高周波用円筒セラミックコンデンサ（セラチップ）
TUBULAR TYPE CERAMIC CAPACITORS (FOR HIGH FREQUENCY)

OPERATING TEMP.	−25℃～+85℃

フロー／WAVE　　リフロー／REFLOW

特長　FEATURES

・高周波特性に優れる
　・インピーダンス特性が良好
　・等価直列抵抗（ESR）が小さい
　・高周波でのQ値が高い
・ハンダくわれ・ぬれ性に対する端子電極対応により、ハンダ付けの信頼性に優れる
・耐熱衝撃性に優れる
・寸法安定性に優れ、高い実装性を誇る
・基板曲げ時の耐ベンディング性に優れる
・チューナ特性に優れる

・Excellent high-frequency characteristics:
　* Good impedance characteristics
　* Low equivalent series resistance
　* Large Q-value at high frequencies
・Compatible with 0603 and 0805 component solder pad dimensions
・Highly resistant to heat and impact
・Excellent solderability and ability to withstand PCB bending
・Excellent tuner characteristics

用途　APPLICATIONS

・通信機器用
　携帯電話、PHS、コードレス電話etc
・民生機器用
　チューナ、ビデオ、テレビetc

・Communications Equipment: portable telephones, PHS, other wireless applications, etc.
・Consumer Electronic Appliances: tuners, video equipment, television sets, etc.

形名表記法　ORDERING CODE

1 定格電圧〔VDC〕

U	50

2 分類

CN	円筒コンデンサ

3 形状寸法〔mm〕

033	1.6×1.0
053	2.0×1.25

4 温度特性〔ppm/℃〕

△A	± 5%		
△B	±10%		
C□	0：CK、CJ、CH	□許容差	
R□	−220：RK,RJ,RH		
S□	−330：SK,SJ,SH	H	± 60
T□	−470：TK,TJ,TH	J	±120
U□	−750：UK,UJ	K	±250
SL	+350～−1000	L	±500

△＝スペース

5 公称静電容量〔pF〕

例	
0R5	0.5
010	1
472	4700

R＝小数点

6 容量許容差

	10pF以下	10pF超
C△	± 0.25 pF	
D△	± 0.5 pF	
J△		± 5%
K△		±10%

△＝スペース

7 包装

△△	単品（袋づめ）
−2	テーピング
−7	バルクカセット品

△＝スペース

U C N 0 3 3 C H 1 0 0 D △ − 2
1 2 3 4 5 6 7

1 Rated voltage〔VDC〕

U	50

2 Type

CN	Tubular capacitor

3 External Dimensions〔mm〕

033	1.6×1.0
053	2.0×1.25

4 Temperature characteristics〔ppm/℃〕

△A	± 5%		
△B	±10%		
C□	0：CK、CJ、CH	□=Tolerance	
R□	−220：RK,RJ,RH		
S□	−330：SK,SJ,SH	H	± 60
T□	−470：TK,TJ,TH	J	±120
U□	−750：UK,UJ	K	±250
SL	+350～−1000	L	±500

△＝Blank space

5 Nominal Capacitance〔pF〕

0R5	0.5
010	1
472	4700

*R=decimal point

6 Capacitance Tolerances

	10pF≦	10pF>
C△	± 0.25 pF	
D△	± 0.5 pF	
J△		± 5%
K△		±10%

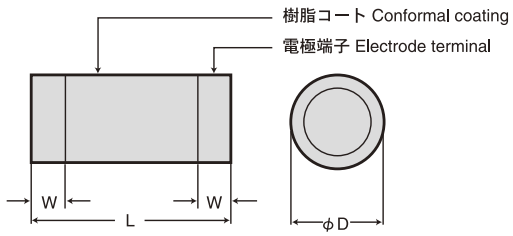
△＝Blank space

7 Packaging

△△	Bulk
−2	Tape & reel
−7	Bulk cassette

△＝Blank space

外形寸法　EXTERNAL DIMENSIONS



Type	L	φD	W
033	$1.6^{+0.2}_{-0.1}$ ($0.063^{+0.008}_{-0.004}$)	1.0±0.1 (0.039±0.004)	$0.3^{+0.20}_{-0.15}$ ($0.012^{+0.008}_{-0.006}$)
053	$2.0^{+0.3}_{-0.1}$ ($0.079^{+0.012}_{-0.004}$)	1.25±0.2 (0.049±0.008)	$0.3^{+0.3}_{-0.1}$ ($0.012^{+0.012}_{-0.004}$)

Unit：mm (inch)

概略バリエーション　AVAILABLE CAPACITANCE RANGE

Class1（Temperature compensating）

WV	50V (UCN)											
Temp.char.	C□		R□		S□		T□		U□		SL	
Type	033	053	033	053	033	053	033	053	033	053	033	053
Cap [pF]	[pF 3digits]											
0.5	0R5											
0.75	R75											
1	010											
1.5	1R5											
2	020											
2.5	2R5											
3	030											
3.5	3R5											
4	040											
4.5	4R5											
5	050											
6	060											
7	070											
8	080											
9	090											
10	100											
11	110											
12	120											
13	130											
15	150											
16	160											
18	180											
20	200											
22	220											
24	240											
27	270											
30	300											
33	330											
36	360											
39	390											
43	430											
47	470											
51	510											
56	560											
68	680											
75	750											
82	820											
91	910											
100	101											
120	121											
150	151											

Class2（High dielectric constant）

WV	50V (UCN)		
Temp.char.	A	B	
Type	053	033	053
Cap [pF]	[pF 3digits]			
68	680			
82	820			
100	101			
120	121			
150	151			
180	181			
220	221			
270	271			
330	331			
390	391			
470	471			
560	561			
680	681			
820	821			
1000	102			
1500	152			
2200	222			
3300	332			
4700	472			
8200	822			
10000	103			
15000	153			
22000	223			

仕様　SPECIFICATIONS

033Type

温度特性 Temp.char.	静電容量変化率 Capacitance Change	静電容量許容差 CapacitanceTolerance	Q or tan δ
CK	0±250ppm/℃	0.5～5pF C（±0.25pF）	Q 400+20・Cmin (C≦27pF)
RK	−220±250		
SK	−330±250		
TK	−470±250		
UK	−750±250		
CJ	0±120ppm/℃	6～10pF D（±0.5pF）	500min (30≦C≦39pF)
RJ	−220±120		
SJ	−330±120		
TJ	−470±120		
UJ	−750±120		
CH	0±60ppm/℃	11～100pF J（±5%）	100min (43≦C≦100pF)
RH	−220±60		
SH	−330±60		
TH	−470±60		
SL	+350～−1000ppm/℃		
B	±10%	K（±10%）	tan δ 2.5%max

053Type

温度特性 Temp.char.	静電容量変化率 Capacitance Change	静電容量許容差 CapacitanceTolerance	Q or tan δ
CK	0±250ppm/℃	0.5～5pF C（±0.25pF）	Q 400+20・Cmin (C≦27pF)
RK	−220±250		
SK	−330±250		
TK	−470±250		
UK	−750±250		
CJ	0±120ppm/℃	6～10pF D（±0.5pF）	1000min (30≦C≦39pF)
RJ	−220±120		
SJ	−330±120		
TJ	−470±120		
UJ	−750±120		500min (43≦C≦68pF)
CH	0±60ppm/℃	11～150pF J（±5%）	
RH	−220±60		
SH	−330±60		100min (75≦C≦150pF)
TH	−470±60		
SL	+350～−1000ppm/℃		
A	± 5%	K（±10%）	tan δ 1.5%max
B	±10%		tan δ 2.5%max

セレクションガイド Selection Guide P.10
アイテム一覧 Part Numbers P.108
特性図 Electrical Characteristics P.110
梱包 Packaging P.111
信頼性 Reliability Data P.112
使用上の注意 Precautions P.122
etc

033Type

Class1

定格電圧 RatedVoltage (DC)	形名 Ordering code		EHS (Environmental Hazardous Substances)	温度特性 Temperature characteristics	公称静電容量 Capacitance〔pF〕	静電容量許容差 Capacitance tolerance	Q or tan δ	絶縁抵抗 Insulation resistance
50V	UCN033 △0R5 □		RoHS	CK,RK SK,TK UK,SL	0.5	±0.25pF	Q≧400＋20・C （C：静電容量） (C:capacitance)	10000MΩmin.
	UCN033 △R75 □		RoHS		0.75			
	UCN033 △010 □		RoHS		1			
	UCN033 △1R5 □		RoHS		1.5			
	UCN033 △020 □		RoHS		2			
	UCN033 △2R5 □		RoHS	CJ,RJ,SJ	2.5			
	UCN033 △030 □		RoHS	TJ,UJ,SL	3			
	UCN033 △3R5 □		RoHS	CH RH SH TH UJ SL	3.5			
	UCN033 △040 □		RoHS		4			
	UCN033 △4R5 □		RoHS		4.5			
	UCN033 △050 □		RoHS		5			
	UCN033 △060 □		RoHS		6	±0.5pF		
	UCN033 △070 □		RoHS		7			
	UCN033 △080 □		RoHS		8			
	UCN033 △090 □		RoHS		9			
	UCN033 △100 □		RoHS		10			
	UCN033 △110 □		RoHS		11	± 5%		
	UCN033 △120 □		RoHS		12			
	UCN033 △130 □		RoHS		13			
	UCN033 △150 □		RoHS	RH,SH,TH,UJ,SL	15			
	UCN033 △160 □		RoHS	SH,TH,UJ,SL	16			
	UCN033 △180 □		RoHS		18			
	UCN033 △200 □		RoHS	TH,UJ,SL	20			
	UCN033 △220 □		RoHS		22			
	UCN033 △240 □		RoHS	UJ,SL	24			
	UCN033 △270 □		RoHS		27			
	UCN033 SL300 □		RoHS	SL	30		Q≧500	
	UCN033 SL330 □		RoHS		33			
	UCN033 SL360 □		RoHS		36			
	UCN033 SL390 □		RoHS		39			
	UCN033 SL430 □		RoHS		43		Q≧100	
	UCN033 SL470 □		RoHS		47			
	UCN033 SL510 □		RoHS		51			
	UCN033 SL560 □		RoHS		56			
	UCN033 SL620 □		RoHS		62			
	UCN033 SL680 □		RoHS		68			
	UCN033 SL750 □		RoHS		75			
	UCN033 SL820 □		RoHS		82			
	UCN033 SL910 □		RoHS		91			
	UCN033 SL101 □		RoHS		100			

形名の△は温度特性記号、□は静電容量許容差記号が入ります。 △ Please specify the temperature characteristics and □ capacitance tolerance code.

Class2

定格電圧 RatedVoltage (DC)	形名 Ordering code		EHS (Environmental Hazardous Substances)	温度特性 Temperature characteristics	公称静電容量 Capacitance〔pF〕	静電容量許容差 Capacitance tolerance	Q or tan δ	絶縁抵抗 Insulation resistance
50V	UCN033 B121 □		RoHS	B	120	±10% ±20%	tan δ ≦2.5	10000MΩmin.
	UCN033 B151 □		RoHS		150			
	UCN033 B181 □		RoHS		180			
	UCN033 B221 □		RoHS		220			
	UCN033 B271 □		RoHS		270			
	UCN033 B331 □		RoHS		330			

形名の△は温度特性記号、□は静電容量許容差記号が入ります。 △ Please specify the temperature characteristics and □ capacitance tolerance code.

053Type

Class1

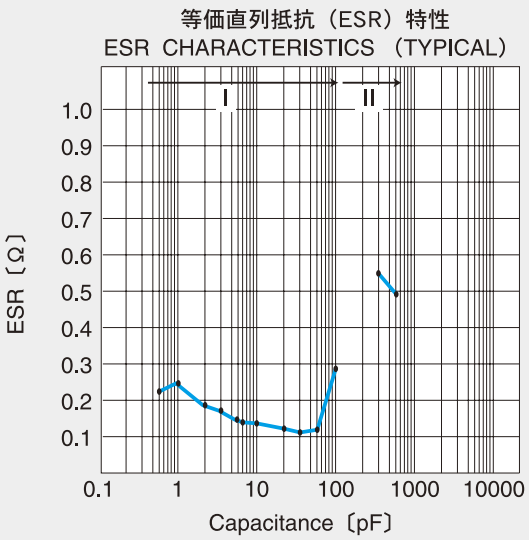
定格電圧 RatedVoltage (DC)	形名 Ordering code		EHS (Environmental Hazardous Substances)	温度特性 Temperature characteristics	公称静電容量 Capacitance〔pF〕	静電容量許容差 Capacitance tolerance	Q or tanδ	絶縁抵抗 Insulation resistance
50V	UCN053 △0R5□		RoHS	CK,RK SK,TK UK,SL	0.5	±0.25pF	Q≧400＋20・C (C：静電容量) (C:capacitance)	10000MΩmin.
	UCN053 △R75□		RoHS		0.75			
	UCN053 △010□		RoHS		1			
	UCN053 △1R5□		RoHS		1.5			
	UCN053 △020□		RoHS		2			
	UCN053 △2R5□		RoHS	CJ,RJ,SJ TJ,UJ,SL	2.5			
	UCN053 △030□		RoHS		3			
	UCN053 △3R5□		RoHS	CH RH SH TH UJ SL	3.5			
	UCN053 △040□		RoHS		4			
	UCN053 △4R5□		RoHS		4.5			
	UCN053 △050□		RoHS		5			
	UCN053 △060□		RoHS		6	±0.5pF		
	UCN053 △070□		RoHS		7			
	UCN053 △080□		RoHS		8			
	UCN053 △090□		RoHS		9			
	UCN053 △100□		RoHS		10			
	UCN053 △110□		RoHS		11	± 5%		
	UCN053 △120□		RoHS		12			
	UCN053 △130□		RoHS		13			
	UCN053 △150□		RoHS		15			
	UCN053 △160□		RoHS		16			
	UCN053 △180□		RoHS		18			
	UCN053 △200□		RoHS		20			
	UCN053 △220□		RoHS	SH,TH,UJ,SL	22			
	UCN053 △240□		RoHS	TH,UJ,SL	24			
	UCN053 △270□		RoHS		27			
	UCN053 △300□		RoHS	UJ,SL	30		Q≧1000	
	UCN053 SL330□		RoHS	SL	33			
	UCN053 SL360□		RoHS		36			
	UCN053 SL390□		RoHS		39			
	UCN053 SL430□		RoHS		43		Q≧500	
	UCN053 SL470□		RoHS		47			
	UCN053 SL510□		RoHS		51			
	UCN053 SL560□		RoHS		56			
	UCN053 SL620□		RoHS		62			
	UCN053 SL680□		RoHS		68			
	UCN053 SL750□		RoHS		75		Q≧100	
	UCN053 SL820□		RoHS		82			
	UCN053 SL910□		RoHS		91			
	UCN053 SL101□		RoHS		100			
	UCN053 SL121□		RoHS		120			
	UCN053 SL151□		RoHS		150			

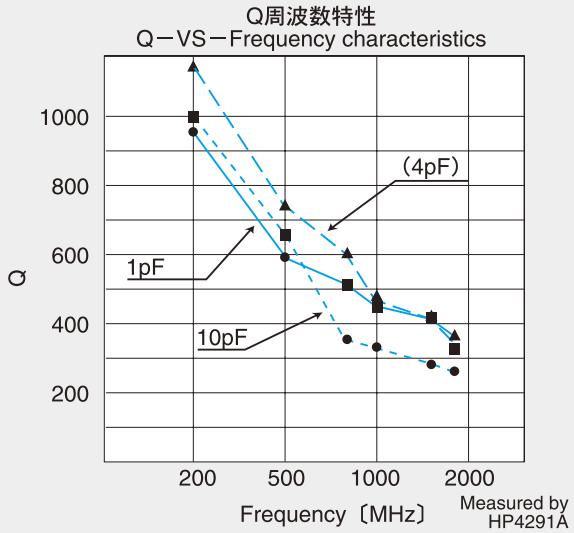
形名の△は温度特性記号、□は静電容量許容差記号が入ります。 △ Please specify the temperature characteristics and □ capacitance tolerance code.

Class2

定格電圧 RatedVoltage (DC)	形名 Ordering code		EHS (Environmental Hazardous Substances)	温度特性 Temperature characteristics	公称静電容量 Capacitance〔pF〕	静電容量許容差 Capacitance tolerance	Q or tanδ	絶縁抵抗 Insulation resistance
50V	UCN053 A680□		RoHS	A	68	±10% ±20%	tanδ ≦1.5%	10000MΩmin.
	UCN053 A820□		RoHS		82			
	UCN053 A101□		RoHS		100			
	UCN053 A121□		RoHS		120			
	UCN053 A151□		RoHS		150			
	UCN053 A181□		RoHS		180			
	UCN053 B221□		RoHS	B	220		tanδ ≦2.5%	
	UCN053 B271□		RoHS		270			
	UCN053 B331□		RoHS		330			
	UCN053 B391□		RoHS		390			
	UCN053 B471□		RoHS		470			

形名の□は静電容量許容差記号が入ります。 □ Please specify the capacitance tolerance code.

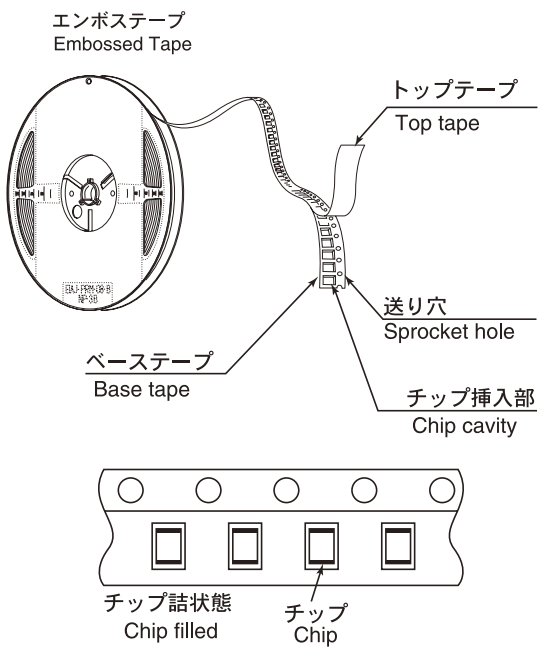

等価直列抵抗（ESR）特性
ESR CHARACTERISTICS （TYPICAL）
ESR〔Ω〕
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
I
II
0.1
1
10
100
1000
10000
Capacitance〔pF〕


Q周波数特性
Q－VS－Frequency characteristics
Q
1000
800
600
400
200
(4pF)
1pF
10pF
200
500
1000
2000
Frequency〔MHz〕
Measured by
HP4291A

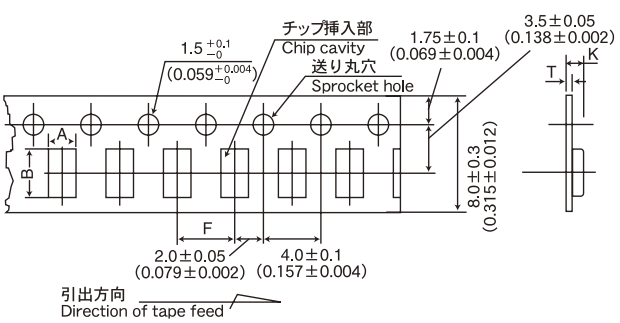
①最小受注単位数　Minimum Quantity

形式 Type	最小受注単位数（PCS） Minimum Quantity		
	袋づめ Bulk	バルクカセット Bulk cassette	テーピング Tape&Reel
033	5000	10000	3000
053	2000	6000	3000

②テーピング材質　Tape Material



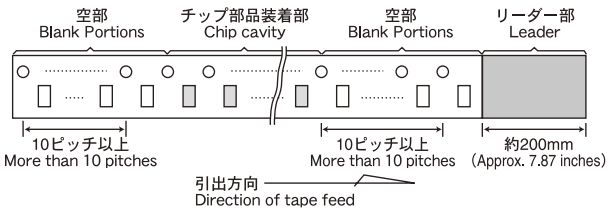
③テーピング寸法　Taping Dimensions



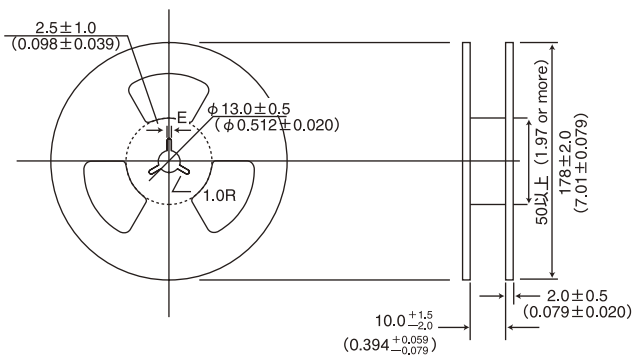
形　式 Type	チップ挿入部 Chip cavity		挿入ピッチ Insertion Pitch	テープ厚み Tape Thickness	
	A	B	F	K	T
033	1.4±0.1 (0.055±0.004)	1.9±0.2 (0.075±0.008)	4.0±0.1 (0.157±0.004)	1.4max. (0.055max)	0.30max. (0.012max)
053	1.45±0.1 (0.057±0.004)	2.35±0.2 (0.093±0.008)	4.0±0.1 (0.157±0.004)	2.0max. (0.079max)	0.30max. (0.012max)

Unit：mm（inch）

④リーダー部／空部　Leader and Blank Portion



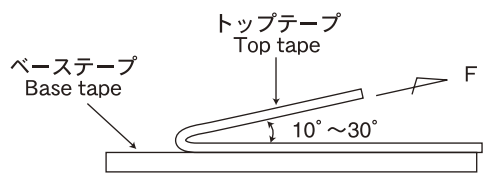
⑤リール寸法　Reel Size



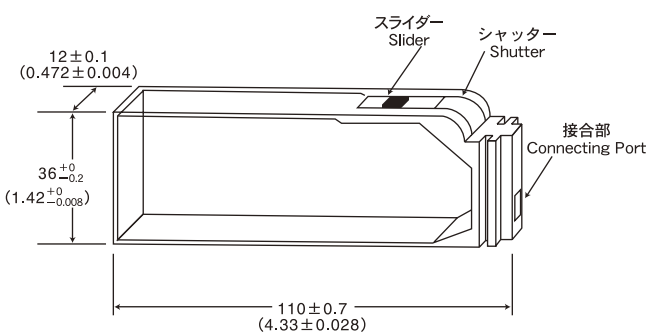
Unit = mm (inch)

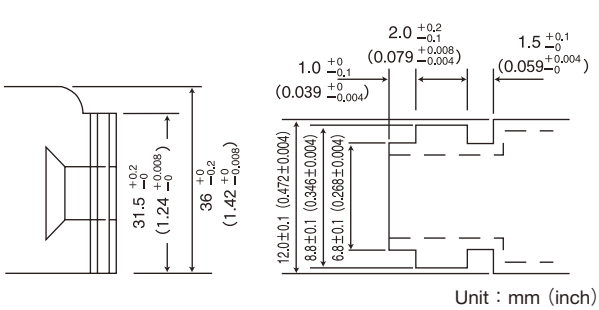
⑥トップテープ強度　Top Tape Strength

トップテープの剥離力は、下図矢印方向にて0.2～0.8Nとなります。
The top tape requires a peel-off force of 0.2 to 0.8N in the direction of the arrow as illutrated below.



⑦バルクカセット　Bulk Cassette





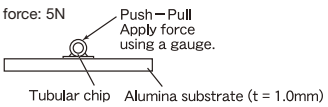
Unit：mm（inch）

TUBULAR TYPE CERAMIC CAPACITORS

Item		Specified Value		Test Methods and Remarks
		Temperature Compensating (Class 1)	High Permittivity (Class 2)	
		Tubular (*CN)	Tubular (*CN)	
1.Operating Temperature Range		−25 to +85℃	−25 to +85℃	
2.Storage Temperature Range		−25 to +85℃	−25 to +85℃	
3.Rated Voltage		50VDC	50VDC	
4.Withstanding Voltage	Between terminals	No abnormality	No abnormality	Tubular (*CN): Applied voltage: Rated voltage×3 (Class 1) Rated voltage×2.5 (Class 2) Duration: 1 to 5 sec. Charge/discharge current: 50mA max. (Class 1,2)
5.Insulation Resistance		10000 MΩ min	10000 MΩ min	Applied voltage: Rated voltage Duration: 60±5 sec.
6. Capacitance		0.5 to 5 pF : ±0.25 pF 6 to 10 pF : ±0.5 pF 11 pF or over : ± 5%	±10% ±20%	Tubular (*CN): Measuring frequency: 1MHz ±20% (Class 1) 1kHz ±20% (Class 2) Measuring voltage: 1 ±0.5Vrms (Class1,2) Bias application: None
7.Q or Tangent of Loss Angle (tan δ)		053: Under 30 pF : Q≧400 + 20C 30 pF or over : Q≧1000 SL, 43 pF or over : Q≧500 033: Under 30 pF : Q≧400 + 20C SL, 30 to 39 pF : Q≧500 SL, 43 to 100 pF : Q≧100 C= Nominal capacitance	A: 1.5% max. B: 2.5% max.	Tubular (*CN): Measuring frequency: 1MHz±20% (Class 1) 1kHz±20% (Class 2) Measuring voltage: 1 ±0.5Vrms (Class1,2) Bias application: None

Withstanding voltage is also referred to as "voltage proof" under IEC specifications.

TUBULAR TYPE CERAMIC CAPACITORS

Item		Specified Value		Test Methods and Remarks
		Temperature Compensating (Class 1)	High Permittivity (Class 2)	
		Tubular (*CN)	Tubular (*CN)	
8.Capacitance Change due to Temperature or Rate of Capacitance Change	(When voltage is not applied)	CK：0±250 CJ：0±120 CH：0±60 RK：−220±250 RJ：−220±120 RH：−220±60 SK：−330±250 SJ：−330±120 SH：−330±60 TK：−470±250 TJ：−470±120 TH：−470±60 UK：−750±250 UJ：−750±120 SL：+350 to −1000 (ppm/℃)	A：±5% B：±10%	According to JIS C 5102 clause 7.12. Temperature compensating: Measurement of capacitance at 20℃ and 85℃ shall be made to calculate temperature characteristic by the following equation. $\frac{(C_{85}-C_{20})}{C_{20}\times\triangle T}\times10^6$ (ppm/℃) $\frac{(C_{-25}-C_{20})}{C_{20}\times\triangle T}\times10^6$ (ppm/℃) High permittivity : Change of maximum capacitance deviation in step 1 to 5 Temperature at step 1: +20℃ Temperature at step 2: -25℃ Temperature at step 3: +20℃ (Reference temperature) Temperature at step 4: +85℃ Temperature at step 5: +20℃
9.Adhesion of Electrode		No damage	No damage	Tubular (*CN): Applied force: 5N 
10.Solderability		At least 80% of terminal electrodes is covered by new solder.	At least 80% of terminal electrodes is covered by new solder.	Tubular (*CN): According to JIS C 5102 clause 8.13. Solder temperature: 230±5℃ Duration: 4±1 sec.

TUBULAR TYPE CERAMIC CAPACITORS

Item	Specified Value		Test Methods and Remarks
	Temperature Compensating (Class 1)	High Permittivity (Class 2)	
	Tubular (*CN)	Tubular (*CN)	
11.Resistance to Soldering Heat	Appearance: No abnormality Capacitance change: Within ±2.5% or ±0.25pF, whichever is larger. Q: Initial value Insulation resistance: Initial value Withstanding voltage (between terminals): No abnormality	Appearance: No abnormality Capacitance change: A: Within ±3% B: Within ±5% tan δ: Initial value Insulation resistance: Initial value Withstanding voltage (between terminals): No abnormality	Tubular (*CN): According to JIS C 5102 clause 8.14. Solder temperature: 270±5℃ Duration: 3±0.5 sec. Preheating conditions: 80 to 120℃, 2 min. 150 to 200℃, 2 min. Recovery: Recovery for the following period under the standard condition after the test. 24±2 hrs (Class 1) 48±4 hrs (Class 2)
12.Thermal Shock	Appearance: No abnormality Capacitance change: Within ±2.5% or ±0.25pF, whichever is larger. Q: Initial value 0.5～27pF Q≧400+20C SL 30～39pF Q≧500 43～100pF Q≧100 Insulation resistance: Initial value Withstanding voltage (between terminals): No abnormality	Appearance: No abnormality Capacitance change: A: Within ±3% B: Within ±5% tan δ: Initial value Insulation resistance: Initial value Withstanding voltage (between terminals): No abnormality	Tubular (*CN): Conditions for 1 cycle: Step 1: Room temperature 10 min. Step 2: -25 $^{+0}_{-3}$℃ 30 min. Step 3: Room temperature 10 min. Step 4: +85 $^{+3}_{-0}$℃ 30 min. Number of cycles: 5 Recovery: Recovery for the following period under the standard condition after the test. 24±2 hrs (Class 1) 48±4 hrs (Class 2)

Withstanding voltage is also referred to as "voltage proof" under IEC specifications.

Thermal Shock is also referred to as "rapid change of temperature" under IEC specifications.

TUBULAR TYPE CERAMIC CAPACITORS

Item	Specified Value		Test Methods and Remarks
	Temperature Compensating (Class 1)	High Permittivity (Class 2)	
	Tubular (*CN)	Tubular (*CN)	
13.Damp Heat (steady state)	Appearance : No abnormality Capacitance change: Within ±5% or ±0.5pF, whichever is larger. Q (033): 0.5 to 9 pF : Q≧200 + 10C 10 to 27 pF : Q≧275 + 2.5C 30 to 39 pF : Q≧250 (SL) 43 to 100 pF: Q≧50 (SL) Q (053): C≧30 pF : Q≧350 10≦C<30 pF : Q≧275 + 2.5C C<10 pF : Q≧200 + 10C 053SL43 pF or over : Q≧250 C= Nominal capacitance Insulation resistance : 1000 MΩ min.	Appearance : No abnormality Capacitance change: A: Within ±7.5% B: Within ±10% tan δ : A : 3% max. B : 5% max. Insulation resistance: 1000 MΩ min.	Tubular (*CN033,053): Temperature: 40±2℃ 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±2 hrs (Class 1) 48±4 hrs (Class 2)
14.Loading under Damp Heat	Appearance: No abnormality Capacitance change: Within ±7.5% or ±0.75pF, whichever is larger. Q (033): 0.5 to 27 pF: Q≧100 + 10C/3 30 to 39 pF : Q≧250 (SL) 43 to 100 pF: Q≧30 (SL) Q (053): C≧30 pF: Q≧200 C<30 pF : Q≧100 + 10C/3 053SL43 pF or over: Q≧150 C= Nominal capacitance Insulation resistance: 500 MΩ min.	Appearance: No abnormality Capacitance change: A : Within ±7.5% B : Within ±10% tan δ : A : 5% max. B : 5% max. Insulation resistance: 500 MΩ min.	According to JIS C 5102 clause 9.9. Tubular (*CN): Temperature: 40±2℃ Humidity: 90 to 95% RH Duration: 500^{+24}_{-0} hrs (*CN033,053) Applied voltage: Rated voltage Charge and discharge current: 50mA max. (Class 1,2) Recovery: Recovery for the following period under the standard condition after the removal from test chamber. 24±2 hrs (Class 1) 48±4 hrs (Class 2)

Withstanding voltage is also referred to as "voltage proof" under IEC specifications.

TUBULAR TYPE CERAMIC CAPACITORS

Item	Specified Value		Test Methods and Remarks
	Temperature Compensating (Class 1)	High Permittivity (Class 2)	
	Tubular (*CN)	Tubular (*CN)	
15. Load Test under High Temp	Appearance: No abnormality Capacitance change: Within ±3% or ±0.3pF, whichever is larger. Q (033): 0.5 to 9 pF : Q≧200 + 10C 10 to 27 pF : Q≧275 + 2.5C 30 to 39 pF : Q≧250 (SL) 43 to 100 pF: Q≧50 (SL) Q (053): C≧30 pF : Q≧350 10≦C＜30 pF: Q≧275 + 2.5C C＜10 pF : Q≧200 + 10C 053SL43 pF or over: Q≧250 C= Nominal capacitance Insulation resistance: 1000MΩ min.	Appearance: No abnormality Capacitance change: A: Within ±7.5% B: Within ±10% tan δ: A : 3% max. B : 4% max. Insulation resistance: 1000 MΩ min.	According to JIS C 5102 clause 9.10. Tubular (*CN): Temperature: 85±2℃ Duration: 1000^{+48}_{0} hrs (*CN033,053) Applied voltage: Rated voltage×2 (Class 1,2) Charge and discharge current: 50mA max. (Class 1,2) Recovery: Recovery for the following period under the standard condition after the removal from test chamber. 24±2 hrs (Class 1) 48±4 hrs (Class 2)

Note 1:

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

5 to 35℃ of temperature, 45 to 85% relative humidity and 86 to 106kPa of air pressure.

When there are questions concerning measurement results:

In order to provide correlation data, the test shall be conducted under condition of 20±2℃ of temperature, 60 to 70% relative humidity and 86 to 106kPa of air pressure.

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

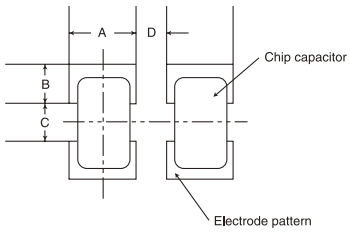
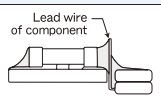
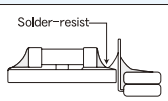
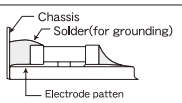
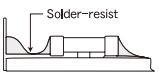
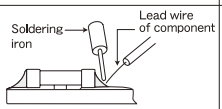
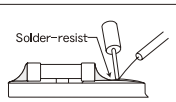
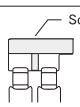
*Please specify the rated voltage code.

Withstanding voltage is also referred to as "voltage proof" under IEC specifications.

Precautions on the use of Tubular Type

Stages	Precautions	Technical considerations
1. Circuit Design	◆Verification of operating environment, electrical rating and performance 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. ◆Operating Voltage (Verification of Rated voltage) 1. The operating voltage for capacitors must always be lower than their rated values. 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. 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. ◆Operating Current (Limitation in the current) 1. General purpose capacitors are usually designed in a DC environment. Therefore, if capacitors are used in the circuits where AC or Pulse voltages are loaded, a large current running through the capacitor may result in a short-circuit due to self-generated heat. ◆*Operating Environment precautions 1. Capacitors should not be used in the following environments: (1) Environmental conditions to avoid a. exposure to water or salt water. b. exposure to moisture or condensation. c. exposure to corrosive gases (such as hydrogen sulfide, sulfurous acid, chlorine, and ammonia)	

Precautions on the use of Tubular Type

Stages	Precautions	Technical considerations
2. PCB Design	◆Pattern configurations (Design of Land-patterns) 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: (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. (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.	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). Examples of improper pattern designs are also shown. (1) Recommended land dimensions for a typical chip capacitor Electrode patterns for PCBs  Recommended land patterns for wave soldering Unit: (mm) Type / Location: 053 / 033 A: 1.2 / 1.0 B: 1.2 / 1.0 C: 1.1 / 0.8~1.0 D: 1.0 / 0.8 Recommended land patterns for reflow soldering Unit: (mm) Type / Location: 053 / 033 A: 1.2 / 0.9 B: 0.8 / 0.6 C: 1.0 / 0.9 D: 0.5 or more / 0.5 or more Notes; 1. When designing land patterns, rounded corners on the solder pad might result in better solderability. 2. The size of the solder pad can vary depending on the part location and amount of solder. Therefore, please carefully consider location and solder amounts when designing solder pads. • Examples of good and bad solder application Item / Not recommended / Lead wire of component Mixe-mounting of SMD and leaded components   Component placement close to the chassis   Hand-soldering of leaded components near mounted components   Horizontal component placement  

Precautions on the use of Tubular Type

Stages	Precautions	Technical considerations
3. Considerations for automatic placement	◆Adjustment of mounting machine-1 1. Excessive impact load should not be imposed on the capacitors when mounting onto the PC boards.	1. If the lower limit of the pick-up nozzle is low, too much force may be imposed on the capacitors, causing damage. To avoid this, the following points should be considered before lowering the pick-up nozzle: (1) The lower limit of the pick-up nozzle should be adjusted to the surface level of the PC board after correcting for deflection of the board. (2) The pick-up pressure should be adjusted between 1 and 3 N or less static loads. (3) In case of double-sided mounting, a supporting pin should be used under the PC board to minimize the effect of pick-up nozzle impact on the board. (Fig. 1) (4) The following figures show typical results when the bottom dead center of the pick-up nozzle is too low. (Figs 2,3)
	◆Selection of Adhesives 1. Mounting capacitors with adhesives in preliminary assembly, before the soldering stage, may lead to degraded capacitor characteristics unless the following factors are appropriately checked; the size of land patterns, type of adhesive, amount applied, hardening temperature and hardening period. Therefore, it is imperative to consult the manufacturer of the adhesives on proper usage and amounts of adhesive to use.	1. Some adhesives may cause reduced insulation resistance. The difference between the shrinkage percentage of the adhesive and that of the capacitors may result in stresses on the capacitors and lead to cracking. Moreover, too little or too much adhesive applied to the board may adversely effect component placement, so the following precautions shou-ld be noted in the application of adhesives. (1) Required adhesive characteristics a. The adhesive should be strong enough to hold parts on the board during the mounting & solder process. b. The adhesive should have sufficient strength at high temperatures. c. The adhesive should have good coating and thickness consistency. d. The adhesive should be used during its prescribed shelf life. e. The adhesive should harden rapidly f. The adhesive must not be contaminated. g. The adhesive should have excellent insulation characteristics. h. The adhesive should not be toxic and have no emission of toxic gasses. (2) The recommended amount of adhesives is as follows; When using adhesives to mount capacitors on a PCB, inappropriate amounts of adhesive on the board may adversely affect component placement. Too little adhesive may cause the capacitors to fall off the board during the solder process. Too much adhesive may cause defective soldering due excessive flow of adhesive on to the land or solder pad. [Recommended conditions]

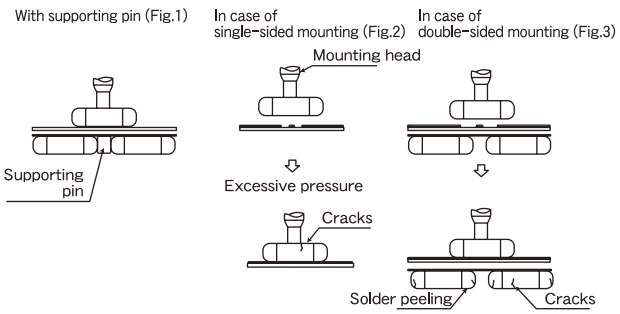
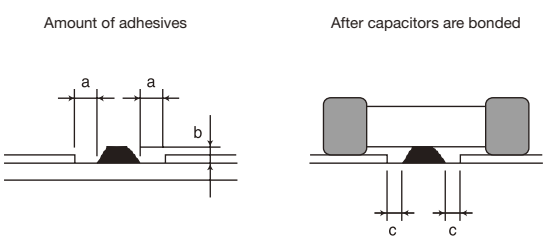
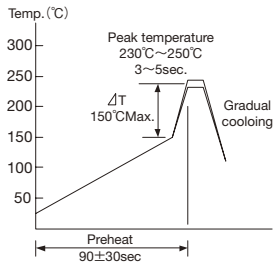
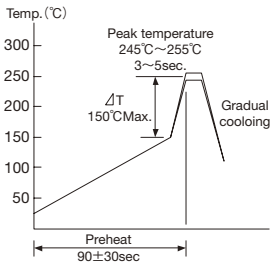
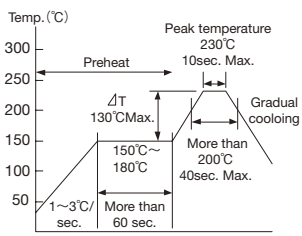
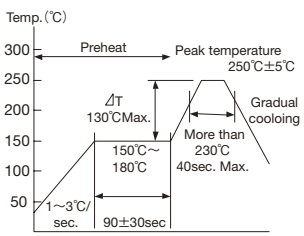
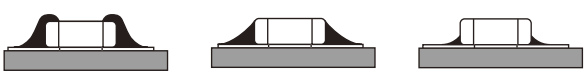


Figure	2125 case sizes as examples
a	0.3mm min
b	200～300μm (when two points applied)
c	Adhesives should not contact the pad



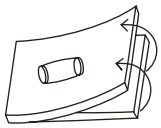
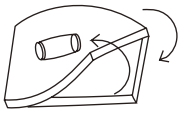
Precautions on the use of Tubular Type

Stages	Precautions	Technical considerations
4. Soldering	◆Selection of Flux 1. When soldering capacitors on the board, flux should be applied thinly and evenly. 2. Flux used should be with less than or equal to 0.1 wt% (equivalent to Chroline) of halogenated content. Flux having a strong acidity content should not be applied. 3. When using water-soluble flux, special care should be taken to properly clean the boards. ◆Wave Soldering Temperature, time, amount of solder, etc. are specified in accordance with the following recommended conditions. ◆*Reflow Soldering 1Temperature, time, amount of solder, etc. are specified in accordance with the following recommended conditions. 2. The time between solder paste application and capacitor placement should be as short as possible 3. The selection of appropriate solder materials is required.	1. Flux is used to increase solderability in wave 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. 2. With too much halogenated substance (Chlorine, etc.) content is used to activate the flux, 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. 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. 〔Recommended conditions for soldering〕 〔62Sn Solder Flow〕 Temperature Profile  〔PbFree Solder Flow〕 Temperature Profile  1-1. If capacitors are used beyond the range of the following recommended conditions, heat stresses may cause cracks inside the capacitors, and consequently degrade the reliability of the capacitors. Above all, rapid heating/cooling or partial heating tend to be the major causes of cracks. 〔Recommended conditions for soldering〕 〔62Sn Solder Reflow〕 Temperature Profile  〔PbFree Solder Reflow〕 Temperature Profile  1-2. Excessively long soldering times or high soldering temperatures may cause separation of the terminations from chip bodies, or leakage of capacity. 2. If solder paste is left exposed for a long period of time before capacitors are placed the surface dries out and a membrane film will form on the board surface causing a considerable reduction in solderability. 3. During the reflow process, when too much solder paste is applied excess solder mass can produce mechanical and heat stresses on the capacitors and may consequently result in the breakage or cracking of the components. On the other hand, too little solder paste will weaken the adhesion characteristics and may consequently cause separation of components and degrade the circuit reliability. (a) Too much solder (b) Appropriate amount of solder (c) Too little solder  4. With inappropriate solder materials, solder balls may form. These solder balls must be thoroughly removed, since the balls would cause a reduction in capacitor electrical characteristics or degradation of reliability.

Precautions on the use of Tubular Type

<table>
<tr><th>Stages</th><th>Precautions</th><th>Technical considerations</th></tr>
<tr><td>4. Soldering</td><td>◆Hand soldering with iron
1 Temperature, time, amount of solder, etc. are specified in accordance with the following recommended conditions.
2. When touch-up work is required for repair, preheating must be conducted with appropriate temperature control.
3. Special attention should be paid to the diameter of the soldering iron tip and wattage when additional part mounting or repair work takes place.
4. The solder iron should only directly touch the external electrodes.
5. Ammount of solder should be applied at the appropriate level.</td><td>1. If capacitors are used beyond the range of the following recommended conditions, heat stresses may cause cracks inside the capacitors, and consequently degrade the reliability of the capacitors. Above all, rapid heating/cooling or partial heating tend to be the major causes of cracks.
2. Recommended conditions for solder iron touch-up
[Example of soldering iron]
<table><tr><th>Soldering iron's temperature [℃]</th><th>Watt [W]</th><th>Iron tip dia. [mm]</th></tr><tr><td>Below 270</td><td>Below 20</td><td>Below 3.0 in diameter</td></tr></table>Temperature range between iron tip and preheating temperature. 130℃ or less
Duration 3 seconds or less
Number of times 3 times or less
3. Selection of soldering irons
Temperature at the tip of the soldering iron varies depending on the type of soldering iron. If the temperature at the tip of the soldering iron is too high thermal stresses may cause cracks in the component.
4. If the soldering iron tip touches the ceramic material directly, the component may develop heat stresses, and cracks.
5. During the solder iron process, when too much solder is used it can result in mechanical and heat stresses on the capacitors and may consequently result in the breakage or cracking of the components. On the other hand, too little solder will weaken the adhesion characteristics and may consequently cause separation of components and degrade the circuit reliability.
(Appropriate application of soldering iron) (Appropriate amount of solder)
  </td></tr>
<tr><td>5. Cleaning</td><td>◆Board cleaning
1. When using ultrasonic cleaning on PC boards with capacitors, avoid subjecting the PCB directly to vibration. Special attention should be paid to output frequency and duration of ultrasonic cleaning.
2. Cleaning conditions should be determined after verifying, through a test run, that the cleaning process does not affect the capacitor's characteristics.</td><td>1. 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;
Ultrasonic output Below 20 W/ℓ
Ultrasonic frequency Below 40 kHz
Ultrasonic clearning period 5 min. or less
2. In case of insufficient cleaning
(1) The halogenated content in the flux residue may lead to corrosion of the terminal electrodes or degradation of insulation resistance.
(2) When using water-soluble flux, it may degrade insulation resistance characteristics of the capacitor surface.</td></tr>
<tr><td>6. Post cleaning processes</td><td>◆Application of resin molding, etc. to the PCB and components.
1. Please contact your local Taiyo Yuden sales office before performing resin coating or molding on mounted capacitors.</td><td>1-1. 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.
1-2. 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.
1-3. Some types of coating or molding material may degrade humidity resistance. Therefore, it is highly recommended you contact the material manufacturer before using.</td></tr>
</table>

Precautions on the use of Tubular Type

Stages	Precautions	Technical considerations
7. Handling	◆Breakaway PC boards (splitting along perforations) 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. ◆Mechanical considerations 1. Be careful not to subject the capacitors to excessive mechanical shocks. 2. If ceramic capacitors are dropped on the floor or a hard surface they should not be used.	1. If the board is subjected to the stresses of deflection and twisting (as shown below) when splitting or breaking away the boards, it may cause cracks in the board. Deflection  Twisting  1. Because the capacitor is made of ceramic, mechanical shocks applied to the board may damage or crack the capacitors. 2.Ceramic capacitors which are dropped onto the floor or a hard surface may develop defects and have a higher risk of failure over time.
8. Storage conditions	◆Storage 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. Recommended conditions: Ambient temperature Below 40 deg ℃ Humidity Below 70% RH 2. Capacitors should not be kept in an environment filled with decomposition gases such as (sulfurous hydrogen, sulfurous acid, chlorine, ammonia, etc.) 3. Capacitors should not be kept in a location where they may be exposed to moisture, condensation or direct sunlight.	1. Under high temperature/high humidity conditions, the decrease in solderability due to the oxidation of terminal electrodes and deterioration of taping and packaging characteristics may be accelerated, so the products should be used within 6 months after delivery. After the above period, the solderability should be checked before using the capacitors. 2. Harmful gasses in the ambient air may also degrade the solderability of the terminal electrodes resulting in a deterioration of the capacitor's reliability. 3. Direct sunlight, the photochemical effect of resin coatings, or a rapid change in the humidity may cause condensation on or around the terminals. So special care must be taken to prevent reduced solderability or performance of the capacitors.