SPECIFICATION

SPEC. No. A-YFF-a
DATE : 2017 Jan.

To

Non-Controlled Copy

CUSTOMER'S PRODUCT NAME	TDK'S PRODUCT NAME 3 Terminal Filter YFF Series/ Automotive grade (Feed through type)

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
Ceramic Capacitors Business Group

APPROVED	Person in charge

APPROVED	CHECKED	Person in charge

1. SCOPE

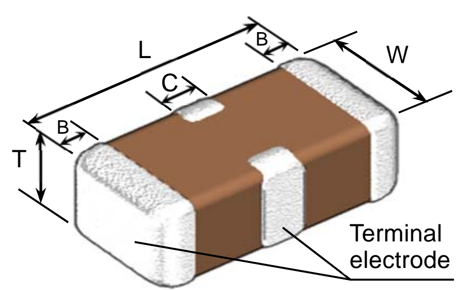
This specification is applicable to 3 terminal filter feed through type with a priority over the other relevant specifications.
Production places defined in this specification shall be TDK Corporation Japan, TDK (Suzhou) Co., Ltd and TDK Components U.S.A. Inc.

EXPLANATORY NOTE:
This specification warrants the quality of the product. The product should be evaluated or confirmed a state of mounted on your product.
If the use of the chips goes beyond the bounds of the specification, we can not afford to guarantee.

2. CODE CONSTRUCTION

(Example):	YFF18	AC	1C	104	M	T	0Y0N
	(1)	(2)	(3)	(4)	(5)	(6)	(7)

(1) Type
<YFF18AC,YFF21AC,YFF31AH>



*As for dimensions of each product, please refer to detailed inforamtion on TDK web.

(2) Product Classfication

Symbol	Product Classification
AC	STD 3Terminals for Power Line
AH	For 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

(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 221 → 220pF
104 → 100,000pF = 0.1μF

(5) Capacitance tolerance

Symbol	Tolerance
M	±20 %

(6) Packaging

Symbol	Packaging
T	Taping

(7) TDK Internal code

3. RATED CURRENT

As for Rated Current of each product, please refer to detailed inforamtion on TDK web.

4. OPERATING TEMPERATURE RANGE

As for Operating Temperature range of each product, please refer to detailed inforamtion on TDK web.

5. STORING CONDITION AND TERM

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

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 (3x).
2	Direct Current Resistance (Rdc)		As for Direct Current spec of each product, please refer to detailed inforamtion on TDK web.	Measuring current shall be 100mA max..
3	Capacitance		Within the specified tolerance.	Measuring frequency: 1kHz±10% Measuring voltage: 1.0±0.2Vrms
4	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 Appendix1 and apply a pushing force of 17.7N.
5	Bending	External appearance	No mechanical damage.	Reflow solder the products on a P.C. Board shown in Appendix1 and bend it for 2mm (1mm is applied for YFF31AH type). (Unit:mm)
		Capacitance	Change from the value before test ±12.5 %	
		Resistance for DC (Rdc)	500mΩ max. except for following parts. 150mΩmax.: YFF21AC1E103M 100mΩmax.: YFF18AC1H103M YFF18AC1E223M YFF21AC1E223M~104M 50mΩmax.: YFF18AC1C104M YFF21AC1C474M YFF31AH2A104M,105M	

(continued)

table 1

No.	Item		Performance	Test or inspection method
6	Solderability		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. A section	Completely soak both terminations in solder at the following conditions. 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) Flux: Isopropyl alcohol (JIS K 8839) Rosin (JIS K 5902) 25% solid solution.
7	Resistance to solder heat	External appearance	No cracks are allowed and terminations shall be covered at least 60% with new solder.	Completely soak both terminations in solder at the following conditions. 260±5°C for 10±1s. Preheating condition Temp.: 110~140°C Time : 30~60s. Solder : Sn-3.0Ag-0.5Cu or Sn-37Pb Flux : Isopropyl alcohol (JIS K 8839) Rosin (JIS K 5902) 25% solid solution. Leave the capacitors in ambient condition for 24±2h before measurement.
		Capacitance	Change from the value before test ±7.5 %	
		Resistance for DC (Rdc)	500mΩ max. except for following parts. 150mΩmax.:YFF21AC1E103M 100mΩmax.:YFF18AC1H103M YFF18AC1E223M YFF21AC1E223M~104M 50mΩmax. YFF18AC1C104M,474M YFF31AH2A104M,105M	
8	Vibration	External appearance	No mechanical damage.	Reflow Solder the products on a P.C. Board shown in Appendix2 before testing. Vibrate the products with following conditions. Applied force : 5G max. Frequency : 10 - 2,000Hz Duration : 20 min. Cycle : 12 cycles in each 3 mutually perpendicular directions.
		Capacitance	Change from the value before test ±7.5 %	
		Resistance for DC (Rdc)	500mΩ max. except for following parts. 150mΩmax.:YFF21AC1E103M 100mΩmax.:YFF18AC1H103M YFF18AC1E223M YFF21AC1E223M~104M 50mΩmax. YFF18AC1C104M,474M YFF31AH2A104M,105M	

(continued)

<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Performance</th><th>Test or inspection method</th></tr>
<tr><td rowspan="3">9</td><td rowspan="3">Temperature cycle</td><td>External appearance</td><td>No mechanical damage.</td><td rowspan="3">Reflow solder the products on a P.C. board shown in Appendix2 before testing.

Expose the product in the condition step1 through step 4 and repeat 1,000 times consecutively.

Leave the products in ambient condition for 24±2h before measurement.

<table><tr><th>Step</th><th>Temperature(°C)</th><th>Time(min.)</th></tr><tr><td>1</td><td>-55 ±3</td><td>30 ± 3</td></tr><tr><td>2</td><td>25</td><td>2 - 5</td></tr><tr><td>3</td><td>125 ± 2</td><td>30 ± 2</td></tr><tr><td>4</td><td>25</td><td>2 - 5</td></tr></table></td></tr>
<tr><td>Capacitance</td><td>Change from the value before test
±7.5 %</td></tr>
<tr><td>Resistance for DC (Rdc)</td><td>500mΩ max. except for following parts.

150mΩmax.:YFF21AC1E103M
100mΩmax.:YFF18AC1H103M
YFF18AC1E223M
YFF21AC1E223M~104M
50mΩmax. YFF18AC1C104M,474M
YFF31AH2A104M,105M</td></tr>
<tr><td rowspan="3">10</td><td rowspan="3">Moisture Resistance (Steady State)</td><td>External appearance</td><td>No mechanical damage.</td><td rowspan="3">Reflow solder the products on a P.C. board shown in Appendix2 before testing.

Leave at temperature 40±2°C,
90 to 95%RH for 500 +24,0h.

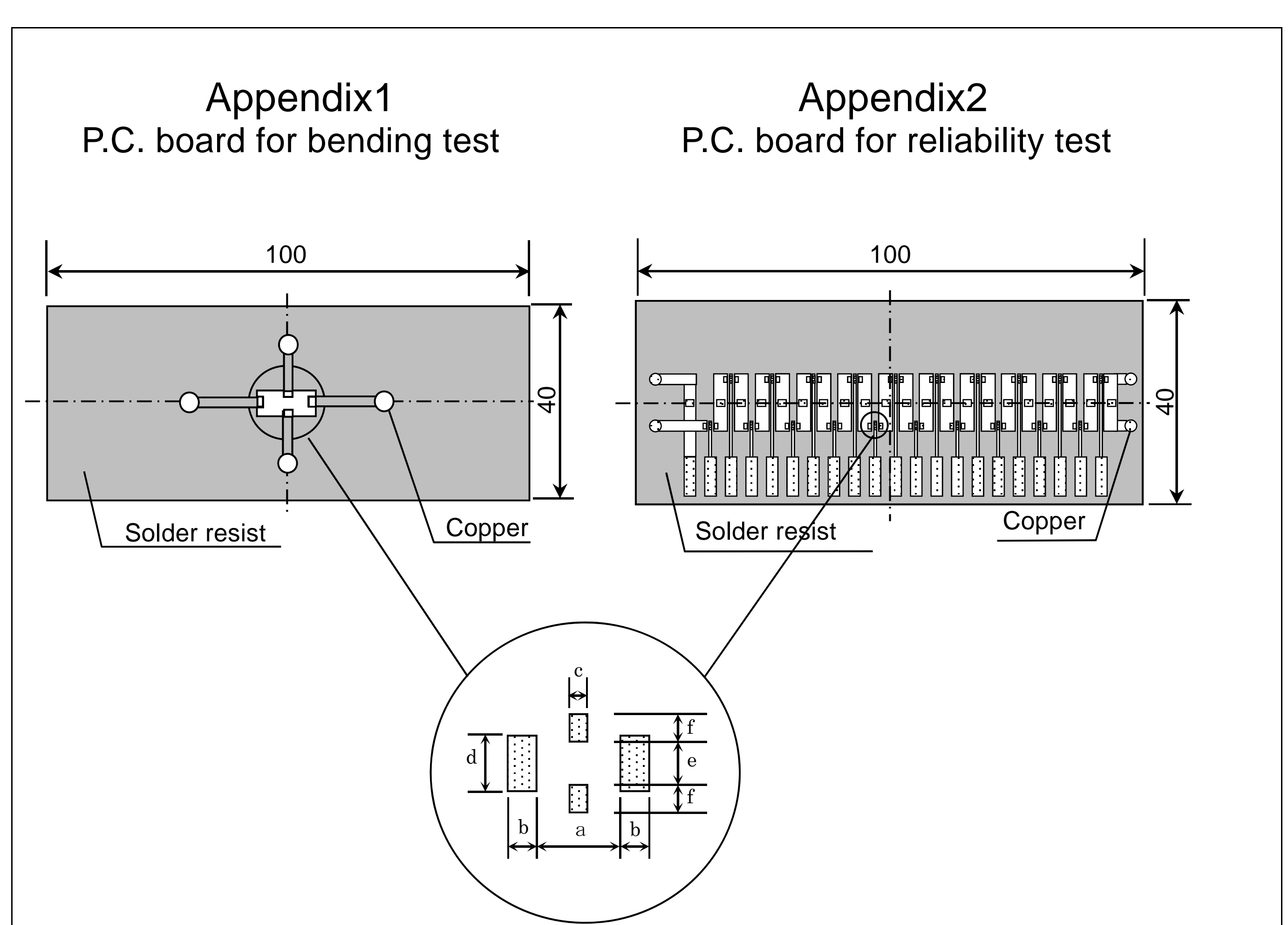
Leave the products in ambient condition for 24±2h before measurement.</td></tr>
<tr><td>Capacitance</td><td>Change from the value before test
±12.5 %</td></tr>
<tr><td>Resistance for DC (Rdc)</td><td>500mΩ max. except for following parts.

150mΩmax.:YFF21AC1E103M
100mΩmax.:YFF18AC1H103M
YFF18AC1E223M
YFF21AC1E223M~104M
50mΩmax. YFF18AC1C104M,474M
YFF31AH2A104M,105M</td></tr>
</table>

(continued)

No.	Item		Performance	Test or inspection method
11	Moisture Resistance	External appearance	No mechanical damage.	Reflow solder the products on a P.C. board shown in Appendix2 before testing. Apply the rated voltage at temperature 85°C and 85%RH for 1,000 +48,0h. Charge/discharge current shall not exceed 50mA. Leave the products in ambient condition for 24±2h before measurement. Voltage conditioning: Voltage treat the products under testing temperature and voltage for 1 hour. Leave the products in ambient condition for 24±2h before measurement. Use this measurement for initial value.
		Capacitance	Change from the value before test ± 12.5 %	
		Resistance for DC (Rdc)	500mΩ max. except for following parts. 150mΩmax.:YFF21AC1E103M 100mΩmax.:YFF18AC1H103M YFF18AC1E223M YFF21AC1E223M~104M 50mΩmax. YFF18AC1C104M,474M YFF31AH2A104M,105M	
12	Life	External Appearance	No mechanical damage.	Reflow solder the products on a P.C. board shown in Appendix2 before testing. Apply the following rated voltage at 125±2℃ for 1,000+48,0h. - Rated voltagex1: 1,000pF and over except for YFF31 - Rated voltagex2: Under 1,000pF, YFF31AH2A104M,105M Apply the rated current except for following parts. - DC 10A:YFF31AH2A104M - DC 6A: YFF31AH2A105M - DC 4A: YFF18AC1C104M - DC 2A: YFF21AC1E223M~104M YFF21AC1C474M - DC 1A: YFF18AC1H220M~103M YFF18AC1E223M YFF21AC1E103M - DC 0.4A: YFF21AC1H220M~472M Charge/discharge current shall not exceed 50mA. Voltage conditioning: Voltage treat the products under testing temperature and voltage for 1h. Leave the product in ambient condition for 24±2h before measurement. Use this measurement for initial value.
		Capacitance	Change from the value before test ± 15 %	
		Resistance for DC (Rdc)	500mΩ max. except for following parts. 150mΩmax.:YFF21AC1E103M 100mΩmax.:YFF18AC1H103M YFF18AC1E223M YFF21AC1E223M~104M 50mΩmax. YFF18AC1C104M,474M YFF31AH2A104M,105M	

*As for the initial measurement of products on number 5,7,8,9 and 10, leave products at 150 -10,0°C for 1 hour and measure the value after leaving products for 24±2h in ambient condition.



(Unit: mm)

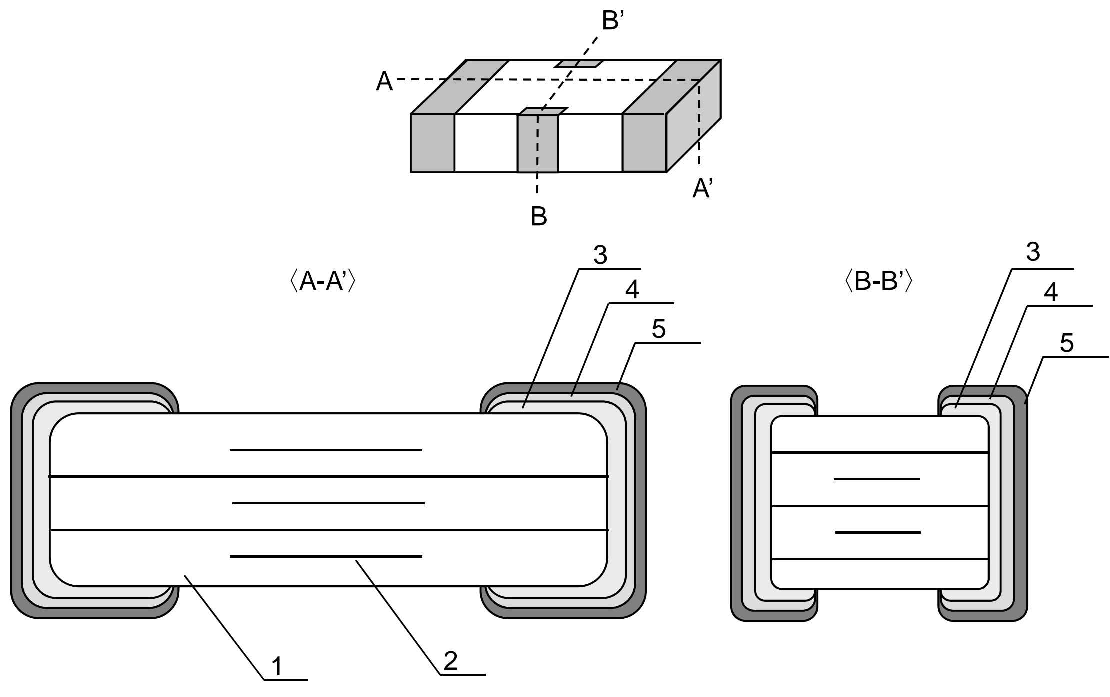
Type \ Symbol	a	b	c	d	e	f
YFF18	1	0.6	0.4	0.6	0.4	0.4
YFF21	1.4	0.6	0.5	0.8	0.6	0.65
YFF31	2.5	1.2	1.4	1.3	0.8	0.9

1. Material : Glass Epoxy (As per JIS C6484 GE4)
2. Thickness : 1.6mm

Copper (Thickness: Others 0.035mm)

Solder resist

8. INSIDE STRUCTURE AND MATERIAL



No.	NAME	MATERIAL
1	Dielectric	$CaZrO_3$ or $BaTiO_3$
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 TDK tape packaging specification.

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

*Composition of Inspection No.

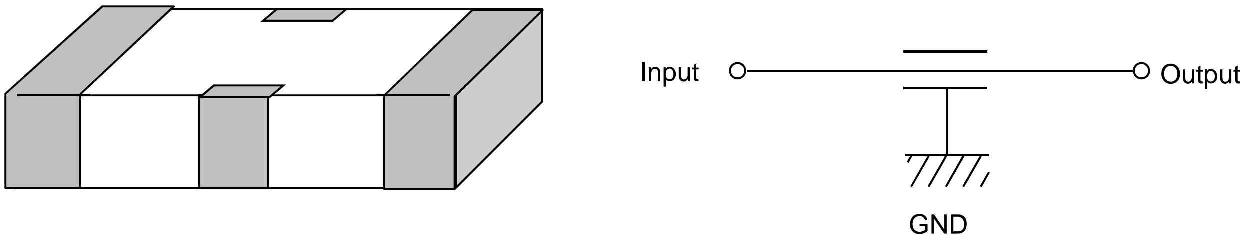
Example F 7 A – OO – OOO
(a) (b) (c) (d) (e)

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

10. SOLDERING CONDITION

Soldering is limited to Reflow soldering.

11. EQUIVALENT CIRCUIT DIAGRAM



12. Caution

No.	Process	Condition
1	Operating Condition (Storage, Transportation)	1-1. Storage 1) The product must be stored in an ambient temperature of 5 to 40℃ with a relative humidity of 20 to 70%RH. The products should be used within 6 months upon receipt. 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. 3) Avoid storing in sun light and falling of dew. 4) Do not use product under high humidity and high and low atmospheric pressure which may affect product reliability. 5) Product should be tested for the solderability when they are stored for long time. 1-2. Handling in transportation 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)
2	Circuit design ⚠Caution	2-1. Operating temperature Operating temperature should be followed strictly within this specification, especially be careful with maximum temperature. 1) Do not use product above the maximum allowable operating temperature. 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℃) 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.

<table>
<tr><th>No</th><th>Process</th><th>Condition</th></tr>
<tr><td>2</td><td>Circuit design
⚠Caution</td><td>
2-2. Operating voltage
1) Operating voltage across the terminals should be below the rated voltage.
When AC and DC are super imposed, V_{0-P} must be below the rated voltage.
—— (1) and (2)
AC or pulse with overshooting, V_{P-P} must be below the rated voltage.
—— (3), (4) and (5)
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.
<table>
<tr><th>Voltage</th><th>(1) DC voltage</th><th>(2) DC+AC voltage</th><th>(3) AC voltage</th></tr>
<tr><td>Positional Measurement (Rated voltage)</td><td>V_{0-P}
0</td><td>V_{0-P}
0</td><td>V_{P-P}
0</td></tr>
</table>
<table>
<tr><th>Voltage</th><th>(4) Pulse voltage (A)</th><th>(5) Pulse voltage (B)</th></tr>
<tr><td>Positional Measurement (Rated voltage)</td><td>V_{P-P}
0</td><td>V_{P-P}</td></tr>
</table>
2) Even below the rated voltage, if repetitive high frequency AC or pulse is applied, the reliability of the products may be reduced.

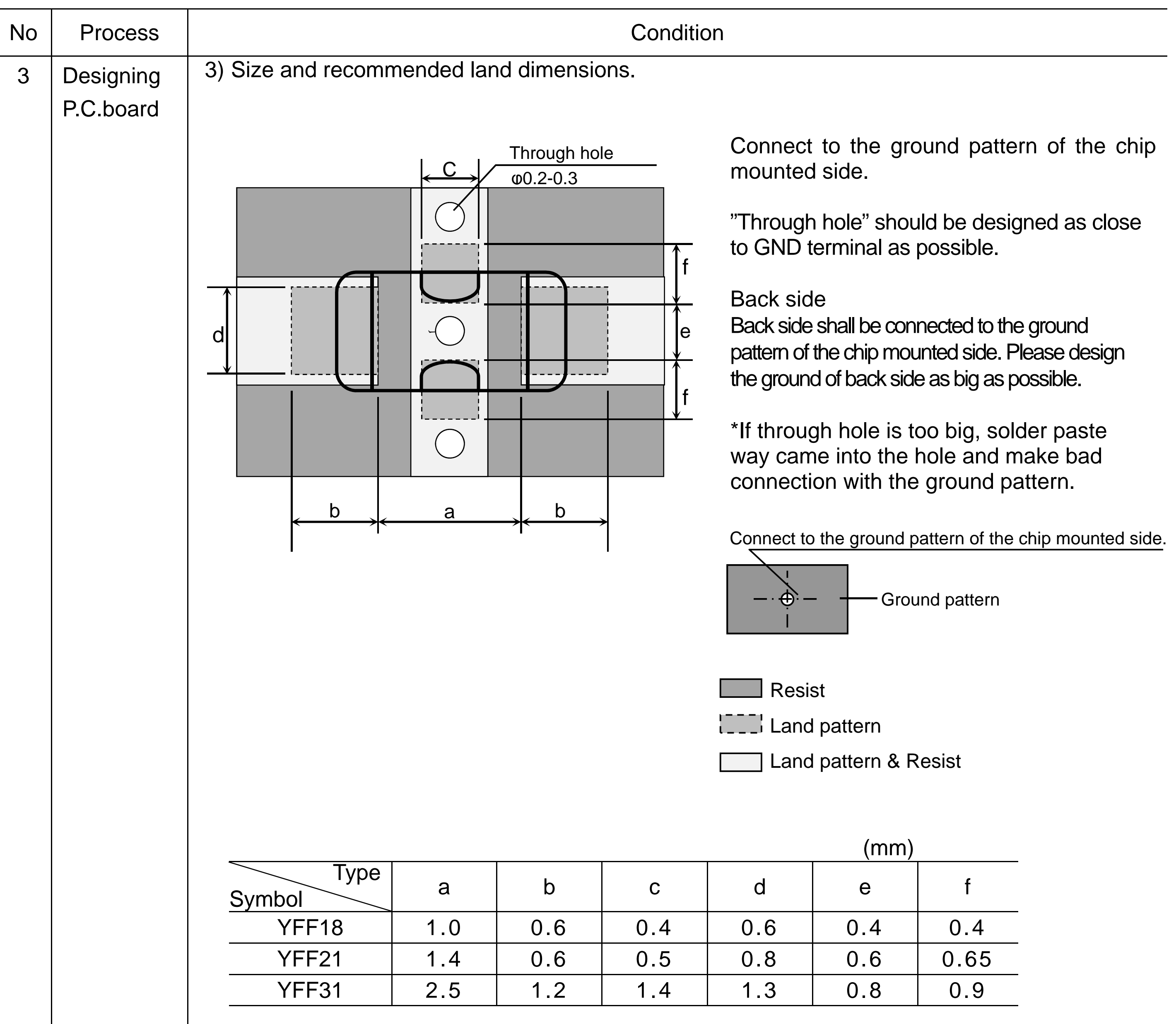
3) The effective capacitance will vary depending on applied DC and AC voltages.
The products should be selected and designed in taking the voltages into consideration.

2-3. Frequency
When the products are used in AC and/or pulse voltages, the products may vibrate themselves and generate audible sound.
</td></tr>
<tr><td>3</td><td>Designing
P.C. board</td><td>
The amount of solder at the terminations has a direct effect on the reliability of the products.

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.

2) Avoid using common solder land for multiple terminations and provide individual solder land for each terminations.
</td></tr>
</table>

No	Process	Condition
3	Designing P.C.board	3) Size and recommended land dimensions.

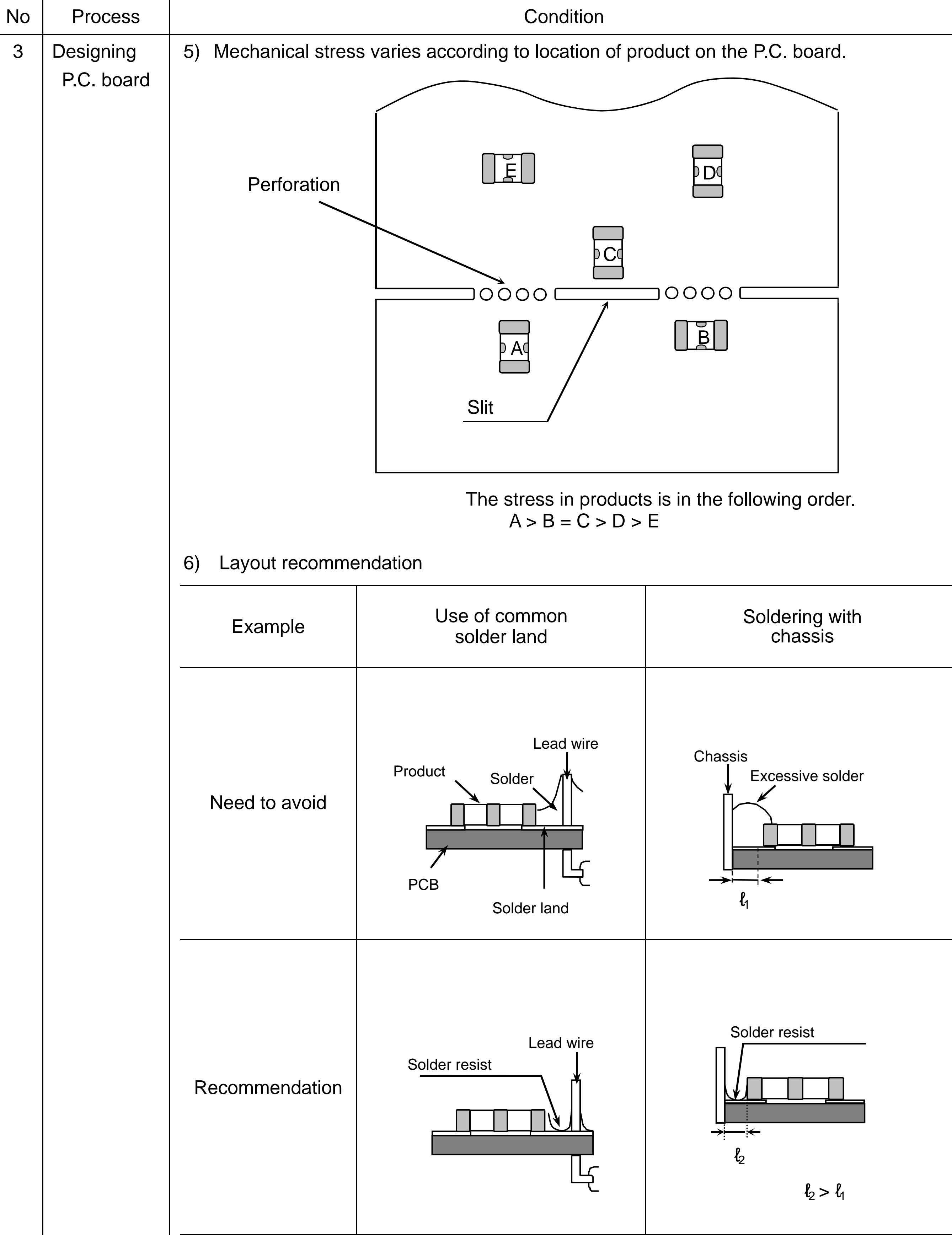


(mm)

Type / Symbol	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

No	Process	Condition
3	Designing P.C. board	4) Recommended product layout is as following.

	Disadvantage against bending stress	Advantage against bending stress
Mounting face	Perforation or slit Break P.C. board with mounted side up.	Perforation or slit Break P.C. board with mounted side down.
Chip arrangement (Direction)	Mount perpendicularly to perforation or slit Perforation or slit	Mount in parallel with perforation or slit Perforation or slit
Distance from slit	Closer to slit is higher stress ℓ_1 $(\ell_1 < \ell_2)$	Away from slit is less stress ℓ_2 $(\ell_1 < \ell_2)$



No	Process	Condition
3	Designing P.C. board	5) Mechanical stress varies according to location of product on the P.C. board. The stress in products 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	Lead wire, Product, Solder, PCB, Solder land	Chassis, Excessive solder, ℓ_1
Recommendation	Lead wire, Solder resist	Solder resist, ℓ_2, $\ell_2 > \ell_1$

<table>
<tr><th>No</th><th>Process</th><th>Condition</th></tr>
<tr><td>4</td><td>Mounting</td><td>
4-1. Stress from mounting head
If the mounting head is adjusted too low, it may induce excessive stress in the product to result in cracking. Please take following precautions.

1) Adjust the bottom dead center of the mounting head to reach on the P.C. board surface and not press it.

2) Adjust the mounting head pressure to be 1 to 3N of static weight.

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.
<table>
<tr><th></th><th>Not recommended</th><th>Recommended</th></tr>
<tr><td>Single sided mounting</td><td>Crack</td><td>Support pin</td></tr>
<tr><td>Double-sides mounting</td><td>Solder peeling
Crack</td><td>Support pin</td></tr>
</table>
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.
</td></tr>
</table>

No.	Process	Condition
5	Soldering	5-1. Flux selection

5-1. Flux selection

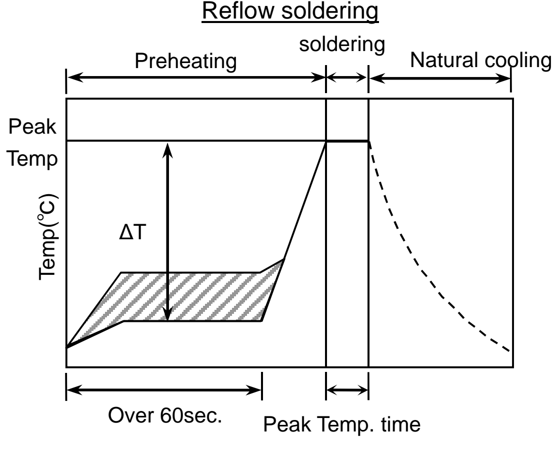
Although highly-activated flux gives better solderability, substances which increase activity may also have a serious effect on the product.
To avoid such degradation, it is recommended following.

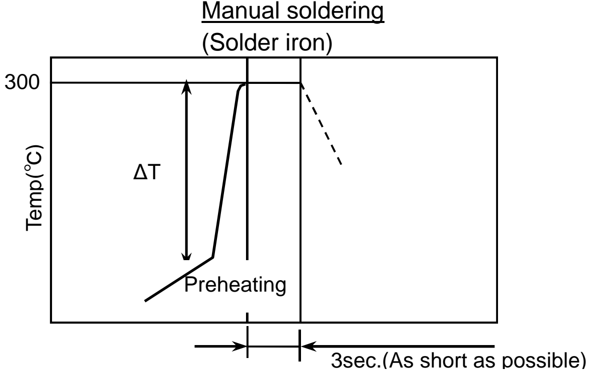
1) It is recommended to use a mildly activated rosin flux (less than 0.1wt% chlorine). Strong flux is not recommended.

2) Excessive flux must be avoided. Please provide proper amount of flux.

3) When water-soluble flux is used, enough washing is necessary.

5-2. Recommended soldering profile by various methods





5-3. Recommended soldering peak temp and peak temp duration

Solder \ Temp./Duration	Reflow soldering	
	Peak temp(℃)	Duration(sec.)
Sn-Pb Solder	230 max.	20 max.
Lead Free Solder	260 max.	10 max.

Recommended solder compositions
Sn-37Pb (Sn-Pb solder)
Sn-3.0Ag-0.5Cu (Lead Free Solder)

No.	Process	Condition
5	Soldering	5-4. Avoiding thermal shock

1) Preheating condition

Soldering	Temp. (℃)
Reflow soldering	ΔT ≦ 150
Manual soldering	ΔT ≦ 150

2) Cooling condition

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

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.

Excessive solder		Higher tensile force in product to cause crack
Adequate	Maximum amount Minimum amount	
Insufficient solder		Low robustness may cause contact failure or product come off the P.C. board.

5-6. Solder repair by solder iron

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. (Please preheat the product with the condition in 5-4 to avoid the thermal shock.)

Recommended solder iron condition (Sn-Pb Solder and Lead Free Solder)

Temp. (℃)	Duration (sec.)	Wattage (W)	Shape (mm)
300 max.	3 max.	20 max.	Ø 3.0 max.

2) Direct contact of the soldering iron with ceramic dielectric of product may cause crack. Do not touch the ceramic dielectric and the terminations by solder iron.

No.	Process	Condition
5	Soldering	5-7. Sn-Zn solder Sn-Zn solder affects product reliability. Please contact TDK in advance when utilize Sn-Zn solder. 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)
6	Cleaning	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. 2) If cleaning condition is not suitable, it may damage the product. 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). 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/ℓmax. Frequency : 40 kHz max. Washing time : 5 minutes max. 2)-3. If the cleaning fluid is contaminated, density of Halogen increases, and it may bring the same result as insufficient cleaning.
7	Coating and molding of the P.C. board	1) When the P.C. board is coated, please verify the quality influence on the product. 2) Please verify carefully that there is no harmful decomposing or reaction gas emission during curing which may damage the product. 3) Please verify the curing temperature.

No.	Process	Condition
8	Handling after product mounted ⚠Caution	1) Please pay attention not to bend or distort the P.C. board after soldering in handling otherwise the product may crack. Bend Twist 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. (1)Example of a board cropping jig 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 capacitor is compressive. 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 capacitor, which may cause cracks. Outline of jig: Printed Circuit board, V-groove, Board Cropping jig, Slot Recommended: Printed Circuit board, Component, Direction of load, Load point, V-groove, Slot Unrecommended: Load point, Direction of load, Printed Circuit board, V-groove, Slot

No.	Process	Condition
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.

<u>Unrecommended example</u>: Misalignment of blade position between top and bottom, right and left, or front and rear blades may cause a crack in the product.

Outline of machine

Top blade

Printed circuit board

Principle of operation

Top blade

Printed circuit board

V-groove

Bottom blade

Cross-section diagram

Printed circuit board

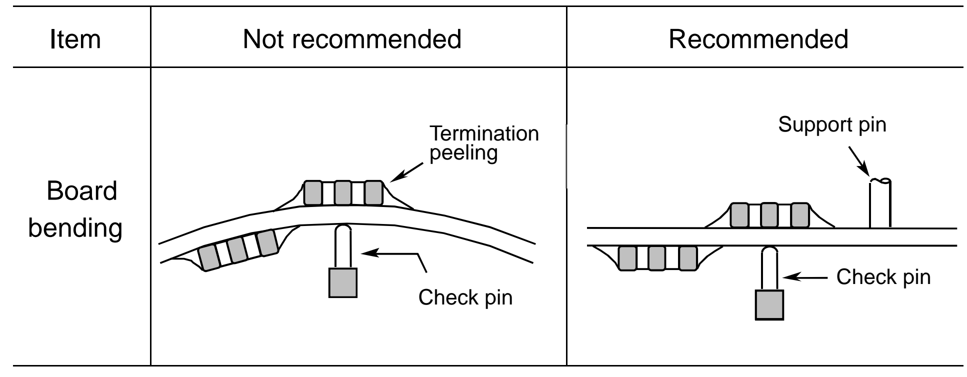
Top blade

V-groove

Bottom blade

Recommended	Unrecommended		
	Top-bottom misalignment	Left-right misalignment	Front-rear misalignment
Top blade Board Bottom blade	Top blade Bottom blade	Top blade Bottom blade	Top blade Bottom blade

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	Termination peeling Check pin	Support pin Check pin

No.	Process	Condition
9	Handling of loose product	1) If dropped the product may crack. Once dropped do not use it. Especially, the large case sized products are tendency to have cracks easily, so please handle with care. Crack Floor 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.C.board Crack
10	Capacitance aging	The products have aging in the capacitance. They may not be used in precision time constant circuit. In case of the time constant circuit, the evaluation should be done well.
11	Estimated life and estimated failure rate of product	As per the estimated life and the estimated failure rate depend on the temperature and the voltage. This can be calculated by the equation described in JEITA RCR-2335C Annex F (Informative) Calculation of the estimated lifetime and the estimated failure rate (Voltage acceleration coefficient : 3 multiplication rule, Temperature acceleration coefficient : 10°C rule) The failure rate can be decreased by reducing the temperature and the voltage but they will not be guaranteed.

No.	Process	Condition
12	Caution during operation of equipment	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. 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 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. (1) Environment where a product is spattered with water or oil (2) Environment where a product is exposed to direct sunlight (3) Environment where a product is exposed to Ozone, ultraviolet rays or radiation (4) Environment where a product exposed to corrosive gas (e.g. hydrogen sulfide, sulfur dioxide, chlorine, ammonia gas etc.) (5) Environment where a product exposed to vibration or mechanical shock exceeding the specified limits. (6) Atmosphere change with causes condensation
13	Others ⚠Caution	The products listed on this specification sheet are intended for use in general electronic equipment (AV equipment, telecommunications equipment, home appliances, amusement equipment, computer equipment, personal equipment, office equipment, measurement equipment, industrial robots) under a normal operation and use condition. The products are not designed or warranted to meet the requirements of the applications listed below, whose performance and/or quality require a more stringent level of safety or reliability, or whose failure, malfunction or trouble 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. (1) Aerospace/Aviation equipment (2) Transportation equipment (Electric trains, Ships, etc. except for Automotive applications) (3) Medical equipment (Excepting Pharmaceutical Affairs Law classification Class1, 2) (4) Power-generation control equipment (5) Atomic energy-related equipment (6) Seabed equipment (7) Transportation control equipment (8) Public information-processing equipment (9) Military equipment (10) Electric heating apparatus, burning equipment (11) Disaster prevention/crime prevention equipment (12) Safety equipment (13) Other applications that are not considered general-purpose applications 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.

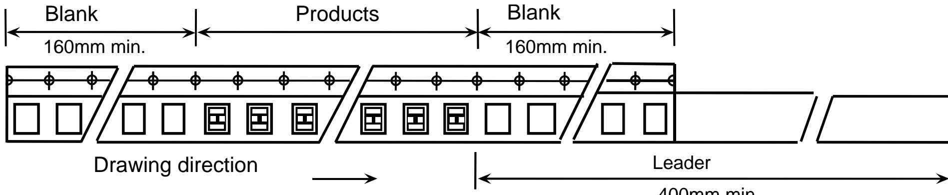
13. TAPE PACKAGING SPECIFICATION

1. CONSTRUCTION AND DIMENSION OF TAPING

1-1. Dimensions of carrier tape

Dimensions of paper tape shall be according to Appendix 2.
Dimensions of plastic tape shall be according to Appendix 3.

1-2. Bulk part and leader of taping

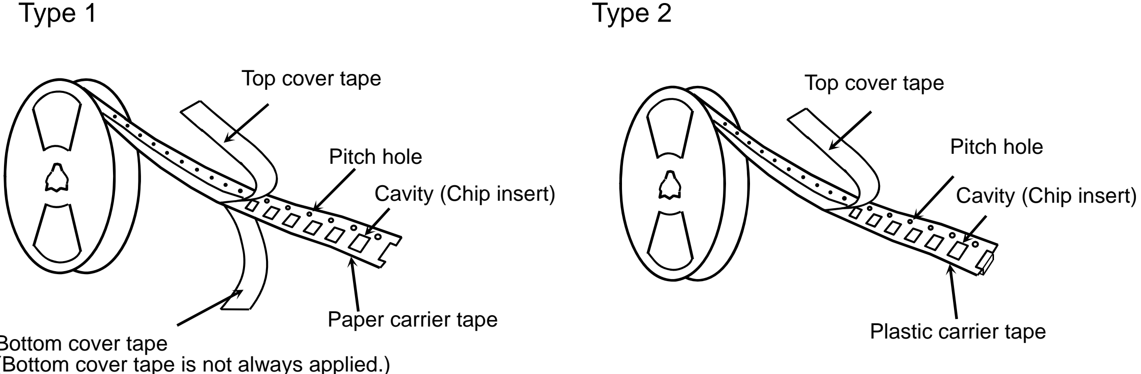


1-3. Dimensions of reel

Dimensions of ϕ178 reel shall be according to Appendix 4.

Dimensions of ϕ330 reel shall be according to Appendix 5.

1-4. Structure of taping



2. PRODUCT QUANTITY

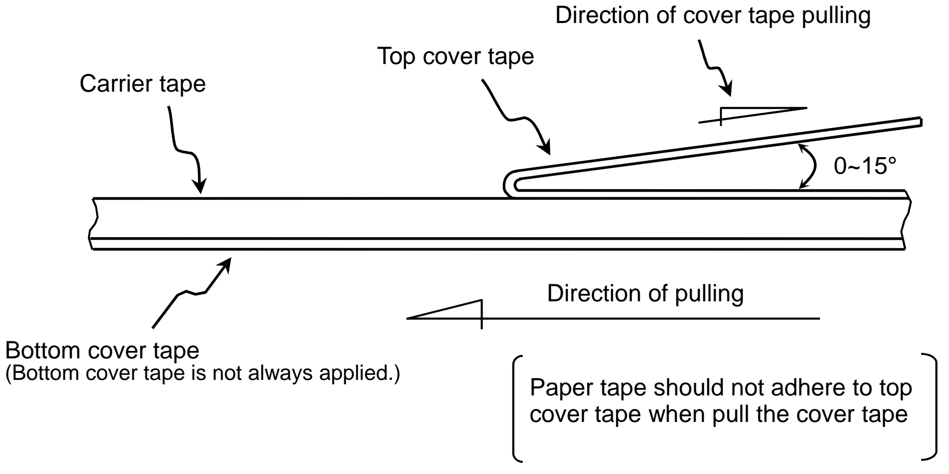
As for product quantity and taping material of each product, please refer to detailed information on TDK web.

3. PERFORMANCE SPECIFICATIONS

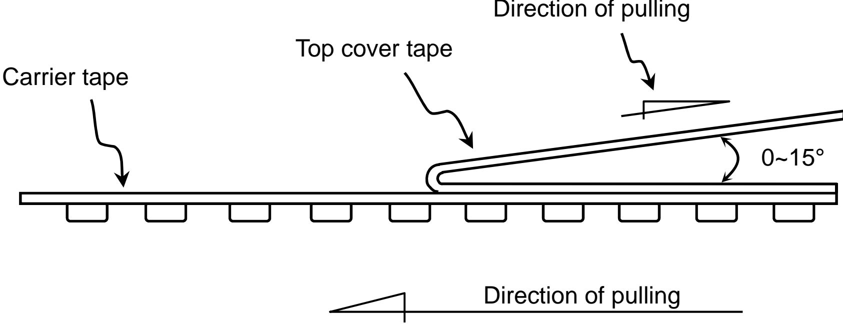
3-1. Fixing peeling strength (top tape)

0.05-0.7N. (See the following figure.)

TYPE 1 (Paper)



TYPE 2 (Plastic)



3-2. Carrier tape shall be flexible enough to be wound around a minimum radius of 30mm with components in tape.

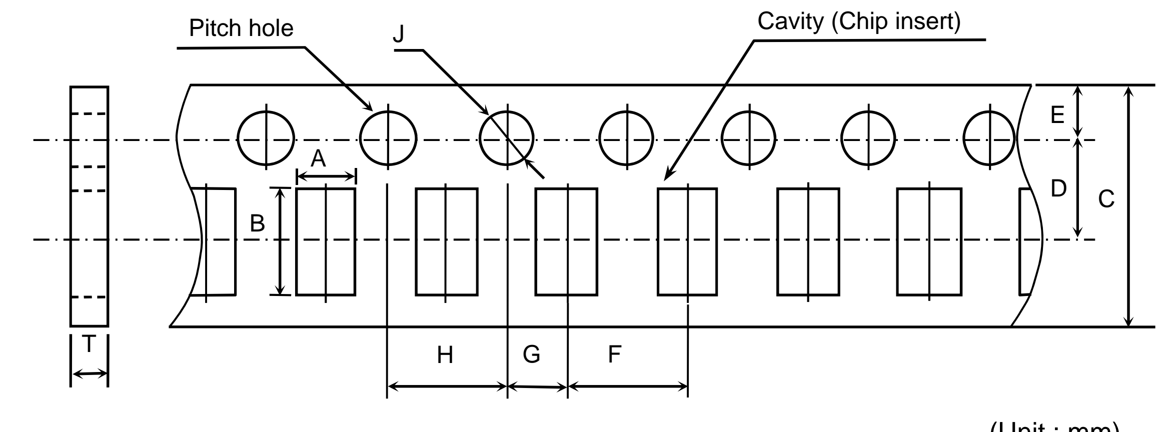
3-3. The missing of components shall be less than 0.1%

3-4. Components shall not stick to fixing tape.

3-5. The fixing tapes shall not protrude beyond the edges of the carrier tape nor shall cover the sprocket holes.

Appendix 2

Paper Tape



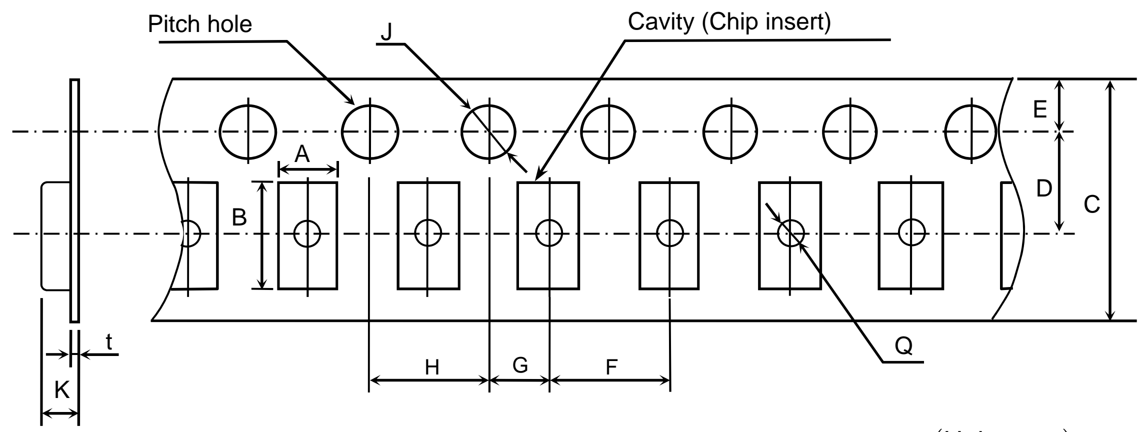
(Unit : mm)

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

Type \ Symbol	G	H	J	T
YFF18	2.00±0.05	4.00±0.10	Ø 1.5 $^{+0.10}_{0}$	1.2 max.
YFF21				

Appendix 3

Plastic Tape



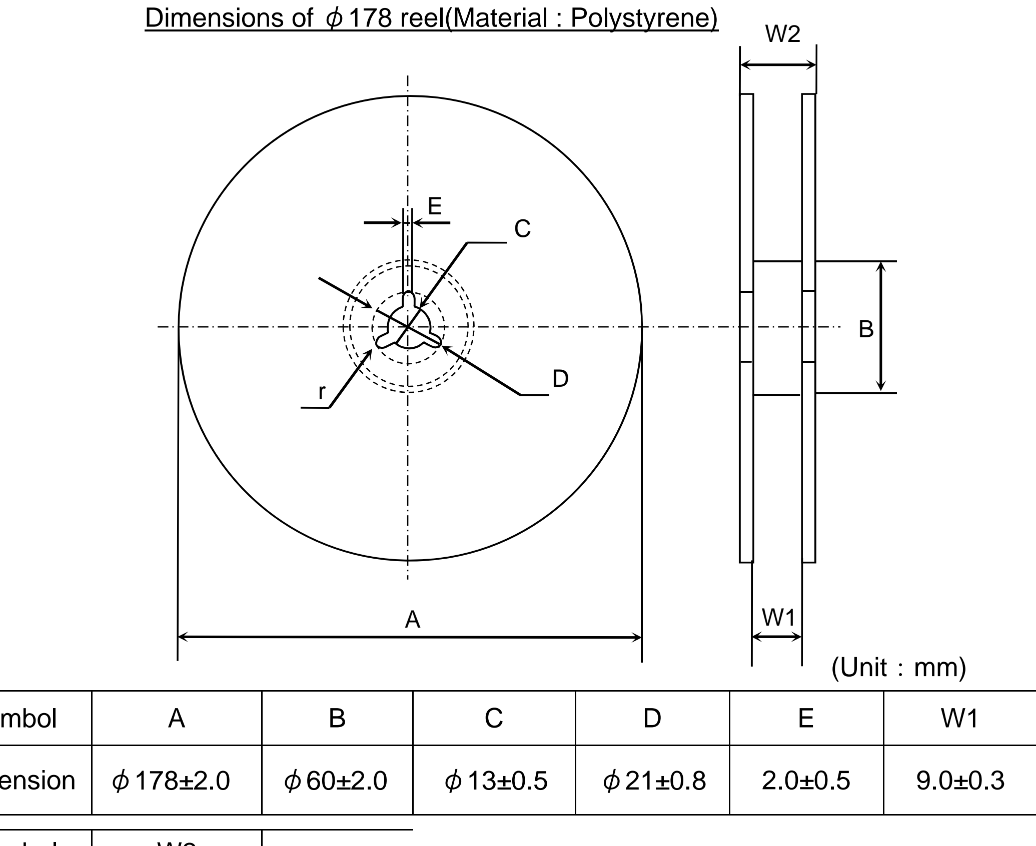
(Unit : mm)

Type \ Symbol	A	B	C	D	E	F
YFF31	1.90 typ.	3.50 typ.	8.00±0.30	3.50±0.05	1.75±0.10	4.00±0.10

Type \ Symbol	G	H	J	K	t	Q
YFF31	2.00±0.05	4.00±0.10	ϕ1.5 Top	2.5 max.	0.3 max.	ϕ0.5 min.

Appendix 4

Dimensions of ϕ178 reel(Material : Polystyrene)



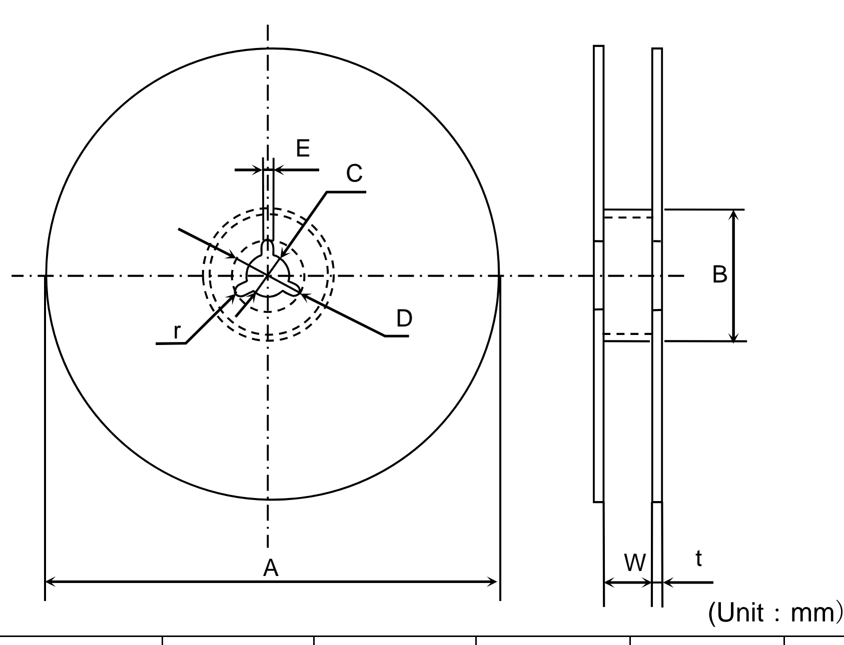
(Unit : mm)

Symbol	A	B	C	D	E	W1
Dimension	ϕ178±2.0	ϕ60±2.0	ϕ13±0.5	ϕ21±0.8	2.0±0.5	9.0±0.3

Symbol	W2	r
Dimension	13.0±1.4	1.0

Appendix 5

Dimensions of ϕ330 reel(Material : Polystyrene)



(Unit : mm)

Symbol	A	B	C	D	E	W
Dimension	ϕ382 max. (Nominal ϕ330)	ϕ50 min.	ϕ13±0.5	ϕ21±0.8	2.0±0.5	10.0±1.5

Symbol	t	r
Dimension	2.0±0.5	1.0