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Thin-Film-Transistor LCD Module Model: GWTQ24NPDL1R0

Acceptance					

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2013.12.23	2013.12.23		2013.12.23
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### Revise Records

Rev.	Date	Contents	Written	Approved
А	2013/12/20	Preliminary Specification	Aron Jau	Stanley Wang

### Special Notes

Note1.	



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### **General Description and Features**

GWTQ24NPDL1R0 is a TM (Transmissive) type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module, a driver circuit a, a back-light unit and touch panel. The resolution of a 2.4" contains 240(RGB) x 320 dots and can display up to 65K colors. The following table described the features of GWTQ24NPDL1R0.

- Transmissive and back-light with 4 LEDs are available.
- TN (Twisted Nematic) mode.
- ROHS Compliance
- 4 wire touch panel

### 1.2 LCD Module

Item	Specification	Unit
Screen Size	2.4 inches	Diagonal
Display Resolution	240(H) x RGB x 320(V)	Dot
Active Area	36.72 (H) x 48.96 (V)	mm
Outline Dimension	42.72 (H) x 60.26 (V) x 3.71 (D)	mm
Display Mode	Normally white/Transmissive	
Pixel Arrangement	RGB Vertical-Stripe	
Display Color	65K	
Viewing Direction (Gray Inversion)	12 o'clock	
Driver IC	ILI9341V	
Input Interface	8080 16 bit parallel interface	

### Mechanical Information

Item		Min.	Тур.	Max.	Unit	Note
	Horizontal (H)		42.72		mm	
Module Size	Vertical (V)	-	60.26		mm	(1)
	Thickness (T)		3.71		mm	(1)
We	ight		TBD		g	

Note (1) Not include FPC.

Refer to the Dimensional Outlines for further information.





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### **Electrical Specifications** 3

- 3.1 Absolute Max. Ratings
  - 3.1.1 Absolute Ratings of Environment

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

 $(Ta=25\pm2^{\circ}C, V_{SS}=GND=0)$ 

Item	Symbol	Min.	Max.	Unit	Note
Storage temperature	$T_{STG}$	-30	80	°C	(1)
Operating temperature	$T_{OPR}$	-20	70	°C	(1,2,3)

- Note (1) 90 % RH Max. (  $40 \, ^{\circ}\text{C} \ge \text{Ta}$  ). Maximum wet-bulb temperature at 39  $^{\circ}\text{C}$  or less. (Ta >  $40 \, ^{\circ}\text{C}$ ) No condensation.
- Note (2) In case of below 0°, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character
- Note (3) Only operation is guarantied at operating temperature. Contrast, response time, another display quality are evaluated at +25°C.

### 3.2 Electrical Absolute Rating

### 3.2.1 TFT-LCD Module

 $(Ta=25\pm2^{\circ}C, V_{SS}=GND=0)$ 

Item	Symbol	Value		Unit	Condition
Item	Зуппоот	Min.	Max.	Offic	Condition
Power supply voltage	IOVCC/VCI	-0.3	3.3	V	
Input voltage for logic	VIN	-0.5	VCC+0.3	V	

### Back-Light Unit 3.2.2

Item	Symbol	Min.	Max.	Unit	Note
Current of One LED	$\mathbf{I}_{LED}$		30	mA	(1)

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded. Functional operation should be restricted to the conditions described under normal operating conditions.



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### 4 Electrical Characteristics

4.1 TFT-LCD Module

 $(Ta=25\pm2^{\circ}C)$ 

Itom		Symbol		Value	Unit	Condition	
100	Item		Min.	Тур.	Max.	Offic	Condition
Power supply voltage		IOVCC VCI	2.5	2.8	3.3	V	
Input Voltage for logic	H Level	VIH	0.8xIOVCC	-	IOVCC	V	
	L Level	VIL	-0.3	-	0.2xIOVCC	٧	
Digital Current		ICC	-	TBD	TBD	mA	

Note (1) The specified power consumption is under the conditions at  $IOV_{CC}$ = 2.8V,  $F_V$ =60Hz, whereas a Power dissipation check pattern below is displayed.





**Active Area** 

### 4.2 Backlight Unit

The back-light system is an edge-lighting type with white LED (Light Emitting Diode)s.

Item	Cumbal		Value		Unit	Condition	
Item	Symbol	Min.	Тур.	Max.	Offic	Condition	
LED Voltage	$V_L$	3.0	3.2	3.4	٧		
LED Current	$\mathbf{I}_{f}$	-	60	80	mA		
Power Consumption	$P_{BL}$	-	192	272	mW	(2)	
LED Life time	-	20000	-	-	Hr		

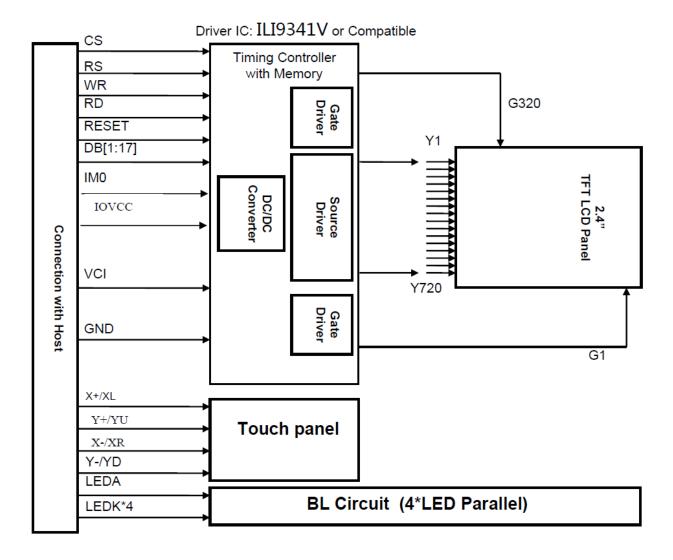
Note: (1) 4 LED parallel.

- (2) Where  $I_f$  = 60mA,  $V_L$  = 3.2V,  $P_{BL}$  =  $V_L \times I_f$
- (3) The "LED life time" is defined as the module brightness decrease to 50% original brightness at  $Ta=25\,^{\circ}C$  and IL=60mA. The LED lifetime could be decreased if operating IL is larger than 60 mA.



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### **Block Diagram**





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## 6 Input Terminal Pin Assignment

6.1 CN1 Pin Assignment

Pin No.	Symbol	I/O	Function	Remark
1	FMARK/NC	-	No connection	
2	VCI	Р	Digital IO Pad power supply(2.8V)	
3	IOVCC	Р	Digital IO Pad power supply(2.8V)	
4	/CS	I	Chip Select	
5	RS	I	Command/Data Select	
6	/WR	I	Write signal	
7	/RD	I	Read signal	
8	/RESET	I	LCD RERSET TERMINAL ACITVE"L"	
9	DB0	I/O	Data bus.	
10	DB1	I/O	Data bus.	
11	DB2	I/O	Data bus.	
12	DB3	I/O	Data bus.	
13	DB4	I/O	Data bus.	
14	DB5	I/O	Data bus.	
15	DB6	I/O	Data bus.	
16	DB7	I/O	Data bus.	
17	DB8	I/O	Data bus.	
18	DB9	I/O	Data bus.	
19	DB10	I/O	Data bus.	
20	DB11	I/O	Data bus.	
21	DB12	I/O	Data bus.	
22	DB13	I/O	Data bus.	
23	DB14	I/O	Data bus.	
24	DB15	I/O	Data bus.	
25	NC	-	No connection	
26	YU	0	Touch panel up	
27	XR	0	Touch panel right	
28	YD	0	Touch panel down	
29	XL	0	Touch panel left	
30	LEDA	Р	Anode of LED backlight.	
31	LEDK1	Р	Cathode of LED backlight.	
32	LEDK2	Р	Cathode of LED backlight.	
J_				





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34	LEDK4	Р	Cathode of LED backlight.	
35	GND	Р	Ground	
36	GND	Р	Ground	
37	IM0	-	No connection	



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### **Touch Screen Panel Specifications**

## 7.1 Touch Panel

### 7.1.1 Electrical Characteristics

Item	Min.	Тур.	Max.	Unit	Note
Linearity	-1.5	-	1.5	%	After environment & life test
Terminal resistance	200	-	650	Ω	X(Film side)
Terminal resistance	350	-	800	Ω	Y(Glass side)
Insulation resistance	10	-	-	$M\Omega$	DC 25V
Voltage	-	5	-	V	DC
Response time	-	-	10	ms	100kohm pull-up
Transparency	80	-	-	%	

Caution (1): Do not operate it with a thing except a polyacetal pen (tip R0.8mm or less) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

### 7.1.2 Mechanical & Reliability Characteristics

Item	Min.	Тур.	Max.	Unit	Note
Activation force	-	20	50	g	(1)
Hitting Durability	1,000,000	ı	ı	times	(3)
Sliding Durability	100,000			times	(2)
Surface hardness	3	-	-	Н	JIS K5400

Note (1) Input: Finger or polyacetal pen 0.8R

Note (2) Measurement for surface area.

-Scratch 100,000 times straight line on the film with a stylus change every 20,000 times.

-Force: 100gf.

-Speed: 60mm/sec.

-Stylus: R0.8 polyacetal tip.

Note 3: Hit 1,000,000 times on the film with an R12.5mm tip.

-Force: 250gf.

-Speed: 2 times/sec.



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### 8 Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room Measuring equipment: BM-7A

Item		Symbol	Condition	Min	Type	Max	Unit	Note
Brightness		В			160	1	cd/m <sup>2</sup>	
Response	time	$T_{R+}T_{F}$	θ=0°		50	70	ms	
Uniformi	ity	Un		80	85		%	
Contrast r	atio	CR	At optimized viewing angle	150	250			
	Red	$R_X$			0.633	1		
	Reu	$R_{Y}$	θ=0° Normal Viewing Angle		0.329			
	Green	$G_X$			0.297			
Color		$G_Y$			0.577			
Chromaticity	Blue	$B_X$			0.133			
		$B_Y$			0.129			
	White	Wx			0.280			
	vville	Wy			0.320			
	Hor	$\theta_{R}$			45			
Viewing	Hor.	$\theta_{L}$	CR≥10		45		Degree	
Angle (6H)	Vor	$\theta_{\sf U}$	CK210		45			
	Ver.	$\theta_{D}$			20			



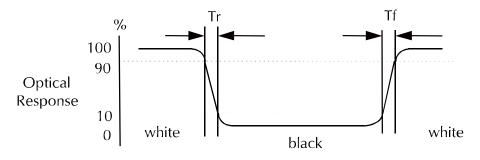
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### a. Test equipment setup

After stabilizing and leaving the panel alone shall be warmed up for the stable operation of LCM, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-5A/BM-7(fast) with a viewing angle of 2° at a distance of 50cm and normal direction.

### b. Definition of response time: Tr and Tf

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".



### c. Definition of contrast ratio:

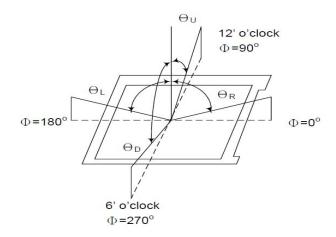
Brightness measured when LCD is at "white state" Contrast Ratio (CR) = Brightness measured when LCD is at "black state"

d. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.



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### e. View Angle



Definition of Luminance of White: Luminance of white at the center points

Light Source of Back-Light Unit	LED Type	
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g. Definition of White Uniformity



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### 9 Test

No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: 20±5°C. Humidity: 65±5%RH.

Tests will be not conducted under functioning state.

No.	Parameter	Condition	Notes
1	High Temperature Operating	70°C±2°C, 120hrs	
2	Low Temperature Operating	-20°C±2°C, 120hrs	1
3	High Temperature Storage	80°C±2°C, 120hrs.	2
4	Low Temperature Storage	-30°C±2°C, 120hrs.	1,2
5	Moisture storage	40°C±2°C, 90%, 120hrs	1,2
		Packaging, Frequency: 10-55Hz	
6	Vibration Test	Amplitude: 1.0mm,	3
		Each direction on X,Y axe 0.5 houre, circle 2 hours	
7	Drop Test	To be measured after dropping from 60cm high on the concrete surface in packing state.    Dropping method corner dropping:    A corner: Once edge dropping.	

Notes:

- 1. No dew condensation to be observed.
- 2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.
- 3. Vibration test will be conducted to the product itself without putting I in a container.

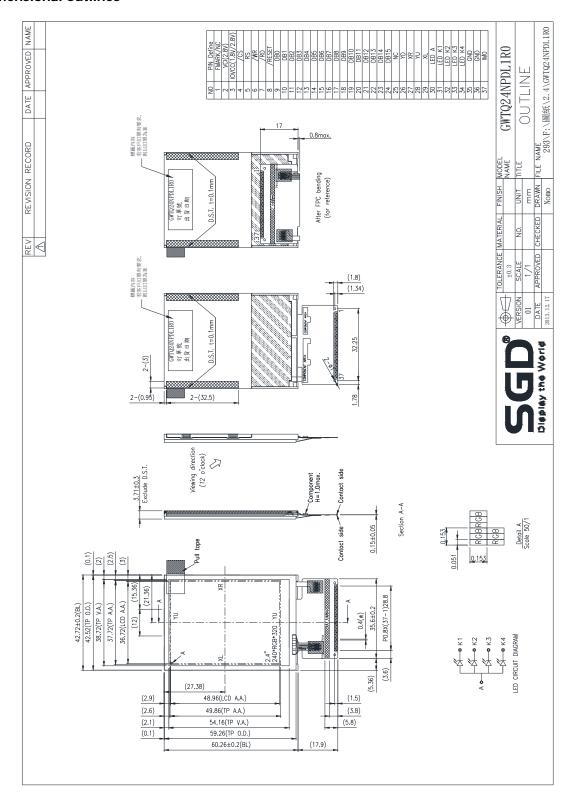




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### 10 Dimensional outlines





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### 11 Incoming Inspection Standards

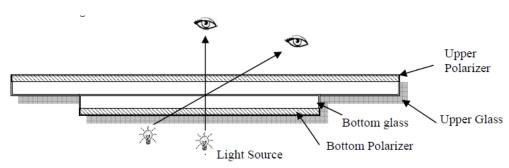
11.1 Inspection performed under the following conditions is recommended

Temperature : 25±5°C Humidity: 65%±10%RH

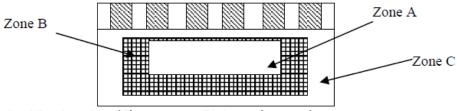
Viewing Angle: Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

distance: 30-50cm



### 11.2 Definition



Zone A: Effective Viewing Area(Character or Digit can be seen)

Zone B: Viewing Area except Zone A

Zone C: Outside (Zone A+Zone B) which can not be seen after assembly by customer.)

Note:

As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer.





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### 11.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class  $\,II\,$ 

AOI:

Major defect	Minor defect
0.65	1.5

LCD: Liquid Crystal Display, TP: Touch Panel, LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
		1) No display, Open or miss line	
1	Functional defects	2) Display abnormally, Short	
1	i unctional defects	3) Backlight no lighting, abnormal lighting.	
		4) TP no function	Major
2	Missing Missing component		
3	Outline dimension	Overall outline dimension beyond the drawing is not	
5		allowed	
4	Color tone Color unevenness, refer to limited sample		
5	Soldering appearance Good soldering , Peeling off is not allowed.		Minor
6	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

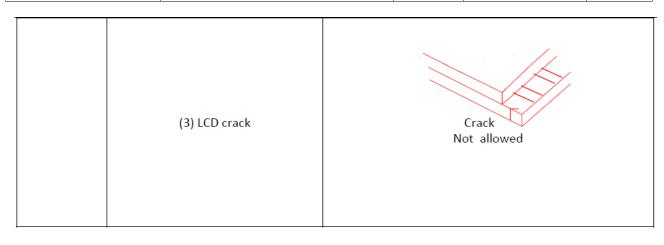
### 11.4 Criteria (Visual)

	11.4 Citeria (visual)							
Number	ltems	Criteria(mm)						
1.0 LCD Crack/Broken	(1) The edge of LCD broken							
X: Length Y: Width		X Y Z						
Z: Height L: Length of ITO,		≤3.0mm						
T: Height of LCD	(2)LCD corner broken	X         Y         Z           ≤3.0mm         ≤L         ≤T						



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Number	Items										
2.0	Spot defect	① light dot(LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain)									
		Zone	Zone Acceptable Qty								
	$\left(\begin{array}{c} \\ \end{array}\right)^{\gamma}$	χ Φ≤0.10	А	В	С						
	¥ +		lgne	Ignore							
	<b>←</b>	0.10<Φ≤0.15	3( distance	e≧10mm)	1						
	Ф=(X+Y)/2	0.15<Φ≤0.2	1		Ignore						
		0.2<Ф	C	)							
		②Dim spot(LCD/TI	P/Polarizer dim o	lot, light leakage	e、dark spot)	-					
		Zone	Zone Acceptable Qty								
		Size (mm)	А	В	С						
		Ф≤0.1	lgno	ore							
		0.1<Φ≤0.2	2( distance	e≧10mm)	Ignore						
		0.2<Φ≤0.3	1	-	ignore						
						Ф>0.3	C	)			
		③ Polarizer accident	ted spot			r					
		Zone		Acceptable Qty	,						
		Size (mm)	А	В	С						
		Ф≤0.2	lgr	iore							
		0.2<Φ≤0.5	2( distanc	e≧10mm)	Ignore						
		Ф>0.5		0	-						

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	Line defect (LCD/TP			Acceptable Qty			
	/Polarizer black/white	Width(mm)	Length(mm)				
	line,			A	В	С	
	scratch,	Ф≤0.03	Ignore	Igno	ore		
	stain)	0.03 <w≤0.05< td=""><td>L≤3.0</td><td>N≤</td><td colspan="2">N≤2</td></w≤0.05<>	L≤3.0	N≤	N≤2		
		0.05 <w≤0.08< td=""><td>L≤2.0</td><td colspan="2">N≤2</td><td></td></w≤0.08<>	L≤2.0	N≤2			
		0.08 <w< td=""><td>De</td><td>fine as spo</td><td colspan="2">ine as spot defect</td></w<>	De	fine as spo	ine as spot defect		
			•				
		Zone	А	cceptable	Qty		
		Size (mm)	Α	В		С	
3.0	Polarizer Bubble	Ф≤0.2	Ignore				
5.0	Бирые	0.2<Φ≤0.4	2(distance ≧	10mm)		Ignore	
		0.4<Φ≤0.6	1		'	FIIOTE	
		0.6<Φ	0				
4.0	SMT	According to IPC-A-610 defect ,the others are		lard . Fund	ction defe	ect and mis	





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				,	Acceptable	0+17	
		TP bubble/	Size Φ (mm)	A	В	C	
		accidented	Ф≤0.1	Igr	nore		
		spot	0. 1⟨Φ≤0. 2		tance≧	-	
			0. 2<Φ≤0. 3		1	Ignore	
			0. 3< Ф		0	-	
						•	
		Assembly	harrana	معالم ا	of books	ht ≤0.15mm	
		deflection	beyond	i the eage	or backing	nt <0.15mm	
5. 0	TP Related	Newton Ring	Newton Ring area NG Newton Ring area OK		rea	2.排尿難生	



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TP corner broken X: length Y: width Z: height	x x≤3.0mm * Circuitry allowed.	Y Y≤3.0mm broken is	z z <lcd thickness</lcd 	z
TP edge broken X: length Y: width Z: height	x x≤6.0mm * Circuitr allowed.	Y Y≤2.0mm y broken is	z z <lcd thickness s not</lcd 	z

Criteria (functional items)

 riceria ( Idirecionar recins)						
Number	Items	Criteria (mm)				
1	No display	Not allowed				
2	Missing segment	Not allowed				
3	Short	Not allowed				
4	Backlight no lighting	Not allowed				
5	TP no function	Not allowed				

