7.0” 1200 x 1920

High brightness color TFT-LCD module

Model: VM07B9 V1

Version：01

Date: Jul. 01st, 2023

Note: This specification is subject to change without notice

Customer： _____ **Date：** _____

Approved	**Prepared**
Date:	**Date:**

Contents

RECORD OF REVISION

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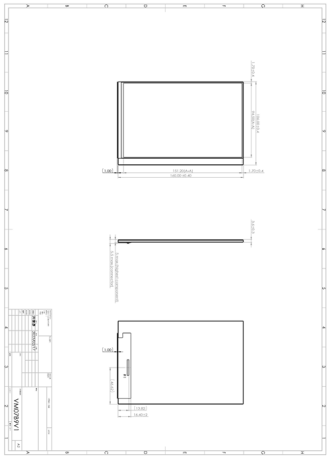
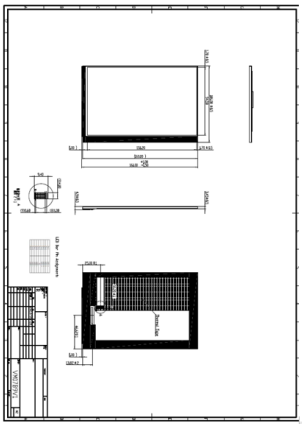
0.2 2023/07/01	6	White luminance (center) Cd/m² 1000 (Typ) Contrast ratio 1200:1 (Typ.) Optical Response Time msec 30 ms (Typ. On/off) Normal Input Voltage VDD Volt 1.8 Power Consumption (Vcc Line + LED backlight) Watt TBD (VDD line=TBD; LED lines= 4.2 W) Weight Grams TBD Physical size mm 106.0 (W)× 161.0 (H)× 3.6 (D, Max) Electrical Interface MIPI Support colors 16.7M colors (8 bits) Surface Treatment Hard coating Temperature range Operating °C -10 ~ 60 (TFT surface) Storage °C -20 ~ 70 RoHS Compliance RoHS Compliance	White luminance (center) Cd/m² 1600 (Typ) Contrast ratio 1200:1 (Typ.) Optical Response Time msec 30 ms (Typ. On/off) Normal Input Voltage VDD Volt 3.3 Power Consumption (Vcc Line + LED backlight) Watt TBD (VDD line=TBD; LED lines= 6.3 W) Weight Grams 470 Physical size mm 106.0 (W)× 161.0 (H)× 4.9 (D, typ.) Electrical Interface MIPI Support colors 16.7M colors (8 bits) Surface Treatment Hard coating Temperature range Operating °C -10 ~ 60 (TFT surface) Storage °C -10 ~ 60 RoHS Compliance RoHS Compliance	
	12	4.2 Backlight unit Parameter Min Typ Max Unit Note LED voltage (VL) 21 [V] 2 LED current (IL) 200 [mA] 2 LED power (PL) 4.2 [W] LED life time (MTBF) 100,000 [Hour] 1 Note 1: The "LED lift time" is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25℃ and typical LED Current at 200 mA. Note 2: The variance of LED Light Bar power consumption is ±10%. Calculator value for reference (IL × VL = PLED).	4.2 Backlight unit Parameter Min Typ Max Unit Note LED voltage (VL) 21 [V] 2 LED current (IL) 300 [mA] 2 LED power (PL) 6.3 [W] LED life time (MTBF) 80,000 [Hour] 1 Note 1: The "LED lift time" is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25℃ and typical LED Current at 300 mA. Note 2: The variance of LED Light Bar power consumption is ±10%. Calculator value for reference (IL × VL = PLED).	
	14		4.3.2 LED bar pin define Pin NO Pin name Description 1 LED + LED power voltage 21V 2 LED + LED power voltage 21V 3 LED + LED power voltage 21V 4 LED + LED power voltage 21V 5 NC No connection 6 LED - LED power ground. 7 LED - LED power ground. 8 LED - LED power ground. 9 LED - LED power ground.	
	22			

1. Handling Precautions

1) Since front polarizer is easily damaged, pay attention not to scratch it.
2) Be sure to turn off power supply when inserting or disconnecting from input connector.
3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
4) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
7) Do not open or modify the Module Assembly.
8) Do not press the reflector sheet at the back of the module to any directions.
9) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
10) After installation of the TFT Module into an enclosure, do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.

2. General Description

2.1 Overview

This specification applies to the Color Active Matrix Liquid Crystal Display composed of a TFT-LCD display a LED backlight system. The screen format is intended to support 1200(H) x 1920(V) screen and 16.7M (8 bits) color support.

2.2 Features

- High brightness display, 1600nits by LED backlight.
- Long operation lifetime BLU design
- Wide view angle
- Wide operation temperature
- RoHS Compliance

2.3 Application

Industrial applications.

2.4 Display specifications

Items	Unit	Specification
Screen Diagonal	inch	7.0”
Active Area	mm	94.5 (H) X 151.2 (V)
Pixels H x V	pixels	1200 x3(RGB) x 1920
Pixels Pitch	um	78.75 (per one triad) x 78.75
Pixel Arrangement		RGB Vertical stripe
Display mode		Normally black
White luminance (center)	Cd/m^2	1600 (Typ)
Contrast ratio		1200:1 (Typ.)
Optical Response Time	msec	30 ms (Typ. On/off)
Normal Input Voltage VDD	Volt	3.3
Power Consumption (Vcc Line + LED backlight)	Watt	TBD (VDD line=TBD; LED lines= 6.3 W)
Weight	Grams	470
Physical size	mm	106.0 (W)× 161.0 (H)× 4.9(D, typ.)
Electrical Interface		MIPI
Support colors		16.7M colors (8 bits)
Surface Treatment		Hard coating
Temperature range Operating Storage	 ^0C ^0C	 -10 ~ 60 (TFT surface) -10 ~ 60
RoHS Compliance		RoHS Compliance

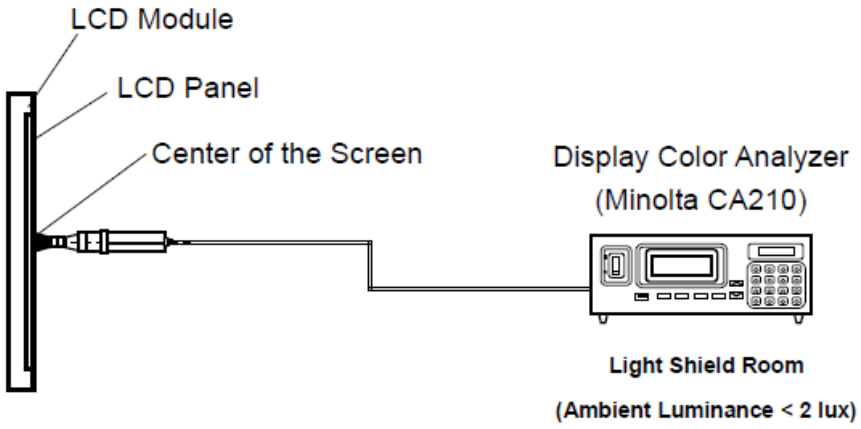
2.5 Optical characteristics

The following optical characteristics are measured under stable condition at 25 ^{0}C

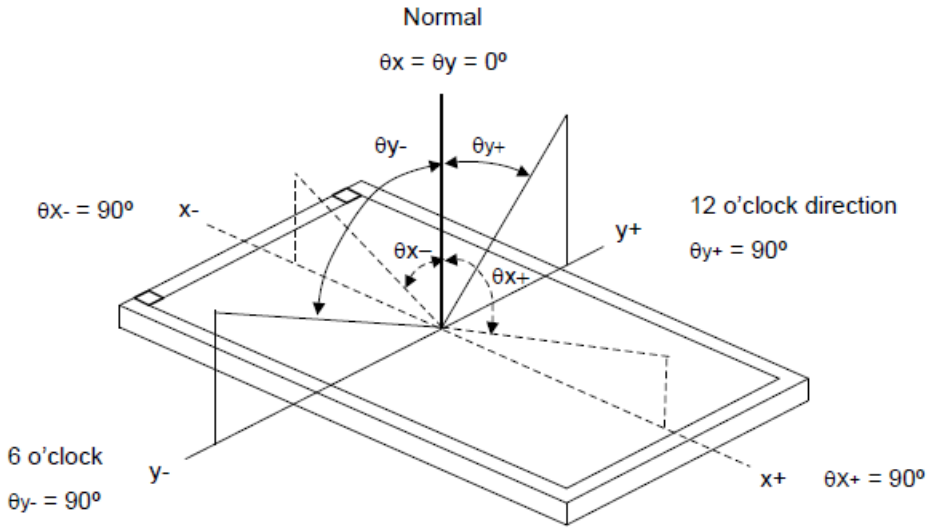
Items	Unit	Conditions	Min.	Typ.	Max.	Note
Viewing angle	Deg.	Horizontal (Right)	75	80		2
		CR=10 (Left)	75	80		
		Vertical (Up)	75	80		
		CR=10 (Down)	75	80		
Contrast Ratio		Normal Direction	1000	1200		3
Response Time	msec	Raising + Falling		30	40	4
Color coordinates (CIE) White		Red x	-0.05	0.669	+0.05	
		Red y		0.326		
		Green x		0.280		
		Green y		0.631		
		Blue x		0.193		
		Blue y		0.087		
		White x		0.303		5
		White y		0.340		
Center Luminance	Cd/m^2		1280	1600		6
Luminance Uniformity	%		70	75		7
Color gamut	%		75	80		
Flicker	dB				-20	

Note 1: Measurement method

The LCD module should be stabilized at given temperature for 0.5 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.



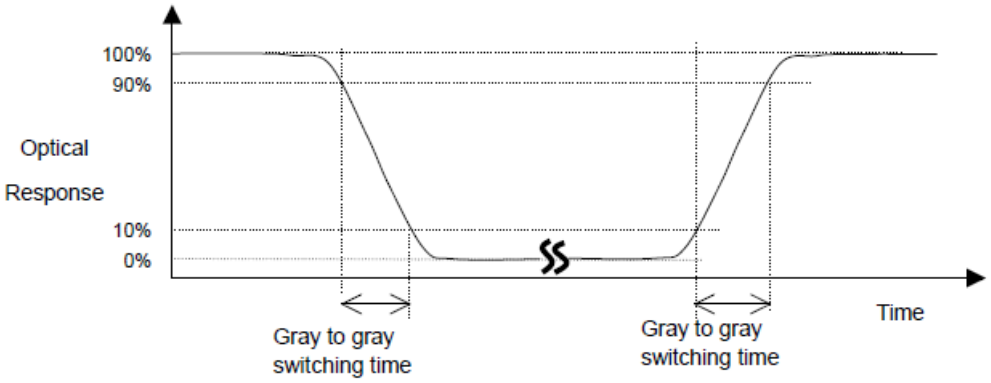
Note 2: Definition of viewing angle



Note 3: Contrast ratio is measured by Minolta CA310

Note 4: Definition of Response time

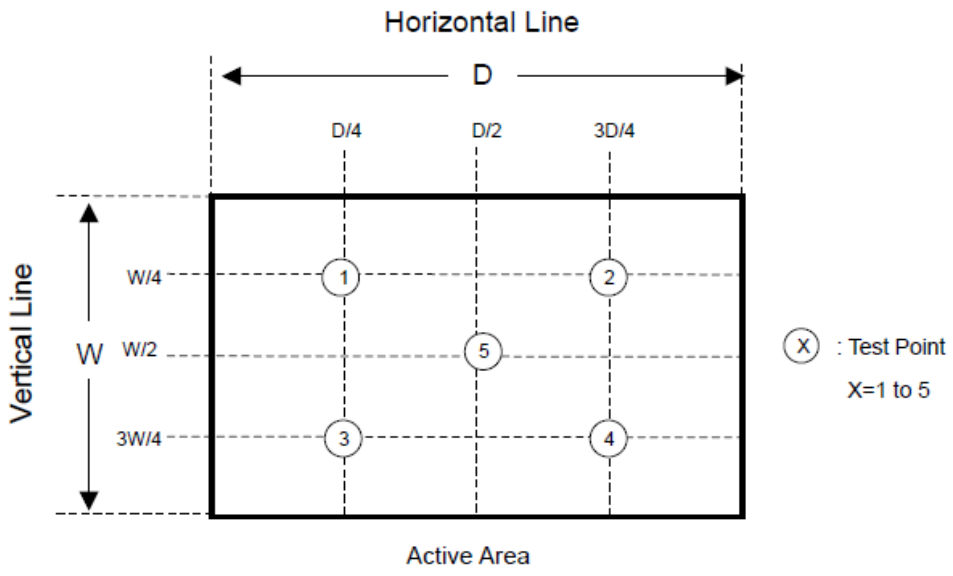
The output signals of photo detector are measured when the input signals are changed from “Full Black” to “Full White” (rising time), and from “Full White” to “Full Black” (falling time), respectively. The response time is interval between the 10% and 90% of amplitudes. Please refer to the figure as below.



Note 5: Color chromaticity and coordinates (CIE) is measured by Minolta CA310

Note 6: Center luminance is measured by Minolta CA310

Note 7: Luminance uniformity of these 5 points is defined as below and measured by Minolta CA310



Uniformity = (Min. Luminance of 5 points) / (Max. Luminance of 5 points)

3. Absolute Maximum Ratings

Absolute maximum ratings of the module are as following:

3.1 TFT LCD module

Items	Symbol	Min	Max	Unit	Conditions
Power supply voltage	IOV_{CC}	-0.3	2.1	Volt	Note 1, 2
	VSP	-0.3	6.6		
	VSN	-7.3	0.3		

3.2 Backlight unit

Items	Symbol	Min	Max	Unit	Conditions
LED bar input current			480	mA	

3.3 Environment

Items	Symbol	Values			Unit	Conditions
		Min.	Typ.	Max.		
Operation temperature	T_{OS}	-10	-	60	^0C	Note 3
Operation Humidity	H_{OP}	10		85	%	
Storage temperature	T_{ST}	-10		60	^0C	
Storage Humidity	H_{ST}	5		90	%	

Note 1: With in Ta= 25℃

Note 2: Permanent damage to the device may occur if exceed maximum values

Note 3: For quality performance, please refer to IIS (Incoming Inspection Standard).

4. Electrical characteristics

4.1 LCD electronics specification

4.1.1 Power specification

Parameter		Symbol	Values			Unit	Notes
			Min.	Typ.	Max.		
Power Supply Input Voltage		IOVCC	-0.3	1.8	2.1	V	Ta = 25 ℃ Note 1
		VSP	-0.3	5.5	6.6	V	
		VSN	-7.3	-5.5	0.3	V	
Current Consumption	Operating		TBD				-
	Sleep in						

Note:
1.This is the voltage range of the IC. In this range, when the voltage is too low, the brightness of LCD may decrease

4.2 Backlight unit

Parameter	Min	Typ	Max	Unit	Note
LED voltage (VL)		21		[V]	2
LED current (IL)		300		[mA]	2
LED power (PL)		6.3		[W]	
LED lite time (MTBF)		80,000		[Hour]	1

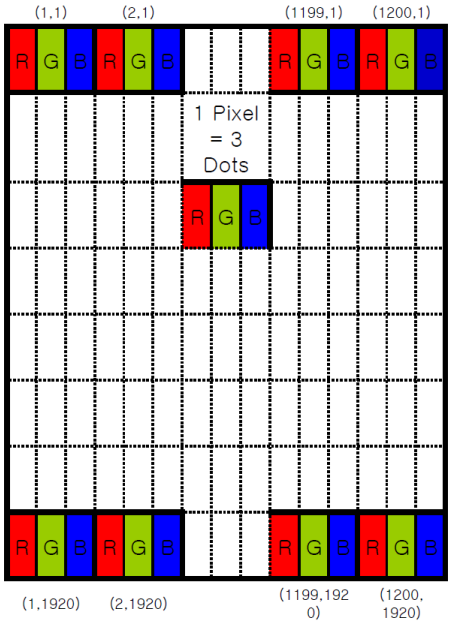
Note 1: The “LED lift time” is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25℃ and typical LED Current at 300 mA

Note 2: The variance of LED Light Bar power consumption is ±10%. Calculator value for reference (IL × VL = PLED)

4.3 Interface connector

4.3.1 TFT connector(CN1)

Pin NO.	Pin name	Description	Pin NO.	Pin name	Description
1	NC	No connection	21	MIPI_3P	MIPI Positive data signal (+)
2	IOVCC	Power supply for system ,IOVCC=1.8V	22	GND	Ground
3	IOVCC		23	NC	No connection
4	GND	Ground	24	NC	No connection
5	RST	Device reset signal	25	GND	Ground
6	NC	No connection	26	NC/TE	Tearing effect output signal for NVM(OTP),Let it open when not in use
7	GND	Ground	27	PWMO	PWM control signal for LED driver
8	MIPI_0N	MIPI Negative data signal (-)	28	NC/BIST	Enables the Test Image Generation function, if not used, connect to ground
9	MIPI_0P	MIPI Positive data signal (+)	29	NC	No connection
10	GND	Ground	30	GND	Ground
11	MIPI_1N	MIPI Negative data signal (-)	31	LED-	LED cathode
12	MIPI_1P	MIPI Positive data signal (+)	32	LED-	
13	GND	Ground	33	NC	No connection
14	MIPI_CKN	MIPI Negative clock signal (-)	34	VSN	Analog supply negative voltage
15	MIPI_CKP	MIPI Positive clock signal (+)	35	VSN	
16	GND	Ground	36	NC	No connection
17	MIPI_2N	MIPI Negative data signal (-)	37	VSP	Analog supply positive voltage
18	MIPI_2P	MIPI Positive data signal (+)	38	VSP	
19	GND	Ground	39	LED+	LED anode
20	MIPI_3N	MIPI Negative data signal (-)	40	LED+	



4.3.2 LED bar pin define

Pin NO	Pin name	Description
1	LED +	LED power voltage 21V
2	LED +	LED power voltage 21V
3	LED +	LED power voltage 21V
4	LED +	LED power voltage 21V
5	NC	No connection
6	LED -	LED power ground.
7	LED -	LED power ground.
8	LED -	LED power ground.
9	LED -	LED power ground.

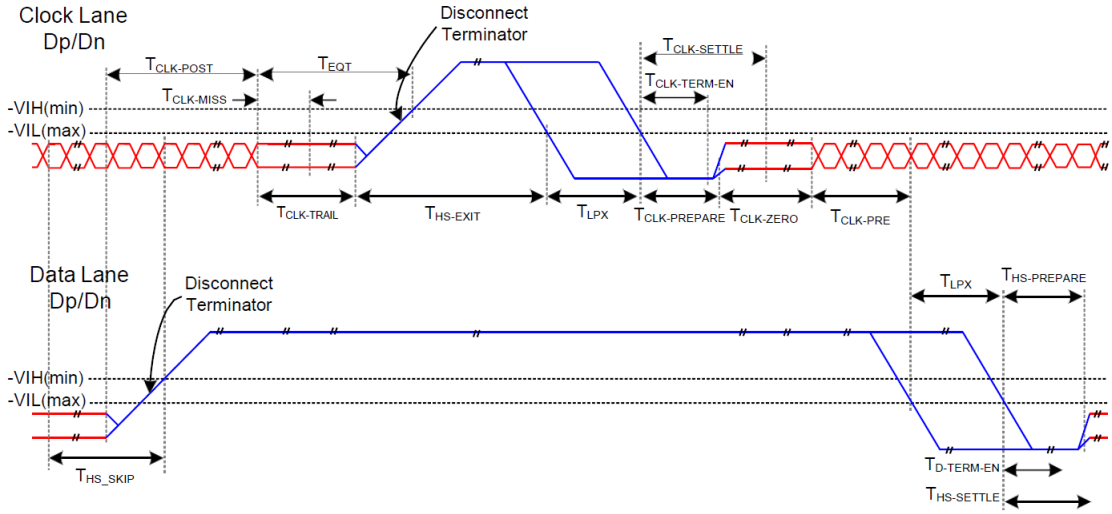
5. Signal characteristics

5.1 Electrical interface connection

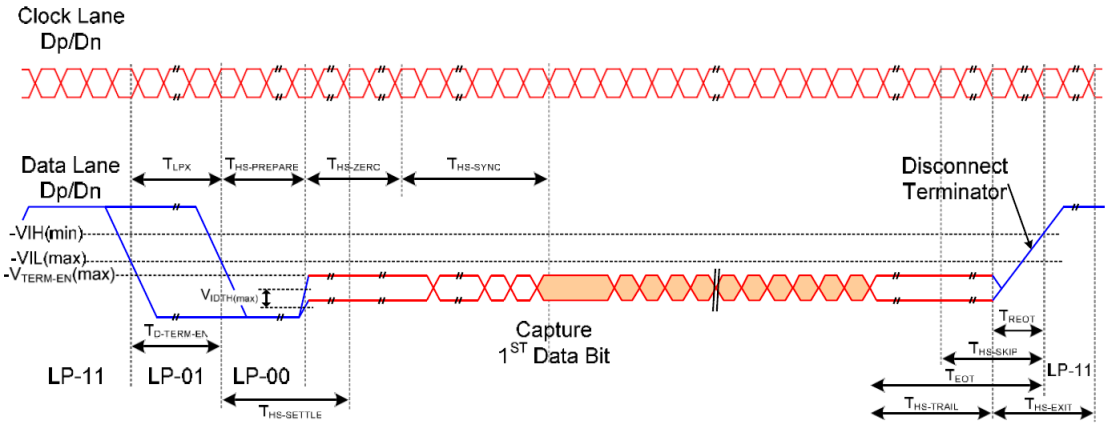
The Interface Connector assignments are listed in Table.

1	Ag_GND	41	NC	81	VSP	121	DUMMY	161	DUMMY	201	DUMMY	241	VGH	281	CLKN	321	BIST_EN
2	NULL	42	NC	82	VSP	122	DUMMY	162	DUMMY	202	DUMMY	242	VCOM	282	CLKP	322	PWRMD
3	Ag_GND	43	VCC	83	VSP	123	DUMMY	163	DUMMY	203	DUMMY	243	VCOM	283	GND	323	NC
4	Ag_GND	44	GND	84	GND	124	DUMMY	164	DUMMY	204	DUMMY	244	VCOM	284	D1N	324	LNSW0
5	GND	45	D3N	85	GND	125	DUMMY	165	DUMMY	205	DUMMY	245	SCK	285	D1P	325	LNSW1
6	GND_db	46	D3P	86	GND	126	DUMMY	166	DUMMY	206	DUMMY	246	SDAO	286	GND	326	NC
7	VGL	47	GND	87	VSN	127	DUMMY	167	DUMMY	207	DUMMY	247	RESETB	287	D0N	327	MIPI_LAN0
8	VGL	48	D2N	88	VSN	128	DUMMY	168	DUMMY	208	DUMMY	248	STBYB	288	D0P	328	MIPI_LAN1
9	Dummy	49	D2P	89	VSN	129	DUMMY	169	DUMMY	209	DUMMY	249	DIMO	289	GND	329	NC
10	VGH	50	GND	90	PN_SWAP	130	DUMMY	170	DUMMY	210	DUMMY	250	TP_SYNC	290	GND	330	NC
11	VGH	51	CLKN	91	BIST_EN	131	DUMMY	171	DUMMY	211	DUMMY	251	SDAI	291	VCC	331	TESTIN
12	VCOM	52	CLKP	92	PWRMD	132	DUMMY	172	DUMMY	212	DUMMY	252	PWMI	292	VCC	332	TESTOUT
13	VCOM	53	GND	93	NC	133	DUMMY	173	DUMMY	213	DUMMY	253	CSB	293	DRVH3	333	VCOMOUT
14	VCOM	54	D1N	94	LNSW0	134	DUMMY	174	DUMMY	214	DUMMY	254	MIPI_TYPE	294	DRVH2	334	VCOMOUT
15	SCK	55	D1P	95	LNSW1	135	DUMMY	175	DUMMY	215	DUMMY	255	VCC	295	DRVH1	335	VCOMOUT
16	SDAO	56	GND	96	NC	136	DUMMY	176	DUMMY	216	DUMMY	256	VDD	296	VSP_O	336	VPP
17	RESETB	57	D0N	97	MIPI_LAN0	137	DUMMY	177	DUMMY	217	DUMMY	257	GND	297	VSP	337	VGH_L
18	STBYB	58	D0P	98	MIPI_LAN1	138	DUMMY	178	DUMMY	218	DUMMY	258	VSP	298	GND	338	VGH_L
19	DIMO	59	GND	99	NC	139	DUMMY	179	DUMMY	219	DUMMY	259	VSP	299	VSN	339	Dummy
20	TP_SYNC	60	GND	100	NC	140	DUMMY	180	DUMMY	220	DUMMY	260	GND	300	VSN_O	340	VGL
21	SDAI	61	VCC	101	TESTIN	141	DUMMY	181	DUMMY	221	DUMMY	261	GND	301	DRVL2	341	VGL
22	PWMI	62	VCC	102	TESTOUT	142	DUMMY	182	DUMMY	222	DUMMY	262	VSN	302	DRVL1	342	GND_dr
23	CSB	63	DRVH3	103	VCOMOUT	143	DUMMY	183	DUMMY	223	DUMMY	263	VSN	303	VLPH	343	GND_dg
24	MIPI_TYPE	64	DRVH2	104	VCOMOUT	144	DUMMY	184	DUMMY	224	DUMMY	264	VCOM0	304	VLPH	344	GND
25	VCC	65	DRVH1	105	VCOMOUT	145	DUMMY	185	DUMMY	225	DUMMY	265	VCOM0	305	VDD	345	Ag_GND
26	VDD	66	VSP_O	106	VPP	146	DUMMY	186	DUMMY	226	DUMMY	266	VCOM0	306	VDD	346	Ag_GND
27	GND	67	VSP	107	VGH_L	147	DUMMY	187	DUMMY	227	DUMMY	267	VCOM_EN	307	VDD	347	NULL
28	VSP	68	GND	108	VGH_L	148	DUMMY	188	DUMMY	228	DUMMY	268	VCL	308	VCC_EN	348	Ag_GND
29	VSP	69	VSN	109	Dummy	149	DUMMY	189	DUMMY	229	DUMMY	269	VCL	309	VCC	FPC PIN based on HX8279-D01*2	
30	GND	70	VSN_O	110	VGL	150	DUMMY	190	DUMMY	230	DUMMY	270	VCL	310	GND		
31	GND	71	DRVL2	111	VGL	151	DUMMY	191	DUMMY	231	Ag_GND	271	NC	311	VSP		
32	VSN	72	DRVL1	112	GND_dr	152	DUMMY	192	DUMMY	232	NULL	272	NC	312	VSP		
33	VSN	73	VLPH	113	GND_dg	153	DUMMY	193	DUMMY	233	Ag_GND	273	VCC	313	VSP		
34	VCOM0	74	VLPH	114	GND	154	DUMMY	194	DUMMY	234	Ag_GND	274	GND	314	GND		
35	VCOM0	75	VDD	115	Ag_GND	155	DUMMY	195	DUMMY	235	GND	275	D3N	315	GND		
36	VCOM0	76	VDD	116	Ag_GND	156	DUMMY	196	DUMMY	236	GND_db	276	D3P	316	GND		
37	VCOM_EN	77	VDD	117	NULL	157	DUMMY	197	DUMMY	237	VGL	277	GND	317	VSN		
38	VCL	78	VCC_EN	118	Ag_GND	158	DUMMY	198	DUMMY	238	VGL	278	D2N	318	VSN		
39	VCL	79	VCC	119	DUMMY	159	DUMMY	199	DUMMY	239	Dummy	279	D2P	319	VSN		
40	VCL	80	GND	120	DUMMY	160	DUMMY	200	DUMMY	240	VGH	280	GND	320	PN_SWAP		

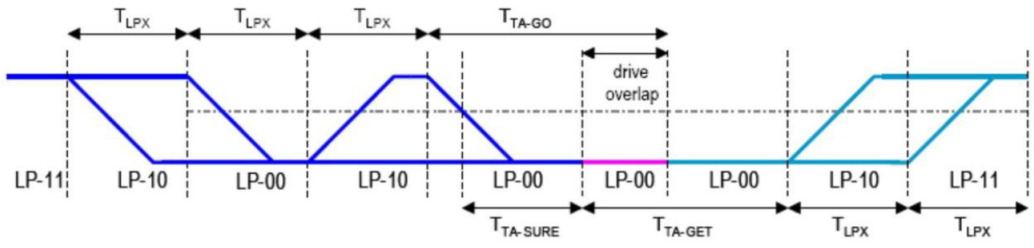
5.2 MIPI interface timing



Switching the clock lane between clock transmission and low-power mode



Timing of high-speed data transmission in bursts



Turnaround Procedure

Parameter	Description	Spec.			Unit
		Min.	Typ.	Max.	
T_{REOT}	30%-85% rise time and fall time	-	-	35	ns
$T_{CLK-MISS}$	Timeout for receiver to detect absence of Clock transitions and disable the Clock Lane HS-RX.	-	-	60	ns
$T_{CLK-POST}$*1	Time that the transmitter continues to send HS clock after the last associated Data Lane has t ransitioned to LP Mode. Interval is defined as the period from the end of THS-TRAIL to the beginning of $T_{CLK-TRAIL}$.	60 ns + 52*UI (For DCS)	-	-	ns
$T_{CLK-PRE}$	Time that the HS clock shall be driven by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode.	8	-	-	ns
$T_{CLK-SETTLE}$	Time interval during which the HS receiver shall ignore any Clock Lane HS transitions, starting from the beginning of $T_{CLK-PRE}$.	95	-	300	ns
$T_{CLK-TERM-EN}$	Time for the Clock Lane receiver to enable the HS line termination, starting from the time point when Dn crosses $V_{IL,MAX}$.	Time for Dn to reach $V_{TERM-EN}$	-	38	ns
$T_{HS-SETTLE}$	Time interval during which the HS receiver shall ignore any Data Lane HS transitions, starting from the beginning of $T_{HSPREPARE}$.	85 ns + 6*UI		145 ns + 10*UI	ns
T_{EOT}	Time from start of $T_{HS-TRAIL}$ or $T_{CLK-TRAIL}$ period to start of LP-11 state	-	-	105ns+48*UI	-
$T_{HS-EXIT}$(1)	time to drive LP-11 after HS burst	100	-	-	ns
$T_{HS-PREPARE}$	Time to drive LP-00 to prepare for HS transmission	40ns + 4*UI	-	85ns+6*UI	ns
$T_{HS-PREPARE}$ + $T_{HS-ZERO}$	$T_{HS-PREPARE}$ + Time to drive HS-0 before the Sync sequence	145ns + 10*UI	-	-	ns
$T_{HS-SKIP}$	Time-out at RX to ignore transition period of EoT	40	-	55ns+4*UI	ns
$T_{HS-TRAIL}$	Time to drive flipped differential state after last payload data bit of a HS transmission burst	60 + 4*UI	-	-	ns
T_{LPX}	Length of any Low-Power state period	50	-	-	ns
Ratio T_{LPX}	Ratio of $T_{LPX(MASTER)}$/$T_{LPS(SLAVE)}$ between Master and Slave side	2/3	-	3/2	-
T_{TA-GET}	Time to drive LP-00 by new TX	5*T_{LPX}			ns
T_{TA-GO}	Time to drive LP-00 after Turnaround Request	4*T_{LPX}			ns
$T_{TA-SURE}$	Time-out before new TX side starts driving	T_{LPX}	-	2*T_{LPX}	ns

Note: (1) For image transmission:
$T_{CLK-POST}$ min value =164 when MIPI max frequency per lane = 0.53Gbps.
$T_{CLK-POST}$ min value =112 when MIPI max frequency per lane = 1Gbps

5.3 Porch setting

Parameter	Symbol	Min.	Typ.	Max.	Unit
Horizontal Sync. Width	hpw	10	24	-	Clock
Horizontal Sync. Back Porch	hbp	50	80	-	Clock
Horizontal Sync. Front Porch	hfp	20	60	-	Clock
Vertical Sync. Width	vs	-	2	-	Line
Vertical Sync. Back Porch	vbp	-	10	-	Line
Vertical Sync. Front Porch	vfp	-	14	-	Line

5.4 Reset timing

When RESETB of the reset pin equals to Low, it will be in the condition of reset. Wh en it is in the condition of reset, it will make the device recover the initial set.

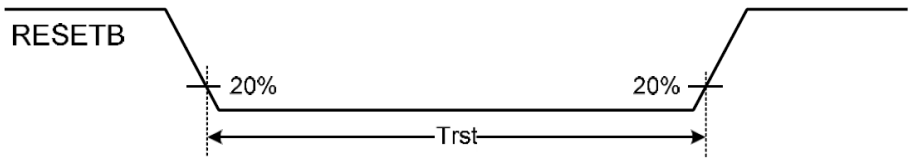
However, in order to avoid the reset noise cause reset, there is a mechanism to judge about whether the reset is needed or not.

The closed interval of low can be shown as the following.

(VDD=1.7V~2.0V, VSS=0V, T_{OPR} =-20℃~+85℃)

Parameter	Symbol	Conditions	Values			Unit
			Min.	Typ.	Max.	
Reset low pulse width	Trst	-	20	-	-	s

Reset timing

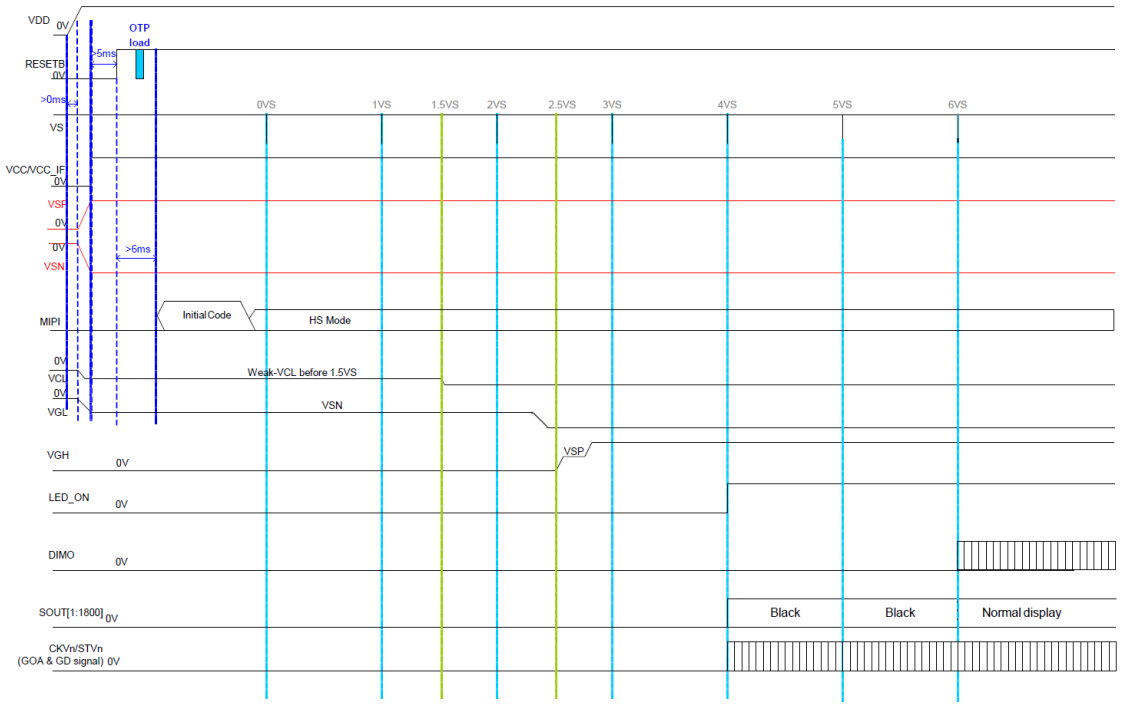


Reset timing

6. Power sequence

6.1 Power ON/OFF sequence

To prevent a latch-up or DC operation of the LCD FOG, the power on/off sequence shall be as shown in below



Note: (1) Finish to write the GOA MUX (page1 registers) and GOA timing setting (page3 registers) within 50ms after reset pulls to high.

Power on sequence with PWRMD=0 and repair OP disable

7. Reliability Test

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta=40℃, 80%RH, 72hours	
High Temperature Operation (HTO)	Ts= 60℃, 72hours	3
Low Temperature Operation (LTO)	Ta= -10℃, 72hours	
High Temperature Storage (HTS)	Ta= 60℃, 72hours	
Low Temperature Storage (LTS)	Ta= -10℃, 72hours	
Thermal Shock Test (TST)	-20℃/30min, 60℃/30min, 100 cycles	
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (ElectroStatic Discharge)	Contact Discharge: ± 4KV, 150pF(330Ω) 1sec/cycle	
	Air Discharge: ± 8KV, 150pF(330Ω) 1sec/cycle	

Note 1: The TFT-LCD module will not sustain damage after being subjected to 100 cycles of rapid temperature change. A cycle of rapid temperature change consists of varying the temperature from -10℃ to 50℃, and back again. Power is not applied during the test. After temperature cycling, the unit is placed in normal room ambient for at least 4 hours before power on.

Note 2: According to EN61000-4-2 , ESD class B: Some performance degradation allowed. No data lost. Self-recoverable. No hardware failures.

Note 3: TFT surface.

Note 4: There should be no condensation on the surface of panel during test.

Note 5: In the standard conditions, there is no function failure issue occurred. All the cosmetic specification is judged before reliability test.

Note 6: Before cosmetic and function test, the product must have enough recovery time, at least 4 hours at room temperature.

8. Shipping package
(TBD)

9. Mechanical Characteristics