

# Reference Specification

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

Product specifications in this catalog are as of Mar. 2022, 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	Vo-p	Vo-p	Vp-p	Vp-p	Vp-p

#### 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

4. Power plant control equipment

3. Undersea equipment 6. Transportation equipment (vehicles, trains, ships, etc.) 5. Medical equipment

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

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 specification is applied to 200°C Operation Leaded MLCC RHS series iin 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

RHS 472 H01 ex.) Q9 2A Κ 0 Α2 В Series Temperature Rated Capacitance Capacitance Dimension Individual Package Lead Specification Characteristics Tolerance Voltage (LxW) Style

Series

Code	Content
RHS	Epoxy coated, 200°C max.

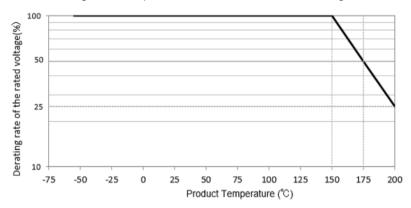
• Temperature Characteristics

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

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 472

$$47 \times 10^2 = 4700 pF$$

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
Α	Taping type of Ammo
В	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 : (Except dimension code : 0,1)

Rated voltage
DC100V

Dimension code

0,1

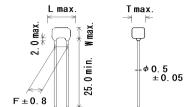
N
103K

2

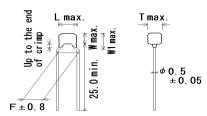
CM 224
K1N

## 4. Part number list

• Straight Long (Lead Style:A2)



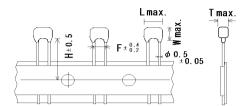
Inside Crimp (Lead Style:K\*)



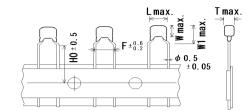
Unit: mm

Customer	Murata Part Number	T.C.	DC Rated	Сар.	Сар.		Dime	ension (	(mm)		Dimension (LxW)	Pack qty.
Part Number	iviulata i alt ivullibei	1.0.	Volt. (V)	Сар.	Tol.	L	W	W1	F	Т	Lead Style	
	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	Murata Part Number	T.C.	DC Rated	Сар.	Сар.		D	imensi	on (mr	n)		Dimension (LxW)	Pack qty.
Part Number	Warata Fart Nambor	1.0.	Volt. (V)	оцр.	Tol.	L	W	W1	F	T	H/H0	Lead Style	
	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

Reference only

No.  1 Pr Ele 2 Hii Te Ex (S	AEC-Q200  re-and Post-S lectrical Test ligh emperature xposure Storage)  remperature cycling	Test Item	Specification  No defects or abnormalities except color change of outer coating.  within ±12.5%  0.04 max.  More than 1,000MΩ or 50 MΩ•μF (Whichever is smaller)  No defects or abnormalities except color change of outer coating.  within ±12.5%  0.05 max.  1,000MΩ or 50MΩ•μF min. (Whichever is smaller)  No defects or abnormalities.  within ±12.5%	AEC-Q200 Test Method  -  Sit the capacitor for 1000±12 hours at 200±5°C. Let sit for 24±2 hours at *room condition , then measure.  •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 1000 cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at *room condition, then measure.  Step 1 2 3 4  Temp. (°C) -55+0/-3 Room 200+5/-0 Room Temp.  Time (min.) 15±3 1 15±3 1  •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.  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.
1 Pr Elector Service S	re-and Post-Silectrical Test ligh emperature exposure Storage)	Appearance Capacitance Change D.F. I.R. Appearance Capacitance Change D.F. I.R.  Appearance Capacitance Change D.F. I.R.	No defects or abnormalities except color change of outer coating. within ±12.5%  0.04 max. More than 1,000MΩ or 50 MΩ•μF (Whichever is smaller) No defects or abnormalities except color change of outer coating. within ±12.5%  0.05 max. 1,000MΩ or 50MΩ•μF min. (Whichever is smaller)  No defects or abnormalities. within ±12.5%	Sit the capacitor for 1000±12 hours at 200±5°C. Let sit for 24±2 hours at *room condition , then measure.  •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 1000 cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at *room condition, then measure.  Step 1 2 3 4 4 Temp. (*C) -55+0/-3 Room Temp. 200+5/-0 Room Temp. Time (min.) 15±3 1 15±3 1  •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.  Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
2 High	emperature (xxposure Storage)  emperature (xxposure Storage)	Appearance Capacitance Change D.F. I.R. Appearance Capacitance Change D.F. I.R.  Appearance Change D.F. I.R.	change of outer coating. within $\pm 12.5\%$ 0.04 max.  More than 1,000M $\Omega$ or 50 M $\Omega$ •µF (Whichever is smaller)  No defects or abnormalities except color change of outer coating. within $\pm 12.5\%$ 0.05 max.  1,000M $\Omega$ or 50M $\Omega$ •µF min. (Whichever is smaller)  No defects or abnormalities. within $\pm 12.5\%$	at *room condition , then measure.  -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 1000 cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at *room condition, then measure.  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  -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.  Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
2 Hin Te Ex (S	ligh emperature exposure Storage) emperature explaining	Capacitance Change D.F. I.R. Appearance Capacitance Change D.F. I.R.  Appearance Change D.F. I.R.	change of outer coating. within $\pm 12.5\%$ 0.04 max.  More than 1,000M $\Omega$ or 50 M $\Omega$ •µF (Whichever is smaller)  No defects or abnormalities except color change of outer coating. within $\pm 12.5\%$ 0.05 max.  1,000M $\Omega$ or 50M $\Omega$ •µF min. (Whichever is smaller)  No defects or abnormalities. within $\pm 12.5\%$	at *room condition , then measure.  -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 1000 cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at *room condition, then measure.  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  -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.  Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
Te Ex (S	emperature xxposure Storage)  emperature cycling	Capacitance Change D.F. I.R. Appearance Capacitance Change D.F. I.R.  Appearance Change D.F. I.R.	change of outer coating. within $\pm 12.5\%$ 0.04 max.  More than 1,000M $\Omega$ or 50 M $\Omega$ •µF (Whichever is smaller)  No defects or abnormalities except color change of outer coating. within $\pm 12.5\%$ 0.05 max.  1,000M $\Omega$ or 50M $\Omega$ •µF min. (Whichever is smaller)  No defects or abnormalities. within $\pm 12.5\%$	at *room condition , then measure.  -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 1000 cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at *room condition, then measure.  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  -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.  Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
3 Te Cy	emperature cycling	Change D.F. I.R.  Appearance Capacitance Change D.F. I.R.  Appearance Capacitance Change D.F.	within $\pm 12.5\%$ 0.04 max.  More than 1,000M $\Omega$ or 50 M $\Omega$ •µF (Whichever is smaller)  No defects or abnormalities except color change of outer coating.  within $\pm 12.5\%$ 0.05 max.  1,000M $\Omega$ or 50M $\Omega$ •µF min. (Whichever is smaller)  No defects or abnormalities.  within $\pm 12.5\%$	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 1000 cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at *room condition, then measure.  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  *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.  Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
3 Te Cy	emperature cycling	Change D.F. I.R.  Appearance Capacitance Change D.F. I.R.  Appearance Capacitance Change D.F.	More than 1,000MΩ or 50 MΩ•μF (Whichever is smaller)  No defects or abnormalities except color change of outer coating.  within ±12.5%  0.05 max.  1,000MΩ or 50MΩ•μF min.  (Whichever is smaller)  No defects or abnormalities.  within ±12.5%	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 1000 cycles according to the four heat treatments listed in the following table. Let sit for 24±2 hours at *room condition, then measure.  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  *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.  Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
Cy	doisture	D.F. I.R. Appearance Capacitance Change D.F. I.R. Appearance Capacitance Change D.F. D.F.	More than 1,000MΩ or 50 MΩ•μF (Whichever is smaller)  No defects or abnormalities except color change of outer coating.  within ±12.5%  0.05 max.  1,000MΩ or 50MΩ•μF min.  (Whichever is smaller)  No defects or abnormalities.  within ±12.5%	then let sit for 24±2 hours at *room condition.  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.  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  *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.  Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
Cy	doisture	Appearance Capacitance Change D.F. I.R. Appearance Capacitance Change D.F.	(Whichever is smaller)  No defects or abnormalities except color change of outer coating.  within ±12.5%  0.05 max.  1,000MΩ or 50MΩ·μF min.  (Whichever is smaller)  No defects or abnormalities.  within ±12.5%	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.    Step
Cy	doisture	Capacitance Change D.F. I.R.  Appearance Capacitance Change D.F.	No defects or abnormalities except color change of outer coating.  within ±12.5%  0.05 max.  1,000MΩ or 50MΩ·μF min.  (Whichever is smaller)  No defects or abnormalities.  within ±12.5%	the following table. Let sit for 24±2 hours at *room condition, then measure.    Step
Cy	doisture	Capacitance Change D.F. I.R.  Appearance Capacitance Change D.F.	change of outer coating.  within ±12.5%  0.05 max.  1,000MΩ or 50MΩ·μF min.  (Whichever is smaller)  No defects or abnormalities.  within ±12.5%	the following table. Let sit for 24±2 hours at *room condition, then measure.    Step
4 Mo	<b>l</b> oisture	Change D.F. I.R.  Appearance Capacitance Change D.F.	within ±12.5%  0.05 max.  1,000MΩ or 50MΩ•μF min. (Whichever is smaller)  No defects or abnormalities. within ±12.5%	Step
.		Change D.F. I.R.  Appearance Capacitance Change D.F.	0.05 max.  1,000MΩ or 50MΩ•μF min. (Whichever is smaller)  No defects or abnormalities. within ±12.5%	Temp. (°C) -55+0/-3 Room Temp. 200+5/-0 Room Temp.  Time (min.) 15±3 1 15±3 1  •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.  Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
.		D.F. I.R.  Appearance Capacitance Change D.F.	1,000MΩ or 50MΩ•μF min. (Whichever is smaller)  No defects or abnormalities. within ±12.5%	Perform the heat treatment at 150+0/-10°C for 60±5 min and then let sit for 24±2 hours at *room condition.  Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
.		Appearance Capacitance Change D.F.	1,000MΩ or 50MΩ•μF min. (Whichever is smaller)  No defects or abnormalities. within ±12.5%	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.  Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
.		Appearance Capacitance Change D.F.	(Whichever is smaller)  No defects or abnormalities.  within ±12.5%	Perform the heat treatment at 150+0/-10°C for 60±5 min and then let sit for 24±2 hours at *room condition.  Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
.		Capacitance Change D.F.	No defects or abnormalities. within ±12.5%	•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.  Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
.		Capacitance Change D.F.	within ±12.5%	Perform the heat treatment at 150+0/-10°C for 60±5 min and then let sit for 24±2 hours at *room condition.  Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
.		Capacitance Change D.F.	within ±12.5%	then let sit for 24±2 hours at *room condition.  Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
		Capacitance Change D.F.	within ±12.5%	Apply the 24h heat (25 to 65°C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.
		Capacitance Change D.F.	within ±12.5%	treatment shown below, 10 consecutive times.
R	desistance	Change D.F.		· ·
		D.F.	0.05 max.	Let sit for 24±2 hours at *room condition, then measure.
			0.05 max.	7
		I.K.		Temperature Humidity Humidity  80~98% Humidity 80~98% Humidity  80~98% Humidity
			500MΩ or 25MΩ•μF min.	(°C) Humidity 90~98% <b>V</b> 90~98% <b>V</b> 90~98% 70
			(Whichever is smaller)	65
				60
				55
				<u>\$50</u> 845
				840
				<u>\$35</u>
				30 25 5
				20 +10
				15 - 2 °C
				10 Initial measurement 5
				0
				-5
				-10 One cycle 24 hours
				0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
				Hours
				•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.
	iased	Appearance	No defects or abnormalities.	Apply the rated voltage and DC1.3+0.2/-0V (add 100kΩ resistor)
Hu	lumidity	Capacitance	within ±12.5%	at 85±3°C and 80 to 85% humidity for 1000±12 hours.
		Change	0.05	Remove and let sit for 24±2 hours at *room condition, then measure.
		D.F.	0.05 max.	The charge/discharge current is less than 50mA.
		I.R.	500MΩ or 25MΩ·μF min.	• Pretreatment
			(Whichever is smaller)	Perform a heat treatment at 150+0/-10°C for one hour.
1=		A	No. 1 Control 199	and then set at room temperature for 24±2 hours.
	perational	Appearance	No defects or abnormalities except color	Apply 25% of the rated voltage for 1000±12 hours at 200±5°C.
Lif	ife	0	change of outer coating.	Let sit for 24±2 hours at *room condition, then measure.
		Capacitance	within ±15.0%	The charge/discharge current is less than 50mA.
		Change	0.04	•Pretreatment
		D.F.	0.04 max.	Apply test voltage for 60±5 min at test temperature.
		I.R.	100MΩ or 5MΩ•μF min.	Remove and let sit for 24±2 hours at *room condition.
			(Whichever is smaller)	le c
	xternal Visual		No defects or abnormalities.	Visual inspection.
	hysical Dimer	nsion	Within the specified dimensions.	Using calipers and micrometers.
	larking	i.	To be easily legible.	Visual inspection.
	lesistance	Appearance	No defects or abnormalities.	Per MIL-STD-202 Method 215
to	Solvents	Capacitance	Within the specified tolerance.	Solvent 1 : 1 part (by volume) of isopropyl alcohol
		D.F.	0.025 max.	3 parts (by volume) of mineral spirits
		I.R.	More than 10,000MΩ or 500 MΩ∙μF	Solvent 2 : Terpene defluxer
			(Whichever is smaller)	Solvent 3 : 42 parts (by volume) of water
				1part (by volume) of propylene glycol monomethyl ether
1				1 part (by volume) of monoethanolamine
	condition" Te		to 35°C, Relative humidity : 45 to 75%, Atm	, , , ,

Reference only

			Referen	•			
No.		0 Test Item	Specification		C-Q200 Tes		
11	Mechanical	Appearance	No defects or abnormalities.	Three shocks in each direction			
	Shock	Capacitance	Within the specified tolerance.	nutually perpendicular axes of	•	,	•
		D.F.	0.025 max.	The specified test pulse should			
<u> </u>				duration: 0.5ms, peak value:		, ,	<u></u>
12	Vibration	Appearance	No defects or abnormalities.	The capacitor should be subject		'	
		Capacitance	Within the specified tolerance.	naving a total amplitude of 1.5	mm, the free	quency being	varied
		D.F.	0.025 max.	uniformly between the approxi	mate limits of	of 10 and 2000	)Hz.
				The frequency range, from 10	to 2000Hz a	and return to 1	0Hz,
				should be traversed in approxi	imately 20 m	nin. This motio	n
				should be applied for 12 items	in each 3 m	nutually perper	ndicular
				directions (total of 36 times).			
13-1	Resistance	Appearance	No defects or abnormalities.	The lead wires should be imme	ersed in the	melted solder	1.5 to 2.0mm
	to Soldering	Capacitance	Within ±7.5%	rom the root of terminal at 260	0±5°C for 10	±1 seconds.	
	Heat	Change					
	(Non-	Dielectric	No defects	Pre-treatment			
	Preheat)	Strength		Capacitor should be stored at			
		(Between		hen place at *room condition f	for 24±2 hou	urs before initia	al measurement.
		terminals)		Post-treatment			
<u> </u>				Capacitor should be stored for			
13-2	Resistance	Appearance	No defects or abnormalities.	First the capacitor should be s			
	to Soldering	Capacitance	Within ±7.5%	Γhen, the lead wires should be			
	Heat	Change	<u> </u>	1.5 to 2.0mm from the root of t	terminal at 2	260±5°C for 7.5	5+0/-1 seconds.
	(On-	Dielectric	No defects				
	Preheat)	Strength		Pre-treatment			
		(Between		Capacitor should be stored at			
		terminals)		hen place at *room condition f	for 24±2 hou	urs before initia	al measurement.
				Post-treatment			
				Capacitor should be stored for	24±2 hours	s at *room con	dition.
13-3	Resistance	Appearance	No defects or abnormalities.	Test condition			
	to Soldering	Capacitance	Within ±7.5%	Termperature of iron-tip: 350			
	Heat	Change		Soldering time: 3.5±0.5 seco	onds		
	(soldering	Dielectric	No defects	Soldering position			
	iron method)	Strength		Straight Lead : 1.5 to 2.0mm			
		(Between		Crimp Lead: 1.5 to 2.0mm from	om the end	of lead bend.	
		terminals)					
				Pre-treatment			
				Capacitor should be stored at			
				hen place at *room condition f	for 24±2 hou	urs before initia	al measurement.
				Post-treatment			
				Capacitor should be stored for			
14	Thermal	Appearance	No defects or abnormalities except color	Perform the 300 cycles accord	•		ents listed in the
	Shock		change of outer coating.	ollowing table (Maximum trans		,	
		Capacitance	within ±12.5%	et sit for 24±2 hours at *room	condition, t	nen measure.	
		Change	0.05	Step	1	2	
		D.F.	0.05 max.	Temp.	-55+0/-3	200+5/-0	
		I.R.	1,000MΩ or 50MΩ·μF min.	(°C)	55.01-5	200.31-0	
			(Whichever is smaller)	Time	15±3	15±3	
				(min.)	1323	1023	
				Duesting atoms and			
				Pretreatment	450 / 0/ 100 1	O. f CO :	4
				Perform the heat treatment at			and
45	FOD	A	No defeate and 199	hen let sit for 24±2 hours at *r	oom condition	on.	
15	ESD	Appearance	No defects or abnormalities.	Per AEC-Q200-002			
		Capacitance	Within the specified tolerance.				
		D.F.	0.025 max.				
		I.R.	More than 10,000MΩ or 500 MΩ·μF				
40	Calde L''''		(Whichever is smaller)	The terminal of a control of	aliana e al tri	and other first	hanal
16	Solderability		Lead wire should be soldered with	The terminal of a capacitor is o			
			uniform coating on the axial direction	JIS-K-8101) and rosin (JIS-K-	, ,	•	
			over 95% of the circumferential direction.	hen into molten solder (JIS-Z-	•		
				depth of dipping is up to about	1.5 to 2mm	irom the term	ımaı body.
				Famous afficient			
				Temp. of solder :	Cn 2 04 0	EC\	
				245±5°C Lead Free Solder (\$		ocu)	
* "			Eta 25°C Dalatina humaliita 45.1 35°C 1	235±5°C H60A or H63A Eute			
roor	m condition" T	emperature : 1	5 to 35°C, Relative humidity : 45 to 75%, Atm	priere pressure : 86 to 106KPa	а		

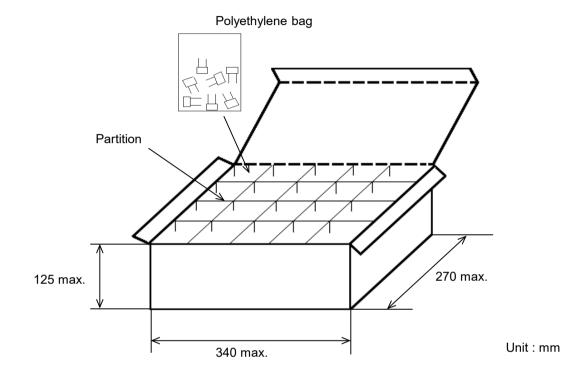
Reference only

	1.50.00		ī	Reference of	Ť					
No.		00 Test Item		Specification	AEC-Q200 Test Method					
17	Electrical	Apperance	No defects or		Visual inspection.					
	Characte-	Capacitance	<del>-</del>	cified tolerance.	The capacitance/D.F. should be measured at 25°C at the frequency					
	rization D.F. 0.025 m		0.025 max.		and voltage shown in the table.					
					Frequency Voltage					
					1±0.1kHz 1±0.2V(r.m.s.)					
		1 1 2	5	140,000,40, 500,40, 5	Ti : 10: 10: 11: 11: 11: 11: 11: 11: 11: 1					
		Insulation	Room	10,000MΩ or 500MΩ•μF min.	The insulation resistance should be measured at 25±3 °C with a					
		Resistance	Temperature	(Whichever is smaller)	DC voltage not exceeding the rated voltage at normal temperature					
		(I.R.)			and humidity and within 2 min. of charging.					
			1.151.	0.5140 0.4140 5	(Charge/Discharge current ≤ 50mA.)  The insulation resistance should be measured at 200±5 °C with a					
			High	0.5MΩ or 0.1MΩ•μF min.						
			Temperature	(Whichever is smaller)	DC voltage not exceeding 25% of the rated voltage at normal					
					temperature and humidity and within 2 min. of charging.					
		Dielectric	Between	No defects or abnormalities.	(Charge/Discharge current ≤ 50mA.)  The capacitor should not be damaged when DC voltage of 250%					
		Strength	Terminals	no delects of abhormalities.	of the rated voltage is applied between the terminations for 1 to 5					
		Outerigui	Ciminais		seconds.					
					(Charge/Discharge current ≦ 50mA.)					
			Body	No defects or abnormalities.	The capacitor is placed in a container with metal					
			Insulation		balls of 1mm diameter so that each terminal.					
					short-circuit is kept approximately 2mm from Approx.					
					the balls, and 250% of the rated DC voltage is					
					impressed for 1 to 5 seconds between					
					capacitor terminals and metal balls.  Metal					
					(Charge/Discharge current ≦ 50mA.) balls					
18	Terminal	Tensile	Termination ne	ot to be broken or loosened.	As in the figure, fix the capacitor body, apply the force gradually					
	Strength	Strength			to each lead in the radial direction of the capacitor until reaching					
	Strength Strength				10N and then keep the force applied for 10±1 seconds.					
					1/44/1					
					↓					
					F   1					
		D din	T	-4.4. h. b. b. b. b	*					
		Bending	Termination no	ot to be broken or loosened.	Each lead wire should be subjected to a force of 2.5N and then					
		Strength			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.					
19	Capacitance		Mithin the end	cified Tolerance.	The capacitance change should be measured after 5min. at					
ıJ	Temperature			C : within ±15%	each specified temperature step.					
	Characteristic	s		°C : within +15/-70%						
					Step Temperature(°C)					
					1 25±2					
					2 -55±3					
					3 25±2					
					4 200±5 5 25±2					
					5 25±2					
					The ranges of capacitance change compared with the above					
					The ranges of capacitance change compared with the above					
					The ranges of capacitance change compared with the above 25°C value over the temperature ranges shown in the 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.					
					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					
				ive humidity : 45 to 75%, Atmosphe	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.					

# 6. Packing specification

•Bulk type (Packing style code : B)

The size of packing case and packing way



The number of packing =  $^{*1}$  Packing quantity ×  $^{*2}$  n

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

\*2 : Standard n = 20 (bag)

# Note)

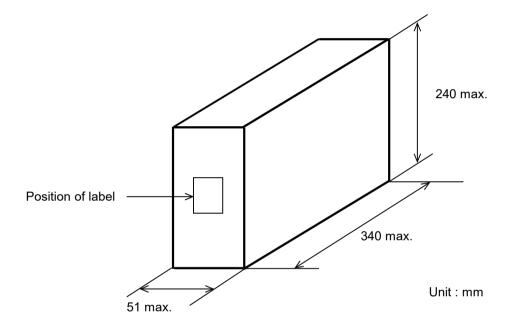
The outer package and the number of outer packing be changed by the order getting amount.

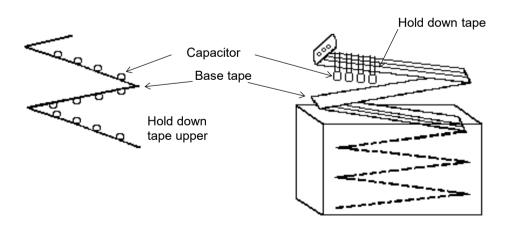
JKBCRPE02

-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





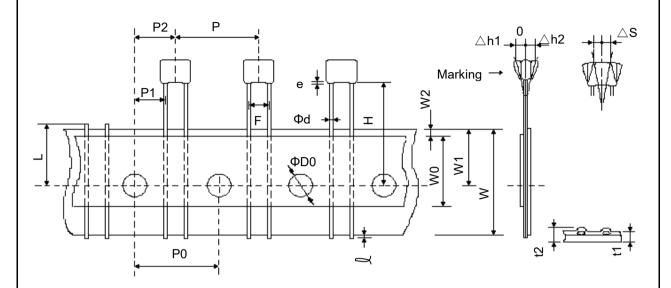
EKTRPE01

# 7. Taping specification

# 7-1. Dimension of capacitors on tape

Straight taping type < Lead Style : DG >

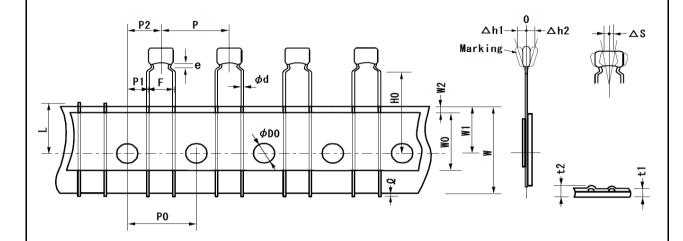
Pitch of component 12.7mm / Lead spacing 2.5mm



Unit: mm

Item	Code	Dimensions	Remarks
Pitch of component	Р	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	Н	20.0+/-0.5	
Protrusion length	L	0.5 max.	
Diameter of sprocket hole	ФD0	4.0+/-0.1	
Lead diameter	Фd	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	∆h1	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	е	2.0 max.	

Inside crimp taping type < Lead Style : M2 > Pitch of component 12.7mm / Lead spacing 5.0mm

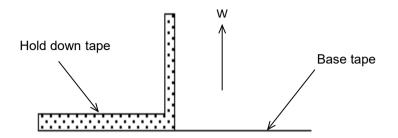


Unit: mm

Item	Code	Dimensions	Remarks
Pitch of component	Р	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	Q	0.5 max.	
Diameter of sprocket hole	ФD0	4.0+/-0.1	
Lead diameter	Фd	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)	
	Δ h2	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	е	Up to the end of crimp	

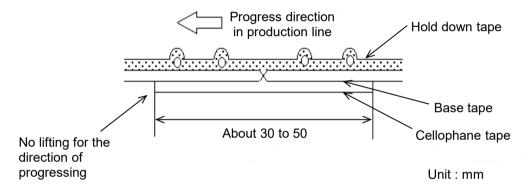
## 7-2. Splicing way of tape

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

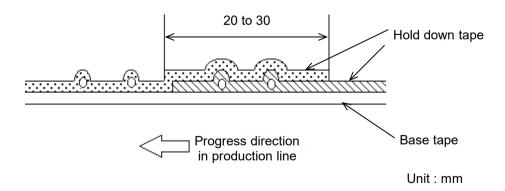


## 2) Splicing of tape

- a) When base tape is spliced
  - •Base tape shall be spliced by cellophane tape. (Total tape thickness shall be less than 1.05mm.)



- b) When hold down tape is spliced
  - •Hold down tape shall be spliced with overlapping. (Total tape thickness shall be less than 1.05mm.)



c) When both tape are spliced

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