

SPECIFICATION

Metal Core SMD POWER INDUCTORS

(MCOIL™, MD Series)

MDMK2020 TYPE

(2 / 1 2)	Table 1	
	ELECTRICAL CHARACTERISTICS	

Ordering Code	Nominal Inductance [μH]	Inductance Tolerance [%]	D.C. Resistance [mΩ]		Rated Current [mA]			
			Typ	Max	Saturation Current Idc1(Typ)	Temperature Rise Current Idc2(Typ)	Saturation Current Idc1(max)	Temperature Rise Current Idc2(max)
MDMK2020TR47MM	0.47	±20	40	46	4800	2450	4200	2300
MDMK2020T1R0MM	1.0	±20	56	64	2900	2050	2550	1900
MDMK2020T1R5MM	1.5	±20	75	86	2300	1750	2000	1650
MDMK2020T2R2MM	2.2	±20	95	109	2000	1550	1750	1450
MDMK2020T3R3MM	3.3	±20	155	178	1550	1200	1350	1150
MDMK2020T4R7MM	4.7	±20	210	242	1300	1050	1150	950

Absolute maximum voltage: DC25V

- *) The saturation current value (Idc1) is the DC current value having inductance decrease down to 30%. (at 20 deg C)
- *) The temperature rise current value (Idc2) is the DC current value having temperature increase up to 40 deg C. (at 20 deg C)
- *) The rated current is the DC current value that satisfies both of current saturation current value and temperature rise current value.

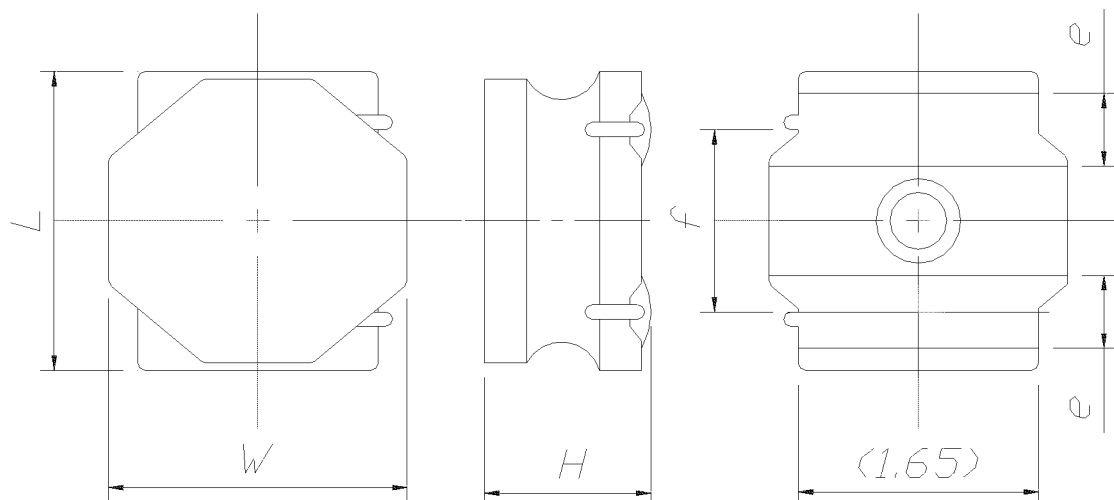
※ Caution for Temperature Rise.

Temperature rise of this inductor depends on the installed board condition.

It shall be confirmed in the actual end product that temperature rise of inductor is within operating temperature.

Table 2	
(3 / 1 2)	EXTERNAL DIMENSIONS AND STRUCTURAL DRAWING

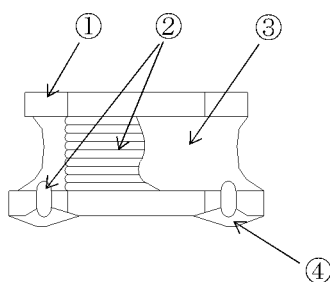
1. External dimensions



Description	Mark	Dimensions
Length	L	2.0 ± 0.15
Width	W	2.0 ± 0.15
Height	H	1.2Max.
Width of Electrode	e	0.50 ± 0.2
Space between electrodes	f	1.25 ± 0.2

(Unit: mm)

2. Structural drawing

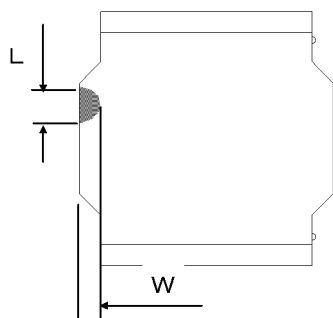


① Core	Metal magnetic core	
② Winding wire	Polyurethane-copper wire	
③ Over-coating resin	Epoxy resin, containing Metal magnetic powder	
④ Electrode	External electrode (substrate)	Ag
	External electrode (top surface solder coating)	Sn-Ag-Cu

(4 / 1 2)	Table 2	
	EXTERNAL DIMENSIONS AND STRUCTURAL DRAWING	

3. Core chipping

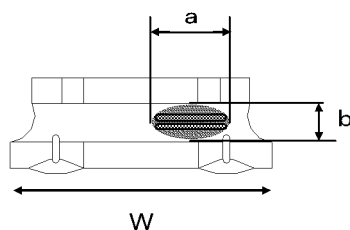
The appearance standard of the chipping size in top side, of bottom side metal magnetic core is following dimension.



L	W
0.4mmMax.	0.4mmMax.

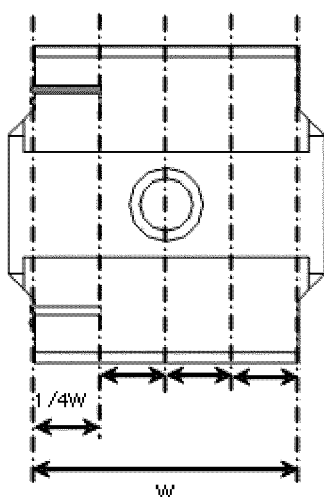
4. Exposed wire tolerance limit of coating resin part on product side





Size of exposed wire occurring to coating resin is specified below.



- ① Width direction (dimension a) : Acceptable when $a \leq w/2$
Nonconforming when $a > w/2$
- ② Length direction (dimension b) : Dimension b is not specified.
- ③ When total area of exposed wire occurring to each sides is not greater than 50% of coating resin area, that is acceptable.

5. Electrode appearance criterion for exposed wire



Cross section of joint part	Appearance judgment
 Only top side of wire is exposed. (regardless of whole top side of wire exposed)	 Good
 Wire is soldered insufficiently and less than half of outer diameter is covered with solder.	 Less than one-quarter of width of insufficiently soldered portion shall be acceptable. (More than one-quarter shall be segregated as reject.)

(6 / 1 2)	Table 3
	MECHANICAL PERFORMANCE / ENVIRONMENTAL TEST PERFORMANCE SPECIFICATIONS

ENVIRONMENT TESTS	Test Item	Standard	Test method														
	Resistance to vibration	$\Delta L/L$: within $\pm 10\%$ No abnormality observed in appearance.	The test samples shall be soldered to the test board by the reflow soldering conditions shown in Table 6. Then it shall be submitted to below test conditions. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Frequency range</td> <td>10Hz ~55 Hz</td> </tr> <tr> <td>Total Amplitude</td> <td>1.5 mm (May not exceed acceleration 196 m/S²)</td> </tr> <tr> <td>Sweeping Method</td> <td>10Hz to 55Hz to 10 Hz for 1 min.</td> </tr> <tr> <td>Time</td> <td>For 2 hours on each X, Y, and Z axis.</td> </tr> </table>	Frequency range	10Hz ~55 Hz	Total Amplitude	1.5 mm (May not exceed acceleration 196 m/S ²)	Sweeping Method	10Hz to 55Hz to 10 Hz for 1 min.	Time	For 2 hours on each X, Y, and Z axis.						
	Frequency range	10Hz ~55 Hz															
	Total Amplitude	1.5 mm (May not exceed acceleration 196 m/S ²)															
	Sweeping Method	10Hz to 55Hz to 10 Hz for 1 min.															
	Time	For 2 hours on each X, Y, and Z axis.															
Resistance to soldering heat (Reflow)	$\Delta L/L$: within $\pm 10\%$ No abnormality observed in appearance.	The test sample shall be exposed to reflow oven at 230 ± 5 deg C for 40 seconds, with peak temperature at 260 ± 5 deg C for 5 seconds, 2 times. Test board thickness: 1.0 mm Test board material: glass epoxy-resin															
Solderability	At least 90 % of surface of terminal electrode is covered by new solder.	The test samples shall be dipped in flux, and then immersed in molten solder as shown in below table. Flux: Methanol solution containing rosin 25 %. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Solder Temperature</td> <td>245 ± 5 deg C</td> </tr> <tr> <td>Time</td> <td>5 ± 1.0 s.</td> </tr> <tr> <td>Immersing Speed</td> <td>25 mm/s</td> </tr> </table>	Solder Temperature	245 ± 5 deg C	Time	5 ± 1.0 s.	Immersing Speed	25 mm/s									
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Immersing Speed	25 mm/s																
Temperature characteristics	$\Delta L/L$: within $\pm 10\%$ No abnormality observed in appearance.	Measurement of inductance shall be taken at temperature range within -40 deg C to $+125$ deg C. With reference to inductance value at $+20$ deg C, change rate shall be calculated.															
Thermal shock	$\Delta L/L$: within $\pm 10\%$ No abnormality observed in appearance.	The test samples shall be soldered to the test board by the reflow soldering conditions shown in Table 6. The test samples shall be placed at specified temperature for specified time by step 1 to step 4 as shown in below table in sequence. The temperature cycle shall be repeated 100 cycles. Conditions of steps for 1 cycle <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>Temperature</th> <th>Time (min)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-40 ± 3 deg C</td> <td>30 ± 3</td> </tr> <tr> <td>2</td> <td>Room Temp.</td> <td>3 maximum</td> </tr> <tr> <td>3</td> <td>85 ± 2 deg C</td> <td>30 ± 3</td> </tr> <tr> <td>4</td> <td>Room Temp</td> <td>3 maximum</td> </tr> </tbody> </table>	Step	Temperature	Time (min)	1	-40 ± 3 deg C	30 ± 3	2	Room Temp.	3 maximum	3	85 ± 2 deg C	30 ± 3	4	Room Temp	3 maximum
Step	Temperature	Time (min)															
1	-40 ± 3 deg C	30 ± 3															
2	Room Temp.	3 maximum															
3	85 ± 2 deg C	30 ± 3															
4	Room Temp	3 maximum															
Low temperature life test	$\Delta L/L$: within $\pm 10\%$ No abnormality observed in appearance.	The test samples shall be soldered to the test board by the reflow soldering conditions shown in Table 6. After that, the test samples shall be placed at test conditions as shown in below table. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Temperature</td> <td>-40 ± 2 deg C</td> </tr> <tr> <td>Time</td> <td>500 +24/-0 h</td> </tr> </table>	Temperature	-40 ± 2 deg C	Time	500 +24/-0 h											
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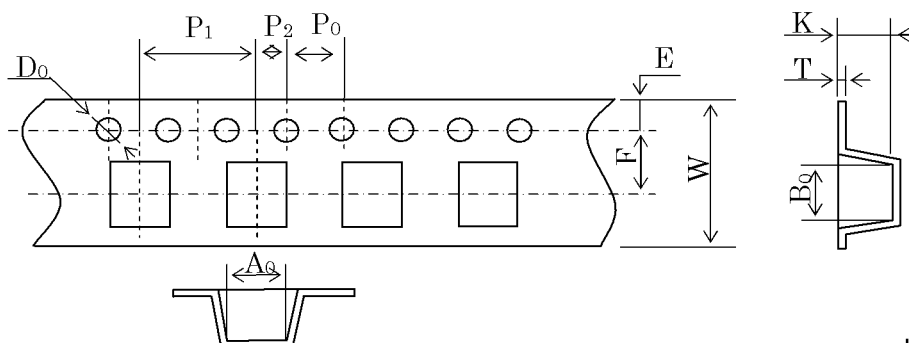
(7 / 1 2)	Table 3
	MECHANICAL PERFORMANCE / ENVIRONMENTAL TEST PERFORMANCE SPECIFICATIONS

	Test Item	Standard	Test method							
ENVIRONMENT TESTS	Loading at high temperature life test	$\Delta L/L$: within ± 10 % No abnormality observed in appearance.	<p>The test samples shall be soldered to the test board by the reflow soldering conditions shown in Table 6. The test samples shall be placed in thermostatic oven set at specified temperature and applied the rated current continuously as shown in below table.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Temperature</td> <td>85\pm2 deg C</td> </tr> <tr> <td>Applied current</td> <td>Rated current (Refer to Table 1)</td> </tr> <tr> <td>Time</td> <td>500 +24/-0 h</td> </tr> </table>	Temperature	85 \pm 2 deg C	Applied current	Rated current (Refer to Table 1)	Time	500 +24/-0 h	
	Temperature	85 \pm 2 deg C								
	Applied current	Rated current (Refer to Table 1)								
Time	500 +24/-0 h									
Damp heat life test	$\Delta L/L$: within ± 10 % No abnormality observed in appearance.	<p>The test samples shall be soldered to the test board by the reflow soldering conditions shown in Table 6. The test samples shall be placed in thermostatic oven set at specified temperature and humidity as shown in below table.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Temperature</td> <td>60\pm2 deg C</td> </tr> <tr> <td>Humidity</td> <td>90~95 %RH</td> </tr> <tr> <td>Time</td> <td>500 +24/-0 h</td> </tr> </table>	Temperature	60 \pm 2 deg C	Humidity	90~95 %RH	Time	500 +24/-0 h		
Temperature	60 \pm 2 deg C									
Humidity	90~95 %RH									
Time	500 +24/-0 h									
Loading under damp heat life test	$\Delta L/L$: within ± 10 % No abnormality observed in appearance.	<p>The test samples shall be soldered to the test board by the reflow soldering conditions shown in Table 6. The test samples shall be placed in thermostatic oven set at specified temperature and humidity and applied the rated current continuously as shown in below table.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Temperature</td> <td>60\pm2 deg C</td> </tr> <tr> <td>Humidity</td> <td>90~95 %RH</td> </tr> <tr> <td>Applied current</td> <td>Rated current (Refer to Table 1)</td> </tr> <tr> <td>Time</td> <td>500 +24/-0 h</td> </tr> </table>	Temperature	60 \pm 2 deg C	Humidity	90~95 %RH	Applied current	Rated current (Refer to Table 1)	Time	500 +24/-0 h
Temperature	60 \pm 2 deg C									
Humidity	90~95 %RH									
Applied current	Rated current (Refer to Table 1)									
Time	500 +24/-0 h									

Standard measuring condition	Unless otherwise specified, the test samples are placed at room temperature and humidity and measured within 48 hours after exposure to test conditions.
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(8/12)	Table 4	
	TAPE & REEL PACKAGING DIMENSIONS	

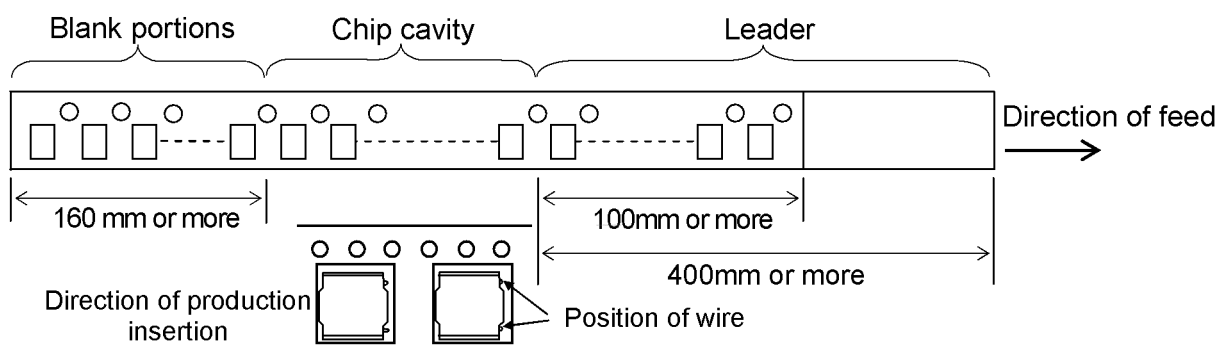
1. Dimensions



Unit: mm

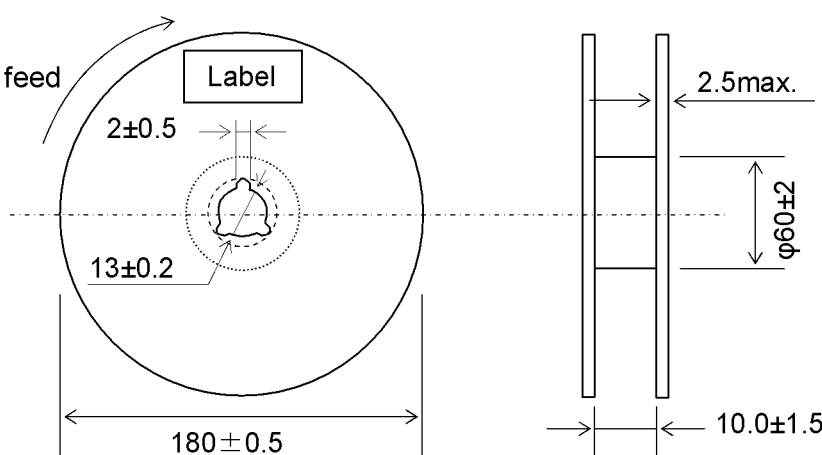
A ₀	B ₀	W	F	E	P ₁	P ₂	P ₀	D ₀	T	K
2.2 ±0.1	2.2 ±0.1	8.0 ±0.2	3.5 ±0.1	1.75 ±0.1	4.0 ±0.1	2.0 ±0.05	4.0 ±0.1	φ 1.5 +0.1 -0	0.25 ±0.05	1.3 ±0.05

2. Direction of rolling



3. Reel

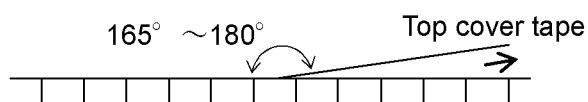
Direction of feed



Unit: mm

Label position: On the opposite side of sprocket holes side of reel

4. Top tape strength



Peel-off strength : 0.1 N ~ 1.3 N
 Peel-off angle : 165° ~ 180°
 Peel-off speed : 300 mm/min

(9 / 1 2)	Table 5	
	PACKING FORM	

1. The number of components

A tape & reel package contains 2500 inductors.

2. Tape and Reel

Emboss carrier tape: 8mm-width and 4 mm-pitch

Reel: 180 mm-diameter

3. The allowable number of empty chip cavities

Maximum two (2) chip cavities missing product may exist in a reel but they may not be consecutive two cavities.

4. Marking

The following items shall be marked legibly on per tape & reel package.

- (1) Customer part No.
- (2) Our part No.
- (3) Supplier name (TAIYO YUDEN CO., LTD.)
- (4) Control No.
- (5) Date (stamp)
- (6) Quantity
- (7) Country of the origin

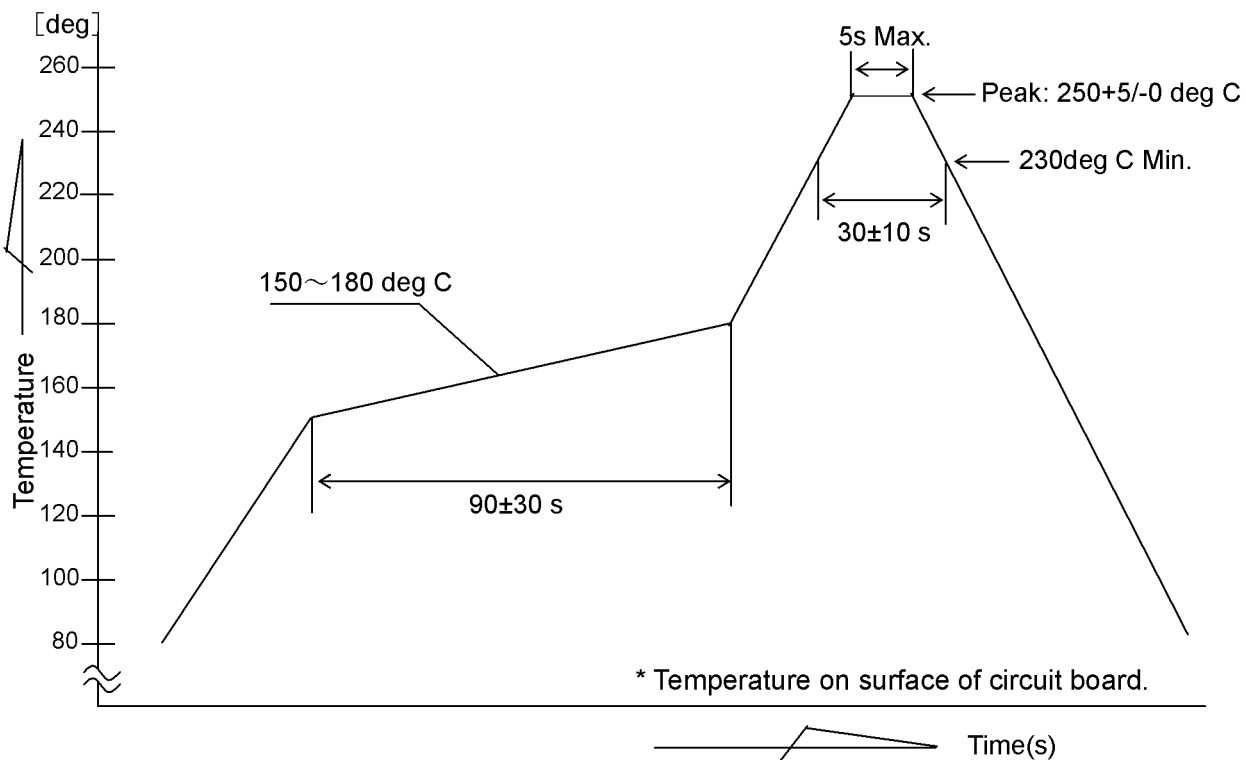
5. Dimensions of packing box (for Tape & Reel package)

Length	135 mm
Width	185 mm
Height	185 mm

Standard Quantity: 25000 pcs.

A packing box contains 10 reels maximum.

(10 / 12)	Table 6
	REFLOW PROFILE CHART (REFERENCE)

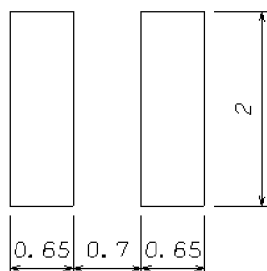


The products may be exposed to reflow soldering process of above profile up to two times.

(11 / 12)	Precautions	
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1. Surface Mounting

- Mounting and soldering conditions should be checked beforehand.
- Applicable soldering process to this products is reflow soldering only.
- Recommended Land-Pattern :



(Unit: mm)

2. Handling

- Keep the products away from all magnets and magnetic objects.
- Be careful not to subject the products to excessive mechanical shocks.
- Please avoid applying impact to the products after mounted on pc board.
- Avoid ultrasonic cleaning.
- Between the terminals on the bottom of the products, please do not provided pattern. Parts are arranged around the products (top panel, side) on the surface of the products. Please do not contact.

3. Storage

To prevent deterioration of the solderability of terminal electrodes and/or the packing materials of the products, please store the products under following storage conditions.

Ambient temperature range -5 deg C to 40 deg C

Humidity 70 % RH maximum

Even under the ideal storage conditions, solderability of inductor's electrode deteriorates as time passes, so inductors should be used within 6 months after the delivery time.

4. Regarding Regulations

- Any Class- I or Class- II ozone-depleting substance (ODS) listed in the Clean Air Act in US for regulation is not included in the products or applied to the products at any stage of whose manufacturing processes.
- Certain brominated flame retardants (PBBs, PBDEs) are not used at all.
- The products of this specifications are not subject to the Export Trade Control Order in Japan or the Export Administration Regulations in US.

5. RoHS compliance

This product conforms to "RoHS compliance".

6. Production Sites and country of origin

TAIYO YUDEN CO., LTD. : JAPAN

TAIYO YUDEN (PHILIPPINES) INC. : Philippines

(12 / 12)	Precautions	
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7. Guarantee

The guaranteed operating conditions of the products are in accordance with the conditions specified in this specifications.

Please note that TAIYO YUDEN CO., LTD. takes no responsibility for any failure and/or abnormality which is caused by use under other than the aforesaid operating conditions.

SPECIAL NOTICE

■ All of the contents specified here are subject to change without notice due to technical improvements, etc. Therefore, please check latest version of the components specifications carefully before practical application or usage of the components. Please note that TAIYO YUDEN CO., LTD. shall not be responsible for any defects in products or equipment incorporating such products, which are caused under the conditions other than those specified in this specification or individual specification.

■ Please conduct validation and verification of products in actual condition of mounting and operating environment before commercial shipment of the equipment.

■ All electronic components in this specification are developed, designed and intended for use in general electronics equipment. (for Av, office automation, household, office supply, information service, telecommunications, (such as mobile phone or PC) etc.).

Before incorporating the components or devices into any equipment in the field such as transportation, (automotive control, train control, ship control), transportation signal, disaster prevention, medical, public information network (telephone exchange, base station) etc. which may have direct influence to harm or injure a human body, please contact TAIYO YUDEN CO., LTD. for more detail in advance.

Do not incorporate the products into any equipment in fields such as aerospace, aviation, unclear control, submarine system, military, etc. where higher safety and reliability are especially required.

In addition, even electronic components or functional modules that are used for the general electronic equipment, if the equipment or the electric circuit require high safety or reliability function or performances, a sufficient reliability evaluation check for safety shall be performed before commercial shipment and moreover, due consideration to install a protective circuit is strongly recommended at customer's design stage.

■ The contents of this specification are applicable to the products which are purchased from our sales offices or distributors (so called "TAIYO YUDEN's official sales channel").

It is only applicable to the products purchased from any of TAIYO YUDEN's official sales channel.

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