Reference Specification

200°C Operation Leaded MLCC for Automotive with AEC-Q200

RHS Series

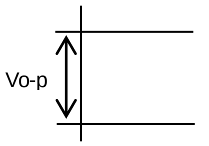
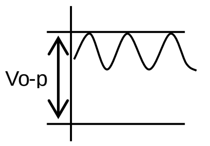
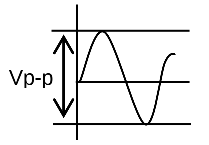
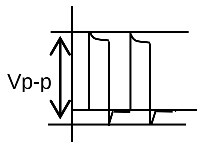
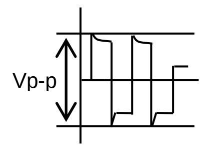
Product specifications in this catalog are as of Jul. 2019, and are subject to change or obsolescence without notice.
Please consult the approval sheet before ordering.Please read rating and Cautions first.

⚠ CAUTION

1. OPERATING VOLTAGE

When DC-rated capacitors are to be used in AC or ripple current circuits, be sure to maintain the Vp-p value of the applied voltage or the Vo-p which contains DC bias within the rated voltage range. When the voltage is started to apply to the circuit or it is stopped applying, the irregular voltage may be generated for a transit period because of resonance or switching. Be sure to use a capacitor within rated voltage containing these irregular voltage.

When DC-rated capacitors are to be used in input circuits from commercial power source (AC filter), be sure to use Safety Recognized Capacitors because various regulations on withstand voltage or impulse withstand established for each equipment should be taken into considerations.

Voltage	DC Voltage	DC+AC Voltage	AC Voltage	Pulse Voltage(1)	Pulse Voltage(2)
Positional Measurement					

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.

5. VIBRATION AND IMPACT

Do not expose a capacitor or its leads to excessive shock or vibration during use.

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.

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.

9. LIMITATION OF APPLICATIONS

Please contact us before using our products for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property.

1. Aircraft equipment
2. Aerospace equipment
3. Undersea equipment
4. Power plant control equipment
5. Medical equipment
6. Transportation equipment (vehicles, trains, ships, etc.)
7. Traffic signal equipment
8. Disaster prevention / crime prevention equipment
9. Data-processing equipment exerting influence on public
10. Application of similar complexity and/or reliability requirements to the applications listed in the above.

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.

⚠ 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 specification.

1. Application

This specification is applied to 200°C Operation Leaded MLCC RHS series in accordance with AEC-Q200 requirements used for Automotive Electronic equipment.

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	7J	2D	101	J	1	A2	H01	B
Series	Temperature Characteristic	Rated voltage	Capacitance	Capacitance tolerance	Dimension code	Lead code	Individual specification code	Packing style code

- Series

Code	Content
RHS	Epoxy coated, 200°C max.

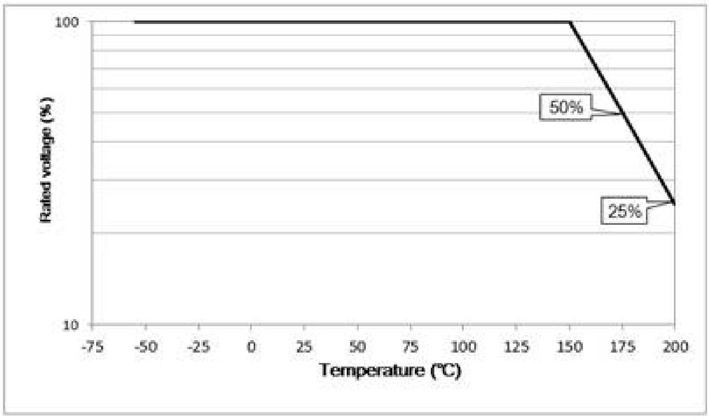
- Temperature characteristic

Code	Temp. Char.	Temp. Range	Temp. coeff.(ppm/°C)	Standard Temp.	Operating Temp. Range
7J	UNJ (Murta code)	-55～25°C	-750+120/-347	25°C	-55～200°C
		25～125°C	-750±120		
		25～125°C	-750+347/-120		

- Rated voltage

Code	Rated voltage
2D	DC200V
2H	DC500V

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 101.

  10×10^{1} = 100pF

ETRH07C

- Capacitance tolerance

Code	Capacitance tolerance
J	+/-5%

- Dimension code

Code	Dimensions (LxW) mm max.
1	4.2 x 3.5
2	5.5 x 4.0

- Lead code

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

Lead wire is solder coated CP wire.

- Individual specification code
  Murata's control code
  Please refer to [Part number list].

- Packing style code

Code	Packing style
A	Taping type of Ammo
B	Bulk type

3. Marking

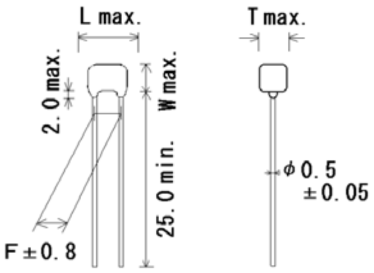
Temp. char. : Letter code : 2 (UNJ char.)
Capacitance : 3 digit numbers
Capacitance tolerance : Code
Rated voltage : Letter code : 6 (DC200V only. Except dimension code : 1)
Letter code : 9 (DC500V only)
Company name code : Abbreviation : (Except dimension code : 1)

(Ex.)

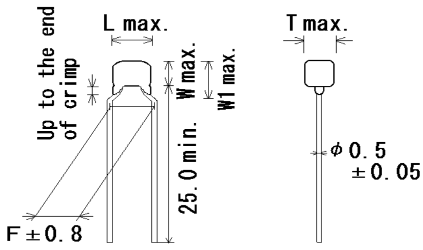
Dimension code \ Rated voltage	200V	500V
1	2 101J	—
2	103 J62	101 J92

4. Part number list

・Straight Long
(Lead Code:A2)



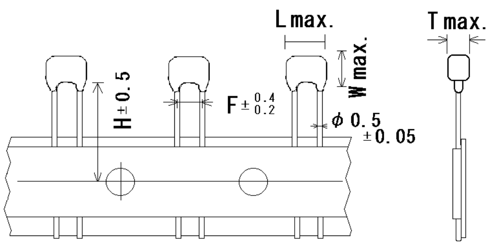
・Inside Crimp
(Lead Code:K1)



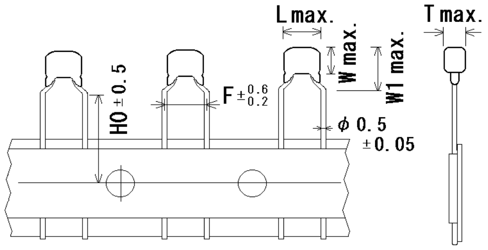
Unit : mm

Customer Part Number	Murata Part Number	T.C.	DC Rated Volt. (V)	Cap.	Cap. tol.	Dimension (mm)					Size Lead Code	Pack qty. (pcs)
						L	W	W1	F	T		
	RHS7J2D101J1A2H01B	UNJ	200	100pF	±5%	4.2	3.5	-	2.5	2.8	1A2	500
	RHS7J2D151J1A2H01B	UNJ	200	150pF	±5%	4.2	3.5	-	2.5	2.8	1A2	500
	RHS7J2D221J1A2H01B	UNJ	200	220pF	±5%	4.2	3.5	-	2.5	2.8	1A2	500
	RHS7J2D331J1A2H01B	UNJ	200	330pF	±5%	4.2	3.5	-	2.5	2.8	1A2	500
	RHS7J2D471J1A2H01B	UNJ	200	470pF	±5%	4.2	3.5	-	2.5	2.8	1A2	500
	RHS7J2D681J1A2H01B	UNJ	200	680pF	±5%	4.2	3.5	-	2.5	2.8	1A2	500
	RHS7J2D102J1A2H01B	UNJ	200	1000pF	±5%	4.2	3.5	-	2.5	2.8	1A2	500
	RHS7J2D152J1A2H01B	UNJ	200	1500pF	±5%	4.2	3.5	-	2.5	2.8	1A2	500
	RHS7J2D222J1A2H01B	UNJ	200	2200pF	±5%	4.2	3.5	-	2.5	2.8	1A2	500
	RHS7J2D332J1A2H01B	UNJ	200	3300pF	±5%	4.2	3.5	-	2.5	2.8	1A2	500
	RHS7J2D472J1A2H01B	UNJ	200	4700pF	±5%	4.2	3.5	-	2.5	2.8	1A2	500
	RHS7J2D682J2A2H01B	UNJ	200	6800pF	±5%	5.5	4.0	-	2.5	3.3	2A2	500
	RHS7J2D103J2A2H01B	UNJ	200	10000pF	±5%	5.5	4.0	-	2.5	3.3	2A2	500
	RHS7J2D101J1K1H01B	UNJ	200	100pF	±5%	4.2	3.5	5.0	5.0	2.8	1K1	500
	RHS7J2D151J1K1H01B	UNJ	200	150pF	±5%	4.2	3.5	5.0	5.0	2.8	1K1	500
	RHS7J2D221J1K1H01B	UNJ	200	220pF	±5%	4.2	3.5	5.0	5.0	2.8	1K1	500
	RHS7J2D331J1K1H01B	UNJ	200	330pF	±5%	4.2	3.5	5.0	5.0	2.8	1K1	500
	RHS7J2D471J1K1H01B	UNJ	200	470pF	±5%	4.2	3.5	5.0	5.0	2.8	1K1	500
	RHS7J2D681J1K1H01B	UNJ	200	680pF	±5%	4.2	3.5	5.0	5.0	2.8	1K1	500
	RHS7J2D102J1K1H01B	UNJ	200	1000pF	±5%	4.2	3.5	5.0	5.0	2.8	1K1	500
	RHS7J2D152J1K1H01B	UNJ	200	1500pF	±5%	4.2	3.5	5.0	5.0	2.8	1K1	500
	RHS7J2D222J1K1H01B	UNJ	200	2200pF	±5%	4.2	3.5	5.0	5.0	2.8	1K1	500
	RHS7J2D332J1K1H01B	UNJ	200	3300pF	±5%	4.2	3.5	5.0	5.0	2.8	1K1	500
	RHS7J2D472J1K1H01B	UNJ	200	4700pF	±5%	4.2	3.5	5.0	5.0	2.8	1K1	500
	RHS7J2D682J2K1H01B	UNJ	200	6800pF	±5%	5.5	4.0	6.0	5.0	3.3	2K1	500
	RHS7J2D103J2K1H01B	UNJ	200	10000pF	±5%	5.5	4.0	6.0	5.0	3.3	2K1	500
	RHS7J2H101J2K1H01B	UNJ	500	100pF	±5%	5.5	4.0	6.0	5.0	3.3	2K1	500
	RHS7J2H151J2K1H01B	UNJ	500	150pF	±5%	5.5	4.0	6.0	5.0	3.3	2K1	500
	RHS7J2H221J2K1H01B	UNJ	500	220pF	±5%	5.5	4.0	6.0	5.0	3.3	2K1	500
	RHS7J2H331J2K1H01B	UNJ	500	330pF	±5%	5.5	4.0	6.0	5.0	3.3	2K1	500
	RHS7J2H471J2K1H01B	UNJ	500	470pF	±5%	5.5	4.0	6.0	5.0	3.3	2K1	500
	RHS7J2H681J2K1H01B	UNJ	500	680pF	±5%	5.5	4.0	6.0	5.0	3.3	2K1	500
	RHS7J2H102J2K1H01B	UNJ	500	1000pF	±5%	5.5	4.0	6.0	5.0	3.3	2K1	500
	RHS7J2H152J2K1H01B	UNJ	500	1500pF	±5%	5.5	4.0	6.0	5.0	3.3	2K1	500
	RHS7J2H222J2K1H01B	UNJ	500	2200pF	±5%	5.5	4.0	6.0	5.0	3.3	2K1	500
	RHS7J2H332J2K1H01B	UNJ	500	3300pF	±5%	5.5	4.0	6.0	5.0	3.3	2K1	500
	RHS7J2H472J2K1H01B	UNJ	500	4700pF	±5%	5.5	4.0	6.0	5.0	3.3	2K1	500

・Straight Taping
(Lead Code:DG)



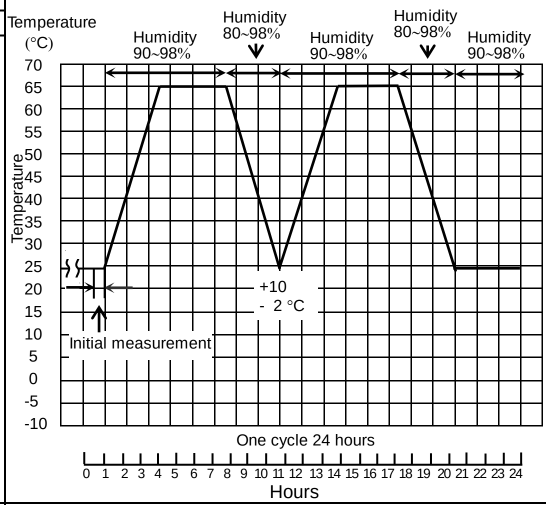
・Inside Crimp Taping
(Lead Code: M2)



Unit : mm

Customer Part Number	Murata Part Number	T.C.	DC Rated volt. (V)	Cap.	Cap. tol.	Dimension (mm)						Size Lead Code	Pack qty. (pcs)
						L	W	W1	F	T	H/H0		
	RHS7J2D101J1DGH01A	UNJ	200	100pF	±5%	4.2	3.5	-	2.5	2.8	20.0	1DG	2000
	RHS7J2D151J1DGH01A	UNJ	200	150pF	±5%	4.2	3.5	-	2.5	2.8	20.0	1DG	2000
	RHS7J2D221J1DGH01A	UNJ	200	220pF	±5%	4.2	3.5	-	2.5	2.8	20.0	1DG	2000
	RHS7J2D331J1DGH01A	UNJ	200	330pF	±5%	4.2	3.5	-	2.5	2.8	20.0	1DG	2000
	RHS7J2D471J1DGH01A	UNJ	200	470pF	±5%	4.2	3.5	-	2.5	2.8	20.0	1DG	2000
	RHS7J2D681J1DGH01A	UNJ	200	680pF	±5%	4.2	3.5	-	2.5	2.8	20.0	1DG	2000
	RHS7J2D102J1DGH01A	UNJ	200	1000pF	±5%	4.2	3.5	-	2.5	2.8	20.0	1DG	2000
	RHS7J2D152J1DGH01A	UNJ	200	1500pF	±5%	4.2	3.5	-	2.5	2.8	20.0	1DG	2000
	RHS7J2D222J1DGH01A	UNJ	200	2200pF	±5%	4.2	3.5	-	2.5	2.8	20.0	1DG	2000
	RHS7J2D332J1DGH01A	UNJ	200	3300pF	±5%	4.2	3.5	-	2.5	2.8	20.0	1DG	2000
	RHS7J2D472J1DGH01A	UNJ	200	4700pF	±5%	4.2	3.5	-	2.5	2.8	20.0	1DG	2000
	RHS7J2D682J2DGH01A	UNJ	200	6800pF	±5%	5.5	4.0	-	2.5	3.3	20.0	2DG	1500
	RHS7J2D103J2DGH01A	UNJ	200	10000pF	±5%	5.5	4.0	-	2.5	3.3	20.0	2DG	1500
	RHS7J2D101J1M2H01A	UNJ	200	100pF	±5%	4.2	3.5	5.0	5.0	2.8	20.0	1M2	2000
	RHS7J2D151J1M2H01A	UNJ	200	150pF	±5%	4.2	3.5	5.0	5.0	2.8	20.0	1M2	2000
	RHS7J2D221J1M2H01A	UNJ	200	220pF	±5%	4.2	3.5	5.0	5.0	2.8	20.0	1M2	2000
	RHS7J2D331J1M2H01A	UNJ	200	330pF	±5%	4.2	3.5	5.0	5.0	2.8	20.0	1M2	2000
	RHS7J2D471J1M2H01A	UNJ	200	470pF	±5%	4.2	3.5	5.0	5.0	2.8	20.0	1M2	2000
	RHS7J2D681J1M2H01A	UNJ	200	680pF	±5%	4.2	3.5	5.0	5.0	2.8	20.0	1M2	2000
	RHS7J2D102J1M2H01A	UNJ	200	1000pF	±5%	4.2	3.5	5.0	5.0	2.8	20.0	1M2	2000
	RHS7J2D152J1M2H01A	UNJ	200	1500pF	±5%	4.2	3.5	5.0	5.0	2.8	20.0	1M2	2000
	RHS7J2D222J1M2H01A	UNJ	200	2200pF	±5%	4.2	3.5	5.0	5.0	2.8	20.0	1M2	2000
	RHS7J2D332J1M2H01A	UNJ	200	3300pF	±5%	4.2	3.5	5.0	5.0	2.8	20.0	1M2	2000
	RHS7J2D472J1M2H01A	UNJ	200	4700pF	±5%	4.2	3.5	5.0	5.0	2.8	20.0	1M2	2000
	RHS7J2D682J2M2H01A	UNJ	200	6800pF	±5%	5.5	4.0	6.0	5.0	3.3	20.0	2M2	1500
	RHS7J2D103J2M2H01A	UNJ	200	10000pF	±5%	5.5	4.0	6.0	5.0	3.3	20.0	2M2	1500
	RHS7J2H101J2M2H01A	UNJ	500	100pF	±5%	5.5	4.0	6.0	5.0	3.3	20.0	2M2	1500
	RHS7J2H151J2M2H01A	UNJ	500	150pF	±5%	5.5	4.0	6.0	5.0	3.3	20.0	2M2	1500
	RHS7J2H221J2M2H01A	UNJ	500	220pF	±5%	5.5	4.0	6.0	5.0	3.3	20.0	2M2	1500
	RHS7J2H331J2M2H01A	UNJ	500	330pF	±5%	5.5	4.0	6.0	5.0	3.3	20.0	2M2	1500
	RHS7J2H471J2M2H01A	UNJ	500	470pF	±5%	5.5	4.0	6.0	5.0	3.3	20.0	2M2	1500
	RHS7J2H681J2M2H01A	UNJ	500	680pF	±5%	5.5	4.0	6.0	5.0	3.3	20.0	2M2	1500
	RHS7J2H102J2M2H01A	UNJ	500	1000pF	±5%	5.5	4.0	6.0	5.0	3.3	20.0	2M2	1500
	RHS7J2H152J2M2H01A	UNJ	500	1500pF	±5%	5.5	4.0	6.0	5.0	3.3	20.0	2M2	1500
	RHS7J2H222J2M2H01A	UNJ	500	2200pF	±5%	5.5	4.0	6.0	5.0	3.3	20.0	2M2	1500
	RHS7J2H332J2M2H01A	UNJ	500	3300pF	±5%	5.5	4.0	6.0	5.0	3.3	20.0	2M2	1500
	RHS7J2H472J2M2H01A	UNJ	500	4700pF	±5%	5.5	4.0	6.0	5.0	3.3	20.0	2M2	1500

5. AEC-Q200 Murata Standard Specifications and Test Methods

<table>
<tr><th>No.</th><th colspan="2">AEC-Q200
Test Item</th><th>Specification</th><th>AEC-Q200 Test Method</th></tr>
<tr><td>1</td><td colspan="2">Pre-and Post-Stress Electrical Test</td><td colspan="2">-</td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">High Temperature Exposure (Storage)</td><td>Appearance</td><td>No defects or abnormalities except color change of outer coating.</td><td rowspan="4">Sit the capacitor for 1,000±12h at 200±5°C. Let sit for 24±2h at *room condition, then measure.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±3% or ±0.3pF
(Whichever is larger)</td></tr>
<tr><td>Q</td><td>Q ≥ 350</td></tr>
<tr><td>I.R.</td><td>1,000MΩ min.</td></tr>
<tr><td rowspan="4">3</td><td rowspan="4">Temperature Cycling</td><td>Appearance</td><td>No defects or abnormalities except color change of outer coating</td><td rowspan="4">Perform the 1,000 cycles according to the four heat treatments listed in the following table. Let sit for 24±2 h at *room condition, then measure.<table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (°C)</td><td>-55+0/-3</td><td>Room Temp.</td><td>200+5/-0</td><td>Room Temp.</td></tr><tr><td>Time (min.)</td><td>15±3</td><td>1</td><td>15±3</td><td>1</td></tr></table></td></tr>
<tr><td>Capacitance Change</td><td>Within ±5% or ±0.5pF
(Whichever is larger)</td></tr>
<tr><td>Q</td><td>Q ≥ 350</td></tr>
<tr><td>I.R.</td><td>1,000MΩ min.</td></tr>
<tr><td rowspan="4">4</td><td rowspan="4">Moisture Resistance</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="4">Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
Let sit for 24±2 h at *room condition, then measure.
</td></tr>
<tr><td>Capacitance Change</td><td>Within ±5% or ± 0.5pF
(Whichever is larger)</td></tr>
<tr><td>Q</td><td>Q ≥ 200</td></tr>
<tr><td>I.R.</td><td>500MΩ min.</td></tr>
<tr><td rowspan="4">5</td><td rowspan="4">Biased Humidity</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="4">Apply the rated voltage and DC1.3+0.2/-0 V (add 100kΩ resistor) at 85±3°C and 80 to 85% humidity for 1,000±12h.
Remove and let sit for 24±2 h at *room condition, then measure.
The charge/discharge current is less than 50mA.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±5% or ± 0.5pF
(Whichever is larger)</td></tr>
<tr><td>Q</td><td>Q ≥ 200</td></tr>
<tr><td>I.R.</td><td>500MΩ min.</td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">Operational Life</td><td>Appearance</td><td>No defects or abnormalities except color change of outer coating</td><td rowspan="4">Apply 25% of the rated voltage for 1,000±12h at 200±5°C.
Let sit for 24±2 h at *room condition, then measure.
The charge/discharge current is less than 50mA.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±3% or ±0.3pF
(Whichever is larger)</td></tr>
<tr><td>Q</td><td>Q ≥ 350</td></tr>
<tr><td>I.R.</td><td>1,000MΩ min.</td></tr>
<tr><td>7</td><td colspan="2">External Visual</td><td>No defects or abnormalities</td><td>Visual inspection</td></tr>
<tr><td>8</td><td colspan="2">Physical Dimension</td><td>Within the specified dimensions</td><td>Using calipers and micrometers.</td></tr>
<tr><td>9</td><td colspan="2">Marking</td><td>To be easily legible.</td><td>Visual inspection</td></tr>
<tr><td rowspan="4">10</td><td rowspan="4">Resistance to Solvents</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="4">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</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>Q</td><td>Q ≥ 1,000</td></tr>
<tr><td>I.R.</td><td>10,000MΩ min.</td></tr>
</table>

* “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">AEC-Q200
Test Item</th><th>Specification</th><th>AEC-Q200 Test Method</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:1,500G and velocity change: 4.7m/s.</td></tr>
<tr><td>Capacitance</td><td>Within the specified tolerance</td></tr>
<tr><td>Q</td><td>Q ≥ 1,000</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 2,000Hz.
The frequency range, from 10 to 2,000Hz 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>Q</td><td>Q ≥ 1,000</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.

• Post-treatment
Capacitor should be stored for 24±2 hours at *room condition.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF
(Whichever is larger)</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.

• Post-treatment
Capacitor should be stored for 24±2 hours at *room condition.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF
(Whichever is larger)</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.

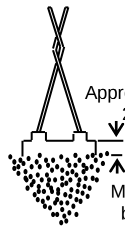
• Post-treatment
Capacitor should be stored for 24±2 hours at *room condition.</td></tr>
<tr><td>Capacitance Change</td><td>Within ±2.5% or ±0.25pF
(Whichever is larger)</td></tr>
<tr><td>Dielectric Strength (Between terminals)</td><td>No defects</td></tr>
<tr><td rowspan="4">14</td><td rowspan="4">Thermal Shock</td><td>Appearance</td><td>No defects or abnormalities</td><td rowspan="4">Perform the 300 cycles according to the two heat treatments listed in the following table(Maximum transfer time is 20s.). Let sit for 24±2 h 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></td></tr>
<tr><td>Capacitance Change</td><td>Within ±5% or ±0.5pF
(Whichever is larger)</td></tr>
<tr><td>Q</td><td>Q ≥ 350</td></tr>
<tr><td>I.R.</td><td>1,000MΩ min.</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>Q</td><td>Q ≥ 1,000</td></tr>
<tr><td>I.R.</td><td>10,000MΩ min.</td></tr>
<tr><td>16</td><td colspan="2">Solderability</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 a capacitor is dipped into a solution of ethanol (JIS-K-8101) and rosin (JIS-K-5902) (25%rosin in weight propotion) and then into molten solder (JIS-Z-3282) for 2±0.5 sec. In both cases the depth of dipping is up to about 1.5 to 2mm from the terminal body.

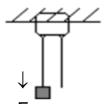
Temp. of solder :
245±5°C Lead Free Solder(Sn-3.0Ag-0.5Cu)
235±5°C H60A or H63A Eutectic Solder</td></tr>
</table>

* “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">AEC-Q200
Test Item</th><th colspan="2">Specifications</th><th>AEC-Q200 Test Method</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, Q should be measured at 25°C at the frequency and voltage shown in the table.
<table>
<tr><th>Nominal Cap.</th><th>Frequency</th><th>Voltage</th></tr>
<tr><td>C ≤ 1000pF</td><td>1±0.1MHz</td><td>AC0.5 to 5V(rms)</td></tr>
<tr><td>C > 1000pF</td><td>1±0.1kHz</td><td>AC1±0.2V(rms)</td></tr>
</table></td></tr>
<tr><td>Q</td><td colspan="2">Q ≥ 1,000</td></tr>
<tr><td rowspan="2">Insulation Resistance (I.R.)</td><td>Room Temperature</td><td>10,000MΩ min.</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>20MΩ min.</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>Dielectric Strength</td><td>Between Terminals

Body Insulation</td><td>No defects or abnormalities

No defects or abnormalities</td><td>The capacitor should not be damaged when voltage in Table is applied between the terminations for 1 to 5 seconds.
(Charge/Discharge current ≤ 50mA.)
<table>
<tr><th>Rated voltage</th><th>Test voltage</th></tr>
<tr><td>DC200V</td><td>250% of the rated voltage</td></tr>
<tr><td>DC500V</td><td>150% of the rated voltage</td></tr>
</table>
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 as shown in the figure, and voltage in table is impressed for 1 to 5 seconds between capacitor terminals and metal balls.
(Charge/Discharge current ≤ 50mA.)


<table>
<tr><th>Rated voltage</th><th>Test voltage</th></tr>
<tr><td>DC200V</td><td>250% of the rated voltage</td></tr>
<tr><td>DC500V</td><td>150% of the rated voltage</td></tr>
</table></td></tr>
<tr><td rowspan="2">18</td><td rowspan="2">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>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">Within the specified Tolerance.
-750+120/-347ppm/°C (-55～25°C)
-750±120ppm/°C (25～125°C)
-750+347/-120ppm/°C (125～200°C)</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 temperature coefficient is determind using the capacitance measured in step 3 as a reference. When cycling the temperature sequentially from step 1 through 5 (-55°C to +150°C) the capacitance should be within the specified tolerance for the temperature coefficient and capacitance change as Table A.
The capacitance drift is caluculated by dividing the differences betweeen the maximum and minimum measured values in the step 1, 3 and 5 by the capacitance value in step 3.</td></tr>
</table>

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

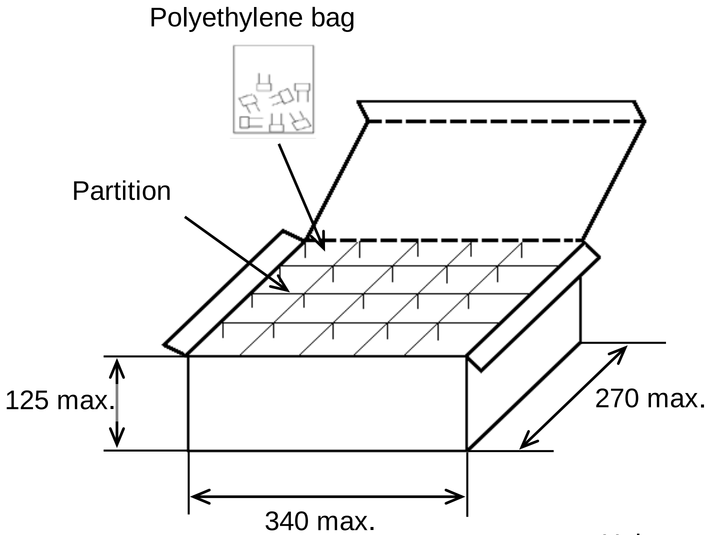
6. Packing specification

- Bulk type (Packing style code : B)

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

∗1 : Please refer to [Part number list].
∗2 : Standard n = 20 (bag)

The size of packing case and packing way



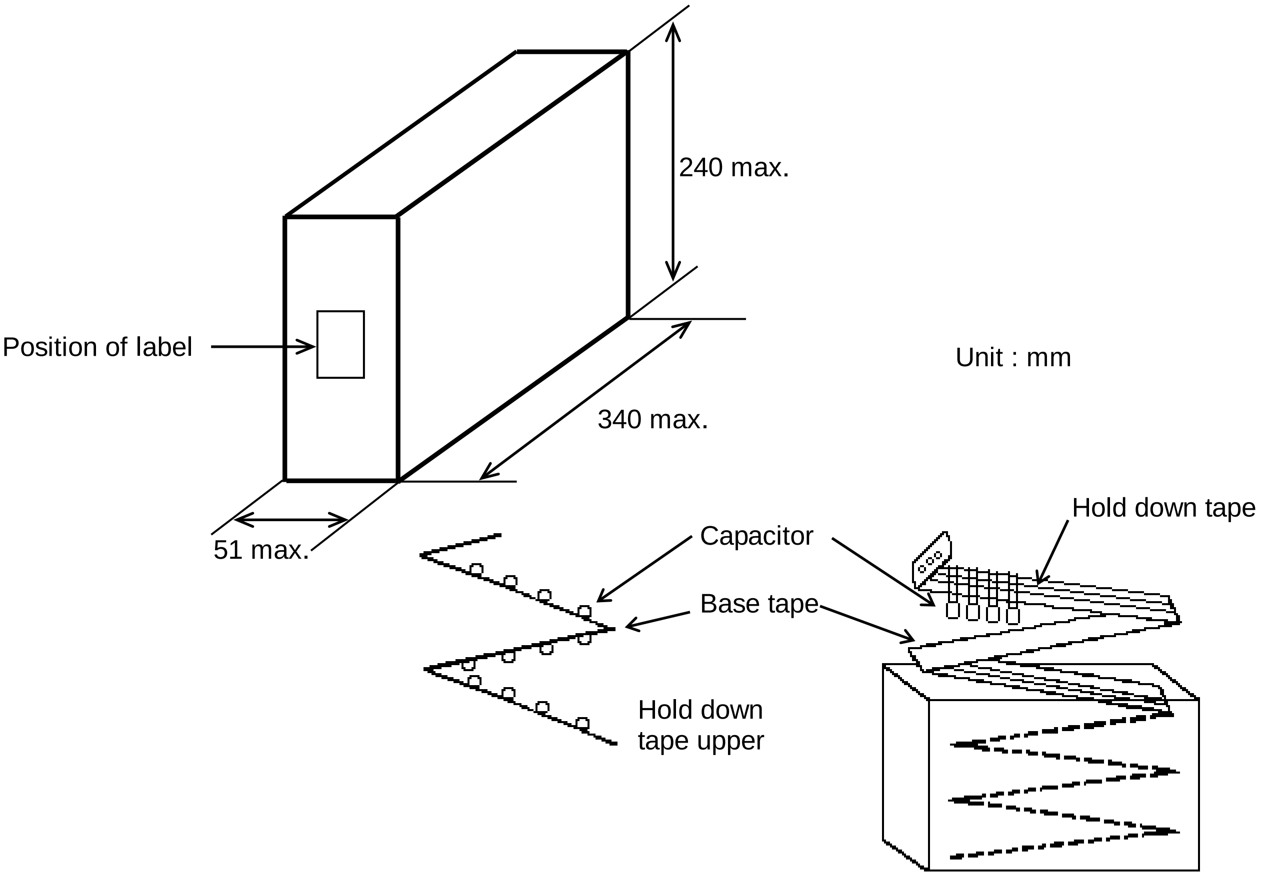
Unit : mm

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)

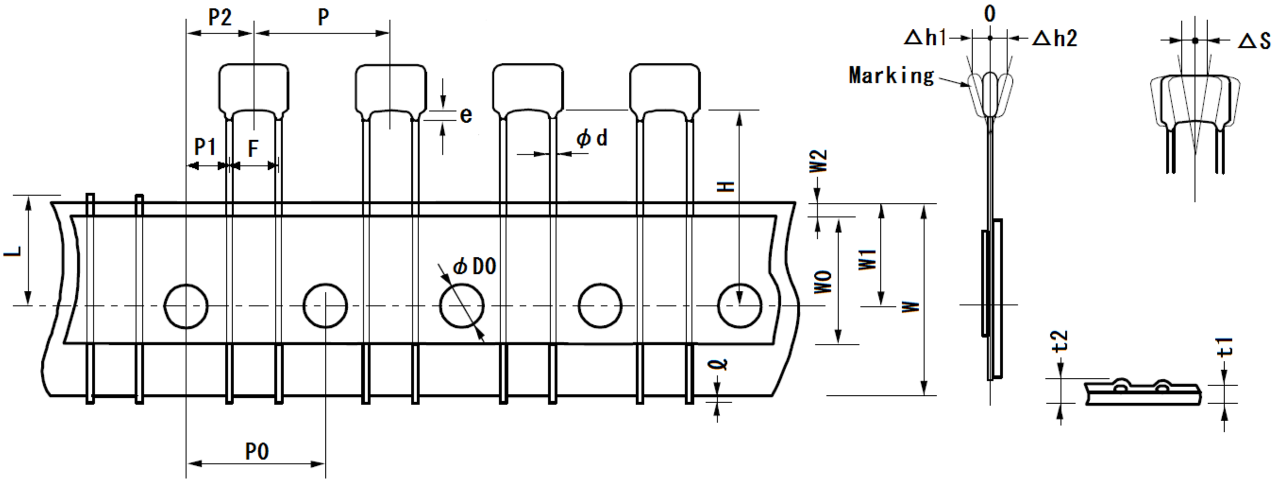
· A crease is made every 25 pitches, and the tape with capacitors is packed zigzag into a case.
· When body of the capacitor is piled on other body under it.

The size of packing case and packing way



Unit : mm

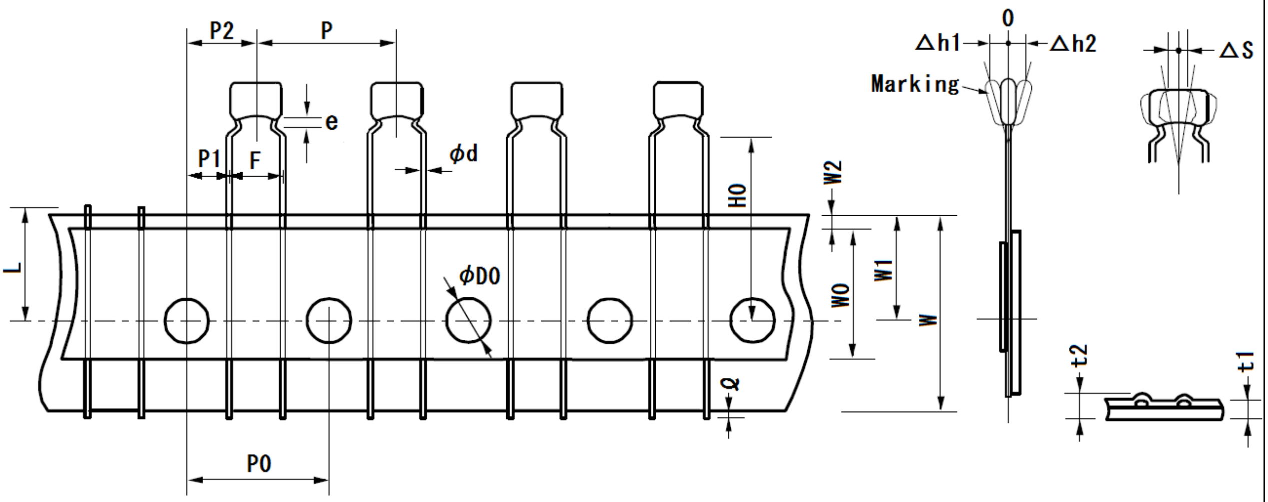
7. Taping specification
  7-1. Dimension of capacitors on tape
    Straight taping type < Lead code : DG >
    Pitch of component 12.7mm / Lead spacing 2.5mm



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	D0	4.0+/-0.1	
Lead diameter	d	0.50+/-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 Δh2	1.0 max.	
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 code : M2 >
Pitch of component 12.7mm / Lead spacing 5.0mm

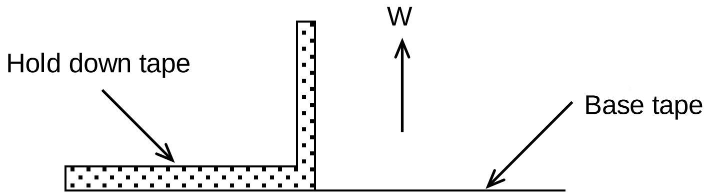


Unit : mm

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	D0	4.0+/-0.1	
Lead diameter	ϕd	0.50+/-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

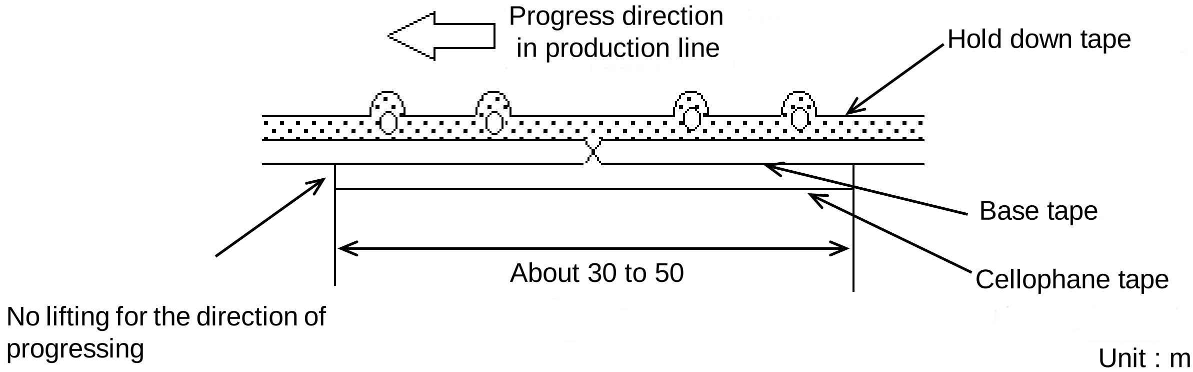
1) Adhesive force of tape is over 3N at test condition as below.



2) Splicing of tape

a) When base tape is spliced

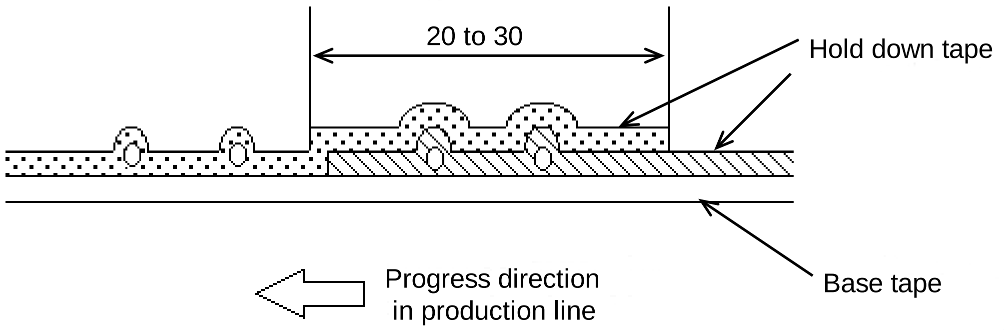
•Base tape shall be spliced by cellophane tape.
(Total tape thickness shall be less than 1.05mm.)



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.

EU RoHS and Halogen Free

This products of the following crresponds to EU RoHS and Halogen Free

(1) RoHS

EU RoHs 2011/65/EC compliance

maximum concentration values tolerated by weight in homogeneous materials
・1000 ppm maximum Lead
・1000 ppm maximum Mercury
・100 ppm maximum Cadmium
・1000 ppm maximum Hexavalent chromium
・1000 ppm maximum Polybrominated biphenyls (PBB)
・1000 ppm maximum Polybrominated diphenyl ethers (PBDE)

(2) Halogen-Free

The International Electrochemical Commission's (IEC) Definition
of Halogen-Free (IEC 61249-2-21) compliance

・900 ppm maximum chlorine
・900 ppm maximum bromine
・1500 ppm maximum total chlorine and bromine