

# SPECIFICATION

SPEC. No. C060NAA00321  
DATE: Apr.26th,2017

To

XIAMEN XIANGGAO ELECTRONICS CO.,LTD

CUSTOMER'S PRODUCT NAME  
HHM22137A1

TDK'S PRODUCT NAME  
HHM22137A1

## RECEIPT CONFIRMATION

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

TDK Corporation  
Sales  
Electronic Components Sales &  
Marketing Group

Engineering  
Electronic Components Business Company  
Communication Devices Business Group

APPROVED	Person in charge

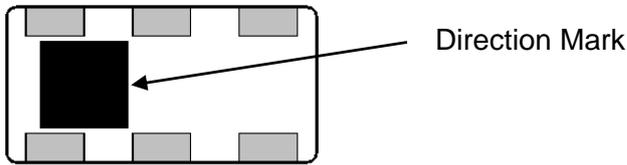
APPROVED	CHECKED	Person in charge
<i>N. Harada</i>	<i>N. Ootsuka</i>	<i>H. Ashida</i>



**Directional Coupler Specification**  
(TDK Part Number : HHM22137A1)

Apr.26th,2017  
TDK Corporation

**1. Marking**



**2. Mechanical Outline**

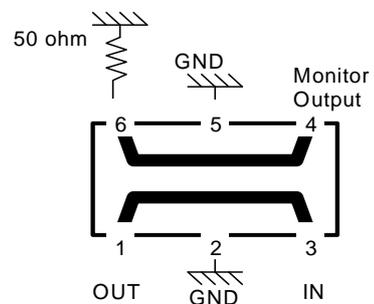
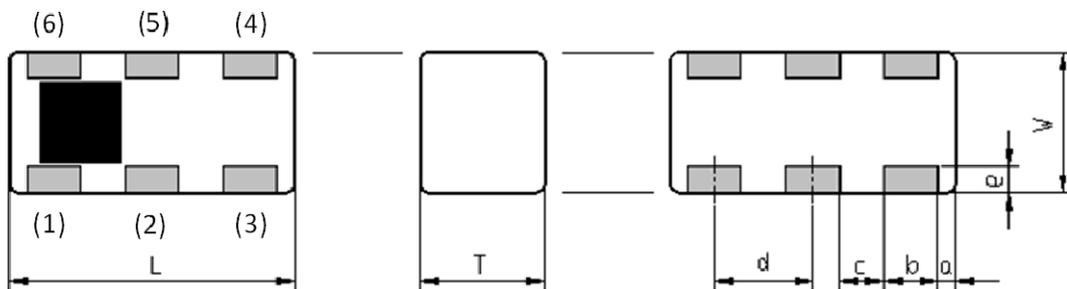
**2-1 Package**

Package:	Surface mount package
Delivery medium:	Tape on reel
Soldering method:	IR-reflow
Size:	1.60 X 0.80mm typ.
Height:	0.60 mm typ.

**[MECHANICAL CHARACTERISTICS]**

[Top View]

[Bottom View]



Dimensions (mm)

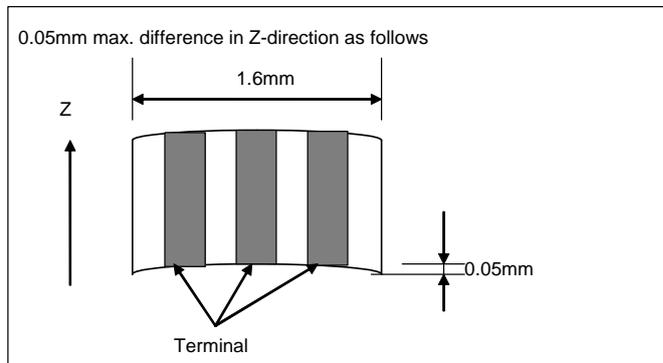
L	W	T	a	b	c	d	e
1.60	0.80	0.60	0.10	0.30	0.25	0.55	0.15
+/-0.10	+/-0.10	+/-0.10	+/-0.10	+/-0.10	+/-0.10	+/-0.10	+/-0.10

Terminal functions

(1)	Output Port
(2)	GND
(3)	Input Port

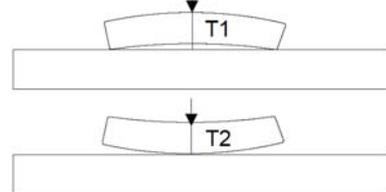
(4)	Monitor Output Port
(5)	GND
(6)	50ohm Termination

## 2-2. Coplanarity of HHM22137A1



### Coplanarity measurement method

$$\text{Coplanarity} = T1 - T2$$



Each terminal extends the full of the **HHM22137A1**. Hence any coplanarity deviation between terminals is due to curvature in the substrate. TDK guarantees that the edge of each terminal is within 0.05mm of the horizontal plane.

## 3. Environment (Temperature & Humidity)

### 3-1 Operating & Storage condition

Storage temperature range: -40 ~ +85 °C

Operating temperature range: -40 ~ +85 °C

Humidity: 0 ~ 90 % RH (Max. wet bulb temperature 38°C)

### 3-2 Storage condition before soldering

Temperature: +5 ~ +30 °C

Humidity: 20 ~ 70 % RH

Term of storage: Within 6 months

Baking: Unnecessary

**4. Electrical Specification**

(Ta=25+/-5 °C)

Parameter	Frequency (MHz)	TDK Spec			Comments
		Min.	Typ.	Max.	
Coupling Factor (dB)	578 to 673	-	27.3	-	Input and output 50ohms
	673 to 2700	-	24.7	-	
	2700 to 3500	-	14.3	-	
	3500 to 12750	-	8.7	-	
Coupling Factor (dB)	673 to 2700	22.0	25.5	28.5	Input and output VSWR 2:1 (R=100ohm)
	2700 to 3500	13.0	14.6	-	
	3500 to 12750	7.0	9.8	-	
Insertion Loss (dB)	578 to 2700	-	0.13	0.20	Input and output 50ohms
Isolation (dB)	673 to 2700	45.0	47.0	-	Input and output 50ohms
Isolation (dB)	673 to 2700	20.0	23.2	-	Input port at 40:1 VSWR (R=2000ohm)
	2700 to 3500	13.0	14.1	-	
	3500 to 12750	4.0	8.0	-	
Part to part coupling factor variation	673 to 2700	1.0	0.3	1.0	Input and output VSWR 2:1
Over temperature coupling factor variation	673 to 2700	-0.5	0.3	0.5	Input and output VSWR 2:1
Return Loss (dB)	( Input Port )	578 to 2700	-	-	-15.0
		2700 to 3500	-	-	-
		3500 to 12750	-	-	-
	( Coupling Port )	578 to 2700	-	-19.9	-15.0
		2700 to 3500	-	-12.5	-10.0
		3500 to 12750	-	-1.0	0.0
Coupling factor variation over frequency (MHz)	578 to 673	-0.65	±0.54	0.65	
	699 to 748	-0.35	±0.25	0.35	
	807 to 849	-0.20	±0.16	0.20	
	852 to 894	-0.20	±0.15	0.20	
	880 to 915	-0.20	±0.10	0.20	
	925 to 960	-0.20	±0.13	0.20	
	1425 to 1465	-0.10	±0.00	0.10	
	1475 to 1510	-0.10	±0.01	0.10	
	1525 to 1560	-0.10	±0.02	0.10	
	1625 to 1661	-0.10	±0.05	0.10	
	1705 to 1785	-0.20	±0.14	0.20	
	1805 to 1885	-0.30	±0.19	0.30	
	1850 to 1920	-0.30	±0.18	0.30	
	1920 to 2025	-0.40	±0.03	0.40	
	2110 to 2170	-0.30	±0.17	0.30	
	2300 to 2400	-0.30	±0.09	0.30	
2490 to 2700	-1.70	±1.32	1.70		

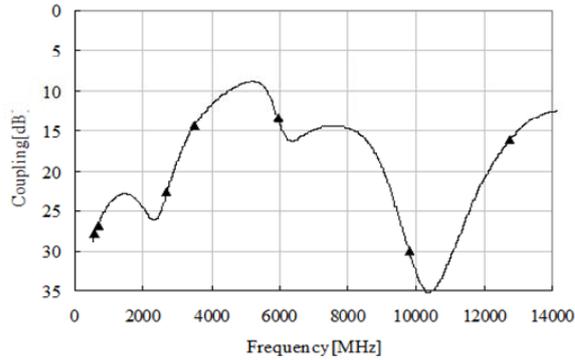
Parameter	Frequency (MHz)	TDK Spec			Comments
		Min.	Typ.	Max.	
Insertion loss from coupling and 50ohm term port	578 to 2700	-	0.92	1.30	
Characteristic Impedance (ohm) ( Input / Output Port ) ( Coupling Port ) ( Termination Port )		50 (Nominal)			
Power Capacity (dBm)		-	-	35	

**Coupler Type**

Daisy Chain Available	Yes
Bi-Directional	No

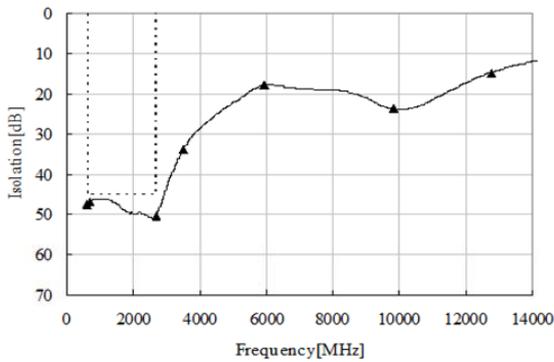
## 5. Typical electrical characteristics

### Coupling



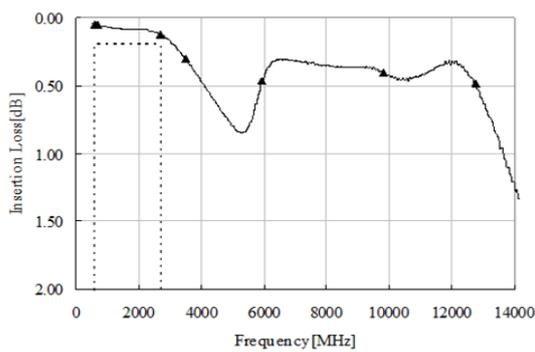
Frequency	Coupling
578 MHz	27.8 dB
673 MHz	26.8 dB
2700 MHz	22.7 dB
3500 MHz	14.3 dB
5950 MHz	13.4 dB
9800 MHz	30.1 dB
12750 MHz	16.1 dB

### Isolation



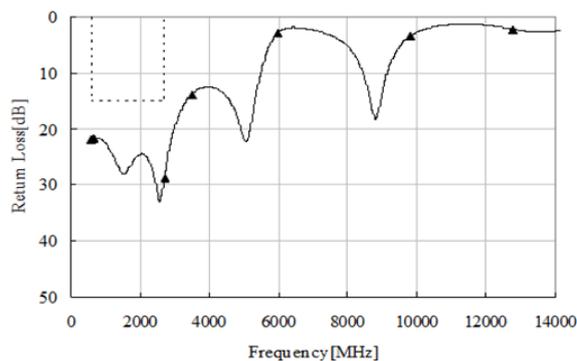
Frequency	Isolation
578 MHz	47.7 dB
673 MHz	47.1 dB
2700 MHz	50.6 dB
3500 MHz	34.0 dB
5950 MHz	18.0 dB
9800 MHz	23.8 dB
12750 MHz	14.9 dB

### Insertion Loss



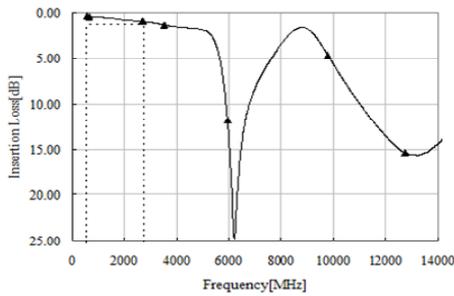
Frequency	Insertion Loss
578 MHz	0.05 dB
673 MHz	0.05 dB
2700 MHz	0.12 dB
3500 MHz	0.31 dB
5950 MHz	0.47 dB
9800 MHz	0.41 dB
12750 MHz	0.48 dB

### Return Loss (Coupling Port)



Frequency	Return Loss
578 MHz	22.0 dB
673 MHz	21.7 dB
2700 MHz	28.9 dB
3500 MHz	13.8 dB
5950 MHz	3.1 dB
9800 MHz	3.5 dB
12750 MHz	2.2 dB

Insertion Loss @ Coupling and 50 ohm term port

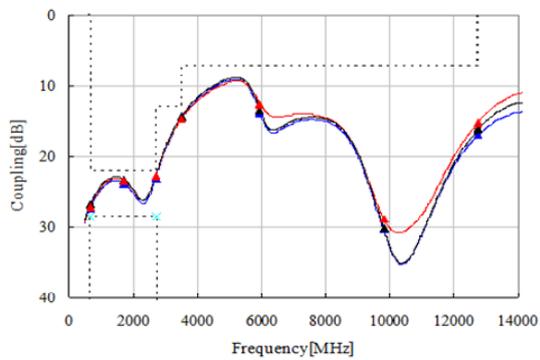


Frequency	Insertion Loss
578 MHz	0.39 dB
673 MHz	0.40 dB
2700 MHz	0.92 dB
3500 MHz	1.30 dB
5950 MHz	11.78 dB
9800 MHz	4.76 dB
12750 MHz	15.37 dB

Coupling @ input and output 50ohm

Coupling @ input 100ohm

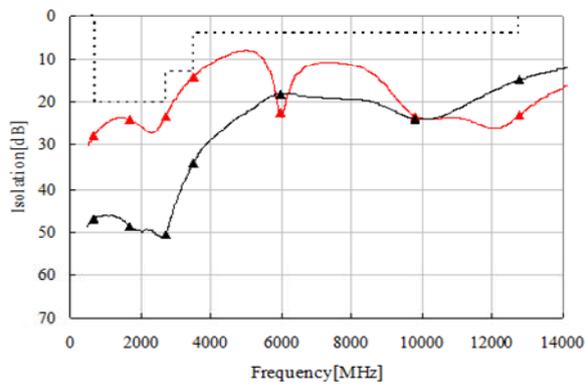
Coupling @ output 100ohm



Frequency	Coupling		
	50ohm	In/100	Out/100
673 MHz	26.8	27.3	27.0 dB
1700 MHz	23.3	23.8	23.4 dB
2700 MHz	22.7	23.1	22.7 dB
3500 MHz	14.3	14.6	14.6 dB
5950 MHz	13.4	13.8	12.5 dB
9800 MHz	30.1	30.3	28.8 dB
12750 MHz	16.1	16.9	15.1 dB

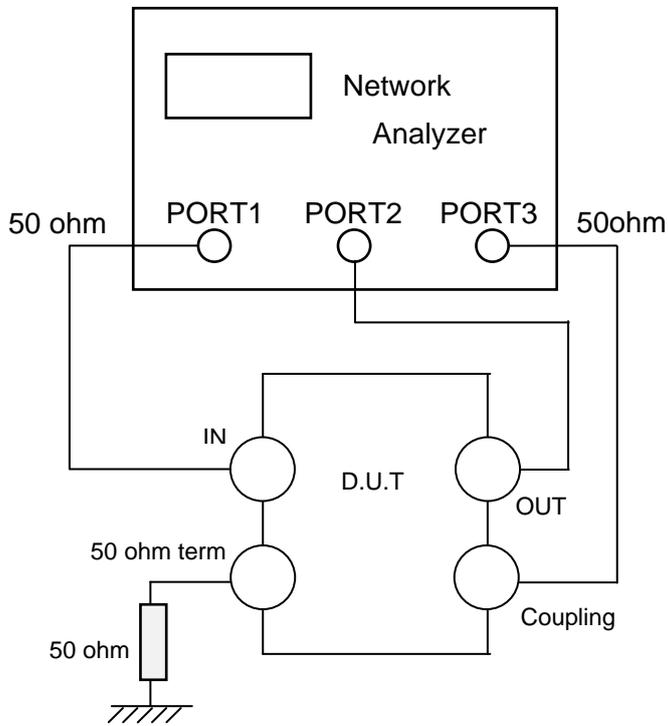
Isolation @ input and output 50ohm

Isolation @ input 2000 ohm



Frequency	Isolation	
	50ohm	2000ohm
673 MHz	47.1	27.8 dB
1700 MHz	48.9	24.0 dB
2700 MHz	50.6	23.2 dB
3500 MHz	34.0	14.1 dB
5950 MHz	18.0	22.4 dB
9800 MHz	23.8	23.1 dB
12750 MHz	14.9	23.0 dB

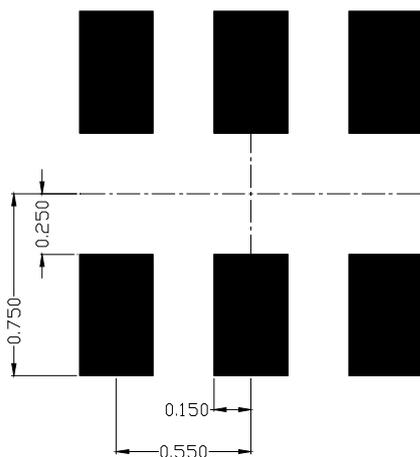
## 6. Test Circuit



**Note 1:** The Port Extension function on the Network Analyzer is used to extend the calibration plane to the DUT terminals.

**Note 2:** Loss in the PCB traces is compensated for by measurement data taken on a PCB Thru' line.

## 7. Recommended Land Pattern



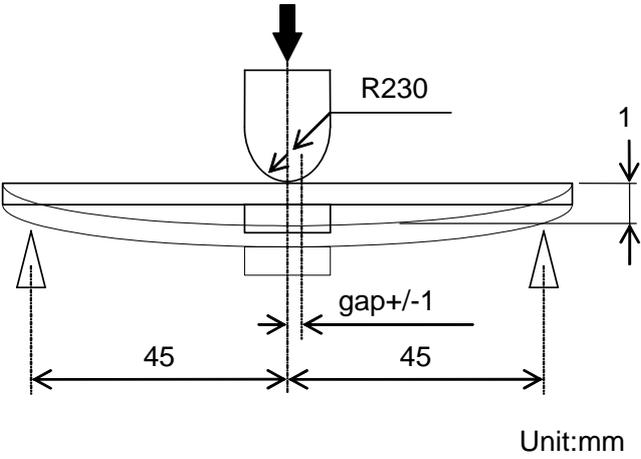
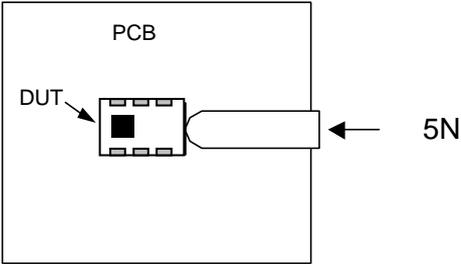
Unit: mm

## **8. Environmental and quality proposal**

This product satisfies the electrical specification after the following tests.

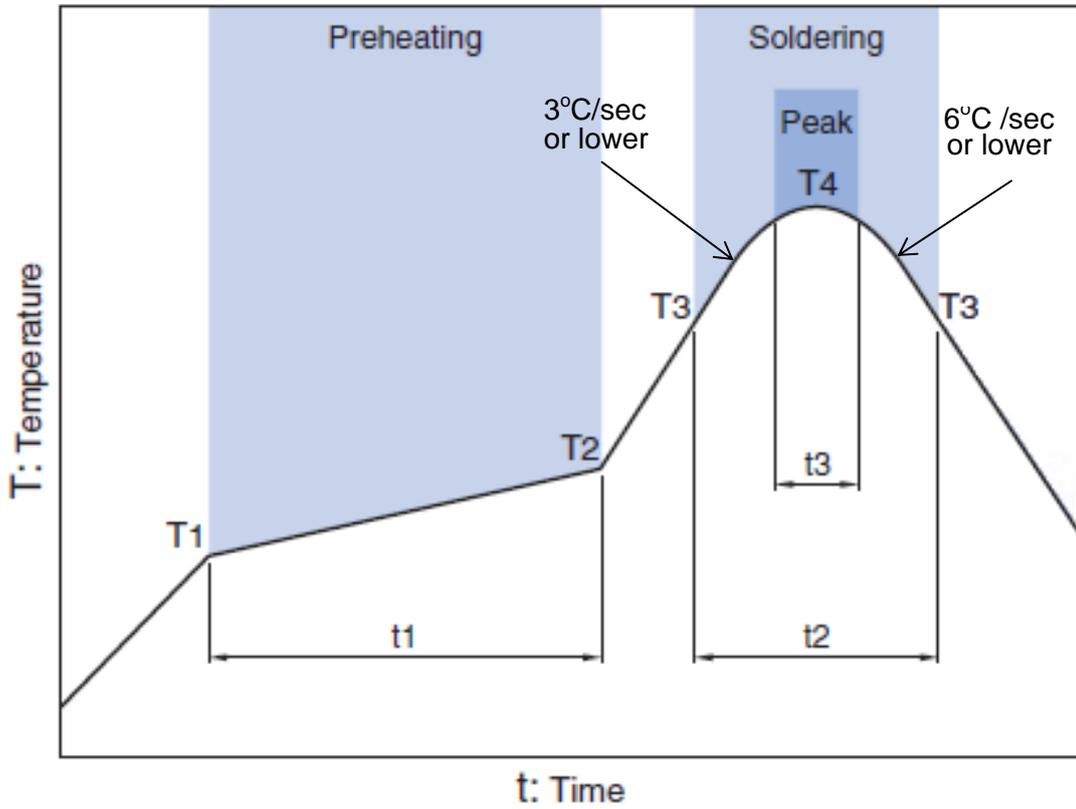
(When measured after two hours in normal conditions)

Temperature characteristics:	All data initially taken at +25°C, then repeated at -40°C and again at +85°C.
Heat proof:	+85 °C+/-2 °C for 1000 hours
Cold proof:	-40 °C +/-2 °C or 500 hours
Moisture proof:	+60 °C +/-2 °C, 90~95% R.H. for 1000 hours
Heat shock:	-40 ~ +85 °C for 350 cycles each cycle being 30 min
Vibration:	10-500Hz vibration frequency (10G Max.) with 1.52mmp-p amplitude for two hours in x,y,z directions
Mechanical shock:	1.Acceleration 1000m/s <sup>2</sup> 2.Direction X, Y, Z ,X',Y',Z',axes 3.Time 6ms duration and 3 times in each direction
Solderability	The dipped surface of the terminal shall be at least 75% covered with solder after dipped in solder bath of 245 °C+/-3 °C for 3+/-0.5 sec. Remark solder: Sn-3.0Ag-0.5Cu Remark flux: Rosin 25%, Alcohol 75%
Solder heat shock:	It shall be possible to hot air reflow the components three times with a temperature profile shown below.
Drop shock:	Dropped onto steel plate or concrete from 100cm height three times.
Bending test:	Solder specimen components on the test printed circuit board(L:100 x w:40 x t:0.8mm) in appended recommended PCB pattern Apply the load in direction of the arrow until bending reaches 1mm for 5+/-1 sec.

	 <p>Unit:mm</p>
<p>Board adhesion (Push test):</p>	<p>Solder specimen components on the test printed circuit board(L:100 x w:40 x t:0.8mm) in appended recommended PCB pattern Apply the load in direction of the arrow until 5N for 5 +/-1 sec .</p>  <p>PCB DUT 5N</p>

### 9. Recommended reflowing temperature profile

Pb free solder



Preheating			Soldering			
			Critical zone (T3 to T4)		Peak	
Temp.	Temp.	Time	Temp.	Time	Temp.	Time
T1	T2	t1	T3	t2	T4	t3 *
150°C	200°C	60 to 120sec	217°C	60 to 120sec	240 to 260°C	30 sec Max

\* t3 : Time within 5°C of actual peak temperature

The maximum number of reflow is 3.

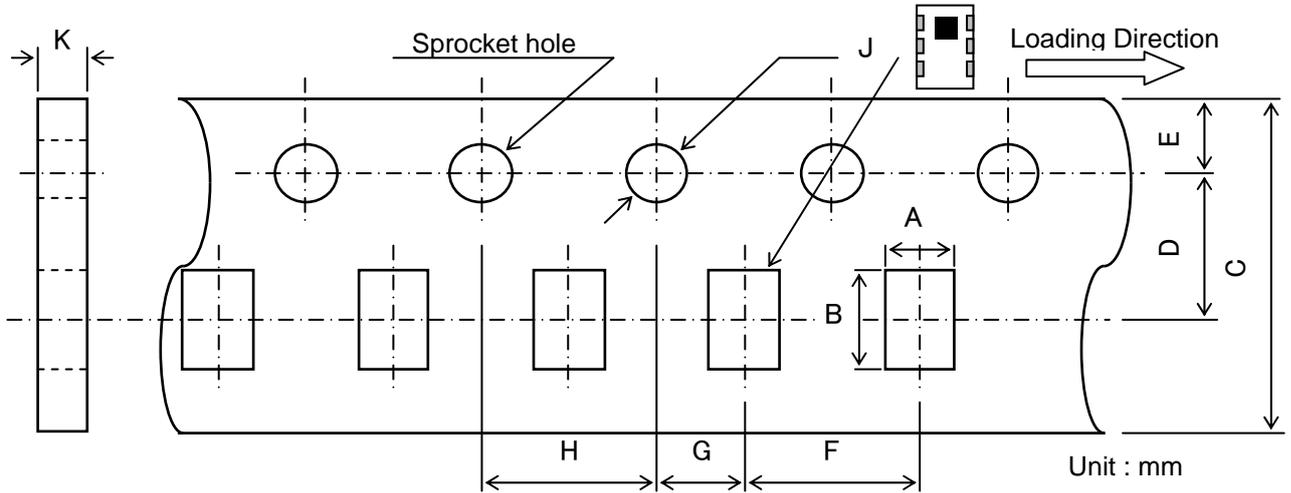
Note: Lead free solder is recommended.

Recommended solder is Sn-3.0Ag-0.5Cu. (M705 by Senju Metal Industry)

## 10. Packing

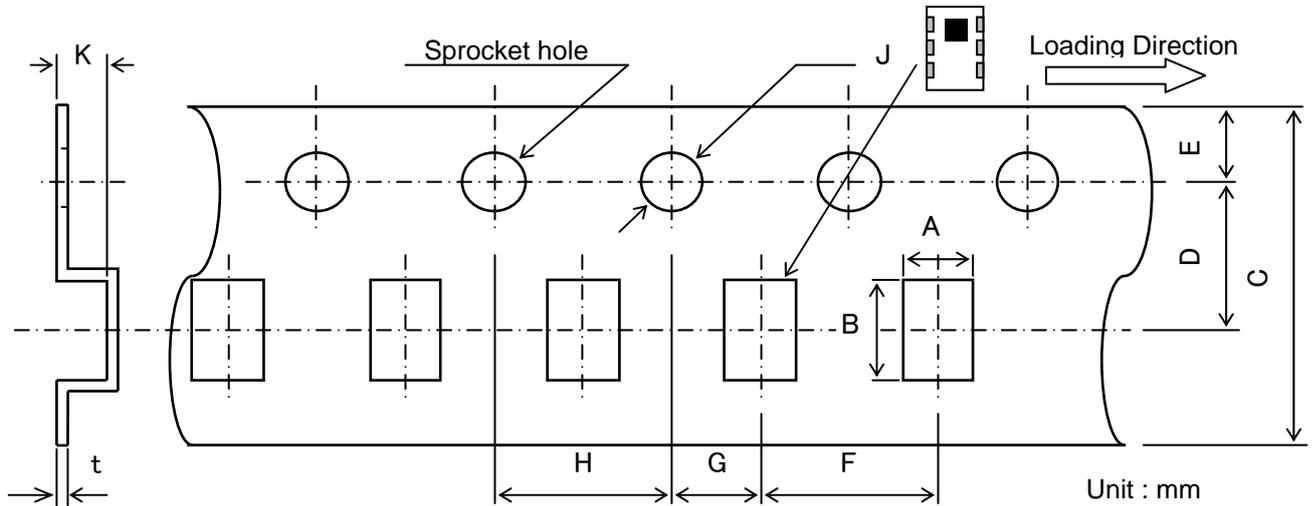
### 10-1 Carrier tape

Carrier tape 1 , Material : paper



A	B	C	D	E	F	G	H	J	K
0.97	1.8	8.0	3.5	1.75	4.0	2.0	4.0	1.5	0.8
+/-0.05	+/-0.05	+/-0.2	+/-0.05	+/-0.1	+/-0.1	+/-0.05	+/-0.1	+0.1/-0	MAX

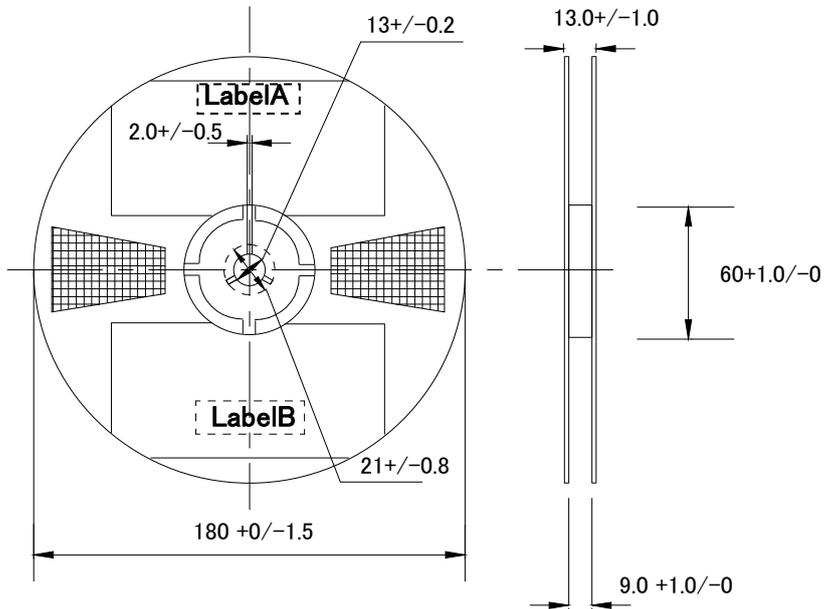
Carrier tape 2 , Material : PS



A	B	C	D	E	F	G	H	J	K	t
0.97	1.8	8.0	3.5	1.75	4.0	2.0	4.0	1.5	0.8	0.25
+/-0.05	+/-0.05	+/-0.2	+/-0.05	+/-0.1	+/-0.1	+/-0.05	+/-0.1	+0.1/-0	MAX	+/-0.05

"Carrier tape 1" is currently adopted. "Carrier tape 2" will be running change after Feb.2016.

**10-2. Reel Dimensions**



Unit : mm

**10-3. Standard Reel Packaging quantities**

4000pcs./reel

## **11. Other**

### **11-1 Notice**

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.

Aerospace/Aviation equipment  
Transportation equipment (cars, electric trains, ships, etc.)  
Medical equipment  
Power-generation control equipment  
Atomic energy-related equipment  
Seabed equipment  
Transportation control equipment  
Public information-processing equipment  
Military equipment  
Electric heating apparatus, burning equipment  
Disaster prevention/crime prevention equipment  
Safety equipment  
Other applications that are not considered general-purpose applications

When using this product in general-purpose applications, you are kindly requested to take into consideration securing protection circuit/equipment or providing backup circuits, etc., to ensure higher safety.

### **11-2 Product Origin**

1. TDK Akita Corporation, Akita, Japan
2. TDK Dalian Corporation, Dalian ,China