PRODUCT	:	LCD MODULE
MODEL NO	:	LCD200DLAF-01-100N
SUPPLIER	:	LCD Mikroelektronik GmbH
DATE	:	Feb.26.2021

SPECIFICATION

Prepared by	Checked	Approved

CUSTOMER:
MODEL NO.:   DATE:

Prepared by	Checked	Approved

ADD: Otto-Lilienthal-Str. 13, D-76275 Ettlingen

E-mail :   lcd@lcd-mikroelektronik.com
Web: http://www.lcd-mikroelektronik.com

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Revision Record

Rev No.	Rev Date	Contents	Remarks
1.0	APR.04.2018	New creation	
1.1	May.07.2019	Modify mechanical drawing and backlight	P5,P8
1.2	Feb.26.2021	Modify mechanical drawing	P5

1. General Specifications

No	Item	Contents	Unit
1	Size	2	inch
2	Resolution	240RGB*320	
3	Interface	8080 series CPU, RGB	
4	Color Depth	262K	
5	Technology Type	a-Si TFT	
6	Pixel Pitch	0.1275*0.1275	mm
7	Display Mode	Transmissive, IPS　NB	
8	Viewing Direction	ALL VIEW	
9	LCM (W x H x D)	35.6*48.7*2.47	mm
10	Active Area (W x H)	30.6*40.8	mm
11	With/Without CTP	Without CTP	
12	LED Numbers	3	

2. Mechanical Drawing

CUSTOMER'S APPROVED: DATE: PAGE:

NO.	DESCRIPTION	DATE
1		
2	Modify driver IC.	2021.2.26
3	Modify backlight circuit diagram.	2018.9.29
4		
5		

Backlight circuit diagram:
$Vf = 8.5V(min.) \ 9.0V(typ.) \ 9.5V(max.)$
$If = 20mA$

240RGB*320
ALL VIEW

(0, 0)

*48.7 LED
*46.6 LCD O.D.
40.8 LCD A.A.

*17.9±0.5
*5±0.5
25.5±0.1
5±0.5
50

*35.6 LED
*33.6 LCD O.D.
30.6 LCD A.A.

STIFFENER
CONTACT 0.3±0.05

*2.47 TFT
*2.35±0.1 LED

Reflector Film
ROHS TC0314A-10 ??? XX

50
P0.5*(50-1) =24.5
0.3
1
3.5 ±0.3
0.5

Unit:mm
Chk   Apv

1	Operating Voltage:	VDD=2.75V (typ.)
2	Resolution:	240RGB*320
3	Color:	262K
4	Interface:	8080 series CPU, RGB
5	Display type:	Transmissive, IPS
6	Viewing Direction:	ALL VIEW
7	Operating Temp:	-20°C~70°C
8	Storage Temp:	-30°C~80°C
9	Driver IC:	ST7789V2
10	Unspecified tolerance:	±0.2
11	LCM Luminance:	440 cd/m^2 (min.) 530 cd/m^2 (typ.)

PIN	NAME:				
1	LEDK	26	DB2		
2	LEDK	27	DB1		
3	LEDA	28	DB0		
4	LEDA	29	GND		
5	GND	30	SDA		
6	VCOM	31	DOTCLK		
7	VGH	32	ENABLE		
8	VDDI	33	HSYNC		
9	SDO	34	VHYNC		
10	TE	35	RDX		
11	DB17	36	WRX		
12	DB16	37	DCX		
13	DB15	38	CSX		
14	DB14	39	RESX		
15	DB13	40	GND		
16	DB12	41	IM0		
17	DB11	42	IM1		
18	DB10	43	IM2		
19	DB9	44	IM3		
20	DB8	45	GND		
21	DB7	46	VDD		
22	DB6	47	VDD		
23	DB5	48	GND		
24	DB4	49	GND		
25	DB3	50	VGL		

3. PIN Assignment

Pin No	Symbol	I/O	Function	Remark
1-2	LEDK	P	LED cathode	
3-4	LEDA	P	LED anode	
5	GND	P	Ground	
6	VCOM	P	Common Voltage	
7	VGH	P	Gate ON Voltage	
8	VDDI	I	Power Supply for I/O System	
9	SDO	O	-SPI interface output pin. -The data is output on the falling edge of the SCL signal. -If not used, let this pin open.	
10	TE	O	-Tearing effect signal is used to synchronize MCU to frame memory writing. -If not used, please let this pin open	
11-28	DB17-DB0	I	-DB[17:0] are used as MCU parallel interface data bus. 18-bit I/F: DB[17:0] are used. -If not used, please fix this pin at VDDI or DGND.	
29	GND	P	Ground	
30	SDA	I/O	-When IM3: Low, SPI interface input/output pin. -When IM3: High, SPI interface input pin. -The data is latched on the rising edge of the SCL signal. -If not used, please fix this pin at VDDI or DGND level.	
31	DOTCLK	I	-Dot clock signal for RGB interface operation. -If not used, please fix this pin at VDDI or DGND.	
32	ENABLE	I	-Data enable signal for RGB interface operation. -If not used, please fix this pin at VDDI or DGND.	
33	HSYNC	I	-Horizontal (Line) synchronizing input signal for RGB interface operation. - If not used, please fix to VDDI or DGND	
34	VHYNC	I	-Vertical (Frame) synchronizing input signal for RGB interface operation. -If not used, please fix to the VDDI or DGND.	
35	RDX	I	-Read enable in 8080 MCU parallel interface. -If not used, please fix this pin at VDDI or DGND.	
36	WRX	I	-Write enable in MCU parallel interface. - Display data/command selection pin in 4-line serial interface. - Second Data lane in 2 data lane serial interface. -If not used, please fix this pin at VDDI or DGND.	
37	DCX	I	-Display data/command selection pin in parallel interface. -This pin is used to be serial interface clock. DCX='1': display data or parameter. DCX='0': command data. -If not used, please fix this pin at VDDI or DGND.	

Pin No	Symbol	I/O	Function	Remark
38	CSX	I	-Chip selection pin Low enable. High disable.	
39	RESX	I	-This signal will reset the device and it must be applied to properly initialize the chip. -Signal is active low.	
40	GND	P	Ground	
41-44	IM0-IM3	I	NOTE1	
45	GND	P	Ground	
46-47	VDD	P	Power supply	
48-49	GND	P	Ground	
50	VGL	P	Gate OFF Voltage	

PS. For further details, please refer to ST7789V2 data sheet.

NOTE1: -The MCU interface mode select.

IM3	IM2	IM1	IM0	MPU Interface Mode	Data pin
0	0	0	0	80-8bit parallel I/F	DB[7:0]
0	0	0	1	80-16bit parallel I/F	DB[15:0]
0	0	1	0	80-9bit parallel I/F	DB[8:0]
0	0	1	1	80-18bit parallel I/F	DB[17:0],
0	1	0	1	3-line 9bit serial I/F	SDA: in/out
				2 data lane serial I/F	SDA: in/out WRX: in
0	1	1	0	4-line 8bit serial I/F	SDA: in/out
1	0	0	0	80-16bit parallel I/F Ⅱ	DB[17:10], DB[8:1]
1	0	0	1	80-8bit parallel I/F Ⅱ	DB[17:10]
1	0	1	0	80-18bit parallel I/F Ⅱ	DB[17:0],
1	0	1	1	80-9bit parallel I/F Ⅱ	DB[17:9]
1	1	0	1	3-line 9bit serial I/F Ⅱ	SDA: in/ SDO: out
1	1	1	0	4-line 8bit serial I/F Ⅱ	SDA:in/ SDO: out

4. Absolute Maximum Rating

AGND = GND = 0V , Ta = 25° C

Item	Symbol	Min	Max	Unit	Remark
Power Voltage	VDD	-0.3	4.6	V	
	VDDI	-0.3	4.6	V	
Operating Temperature	OPR	-20	70	C	
Storage Temperature	STG	-30	80		

The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

5. Electrical Characteristics

5.1. Recommended Operating Condition

AGND = GND = 0V , Ta = 25° C

Item	Symbol	Min	Typ.	Max	Unit	Remark
Power Voltage	VDD	2.4	2.75	3.3	V	
Input logic high voltage	V_{IH}	0.7VDDI	-	VDDI	V	
Input logic low voltage	V_{IL}	VSS	-	0.3VDDI	V	

5. 2.Rcommended Driving Condition for Backlight

Ta = 25° C

Item	Symbol	Min	Typ.	Max	Unit	Remark
Forward Voltage	Vf	8.5	9.0	9.5	V	
Forward Current	If		20		mA	
Operating Life Time	-	20000			Hours	℃

Note 1:The LED supply voltage is defined by the number of LED at Ta=25

and

If =20mA.

Note 2:The "Operating Life Time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ and If =20 mA. The LED lifetime could be decreased if operating If is lager than20mA.

6. Timing Characteristics

6.1. AC Electrical Characteristics

8080 Series MCU Parallel Interface Characteristics: 18/16/9/8-bit Bus
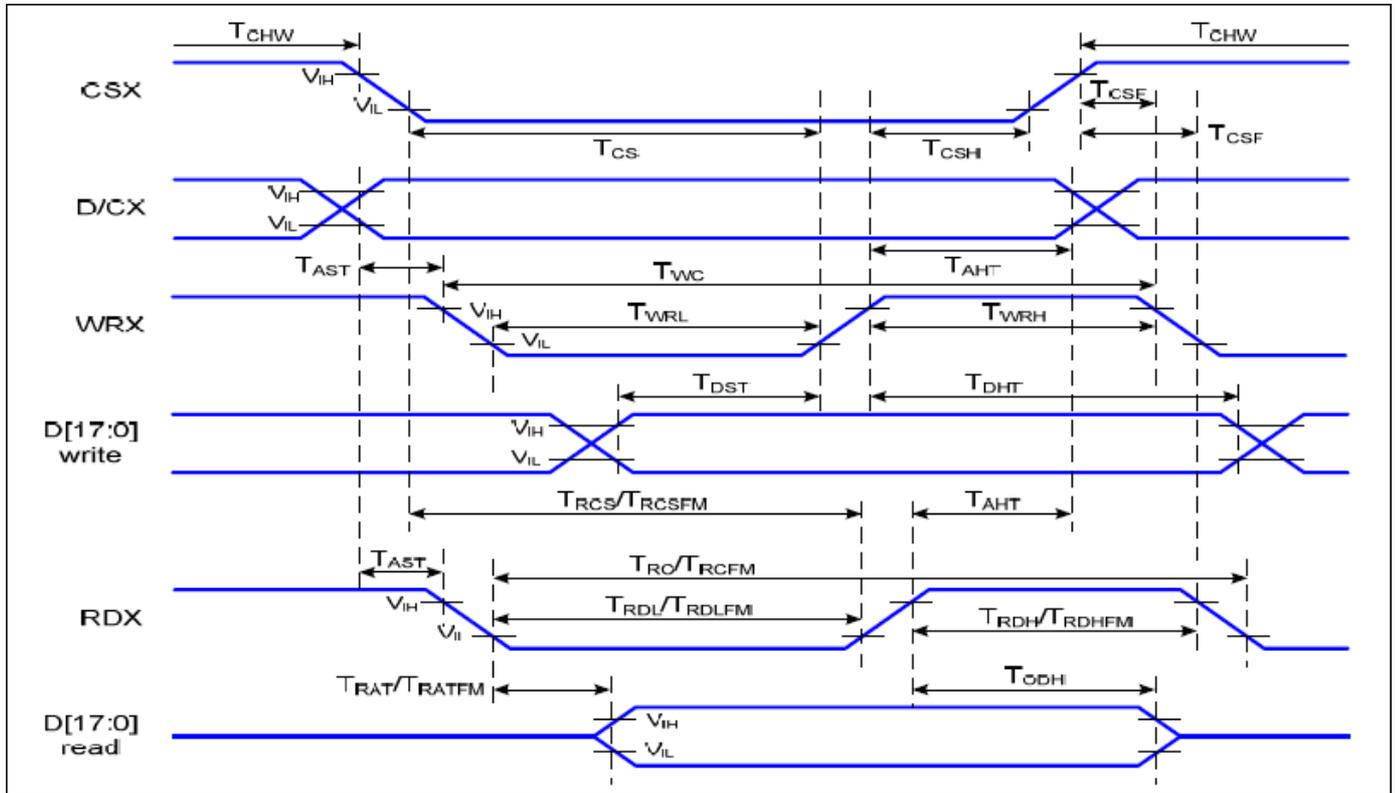
Parallel Interface Timing Characteristics (8080-Series MCU Interface)

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta= -30 to 70 ℃

Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T_{AST}	Address setup time	0		ns	-
	T_{AHT}	Address hold time (Write/Read)	10		ns	
CSX	T_{CHW}	Chip select "H" pulse width	0		ns	-
	T_{CS}	Chip select setup time (Write)	15		ns	
	T_{RCS}	Chip select setup time (Read ID)	45		ns	
	T_{RCSFM}	Chip select setup time (Read FM)	355		ns	
	T_{CSF}	Chip select wait time (Write/Read)	10		ns	
	T_{CSH}	Chip select hold time	10		ns	
WRX	T_{WC}	Write cycle	66		ns	
	T_{WRH}	Control pulse "H" duration	15		ns	
	T_{WRL}	Control pulse "L" duration	15		ns	
RDX (ID)	T_{RC}	Read cycle (ID)	160		ns	When read ID data
	T_{RDH}	Control pulse "H" duration (ID)	90		ns	
	T_{RDL}	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	T_{RCFM}	Read cycle (FM)	450		ns	When read from frame memory
	T_{RDHFM}	Control pulse "H" duration (FM)	90		ns	
	T_{RDLFM}	Control pulse "L" duration (FM)	355		ns	
D[17:0]	T_{DST}	Data setup time	10		ns	For CL=30pF
	T_{DHT}	Data hold time	10		ns	
	T_{RAT}	Read access time (ID)		40	ns	
	T_{RATFM}	Read access time (FM)		340	ns	
	T_{ODH}	Output disable time	20	80	ns	

8080 Parallel Interface Characteristics

$V_{IH}=0.7 \times VDDI$
$V_{IL}=0.3 \times VDDI$
$T_R=T_F<=15ns$

$V_{OH}=0.8 \times VDDI$
$V_{OL}=0.2 \times VDDI$
$T_R=T_F<=15ns$

: Rising and Falling Timing for I/O Signal
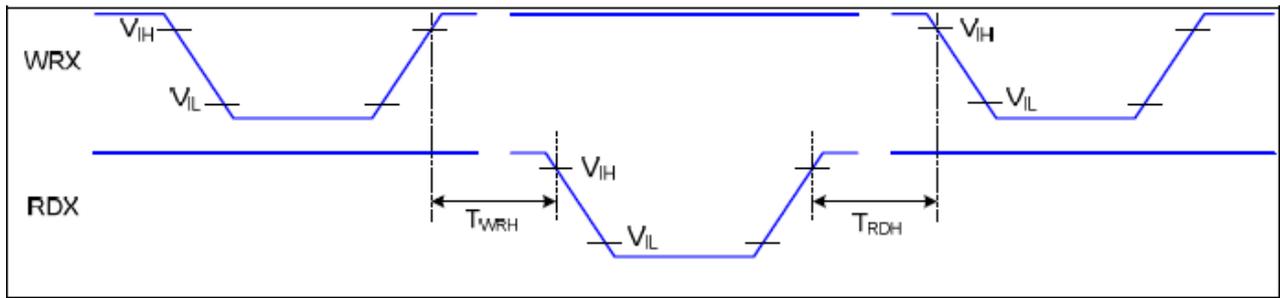
Write-to-Read and Read-to-Write Timing

Note: The rising time and falling time (Tr, Tf) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

Serial Interface Characteristics (3-line serial):

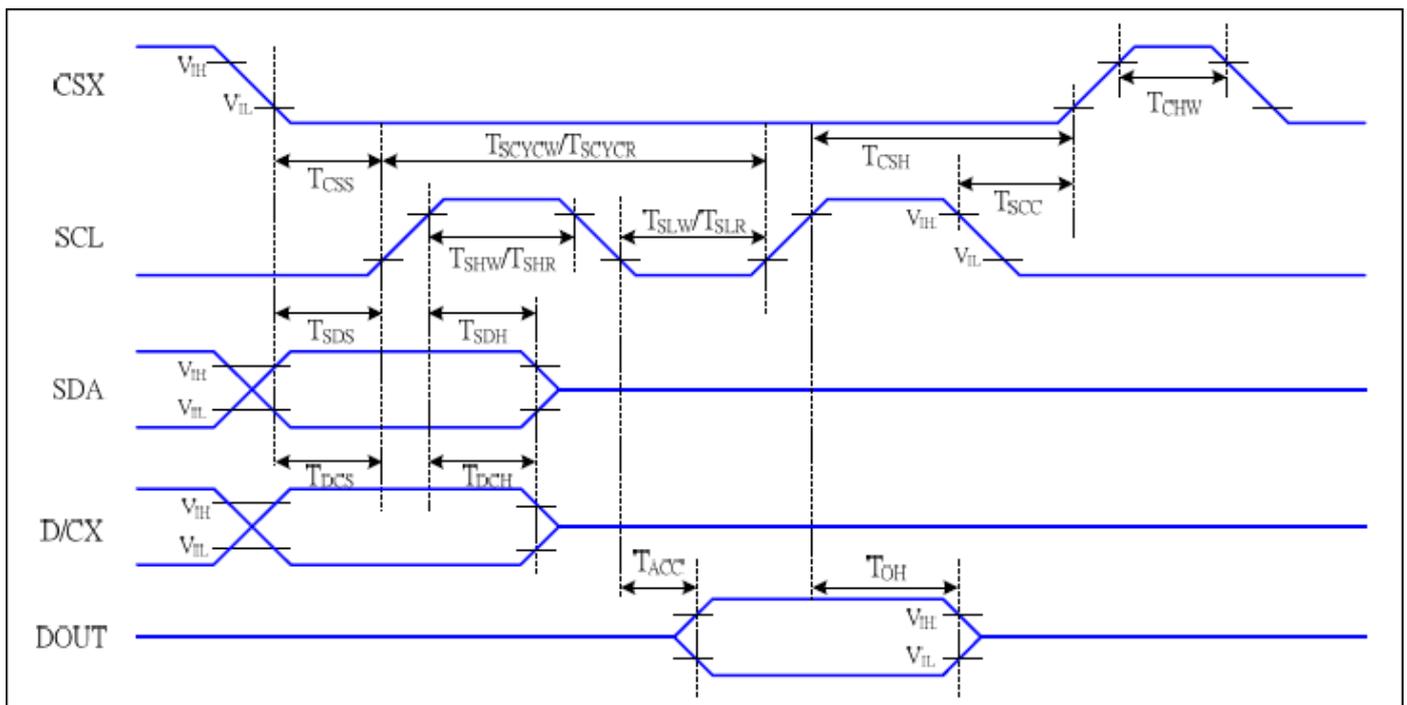
3-line serial Interface Timing Characteristics

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 to 70 ℃

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	16		ns	
	T_{SHW}	SCL "H" pulse width (Write)	7		ns	
	T_{SLW}	SCL "L" pulse width (Write)	7		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	T_{SDS}	Data setup time	7		ns	
	T_{SDH}	Data hold time	7		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

3-line serial Interface Characteristics

Note : The rising time and falling time (Tr, Tf) of input signal are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

Serial Interface Characteristics (4-line serial):

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 to 70 ℃

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	16		ns	-write command & data ram
	T_{SHW}	SCL "H" pulse width (Write)	7		ns	
	T_{SLW}	SCL "L" pulse width (Write)	7		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	-read command & data ram
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
D/CX	T_{DCS}	D/CX setup time	10		ns	
	T_{DCH}	D/CX hold time	10		ns	
SDA (DIN)	T_{SDS}	Data setup time	7		ns	
	T_{SDH}	Data hold time	7		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

RGB Interface Characteristics:

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 ~ 70 ℃

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T_{SYNCS}	VSYNC, HSYNC Setup Time	30	-	ns	
ENABLE	T_{ENS}	Enable Setup Time	25	-	ns	
	T_{ENH}	Enable Hold Time	25	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	60	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	60	-	ns	
	T_{CYCD}	DOTCLK Cycle Time	120	-	ns	
	Trghr, Trghf	DOTCLK Rise/Fall time	-	20	ns	
DB	T_{PDS}	PD Data Setup Time	50	-	ns	
	T_{PDH}	PD Data Hold Time	50	-	ns	

Reset Timing:
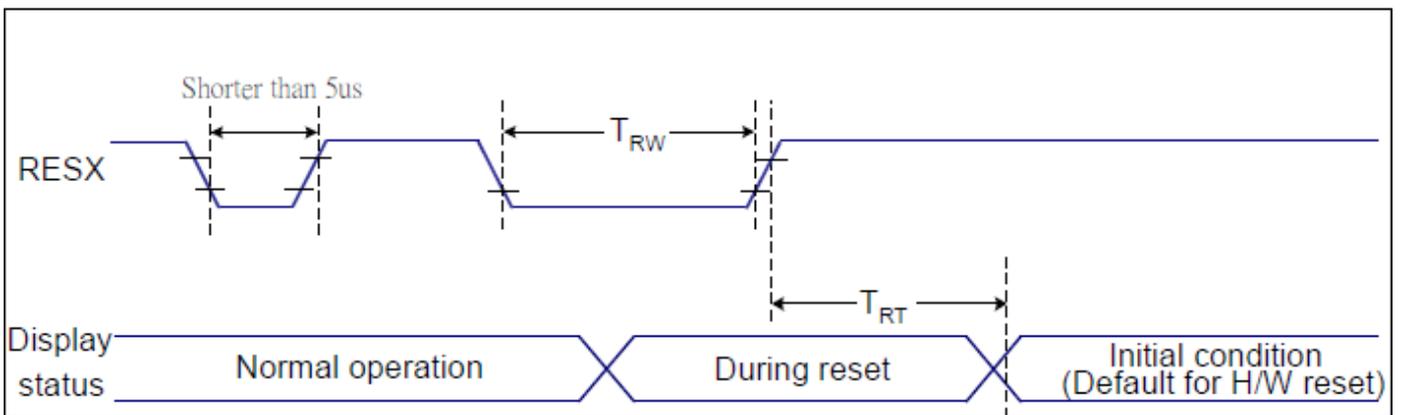
VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=-30 ~ 70 ℃

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120 (Note 1, 6, 7)	ms

6. 2.DC Electrical Characteristics

Parameter	Symbol	Condition	Specification			Unit	Related Pins
			MIN.	TYP.	MAX.		
Power & Operation Voltage							
System Voltage	VDD	Operating voltage	2.4	2.75	3.3	V	
Interface Operation Voltage	VDDI	I/O Supply Voltage	1.65	1.8	3.3	V	
Gate Driver High Voltage	VGH		12.2		14.97	V	Note 4
Gate Driver Low Voltage	VGL		-12.5		-7.16	V	
Gate Driver Supply Voltage		| VGH-VGL |	19.36		27.47	V	Note 5
Input / Output							
Logic-High Input Voltage	VIH		0.7VDDI		VDDI	V	Note 1
Logic-Low Input Voltage	VIL		VSS		0.3VDDI	V	Note 1
Logic-High Output Voltage	VOH	IOH = -1.0mA	0.8VDDI		VDDI	V	Note 1
Logic-Low Output Voltage	VOL	IOL = +1.0mA	VSS		0.2VDDI	V	Note 1
Logic-High Input Current	IIH	VIN = VDDI			1	uA	Note 1
Logic-Low Input Current	IIL	VIN = VSS	-1			uA	Note 1
Input Leakage Current	IIL	IOH = -1.0mA	-0.1		+0.1	uA	Note 1
VCOM Voltage							
VCOM amplitude	VCOM			VSS		V	
Source Driver							
Source Output Range	Vsout		VAN		VAP	V	
Gamma Reference Voltage(Positive)	VAP		4.45		6.4	V	Note 6
Gamma Reference Voltage(Negative)	VAN		-4.6		-2.65	V	
Source Output Settling Time	Tr	Below with 99% precision			20	us	Note 2
Output Offset Voltage	VOFFSET				35	mV	Note 3

Notes:

1. TA= -30 to 70℃ (to +85℃ no damage).

2. Source channel loading= 2KΩ+12pF/channel, Gate channel loading=5KΩ+40pF/channel.

3. The Max. value is between measured point of source output and gamma setting value.

4. When evaluating the maximum and minimum of VGH, VDD=2.8V.

5. The maximum value of |VGH-VGL| can no over 30V.

6. Default register setting of Vcom and Vcomoffset is 20h

6. 3.Power on/off sequence

VDDI and VDD can be applied in any order.

VDD and VDDI can be power down in any order.

During power off, if LCD is in the Sleep Out mode, VDD and VDDI must be powered down minimum 120msec after RESX has been released.

During power off, if LCD is in the Sleep In mode, VDDI or VDD can be powered down minimum 0msec after RESX has been released.

CSX can be applied at any timing or can be permanently grounded. RESX has priority over CSX.

Note 1: There will be no damage to the display module if the power sequences are not met.
Note 2: There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.
Note 3: There will be no abnormal visible effects on the display between end of Power On Sequence and before receiving Sleep Out command. Also between receiving Sleep In command and Power Off Sequence.
Note 4: If RESX line is not held stable by host during Power On Sequence as defined in the sequence below, then it will be necessary to apply a Hardware Reset (RESX) after Host Power On Sequence is complete to ensure correct operation. Otherwise function is not guaranteed.

The power on/off sequence is illustrated below
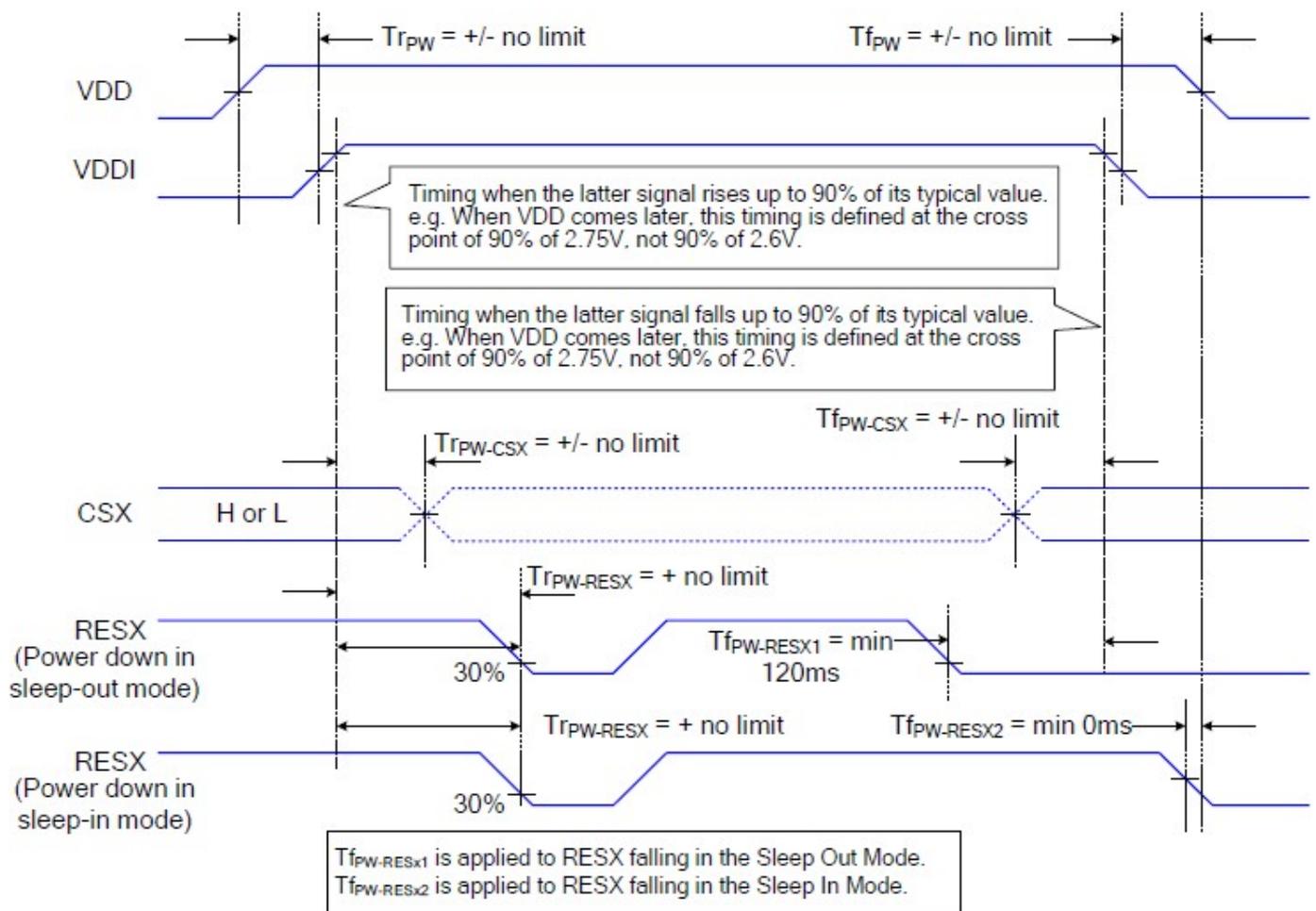
7. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	θ θ T θ	CR≥10 θ °		80		Degree	Note 2
	B θ			80			
	L			80			
	R			80			

Contrast Ratio	CR	= 0	640	800			Note 1

		°					Note 3

Chromaticity	W_x	x			0.296			Note 1
								Note 5
	W_y	y			0.325			

Uniformity	U		80	-	-	%	Note 5

Test Conditions:

1. If=20mA(Backlight current), VDD =2.75V,the ambient temperature is 25。C.
2. The test systems refer to Note 2.

Note1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5Minutes operation, the optical properties are measured at the center point of the LCD screen. ALL input terminals LCD panel must be ground when measuring the center area of the panel.
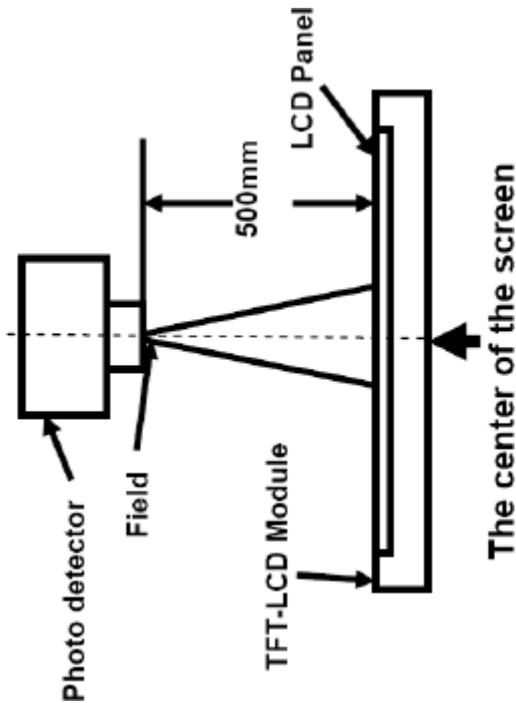
Item	Photo detector	Field
		o
~~Contrast Ratio~~	CS1000	1
Luminance		
Lum Uniformity		
Chromaticity	CS1000	
Response Time	DMS703	
		-

Note2: Definition of viewing angle range and measurement system.
Viewing angle is measured at the center point of the LCD by CONOSCOPE (DMS703)
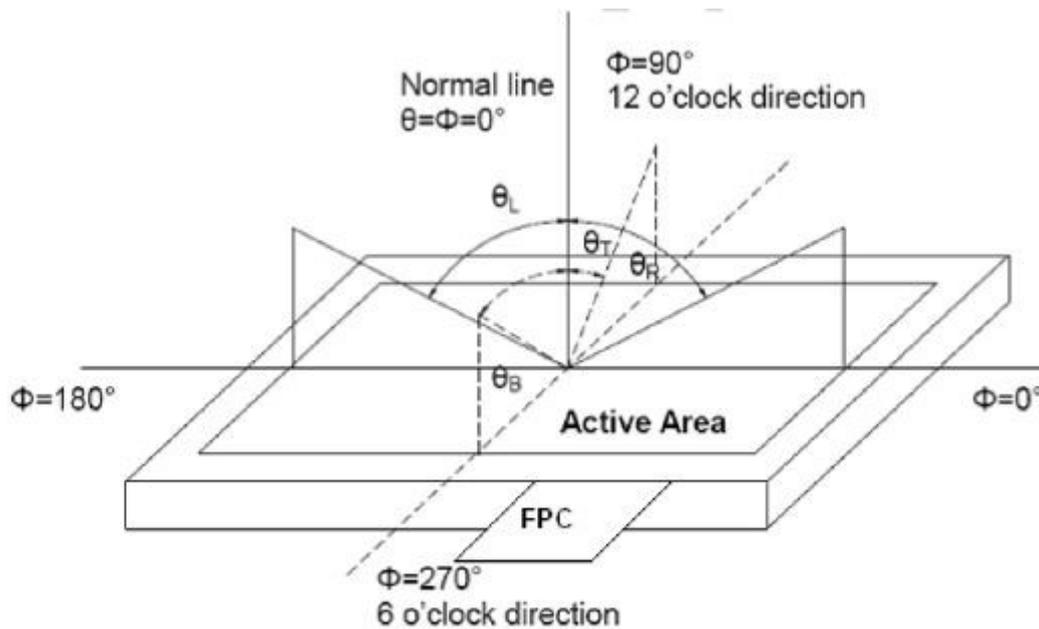
Note3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

"White state ":The state is that the LCD should drive by Vwhite.

"Black state ":The state is that the LCD should drive by Vblack.

Vwhite: To be determined   Vblack: To be determined

Note4:Definition of Response time

The response time is defined as the LCD optical switching time interval between "White"state and "Black" state. Rise time (T_{ON})is the time between photo detector output intensity changed from 90% to 10%.And fall time (T_{OFF})is the time between photo detector output intensity changed from 10% to90%.
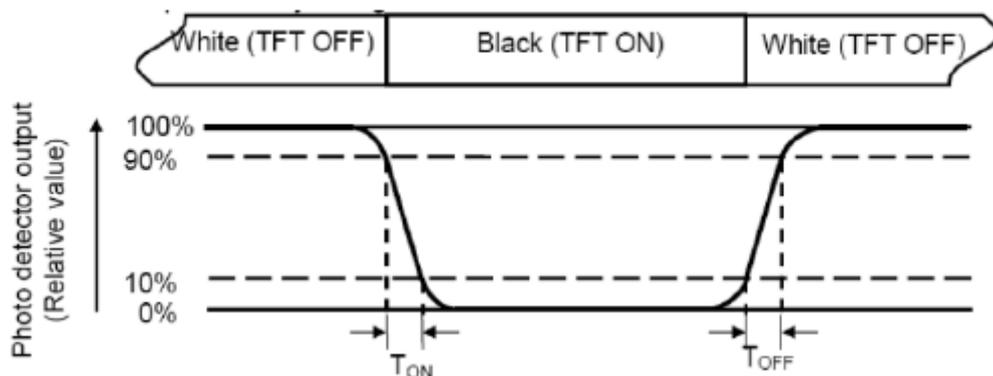
Note5:Definition of color chromaticity（CIE1931）

Color coordinates measured at center point of LCD.

Note6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas(Refer Fig.2).Every measuring point is placed at the center of each measuring area.

    Luminance Uniformity (U)=Lmin/Lmax

    L--------Active area length   W------- Active area width
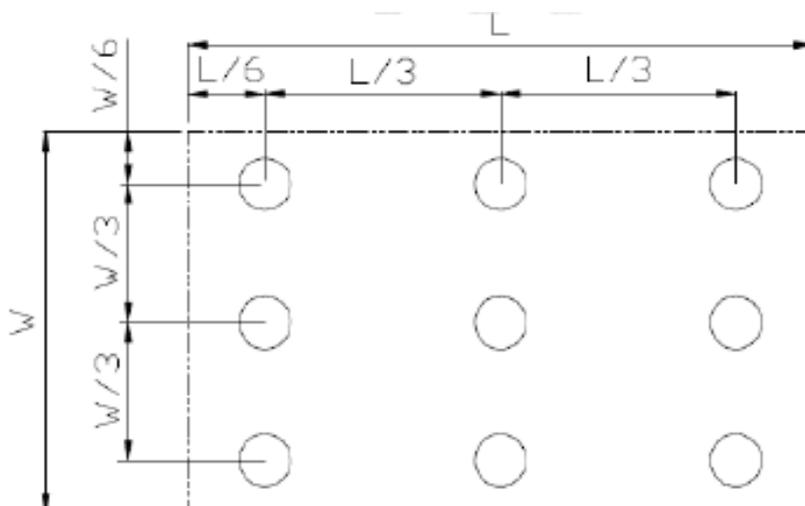
    L max: The measured Maximum luminance of all measurement position.

    L min: The measured Minimum luminance of all measurement position.

Note7: Definition of luminance: Measure the luminance of white state at center point.

8. Environmental/Reliability Test

No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	80±2℃ /240 hours	Inspection after 2~4hours storage at room temperature,the sample shall 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.
2	Low Temperature Storage	-30±2℃ /240 hours	
3	High Temperature Operating	70±2℃ /240 hours	
4	Low Temperature Operating	-30℃ /240 hours	
5	Temperature Cycle	-20±2 ~ 25 ~ 80℃ 10cycles (30min.) (5min.) (30min.)	
6	Damp Proof Test		
7	Vibration Test	Frequency：10Hz~55Hz~10Hz X，Y，Z direction for total Amplitude：1.5mm； 3hours (Packing condition)	
8	Dropping test	Drop to the ground from 1m height, one time, every side of carton. (Packing condition)	
9	ESD test	Voltage:±8KV R: 330Ω C: 150pF Air discharge, 10time	
		Voltage:±6KV R: 330Ω C: 150pF Contact discharge, 10time	

Remark:
1.The test samples should be applied to only one test item.
2.Sample size for each test item is 5~10pcs.
3.For Damp Proof Test, Pure water(Resistance＞10MΩ) 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.
6.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.
7.Please use automatic switch menu(or roll menu) testing mode when test operating mode.

9. Packing Drawing

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PRODUCT PART NO.: ☐ 200DLAF-01-100N

PACKING TYPE: BY EPE TRAY(T200DLAF-01-100A)

PACKLING ORDER:

1) Putting 20 pcs Modules on each EPE tray.

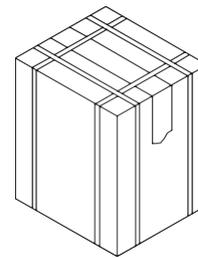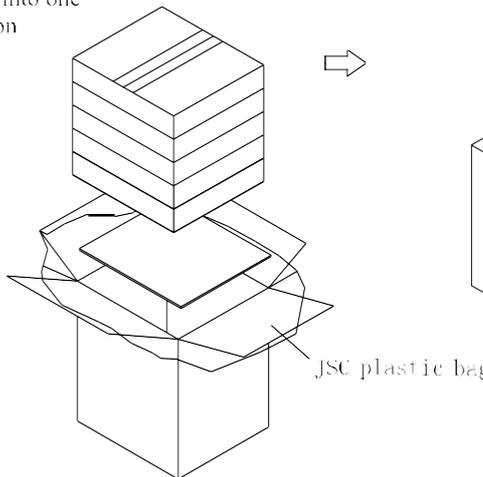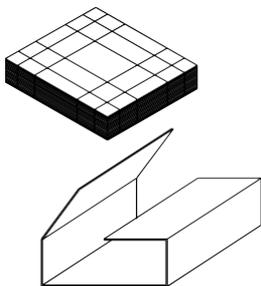2) Putting 8 pcs EPE trays together with EPE paper on the top of EPE tray.

3) Assembling the boards and the tray together with adhesive tape

Paper board — EPE board
Paper board
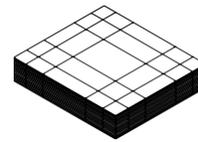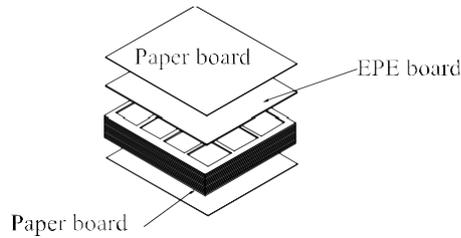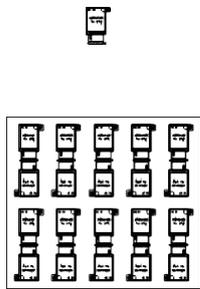
4) Putting in the inner small carton (TYPE:II82)

5) Putting 5 small cartons into one outcarton

6) Packing finished

JSC plastic bag

Note: 20 pcs in a tray, 8 trays in a inner carton.5 inner cartons in a out carton, so 20×8×5=800pcs/Outcarton

Dimension (Small carton): 385*325*87mm   Dimension (Out carton): 394*344*470mm

10. Standard Specifications For Product Quality

10.1. Manner of test:

10.1.1   The test must be under 40W fluorescent light, and the distance of view must be at 30±10cm.

   10.1.2   Room temperature 25±5℃   Humidity: (60±10)％RH.

10.2. Quality specification

It shall be based on GB2828-87, inspection level Ⅱ.

	IETM	CHECK LEVEL	AQL
MAJOR (MA)	1. Liquid crystal leakage 2. Wrong polarizer 3. Outside dimension 4. Bright dot、Dark dot 5. Display abnormal 6. Glass crack Spot Defect (Including black spot、white spot、pinhole、foreign particle、bubbles、hurt）	Ⅱ	0.65
MINOR (MI)	1. Line Defect (Including black line、white line、cratch) 2. Fragment 4. Incision defect 5. Newton's ring 6. Other visual defects	Ⅱ Ⅰ	1.0

10.3.   Definition of area:

   10.3.1 Ⅰ area: viewing area

      Ⅱ area: outside viewing area

10.4. Standard of appearance test for Ⅰ area: (unit: mm)

      NOTE：Defect ignore for Ⅱ area.

10.4.1 Bright/Dark Dots explain

Name	Explain	Definition
Bright dot	Dots appear bright and unchanged in size in which LCD panel isdisplaying under black pattern 亮點	The definition of dot: The size of a defective dot over 1/2 of single pixel dot is regarded as one defective dot . NOTE: One pixel consists of 3 sub-pixels, including R,G, and B dot.(Sub-pixel = Dot)
Dark dot	Dots appear dark and unchanged in size in which LCD panel isdisplaying under pure red, green, blue pattern. （ ）	
ADJACENT DOT	Adjacent two sub-pixel are defect define two dot defect	
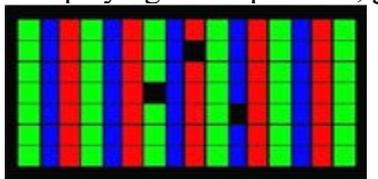
10.4.2 Inspection standard

№	Items	Criterion			Checking Manner	Defect Classes
1	Bright/dark dot	Under 6" (contain 6")	Bright dot：$N \leq 2$ Dark dot：$N \leq 4$ Note: be more than 5mm apart		Checking with eyes	MAJ
		6"-12"	Bright dot：$N \leq 5$ Dark dot： Total Bright and Dark Dots：N≤8 **Note :** 1. Two bright dot defects (red, green, blue, and white) should be larger than 15mm. 2. The distance between black dot defects or black and bright dot defects should be more than 5mm apart.			
2	Spot Defect (Including black spot.white spot. Pinhole.foreign particle.bubbles.hair) D=(X+Y)/2	contain 6"）	$D \leq 0.1$ Ignore $0.1 < D \leq 0.35$ N≤3 $0.35 < D$ N=0		Checking with eyes	MIN
		6"-12"	$D \leq 0.3$ Ignore $0.3 < D \leq 0.6$ N≤4 $0.6 < D$ N=0			

№	Items	Criterion			Checking manner	Defect classes
			<			
3	(Including black Line.white line. scratch)	Under 6" (contain 6")	$0.04 < W \le 0.04$ $L \le 5$ $N \le 2$ $W > 0.06$ $N=0$		Checking with eyes	MIN
		6"-12"	$W \le 0.07$ Ignore $W > 0.1$ $W \le 0.10$ $L \le 10$ $N \le 4$			
4	Display abnormal	Not allowed			Checking with eyes	MAJ
5	Outside dimension	Accord with drawing			Callipers	MAJ
6	Class crack	Not allowed			Checking with eyes	MAJ
7	Leak	Not allowed Note ：			Checking with eyes	MAJ
8	Corner fragment	$X \le$ $Y \le$ $Z \le$ Ignore 2.T: Glass thickness X: Length Y: Width Z: thickness 1.No hurt identifying .wire.seal			Checking with eyes	MIN
	Side fragment	Note ：$Z \le T$ Ignore 2.T: Glass thickness X: Length Y: Width Z: thickness 1.No hurt identifying .wire.seal			Checking with eyes	MIN
9	Step fragment	$Y \le 1$ and $Y \le 1/4 L$			Checking with eyes	MIN
	Incision defect	$Y \le 1$ and accord with outside dimension			Checking with eyes	MIN
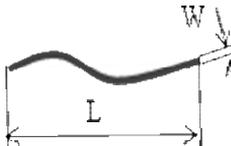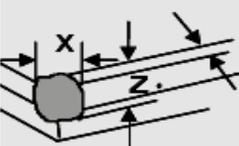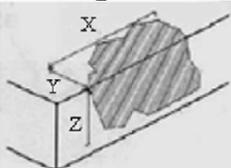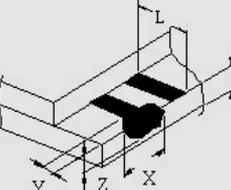
№	Items	Criterion		Checking manner	Defect classes
10	Newton's ring (CTP or Cover) D=(X+Y)/2	Under 6" (contain 6")	~~D≥25~~ ~~N≤3~~ 25 N=0	Checking with eyes	MIN
		6"-12"	~~D≥700~~ ~~N≤9~~ 7		
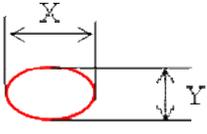
11. Precautions for Use of LCD Modules
11.1 Handing Precautions

(1) The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

(2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

(3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass,tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents

- Isopropyl alcohol
- Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

(6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.

- Water
- Ketone
- Aromatic solvents

Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.

(7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

(8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I   O cable
or the backlight cable.

(9) Do not attempt to disassemble or process the LCD module.

(10) NC terminal should be open. Do not connect anything.

(11) If the logic circuit power is off, do not apply the input signals.

(12) Electro-Static Discharge Control,Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential.Be sure to ground the body when handling the LCD modules.

- Tools required for assembling, such as soldering irons, must be properly grounded. make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.

- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended.As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.

The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

(13)Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.
- Do not alter, modify or change the shape of the tab on the metal frame.
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist LCM.

11.2 Storage Precautions
When storing the LCD modules, the following precaution is necessary.
(1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.
(2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C.
(3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped).

11.3 Others
Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear.A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following

sections when handling the modules.
- Exposed area of the printed circuit board.
-Terminal electrode sections.

11.4 USING LCD MODULES
Installing LCD Modules
The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.
(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.
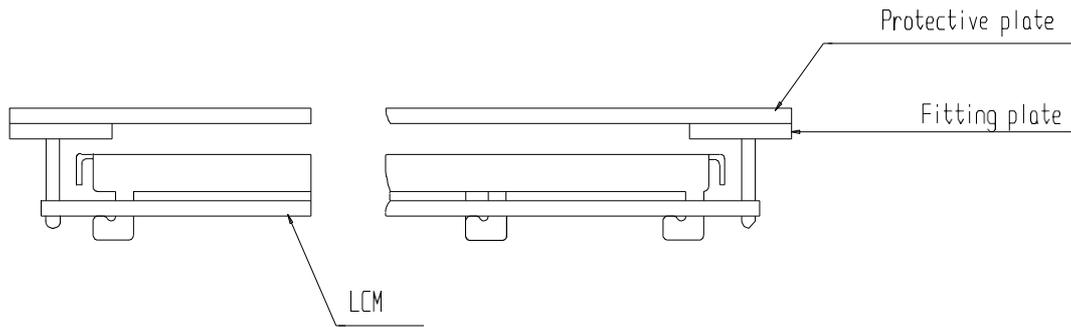
(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ±0.1mm.

Precaution for assemble the module with BTB connector:
Please note the position of the male and female connector position,don't assemble or assemble like the method which the following picture shows
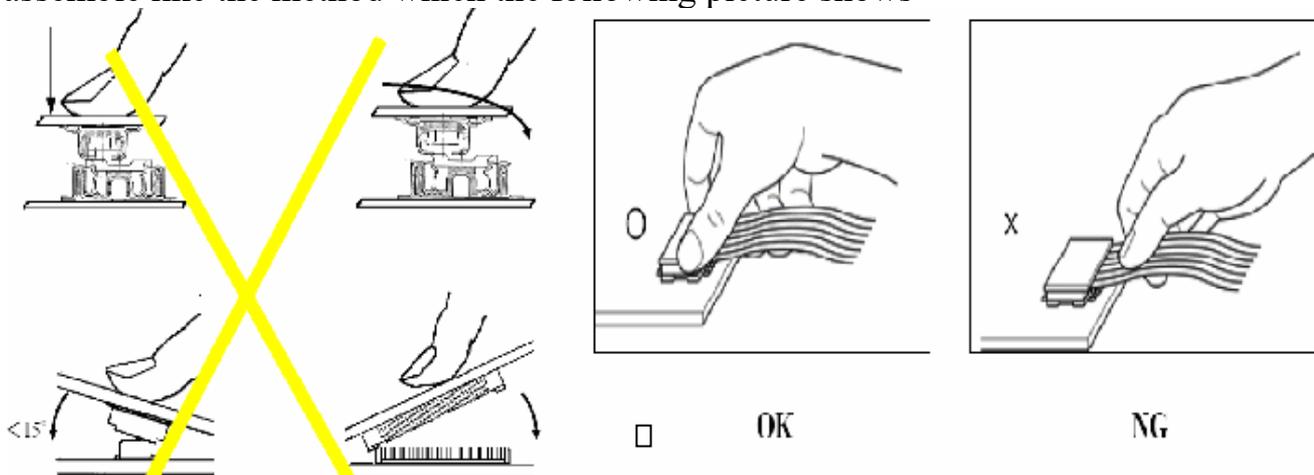
Precaution for soldering to the LCM

	Hand soldering	Machine drag	Machine press soldering
No ROHS Product	290°C~350°C. Time : 3-5S.	330°C ~350°C. Speed : 4-8mm/s.	300°C~330C. Time : 3-6S. Press: 0.8~1.2Mpa
ROHS Product	340°C~370°C. Time : 3-5S.	350°C ~370°C. Time : 4-8 mm/s.	330°C~360C. Time : 3-6S. Press: 0.8~1.2Mpa

(1) If soldering flux is used, be sure to remove any remaining flux after finishing to

soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

    (2) When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

    (3) When remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

Precautions for Operation

    (1) It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause 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.

    (2) 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 operating temperature.

    (3) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.

    (4) 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.

    (5) Input each signal after the positive/negative voltage becomes stable.

    (6) Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

Safety

    (1) It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

    (2) If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

11.5 The disposal of waste

   For waste disposal, our recommendations are as follows, please refer to your company and the relevant provisions of the state laws and regulations of the act accordingly

  1. Packing materials disposal for our packaging (carton/PS tray/EPE tray/PET tray)

  1)Our company used to recycle and reuse materials, packing materials can be you just need to transfer to material recycling companies

  2. Our scrap module can't be recycled for reuse, so please dispose of,

  1) Our scrap module can't be recycled for reuse, products and components are "served" can lead to accidents

  2) Our scrap can be transfer to material recycling companies, dismantling, to ensure that

scrap in relatively advanced technology products, environmental protection measures of relatively perfect environment for processing.

3. WEEE order must be executed in product scrap.

12. Prior Consult Matter

1.①For standard products, we keep the right to change material, process ... for improving the product property without notice on our customer.

For OEM products, if any change needed which may affect the product property, we will consult with our customer in advance.

2.If you have special requirement about reliability condition, please let us know before you start the test on our samples.

13. Factory

FACTORY NAME: LCD Mikroelektronik GmbH
FACTORY ADDRESS: Otto-Lilienthal-Str. 13, D-76275 Ettlingen