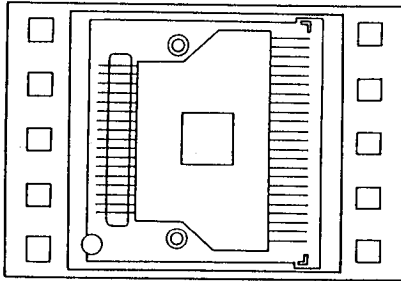


1. General Description**(1) Preface**

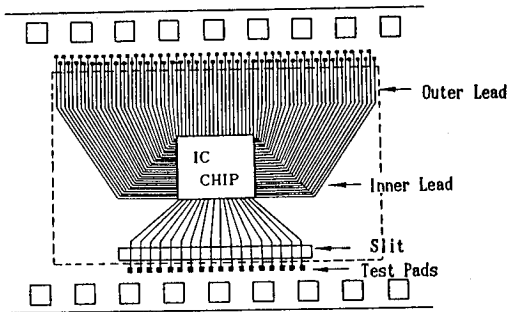
TCP (Tape Carrier Package) mount a LSI chip on the thin polyimide film directly. It applies to the small size LCD for communication equipment, pager and other handheld equipment which having a LCD display for its feature of flexible shape, smallness and thinness.

(2) Features of TCP

- High density mounting , downsizing and light weight of equipment
- Suitable for thin equipment
- Apply to the any kind of LCD driver

(3) Small Size LCD Driver TCP Example

2. Outline of TCP
(1) TCP Tape

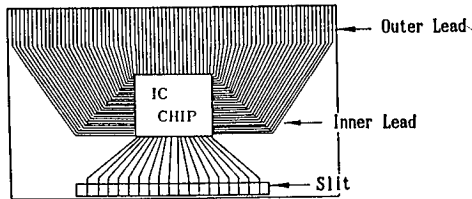


The circuit patterns are formed on the 35mm or 70mm width polyimide tape consecutively. The LSI is connected to the inner leads of the circuit patterns.

Gold bumps are formed on pads of the LSI by plating. The LSI is connected by the bumps.

Surface of LSI and inner leads are molded by the resin.

(2) After Punching



When using, TCP is punched one by one.

Normally, the outer leads are plated by tin.
(Gold plating is also available.)

There are two mount types of TCP.

Face-up -- LSI is attached to the polyimide side of the TCP.

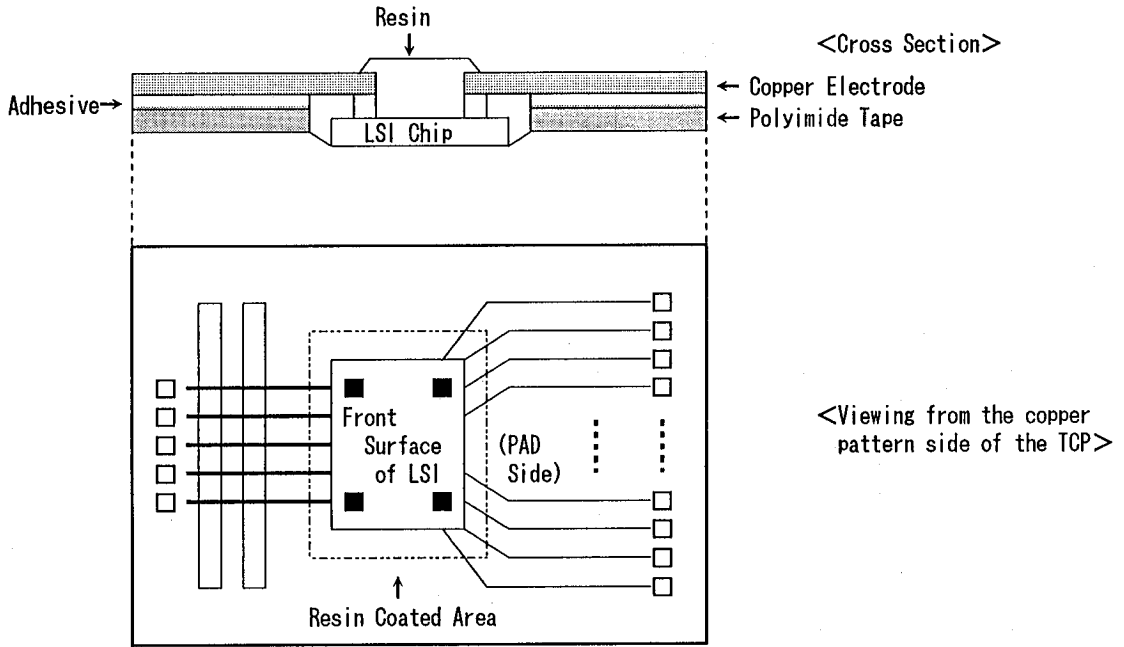
Face-down -- LSI is attached to the copper electrode side of the TCP.

The order of output terminals is just reversed by which type using face-up or face-down type.

When requesting the TCP designing to us, please take the order of output terminals and direction of chip face into consideration.

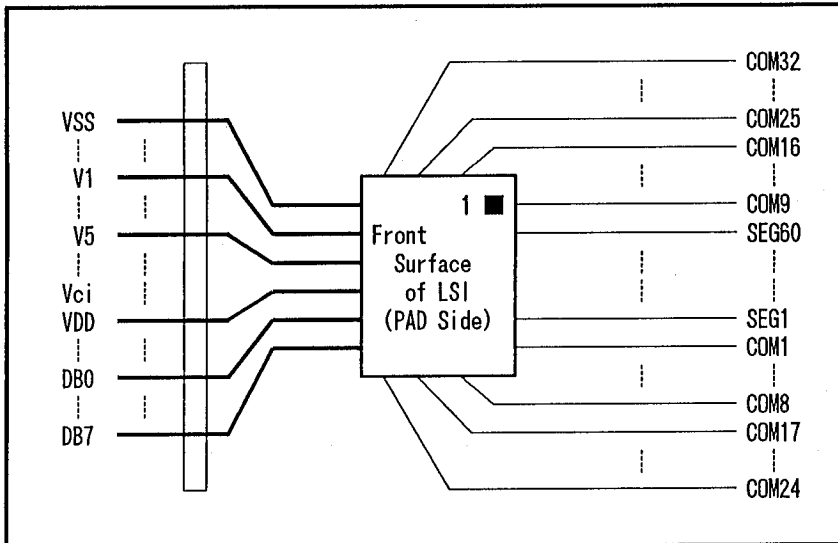
Note : In case of changing chip face direction (for example face-up to face-down) after making TCP tape , it may need remaking the TCP tape and its expenses.

(3) Face-up Type



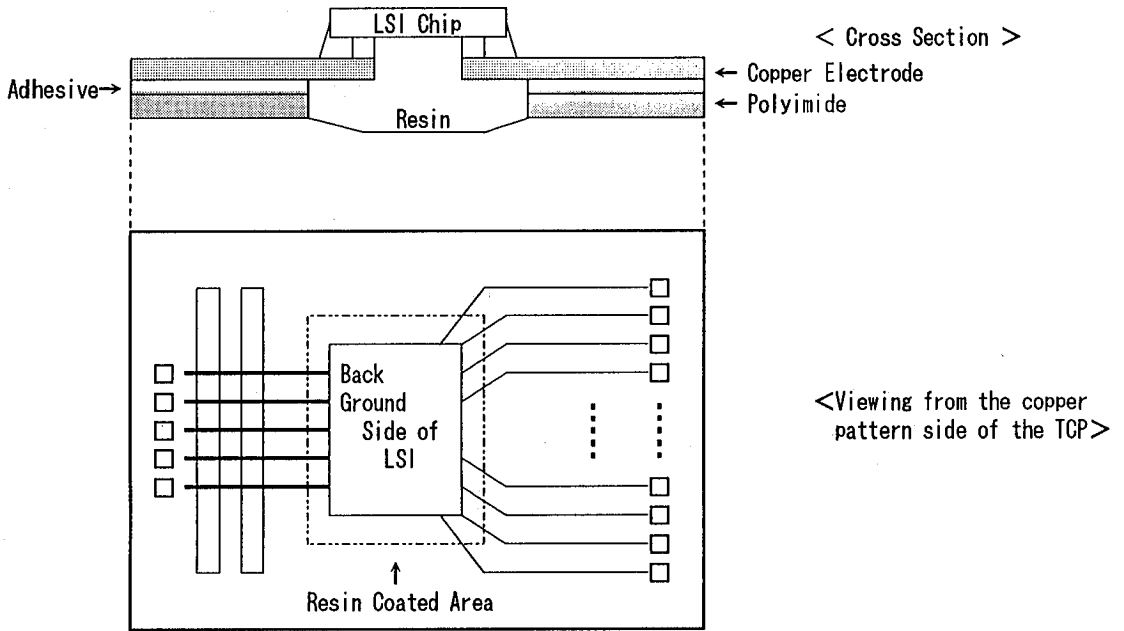
In case of the face-up type mounting, the surface of LSI (PAD Side) is up viewing from the copper electrode side of the TCP.

The face-up example of NJU6406B is in the following.



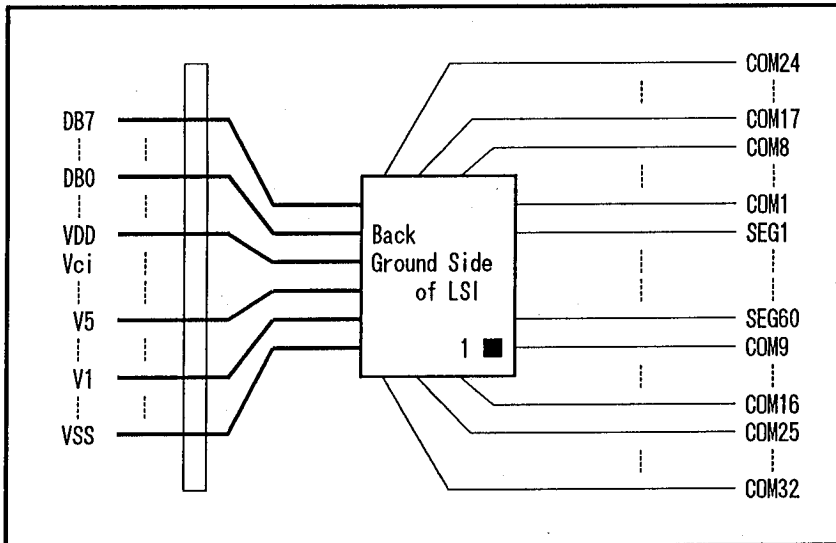
< Face-up example of NJU6406B >

(4) Face-down Type



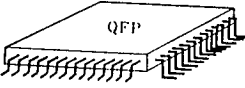
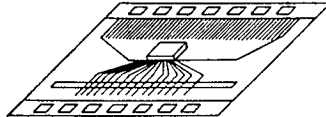
In case of the face-down type mounting, the back ground side of LSI is up viewing from copper electrode side of the TCP.

The face-down example of NJU6406B is in the following.



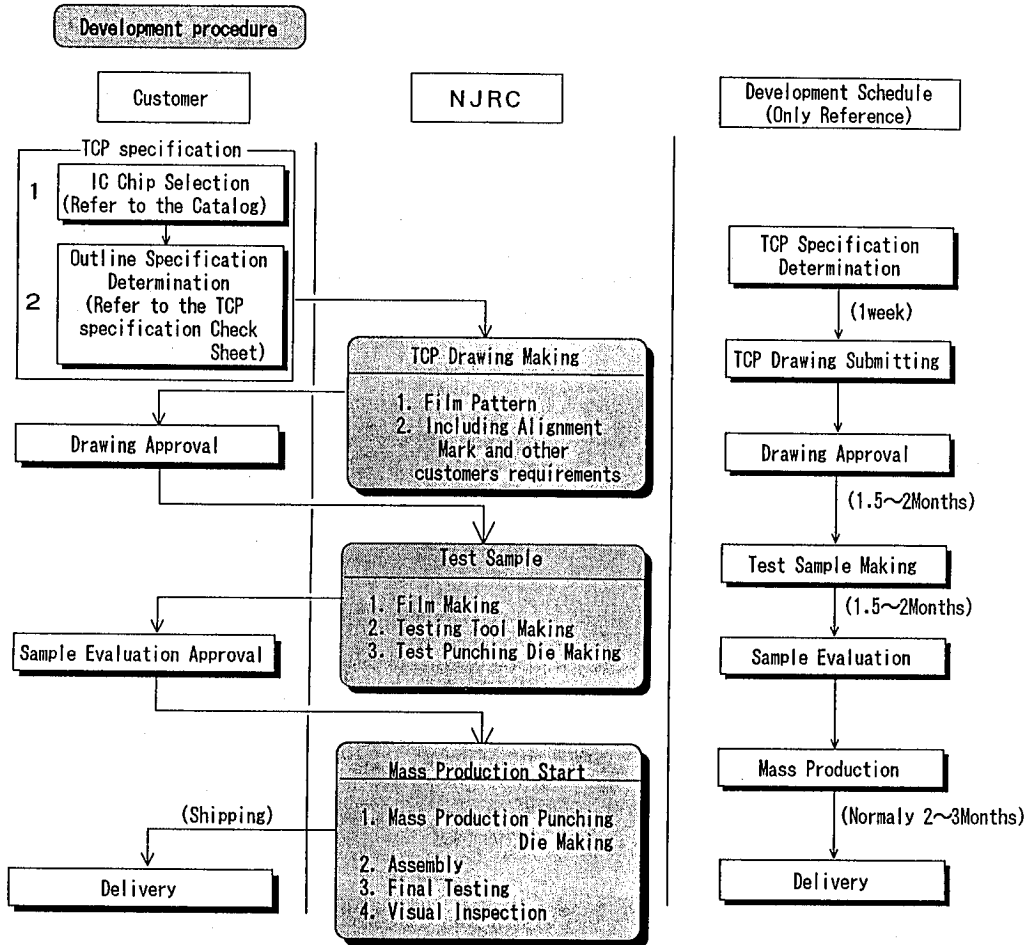
< Face-down example of NJU6406B >

3. Advantages of TCP

	QFP-100PIN	TCP
		
Weight	1.5g (QFP-100)	0.3g (Outline 24mm×34mm)
Thickness	2.9mm (MAX)	0.8mm (MAX)
Pin Number	Generally 100 pins MAX	300 pin MAX
Mounting Area	Normalize to 1	1/2 ~ 1/5

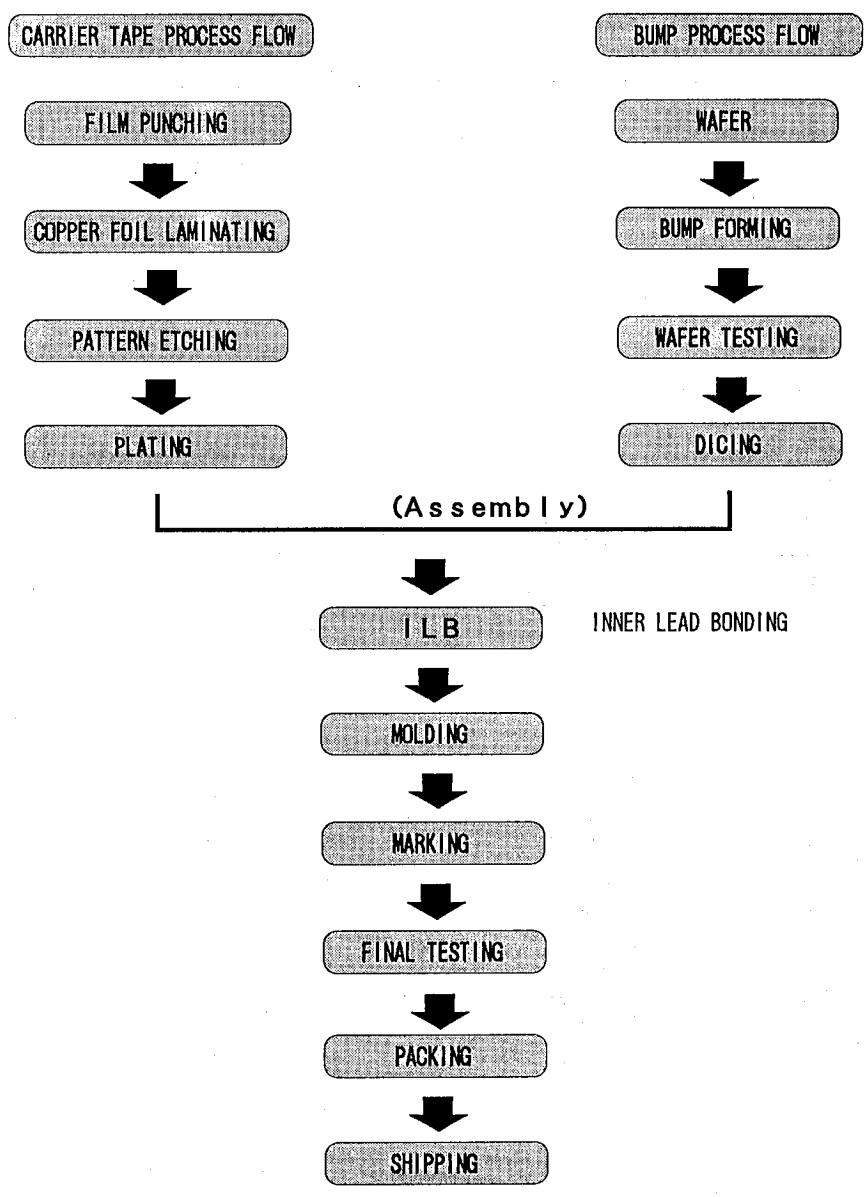
4. Procedure of TCP Development

NJRC will fully support to select the LCD driver, designing the tape layout according to customer's requirement, uses and purpose.



Note : Development schedule depends on outline specification and other specification of TCP.
Please contact us about the exact schedule.

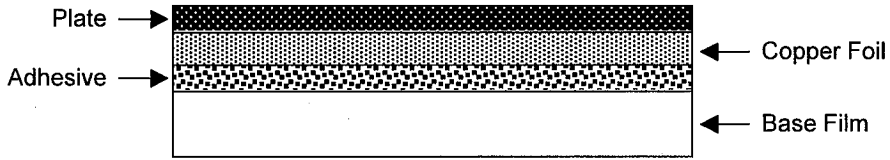
5. Flow Chart of TCP Process



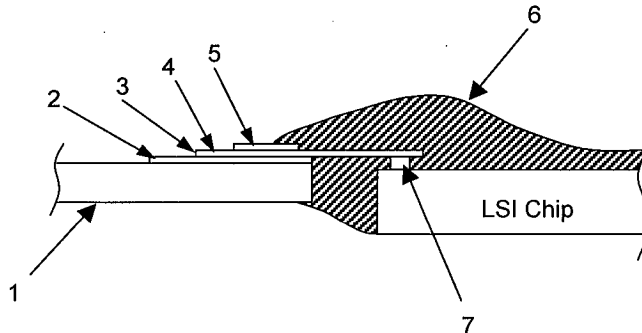
TCP MOUNTED LCD DRIVER

6. Example of TCP Cross Section Structure

(1) Structure of 3 Layer Tape



(2) Structure of TCP Cross Section(Face-up)



No.	Name	Material	Thickness
1	Base Film	UPILEX	35mm Wide → $75 \pm 8\mu\text{m}$ 70mm Wide → $75 \pm 8\mu\text{m}$
2	Adhesive	Epoxi type	$19\mu\text{m} \pm 4\mu\text{m}$
3	Conductor Layer	Electrolysis Copper Foil	$25\mu\text{m} \pm 5\mu\text{m}$
4	Plating	Au(Gold) Sn(Tin)	Au(Gold) → $0.3 \text{ to } 0.9 \pm 0.3\mu\text{m}$ Sn(Tin) → $0.2 \text{ to } 0.6 \pm 0.3\mu\text{m}$
5	Resist	Epoxi type	$25 \pm 20\mu\text{m}$
6	Sealing Material	Epoxi type	-
7	Bump	Au(Gold)	-
8	Thickness of TCP		Total 0.8mm(MAX)
	Thickness of Chip	Silicone	$400\mu\text{m} \pm 30\mu\text{m}$

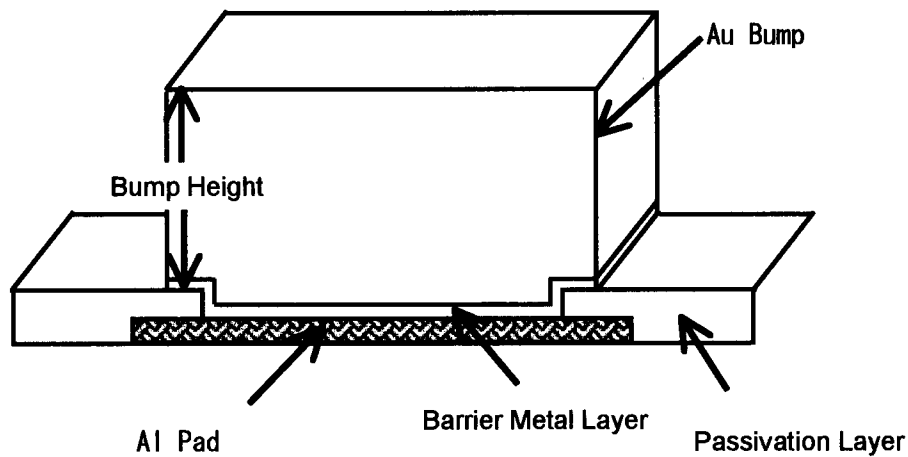
TCP MOUNTED LCD DRIVER

7.Bump

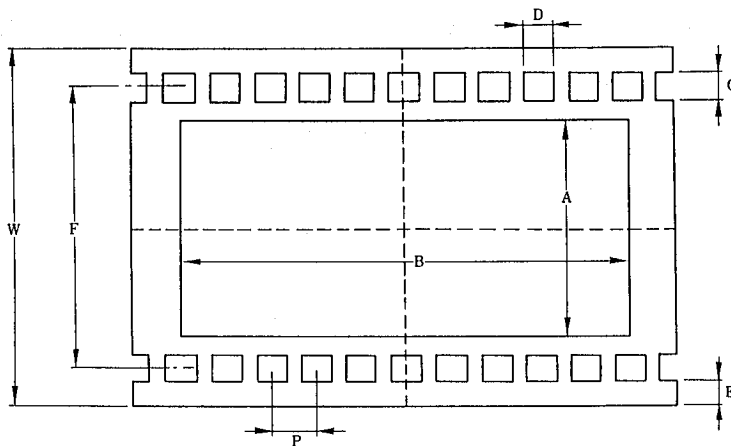
NJRC uses straight bump for TCP. The specification of the bump is shown in the following table.

Items	Specification
Chip Thickness	400 μ m, 625 μ m, 675 μ m
Chip Back Side	Back Ground Silicone
Bump Form	Straight
Bump Height	17.5 μ m \pm 4 μ m, 15 μ m \pm 4 μ m, 25 μ m \pm 4 μ m (Average in a lot)
Bump Hardness	30 to 70HV

Bump Structure



8. Specification of Carrier Tape



NJRC prepares two types of 35mm·Wide and 70mm·Wide TCP. When design the TCP specification referring to the dimensions in the following table.

Pads for testing (open - short test, final test) and plating lead pattern for Au Plating of inner/outer leads are include in the pattern effective area.

Therefore, please take the above pads area into consideration when designing the TCP size.

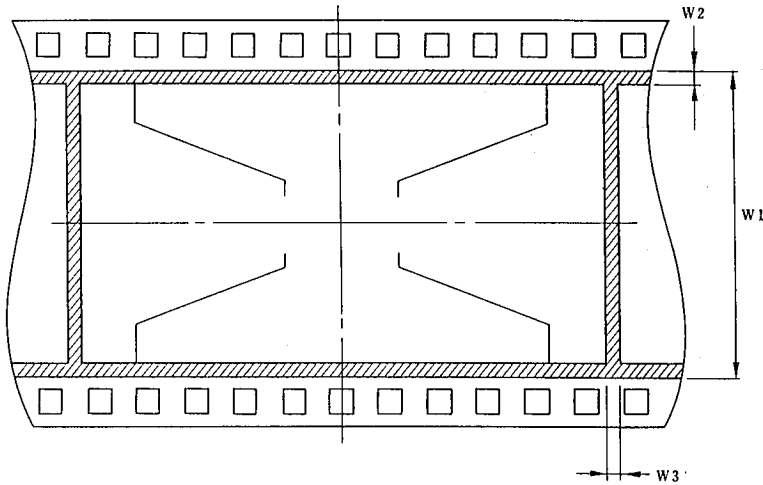
<Dimensions Table>

(Unit : mm)

Tape Format	Maximum Pattern Effective Area	Maximum Effective Length	Sprocket Hole		Distance from Tape Edge	Between Sprocket Center	Sprocket Hole Pitch	Tape Width	
	A	B	Height	Width					C
35mm Wide	25.00	60.0	1.981	1.981	2.01	28.977	4.75	34.975	
70mm Wide	59.00	66.5	1.981	1.981	2.01	63.949	4.75	69.950	

Note : If you need other tape specifications, please contact us anytime.

9. Plating Lead Pattern



In case of Au plating TCP, it needs plating lead pattern area (oblique line area) for Au evaporation.

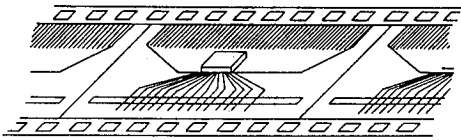
The pattern effective area is inside of plating lead pattern area.

The dimensions are shown in the following table.

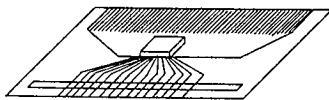
Symbol Tape Form	W1	W2	W3
35mm Wide	26.4MAX	0.5 \leq	0.3 \leq
70mm Wide	61.0MAX	0.5 \leq	0.3 \leq

(Unit : mm)

10. Connecting Method of the TCP to the LCD Panel



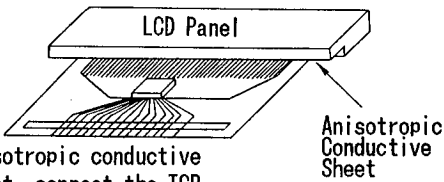
NJRC supplies the TCP by the roll up reel tape.
(Tray may be available. Please contact us.)



When using, punch the TCP one by one.

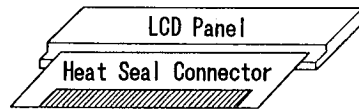


Example of Connecting Method using Anisotropic sheet

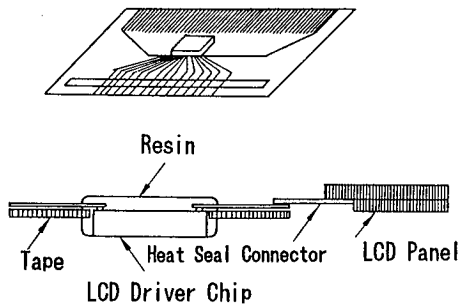
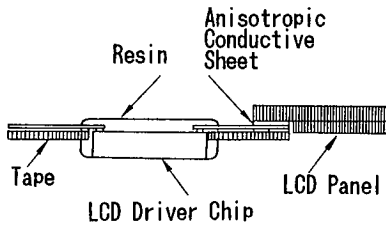


Anisotropic conductive sheet connect the TCP to the LCD panel by heat-press.

Example of Connecting Method using Heat Seal



Heat seal connector connect the TCP to the LCD panel by heat-press.





11. Reliability Tests

Test Item	Test Condition.	Test Time
Pressure Cooker Test	Ta=121(°C), 100(%RH), 2(kg/Cm ²)	500H
High Temperature Humidity Storage	Ta=60(°C), 90(%RH)	1000H
Temperature Humidity-Bias	Ta=85(°C), 85(%RH), V _{DD} =+5.5(V)	1000H
High Temperature Operating Life	Ta=125(°C), V _{DD} =+5.5(V)	1000H
Temperature Cycle	-55(°C)30min ~ 125(°C)30min 100cycles Atmospheric Phase	
High Temperature Storage	Ta=125(°C)	1000H
Low Temperature Storage	Ta=-40(°C)	1000H
Thermal Shock	0(°C)5min ~ 100(°C)5min 10cycles Liquid Phase	
Soldering Heat	260(°C), 10sec Lead Dipping	
Temperature Humidity Cycle	MIL-STD-883, 1004 10cycles Atmospheric Phase	
Vibration	10~55~10(Hz), Sweep time 1min, 1.5(mm) X, Y, Z 2HR each	
Solderability	230(°C), 5sec flux	
Lead Strength	90° → 180° → 90° → 0° → 90° Load 0g	

Note : Vibration, Solderability, Lead Strength are only for Reference.

TCP MOUNTED LCD DRIVER

12. LCD Driver Line-Up

Type No.	Function	Pin	Chip	Package	TCP
NJU6460A	16-character/1-line Dot Matrix LCD Controller Driver	75	✓	-	✓
NJU6408B NJU6468	8-character/2-line Dot Matrix LCD Controller Driver With Extension Function	80	✓	✓	✓
NJU6420B	16-character/2-line Dot Matrix LCD Controller Driver	100	✓	✓	-
NJU6423B/BL/BS	20-character/2-line Dot Matrix LCD Controller Driver	100	✓	✓	*
NJU6406B NJU6466	24-character/2-line Dot Matrix LCD Controller Driver	118	✓	-	*
NJU6425	10-character/3-line Dot Matrix LCD Controller Driver	100	-	✓	-
NJU6427	10-character/3-line+1segment Dot Matrix LCD Controller Driver	100	-	✓	-
NJU6426	8-character/4-line Dot Matrix LCD Controller Driver With Extension Function	100	✓	✓	-
NJU6467	12-character/1-line Dot Matrix LCD Controller Driver	64	✓	✓	-
NJU6428/29Series NJU6469	12-character/2-line Dot Matrix LCD Controller Driver	100	✓	✓	✓
NJU6461	12-character/2-line Dot Matrix LCD Controller Driver	138	✓	-	✓
NJU6424	10-character/3-line Dot Matrix LCD Controller Driver	100	✓	✓	-
NJU6620	12-character/4-line Dot Matrix LCD Controller Driver	146	✓	-	✓
NJU6520	14-character/2-line Dot Matrix LCD Controller Driver With Smooth Scroll Function	140	✓	-	✓
NJU6470	16-character/1-line Dot Matrix LCD Controller Driver With Key Scan Function	100	-	✓	-
NJU6623A	15-character/1-line Dot Matrix LCD Controller Driver With Output Port	100	-	✓	-
NJU6624A/B	12-character/1-line Dot Matrix LCD Controller Driver With Smooth Scroll Function	100	-	✓	-
NJU6624C	14-character/1-line Dot Matrix LCD Controller Driver With Key Scan Function	100	-	✓	-
NJU6636	16-character/2-line Dot Matrix LCD Controller Driver	185	✓	-	✓
NJU6637	16-character/3-line Dot Matrix LCD Controller Driver	122	✓	-	✓
NJU6407C/CR	Dot Matrix LCD 40-out segment Driver	56	✓	✓	-
NJU6417C	Dot Matrix LCD 40-out segment Driver	80	✓	✓	-
NJU6415/16/45/46	Dot Matrix LCD 80-out segment Driver	100	✓	✓	-
NJU6432B	Duplex LCD Driver	64	✓	✓	✓
NJU6533	1/3, 1/4 Duty LCD Driver	48	-	*	-
NJU6433	1/4 Duty LCD Driver	64	✓	✓	✓
NJU6435 Series	1/2, 1/3 Duty LCD Driver with Key Scan	64	✓	✓	-
NJU6535	1/3, 1/4 Duty LCD Driver	64	✓	✓	-
NJU6436	1/4 Duty LCD Driver with Key Scan	100	✓	✓	-
NJU6437	1/4 Duty LCD Driver	46	✓	-	✓
NJU6438	1/4 Duty LCD Driver	57	✓	-	✓
NJU6439	1/4 Duty LCD Driver	57	✓	-	✓
NJU6450A/52A NJU6570/72	16-common 61-segment Bit Map LCD Driver	100	✓	✓	✓
NJU6451A/53A NJU6457/58	80-segment Bit Map Extension LCD Driver	100	✓	✓	-
NJU6538 NJU6539	10-common 65-segment Bit Map LCD Driver With Key Scan Function	100	-	✓	-
NJU6575/A	33-common 134-segment Bit Map LCD Driver	239	✓	-	✓
NJU6578	33-common 102-segment Bit Map LCD Driver	200	✓	-	✓
NJU6674	39-common 132-segment Bit Map LCD Driver	248	✓	-	✓
NJU6675	58-common 96-segment Bit Map LCD Driver	187	✓	-	✓
NJU6576	34-common 101-segment Bit Map LCD Driver	207	✓	-	✓
NJU6580	17-common 96-segment Bit Map LCD Driver With Smooth Scroll Function	150	✓	-	✓
NJU6583	33-common 96-segment Bit Map LCD Driver With Smooth Scroll Function	165	✓	-	✓
NJU6673	25-common 100-segment Bit Map LCD Driver	212	✓	-	✓
NJU6676	65-common 132-segment Bit Map LCD Driver With Extension Function	272	✓	-	✓
NJU6655	65-common 160-segment Bit Map LCD Driver With Extension Function	330	✓	-	✓
NJU6677	88-common 132-segment Bit Map LCD Driver	258	✓	-	✓
NJU6678V	104-common 132-segment Bit Map LCD Driver	283	✓	-	✓
NJU6679	128-common 132-segment Bit Map LCD Driver	301	✓	-	✓
NJU6680	128-common 128-segment 4-level Gray Scale Bit Map LCD Driver	394	✓	-	✓
NJU6682	160-common 132-segment 4-level Gray Scale Bit Map LCD Driver	338	✓	-	✓
NJU6815	80 X RGB segment 128-common 4096-Color STN Map LCD Driver	620	✓	-	✓
NJU6818	104 X RGB segment 80-common 4096-Color STN Map LCD Driver	748	✓	-	✓
NJU6820	128 X RGB segment 40-common 4096-Color STN Map LCD Driver	806	✓	-	✓
NJU6824	128 X RGB segment 128-common 4096-Color STN Map LCD Driver	817	✓	-	✓
NJU6825	128 X RGB segment 162-common 4096-Color STN Map LCD Driver	236	-	-	✓
NJU6854	132 X RGB segment 132-common 65536-Color STN Map LCD Driver	761	✓	-	✓
NJU6855	128 X RGB segment 160-common 65536-Color STN Map LCD Driver	793	✓	-	✓

CHIP ✓ : Available - : Not Available
Package ✓ : QFP - : Not Available * : QFN
TCP ✓ : Custom TCP - : Not Available

TCP MOUNTED LCD DRIVER

13. TCP Specification Check Sheet

TCP SPECIFICATION CHECK SHEET

Check Item	Condition	Answer
1 LSI Chip	Please refer to our data book.	NJU _____
2 Mounting Direction of Chip Face	Face-up or Face-down ?	Face-up • Face-down
3 Tape Form	35mm Wide or 70mm Wide ?	_____ mm Wide
4 Plating	Tin(Sn) or Gold(Au) Plating ?	Tin(Sn) • Gold(Au)
5 Display Capacity	How many Character, Line , and Icon you need ?	Character : _____ Line : _____ Icon : _____
6 Input/Output Terminal	LCD Side <ul style="list-style-type: none"> • 7(8) COM drivers display 1 Line. • 5 SEG drivers display 1 Character. How many number of COM and SEG drivers you use? Which COM and SEG drivers you do not use ?	Using Drivers Number of COM : _____ Number of SEG : _____ Name of Unusing Drivers COM : _____ SEG : _____
	Interface Side <p>Use or unuse Cursor Line and COMMK ?</p> <p>How many interface terminals you are using ?</p> <p>*Please attach the copy of the pad location describes in each data sheet with put a circle around your using interface terminals.</p> <p>Note : (1) Two external capacitors required in doubler application and three external capacitors required in tripler application. (2) Some product having test terminal(s) we put the outer lead regardless your instruction.</p>	Cursor Line :USE • UNUSE COMMK :USE • UNUSE Total number of outer leads : _____
7 Bending	Bending is not guaranteed.	Please contact us if you need bending.
8 Flex	One Side or Both Side or No Need	• One Side • Both Side • No Need
9 Ship Out Form	Reel Form (Normal) Tray Form (Tray making charge necessary)	Reel • Tray

TCP MOUNTED LCD DRIVER

Check Item	Answer																		
10 Out Line (1)	<ul style="list-style-type: none"> When decide the size of TCP, please consider about the plating pattern area. <p style="margin-left: 20px;">Size of W1= mm , Size of H= mm</p> <div style="text-align: center; margin: 10px 0;"> </div>																		
11 Out Line (2)	<ul style="list-style-type: none"> When decide the size of TCP, please consider about the plating pattern area. <p style="margin-left: 20px;">Size of W2= mm , Size of H= mm</p> <div style="text-align: center; margin: 10px 0;"> </div>																		
12 Schedule and Q'ty Requirement	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="padding: 5px;">Process</th> <th style="padding: 5px;">1st E.S</th> <th style="padding: 5px;">2nd E.S</th> <th style="padding: 5px;">1st P.P</th> <th style="padding: 5px;">2nd P.P</th> <th style="padding: 5px;">M.P</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">Schedule</td> <td style="padding: 5px;">/</td> <td style="padding: 5px;">/</td> <td style="padding: 5px;">/</td> <td style="padding: 5px;">/</td> <td style="padding: 5px;">/</td> </tr> <tr> <td style="padding: 5px;">Q'ty</td> <td style="padding: 5px;">k</td> <td style="padding: 5px;">k</td> <td style="padding: 5px;">k</td> <td style="padding: 5px;">k</td> <td style="padding: 5px;">k</td> </tr> </tbody> </table> <p style="margin-top: 10px;">Total Lot k pcs.</p>	Process	1st E.S	2nd E.S	1st P.P	2nd P.P	M.P	Schedule	/	/	/	/	/	Q'ty	k	k	k	k	k
Process	1st E.S	2nd E.S	1st P.P	2nd P.P	M.P														
Schedule	/	/	/	/	/														
Q'ty	k	k	k	k	k														