥ 0.047μF; 0805 ≥ 0.18μF;
1206 ≥ 0.47μF</td></tr>
<tr><td rowspan="3">25V</td><td rowspan="3">≤ 5.0%</td><td>≤ 10.0%</td><td>0805 ≥ 1μF; 1210 ≥ 10μF;</td></tr>
<tr><td>≤ 14.0%</td><td>0603 ≥ 0.33 μF;0805 ≥ 2.2μF;
1206 ≥ 4.7uF</td></tr>
<tr><td>≤ 15.0%</td><td>0402 ≥ 0.10μF; 0603 ≥ 0.47μF;
0805 ≥ 4.7μF; 1206 ≥ 6.8μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤ 5.0%</td><td>≤ 10.0%</td><td>0603 ≥ 0.15μF; 0805 ≥ 0.68μF;
1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td></tr>
<tr><td>≤ 15.0%</td><td>0402 ≥ 0.033μF; 0603 ≥ 0.68μF;
0805 ≥ 2.2uF; 1206 ≥ 6.8uF;
1210 ≥ 22uF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≤ 7.5%</td><td>≤ 15.0%</td><td>0402 ≥ 0.33μF; 0603 ≥ 0.33μF;
0805 ≥ 2.2μF; 1206 ≥ 2.2μF;
1210 ≥ 22μF</td></tr>
<tr><td>≤ 20.0%</td><td>0402 ≥ 1μF</td></tr>
<tr><td>6.3V</td><td>≤ 15.0%</td><td>≤ 30.0%</td><td>0402 ≥ 2.2uF;0603 ≥ 10 μ ;0805 ≥ 10μF
1210 ≥ 100μF</td></tr>
</table>
Y5V:
<table>
<tr><th>Rated vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr>
<tr><td>≥ 50V</td><td>≤ 7.5%</td><td>≤ 10.0%</td><td>0603 ≥ 0.1uF;0805 ≥ 0.47uF</td></tr>
<tr><td>35V</td><td>≤ 10.0%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≤ 7.5%</td><td>≤ 10.0%</td><td>0402 ≥ 0.047uF;0603 ≥ 0.1μF;
0805 ≥ 0.33μF;1206 ≥ 1μF;
1210 ≥ 4.7μF</td></tr>
<tr><td>≤ 15.0%</td><td>0402 ≥ 0.068μF; 0603 ≥ 0.47μF
1206 ≥ 4.7uF;1210 ≥ 22μF</td></tr>
<tr><td rowspan="2">16V (C<1.0μF)</td><td rowspan="2">≤ 10.0%</td><td>≤ 12.5%</td><td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td></tr>
<tr><td>≤ 20.0%</td><td>0402 ≥ 0.22μF</td></tr>
<tr><td>16V (C ≥ 1.0μF)</td><td>≤ 12.5%</td><td>≤ 20.0%</td><td>0805 ≥ 3.3μF; 1206 ≥ 10μF;
1210 ≥ 22μF; 1812 ≥ 47μF</td></tr>
<tr><td>10V</td><td>≤ 20.0%</td><td>---</td><td>---</td></tr>
<tr><td>6.3V</td><td>≤ 30.0%</td><td>---</td><td>---</td></tr>
</table>
• I.R.: ≥ 10V, ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.
6.3V, RxC ≥ 10 Ω -F</td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>11.</td><td>High Temperature Load
(Endurance)</td><td>
• Test temp.:
X7R: 125 ± 3℃
X5R, Y5V: 85 ± 3℃
• To apply voltage: 200% of rated voltage.
Exception item:
<table>
<tr><th>U_R</th><th>Size and Cap. Range</th><th>To apply voltage</th></tr>
<tr><td>100V</td><td>1210, Cap. ≥ 105</td><td rowspan="5">150% of rated voltage</td></tr>
<tr><td rowspan="4">250V</td><td>1812, Cap. ≥ 105</td></tr>
<tr><td>1825, Cap. ≥ 105</td></tr>
<tr><td>2220, Cap. ≥ 105</td></tr>
<tr><td>2225, Cap. ≥ 105</td></tr>
</table>
• Test time: 1000+24/-0 hrs.
• Measurement to be made after keeping at room temp. for 48±4 hrs.
</td><td>
• No remarkable damage.
• Cap change:
X7R, X5R: ≥ 10V, within ± 15%; 6.3V, within ± 25%
Y5V: ≥ 10V, within ± 30%; 6.3V, within +30/-40%
• Q/D.F. value:
X7R, X5R:
<table>
<tr><th>Rated vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr>
<tr><td>≥ 50V</td><td>≤ 3.0%</td><td>≤ 6.0%</td><td>0603 ≥ 0.047μF; 0805 ≥ 0.18μF; 1206 ≥ 0.47μF</td></tr>
<tr><td rowspan="3">25V</td><td rowspan="3">≤ 5.0%</td><td>≤ 10.0%</td><td>0805 ≥ 1μF; 1210 ≥ 10μF;</td></tr>
<tr><td>≤ 14.0%</td><td>0603 ≥ 0.33 μF;0805 ≥ 2.2μF; 1206 ≥ 4.7uF</td></tr>
<tr><td>≤ 15.0%</td><td>0402 ≥ 0.10μF; 0603 ≥ 0.47μF;
0805 ≥ 4.7μF; 1206 ≥ 6.8μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤ 5.0%</td><td>≤ 10.0%</td><td>0603 ≥ 0.15μF; 0805 ≥ 0.68μF;
1206 ≥ 2.2μF; 1210 ≥ 4.7μF</td></tr>
<tr><td>≤ 15.0%</td><td>0402 ≥ 0.033μF; 0603 ≥ 0.68μF; 0805 ≥ 2.2uF; 1206 ≥ 6.8uF; 1210 ≥ 22uF</td></tr>
<tr><td rowspan="2">10V</td><td rowspan="2">≤ 7.5%</td><td>≤ 15.0%</td><td>0402 ≥ 0.33μF; 0603 ≥ 0.33μF; 0805 ≥ 2.2μF; 1206 ≥ 2.2μF; 1210 ≥ 22μF</td></tr>
<tr><td>≤ 20.0%</td><td>0402 ≥ 1μF</td></tr>
<tr><td>6.3V</td><td>≤ 15.0%</td><td>≤ 30.0%</td><td>0402 ≥ 2.2uF; 0603 ≥ 10 μ ; 0805 ≥ 10μF
1210 ≥ 100μF</td></tr>
</table>
Y5V:
<table>
<tr><th>Rated vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr>
<tr><td>≥ 50V</td><td>≤ 7.5%</td><td>≤ 10.0%</td><td>0603 ≥ 0.1uF;0805 ≥ 0.47uF</td></tr>
<tr><td>35V</td><td>≤ 10.0%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≤ 7.5%</td><td>≤ 10.0%</td><td>0402 ≥ 0.047uF;0603 ≥ 0.1μF;
0805 ≥ 0.33μF;1206 ≥ 1μF; 1210 ≥ 4.7μF</td></tr>
<tr><td>≤ 15.0%</td><td>0402 ≥ 0.068μF;0603 ≥ 0.47uF;
1206 ≥ 4.7uF; 1210 ≥ 22μF</td></tr>
<tr><td rowspan="2">16V (C<1.0μF)</td><td rowspan="2">≤ 10.0%</td><td>≤ 12.5%</td><td>0402 ≥ 0.068μF; 0603 ≥ 0.6</td></tr>
<tr><td>≤ 20.0%</td><td>0402 ≥ 0.22μF</td></tr>
<tr><td>16V (C ≥ 1.0μF)</td><td>≤ 12.5%</td><td>≤ 20.0%</td><td>0805 ≥ 3.3μF;1206 ≥ 10μF;1210 ≥ 22μF; 1812 ≥ 47μF</td></tr>
<tr><td>10V</td><td>≤ 20.0%</td><td>---</td><td>---</td></tr>
<tr><td>6.3V</td><td>≤ 30.0%</td><td>---</td><td>---</td></tr>
</table>
• I.R.: ≥ 10V, ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.
6.3V, RxC ≥ 10 Ω -F
</td></tr>
<tr><td>12.</td><td>Substrate bending test
(Resistance to Flexure of Substrate)</td><td>
• The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5 ± 1 sec.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs.
</td><td>
• No remarkable damage.
• Cap change :
X7R, X5R: within ± 12.5%
Y5V: within ± 30%
(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)
</td></tr>
<tr><td>13.</td><td>Robustness of terminations
(Adhesive Strength of Termination)</td><td>
• Pressurizing force : 5N (≤ 0603) and 10N (>0603)
• Test time: 10 ± 1 sec.
</td><td>
• No remarkable damage or removal of the terminations.
</td></tr>
</table>

MA GP

GENERAL PURPOSE
CAPACITORS SERIES

Introduction

POSPERITY Multilayer Ceramic Chip Capacitors supplied in bulk or tape & reel package are ideally suitable for thick-film hybrid circuits and automatic surface mounting on any printed circuit boards.

The nickel-barrier terminations are consisted of a nickel barrier layer over the silver metallization and then finished by electroplated solder layer to ensure the terminations have good solderability. The nickel barrier layer in terminations prevents the dissolution of termination when extended immersion in molten solder at elevated solder temperature.

Features

» A wide selection of sizes is available (0402 to 2225).
» High capacitance in given case size.
» Capacitor with lead-free termination (pure Tin).
» RoHS compliant
» HALOGEN compliant

Applications

» For general digital circuit.
» For power supply bypass capacitors.
» For consumer electronics.
» For telecommunication.
» DC to DC converter

How to order

MA	1206	XR	-	104	K	-	500	PR	G
PDC Family	Size	Dielectric		Capacitance	Tolerance		Rated voltage	Packaging	Control Code
	Inch (mm) 0402 (1005) 0603 (1608) 0805 (2012) 1206 (3216) 1210 (3225) 1808 (4520) 1812 (4532) 1825 (4563) 2220 (5750) 2225 (5763)	CG: C0G(NPO) XR: X7R or X5R YV: Y5V		Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: R47=0.47pF 0R5=0.5pF 1R0=1.0pF 100=10x10^0 =10pF	B= ± 0.1pF C= ± 0.25pF D= ± 0.5pF F= ± 1% G= ± 2% J= ± 5% K= ± 10% M= ± 20% Z=-20/+80%		Two significant digits followed by no. of zeros. And R is in place of decimal point. 6R3 = 6.3 VDC 100=10 VDC 160=16 VDC 250=25 VDC 500=50 VDC	ER: Tape and Reel, Embossed Tape PR: Tape and Reel, Paper Tape No Code: Bulk	G: RoHS compliant P: Pb/Sn Plating(Tin/lead with min. 5% lead)*

* For more information, please contact with PDC local representative.

General electrical data

Dielectric	C0G(NP0)	X7R	Y5V	X5R
Size	0402, 0603, 0805, 1206, 1210, 1812	0402, 0603, 0805, 1206, 1210, 1812, 2220, 2225	0402, 0603, 0805, 1206, 1210, 1812	0402,0603
Capacitance*	0.1pF to 39nF	100pF to 1μF	10nF to 1.0μF	27nF to 1.0μF
Capacitance tolerance	Cap ≤ 5pF: B (± 0.1pF), C (± 0.25pF) 5pF<Cap<10pF: C (± 0.25pF), D (± 0.5pF) Cap ≥ 10pF: F (± 1%), G (± 2%), J (± 5%), K (± 10%)	J (± 5%), K (± 10%), M (± 20%)	M (± 20%), Z (-20/+80%)	J (± 5%), K (± 10%), M (± 20%)
Rated voltage (WVDC)	16V, 25V, 50V	10V, 16V, 25V, 50V		6.3V,10V, 16V, 25V,
Tan δ *	Cap<30pF: Q ≥ 400+20C Cap ≥ 30pF: Q ≥ 1000	Note 1		
Insulation resistance at Ur	≥ 10G Ω	≥ 10G Ω or RxC ≥ 100 Ω xF whichever is less		
Operating temperature	-55 to +125℃		-25 to +85℃	-55 to +85℃
Capacitance characteristic	± 30ppm	± 15%	+30/-80%	± 15%
Termination	Cu (or Ag)/Ni/Sn (lead-free termination)			

* Measured at the condition of 30~70% related humidity.
C0G(NPO): Apply 1.0 ± 0.2Vrms, 1.0MHz ± 10% for Cap ≤ 1000pF and 1.0 ± 0.2Vrms, 1.0kHz ± 10% for Cap>1000pF, 25℃ at ambient temperature
X7R: Apply 1.0 ± 0.2Vrms, 1.0kHz ± 10%, at 25℃ ambient temperature.
Y5V: Apply 1.0 ± 0.2Vrms, 1.0kHz ± 10%, at 20℃ ambient temperature.

* X7R/X5R

Rated vol.	D.F.	Exception of D.F.	
≥ 50V	≤ 2.5%	≤ 3.0%	0603 ≥ 0.047μF; 0805 ≥ 0.18μF;1206 ≥ 0.47μF
25V	≤ 3.5%	≤ 5.0%	0805 ≥ 1μF;1210 ≥ 10μF
		≤ 7.0%	0603 ≥ 0.33μF
16V	≤ 3.5%	≤ 5.0%	0402 ≥ 0.033μF; 0603 ≥ 0.15μF; 0805 ≥ 0.68μF; 1206 ≥ 2.2μF
		≤ 10.0%	1210 ≥ 22μF; 0603 ≥ 0.68μF
10V	≤ 5.0%	≤ 10.0%	0603 ≥ 1μF; 0805 ≥ 2.2μF

* Y5V

Rated vol.	D.F.	Exception of D.F.	
≥ 50V	≤ 5.0%	7.0%	0603 ≥ 0.1μF; 0805 ≥ 0.47μF
25V	≤ 5.0%	≤ 7.0%	0402 ≥ 0.047μF; 0603 ≥ 0.1μF; 0805 ≥ 0.33μF; 1206 ≥ 1μF
		≤ 9.0%	0402 ≥ 0.068μF; 0603 ≥ 0.47μF
16V (C<1.0μF)	≤ 7.0%	≤ 9.0%	0402 ≥ 0.068μF; 0603 ≥ 0.68μF
16V (C ≥ 1.0μF)	≤ 9.0%	≤12.5%	0805 ≥ 4.7μF; 1206 ≥ 10μF; 1210 ≥ 22μF; 1812 ≥ 47μF
10V	≤ 12.5%	---	--

Capacitance range (C0G/NPO Dielectric)

0402, 0603, 0805 Sizes.

DIELECTRIC		C0G(NPO)											
SIZE		0402				0603				0805			
RATED VOLTAGE (VDC)		10	16	25	50	10	16	25	50	10	16	25	50
Capacitance	0.1pF (0R1)												
	0.2pF (0R2)												
	0.3pF (0R3)												
	0.4pF (0R4)												
	0.5pF (0R5)												
	0.6pF (0R6)												
	0.7pF (0R7)												
	0.8pF (0R8)												
	0.9pF (0R9)												
	1.0pF (1R0)												
	1.2pF (1R2)												
	1.5pF (1R5)												
	1.8pF (1R8)												
	2.2pF (2R2)												
	2.7pF (2R7)												
	3.3pF (3R3)												
	3.9pF (3R9)												
	4.7pF (4R7)												
	5.6pF (5R6)												
	6.8pF (6R8)												
	8.2pF (8R2)												
	10pF (100)												
	12pF (120)												
	15pF (150)												
	18pF (180)												
	22pF (220)												
	27pF (270)												
	33pF (330)												
	39pF (390)												
	47pF (470)												
	56pF (560)												
	68pF (680)												
	82pF (820)												
	100pF (101)												
	150pF (151)												
	180pF (181)												
	220pF (221)												
	270pF (271)												
	330pF (331)												
	390pF (391)												
	470pF (471)												
	560pF (561)												
	680pF (681)												
	820pF (821)												
	1,000pF (102)												
	1,200pF (122)												
	1,500pF (152)												
	1,800pF (182)												
	2,200pF (222)												
	2,700pF (272)												
	3,300pF (332)												
	3,900pF (392)												
	4,700pF (472)												
	5,600pF (562)												
	6,800pF (682)												
	8,200pF (822)												
	0.010μF (103)												

Capacitance range (C0G/NPO Dielectric)

1206, 1210, 1812 Sizes

DIELECTRIC		C0G(NPO)											
SIZE		1206				1210				1812			
RATED VOLTAGE (VDC)		10	16	25	50	10	16	25	50	10	16	25	50
Capacitance	1.0pF (1R0)												
	1.2pF (1R2)												
	1.5pF (1R5)												
	1.8pF (1R8)												
	2.2pF (2R2)												
	2.7pF (2R7)												
	3.3pF (3R3)												
	3.9pF (3R9)												
	4.7pF (4R7)												
	5.6pF (5R6)												
	6.8pF (6R8)												
	8.2pF (8R2)												
	10pF (100)												
	12pF (120)												
	15pF (150)												
	18pF (180)												
	22pF (220)												
	27pF (270)												
	33pF (330)												
	39pF (390)												
	47pF (470)												
	56pF (560)												
	68pF (680)												
	82pF (820)												
	100pF (101)												
	120pF (121)												
	150pF (151)												
	180pF (181)												
	220pF (221)												
	270pF (271)												
	330pF (331)												
	390pF (391)												
	470pF (471)												
	560pF (561)												
	680pF (681)												
	820pF (821)												
	1,000pF (102)												
	1,200pF (122)												
	1,500pF (152)												
	1,800pF (182)												
	2,200pF (222)												
	2,700pF (272)												
	3,300pF (332)												
	3,900pF (392)												
	4,700pF (472)												
	5,600pF (562)												
	6,800pF (682)												
	8,200pF (822)												
	0.010µF (103)												
	0.012µF (123)												
	0.015µF (153)												
	0.018µF (183)												
	0.022µF (223)												
	0.027µF (273)												
	0.033µF (333)												
	0.039µF (393)												

Capacitance range (X7R Dielectric)

0402, 0603, 0805, 1206 Sizes

DIELECTRIC		X7R															
SIZE		0402				0603					0805				1206			
RATED VOLTAGE (VDC)		10	16	25	50	6.3	10	16	25	50	10	16	25	50	10	16	25	50
Capacitance	100pF (101)																	
	120pF (121)																	
	150pF (151)																	
	180pF (181)																	
	220pF (221)																	
	270pF (271)																	
	330pF (331)																	
	390pF (391)																	
	470pF (471)																	
	560pF (561)																	
	680pF (681)																	
	820pF (821)																	
	1,000pF (102)																	
	1,200pF (122)																	
	1,500pF (152)																	
	1,800pF (182)																	
	2,200pF (222)																	
	2,700pF (272)																	
	3,300pF (332)																	
	3,900pF (392)																	
	4,700pF (472)																	
	5,600pF (562)																	
	6,800pF (682)																	
	8,200pF (822)																	
	0.010μF (103)																	
	0.012μF (123)																	
	0.015μF (153)																	
	0.018μF (183)																	
	0.022μF (223)																	
	0.027μF (273)																	
	0.033μF (333)																	
	0.039μF (393)																	
	0.047μF (473)																	
	0.056μF (563)																	
	0.068μF (683)																	
	0.082μF (823)																	
	0.10μF (104)																	
	0.12μF (124)																	
	0.15μF (154)																	
	0.18μF (184)																	
	0.22μF (224)																	
	0.27μF (274)																	
	0.33μF (334)																	
	0.39μF (394)																	
	0.47μF (474)																	
	0.56μF (564)																	
	0.68μF (684)																	
	0.82μF (824)																	
	1.0μF (105)																	

Capacitance range (X7R Dielectric)

1210, 1812, 2220, 2225 Sizes

DIELECTRIC		X7R										
SIZE		1210				1812				1825	2220	2225
RATED VOLTAGE (VDC)		10	16	25	50	10	16	25	50	50	50	50
Capacitance	100pF (101)											
	120pF (121)											
	150pF (151)											
	180pF (181)											
	220pF (221)											
	270pF (271)											
	330pF (331)											
	390pF (391)											
	470pF (471)											
	560pF (561)											
	680pF (681)											
	820pF (821)											
	1,000pF (102)											
	1,200pF (122)											
	1,500pF (152)											
	1,800pF (182)											
	2,200pF (222)											
	2,700pF (272)											
	3,300pF (332)											
	3,900pF (392)											
	4,700pF (472)											
	5,600pF (562)											
	6,800pF (682)											
	8,200pF (822)											
	0.010µF (103)											
	0.012µF (123)											
	0.015µF (153)											
	0.018µF (183)											
	0.022µF (223)											
	0.027µF (273)											
	0.033µF (333)											
	0.039µF (393)											
	0.047µF (473)											
	0.056µF (563)											
	0.068µF (683)											
	0.082µF (823)											
	0.10µF (104)											
	0.12µF (124)											
	0.15µF (154)											
	0.18µF (184)											
	0.22µF (224)											
	0.27µF (274)											
	0.33µF (334)											
	0.39µF (394)											
	0.47µF (474)											
	0.56µF (564)											
	0.68µF (684)											
	0.82µF (824)											
	1.0µF (105)											

Capacitance range (X5R Dielectric)

0402, 0603 Sizes

DIELECTRIC		X5R							
SIZE		0402				0603			
RATED VOLTAGE(VDC)		6.3	10	16	25	6.3	10	16	25
Capacitance	0.027μF (273)								
	0.033μF (333)								
	0.039μF (393)								
	0.047μF (473)								
	0.056μF (563)								
	0.068μF (683)								
	0.082μF (823)								
	0.100μF (104)								
	0.220μF (224)								
	0.270μF (274)								
	0.330μF (334)								
	0.390μF (394)								
	0.470μF (474)								
	0.680μF (684)								
	0.820μF (824)								
	1.000μF (105)								

Capacitance range (Y5V Dielectric)

0402, 0603, 0805 Sizes

DIELECTRIC		Y5V												
SIZE		0402					0603					0805			
RATED VOLTAGE(VDC)		6.3	10	16	25	50	6.3	10	16	25	50	10	16	25	50
Capacitance	0.010μF (103)														
	0.015μF (153)														
	0.022μF (223)														
	0.033μF (333)														
	0.047μF (473)														
	0.068μF (683)														
	0.10μF (104)														
	0.15μF (154)														
	0.22μF (224)														
	0.33μF (334)														
	0.47μF (474)														
	0.68μF (684)														
	1.0μF (105)														

Capacitance range (Y5V Dielectric)

1206, 1210, 1812 Sizes

DIELECTRIC		Y5V											
SIZE		1206				1210				1812			
RATED VOLTAGE (VDC)		10	16	25	50	10	16	25	50	10	16	25	50
Capacitance	0.010μF (103)												
	0.015μF (153)												
	0.022μF (223)												
	0.033μF (333)												
	0.047μF (473)												
	0.068μF (683)												
	0.10μF (104)												
	0.15μF (154)												
	0.22μF (224)												
	0.33μF (334)												
	0.47μF (474)												
	0.68μF (684)												
	1.0μF (105)												

Reliability test conditions and requirements

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>1.</td><td>Visual and Mechanical</td><td>• ---</td><td>• No remarkable defect.
• Dimensions to conform to individual specification sheet.</td></tr>
<tr><td>2.</td><td>Capacitance</td><td>• Class I: C0G(NPO)</td><td>• Shall not exceed the limits given in the detailed spec.</td></tr>
<tr><td>3.</td><td>Q/ D.F. (Dissipation Factor)</td><td>• Cap ≤ 1000pF, 1.0 ± 0.2Vrms, 1MHz ± 10%
• Cap>1000pF, 1.0 ± 0.2Vrms, 1KHz ± 10%
• Cap ≤ 10μF, 1.0 ± 0.2Vrms, 1KHz ± 10%
• Cap>10μF, 0.5 ± 0.2Vrms, 120Hz ± 20%</td><td>• C0G(NP0): Cap ≥ 30pF, Q ≥ 1000; Cap<30pF, Q ≥ 400+20C
• X7R, X5R:
<table>
<tr><th>Rated vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr>
<tr><td>≥ 50V</td><td>≤ 2.5%</td><td>≤ 3%</td><td>0603 ≥ 0.047μF; 0805 ≥ 0.18μF,
1206 ≥ 0.47μF</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≤ 3.5%</td><td>≤ 5%</td><td>0805 ≥ 1μF;</td></tr>
<tr><td>≤ 7%</td><td>0603 ≥ 0.33μF</td></tr>
<tr><td rowspan="2">16V</td><td rowspan="2">≤ 3.5%</td><td>≤ 5%</td><td>0402 ≥ 0.033μF; 0603 ≥ 0.15μF;
0805 ≥ 0.68μF</td></tr>
<tr><td>≤ 10%</td><td>0603 ≥ 0.68μF</td></tr>
<tr><td>10V</td><td>≤ 5.0%</td><td>≤ 10%</td><td>0603 ≥ 1μF; 0805 ≥ 2.2μF;
1210 ≥ 22μF</td></tr>
<tr><td>6.3V</td><td>≤ 10%</td><td>---</td><td>---</td></tr>
</table>
• Y5V:
<table>
<tr><th>Rated vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr>
<tr><td>≥ 50V</td><td>≤ 5.0%</td><td>≤ 7%</td><td>0603 ≥ 0.1μF; 0805 ≥ 0.47μF;</td></tr>
<tr><td>35V</td><td>≤ 7%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≤ 5.0%</td><td>≤ 7%</td><td>0402 ≥ 0.047μF ;0603 ≥ 0.1μF;
0805 ≥ 0.33μF;
1206 ≥ 1μF</td></tr>
<tr><td>≤ 9%</td><td>0402 ≥ 0.068μF;
0603 ≥ 0.47μF</td></tr>
<tr><td>16V (C<1.0μF)</td><td>≤ 7.0%</td><td>≤ 9%</td><td>0402 ≥ 0.068μF;
0603 ≥ 0.68μF</td></tr>
<tr><td>16V (C ≥ 1.0μF)</td><td>≤ 9.0%</td><td>≤ 12.5%</td><td>0805 ≥ 4.7μF; 1206 ≥ 10μF;
1210 ≥ 22μF; 1812 ≥ 47μF</td></tr>
<tr><td>10V</td><td>≤ 12.5%</td><td>---</td><td>---</td></tr>
<tr><td>6.3V</td><td>≤ 20%</td><td>---</td><td>--</td></tr>
</table></td></tr>
<tr><td>4.</td><td>Temperature Coefficient</td><td>• With no electrical load.
<table>
<tr><th>T.C.</th><th>Operating Temp</th></tr>
<tr><td>C0G(NPO)</td><td></td></tr>
<tr><td>C0G(NPO)</td><td></td></tr>
<tr><td>X7R</td><td></td></tr>
<tr><td>X5R</td><td></td></tr>
<tr><td>Y5V</td><td></td></tr>
</table></td><td>•
<table>
<tr><th>T.C.</th><th>Capacitance Change</th></tr>
<tr><td>C0G(NPO)</td><td>Within ± 30ppm/℃</td></tr>
<tr><td>C0G(NPO)</td><td>Within ± 120ppm/℃</td></tr>
<tr><td>X7R</td><td>Within ± 15%</td></tr>
<tr><td>X5R</td><td>Within ± 15%</td></tr>
<tr><td>Y5V</td><td>Within +30%/-80%</td></tr>
</table></td></tr>
<tr><td>5.</td><td>Dielectric Strength</td><td>• To apply voltage (≤ 50V) 250%.
• Duration: 1 to 5 sec.
• Charge and discharge current less than 50mA.</td><td>• No evidence of damage or flash over during test.</td></tr>
<tr><td>6.</td><td>Insulation Resistance</td><td>• To apply rated voltage for max. 120 sec.</td><td>• NP0 : ≥ 100G Ω or RxC ≥ 1000 Ω -F whichever is smaller.
• X7R, X5R, Y5V : ≥ 10G Ω or RxC ≥ 100 Ω -F whichever is smaller.</td></tr>
<tr><td>7.</td><td>Adhesive Strength of Termination</td><td>• Pressurizing force :
0201: 2N
0402 & 0603 : 5N
>0603 : 10N
• Test time: 10 ± 1 sec.</td><td>• No remarkable damage or removal of the terminations.</td></tr>
<tr><td>8.</td><td>Solderability</td><td>• Solder temperature: 235 ± 5℃
• Dipping time: 2 ± 0.5 sec.</td><td>• 75% min. coverage of all metalized area.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>9.</td><td>Bending Test</td><td>• The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5 ± 1 sec.</td><td>• No remarkable damage.
• Cap change :
NP0: within ± 10%
X7R, X5R: within ± 12.5%
Y5V: within ± 30%
(This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)</td></tr>
<tr><td>10.</td><td>Resistance to Soldering Heat</td><td>• Solder temperature: 260 ± 5℃
• Dipping time: 10 ± 1 sec
• Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder.
• Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs (Class II only) at room temp.
• Measurement to be made after keeping at room temp. for 24 ± 2hrs (Class I) or 48 ± 4 hrs (Class II).</td><td>• No remarkable damage.
• Cap change:
NP0: within ± 2.5% or ± 0.25pF whichever is larger.
X7R, X5R: within ± 7.5%
Y5V: within ± 20%
• 25% max. leaching on each edge.</td></tr>
<tr><td>11.</td><td>Temperature Cycle</td><td>• Conduct the five cycles according to the temperatures and time.
<table>
<tr><th>Step</th><th></th><th>Time (min.)</th></tr>
<tr><td>1</td><td>Min. operating temp. +0/-3</td><td>30 ± 3</td></tr>
<tr><td>2</td><td>Room temp.</td><td>2~3</td></tr>
<tr><td>3</td><td>Max. operating temp. +3/-0</td><td>30 ± 3</td></tr>
<tr><td>4</td><td>Room temp.</td><td>2~3</td></tr>
</table>
• Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).</td><td>• No remarkable damage.
• Cap change :
NP0: within ± 2.5% or ± 0.25pF whichever is larger.
X7R, X5R: within ± 15%
Y5V: within ± 20%
• Q/D.F. ≤ 1.5 × initial requirement
• I.R. ≥ 0.25 × initial requirements.</td></tr>
<tr><td>12.</td><td>Humidity (Damp Heat) Steady State</td><td>• Test temp.: 40 ± 2℃
• Humidity: 90~95% RH
• Test time: 500+24/-0hrs.
• Measurement to be made after keeping at room temp. for 24 ± 2 hrs (Class I) or 48 ± 4 hrs (Class II).</td><td>• No remarkable damage.
• Cap change:
C0G(NPO):within 5% or ± 0.5pF whichever is larger.
X7R, X5R: ≥ 10V, within ± 15%;
6.3V, within ± 25%
Y5V: ≥ 10V, within ± 30%;
6.3V, within +30/-40%
• Q/D.F. value:
NP0:Cap ≥ 30pF, Q ≥ 350; 10pF ≤ Cap<30pF, Q ≥ 275+2.5C
Cap<10pF, Q ≥ 200+10C
• X7R, X5R:
<table>
<tr><th>Rated vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr>
<tr><td>≥ 50V</td><td>≤ 3.0%</td><td>≤ 6.0%</td><td>0603 ≥ 0.047μF; 0805 ≥ 0.18μF;
1206 ≥ 0.47μF</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≤ 5.0%</td><td>≤ 10.0%</td><td>0805 ≥ 1μF; 1210 ≥ 10μF;</td></tr>
<tr><td>≤ 14.0%</td><td>0603 ≥ 0.33μF</td></tr>
<tr><td>16V</td><td>≤ 5.0%</td><td>≤ 10.0%</td><td>0402 ≥ 0.033μF; 0603 ≥ 0.15μF;
0805 ≥ 0.68μF; 1206 ≥ 2.2μF</td></tr>
<tr><td>10V</td><td>≤ 7.5%</td><td>≤ 15.0%</td><td>0402 ≥ 0.056μF; 0603 ≥ 0.33μF;
0805 ≥ 2.2μF; 1206 ≥ 2.2μF;</td></tr>
<tr><td>6.3V</td><td>≤ 15.0%</td><td>≤ 30.0%</td><td>0805 ≥ 10μF; 1210 ≥ 100μF</td></tr>
</table>
• Y5V:
<table>
<tr><th>Rated vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr>
<tr><td>≥ 50V</td><td>≤ 7.5%</td><td>---</td><td>---</td></tr>
<tr><td>35V</td><td>≤ 10%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≤ 7.5%</td><td>≤ 10.0%</td><td>0402 ≥ 0.047μF;0603 ≥ 0.1μF;
0805 ≥ 0.33μF;1206 ≥ 1μF;
1210 ≥ 4.7μF</td></tr>
<tr><td>≤ 12.5%</td><td>0402 ≥ 0.068μF; 0603 ≥ 0.47μF</td></tr>
<tr><td>16V (C<1.0μF)</td><td>≤ 10.0%</td><td>≤ 12.5%</td><td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td></tr>
<tr><td>16V (C ≥ 1.0μF)</td><td>≤ 12.5%</td><td>≤ 20%</td><td>0805 ≥ 4.7μF; 1206 ≥ 10μF;
1210 ≥ 22μF; 1812 ≥ 47μF</td></tr>
<tr><td>10V</td><td>≤ 15.0%</td><td>---</td><td>---</td></tr>
<tr><td>6.3V</td><td>≤ 30%</td><td>---</td><td>---</td></tr>
</table>
• I.R.: ≥ 10V, ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller. ;6.3V, RxC ≥ 10 Ω -F</td></tr>
</table>

Reliability test conditions and requirements

<table>
<tr><th>No.</th><th>Item</th><th>Test Condition</th><th>Requirements</th></tr>
<tr><td>13.</td><td>High Temperature Load (Endurance)</td><td>• Test temp.:
C0G(NPO), X7R: 125 ± 3℃
X5R, Y5V: 85 ± 3℃
• To apply voltage: 200% of rated voltage.
• Test time: 1000+24/-0 hrs.
• Measurement to be made after keeping at room temp. for 48 ± 4 hrs.</td><td>• No remarkable damage.
• Cap change:
C0G(NPO): ± 3% or ± 3pF whichever is larger
X7R, X5R: ≥ 10V, within ± 20%;
6.3V, within ± 25%
Y5V: ≥ 10V, within ± 30%;
6.3V, within +30/-40%
• Q/D.F. value:
C0G(NPO):Cap ≥ 30pF, Q ≥ 350; 10pF ≤ Cap<30pF, Q ≥ 275+2.5C
Cap<10pF, Q ≥ 200+10C
• X7R, X5R:
<table>
<tr><th>Rated vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr>
<tr><td>≥ 50V</td><td>≤ 3.0%</td><td>≤ 6.0%</td><td>0603 ≥ 0.047μF; 0805 ≥ 0.18μF;
1206 ≥ 0.47μF</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≤ 5.0%</td><td>≤ 10.0%</td><td>0805 ≥ 1μF; 1210 ≥ 10μF;</td></tr>
<tr><td>≤ 14.0%</td><td>0603 ≥ 0.33μF</td></tr>
<tr><td>16V</td><td>≤ 5.0%</td><td>≤ 10.0%</td><td>0402 ≥ 0.033μF; 0603 ≥ 0.15μF;0805 ≥ 0.68μF
1206 ≥ 2.2μF</td></tr>
<tr><td>10V</td><td>≤ 7.5%</td><td>≤ 15.0%</td><td>0402 ≥ 0.056μF; 0603 ≥ 0.33μF;
0805 ≥ 2.2μF1206 ≥ 2.2μF; 1210 ≥ 22μF</td></tr>
<tr><td>6.3V</td><td>≤ 15.0%</td><td>≤ 30.0%</td><td>0805 ≥ 10μF; 1210 ≥ 100μF</td></tr>
</table>
• Y5V:
<table>
<tr><th>Rated vol.</th><th>D.F.</th><th colspan="2">Exception of D.F.</th></tr>
<tr><td>≥ 50V</td><td>≤ 7.5%</td><td>---</td><td>---</td></tr>
<tr><td>35V</td><td>≤ 10%</td><td>---</td><td>---</td></tr>
<tr><td rowspan="2">25V</td><td rowspan="2">≤ 7.5%</td><td>≤ 10.0%</td><td>0603 ≥ 0.1μF; 0805 ≥ 0.33μF;
1206 ≥ 1μF; 1210 ≥ 4.7μF</td></tr>
<tr><td>≤ 12.5%</td><td>0402 ≥ 0.068μF</td></tr>
<tr><td>16V
(C<1.0μF)</td><td>≤ 10.0%</td><td>≤ 12.5%</td><td>0402 ≥ 0.068μF; 0603 ≥ 0.68μF</td></tr>
<tr><td>16V
(C ≥ 1.0μF)</td><td>≤ 12.5%</td><td>≤ 20%</td><td>0805 ≥ 4.7μF; 1206 ≥ 10μF;
1210 ≥ 22μF; 1812 ≥ 47μF</td></tr>
<tr><td>10V</td><td>≤ 15.0%</td><td>---</td><td>---</td></tr>
<tr><td>6.3V</td><td>≤ 30%</td><td>---</td><td>---</td></tr>
</table>
• I.R.: ≥ 10V, ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.; 6.3V, RxC ≥ 10 Ω -F</td></tr>
</table>

Introduction

MLCC consists of a conducting material and electrodes. To manufacture a chip-type SMT and achieve miniaturization, high density and high efficiency, ceramic condensers are used.

PDC HH series MLCC is used at high frequencies generally have a small temperature coefficient of capacitance, typical within the ±30ppm/℃ required for NP0 (C0G) classification and have excellent conductivity internal electrode. Thus, PDC HH series MLCC will be with the feature of low ESR and high Q characteristics.

Features

- » High Q and low ESR performance at high frequency.
- » Quality improvement of telephone calls for low power loss and better performance.
- » RoHS compliant.
- » HALOGEM compliant.

Applications

- » Mobile telecommunication: Mobile phone, WLAN.
- » RF module: Power amplifier, VCO.
- » Tuners.

How to order

HH	15	N	8R2	D	500	L	T
Series	Size	Dielectric	Capacitance	Tolerance	Rated voltage	Termination	Packaging
HH=High Q/ Low ESR	15=0402 (1005) 18=0603 (1608) 21=0805 (2012)	N=NP0 (C0G)	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: R47=0.47pF 0R5=0.5pF 1R0=1.0pF 100=10x10^0 =10pF	B= ± 0.1pF C= ± 0.25pF D= ± 0.5pF F= ± 1% G= ± 2% J= ± 5%	Two significant digits followed by no. of zeros. And R is in place of decimal point. 160=16 VDC 250=25 VDC 101=100 VDC 201= 200 VDC 251=250 VDC 501=500 VDC 631=630 VDC	L=Ag/Ni/Sn C=Cu/Ni/Sn	T=7" reeled G= 13" reeled

General electrical data

Dielectric	NP0		
Size	0402, 0603,0805		
Capacitance*	0402: 0.5pF to 470pF**	0603: 0.5pF to 3300pF	0805: 0.5pF to 390pF
Capacitance tolerance	Cap ≤ 5pF: B (± 0.1pF), C (± 0.25pF) 5pF<Cap<10pF: C (± 0.25pF), D (± 0.5pF) Cap ≥ 10pF: F (± 1%), G (± 2%), J (± 5%)		
Rated voltage (WVDC)	16V, 25V, 50V, 100V, 200V, 250V, 500V, 630V,		
Q*	Cap<30pF: Q ≥ 400+20C Cap ≥ 30pF: Q ≥ 1000		
Insulation resistance at Ur	≥ 10G Ω		
Operating temperature	-55 to +125℃		
Capacitance change	± 30ppm		
ESR	Cap<2.2pF: ≤ 1000m Ω @900 ± 100MHz 2.2pF ≤ Cap ≤ 470pF: ≤ 500m Ω @900 ± 100MHz Cap>470pF: ≤ 500m Ω @60 ± 10MHz		
Termination	Ag or Cu / Ni/Sn (lead-free termination)		

* Measured at the conditions of 25℃ ambient temperature and 30~70% related humidity.
Apply 1.0 ± 0.2Vrms, 1.0MHz ± 10% for Cap ≤ 1000pF and 1.0 ± 0.2Vrms, 1.0kHz ± 10% for Cap>1000pF.

** 0402, Capacitance <0.5pF: On request.

Capacitance range

DIELECTRIC		NP0										
SIZE		0402			0603				0805			
RATED VOLTAGE (VDC)		16	25	50	16	25	50	100	50	100	200 250	500 630
Capacitance	0.5pF (0R5)											
	0.6pF (0R6)											
	0.7pF (0R7)											
	0.8pF (0R8)											
	0.9pF (0R9)											
	1.0pF (1R0)											
	1.2pF (1R2)											
	1.5pF (1R5)											
	1.8pF (1R8)											
	2.2pF (2R2)											
	2.7pF (2R7)											
	3.3pF (3R3)											
	3.9pF (3R9)											
	4.7pF (4R7)											
	5.6pF (5R6)											
	6.8pF (6R8)											
	8.2pF (8R2)											
	10pF (100)											
	12pF (120)											
	15pF (150)											
	18pF (180)											
	22pF (220)											
	27pF (270)											
	33pF (330)											
	39pF (390)											
	47pF (470)											
	56pF (560)											
	68pF (680)											
	82pF (820)											
	100pF (101)											
	120pF (121)											
	150pF (151)											
	180pF (181)											
	220pF (221)											
	270pF (271)											
	330pF (331)											
	390pF (391)											
	470pF (471)											
	560pF (561)											
	680pF (681)											
	820pF (821)											
	1,000pF (102)											
	1,200pF (122)											
	1,500pF (152)											
	1,800pF (182)											
	2,200pF (222)											
	2,700pF (272)											
	3,300pF (332)											

1. 0402, Capacitance <0.5pF: On request.
2. For more information about products with special capacitance or other data, please contact PDC local representative.

Electrical characteristics

Q factor specification vs. Specific frequency

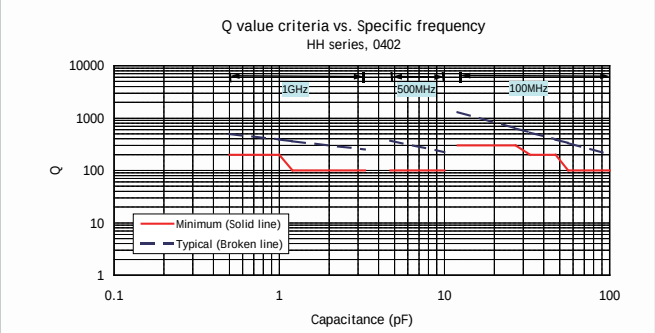


Fig. 2 Q factor specification vs. Specific frequency for 0402

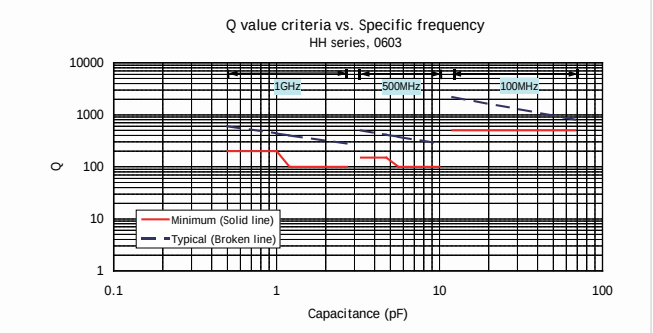


Fig. 3 Q factor specification vs. Specific frequency for 0603

Typical ESR vs. Frequency

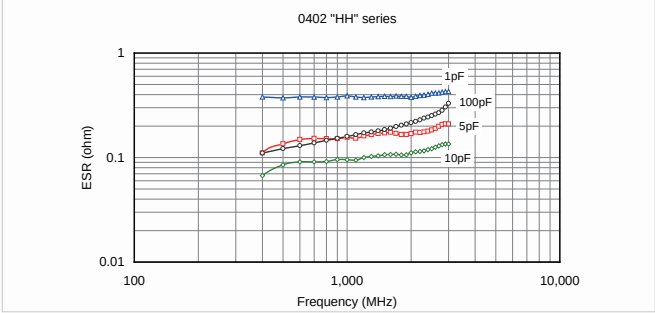


Fig. 4 ESR vs. Frequency 0402

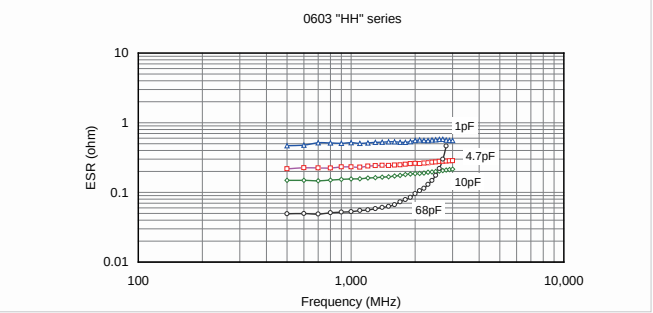


Fig. 5 ESR vs. Frequency 0603

Typical Impedance vs. Frequency

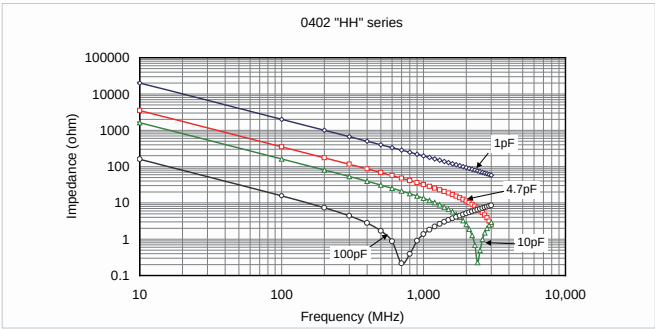


Fig. 6 Impedance vs. Frequency 0402

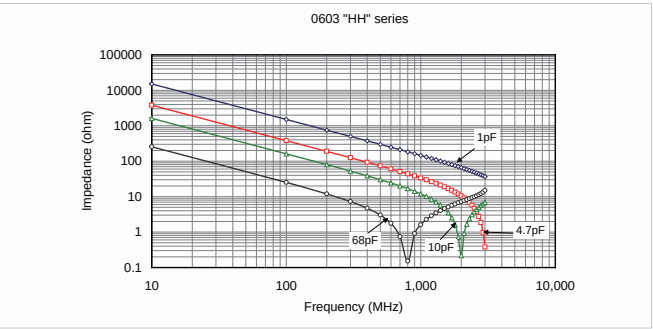


Fig. 7 Impedance vs. Frequency 0603

SRF vs. Capacitance

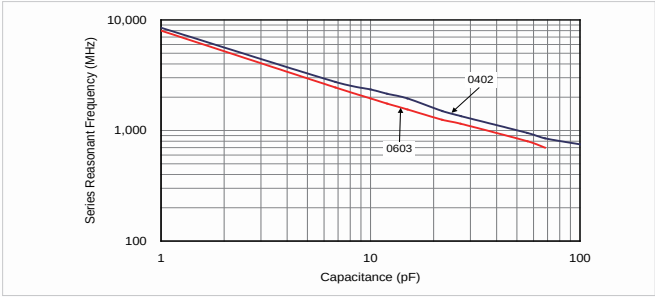


Fig. 8 SRF vs. Capacitance

Reliability test conditions and requirements

No.	Item	Test Conditions	Requirements
1.	Visual and Mechanical	• ---	• No remarkable defect. • Dimensions to conform to individual specification sheet.
2.	Capacitance	• Cap ≤ 1000pF, 1.0 ± 0.2Vrms, 1MHz ± 10%	• Shall not exceed the limits given in the detailed spec.
3.	Q/ D.F. (Dissipation Factor)	• Cap>1000pF, 1.0 ± 0.2Vrms, 1KHz ± 10% • At 25℃ ambient temperature.	• NP0: Cap ≥ 30pF, Q ≥ 1000; Cap<30pF, Q ≥ 400+20C
4.	Dielectric Strength	• To apply voltage: 250% of rated voltage. • Duration: 1 to 5 sec. • Charge and discharge current less than 50mA.	• No evidence of damage or flash over during test.
5.	Insulation Resistance	• To apply rated voltage for max. 120 sec.	• ≥ 10G Ω
6.	Temperature Coefficient	• With no electrical load. • Operating temperature: -55~125℃ at 25℃	• Capacitance change: within ± 30ppm/℃
7.	Adhesive Strength of Termination	• Pressurizing force : 5N (≤ 0603) and 10N (>0603) • Test time: 10 ± 1 sec.	• No remarkable damage or removal of the terminations.
8.	Vibration Resistance	• Vibration frequency: 10~55 Hz/min. • Total amplitude: 1.5mm • Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)	• No remarkable damage. • Cap change and Q/D.F.: To meet initial spec.
9.	Solderability	• Solder temperature: 235 ± 5℃ • Dipping time: 2 ± 0.5 sec.	• 95% min. coverage of all metalized area.
10.	Bending Test	• The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5 ± 1 sec. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs.	• No remarkable damage. • Cap change: within ± 5.0% or ± 0.5pF whichever is larger. (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)
11.	Resistance to Soldering Heat	• Solder temperature: 270 ± 5℃ • Dipping time: 10 ± 1 sec • Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs. (Class I) or 48 ± 4 hrs. (Class II).	• No remarkable damage. • Cap change: within ± 2.5% or ± 0.25pF whichever is larger. • Q/D.F., I.R. and dielectric strength: To meet initial requirements. • 25% max. leaching on each edge.
12.	Temperature Cycle	• Conduct the five cycles according to the temperatures and time. Step / Temp. (℃) / Time (min.) 1 / Min. operating temp. +0/-3 / 30 ± 3 2 / Room temp. / 2~3 3 / Max. operating temp. +3/-0 / 30 ± 3 4 / Room temp. / 2~3 • Measurement to be made after keeping at room temp. for 24 ± 2 hrs.	• No remarkable damage. • Cap change : within ± 2.5% or ± 0.25pF whichever is larger. • Q/D.F., I.R. and dielectric strength: To meet initial requirements.
13.	Humidity (Damp Heat) Steady State	• Test temp.: 40 ± 2℃ • Humidity: 90~95% RH • Test time: 500+24/-0hrs. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs.	• No remarkable damage. • Cap change: within ± 5.0% or ± 0.5pF whichever is larger. • Q/D.F. value: NP0: Cap ≥ 30pF, Q ≥ 350; 10pF ≤ Cap<30pF, Q ≥ 275+2.5C Cap<10pF; Q ≥ 200+10C • I.R.: ≥ 1G Ω .
14.	Humidity (Damp Heat) Load	• Test temp.: 40 ± 2℃ • Humidity: 90~95%RH • Test time: 500+24/-0 hrs. • To apply voltage : rated voltage • Measurement to be made after keeping at room temp. for 24 ± 2 hrs.	• No remarkable damage. • Cap change: within ± 7.5% or ± 0.75pF whichever is larger. • Q/D.F. value: NP0: Cap ≥ 30pF, Q ≥ 200; Cap<30pF, Q ≥ 100+10/3C • I.R.: ≥ 500M Ω .
15.	High Temperature Load (Endurance)	• Test temp.:NP0, X7R: 125 ± 3℃ • To apply voltage: 200% of rated voltage. • Test time: 1000+24/-0 hrs. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs.	• No remarkable damage. • Cap change: within ± 3.0% or ± 0.3pF whichever is larger. • Q/D.F. value: NP0: Cap ≥ 30pF, Q ≥ 350 10pF ≤ Cap<30pF, Q ≥ 275+2.5C Cap<10pF, Q ≥ 200+10C • I.R.: ≥ 1G Ω .

Introduction

MLCC consists of a conducting material and electrodes. To manufacture a chip-type SMT and achieve miniaturization, high density and high efficiency, ceramic condensers are used.

PDC RF series MLCC is used at high frequencies generally have a small temperature coefficient of capacitance, typical within the ±30ppm/℃ required for NP0 (C0G) classification and have excellent conductivity internal electrode. Thus, PDC RF series MLCC will be with the feature of low ESR and high Q characteristics.

Features

- » High Q and low ESR performance at high frequency.
- » Ultra low capacitance to 0.1pF.
- » Can offer high precision tolerance to ±0.05pF.
- » Quality improvement of telephone calls for low power loss and better performance.
- » RoHS compliant.
- » HALOGEM compliant.

Applications

- » Telecommunication products & equipments: Mobile phone, WLAN, Base station.
- » RF module: Power amplifier, VCO.
- » Tuners.

How to order

RF	21	N	100	J	251	C	T
Series	Size	Dielectric	Capacitance	Tolerance	Rated voltage	Termination	Packaging
RF=Ultra High Q & Low ESR	03=0201 (0603) 15=0402 (1005) 18=0603 (1608) 21=0805 (2012)	N=NP0 (C0G)	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 0R5=0.5pF 1R0=1.0pF 100=10x10^0 =10pF	A= ± 0.05pF B= ± 0.1pF C= ± 0.25pF D= ± 0.5pF F= ± 1% G= ± 2% J= ± 5%	Two significant digits followed by no. of zeros. And R is in place of decimal point. 6R3=6.3 VDC 100=10 VDC 250=25 VDC 500=50 VDC 101=100 VDC 251=250 VDC	C=Cu/Ni/Sn	T= 7" reeled G= 13" reeled

General electrical data

Dielectric	NP0
Size	0201, 0402, 0603, 0805
Capacitance*	0201: 0.1pF to 33pF; 0402: 0.1pF to 22pF; 0603: 0.3pF to 47pF; 0805: 0.3pF to 100pF
Capacitance tolerance	Cap ≤ 5pF: A (± 0.05pF), B (± 0.1pF), C (± 0.25pF) 5pF<Cap<10pF: B (± 0.1pF), C (± 0.25pF), D (± 0.5pF) Cap ≥ 10pF: F (± 1%), G (± 2%), J (± 5%)
Rated voltage (WVDC)	6.3V, 10V, 25V, 50V, 100V, 250V
Q*	Cap ≥ 30pF, Q ≥ 1000; Cap<30pF,Q ≥ 400+20C
Insulation resistance at Ur	≥ 10G Ω
Operating temperature	-55 to +125℃
Capacitance change	± 30ppm/℃
Termination	Cu/Ni/Sn (lead-free termination)

* Measured at the conditions of 25℃ ambient temperature and 30~70% related humidity.
Apply 1.0 ± 0.2Vrms, 1.0MHz ± 10% for Cap ≤ 1000pF and 1.0 ± 0.2Vrms, 1.0kHz ± 10% for Cap>1000pF.

Capacitance range

DIELECTRIC		NP0										
SIZE		0201			0402		0603			0805		
RATED VOLTAGE (VDC)		6.3	10	25	50	100	50	100	250	50	100	250
Capacitance	0.1pF (0R1)											
	0.2pF (0R2)											
	0.3pF (0R3)											
	0.4pF (0R4)											
	0.5pF (0R5)											
	0.6pF (0R6)											
	0.7pF (0R7)											
	0.8pF (0R8)											
	0.9pF (0R9)											
	1.0pF (1R0)											
	1.2pF (1R2)											
	1.5pF (1R5)											
	1.8pF (1R8)											
	2.2pF (2R2)											
	2.7pF (2R7)											
	3.3pF (3R3)											
	3.9pF (3R9)											
	4.7pF (4R7)											
	5.6pF (5R6)											
	6.8pF (6R8)											
	8.2pF (8R2)											
	10pF (100)											
	11pF (110)											
	12pF (120)											
	13pF (130)											
	15pF (150)											
	16pF (160)											
	18pF (180)											
	20pF (200)											
	22pF (220)											
	24pF (240)											
	27pF (270)											
	30pF (300)											
	33pF (330)											
	36pF (360)											
	39pF (390)											
	43pF (430)											
	47pF (470)											
	56pF (560)											
	68pF (680)											
	82pF (820)											
	100pF (101)											

* For more information about products with special capacitance or other data, please contact PDC local representative.

Electrical Characteristics

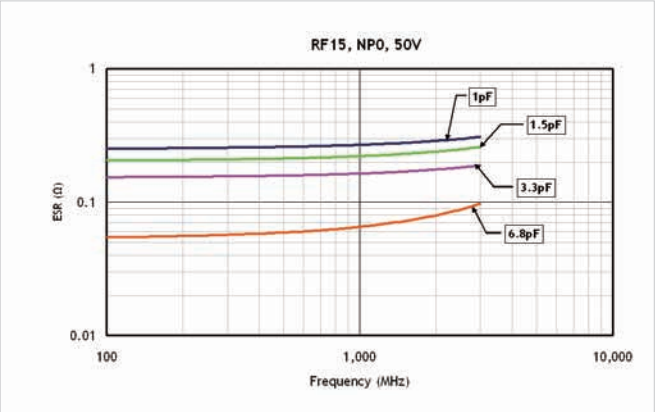


Fig. 2 ESR vs. Frequency

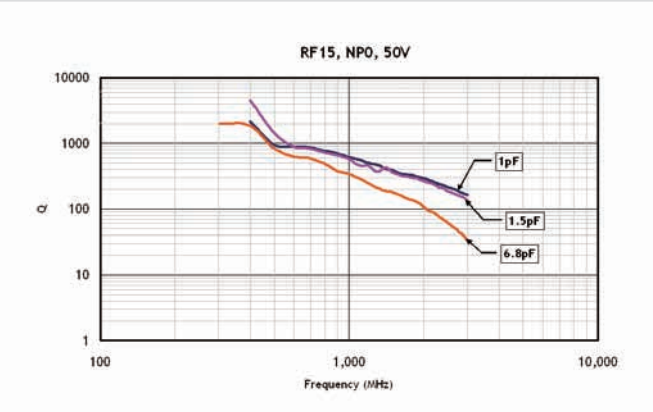


Fig. 3 Q vs. Frequency

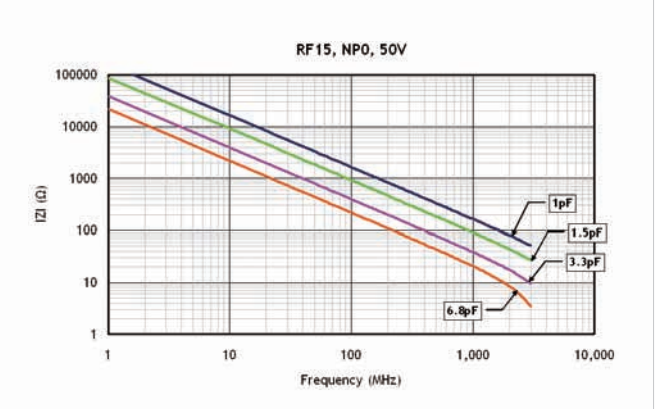


Fig. 4 Impedance vs. Frequency

Electrical Characteristics(Con.)

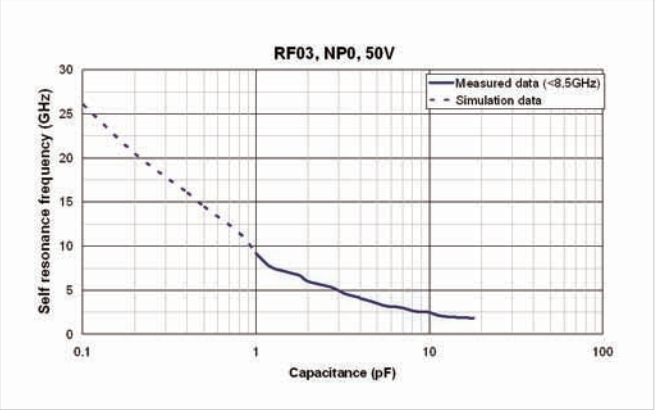


Fig. 5 Self resonance frequency vs. Capacitance (0201 size)

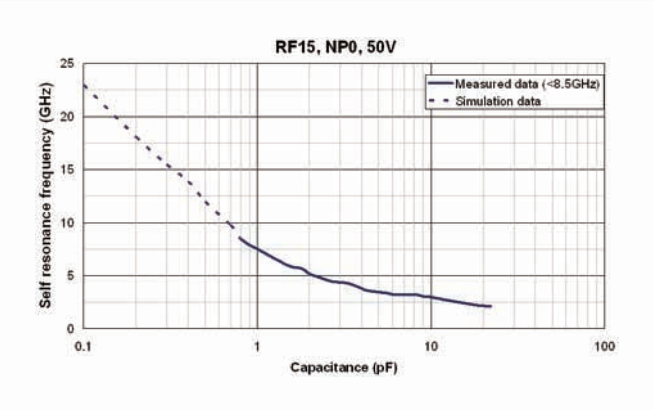


Fig. 6 Self resonance frequency vs. Capacitance (0402 size)

Electrical Characteristics(Con.)

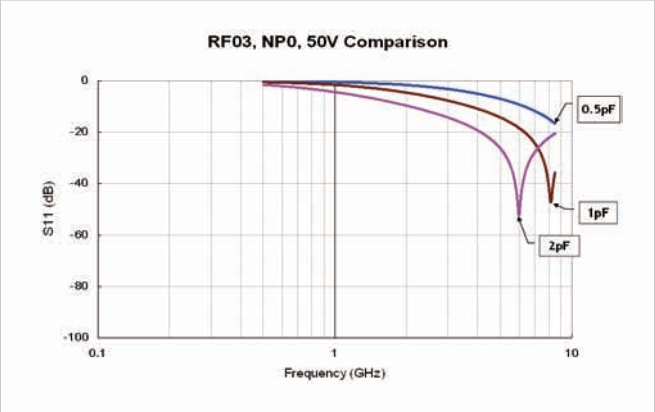


Fig. 7 S11 vs. frequency. (0201 size)

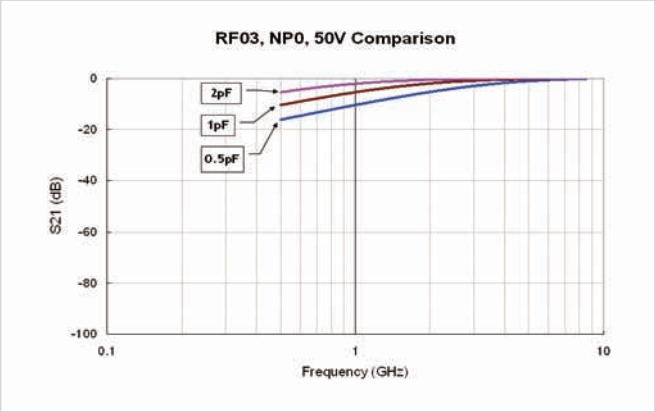


Fig. 8 S21 vs. frequency. (0201 size)

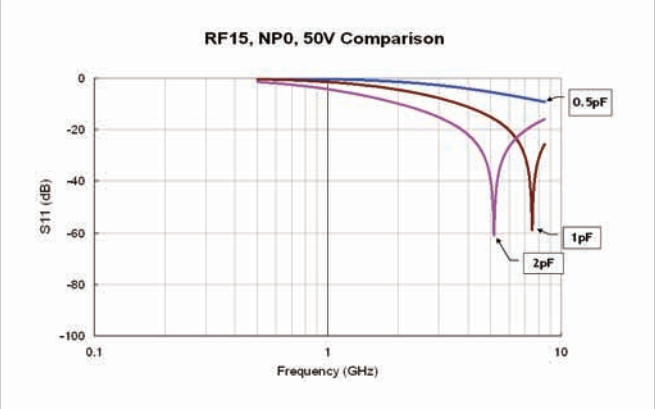


Fig. 9 S11 vs. frequency. (0402 size)

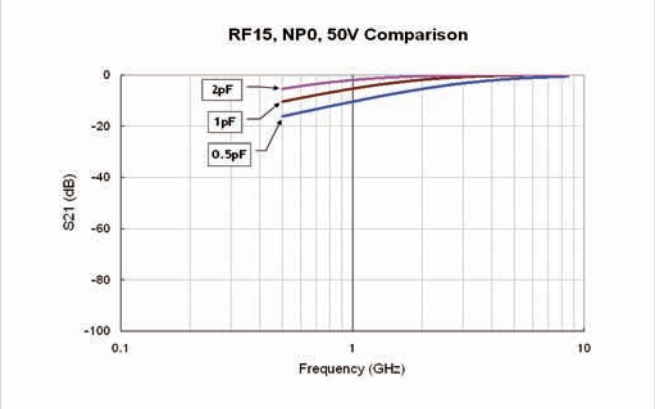


Fig. 10 S21 vs. frequency. (0402 size)

Reliability test conditions and requirements

No.	Item	Test Conditions	Requirements
1.	Visual and Mechanical	• ---	• No remarkable defect. • Dimensions to conform to individual specification sheet.
2.	Capacitance	• 1.0 ± 0.2Vrms, 1MHz ± 10%	• Shall not exceed the limits given in the detailed spec.
3.	Q/ D.F. (Dissipation Factor)	• At 25℃ ambient temperature.	• Cap<30pF, Q ≥ 800+20C; Cap ≥ 30pF, Q ≥ 1400
4.	Dielectric Strength	• To apply voltage: ≤ 100V, ≥ 250% of rated voltage. 250V, ≥ 200% of rated voltage. • Duration: 1 to 5 sec. • Charge and discharge current less than 50mA.	• No evidence of damage or flash over during test.
5.	Insulation Resistance	• To apply rated voltage for max. 120 sec.	• ≥ 10G Ω
6.	Temperature Coefficient	• With no electrical load. • Operating temperature: -55~125℃ at 25℃	• Capacitance change: within ± 30ppm/℃
7.	Adhesive Strength of Termination	• Pressurizing force : 10N • Test time: 10 ± 1 sec.	• No remarkable damage or removal of the terminations.
8.	Vibration Resistance	• Vibration frequency: 10~55 Hz/min. • Total amplitude: 1.5mm • Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)	• No remarkable damage. • Cap change and Q/D.F.: To meet initial spec.
9.	Solderability	• Solder temperature: 235 ± 5℃ • Dipping time: 2 ± 0.5 sec.	• 95% min. coverage of all metalized area.
10.	Bending Test	• The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5 ± 1 sec. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs.	• No remarkable damage. • Cap change: within ± 5.0% or ± 0.5pF whichever is larger. (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)
11.	Resistance to Soldering Heat	• Solder temperature: 270 ± 5℃ • Dipping time: 10 ± 1 sec • Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs.	• No remarkable damage. • Cap change: within ± 2.5% or ± 0.25pF whichever is larger. • Q/D.F., I.R. and dielectric strength: To meet initial requirements. • 25% max. leaching on each edge.
12.	Temperature Cycle	• Conduct the five cycles according to the temperatures and time. Step / Temp. (℃) / Time (min.) 1 / Min. operating temp. +0/-3 / 30 ± 3 2 / Room temp. / 2~3 3 / Max. operating temp. +3/-0 / 30 ± 3 4 / Room temp. / 2~3 • Measurement to be made after keeping at room temp. for 24 ± 2 hrs.	• No remarkable damage. • Cap change : within ± 2.5% or ± 0.25pF whichever is larger. • Q/D.F., I.R. and dielectric strength: To meet initial requirements.
13.	Humidity (Damp Heat) Steady State	• Test temp.: 40 ± 2℃ • Humidity: 90~95% RH • Test time: 500+24/-0hrs. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs.	• No remarkable damage. • Cap change: within ± 5.0% or ± 0.5pF whichever is larger. • Q/D.F. value: Cap ≥ 30pF, Q ≥ 350; 10pF ≤ Cap<30pF, Q ≥ 275+2.5C Cap<10pF; Q ≥ 200+10C • I.R.: ≥ 1G Ω .
14.	Humidity (Damp Heat) Load	• Test temp.: 40±2℃ • Humidity: 90~95%RH • Test time: 500+24/-0 hrs. • To apply voltage : rated voltage • Measurement to be made after keeping at room temp. for 24 ± 2 hrs.	• No remarkable damage. • Cap change: within ± 7.5% or ± 0.75pF whichever is larger. • Q/D.F. value: Cap ≥ 30pF, Q ≥ 200; Cap<30pF, Q ≥ 100+10/3C • I.R.: ≥ 500M Ω .
15.	High Temperature Load (Endurance)	• Test temp.: 125 ± 3℃ • To apply voltage: 200% of rated voltage. • Test time: 1000+24/-0 hrs. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs.	• No remarkable damage. • Cap change: within ± 3.0% or ± 0.3pF whichever is larger. • Q/D.F. value: Cap ≥ 30pF, Q ≥ 350 10pF ≤ Cap<30pF, Q ≥ 275+2.5C Cap<10pF, Q ≥ 200+10C • I.R.: ≥ 1G Ω .

CAPACITOR ARRAY

0612/ 0508 SIZE
CAP ARRAY SERIES

Introduction

PDC middle and high voltage series MLCC is designed by a special internal electrode pattern, which can reduce voltage concentrations by distributing voltage gradients throughout the entire capacitor. This special design also affords increased capacitance values in a given case size and voltage rating.
PDC capacitor arrays are developed to offer designers the opportunity to lower placement costs increase assembly line output through lower component count per board.

Features

- » High density mounting due to mounting space saving.
- » Mounting cost saving.
- » Increased throughput.
- » RoHS compliant.
- » HALOGEM compliant.

Applications

- » For use as a bypass for digital and analog signal line noise
- » Computer motherboards and peripherals.
- » The other common electronic circuits.

How to order

Y	4C	3	B	103	K	500	C	T
Series	Cap. Nr.	Termination pitch	Dielectric	Capacitance	Tolerance	Rated voltage	Termination	Packaging
Y=Capacitor array	4C=4xCap	3=0.03" pitch 2=0.02" pitch	N=NP0 (C0G) B=X7R F=Y5V	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 103 =10x10^3 =10,000pF =10nF	J= ± 5% K= ± 10% M= ± 20% Z=-20/+80%	Two significant digits followed by no. of zeros. And R is in place of decimal point. eg.: 160=16 VDC 250=25 VDC 500=50 VDC	C=Cu/Ni/Sn	T=7" reeled

General electrical data

Size	4 x 0402, 4 x 0603	4 x 0603	
Dielectric	NP0	X7R	Y5V
Capacitance*	10pF to 470pF	180pF to 100nF	10nF to 100nF
Capacitance tolerance**	J (± 5%), K (± 10%)	K (± 10%), M (± 20%)	Z (-20/+80%)
Rated voltage (WVDC)	25, 50V	16V, 25V, 50V	16V, 50V
Q/Tan δ *	Cap<30pF: Q ≥ 400+20C Cap ≥ 30pF: Q ≥ 1000	Ur=50V, ≤ 2.5% Ur=25V&16V, ≤ 3.5%	Ur=50V, ≤ 5% Ur=16V, ≤ 7%
Insulation resistance at Ur	≥ 10G Ω	≥ 10G Ω or RxC ≥ 500 Ω xF whichever is less	
Operating temperature	-55 to +125℃		-25 to +85℃
Capacitance characteristic	± 30ppm	± 15%	+30/-80%
Termination	Ni/Sn (lead-free termination)		

* Measured at 30~70% related humidity.
NP0: Apply 1.0 ± 0.2Vrms, 1.0MHz ± 10% at the conditions of 25℃ ambient temperature.
X7R: Apply 1.0 ± 0.2Vrms, 1.0kHz ± 10%, at the conditions of 25℃ ambient temperature.
Y5V: Apply 1.0 ± 0.2Vrms, 1.0kHz ± 10%, at the conditions of 20℃ ambient temperature.

** Preconditioning for Class II MLCC: Perform a heat treatment at 150 ± 10℃ for 1 hour, then leave in ambient condition for 24 ± 2 hours before measurement.

CAPACITOR ARRAY

Capacitance range

SIZE		4 x 0402 (0508)	4 x 0603 (0612)						
DIELECTRIC		NP0	NP0		X7R			Y5V	
RATED VOLTAGE (VDC)		50	25	50	16	25	50	16	50
Capacitance	10pF (100)								
	15pF (150)								
	22pF (220)								
	33pF (330)								
	47pF (470)								
	68pF (680)								
	100pF (101)								
	150pF (151)								
	180pF (181)								
	220pF (221)								
	270pF (271)								
	330pF (331)								
	470pF (471)								
	1,000pF (102)								
	1,500pF (152)								
	2,200pF (222)								
	3,300pF (332)								
	4,700pF (472)								
	6,800pF (682)								
	0.010μF (103)								
	0.015μF (153)								
	0.022μF (223)								
	0.033μF (333)								
	0.047μF (473)								
	0.068μF (683)								
	0.10μF (104)								

Reliability test conditions and requirements

No.	Item	Test Condition	Requirements
1.	Visual and Mechanical	• ---	• No remarkable defect. • Dimensions to conform to individual specification sheet.
2.	Capacitance	• Class I: (NP0)	• Shall not exceed the limits given in the detailed spec.
3.	Q/ D.F. (Dissipation Factor)	• 1.0 ± 0.2Vrms, 1MHz ± 10% • Class II: (X7R, Y5V) • 1.0 ± 0.2Vrms, 1kHz ± 10%	• NP0: Cap ≥ 30pF, Q ≥ 1000; Cap<30pF, Q ≥ 400+20C • X7R: Ur= ≥ 25V, ≤ 2.5% Ur=16V, ≤ 3.5% • Y5V: ≤ 5.0%
4.	Dielectric Strength	• To apply voltage (≤ 50V) 250%. • Duration: 1 to 5 sec. • Charge and discharge current less than 50mA.	• No evidence of damage or flash over during test.
5.	Insulation Resistance	• To apply rated voltage for max. 120 sec.	• ≥ 10G Ω or RxC ≥ 500 Ω -F whichever is smaller.
6.	Temperature Coefficient	• With no electrical load. T.C. / Operating Temp NP0 / -55~125℃ at 25℃ X7R / -55~125℃ at 25℃ Y5V / -25~85℃ at 20℃	• T.C. / Capacitance Change NP0 / Within ± 30ppm/℃ X7R / Within ± 15% Y5V / Within +30%/-80%

Reliability test conditions and requirements

No.	Item	Test Condition	Requirements
7.	Adhesive Strength of Termination	• Pressurizing force : 5N (≤ 0603) and 10N (>0603) • Test time: 10 ± 1 sec.	• No remarkable damage or removal of the terminations.
8.	Vibration Resistance	• Vibration frequency: 10~55 Hz/min. • Total amplitude: 1.5mm • Test time: 6 hrs. (Two hrs each in three mutually perpendicular directions.)	• No remarkable damage. • Cap change and Q/D.F.: To meet initial spec.
9.	Solderability	• Solder temperature: 235 ± 5℃ • Dipping time: 2 ± 0.5 sec.	• 95% min. coverage of all metalized area.
10.	Bending Test	• The middle part of substrate shall be pressurized by means of the pressurizing rod at a rate of about 1 mm per second until the deflection becomes 1 mm and then the pressure shall be maintained for 5 ± 1 sec. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs.	• No remarkable damage. • Cap change : NP0: within ± 5.0% or ± 0.5pF whichever is larger. X7R: within ± 12.5% Y5V: within ± 30% (This capacitance change means the change of capacitance under specified flexure of substrate from the capacitance measured before the test.)
11.	Resistance to Soldering Heat	• Solder temperature: 270 ± 5℃ • Dipping time: 10 ± 1 sec • Preheating: 120 to 150℃ for 1 minute before immerse the capacitor in a eutectic solder. • Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs. (Class I) or 48 ± 4 hrs. (Class II).	• No remarkable damage. • Cap change: NP0: within ± 2.5% or ± 0.25pF whichever is larger. X7R: within ± 7.5% Y5V: within ± 20% • Q/D.F., I.R. and dielectric strength: To meet initial requirements. • 25% max. leaching on each edge.
12.	Temperature Cycle	• Conduct the five cycles according to the temperatures and time. • Before initial measurement (Class II only): Perform 150+0/-10℃ for 1 hr and then set for 48 ± 4 hrs at room temp. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs. (Class I) or 48 ± 4 hrs. (Class II).	• No remarkable damage. • Cap change : NP0: within ± 2.5% or ± 0.25pF whichever is larger. X7R: within ± 7.5% Y5V: within ± 20% • Q/D.F., I.R. and dielectric strength: To meet initial requirements.
13.	Humidity (Damp Heat) Steady State	• Test temp.: 40±2℃ • Humidity: 90~95% RH • Test time: 500+24/-0hrs. • Measurement to be made after keeping at room temp. for 24±2 hrs. (Class I) or 48 ± 4 hrs. (Class II).	• No remarkable damage. • Cap change: NP0: within ± 5.0% or ± 0.5pF whichever is larger. X7R: within ± 12.5% Y5V: within ± 30% • Q/D.F. value: NP0: Cap ≥ 30pF, Q ≥ 350; 10pF ≤ Cap<30pF, Q ≥ 275+2.5C Cap<10pF; Q ≥ 200+10C X7R: Ur=50V, ≤ 3.0% Ur=16V, ≤ 5.0% Y5V: ≤ 7.5% • I.R.: ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.
14.	Humidity (Damp Heat) Load	• Test temp.: 40±2℃ • Humidity: 90~95%RH • Test time: 500+24/-0 hrs. • To apply voltage : rated voltage. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs. (Class I) or 48 ± 4 hrs. (Class II).	• No remarkable damage. • Cap change: NP0: within ± 7.5% or ± 0.75pF whichever is larger. X7R: within ± 12.5% Y5V: within ± 30% • Q/D.F. value: NP0: Cap ≥ 30pF, Q ≥ 200; Cap<30pF, Q ≥ 100+10/3C X7R: Ur=50V, ≤ 3.0% Ur=16V, ≤ 5.0% Y5V: ≤ 7.5% • I.R.: ≥ 500M Ω or RxC ≥ 25 Ω -F whichever is smaller.
15.	High Temperature Load (Endurance)	• Test temp.: NP0, X7R: 125 ± 3℃ Y5V: 85 ± 3℃ • To apply voltage: 200% of rated voltage. • Test time: 1000+24/-0 hrs. • Measurement to be made after keeping at room temp. for 24 ± 2 hrs. (Class I) or 48 ± 4 hrs. (Class II).	• No remarkable damage. • Cap change: NP0: within ± 3.0% or ± 0.3pF whichever is larger. X7R: within ± 12.5% Y5V: within ± 30% • Q/D.F. value: NP0: Cap ≥ 30pF, Q ≥ 350 10pF ≤ Cap<30pF, Q ≥ 275+2.5C Cap<10pF, Q ≥ 200+10C X7R: Ur=50V, ≤ 3.0% Ur=16V, ≤ 5.0% Y5V: ≤ 7.5% • I.R.: ≥ 1G Ω or RxC ≥ 50 Ω -F whichever is smaller.

APPLICATION NOTES

Storage

To prevent the damage of solderability of terminations, the following storage conditions are recommended:

Indoors under 5 ~ 40℃ and 20% ~ 70% RH.

No harmful gases containing sulfuric acid, ammonia, hydrogen sulfide or chlorine.

Packaging should not be opened until the capacitors are required for use. If opened, the pack should be re-sealed as soon as is practicable. Taped product should be stored out of direct sunlight, which might promote deterioration in tape or adhesion performance. The capacitors should be used within 6 months and checked the solderability before use.

Handling

Chip capacitors are dense, hard, brittle, and abrasive materials. They are liable to suffer mechanical damage, in the form of cracks or chips. Chip Capacitors should be handled with care to avoid contamination or damage. To use vacuum or plastic tweezers to pick up or plastic tweezers is recommended for manual placement. Tape and reeled packages are suitable for automatic pick and placement machine.

Preheat

In order to minimize the risk of thermal shock during soldering, a carefully controlled preheat is required. The rate of preheat should not exceed 4℃ per second and the final preheat temperature should be within 100℃ of the soldering temperature for small chips such as 0402, 0603, 0805 and 1206, within 50℃ of the soldering temperature for bigger chips such as 1210, 1808, 1812, 1825, 2211, 2220 and 2225, etc.

Soldering

Use middy activated rosin RA and RMA fluxes do not use activated flux. The amount of solder in each solder joint should be controlled to prevent the damage of chip capacitors caused by the stress between solder, chips, and substrate.

Hand soldering with temperature-controlled iron not exceeding 30 watts and diameter of tip less than 1.2 mm is recommended, tip of iron should not contact the ceramic body directly, and the temperature of iron should be set to not more than 260℃ .

For bigger chips such as 1808, 1812, 2211, 2220, 2225 etc. wave soldering and hand soldering are no recommended.

Refer IPC/JEDEC J-STD-020D Method recommended soldering profiles :

Reflow not sooner than 15 minutes and not longer than 4 hrs after removal from the temperature/humidity chamber, subject the sample to 3 cycle of the appropriate reflow conditions as defined as blow Table description.

Profile Feature	Pb-Free Assembly
Preheat/Soak Temperature Min.(Tsmin) Temperature Max.(Tsmax) Time(ts) from (Tsmin to Tsmax)	150℃ 200℃ 60 to 120 seconds
Ramp-up rate(TL to Tp)	3℃ /second max.
Liquidous temperature(TL) Time(tL) maintained above TL	217℃ 60 to 150 seconds
Peak package body temperature(Tp)	For user Tp must not exceed the Classification temp 260℃ For suppliers Tp must equal or exceed the Classification temp 260℃
Time(Tp)* within 5℃ of the specified classification temperature(Tc)	30* second
Ramp-down rate (Tp to TL)	6℃ /second max.
Time 25℃ to peak temperature 260℃	8 minutes max.

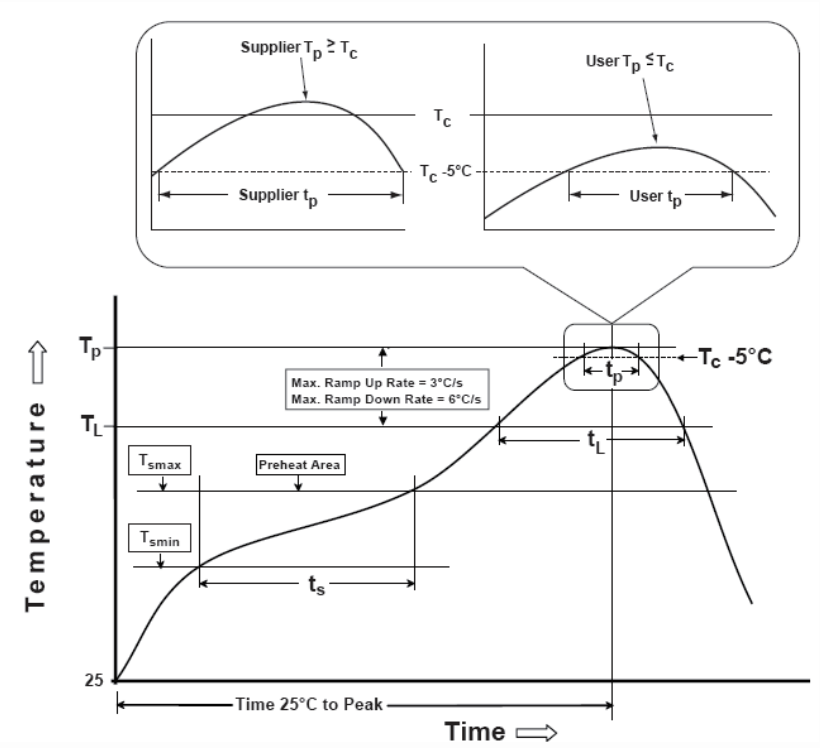
Lead-free : Soldering temperature = 235 to 260℃ , depending on product.

Maximum temperature = Minimum temperature (235℃)+ΔT+ Tolerance for oven process and measurement(5 ~ 7℃)

Time at peak temperature = 10sec, Dwell above 217℃ = 90sec, Ramping rate = 3℃ /sec(heating) and 6℃ /sec(heating).

APPLICATION NOTES

Classification Reflow Profiles



Chip Size	ΔT
0402,0603,0805,1206	25 ℃
1210, 1808, 1812, 2211, 2220, 2225	50 ℃

Soldering	Solder Temp.(Tc)	Soldering Time (tp)
Reflow	235 – 260 ℃	< 15 sec.
Wave	230 – 260 ℃	< 5 sec.

Note :
For example , Tc is 260℃ and time tp is 15sec.

for user :
The peak temperature must not exceed 260℃ . The time above 255℃ must not exceed 15 seconds.

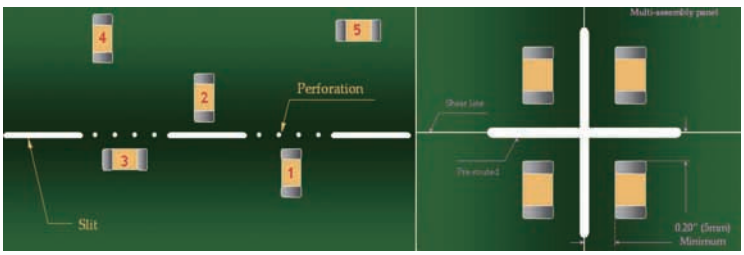
Cooling

After soldering, cool the chips and the substrate gradually to room temperature. Natural cooling in air is recommended to minimize stress in the solder joint. A cooling rate not exceeding 4℃ per second should be used when forced cooling is necessary.

Cleaning

All flux residues must be removed by using suitable electronic-grade vapor-cleaning solvents to eliminate contamination that could cause electrolytic surface corrosion. Good results can be obtained by using ultrasonic cleaning of the solvent. The choice of the proper system is depends upon many factors such as component mix, flux, and solder paste and assembly method. The ability of the cleaning system to remove flux residues and contamination from under the chips is very important.

The stress v.s. position on PCB during bending



» Magnitude of stress
1 > 2 ≈ 3 > 4 > 5

PACKAGE DIMENSION AND QUANTITY

Size	Thickness (mm)	Paper tape		Plastic tape		Tray packaged (pcs/tray)
		7" reel	13" reel	7" reel	13" reel	
0201(0603)	0.30 ± 0.03	15k	70k	-	-	-
0402 (1005)	0.50 ± 0.05	10k	50K	-	-	-
	0.50 +0.02/-0.05	10k	50K	-	-	-
	0.60 +0.05/-0.15	10k	-	-	-	-
0603 (1608)	0.50 ± 0.10	4k	-	-	-	-
	0.80 ± 0.07	4k	15k	-	-	-
	0.80+0.15/-0.10	4k	15k	-	-	-
0805 (2012)	0.50 ± 0.10	4k	15k	-	-	-
	0.60 ± 0.10	4k	15k	-	-	-
	0.80 ± 0.10	4k	15k	-	-	-
	0.85 ± 0.10	4k	15k	-	-	-
	1.25 ± 0.10	-	-	3k	10k	-
	1.25 ± 0.20	-	-	3k	10k	-
1206 (3216)	0.80 ± 0.10	4k	15k	-	-	-
	0.85 ± 0.10	4k	15k	-	-	-
	0.95 ± 0.10	-	-	3k	10k	-
	1.15 ± 0.15	-	-	3k	10k	-
	1.25 ± 0.10	-	-	3k	10k	-
	1.60 ± 0.20	-	-	2k	10k	-
	1.60 +0.30/-0.10	-	-	2k	9k	-
1210 (3225)	0.85 ± 0.10	-	-	4k	10k	-
	0.95 ± 0.10	-	-	3k	10k	-
	1.25 ± 0.10	-	-	3k	10k	-
	1.60 ± 0.20	-	-	2k	-	-
	2.00 ± 0.20	-	-	1k	6k	-
	2.50 ± 0.30	-	-	1k	-	-
1808 (4520)	1.25 ± 0.10	-	-	2k	10k	-
	1.60 ± 0.20	-	-	2k	8k	-
	2.00 ± 0.20	-	-	1k	6k	-
1812 (4532)	1.25 ± 0.10	-	-	1k	-	-
	1.60 ± 0.20	-	-	1k	-	-
	2.00 ± 0.20	-	-	1k	-	-
	2.50 ± 0.30	-	-	0.5k	3k	-
	2.80 ± 0.30	-	-	0.5k	-	-
1825 (4563)	2.00 ± 0.20	-	-	1k	-	-
	2.50 ± 0.30	-	-	0.5k	-	-
2211 (5728)	2.00 ± 0.20	-	-	1k	-	-
	2.50 ± 0.30	-	-	0.5k	-	-
2220 (5750)	2.00 ± 0.20	-	-	1k	-	-
	2.50 ± 0.30	-	-	0.5k	-	-
2225 (5763)	2.00 ± 0.20	-	-	1k	-	-
	2.50 ± 0.30	-	-	0.5k	-	-
2020	2.80 ± 0.30 3.10 ± 0.30 3.50 ± 0.30	-	-	-	-	50
3035		-	-	-	-	50
3333		-	-	-	-	50
3530		-	-	-	-	50
3640		-	-	-	-	50
3940		-	-	-	-	50
4045		-	-	-	-	50
4238		-	-	-	-	50
4252		-	-	-	-	50
4540		-	-	-	-	50
5550		-	-	-	-	25
5780		-	-	-	-	25
5868		-	-	-	-	25
6560		-	-	-	-	25
7680		-	-	-	-	25
7875		-	-	-	-	25
7880		-	-	-	-	25
8550		-	-	-	-	25
8840		-	-	-	-	25
42102		-	-	-	-	25
10642		-	-	-	-	25
13060		-	-	-	-	25

PACKAGE DIMENSION AND QUANTITY

Package Dimension And Quantity(Con.)

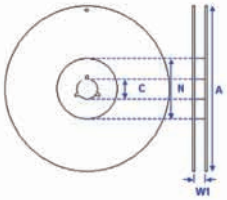


Fig. 4 The dimension of reel

Size	0402, 0603, 0805, 1206, 1210			1812, 1825, 2211, 2220, 2225	0201	
Reel size	7"	10"	13"	7"	7"	13"
C	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2	13.0+0.5/-0.2
W_1	8.4+1.5/-0	8.4+1.5/-0	8.4+1.5/-0	12.4+2.0/-0	8.4+1.5/-0	8.4+1.5/-0
A	178.0 ± 0.10	250.0 ± 1.0	330.0 ± 1.0	178.0 ± 0.10	178.0 ± 0.10	330.0 ± 1.0
N	60.0+1.0/-0	100.0 ± 1.0	100 ± 1.0	80.0 ± 1.0	60.0+1.0/-0	100 ± 1.0

Cardboard Tape Dimesions

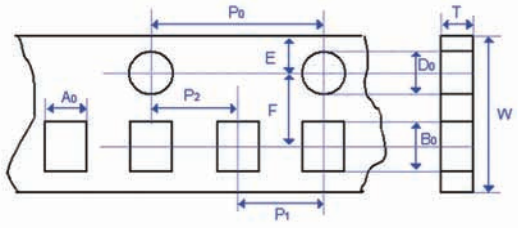


Fig. 2 The dimension of paper tape

Embossed Tape Dimensions

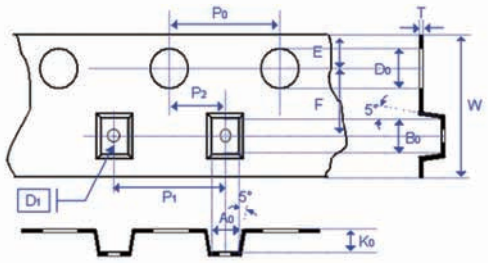


Fig. 3 The dimension of plastic tape

Size	0201	0402	0603		0805		1206			1210	
Chip Thickness	0.30 ± 0.03	0.50 ± 0.05	0.80 ± 0.07	0.80+0.15/-0.10	0.80 ± 0.10	1.25 ± 0.10 1.25 ± 0.20	0.80 ± 0.10	0.95 ± 0.10 1.25 ± 0.10	1.60 ± 0.20 1.60+0.3/-0/1	0.95 ± 0.10 1.25 ± 0.10 1.60 ± 0.20	2.50 ± 0.30
A_0	0.38 ± 0.05	0.62 ± 0.05	1.00+0.05/-0.10	1.02+0.05/-0.10	1.50 ± 0.10	<1.65	2.00 ± 0.10	<2.00	<2.00	<3.05	<3.10
B_0	0.68 ± 0.05	1.12 ± 0.05	1.80 ± 0.10	1.80 ± 0.10	2.30 ± 0.10	<2.40	3.50 ± 0.10	<3.60	<3.70	<3.80	<4.00
T	0.42 ± 0.05	0.60 ± 0.05	0.95 ± 0.05	0.97 ± 0.05	0.95 ± 0.05	0.23 ± 0.05	0.95 ± 0.05	0.23 ± 0.05	0.23 ± 0.05	0.23 ± 0.05	0.23 ± 0.05
K_0	-	-	-	-	-	<2.50	-	<2.50	<2.50	<2.50	<3.50
W	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10
P_0	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.100	4.00 ± 0.10
$10xP_0$	40.0 ± 0.10	40.00 ± 0.20	40.00 ± 0.20	40.00 ± 0.20	40.00 ± 0.20	40.00 ± 0.20	40.00 ± 0.20	40.00 ± 0.20	40.00 ± 0.20	40.00 ± 0.20	40.0 ± 0.10
P_1	2.00 ± 0.05	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10
P_2	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05
D_0	1.55 ± 0.05	1.55 ± 0.05	1.55 ± 0.05	1.55 ± 0.05	1.55 ± 0.05	1.50 ± 0.10/-0	1.55 ± 0.05	1.50 ± 0.10/-0	1.50 ± 0.10/-0	1.50 ± 0.10/-0	1.50 ± 0.10/-0
D_1	-	-	-	-	-	1.00 ± 0.10	-	1.00 ± 0.10	1.00 ± 0.10	1.00 ± 0.10	1.00 ± 0.10
E	1.75 ± 0.05	1.75 ± 0.05	1.75 ± 0.05	1.75 ± 0.05	1.75 ± 0.05	1.75 ± 0.10	1.75 ± 0.10	1.75 ± 0.10	1.75 ± 0.10	1.75 ± 0.10	1.75 ± 0.10
F	3.50 ± 0.05	3.50 ± 0.05	3.50 ± 0.05	3.50 ± 0.05	3.50 ± 0.05	3.50 ± 0.05	3.50 ± 0.05	3.50 ± 0.05	3.50 ± 0.05	3.50 ± 0.05	3.50 ± 0.05

Size	1808		1812		1825		2211		2220		2225	
Chip Thickness	1.25 ± 0.10 1.60 ± 0.20	2.00 ± 0.20	1.25 ± 0.10 1.60 ± 0.20 2.00 ± 0.20	2.50 ± 0.30	1.60 ± 0.20 2.00 ± 0.20	2.50 ± 0.30	1.60 ± 0.20 2.00 ± 0.20	2.50 ± 0.20	1.40 ± 0.15 1.60 ± 0.20 2.00 ± 0.20	2.50 ± 0.30	2.00 ± 0.20	2.50 ± 0.30
A_0	<2.50	<2.50	<3.90	<3.90	<6.80	<6.80	<3.30	<3.30	<5.80	<5.80	<6.80	<6.80
B_0	<5.30	<5.30	<5.30	<5.30	<5.30	<5.30	<6.50	<6.50	<6.50	<6.50	<6.50	<6.50
T	0.25 ± 0.05	0.25 ± 0.05	0.25 ± 0.05	0.25 ± 0.05	0.30 ± 0.10	0.30 ± 0.10	0.30 ± 0.10	0.30 ± 0.10	0.30 ± 0.10	0.30 ± 0.10	0.30 ± 0.10	0.30 ± 0.10
K_0	<2.50	<2.50	<2.50	<3.00	<2.50	<3.10	<2.50	<3.10	<2.50	<3.10	<2.50	<3.10
W	12.0 ± 0.20	12.0 ± 0.20	12.0 ± 0.20	12.0 ± 0.20	12.0 ± 0.20	12.0 ± 0.20	12.0 ± 0.20	12.0 ± 0.20	12.0 ± 0.20	12.0 ± 0.20	12.0 ± 0.20	12.0 ± 0.20
P_0	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10	4.00 ± 0.10
$10xP_0$	40.0 ± 0.20	40.0 ± 0.20	40.00 ± 0.20	40.00 ± 0.20	40.00 ± 0.20	40.00 ± 0.20	40.0 ± 0.20	40.0 ± 0.20	40.00 ± 0.20	40.00 ± 0.20	40.00 ± 0.20	40.00 ± 0.20
P_1	4.00 ± 0.10	4.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10	8.00 ± 0.10
P_2	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05	2.00 ± 0.05
D_0	1.50 ± 0.10/-0	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0	1.50+0.10/-0
D_1	1.50 ± 0.10	1.50 ± 0.10	1.50 ± 0.10	1.50+/-0.10	1.50 ± 0.10	1.50 ± 0.10	1.50 ± 0.10	1.50 ± 0.10	1.50 ± 0.10	1.50 ± 0.10	1.50 ± 0.10	1.50 ± 0.10
E	1.75 ± 0.10	1.75 ± 0.10	1.75 ± 0.10	1.75+/-0.1	1.75 ± 0.1	1.75 ± 0.10	1.75 ± 0.10	1.75 ± 0.10	1.75 ± 0.1	1.75 ± 0.10	1.75 ± 0.10	1.75 ± 0.10
F	5.50 ± 0.05	5.50 ± 0.05	5.50 ± 0.05	5.50+/-0.05	5.50 ± 0.05	5.50 ± 0.05	5.50 ± 0.05	5.50 ± 0.05	5.50 ± 0.05	5.50 ± 0.05	5.50 ± 0.05	5.50 ± 0.05

PACKAGE DIMENSION AND QUANTITY

External Dimensions

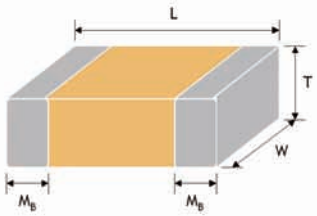


Fig. 1 The outline of MLCC

If the dimension you are looking for is not contained, please don't hesitate just contact us and we can develop suitable dimension per your applications and circuit design.

Size Inch (mm)	L (mm)	W (mm)	T(mm)	MB min (mm)
0201 (0603)*	0.60 ± 0.03	0.30 ± 0.03	0.33 max.	0.10
0402(1005)*	1.00 ± 0.05	0.50 ± 0.05	0.55 max.	0.15
	1.00 +0.15/-0.10	0.50 +0.15/-0.10	0.65 max.	
0603 (1608)*	1.60 ± 0.10	0.80 ± 0.10	0.87 max.	0.20
	1.60 +0.15/-0.10	0.80 +0.15/-0.10	0.95 max.	
	1.60 ± 0.20****	0.80 ± 0.15		
0805 (2012)	2.00 ± 0.15	1.25 ± 0.10	1.35 max.	0.30
	2.00 ± 0.20 2.10 ± 0.20****	1.25 ± 0.20	1.45 max.	
1206 (3216)	3.20 ± 0.15	1.60 ± 0.15	1.35 max.	0.30
	3.20 ± 0.20 3.30 ± 0.30****	1.60 ± 0.20	1.80 max.	
	3.20+0.30/-0.10 3.30 ± 0.30****	1.60+0.30/-0.10	1.90 max.	
1210 (3225)	3.20 ± 0.30	2.50 ± 0.20	1.35 max.	0.30
	3.20 ± 0.40 3.30 ± 0.40****	2.50 ± 0.30	2.80 max.	
1808 (4520)	4.50 ± 0.40 (4.50+0.5/-0.3)** 4.60 ± 0.50****	2.00 ± 0.20 2.03 ± 0.25	2.20 max.	0.30 (0.25)**
1812 (4532)	4.50 ± 0.40 (4.50+0.5/-0.3)*** 4.60 ± 0.50****	3.20 ± 0.30 3.20 ± 0.40	2.20 max. 3.10 max.	0.30 (0.25)***
1825(4563)	4.50 ± 0.40 4.60 ± 0.50****	6.30 ± 0.40	2.80 max.	0.30
2211 (5728)	5.70 ± 0.40	2.80 ± 0.30	2.80 max.	0.30
2220 (5750)	5.70 ± 0.40 5.70 ± 0.50****	5.00 ± 0.40	2.80 max.	0.30
2225 (5763)	5.70 ± 0.40 5.70 ± 0.50****	6.30 ± 0.40	2.80 max.	0.30
2020	5.00 ± 0.40	5.00 ± 0.40	3.80	0.30
3035	7.60 ± 0.50	8.90 ± 0.50	3.80	0.30
3333	8.40 ± 0.50	8.40 ± 0.50	3.80	0.30
3530	8.90 ± 0.50	7.60 ± 0.50	3.80	0.30
3640	9.10 ± 0.50	10.20 ± 0.50	3.80	0.30
3940	9.90 ± 0.50	10.20 ± 0.50	3.80	0.30
4045	10.20 ± 0.50	11.40 ± 0.50	3.80	0.30
4238	10.70 ± 0.50	9.70 ± 0.50	3.80	0.30
4252	10.70 ± 0.50	13.10 ± 0.50	3.80	0.30
4540	11.40 ± 0.50	10.20 ± 0.50	3.80	0.30
5550	14.00 ± 0.60	12.70 ± 0.60	3.80	0.30
5780	14.50 ± 0.60	20.30 ± 0.60	3.80	0.30
5868	14.70 ± 0.60	17.30 ± 0.70	3.80	0.30
6560	16.50 ± 0.70	15.20 ± 0.70	3.80	0.30
7680	19.30 ± 0.70	20.30 ± 0.70	3.80	0.30
7875	19.80 ± 0.70	19.10 ± 0.70	3.80	0.30
7880	19.80 ± 0.70	20.30 ± 0.70	3.80	0.30
8550	21.60 ± 0.80	12.70 ± 0.80	3.80	0.30
8840	22.40 ± 0.80	10.20 ± 0.80	3.80	0.30
42102	10.70 ± 0.50	25.90 ± 0.90	3.80	0.30
10642	26.90 ± 0.90	10.70 ± 0.50	3.80	0.30
13060	33.00 ± 0.90	15.20 ± 0.60	3.80	0.30

* Reflow soldering only.
** For 1808 safety certificated product.
*** For 1812 safety certificated product.
**** For FP series product.