INNOCHIPS TECHNOLOGY

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Multilayer Chip Varistor

Innochips Technology Co. Ltd.

1. SCOPE

This specification applies to chip varistors for use in electric equipment. It can be possible to change the specification under document agreement between design engineers of each party.

2. FEATURES

- SMD type chip varistors provide highly reliable surface mount application.
- Wide operating voltage range.
- Large withstanding surge current and energy at small size
- Suitable for high speed signal line due to small capacitance
- Excellent solderability and superior heat resistance

☆ The ICT chip varistors provide excellent application reliability as a result of their Ag base terminal electrodes with Ni + Sn-Pb electroplating

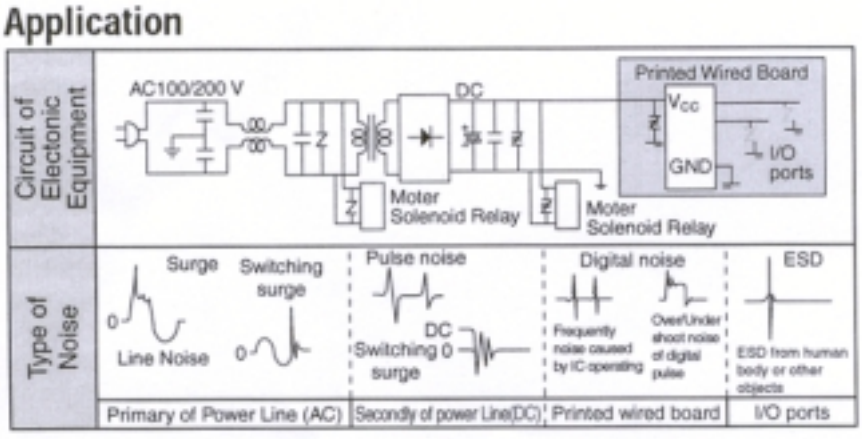
☆ There is no asymmetrical degradation as with bismuth zinc oxide varistors

3. APPLICATIONS

☆ Development Target:

For the information and communication equipment

- For signal line of cellular phone
- Transient voltage protection for IC and transistor.
- ESD and I/O protection.
- Telecommunication transient protection.



4. PART NUMBER CODE

ICVN	05	05	X	150	P	B
①	②	③	④	⑤	⑥	⑦

① SERIES NAME

CODE	PRODUCT NAME
ICVN	Normal type chip varistor
ICVL	Low capacitance type chip varistor

② SIZE DESIGNATOR

CODE	SIZE(mm)
05	1.0 × 0.5
10	1.6 × 0.8
21	2.0 × 1.25
31	3.2 × 1.6

③ WORKING VOLTAGE

CODE	VOLTAGE(VDC)	CODE	VOLTAGE(VDC)
03	3.3	18	18.0
05	5.6	26	26.0
09	9.0	30	30.0
12	12.0	48	48.0
14	14.0	60	60.0

④ ENERGY

CODE	ENERGY (J)	CODE	ENERGY (J)
A	0.1	H	1.2
C	0.3	J	1.5
D	0.4	P	3.0
F	0.7	V	0.02
G	0.9	X	0.05

⑤ CLAMPING VOLTAGE

CODE	VOLTAGE (V)	CODE	VOLTAGE (V)
100	10.0	500	50.0
150	15.5	560	56.0
200	20.0	580	58.0
250	25.0	620	62.0
300	30.0	650	65.0
390	39.0	101	100.0
400	40.0	121	120.0

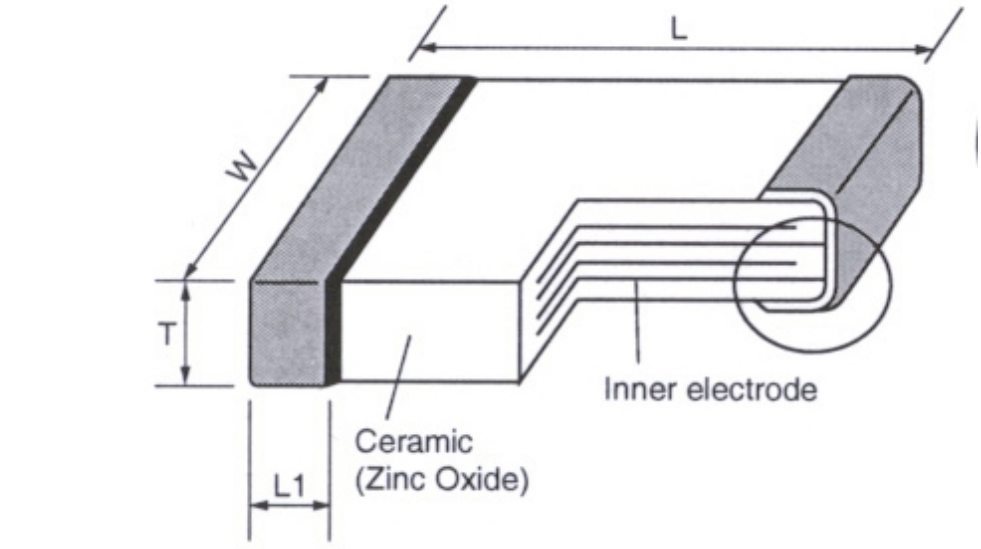
⑥ TERMINATION TYPE

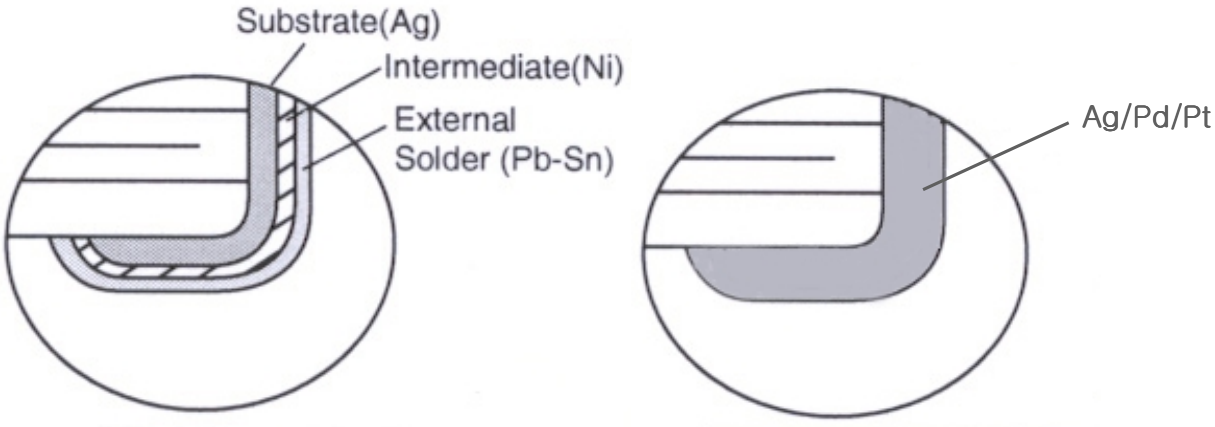
CODE	TYPE
S	Solderable (Ag/Pd/Pt)
P	Electroplate (Ni/Sn-Pb)

⑩ PACKAGING TYPE

CODE	TYPE
B	Bulk pack
R	Tape & Reel pack
E	Embossed tape pack

5. CONFIGURATION AND DIMENSIONS





CODE	DIMENSION (mm)			
	L	W	T	L1
05	1.0 ±0.05	0.5 ±0.05	0.5±0.05	0.2 +0.15/-0.1
10	1.6 ±0.1	0.8 ±0.1	0.8 ±0.1	0.3 ± 0.2
21	2.0 ±0.1	1.25 ±0.1	1.35 MAX	0.5 +0.2/-0.3
31	3.2 ±0.15	1.6 ±0.15	1.45 MAX	0.5 +0.2/-0.3

6. NOMINAL SPECIFICATIONS ACCORDING TO THE CHIP SIZE

■ NORMAL TYPE

Chip Size	ICT Part Number	Working Voltage	Varistor Voltage	Clamping Voltage	Peak Current	Transient Energy	Capacitance
	symbol	V_{WM}	V_B	V_C	I_{peak}	E_{trans}	C
	Units	volts (max.)	volts	volts (max.)	Amp (max.)	Joules (max.)	pF (typ.)
	Test Condition	<50μA	1mA DC	8/20μs	8/20μs	10/1000μs	0.5Vrms @1MHz
1005	ICVN0505X150	5.6	7.6 - 9.3	15.5	20	0.05	360
	ICVN0509X200	9.0	11.0-14.0	20.0	20	0.05	230
	ICVN0514X300	14.0	16.5-20.3	30.0	20	0.05	120
	ICVN0518X400	18.0	22.9-28.0	40.0	20	0.05	90
1608	ICVN1003A100	3.3	4.1 - 6.0	10	30	0.1	1230
	ICVN1005A150	5.6	7.6 - 9.3	15.5	30	0.1	825
	ICVN1009A200	9.0	11.0-15.0	20	30	0.1	550
	ICVN1014A300	14.0	16.5-20.3	30	30	0.1	424
	ICVN1018A400	18.0	22.9-28.0	40	30	0.1	225
	ICVN1026A580	26.0	31.0-38.0	58	30	0.1	160
	ICVN1030A650	30.0	37.0-46.0	65	30	0.1	150
2012	ICVN2103A100	3.3	4.1 - 6.0	10	40	0.1	930
	ICVN2105A150	5.6	7.6 - 9.3	15.5	40	0.1	860
	ICVN2109A200	9	11.0-14.0	20	40	0.1	585
	ICVN2112A250	12	14.0-18.3	25	40	0.1	400
	ICVN2114A300	14	16.5-20.3	30	40	0.1	280
	ICVN2118A400	18	22.9-28.0	40	30	0.1	275
	ICVN2126A580	26	31.0-38.0	58	30	0.1	110
	ICVN2130A650	30	37.0-46.0	65	30	0.1	80
3216	ICVN3103A100	3.3	4.1 - 6.0	10	40	0.1	1500
	ICVN3105A150	5.6	7.6 - 9.3	15.5	40	0.1	870
	ICVN3114A300	14	16.5-20.3	30	40	0.1	500
	ICVN3118A400	18	22.9-28.0	40	30	0.1	270
	ICVN3126D580	26	30.5-37.3	58	120	0.4	450
	ICVN3130D650	30	37.0-45.0	65	120	0.4	400
	ICVN3148D101	48	56.0-68.0	100	100	0.4	185

HIGH SPEED TYPE

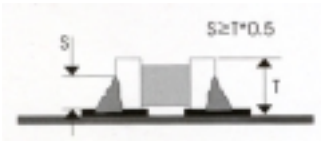
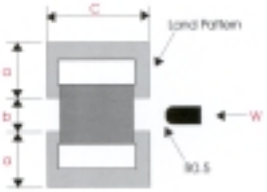
- Typical ESD failure voltage for CMOS and/or Bi Polar is ≥200V.
- 15kV ESD pulse (air discharge) per IEC 1000-4-2.Level 4, generates <20mJ of energy.
- Low capacitance(<200pF) is required for high-speed data transmission.
- Low leakage current(I_L) is necessary for battery operated equipment.

Chip Size	ICT Part Number	Working Voltage	Clamping Voltage	Peak Current	Transient Energy	Capacitance
	symbol	V_{WM}	V_C	I_{peak}	E_{trans}	C
	Units	volts (max.)	volts (max.)	Amp (max.)	Joules (max.)	pF (typ.)
	Test Condition	<10μA	8/20μs	8/20μs	10/1000μs	0.5Vrms @1MHz
1005	ICVL0518V500	≤18.0	<50.0	15	0.02	40
1608	ICVL1018X500	≤18.0	50	20	0.05	75
2012	ICVL2118A500	≤18.0	50	30	0.1	100
3216	ICVL3118A500	≤18.0	50	30	0.1	200

TERMINOLOGY

- **V_{wm}** : Maximum steady state DC operating voltage the varistor can maintain and not exceed 50μA leakage current.
- **V_B** : Voltage across the device measured at 1mA DC current
- **V_C** : Maximum peak voltage across the varistor measured at a specified pulse and waveform
- **I_{peak}** : Maximum peak current which may be applied with the specified waveform without device failure
- **C** : Device capacitance measured with zero volt bias 0.5Vrms and 1MHz

7. PERFORMANCE

ITEM	REQUIREMENTS				TEST CONDITION
	1005	1608	2012	3216	
Operating temperature range	-55℃ ~ +125℃				—
Storage temp. & humidity range	40℃ max , 70% RH max.				At packing condition
Resistance to solder heat	1. No damage such as cracks should be caused in chip element. 2. More then 75% of the terminal electrode shall be covered with new solder				Preheat temperature : 100 to 150℃ preheat time : 1 min. Solder temperature : 260 ±10℃ dipping time : 10± 0.5sec
Solderability	1. More than 90% of the terminal shall be covered with new solder.				Preheat temperature : 100 to 150℃ preheat time : 1 min. Solder temperature : 230 ±10℃ dipping time : 3± 1sec.
Reflow soldering	1. More then 50% of the terminal electrode shall be covered with new solder. 2. Varistor voltage change : ±within 10% 				Preheat temperature : 150℃ preheat time : 1 min. Solder temperature : 230℃ soldering time : 10 sec.max (Reflow soldering profile)
Tensile strength (terminal strength)	1. No mechanical damage				
W	-	1.0	2.0	2.5	
Adhesion of terminal electrode (Flexure strength)	1. No mechanical damage				
a	-	1.0	1.0	1.3	
b	-	0.8	1.0	1.5	
c	-	1.3	1.3	3.0	
W	-	2.0	4.0	5.0	
Body strength (bending strength)	1. The body shall not be damaged by forces applied on the right				
d	-	1.3	1.3	2.0	
W	-	2.0	3.0	4.0	

ITEM	REQUIREMENTS				TEST CONDITION
	1005	1608	2012	3216	
Drop	1. No mechanical damage				Drop 10 times on a concrete floor from a height of 91cm
Vibration	1. No mechanical damage				Frequency : 10～55～10Hz Amplitude : 1.52 mm Direction and time X,Y,X directions for 2 hours
Temperature cycle	1. No mechanical damage 2. Varistor voltage change : ±within 10%				Step 1. -40±3℃ 30±3min. Step 2. 85±3℃ 30±3min. Number of cycle : 100 times
Heat load resistance	1. No mechanical damage 2. Varistor voltage change : ±within 10%				Temperature : 85±2℃ Applied Voltage : working voltage Time : 1,000 hours Measured at room ambient temperature after placing for 24 hours
Low temp. resistance	1. No mechanical damage 2. Varistor voltage change : ±within 10%				Temperature : -40±5℃ Time : 1,000 hours Measured at room ambient temperature after placing for 24 hours
Humidity resistance	1. No mechanical damage 2. Varistor voltage change :±within 10%				Temperature : 40±2℃ Humidity : 90～95%RH Time : 500 hours Measured at room ambient temperature after placing for 24 hours
Humidity load resistance	1. No mechanical damage 2. Varistor voltage change :±within 10%				Temperature : 40±2℃ Humidity : 90～95%RH Applied voltage :Working Voltage Time : 500 hours Measured at room ambient temperature after placing for 24 hours

ITEM	REQUIREMENTS				TEST CONDITION
	1005	1608	2012	3216	
Maximum surge current	1. Varistor voltage change : ±within 10% IEC1000-4-5 standard 1.2/50㎲ - 8/20㎲ voltage-current combination pulse				Temperature : 25±5℃ Humidity : 30～65% RH Polarity : + , - Number of hit : each 1 time Surge pulse : 8/20㎲ pulse Applied current : maximum surge current(Is)
Maximum surge energy	1. Varistor voltage change : ±within 10% IEC1000-4-5 standard 10/1000㎲ current pulse				Temperature : 25±5℃ Humidity : 30～65% RH Number of hit : 1 time Surge pulse : 10/1000㎲ pulse Applied current : maximum surge current(Ws)
ESD life	1. No mechanical damage 2. Varistor voltage change : ±within 10% ESD gun (IEC1000-4-2 standard) C=150pF R=330Ω				Discharge : contact discharge Voltage : 8,000V(level 4) Polarity : + , - Number : 10,000 times in 10 sec.
ESD test	1. No mechanical damage 2. Varistor voltage change : ±within 10% ESD gun (IEC1000-4-2 standard) C=150pF R=330Ω				Discharge : Air discharge Voltage : 25,000V(special level) Polarity : + , - Number : 10 times in 10 sec

8. PACKING SPECIFICATION

I. TAPING

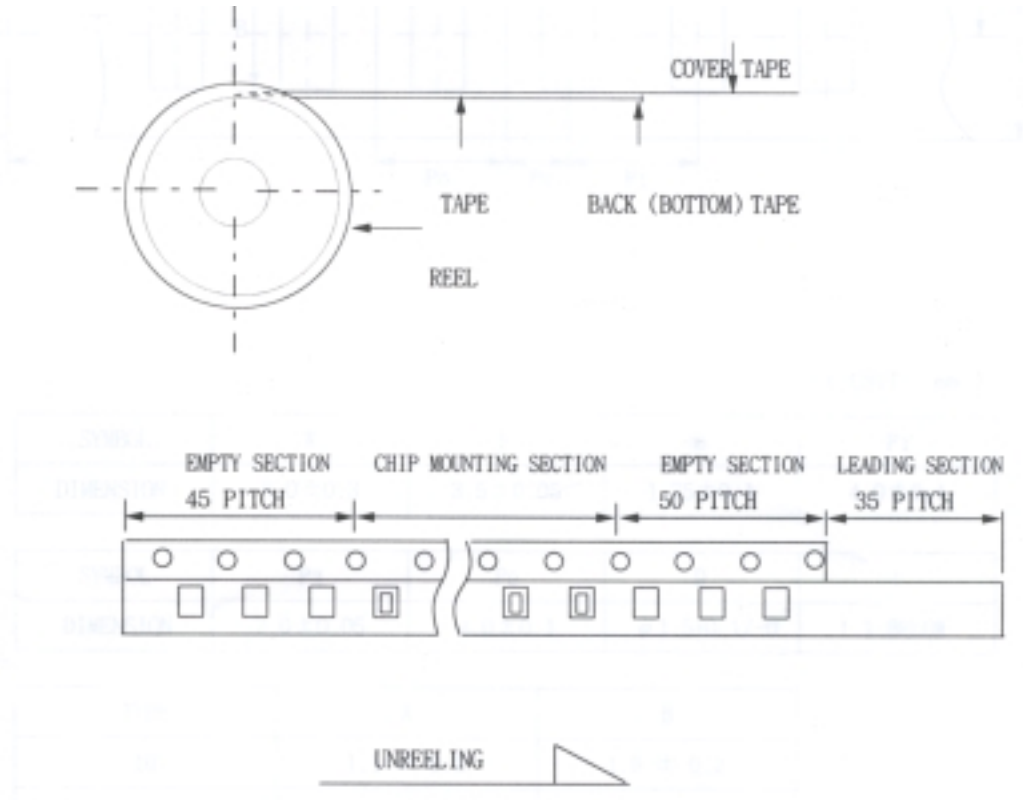
1. SCOPE

This specification applies to taping of chip varistor.

It can be possible to change the specification under document agreement between design engineers of each party.

2. STRUCTURE AND MATERIAL

2-1 TAPING FIGURE



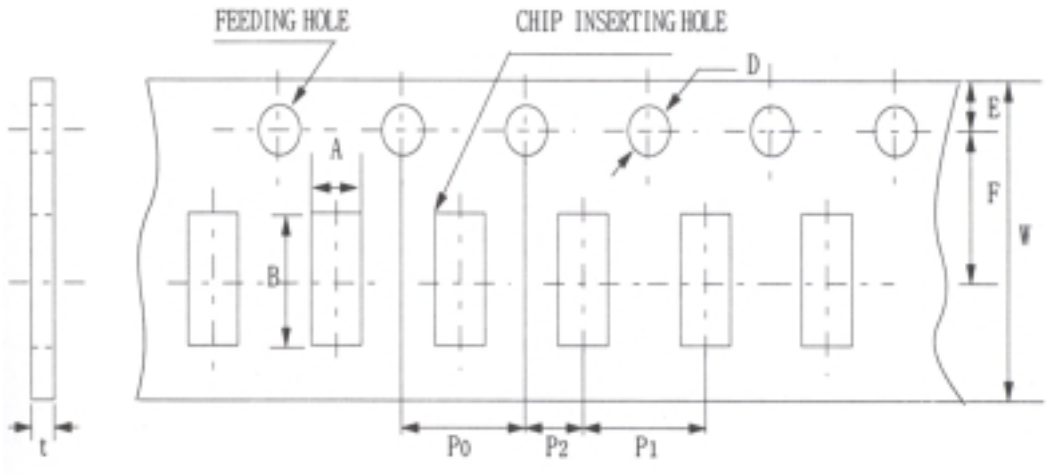
2-2 MATERIAL AND QUANTITY

TYPE / MATERIAL	05(0402)	10(0603)	21(0805) OR 31(1206)	
			T≤0.85mm	T≥1.0mm
PAPER	10,000 PCS/REEL	4,000 PCS/REEL	4,000 PCS/REEL	NA
PLASTIC	NA	NA	*	2,000 PCS/REEL

☞ NA : NOT AVAILABLE , * : OPTION

2-3 SIZE

1) Paper tape chip section (for 10,21 and 31 type)



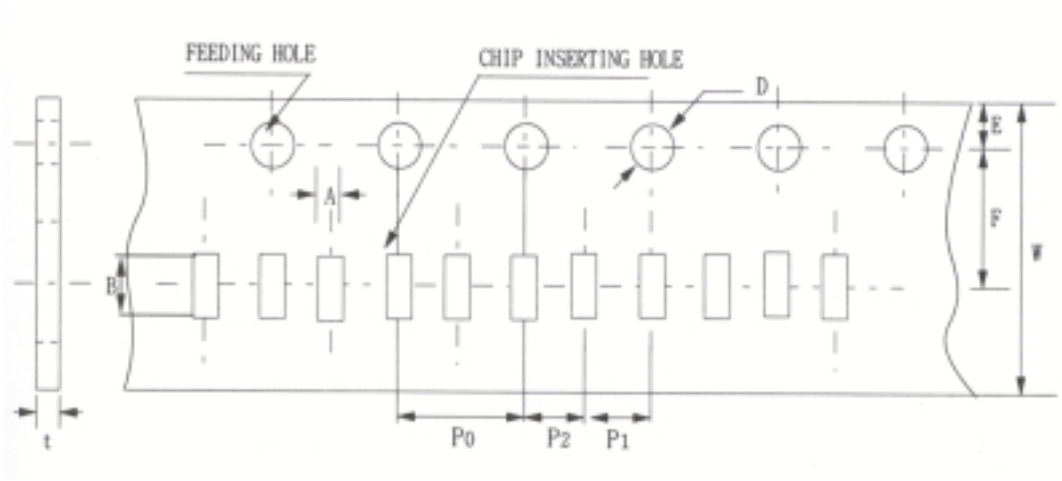
(UNIT :mm)

SYMBOL	W	F	E	P_1
DIMENSION	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1

SYMBOL	P_2	P_0	D	t
DIMENSION	2.0±0.05	4.0±0.1	ϕ1.5+0.1/-0	1.1 BELOW

TYPE	A	B
10	1.1 ± 0.2	1.9 ± 0.2
21	1.6 ± 0.2	2.4 ± 0.2
31	2.0 ± 0.2	3.6 ± 0.2

2) Paper tape chip section (for 05 type)



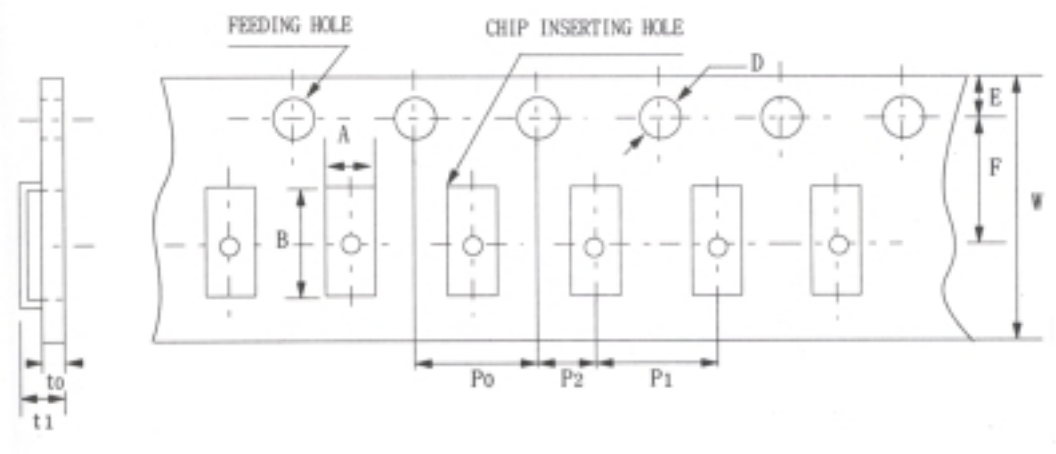
(UNIT :mm)

SYMBOL	W	F	E	P_1
DIMENSION	8.0±0.3	3.5±0.05	1.75±0.1	2.0±0.05

SYMBOL	P_2	P_0	D	t
DIMENSION	2.0±0.05	4.0±0.1	ϕ1.5+0.1/-0	0.6 ± 0.05

TYPE	A	B
05	0.65 ± 0.05 - 0.10	1.15 + 0.05 - 0.10

3) Plastic tape chip section



(UNIT :mm)

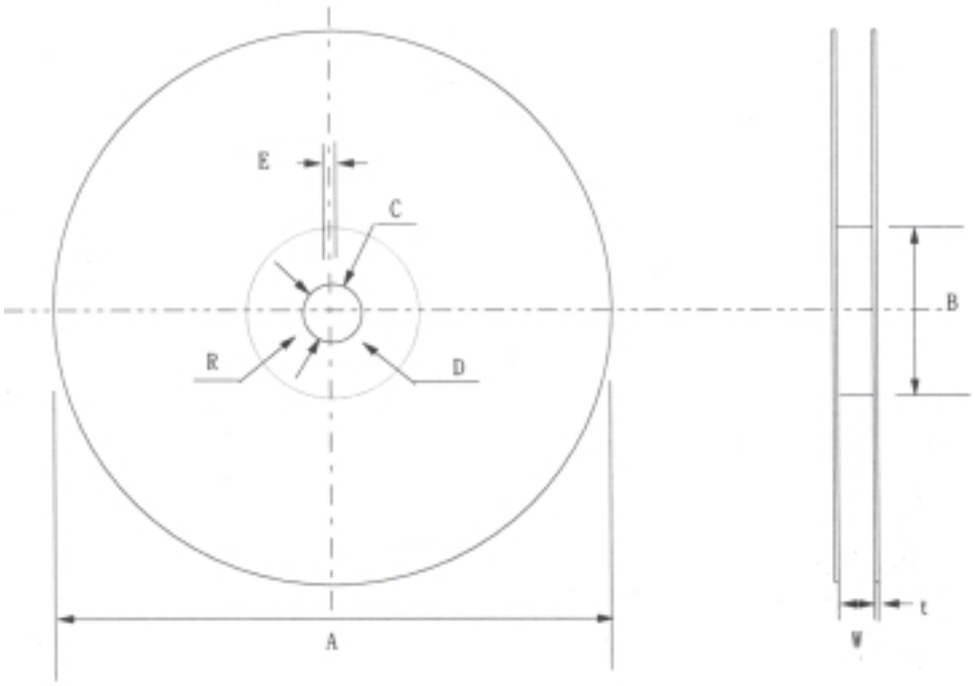
SYMBOL	W	F	E	P_1
DIMENSION	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1

SYMBOL	P_2	P_0	D	t
DIMENSION	2.0±0.05	4.0±0.1	ϕ1.5+0.1/-0	0.6 BELOW

SYMBOL	t1			
DIMENSION	2.5 Max			

TYPE	A	B
21	1.45 ± 0.2	2.3 ± 0.2
31	2.0 ± 0.2	3.6 ± 0.2

2-4 REEL SIZE



(UNIT :mm)

SYMBOL	A	B	C	D
DIMENSION	ϕ178±2.0	MIN. ϕ50	ϕ13±0.5	21±0.8

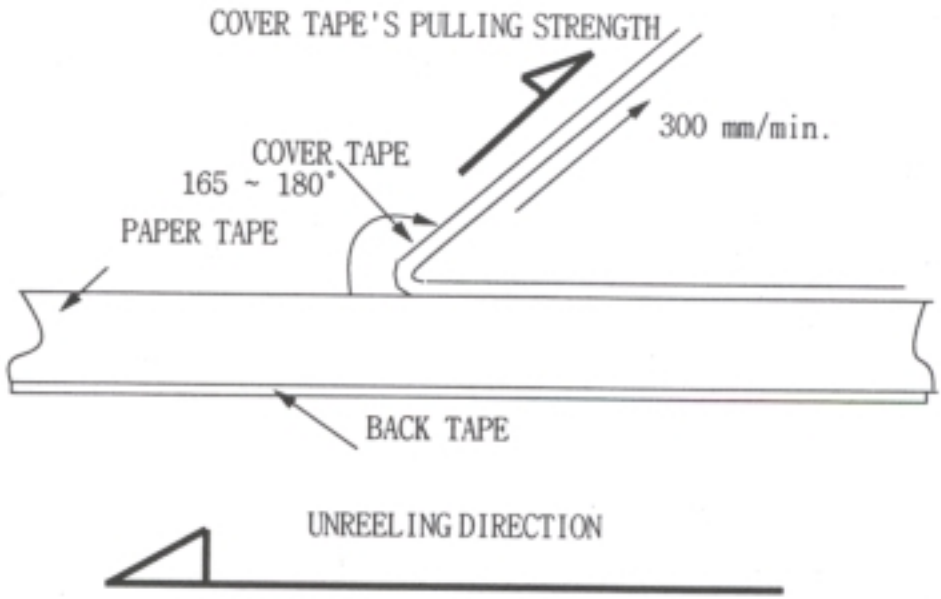
SYMBOL	E	W	t	R
DIMENSION	2.0±0.5	10±1.5	0.8±0.2	1.0

3. COVER TAPE REEL-OFF FORCE

3-1 PEEL-OFF FORCE

5 g.f ≤peel-off force ≤ 70 g.f

3-2 MEASURING METHOD



4. TAPING PACKING SPECIFICATION

4-1 MINIMUM BENDING RADIUS OF TAPING TAPE

There is no chip-out or paper broken, etc. until the 15mm of taping tape's bending radius.

4-2 ADHESION TO THE TAPE

There is no adhesion between the chips and the tapes (bottom & top tape).

4-3 CHIP HOLE'S CLEARANCE, ETC.

When it's time to peel-off the tape, there is no hindrance which is occurred by chip clearance, dirt and debris. also, mounting M/C's nozzle should not choked up by the paper's debris.

Ⅱ. BULK CASE PACKAGING

1. SCOPE

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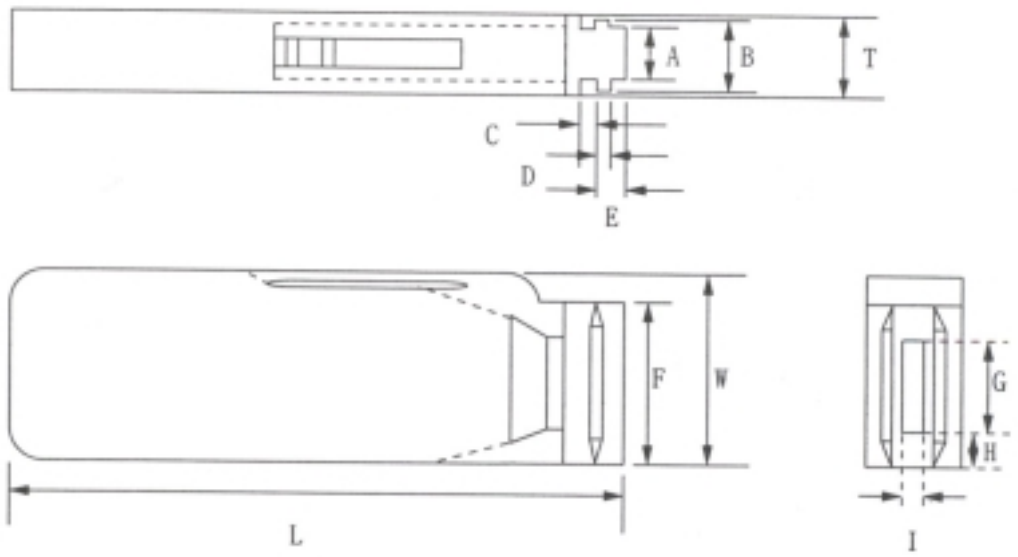
2. STRUCTURE AND DIMENSION



(UNIT :mm)

SYMBOL	A	B	T	C	D	E
DIMENSION	6.8±0.1	8.8±0.1	12±0.1	1.5 +0.1,-0	2+0/-0.1	4.7±0.1

SYMBOL	F	W	G	H	L	I
DIMENSION	31.5+0.2/-0	36+0/-0.2	19±0.35	7±0.35	110±0.7	5±0.35

3. MATERIAL AND PACKING QUANTITY

1) Material : ABS Plastic

2) Quantity

SIZE	05	10(0603)	21 (0805)	
			T≤0.85mm	T≥1.0mm
QUANTITY	80,000	15,000	10,000	5,000