AMP DISPLAY INC.

A Brighter Solution

SPECIFICATIONS

CUSTOMER	
CUSTOMER PART NO.	
AMP PART NO.	**AM-240320D5TOQW-T04H(R)**
APPROVED BY	
DATE	

☐ **Approved For Specifications**

☐ **Approved For Specifications & Sample**

AMP DISPLAY INC

9856 SIXTH STREET RANCHO CUCAMONGA CA 91730

TEL: 909-980-13410 FAX: 909-980-1419

WWW.AMPDISPLAY.COM

APPROVED BY	CHECKED BY	ORGANIZED BY

RECORD OF REVISION

Revision Date	Page	Contents	Editor
2011/3/16	-	New Release	Patrick

1 Features

LCD 3.2 inch Amorphous-TFT-LCD (Thin Film Transistor Liquid Crystal Display) for mobile-phone or handy electrical equipments.

(1) Construction: 3.2” a-Si color TFT-LCD, White LED Backlight, touch panel and FPCB.

(2) Main LCD : 2.1 Amorphous-TFT 3.2 inch display, transmissive, Normally white type, 9 o’clock.
2.2 240(RGB)X320 dots Matrix,1/320 Duty.
2.3 Narrow-contact ledge technique.
2.4 Main LCD Driver IC: ILI9325C equivalent.
2.5 262K: Red-6bit, Green-6bit, Blue-6bit (18-bit interface)

(3) Low cross talk by frame rate modulation

(4) Direct data display with display RAM

(5) Partial display function: You can save power by limiting the display space.

(6) Interface: MPU and RGB Interface. (Select by H/W Jumper). Default: MCU Interface.

(7) SPI and Digital RGB 18-bit interface selectable.

IM3	IM2	IM1	IM0	MPU mode	DB Pin in use	Remark
PIN9	JP2	PIN8	PIN7			
0	0 (2,3Short)	1	0	80-16BIT	DB[17:10],DB[8:1]	MCU Interface.
0	0 (2,3Short)	1	1	80-8BIT	DB[17:10]	
1	0 (2,3Short)	1	0	80-18BIT	DB[17:0]	
1	0 (2,3Short)	1	1	80-9BIT	DB[17:9]]	
0	1 (1,2Short)	0	ID	SPI	SDI ,SDO	Must change JP2; SPI, RGB Interface

* Others setting invalid

(8) Abundant command functions:
Area scroll function
Display direction switching function
Power saving function

Electric volume control function: you are able to program the temperature compensation function.

2 Mechanical specifications

Dimensions and weight

Item		Specifications	Unit
Active Display Size		3.2 inch diagonal(81.28mm)	mm
Main LCD	Outline Dimension	55.64 (H) x 77.3(V)	mm
	Pixel pitch	0.2025 (H) x 0.2025(V)	mm
	Active area	48.6 (H) x 64.8 (V)	mm
	Number of Pixels	240(H)x320(V) pixels	mm

*1. This specification is about External shape on shipment from AMPIRE.

3 Absolute max. ratings and environment

3-1 Absolute max. ratings

Ta=25°C GND=0V

Item	Symbol	Min.	Max.	Unit	Remarks
Power voltage	VDD – GND	-0.3	+3.3	V	
Power voltage	LED A – LED K	-0.5	+4.0	V	Parallel
Input voltage	VIN	-0.5	VDD	V	

3-2 Environment

Item	Specifications	Remarks
Storage temperature	Max. +80°C Min. -30°C	Note 1: Non-condensing
Operating temperature	Max. +70°C Min. -10°C	Note 1: Non-condensing

Note 1：Ta≦+40°C・・・・Max.85%RH

Ta＞+40°C・・・・The max. humidity should not exceed the humidity with 40°C 85%RH.

4 Electrical specifications

4-1 Electrical characteristics of LCM

(V_{DD}=3.0V, Ta=25 °C)

Item	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
IC power voltage	V_{DD}		2.6	2.8	3.3	V
High-level input voltage	V_{IHC}		0.8		V_{DD}	V
Low-level input voltage	V_{ILC}		-0.3		$0.2V_{DD}$	V
Consumption current of VDD	I_{DD}	LED OFF	-	10	-	mA
Consumption current of LED	I_{LED_ON}	V_{LED}=19.2V	-	15	20	mA

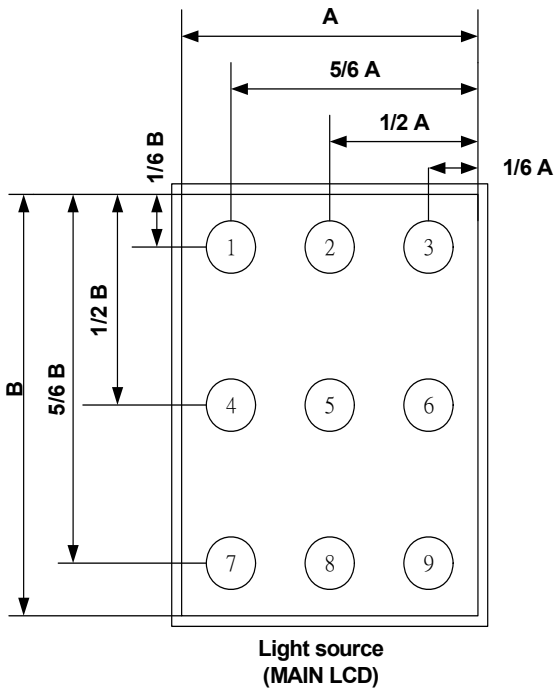
※ 1. 1/320 duty.

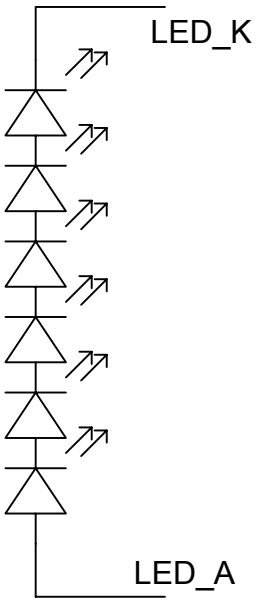
4-2 LED back light specification

Item	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Forward voltage	V_f	I_f =15mA	-	(19)	-	V
Forward current	I_f	Ta=25C	-	(15)	(20)	mA
Uniformity (with L/G)	-	I_f=15mA	70%	-	-	
C.I.E.	X		0.245	0.30	0.375	
	Y		0.255	0.31	0.385	
Luminous color	White					
Chip connection	6 chip serial connection					

Note: (value), value=estimate value.

Bare LED measure position:





*1 Uniformity (LT): $\frac{Min(P1 \sim P9)}{Max(P1 \sim P9)} \times 100 \geq 80\%$

4.3 Touch Panel Electrical Specification

Parameter	Condition	Standard Value
Terminal Resistance	X Axis	200Ω ~ 900Ω
	Y Axis	200Ω ~ 900Ω
Insulating Resistance	DC 25 V	More than 20MΩ
Linearity	--	±1.5 %
Notes life by Pen	Note a	100,000 times(min)
Input life by finger	Note b	1,000,000 times (min)

Note A .

Hitting pad：Tip R8 mm Silicone rudder, & Tip R0.8 mm stylus pen(POM).

Load：250 g.

Hitting speed：2 times / sec.

Electric load：None.

Note B .

Hitting pad：Tip R0.8 mm stylus pen (POM).

Load ：250 g.

Sliding speed：150mm / sec.

Sliding length：25mm.

Electric load：None.

	Symbol	Function
1	XL	Touch Panel Left Signal in X Axis
2	YD	Touch Panel Bottom Signal in Y Axis
3	XR	Touch Panel Right Signal in X Axis
4	YU	Touch Panel Top Signal in Y Axis

5 Main LCD

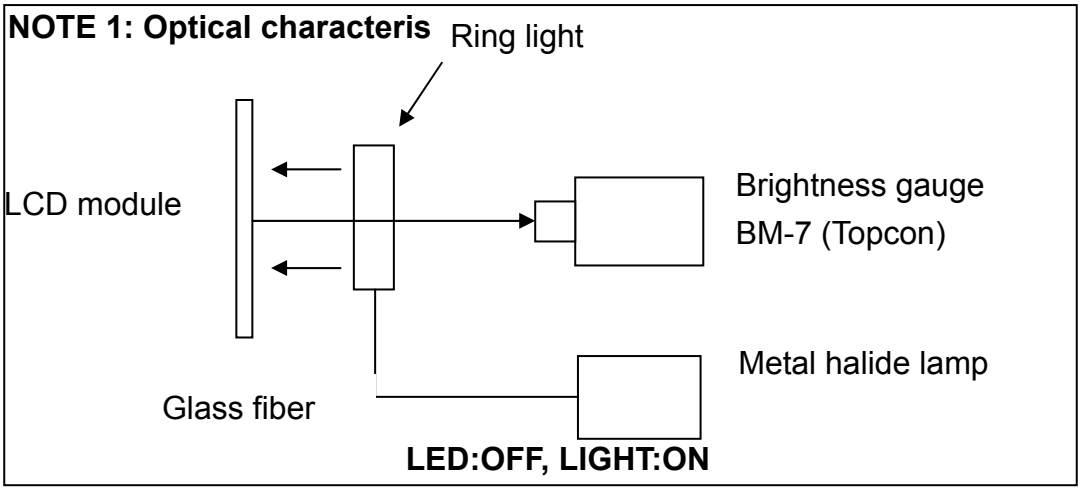
5-1 Optical characteristics

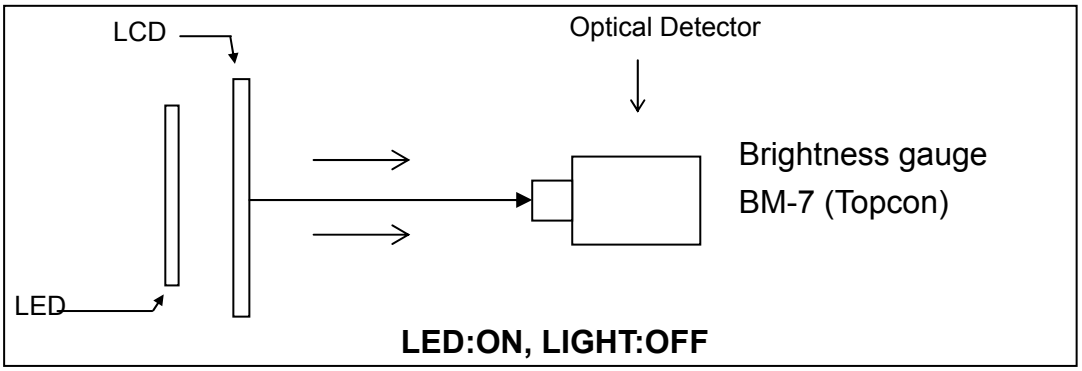
(1/320 Duty in case except as specified elsewhere Ta = 25°C)

Item		Symbol	Min.	Std.	Max.	Unit	Conditions
Contrast ratio		CR	150	200	-	-	θ=0° Φ=0° Normal viewing angle
Response time	Rising	Tr	-	15	-	ms	
	Faling	Tf	-	35	-		
White luminance (center of screen)		YL		160		cd/m2	
Color chromaticity (CIE1931)	Red	Rx	0.54	0.59	0.63		
		RY	0.30	0.34	0.38		
	Green	GX	0.29	0.33	0.37		
		GY	0.56	0.60	0.64		
	Blue	Bx	0.10	0.14	0.18		
		BY	0.02	0.06	0.10		
	White	WX	0.26	0.30	0.37		
		WY	0.27	0.31	0.38		
Visual angle	Hor.	θL	(38.7)			Degree	CR>10
		θR	(15)				
	Ver.	Θf	(62.7)				
		θb	(62.2)				

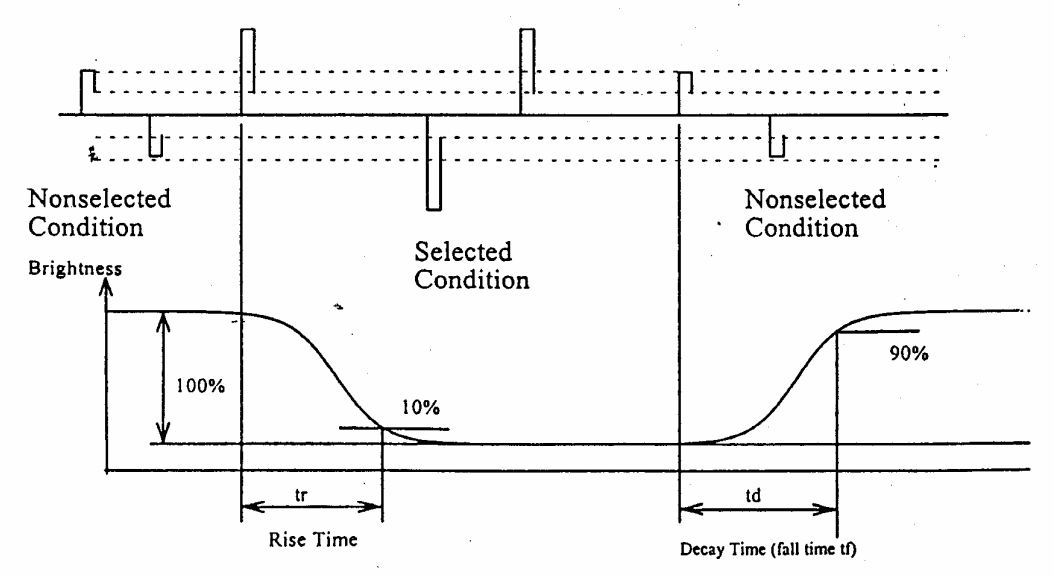
Note: (value), value=estimate value.

NOTE 1: Optical characteris

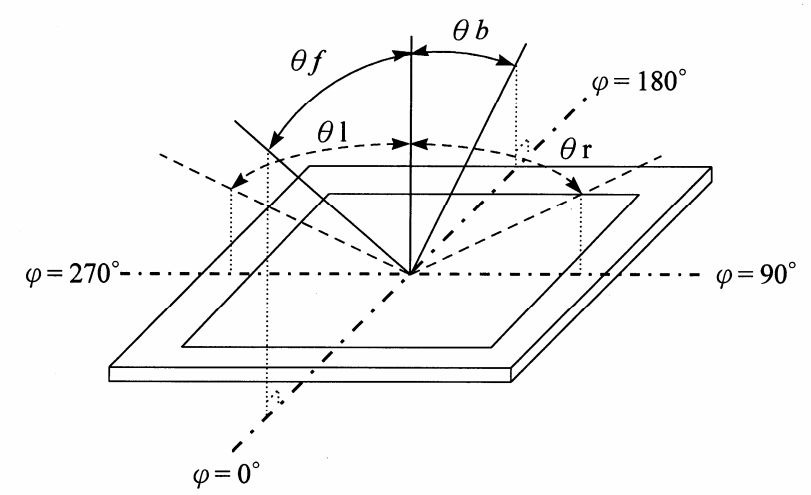




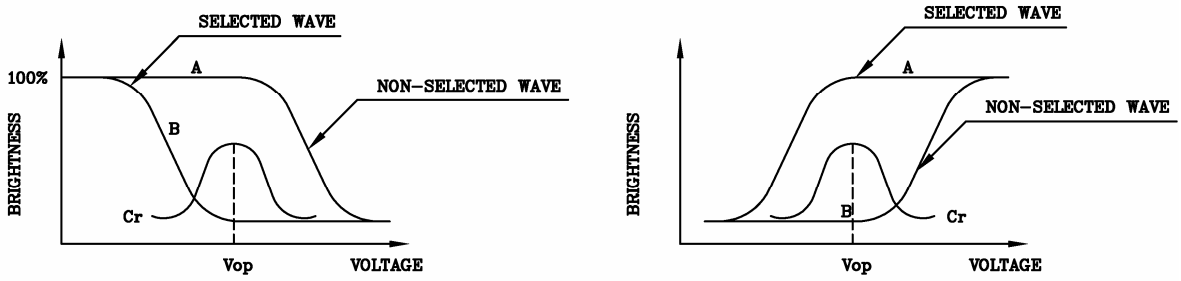
NOTE 2: Response tome definition



NOTE 3: φ、θ definition

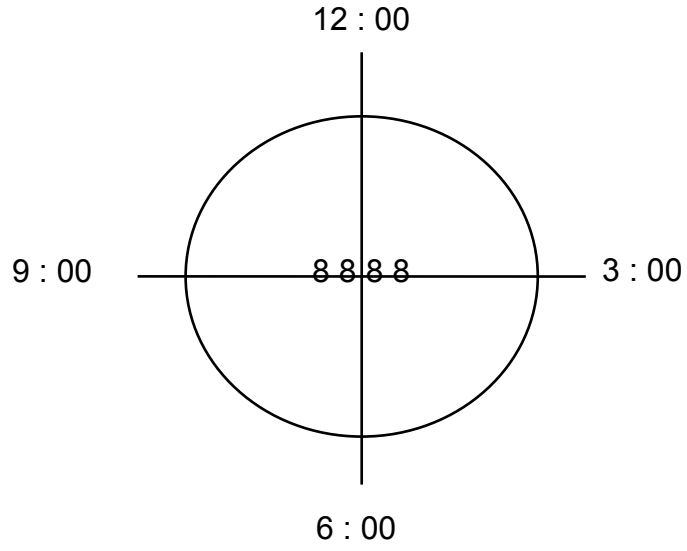


NOTE 4: Contrast definition



Contrast Ratio : Cr=A/B

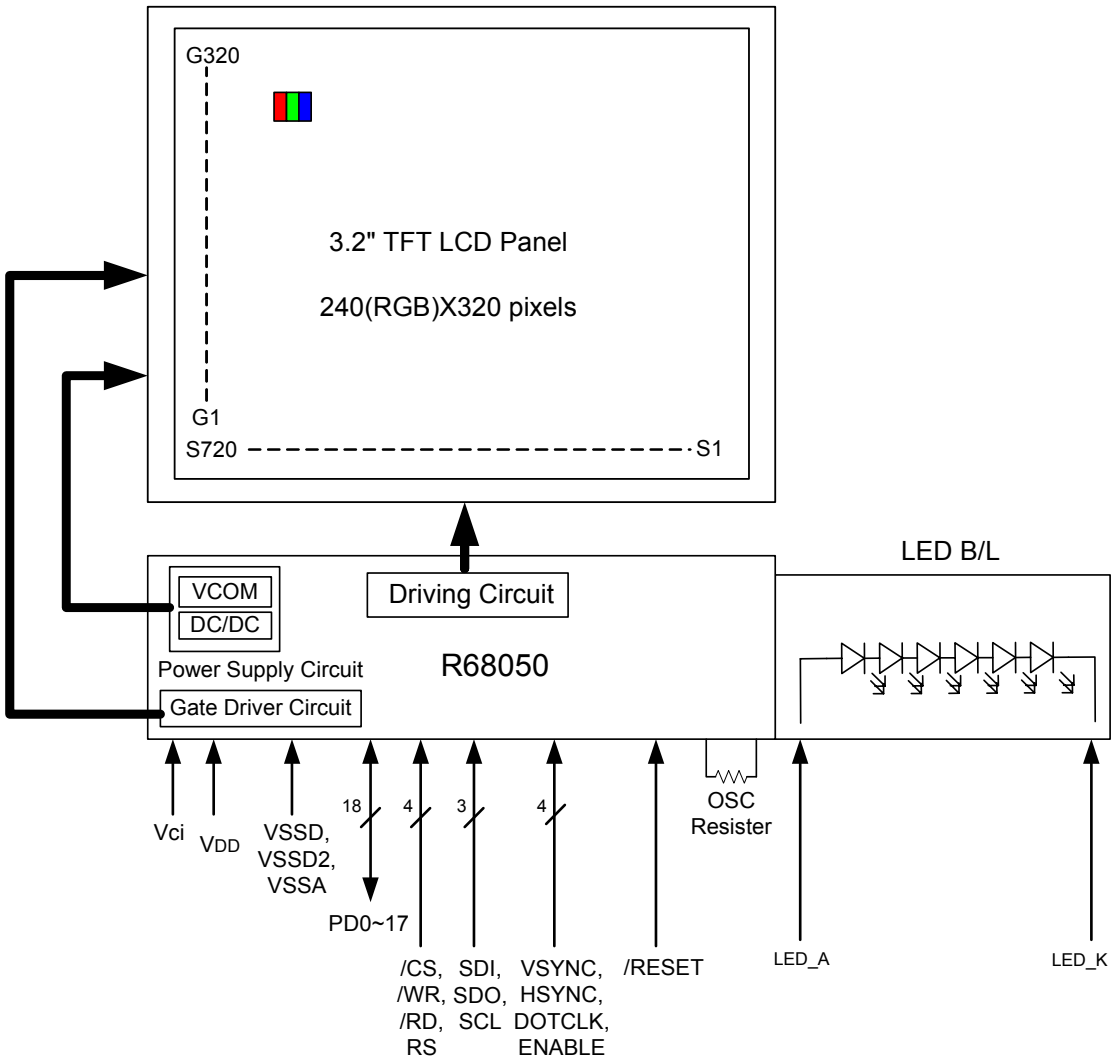
NOTE 5: Visual angle direction priority



6 Block Diagram

Block diagram (Main LCD)

Display format: A-Si TFT transmissive, normally white type, 12 o'clock.
Display composition: 240 x RGB x 320 dots
LCD Driver: RM68050 or equivalent.



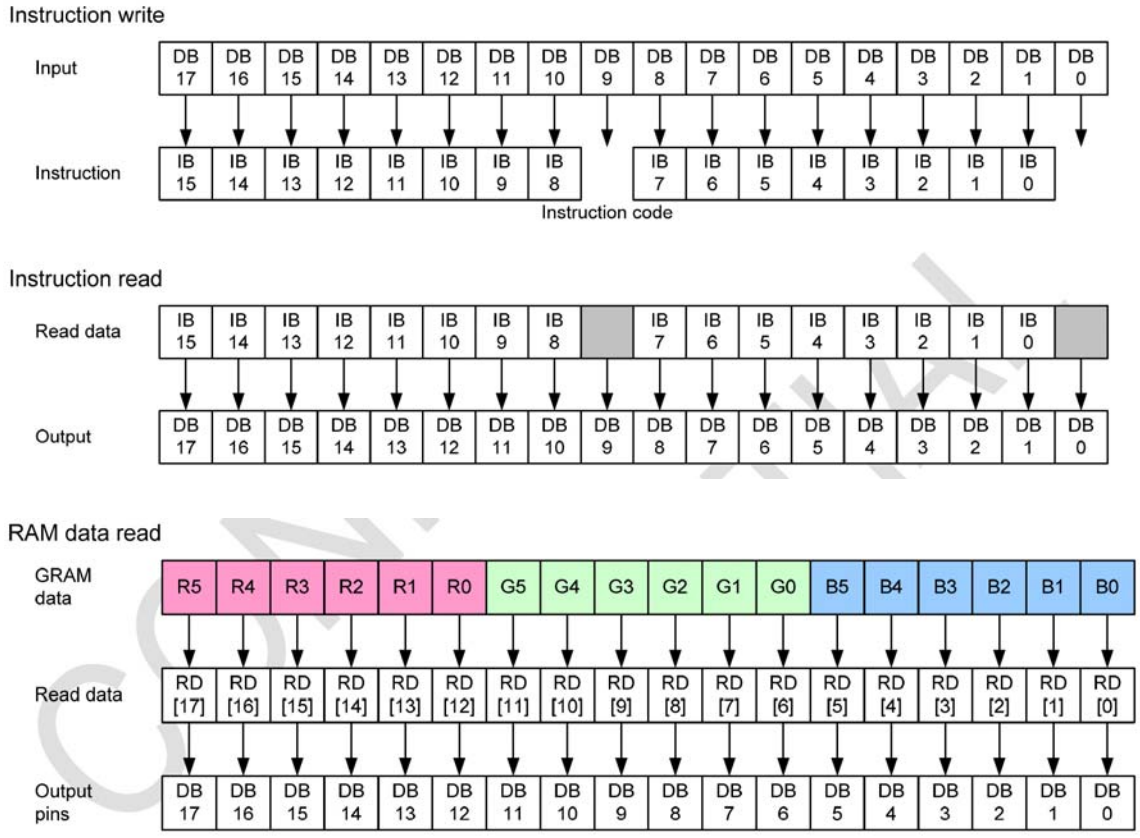
7 Interface specifications

Connecter pitch:0.3mm

Recommend Connecter: JAE FF0245S

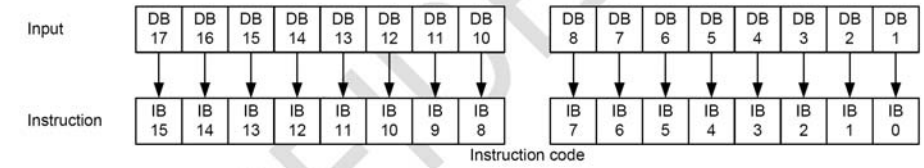
<table>
<tr><th>Pin No.</th><th>Terminal</th><th>Functions</th></tr>
<tr><td>1</td><td>VSS</td><td>Ground pins.</td></tr>
<tr><td>2</td><td>XL</td><td>Touch Panel Left Side.</td></tr>
<tr><td>3</td><td>XR</td><td>Touch Panel Right Side.</td></tr>
<tr><td>4</td><td>YD</td><td>Touch Panel Down Side.</td></tr>
<tr><td>5</td><td>YU</td><td>Touch Panel Up Side.</td></tr>
<tr><td>6</td><td>VSS</td><td>Ground pins.</td></tr>
<tr><td>7</td><td>IM0/ID</td><td rowspan="5"><table>
<tr><th>IM3</th><th>IM1</th><th>IM0/ID</th><th>MPU-Interface Mode</th><th>DB Pin in use</th></tr>
<tr><td>0</td><td>1</td><td>0</td><td>i80-system 16-bit interface</td><td>DB[17:10], DB[8:1]; (JP1 2-3short)</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>i80-system 8-bit interface</td><td>DB[17:10]; (JP1 2-3short)</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>i80-system 18-bit interface</td><td>DB[17:0]; (JP1 2-3short)</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>i80-system 9-bit interface</td><td>DB[17:9]; (JP1 2-3short)</td></tr>
<tr><td>0</td><td>0</td><td>ID</td><td>Serial Peripheral Interface</td><td>SDI, SDO; (JP1 1-2short)</td></tr>
</table></td></tr>
<tr><td>8</td><td>IM1</td></tr>
<tr><td>9</td><td>IM3</td></tr>
<tr><td>10</td><td>SDO</td><td>Serial bus interface data output pin.</td></tr>
<tr><td>11</td><td>NC</td><td>No Connection.</td></tr>
<tr><td>12</td><td>SDI</td><td>Serial bus interface data input pin.</td></tr>
<tr><td>13-30</td><td>D17-D0</td><td>18-bit bidirectional bus
Connect to VSS when the serial interface is selected.</td></tr>
<tr><td>31</td><td>/CS</td><td>Chip selection pin.
The “L” level enables inputting commands and reading /writing data.</td></tr>
<tr><td>32</td><td>/RESET</td><td>Switching to “L” initializes internally.
Must be reset after the power is supplied.</td></tr>
<tr><td>33</td><td>RS</td><td>Command/display Data Selection.</td></tr>
<tr><td>34</td><td>WR/SCL</td><td>Write enable signal/Serial bus interface clock input pin.</td></tr>
<tr><td>35</td><td>/RD</td><td>Read enable signal.</td></tr>
<tr><td>36</td><td>VSYNC</td><td>Frame synchronizing signal in RGB I/F mode. (JP1 1-2short)</td></tr>
<tr><td>37</td><td>HSYNC</td><td>Frame synchronizing signal in RGB I/F mode. (JP1 1-2short)</td></tr>
<tr><td>38</td><td>DOTCLK</td><td>Dot clock signal in RGB I/F mode. (JP1 1-2short)</td></tr>
<tr><td>39</td><td>ENABLE</td><td>A data ENABLE signal in RGB I/F mode. (JP1 1-2short)</td></tr>
<tr><td>40</td><td>VCC</td><td rowspan="2">Power supply for Step-up circuit. (VCI=2.5~3.3V).</td></tr>
<tr><td>41</td><td>VCC</td></tr>
<tr><td>42</td><td>VSS</td><td>Ground pins.</td></tr>
<tr><td>43</td><td>LED_K</td><td>Power supply for LED (Cathode).</td></tr>
<tr><td>44</td><td>LED_A</td><td>Power supply for LED (Anode).</td></tr>
<tr><td>45</td><td>VSS</td><td>Ground pins.</td></tr>
</table>

7-1 80-system 18-bit interface

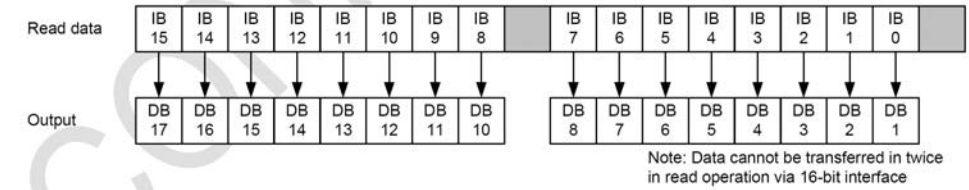


7-2 80-system 16-bit interface

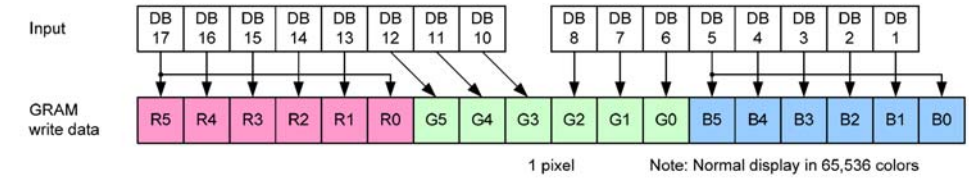
Instruction write



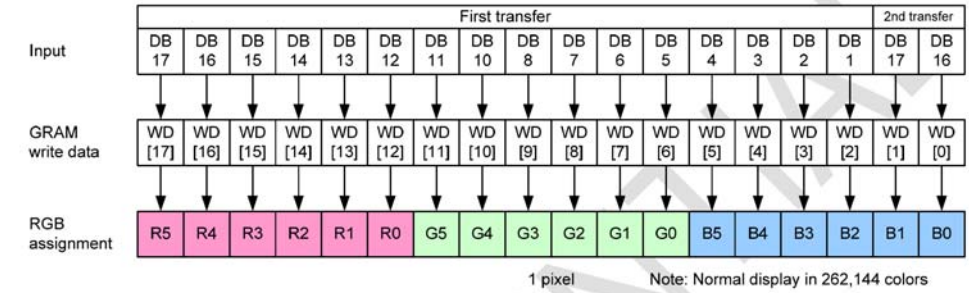
Instruction read



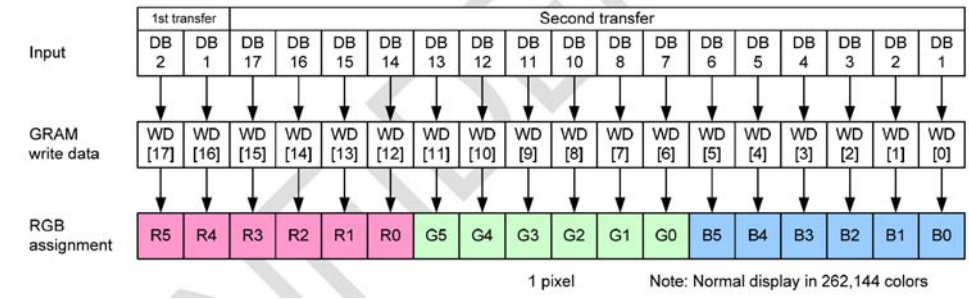
RAM data write (single transfer mode: TRIREG = 0)



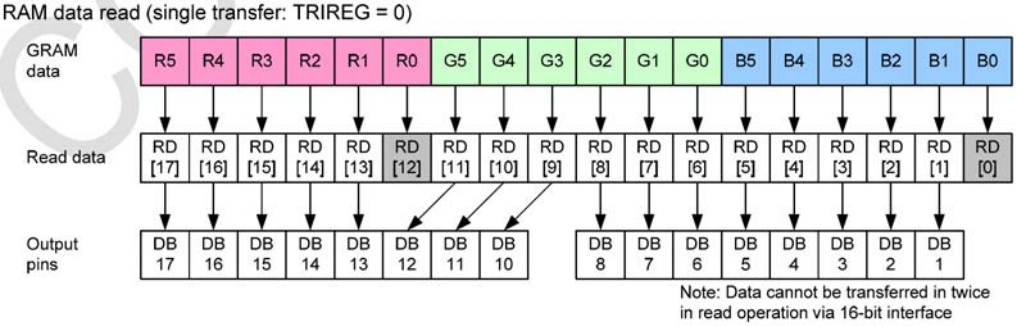
RAM data write (2 transfer mode: TRIREG = 1, DFM = 0)



RAM data write (2 transfer mode: TRIREG = 1, DFM = 1)

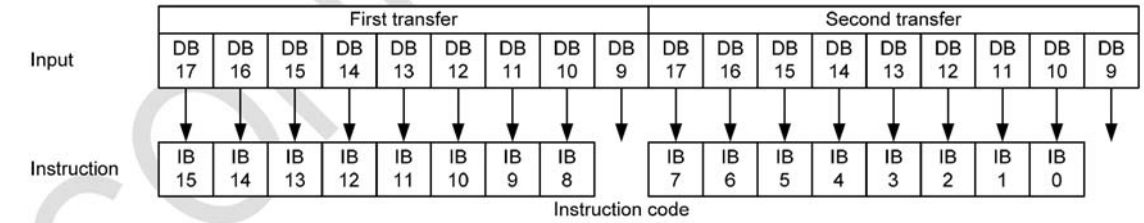


RAM data read (single transfer: TRIREG = 0)

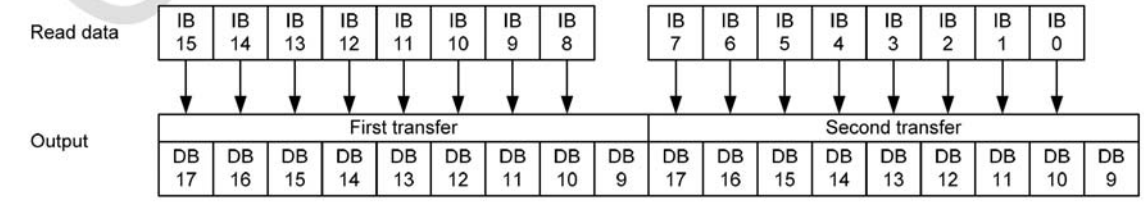


7-3 80-system 9-bit interface

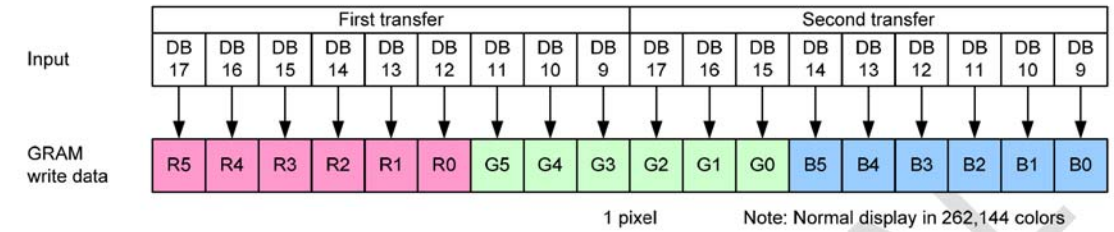
Instruction write



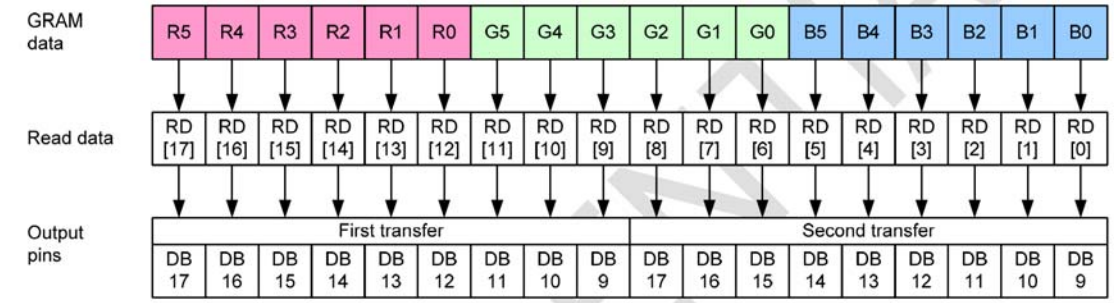
Device code read



RAM data write

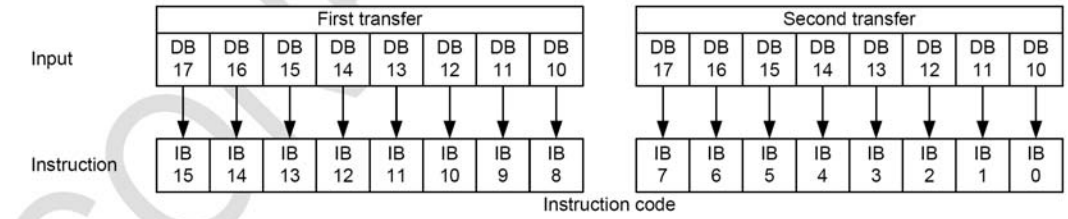


RAM data read

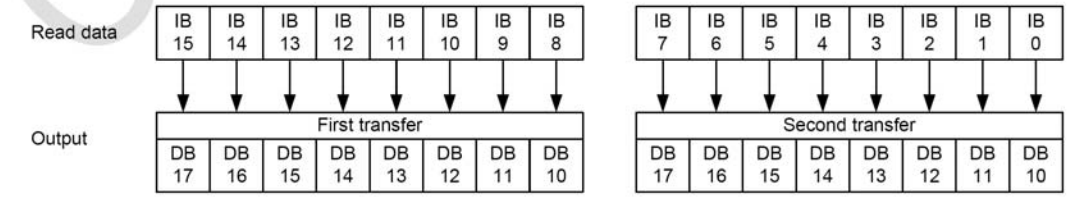


7-4 80-system 8-bit interface

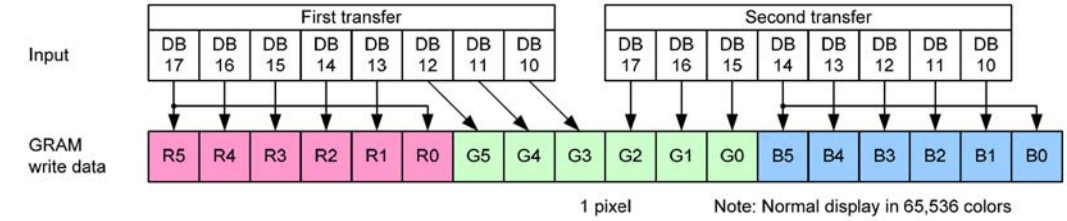
Instruction write



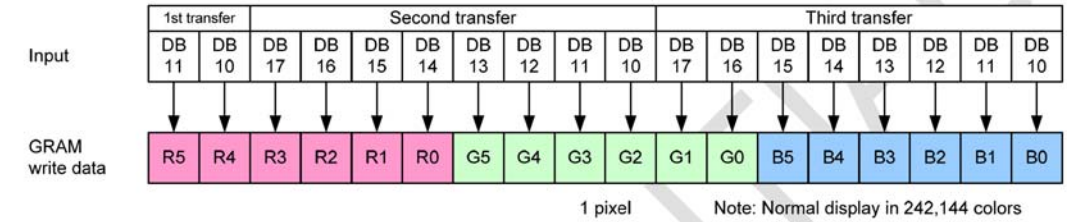
Device code read



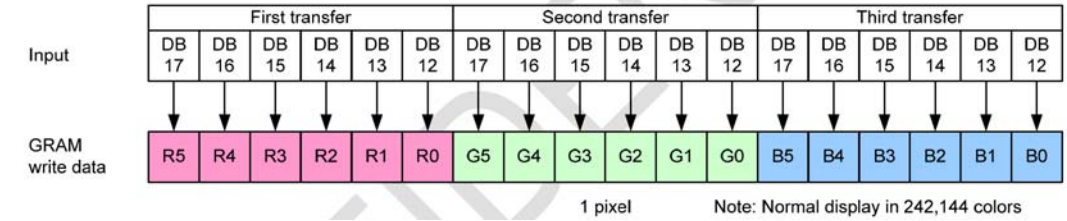
RAM data write (2-transfer mode: TRIREG = 0)



RAM data write (3-transfer mode: TRIREG = 1, DFM = 0)



RAM data write (3-transfer mode: TRIREG = 1, DFM = 1)



7-5 Instruction List

Main LCD Driver IC: ILI9325C

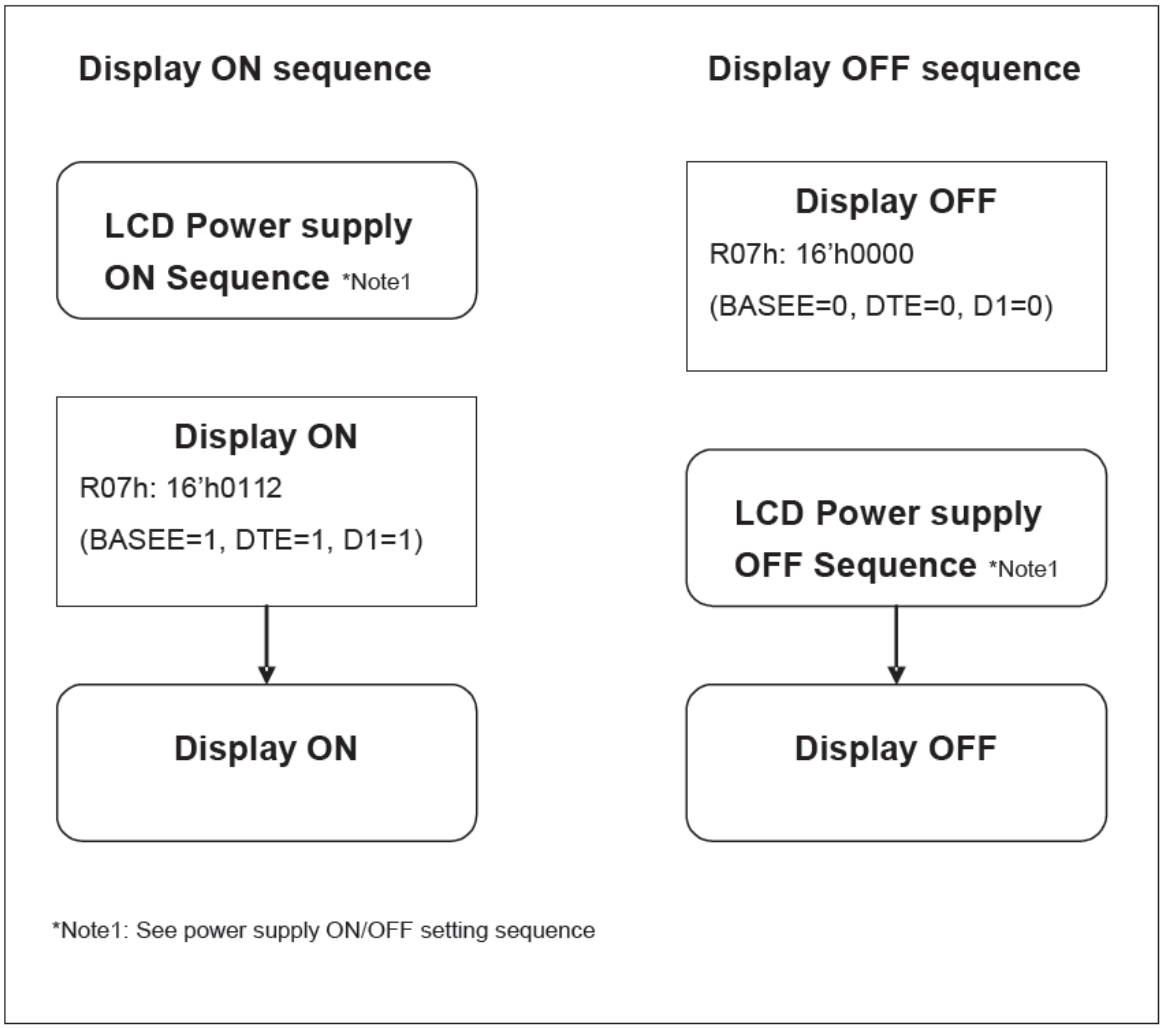
No.	Registers Name	R/W	RS	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
IR	Index Register	W	0	-	-	-	-	-	-	-	-	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
00h	Driver Code Read	RO	1	1	0	0	1	0	0	1	1	0	0	1	0	0	1	0	1
01h	Driver Output Control 1	W	1	0	0	0	0	0	SM	0	SS	0	0	0	0	0	0	0	0
02h	LCD Driving Control	W	1	0	0	0	0	0	0	B/C	0	0	0	0	0	0	0	0	0
03h	Entry Mode	W	1	TRI	DFM	0	BGR	0	0	0	0	ORG	0	I/D1	I/D0	AM	0	0	0
05h	16 bits data format control	W	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	EPF1	EPF0
07h	Display Control 1	W	1	0	0	PTDE1	PTDE0	0	0	0	BASEE	0	0	GON	DTE	CL	0	D1	D0
08h	Display Control 2	W	1	0	0	0	0	FP3	FP2	FP1	FP0	0	0	0	0	BP3	BP2	BP1	BP0
09h	Display Control 3	W	1	0	0	0	0	0	0	PTS1	PTS0	0	0	PTG1	PTG0	ISC3	ISC2	ISC1	ISC0
0Ah	Display Control 4	W	1	0	0	0	0	0	0	0	0	0	0	0	0	FMARKOE	FMI2	FMI1	FMI0
0Ch	RGB Display Interface Control 1	W	1	0	ENC2	ENC1	ENC0	0	0	0	RM	0	0	DM1	DM0	0	0	RIM1	RIM0
0Dh	Frame Maker Position	W	1	0	0	0	0	0	0	0	FMP8	FMP7	FMP6	FMP5	FMP4	FMP3	FMP2	FMP1	FMP0
0Fh	RGB Display Interface Control 2	W	1	0	0	0	0	0	0	0	0	0	0	0	VSPL	HSPL	0	EPL	DPL
10h	Power Control 1	W	1	0	0	0	SAP	0	BT2	BT1	BT0	APE	AP2	AP1	AP0	0	0	SLP	STB
11h	Power Control 2	W	1	0	0	0	0	0	DC12	DC11	DC10	0	DC02	DC01	DC00	0	VC2	VC1	VC0
12h	Power Control 3	W	1	0	0	0	0	0	0	0	0	VCIRE	0	0	0	VRH3	VRH2	VRH1	VRH0
13h	Power Control 4	W	1	0	0	0	VDV4	VDV3	VDV2	VDV1	VDV0	0	0	0	0	0	0	0	0
20h	Horizontal GRAM Address Set	W	1	0	0	0	0	0	0	0	0	AD7	AD6	AD5	AD4	AD3	AD2	AD1	AD0
21h	Vertical GRAM Address Set	W	1	0	0	0	0	0	0	0	AD16	AD15	AD14	AD13	AD12	AD11	AD10	AD9	AD8
22h	Write Data to GRAM	W	1	RAM write data (WD17-0) / read data (RD17-0) bits are transferred via different data bus lines according to the selected interfaces.															
29h	Power Control 7	W	1	0	0	0	0	0	0	0	0	0	0	VCM5	VCM4	VCM3	VCM2	VCM1	VCM0
2Bh	Frame Rate and Color Control	W	1	0	0	0	0	0	0	0	0	0	0	0	0	FRS[3]	FRS[2]	FRS[1]	FRS[0]
30h	Gamma Control 1	W	1	0	0	0	0	0	KP1[2]	KP1[1]	KP1[0]	0	0	0	0	0	KP0[2]	KP0[1]	KP0[0]
31h	Gamma Control 2	W	1	0	0	0	0	0	KP3[2]	KP3[1]	KP3[0]	0	0	0	0	0	KP2[2]	KP2[1]	KP2[0]
32h	Gamma Control 3	W	1	0	0	0	0	0	KP5[2]	KP5[1]	KP5[0]	0	0	0	0	0	KP4[2]	KP4[1]	KP4[0]
35h	Gamma Control 4	W	1	0	0	0	0	0	RP1[2]	RP1[1]	RP1[0]	0	0	0	0	0	RP0[2]	RP0[1]	RP0[0]
36h	Gamma Control 5	W	1	0	0	0	VRP1[4]	VRP1[3]	VRP1[2]	VRP1[1]	VRP1[0]	0	0	0	0	VRP0[3]	VRP0[2]	VRP0[1]	VRP0[0]
37h	Gamma Control 6	W	1	0	0	0	0	0	KN1[2]	KN1[1]	KN1[0]	0	0	0	0	0	KN0[2]	KN0[1]	KN0[0]
38h	Gamma Control 7	W	1	0	0	0	0	0	KN3[2]	KN3[1]	KN3[0]	0	0	0	0	0	KN2[2]	KN2[1]	KN2[0]
39h	Gamma Control 8	W	1	0	0	0	0	0	KN5[2]	KN5[1]	KN5[0]	0	0	0	0	0	KN4[2]	KN4[1]	KN4[0]
3Ch	Gamma Control 9	W	1	0	0	0	0	0	RN1[2]	RN1[1]	RN1[0]	0	0	0	0	0	RN0[2]	RN0[1]	RN0[0]

No.	Registers Name	R/W	RS	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
3Dh	Gamma Control 10	W	1	0	0	0	VRN1[4]	VRN1[3]	VRN1[2]	VRN1[1]	VRN1[0]	0	0	0	0	VRN0[3]	VRN0[2]	VRN0[1]	VRN0[0]
50h	Horizontal Address Start Position	W	1	0	0	0	0	0	0	0	0	HSA7	HSA6	HSA5	HSA4	HSA3	HSA2	HSA1	HSA0
51h	Horizontal Address End Position	W	1	0	0	0	0	0	0	0	0	HEA7	HEA6	HEA5	HEA4	HEA3	HEA2	HEA1	HEA0
52h	Vertical Address Start Position	W	1	0	0	0	0	0	0	0	VSA8	VSA7	VSA6	VSA5	VSA4	VSA3	VSA2	VSA1	VSA0
53h	Vertical Address End Position	W	1	0	0	0	0	0	0	0	VEA8	VEA7	VEA6	VEA5	VEA4	VEA3	VEA2	VEA1	VEA0
60h	Driver Output Control 2	W	1	GS	0	NL5	NL4	NL3	NL2	NL1	NL0	0	0	SCN5	SCN4	SCN3	SCN2	SCN1	SCN0
61h	Base Image Display Control	W	1	0	0	0	0	0	0	0	0	0	0	0	0	0	NDL	VLE	REV
66h	SPI Read/Write Control	W	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R/WX (0)
6Ah	Vertical Scroll Control	W	1	0	0	0	0	0	0	0	VL8	VL7	VL6	VL5	VL4	VL3	VL2	VL1	VL0
80h	Partial Image 1 Display Position	W	1	0	0	0	0	0	0	0	PTDP08	PTDP07	PTDP06	PTDP05	PTDP04	PTDP03	PTDP02	PTDP01	PTDP00
81h	Partial Image 1 Area (Start Line)	W	1	0	0	0	0	0	0	0	PTSA08	PTSA07	PTSA06	PTSA05	PTSA04	PTSA03	PTSA02	PTSA01	PTSA00
82h	Partial Image 1 Area (End Line)	W	1	0	0	0	0	0	0	0	PTEA08	PTEA07	PTEA06	PTEA05	PTEA04	PTEA03	PTEA02	PTEA01	PTEA00
83h	Partial Image 2 Display Position	W	1	0	0	0	0	0	0	0	PTDP18	PTDP17	PTDP16	PTDP15	PTDP14	PTDP13	PTDP12	PTDP11	PTDP10
84h	Partial Image 2 Area (Start Line)	W	1	0	0	0	0	0	0	0	PTSA18	PTSA17	PTSA16	PTSA15	PTSA14	PTSA13	PTSA12	PTSA11	PTSA10
85h	Partial Image 2 Area (End Line)	W	1	0	0	0	0	0	0	0	PTEA18	PTEA17	PTEA16	PTEA15	PTEA14	PTEA13	PTEA12	PTEA11	PTEA10
90h	Panel Interface Control 1	W	1	0	0	0	0	0	0	DIVI1	DIVI00	0	0	0	RTNI4	RTNI3	RTNI2	RTNI1	RTNI0
92h	Panel Interface Control 2	W	1	0	0	0	0	0	NOWI2	NOWI1	NOWI0	0	0	0	0	0	0	0	0
95h	Panel Interface Control 4	W	1	0	0	0	0	0	0	DIVE1	DIVE0	0	0	0	0	0	0	0	0
97h	Panel Interface Control 5	W	1	0	0	0	0	NOWE3	NOWE2	NOWE1	NOWE0	0	0	0	0	0	0	0	0
A1h	OTP VCM Programming Control	W	1	0	0	0	0	OTP_PGM_EN	0	0	0	0	0	VCM_OTP5	VCM_OTP4	VCM_OTP3	VCM_OTP2	VCM_OTP1	VCM_OTP0
A2h	OTP VCM Status and Enable	W	1	PGM_CNT1	PGM_CNT0	VCM_D5	VCM_D4	VCM_D3	VCM_D2	VCM_D1	VCM_D0	0	0	0	0	0	0	0	VCM_EN
A5h	OTP Programming ID Key	W	1	KEY 15	KEY 14	KEY 13	KEY 12	KEY 11	KEY 10	KEY 9	KEY 8	KEY 7	KEY 6	KEY 5	KEY 4	KEY 3	KEY 2	KEY 1	KEY 0
B1h	Write Display Brightness	W	1	X	X	X	X	X	X	X	X	DBV7	DBV6	DBV5	DBV4	DBV3	DBV2	DBV1	DBV0
B2h	Read Display Brightness	R	1	X	X	X	X	X	X	X	X	DBV7	DBV6	DBV5	DBV4	DBV3	DBV2	DBV1	DBV0
B3h	Write CTRL Display value	W	1	X	X	X	X	X	X	X	X	X	X	BCTRL	X	DD	BL	X	X
B4h	Read CTRL Display value	R	1	X	X	X	X	X	X	X	X	X	X	BCTRL	X	DD	BL	X	X
B5h	Write Content Adaptive Brightness Control value	W	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C[1:0]	

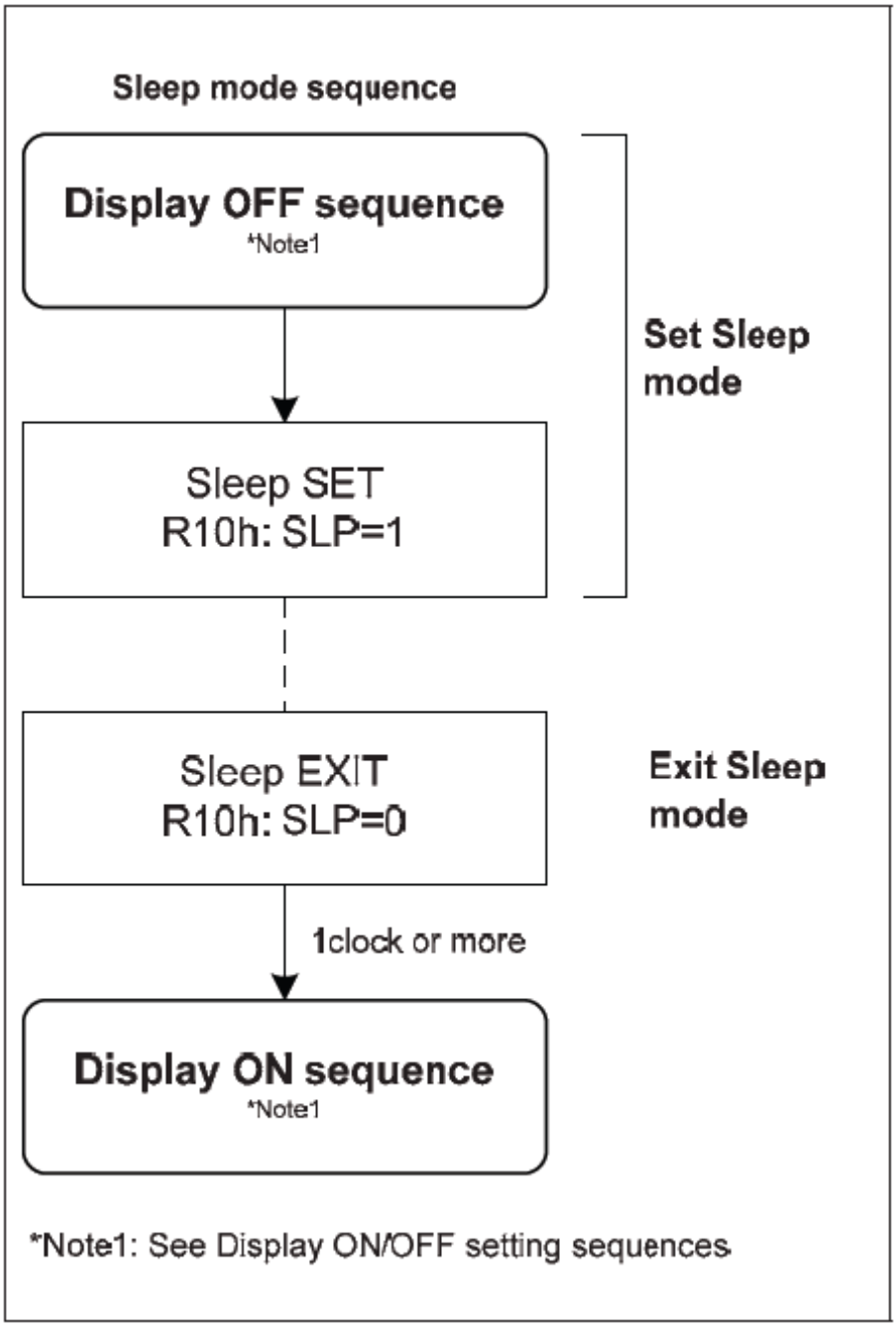
No.	Registers Name	R/W	RS	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
B6h	Read Content Adaptive Brightness Control value	R	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	C[1:0]	
BEh	Write CABC Minimum Brightness	W	1	X	X	X	X	X	X	X	X	CMB[7:0]							
BFh	Read CABC Minimum Brightness	R	1	X	X	X	X	X	X	X	X	CMB[7:0]							
C8h	CABC Control 1	W	1	X	X	X	X	X	X	X	X	PWM_DIV[7:0]							
C9h	CABC Control 2	W	1	X	X	X	X	X	X	X	X	THRES_MOV[3:0]				THRES_STILL[3:0]			
CAh	CABC Control 3	W	1	X	X	X	X	X	X	X	X	0	0	0	0	THRES_UI[3:0]			
CBh	CABC Control 4	W	1	X	X	X	X	X	X	X	X	DTH_MOV[3:0]				DTH_STILL[3:0]			
CCh	CABC Control 5	W	1	X	X	X	X	X	X	X	X	0	0	0	0	DTH_UI[3:0]			
CDh	CABC Control 6	W	1	X	X	X	X	X	X	X	X	DIM_OPT2[3:0]				0	DIM_OPT1[2:0]		
CEh	CABC Control 7	W	1	X	X	X	X	X	X	X	X	SCD_VLINE[8:0]							

8 Application

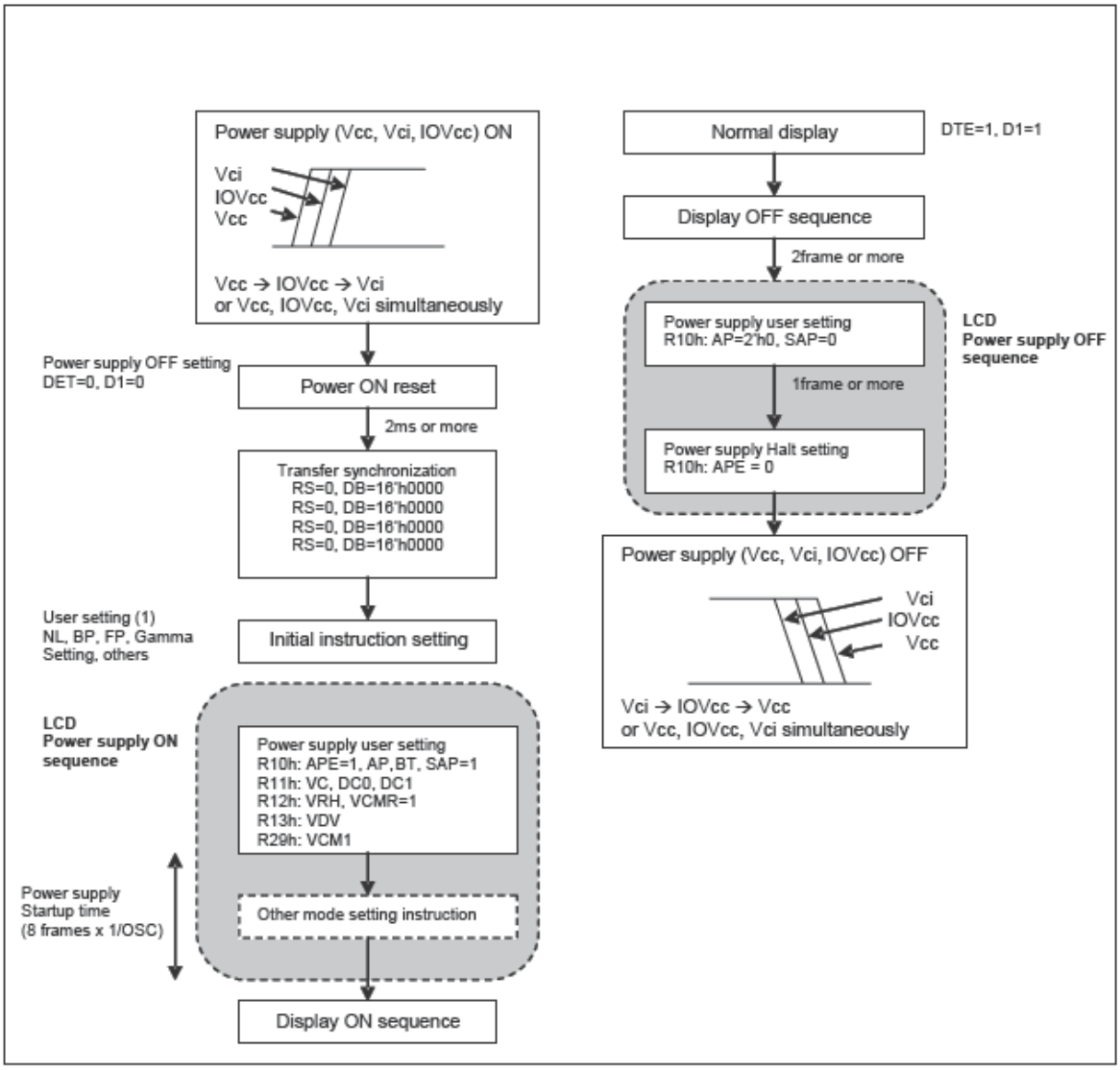
8-1 Display ON / OFF



8-2 Sequence to exit sleep mode



8-3 Power Supply Configuration

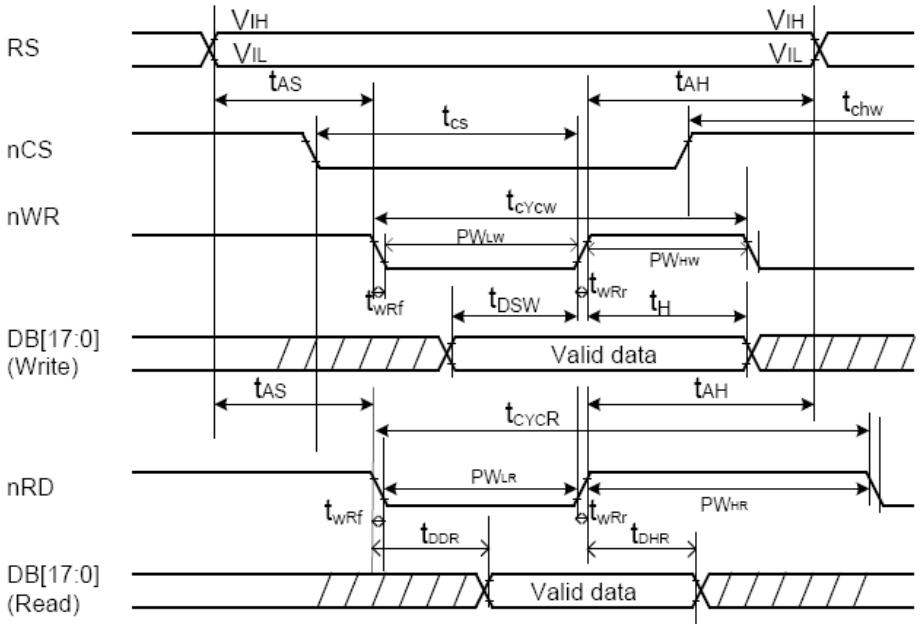


Power Supply ON/OFF Sequence

9 Electrical Characteristics

Normal Write Mode (IOVCC = 1.65~3.3V)

Item		Symbol	Unit	Min.	Typ.	Max.	Test Condition
Bus cycle time	Write	t_{CYCW}	ns	80	-		-
	Read	t_{CYCR}	ns	300	-	-	-
Write low-level pulse width		PW_{LW}	ns	50	-	500	-
Write high-level pulse width		PW_{HW}	ns	15	-	-	-
Read low-level pulse width		PW_{LR}	ns	150	-	-	-
Read high-level pulse width		PW_{HR}	ns	150	-	-	
Write / Read rise / fall time		t_{WRr}/t_{WRf}	ns	-	-	25	
Setup time	Write (RS to nCS, E/nWR)	t_{AS}	ns	10	-	-	
	Read (RS to nCS, RW/nRD)			5	-	-	
Address hold time		t_{AH}	ns	5	-	-	
Write data set up time		t_{DSW}	ns	10	-	-	
Write data hold time		t_H	ns	15	-	-	
Read data delay time		t_{DDR}	ns	-	-	100	
Read data hold time		t_{DHR}	ns	5	-	-	



10 QUALITY AND RELIABILITY

1. Scope

Specifications contain

1.1 Display Quality Evaluation

1.2 Mechanics Specification

2. Sampling Plan

Unless there is other agreement, the sampling plan for incoming inspection shall follow MIL-STD-105E LEVEL II.

2.1 Lot size: Quantity per shipment as one lot (different model as different lot).

2.2 Sampling type: Normal inspection, single sampling.

2.3 Sampling level: Level II.

2.4 AQL: Acceptable Quality Level

Major defect: AQL=0.65

Minor defect: AQL=1.0

3. Panel Inspection Condition

3.1 Environment:

Room Temperature: 25±5°C.

Humidity: 65±5% RH.

Illumination: 300 ~ 700 Lux.

3.2 Inspection Distance:

35-40 cm

3.3 Inspection Angle:

The vision of inspector should be perpendicular to the surface of the Module.

3.4 Inspection time：

Perceptibility Test Time: 20 seconds max.

4. Display Quality

4.1 Function Related:

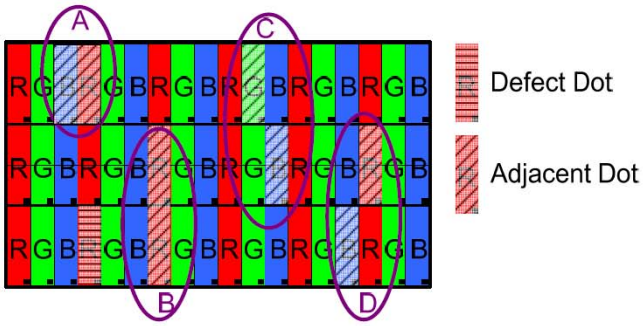
The function defects of line defect, abnormal display, and no display are considered Major defects.

4.2 Bright/Dark Dots:

Defect Type / Specification	G0 Grade	A Grade
Bright Dots	0	N≤ 1
Dark Dots	0	N≤ 3
Total Bright and Dark Dots	0	N≤ 3

[Note 1]

Judge defect dot and adjacent dot as following.



(1) One pixel consists of 3 sub-pixels, including R,G, and B dot.(Sub-pixel = Dot)

(2) The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.

(3) Allow above (as A, B, C and D status) adjacent defect dots, including bright and dart adjacent dot. And they will be counted 2 defect dots in total quantity.

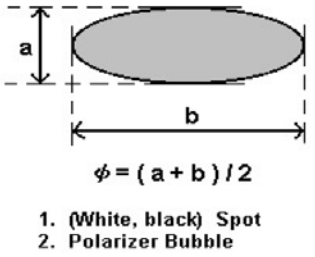
(4) Defects on the Black Matrix, out of Display area, are not considered as a defect or counted.

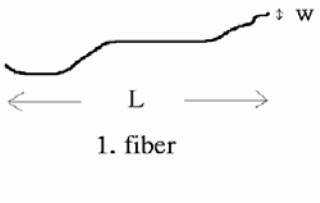
(5) There should be no distinct non-uniformity visible through 6% ND Filter within 2 sec inspection times.

4.3 Visual Inspection specifications:

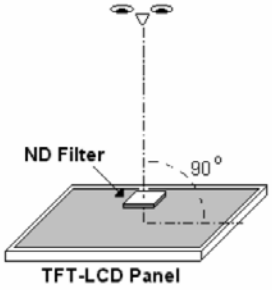
Defect Type	Specification	Count(N)
Dot Shape (Particle、Scratch and Bubbles in display area)	D≤0.15mm	Ignored
	0.15mm < D≤ 0.3mm	N≤ 3
	D > 0.3mm	N=0
Line Shape (Particles、Scratch、Lint and Bubbles in display area)	W≤ 0.05mm	Ignored
	0.05mm<W≤ 0.1mm ，L≤ 3mm	N≤ 3
	W > 0.1mm ， L > 3mm	N=0

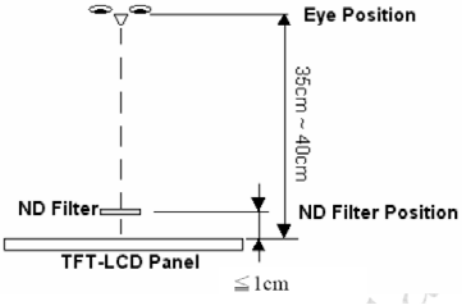
[Note 2] W : Width[mm], L : Length[mm], N : Number, φ : Average Diameter





[Note 3] Bright dot is defined through 6% transmission ND Filter as following.





RELIABILITY

Test Item	Test Conditions	Note
High Temperature Operation	70±3°C , t=72 hrs	
Low Temperature Operation	-10±3°C , t=72 hrs	
High Temperature Storage	80±3°C , t=72hrs	1,2
Low Temperature Storage	-30±3°C , t=72 hrs	1,2
Temperature /Humidity Storage Test	60°C, Humidity 90%, 72 hrs	1,2
Temperature /Humidity Operation Test	40°C, Humidity 90%, 72 hrs	1,2
Thermal Shock Test	-20°C ~ 70°C 60 min 60 min. (1 cycle) Total 20 cycle	1,2

Note 1 : Condensation of water is not permitted on the module.

Note 2 : The module should be inspected after 1 hour storage in normal conditions (15-35°C , 45-65%RH).

Definitions of life end point :

- Current drain should be smaller than the specific value.
- Function of the module should be maintained.
- Appearance and display quality should not have degraded noticeably.
- Contrast ratio should be greater than 50% of the initial value.

11 USE PRECAUTIONS

11-1 Handling precautions

1) The polarizing plate may break easily so be careful when handling it. Do not touch, press or rub it with a hard-material tool like tweezers.
2) Do not touch the polarizing plate surface with bare hands so as not to make it dirty. If the surface or other related part of the polarizing plate is dirty, soak a soft cotton cloth or chamois leather in benzine and wipe off with it. Do not use chemical liquids such as acetone, toluene and isopropyl alcohol. Failure to do so may bring chemical reaction phenomena and deteriorations.
3) Remove any spit or water immediately. If it is left for hours, the suffered part may deform or decolorize.
4) If the LCD element breaks and any LC stuff leaks, do not suck or lick it. Also if LC stuff is stuck on your skin or clothing, wash thoroughly with soap and water immediately.

11-2 Installing precautions

1) The PCB has many ICs that may be damaged easily by static electricity. To prevent breaking by static electricity from the human body and clothing, earth the human body properly using the high resistance and discharge static electricity during the operation. In this case, however, the resistance value should be approx. 1MΩ and the resistance should be placed near the human body rather than the ground surface. When the indoor space is dry, static electricity may occur easily so be careful. We recommend the indoor space should be kept with humidity of 60% or more. When a soldering iron or other similar tool is used for assembly, be sure to earth it.
2) When installing the module and ICs, do not bend or twist them. Failure to do so may crack LC element and cause circuit failure.
3) To protect LC element, especially polarizing plate, use a transparent protective plate (e.g., acrylic plate, glass etc) for the product case.
4) Do not use an adhesive like a both-side adhesive tape to make LCD surface (polarizing plate) and product case stick together. Failure to do so may cause the polarizing plate to peel off.

11-3 Storage precautions

1) Avoid a high temperature and humidity area. Keep the temperature between 0°C and 35°C and also the humidity under 60%.
2) Choose the dark spaces where the product is not exposed to direct sunlight or fluorescent light.
3) Store the products as they are put in the boxes provided from us or in the same conditions as we recommend.

11-4 Operating precautions

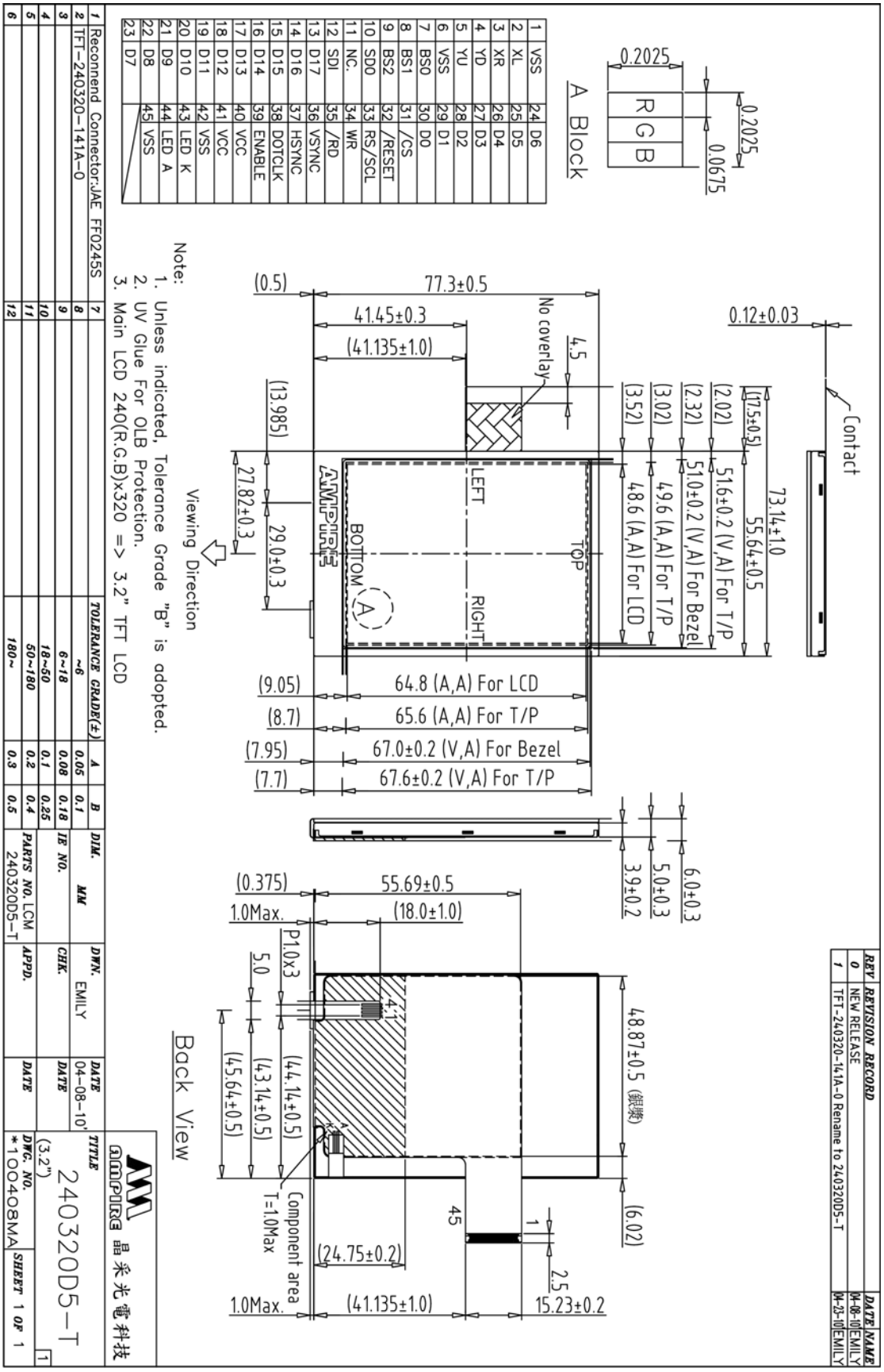
1) Do not boost the applied drive voltage abnormally. Failure to do so may break ICs. When applying power voltage, check the electrical features beforehand and be careful. Always turn off the power to the LC module controller before removing or inserting the LC module input connector. If the input connector is removed or inserted while the power is turned on, the LC module internal circuit may break.
2) The display response may be late if the operating temperature is under the normal standard, and the display may be out of order if it is above the normal standard. But this is not a failure; this will be restored if it is within the normal standard.
3) The LCD contrast varies depending on the visual angle, ambient temperature, power voltage etc. Obtain the optimum contrast by adjusting the LC dive voltage.
4) When carrying out the test, do not take the module out of the low-temperature space suddenly. Failure to do so will cause the module condensing, leading to malfunctions.
5) Make certain that each signal noise level is within the standard (L level: 0.2Vdd or less and H level: 0.8Vdd or more) even if the module has functioned properly. If it is beyond the standard, the module may often malfunction. In addition, always connect the module when making noise level measurements.
6) The CMOS ICs are incorporated in the module and the pull-up and pull-down function is not adopted for the input so avoid putting the input signal open while the power is ON.
7) The characteristic of the semiconductor element changes when it is exposed to light emissions, therefore ICs on the LCD may malfunction if they receive light emissions. To prevent these malfunctions, design and assemble ICs so that they are shielded from light emissions.
8) Crosstalk occurs because of characteristics of the LCD. In general, crosstalk

occurs when the regularized display is maintained. Also, crosstalk is affected by the LC drive voltage. Design the contents of the display, considering crosstalk.

11-5 Other

1) Do not disassemble or take the LC module into pieces. The LC modules once disassembled or taken into pieces are not the guarantee articles.
2) The residual image may exist if the same display pattern is shown for hours. This residual image, however, disappears when another display pattern is shown or the drive is interrupted and left for a while. But this is not a problem on reliability.
3) AMIPRE will provide one years warrantee for all products and three months warrantee for all repairing products.

12 MECHANICAL DRAWING



1	VSS	24	D6																				
2	XL	25	D5																				
3	XR	26	D4																				
4	YD	27	D3																				
5	YU	28	D2																				
6	VSS	29	D1																				
7	BS0	30	D0																				
8	BS1	31	/CS																				
9	BS2	32	/RESET																				
10	SD0	33	RS/SCL																				
11	NC.	34	WR																				
12	SDI	35	/RD																				
13	D17	36	VSYNC																				
14	D16	37	HSYNC																				
15	D15	38	DOTCLK																				
16	D14	39	ENABLE																				
17	D13	40	VCC																				
18	D12	41	VCC																				
19	D11	42	VSS																				
20	D10	43	LED K																				
21	D9	44	LED A																				
22	D8	45	VSS																				
23	D7																						

Note:
1. Unless indicated, Tolerance Grade "B" is adopted.
2. UV Glue For OLB Protection.
3. Main LCD 240(R.G.B)x320 => 3.2" TFT LCD

REV	REVISION RECORD	DATE	NAME
0	NEW RELEASE	04-08-10	EMILY
1	TFT-240320-141A-0 Rename to 240320D5-T	04-23-10	EMILY

1	Reconnend Connector:JAE FF0245S	7			TOLERANCE GRADE(±)	A	B	DIM.	DWN.	DATE	TITLE												
2	TFT-240320-141A-0	8			~6	0.05	0.1	MM	EMILY	04-08-10	240320D5-T												
3		9			6~18	0.08	0.18	IB NO.	CHK.	DATE	(3.2")												
4		10			18~50	0.1	0.25	PARTS NO. LCM 240320D5-T	APPD.	DATE	DWG. NO. *100408MA												
5		11			50~180	0.2	0.4				SHEET 1 OF 1												
6		12			180~	0.3	0.5																