

# DELIVERY SPECIFICATION

SPEC. No. A-YFF-b

D A T E : 2018, Aug.

To

**Non-Controlled Copy**

CUSTOMER'S PRODUCT NAME

TDK PRODUCT NAME

3-terminal Feed Through Filter

Tape packaging 【RoHS compliant】

YFF18, 21, 31 series

Please return this specification to TDK representatives with your signature.

If orders are placed without returned specification, please allow us to judge that specification is accepted by your side.

## RECEIPT CONFIRMATION

DATE: \_\_\_\_\_ YEAR \_\_\_\_\_ MONTH \_\_\_\_\_ DAY \_\_\_\_\_

Test conditions in this specification based on AEC-Q200 for automotive application.

TDK Corporation

Sales

Electronic Components

Sales & Marketing Group

Engineering

Electronic Components Business Company

APPROVED	Person in charge

APPROVED	CHECKED	Person in charge

## 1. SCOPE

This specification is applicable to 3-terminal feed through filter with a priority over the other relevant specifications.

Production places defined in this specification shall be TDK Corporation Japan, TDK(Suzhou)Co.,Ltd and TDK Components U.S.A. Inc.

### EXPLANATORY NOTE:

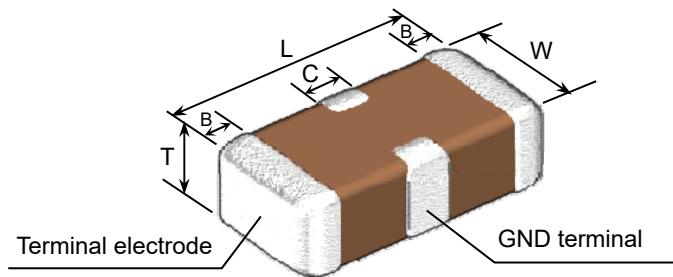
This specification warrants the quality of the 3-terminal feed through filter. Filters should be evaluated or confirmed a state of mounted on your product.

If the use of the filters goes beyond the bounds of this specification, we can not afford to guarantee.

## 2. CODE CONSTRUCTION

(Example)	YFF18	AC	1C	104	M	T	○○○○
	YFF21	AC	1E	104	M	T	○○○○
	<u>YFF31</u>	<u>AH</u>	<u>2A</u>	<u>105</u>	<u>M</u>	<u>T</u>	<u>○○○○</u>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)

### (1)Type



Type	Dimensions (Unit : mm)				
	L	W	T	B	C
YFF18	1.60±0.20	0.80±0.15	0.60±0.10	0.25±0.20	0.40±0.20
YFF21	2.00±0.20	1.25±0.20	0.85±0.15	0.30±0.20	0.50+0.30/-0.20
YFF31	3.20±0.20	1.60±0.20	1.30±0.20	0.40±0.30	1.20±0.30

\*As for each item, please refer to the table A in the end of the specification.

### (2)Product Classification

Symbol	Product Classification
A C	For Automotive general use
A H	For Automotive Large-current power Line

### (3)Rated Voltage

Symbol	Rated Voltage
2 A	DC 100 V
1 H	DC 50 V
1 E	DC 25 V
1 C	DC 16 V
1 A	DC 10 V
0 J	DC 6.3 V

- (4) Rated Capacitance  
 Stated in three digits and in units of pico farads (pF).  
 The first and Second digits identify the first and second significant figures of the capacitance, the third digit identifies the multiplier.

(Example)

Symbol	Rated Capacitance
104	100,000pF
105	1,000,000pF

- (5)Capacitance tolerance

Symbol	Tolerance
M	± 20 %

- (6)Packaging

Symbol	Packaging
T	Taping

- (7)TDK internal code

### 3. OPERATING TEMPERATURE RANGE

Min. operating Temperature	Max. operating Temperature	Reference Temperature
-55°C	125°C	25°C

### 4. RATED CURRENT

Rated current depend on operating temperature.  
 As for details, please refer to the table A in the end of the specification.

### 5. STORING CONDITION AND TERM

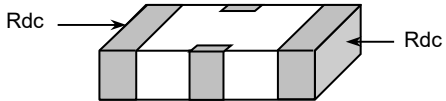
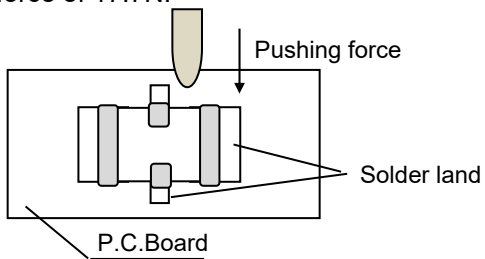
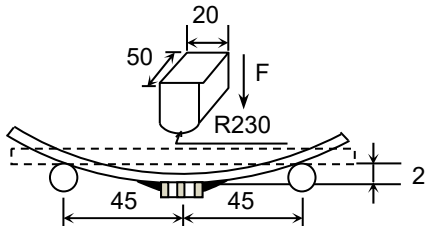
5 to 40°C at 20 to 70%RH  
 6 months Max. upon receipt.

### 6. INDUSTRIAL WASTE DISPOSAL

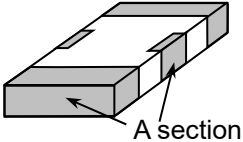
Dispose this product as industrial waste in accordance with the industrial Waste Law.

## 7. PERFORMANCE

Table 1

No.	Item	Performance	Test or inspection method
1	External Appearance	No defects which may affect performance.	Inspect with magnifying glass (3×).
2	Insulation Resistance	10,000MΩ or 500MΩ·μF min. (As for the capacitors of rated voltage 16V DC and lower, 100MΩ·μF min.,) whichever smaller.	Apply rated voltage for 60s.
3	Direct Current Resistance (Rdc)	Please refer to the table A in the end of the specification.	Measuring current shall be 100mA max. 
4	Voltage Proof	Withstand test voltage without insulation breakdown or other damage.	2.5 times of rated voltage shall be applied for 1s. Charge / discharge current shall not exceed 50mA.
5	Capacitance	Within the specified tolerance.	As for measuring condition, please refer to the table A in the end of the specification..
6	Robustness of Terminations	No sign of termination coming off, breakage of ceramic, or other abnormal signs.	Reflow solder the products on a P.C.Board shown in Appendix 2 and apply a pushing force of 17.7N. 
7	Bending	External appearance	Reflow solder the products on a P.C.Board shown in Appendix 1 and bend it for 2mm. (1mm is applied for YFF31AH type.)   (Unit : mm)
	Capacitance	Change from the value before test  ± 12.5 %	
	Direct current Resistance (Rdc)	Please refer to the table A in the end of the specification.	

(continued)

No.	Item	Performance	Test or inspection method								
8	Solderability	<p>New solder to cover over 75% of termination. 25% may have pin holes or rough spots but not concentrated in one spot. Ceramic surface of A sections shall not be exposed due to melting or shifting of termination material.</p> 	<p>Completely soak both terminations in solder at the following conditions.</p> <p>Solder : Sn-3.0Ag-0.5Cu or Sn-37Pb Temperature : 245±5°C(Sn-3.0Ag-0.5Cu) 235±5°C(Sn-37Pb) Soaking time : 3±0.3s(Sn-3.0Ag-0.5Cu) 2±0.2s(Sn-37Pb)</p> <p>Flux : Isopropyl alcohol (JIS K 8839) Rosin (JIS K 5902) 25% solid solution.</p>								
9	Resistance to solder heat	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="336 696 491 801">External appearance</td> <td data-bbox="491 696 949 801">No cracks are allowed and terminations shall be covered at least 60% with new solder.</td> </tr> <tr> <td data-bbox="336 801 491 1003">Capacitance</td> <td data-bbox="491 801 949 1003"> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Change from the value before test</td> </tr> <tr> <td style="text-align: center;">± 7.5 %</td> </tr> </table> </td> </tr> <tr> <td data-bbox="336 1003 491 1344">Direct current resistance (Rdc)</td> <td data-bbox="491 1003 949 1344">Please refer to the table A in the end of the specification.</td> </tr> </table>	External appearance	No cracks are allowed and terminations shall be covered at least 60% with new solder.	Capacitance	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Change from the value before test</td> </tr> <tr> <td style="text-align: center;">± 7.5 %</td> </tr> </table>	Change from the value before test	± 7.5 %	Direct current resistance (Rdc)	Please refer to the table A in the end of the specification.	<p>Completely soak both terminations in solder at the following conditions. 260±5°C for 10±1s.</p> <p>Preheating condition Temp.: 110 ~ 140°C Time : 30 ~ 60s.</p> <p>Solder : Sn-3.0Ag-0.5Cu or Sn-37Pb</p> <p>Flux : Isopropyl alcohol (JIS K 8839) Rosin (JIS K 5902) 25% solid solution.</p> <p>Leave the products in ambient condition for 24±2h before measurement.</p>
External appearance	No cracks are allowed and terminations shall be covered at least 60% with new solder.										
Capacitance	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Change from the value before test</td> </tr> <tr> <td style="text-align: center;">± 7.5 %</td> </tr> </table>	Change from the value before test	± 7.5 %								
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10	Vibration	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td data-bbox="336 1350 491 1433">External appearance</td> <td data-bbox="491 1350 949 1433">No mechanical damage.</td> </tr> <tr> <td data-bbox="336 1433 491 1630">Capacitance</td> <td data-bbox="491 1433 949 1630"> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Change from the value before test</td> </tr> <tr> <td style="text-align: center;">± 7.5 %</td> </tr> </table> </td> </tr> <tr> <td data-bbox="336 1630 491 1888">Direct current resistance (Rdc)</td> <td data-bbox="491 1630 949 1888">Please refer to the table A in the end of the specification.</td> </tr> </table>	External appearance	No mechanical damage.	Capacitance	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Change from the value before test</td> </tr> <tr> <td style="text-align: center;">± 7.5 %</td> </tr> </table>	Change from the value before test	± 7.5 %	Direct current resistance (Rdc)	Please refer to the table A in the end of the specification.	<p>Reflow solder the products on a P.C.Board shown in Appendix 2 before testing.</p> <p>Vibrate the products with following conditions.</p> <p>Applied force : 5G max. Frequency : 10~2,000Hz Duration : 20 min. Cycle : 12 cycles in each 3 mutually perpendicular directions.</p>
External appearance	No mechanical damage.										
Capacitance	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">Change from the value before test</td> </tr> <tr> <td style="text-align: center;">± 7.5 %</td> </tr> </table>	Change from the value before test	± 7.5 %								
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Direct current resistance (Rdc)	Please refer to the table A in the end of the specification.										

(continued)

No.	Item	Performance	Test or inspection method																
11	Temperature cycle	External appearance	No mechanical damage.																
		Capacitance	<p style="text-align: center;">_____</p> <p style="text-align: center;">Change from the value before test</p> <p style="text-align: center;">_____</p> <p style="text-align: center;">Please refer to the table A in the end of the specification.</p> <p style="text-align: center;">_____</p>																
		Direct current resistance (Rdc)	Please refer to the table A in the end of the specification.	<p>Reflow solder the product on a P.C.Board shown in Appendix 2 before testing.</p> <p>Expose the product in the condition step1 through step 4 and repeat 1,000 times consecutively.</p> <p>Leave the products in ambient condition for 24±2h before measurement.</p> <table border="1" data-bbox="983 510 1449 808"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Time(min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Min. operating temp. ± 3</td> <td>30 ± 3</td> </tr> <tr> <td>2</td> <td>Ambient Temp.</td> <td>2 ~ 5</td> </tr> <tr> <td>3</td> <td>Max. operating temp. ± 2</td> <td>30 ± 2</td> </tr> <tr> <td>4</td> <td>Ambient Temp.</td> <td>2 ~ 5</td> </tr> </tbody> </table> <p>As for Min./ Max. operating temp., please refer to "3.OPERATING TEMPERATURE RANGE".</p>	Step	Temperature (°C)	Time(min.)	1	Min. operating temp. ± 3	30 ± 3	2	Ambient Temp.	2 ~ 5	3	Max. operating temp. ± 2	30 ± 2	4	Ambient Temp.	2 ~ 5
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1	Min. operating temp. ± 3	30 ± 3																	
2	Ambient Temp.	2 ~ 5																	
3	Max. operating temp. ± 2	30 ± 2																	
4	Ambient Temp.	2 ~ 5																	
	Insulation Resistance	Meet the initial spec.																	
12	Moisture Resistance (Steady State)	External appearance	No mechanical damage.																
		Capacitance	<p style="text-align: center;">_____</p> <p style="text-align: center;">Change from the value before test</p> <p style="text-align: center;">_____</p> <p style="text-align: center;">Please refer to the table A in the end of the specification.</p> <p style="text-align: center;">_____</p>																
		Direct current resistance (Rdc)	Please refer to the table A in the end of the specification.	<p>Reflow solder the product on a P.C.Board shown in Appendix 2 before testing.</p> <p>Leave at temperature 40±2°C, 90 to 95%RH for 500 +24,0h.</p> <p>Leave the products in ambient condition for 24±2h before measurement.</p>															
		Insulation Resistance	1,000MΩ or 50MΩ·μF min. (As for the capacitors of rated voltage 16V DC and lower, 10MΩ·μF min.), whichever smaller.																

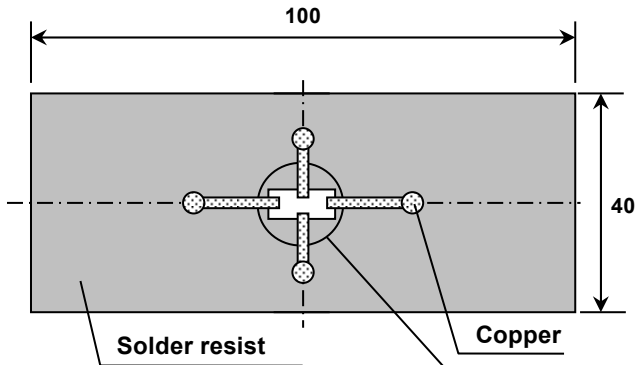
(continued)

No.	Item	Performance	Test or inspection method
13	Moisture Resistance	External appearance	No mechanical damage.
		Capacitance	Change from the value before test Please refer to the table A in the end of the specification.
		Direct current resistance (Rdc)	Please refer to the table A in the end of the specification.
		Insulation Resistance	500MΩ or 25MΩ·μF min. (As for the capacitors of rated voltage 16V DC and lower, 5MΩ·μF min.), whichever smaller.
14	Life	External appearance	No mechanical damage.
		Capacitance	Change from the value before test Please refer to the table A in the end of the specification.
		Direct current resistance (Rdc)	Please refer to the table A in the end of the specification.
		Insulation Resistance	1,000MΩ or 50MΩ·μF min. (As for the capacitors of rated voltage 16V DC and lower, 10MΩ·μF min.), whichever smaller.
			<p>Reflow solder the products on a P.C.Board shown in Appendix 2 before testing.</p> <p>Apply the rated voltage at temperature 85±2°C and 85%RH for 1,000 +48,0h.</p> <p>Charge/discharge current shall not exceed 50mA.</p> <p>Leave the products in ambient condition for 24±2h before measurement.</p> <p>Voltage conditioning : Voltage treat the products under testing temperature and voltage for 1 hour.</p> <p>Leave the products in ambient condition for 24±2h before measurement.</p> <p>Use this measurement for initial value.</p>
			<p>Reflow solder the products on a P.C.Board shown in Appendix 2 before testing.</p> <p>Test condition : maximum operating temperature ±2°C for 1,000 +48,0h As for applied voltage and current, please refer to the table A in the end of the specification.</p> <p>Charge/discharge current shall not exceed 50mA.</p> <p>Voltage conditioning : Voltage treat the products under testing temperature and voltage for 1 hour.</p> <p>Leave the products in ambient condition for 24±2h before measurement.</p> <p>Use this measurement for initial value.</p>

\*As for the initial measurement of product on number 9, 10, 11 and 12, leave products at 150 -10,0°C for 1h and measure the value after leaving product for 24±2h in ambient condition.

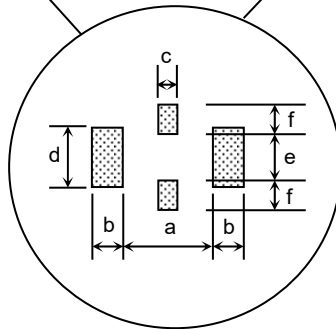
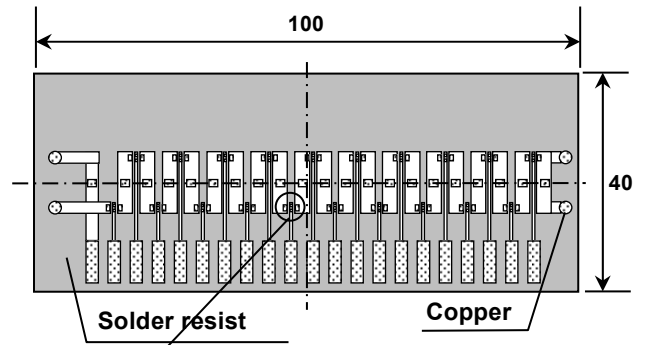
## Appendix 1

### P.C.Board for bending test



## Appendix 2

### P.C.Board for reliability test





(Unit: mm)

Type	Dimensions					
	a	b	c	d	e	F
YFF18	1.0	0.6	0.4	0.6	0.4	0.4
YFF21	1.4	0.6	0.5	0.8	0.6	0.65
YFF31	2.5	1.2	1.4	1.3	0.8	0.9

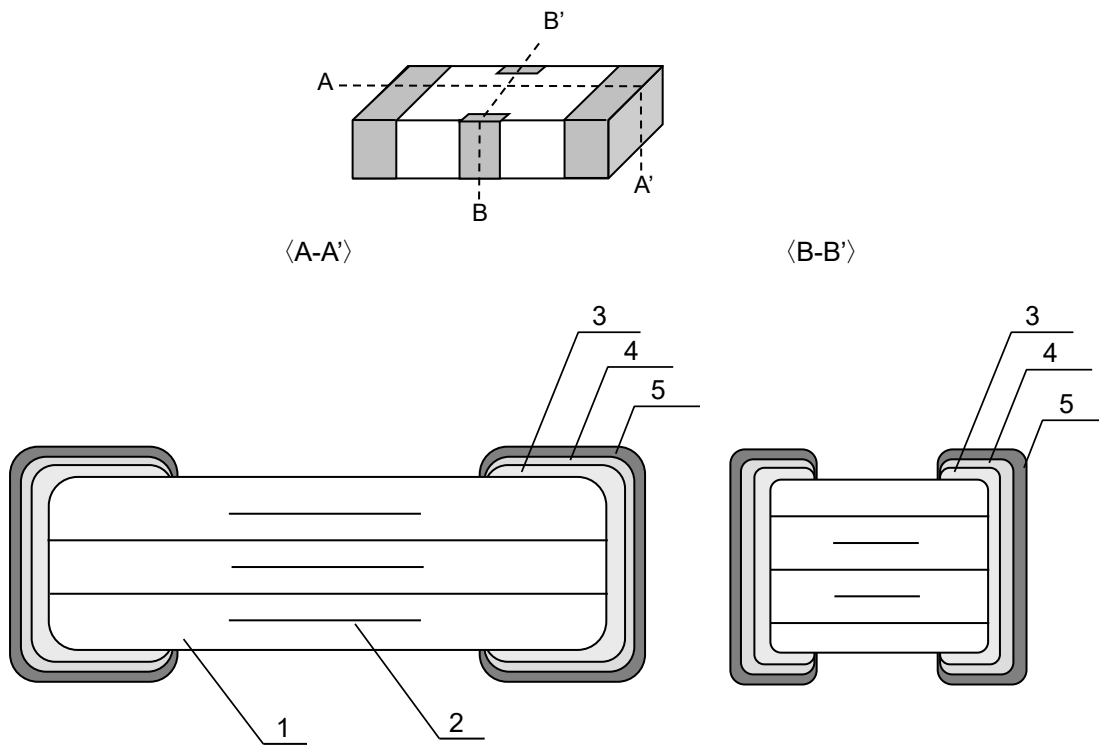
1. Material : Glass Epoxy(As per JIS C6484 GE4)

2. Thickness : Appendix 1 — 1.0mm  
: Appendix 2 — 1.6mm

 Copper(Thickness:0.035mm)  
 Solder resist



## 8. INSIDE STRUCTURE AND MATERIAL



No.	NAME	MATERIAL
1	Dielectric	CaZrO <sub>3</sub> or BaTiO <sub>3</sub>
2	Electrode	Ni
3	Termination	Cu
4		Ni
5		Sn

## 9. PACKAGING

Packaging shall be done to protect the components from the damage during transportation and storing, and a label which has the following information shall be attached.  
Tape packaging is as per 13. TAPE PACKAGING SPECIFICATION.

- 1) Inspection No.
- 2) TDK P/N
- 3) Customer's P/N
- 4) Quantity

\*Composition of Inspection No.

Example     F 8 A - 23 - 001  
                   (a) (b) (c)     (d)     (e)

- a) Line code
- b) Last digit of the year
- c) Month and A for January and B for February and so on. (Skip I)
- d) Inspection Date of the month.
- e) Serial No. of the day

\*Composition of new Inspection No.

(Will be implemented on and after Jan. 1, 2019)

Example     

I	F	9	A	2	3	A	0	0	1
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(g)	(g)	(g)

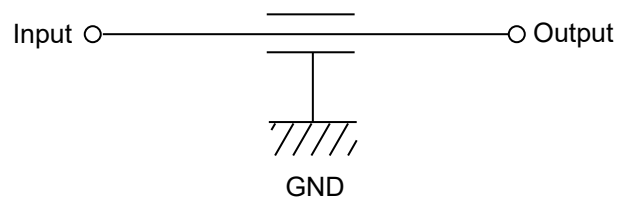
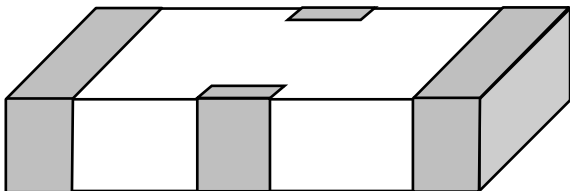
- (a) Prefix
- (b) Line code
- (c) Last digit of the year
- (d) Month and A for January and B for February and so on. (Skip I)
- (e) Inspection Date of the month.
- (f) Serial No. of the day(00 ~ ZZ)
- (g) Suffix(00 ~ ZZ)

\* It is planned to shift to the new inspection No. on and after January 2019, but the implementation timing may be different depending on shipment bases.  
Until the shift is completed, either current or new composition of inspection No. will be applied.


## 10. SOLDERING CONDITION


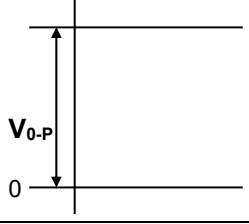
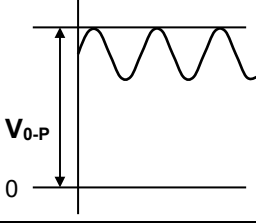
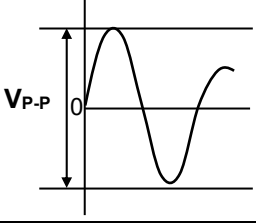
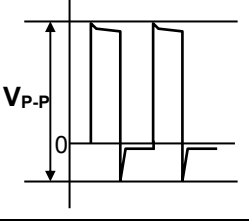
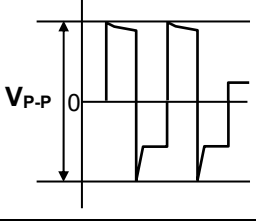
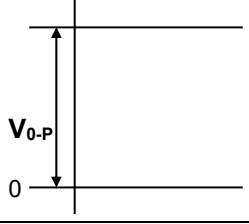
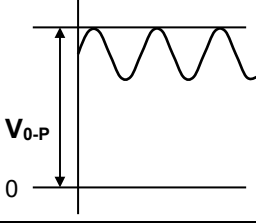
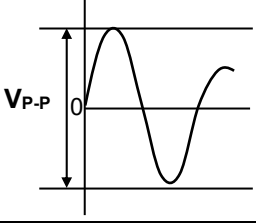
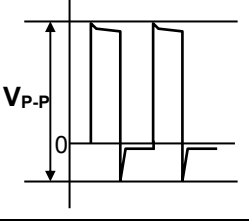
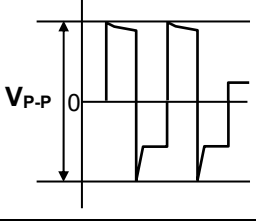
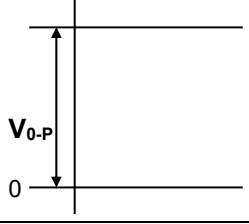
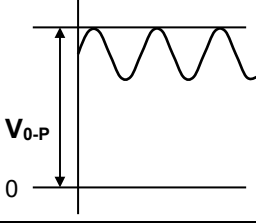
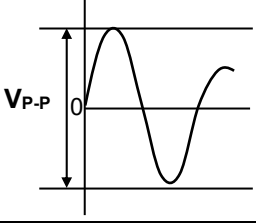
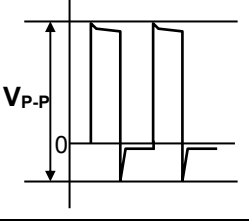
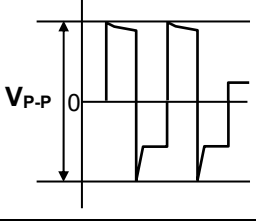
Reflow soldering only.

## 11. EQUIVALENT CIRCUIT DIAGRAM



## 12. CAUTION

No.	Process	Condition
1	Operating Condition (Storage, Use, Transportation)	<p>1-1. Storage, Use</p> <ol style="list-style-type: none"> <li>1) The product must be stored in an ambient temperature of 5 to 40°C with a relative humidity of 20 to 70%RH. The products should be used within 6 months upon receipt.</li> <li>2) The product must be operated and stored in an environment free of dew condensation and these gases such as Hydrogen Sulphide, Hydrogen Sulphate, Chlorine, Ammonia and sulfur.</li> <li>3) Avoid storing in sun light and falling of dew.</li> <li>4) Do not use product under high humidity and high and low atmospheric pressure which may affect product reliability.</li> <li>5) Product should be tested for the solderability when they are stored for long time.</li> </ol> <p>1-2. Handling in transportation</p> <p>In case of the transportation of the product, the performance of the product may be deteriorated depending on the transportation condition.            (Refer to JEITA RCR-2335C 9.2 Handling in transportation)</p>
2	Circuit design  Caution	<p>2-1. Operating temperature</p> <p>Operating temperature should be followed strictly within this specification, especially be careful with maximum temperature.</p> <ol style="list-style-type: none"> <li>1) Do not use product above the maximum allowable operating temperature.</li> <li>2) Surface temperature including self heating should be below maximum operating temperature.            (Due to dielectric loss, product will heat itself when AC is applied. Especially at high frequencies around its SRF, the heat might be so extreme that it may damage itself or the product mounted on. Please design the circuit so that the maximum temperature of the product including the self heating to be below the maximum allowable operating temperature. Temperature rise at product's surface shall be below 20°C)</li> <li>3) The electrical characteristics of the product will vary depending on the temperature. The product should be selected and designed in taking the temperature into consideration.</li> </ol>

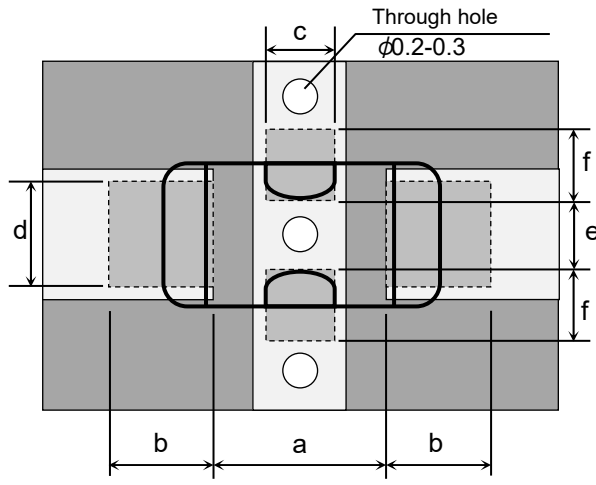
No.	Process	Condition														
2	Circuit design  Caution	<p>2-2. Operating voltage</p> <p>1) Operating voltage across the terminals should be below the rated voltage. When AC and DC are super imposed, <math>V_{0-P}</math> must be below the rated voltage. — (1) and (2)</p> <p>AC or pulse with overshooting, <math>V_{P-P}</math> must be below the rated voltage. — (3), (4) and (5)</p> <p>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 the product within rated voltage containing these Irregular voltage.</p> <table border="1" data-bbox="422 542 1401 817"> <thead> <tr> <th data-bbox="422 542 619 586">Voltage</th> <th data-bbox="625 542 874 586">(1) DC voltage</th> <th data-bbox="880 542 1136 586">(2) DC+AC voltage</th> <th data-bbox="1142 542 1401 586">(3) AC voltage</th> </tr> </thead> <tbody> <tr> <td data-bbox="422 595 619 817">Positional Measurement (Rated voltage)</td> <td data-bbox="625 595 874 817">  </td> <td data-bbox="880 595 1136 817">  </td> <td data-bbox="1142 595 1401 817">  </td> </tr> </tbody> </table> <table border="1" data-bbox="422 846 1136 1122"> <thead> <tr> <th data-bbox="422 846 619 891">Voltage</th> <th data-bbox="625 846 874 891">(4) Pulse voltage (A)</th> <th data-bbox="880 846 1136 891">(5) Pulse voltage (B)</th> </tr> </thead> <tbody> <tr> <td data-bbox="422 900 619 1122">Positional Measurement (Rated voltage)</td> <td data-bbox="625 900 874 1122">  </td> <td data-bbox="880 900 1136 1122">  </td> </tr> </tbody> </table> <p>2) Even below the rated voltage, if repetitive high frequency AC or pulse is applied, the reliability of the products may be reduced.</p> <p>3) The effective capacitance will vary depending on applied DC and AC voltages. The products should be selected and designed in taking the voltages into consideration.</p> <p>2-3. Frequency</p> <p>When the products are used in AC and/or pulse voltages, the products may vibrate themselves and generate audible sound.</p>	Voltage	(1) DC voltage	(2) DC+AC voltage	(3) AC voltage	Positional Measurement (Rated voltage)				Voltage	(4) Pulse voltage (A)	(5) Pulse voltage (B)	Positional Measurement (Rated voltage)		
Voltage	(1) DC voltage	(2) DC+AC voltage	(3) AC voltage													
Positional Measurement (Rated voltage)																
Voltage	(4) Pulse voltage (A)	(5) Pulse voltage (B)														
Positional Measurement (Rated voltage)																
3	Designing P.C.board	<p>The amount of solder at the terminations has a direct effect on the reliability of the products.</p> <p>1) The greater the amount of solder, the higher the stress on the products, and the more likely that it will break. When designing a P.C.board, determine the shape and size of the solder lands to have proper amount of solder on the terminations.</p> <p>2) Avoid using common solder land for multiple terminations and provide individual solder land for each terminations.</p>														

No.	Process	Condition
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3 Designing P.C.board

3) Size and recommended land dimensions.

Chip mounted size



- Resist
- Land pattern
- Land pattern & Resist

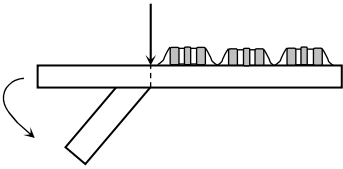
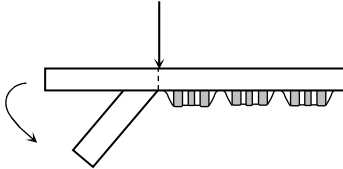
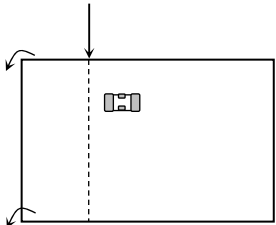
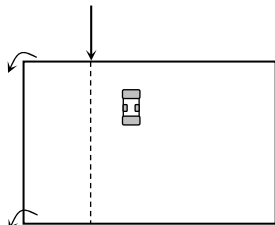
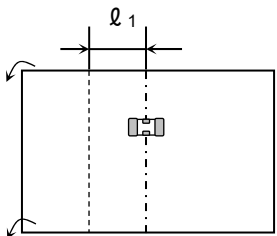
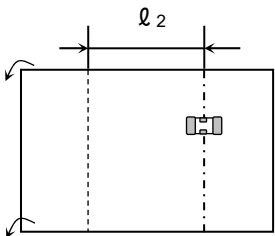
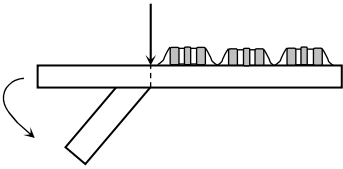
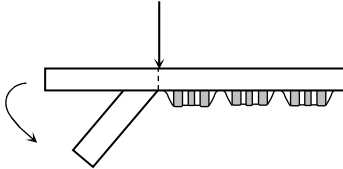
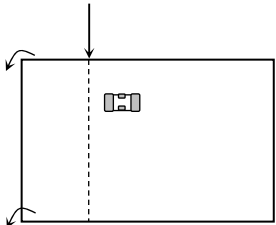
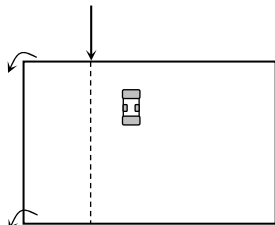
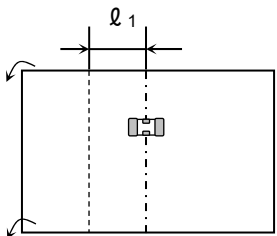
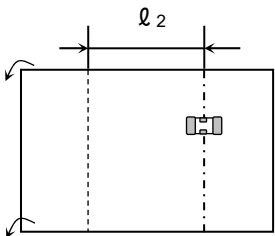
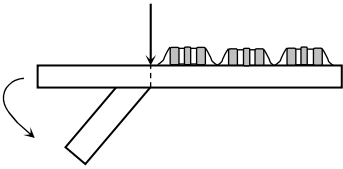
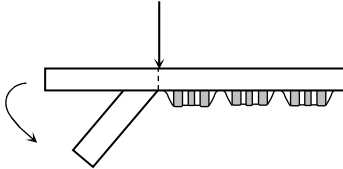
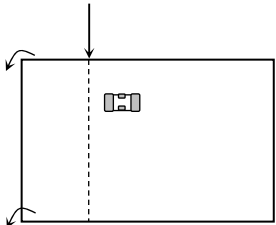
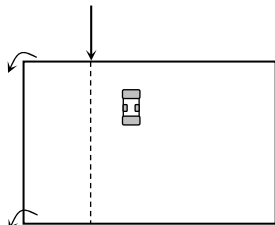
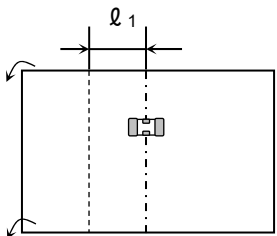
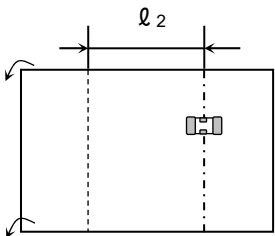
YFF Series is having the unique Ground structure and eliminate unnecessary noise at the wide frequency range. The following points should be considered at the pad design to obtain the better performance.

- 1) Ground pattern should be designed as big as possible.
- 2) Make through hole and connect to the ground pattern of the chip mounted side.
- 3) Through hole should be designed as close to GND terminal as possible.

Notes) \*If through hole is too big, solder paste way came into the hole and make bad connection with the ground pattern.

(mm)

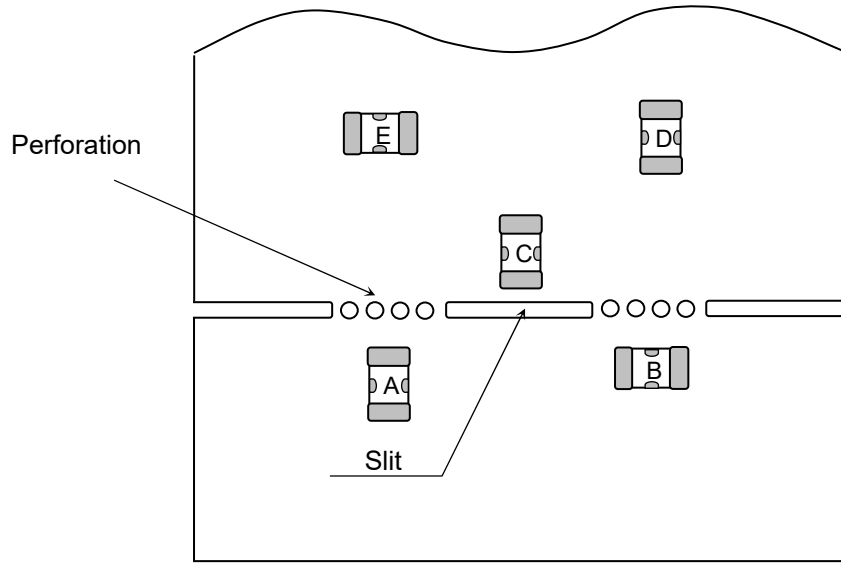
Symbol \ Type	a	b	c	d	e	f
YFF18	1.00	0.60	0.40	0.60	0.40	0.40
YFF21	1.40	0.60	0.50	0.80	0.60	0.65
YFF31	2.50	1.20	1.40	1.30	0.80	0.90

No.	Process	Condition												
3	Designing P.C.board	<p data-bbox="408 226 975 259">4) Recommended product layout is as following.</p> <table border="1" data-bbox="429 288 1449 1637"> <thead> <tr> <th data-bbox="429 288 603 371"></th> <th data-bbox="603 288 1027 371">Disadvantage against bending stress</th> <th data-bbox="1027 288 1449 371">Advantage against bending stress</th> </tr> </thead> <tbody> <tr> <td data-bbox="429 371 603 745">Mounting face</td> <td data-bbox="603 371 1027 745"> <p data-bbox="711 416 919 445">Perforation or slit</p>  <p data-bbox="639 640 895 707">Break P.C.board with mounted side up.</p> </td> <td data-bbox="1027 371 1449 745"> <p data-bbox="1136 416 1343 445">Perforation or slit</p>  <p data-bbox="1070 640 1326 707">Break P.C.board with mounted side down.</p> </td> </tr> <tr> <td data-bbox="429 745 603 1162">Chip arrangement (Direction)</td> <td data-bbox="603 745 1027 1162"> <p data-bbox="711 864 919 893">Perforation or slit</p>  </td> <td data-bbox="1027 745 1449 1162"> <p data-bbox="1136 864 1343 893">Perforation or slit</p>  </td> </tr> <tr> <td data-bbox="429 1162 603 1637">Distance from slit</td> <td data-bbox="603 1162 1027 1637"> <p data-bbox="616 1167 951 1196">Closer to slit is higher stress</p>  <p data-bbox="863 1536 991 1570"><math>( l_1 &lt; l_2 )</math></p> </td> <td data-bbox="1027 1162 1449 1637"> <p data-bbox="1040 1167 1375 1196">Away from slit is less stress</p>  <p data-bbox="1278 1536 1406 1570"><math>( l_1 &lt; l_2 )</math></p> </td> </tr> </tbody> </table>		Disadvantage against bending stress	Advantage against bending stress	Mounting face	<p data-bbox="711 416 919 445">Perforation or slit</p>  <p data-bbox="639 640 895 707">Break P.C.board with mounted side up.</p>	<p data-bbox="1136 416 1343 445">Perforation or slit</p>  <p data-bbox="1070 640 1326 707">Break P.C.board with mounted side down.</p>	Chip arrangement (Direction)	<p data-bbox="711 864 919 893">Perforation or slit</p> 	<p data-bbox="1136 864 1343 893">Perforation or slit</p> 	Distance from slit	<p data-bbox="616 1167 951 1196">Closer to slit is higher stress</p>  <p data-bbox="863 1536 991 1570"><math>( l_1 &lt; l_2 )</math></p>	<p data-bbox="1040 1167 1375 1196">Away from slit is less stress</p>  <p data-bbox="1278 1536 1406 1570"><math>( l_1 &lt; l_2 )</math></p>
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No.	Process	Condition
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3 Designing P.C.board

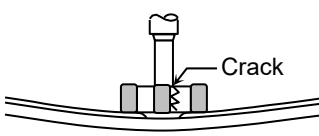
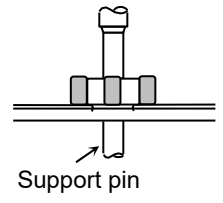
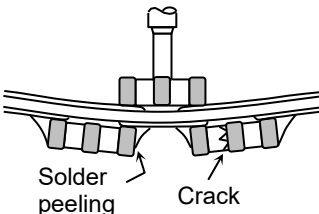
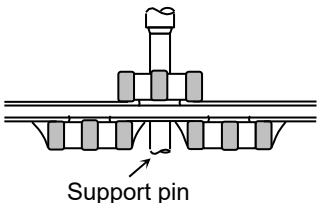
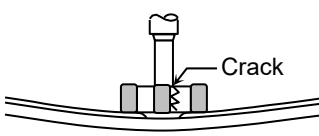
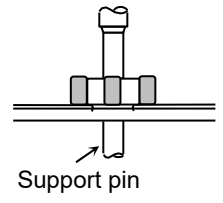
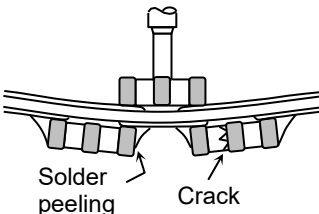
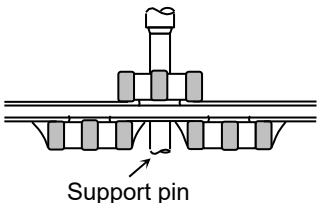
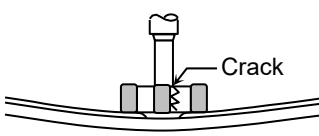
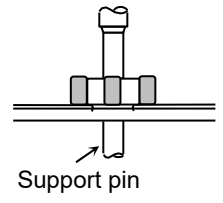
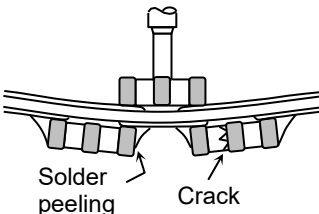
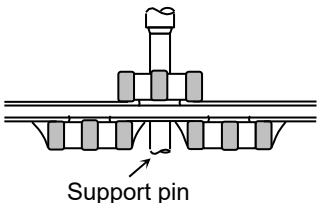
5) Mechanical stress varies according to location of product on the P.C.board.



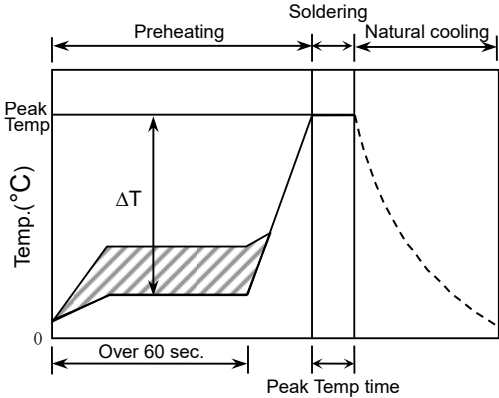
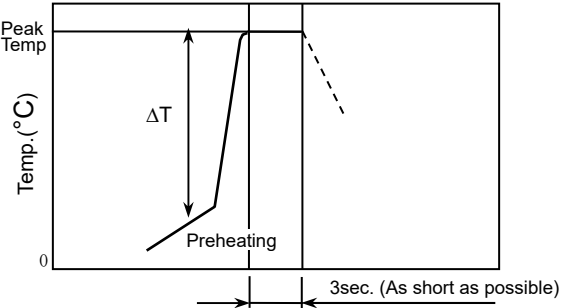
The stress in product is in the following order.  
 $A > B = C > D > E$

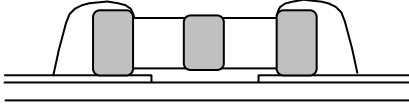
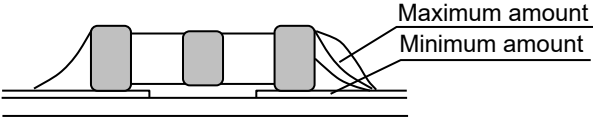
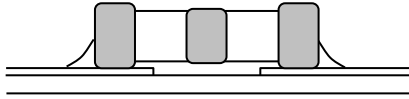
6) Layout recommendation

Example	Use of common solder land	Soldering with chassis
Need to avoid		
Recommendation		


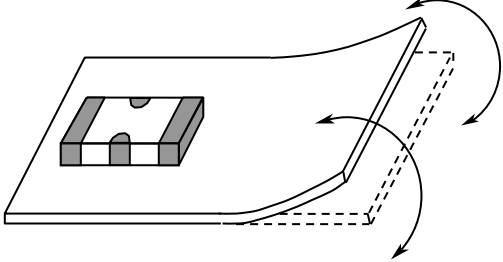
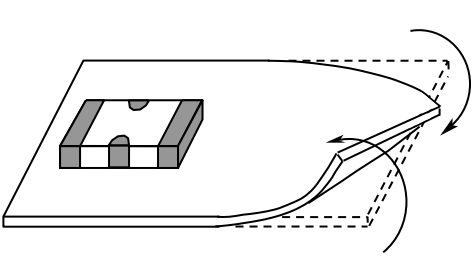
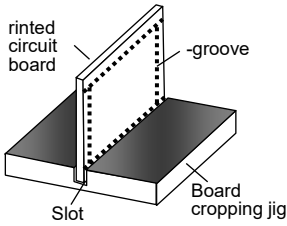
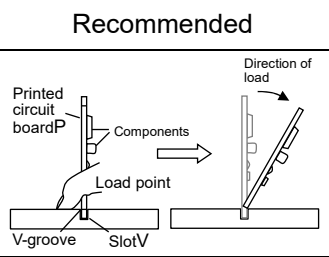
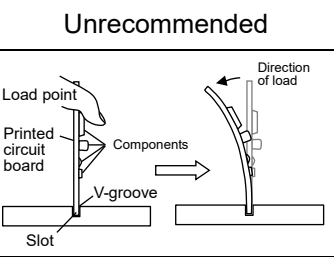
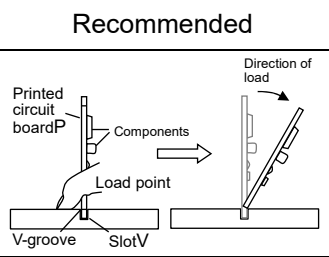
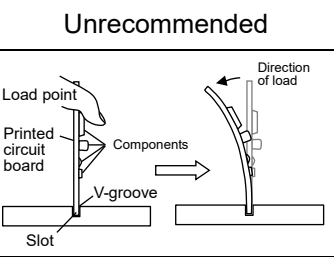
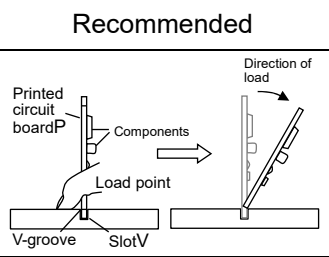
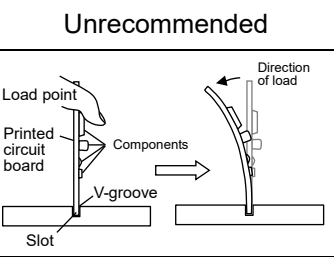
No.	Process	Condition									
4	Mounting	<p>4-1. Stress from mounting head</p> <p>If the mounting head is adjusted too low, it may induce excessive stress in the product to result in cracking. Please take following precautions.</p> <ol style="list-style-type: none"> <li>1) Adjust the bottom dead center of the mounting head to reach on the P.C.board surface and not press it.</li> <li>2) Adjust the mounting head pressure to be 1 to 3N of static weight.</li> <li>3) To minimize the impact energy from mounting head, it is important to provide support from the bottom side of the P.C.board. See following examples.</li> </ol> <table border="1" data-bbox="422 672 1385 1243"> <thead> <tr> <th data-bbox="422 672 619 728"></th> <th data-bbox="619 672 1013 728">Not recommended</th> <th data-bbox="1013 672 1385 728">Recommended</th> </tr> </thead> <tbody> <tr> <td data-bbox="422 728 619 981">Single sided mounting</td> <td data-bbox="619 728 1013 981">  <p>Crack</p> </td> <td data-bbox="1013 728 1385 981">  <p>Support pin</p> </td> </tr> <tr> <td data-bbox="422 981 619 1243">Double-sides mounting</td> <td data-bbox="619 981 1013 1243">  <p>Solder peeling</p> <p>Crack</p> </td> <td data-bbox="1013 981 1385 1243">  <p>Support pin</p> </td> </tr> </tbody> </table> <p>When the centering jaw is worn out, it may give mechanical impact on the product to cause crack. Please control the close up dimension of the centering jaw and provide sufficient preventive maintenance and replacement of it.</p>		Not recommended	Recommended	Single sided mounting	 <p>Crack</p>	 <p>Support pin</p>	Double-sides mounting	 <p>Solder peeling</p> <p>Crack</p>	 <p>Support pin</p>
	Not recommended	Recommended									
Single sided mounting	 <p>Crack</p>	 <p>Support pin</p>									
Double-sides mounting	 <p>Solder peeling</p> <p>Crack</p>	 <p>Support pin</p>									



No.	Process	Condition														
5	Soldering	<p>5-1. Flux selection</p> <p>Flux can seriously affect the performance of capacitors. Confirm the following to select the appropriate flux.</p> <ol style="list-style-type: none"> <li>1) It is recommended to use a mildly activated rosin flux (less than 0.1wt% chlorine). Strong flux is not recommended.</li> <li>2) Excessive flux must be avoided. Please provide proper amount of flux.</li> <li>3) When water-soluble flux is used, enough washing is necessary.</li> </ol> <p>5-2. Recommended soldering profile by various methods</p> <p style="text-align: center;"><b>Reflow soldering</b></p>  <p style="text-align: center;"><b>Manual soldering (Solder iron)</b></p>  <p>* As for peak temperature of manual soldering, please refer “5-6. Solder repair by solder iron” .</p> <p>5-3. Recommended soldering peak temp and peak temp duration</p> <table border="1" data-bbox="502 1556 1177 1796"> <thead> <tr> <th rowspan="2" style="text-align: center;">Temp./Duration</th> <th colspan="2" style="text-align: center;">Reflow soldering</th> </tr> <tr> <th style="text-align: center;">Peak temp(°C)</th> <th style="text-align: center;">Duration(sec.)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Solder</td> <td></td> <td></td> </tr> <tr> <td style="text-align: center;">Sn-Pb Solder</td> <td style="text-align: center;">230 max.</td> <td style="text-align: center;">20 max.</td> </tr> <tr> <td style="text-align: center;">Lead Free Solder</td> <td style="text-align: center;">260 max.</td> <td style="text-align: center;">10 max.</td> </tr> </tbody> </table> <p>Recommended solder compositions  Lead Free Solder : Sn-3.0Ag-0.5Cu  Sn-Pb solder : Sn-37Pb</p>	Temp./Duration	Reflow soldering		Peak temp(°C)	Duration(sec.)	Solder			Sn-Pb Solder	230 max.	20 max.	Lead Free Solder	260 max.	10 max.
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Lead Free Solder	260 max.	10 max.														

No.	Process	Condition														
5	Soldering	<p>5-4. Avoiding thermal shock</p> <p>1) Preheating condition</p> <table border="1" data-bbox="539 309 975 472"> <thead> <tr> <th>Soldering</th> <th>Temp. (°C)</th> </tr> </thead> <tbody> <tr> <td>Reflow soldering</td> <td><math>\Delta T \leq 150</math></td> </tr> <tr> <td>Manual soldering</td> <td><math>\Delta T \leq 150</math></td> </tr> </tbody> </table> <p>2) Cooling condition Natural cooling using air is recommended. If the product is dipped into a solvent for cleaning, the temperature difference (<math>\Delta T</math>) must be less than 100°C.</p> <p>5-5. Amount of solder Excessive solder will induce higher tensile force in product when temperature changes and it may result in chip cracking. In sufficient solder may detach the product from the P.C.board.</p> <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 30%;">Excessive solder</div> <div style="width: 30%; text-align: center;">  </div> <div style="width: 30%;">Higher tensile force in product to cause crack</div> </div> <hr/> <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="width: 30%;">Adequate</div> <div style="width: 30%; text-align: center;">  </div> </div> <hr/> <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 30%;">Insufficient solder</div> <div style="width: 30%; text-align: center;">  </div> <div style="width: 30%;">Low robustness may cause contact failure or product come off the P.C.board.</div> </div> <hr/> <p>5-6. Solder repair by solder iron</p> <p>1) Selection of the soldering iron tip Tip temperature of solder iron varies by its type, P.C.board material and solder land size. The higher the tip temperature, the quicker the operation. However, heat shock may cause a crack in the product. Please make sure the tip temp. before soldering and keep the peak temp and time in accordance with following recommended condition.</p> <p style="text-align: center;">Recommended solder iron condition (Sn-Pb Solder and Lead Free Solder)</p> <table border="1" data-bbox="539 1644 1374 1749"> <thead> <tr> <th>Temp. (°C)</th> <th>Duration (sec.)</th> <th>Wattage (W)</th> <th>Shape (mm)</th> </tr> </thead> <tbody> <tr> <td>350 max.</td> <td>3 max.</td> <td>20 max.</td> <td>∅ 3.0 max.</td> </tr> </tbody> </table> <p>* Please preheat the chip capacitors with the condition in 5-4 to avoid the thermal shock.</p> <p>2) Direct contact of the soldering iron with ceramic dielectric of products may cause crack. Do not touch the ceramic dielectric and the terminations by solder iron.</p>	Soldering	Temp. (°C)	Reflow soldering	$\Delta T \leq 150$	Manual soldering	$\Delta T \leq 150$	Temp. (°C)	Duration (sec.)	Wattage (W)	Shape (mm)	350 max.	3 max.	20 max.	∅ 3.0 max.
Soldering	Temp. (°C)															
Reflow soldering	$\Delta T \leq 150$															
Manual soldering	$\Delta T \leq 150$															
Temp. (°C)	Duration (sec.)	Wattage (W)	Shape (mm)													
350 max.	3 max.	20 max.	∅ 3.0 max.													

No.	Process	Condition
5	Soldering	<p>5-7. Sn-Zn solder Sn-Zn solder affects product reliability. Please contact TDK in advance when utilize Sn-Zn solder.</p> <p>5-8. Countermeasure for tombstone The misalignment between the mounted positions of the products and the land patterns should be minimized. The tombstone phenomenon may occur especially the products are mounted (in longitudinal direction) in the same direction of the reflow soldering. (Refer to JEITA RCR-2335C Annex A (Informative) Recommendations to prevent the tombstone phenomenon)</p>
6	Cleaning	<p>1) If an unsuitable cleaning fluid is used, flux residue or some foreign articles may stick to product surface to deteriorate especially the insulation resistance.</p> <p>2) If cleaning condition is not suitable, it may damage the product.</p> <p>2)-1. Insufficient washing (1) Terminal electrodes may corrode by Halogen in the flux.  (2) Halogen in the flux may adhere on the surface of product, and lower the insulation resistance.  (3) Water soluble flux has higher tendency to have above mentioned problems (1) and (2).</p> <p>2)-2. Excessive washing When ultrasonic cleaning is used, excessively high ultrasonic energy output can affect the connection between the ceramic product body and the terminal electrode. To avoid this, following is the recommended condition.  Power : 20 W/l max. Frequency : 40 kHz max. Washing time : 5 minutes max.</p> <p>2)-3. If the cleaning fluid is contaminated, density of Halogen increases, and it may bring the same result as insufficient cleaning.</p>
7	Coating and molding of the P.C.board	<p>1) When the P.C.board is coated, please verify the quality influence on the product.</p> <p>2) Please verify carefully that there is no harmful decomposing or reaction gas emission during curing which may damage the product.</p> <p>3) Please verify the curing temperature.</p>

No.	Process	Condition				
8	Handling after chip mounted  Caution	<p>1) Please pay attention not to bend or distort the P.C.board after soldering in handling otherwise the product may crack.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Bend</p>  </div> <div style="text-align: center;"> <p>Twist</p>  </div> </div> <p>2) Printed circuit board cropping should not be carried out by hand, but by using the proper tooling. Printed circuit board cropping should be carried out using a board cropping jig as shown in the following figure or a board cropping apparatus to prevent inducing mechanical stress on the board.</p> <p>(1) Example of a board cropping jig</p> <p>Recommended example: The board should be pushed from the back side, close to the cropping jig so that the board is not bent and the stress applied to the product is compressive.</p> <p>Unrecommended example: If the pushing point is far from the cropping jig and the pushing direction is from the front side of the board, large tensile stress is applied to the product, which may cause cracks.</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>Outline of jig</p>  </div> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%; text-align: center;">Recommended</th> <th style="width: 50%; text-align: center;">Unrecommended</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">  </td> <td style="text-align: center;">  </td> </tr> </tbody> </table> </div>	Recommended	Unrecommended		
Recommended	Unrecommended					
						

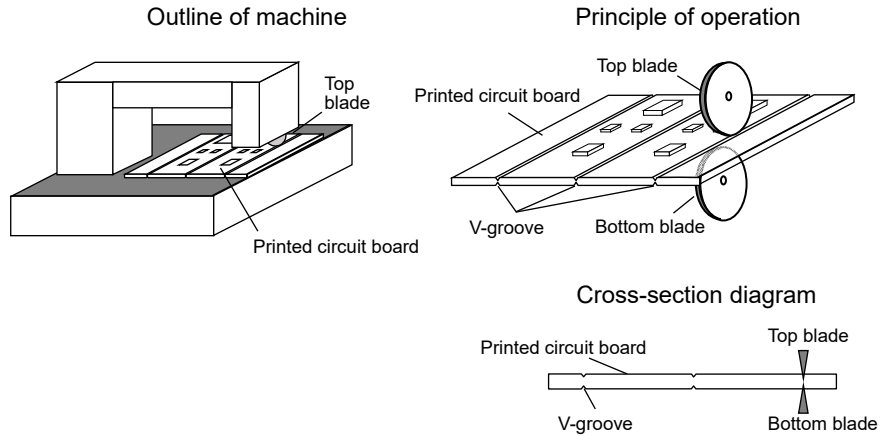
No.	Process	Condition
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8

Handling after chip mounted  
 ⚠ Caution

(2) Example of a board cropping machine

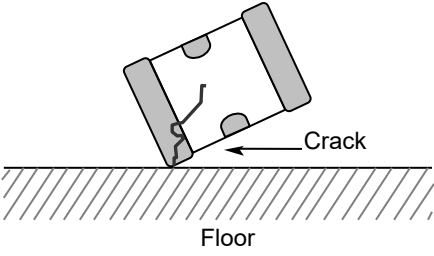
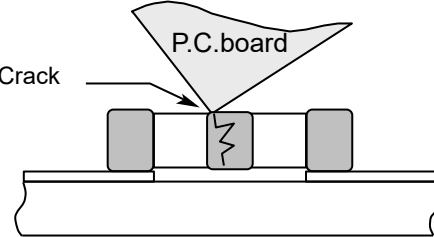
An outline of a printed circuit board cropping machine is shown below. The top and bottom blades are aligned with one another along the lines with the V-grooves on printed circuit board when cropping the board.  
 Unrecommended example: Misalignment of blade position between top and bottom, right and left, or front and rear blades may cause a crack in the product.




Recommended	Unrecommended		
	Top-bottom misalignment	Left-right misalignment	Front-rear misalignment
<p>Top blade</p> <p>Board</p> <p>Bottom blade</p>	<p>Top blade</p> <p>Bottom blade</p>	<p>Top blade</p> <p>Bottom blade</p>	<p>Top blade</p> <p>Bottom blade</p>

3) When functional check of the P.C. board is performed, check pin pressure tends to be adjusted higher for fear of loose contact. But if the pressure is excessive and bend the P.C. board, it may crack the product or peel the terminations off. Please adjust the check pins not to bend the P.C. board.

Item	Not recommended	Recommended
Board bending	<p>Termination peeling</p> <p>Check pin</p>	<p>Support pin</p> <p>Check pin</p>

No.	Process	Condition
9	Handling of loose product	<p>1) If dropped the product may crack. Once dropped do not use it. Especially, the large case sized product are tendency to have cracks easily, so please handle with care.</p>  <p>2) Piling the P.C.board after mounting for storage or handling, the corner of the P.C. board may hit the product of another board to cause crack.</p> 
10	Caution during operation of equipment	<p>1) A product shall not be touched directly with bare hands during operation in order to avoid electric shock. Electric energy held by the product may be discharged through the human body when touched with a bare hand. Even when the equipment is off, a product may stay charged. The product should be handled after being completely discharged using a resistor.</p> <p>2) The terminals of a product shall not be short-circuited by any accidental contact with a conductive object. A product shall not be exposed to a conductive liquid such as an acid or alkali solution. A conductive object or liquid, such as acid and alkali, between the terminals may lead to the breakdown of a product due to short circuit</p> <p>3) Confirm that the environment to which the equipment will be exposed during transportation and operation meets the specified conditions. Do not to use the equipment in the following environments.</p> <ol style="list-style-type: none"> <li>(1) Environment where a product is splattered with water or oil</li> <li>(2) Environment where a product is exposed to direct sunlight</li> <li>(3) Environment where a product is exposed to Ozone, ultraviolet rays or radiation</li> <li>(4) Environment where a product exposed to corrosive gas(e.g. hydrogen sulfide, sulfur dioxide, chlorine. ammonia gas etc.)</li> <li>(5) Environment where a product exposed to vibration or mechanical shock exceeding the specified limits.</li> <li>(6) Atmosphere change with causes condensation</li> </ol>

No.	Process	Condition
11	Others  Caution	<p>The product listed in this specification is intended for use in automotive applications under-normal operation and usage conditions.</p> <p>The product is not designed or warranted to meet the requirements of application listed below, whose performance and/or quality requires a more stringent level of safety or reliability, or whose failure, malfunction or defect could cause serious damage to society, person or property. Please understand that we are not responsible for any damage or liability caused by use of the products in any of the applications below or for any other use exceeding the range or conditions set forth in this specification sheet. If you intend to use the products in the applications listed below or if you have special requirements exceeding the range or conditions set forth in this specification, please contact us.</p> <ul style="list-style-type: none"> <li>(1) Aerospace/Aviation equipment</li> <li>(2) Transportation equipment (electric trains, ships etc.)</li> <li>(3) Medical equipment (Excepting Pharmaceutical Affairs Law classification Class1, 2)</li> <li>(4) Power-generation control equipment</li> <li>(5) Atomic energy-related equipment</li> <li>(6) Seabed equipment</li> <li>(7) Transportation control equipment</li> <li>(8) Public information-processing equipment</li> <li>(9) Military equipment</li> <li>(10) Electric heating apparatus, burning equipment</li> <li>(11) Disaster prevention/crime prevention equipment</li> <li>(12) Safety equipment</li> <li>(13) Other applications that are not considered general-purpose applications</li> </ul> <p>When designing your equipment even for general-purpose applications, you are kindly requested to take into consideration securing protection circuit/device or providing backup circuits in your equipment.</p> <p>In addition, although the product listed in this specification is intended for use in automotive applications as described above, it is not prohibited to use for general electronic equipment, whose performance and/or quality doesn't require a more stringent level of safety or reliability, or whose failure, malfunction or defect could not cause serious damage to society, person or property.</p> <p>Therefore, the description of this caution will be applied, when the product is used in general electronic equipment under a normal operation and usage conditions.</p>

# 13. TAPE PACKAGING SPECIFICATION

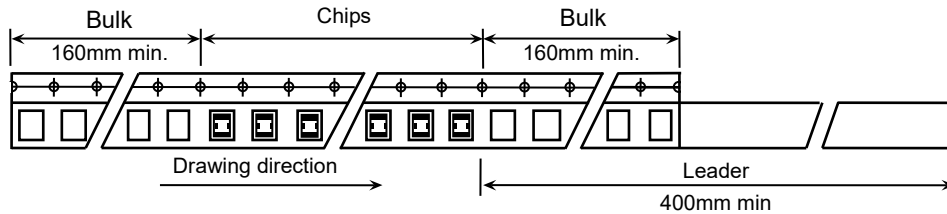
## 1. CONSTRUCTION AND DIMENSION OF TAPING

### 1-1. Dimensions of carrier tape

Dimensions of paper tape shall be according to Appendix 3.

Dimensions of plastic tape shall be according to Appendix 4.

### 1-2. Bulk part and leader of taping



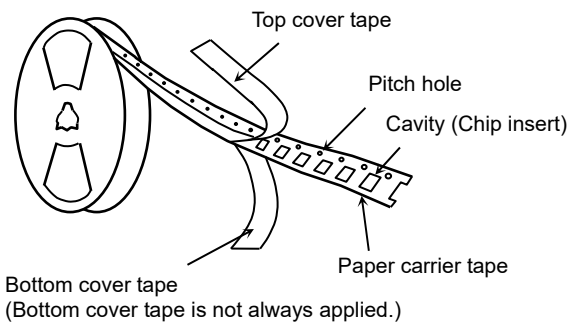
### 1-3. Dimensions of reel

Dimensions of  $\phi 178$  reel shall be according to Appendix 5.

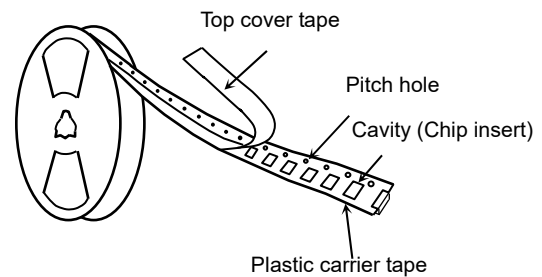
Dimensions of  $\phi 330$  reel shall be according to Appendix 6.

### 1-4. Structure of taping

#### <Paper>



#### <Plastic>



## 2. PRODUCT QUANTITY

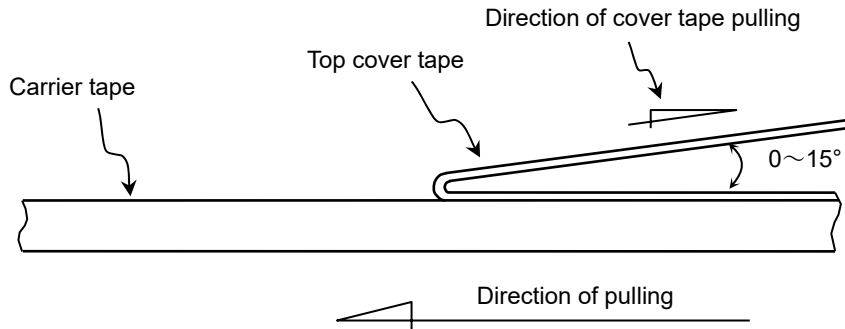
Please refer to the table A in the end of the specification.



### 3. PERFORMANCE SPECIFICATIONS

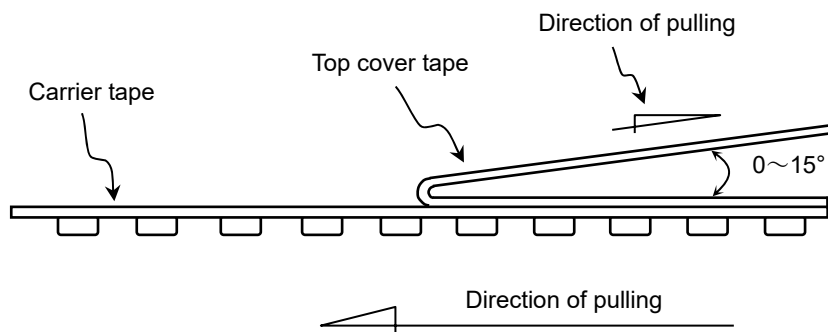
- 3-1. Fixing peeling strength (top tape)  
 $0.05\text{N} < \text{Peeling strength} < 0.7\text{N}$

<Paper>



[ Paper tape should not adhere to top cover tape when pull the cover tape. ]

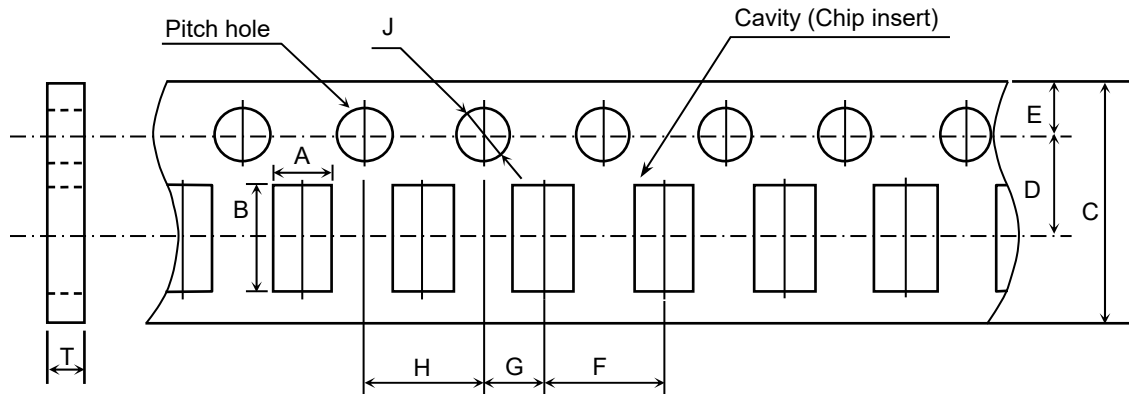
<Plastic>



- 3-2. Carrier tape shall be flexible enough to be wound around a minimum radius of 30mm with components in tape.
- 3-3. The missing of components shall be less than 0.1%
- 3-4. Components shall not stick to fixing tape.
- 3-5. When removing the cover tape, there shall not be difficulties by unfitting clearance gap, burrs and crushes of cavities. Also the sprocket holes shall not be covered by absorbing dust into the suction nozzle.

## Appendix 3

### Paper Tape



(Unit : mm)

Symbol Type	A	B	C	D	E	F
YFF18	( 1.10 )	( 1.90 )	8.00 ± 0.30	3.50 ± 0.05	1.75 ± 0.10	4.00 ± 0.10
YFF21	( 1.50 )	( 2.30 )				

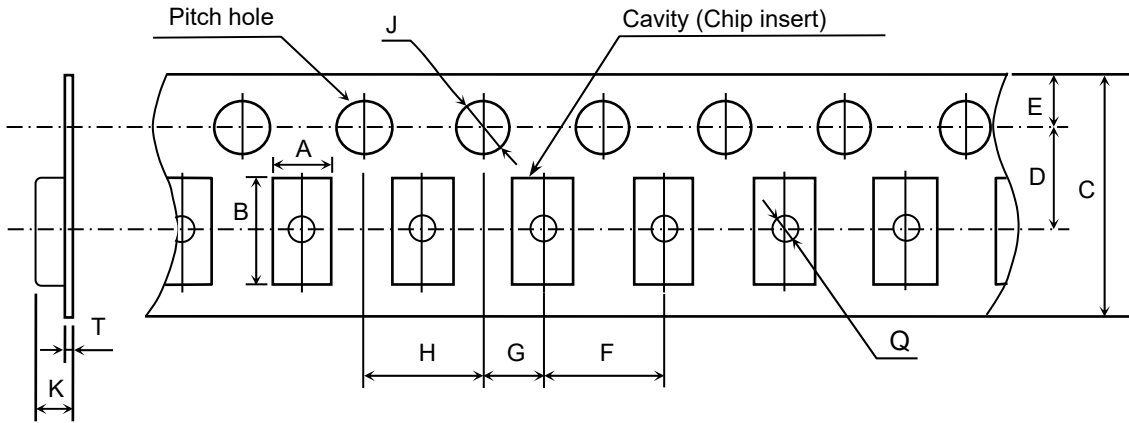
  

Symbol Type	G	H	J	T
YFF18	2.00 ± 0.05	4.00 ± 0.10	∅ 1.5 $\begin{matrix} +0.10 \\ 0 \end{matrix}$	1.20 max.
YFF21				

( ) Reference value.

## Appendix 4

### Plastic Tape

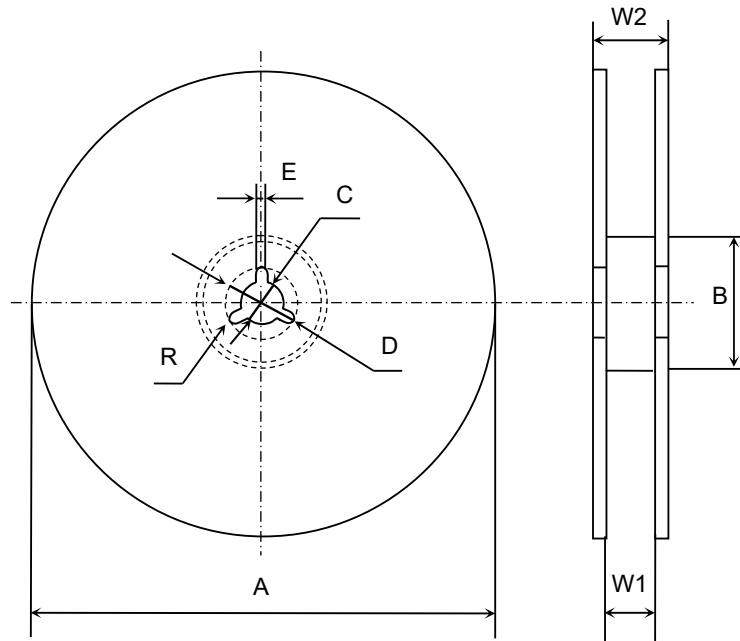


(Unit : mm)

Symbol Type	A	B	C	D	E	F
YFF31	( 1.90 )	( 3.50 )	8.00±0.30	3.50±0.05	1.75±0.10	4.00±0.10
Symbol Type	G	H	J	K	T	Q
YFF31	2.00±0.05	4.00±0.10	$\phi 1.5 \begin{matrix} +0.10 \\ 0 \end{matrix}$	2.50 max.	0.30 max.	$\phi 0.50$ min.

( ) Reference value.

**Appendix 5**  
Dimensions of reel (Material : Polystyrene)

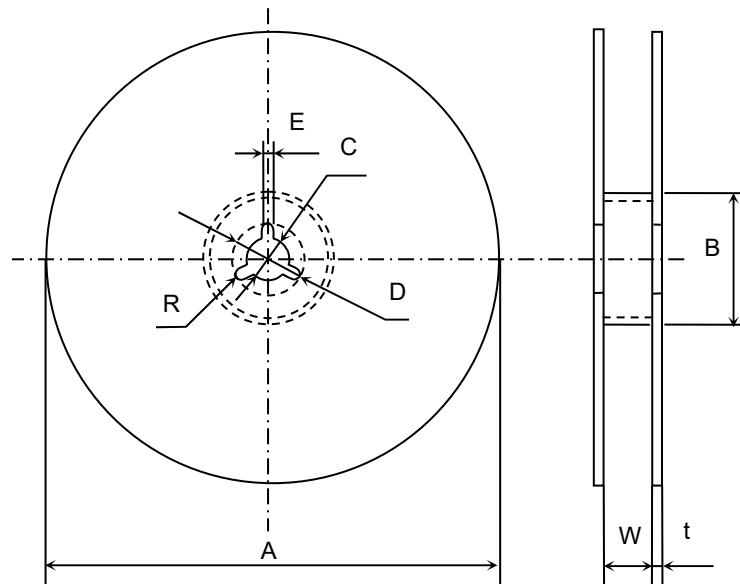


(Unit : mm)

Symbol	A	B	C	D	E	W1
Dimension	$\phi 178 \pm 2.0$	$\phi 60 \pm 2.0$	$\phi 13 \pm 0.5$	$\phi 21 \pm 0.8$	$2.0 \pm 0.5$	$9.0 \pm 0.3$

Symbol	W2	R
Dimension	$13.0 \pm 1.4$	1.0

**Appendix 6**  
Dimensions of reel (Material : Polystyrene)



(Unit : mm)

Symbol	A	B	C	D	E	W
Dimension	$\phi 382$ max. (Nominal $\phi 330$ )	$\phi 50$ min.	$\phi 13 \pm 0.5$	$\phi 21 \pm 0.8$	$2.0 \pm 0.5$	$10.0 \pm 1.5$

Symbol	t	R
Dimension	$2.0 \pm 0.5$	1.0

# 14.Table A (TDK products line up)

No	Your Part No.	TDK product	Dimensions			Rated Current (A)		Direct Current Resistance (mΩ)		Capacitance		Temp cycle	Moisture Resistance (Steady state)	Moisture Resistance	Life		Tape packaging materials	Qty. per 1 reel	
			L (mm)	W (mm)	T (mm)	125°C	105°C		Applied for test No.7,9~14.	Measuring frequency	Measuring voltage	ΔC/C	ΔC/C	ΔC/C	Test voltage		φ 178mm	φ 330mm	
1		YFF18AC1H220M	1.60±0.20	0.80±0.15	0.60±0.10	DC1A	-	300 max.	500 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	2.0 x R.V.	Paper	4,000	10,000
2		YFF18AC1H470M	1.60±0.20	0.80±0.15	0.60±0.10	DC1A	-	300 max.	500 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	2.0 x R.V.	Paper	4,000	10,000
3		YFF18AC1H101M	1.60±0.20	0.80±0.15	0.60±0.10	DC1A	-	300 max.	500 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	2.0 x R.V.	Paper	4,000	10,000
4		YFF18AC1H221M	1.60±0.20	0.80±0.15	0.60±0.10	DC1A	-	300 max.	500 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	2.0 x R.V.	Paper	4,000	10,000
5		YFF18AC1H471M	1.60±0.20	0.80±0.15	0.60±0.10	DC1A	-	300 max.	500 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	2.0 x R.V.	Paper	4,000	10,000
6		YFF18AC1H102M	1.60±0.20	0.80±0.15	0.60±0.10	DC1A	-	300 max.	500 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	1.0 x R.V.	Paper	4,000	10,000
7		YFF18AC1H222M	1.60±0.20	0.80±0.15	0.60±0.10	DC1A	-	300 max.	500 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	1.0 x R.V.	Paper	4,000	10,000
8		YFF18AC1H472M	1.60±0.20	0.80±0.15	0.60±0.10	DC1A	-	300 max.	500 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	1.0 x R.V.	Paper	4,000	10,000
9		YFF18AC1H103M	1.60±0.20	0.80±0.15	0.60±0.10	DC1A	-	80 max.	100 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	1.0 x R.V.	Paper	4,000	10,000
10		YFF18AC1E223M	1.60±0.20	0.80±0.15	0.60±0.10	DC1A	-	50 max.	100 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	1.0 x R.V.	Paper	4,000	10,000
11		YFF18AC1C104M	1.60±0.20	0.80±0.15	0.60±0.10	DC1A	-	30 max.	50 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	1.0 x R.V.	Paper	4,000	10,000
12		YFF18AC0J105M	1.60±0.20	0.80±0.15	0.60±0.10	DC2A	-	20 max.	50 max.	1kHz	0.5Vrms	±7.5%	±12.5%	±12.5%	±15%	1.0 x R.V.	Paper	4,000	10,000
13		YFF21AC1H220M	2.00±0.20	1.25±0.20	0.85±0.15	DC1A	-	300 max.	500 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	2.0 x R.V.	Paper	4,000	10,000
14		YFF21AC1H470M	2.00±0.20	1.25±0.20	0.85±0.15	DC1A	-	300 max.	500 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	2.0 x R.V.	Paper	4,000	10,000
15		YFF21AC1H101M	2.00±0.20	1.25±0.20	0.85±0.15	DC1A	-	300 max.	500 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	2.0 x R.V.	Paper	4,000	10,000
16		YFF21AC1H221M	2.00±0.20	1.25±0.20	0.85±0.15	DC1A	-	300 max.	500 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	2.0 x R.V.	Paper	4,000	10,000
17		YFF21AC1H471M	2.00±0.20	1.25±0.20	0.85±0.15	DC1A	-	300 max.	500 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	2.0 x R.V.	Paper	4,000	10,000
18		YFF21AC1H102M	2.00±0.20	1.25±0.20	0.85±0.15	DC0.4A	-	300 max.	500 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	1.0 x R.V.	Paper	4,000	10,000
19		YFF21AC1H222M	2.00±0.20	1.25±0.20	0.85±0.15	DC0.4A	-	300 max.	500 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	1.0 x R.V.	Paper	4,000	10,000
20		YFF21AC1H472M	2.00±0.20	1.25±0.20	0.85±0.15	DC0.4A	-	300 max.	500 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	1.0 x R.V.	Paper	4,000	10,000
21		YFF21AC1E103M	2.00±0.20	1.25±0.20	0.85±0.15	DC0.4A	-	100 max.	150 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	1.0 x R.V.	Paper	4,000	10,000
22		YFF21AC1E223M	2.00±0.20	1.25±0.20	0.85±0.15	DC1A	-	80 max.	100 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	1.0 x R.V.	Paper	4,000	10,000
23		YFF21AC1E473M	2.00±0.20	1.25±0.20	0.85±0.15	DC1A	-	80 max.	100 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	1.0 x R.V.	Paper	4,000	10,000
24		YFF21AC1E104M	2.00±0.20	1.25±0.20	0.85±0.15	DC1A	-	80 max.	100 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	1.0 x R.V.	Paper	4,000	10,000
21		YFF21AC1C474M	2.00±0.20	1.25±0.20	0.85±0.15	DC1A	-	30 max.	50 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	1.0 x R.V.	Paper	4,000	10,000
21		YFF31AH2A104M	3.20±0.20	1.60±0.20	1.30±0.20	DC6A	DC10A	2.5 max.	50 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	2.0 x R.V.	Plastic	2,000	10,000
22		YFF31AH2A105M	3.20±0.20	1.60±0.20	1.30±0.20	DC4A	DC6A	5 max.	50 max.	1kHz	1.0Vrms	±7.5%	±12.5%	±12.5%	±15%	2.0 x R.V.	Plastic	2,000	10,000