

Please read this notice before using the TAIYO YUDEN products.



REMINDERS

- Product information in this catalog is as of October 2008. All of the contents specified herein are subject to change without notice due to technical improvements, etc. Therefore, please check for the latest information carefully before practical application or usage of the Products.

Please note that Taiyo Yuden Co., Ltd. shall not be responsible for any defects in products or equipment incorporating such products, which are caused under the conditions other than those specified in this catalog or individual specification.

- Please contact Taiyo Yuden Co., Ltd. for further details of product specifications as the individual specification is available.

- Please conduct validation and verification of products in actual condition of mounting and operating environment before commercial shipment of the equipment.

- All electronic components or functional modules listed in this catalog are developed, designed and intended for use in general electronics equipment.(for AV, office automation, household, office supply, information service, telecommunications, (such as mobile phone or PC) etc.). Before incorporating the components or devices into any equipment in the field such as transportation,(automotive control, train control, ship control), transportation signal, disaster prevention, medical, public information network (telephone exchange, base station) etc. which may have direct influence to harm or injure a human body, please contact Taiyo Yuden Co., Ltd. for more detail in advance.

Do not incorporate the products into any equipment in fields such as aerospace, aviation, nuclear control, submarine system, military, etc. where higher safety and reliability are especially required.

In addition, even electronic components or functional modules that are used for the general electronic equipment, if the equipment or the electric circuit require high safety or reliability function or performances, a sufficient reliability evaluation check for safety shall be performed before commercial shipment and moreover, due consideration to install a protective circuit is strongly recommended at customer's design stage.

- The contents of this catalog are applicable to the products which are purchased from our sales offices or distributors (so called "TAIYO YUDEN's official sales channel").

It is only applicable to the products purchased from any of TAIYO YUDEN's official sales channel.

- Please note that Taiyo Yuden Co., Ltd. shall have no responsibility for any controversies or disputes that may occur in connection with a third party's intellectual property rights and other related rights arising from your usage of products in this catalog. Taiyo Yuden Co., Ltd. grants no license for such rights.

- Caution for export

Certain items in this catalog may require specific procedures for export according to "Foreign Exchange and Foreign Trade Control Law" of Japan, "U.S. Export Administration Regulations," and other applicable regulations. Should you have any question or inquiry on this matter, please contact our sales staff.

Should you have any question or inquiry on this matter, please contact our sales staff.

超低歪積層セラミックコンデンサ (CFCAP™)

SUPER LOW DISTORTION MULTILAYER CERAMIC CAPACITORS (CFCAP™)

OPERATING TEMP. -55~+125°C



リフロー/REFLOW

特長 FEATURES

- ・新規開発を行った誘電体材料を使用し優れた温度特性と内部電極にNiを用いることで、小型・高容量・低コストを実現しました
- ・低歪み率、低ショックノイズでアナログ回路や携帯機器のデジタル回路に最適です
- ・耐熱性、耐破壊電圧、機械的強度が高くフィルムコンデンサの置き換えに最適です

- ・ Newly developed dielectric material and the use of nickel for internal electrodes provide excellent temperature characteristics with high capacitance, small case size and low cost.
- ・ Low distortion and low shock noise make these capacitors well suited for use in analog or digital mobile devices.
- ・ Excellent heat-resistance, high break down voltage, and mechanical strength make these capacitors well suited for replacing film capacitors.

用途 APPLICATIONS

- ・ AV関連機器などの信号回路
- ・ アナログ信号のカップリング用途
- ・ 携帯電話のPLL回路
- ・ 良好な温度特性による時定数回路、発信回路、フィルタなど

- ・ Signal line for AV products
- ・ Analog signal coupling applications
- ・ PLL circuit of mobile phones
- ・ Good temperature characteristics for time constant circuits, oscillation circuits and filters

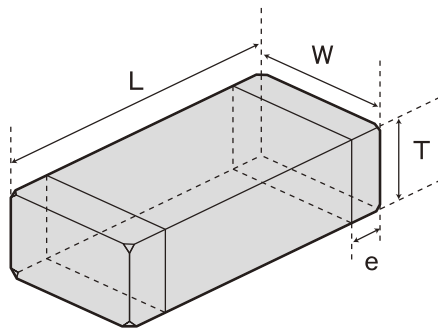
形名表記法 ORDERING CODE

1 定格電圧 [VDC]	3 端子電極	5 シリーズ記号	7 容量許容差	9 個別仕様
U 50 G 35 T 25 E 16 L 10	K メッキ品	SD スタンダード	K ±10%	— 標準
2 シリーズ名	4 形状寸法 (EIA) L×W (mm)	6 公称静電容量 (μF)	8 製品厚み (mm)	10 包装
M 積層コンデンサ	105 (0402) 1.0×0.5 107 (0603) 1.6×0.8 212 (0805) 2.0×1.25 316 (1206) 3.2×1.6	例 223 0.022 104 0.1	V 0.5 A 0.8 D 0.85 F 1.15 G 1.25 L 1.6	T φ178mm テーピング (4mmピッチ) 107, 212, 316形状 F φ178mm テーピング (2mmピッチ) 105形状
				11 当社管理記号
				△ 標準品 △=スペース

T M K 3 1 6 S D 1 0 4 K L - T △

1 Rated voltage [VDC]	3 End termination	5 Series symbol	7 Capacitance tolerance	9 Special code
U 50 G 35 T 25 E 16 L 10	K Plated	SD Standard	K ±10%	— Standard products
2 Series name	4 Dimensions(case size) (mm)	6 Nominal capacitance (μF)	8 Thickness (mm)	10 Packaging
M Multilayer ceramic capacitors	105 (0402) 1.0×0.5 107 (0603) 1.6×0.8 212 (0805) 2.0×1.25 316 (1206) 3.2×1.6	example 223 0.022 104 0.1	V 0.5 A 0.8 D 0.85 F 1.15 G 1.25 L 1.6	T φ178mm Taping (4mm pitch) 0603, 0805, 1206Type F φ178mm Taping (2mm pitch) 0402Type
				11 Internal code
				△ Standard products △=Blank space

外形寸法 EXTERNAL DIMENSIONS



Type (EIA)	L	W	T		e
□MK105 (0402)	1.0±0.05 (0.039±0.002)	0.5±0.05 (0.020±0.002)	0.5±0.05 (0.020±0.002)	V	0.25±0.10 (0.010±0.004)
□MK107 (0603)	1.6±0.10 (0.063±0.004)	0.8±0.10 (0.031±0.004)	0.8±0.10 (0.031±0.004)	A	0.35±0.25 (0.014±0.010)
□MK212 (0805)	2.0±0.10 (0.079±0.004)	1.25±0.10 (0.049±0.004)	0.85±0.10 (0.033±0.004)	D	0.5±0.25 (0.020±0.010)
			1.25±0.10 (0.049±0.004)	G	
□MK316 (1206)	3.2±0.15 (0.126±0.006)	1.6±0.15 (0.063±0.006)	1.15±0.10 (0.045±0.004)	F	0.5 ^{+0.35} _{-0.25} (0.020 ^{+0.014} _{-0.010})
			1.6±0.20 (0.063±0.008)	L	

Unit : mm (inch)

4

CAPACITORS

概略バリエーション AVAILABLE CAPACITANCE RANGE

Cap [μF]	Type	105				107				212				316	
	Temp.Char	SD				SD				SD				SD	
	VDC [pF:3digits]	50V	25V	16V	10V	50V	25V	16V	10V	50V	35V	16V	10V	35V	25V
0.00039	391	V													
0.00047	471	V													
0.00056	561	V													
0.00068	681		V												
0.00082	821		V												
0.001	102		V			A									
0.0012	122		V			A									
0.0015	152			V		A									
0.0018	182			V		A									
0.0022	222			V		A									
0.0027	272			V		A									
0.0033	332				V	A									
0.0039	392				V		A			D					
0.0047	472				V		A			D					
0.0056	562							A		D					
0.0068	682							A		D					
0.0082	822							A		D					
0.01	103							A		D					
0.012	123								A		D				
0.015	153								A		D				
0.018	183								A		G				
0.022	223								A		G				
0.027	273										G				
0.033	333											D		F	
0.039	393													F	
0.047	473												D		F
0.056	563														F
0.068	683												G		F
0.082	823												G		L
0.1	104												G		L

※グラフ記号は製品厚みを表します。 Letters in the table indicate thickness.

シリーズコード Series Code	静電容量許容差 [%] Capacitance tolerance	tan δ [%] Dissipation factor
SD	±10 (K)	0.1max.

セレクトションガイド
Selection Guide



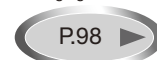
アイテム一覧
Part Numbers



特性図
Electrical Characteristics



梱包
Packaging



信頼性
Reliability Data



使用上の注意
Precautions



アイテム一覧 PART NUMBERS

■105TYPE (0402 case size)

定 格 電 圧 Rated Voltage	形 名 Ordering code		EHS (Environmental Hazardous Substances)	公 称 静電容量 Capacitance 〔μF〕	温度特性 Temperature characteristics Standard type	tan δ Dissipation factor 〔%〕Max.	実装条件 Soldering method R:リフロー Reflow soldering W: フロー Wave soldering	静電容量 許 容 差 Capacitance tolerance	厚 み Thickness 〔mm〕(inch)
50V	UMK105 SD391KV		RoHS	0.00039	Standard type	0.1	R	±10%*	0.5±0.05 (0.020±0.002)
	UMK105 SD471KV		RoHS	0.00047					
	UMK105 SD561KV		RoHS	0.00056					
25V	TMK105 SD681KV		RoHS	0.00068					
	TMK105 SD821KV		RoHS	0.00082					
	TMK105 SD102KV		RoHS	0.0010					
16V	TMK105 SD122KV		RoHS	0.0012					
	EMK105 SD152KV		RoHS	0.0015					
	EMK105 SD182KV		RoHS	0.0018					
	EMK105 SD222KV		RoHS	0.0022					
	EMK105 SD272KV		RoHS	0.0027					
10V	LMK105 SD332KV		RoHS	0.0033					
	LMK105 SD392KV		RoHS	0.0039					
	LMK105 SD472KV		RoHS	0.0047					

*: J公差(±5%)も対応致します。御相談ください。

*: The product with "J" tolerance of ±5% is also available. Please contact our local sales.

■107TYPE (0603 case size)

定 格 電 圧 Rated Voltage	形 名 Ordering code		EHS (Environmental Hazardous Substances)	公 称 静電容量 Capacitance 〔μF〕	温度特性 Temperature characteristics Standard type	tan δ Dissipation factor 〔%〕Max.	実装条件 Soldering method R:リフロー Reflow soldering W: フロー Wave soldering	静電容量 許 容 差 Capacitance tolerance	厚 み Thickness 〔mm〕(inch)
50V	UMK107 SD102KA		RoHS	0.0010	Standard type	0.1	R	±10%*	0.8±0.1 (0.031±0.004)
	UMK107 SD122KA		RoHS	0.0012					
	UMK107 SD152KA		RoHS	0.0015					
	UMK107 SD182KA		RoHS	0.0018					
	UMK107 SD222KA		RoHS	0.0022					
	UMK107 SD272KA		RoHS	0.0027					
25V	UMK107 SD332KA		RoHS	0.0033					
	TMK107 SD392KA		RoHS	0.0039					
	TMK107 SD472KA		RoHS	0.0047					
16V	EMK107 SD562KA		RoHS	0.0056					
	EMK107 SD682KA		RoHS	0.0068					
	EMK107 SD822KA		RoHS	0.0082					
10V	EMK107 SD103KA		RoHS	0.010					
	LMK107 SD123KA		RoHS	0.012					
	LMK107 SD153KA		RoHS	0.015					
	LMK107 SD183KA		RoHS	0.018					
	LMK107 SD223KA		RoHS	0.022					

*: J公差(±5%)も対応致します。御相談ください。

*: The product with "J" tolerance of ±5% is also available. Please contact our local sales.

■212TYPE (0805 case size)

定 格 電 圧 Rated Voltage	形 名 Ordering code		EHS (Environmental Hazardous Substances)	公 称 静電容量 Capacitance 〔μF〕	温度特性 Temperature characteristics Standard type	tan δ Dissipation factor 〔%〕Max.	実装条件 Soldering method R:リフロー Reflow soldering W: フロー Wave soldering	静電容量 許 容 差 Capacitance tolerance	厚 み Thickness 〔mm〕(inch)
50V	UMK212 SD392KD		RoHS	0.0039	Standard type	0.1	R	±10%*	0.85±0.1 (0.033±0.004)
	UMK212 SD472KD		RoHS	0.0047					
	UMK212 SD562KD		RoHS	0.0056					
	UMK212 SD682KD		RoHS	0.0068					
	UMK212 SD822KD		RoHS	0.0082					
	UMK212 SD103KD		RoHS	0.01					
35V	GMK212 SD123KD		RoHS	0.012					1.25±0.1 (0.049±0.004)
	GMK212 SD153KD		RoHS	0.015					
	GMK212 SD183KG		RoHS	0.018					
	GMK212 SD223KG		RoHS	0.022					
	GMK212 SD273KG		RoHS	0.027					
16V	EMK212 SD333KD		RoHS	0.033					0.85±0.1 (0.033±0.004)
	LMK212 SD473KD		RoHS	0.047					
10V	LMK212 SD683KG		RoHS	0.068					1.25±0.1 (0.049±0.004)
	LMK212 SD823KG		RoHS	0.082					
	LMK212 SD104KG		RoHS	0.1					

*: J公差(±5%)も対応致します。御相談ください。

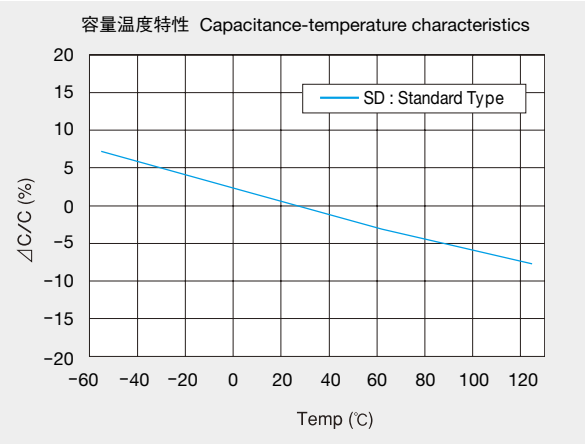
*: The product with "J" tolerance of ±5% is also available. Please contact our local sales.

■316TYPE (1206 case size)

定 格 電 圧 Rated Voltage	形 名 Ordering code		EHS (Environmental Hazardous Substances)	公 称 静電容量 Capacitance 〔μF〕	温度特性 Temperature characteristics Standard type	tan δ Dissipation factor 〔%〕Max.	実装条件 Soldering method R:リフロー Reflow soldering W: フロー Wave soldering	静電容量 許 容 差 Capacitance tolerance	厚 み Thickness 〔mm〕(inch)
35V	GMK316 SD333KF		RoHS	0.033	Standard type	0.1	R	±10%*	1.15±0.1 (0.045±0.004)
	GMK316 SD393KF		RoHS	0.039					
	TMK316 SD473KF		RoHS	0.047					
25V	TMK316 SD563KF		RoHS	0.056					
	TMK316 SD683KF		RoHS	0.068					
	TMK316 SD823KL		RoHS	0.082					
	TMK316 SD104KL		RoHS	0.1					

*: J公差(±5%)も対応致します。御相談ください。

*: The product with "J" tolerance of ±5% is also available. Please contact our local sales.



梱包 PACKAGING

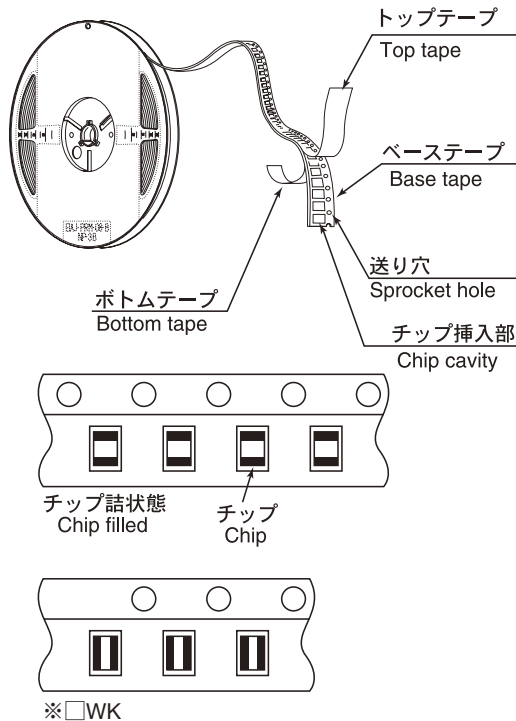
①最小受注単位数 Minimum Quantity

■テーピング梱包 Taped packaging

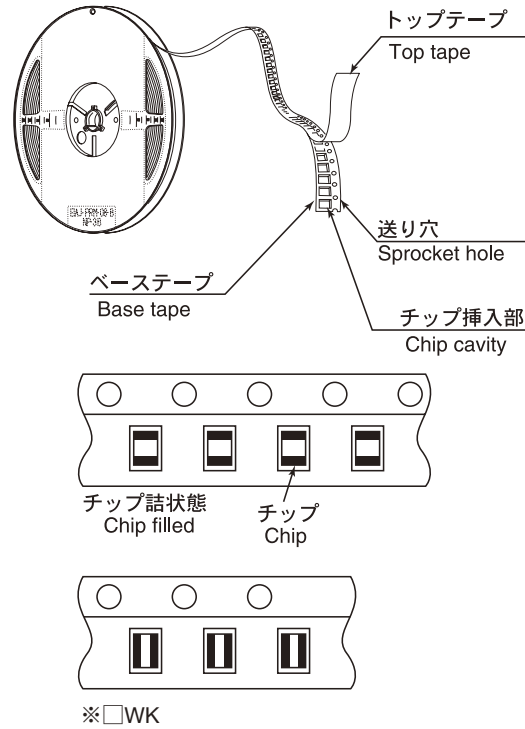
形式(EIA) Type	製品厚み Thickness		標準数量 Standard quantity [pcs]	
	mm (inch)	code	紙テープ paper	エンボステープ Embossed tape
□MK042(01005)	0.2(0.008)	C	15000	—
□MK063(0201)	0.3(0.012)	P	15000	—
□2K096(0302)	0.3(0.012)	P	10000	—
	0.45(0.018)	K		
□WK105(0204)	0.3(0.012)	P	10000	—
□MK105(0402)	0.5(0.020)	V, W	10000	—
□VK105(0402)		W		
□MK107(0603)	0.45(0.018)	K	4000	—
	0.5(0.020)	V	—	4000
□WK107(0306)	0.8(0.031)	A	4000	—
□2K110(0504)	0.5(0.020)	V	4000	—
	0.8(0.031)	A	4000	—
	0.6(0.024)	B	4000	—
□MK212(0805)	0.45(0.018)	K	4000	—
	0.85(0.033)	D	4000	—
	1.25(0.049)	G	—	3000
□4K212(0805)	0.85(0.033)	D	4000	—
	0.85(0.033)	D	4000	—
	0.85(0.033)	D	4000	—
□MK316(1206)	1.15(0.045)	F	—	3000
	1.25(0.049)	G	—	3000
	1.6(0.063)	L	—	2000
□MK325(1210)	0.85(0.033)	D	—	2000
	1.15(0.045)	F		
	1.5(0.059)	H		
	1.9(0.075)	N		
	2.0max(0.079)	Y	—	2000
□MK432(1812)	2.5(0.098)	M	—	500(T), 1000(P)
	2.5(0.098)	M	—	500

②テーピング材質 Taping material
紙テープ
Card board carrier tape

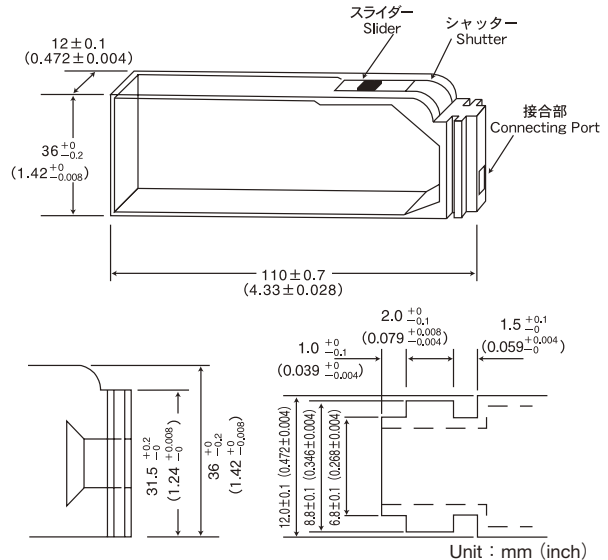
※プレスポケットタイプは、
ボトムテープ無し。



エンボステープ
Embossed Tape



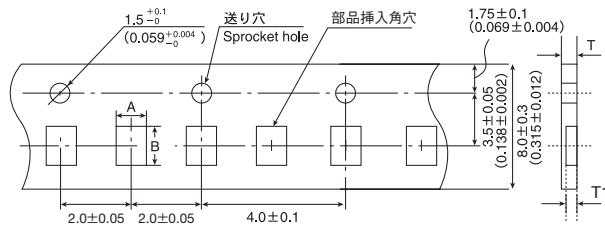
③バルクカセット Bulk Cassette



105, 107, 212形状で個別対応致しますのでお問い合わせ下さい。
Please contact any of our offices for accepting your requirement according to dimensions 0402, 0603, 0805.(inch)

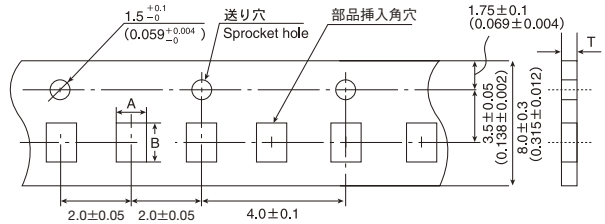
梱包 PACKAGING

③テーピング寸法 Taping dimensions 紙テープ Paper Tape (8mm幅) (0.315inches wide)



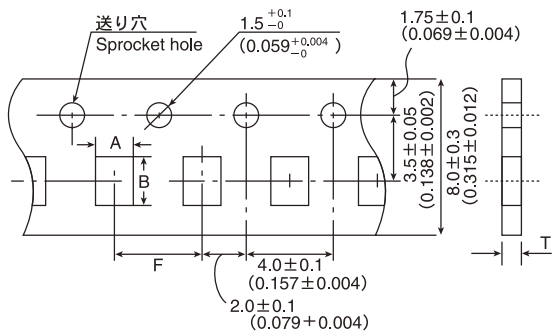
Type (EIA)	チップ挿入部 Chip Cavity		挿入ピッチ Insertion Pitch	テープ厚み Tape Thickness	
	A	B		T	T1
□MK042 (01005)	0.25 (0.010)	0.45 (0.018)	2.0 ± 0.05 (0.079 ± 0.002)	0.36max. (0.014)	0.27max. (0.011)
□MK063 (0201)	0.37 (0.016)	0.67 (0.027)	2.0 ± 0.05 (0.079 ± 0.002)	0.45max. (0.018)	0.42max. (0.017)
□WK105 (0204)	0.65 (0.026)	1.15 (0.045)	2.0 ± 0.05 (0.079 ± 0.002)	0.45max. (0.018max)	0.42max. (0.017max)

Unit : mm (inch)



Type (EIA)	チップ挿入部 Chip Cavity		挿入ピッチ Insertion Pitch	テープ厚み Tape Thickness	
	A	B		T	
□2K096 (0302)	0.72 (0.028)	1.02 (0.040)	2.0 ± 0.05 (0.079 ± 0.002)	0.45max.(0.018max) 0.6max.(0.024max)	
□MK105 (0402)	0.65 (0.026)	1.15 (0.045)	2.0 ± 0.05 (0.079 ± 0.002)	0.8max. (0.031max.)	

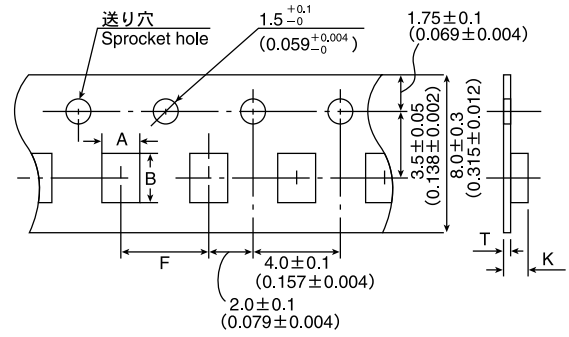
Unit : mm (inch)



Type (EIA)	チップ挿入部 Chip Cavity		挿入ピッチ Insertion Pitch	テープ厚み Tape Thickness	
	A	B		T	
□MK107 (0603)	1.0 (0.039)	1.8 (0.071)	4.0 ± 0.1 (0.157 ± 0.004)	1.1max. (0.043max.)	
□WK107 (0306)					
□2K110 (0504)	1.15 (0.045)	1.55 (0.061)	4.0 ± 0.1 (0.157 ± 0.004)	1.0max. (0.039max.)	
□MK212 (0805)	1.65 (0.065)	2.4 (0.094)	4.0 ± 0.1 (0.157 ± 0.004)	1.1max. (0.043max.)	
□WK212 (0508)					
□4K212 (0805)					
□2K212 (0805)					
□MK316 (1206)	2.0 (0.079)	3.6 (0.142)			

Unit : mm (inch)

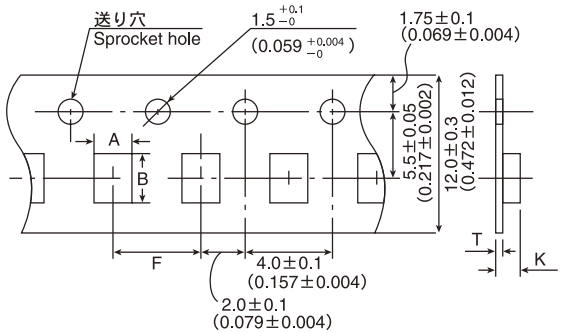
エンボステープ Embossed tape (8mm幅) (0.315inches wide)



Type (EIA)	チップ挿入部 Chip cavity		挿入ピッチ Insertion Pitch	テープ厚み Tape Thickness	
	A	B		K	T
□WK107 (0306)	1.0 (0.039)	1.8 (0.071)	4.0 ± 0.1 (0.157 ± 0.004)	1.3max. (0.051max.)	0.25 ± 0.1 (0.01 ± 0.004)
□MK212 (0805)	1.65 (0.065)	2.4 (0.094)			
□MK316 (1206)	2.0 (0.079)	3.6 (0.142)		3.4max. (0.134max.)	0.6max. (0.024max.)
□MK325 (1210)	2.8 (0.110)	3.6 (0.142)			

Unit : mm (inch)

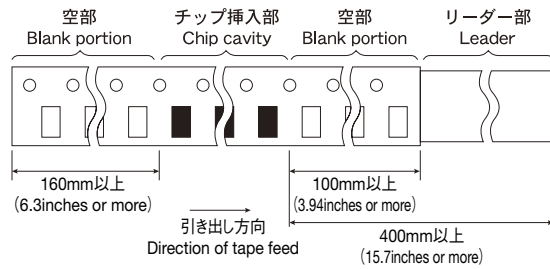
エンボステープ Embossed tape (12mm幅) (0.472inches wide)



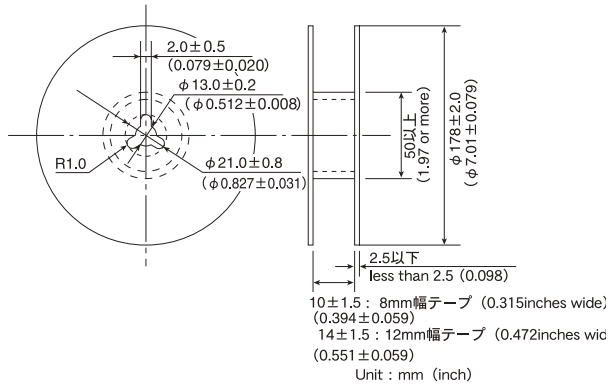
Type (EIA)	チップ挿入部 Chip cavity		挿入ピッチ Insertion Pitch	テープ厚み Tape Thickness	
	A	B		K	T
□MK432 (1812)	3.7 (0.146)	4.9 (0.193)	8.0 ± 0.1 (0.315 ± 0.004)	4.0max. (0.157max.)	0.6max. (0.024max.)

Unit : mm (inch)

④ リーダー部／空部 Leader and Blank portion

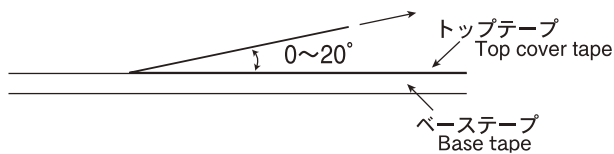


⑤ リール寸法 Reel size

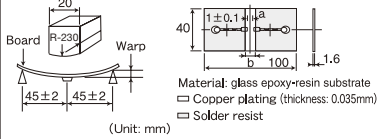
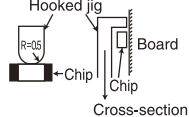


⑥ トップテープ強度 Top Tape Strength

トップテープのはがし力は下図矢印方向にて0.1～0.7Nとなります。
The top tape requires a peel-off force of 0.1～0.7N in the direction of the arrow as illustrated below.



Super Low Distortion Multilayer Ceramic Capacitors (CFCAP)

Item	Specified Value	Test Methods and Remarks
1. Operating Temperature Range	−55 to +125°C	
2. Storage Temperature Range	−55 to +125°C	
3. Rated Voltage	10VDC, 16VDC, 25VDC, 35VDC, 50VDC,	
4. Withstanding Voltage Between terminals	No breakdown or damage	Applied voltage: Rated voltage × 3 Duration: 1 to 5 sec. Charge/discharge current: 50mA max.
5. Insulation Resistance	10000 MΩ or 500MΩ μF, whichever is smaller	Applied voltage: Rated voltage Duration: 60 ± 5 sec. Charge/discharge current: 50mA max.
6. Capacitance (Tolerance)	± 10%	Measuring frequency : 1 k Hz ± 10% Measuring voltage : 1 ± 0.2Vrms Bias application: None
7. Tangent of Loss Angle (tan δ)	0.1% max	Measuring frequency : 1 k Hz ± 10% Measuring voltage : 1 ± 0.2Vrms Bias application: None
8. Resistance to Flexure of Substrate	Appearance: No abnormality Capacitance change: ± 5%	Warp: 1mm Speed: 0.5mm/second Duration: 10 seconds The measurement shall be made with the board in the bent position.  (Unit: mm)
9. Body strength		
10. Adhesion of electrode	No separation or indication of separation of electrode.	Applied force: 5N Duration: 30 ± 5 seconds 
11. Solderability	At least 95% of terminal electrode is covered by new solder.	Solder temp.: 230 ± 5°C Duration: 4 ± 1 seconds
12. Resistance to soldering	Appearance: No abnormality Capacitance change: ± 2.5% max. tan δ : Initial value Insulation resistance: Initial value Withstanding voltage (between terminals): No abnormality	Solder temp.: 270 ± 5°C Duration: 3 ± 0.5 seconds Preheating conditions: 80 to 100°C, 2 to 5 min. or 5 to 10 min. 150 to 200°C, 2 to 5 min. or 5 to 10 min. Recovery: Recovery for the following period under the standard condition after the test: 24 ± 2hrs
13. Thermal shock	Appearance: No abnormality Capacitance change: ± 2.5% max tan δ : Initial value Insulation resistance: Initial value Withstanding voltage (between terminals): No abnormality	Conditions for 1 cycle: Step 1: Minimum operating temperature $+0_{-3}^{\circ}\text{C}$ 30 ± 3 minutes Step 2: Room temperature 2 to 3min. Step 3: Maximum operating temperature -0_{+3}°C 30 ± 3 minutes Step 4: Room temperature 2 to 3min. Number of cycles: 5 times Recovery after the test: 24 ± 2hrs
14. Damp heat (steady state)	Appearance: No abnormality Capacitance change: ± 5% max tan δ : 0.5% max Insulation resistance 50MΩ μF or 1000MΩ whichever is smaller	Temperature: 40 ± 2°C Humidity: 90 to 95% RH Duration: 500 $+24_{-0}$ hrs Recovery: Recovery for the following period under the standard condition after the removal from test chamber: 24 ± 2hrs

Super Low Distortion Multilayer Ceramic Capacitors (CFCAP)

Item	Specified Value	Test Methods and Remarks
15.Loading under Damp Heat	Appearance: No abnormality Capacitance change: $\pm 7.5\%$ max $\tan \delta$: 0.5% max Insulation resistance: 25M Ω μ F or 500M Ω whichever is smaller	According to JIS C 5102 clause 9.9. Temperature: 40 $\pm 2^\circ$ C Humidity: 90 to 95% RH Duration: 500 $^{+24}_{-0}$ hrs Applied voltage: Rated voltage Charge/discharge current: 50mA max Recovery: Recovery for the following period under the standard condition after the removal from test chamber: 24 ± 2 hrs
16.Loading at High Temperature	Appearance: No abnormality Capacitance change: $\pm 3\%$ max $\tan \delta$: 0.35% max Insulation resistance: 50M Ω μ F or 1000M Ω whichever is smaller	According to JIS C 5102 clause 9.9. Temperature: 125 $\pm 3^\circ$ C Duration: 1000 $^{+48}_{-0}$ hrs Applied voltage: Rated voltage x 2 Recovery: Recovery for the following period under the standard condition after the removal from test chamber: 24 ± 2 hrs

Note on standard condition: "standard condition" referred to herein is defined as follows.

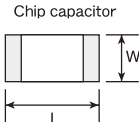
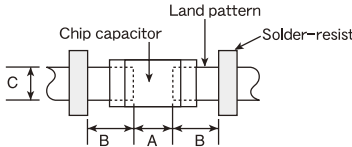
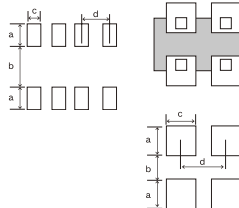
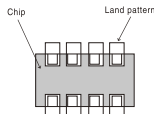
Temperature: 5 to 35 $^\circ$ C, Relative humidity: 45 to 85 %, Air pressure: 86 to 106kpa,

When there are questions concerning measurement results: In order to provide correlation data, the test shall be conducted under condition.

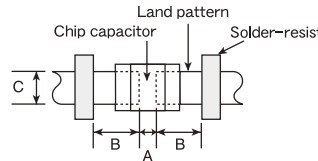
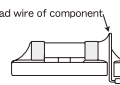
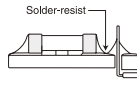
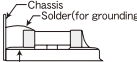
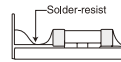
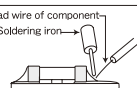
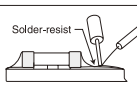


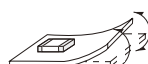
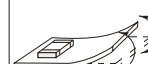
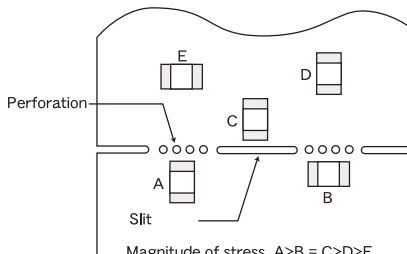
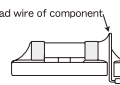
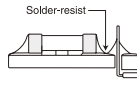
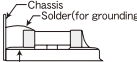
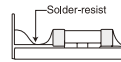
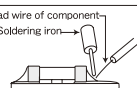
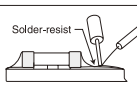


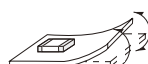
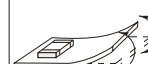
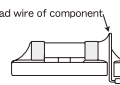
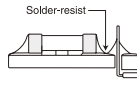
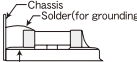
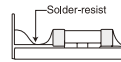
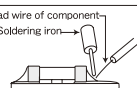
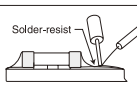


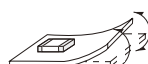
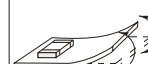
Temperature: 20 $\pm 2^\circ$ C, Relative humidity: 60 to 70 %, Air pressure: 86 to 106kpa

Unless otherwise specified, all the tests are conducted under the "standard condition."

Precautions on the use of Multilayer Ceramic Capacitors

Stages	Precautions	Technical considerations																																																																																																																															
1.Circuit Design	<p>Verification of operating environment, electrical rating and performance</p> <p>1. A malfunction in medical equipment, spacecraft, nuclear reactors, etc. may cause serious harm to human life or have severe social ramifications. As such, any capacitors to be used in such equipment may require higher safety and/or reliability considerations and should be clearly differentiated from components used in general purpose applications.</p> <p>Operating Voltage (Verification of Rated voltage)</p> <p>1. The operating voltage for capacitors must always be lower than their rated values.</p> <p>If an AC voltage is loaded on a DC voltage, the sum of the two peak voltages should be lower than the rated value of the capacitor chosen. For a circuit where both an AC and a pulse voltage may be present, the sum of their peak voltages should also be lower than the capacitor's rated voltage.</p> <p>2. Even if the applied voltage is lower than the rated value, the reliability of capacitors might be reduced if either a high frequency AC voltage or a pulse voltage having rapid rise time is present in the circuit.</p>																																																																																																																																
2.PCB Design	<p>Pattern configurations (Design of Land-patterns)</p> <p>1. When capacitors are mounted on a PCB, the amount of solder used (size of fillet) can directly affect capacitor performance. Therefore, the following items must be carefully considered in the design of solder land patterns:</p> <p>(1) The amount of solder applied can affect the ability of chips to withstand mechanical stresses which may lead to breaking or cracking. Therefore, when designing land-patterns it is necessary to consider the appropriate size and configuration of the solder pads which in turn determines the amount of solder necessary to form the fillets.</p> <p>(2) When more than one part is jointly soldered onto the same land or pad, the pad must be designed so that each component's soldering point is separated by solder-resist.</p>	<p>1.The following diagrams and tables show some examples of recommended patterns to prevent excessive solder amounts. (larger fillets which extend above the component end terminations)</p> <p>Examples of improper pattern designs are also shown.</p> <p>(1) Recommended land dimensions for a typical chip capacitor land patterns for PCBs</p> <div></div> <p>Recommended land dimensions for wave-soldering (unit: mm)</p> <table><tr><th>Type</th><th>107</th><th>212</th><th>316</th><th>325</th></tr><tr><td rowspan="2">Size</td><td>L</td><td>1.6</td><td>2.0</td><td>3.2</td></tr><tr><td>W</td><td>0.8</td><td>1.25</td><td>1.6</td><td>2.5</td></tr><tr><td>A</td><td>0.8~1.0</td><td>1.0~1.4</td><td>1.8~2.5</td><td>1.8~2.5</td></tr><tr><td>B</td><td>0.5~0.8</td><td>0.8~1.5</td><td>0.8~1.7</td><td>0.8~1.7</td></tr><tr><td>C</td><td>0.6~0.8</td><td>0.9~1.2</td><td>1.2~1.6</td><td>1.8~2.5</td></tr></table> <p>Recommended land dimensions for reflow-soldering (unit: mm)</p> <table><tr><th>Type</th><th>042</th><th>063</th><th>105</th><th>107</th><th>212</th><th>316</th><th>325</th><th>432</th></tr><tr><td rowspan="2">Size</td><td>L</td><td>0.4</td><td>0.6</td><td>1.0</td><td>1.6</td><td>2.0</td><td>3.2</td><td>4.5</td></tr><tr><td>W</td><td>0.2</td><td>0.3</td><td>0.5</td><td>0.8</td><td>1.25</td><td>1.6</td><td>2.5</td></tr><tr><td>A</td><td>0.15~0.25</td><td>0.20~0.30</td><td>0.45~0.55</td><td>0.8~1.0</td><td>0.8~1.2</td><td>1.8~2.5</td><td>1.8~2.5</td><td>2.5~3.5</td></tr><tr><td>B</td><td>0.10~0.20</td><td>0.20~0.30</td><td>0.40~0.50</td><td>0.6~0.8</td><td>0.8~1.2</td><td>1.0~1.5</td><td>1.0~1.5</td><td>1.5~1.8</td></tr><tr><td>C</td><td>0.15~0.30</td><td>0.25~0.40</td><td>0.45~0.55</td><td>0.6~0.8</td><td>0.9~1.6</td><td>1.2~2.0</td><td>1.8~3.2</td><td>2.3~3.5</td></tr></table> <p>Excess solder can affect the ability of chips to withstand mechanical stresses. Therefore, please take proper precautions when designing land-patterns.</p> <div></div> <table><tr><th>Type</th><th>212 (4 circuits)</th></tr><tr><td rowspan="2">Size</td><td>L</td><td>2.0</td></tr><tr><td>W</td><td>1.25</td></tr><tr><td>a</td><td>0.5~0.6</td></tr><tr><td>b</td><td>0.5~0.6</td></tr><tr><td>c</td><td>0.2~0.3</td></tr><tr><td>d</td><td>0.5</td></tr></table> <table><tr><th>Type</th><th>212 (2 circuits)</th><th>110 (2 circuits)</th><th>096 (2 circuits)</th></tr><tr><td rowspan="2">Size</td><td>L</td><td>2.0</td><td>1.37</td><td>0.9</td></tr><tr><td>W</td><td>1.25</td><td>1.0</td><td>0.6</td></tr><tr><td>a</td><td>0.5~0.6</td><td>0.35~0.45</td><td>0.25~0.35</td></tr><tr><td>b</td><td>0.5~0.6</td><td>0.55~0.65</td><td>0.15~0.25</td></tr><tr><td>c</td><td>0.5~0.6</td><td>0.3~0.4</td><td>0.15~0.25</td></tr><tr><td>d</td><td>1.0</td><td>0.64</td><td>0.45</td></tr></table>	Type	107	212	316	325	Size	L	1.6	2.0	3.2	W	0.8	1.25	1.6	2.5	A	0.8~1.0	1.0~1.4	1.8~2.5	1.8~2.5	B	0.5~0.8	0.8~1.5	0.8~1.7	0.8~1.7	C	0.6~0.8	0.9~1.2	1.2~1.6	1.8~2.5	Type	042	063	105	107	212	316	325	432	Size	L	0.4	0.6	1.0	1.6	2.0	3.2	4.5	W	0.2	0.3	0.5	0.8	1.25	1.6	2.5	A	0.15~0.25	0.20~0.30	0.45~0.55	0.8~1.0	0.8~1.2	1.8~2.5	1.8~2.5	2.5~3.5	B	0.10~0.20	0.20~0.30	0.40~0.50	0.6~0.8	0.8~1.2	1.0~1.5	1.0~1.5	1.5~1.8	C	0.15~0.30	0.25~0.40	0.45~0.55	0.6~0.8	0.9~1.6	1.2~2.0	1.8~3.2	2.3~3.5	Type	212 (4 circuits)	Size	L	2.0	W	1.25	a	0.5~0.6	b	0.5~0.6	c	0.2~0.3	d	0.5	Type	212 (2 circuits)	110 (2 circuits)	096 (2 circuits)	Size	L	2.0	1.37	0.9	W	1.25	1.0	0.6	a	0.5~0.6	0.35~0.45	0.25~0.35	b	0.5~0.6	0.55~0.65	0.15~0.25	c	0.5~0.6	0.3~0.4	0.15~0.25	d	1.0	0.64	0.45
Type	107	212	316	325																																																																																																																													
Size	L	1.6	2.0	3.2																																																																																																																													
	W	0.8	1.25	1.6	2.5																																																																																																																												
A	0.8~1.0	1.0~1.4	1.8~2.5	1.8~2.5																																																																																																																													
B	0.5~0.8	0.8~1.5	0.8~1.7	0.8~1.7																																																																																																																													
C	0.6~0.8	0.9~1.2	1.2~1.6	1.8~2.5																																																																																																																													
Type	042	063	105	107	212	316	325	432																																																																																																																									
Size	L	0.4	0.6	1.0	1.6	2.0	3.2	4.5																																																																																																																									
	W	0.2	0.3	0.5	0.8	1.25	1.6	2.5																																																																																																																									
A	0.15~0.25	0.20~0.30	0.45~0.55	0.8~1.0	0.8~1.2	1.8~2.5	1.8~2.5	2.5~3.5																																																																																																																									
B	0.10~0.20	0.20~0.30	0.40~0.50	0.6~0.8	0.8~1.2	1.0~1.5	1.0~1.5	1.5~1.8																																																																																																																									
C	0.15~0.30	0.25~0.40	0.45~0.55	0.6~0.8	0.9~1.6	1.2~2.0	1.8~3.2	2.3~3.5																																																																																																																									
Type	212 (4 circuits)																																																																																																																																
Size	L	2.0																																																																																																																															
	W	1.25																																																																																																																															
a	0.5~0.6																																																																																																																																
b	0.5~0.6																																																																																																																																
c	0.2~0.3																																																																																																																																
d	0.5																																																																																																																																
Type	212 (2 circuits)	110 (2 circuits)	096 (2 circuits)																																																																																																																														
Size	L	2.0	1.37	0.9																																																																																																																													
	W	1.25	1.0	0.6																																																																																																																													
a	0.5~0.6	0.35~0.45	0.25~0.35																																																																																																																														
b	0.5~0.6	0.55~0.65	0.15~0.25																																																																																																																														
c	0.5~0.6	0.3~0.4	0.15~0.25																																																																																																																														
d	1.0	0.64	0.45																																																																																																																														

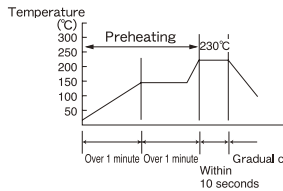
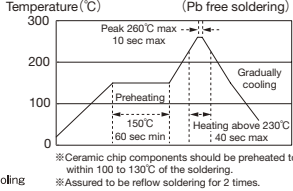
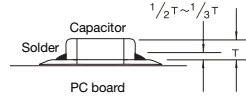
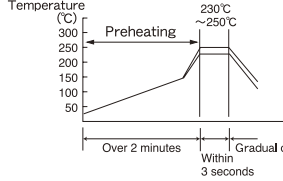
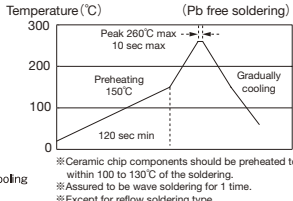
Precautions on the use of Multilayer Ceramic Capacitors

Stages	Precautions	Technical considerations																																														
2.PCB Design	<p>Pattern configurations (Capacitor layout on panelized [breakaway] PC boards)</p> <p>1. After capacitors have been mounted on the boards, chips can be subjected to mechanical stresses in subsequent manufacturing processes (PCB cutting, board inspection, mounting of additional parts, assembly into the chassis, wave soldering the reflow soldered boards etc.) For this reason, planning pattern configurations and the position of SMD capacitors should be carefully performed to minimize stress.</p>	<p>LWDC Recommended land dimensions for reflow-soldering</p> <div></div> <table><tr><th>Type</th><th>105</th><th>107</th><th>212</th></tr><tr><td rowspan="2">SMD</td><td>L</td><td>0.52</td><td>0.8</td><td>1.25</td></tr><tr><td>W</td><td>1.0</td><td>1.6</td><td>2.0</td></tr><tr><td>A</td><td>0.18~0.22</td><td>0.25~0.3</td><td>0.5~0.7</td></tr><tr><td>B</td><td>0.2~0.25</td><td>0.3~0.4</td><td>0.4~0.5</td></tr><tr><td>C</td><td>0.9~1.1</td><td>1.5~1.7</td><td>1.9~2.1</td></tr></table> <p>(unit: mm)</p> <p>(2) Examples of good and bad solder application</p> <table><tr><th>Items</th><th>Not recommended</th><th>Recommended</th></tr><tr><td>Mixed mounting of SMD and leaded components</td><td></td><td></td></tr><tr><td>Component placement close to the chassis</td><td></td><td></td></tr><tr><td>Hand-soldering of leaded components near mounted components</td><td></td><td></td></tr><tr><td>Horizontal component placement</td><td></td><td></td></tr></table> <p>1-1. The following are examples of good and bad capacitor layout; SMD capacitors should be located to minimize any possible mechanical stresses from board warp or deflection.</p> <table><tr><th></th><th>Not recommended</th><th>Recommended</th></tr><tr><td>Deflection of the board</td><td></td><td><p>Position the component at a right angle to the direction of the mechanical stresses that are anticipated.</p></td></tr></table> <p>1-2. To layout the capacitors for the breakaway PC board, it should be noted that the amount of mechanical stresses given will vary depending on capacitor layout. The example below shows recommendations for better design.</p> <div></div> <p>1-3. When breaking PC boards along their perforations, the amount of mechanical stress on the capacitors can vary according to the method used. The following methods are listed in order from least stressful to most stressful: push-back, slit, V-grooving, and perforation. Thus, any ideal SMD capacitor layout must also consider the PCB splitting procedure.</p>	Type	105	107	212	SMD	L	0.52	0.8	1.25	W	1.0	1.6	2.0	A	0.18~0.22	0.25~0.3	0.5~0.7	B	0.2~0.25	0.3~0.4	0.4~0.5	C	0.9~1.1	1.5~1.7	1.9~2.1	Items	Not recommended	Recommended	Mixed mounting of SMD and leaded components			Component placement close to the chassis			Hand-soldering of leaded components near mounted components			Horizontal component placement				Not recommended	Recommended	Deflection of the board		 <p>Position the component at a right angle to the direction of the mechanical stresses that are anticipated.</p>
Type	105	107	212																																													
SMD	L	0.52	0.8	1.25																																												
	W	1.0	1.6	2.0																																												
A	0.18~0.22	0.25~0.3	0.5~0.7																																													
B	0.2~0.25	0.3~0.4	0.4~0.5																																													
C	0.9~1.1	1.5~1.7	1.9~2.1																																													
Items	Not recommended	Recommended																																														
Mixed mounting of SMD and leaded components																																																
Component placement close to the chassis																																																
Hand-soldering of leaded components near mounted components																																																
Horizontal component placement																																																
	Not recommended	Recommended																																														
Deflection of the board		 <p>Position the component at a right angle to the direction of the mechanical stresses that are anticipated.</p>																																														

Precautions on the use of Multilayer Ceramic Capacitors

Stages	Precautions	Technical considerations
3.Considerations for auto-matic placement	<p>Adjustment of mounting machine</p> <p>1. Excessive impact load should not be imposed on the capacitors when mounting onto the PC boards.</p> <p>2. The maintenance and inspection of the mounters should be conducted periodically.</p> 	

Precautions on the use of Multilayer Ceramic Capacitors

Stages	Precautions	Technical considerations
4. Soldering	<p>Selection of Flux</p> <p>1. Since flux may have a significant effect on the performance of capacitors, it is necessary to verify the following conditions prior to use;</p> <p>(1) Flux used should be with less than or equal to 0.1 wt% (equivalent to choline) of halogenated content. Flux having a strong acidity content should not be applied.</p> <p>(2) When soldering capacitors on the board, the amount of flux applied should be controlled at the optimum level.</p> <p>(3) When using water-soluble flux, special care should be taken to properly clean the boards.</p> <p>Soldering</p> <p>Temperature, time, amount of solder, etc. are specified in accordance with the following recommended conditions.</p> <p>Sn-Zn solder paste can affect MLCC reliability performance. Please contact us prior to usage.</p>	<p>1-1. When too much halogenated substance (Chlorine, etc.) content is used to activate the flux, or highly acidic flux is used, an excessive amount of residue after soldering may lead to corrosion of the terminal electrodes or degradation of insulation resistance on the surface of the capacitors.</p> <p>1-2. Flux is used to increase solderability in flow soldering, but if too much is applied, a large amount of flux gas may be emitted and may detrimentally affect solderability. To minimize the amount of flux applied, it is recommended to use a flux-bubbling system.</p> <p>1-3. Since the residue of water-soluble flux is easily dissolved by water content in the air, the residue on the surface of capacitors in high humidity conditions may cause a degradation of insulation resistance and therefore affect the reliability of the components. The cleaning methods and the capability of the machines used should also be considered carefully when selecting water-soluble flux.</p> <p>1-1. Preheating when soldering</p> <p>Heating: Ceramic chip components should be preheated to within 100 to 130°C of the soldering.</p> <p>Cooling: The temperature difference between the components and cleaning process should not be greater than 100°C.</p> <p>Ceramic chip capacitors are susceptible to thermal shock when exposed to rapid or concentrated heating or rapid cooling. Therefore, the soldering process must be conducted with great care so as to prevent malfunction of the components due to excessive thermal shock.</p> <p>Recommended conditions for soldering</p> <p>[Reflow soldering]</p> <p>Temperature profile</p>   <p>Caution</p> <p>1. The ideal condition is to have solder mass (fillet) controlled to 1/2 to 1/3 of the thickness of the capacitor, as shown below:</p>  <p>2. Because excessive dwell times can detrimentally affect solderability, soldering duration should be kept as close to recommended times as possible.</p> <p>[Wave soldering]</p> <p>Temperature profile</p>   <p>Caution</p> <p>1. Make sure the capacitors are preheated sufficiently.</p> <p>2. The temperature difference between the capacitor and melted solder should not be greater than 100 to 130°C</p> <p>3. Cooling after soldering should be as gradual as possible.</p> <p>4. Wave soldering must not be applied to the capacitors designated as for reflow soldering only.</p>

Precautions on the use of Multilayer Ceramic Capacitors

Stages	Precautions	Technical considerations
4. Soldering		<p>[Hand soldering]</p> <p>Temperature profile</p> <p>Temperature (°C) (Pb free soldering)</p> <p>400 300 200 100 0</p> <p>350°C max 3 sec max Gradually cooling 60 sec min</p> <p>(※ $\Delta T \leq 190^\circ\text{C}$ (3216 type max), $\Delta T \leq 130^\circ\text{C}$ (3225 type min)) ※ It is recommended to use 20W soldering iron and the tip is 1φ or less. ※ The soldering iron should not directly touch the components. ※ Assured to be soldering iron for 1 time.</p> <p>Note: The above profiles are the maximum allowable soldering condition, therefore these profiles are not always recommended.</p> <p>Cautions</p> <ol style="list-style-type: none"> 1. Use a 20W soldering iron with a maximum tip diameter of 1.0 mm. 2. The soldering iron should not directly touch the capacitor.
5. Cleaning	<p>Cleaning conditions</p> <ol style="list-style-type: none"> 1. When cleaning the PC board after the capacitors are all mounted, select the appropriate cleaning solution according to the type of flux used and purpose of the cleaning (e.g. to remove soldering flux or other materials from the production process.) 2. Cleaning conditions should be determined after verifying, through a test run, that the cleaning process does not affect the capacitor's characteristics. 	<ol style="list-style-type: none"> 1. The use of inappropriate solutions can cause foreign substances such as flux residue to adhere to the capacitor or deteriorate the capacitor's outer coating, resulting in a degradation of the capacitor's electrical properties (especially insulation resistance). 2. Inappropriate cleaning conditions (insufficient or excessive cleaning) may detrimentally affect the performance of the capacitors. <p>(1) Excessive cleaning</p> <p>In the case of ultrasonic cleaning, too much power output can cause excessive vibration of the PC board which may lead to the cracking of the capacitor or the soldered portion, or decrease the terminal electrodes' strength. Thus the following conditions should be carefully checked;</p> <p>Ultrasonic output Below 20 W/ℓ Ultrasonic frequency Below 40 kHz Ultrasonic washing period 5 min. or less</p>
6. Post cleaning processes	<ol style="list-style-type: none"> 1. With some type of resins a decomposition gas or chemical reaction vapor may remain inside the resin during the hardening period or while left under normal storage conditions resulting in the deterioration of the capacitor's performance. 2. When a resin's hardening temperature is higher than the capacitor's operating temperature, the stresses generated by the excess heat may lead to capacitor damage or destruction. The use of such resins, molding materials etc. is not recommended. 	
7. Handling	<p>Breakaway PC boards (splitting along perforations)</p> <ol style="list-style-type: none"> 1. When splitting the PC board after mounting capacitors and other components, care is required so as not to give any stresses of deflection or twisting to the board. 2. Board separation should not be done manually, but by using the appropriate devices. <p>Mechanical considerations</p> <ol style="list-style-type: none"> 1. Be careful not to subject the capacitors to excessive mechanical shocks. <ol style="list-style-type: none"> (1) If ceramic capacitors are dropped onto the floor or a hard surface, they should not be used. (2) When handling the mounted boards, be careful that the mounted components do not come in contact with or bump against other boards or components. 	

Precautions on the use of Multilayer Ceramic Capacitors

Stages	Precautions	Technical considerations
8.Storage conditions	<p>Storage</p> <p>1. To maintain the solderability of terminal electrodes and to keep the packaging material in good condition, care must be taken to control temperature and humidity in the storage area. Humidity should especially be kept as low as possible.</p> <p>• Recommended conditions</p> <p>Ambient temperature Below 30°C</p> <p>Humidity Below 70% RH</p> <p>The ambient temperature must be kept below 40°C. Even under ideal storage conditions capacitor electrode solderability decreases as time passes, so should be used within 6 months from the time of delivery.</p> <p>• Ceramic chip capacitors should be kept where no chlorine or sulfur exists in the air.</p> <p>2. The capacitance value of high dielectric constant capacitors (type 2 & 3) will gradually decrease with the passage of time, so this should be taken into consideration in the circuit design. If such a capacitance reduction occurs, a heat treatment of 150°C for 1 hour will return the capacitance to its initial level.</p>	<p>1. If the parts are stored in a high temperature and humidity environment, problems such as reduced solderability caused by oxidation of terminal electrodes and deterioration of taping/packaging materials may take place. For this reason, components should be used within 6 months from the time of delivery. If exceeding the above period, please check solderability before using the capacitors.</p>