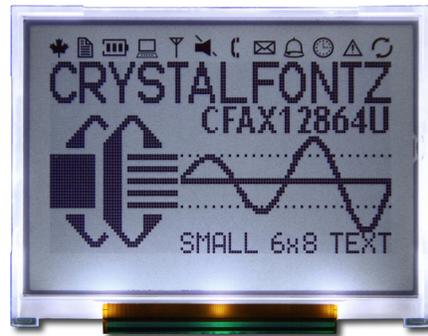




DISPLAY MODULE DATASHEET



Datasheet Release 2016-08-09
for
[CFAX12864U-TFH](#)

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CONTENTS

GENERAL INFORMATION	3
DISPLAY MODULE DESCRIPTION	5
General Specifications	5
Additional Features	5
Display Module Outline Drawing	6
ELECTRICAL CHARACTERISTICS	8
Absolute Maximum Ratings	8
Recommended DC Characteristics	9
LED BACKLIGHT CHARACTERISTICS	10
OPTICAL CHARACTERISTICS	11
Definition of Response Time (Tr, Tf) (STN positive)	12
Definition of Optimal Contrast Setting (STN Positive)	12
Definition of Vertical and Horizontal Viewing Angles (CR _{≥2})	13
INTERFACE DETAILS: PIN DESCRIPTIONS	14
DISPLAY MODULE RELIABILITY TEST RESULTS	18



GENERAL INFORMATION

Datasheet Revision History

Datasheet Release: 2016-08-08
This datasheet replaces the preliminary 2009 datasheet for the CFAQ12864U-TFH display module.

Product Change Notifications

To check for Product Change Notifications for this display module, see the Product Notices tab on a product's web page:
<https://www.crystalfontz.com/product/cfaq12864utfh#pcn>

Product pages without a Product Notices tab do not have Product Change Notifications.

About Variations

Slight variations (for example, contrast, color, or intensity) between lots are normal.

About Volatility

This display module has volatile memory.



The Fine Print

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DISPLAY MODULE DESCRIPTION

GENERAL SPECIFICATIONS

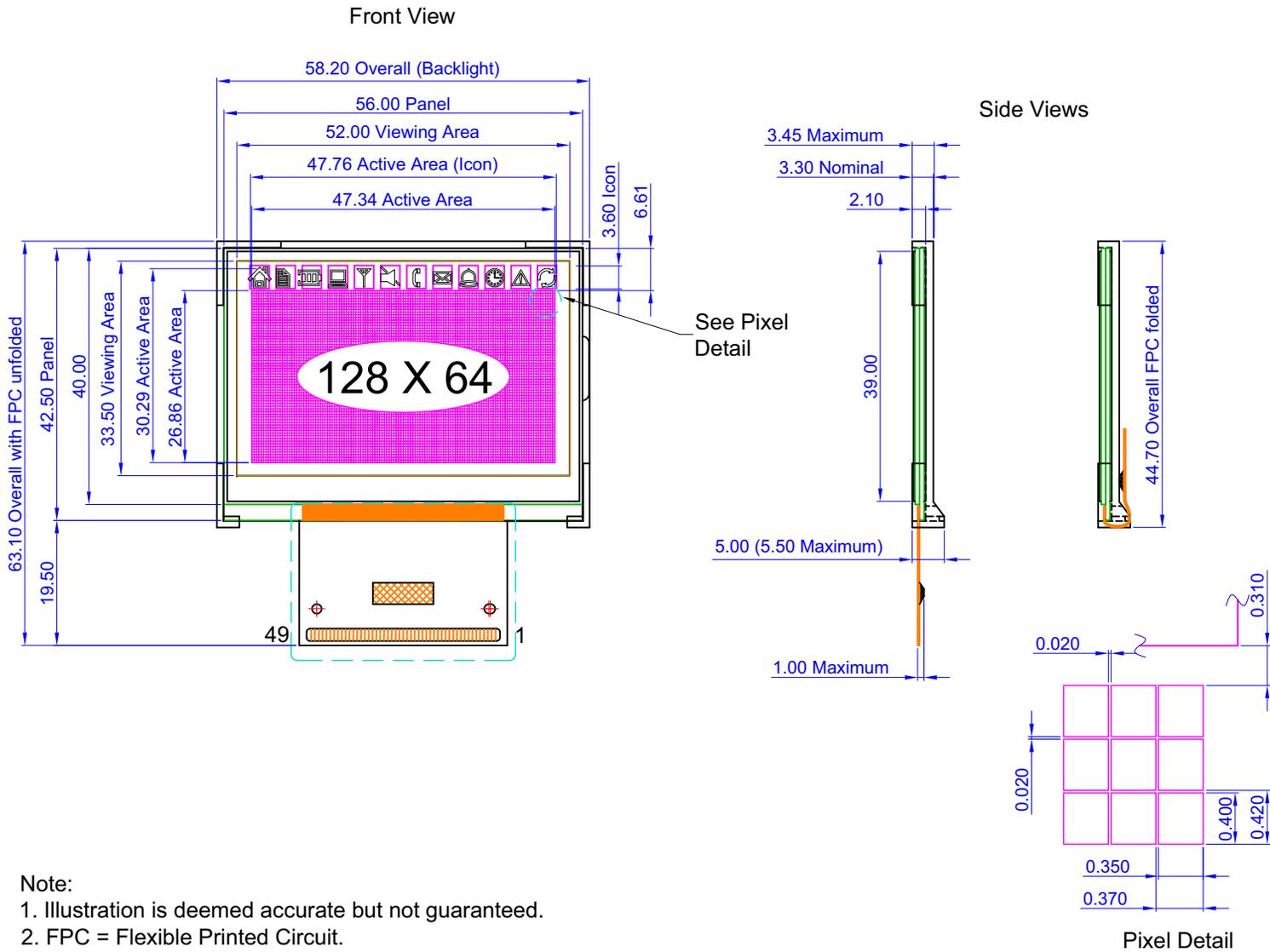
Item	Dimension	Unit
Number of dots	128 x 64	—
Module dimension	58.2 x 63.1 x 5.5 (MAX)	mm
View area	52.0 x 33.5	mm
Active area	47.76 x 30.29	mm
Dot size	0.40 x 0.35	mm
Dot pitch	0.42 x 0.37	mm
LCD type	FSTN Positive Transflective	
Duty	1/64	
View direction	6 o'clock	
Backlight Type	LED, White	
IC	NT7534	

ADDITIONAL FEATURES

- Sample code is available for download under the Datasheets & Files tab on this display's web page.
- For additional communications information, see the Novatek NT7534 datasheet on our website at <https://www.crystalfontz.com/controllers/Novatek/NT7534>.
- This display is RoHS compliant.
- CrystalFontz America Incorporated is ISO 9001:2008 certified.



DISPLAY MODULE OUTLINE DRAWING

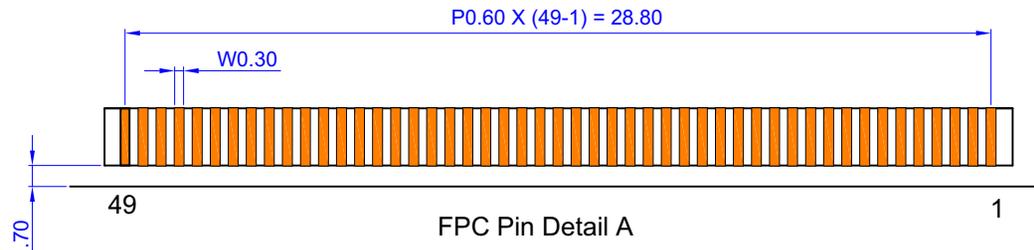
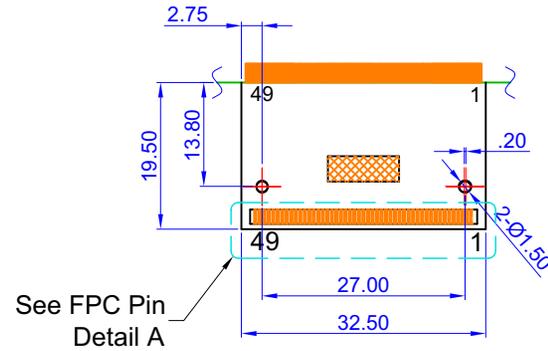


- Note:
1. Illustration is deemed accurate but not guaranteed.
 2. FPC = Flexible Printed Circuit.





FPC Details



Note:

1. Illustration is deemed accurate but not guaranteed.
2. FPC = Flexible Printed Circuit.



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Part No.(s):

CFAX12864U-TFH

Scale:

Not to scale

Units:

Millimeters

Drawing Number:

CFAX12864U_master

Date:

2016-08-08

Hardware Rev.:

Sheet:

2 of 2



ELECTRICAL CHARACTERISTICS

ABSOLUTE MAXIMUM RATINGS

The display module uses an LED backlight. LED backlights are easy to use, but they are also easily damaged.

CAUTION

Ensure that you have proper current and voltage control for your backlight before connecting the backlight circuit.

These are stress ratings only. Functional operation of the display module at these or any other conditions beyond those listed under Recommended DC Characteristics below is not implied. Stresses beyond those listed above can cause permanent damage.

Prolonged exposure at temperatures outside of the operating range may cause permanent damage to the display module.

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	T_{OP}	-20	—	+70	°C
Storage Temperature	T_{ST}	-30	—	+80	°C
Input Voltage	V_{IN}	-0.3	—	$V_{DD}+0.3$	V
Supply Voltage For Logic	$V_{DD}-V_{SS}$	-0.3	—	4.0	V
DC Supply Voltage	V_{OUT}	-0.3	—	15.0	V



RECOMMENDED DC CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage For Logic	$V_{DD}-V_{SS}$	—	3.0	3.3	3.6	V
Supply Voltage For LCD	V_{OP}	Ta=-20°C	—	—	—	V
		Ta=25°C	—	8.5	—	V
		Ta=70°C	—	—	—	V
Input High Volt.	V_{IH}	—	$0.8V_{DD}$	—	V_{DD}	V
Input Low Volt.	V_{IL}	—	V_{SS}	—	$0.2V_{DD}$	V
Output High Volt.	V_{OH}	—	$0.8V_{DD}$	—	V_{DD}	V
Output Low Volt.	V_{OL}	—	V_{DD}	—	$0.2V_{DD}$	V
Supply Current	I_{DD}	$V_{DD}=3.3V$	—	0.18	—	mA

Please kindly consider to design the V_{op} to be adjustable while programing the software to match LCD contrast tolerance.

ESD (ELECTRO-STATIC DISCHARGE)

The circuitry is industry standard CMOS logic and is susceptible to ESD damage. Please use industry standard anti-static precautions as you would for any other static sensitive devices such as expansion cards, motherboards, or integrated circuits. Ground your body, work surfaces, and equipment.



LED BACKLIGHT CHARACTERISTICS

NOTE

We recommend that the white LED backlight be dimmed or turned off during periods of inactivity to conserve its lifetime.

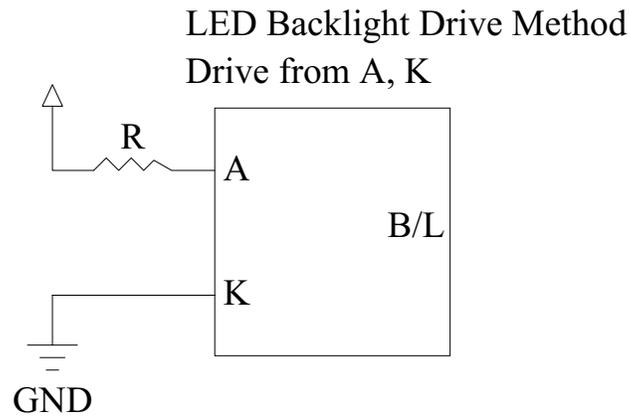
Specification

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	TEST CONDITION
Supply Current	I _{LED}	—	48	60	mA	V= 3.5V
Supply Voltage	V	3.4	3.5	3.6	V	—
Reverse Voltage	V _R	—	—	5	V	—
Color coordinate	X	0.235	0.265	0.295	—	I _{LED} =48mA
	Y	0.265	0.295	0.325		
Luminance (Without LCD)	I _V	440	550	—	CD/M ²	I _{LED} =48mA
			250			I _{LED} =16mA
LED Life Time	—	—	50K	—	Hr.	I _{LED} =48mA 25°C,50-60%RH, (Note 1)
Color	White					

Note: The LED of B/L is drive by current only, drive voltage is for reference only.
drive voltage can make driving current under safety area (current between
minimum and maximum).

Note1 :50K hours is only an estimate for reference.

Backlight Circuit:

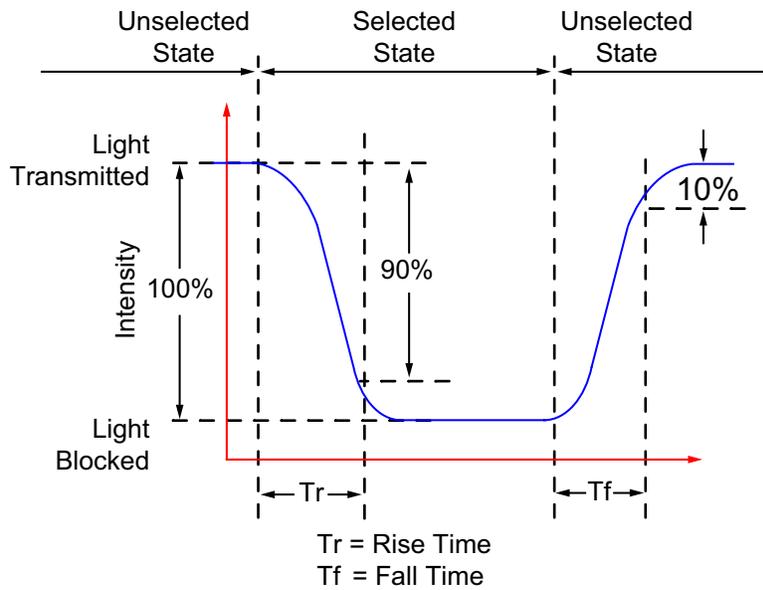


OPTICAL CHARACTERISTICS

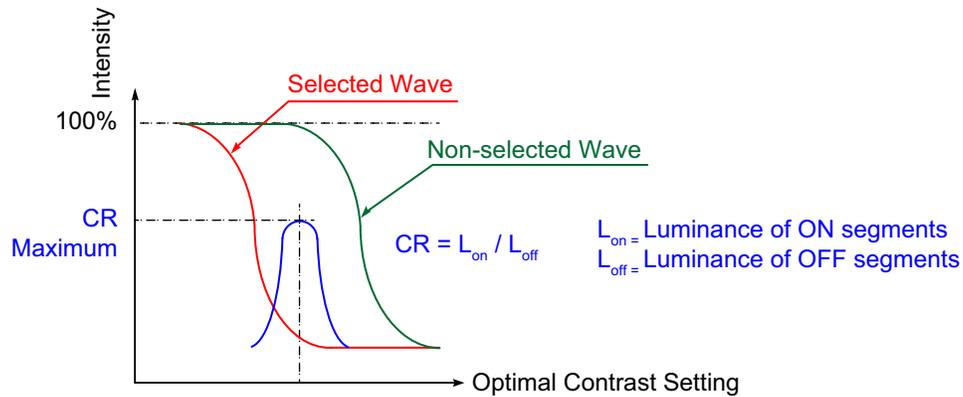
Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	θ	$CR \geq 2$	0	—	30	$\psi = 180^\circ$
	θ	$CR \geq 2$	0	—	60	$\psi = 0^\circ$
	θ	$CR \geq 2$	0	—	45	$\psi = 90^\circ$
	θ	$CR \geq 2$	0	—	45	$\psi = 270^\circ$
Contrast Ratio	CR	—	—	5	—	—
Response Time	T rise	—	—	200	300	ms
	T fall	—	—	250	350	ms



DEFINITION OF RESPONSE TIME (TR, TF) (STN POSITIVE)

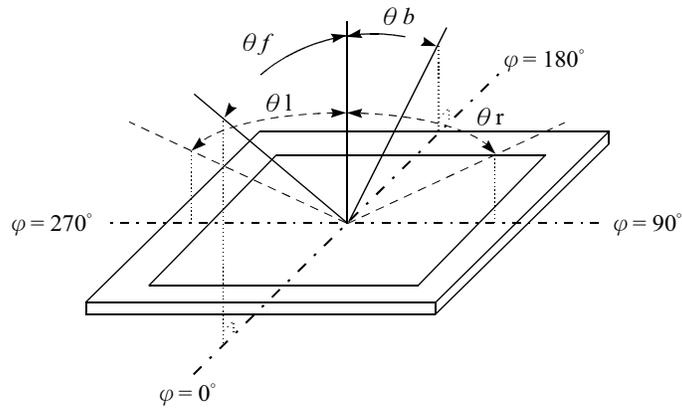


DEFINITION OF OPTIMAL CONTRAST SETTING (STN POSITIVE)





DEFINITION OF VERTICAL AND HORIZONTAL VIEWING ANGLES ($CR_{\geq 2}$)





INTERFACE DETAILS: PIN DESCRIPTIONS

Pin No.	Symbol	I/O	Description															
1	NC		No connection															
2	IRS	I	<p>This terminal selects the resistors for the V0 voltage level adjustment</p> <p>IRS = “H”, Use the internal resistors</p> <p>IRS = “L”, Do not use the internal resistors</p> <p>The V0 voltage level is regulated by an external resistive voltage divider attached to the VR terminal. This pad is enabled only when the master operation mode is selected. It is fixed to either “H” or “L” when the slave operation mode is selected</p>															
3	/HPM	I	<p>This is the power control terminal for the power supply circuit for liquid crystal drive.</p> <p>/HPM = “H”, Normal power mode</p> <p>/HPM = “L”, High power mode</p> <p>This pad is enabled only when the master operation mode is selected and it is fixed to either “H” or “L” when the slave operation mode is selected.</p>															
4	P/S	I	<p>This is the parallel data input/serial data input switch terminal</p> <p>P/S = “H”: Parallel data input</p> <p>P/S = “L”: Serial data input</p> <p>The following applies depending on the P/S status:</p> <table border="1" data-bbox="565 1381 1474 1564"> <thead> <tr> <th>P/S</th> <th>Data/Command</th> <th>Data</th> <th>Read/Write</th> <th>Serial Clock</th> </tr> </thead> <tbody> <tr> <td>“H”</td> <td>A0</td> <td>D0 to D7</td> <td>/RD, /WR</td> <td>-</td> </tr> <tr> <td>“L”</td> <td>A0</td> <td>SI (D7)</td> <td>Write only</td> <td>SCL (D6)</td> </tr> </tbody> </table> <p>When P/S = “L”, fix D0~D5 pads to VDD or VSS level. /RD(E) and /WR (R/W) are fixed to either “H” or “L”. With serial data input, RAM display data reading is not supported.</p>	P/S	Data/Command	Data	Read/Write	Serial Clock	“H”	A0	D0 to D7	/RD, /WR	-	“L”	A0	SI (D7)	Write only	SCL (D6)
P/S	Data/Command	Data	Read/Write	Serial Clock														
“H”	A0	D0 to D7	/RD, /WR	-														
“L”	A0	SI (D7)	Write only	SCL (D6)														
5	C86	I	<p>This is the MPU interface switch terminal</p> <p>C86 = “H”:6800 Series MPU interface</p> <p>C86 = “L”:8080 Series MPU interface</p>															



6	CLS	I	Terminal to select whether enable or disable the display clock internal oscillator circuit. CLS = "H": Internal oscillator circuit for display is enabled CLS = "L": Internal oscillator circuit for display is disabled (requires external input) When CLS = "L", input the display clock through the CL pad.
7	M/S	I	This terminal selects the master/slave operation for the NT7534 chips. Master operation outputs the timing signals that required for LCD display, while slave operation inputs the timing signals required for the liquid crystal display, synchronizing the liquid crystal display system.
8	VR	I	Voltage adjustment pad. Applies voltage between V0 and VSS using a resistive divider.
9	V0	I/O	LCD driver supplies voltages. The voltage determined by the LCD cell is impedance-converted by a resistive driver or an operation amplifier for application. Voltages should be according to the following relationship: $V0 \geq V1 \geq V2 \geq V3 \geq V4 \geq VSS2$ When the on-chip operating power circuit is on ,the following voltages are supplied to V1 to V4 by the on-chip power circuit. Voltages selection is performed by the LCD Bias Set command.
10	V4		
11	V3		
12	V2		
13	V1		
14	NC		No connection
15	NC		No connection
16	C2-	O	Capacitor 2-pad for internal DC/DC voltage converter.
17	C2+	O	Capacitor 2+pad for internal DC/DC voltage converter.
18	C1+		Capacitor 1+pad for internal DC/DC voltage converter.
19	C1-		Capacitor 1-pad for internal DC/DC voltage converter.
20	C3+		Capacitor 3+pad for internal DC/DC voltage converter.
21	NC		No connection
22	VOUT	I/O	DC/DC voltage converter output
23	VSS	O	Ground output for pad option.
24	VDD2	Supply	These are the power supply pads for the step-up voltage circuit for the LCD. These pads must be connected to each other.
25	VDD	O	Power supply output for pad option
26	DUTY1	I	Select the maximum LCD driver duty
27	DUTY0		
28	D7	I/O	This is an 8-bit bi-directional data bus that connects to an 8-bit or 16-bit standard MPU data bus. When the serial interface is selected (P/S= "L"), then D7 serves as the serial data input terminal (SI) and D6 serves as the serial clock input
29	D6		
30	D5		
31	D4		



32	D3		terminal (SCL). When the serial interface is selected , fix D0~D5 pads to VDD or VSS level. When the chip select is inactive, D0 to D7 are set to high impedance.
33	D2		
34	D1		
35	D0		
36	/RD	I	When connected to an 8080 MPU ,it is active LOW. This pad is connected to the /RD signal of the 8080 MPU ,and the NT7534 data bus is in an output status when this signal is “L”. When connected to a 6800 Series MPU, this is active HIGH. This is used as an enable clock input of the 6800 series MPU
37	/WR	I	When connected to an 8080 MPU, this is active LOW . This terminal connects to the 8080 MPU, and the NT7534 data bus are latched at rising edge of the /WR signal. When connected to an 8080 MPU, this is the read/write control signal input terminal. When R/W= “H”: Read When R/W= “L”: Write
38	A0	I	This is connected to the least significant bit of the normal MPU address bus, and it determines whether the data bits are data or a command . A0=“H”: Indicate that D0 to D7 are display data A0=“L”: Indicate that D0 to D7 are control data
39	/RES	I	When /RES is set to “L” the settings are initialized. The reset operation is performed by the /RES signal level.
40	CS2	I	This is the chip select signal
41	/CS1		This is the chip select signal
42	NC		No connection
43	/DOF	I/O	This is the liquid crystal display blanking control terminal. M/S=“H”:output M/S= “L”:Inptu When the NT7534chip is used in master/slave mode, the various DOF terminals must be connected.
44	CL		This is the display clock input terminal .When the NT7534 chips are used in master/slave mode ,the various CL terminals must be connected.
45	FR	I/O	This is the liquid crystal alternating current signal I/O terminal M/S=“H”:output M/S= “L”:Inptut When the NT7534chip is used in master/slave mode, the various FR terminals must be connected.
46	NC		No connection
47	NC		No connection



48	NC		No connection
49	NC		No connection



DISPLAY MODULE RELIABILITY TEST RESULTS

Environmental Test			
Test Item	Content of Test	Test Condition	Note
High Temperature storage	Endurance test applying the high storage temperature for a long time.	80°C 200hrs	2
Low Temperature storage	Endurance test applying the low storage temperature for a long time.	-30°C 200hrs	1,2
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70°C 200hrs	— —
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20°C 200hrs	1
High Temperature/ Humidity storage	The module should be allowed to stand at 60°C,90%RH max For 96hrs under no-load condition excluding the polarizer, Then taking it out and drying it at normal temperature.	60°C,90%RH 96hrs	1,2
Thermal shock resistance	The sample should be allowed stand the following 10 cycles of operation -20°C 25°C 70°C 30min 5min 30min 1 cycle	-20°C/70°C 10 cycles	— —
Vibration test	Endurance test applying the vibration during transportation and using.	Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes	3
Static electricity test	Endurance test applying the electric stress to the terminal.	VS=±600V(contact), ±800v(air), RS=330Ω CS=150pF 10 times	— —

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.