



晶采光電科技股份有限公司
AMPIRE CO., LTD

SPECIFICATIONS FOR LCD MODULE

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

Approved For Specifications

Approved For Specifications & Sample

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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

($V_{DD}=3.0V$, $T_a=25^{\circ}C$)

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

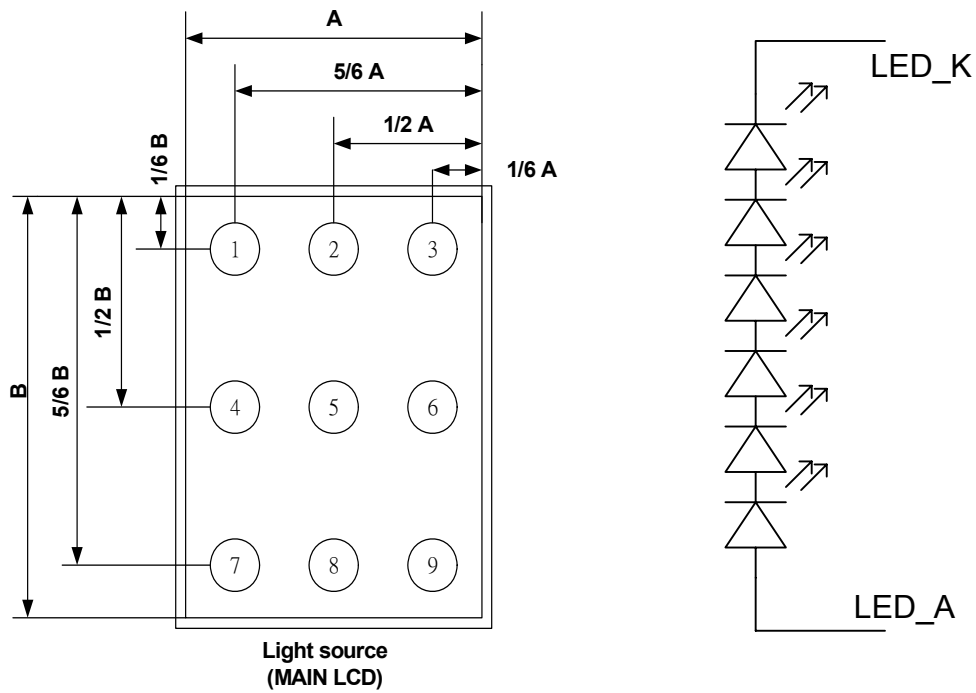
※ 1. 1/320 duty.

4-2 LED back light specification

Item	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Forward voltage	V_f	$I_f = 15\text{mA}$	-	(19)	-	V
Forward current	I_f	$T_a = 25\text{C}$	-	(15)	(20)	mA
Uniformity (with L/G)	-	$I_f = 15\text{mA}$	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): $\frac{\text{Min}(P1 \sim P9)}{\text{Max}(P1 \sim P9)} \times 100 \geq 80\%$

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

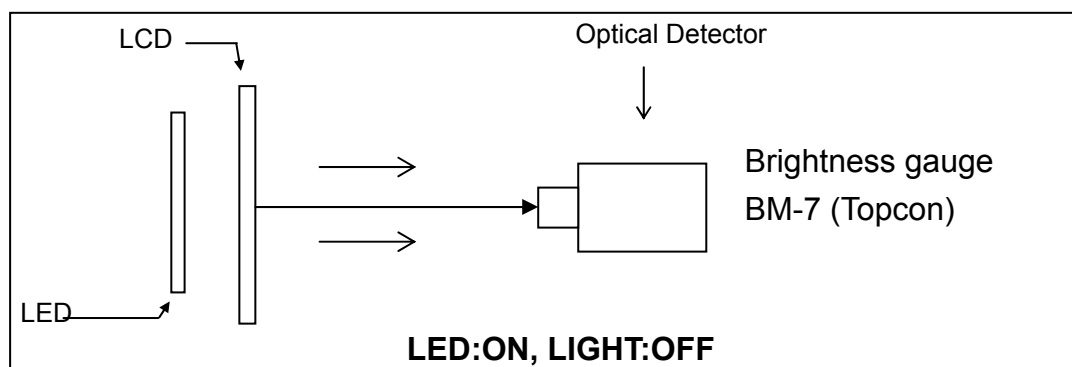
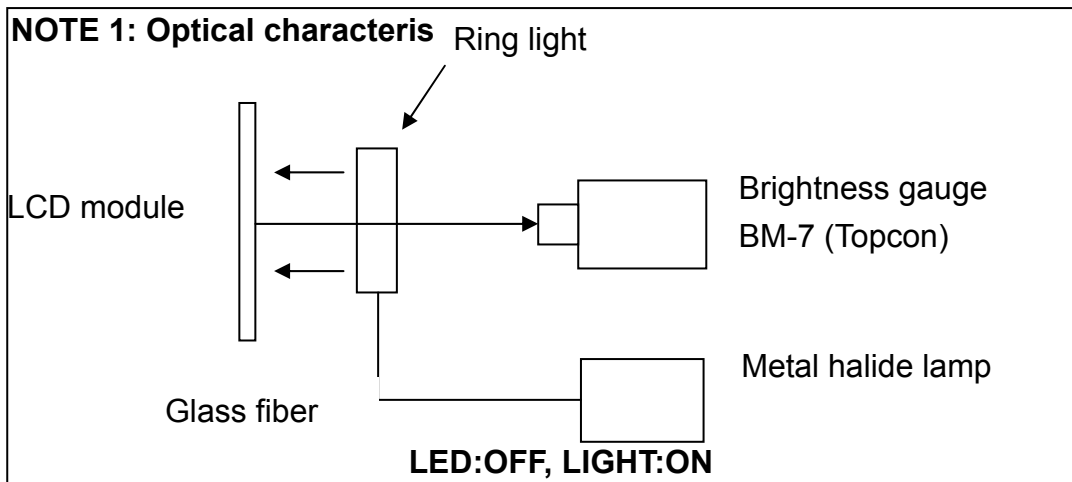
5 Main LCD

5-1 Optical characteristics

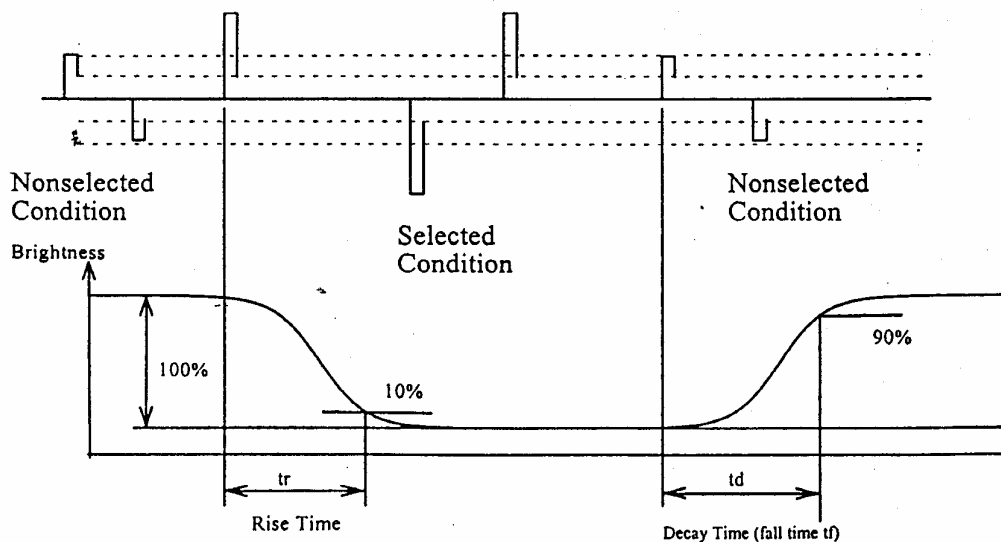
(1/320 Duty in case except as specified elsewhere Ta = 25°C)

Item	Symbol	Min.	Std.	Max.	Unit	Conditions	
Contrast ratio	CR	150	200	-	-	$\theta=0^\circ$ $\Phi=0^\circ$ 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.	θ_L	(38.7)			Degree	CR>10
		θ_R	(15)				
	Ver.	θ_f	(62.7)				
		θ_b	(62.2)				

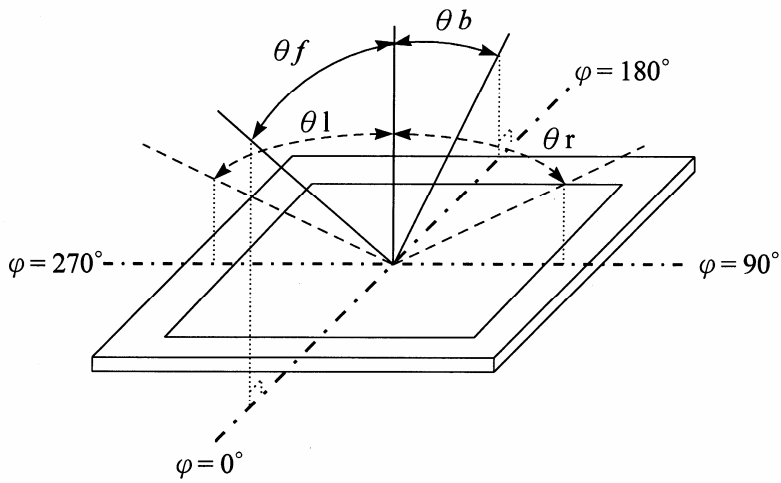
Note: (value), value=estimate value.



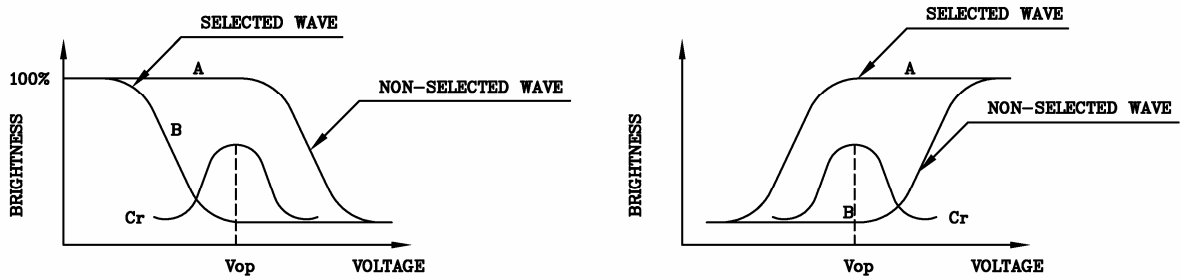
NOTE 2: Response tome definition



NOTE 3: φ 、 θ definition



NOTE 4: Contrast definition

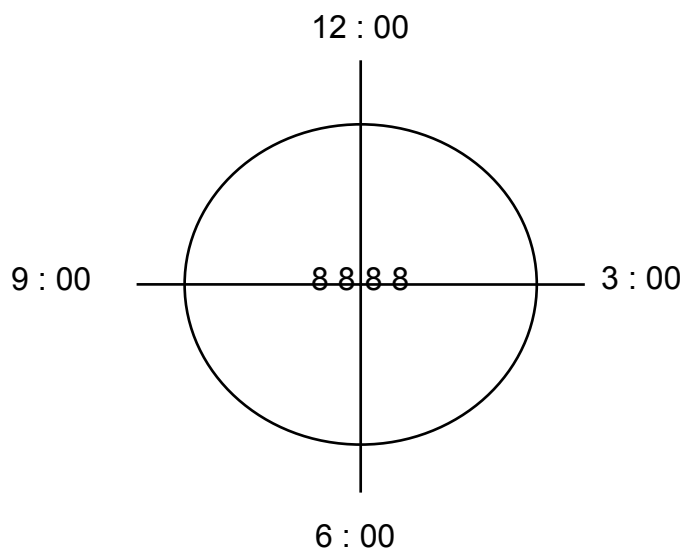


(positive type)

(negative type)

Contrast Ratio : $Cr=A/B$

NOTE 5: Visual angle direction priority



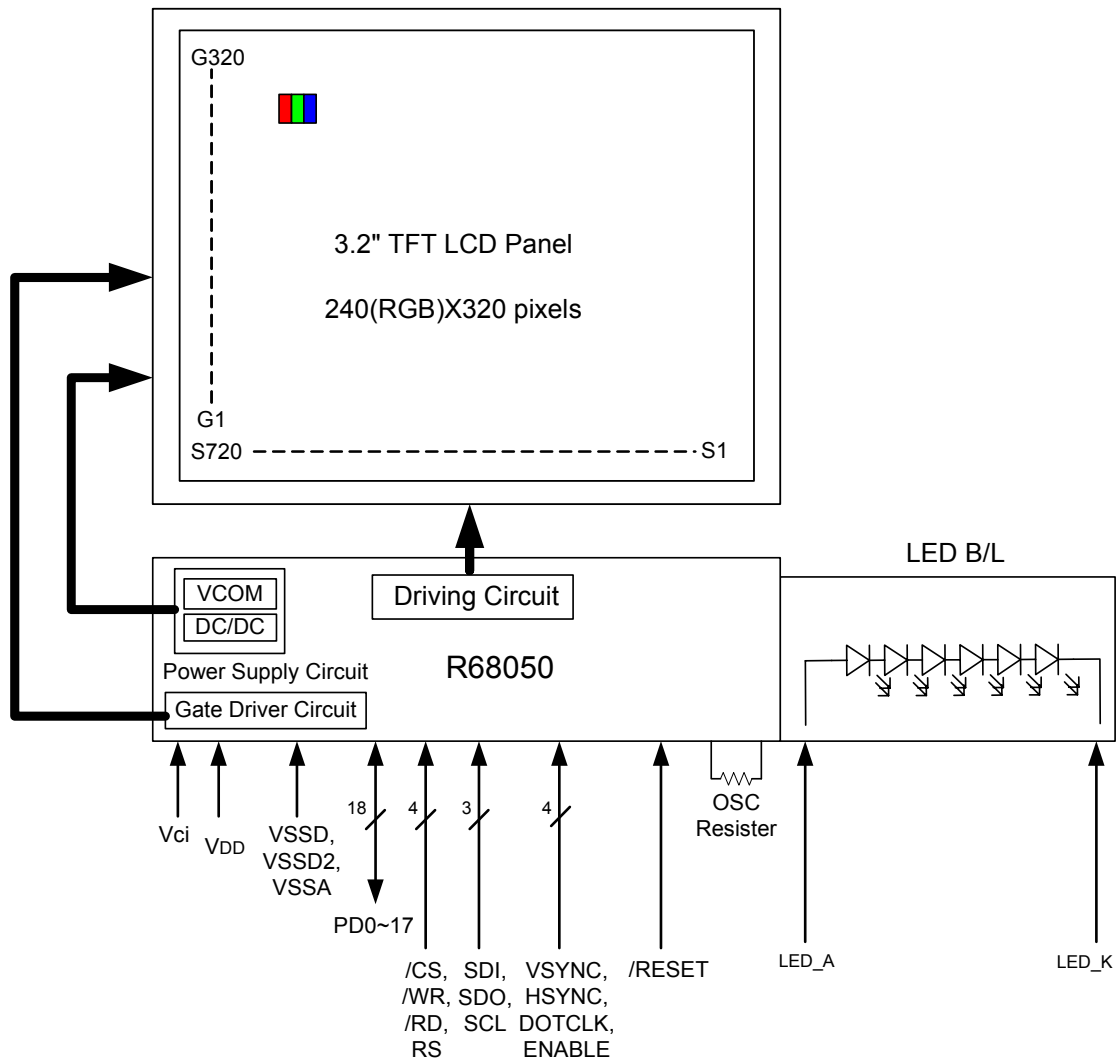
6 Block Diagram

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

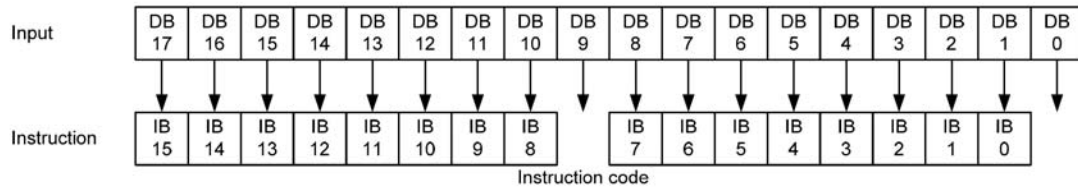
Connector pitch:0.3mm

Recommend Connector: JAE FF0245S

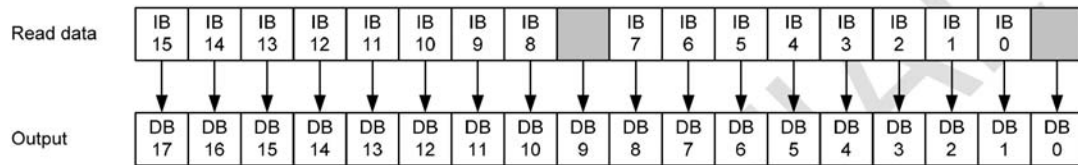
Pin No.	Terminal	Functions				
1	VSS	Ground pins.				
2	XL	Touch Panel Left Side.				
3	XR	Touch Panel Right Side.				
4	YD	Touch Panel Down Side.				
5	YU	Touch Panel Up Side.				
6	VSS	Ground pins.				
7	IM0/ID	IM3	IM1	IM0/ID	MPU-Interface Mode	DB Pin in use
		0	1	0	i80-system 16-bit interface	DB[17:10],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

7-1 80-system 18-bit interface

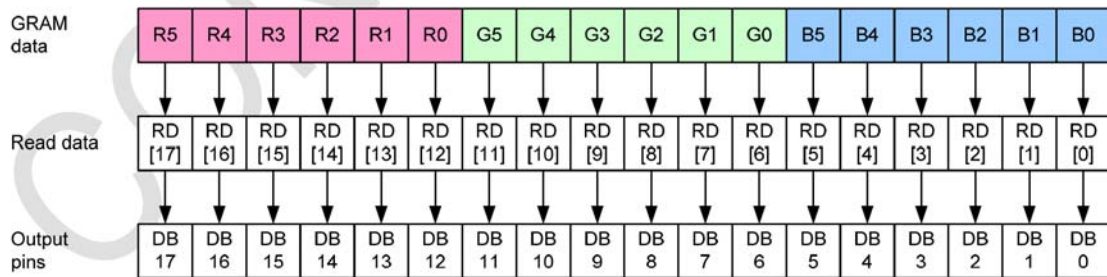
Instruction write



Instruction read

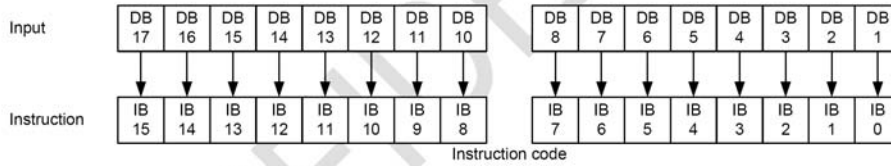


RAM data read

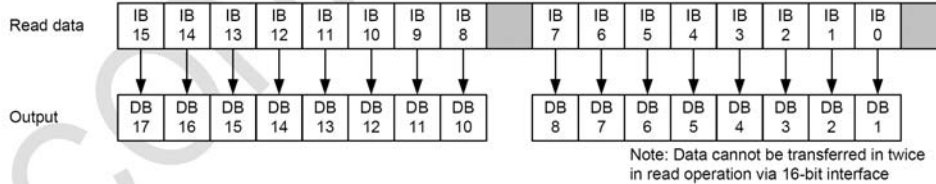


7-2 80-system 16-bit interface

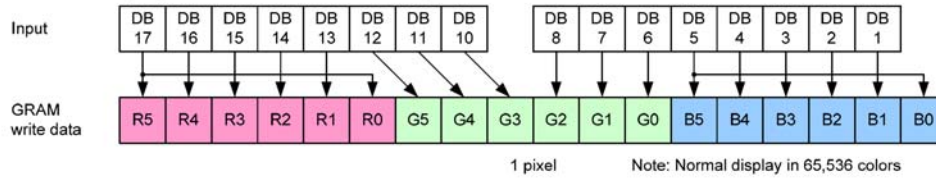
Instruction write



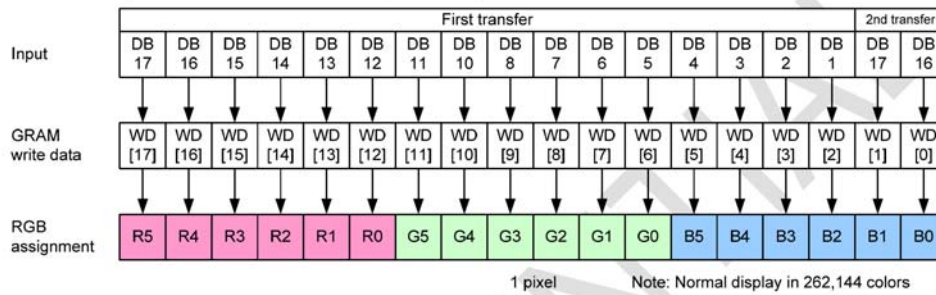
Instruction read



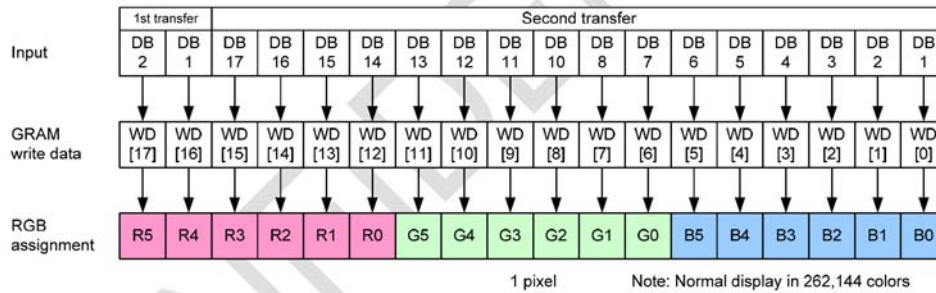
RAM data write (single transfer mode: TRIREG = 0)



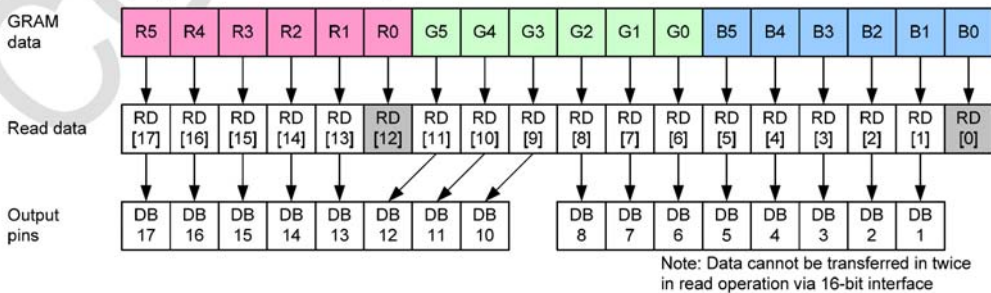
RAM data write (2 transfer mode: TRIREG = 1, DFM = 0)



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

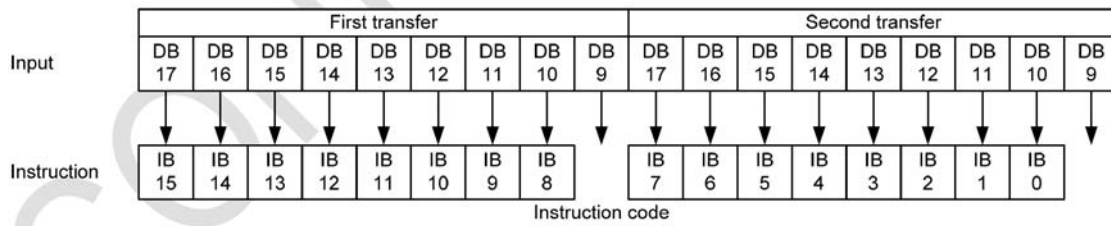


RAM data read (single transfer: TRIREG = 0)

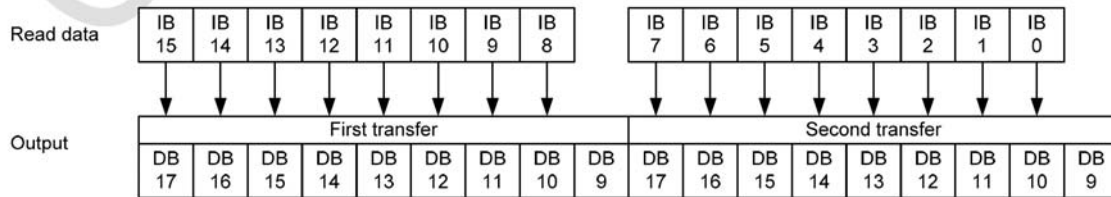


7-3 80-system 9-bit interface

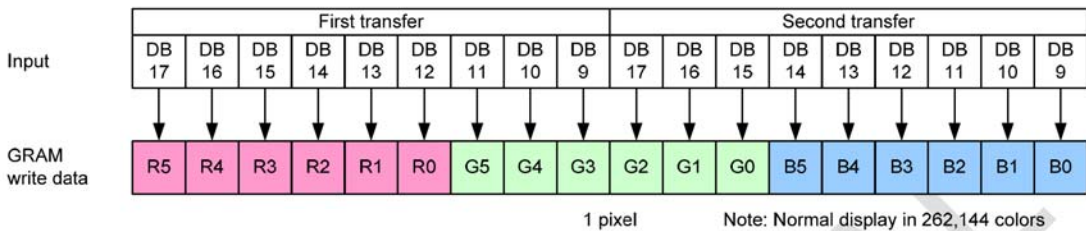
Instruction write



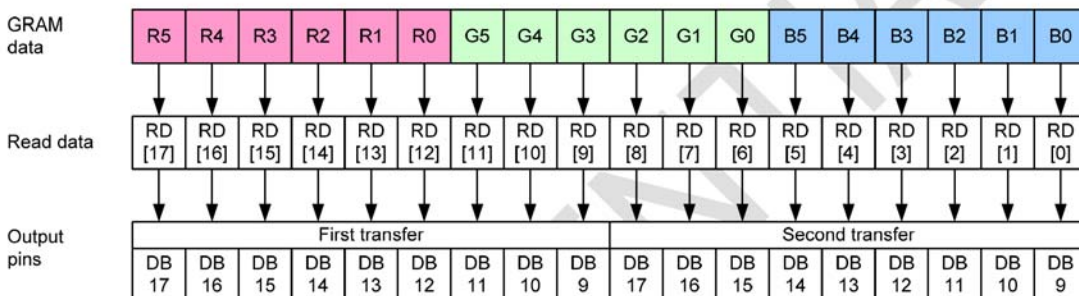
Device code read



RAM data write

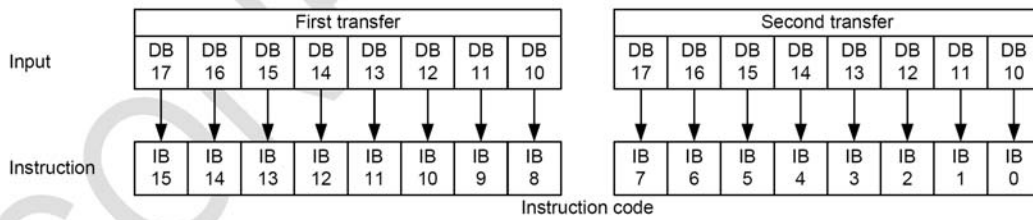


RAM data read

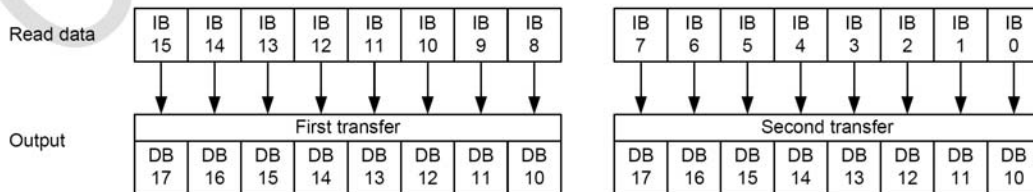


7-4 80-system 8-bit interface

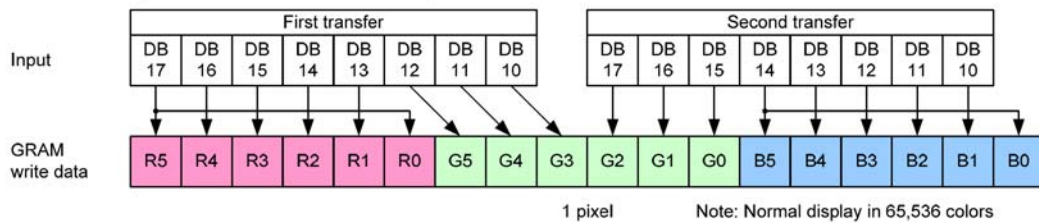
Instruction write



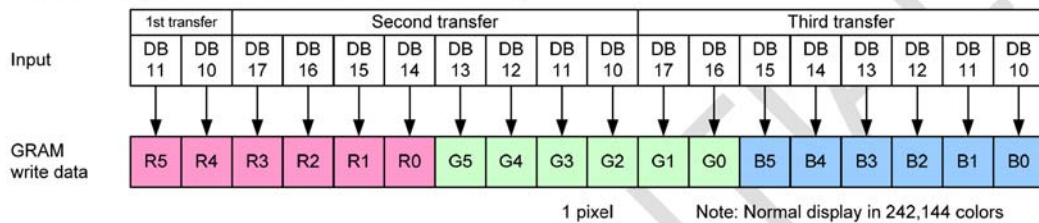
Device code read



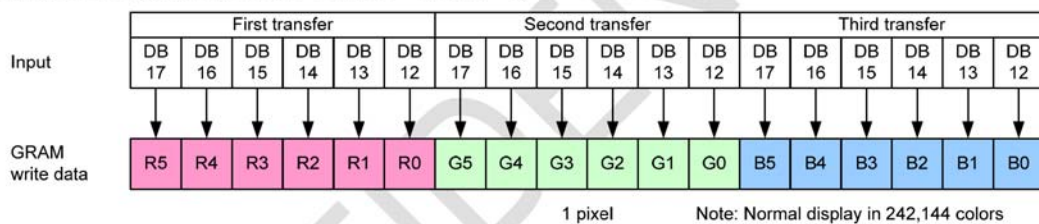
RAM data write (2-transfer mode: TRIREG = 0)



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

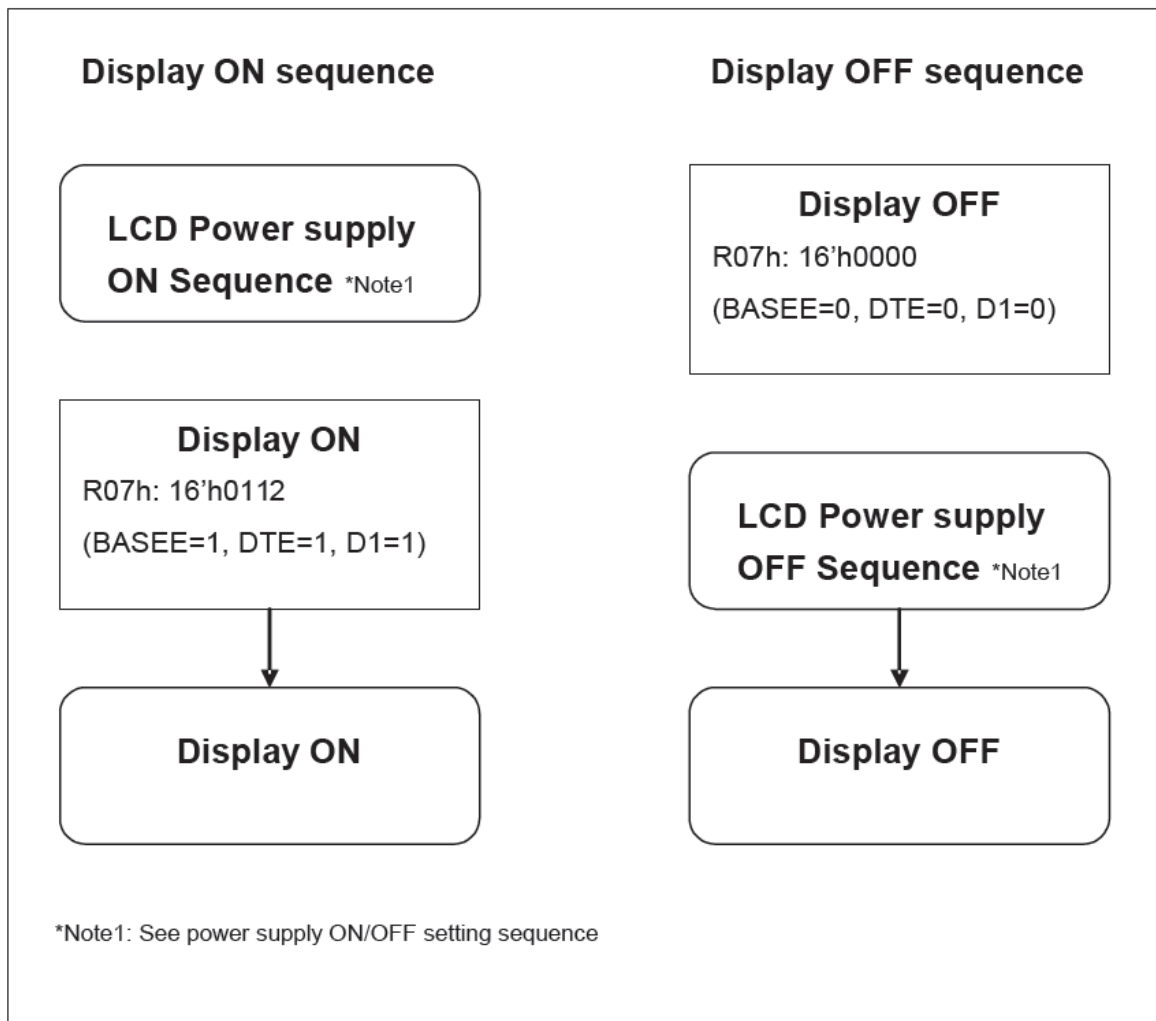


RAM data write (3-transfer mode: TRIREG = 1, DFM = 1)

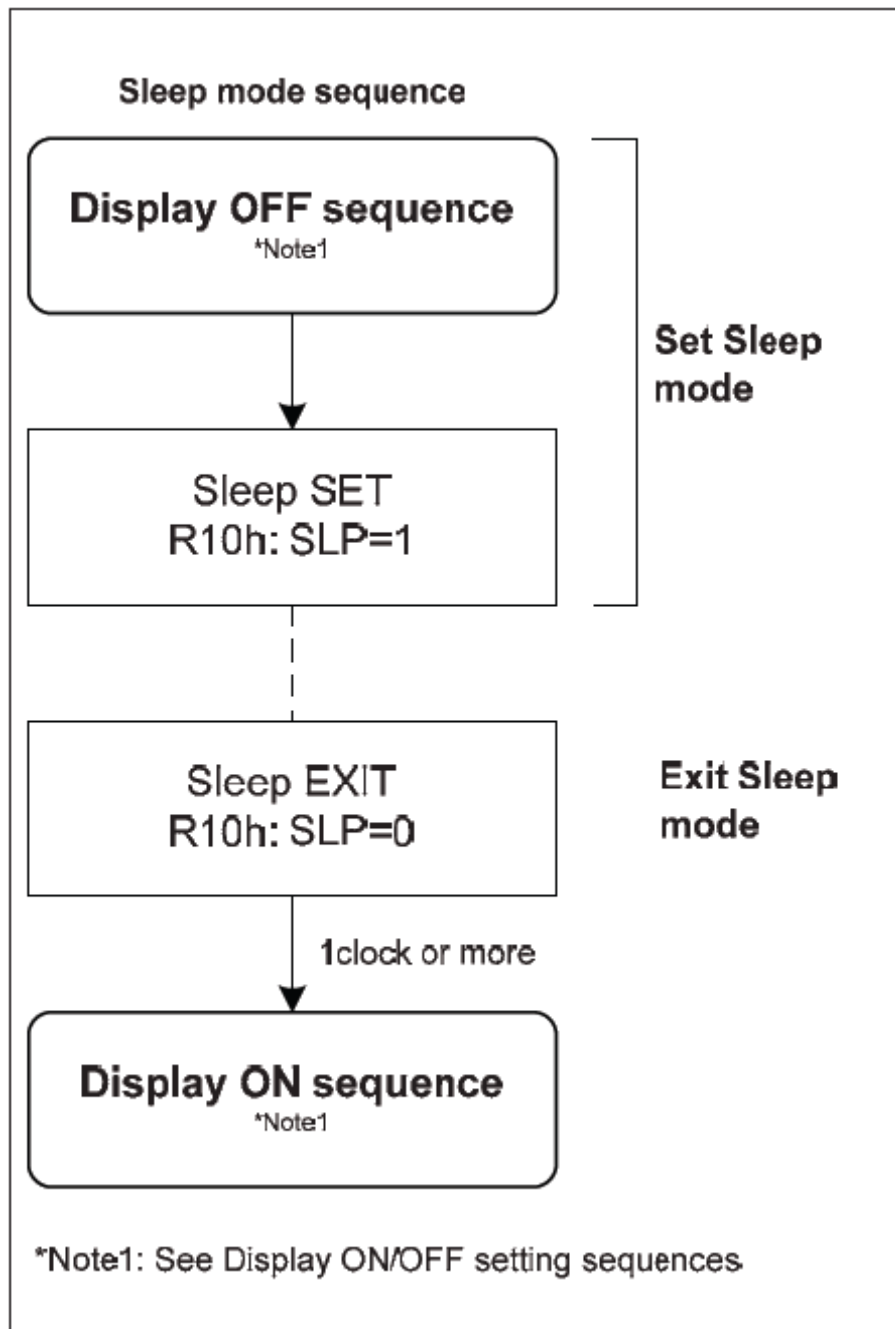


8 Application

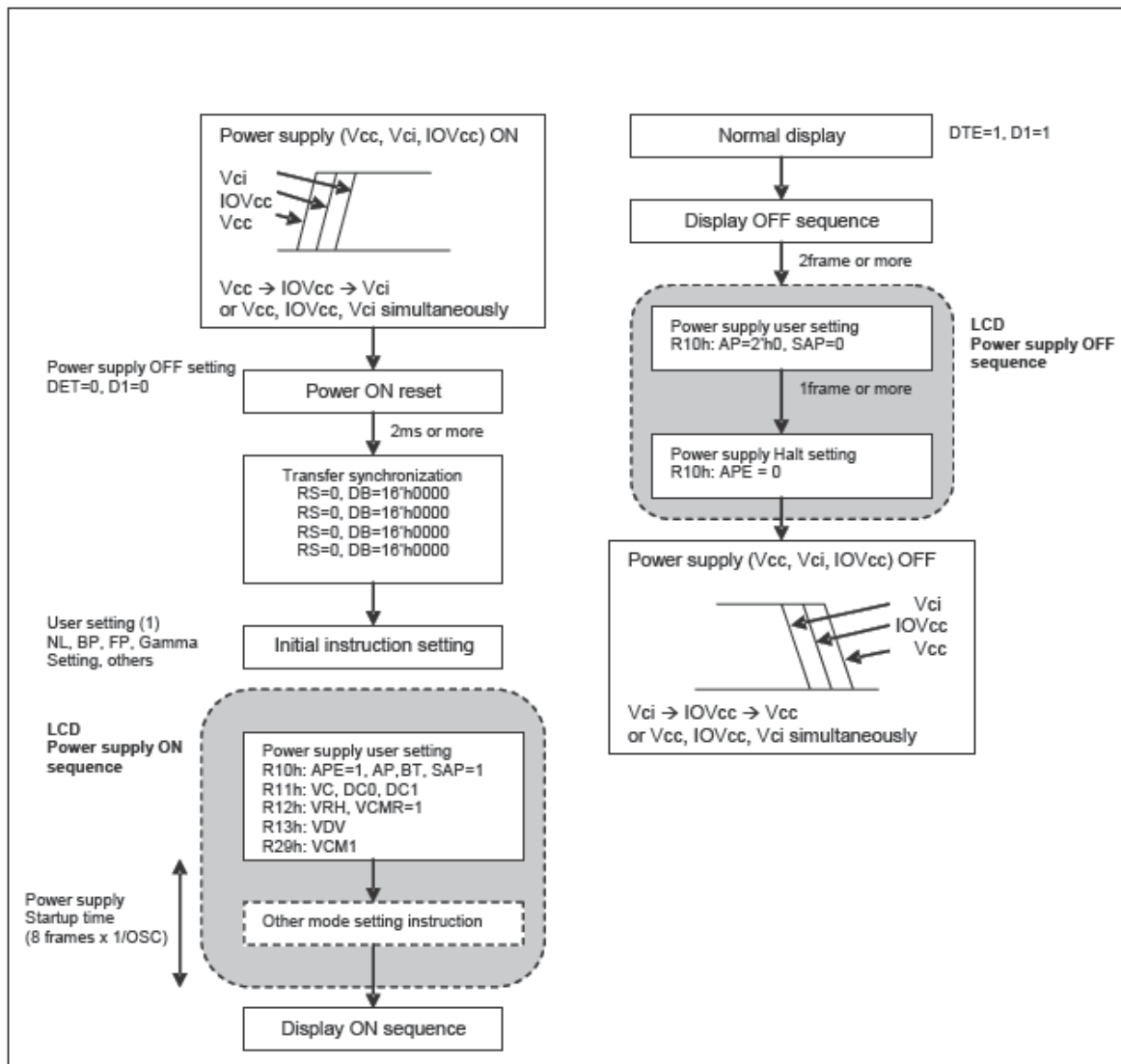
8-1 Display ON / OFF



8-2 Sequence to exit sleep mode



8-3 Power Supply Configuration

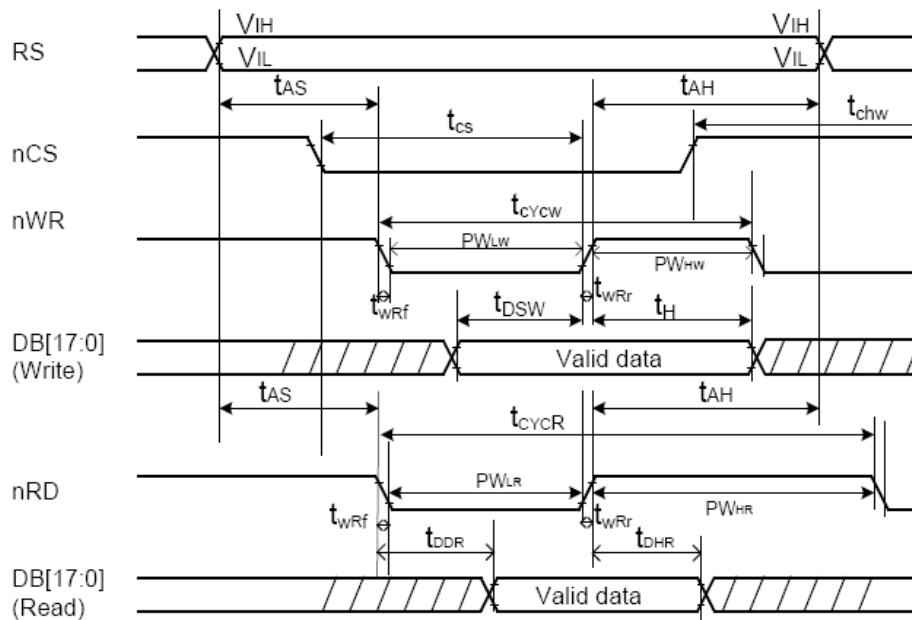


Power Supply ON/OFF Sequence

9 Electrical Characteristics

Normal Write Mode (IOVCC = 1.65~3.3V)

Item	Symbol	Unit	Min.	Typ.	Max.	Test Condition
Bus cycle time	Write	t_{CYW}	ns	80	-	-
	Read	t_{CYR}	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_{WR}/t_{WR}	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: $25\pm 5^{\circ}\text{C}$.

Humidity: $65\pm 5\%$ 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:

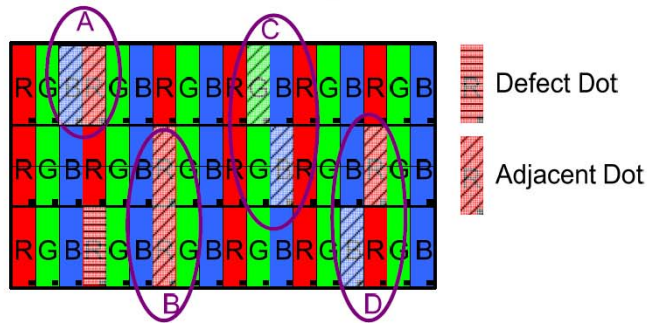
The function defects of line defect, abnormal display, and no display are considered Major defects.

4.2 Bright/Dark Dots:

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

[Note 1]

Judge defect dot and adjacent dot as following.

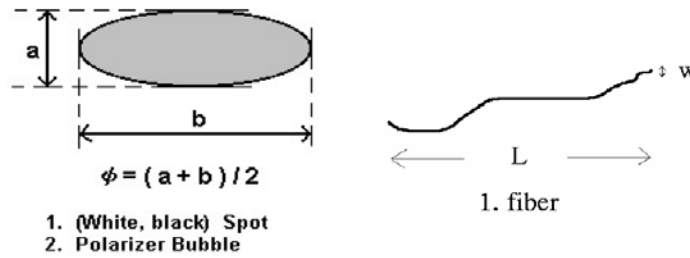


- (1) One pixel consists of 3 sub-pixels, including R,G, and B dot.(Sub-pixel = Dot)
- (2) The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.
- (3) Allow above (as A, B, C and D status) adjacent defect dots, including bright and dark adjacent dot. 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.

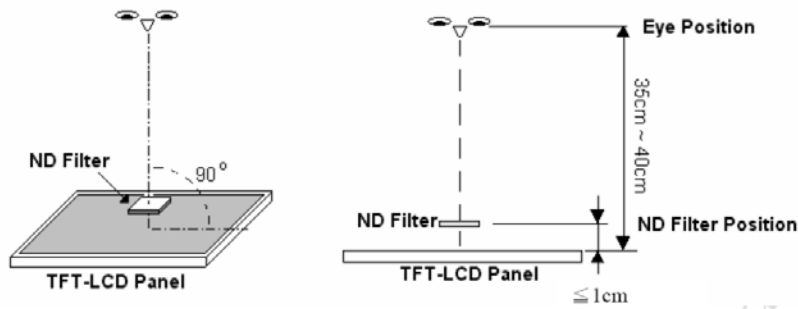
4.3 Visual Inspection specifications:

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

[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. $1M\Omega$ 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 drive 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: 0.2V_{dd} or less and H level: 0.8V_{dd} 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

