



FORMIKE ELECTRONIC CO.,LTD

PRODUCT SPECIFICATION

TFT LCD MODULE

MODEL : KWH018ST04-F01 Version: 1.0

【 ◆ 】 Preliminary Specification

【 】 Finally Specification

CUSTOMER'S APPROVAL	
SIGNATURE:	DATA:

Designed by	R&D Checked by	Quality Department by	Approved by
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● This specification is subject to change without notice. Please contact FORMIKE or it's representative before designing your product based on this specification.

Revision record

[illegible]

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1. General Description

1.1 Description

KWH018ST04-F01 is a Transmissive type color active matrix liquid crystal display (LCD), which uses amorphous thin film transistor (TFT) as switching devices. This product is composed of a TFT LCD panel, driver IC, FPC, and backlight unit . The following table described the features of FORMIKE KWH018ST04-F01.

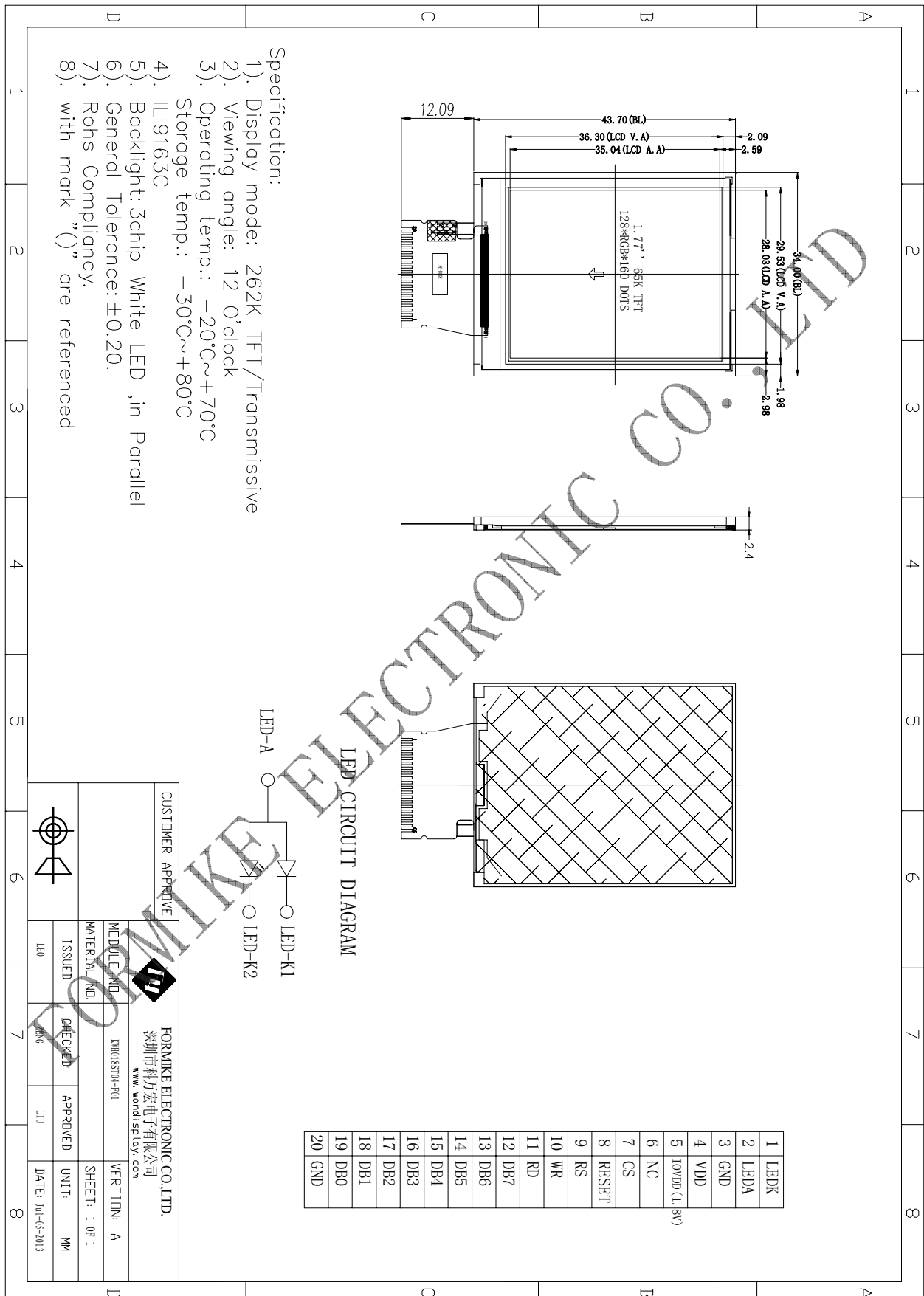
1.2 Application

Mobile phone, Multimedia products
 and other electronic Products
 Etc.

1.3 Features:

Features	Description	UNITS
LCD type	1.8" TFT	--
Dot arrangement	128 (RGB) × 160	dots
Driver IC	ILI9163C	--
Color Depth	65K	
Interface	CPU 8 bits	
Module size	34.00(W) × 43.70 (H) × 2.40(T)	mm
Active area	28.03(W) × 35.04(H)	mm
Dot pitch	0.219 (W) × 0.219 (H)	mm
Back Light	2 White LED In parallel	--
With/Without TSP	Without TSP	
Weight(g)	TBD	

2. External Dimensions



3. Interface Description

PIN NO.	PIN NAME	DESCRIPTION
1	LEDK	Power supply for LED backlight Cathode input.
2	LEDA	Power supply for LED backlight Anode input.
3	GND	Ground.
4	VDD	Driver power supply voltage (+2.5V~+3.6V).
5	IOVDD	Logic I/O Power supply voltage (+1.65V~+3.6V).
6	NC	No connection.
7	CS	Chip select signal, Active "L"
8	RESET	Reset input pin, When reset is "L", Initialization is executed.
9	RS	Command / Display data selection 0: command; 1: display data
10	WR	Write signal input, Active" L "
11	RD	Read signal input, Active" L "
12-19	DB7-DB0	80-system-8-Bit Data Bus.
20	GND	Ground.

4. Absolute Maximum Ratings

The absolute maximum rating is listed on following table. When ILI9163C is used out of the absolute maximum ratings, the ILI9163C may be permanently damaged. To use the ILI9163C within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are exceeded during normal operation, the ILI9163C will malfunction and cause poor reliability.

Item	Symbol	Unit	Value Note
Supply voltage	VPNL	V	-0.3 ~ +4.8
Supply voltage (Logic)	VDDI	V	-0.3 ~ +4.6
Supply voltage (Digital)	VCC	V	-0.3 ~ +2.4
Driver supply voltage	VGH-VGL	V	-0.3 ~ +33.0
Logic input voltage range	VIN	V	-0.3 ~ VDDI + 0.3
Logic output voltage range	VO	V	-0.3 ~ VDDI + 0.3
Operating temperature	Topr	°C	-40 ~ +85
Storage temperature	Tstg	°C	-55 ~ +110

Notes: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

5. Electrical Characteristics

Item	Symbol	Unit	Condition	Min.	Typ.	Max.	Note
Power & Operation Voltage							
Analog Operating voltage	VPNL	V	Operating voltage	2.5	2.78	4.8	Note2
Logic Operating voltage	VDDI	V	I/O supply voltage	1.65	1.8/2.78	3.3	Note2
Digital Operating voltage	VCC	V	Digital supply voltage		1.8		Note2
Gate Driver High voltage	VGH	V		10.0		16.0	Note3
Gate Driver Low voltage	VGL	V		-16.0		-7.5	Note3
Driver Supply voltage		V	VGH-VGL	19		32	Note3
Input/Output							
Logic High level input voltage	VIH	V		0.7VDDI		VDDI	Note1,2,3
Logic Low level input voltage	VIL	V		VSS		0.3VDDI	Note1,2,3
Logic High level output voltage	VOH	V	IOH = -1.0mA	0.8VDDI		VDDI	Note1,2,3
Logic High level output voltage	VOL	V	IOL = 1.0mA	VSS		0.2VDDI	Note1,2,3
Logic input leakage current	IIL	μA	VIN = VDDI or VSS	-0.1		+0.1	Note1,2,3
VCOM Operation							
VCOM High voltage	VCOMH	V	Coom=12nF	2.5		5.0	Note 3
VCOM Low voltage	VCOML	V	Coom=12nF	-2.5		0.0	Note 3

VCOM voltage	Amplitude	VOMA	V	VCOMH-VCOML	4.0		5.5	Note 3
Source Driver								
Source output range		Vsout	V		0.1		AVDD-0.1	Note4
Gamma voltage	reference	GVDD	V		3.0		5.0	Note3

Note 1: VDDI=1.65 to 3.3V, VPNL=2.5 to 4.8V, AGND=GND=0V, Ta=-30 to 70°C (to +85°C no damage)

Note2: Please supply digital VDDI voltage equal or less than analog VPNL voltage. ($VDDI \leq VPNL$)

Note2,3,4: When the measurements are performed with LCD module. Measurement Points are like below.

Note3: CSX, RDX, WRX, D[23:0], D/CX, RESX, TE, PCLK, VS, HS, DE, SDA, SCL, GM2, GM1, GM0, RCM1, RCM0, P68, IM2, IM1, IM0, SRGB, REV, SMX, SMY, RL, TB, IDM, SHUT, PREG, GS and Test pins.

Note5: Source channel loading = 10pF/channel, Gate channel loading = 50pF/channel

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6.Timing Characteristics.

6.1 Reset Timing Characteristics.

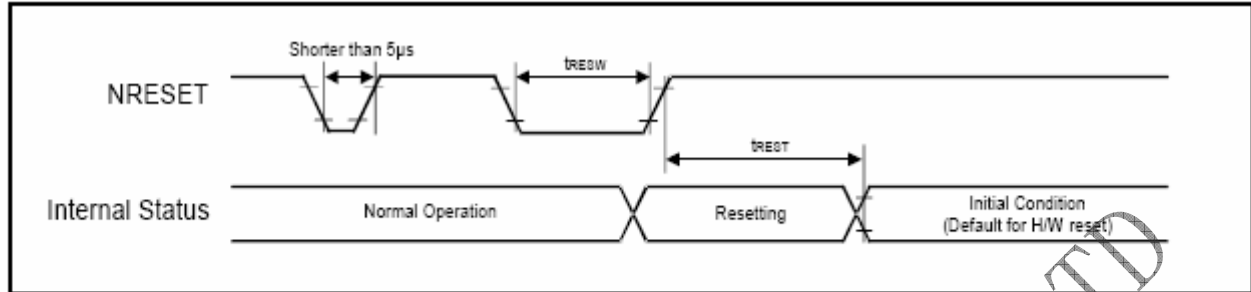


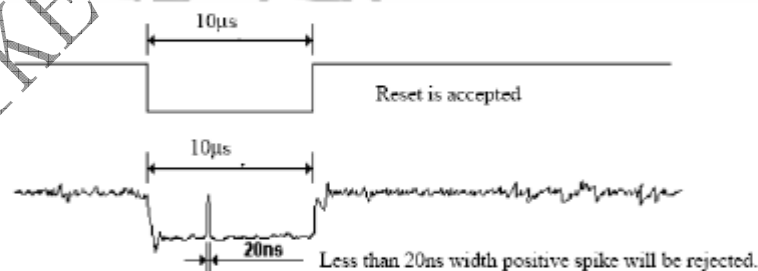
Figure 11. 6 Reset Input Timing

Symbol	Parameter	Related Pins	Min.	Typ.	Max.	Note	Unit
tRESW	Reset low pulse width ⁽¹⁾	NRESET	10	-	-	-	µs
tREST	Reset complete time ⁽²⁾	-	-	-	5	When reset applied during Sleep In mode	ms
		-	-	-	120	When reset applied during Sleep Out mode	ms

Note: (1) Spike due to an electrostatic discharge on !RES line does not cause irregular system reset according to the following table.

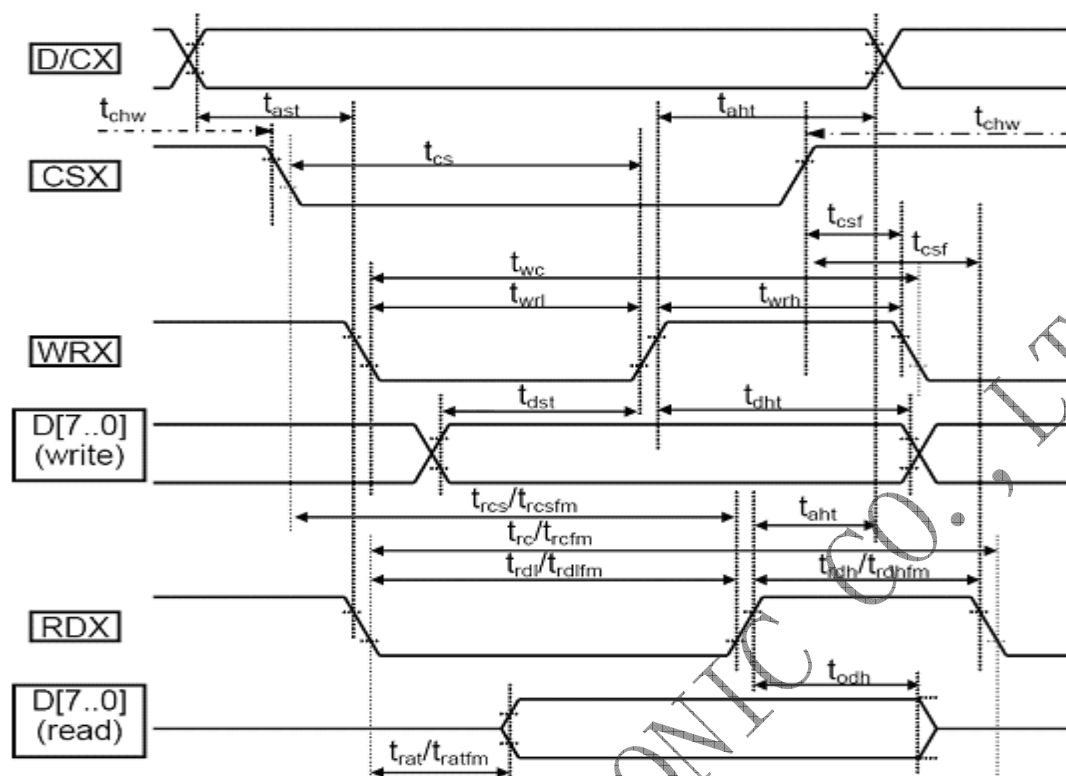
NRESET Pulse	Action
Shorter than 5µs	Reset Rejected
Longer than 10µs	Reset
Between 5µs and 10µs	Reset Start

- (2) During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep out -mode. The display remains the blank state in Sleep In -mode) and then return to Default condition for H/W reset.
- (3) During Reset Complete Time, ID2 and VCOMOF value in OTP will be latched to internal register during this period. This loading is done every time when there is H/W reset complete time (tREST) within 5ms after a rising edge of RESET.
- (4) Spike Rejection also applies during a valid reset pulse as shown as below:



- (5) It is necessary to wait 5msec after releasing RESET before sending commands. Also Sleep Out command cannot be sent for 120ms.

6.2. i80-System Interface Timing Characteristics.



Note: Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

Table AC characteristics of parallel CPU I/F in asynchronous mode

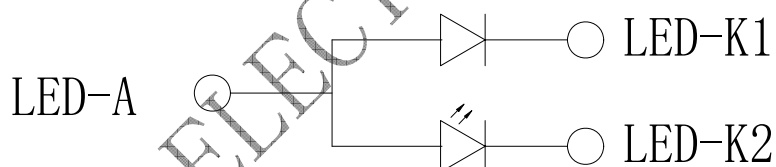
Signal	Symbol	Parameter	min	max	unit	description
D/CX	tast	Address setup time	0		ns	
	taht	Address hold time(Write/Read)	10		ns	
CSX	tchw	S""H" Pulse Width	0		ns	
	tcs	Chip Select setup time (Write)	10		ns	
	trcs	Chip Select setup time (Read ID)	45		ns	
	trcsfm	Chip Select setup time (Read FM)	355		ns	
	tcsf	Chip Select Wait time(Write/read)	10		ns	
WRX	twc	Write cycle	66		ns	
	twrh	Controlpulse H duration	15		ns	
	twrl	Control pulse L duration	15		ns	
RDX	trc	Read cycle (ID)	160		ns	When read ID

	trdh	Control pulse H duration(ID)	90		ns	data
	trdl	Control pulse L duration(ID)	45		ns	
RDX	trcfm	Read cycle (FM)	450		ns	When read from frame memory
	trdhfm	Control pulse H duration (FM)	90		ns	
	trdlfm	Control pulse L duration (FM)	355		ns	
D[17..0]	tdst	Data setup time	10		ns	For maximum CL = 30pF For minimum CL = 8pF
	tdht	Data hold time	10		ns	
	trat	Read access time (ID)		40	ns	
	tratfm	Read access time (FM)		340	ns	
	todh	Output disable time	20	80	ns	

Note 1: VDDI 1.65 to 3.3V, VPNL=2.6 to 3.3V, AGND=GND=0V, Ta=-30 to 70 °C (to +85°C no damage)

Note 2: This input signal rise time and fall time (tr, tf) is specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for input signals

7. Backlight Characteristics.



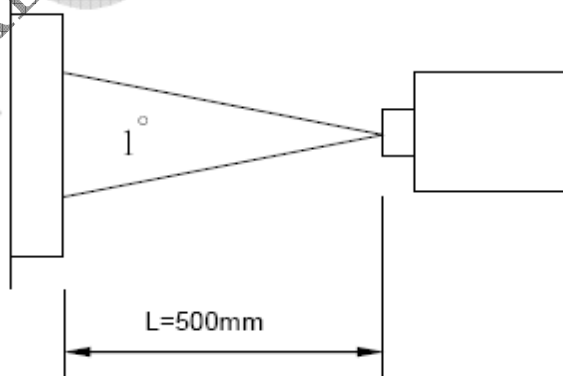
Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition	Note
Supply Voltage	Vf	3.0	3.2	3.4	V	If=30 mA	-
Supply Current	If	-	30	-	mA	-	-
Reverse Voltage	Vr	-	-	5	V	10uA	
Power dissipation	Pd	-	96	-	mW	-	
Luminous Intensity for LCM		-	150	-	Cd/m²	If=30 mA	
Uniformity for LCM	-	80	-	-	%	If=30 mA	
Life Time	-	50000	-	-	Hr	If=30 mA	-
Backlight Color	White						

8.Optical Characteristics

(Using CPT LC+ Normal Polarizer+Corresponding Backlight, reference only)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Transmittance	T		6.5	6.9		%	
Contrast Ratio	CR	*1)		250	-	--	Note 3
Response Time	Tr+ Tf	*3)	-	30		ms	Note 4
Viewing Angle	Vertical	$\theta^*2)$	55	60	-		Note 5
					-		
	Horizontal	$\psi^*2)$	85	90	-		
					-		
Color Filter Chromaticity	White	x y Y	$\theta = \phi = 0^\circ$	0.291	0.311	0.331	Note 6
				0.325	0.345	0.365	
				28.6	31.6	34.6	
	Red	x y Y	$\theta = \phi = 0^\circ$	0.634	0.654	0.674	
				0.312	0.332	0.352	
				15.6	18.6	21.6	
	Green	x y Y	$\theta = \phi = 0^\circ$	0.298	0.318	0.338	
				0.555	0.575	0.595	
				56.7	60.7	64.7	
	Blue	x y Y	$\theta = \phi = 0^\circ$	0.114	0.134	0.154	
				0.117	0.137	0.157	
				12.6	15.6	18.6	
	NTSC			-	58%	-	

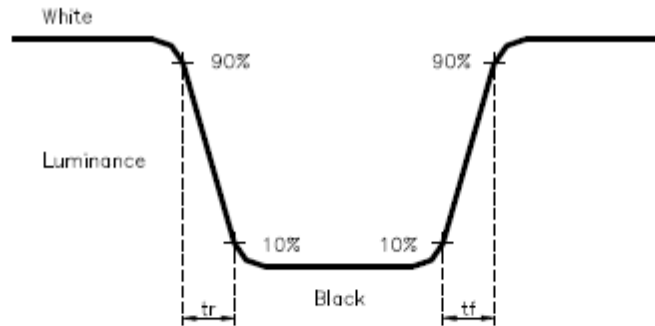
 Note 1.Ambient condition : $25^\circ\text{C} \pm 2^\circ\text{C}$, $60 \pm 10\% \text{RH}$, under 10 Lux in the darkroom .

 Note 2.Measure device : BM-5A (TOPCON) , viewing cone= 1° , $I_L=20\text{mA}$.


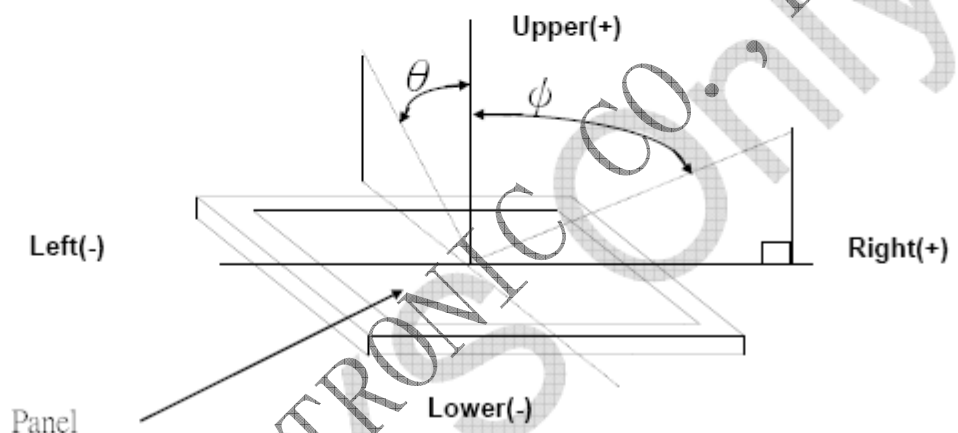
Note 3. Definition of Contrast Ratio :

 $\text{CR} = \text{White Luminance (ON)} / \text{Black Luminance (OFF)}$

Note 4. Definition of response time : The response time is defined as the time interval between the 10% and 90% amplitudes.



Note 5. Definition of view angle(θ , ψ) :



Note 6. Light source: C light.

9. Reliability Test Conditions And Methods

N O.	TEST ITEMS	TEST CONDITION	INSPECTION AFTER TEST
①	High Temperature Storage	$80^{\circ}\text{C} \pm 2^{\circ}\text{C} \times 240\text{Hours}$	Inspection after 2~4hours storage at room temperature, the samples should be free from defects: 1,Air bubble in the LCD. 2,Sealleak. 3,Non-display. 4,Missing segments. 5,Glass crack. 6,Current IDD is twice higher than initial value. 7, The surface shall be free from damage. 8, The electric Characteristics requirements shall be satisfied.
②	Low Temperature Storage	$-30^{\circ}\text{C} \pm 2^{\circ}\text{C} \times 240\text{Hours}$	
③	High Temperature Operation	$70^{\circ}\text{C} \pm 2^{\circ}\text{C} \times 240\text{Hours}$	
④	Low Temperature Operation	$-20^{\circ}\text{C} \pm 2^{\circ}\text{C} / 240\text{Hours}$	
⑤	Thermal Shock (Non-Operation)	$-20^{\circ}\text{C} \pm 2^{\circ}\text{C} \longleftrightarrow 25^{\circ}\text{C} \longleftrightarrow 70^{\circ}\text{C} \pm 2^{\circ}\text{C}$ (30min) (5min) (30min) ← 1cycle → Total 10cycle	
⑥	High Temperature and High Humidity Storage	$40^{\circ}\text{C} \pm 5^{\circ}\text{C} \times 90\%\text{RH} \times 240\text{Hours}$	
⑦	Electro Static Discharge (Operation)	$C=150\text{pF}, R=330\Omega$, oints/panel Air: $\pm 8\text{KV}, 5$ times Contact: $\pm 4\text{KV}, 5$ times (Environment: $15^{\circ}\text{C} \sim 35^{\circ}\text{C}$ $30\% \sim 60\%, 86\text{Kpa} \sim 106\text{Kpa}$)	
⑧	Vibration (Non-Operation)	Frequency: $10\text{Hz} \sim 55\text{Hz} \sim 10\text{Hz}$ Amplitude: 1.5M X,Y,Z direction for total 3hours (Packing Condition)	
⑨	Package Drop Test	Height: 80cm 1 corner, 3 edges, 6 surfaces.	

REMARK:

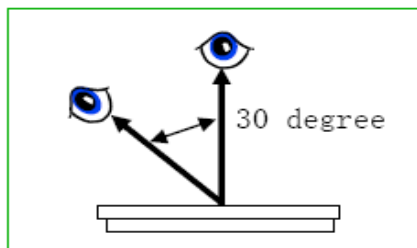
- 1, The Test samples should be applied to only one test item.
- 2, Sample side for each test item is 5~10pcs.
- 3, For Damp Proof Test, Pure water (Resistance $> 10\text{M}\Omega$) should be used.
- 4, In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
- 5, EL evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
- 6, Failure Judgment Criterion: Basic Specification Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

10. Inspection Standard

This standard apply to TFT module specification.

1. Inspection condition:

Under daylight lamp 20~40W, product distance inspector'eye 30cm, incline degree 30°.



2. Inspection standard

NO.	Item	Inspection standard	Rate														
2.1	Dot	Case of Dot defect is below ① Bright Dot (whit spot) : "0" ② Dark Dot (black spot) : "0" (In case of Dark Dot on Main TFT LCD) - NG if there's full Dot defect. - Damaged less than the size of sub-pixel is not counted as defect - Dots darker than the size of sub-pixel are not defined as bright dot defect	minor														
		<table><tr><th>area size (mm)</th><th>Acceptable number</th></tr><tr><td>$\Phi \leq 0.10$</td><td>ignore</td></tr><tr><td>$0.10 < \Phi \leq 0.15$</td><td>3</td></tr><tr><td>$0.15 < \Phi \leq 0.20$</td><td>2</td></tr><tr><td>$0.25 < \Phi \leq 0.25$</td><td>1</td></tr><tr><td>$0.25 < \Phi$</td><td>0</td></tr></table>		area size (mm)	Acceptable number	$\Phi \leq 0.10$	ignore	$0.10 < \Phi \leq 0.15$	3	$0.15 < \Phi \leq 0.20$	2	$0.25 < \Phi \leq 0.25$	1	$0.25 < \Phi$	0		
		area size (mm)		Acceptable number													
		$\Phi \leq 0.10$		ignore													
		$0.10 < \Phi \leq 0.15$		3													
		$0.15 < \Phi \leq 0.20$		2													
		$0.25 < \Phi \leq 0.25$		1													
		$0.25 < \Phi$		0													
2.2	line	<table><tr><th colspan="2">Size (mm)</th><th>Acceptable number</th></tr><tr><td>ignore</td><td>$W \leq 0.03$</td><td>ignore</td></tr><tr><td>$L \leq 4.0$</td><td>$0.03 < W \leq 0.04$</td><td>2</td></tr><tr><td>$L \leq 4.0$</td><td>$0.04 < W \leq 0.05$</td><td>1</td></tr><tr><td></td><td>$0.05 < W$</td><td>Treat with dot non-conformance</td></tr></table>	Size (mm)		Acceptable number	ignore	$W \leq 0.03$	ignore	$L \leq 4.0$	$0.03 < W \leq 0.04$	2	$L \leq 4.0$	$0.04 < W \leq 0.05$	1		$0.05 < W$	Treat with dot non-conformance
		Size (mm)		Acceptable number													
		ignore	$W \leq 0.03$	ignore													
		$L \leq 4.0$	$0.03 < W \leq 0.04$	2													
		$L \leq 4.0$	$0.04 < W \leq 0.05$	1													
	$0.05 < W$	Treat with dot non-conformance															

11. Handling Precautions

11.1 Mounting method

The LCD panel of FORMIKE ELECTRONIC CO., LTD. module consists of two thin glass plates with polarizers which easily be damaged. And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

11.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent

[recommended below] and wipe lightly

- Isopropyl alcohol
- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux
- Chlorine (Cl), Sulfur (S)

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happens by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

11.3 Caution against static charge

The LCD module uses C-MOS LSI drivers, so we recommend that you:

Connect any unused input terminal to V_{dd} or V_{ss}, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

11.4 packing

- Module employs LCD elements and must be treated as such.
- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed direct to sunshine or high temperature/humidity

11.5 Caution for operation

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life.
- An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.
- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature, 50%Rh or less is required.

11.6 storage

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it . And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by the anything else.
It is recommended to store them as they have been contained in the inner container at the time of delivery from us

11.7 Safety

- It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water

12. Precaution For Use

12.1

A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

12.2

On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this specification
- When a new problem is arisen which is not specified in this specifications
- When an inspection specifications change or operating condition change in customer is reported to FORMIKE ELECTRONIC CO.,LTD, and some problem is arisen in this specification due to the change
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.