Holy Stone	Product Name	Ref.	ACC-X-001-007-2402
	ACC1206X475K050TX	Rev.	007

Meets The Requirements of AEC-Q200

Revision History

Referance	Revision	Date	Name	Change Description
ACC-X-001	001	2013/2/18	Meiling	Internal Release
ACC-X-001	002	2013/11/26	Meiling	The shelf life (6 months change to 12 months)
ACC-X-001	003	2014/7/9	Meiling	we recommend to keep the storage humidity (humidity of 20 to 75% RH change to 20 to 70% RH)
ACC-X-001	004	2015/7/21	Stanley	Add Revision History
ACC-X-001	005	2022/2/23	Stanley	8.2 Chip Capacitors Tape Packing (Empty Section 40 & 20 .mm change to 160 & 200 .mm)
ACC-X-001	006	2022/8/4	Stanley	4.2 Reflow Soldering The cycles of soldering : Twice (max.) change to The cycles of soldering :Three times (max.)
ACC-X-001	007	2024/02/01	Meiling	4.2 Reflow Soldering proflie

Holy Stone Enterprise Co., Ltd.

Approved	Checked	Person in charge
May Lin	Stanley Wang	Meiling Liao

Customer： Valeo SH-奇瑞 / No：A240674

1. Scope

This specification is applied to Multilayer Ceramic Chip Capacitor (MLCC) for use in electric equipment.

These part meet with **AEC-Q200** requirements.

The MLCC support for Lead-Free wave and reflow soldering, and electrical characteristic and reliability are same as before. **(This product is compliant with the RoHS.)**

2. Parts Number Code

ACC	1206	X	475	K	050	T	X
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

(1)Product

Product Code	
ACC	**Automotive Grade Capacitors**

(2)Chip Size

Code	Length×Width	unit : mm(inch)
1206	**3.20× 1.60**	**(.126× .063)**

(3)Temperature Characteristics

Code	Temperature Characteristic	Temperature Range	Temperature Coefficient
X	**X7R**	**-55℃~+125℃**	**± 15%**

(4)Capacitance

unit :pico farads(pF)

Code	Nominal Capacitance (pF)
475	**4,700,000.0**

※. *If there is a decimal point, it shall be expressed by an English capital letter R*

(5)Capacitance Tolerance

Code	Tolerance	Nominal Capacitance
K	**± 10.0 %**	**More Than 10 pF**

(6)Rated Voltage

Code	Rated Voltage (Vdc)
050	**50**

(7)Packaging

Code	Type
T	**Tape & Reel**

(8)Special Requirement Code

Code	Type
X	**Polymer Termination**

3. Nominal Capacitance and Tolerance

3.1 Standard Combination of Nominal Capacitance and Tolerance

Class	Characteristic	Tolerance	Nominal Capacitance
Class Ⅱ	**X7R**	**K (± 10.0 %)**	**E-12 series**

3.2 E series(standard Number)

Standard No.	Application Capacitance											
E- 3	1.0				2.2				4.7			
E- 6	1.0		1.5		2.2		3.3		4.7		6.8	
E-12	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2
E-24	1.0	1.2	1.5	1.8	2.2	2.7	3.3	3.9	4.7	5.6	6.8	8.2
	1.1	1.3	1.6	2.0	2.4	3.0	3.6	4.3	5.1	6.2	7.5	9.1

4. Operation Temperature Range

Class	Characteristic	Temperature Range	Reference Temp.
Ⅱ	**X7R**	**-55℃ ~ +125℃**	**25℃**

5. Storage Condition

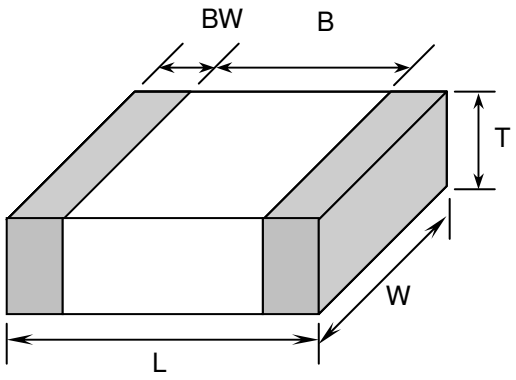
Storage Temperature：5 to 40℃

Relative Humidity：20 to 70 %

Storage Time：12 months max.

6. Dimensions

6.1 Configuration and Dimension：

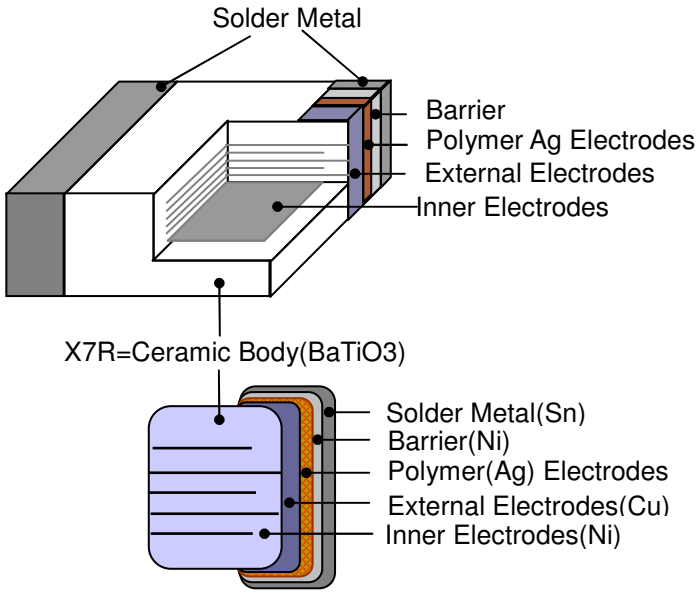


Unit:mm

TYPE	L	W	T	B (min)	BW (min)
1206	3.20± 0.40	1.60± 0.30	1.60± 0.30	1.50	0.30

6.2 Termination Type：

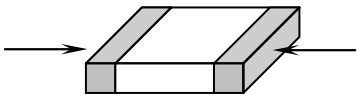
Polymer Termination：



7. Performance

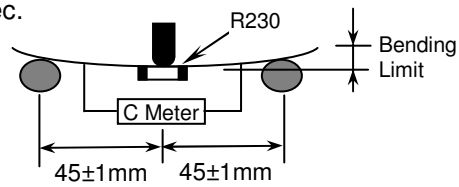
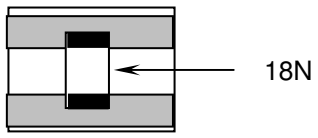
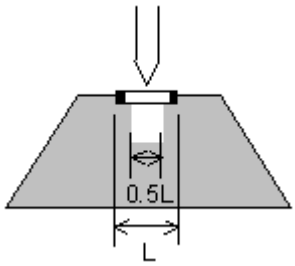
No.	Item		Specification	AEC-Q200 Test Condition
1	Pre- and Post-Stress Electrical Test		—	—
2	High Temperature Exposure (Storage)	Appear-ance	No mechanical damage shall occur	Test Temperature :max. rated temperature. Test Time :1000+12/-0 hours Measure at room temperature after cooling for 24±2 hours.
		Capacit-ance	Char. / Cap. Change X7R / ≦ ± 10%	
		D.F.	Class Ⅱ (X7R): Shell meet the value in table 1.	
		Insulation Resistance	To satisfy the specified initial value	
3	Temperature Cycle	Appear-ance	No mechanical damage shall occur	Class Ⅱ capacitor shall be set for 24± 2 hours at room temperature after one hour heat treatment at 150 +0/-10 ℃ before initial measure. Capacitor shall be subjected to 1000 cycles of the temperature cycle as following: Step / Temp.(℃) / Time(min) 1 / -55+0/-3 / 15±3 2 / Room Temp. / 1 3 / 125+3/-0 / 15±3 4 / Room Temp. / 1 Measure at room temperature after cooling for 24±2 hours. Solder the capacitor on P.C. board shown in Fig 2. before testing.
		Capacit-ance	Char. / Cap. Change X7R / ≦ ± 10%	
		D.F.	Class Ⅱ (X7R): Shell meet the value in table 1.	
		Insulation Resistance	To satisfy the specified initial value	
4	Destructive Physical Analysis		No defects or abnormalities	Per EIA-469
5	Biased Humidity	Appear-ance	No mechanical damage shall occur	Class Ⅱ capacitors applied DC voltage of the rated voltage is applied for one hour at maximum operation temperature ± 3℃then shall be set for 24± 2 hours at room temperature and the initial measurement shall be conducted. Applied Voltage : Rated voltage(500Vdc max.) and DC 1.3 to 1.5V. Add 100Kohm resistor. Temperature : 85±3℃ Relative Humidity : 80 to 85 %RH Test Time : 1000 +12/-0 hours Current Applied : 50 mA Max. Measure at room temperature after cooling for 24±2 hours.
		Capacit-ance	Char. / Cap. Change X7R / ≦ ± 12.5%	
		D.F.	Class Ⅱ (X7R): Shell meet the value in table 1.	
		Insulation Resistance	500MΩ or 25/CΩ Product Whichever Is Smaller	

No.	Item		Specification	AEC-Q200 Test Condition
6	Operational Life	Appear-ance	No mechanical damage shall occur	Class Ⅱ capacitors applied DC voltage (following table) is applied for one hour at maximum operation temperature ±3℃ then shall be set for 24±2 hours at room temperature and the initial measurement shall be conducted. Applied Voltage : 100%Rated Voltage Test Temperature :125±3℃ Test Time : 1000 +12/-0 hours Current Applied : 50 mA Max. Measure at room temperature after cooling for 24±2 hours.
		Capacit-ance	Capacitance Change	
			Char. / Cap. Change	
			X7R / ≦ ± 15.0%	
		D.F.	Class Ⅱ (X7R): Shell meet the value in table 1.	
		Insulation Resistance	1,000MΩ or 50/CΩ Product Whichever Is Smaller	
7	External Visual		No defects or abnormalities	Visual inspection
8	Physical Dimension		Within The Specified dimensions	Using calipers
9	Resistance to Solvents	Appear-ance	No marking defects	It is applicable to marked and/or coated components. Per MIL-STD-202 Method 215. Solvent 1: 1 part (by volume) of isopropyl alcohol 3 parts (by volume) of mineral spirits, or three parts (by volume) of a mixture of 80% (by volume) of kerosene and 20%(by volume) ethylbenzene. Solvent 4: 42 parts (by volume) of water 1 part (by volume) of propylene glycol monomethyl ether 1 part (by volume) of monoethanolamine
		Capacit-ance	Within The Specified Tolerance	
		D.F.	Class Ⅱ (X7R): Shell meet the value in table 1.	
		Insulation Resistance	To satisfy the specified initial value	
10	Mechanical Shock	Appear-ance	No mechanical damage shall occur	Solder the capacitor on P.C. Board shown in Fig 2. before testing. Three shocks in each direction should be applied along 3 mutually perpendicular axes of the test specimen (18 shocks). The specified test pulse should be Half-sine and should have a duration: 0.5ms, peak value: 1500g and velocity change: 15.4 ft/sec.
		Capacit-ance	Within The Specified Tolerance	
		D.F.	Class Ⅱ (X7R): Shell meet the value in table 1.	
		Insulation Resistance	To satisfy the specified initial value	

No.	Item		Specification	AEC-Q200 Test Condition
11	Vibration	Appear-ance	No mechanical damage shall occur	Solder the capacitor on P.C. Board shown in Fig 2. before testing. Perform 12 cycles in each of the 3 mutually perpendicular axes of the capacitor (in total 36 cycles). Subject the capacitor to a simple harmonic motion variing the frequency logarithmically between 10 and 2000 Hz and return to 10 Hz (duration approx. 20 min) with an amplitude of 1.5 mm
		Capacit-ance	Within The Specified Tolerance	
		D.F.	Class Ⅱ (X7R): Shell meet the value in table 1.	
		Insulation Resistance	To satisfy the specified initial value	
12	Resistance to Soldering Heat	Appear-ance	No mechanical damage shall occur	Class Ⅱ capacitor shall be set for 24±2 hours at room temperature after one hour heat treatment at 150 +0/-10℃ before initial measure. Preheat : At 150± 10℃ For 60~120sec Dip : Solder Temperature of 260± 5℃ Dip Time : 10 ± 1sec. Measure at room temperature after cooling for 24±2 hours.
		Capacit-ance	Char. / Cap. Change X7R / Within ± 10%	
		D.F.	Class Ⅱ (X7R): Shell meet the value in table 1.	
		Insulation Resistance	To satisfy the specified initial value	
13	ESD	Appear-ance	No mechanical damage shall occur	Per AEC-Q200-002
		Capacit-ance	Within The Specified Tolerance	
		D.F.	Class Ⅱ (X7R): Shell meet the value in table 1.	
		Insulation Resistance	To satisfy the specified initial value	
14	Solderability		More than 95% of the terminal surface is to be soldered newly, so metal part does not come out or dissolve . 	(a)Preheat at 155℃ for 4 hours,immerse the capacitor in flux. Immerse in solder bath for 5+0/-0.5 sec. at 245±5℃. (b)Should be placed into steam aging for 8 hours 15 minutes.After preheating, immerse the capacitor in flux. Immerse in solder bath for5+0/-0.5 sec. at 245±5℃ (c) Should be placed into steam aging for 8 hours 15 minutes.After preheating, immerse the capacitor in flux. Immerse in solder bath for120±5 sec. at 260±5℃

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specification</th><th>AEC-Q200 Test Condition</th></tr>
<tr><td rowspan="4">15</td><td rowspan="4">Electrical Characteriz-ation</td><td>Appear-ance</td><td>No mechanical damage shall occur</td><td>Visual inspection</td></tr>
<tr><td>Capacit-ance</td><td>Within The Specified Tolerance</td><td rowspan="2">Class Ⅱ (X7R):
<table><tr><td colspan="2">Frequency</td><td>Voltage</td></tr><tr><td>X7R</td><td>1KHz±10%</td><td>1.0±0.2Vrms</td></tr></table>
Perform a heat temperature at 150±3℃ for 30min. then place room temp. for 24±2 hours..</td></tr>
<tr><td>D.F.</td><td>Class Ⅱ (X7R):
Shell meet the value in table 1.</td></tr>
<tr><td>Insulation Resistance</td><td>10,000MΩ or 500/CΩ
Product Whichever Is Smaller</td><td>V≦500V, Rated Voltage
Charge Time：120sec.
Is applied less than 50mA current.</td></tr>
<tr><td>Withstand-ing Voltage</td><td>No dielectric breakdown or mechanical breakdown</td><td>V<100V : 250% Rated Voltage

for 1~5 sec. Current is limited to less than 50mA.</td></tr>
<tr><td>16</td><td>Board Flex</td><td>Appear-ance</td><td>No mechanical damage shall be occur.</td><td rowspan="3">Bending shall be applied to the 3.0 mm for X7R and 3mm for NP0 with rate of 1.0mm/sec.

The duration of the applied forces shall be 60sec.
 
</td></tr>
<tr><td>Capacit-ance</td><td>Capacitance Change
<table><tr><td>Char.</td><td>Cap. Change</td></tr><tr><td>X7R</td><td>≦ ± 12.5%</td></tr></table></td></tr>
<tr><td>17</td><td>Terminal Strength</td><td>Appear-ance</td><td>No mechanical damage shall occur</td></tr>
<tr><td rowspan="3">18</td><td rowspan="3">Beam Load Test</td><td>Capacit-ance</td><td>Within The Specified Tolerance</td><td rowspan="3">Apply a 18N force in parallel with the test jig for 60 sec.
 
</td></tr>
<tr><td>D.F.</td><td>Class Ⅱ (X7R):
Shell meet the value in table 1.</td></tr>
<tr><td>Insulation Resistance</td><td>To satisfy the specified initial value</td></tr>
<tr><td>18</td><td>Beam Load Test</td><td></td><td>The chip endure following force.
<table><tr><th>Chip Length</th><th>Chip Thickness</th><th>Force min.</th></tr><tr><td>≦2.5mm</td><td>>0.5mm</td><td>20N</td></tr><tr><td>≧3.2mm</td><td><1.25mm</td><td>15N</td></tr><tr><td></td><td>≧1.25mm</td><td>54.5N</td></tr></table></td><td>Place the capacitor in the beam load fixture. Apply a force.
 

Speed supplied the Stress Load: 2.5mm / sec.</td></tr>
</table>

Table 1

Temp char: X7R

Size	Rated Voltage	Capacitance Range	D.F.(MAX)	
			2.High Temperature Exposure 3.Temperature cycle 9 Resistance to Solvents 10.Mechanical Shock 11.Vibration 12.Resistance to solder heat 13.ESD 15.Initial 17.Terminal Strength	5.Biased Humidity 6.Operational Life
0402	DC 50V	All Capacitance	10.00%	20.00%
0603	DC 16V	All Capacitance	10.00%	20.00%
	DC 25V	All Capacitance	10.00%	20.00%
	DC 50V	All Capacitance	10.00%	20.00%
	DC 100V	C≧0.1uF	5.00%	10.00%
		C＜0.1uF	2.50%	5.00%
0805	DC 16V	All Capacitance	10.00%	20.00%
	DC 25V	All Capacitance	10.00%	20.00%
	DC 50V	All Capacitance	10.00%	20.00%
	DC 100V	C≧0.1uF	5.00%	10.00%
		C＜0.1uF	2.50%	5.00%
	>DC 100V	All Capacitance	2.50%	5.00%
1206	DC 25V	All Capacitance	10.00%	20.00%
	DC 50V	All Capacitance	10.00%	20.00%
	DC 100V	C≧0.1uF	5.00%	10.00%
		C＜0.1uF	2.50%	5.00%
	>DC 100V	All Capacitance	2.50%	5.00%
1210	DC 25V	All Capacitance	10.00%	20.00%
	DC 50V	All Capacitance	10.00%	20.00%
	DC 100V	C≧0.1uF	5.00%	10.00%
		C＜0.1uF	2.50%	5.00%
	>DC 100V	All Capacitance	2.50%	5.00%
1808	>DC 100V	All Capacitance	2.50%	5.00%
1812	DC 25V	All Capacitance	10.00%	20.00%
	DC 50V	All Capacitance	10.00%	20.00%
	DC 100V	C≧0.1uF	5.00%	10.00%
		C＜0.1uF	2.50%	5.00%
	>DC 100V	All Capacitance	2.50%	5.00%
2220	DC 50V	All Capacitance	10.00%	20.00%
	DC 100V	C≧0.1uF	5.00%	10.00%
		C＜0.1uF	2.50%	5.00%
	>DC 100V	All Capacitance	2.50%	5.00%
2225	>DC 100V	All Capacitance	2.50%	5.00%

Fig.1

P.C. Board for Bending Strength Test

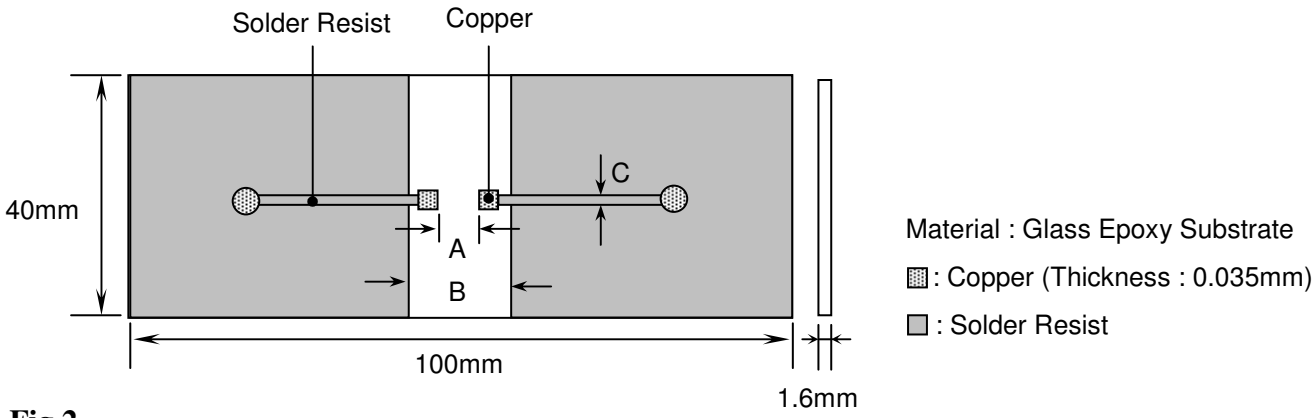
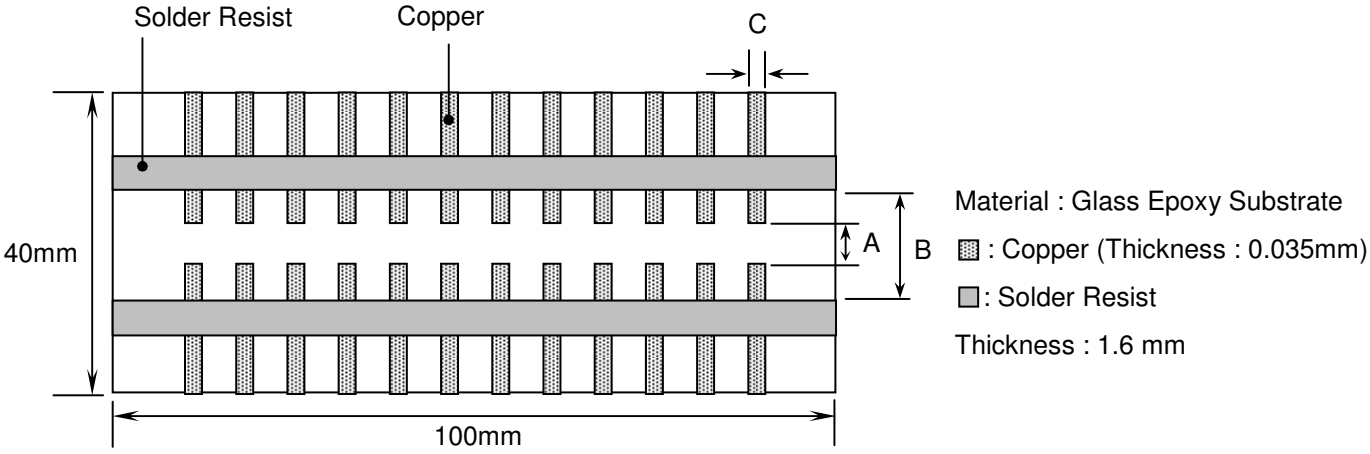


Fig.2

Test Substrate



Unit:mm

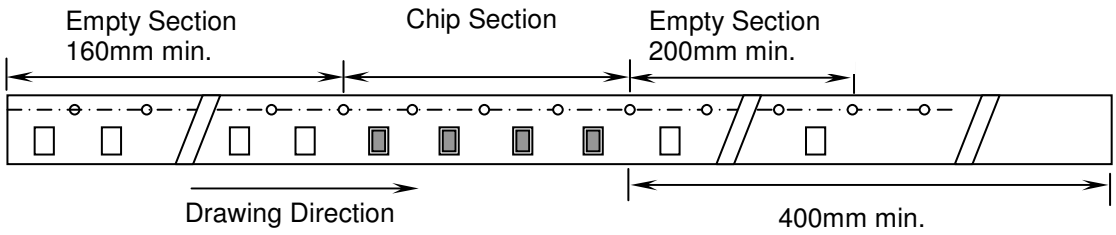
Type	A	B	C
0201	0.2	0.9	0.4
0402	0.5	1.5	0.6
0603	1.0	3.0	1.0
0805	1.2	4.0	1.6
1206	2.2	5.0	2.0
1210	2.2	5.0	2.9
1808	3.5	7.0	2.5
1812	3.5	7.0	3.7
1825	3.5	7.0	6.9
2208	4.5	8.0	2.5
2211	4.5	8.0	3.0
2220	4.5	8.0	5.6
2225	4.5	8.0	7.0

8. Packing

8.1 Bulk Packing

According to customer request.

8.2 Chip Capacitors Tape Packing



8.3 Material And Quantity

Tape Material	0201	0402	0603/0805	
	T≦0.39mm	T≦0.70mm	T≦1.00mm	T＞1.00mm
Paper	15,000 pcs/Reel	10,000 pcs/Reel	4,000 pcs/Reel	NA
Plastic	NA	NA	NA	3,000 pcs/Reel

Tape Material	1206		
	T≦1.00mm	1.00mm＜T≦1.25mm	T＞1.25mm
Paper	4,000 pcs/Reel	NA	NA
Plastic	NA	3,000 pcs/Reel	2,000 pcs/Reel

Tape Material	1808/1210		
	T≦1.25mm	1.25mm＜T≦2.40mm	T＞2.40mm
Paper	NA	NA	NA
Plastic	3,000 pcs/Reel	1,000/2,000 pcs/Reel	500/700/1,000 pcs/Reel

Tape Material	1812/2211/2220		1825/2225		2208
	T≦2.20mm	T＞2.20mm	T≦2.20mm	T＞2.20mm	T≦2.20mm
Paper	NA	NA	NA	NA	NA
Plastic	1,000 pcs/Reel	700 pcs/Reel	700 pcs/Reel	400 pcs/Reel	1,000 pcs/Reel

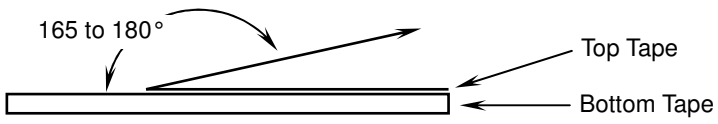
NA：Not Available

8.4 Cover Tape Reel Off Force

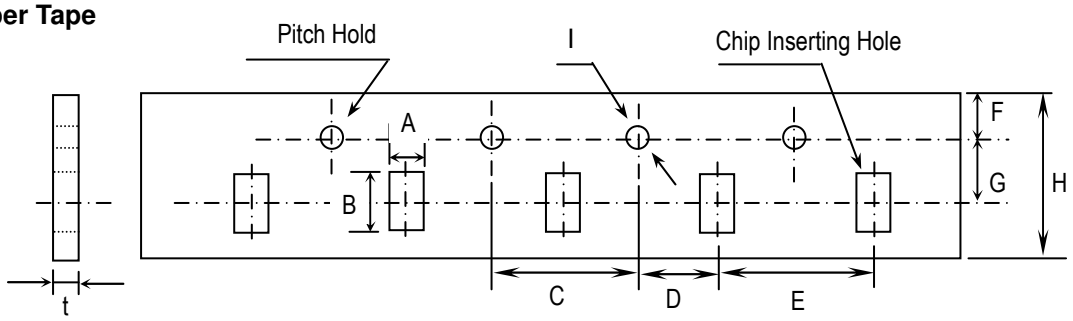
8.4.1 Peel-Off Force

5 g·f ≦Peel-Off Force ≦70 g·f

8.4.2 Measure Method



8.5 Paper Tape

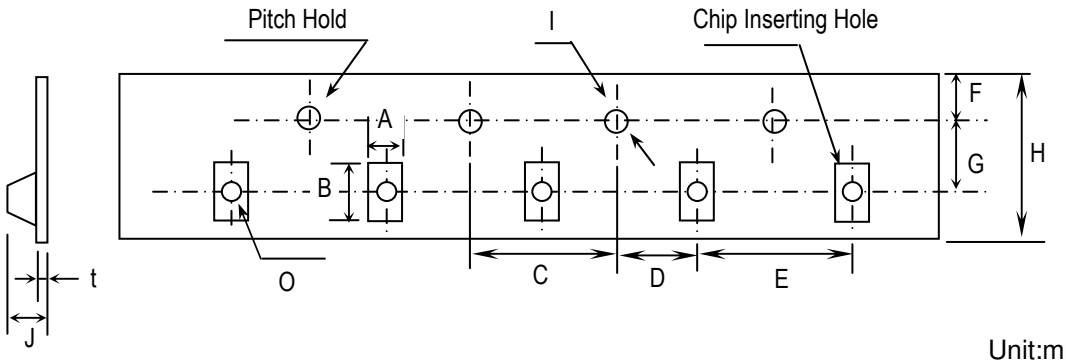


Unit:mm

TYPE	A	B	C	D	E
0201	0.37± 0.1	0.67± 0.1	4.00± 0.1	2.00± 0.05	2.00± 0.1
0402	0.61± 0.1	1.20± 0.1			
0603	1.10± 0.2	1.90± 0.2			4.00± 0.1
0805	1.50± 0.2	2.30± 0.2			
1206	1.90± 0.2	3.50± 0.2			
1210	2.90± 0.2	3.60± 0.2			

TYPE	F	G	H	I	t
0201	1.75± 0.10	3.50± 0.05	8.0± 0.30	φ 1.50 +0.10/-0	1.10 max.
0402					
0603					
0805					
1206					
1210					

8.6 Plastic Tape



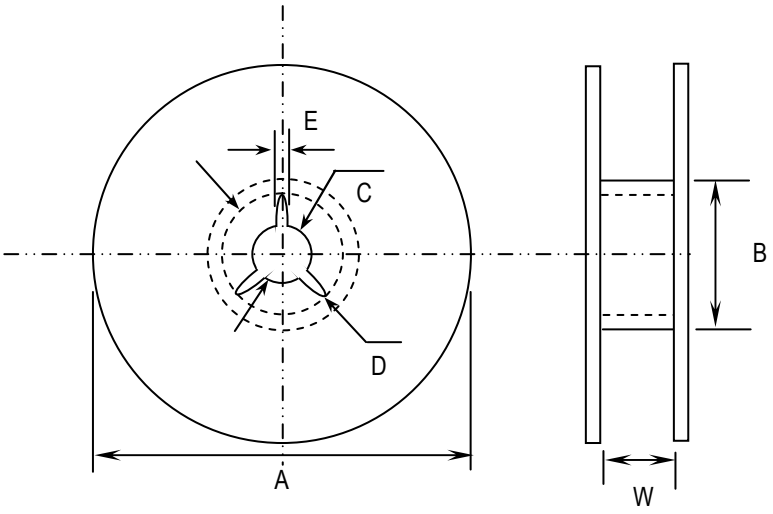
Unit:mm

Type	A	B	C	D	E	F
0805	1.5±0.2	2.3±0.2	4.0± 0.1	2.0± 0.05	4.0± 0.1	1.75± 0.1
1206	1.9±0.2	3.5±0.2				
1210	2.9±0.2	3.6±0.2				
	2.95±0.2	3.65±0.2		2.0± 0.10	8.0± 0.1	
1808	2.5±0.2	4.9±0.2		2.0± 0.05	4.0± 0.1	
1812	3.6±0.2	4.9±0.2			8.0± 0.1	
1825	6.9±0.2	4.9±0.2				
2208	2.5±0.2	6.1±0.2				
2211	3.2±0.2	6.1±0.2				
2220	5.4±0.2	6.1±0.2				
2225	6.9±0.2	6.1±0.2				

Type	G	H	I	J	t	O
0805	3.5± 0.05	8.0± 0.3	φ 1.5+0.1/-0	3.0 max.	0.3 max.	1.0± 0.1
1206						
1210						
	5.5± 0.10	12.0 ± 0.3			0.35 ± 0.05	NA
1808	5.5± 0.05			4.0 max.	0.3 max.	1.5± 0.1
1812						
1825						
2208						
2211						
2220						
2225						

8.7 Reel Dimensions

Reel Material：Polystyrene



Unit:mm

Type	A	B	C	D	E	W
0201	φ 382 max	φ 50 min	φ 13± 0.5	φ 21± 0.8	2.0±0.5	10± 0.15
0402						
0603						
0805						
1206						
1210						
1808	φ 178±2.0	φ 60±2.0				13±0.3
1812						
1825						
2208						
2211						
2220						
2225						

Precautionary Notes:

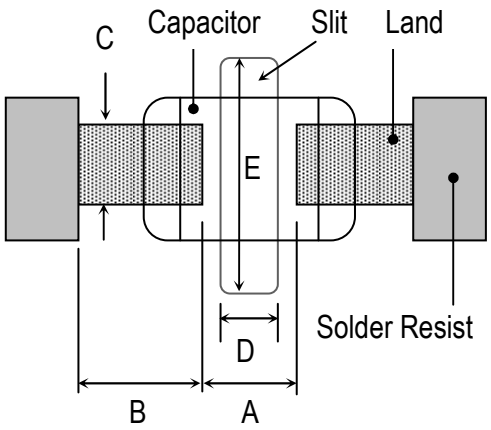
1. Storage

Store the capacitors where the temperature and relative humidity don't exceed 40℃ and 70%RH. We recommend that the capacitors be used within 12 months from the date of manufacturing. Store the products in the original package and do not open the outer wrapped, polyethylene bag, till just before usage. If it is open, seal it as soon as possible or keep it in a desiccant with a desiccation agent.

2. Construction of Board Pattern

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

2.1 Size and recommend land dimensions for reflow soldering .



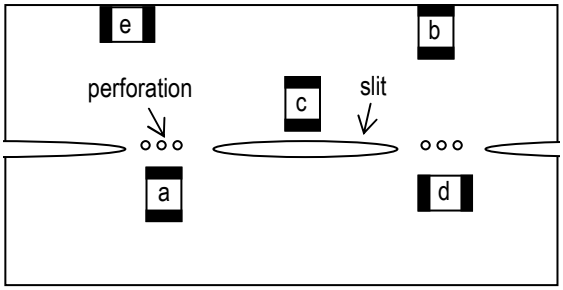
EIA Code	Chip (mm)		Land (mm)				
	L	W	A	B	C	D	E
0201	0.60	0.30	0.2~0.3	0.2~0.4	0.2~0.4	--	--
0402	1.00	0.50	0.3~0.5	0.3~0.5	0.4~0.6	--	--
0603	1.60	0.80	0.4~0.6	0.6~0.7	0.6~0.8	--	--
0805	2.00	1.25	0.7~0.9	0.6~0.8	0.8~1.1	--	--
1206	3.20	1.60	2.2~2.4	0.8~0.9	1.0~1.4	1.0~2.0	3.2~3.7
1210	3.20	2.50	2.2~2.4	1.0~1.2	1.8~2.3	1.0~2.0	4.1~4.6
1808	4.60	2.00	2.8~3.4	1.8~2.0	1.5~1.8	1.0~2.8	3.6~4.1
1812	4.60	3.20	2.8~3.4	1.8~2.0	2.3~3.0	1.0~2.8	4.8~5.3
1825	4.60	6.35	2.8~3.4	1.8~2.0	5.1~5.8	1.0~4.0	7.1~8.3
2208	5.70	2.00	4.0~4.6	2.0~2.2	1.5~1.8	1.0~4.0	3.6~4.1
2211	5.70	2.80	4.0~4.6	2.0~2.2	2.0~2.6	1.0~4.0	4.4~4.9
2220	5.70	5.00	4.0~4.6	2.0~2.2	3.5~4.8	1.0~4.0	6.6~7.1
2225	5.70	6.35	4.0~4.6	2.0~2.2	5.1~5.8	1.0~4.0	7.1~8.3

2.2 Mechanical strength varies according to location of chip capacitors on the P.C. board.

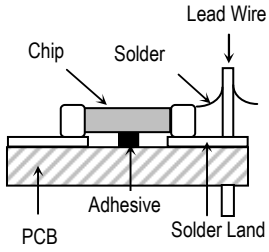
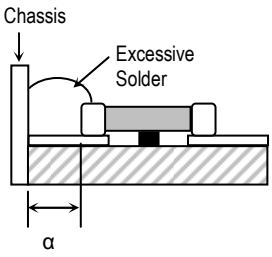
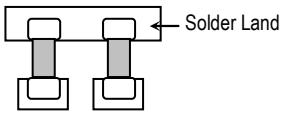
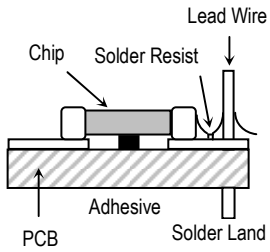
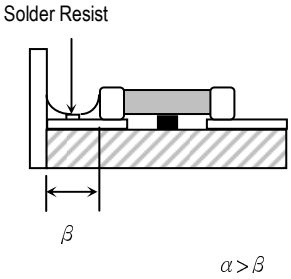
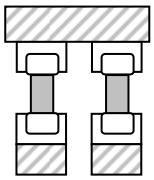
Design layout of components on the PC board such a way to minimize the stress imposed on the components, upon flexure of the boards in depanelization or other processes.

Component layout close to the edge of the board or the "depanelization line" is not recommended.

Susceptibility to stress is in the order of: a>b>c and d>e

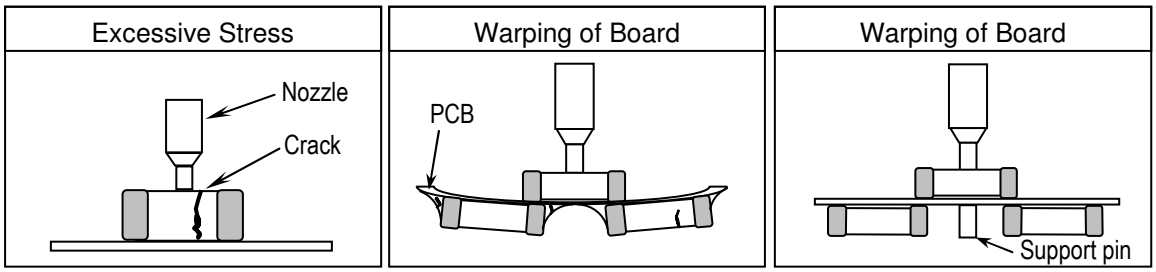


2.3 Layout Recommendation

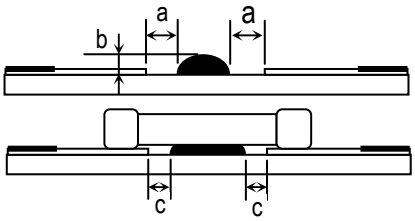
Example	Use of Common Solder Land	Solder With Chassis	Use of Common Solder Land With Other SMD
Need to Avoid			
Recommendation			

3. Mounting

3.1 Sometimes crack is caused by the impact load due to suction nozzle in pick and place operation.
In pick and place operation, if the low dead point is too low, excessive stress is applied to component. This may cause cracks in the ceramic capacitor, therefore it is required to move low dead point of a suction nozzle to the higher level to minimize the board warp age and stress on the components. Nozzle pressure is typically adjusted to 1N to 3N (static load) during the pick and place operation.



3.2 Amount of Adhesive



Example : 0805 & 1206

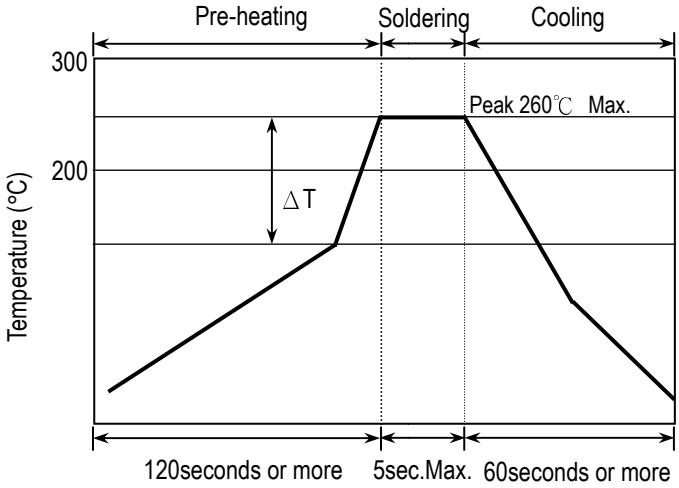
a	0.2mm min.
b	70 ~ 100 μm
c	Do not touch the solder land

4. Soldering

4.1. Wave Soldering

Most of components are wave soldered with solder at Peak Temperature.. Adequate care must be taken to prevent the potential of thermal cracks on the ceramic capacitors. Refer to the soldering methods below for optimum soldering benefits.

Recommend flow soldering temperature Profile



Soldering Method	Peak Temp.(℃) / Duration (sec)
1206/0805/0603	ΔT ≤ 100~150℃ max.
Pb-Sn Solder	250℃(max.) / 3sec(max.)
Lead Free Solder	260℃(max.) / 5sec(max.)

Recommended solder compositions

Sn-37Pb (Pb - Sn Solder)

Sn-3.0Ag-0.5Cu (Lead Free Solder)

To optimize the result of soldering, proper preheating is essential:

1) Preheat temperature is too low
   a. Flux flows to easily
   b. Possibility of thermal cracks
2) Preheat temperature is too high
   a. Flux deteriorates even when oxide film is removed
   b. Causes warping of circuit board
   c. Loss of reliability in chip and other components

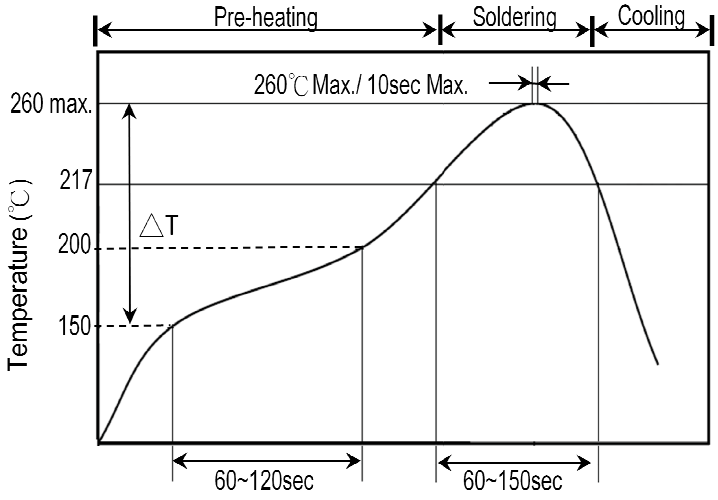
Cooling Condition:

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

4.2 Reflow Soldering

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

Recommend reflow profile for Lead-Free soldering temperature Profile (J-STD-020E)



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

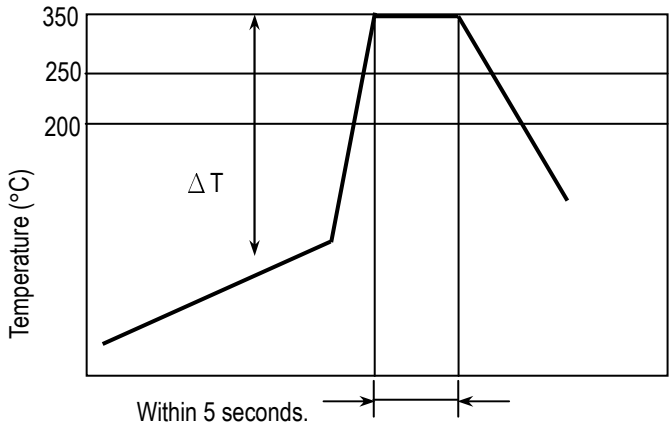
※ The cycles of soldering : Three times (max.)

Maximum Ramp-up = 3℃/Sec.

Maximum Ramp-down Rate = 6℃/Sec.

4.3 Hand Soldering

Sudden temperature change in components, results in a temperature gradient recommended in the following table, and therefore may cause internal thermal cracks in the components. In general a hand soldering method is not recommended unless proper preheating and handling practices have been taken. Care must also be taken not to touch the ceramic body of the capacitor with the tip of solder Iron.



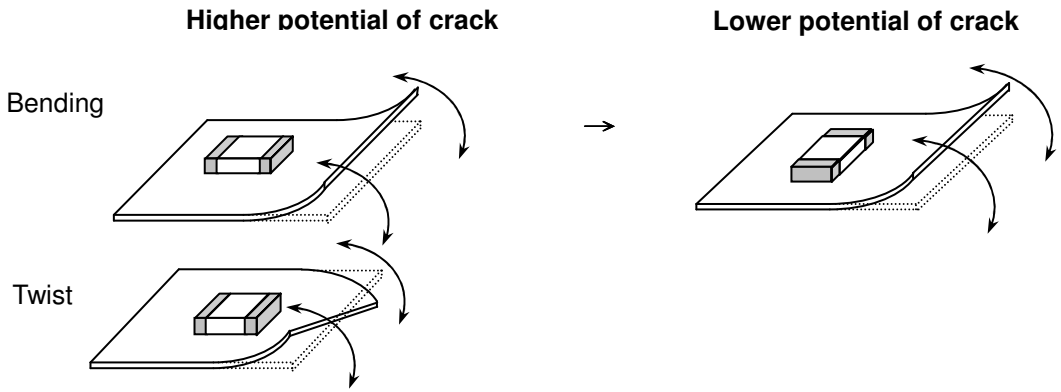
Soldering Method	Change in Temp.(℃)
1206 and Under	ΔT ≦ 150 ℃
1210 and Over	ΔT ≦ 130 ℃

How to Solder Repair by Solder Iron

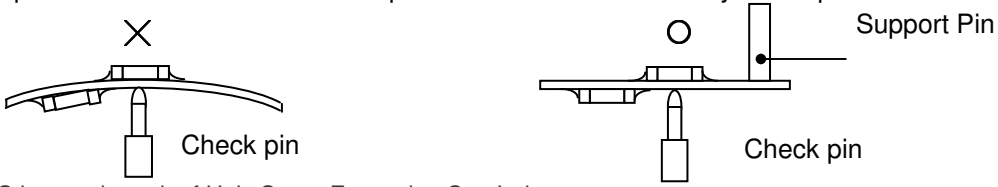
1) Selection of the soldering iron tip
The required temperature of solder iron for any type of repair depends on the type of the tip, the substrate material, and the solder land size.
2) recommended solder iron condition
a.) Preheating Condition：Board and components should be preheated sufficiently at 150℃ or over, and soldering should be conducted with soldering iron as boards and components are maintained at sufficient temperatures.
b.) Soldering iron power shall not exceed 30 W.
c.) Soldering iron tip diameter shall not exceed 3mm.
d.) Temperature of iron tip shall not exceed 350℃., and the process should be finished within 5 seconds. (refer to MIL-STD-202G)
f.) Do not touch the ceramic body with the tip of solder iron. Direct contact of the soldering iron tip to ceramic body may cause thermal cracks.
g.) After soldering operation, let the products cool down gradually in the room temperature.

5. Handling after chip mounted

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



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

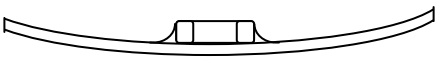


5.3 Mechanical stress due to warping and torsion.

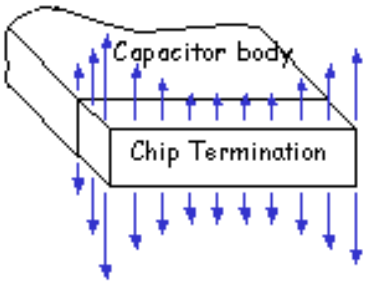
(a) Crack occurrence ratio will be increased by manual separation.

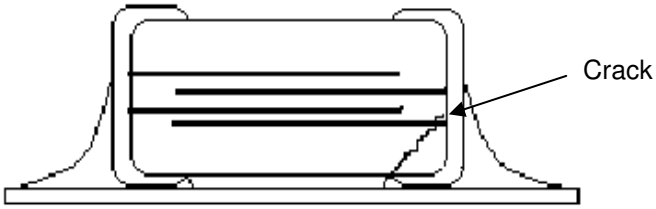
(b) Crack occurrence ratio will be increased by tensile force , rather than compressive force.

╳ :Tensile Stress ○ :Compressive Stress



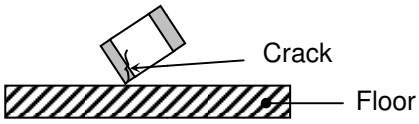
Capacitor Stress Analysis



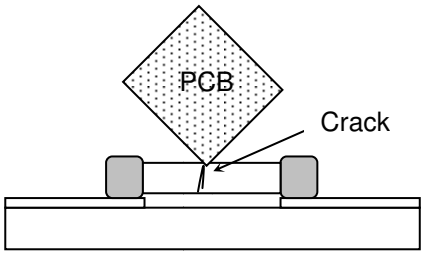


6. Handling of Loose Chip Capacitor

6.1 If dropped the chip capacitor may crack.



6.2 In piling and stacking of the P.C. boards after mounting for storage or handling, the corner of the P.C. board may hit the chip capacitor mounted on another board to cause crack.



7. Safekeeping condition and period

For safekeeping of the products, we recommend to keep the storage temperature between +5 to +40℃ and under humidity of 20 to 70% RH. The shelf life of capacitors is 12 months.