

SPECIFICATIONS

CUSTOMER	:	PTC
SAMPLE CODE	:	SG12864LRU-FGAH04Q
MASS PRODUCTION CODE	:	PG12864LRU-FGAH04Q
SAMPLE VERSION	:	01
SPECIFICATIONS EDITION	:	001
DRAWING NO. (Ver.)	:	JLMD- PG12864LRU-FGAH04Q _001
PACKAGING NO. (Ver.)	:	-

Customer Approved

Date:

POWERTIP
2013.07.18
JS RD APPROVED

Approved	Checked	Designer
閔偉	劉進	周志仙

- ☒ Preliminary specification for design input
☐ Specification for sample approval

POWERTIP TECH. CORP.

Headquarters: No.8, 6th Road, Taichung Industrial Park,
Taichung, Taiwan
台中市 407 工業區六路 8 號

TEL: 886-4-2355-8168
FAX: 886-4-2355-8166

E-mail: sales@powertip.com.tw
[Http://www.powertip.com.tw](http://www.powertip.com.tw)

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Total: 24 Pages

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1. SPECIFICATIONS

1.1 Features

Item	Standard Value
Display Type	128 * 64 Dots
LCD Type	STN, YG , Transflective , Positive,Extended Temp
Driver Condition	LCD Module : 1/64Duty ,1/9Bias
Viewing Direction	6 O'clock
Backlight	YG LED B/L
Weight	-
Other(controller / driver IC)	SAP1024B / NT7086
ROHS	THIS PRODUCT CONFORMS THE ROHS OF PTC Detail information please refer web site : http://www.powertip.com.tw/news.php?area_id_view=1085560481/

1.2 Mechanical Specifications

Item	Standard Value	Unit
Outline Dimension	78.0 (L)* 70.0(W) *14.3MAX(H)	mm
Viewing Area	62.0(L) *44.0(W)	mm
Active Area	56.27(L) *38.35(W)	mm
Characters Size	0.39(L) *0.55(W)	mm
Characters Pitch	0.44(L) * 0.60(W)	mm

Note : For detailed information please refer to LCM drawing

1.3 Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Max.	Unit
Power Supply Voltage	V _{DD}	-	-0.3	7.0	V
LCD Driver Supply Voltage	V _{op}	-	0	30	V
Input Voltage	V _{IN}	-	-0.3	V _{DD} +0.3	V
Operating Temperature	T _{OP}	-	-20	70	°C
Storage Temperature	T _{ST}	-	-30	80	°C
Storage Humidity	H _D	Ta < 60 °C	-	90	%RH

1.4 DC Electrical Characteristics

$V_{DD}=5.0\pm0.5V, V_{SS}=0V, T_a = 25^{\circ}C$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Supply Voltage	V_{DD}	-	2.7	5	5.5	V
“H” Input Voltage	V_{IH}	-	$V_{DD}-2.2$	-	V_{DD}	V
“L” Input Voltage	V_{IL}	-	0	-	0.8	V
“H” Output Voltage	V_{OH}	-	$V_{DD}-0.3$	-	V_{DD}	V
“L” Output Voltage	V_{OL}	-	0	-	0.3	V
Supply Current	I_{DD}	$V_{DD}=5.0V; V_{OP}=TBD$ Pattern=TBD *1	-	TBD	TBD	mA
LCM Driver Voltage	$V_{OP}*2$	-20°C	TBD	TBD	TBD	V
		25°C	TBD	TBD	TBD	
		70°C	TBD	TBD	TBD	

Note :1.Maximum current display

2.The V_{OP} test point is $V_{DD} - V_o$.

1.5 Optical Characteristics

LCD Panel : 1/64Duty , 1/9Bias , $V_{LCD}=TBD$, $T_a=25^{\circ}C$

Item		Symbol	Conditions	Min.	Typ.	Max.	Unit	Reference
Response Time	Rise	tr	-	-	100	150	ms	Note 2
	Fall	tf		-	230	345		
Viewing angle range	Top	$\theta+$	$C \geq 2.0$	-	40	-	Deg.	Note 1
	Bottom	$\theta-$		-	40	-		
	Left	θL		-	40	-		
	Right	θR		-	40	-		
Contrast Ratio		C	-	-	5	-	-	Note 3
Average Brightness (with LCD) *2		IV	IF=350mA	TBD	TBD	-	cd/m2	Note 4
CIE Color Coordinate (With LCD)	X			TBD	TBD	TBD	-	
	Y			TBD	TBD	TBD	-	
Uniformity *1		ΔB		70	-	-	%	

Note 4 :

1 : $\Delta B = B(\min) / B(\max) * 100\%$

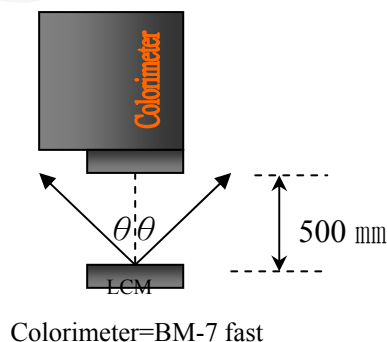
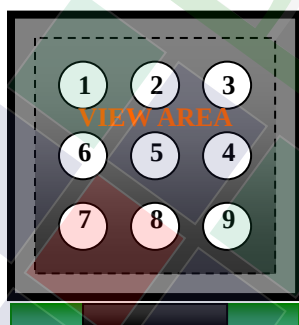
2 : Measurement Condition for Optical Characteristics:

a : Environment: $25^{\circ}C \pm 5^{\circ}C$ / $60 \pm 20\% R.H$, no wind , dark room below 10 Lux at typical lamp current and typical operating frequency.

b : Measurement Distance: 500 ± 50 mm , ($\theta = 0^{\circ}$)

c : Equipment: TOPCON BM-7 fast , (field 1°) , after 10 minutes operation.

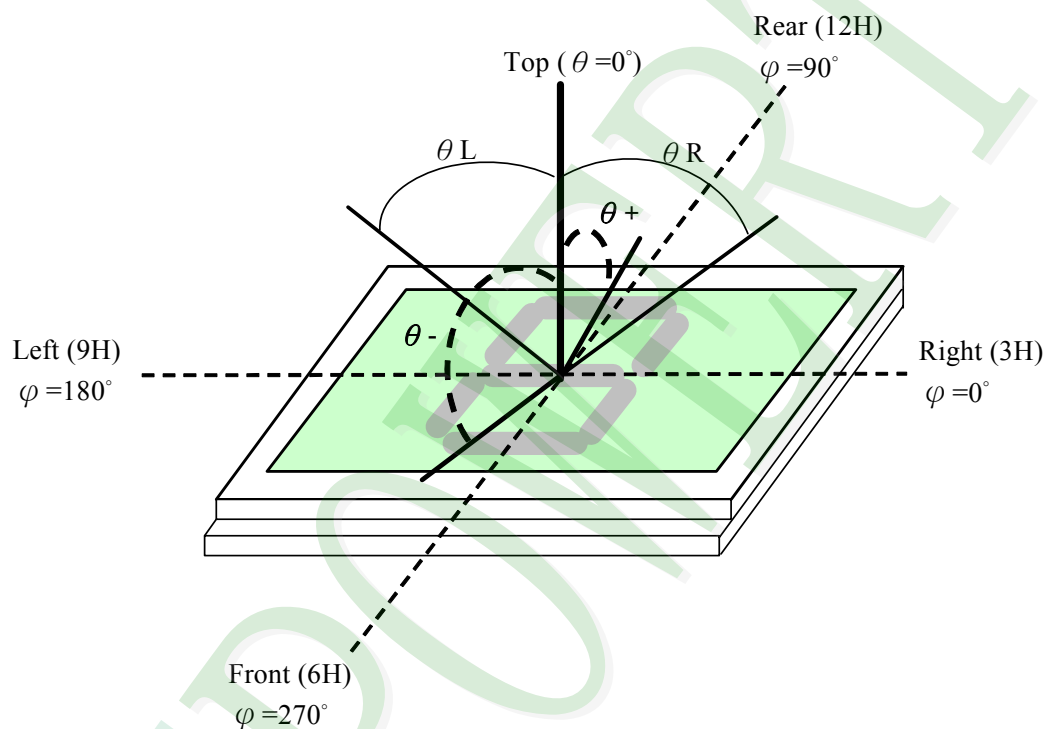
d : The uncertainty of the C.I.E coordinate measurement ± 0.01 , Average Brightness $\pm 4\%$



Note 1.

Optical characteristics-2

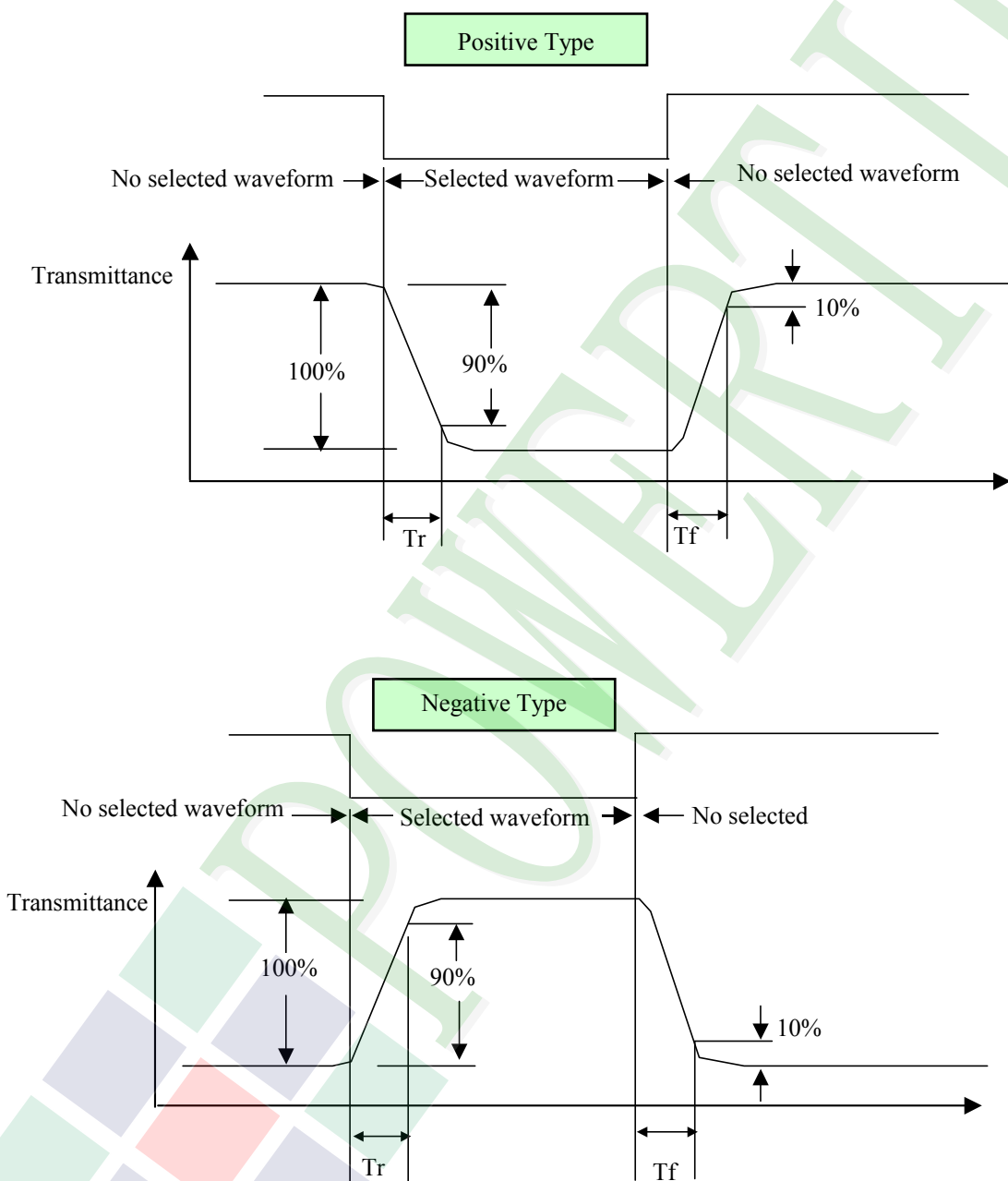
Viewing angle



Note 2.

Optical characteristics-3

Fig.2 Definition of response time



Electrical characteristics-2

※2 Drive waveform

V_{op} : Drive voltage

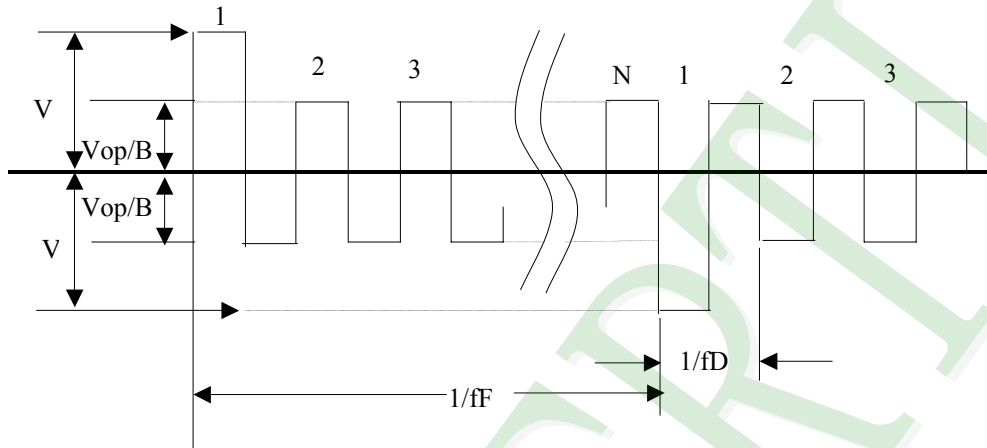
$1/B$: Bias

N : Duty

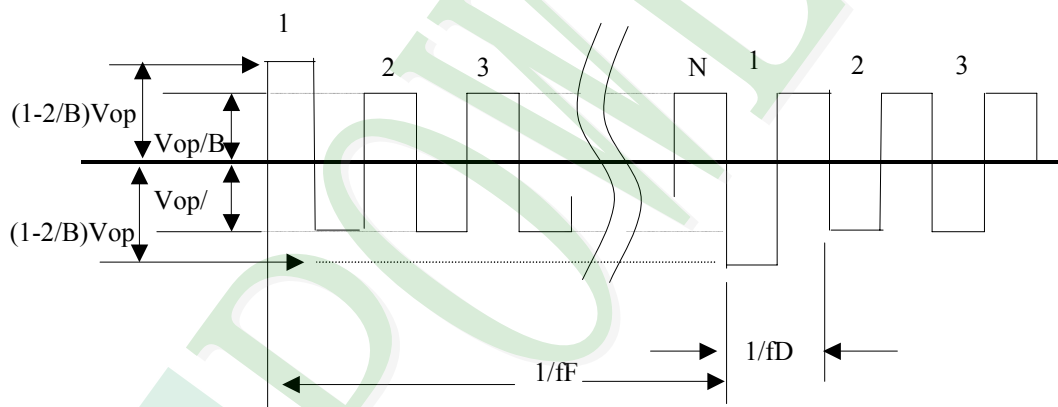
f_F : Frame frequency

f_D : Drive frequency

(1) Selected waveform



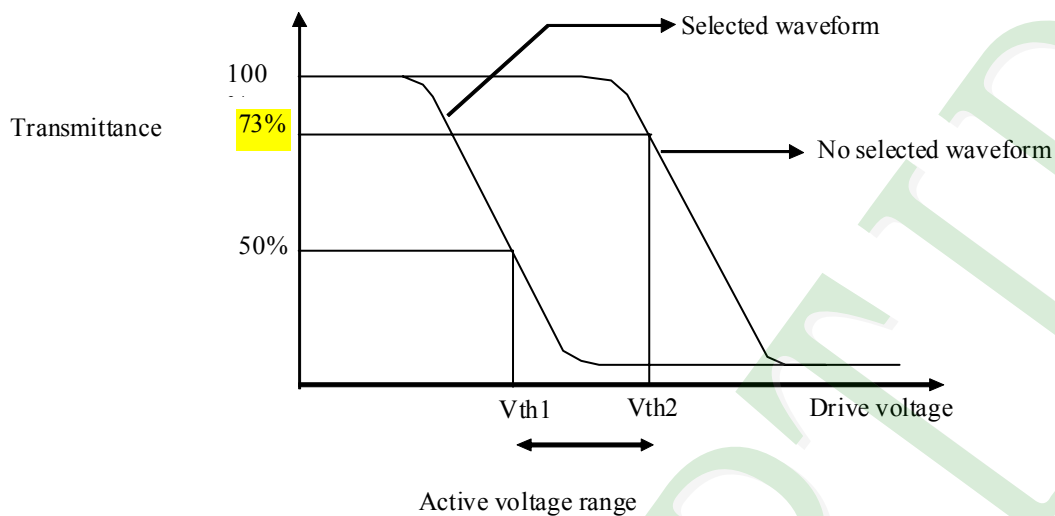
(2) Non- Selected wave form



Note:

Frame frequency is defined as follows: Common side supply voltage peak - to - peak / 2 = 1 period

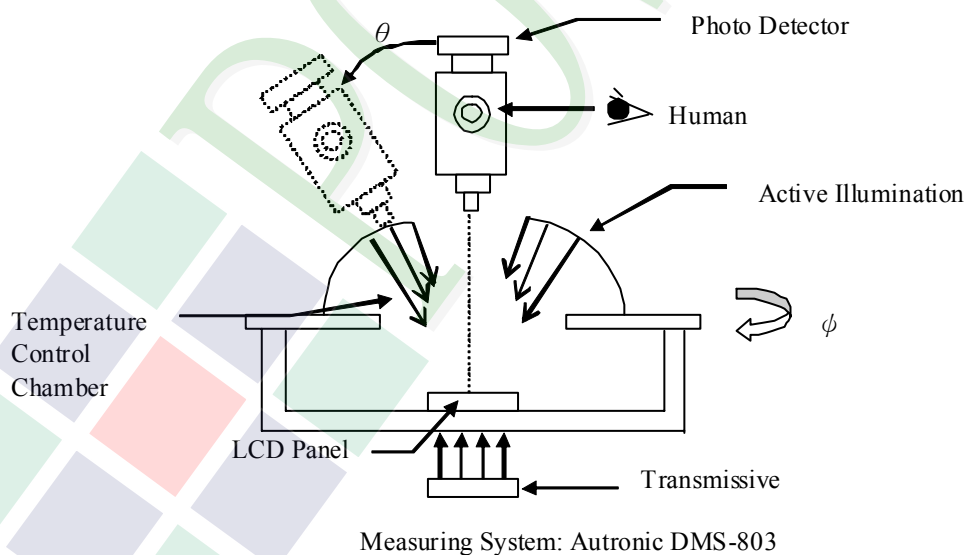
Note 3.: Definition of Vth



	V_{th1}	V_{th2}
View direction	10°	40°
Drive waveform	(Selected waveform)	(No selected waveform)
Transmittance	50%	73%

※1 Contrast ratio
 = (Brightness in OFF state) / (Brightness in ON state)

Outline of Electro-Optical Characteristics Measuring System



1.6 Backlight Characteristics

Maximum Ratings

Item	Symbol	Conditions	Min.	Typ	Max.	Unit
Forward Current	IF	Ta =25°C	-	-	875	mA
Reverse Voltage	VR	Ta =25°C	-	-	10	V
Power Dissipation	PO	Ta =25°C	-	-	4.025	W

Electrical / Optical Characteristics

Electrical / Optical Characteristics						
Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Reverse Current	IR	VR=10V	-	-	0.35	mA
Forward Voltage	VF	IF=350mA	-	4.2	4.6	V
Luminous Intensity (without LCD)	IV		220	270	-	cd/m ²
Dominant wavelength	λ_D		569	-	576	Nm
Color	Yellow-green					

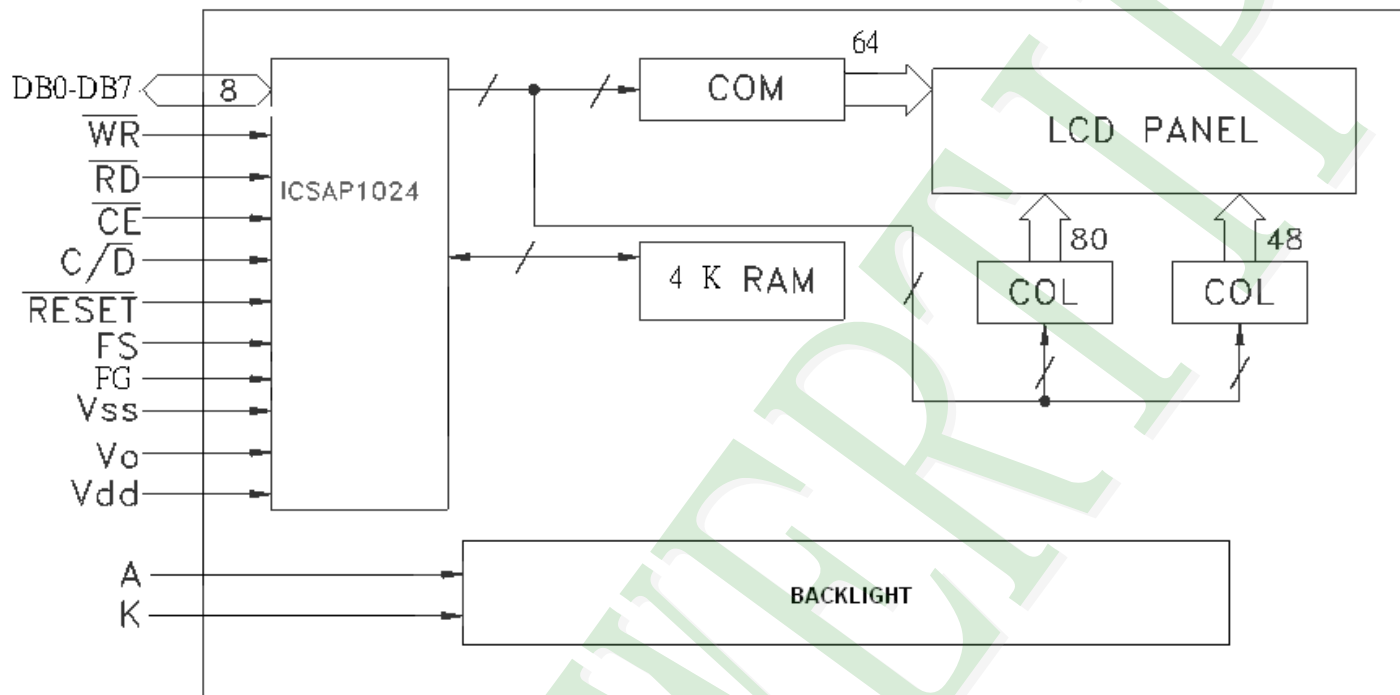
2. MODULE STRUCTURE

2.1 Counter Drawing

2.1.1 LCM Mechanical Diagram

* See Appendix

2.1.2 Block Diagram

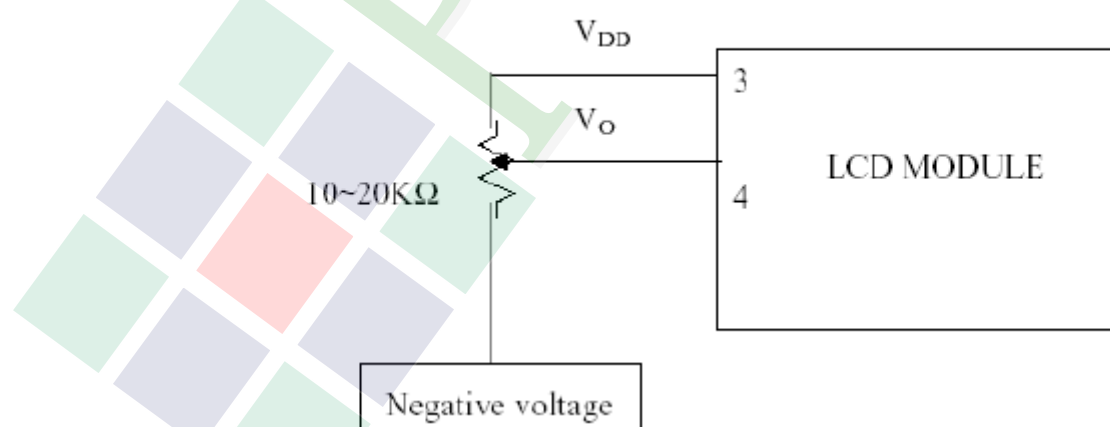


2.2 Interface Pin Description

Pin No.	Symbol	Function
1	FG	Frame ground (connected to metal bezel)
2	V _{SS}	Power Supply (V _{SS} =0);Power supply for LED B/L(-)
3	V _{DD}	Power Supply (V _{DD} >V _{SS}); Power supply for LED B/L(+)
4	V _O	Operating voltage for LCD (variable)
5	$\overline{\text{WR}}$	Data write (write data to the module at "L")
6	$\overline{\text{RD}}$	Data read (read data from the module at "L")
7	$\overline{\text{CE}}$	Chip enable for the module (active at "L")
8	$\text{C}/\overline{\text{D}}$	$\text{C}/\overline{\text{D}} = \text{"H"} : \text{read or write command}$ $\text{C}/\overline{\text{D}} = \text{"L"} : \text{read or write data.}$
9	$\overline{\text{RESET}}$	Controller reset (module reset)
10~17	DB0~DB7	Data bus (DB0=MSB, DB7=LSB)
18	FS	Font select :open or connect to V _{DD} : 6*8 Dots font connect to V _{SS} : 8*8 Dots font

2.2.1 Application Notes

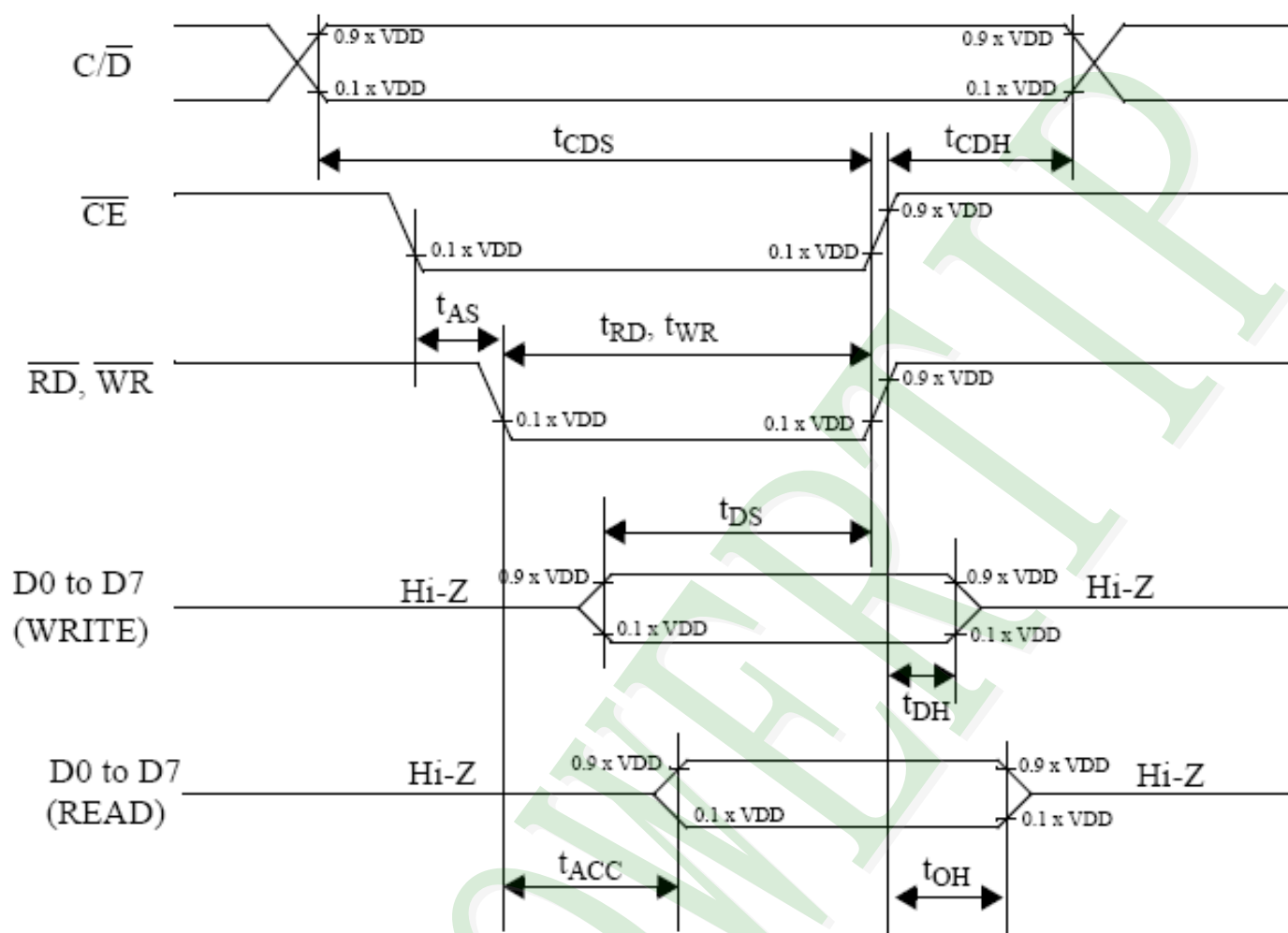
Contrast Adjust



2.2.2 Refer Initial code

TBD

2.3 Timing Characteristics

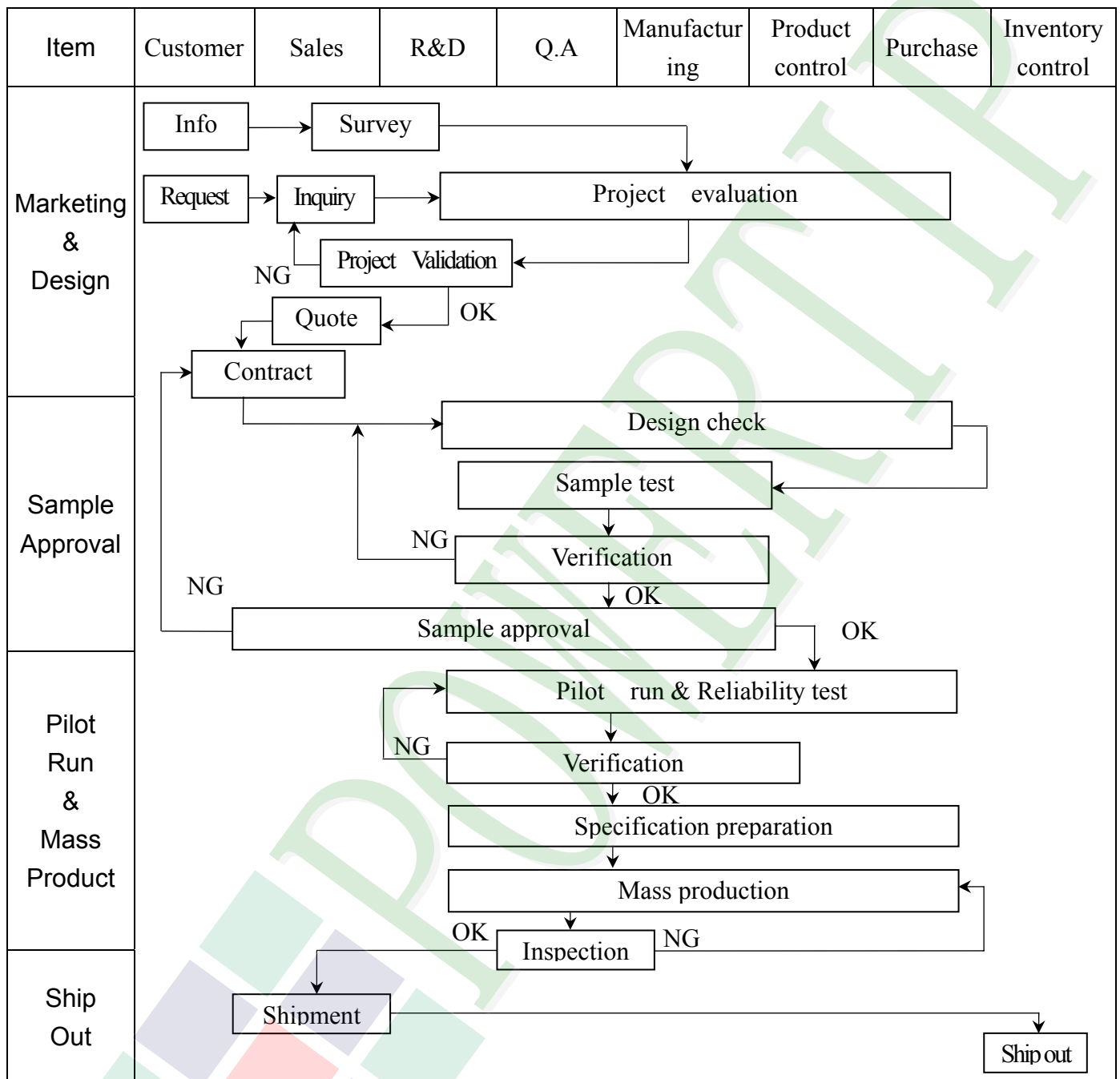


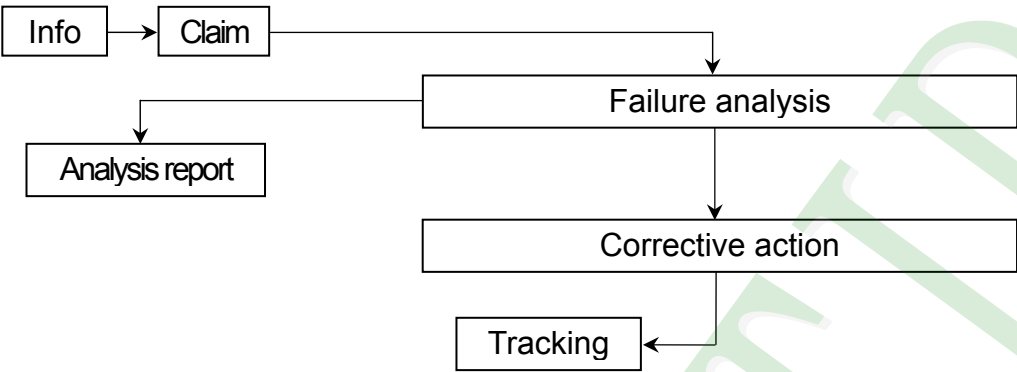
$V_{DD} = 5 V \pm 10\%$; $V_{SS} = 0 V$; $T_{amb} = -20^{\circ}C$ to $+70^{\circ}C$.

symbol	parameter	MIN.	MAX.	test conditons	Unit
t_{CDS}	$\overline{C/D}$ set-up time	100			ns
t_{CDH}	$\overline{C/D}$ hold time	10			ns
t_{RD}, t_{WR}	$\overline{RD}, \overline{WR}$ pulse width	80			ns
t_{AS}	Address set-up time	0			ns
t_{AH}	Address hold time	0			ns
t_{DS}	Data set-up time	80			ns
t_{DH}	Data hold time	40		Note	ns
t_{ACC}	Access time		150	Note	ns
t_{OH}	Output hold time	10	50	Note	ns

3. QUALITY ASSURANCE SYSTEM

3.1 Quality Assurance Flow Chart



Item	Customer	Sales	R&D	Q.A	Manufacturing	Product control	Purchase	Inventory control
Sales Service	 <pre> graph TD Info[Info] --> Claim[Claim] Claim --> Failure[Failure analysis] Claim --> Report[Analysis report] Failure --> Action[Corrective action] Action --> Tracking[Tracking] </pre>							
Q.A Activity	1. ISO 9001 Maintenance Activities 3. Equipment calibration 5. Standardization Management				2. Process improvement proposal 4. Education And Training Activities			

3.2 Inspection Specification

◆Scope : The document shall be applied to LCD Module for Monotype and Color STN(Ver. B01).

◆Inspection Standard : MIL-STD-105E Table Normal Inspection Single Sampling Level II .

◆Equipment : Gauge 、MIL-STD 、Powertip Tester 、Sample

◆Defect Level : Major Defect AQL : 0.4 ; Minor Defect : AQL : 1.5 .

◆OUT Going Defect Level : Sampling .

◆Manner of appearance test :

(1). The test be under 20W×2 fluorescent light ' and distance of view must be at 30 cm.

(2). Standard of inspection : (Unit : mm)

(3). The test direction is base on about around 45° of vertical line. (Fig. 1)

(4). Definition of area . (Fig. 2)

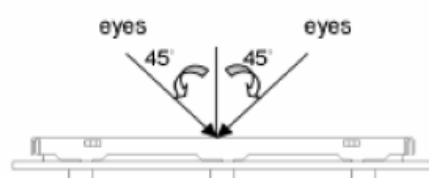


Fig.1

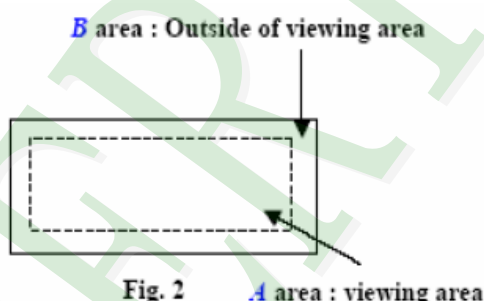


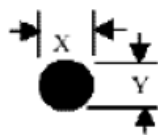
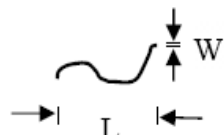
Fig. 2

◆ Specification:

NO	Item	Criterion	Level
01	Product condition	1. 1 The part number is inconsistent with work order of Production.	Major
		1. 2 Mixed production types.	Major
		1. 3 Assembled in inverse direction.	Major
02	Quantity	2. 1 The quantity is inconsistent with work order of production.	Major
03	Outline dimension	3. 1 Product dimension and structure must conform to Structure diagram.	Major
04	Electrical Testing	4. 1 Missing line character and icon.	Major
		4. 2 No function or no display.	Major
		4. 3 Output data is error.	Major
		4. 4 LCD viewing angle defect.	Major
		4. 5 Current consumption exceeds product specifications.	Major

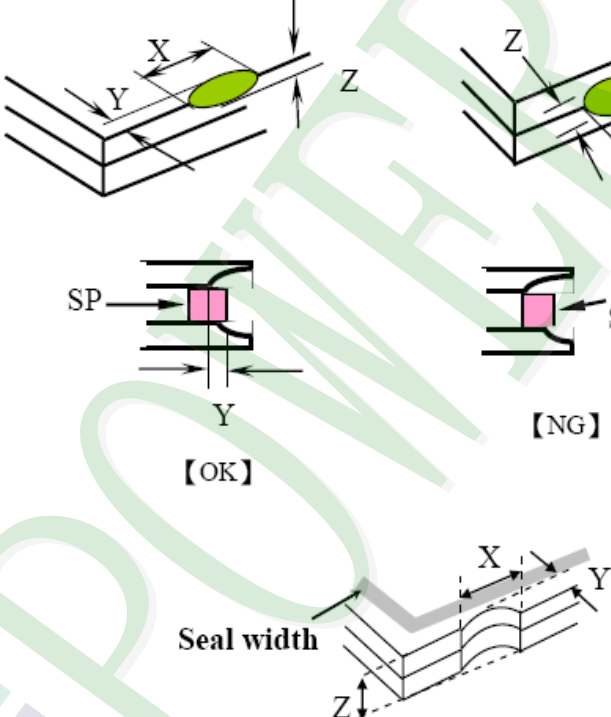
◆ Specification For Monotype and Color STN :

(Ver. B01)

NO	Item	Criterion	Level																																			
05	Black or white dot 、 scratch 、 contamination Round type  $\Phi=(x+y)/2$ Line type 	5. 1 Round type: 5. 1. 1 display only : • White and black spots on display ≤ 0.30 mm , no more than 4 white or black spots present. • Densely spaced : NO more than two spots or lines within 3 mm. 5. 1. 2 Non-display : <table><tr><th rowspan="2">Dimension (diameter : Φ)</th><th colspan="2">Acceptance (Q'ty)</th></tr><tr><th>A area</th><th>B area</th></tr><tr><td>$\Phi \leq 0.10$</td><td>Accept no dense</td><td rowspan="4">Ignore</td></tr><tr><td>$0.10 < \Phi \leq 0.20$</td><td>3</td></tr><tr><td>$0.20 < \Phi \leq 0.30$</td><td>2</td></tr><tr><td>Total quantity</td><td>4</td></tr></table> 5. 1. 3 Line type: <table><tr><th colspan="2">Dimension</th><th colspan="2">Acceptance (Q'ty)</th></tr><tr><th>Length (L)</th><th>Width (W)</th><th>A area</th><th>B area</th></tr><tr><td>---</td><td>$W \leq 0.03$</td><td>Accept no dense</td><td rowspan="3">Ignore</td></tr><tr><td>$L \leq 3.0$</td><td>$0.03 < W \leq 0.05$</td><td rowspan="2">4</td></tr><tr><td>$L \leq 2.5$</td><td>$0.05 < W \leq 0.075$</td></tr><tr><td>---</td><td>$W > 0.075$</td><td colspan="2">As round type</td></tr></table>	Dimension (diameter : Φ)	Acceptance (Q'ty)		A area	B area	$\Phi \leq 0.10$	Accept no dense	Ignore	$0.10 < \Phi \leq 0.20$	3	$0.20 < \Phi \leq 0.30$	2	Total quantity	4	Dimension		Acceptance (Q'ty)		Length (L)	Width (W)	A area	B area	---	$W \leq 0.03$	Accept no dense	Ignore	$L \leq 3.0$	$0.03 < W \leq 0.05$	4	$L \leq 2.5$	$0.05 < W \leq 0.075$	---	$W > 0.075$	As round type		Minor
Dimension (diameter : Φ)	Acceptance (Q'ty)																																					
	A area	B area																																				
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---	$W > 0.075$	As round type																																				
06	Polarizer Bubble	<table><tr><th rowspan="2">Dimension (diameter : Φ)</th><th colspan="2">Acceptance (Q'ty)</th></tr><tr><th>A area</th><th>B area</th></tr><tr><td>$\Phi \leq 0.20$</td><td>Accept no dense</td><td rowspan="4">Ignore</td></tr><tr><td>$0.20 < \Phi \leq 0.50$</td><td>3</td></tr><tr><td>$0.50 < \Phi \leq 1.00$</td><td>2</td></tr><tr><td>$\Phi > 1.00$</td><td>0</td></tr><tr><td>Total quantity</td><td>4</td><td colspan="2"></td></tr></table>	Dimension (diameter : Φ)	Acceptance (Q'ty)		A area	B area	$\Phi \leq 0.20$	Accept no dense	Ignore	$0.20 < \Phi \leq 0.50$	3	$0.50 < \Phi \leq 1.00$	2	$\Phi > 1.00$	0	Total quantity	4			Minor																	
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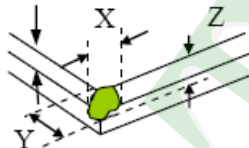
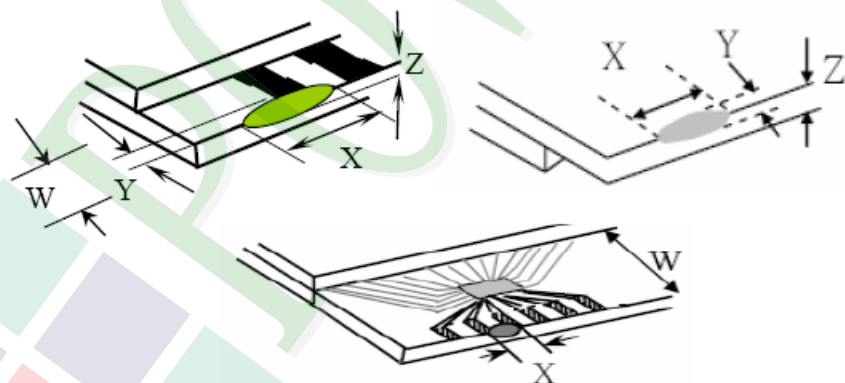
◆ Specification For Monotype and Color STN :

(Ver. B01)

NO	Item	Criterion	Level									
07	The crack of glass	Symbols : X : The length of crack Z : The thickness of crack t : The thickness of glass Y : The width of crack. W : terminal length a : LCD side length 7.1 General glass chip : 7.1.1 Chip on panel surface and crack between panels:  <table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>$\leq a$</td><td>Crack can't enter viewing area</td><td>$\leq 1/2 t$</td></tr><tr><td>$\leq a$</td><td>Crack can't exceed the half of SP width.</td><td>$1/2 t < Z \leq 2 t$</td></tr></table>	X	Y	Z	$\leq a$	Crack can't enter viewing area	$\leq 1/2 t$	$\leq a$	Crack can't exceed the half of SP width.	$1/2 t < Z \leq 2 t$	Minor
		X	Y	Z								
$\leq a$	Crack can't enter viewing area	$\leq 1/2 t$										
$\leq a$	Crack can't exceed the half of SP width.	$1/2 t < Z \leq 2 t$										

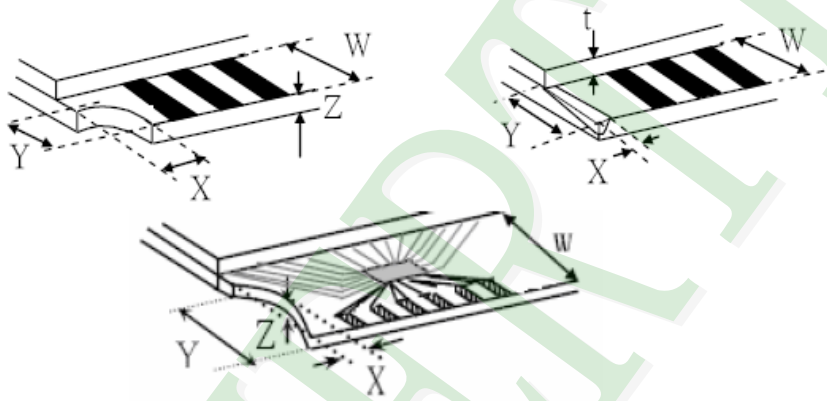
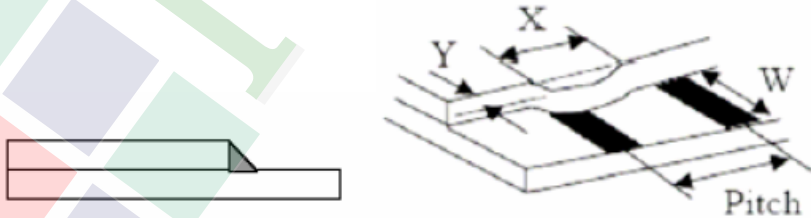
◆ Specification For Monotype and Color STN :

(Ver. B01)

NO	Item	Criterion	Level									
07	The crack of glass	Symbols : X : The length of crack Z : The thickness of crack t : The thickness of glass Y : The width of crack. W : terminal length a : LCD side length 7.1.2 Corner crack :  <table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>$\leq 1/5 a$</td><td>Crack can't enter viewing area</td><td>$Z \leq 1/2 t$</td></tr><tr><td>$\leq 1/5 a$</td><td>Crack can't exceed the half of SP width.</td><td>$1/2 t < Z \leq 2 t$</td></tr></table>	X	Y	Z	$\leq 1/5 a$	Crack can't enter viewing area	$Z \leq 1/2 t$	$\leq 1/5 a$	Crack can't exceed the half of SP width.	$1/2 t < Z \leq 2 t$	Minor
		X	Y	Z								
$\leq 1/5 a$	Crack can't enter viewing area	$Z \leq 1/2 t$										
$\leq 1/5 a$	Crack can't exceed the half of SP width.	$1/2 t < Z \leq 2 t$										
7.2 Protrusion over terminal : 7.2.1 Chip on electrode pad :  <table><tr><th></th><th>X</th><th>Y</th><th>Z</th></tr><tr><td>Front</td><td>$\leq a$</td><td>$\leq 1/2 W$</td><td>$\leq t$</td></tr><tr><td>Back</td><td colspan="3">Neglect</td></tr></table>		X	Y	Z	Front	$\leq a$	$\leq 1/2 W$	$\leq t$	Back	Neglect		
	X	Y	Z									
Front	$\leq a$	$\leq 1/2 W$	$\leq t$									
Back	Neglect											

◆ Specification For Monotype and Color STN :

(Ver. B01)

NO	Item	Criterion	Level									
07	The crack of glass	Symbols : X : The length of crack Z : The thickness of crack t : The thickness of glass Y : The width of crack. W : terminal length a : LCD side length	Minor									
		7.2.2 Non-conductive portion :  <table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>$\leq 1/3 a$</td><td>$\leq W$</td><td>$\leq t$</td></tr></table> ⊙ If the chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications. 7.2.3 Glass remain :  <table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>$\leq a$</td><td>$\leq 1/3 W$</td><td>$\leq t$</td></tr></table>		X	Y	Z	$\leq 1/3 a$	$\leq W$	$\leq t$	X	Y	Z
X	Y	Z										
$\leq 1/3 a$	$\leq W$	$\leq t$										
X	Y	Z										
$\leq a$	$\leq 1/3 W$	$\leq t$										

◆ Specification For Monotype and Color STN :

(Ver. B01)

NO	Item	Criterion	Level
08	Backlight elements	8. 1 Backlight can't work normally.	Major
		8. 2 Backlight doesn't light or color is wrong.	Major
		8. 3 Illumination source flickers when lit.	Major
09	General appearance	9. 1 Pin type must match type in specification sheet.	Major
		9. 2 No short circuits in components on PCB or FPC.	Major
		9. 3 Product packaging must the same as specified on packaging specification sheet.	Minor
		9. 4 The folding and peeled off in polarizer are not acceptable.	Minor
		9. 5 The PCB or FPC between B/L assembled distance (PCB or FPC) is ≤ 1.5 mm.	Minor

4. RELIABILITY TEST

4.1 Reliability Test Condition

(Ver.B01)

NO.	TEST ITEM	TEST CONDITION											
1	High Temperature Storage Test	Keep in 80 ±2℃ 96 hrs Surrounding temperature, then storage at normal condition 4hrs.											
2	Low Temperature Storage Test	Keep in -30 ±2℃ 96 hrs Surrounding temperature, then storage at normal condition 4hrs.											
3	High Temperature / High Humidity Storage Test	Keep in 60℃ / 90% R.H duration for 96 hrs Surrounding temperature, then storage at normal condition 4hrs. (Excluding the polarizer)											
4	Temperature Cycling Storage Test	-30℃ → +25℃ → 80℃ → +25℃ (30mins) (5mins) (30mins) (5mins) ← 10 Cycle → Surrounding temperature, then storage at normal condition 4hrs.											
5	ESD Test	Air Discharge: Apply 2 KV with 5 times Discharge for each polarity +/-	Contact Discharge: Apply 250 V with 5 times discharge for each polarity +/-										
		1.Temperature ambience : 15℃ ~35℃ 2.Humidity relative : 30% ~60% 3.Energy Storage Capacitance(Cs+Cd) : 150pF±10% 4.Discharge Resistance(Rd) : 330Ω±10% 5.Discharge, mode of operation : Single Discharge (time between successive discharges at least 1 sec) (Tolerance if the output voltage indication : ±5%)											
6	Vibration Test (Packaged)	1.Sine wave 10~55 Hz frequency (1 min/sweep) 2.The amplitude of vibration :1.5 mm 3. Each direction (X、Y、Z) duration for 2 Hrs											
7	Drop Test (Packaged)	<table><tr><th>Packing Weight (Kg)</th><th>Drop Height (cm)</th></tr><tr><td>0 ~ 45.4</td><td>122</td></tr><tr><td>45.4 ~ 90.8</td><td>76</td></tr><tr><td>90.8 ~ 454</td><td>61</td></tr><tr><td>Over 454</td><td>46</td></tr></table>		Packing Weight (Kg)	Drop Height (cm)	0 ~ 45.4	122	45.4 ~ 90.8	76	90.8 ~ 454	61	Over 454	46
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0 ~ 45.4	122												
45.4 ~ 90.8	76												
90.8 ~ 454	61												
Over 454	46												
		Drop Direction :※1 corner / 3 edges / 6 sides each 1time											

5. PRECAUTION RELATING PRODUCT HANDLING

5.1 SAFETY

- 5.1.1 If the LCD panel breaks , be careful not to get the liquid crystal to touch your skin.
- 5.1.2 If the liquid crystal touches your skin or clothes , please wash it off immediately by using soap and water.

5.2 HANDLING

- 5.2.1 Avoid any strong mechanical shock which can break the glass.
- 5.2.2 Avoid static electricity which can damage the CMOS LSI—When working with the module , be sure to ground your body and any electrical equipment you may be using.
- 5.2.3 Do not remove the panel or frame from the module.
- 5.2.4 The polarizing plate of the display is very fragile. So , please handle it very carefully, do not touch , push or rub the exposed polarizing with anything harder than an HB pencil lead (glass , tweezers , etc.)
- 5.2.5 Do not wipe the polarizing plate with a dry cloth , as it may easily scratch the surface of plate.
- 5.2.6 Do not touch the display area with bare hands , this will stain the display area.
- 5.2.7 Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.
- 5.2.8 To control temperature and time of soldering is $320 \pm 10^{\circ}\text{C}$ and 3-5 sec.
- 5.2.9 To avoid liquid (include organic solvent) stained on LCM

5.3 STORAGE

- 5.3.1 Store the panel or module in a dark place where the temperature is $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ and the humidity is below 65% RH.
- 5.3.2 Do not place the module near organics solvents or corrosive gases.
- 5.3.3 Do not crush , shake , or jolt the module.

5.4 TERMS OF WARRANTY

- 5.4.1 Applicable warrant period
The period is within thirteen months since the date of shipping out under normal using and storage conditions.
- 5.4.2 Unaccepted responsibility
This product has been manufactured to your company's specification as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product is used in nuclear power control equipment, aerospace equipment , fire and security systems or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required.

[illegible]