Reference Specification

200°C Operation Leaded MLCC for Automotive (Powertrain/Safety)
RHS Series

Product specifications in this catalog are as of Feb. 2024, and are subject to change or obsolescence without notice.
Please consult the approval sheet before ordering.Please read rating and Cautions first.

＜Reference＞Please kindly use our website.
Please refer to the product information page for more information on ceramic capacitors.→ Ceramic capacitor product information
Various data can be obtained directly from the product search.→ Product search (SMD) / Product search (Lead Type)

⚠ CAUTION

1. OPERATING VOLTAGE

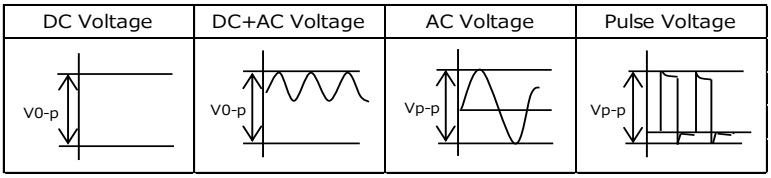
1. Do not apply a voltage to the capacitor that exceeds the rated voltage as called out in the specifications.

1-1. Applied voltage between the terminals of a capacitor shall be less than or equal to the rated voltage.

(1) When AC voltage is superimposed on DC voltage, the zero-to-peak voltage shall not exceed the rated DC voltage. When AC voltage or pulse voltage is applied, the peak-to-peak voltage shall not exceed the rated DC voltage.

(2) Abnormal voltages (surge voltage, static electricity, pulse voltage, etc.) shall not exceed the rated DC voltage.

Typical Voltage Applied to the DC Capacitor



(E: Maximum possible applied voltage.)

1-2. Influence of over voltage

Over voltage that is applied to the capacitor may result in an electrical short circuit caused by the breakdown of the internal dielectric layers. The time duration until breakdown depends on the applied voltage and the ambient temperature.

2. Use a safety standard certified capacitor in a power supply input circuit (AC filter), as it is also necessary to consider the withstand voltage and impulse withstand voltage defined for each device.

2. OPERATING TEMPERATURE AND SELF-GENERATED HEAT

Keep the surface temperature of a capacitor below the upper limit of its rated operating temperature range. Be sure to take into account the heat generated by the capacitor itself.

When the capacitor is used in a high-frequency current, pulse current or the like, it may have the self-generated heat due to dielectric-loss. In case of Class 2 capacitors (Temp.Char. : X7R,X7S,X8L, etc.), applied voltage should be the load such as self-generated heat is within 20 °C on the condition of atmosphere temperature 25 °C. Please contact us if self-generated heat is occurred with Class 1 capacitors (Temp.Char. : C0G,U2J,X8G, etc.). When measuring, use a thermocouple of small thermal capacity-K of Φ0.1mm and be in the condition where capacitor is not affected by radiant heat of other components and wind of surroundings. Excessive heat may lead to deterioration of the capacitor's characteristics and reliability.

3. FAIL-SAFE

Be sure to provide an appropriate fail-safe function on your product to prevent a second damage that may be caused by the abnormal function or the failure of our product.

4. OPERATING AND STORAGE ENVIRONMENT

The insulating coating of capacitors does not form a perfect seal; therefore, do not use or store capacitors in a corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. And avoid exposure to moisture. Before cleaning, bonding, or molding this product, verify that these processes do not affect product quality by testing the performance of a cleaned, bonded or molded product in the intended equipment. Store the capacitors where the temperature and relative humidity do not exceed 5 to 40 °C and 20 to 70%. Use capacitors within 6 months.

Use capacitors within 6 months after delivered. Check the solderability after 6 months or more.

⚠ **CAUTION**

5. VIBRATION AND IMPACT

Do not expose a capacitor or its leads to excessive shock or vibration during use.
Excessive shock or vibration may cause to fatigue destruction of lead wires mounted on the circuit board.
If necessary, take measures to hold a capacitor on the circuit boards by adhesive, molding resin or coating and other.
Please confirm there is no influence of holding measures on the product with an intended equipment.

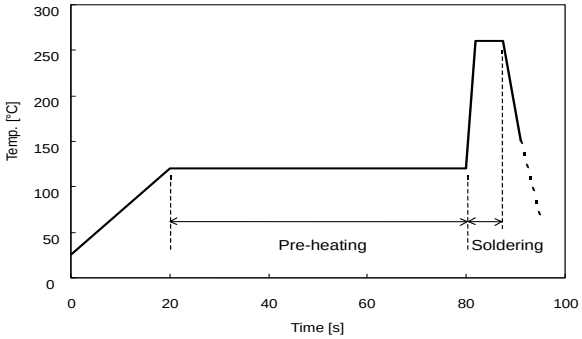
6. SOLDERING

When soldering this product to a PCB/PWB, do not exceed the solder heat resistance specification of the capacitor. Subjecting this product to excessive heating could melt the internal junction solder and may result in thermal shocks that can crack the ceramic element.
Please verify that the soldering process does not affect the quality of capacitors.

6-1. Flow Soldering

Soldering temperature	: 260 ℃ max.
Soldering time	: 7.5 s max.
Preheating temperature	: 120 ℃ max.
Preheating time	: 60 s max.

［Standard Condition for Flow Soldering］



6-2. Reflow Soldering

Do not apply reflow soldering.

6-3. Soldering Iron

Temperature of iron-tip	: 350 °C max.
Soldering iron wattage	: 60 W max.
Soldering time	: 3.5 s max.

7. BONDING AND RESIN MOLDING, RESIN COAT

In case of bonding, molding or coating this product, verify that these processes do not affect the quality of capacitor by testing the performance of a bonded or molded product in the intended equipment.
In case of the amount of applications, dryness / hardening conditions of adhesives and molding resins containing organic solvents (ethyl acetate, methyl ethyl ketone, toluene, etc.) are unsuitable, the outer coating resin of a capacitor is damaged by the organic solvents and it may result, worst case, in a short circuit.
The variation in thickness of adhesive or molding resin may cause a outer coating resin cracking and/or ceramic element cracking of a capacitor in a temperature cycling.

8. TREATMENT AFTER BONDING AND RESIN MOLDING, RESIN COAT

When the outer coating is hot (over 100 °C) after soldering, it becomes soft and fragile.
So please be careful not to give it mechanical stress.
Failure to follow the above cautions may result, worst case, in a short circuit and cause fuming or partial dispersion when the product is used.

⚠ **CAUTION**

9. LIMITATION OF APPLICATIONS

The products listed in the specification(hereinafter the product(s) is called as the “Product(s)”) are designed and manufactured for applications specified in the specification. (hereinafter called as the “Specific Application”)

We shall not warrant anything in connection with the Products including fitness, performance, adequateness, safety, or quality, in the case of applications listed in from (1) to (11) written at the end of this precautions, which may generally require high performance, function, quality, management of production or safety.

Therefore, the Product shall be applied in compliance with the specific application.

WE DISCLAIM ANY LOSS AND DAMAGES ARISING FROM OR IN CONNECTION WITH THE PRODUCTS INCLUDING BUT NOT LIMITED TO THE CASE SUCH LOSS AND DAMAGES CAUSED BY THE UNEXPECTED ACCIDENT, IN EVENT THAT (i) THE PRODUCT IS APPLIED FOR THE PURPOSE WHICH IS NOT SPECIFIED AS THE SPECIFIC APPLICATION FOR THE PRODUCT, AND/OR (ii) THE PRODUCT IS APPLIED FOR ANY FOLLOWING APPLICATION PURPOSES FROM (1) TO (11) (EXCEPT THAT SUCH APPLICATION PURPOSE IS UNAMBIGUOUSLY SPECIFIED AS SPECIFIC APPLICATION FOR THE PRODUCT IN OUR CATALOG SPECIFICATION FORMS, DATASHEETS, OR OTHER DOCUMENTS OFFICIALLY ISSUED BY US*)

1. Aircraft equipment
2. Aerospace equipment
3. Undersea equipment
4. Power plant control equipment
5. Medical equipment
6. Transportation equipment
7. Traffic control equipment
8. Disaster prevention/security equipment
9. Industrial data-processing equipment
10. Combustion/explosion control equipment
11. Equipment with complexity and/or required reliability equivalent to the applications listed in the above.

For exploring information of the Products which will be compatible with the particular purpose other than those specified in the specification, please contact our sales offices, distribution agents, or trading companies with which you make a deal, or via our web contact form.

Contact form: https://www.murata.com/contactform

*We may design and manufacture particular Products for applications listed in (1) to (11). Provided that, in such case we shall unambiguously specify such Specific Application in the specification without any exception.

Therefore, any other documents and/or performances, whether exist or non-exist, shall not be deemed as the evidence to imply that we accept the applications listed in (1) to (11).

⚠ CAUTION

NOTICE

1. CLEANING (ULTRASONIC CLEANING)

To perform ultrasonic cleaning, observe the following conditions.
Rinse bath capacity : Output of 20 watts per liter or less.
Rinsing time : 5 min maximum.
Do not vibrate the PCB/PWB directly.
Excessive ultrasonic cleaning may lead to fatigue destruction of the lead wires.

2. SOLDERING AND MOUNTING

Insertion of the Lead Wire

- When soldering, insert the lead wire into the PCB without mechanically stressing the lead wire.
- Insert the lead wire into the PCB with a distance appropriate to the lead space.

3. CAPACITANCE CHANGE OF CAPACITORS

- Class 2 capacitors (Temp.Char. : X7R,X7S,X8L etc.)
  Class 2 capacitors an aging characteristic, whereby the capacitor continually decreases its capacitance slightly if the capacitor leaves for a long time. Moreover, capacitance might change greatly depending on a surrounding temperature or an applied voltage. So, it is not likely to be able to use for the time constant circuit.
  Please contact us if you need a detail information.

4. WHEN USING THE FREQUENCY EXCEEDING 20kHz

In the case of use exceeding 150 °c, ESR of the capacitor increase by progress at time in the frequency exceeding 20kHz, and the self-heating of the capacitor may be higher.
The heating temperature varies depending on the capacitance value and the applied voltage.
If you are considering using more than 20kHz, please contact us in advance.

⚠ NOTE

1. Please make sure that your product has been evaluated in view of your specifications with our product being mounted to your product.
2. You are requested not to use our product deviating from this product specification.

1. Application

This product specification is applied to Leaded MLCC RHS series.

1. Specific applications:

・Automotive powertrain/safety equipment: Products that can be used for automotive equipment related to running, turning, stopping, safety devices, etc., or equipment whose structure, equipment, and performance are legally required to meet technical standards for safety assurance or environmental protection.

・Automotive infotainment/comfort equipment: Products that can be used for automotive equipment such as car navigation systems and car audio systems that do not directly relate to human life and whose structure, equipment, and performance are not specifically required by law to meet technical standards for safety assurance or environmental protection.

・Medial Equipment [GHTF A/B/C] except for Implant Equipment: Products suitable for use in medical devices designated under the GHTF international classifications as Class A or Class B (the functions of which are not directly involved in protection of human life or property) or in medical devices other than implants designated under the GHTF international classifications as Class C (the malfunctioning of which is considered to pose a comparatively high risk to the human body).

2.Unsuitable Application: Applications listed in “Limitation of applications” in this product specification.

2. Rating

• Applied maximum temperature up to 200°C

Note : Maximum accumulative time to 200°C is within 2000 hours.

• Part Number Configuration

ex.)

RHS	Q9	2A	224	K	2	A2	H01	B
Series	Temperature Characteristics	Rated Voltage	Capacitance	Capacitance Tolerance	Dimension (LxW)	Lead Style	Individual Specification	Package

• Series

Code	Content
RHS	Epoxy coated, 200°C max.

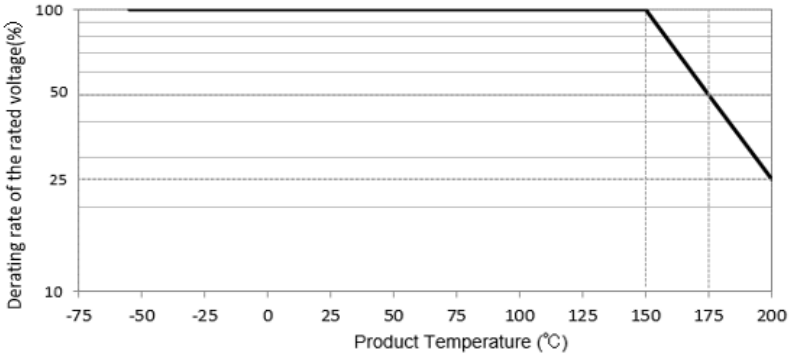
• Temperature Characteristics

Code	Temp. Char.	Temp. Range	Cap. Change	Standard Temp.	Operating Temp. Range
Q9	X9Q (Murata code)	-55～125°C	+/-15%	25°C	-55～200°C
		125～200°C	+15/-70%		

• Rated Voltage

Code	Rated voltage
2A	DC100V

When the product temperature exceeds 150°C, please use this product within the voltage and temperature derated conditions in the figure below.



• Capacitance

The first two digits denote significant figures ; the last digit denotes the multiplier of 10 in pF.

ex.) In case of 224 .

$22 \times 10^4 = 220000$ pF

• Capacitance Tolerance

Code	Capacitance Tolerance
K	+/-10%

• Dimension (LxW)

Please refer to [Part number list].

• Lead Style

*Lead wire is "solder coated CP wire".

Code	Lead Style	Lead spacing (mm)
A2	Straight type	2.5+/-0.8
DG	Straight taping type	2.5+0.4/-0.2
K1	Inside crimp type	5.0+/-0.8
M2	Inside crimp taping type	5.0+0.6/-0.2

• Individual Specification

Murata's control code.

Please refer to [Part number list].

• Package

Code	Package
A	Taping type of Ammo
B	Bulk type

3. Marking

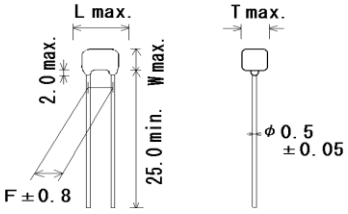
Temp. char. : Letter code : N (X9Q char.)
Capacitance : 3 digit numbers
Capacitance tolerance : Code
Rated voltage : Letter code : 1 (DC100V. Except dimension code : 0,1)
Company name code : Abbreviation : (M) (Except dimension code : 0,1)

(Ex.)

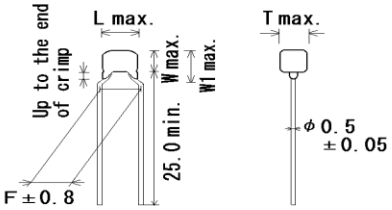
Rated voltage / Dimension code	DC100V
0,1	N 103K
2	(M) 224 K1N

4. Part number list

・Straight Long
(Lead Style:A2)



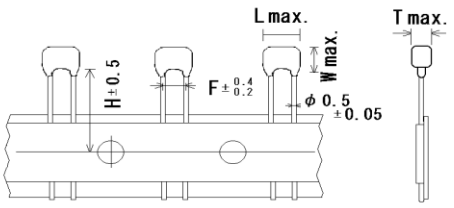
・Inside Crimp
(Lead Style:K*)



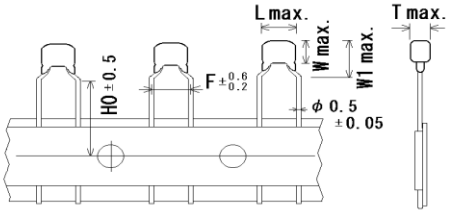
Unit : mm

Customer Part Number	Murata Part Number	T.C.	DC Rated Volt. (V)	Cap.	Cap. Tol.	Dimension (mm)					Dimension (LxW) Lead Style	Pack qty. (pcs)
						L	W	W1	F	T		
	RHSQ92A472K0A2H01B	X9Q	100	4700pF	±10%	3.9	3.5	-	2.5	2.6	0A2	500
	RHSQ92A682K0A2H01B	X9Q	100	6800pF	±10%	3.9	3.5	-	2.5	2.6	0A2	500
	RHSQ92A103K0A2H01B	X9Q	100	10000pF	±10%	3.9	3.5	-	2.5	2.6	0A2	500
	RHSQ92A153K0A2H01B	X9Q	100	15000pF	±10%	3.9	3.5	-	2.5	2.6	0A2	500
	RHSQ92A223K0A2H01B	X9Q	100	22000pF	±10%	3.9	3.5	-	2.5	2.6	0A2	500
	RHSQ92A333K1A2H01B	X9Q	100	33000pF	±10%	4.2	3.5	-	2.5	2.8	1A2	500
	RHSQ92A473K1A2H01B	X9Q	100	47000pF	±10%	4.2	3.5	-	2.5	2.8	1A2	500
	RHSQ92A683K1A2H01B	X9Q	100	68000pF	±10%	4.2	3.5	-	2.5	2.8	1A2	500
	RHSQ92A104K1A2H01B	X9Q	100	0.10μF	±10%	4.2	3.5	-	2.5	2.8	1A2	500
	RHSQ92A154K2A2H01B	X9Q	100	0.15μF	±10%	5.5	4.0	-	2.5	3.3	2A2	500
	RHSQ92A224K2A2H01B	X9Q	100	0.22μF	±10%	5.5	4.0	-	2.5	3.3	2A2	500
	RHSQ92A472K0K1H01B	X9Q	100	4700pF	±10%	3.9	3.5	6.0	5.0	2.6	0K1	500
	RHSQ92A682K0K1H01B	X9Q	100	6800pF	±10%	3.9	3.5	6.0	5.0	2.6	0K1	500
	RHSQ92A103K0K1H01B	X9Q	100	10000pF	±10%	3.9	3.5	6.0	5.0	2.6	0K1	500
	RHSQ92A153K0K1H01B	X9Q	100	15000pF	±10%	3.9	3.5	6.0	5.0	2.6	0K1	500
	RHSQ92A223K0K1H01B	X9Q	100	22000pF	±10%	3.9	3.5	6.0	5.0	2.6	0K1	500
	RHSQ92A333K1K1H01B	X9Q	100	33000pF	±10%	4.2	3.5	5.0	5.0	2.8	1K1	500
	RHSQ92A473K1K1H01B	X9Q	100	47000pF	±10%	4.2	3.5	5.0	5.0	2.8	1K1	500
	RHSQ92A683K1K1H01B	X9Q	100	68000pF	±10%	4.2	3.5	5.0	5.0	2.8	1K1	500
	RHSQ92A104K1K1H01B	X9Q	100	0.10μF	±10%	4.2	3.5	5.0	5.0	2.8	1K1	500
	RHSQ92A154K2K1H01B	X9Q	100	0.15μF	±10%	5.5	4.0	6.0	5.0	3.3	2K1	500
	RHSQ92A224K2K1H01B	X9Q	100	0.22μF	±10%	5.5	4.0	6.0	5.0	3.3	2K1	500

・Straight Taping
(Lead Style:DG)



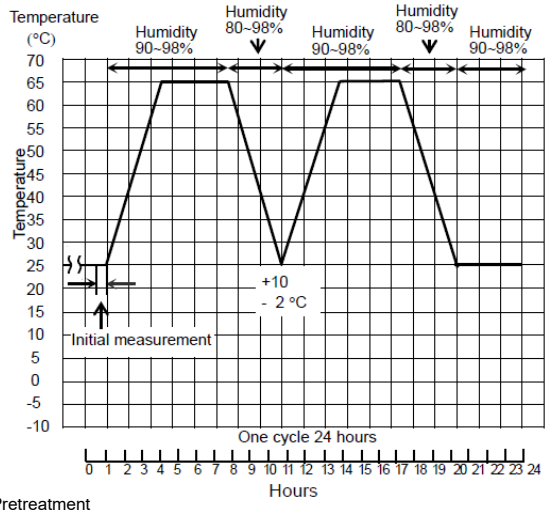
・Inside Crimp Taping
(Lead Style: M∗)



Unit : mm

Customer Part Number	Murata Part Number	T.C.	DC Rated Volt. (V)	Cap.	Cap. Tol.	Dimension (mm)						Dimension (LxW) Lead Style	Pack qty. (pcs)
						L	W	W1	F	T	H/H0		
	RHSQ92A472K0DGH01A	X9Q	100	4700pF	±10%	3.9	3.5	-	2.5	2.6	20.0	0DG	2000
	RHSQ92A682K0DGH01A	X9Q	100	6800pF	±10%	3.9	3.5	-	2.5	2.6	20.0	0DG	2000
	RHSQ92A103K0DGH01A	X9Q	100	10000pF	±10%	3.9	3.5	-	2.5	2.6	20.0	0DG	2000
	RHSQ92A153K0DGH01A	X9Q	100	15000pF	±10%	3.9	3.5	-	2.5	2.6	20.0	0DG	2000
	RHSQ92A223K0DGH01A	X9Q	100	22000pF	±10%	3.9	3.5	-	2.5	2.6	20.0	0DG	2000
	RHSQ92A333K1DGH01A	X9Q	100	33000pF	±10%	4.2	3.5	-	2.5	2.8	20.0	1DG	2000
	RHSQ92A473K1DGH01A	X9Q	100	47000pF	±10%	4.2	3.5	-	2.5	2.8	20.0	1DG	2000
	RHSQ92A683K1DGH01A	X9Q	100	68000pF	±10%	4.2	3.5	-	2.5	2.8	20.0	1DG	2000
	RHSQ92A104K1DGH01A	X9Q	100	0.10µF	±10%	4.2	3.5	-	2.5	2.8	20.0	1DG	2000
	RHSQ92A154K2DGH01A	X9Q	100	0.15µF	±10%	5.5	4.0	-	2.5	3.3	20.0	2DG	1500
	RHSQ92A224K2DGH01A	X9Q	100	0.22µF	±10%	5.5	4.0	-	2.5	3.3	20.0	2DG	1500
	RHSQ92A472K0M2H01A	X9Q	100	4700pF	±10%	3.9	3.5	6.0	5.0	2.6	20.0	0M2	2000
	RHSQ92A682K0M2H01A	X9Q	100	6800pF	±10%	3.9	3.5	6.0	5.0	2.6	20.0	0M2	2000
	RHSQ92A103K0M2H01A	X9Q	100	10000pF	±10%	3.9	3.5	6.0	5.0	2.6	20.0	0M2	2000
	RHSQ92A153K0M2H01A	X9Q	100	15000pF	±10%	3.9	3.5	6.0	5.0	2.6	20.0	0M2	2000
	RHSQ92A223K0M2H01A	X9Q	100	22000pF	±10%	3.9	3.5	6.0	5.0	2.6	20.0	0M2	2000
	RHSQ92A333K1M2H01A	X9Q	100	33000pF	±10%	4.2	3.5	5.0	5.0	2.8	20.0	1M2	2000
	RHSQ92A473K1M2H01A	X9Q	100	47000pF	±10%	4.2	3.5	5.0	5.0	2.8	20.0	1M2	2000
	RHSQ92A683K1M2H01A	X9Q	100	68000pF	±10%	4.2	3.5	5.0	5.0	2.8	20.0	1M2	2000
	RHSQ92A104K1M2H01A	X9Q	100	0.10µF	±10%	4.2	3.5	5.0	5.0	2.8	20.0	1M2	2000
	RHSQ92A154K2M2H01A	X9Q	100	0.15µF	±10%	5.5	4.0	6.0	5.0	3.3	20.0	2M2	1500
	RHSQ92A224K2M2H01A	X9Q	100	0.22µF	±10%	5.5	4.0	6.0	5.0	3.3	20.0	2M2	1500

5. Specification

No.	Test Item		Specification	Test Method (Compliant Standard:AEC-Q200)
1	Pre-and Post-Stress Electrical Test		-	
2	High Temperature Exposure (Storage)	Appearance	No defects or abnormalities except color change of outer coating.	Sit the capacitor for 1000±12 hours at 200±5°C. Let sit for 24±2 hours at *room condition , then measure.
		Capacitance Change	within ±12.5%	
		D.F.	0.04 max.	•Pretreatment Perform the heat treatment at 150+0/-10°C for 60±5 min and
		I.R.	More than 1,000MΩ or 50 MΩ･μF (Whichever is smaller)	then let sit for 24±2 hours at *room condition.
3	Temperature Cycling	Appearance	No defects or abnormalities except color change of outer coating.	Perform the 1000 cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at *room condition, then measure.
		Capacitance Change	within ±12.5%	
		D.F.	0.05 max.	
		I.R.	1,000MΩ or 50MΩ･μF min. (Whichever is smaller)	•Pretreatment Perform the heat treatment at 150+0/-10°C for 60±5 min and then let sit for 24±2 hours at *room condition.
4	Moisture Resistance	Appearance	No defects or abnormalities.	Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times. Let sit for 24±2 hours at *room condition, then measure.
		Capacitance Change	within ±12.5%	
		D.F.	0.05 max.	
		I.R.	500MΩ or 25MΩ･μF min. (Whichever is smaller)	
				•Pretreatment Perform the heat treatment at 150+0/-10°C for 60±5 min and then let sit for 24±2 hours at *room condition.
5	Biased Humidity	Appearance	No defects or abnormalities.	Apply the rated voltage and DC1.3+0.2/-0V (add 100kΩ resistor) at 85±3°C and 80 to 85% humidity for 1000±12 hours. Remove and let sit for 24±2 hours at *room condition, then measure. The charge/discharge current is less than 50mA.
		Capacitance Change	within ±12.5%	
		D.F.	0.05 max.	
		I.R.	500MΩ or 25MΩ･μF min. (Whichever is smaller)	• Pretreatment Perform a heat treatment at 150+0/-10°C for one hour. and then set at room temperature for 24±2 hours.
6	Operational Life	Appearance	No defects or abnormalities except color change of outer coating.	Apply 25% of the rated voltage for 1000±12 hours at 200±5°C. Let sit for 24±2 hours at *room condition, then measure. The charge/discharge current is less than 50mA.
		Capacitance Change	within ±15.0%	
		D.F.	0.04 max.	•Pretreatment Apply test voltage for 60±5 min at test temperature.
		I.R.	100MΩ or 5MΩ･μF min. (Whichever is smaller)	Remove and let sit for 24±2 hours at *room condition.
7	External Visual		No defects or abnormalities.	Visual inspection.
8	Physical Dimension		Within the specified dimensions.	Using calipers and micrometers.
9	Marking		To be easily legible.	Visual inspection.
10	Resistance to Solvents	Appearance	No defects or abnormalities.	Per MIL-STD-202 Method 215 Solvent 1 : 1 part (by volume) of isopropyl alcohol 3 parts (by volume) of mineral spirits Solvent 2 : Terpene defluxer Solvent 3 : 42 parts (by volume) of water 1part (by volume) of propylene glycol monomethyl ether 1 part (by volume) of monoethanolamine
		Capacitance	Within the specified tolerance.	
		D.F.	0.025 max.	
		I.R.	More than 10,000MΩ or 500 MΩ･μF (Whichever is smaller)	

Step	1	2	3	4
Temp. (°C)	-55+0/-3	Room Temp.	200+5/-0	Room Temp.
Time (min.)	15±3	1	15±3	1

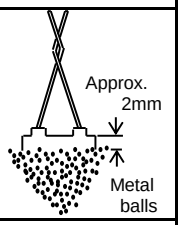
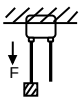
* “room condition” Temperature : 15 to 35°C, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa

<table>
<tr><th>No.</th><th colspan="2">Test Item</th><th>Specification</th><th>Test Method (Compliant Standard:AEC-Q200)</th></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Mechanical Shock</td><td>Appearance</td><td>No defects or abnormalities.</td><td rowspan="3">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 : 4.7m/s.</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance.</td></tr>
<tr><td>D.F.</td><td>0.025 max.</td></tr>
<tr><td rowspan="3">12</td><td rowspan="3">Vibration</td><td>Appearance</td><td>No defects or abnormalities.</td><td rowspan="3">The capacitor should be subjected to a simple harmonic motion having a total amplitude of 1.5mm, the frequency being varied uniformly between the approximate limits of 10 and 2000Hz. The frequency range, from 10 to 2000Hz and return to 10Hz, should be traversed in approximately 20 min. This motion should be applied for 12 items in each 3 mutually perpendicular directions (total of 36 times).</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance.</td></tr>
<tr><td>D.F.</td><td>0.025 max.</td></tr>
<tr><td rowspan="3">13-1</td><td rowspan="3">Resistance to Soldering Heat (Non-Preheat)</td><td>Appearance</td><td>No defects or abnormalities.</td><td rowspan="3">The lead wires should be immersed in the melted solder 1.5 to 2.0mm from the root of terminal at 260±5°C for 10±1 seconds.

• Pre-treatment
Capacitor should be stored at 150+0/-10°C for one hour, then place at *room condition for 24±2 hours before initial measurement.
• Post-treatment
Capacitor should be stored for 24±2 hours at *room condition.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±7.5%</td></tr>
<tr><td>Dielectric Strength (Between terminals)</td><td>No defects</td></tr>
<tr><td rowspan="3">13-2</td><td rowspan="3">Resistance to Soldering Heat (On-Preheat)</td><td>Appearance</td><td>No defects or abnormalities.</td><td rowspan="3">First the capacitor should be stored at 120+0/-5°C for 60+0/-5 seconds. Then, the lead wires should be immersed in the melted solder 1.5 to 2.0mm from the root of terminal at 260±5°C for 7.5+0/-1 seconds.

• Pre-treatment
Capacitor should be stored at 150+0/-10°C for one hour, then place at *room condition for 24±2 hours before initial measurement.
• Post-treatment
Capacitor should be stored for 24±2 hours at *room condition.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±7.5%</td></tr>
<tr><td>Dielectric Strength (Between terminals)</td><td>No defects</td></tr>
<tr><td rowspan="3">13-3</td><td rowspan="3">Resistance to Soldering Heat (soldering iron method)</td><td>Appearance</td><td>No defects or abnormalities.</td><td rowspan="3">Test condition
Termperature of iron-tip : 350±10°C
Soldering time : 3.5±0.5 seconds
Soldering position
Straight Lead : 1.5 to 2.0mm from the root of terminal.
Crimp Lead : 1.5 to 2.0mm from the end of lead bend.

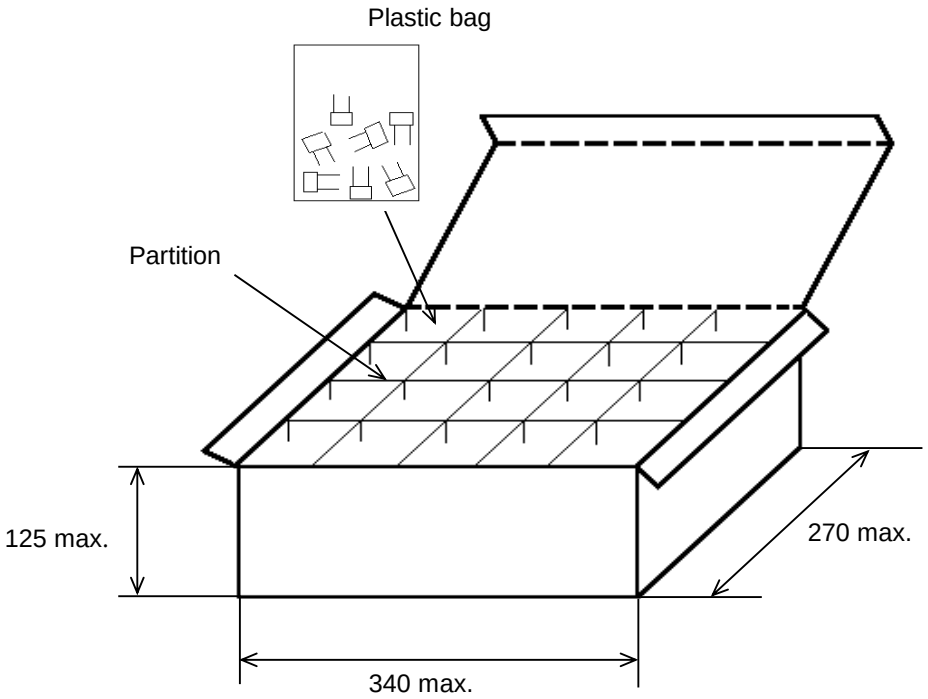
• Pre-treatment
Capacitor should be stored at 150+0/-10°C for one hour, then place at *room condition for 24±2 hours before initial measurement.
• Post-treatment
Capacitor should be stored for 24±2 hours at *room condition.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±7.5%</td></tr>
<tr><td>Dielectric Strength (Between terminals)</td><td>No defects</td></tr>
<tr><td rowspan="4">14</td><td rowspan="4">Thermal Shock</td><td>Appearance</td><td>No defects or abnormalities except color change of outer coating.</td><td rowspan="4">Perform the 300 cycles according to the two heat treatments listed in the following table (Maximum transfer time is 20 seconds.).
Let sit for 24±2 hours at *room condition, then measure.
<table><tr><td>Step</td><td>1</td><td>2</td></tr><tr><td>Temp. (°C)</td><td>-55+0/-3</td><td>200+5/-0</td></tr><tr><td>Time (min.)</td><td>15±3</td><td>15±3</td></tr></table>•Pretreatment
Perform the heat treatment at 150+0/-10°C for 60±5 min and then let sit for 24±2 hours at *room condition.</td></tr>
<tr><td>Capacitance Change</td><td>within ±12.5%</td></tr>
<tr><td>D.F.</td><td>0.05 max.</td></tr>
<tr><td>I.R.</td><td>1,000MΩ or 50MΩ･μF min. (Whichever is smaller)</td></tr>
<tr><td rowspan="4">15</td><td rowspan="4">ESD</td><td>Appearance</td><td>No defects or abnormalities.</td><td rowspan="4">Per AEC-Q200-002</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance.</td></tr>
<tr><td>D.F.</td><td>0.025 max.</td></tr>
<tr><td>I.R.</td><td>More than 10,000MΩ or 500 MΩ･μF (Whichever is smaller)</td></tr>
<tr><td>16</td><td>Solderability</td><td></td><td>Lead wire should be soldered with uniform coating on the axial direction over 95% of the circumferential direction.</td><td>The terminal of capacitor is dipped into a solution of rosin ethanol (25% rosin in weight propotion).
Immerse in solder solution for 2±0.5 seconds.
In both cases the depth of dipping is up to about 1.5 to 2mm from the terminal body.
Temp. of solder : 245±5°C (Sn-3.0Ag-0.5Cu)</td></tr>
<tr><td colspan="5">* “room condition” Temperature : 15 to 35°C, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa</td></tr>
</table>

<table>
<tr><th>No.</th><th colspan="2">Test Item</th><th colspan="2">Specification</th><th>Test Method (Compliant Standard:AEC-Q200)</th></tr>
<tr><td rowspan="6">17</td><td rowspan="6">Electrical Characte-rization</td><td>Apperance</td><td colspan="2">No defects or abnormalities.</td><td>Visual inspection.</td></tr>
<tr><td>Capacitance</td><td colspan="2">Within the specified tolerance.</td><td rowspan="2">The capacitance/D.F. should be measured at 25°C at the frequency and voltage shown in the table.
<table><tr><th>Frequency</th><th>Voltage</th></tr><tr><td>1±0.1kHz</td><td>1±0.2V(r.m.s.)</td></tr></table></td></tr>
<tr><td>D.F.</td><td colspan="2">0.025 max.</td></tr>
<tr><td rowspan="2">Insulation Resistance (I.R.)</td><td>Room Temperature</td><td>10,000MΩ or 500MΩ･μF min.
(Whichever is smaller)</td><td>The insulation resistance should be measured at 25±3 °C with a DC voltage not exceeding the rated voltage at normal temperature and humidity and within 2 min. of charging.
(Charge/Discharge current ≦ 50mA.)</td></tr>
<tr><td>High Temperature</td><td>0.5MΩ or 0.1MΩ･μF min.
(Whichever is smaller)</td><td>The insulation resistance should be measured at 200±5 °C with a DC voltage not exceeding 25% of the rated voltage at normal temperature and humidity and within 2 min. of charging.
(Charge/Discharge current ≦ 50mA.)</td></tr>
<tr><td rowspan="2">Dielectric Strength</td><td>Between Terminals</td><td>No defects or abnormalities.</td><td>The capacitor should not be damaged when DC voltage of 250% of the rated voltage is applied between the terminations for 1 to 5 seconds.
(Charge/Discharge current ≦ 50mA.)</td></tr>
<tr><td>Terminal To External Resin</td><td>No defects or abnormalities.</td><td>The capacitor is placed in a container with metal balls of 1mm diameter so that each terminal, short-circuit is kept approximately 2mm from the balls, and 250% of the rated DC voltage is impressed for 1 to 5 seconds between capacitor terminals and metal balls.
(Charge/Discharge current ≦ 50mA.)
  </td></tr>
<tr><td>18</td><td>Terminal Strength</td><td>Tensile Strength</td><td colspan="2">Termination not to be broken or loosened.</td><td>As in the figure, fix the capacitor body, apply the force gradually to each lead in the radial direction of the capacitor until reaching 10N and then keep the force applied for 10±1 seconds.
  </td></tr>
<tr><td></td><td></td><td>Bending Strength</td><td colspan="2">Termination not to be broken or loosened.</td><td>Each lead wire should be subjected to a force of 2.5N and then be bent 90° at the point of egress in one direction. Each wire is then returned to the original position and bent 90° in the opposite direction at the rate of one bend per 2 to 3 seconds.</td></tr>
<tr><td>19</td><td colspan="2">Capacitance Temperature Characteristics</td><td colspan="2">-55 to 125°C : within ±15%
125 to 200°C : within +15/-70%</td><td>The capacitance change should be measured after 5min. at each specified temperature step.
<table><tr><th>Step</th><th>Temperature(°C)</th></tr><tr><td>1</td><td>25±2</td></tr><tr><td>2</td><td>-55±3</td></tr><tr><td>3</td><td>25±2</td></tr><tr><td>4</td><td>200±5</td></tr><tr><td>5</td><td>25±2</td></tr></table>The ranges of capacitance change compared with the above 25°C value over the temperature ranges shown in the table should be within the specified ranges.
•Pretreatment
Perform the heat treatment at 150+0/-10°C for 60±5 min and then let sit for 24±2 hours at *room condition.
Perform the initial measurement.</td></tr>
<tr><td colspan="6">* “room condition” Temperature : 15 to 35°C, Relative humidity : 45 to 75%, Atmosphere pressure : 86 to 106kPa</td></tr>
</table>

6. Packing specification

・Bulk type (Packing style code : B)

The size of packing case and packing way



Unit : mm

The number of packing = *1 Packing quantity × *2 n

*1 : Please refer to [Part number list].

*2 : Standard n = 20 (bag)

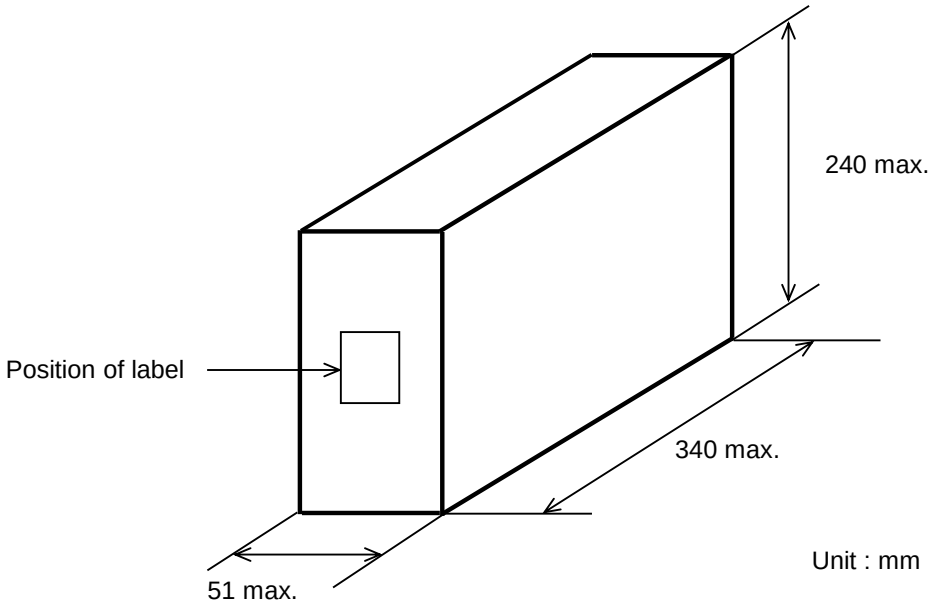
Note)

The outer package and the number of outer packing be changed by the order getting amount.

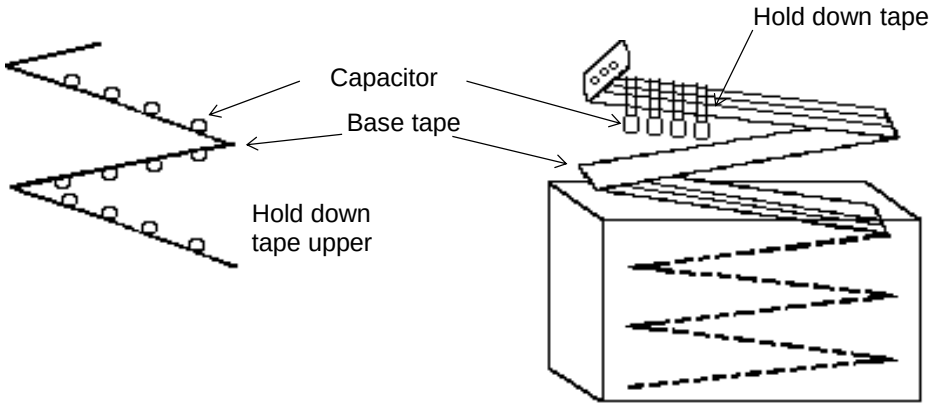
・Ammo pack taping type (Packing style code : A)

A crease is made every 25 pitches, and the tape with capacitors is packed zigzag into a case.
When body of the capacitor is piled on other body under it.

The size of packing case and packing way



Unit : mm

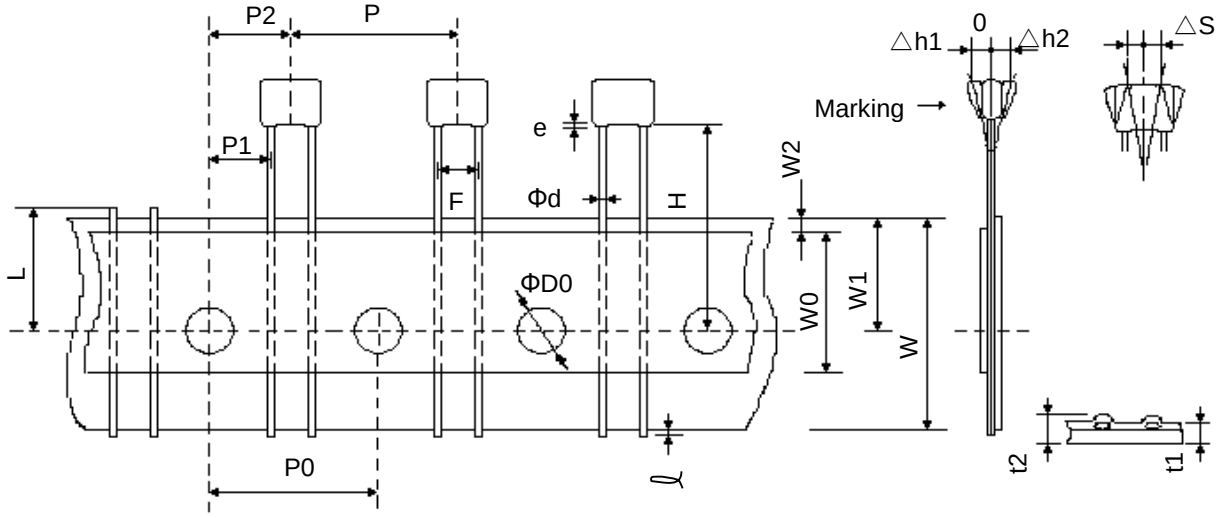


7. Taping specification

7-1. Dimension of capacitors on tape

Straight taping type < Lead Style : DG >

Pitch of component 12.7mm / Lead spacing 2.5mm

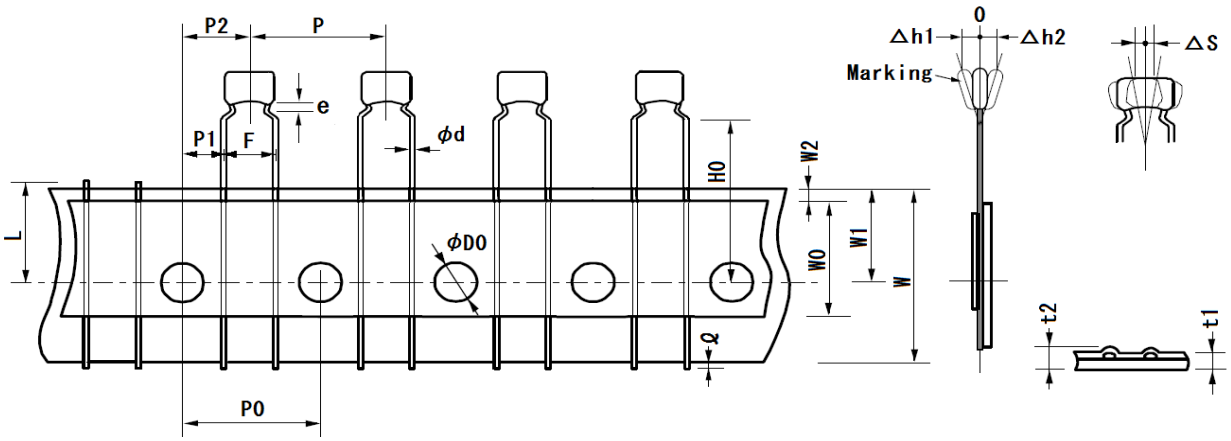


Unit : mm

Item	Code	Dimensions	Remarks
Pitch of component	P	12.7+/-1.0	
Pitch of sprocket hole	P0	12.7+/-0.2	
Lead spacing	F	2.5+0.4/-0.2	
Length from hole center to component center	P2	6.35+/-1.3	Deviation of progress direction
Length from hole center to lead	P1	5.1+/-0.7	
Deviation along tape, left or right defect	ΔS	0+/-2.0	They include deviation by lead bend
Carrier tape width	W	18.0+/-0.5	
Position of sprocket hole	W1	9.0+0/-0.5	Deviation of tape width direction
Lead distance between reference and bottom plane	H	20.0+/-0.5	
Protrusion length	ℓ	0.5 max.	
Diameter of sprocket hole	ΦD0	4.0+/-0.1	
Lead diameter	Φd	0.5+/-0.05	
Total tape thickness	t1	0.6+/-0.3	They include hold down tape thickness
Total thickness of tape and lead wire	t2	1.5 max.	
Deviation across tape	Δh1	1.0 max.	
	Δh2		
Portion to cut in case of defect	L	11.0+0/-1.0	
Hold down tape width	W0	9.5 min.	
Hold down tape position	W2	1.5+/-1.5	
Coating extension on lead	e	2.0 max.	

Inside crimp taping type < Lead Style : M2 >

Pitch of component 12.7mm / Lead spacing 5.0mm

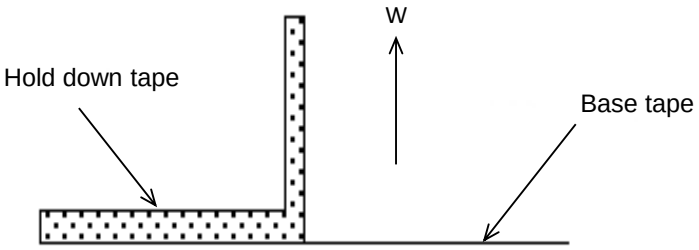


Unit : mm

Item	Code	Dimensions	Remarks
Pitch of component	P	12.7+/-1.0	
Pitch of sprocket hole	P0	12.7+/-0.2	
Lead spacing	F	5.0+0.6/-0.2	
Length from hole center to component center	P2	6.35+/-1.3	Deviation of progress direction
Length from hole center to lead	P1	3.85+/-0.7	
Deviation along tape, left or right defect	ΔS	0+/-2.0	They include deviation by lead bend
Carrier tape width	W	18.0+/-0.5	
Position of sprocket hole	W1	9.0+0/-0.5	Deviation of tape width direction
Lead distance between reference and bottom plane	H0	20.0+/-0.5	
Protrusion length	ℓ	0.5 max.	
Diameter of sprocket hole	ΦD0	4.0+/-0.1	
Lead diameter	Φd	0.5+/-0.05	
Total tape thickness	t1	0.6+/-0.3	They include hold down tape thickness
Total thickness of tape and lead wire	t2	1.5 max.	
Deviation across tape	Δh1	2.0 max. (Dimension code : W)	
	Δh2	1.0 max. (except as above)	
Portion to cut in case of defect	L	11.0+0/-1.0	
Hold down tape width	W0	9.5 min.	
Hold down tape position	W2	1.5+/-1.5	
Coating extension on lead	e	Up to the end of crimp	

7-2. Splicing way of tape

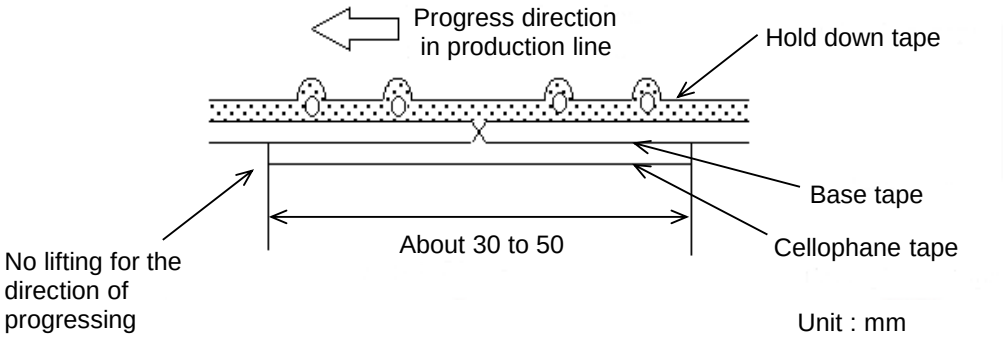
1) Adhesive force of tape is over 3N at test condition as below.



2) Splicing of tape

a) When base tape is spliced

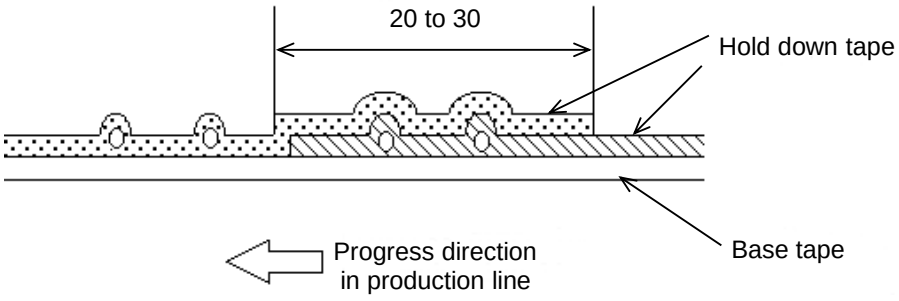
•Base tape shall be spliced by cellophane tape.
(Total tape thickness shall be less than 1.05mm.)



Unit : mm

b) When hold down tape is spliced

•Hold down tape shall be spliced with overlapping.
(Total tape thickness shall be less than 1.05mm.)



Unit : mm

c) When both tape are spliced

•Base tape and hold down tape shall be spliced with splicing tape.