

## 晶采光電科技股份有限公司 AMPIRE CO., LTD

# SPECIFICATIONS FOR LCD MODULE

CUSTOMER	3						
CUSTOMER PAR	RT NO.						
AMPIRE PART	NO.	AM-240320D	5TOQW-T04H(R)				
APPROVED	BY						
DATE							
<ul><li>□ Approved For Specif</li><li>□ Approved For Specif</li></ul>		& Sample					
AMPIRE CO., LTD. 2F., No.88, Sec. 1, Sintai 5th Rd., Sijhih City, Taipei County 221, Taiwan (R.O.C.)台北縣汐止市新台五路一段88號2樓(東方科學園區D棟) TEL:886-2-26967269, FAX:886-2-86967196 or 26967270							
APPROVED BY	СН	ECKED BY	ORGANIZED BY				

Date: 2011/3/16 AMPIRE CO., LTD.

## 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]	
0	0 (2,3Short)	1	1	80-8BIT	DB[17:10]	MCU Interface.
1	0 (2,3Short)	1	0	80-18BIT	DB[17:0]	MICO IIILEITACE.
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

<sup>\*</sup> 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
	Outline Dimension	55.64 (H) x 77.3(V)	mm
Main	Pixel pitch	0.2025 (H) x 0.2025(V)	mm
LCD	Active area	48.6 (H) x 64.8 (V)	mm
	Number of Pixels	240(H)x320(V) pixels	mm

<sup>\*1.</sup> 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 Min30 °C	Note 1: Non-condensing
Operating temperature	Max. +70 °C Min10 °C	Note 1: Non-condensing

Note 1 : Ta≤+40 °C · · · · Max.85%RH

Ta>+40  $^{\circ}$ C · · · The max. humidity should not exceed the humidity with 40  $^{\circ}$ C 85%RH.

## 4 Electrical specifications

## 4-1 Electrical characteristics of LCM

( $V_{DD}$ =3.0V, Ta=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 <sub>IHC</sub>		0.8		$V_{DD}$	V
Low-level input voltage	V <sub>ILC</sub>		-0.3		0.2V <sub>DD</sub>	V
Consumption current of VDD	I <sub>DD</sub>	LED OFF	1	10	1	mA
Consumption current of LED	I <sub>LED_ON</sub>	V <sub>LED</sub> =19.2V	-	15	20	mA

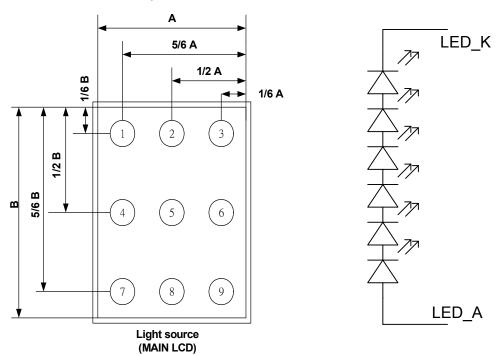
<sup>3 1. 1/320</sup> duty.

## 4-2 LED back light specification

Item	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
Forward voltage	V <sub>f</sub> I <sub>f</sub> =15mA		-	(19)	-	V
Forward current	I <sub>f</sub> Ta=25C		-	(15)	(20)	mA
Uniformity (with L/G)	-	I <sub>f</sub> =15mA	70%	-	-	
C.I.E.	Х		0.245	0.30	0.375	
G.I.E.	Υ		0.255	0.31	0.385	
Luminous color	White					
Chip connection		6 ch	nip serial c	onnection		

Note: (value), value=estimate value.

## Bare LED measure position:



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

## 4.3 Touch Panel Electrical Specification

Parameter	Condition	Standard Value	
Terminal Resistance	X Axis	200Ω ~ 900Ω	
Terminal Resistance	Y Axis	200Ω ~ 900Ω	
Insulating Resistance	DC 25 V	More than $20M\Omega$	
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

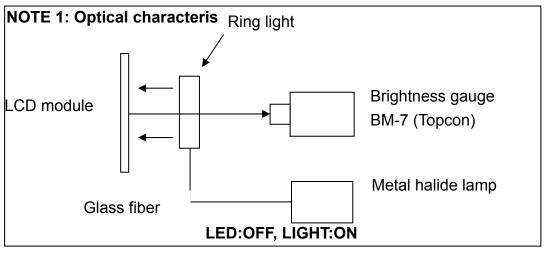
## 5 Main LCD

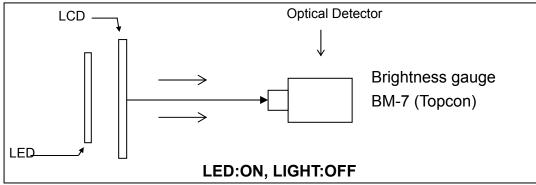
## 5-1 Optical characteristics

 $(1/320 \text{ Duty in case except as specified elsewhere Ta = }25^{\circ}\text{C})$ 

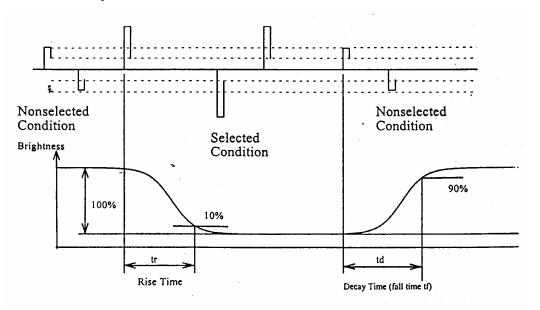
Item		Symbol	Min.	Std.	Max.	Unit	Conditions
Contrast	ratio	CR	150	200	-	-	
Response	Rising	Tr	1	15	-	ms	
time	Faling	Tf	ı	35	-	1113	
White luming (center of se		YL		160		cd/m2	θ=0°
	Red	Rx	0.54	0.59	0.63		Φ=0°
	Reu	RY	0.30	0.34	0.38		
Color	Green	Gx	0.29	0.33	0.37		Normal
Color chromaticity		GY	0.56	0.60	0.64		viewing angle
(CIE1931)		Bx	0.10	0.14	0.18		
(CIL 1931)	Blue	BY	0.02	0.06	0.10		
	White	Wx	0.26	0.30	0.37		
	vviile	WY	0.27	0.31	0.38		
	Hor.	θι		(38.7)			
Visual angle		θR		(15)			CR>10
viodai diigic	Ver.	Θf		(62.7)		Degree	5.0.10
	VGI.	θь		(62.2)			

Note: (value), value=estimate value.

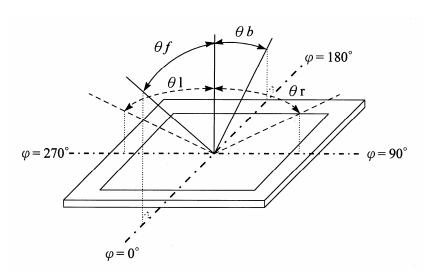




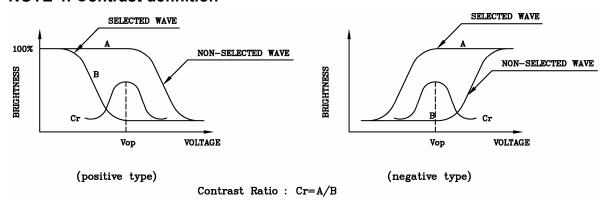
**NOTE 2: Response tome definition** 



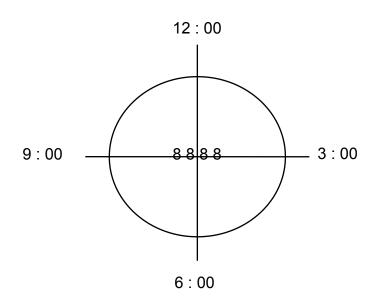
NOTE 3:  $\phi \cdot \theta$  definition



**NOTE 4: Contrast definition** 



**NOTE 5: Visual angle direction priority** 



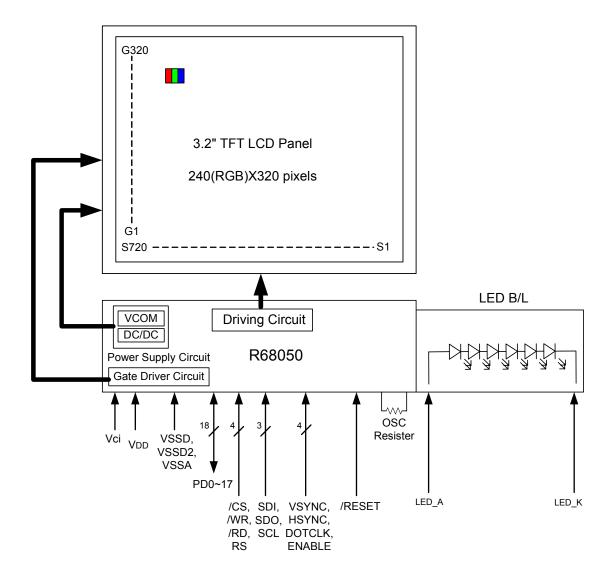
## 6 Block Diagram

Date: 2011/3/16

## **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

Pin No.	Terminal	Functions					
1	VSS	Gro	Ground pins.				
2	XL	Tou	Touch Panel Left Side.				
3	XR	Tou	ch P	anel R	ight Side.		
4	YD	Tou	ch P	anel D	own Side.		
5	YU	Tou	ch P	anel U	p Side.		
6	VSS	Gro	und	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	Seri	al bu	us inter	face data output pin.		
11	NC	No	Conr	nection			
12	SDI				face data input pin.		
13-30	D17-D0	_			onal bus S when the serial inte	erface is selected.	
31	/CS		Chip selection pin. The "L" level enables inputting commands and reading /writing				
32	/RESET		Switching to "L" initializes internally.  Must be reset after the power is supplied.				
33	RS	Con	nma	nd/disp	olay Data Selection.		
34	WR/SCL	Writ	e en	able si	ignal/Serial bus interfa	ace clock input pin.	
35	/RD	Rea	ıd er	able s	ignal.		
36	VSYNC	Frai	ne s	ynchro	nizing signal in RGB	I/F mode. (JP1 1-2short)	
37	HSYNC	Frai	ne s	ynchro	nizing signal in RGB	I/F mode. (JP1 1-2short)	
38	DOTCLK	Dot	Dot clock signal in RGB I/F mode. (JP1 1-2short)				
39	ENABLE	A da	ata E	NABL	E signal in RGB I/F m	ode. (JP1 1-2short)	
40	VCC	Dow	ar eu	nnly fo	ur Sten un circuit (VC	I-2 5~3 3\/\	
41	VCC	LOWE	Power supply for Step-up circuit. (VCI=2.5~3.3V).				
42	VSS	Gro	Ground pins.				
43	LED_K	Pov	er s	upply f	or LED (Cathode).		
44	LED_A	Pov	er s	upply f	or LED (Anode).		
45	VSS	Gro	und	pins.			

## 7-1 80-system 18-bit interface

#### Instruction write DB Input 16 15 14 13 12 11 10 8 6 3 0 IB IB IB ΙB IB Instruction 14 13 12 11 10 9 8 6 5 Instruction read IB 7 ΙB IB ΙB ΙB ΙB IB 1 ΙB ΙB IB ΙB ΙB ΙB ΙB ΙB Read data 15 14 13 12 11 10 9 8 6 5 4 3 2 0 DB 17 DB 16 DB 15 DB 14 DB 12 DB 11 DB 3 DB 2 DB 0 DB DB DB DB DB 7 DB DB DB DB 1 Output 13 10 6 5 9 8 RAM data read GRAM R5 R4 R3 R2 R1 R0 G5 G4 G3 G2 G1 G0 **B5 B4 B3** B2 B1 B0 data RD Read data [17] [16] [15] [14] [13] [12] [11] [9] [8] [7] [6] [5] [4] [3] [2] [1] [0] DB 7 DB Output DB 9 0 pins



DB

10

DB

DB

DB DB DB DB DB DB DB

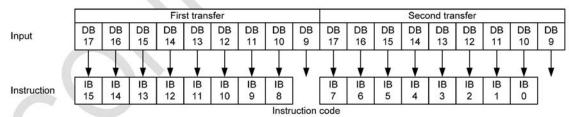
> Note: Data cannot be transferred in twice in read operation via 16-bit interface

Output

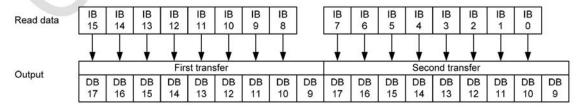
DB DB DB DB DB DB

## 7-3 80-system 9-bit interface

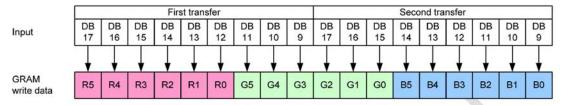
#### Instruction write



#### Device code read



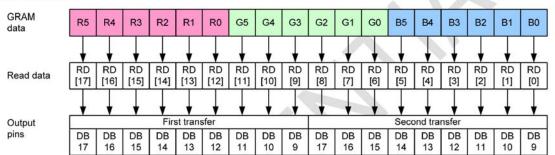
#### RAM data write



1 pixel

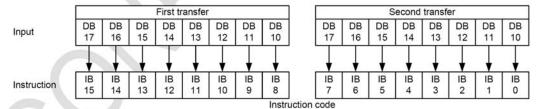
Note: Normal display in 262,144 colors

#### RAM data read

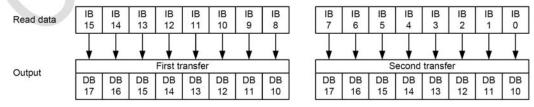


## 80-system 8-bit interface

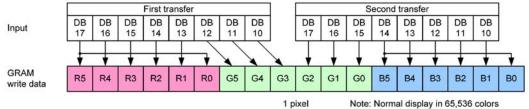
Instruction write



Device code read

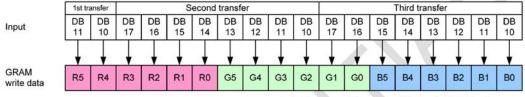


RAM data write (2-transfer mode: TRIREG = 0)



Note: Normal display in 65,536 colors

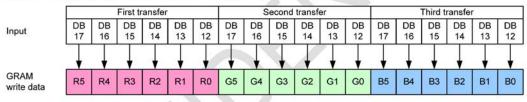
RAM data write (3-transfer mode: TRIREG = 1, DFM = 0)



1 pixel

Note: Normal display in 242,144 colors

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



1 pixel

Note: Normal display in 242,144 colors

## 7-5 Instruction List

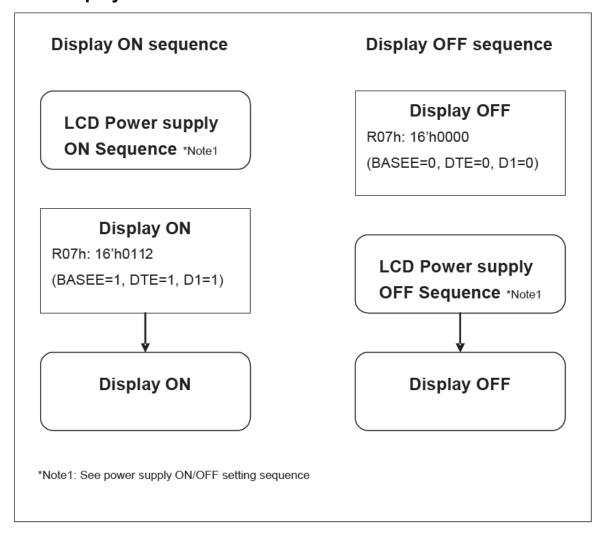
Main LCD Driver IC: ILI9325C

	Decision Name	2044	00	T 046	D44	240	D40	D44	240	DA.	- 00		D.C.	0.5	- 0.1	- 0.0	- 00	-	200
No.	Registers Name	R/W W	RS 0	D15	D14	D13	D12	D11	D10	D9	D8	D7 ID7	D6	D5	D4 ID4	D3 ID3	D2	D1 ID1	D0
00h	Index Register	RO	1	1	0	0	1	0	0	1	1	0	ID6	ID5	0	0	ID2	0	1D0
01h	Driver Code Read  Driver Output Control 1	W	1	0	0	0	0	0	SM	0	SS	0	0	0	0	0	0	0	0
	The second secon		-						-				1						
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	w	1	0	ENC2	ENC1	ENCO	0	0	0	RM	0	0	DM1	DMO	0	0	RIM1	RIMO
	1			1															
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	w	1	0	0	0	0	0	0	0	0	0	0	0	VSPL	HSPL	0	EPL	DPL
$\vdash$	2			8760	10	- 8	87	(220)	522	- 50	1997	- 839	0557	2555		2025/7	5550	0.000	150,000
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 w	ite data (	WD17-0)	read dat	a (RD17-0) b	its are tran	sferred vi	a different	t data bus li	nes accord	ding to the	selected int	terfaces.			
		_	-		_	_	_							_					
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]
_		0.0000	-				termina -	2000			12.00	20000							
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	w	4	0	0	0	0	0	0	0	0	HSA7	HSA6	HSA5	HSA4	HSA3	HSA2	HSA1	HSA0
0011	Position	000				_ ~ _	_ ×		300		. 876	110111	110110	110110	110711	110110	THOU IL	110711	110710
51h	Horizontal Address End	w	1	0	0	0	0	0	0	0	0	HEA7	HEA6	HEA5	HEA4	HEA3	HEA2	HEA1	HEA0
	Position		-	-				_											
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		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R/WX
0011	SFI Read Write Control	**	*		v	Ů.	0	· ·	U	.0	U	v	0	0	0	V	0	V	(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
046	Partial Image 1 Area (Start	w	1	0	0	0		0		0	DTCAGO	DTCAOT	DTCAGE	DTCAGE	DTCADA	DTCAGO	DTCAGO	DTCAOA	DTCAGO
81h	Line)	vv	,	U	U	Ü	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
0.41	Partial Image 2 Area (Start							- 2				PTSA17	DT0146	PTSA15	DT0444	DTOLLO		DT0444	DT0140
84h	Line)	W	1	0	0	0	0	0	0	0	PTSA18	PISA1/	PTSA16	PISAIS	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		1	0	0	0	0	NOWE3	NOWE2	NOWE1	NOWE0	0	0	0	0	0	0	0	0
	T difer interiore control o	W					0	OTP	0		0	100	0	VCM_	VCM_	VCM_	VCM_	VCM_	VCM_
A1h	OTP VCM Programming	w	1	0	0	0				0		0					OTP2	OTP1	OTP0
A1h		W		658				PGM_EN	05 11		359	0	1.50	OTP5	OTP4	OTP3	OTPZ		
A1h A2h	OTP VCM Programming	_	1	PGM_	PGM_	VCM_	VCM_	VCM_	VCM_	VCM_	VCM_	0	0		OTP4	OTP3	0	0	VCM_
A2h	OTP VCM Programming Control OTP VCM Status and Enable	w	1	PGM_ CNT1	PGM_ CNT0	VCM_ D5	VCM_ D4	VCM_ D3	D2	VCM_ D1	VCM_ D0	0	0	OTP5	0	0	0	50.00	EN
A1h A2h A5h	OTP VCM Programming Control	W		PGM_	PGM_	VCM_	VCM_	VCM_	VCM_ D2 KEY 10	VCM_ D1 KEY 9	VCM_	70	0.500	OTP5				0 KEY 1	EN KEY
A2h	OTP VCM Programming Control OTP VCM Status and Enable	w	1	PGM_ CNT1 KEY 15	PGM_ CNT0 KEY 14	VCM_ D5 KEY 13	VCM_ D4 KEY 12	VCM_ D3 KEY 11	D2 KEY 10 X	VCM_ D1 KEY 9	VCM_ D0 KEY 8	0 KEY 7 DBV7	0 KEY 6 DBV6	0 KEY 5 DBV5	0 KEY 4 DBV4	0 KEY 3 DBV3	0 KEY 2 DBV2	KEY 1 DBV1	EN KEY 0 DBV0
A2h A5h	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key	w w	1	PGM_ CNT1 KEY 15	PGM_ CNT0 KEY 14 X	VCM_ D5 KEY 13 X	VCM_ D4 KEY 12 X	VCM_ D3 KEY 11 X	D2 KEY 10 X	VCM_ D1 KEY 9 X	VCM_ D0 KEY 8 X	0 KEY 7	0 KEY 6 DBV6 DBV6	OTP5  0  KEY 5  DBV5  DBV5	0 KEY 4	0 KEY 3 DBV3 DBV3	0 KEY 2	KEY 1	EN KEY
A2h A5h B1h	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness	w w w	1 1 1	PGM_ CNT1 KEY 15	PGM_ CNT0 KEY 14	VCM_ D5 KEY 13	VCM_ D4 KEY 12	VCM_ D3 KEY 11	D2 KEY 10 X	VCM_ D1 KEY 9	VCM_ D0 KEY 8	0 KEY 7 DBV7	0 KEY 6 DBV6 DBV6	OTP5  0  KEY 5  DBV5  DBV5  BCTRL	0 KEY 4 DBV4	0 KEY 3 DBV3 DBV3 DD	0 KEY 2 DBV2	KEY 1 DBV1	EN KEY 0 DBV0
A2h A5h B1h B2h	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value	W W W R	1 1 1 1	PGM_ CNT1 KEY 15 X	PGM_ CNT0 KEY 14 X	VCM_ D5 KEY 13 X	VCM_ D4 KEY 12 X	VCM_ D3 KEY 11 X	D2 KEY 10 X	VCM_ D1 KEY 9 X	VCM_ D0 KEY 8 X	0 KEY 7 DBV7	0 KEY 6 DBV6 DBV6	OTP5  0  KEY 5  DBV5  DBV5	0 KEY 4 DBV4 DBV4	0 KEY 3 DBV3 DBV3	0 KEY 2 DBV2 DBV2	KEY 1 DBV1 DBV1	EN KEY 0 DBV0 DBV0
A2h A5h B1h B2h B3h	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value	W W W R W R	1 1 1 1 1 1 1	PGM_CNT1 KEY 15 X X X	PGM_CNT0 KEY 14 X X X	VCM_D5 KEY 13 X X X	VCM_D4 KEY 12 X X X	VCM_ D3 KEY 11 X X	D2 KEY 10 X X X	VCM_D1 KEY 9 X X X	VCM_D0 KEY 8 X X	0 KEY 7 DBV7 DBV7 X	0 KEY 6 DBV6 DBV6 X	OTP5  0  KEY 5  DBV5  DBV5  BCTRL  BCTRL	0 KEY 4 DBV4 DBV4 X	0 KEY 3 DBV3 DBV3 DD DD	0 KEY 2 DBV2 DBV2 BL BL	KEY 1 DBV1 DBV1 X	EN KEY 0 DBV0 DBV0 X X
A2h A5h B1h B2h B3h B4h	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value Read CTRL Display value	W W W R W	1 1 1 1 1 1	PGM_ CNT1 KEY 15 X	PGM_ CNT0 KEY 14 X	VCM_ D5 KEY 13 X	VCM_ D4 KEY 12 X	VCM_ D3 KEY 11 X	D2 KEY 10 X X	VCM_ D1 KEY 9 X	VCM_ D0 KEY 8 X	0 KEY 7 DBV7 DBV7	0 KEY 6 DBV6 DBV6	OTP5  0  KEY 5  DBV5  DBV5  BCTRL	0 KEY 4 DBV4 DBV4	0 KEY 3 DBV3 DBV3 DD	0 KEY 2 DBV2 DBV2 BL	KEY 1 DBV1 DBV1 X	EN KEY 0 DBV0 DBV0 X
A2h A5h B1h B2h B3h B4h	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value Read CTRL Display value Write Content Adaptive	W W W R W R	1 1 1 1 1 1 1	PGM_ CNT1 KEY 15 X X X	PGM_CNT0 KEY 14 X X X	VCM_D5 KEY 13 X X X X	VCM_D4 KEY 12 X X X	VCM_ D3 KEY 11 X X	D2 KEY 10 X X X	VCM_D1 KEY 9 X X X	VCM_D0 KEY 8 X X	0 KEY 7 DBV7 DBV7 X	0 KEY 6 DBV6 DBV6 X	OTP5  0  KEY 5  DBV5  DBV5  BCTRL  BCTRL	0 KEY 4 DBV4 DBV4 X	0 KEY 3 DBV3 DBV3 DD DD	0 KEY 2 DBV2 DBV2 BL BL	KEY 1 DBV1 DBV1 X	EN KEY 0 DBV0 DBV0 X X
A2h A5h B1h B2h B3h B4h	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value Read CTRL Display value Write Content Adaptive	W W W R W R	1 1 1 1 1 1 1	PGM_CNT1 KEY 15 X X X	PGM_CNT0 KEY 14 X X X	VCM_D5 KEY 13 X X X	VCM_D4 KEY 12 X X X	VCM_ D3 KEY 11 X X	D2 KEY 10 X X X	VCM_D1 KEY 9 X X X	VCM_D0 KEY 8 X X	0 KEY 7 DBV7 DBV7 X	0 KEY 6 DBV6 DBV6 X	OTP5  0  KEY 5  DBV5  DBV5  BCTRL  BCTRL	0 KEY 4 DBV4 DBV4 X	0 KEY 3 DBV3 DBV3 DD DD	0 KEY 2 DBV2 DBV2 BL BL	KEY 1 DBV1 DBV1 X	EN KEY 0 DBV0 DBV0 X X
A2h A5h B1h B2h B3h B4h B5h	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value Read CTRL Display value Write Content Adaptive Brightness Control value	W W W R W R	1 1 1 1 1 1 1 1 1 RS	PGM_CNT1 KEY 15 X X X X	PGM_CNT0 KEY 14 X X X X	VCM_ D5 KEY 13 X X X X	VCM_ D4 KEY 12 X X X X X	VCM_ D3 KEY 111 X X X X X	D2 KEY 10 X X X X	VCM_D1 KEY 9 X X X X	VCM_D0 KEY 8 X X X X	0 KEY 7 DBV7 DBV7 X X X	0 KEY 6 DBV6 DBV6 X X	OTPS  O KEY 5 DBV5 DBV5 BCTRL BCTRL X	0 KEY 4 DBV4 DBV4 X X X	O KEY 3 DBV3 DBV3 DD DD X	0 KEY 2 DBV2 DBV2 BL BL X	KEY 1 DBV1 DBV1 X X	EN KEY 0 DBV0 DBV0 X X 1:0]
A2h A5h B1h B2h B3h B4h B5h	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value Read CTRL Display value Write Content Adaptive Brightness Control value Registers Name	W W W R W R	1 1 1 1 1 1 1	PGM_ CNT1 KEY 15 X X X	PGM_CNT0 KEY 14 X X X X	VCM_D5 KEY 13 X X X X	VCM_D4 KEY 12 X X X X	VCM_ D3 KEY 11 X X X	D2 KEY 10 X X X X	VCM_D1 KEY 9 X X X	VCM_D0 KEY 8 X X X	0 KEY 7 DBV7 DBV7 X X	0 KEY 6 DBV6 DBV6 X X	OTP5  0  KEY 5  DBV5  DBV5  BCTRL  BCTRL  X	0 KEY 4 DBV4 DBV4 X X	0 KEY 3 DBV3 DBV3 DD DD	0 KEY 2 DBV2 DBV2 BL BL	KEY 1 DBV1 DBV1 X X	EN KEY 0 DBV0 DBV0 X X X 1:0]
A2h A5h B1h B2h B3h B4h B5h	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value Read CTRL Display value Write Content Adaptive Brightness Control value Registers Name Read Content Adaptive Brightness Control value	W W W R W R	1 1 1 1 1 1 1 1 1 RS 1	PGM_CNT1 KEY 15 X X X X X	PGM_ CNT0 KEY 14 X X X X X X	VCM_ D5 KEY 13 X X X X X X	VCM_ D4 KEY 12 X X X X X X	VCM_ D3 KEY 111 X X X X X X	D2 KEY 10 X X X X X X X	VCM_D1 KEY 9 X X X X X	VCM_D0 KEY 8 X X X X X	0 KEY 7 DBV7 DBV7 X X X	0 KEY 6 DBV6 DBV6 X X	OTPS  O KEY 5 DBV5 DBV5 BCTRL BCTRL X	0 KEY 4 DBV4 DBV4 X X X	DBV3 DBV3 DBV3 DD DD X DD X	0 KEY 2 DBV2 DBV2 BL BL X	KEY 1 DBV1 DBV1 X X	EN KEY 0 DBV0 DBV0 X X 1:0]
A2h A5h B1h B2h B3h B4h B5h	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value Read CTRL Display value Write Content Adaptive Brightness Control value Registers Name Read Content Adaptive Brightness Control value Write Content Adaptive Brightness Control value Write Content Adaptive Brightness Control value Write CABC Minimum	W W W R W R	1 1 1 1 1 1 1 1 1 RS	PGM_CNT1 KEY 15 X X X X	PGM_CNT0 KEY 14 X X X X	VCM_ D5 KEY 13 X X X X	VCM_ D4 KEY 12 X X X X X	VCM_ D3 KEY 111 X X X X X	D2 KEY 10 X X X X	VCM_D1 KEY 9 X X X X	VCM_D0 KEY 8 X X X X	0 KEY 7 DBV7 DBV7 X X X	0 KEY 6 DBV6 DBV6 X X	OTPS  O KEY 5 DBV5 DBV5 BCTRL BCTRL X	0 KEY 4 DBV4 DBV4 X X X	DBV3 DBV3 DBV3 DD DD X DD X	0 KEY 2 DBV2 DBV2 BL BL X	KEY 1 DBV1 DBV1 X X	EN KEY 0 DBV0 DBV0 X X 1:0]
A2h A5h B1h B2h B3h B4h B5h	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Write CTRL Display value Read Display Brightness Write CTRL Display value Write Content Adaptive Brightness Control value Registers Name Read Content Adaptive Brightness Control value	W W W R W R W R W	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	PGM_CNT1 KEY 15 X X X X X X	PGM_CNT0 KEY 14 X X X X X X	VCM_ D5 KEY 13 X X X X X X X	VCM_ D4 KEY 12 X X X X X X X	VCM_ D3	D2 KEY 10 X X X X X X X	VCM_D1_KEY 9 X X X X X X X X X X X X X X X X X X	VCM_DO REY 8 X X X X X X X X X X X X X X X X X X	0 KEY 7 DBV7 DBV7 X X X	0 KEY 6 DBV6 DBV6 X X	OTPS  O KEY 5 DBV5 DBV5 BCTRL BCTRL X	0 KEY 4 DBV4 DBV4 X X X  CMB	0 KEY 3 DBV3 DBV3 DD DD X D3 X [7:0]	0 KEY 2 DBV2 DBV2 BL BL X	KEY 1 DBV1 DBV1 X X	EN KEY 0 DBV0 DBV0 X X 1:0]
A2h A5h B1h B2h B3h B4h B5h No. B6h	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value Read CTRL Display value Write Control Adaptive Brightness Control value  Registers Name Read Content Adaptive Brightness Control value  Write CABC Minimum Brightness	W W W R W R	1 1 1 1 1 1 1 1 1 RS 1	PGM_CNT1 KEY 15 X X X X X	PGM_ CNT0 KEY 14 X X X X X X	VCM_ D5 KEY 13 X X X X X X	VCM_ D4 KEY 12 X X X X X X	VCM_ D3 KEY 111 X X X X X X	D2 KEY 10 X X X X X X X	VCM_D1 KEY 9 X X X X X	VCM_D0 KEY 8 X X X X X	0 KEY 7 DBV7 DBV7 X X X	0 KEY 6 DBV6 DBV6 X X	OTPS  O KEY 5 DBV5 DBV5 BCTRL BCTRL X	0 KEY 4 DBV4 DBV4 X X X	0 KEY 3 DBV3 DBV3 DD DD X D3 X [7:0]	0 KEY 2 DBV2 DBV2 BL BL X	KEY 1 DBV1 DBV1 X X	EN KEY 0 DBV0 DBV0 X X 1:0]
A2h A5h B1h B2h B3h B4h B5h No. B6h	OTP VCM Programming Control OTP VCM Status and Enable OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value Read CTRL Display value Write Content Adaptive Brightness Control value Registers Name Read Content Adaptive Brightness Control value Write CABC Minimum Brightness Read CABC Minimum Brightness	W W W R W R W R W	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	PGM_CNT1 KEY 15 X X X X X X	PGM_CNT0 KEY 14 X X X X X X	VCM_ D5 KEY 13 X X X X X X X	VCM_ D4 KEY 12 X X X X X X X	VCM_ D3	D2 KEY 10 X X X X X X X	VCM_D1_KEY 9 X X X X X X X X X X X X X X X X X X	VCM_DO REY 8 X X X X X X X X X X X X X X X X X X	0 KEY 7 DBV7 DBV7 X X X	0 KEY 6 DBV6 DBV6 X X	OTPS  O KEY 5 DBV5 DBV5 BCTRL BCTRL X	0 KEY 4 DBV4 DBV4 X X X  CMB	0 KEY 3 DBV3 DBV3 DD DD X  D3 X  [7:0]	0 KEY 2 DBV2 DBV2 BL BL X	KEY 1 DBV1 DBV1 X X	EN KEY 0 DBV0 DBV0 X X 1:0]
A2h A5h B1h B2h B3h B4h B5h No. B6h BEh BFh C8h	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value Read CTRL Display value Write Content Adaptive Brightness Control value Registers Name Read Content Adaptive Brightness Control value Write CABC Killimum Brightness Read CABC Minimum Brightness CABC Control 1	W W W R W R W R W R W R W	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	PGM_CNT1 KEY 15 X X X X X X X	PGM_CNT0 KEY 14 X X X X X X X	VCM_D5_ KEY 13 X X X X X X X X	VCM_D4 KEY 12 X X X X X X X	VCM_ D3	D2 KEY 10 X X X X X X X X X	VCM_D1_KEY 9 X X X X X X X X X X X X X X X X X X	VCM_D0 KEY 8 X X X X X X X X X X X X X X X X X X	0 KEY 7 DBV7 DBV7 X X X	0 KEY 6 DBV6 DBV6 X X	OTP5  0  KEY 5  DBV5  DBV5  BCTRL  BCTRL  X	0 KEY 4 DBV4 DBV4 X X X CMB	0 KEY 3 DBV3 DBV3 DDV3 DD DD X D3 X [7:0]	0 KEY 2 DBV2 DBV2 BL BL X	KEY 1 DBV1 DBV1 X X C[	EN KEY 0 DBV0 DBV0 X X 1:0]
A2h A5h B1h B2h B3h B4h B5h No. B6h BEh	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value Read CTRL Display value Write Content Adaptive Brightness Control value Write Content Adaptive Brightness Control value Write Content Adaptive Brightness Control value Write CABC Minimum Brightness Read CABC Minimum Brightness CABC Control 1 CABC Control 1	W W W R W R W R W R W R W	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	PGM_CNT1 KEY 15 X X X X X X X X	PGM_CNT0 KEY 14 X X X X X X X X X	VCM_D5_ KEY 13 X X X X X X X X X X X	VCM_D4  KEY 12  X  X  X  X  X  X  X	VCM_ D3 KEY 11 X X X X X X X	D2 KEY 10 X X X X X X X X X X	VCM_D1 KEY 9 X X X X X X X X X	VCM_D0_ KEY 8	0 KEY 7 DBV7 DBV7 X X X	0 KEY 6 DBV6 DBV6 X X X	OTP5  0  KEY 5  DBV5  DBV5  BCTRL  BCTRL  X	0 KEY 4 DBV4 DBV4 X X X CMB	0 KEY 3 DBV3 DBV3 DDV3 DD DD X D3 X [7:0]	0 KEY 2 DBV2 DBV2 BL BL X	KEY 1 DBV1 DBV1 X X C[**  C1**  C1**  TILL[3:0]	EN KEY 0 DBV0 DBV0 X X 1:0]
A2h A5h B1h B2h B3h B4h B5h B6h B6h BFh C8h C9h CAh	OTP VCM Programming Control OTP VCM Status and Enable OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value Read CTRL Display value Write Content Adaptive Brightness Control value Registers Name Read Content Adaptive Brightness Control value Write CABC Minimum Brightness Read CABC Minimum Brightness CABC Control 1 CABC Control 1 CABC Control 2 CABC COntrol 3	W W W R W R W R W R W R W R W R W R W R	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	PGM_CNT1 KEY 15 X X X X X X X X X X X X X	PGM_CNT0 KEY 14 X X X X X X X X X X X	VCM_D5 KEY 13 X X X X X X X X X X X X X X	VCM_D4  KEY 12	VCM_ D3	D2 KEY 10 X X X X X X X X X X X X X X X X X X	VCM_D1 KEY 9 X X X X X X X X X X	VCM_D0_ KEY 8	0 KEY 7 DBV7 DBV7 X X X X	O KEY 6 DBV6 DBV6 X X X X THRES_0	OTP5  0  KEY 5  DBV5  DBV5  BCTRL  X  D5  X	0 KEY 4 DBV4 X X X  D4 X CMB	0 KEY 3 DBV3 DBV3 DDV3 DD DD X D3 X [7:0]	0 KEY 2 DBV2 BU2 BU3 BU3 X D2 X THRES_S THRES_S	KEY 1 DBV1 X X C[**  D1 C[**  TILL[3:0] UI[3:0]	EN KEY 0 DBV0 DBV0 X X 1:0]
A2h A5h B1h B2h B3h B4h B5h B6h B6h C8h C9h C8h	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value Read CTRL Display value Read CTRL Display value Write Content Adaptive Brightness Control value Registers Name Read Content Adaptive Brightness Control value Write CABC Milimum Brightness Read CABC Minimum Brightness CABC Control 1 CABC Control 1 CABC Control 2 CABC Control 3 CABC Control 3	W W W R W R W R W R W R W R W R W R W R	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	PGM_CNT1 KEY 15 5 X X X X X X X X X X X X X X X X X X	PGM_CNT0 KEY 14 X X X X X X X X X X X X X X X X X X	VCM_D5 KEY 13 X X X X X X X X X X X X X X X X X X	VCM_D4 KEY 12 X X X X X X X X X X X X X X X X X X	VCM_D3_ D3_ NEFY 11 X X X X X X X X X X X X X X X X X X	D2 KEY 10 X X X X X X X X X X X X X X X X X X	D9 X X X X X X X X X X X X X X X X X X X	VCM_D0 KEY 8 X X X X X X X X X X X X X X X X X X	0 KEY 7 DBV7 DBV7 X X X X	0 KEY 6 DBV6 DBV6 X X X  THRES_	OTP5  0  KEY 5  DBV5  DBV5  BCTRL  X  D5  X	0 KEY 4 DBV4 X X X  D4 X CMB	0 KEY 3 DBV3 DBV3 DDV3 DD DD X D3 X [7:0]	0 KEY 2 DBV2 DBV2 BL BL X  D2 X  THRES_S THRES_DTH_STI	KEY 1 DBV1 X X C[:  D1 C[:  TILL[3:0] U[3:0]	EN KEY 0 DBV0 DBV0 X X 1:0]
A2h A5h B1h B2h B3h B4h B5h No. B6h BFh C8h C9h CAh CBh	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value Read CTRL Display value Write Content Adaptive Brightness Control value Write Content Adaptive Brightness Control value Write Content Adaptive Brightness Control value Write CABC Minimum Brightness Control Value CABC Control 1 CABC Control 1 CABC Control 2 CABC Control 3 CABC Control 4 CABC Control 4	W W R W R W R W R W R W R W R W W W W W	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	PGM_CNT1 KEY 15 X X X X X X X X X X X X X X X X X X	PGM_CNT0 KEY 14 X X X X X X X X X X X X X X X X X X	VCM_D5 KEY 13 X X X X X X X X X X X X X X X X X X	VCM_D4 KEY 12 X X X X X X X X X X X X X X X X X X	VCM D3 KEY 111 X X X X X X X X X X X X X X X X X	D2 KEY 10 X X X X X X X X X X X X X X X X X X	VCM_D1 KEY 9 X X X X X X X X X X X X X X X X X X X	VCM_D0 KEY 8 X X X X X X X X X X X X X X X X X X	0 KEY 7 DBV7 X X X X  0 0	O KEY E O BV6 DBV6 X X X X D6 X X D7 THRES_O DTH_M O	OTP5  0  KEY 5  DBV5  DBV5  BCTRL  K  X  D5  X  D0  OV[3:0]  0	O KEY 4 DBV4 DBV4 X X X X D4 X CMB CMB	0 KEY 3 DBV3 DBV3 DDV3 DD DD X D3 X [7:0]	0 KEY 2 DBV2 DBV2 BL BL X D2 X	KEY 1 DBV1 DBV1 X X C[:  D1 C[:  U[[3:0] U[[3:0] U[3:0]	EN KEY 0 DBV0 DBV0 X X 1:0]
A2h A5h B1h B2h B3h B4h B5h No. B6h BFh C8h C9h CAh CCh CDh	OTP VCM Programming Control OTP VCM Status and Enable OTP Programming ID Key Write Display Brightness Read Display Brightness Write CTRL Display value Read CTRL Display value Read CTRL Display value Write Content Adaptive Brightness Control value Registers Name Read Content Adaptive Brightness Control value Write CABC Milimum Brightness Read CABC Minimum Brightness CABC Control 1 CABC Control 1 CABC Control 2 CABC Control 3 CABC Control 3	W W W R W R W R W R W R W R W R W R W R	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	PGM_CNT1 KEY 15 5 X X X X X X X X X X X X X X X X X X	PGM_CNT0 KEY 14 X X X X X X X X X X X X X X X X X X	VCM_D5 KEY 13 X X X X X X X X X X X X X X X X X X	VCM_D4 KEY 12 X X X X X X X X X X X X X X X X X X	VCM_D3_ D3_ NEFY 11 X X X X X X X X X X X X X X X X X X	D2 KEY 10 X X X X X X X X X X X X X X X X X X	D9 X X X X X X X X X X X X X X X X X X X	VCM_D0 KEY 8 X X X X X X X X X X X X X X X X X X	0 KEY 7 DBV7 X X X X  0 0	O KEY 6 DBV6 DBV6 X X X D6 X	OTP5  0  KEY 5 DBV5 DBV5 DBV5 DBCTRL X  D5 X	O KEY 4 DBV4 DBV4 X X X X D4 X CMB CMB	0 KEY 3 DBV3 DBV3 DBV3 DD X  D3 X  [7:0] [7:0] 0 0	0 KEY 2 DBV2 DBV2 BL BL X D2 X	KEY 1 DBV1 X X C[:  D1 C[:  TILL[3:0] U[3:0]	EN KEY 0 DBV0 DBV0 X X 1:0]

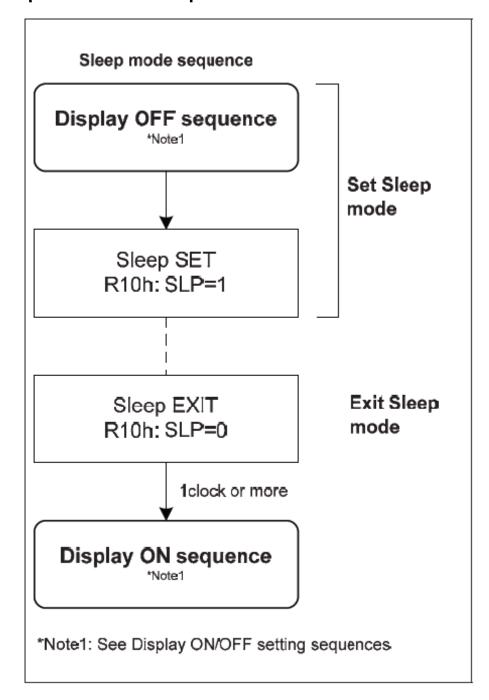
## 8 Application

Date: 2011/3/16

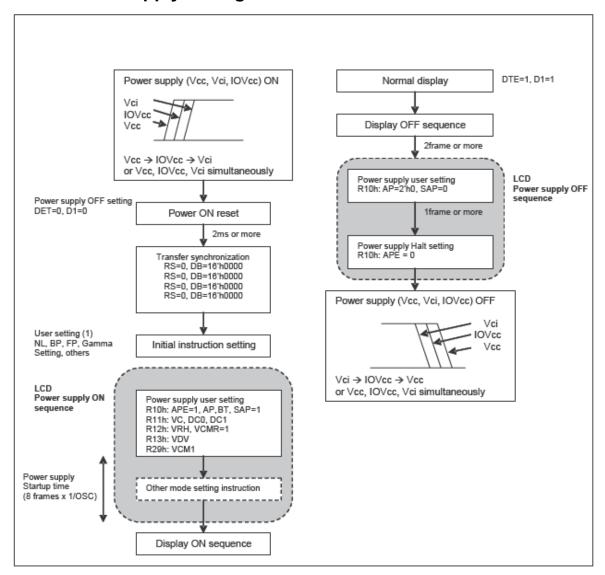
## 8-1 Display ON / OFF



## 8-2 Sequence to exit sleep mode



## 8-3 Power Supply Configuration

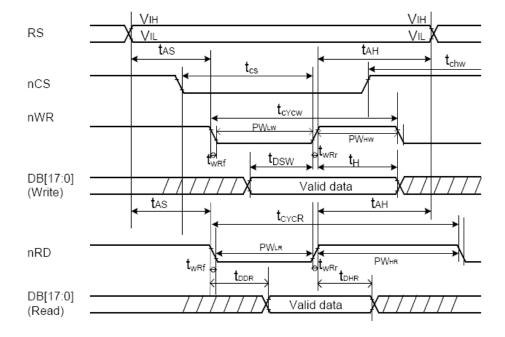


**Power Supply ON/OFF Sequence** 

## 9 Electrical Characteristics

Normal Write Mode (IOVCC = 1.65~3.3V)

	Symbol	Unit	Min.	Тур.	Max.	Test Condition	
Descriptions	Write	toyow	ns	80	-		-
Bus cycle time	Read	toyca	ns	300	-	-	-
Write low-level pulse	PW <sub>LW</sub>	ns	50	-	500	-	
Write high-level pulse	PW <sub>HW</sub>	ns	15	-	-	-	
Read low-level pulse	PW <sub>LR</sub>	ns	150	-	-	-	
Read high-level pulse	PW <sub>HR</sub>	ns	150	-	-		
Write / Read rise / fal	t <sub>WRr</sub> /t <sub>WRf</sub>	ns	-	-	25		
0-1	Write (RS to nCS, E/nWR)		ns	10	-	-	
Setup time	Read ( RS to nCS, RW/nRD )	tas		5	-	-	
Address hold time	t <sub>AH</sub>	ns	5	-	-		
Write data set up time	tosw	ns	10	-	-		
Write data hold time	t <sub>H</sub>	ns	15	-	-		
Read data delay time	t <sub>DDR</sub>	ns	-	-	100		
Read data hold time	t <sub>DHR</sub>	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

Date: 2011/3/16

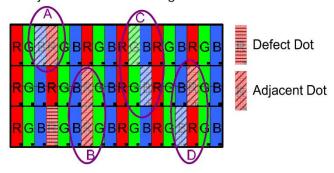
4.1 Function Related:

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.

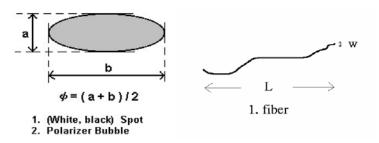


- (1) One pixel consists of 3 sub-pixels, including R,G, and B dot.(Sub-pixel = Dot)
- (2) The definition of dot: The size of a defective dot over 1/2 of whole dot is regarded as one defective dot.
- (3) Allow above (as A, B, C and D status) adjacent defect dots, including bright and dart adjacent dot.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

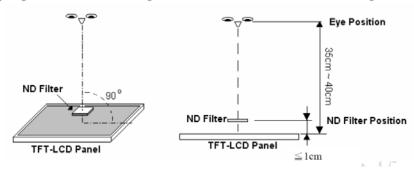
#### 4.3 Visual Inspection specifications:

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

[Note 2] W : Width[mm], L : Length[mm], N : Number,  $\phi$  : 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 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

