

Environmentally Friendly Narrow-pitch Tape Carrier

An ECIA Knowledge Document

Volume 1, Number 7

January 2018

Reaffirmed: June 2023



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This ECIA Knowledge Document was formulated under the cognizance of the Automated Component Handling Committee.

Published by

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Standards and Technology Department
13873 Park Center Road, Suite 315
Herndon, VA 20171

Downsizing trend of passive electronic components

As demand is rising for high speed and high-capacity data communication, and Functionality of assembled products is expanding, an increasing number of passive electronic components such as multilayer ceramic capacitor chips (MLCC), chip inductors and chip resistors are used in mobile communication devices. In particular, each smartphone uses a huge number of MLCCs; high-end models have 600 to 1000 MLCCs, and even low- and middle-end models have 300 to 600 MLCCs. As demand will continue to rise for higher-functionality and lower power consumption of electronic devices, their components will increasingly need to be more compact and to have higher performance.

As shown in Fig1, the downward shift in the size of MLCCs tends to take place on an approximately 10-year cycle, and in the consumer market, the 0402(1005M) size is being replaced by the 0201(0603M) size as a major size. Miniaturization achievement for high volume runners is a major factor behind this trend. The development of 01005(0402M)/0.1 μ F, 0201(0603M)/1 μ F, and 0402(1005M)/10 μ F products at around 2010 have significantly contributed to miniaturization and high-density mounting of components in smartphones and mobile devices. There are continued high expectations for further contribution of passive components to high-functionality, miniaturization and production volume increase since electronic equipment/device market is going to expand and evolve at the high pace we have never experienced.

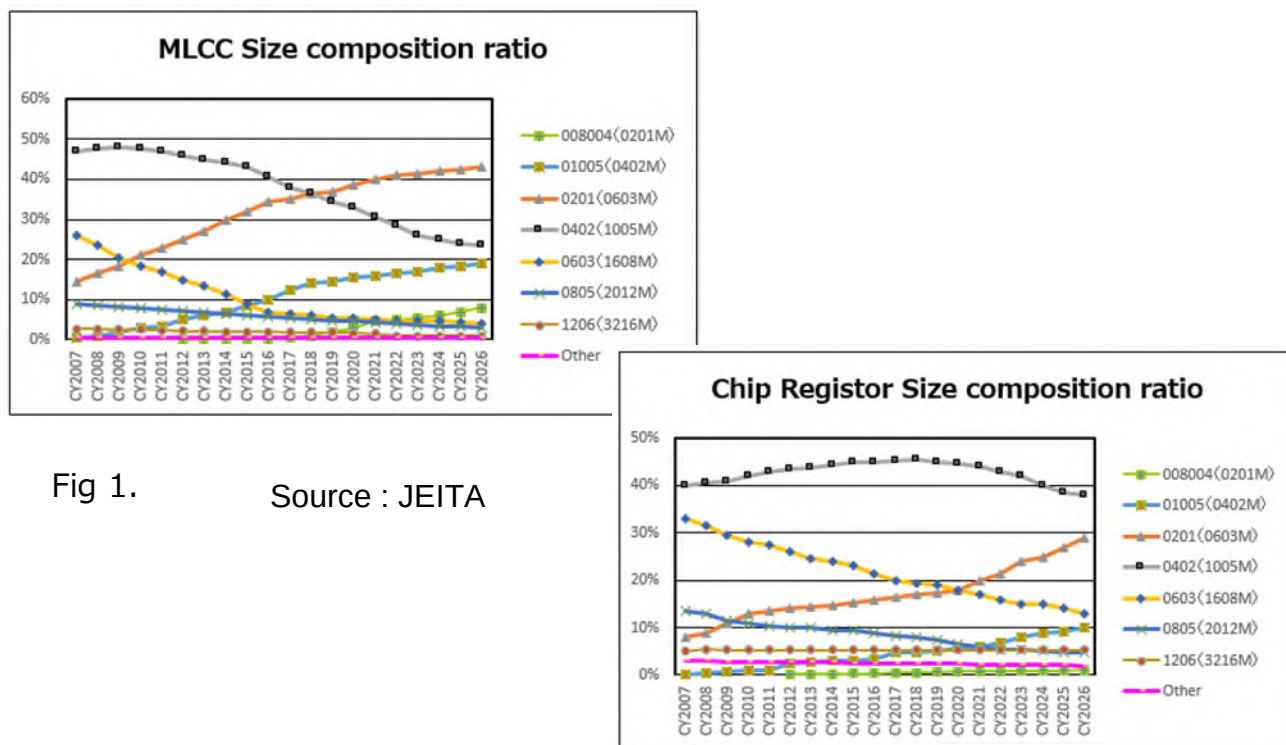


Fig 1.

Source : JEITA

Tape Packaging of Passive Components

Passive components are supplied with tape package where individual component is placed in a pocket in the carrier tape as the reel format. Electronics equipment/device manufacturers use pick and place machine to mount the components on printed circuit board. Thus, the tape package plays an important role to support high speed, accurate, and high density chip components mounting technology. (Fig 2)

Fig 2 .



Source : FUJI MACHINE MFG. CO., LTD.

The tape carrier is usually made of either paper or plastic and classified by dimension spec of tape width and pocket pitch as below Table 1. Currently the W8P2 (tape width 8mm, pocket pitch 2mm) format is widely used in the market.

Table 1.

	W4P1	W8P1	W8P2	W8P4	
008004(0201M)	Plastic	—	—	—	—
01005(0402M)	Plastic	—	Paper	—	—
0201(0603M)	—	Paper	Paper	—	—
0402(1005M)	—	Paper	Paper	—	—
0603(1608M)	—	—	Paper	Paper	Plastic
0805(2012M)	—	—	—	☆Paper	Plastic
1206(3216M)	—	—	—	☆Paper	Plastic

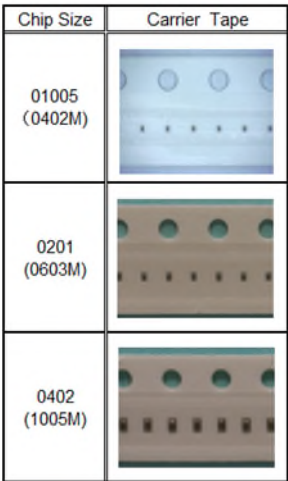
W means width of carrier tape. P means pitch of carrier tape.

W4P1 shows 4mm width and 1mm pitch of carrier tape.

☆When thickness of chip component is 1.0mm and below, paper tape carrier is used.

When thickness of chip component is 1.0mm and below, Paper tape carrier is used. Since the major chip size of MLCC is 0201(0603M) and 0402(1005M), significant volumes of paper tape carriers are being consumed in the market. The W8P2 paper tape carrier of 0402(1005M) ~ 01005(0402M) is shown in Fig.3. Space utilization on tape carrier is getting less with chip size reduction from 0402(1005M) to 01005(0402M).

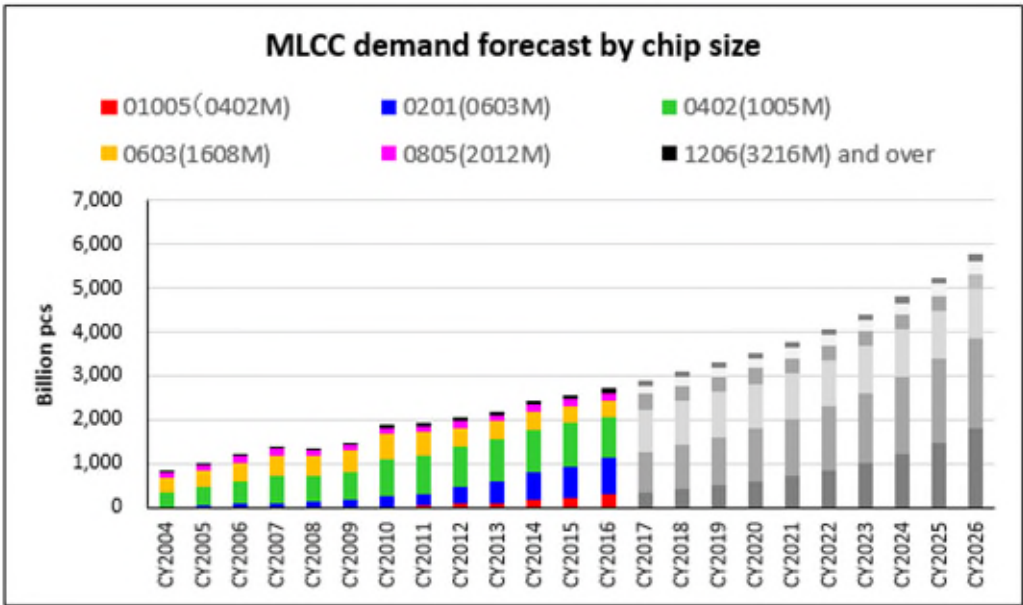
Fig 3.



Demand forecast of MLCC and consumption of paper carrier tape

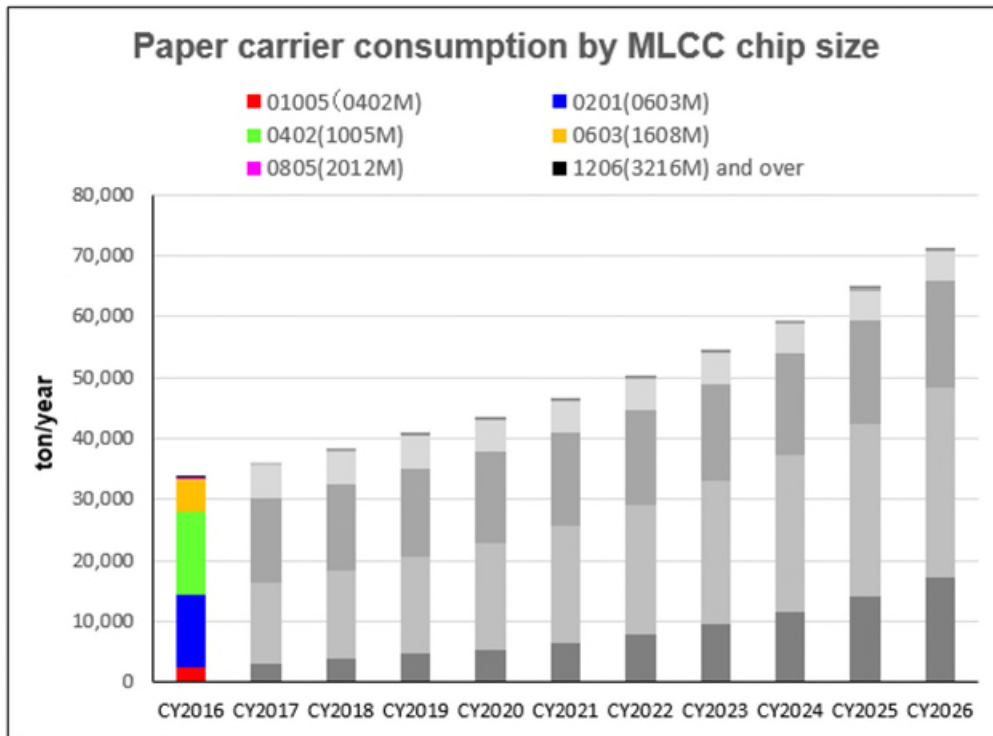
Graph 1 and Graph 2 show MLCC demand forecast and paper consumption growth as carrier tape.

Graph 1 .



Source JEITA
CY2004 ~ CY2020 JEITA MLCC world demand survey March 2017
CY2021 ~ CY2026 Forecasted based on CY2016 ~ CY2020 CAGR

Graph 2.



Source Murata + JEITA
CY2017 ~ CY2020 JEITA MLCC world demand survey March 2017
CY2021 ~ CY2026 Forecasted based on CY2016 ~ CY2020 CAGR

It is predicted that paper carrier consumption would be doubled from CY2017 to CY2026 along with the growth of chip components demand. This will be a significant impact to the environment. Paper carrier consumption in 2017 will be equivalent to approximately 660K trees, and be equivalent to the distance between New York city and Hong Kong city (assuming that a tree is 20m in height) which is around 13,000Km. It will be 1,200K trees or 24,000Km in length (New York - Hong Kong - San Francisco) by CY2026 (Fig 4).

Fig.4



Environmentally friendly narrow pitch paper carrier

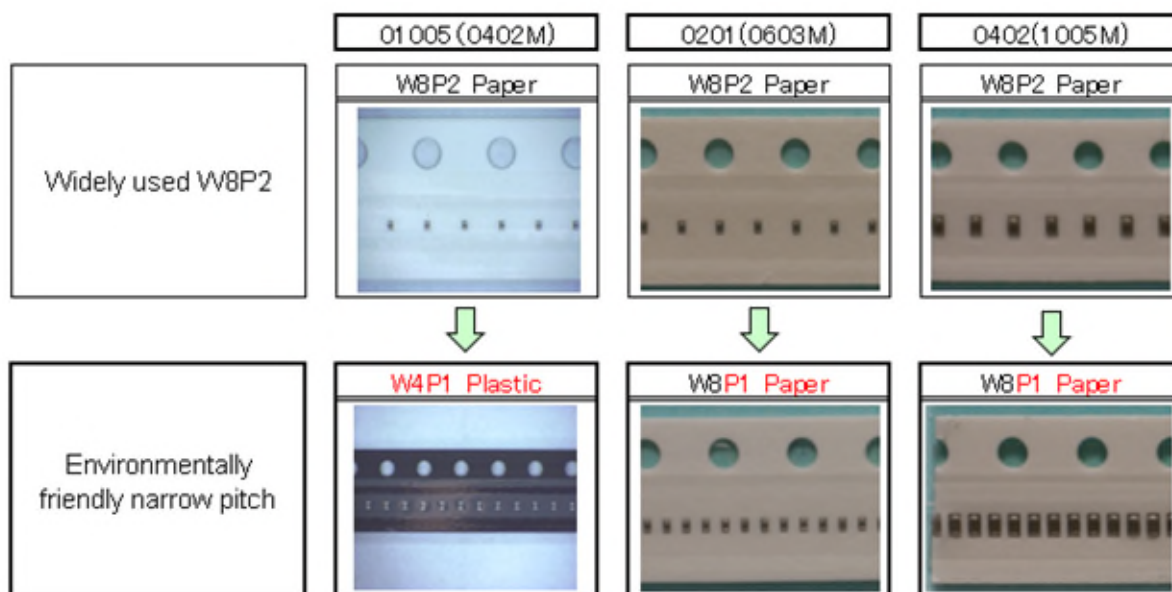
Besides paper carrier consumption increase which gives a significant impact to environment, more plastic cover tapes and plastic carrier reels are consumed at the same time as waste material in assembly line of printed circuit board.

One of solutions to this issue is the use of narrow pitch carrier tape.

Fig.5 compares widely used W8P2 (tape width 8mm, pocket pitch 2mm) tape carrier and W8P1(tape width 8mm, pocket pitch 1mm) narrow pitch tape carrier. W8P1 is currently offered to 0402(1005M) and 0201(0603M) size with doubled component packaged quantity per reel.

On the other hand, W4P1 plastic tape carrier is proposed to 01005(0402M) chip component. W4P1 tape carrier cuts the usage of tape material down to 1/4 the surface area ratio compared to W8P2 paper tape carrier of the same chip size. W4P1 plastic tape carrier is treated for electrostatic-resistance to prevent the occurrence of electrostatic charges induced when the plastic cover tape is peeled off from tape carrier by pick and place machine. Because 01005(0402M) chip is so small that electrostatic charge and fluff and dust come from the paper tape carrier would affect the reliability of chip mounting process and of soldering process. W4P1 tape format is standardized in IEC 60286-3, EIA-971 and JIS C0806-3 specification respectively.

Fig 5



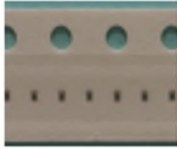
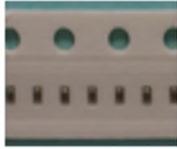
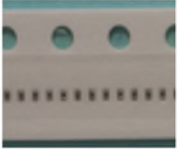
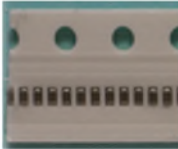
It is easily expected that the consumption of paper tape carrier is cut by half by switching over to narrow pitch tape carrier where it is available.

Challenges for deployment of narrow pitch tape

0402(1005M) and 0201(0603M)

- 1. The deployment of narrow pitch tape (W8P1) will be relatively easy for users because most of pick and place machines in the market can support W8P1 tape format as well as W8P2.
- 2. However, transition period from W8P2 to W8P1 will be difficult time for both component suppliers and users because inefficient production/stock management could be inevitable from standardization point of view.

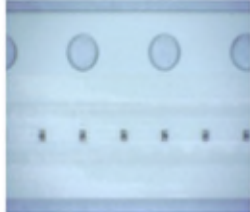
Fig 6.

	W8P2 Paper		W8P1 Paper	
	0201(0603M)	0402(1005M)	0201(0603M)	0402(1005M)
Taping Spec.				
Quantity	15,000pcs/reel	10,000pcs/reel	30,000pcs/reel	20,000pcs/reel
Merit	① Widely available		① Less reel change over times due to doubled package quantity ② Less stock space ③ Less waste material (paper, plastic cover film, reel) consumed	
Demerit	① More waste material (paper, plastic cover film, reel) consumed		① Old model of pick and place machine might not support W8P1	

01005(0402M)

- 1. A new tape carrier cassette is required to use W4P1 tape carrier at user side. This will be additional expense for users for W4P1 deployment. However, it is reported that productivity improvement attributed by W4P1 tape carrier would offset this cost.
- 2. Since 01005(0402M) chip size is relatively new to the market and chip demand volume is still limited compared to 0201(0603M) and 0402(1005M). It is highly recommended that deployment of W4P1 tape carrier is promoted as the industry before the 01005(0402M) market becomes too large.

Fig 7

	W8P2 Paper	W4P1 Plastic
Taping Spec.		
Quantity	20,000 pcs/reel	40,000pcs/reel
Merit	①W8P1tape cassettes is widely available	①Less reel change over times due to doubled package quantity ②Less stock space ③Less Industrial waste (paper, plastic cover film, reel) consumed ④No fluff and dust from tape ⑤No electrostatic charge occurrence
Demerit	①More waste material (paper, plastic cover film, reel) consumed	①W4P1 spacific cassette feeder is needed. ②W8P2 cassette feeder can not be used.

Toward environmentally friendly electronics industry

Bulk packaging system which does not use tape carrier would be the final solution to this environmental challenge to reduce waste material from components carrier tape, however it is will take some time before it is widely deployed in the industry. It is required to take actions immediately towards the reduction of consuming paper tape carrier as the industry.