AMP DISPLAY INC.

A Brighter Solution

SPECIFICATIONS

CUSTOMER	
CUSTOMER PART NO.	
AMP PART NO.	AM-480272Q1TZQW-T01H
APPROVED BY	
DATE	

☑ **Approved For Specifications**

☐ **Approved For Specifications & Sample**

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RECORD OF REVISION

Revision Date	Page	Contents	Editor
2011/11/10	--	New Release	Rober
2012/4/17	6,7	Correct Interface setting	Rober
2012/7/20	6,7	Correct Interface setting	Rober
	27	Correct Outline dimension	

1. INTRODUCTION

This is a color active matrix TFT-LCD that uses amorphous silicon TFT as a switching device . This model is composed of a 4.3inch TFT-LCD panel, a driving circuit, Capacitive touch panel and LED backlight system. This TFT-LCD has a high resolution (480(R.G.B) X 272) and can display up to 262,144 colors.

1-1. Features

(1) Construction : a-Si TFT-LCD with driving system, White LED Backlight.

(2) LCD type :Normally Black,MVA

(3) Number of the Colors : 16.7M colors (R,G,B 8 bit digital each)

(4) RGB Interface 54 pin.

(5) LCD Power Supply Voltage : 3.3V single power input,

(6) Capacitive touch panel

2. PHYSICAL SPECIFICATIONS

Item	Specifications	unit
Display resolution(dot)	480RGB (W) x 272(H)	dots
Display area	95.04 (W) x 53.856 (H)	mm
Pixel pitch	0.198 (W) x 0.198 (H)	mm
Color configuration	R.G.B Vertical stripe	
Overall dimension	120.95 (W) x 105.5 (H)×6.24(T)	mm
Surface treatment	Glare , Hard-Coating(3H)	
Brightness	450	cd/m^2
Contrast ratio	500 : 1	
Backlight unit	LED	
Display color	16.7M	colors
Display Mode	Normally Black	

3. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN	MAX	UNIT	NOTE
Power Supply Voltage	VDD	-0.3	4.5	V	
Digital Supply Voltage	VDDIO	-0.3	4.5	V	
Operation Temperature	Top	-20	70	℃	
Storage Temperature	Tstg	-30	80	℃	

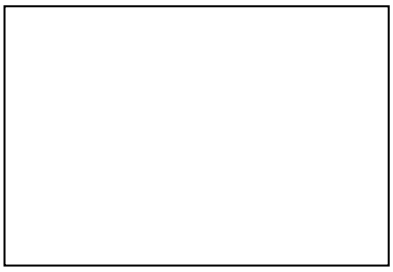
4. ELECTRICAL CHARACTERISTICS

4-1 TFT LCD Module voltage

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Power Supply Voltage	VDD	3.0	3.3	3.6	V	
Digital Supply Voltage	VDDIO	1.65	1.8	VDD	V	
Logic Input Voltage	VIH	VDDIO * 0.7	--	VDDIO	V	
	VIL	0	--	VDDIO * 0.3	V	
LCD Power Current	IDD	-	75	-	mA	(1)

NOTE : (1) Typ : under 64 gray pattern Max : under white pattern

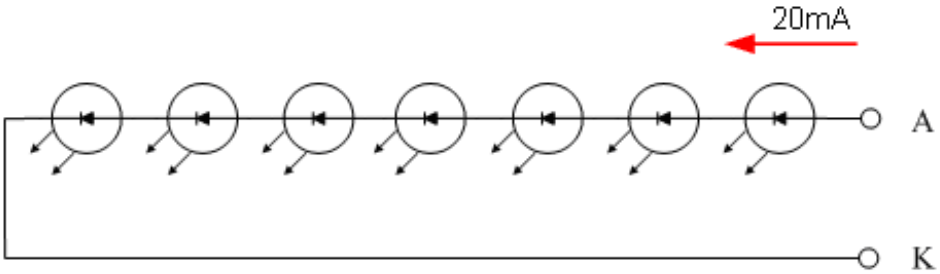
(a) 64 Gray Pattern



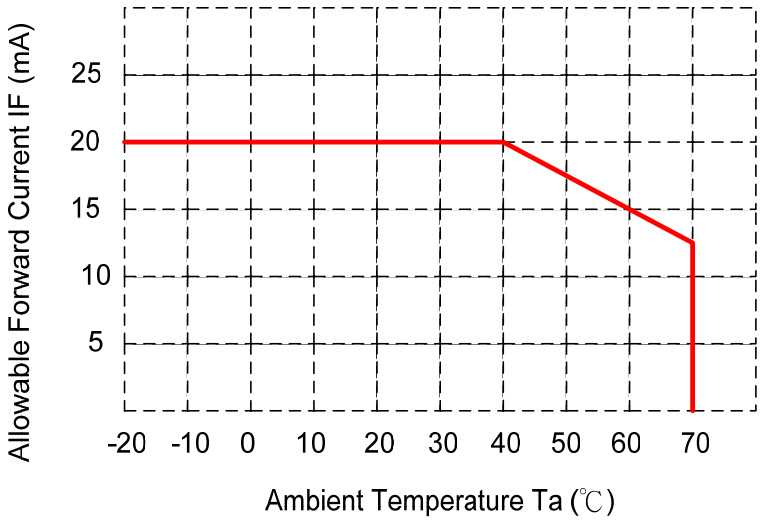
(b) White Pattern

4-2 Backlight Driving Conditions

Paramenter	Symbol	Min.	Typ.	Max.	Unit	Condiction
LED voltage	V_{AK}	--	22.4	--	V	I_{LED} =20mA Ta=25℃
LED forward current	I_{LED}	--	20	--	mA	Ta=25℃
	I_{LED}	--	15	--	mA	Ta=60℃



Note 3 : When LCM is operated over 40℃ ambient temperature, the I_{LED} should be follow :



5. INTERFACE

5.1 TFT INTERFACE

Pin No	Symbol	Function
1	GND	Power Ground
2	GND	Power Ground
3	NC	No connection
4	NC	No connection
5	NC	No connection
6	NC	No connection
7	VDDIO	Power Supply for digital Interface I/O
8	VDD	Power supply for digital circuit
9	VDD	Power supply for digital circuit
10	VS	Vertical sync signal
11	HS	Horizontal sync signal
12	GND	Power Ground
13	DCLK	Clock signal
14	GND	Power Ground
15	DE	Data input enable. Active High to enable the data input
16	L/R	Horizontal scan direction control
17	U/D	Vertical scan direction control
18	CS	Serial communication chip select(floating type)
19	SDA	Serial communication input and output(floating type)
20	SCL	Serial communication clock input(floating type)
21	DISP	Display control/standby mode selection
22	RESET	Global reset, Active low, Internal pull high
23	MODE	SYNC or DE mode selection
24	DR7	Red Data 7 (MSB)
25	DR6	Red Data 6
26	DR5	Red Data 5
27	DR4	Red Data 4
28	DR3	Red Data 3
29	DR2	Red Data 2
30	DR1	Red Data 1
31	DR0	Red Data 0 (LSB)
32	DG7	Green Data 7 (MSB)
33	DG6	Green Data 6
34	DG5	Green Data 5
35	DG4	Green Data 4
36	DG3	Green Data 3
37	DG2	Green Data 2
38	DG1	Green Data 1
39	DG0	Green Data 0 (LSB)
40	DB7	Blue Data 7 (MSB)
41	DB6	Blue Data 6
42	DB5	Blue Data 5

43	DB4	Blue Data 4
44	DB3	Blue Data 3
45	DB2	Blue Data 2
46	DB1	Blue Data 1
47	DB0	Blue Data 0 (LSB)
48	VDD	Power supply for digital circuit
49	GND	Power Ground
50	GND	Power Ground
51	VBL+	LED backlight Anode
52	VBL+	LED backlight Anode
53	VBL-	LED backlight Cathode
54	VBL-	LED backlight Cathode

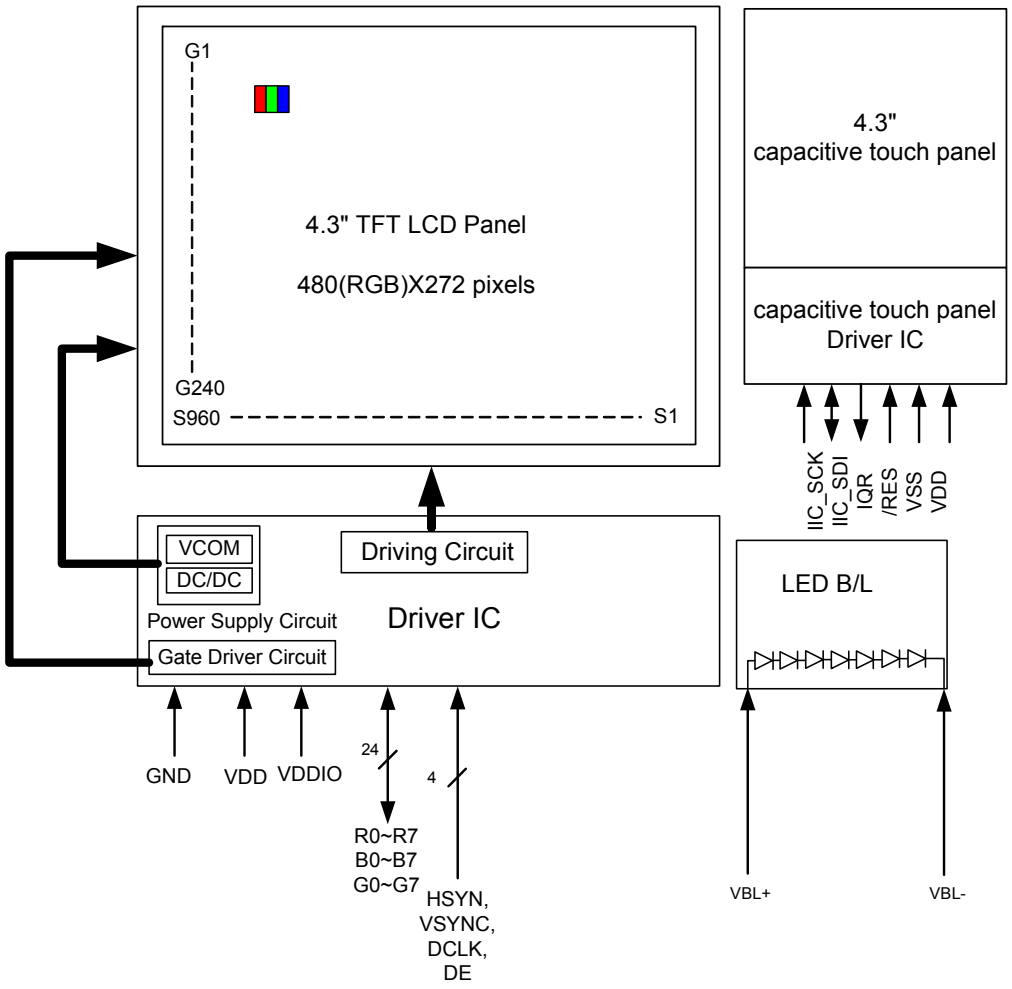
Note(1) When Mode=1 , SYNC mode
When Mode=0, SYNC+DE mode
Note(2) When DISP =1,Normal Display
When DISP =0,Standby Mode
Note(3) Please keep CS SDA SCL in floating type

5.2 Capacitive Touch Panel FPC Descriptions

No.	Symbol	I/O	Description	Remark
1.	GND	-	Ground.(0V)	
2.	SDA	I/O	I2C Interface.	
3.	SCL	I		
4.	VDD	-	Power Supply for TP controller.(3.3V)	
5.	INT	O	IRQ Terminal.	
6.	XRES	I	Terminal of Reset TP controller.	

Connector Part NO: STARCONN 089H06-000000-G2-R or equivalent.

6.**BLOCK DIAGRAM**

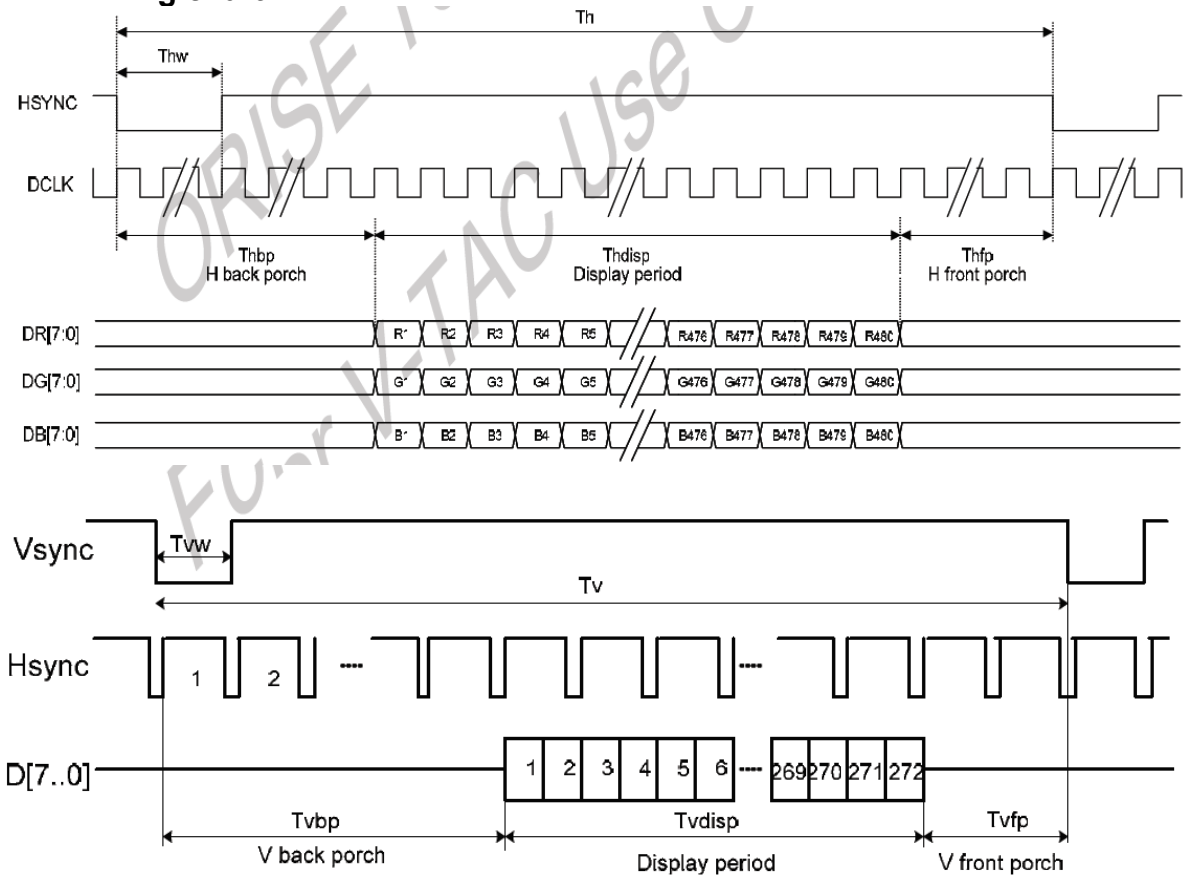


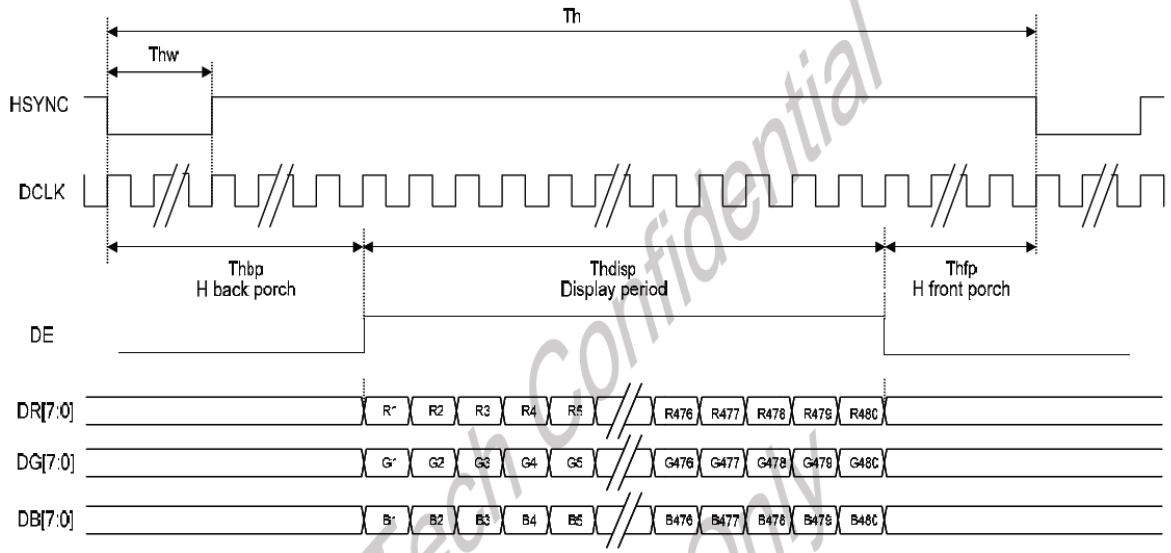
7. INPUT SIGNAL :

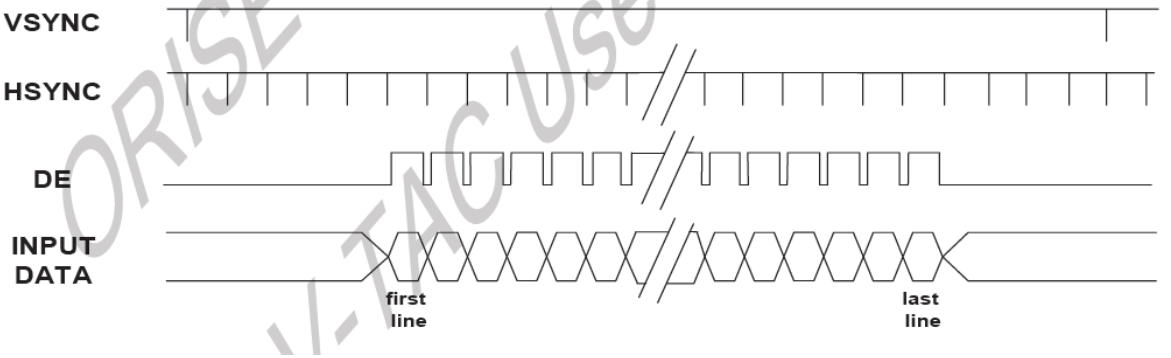
7-1 Timing Specification.

Item		Symbol	Min.	Typ.	Max.	Unit	
DCLK Frequency		Fclk	5	9	12	MHz	
DCLK Period		Tclk	83	110	200	ns	
Hsync	Period Time	Th	490	531	605	DCLK	
	Display Period	Thdisp		480		DCLK	
	Back Porch	Thbp	8	43		DCLK	By H_BLANKING setting
	Front Porch	Thfp	2	8		DCLK	
	Pulse Width	Thw	1			DCLK	
Vsync	Period Time	Tv	275	288	335	H	
	Display Period	Tvdisp		272		H	
	Back Porch	Tvbp	2	12		H	By V_BLANKING setting
	Front Porch	Tvfp	1	4		H	
	Pulse Width	Tvw	1	10		H	

7-2 Timing chart





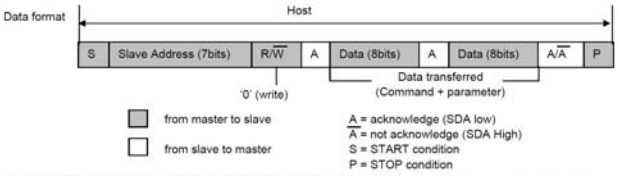


7-3 AC Timing characteristic of the capacitive touch panel

IIC Interface (T/P Controller) Slave Address=0x5C.

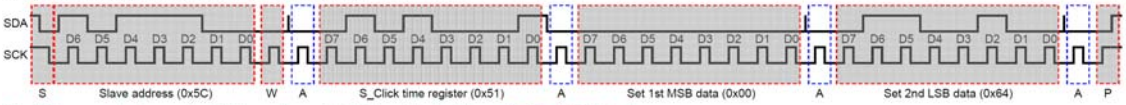
Standard IIC Timing

Write Operating



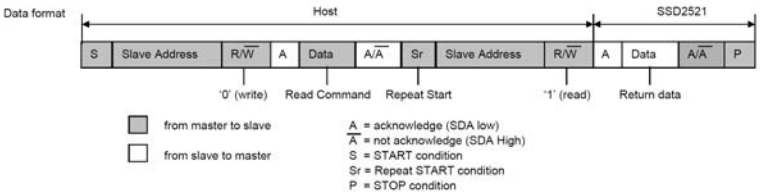
Example 1 (Set Drive Line Number to 18 lines (1 parameter command))

Example 2 (Set Single click time to 100ms (2 parameters command))

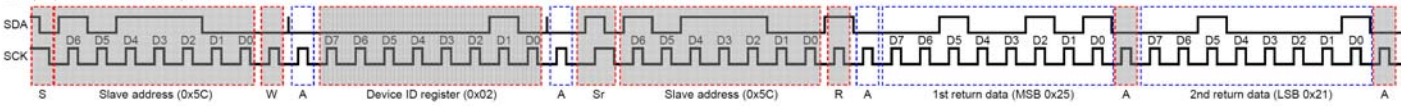


Note: All the command and parameter data byte must be sent within 1 transaction (i.e. between START and STOP signal)

Read Operation

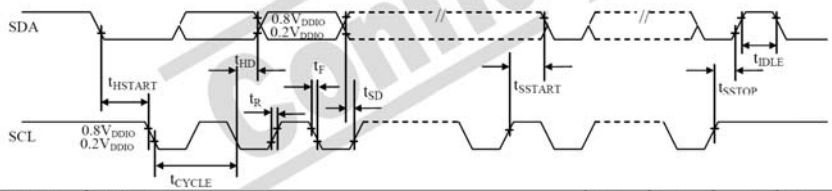


Example (Read ID from SSD2521)



Note: A Repeat-START condition must be use between the address setup and data read transaction.
All the data must be read within one transaction ot the address counter will return to 0 after the SSD2521 received a STOP signal (i.e. the return data will always start from 1st data bye when host issued READ request).

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	2.5	-	-	us
t_{HSTART}	Start condition Hold Time	0.6	-	-	us
t_{HD}	Data Hold Time (for "SDA_{OUT}" pin)	0	-	-	ns
	Data Hold Time (for "SDA_{IN}" pin)	300	-	-	ns
t_{SD}	Data Setup Time	100	-	-	ns
t_{SSTART}	Start condition Setup Time (Only relevant for a repeated Start condition)	0.6	-	-	us
t_{SSTOP}	Stop condition Setup Time	0.6	-	-	us
t_R	Rise Time for data and clock pin	-	-	300	ns
t_F	Fall Time for data and clock pin	-	-	300	ns
t_{IDLE}	Idle Time before a new transmission can start	1.3	-	-	us



Symbol	Parameter	Min	Typ	Max	Unit
t_{PR}	Power rise time	-	-	30	us
t_{PD}	Power delay time	-	-	30	us
t_{STABLE}	Chip stable time	-	-	10	us
t_{RES}	Reset pulse	4	-	-	us
t_{READY}	Chip need time after hardware reset	-	-	1	us

7-4 TP controller command table

Reg#	Function	R/W/C	No. of Byte	Parameter	Default
R00h	No Operation	C	0	N/A	N/A
R01h	Software Reset	C	0	N/A	N/A
R02h	Device ID	R	2	nibble based representation of "2521"	0x2521
R06h	Number of Driving Electrodes	W	1	[7:4]: Reserved [3:0]: Select between 6 to 21 electrodes according to mapping in specification.	0x0F
R07h	Number of Sensing Electrodes	W	1	[7:3]: Reserved [2:0]: Select between 6 to 12 electrodes according to mapping in specification.	0x06
R08h	Select Drive Pin and Slew Rate for Drive Line 00	W	1	[7:5] Slew rate [4:0] Drive pin select	0x00
R09h	Select Drive Pin and Slew Rate for Drive Line 01	W	1	[7:5] Slew rate [4:0] Drive pin select	0x01
RAh	Select Drive Pin and Slew Rate for Drive Line 02	W	1	[7:5] Slew rate [4:0] Drive pin select	0x02
RBh	Select Drive Pin and Slew Rate for Drive Line 03	W	1	[7:5] Slew rate [4:0] Drive pin select	0x03
RCh	Select Drive Pin and Slew Rate for Drive Line 04	W	1	[7:5] Slew rate [4:0] Drive pin select	0x04
RDh	Select Drive Pin and Slew Rate for Drive Line 05	W	1	[7:5] Slew rate [4:0] Drive pin select	0x05
REh	Select Drive Pin and Slew Rate for Drive Line 06	W	1	[7:5] Slew rate [4:0] Drive pin select	0x06
RFh	Select Drive Pin and Slew Rate for Drive Line 07	W	1	[7:5] Slew rate [4:0] Drive pin select	0x07
R10h	Select Drive Pin and Slew Rate for Drive Line 08	W	1	[7:5] Slew rate [4:0] Drive pin select	0x08
R11h	Select Drive Pin and Slew Rate for Drive Line 09	W	1	[7:5] Slew rate [4:0] Drive pin select	0x09
R12h	Select Drive Pin and Slew Rate for Drive Line 10	W	1	[7:5] Slew rate [4:0] Drive pin select	0x0A
R13h	Select Drive Pin and Slew Rate for Drive Line 11	W	1	[7:5] Slew rate [4:0] Drive pin select	0x0B
R14h	Select Drive Pin and Slew Rate for Drive Line 12	W	1	[7:5] Slew rate [4:0] Drive pin select	0x0C
R15h	Select Drive Pin and Slew Rate for Drive Line 13	W	1	[7:5] Slew rate [4:0] Drive pin select	0x0D
R16h	Select Drive Pin and Slew Rate for Drive Line 14	W	1	[7:5] Slew rate [4:0] Drive pin select	0x0E
R17h	Select Drive Pin and Slew Rate for Drive Line 15	W	1	[7:5] Slew rate [4:0] Drive pin select	0x0F
R18h	Select Drive Pin and Slew Rate for Drive Line 16	W	1	[7:5] Slew rate [4:0] Drive pin select	0x10
R19h	Select Drive Pin and Slew Rate for Drive Line 17	W	1	[7:5] Slew rate [4:0] Drive pin select	0x11
R1Ah	Select Drive Pin and Slew Rate for Drive Line 18	W	1	[7:5] Slew rate [4:0] Drive pin select	0x12

R1Bh	Select Drive Pin and Slew Rate for Drive Line 19	W	1	[7:5] Slew rate [4:0] Drive pin select	0x13
R1Ch	Select Drive Pin and Slew Rate for Drive Line 20	W	1	[7:5] Slew rate [4:0] Drive pin select	0x14
R23h	System Enable (wake-up)	C	1	Dummy Byte. For example, 0x00 can be sent.	N/A
R24h	System Disable (go to sleep)	C	1	Dummy Byte. For example, 0x00 can be sent.	N/A
R25h	Write Operation Mode	W	1	[7:4]: reserved [3:0]: 0000 = Idle mode 0001 = Idle mode 0010 = Fast Scan, 200Hz 0011 = Fast Scan, 166Hz 0100 = Fast Scan, 142Hz 0101 = Fast Scan, 125Hz 0110 = Fast Scan, 100Hz 0111 = Normal Scan, 83.3Hz 1000 = Normal Scan, 71.4Hz 1001 = Normal Scan, 62.5Hz 1010 = Normal Scan, 55.5Hz 1011 = Normal Scan, 50.0Hz 1100 = Slow Scan, 45.5Hz 1101 = Slow Scan, 37.0Hz 1110 = Slow Scan, 30.3Hz 1111 = Slow Scan, 25.0Hz	0x00
R26h	Read Operation Mode	R	1	Ditto	0x00
R27h	Set Power Down Time	W	1	[7:3]: reserved [2:0]: 000 = 200ms (5Hz) 001 = 140ms (7Hz) 010 = 100ms (10Hz) 011 = 70ms (14Hz) 100 = 50ms (20Hz) 101 = 35ms (28Hz) 110 = 25ms (40Hz) 111 = 17.7ms (56Hz)	0x04
R28h	Set No. of Frames escape without finger touch before entering Power Save Mode.	W	1	[7:4]: reserved [3:0]: 0000 = 20 frames 0001 = 40 frames 0010 = 60 frames 0011 = 80 frames 0100 = 100 frames 0101 = 120 frames 0110 = 140 frames 0111 = 160 frames 1000 = 180 frames 1011 = 200 frames 1011 = 220 frames 1011 = 240 frames 1100 = 260 frames 1101 = 280 frames 1110 = 300 frames 1111 = 320 frames	0x08
R29h	Number of idle cycles insert between driving two rows.	W	1	[7:4]: reserved [2:0] =: No. of idle cycles – 2 Range: 2 – 9 cycles	0x07

R2Ah	Number of Sub Frames per frame scan.	W	1	[7:2]: reserved [1:0]: No. of sub frames – 1 Range: 1 – 4 sub frames	0x03
R33h	Min Finger Area (in unit of crossover points)	W	1	[7:0]: set minimum area for valid finger detection	0x02
R34h	Min Finger Level (in unit of delta difference)	W	1	[7:0] set minimum level for valid finger detection	0x05
R35h	Min Finger Weight (in unit of delta difference)	W	2	[7:0]: set minimum weight for valid finger detection	0x00 0x0A
R36h	Max Finger Area (in unit of crossover points)	W	1	[7:0]: set maximum area for valid finger detection	0x1E
R37h	Control depth of image segmentation	W	1	[7:2]: reserved [1:0]: 0 = 68% of max value 1 = 63% of max value 2 = 56% of max value 3 = 49% of max value	0x00
R38h	Select Delta Data Range	W	1	[7:2]: reserved [1:0]: 00 = delta_data[7:0] 01 = delta_data[8:1] 10 = delta_data[9:2] 11 = delta_data[10:3]	0x00
R39h	Select CG calculation method	W	1	[7:1]: reserved [0]: 0 = Weighted Avg. 1 = Curve Fitting	0x00
R3Ah	Enable filtering in init calibration sequence	W	1	[7:1]: reserved [0]: 0 = disable filter 1 = enable filter	0x00
R3Bh	Invert polarity of delta	W	1	[7:1]: reserved [0]: 0 = invert 1 = non-invert	0x00
R51h	Single Click Timing (in 1ms unit)	W	2	[15:11]: Reserved [10:0]: define single click timing	0x00 0x00
R52h	Double Click Timing (in 1ms unit)	W	2	[15:11]: Reserved [10:0]: define double click timing	0x00 0x00
R53h	CG Tolerance (in 1/32 electrode span)	W	1	[7]: Reserved [6:0]: define CG tolerance	0x00
R54h	X Tracking tolerance (in 1/32 electrode span)	W	1	[7:0]: X coordinate tracking tolerance	0x00
R55h	Y Tracking tolerance (in 1/32 electrode span)	W	1	[7:0] Y coordinate tracking tolerance	0x00
R56h	Enable Adaptive Moving Average filter to smooth fingers' output coordinates.	W	1	[7:1]: reserved [0]: 0 = disable filter 1 = enable filter	0x00
R57h	Select the scaling factor for finger speed (in 1/32 electrode span)	W	1	[7:1]: reserved [0]: 0 = speed / 4 1 = speed / 8	0x00
R58h	Select the scaling factor for finger press weight (in unit of a delta difference)	W	1	[7:2]: reserved [1:0]: 00 = weight/1 01 = weight/2 10 = weight/4 11 = weight/8	0x00

R66h	Scaling factor for X coordinate. Floating point format is ##.######.	W	1	[7:0]: X scaling factor. 2-bit integer part and 6-bit fractional part.	0x40
R67h	Scaling factor for Y coordinate. Floating point format is ##.######.	W	1	[7:0]: Y scaling factor. 2-bit integer part and 6-bit fractional part.	0x40
R68h	Offset of X coordinate. (in unit of pixel. That is, after X scaling)	W	1	[7:6]: reserved [5:0]: X offset	0x00
R69h	Offset of Y coordinate. (in unit of pixel. That is, after Y scaling)	W	1	[7:6]: reserved [5:0]: Y offset	0x00
R79h	Event Status	R	1	[7]: Reserved [6]: Large Object detected [5]: FIFO overflow [4]: FIFO not empty [3]: Finger 3 detected [2]: Finger 2 detected [1]: Finger 1 detected [0]: Finger 0 detected	N/A
R7Ah	Event Mask	W	2	[15]: Unknown event mask [14:8]: Reserved [7]: FM Event mask [6]: FL Event mask [5]: FE Event mask [4]: DFDC Event mask [3]: DFSC Event mask [2]: SFDC Event mask [1]: SFSC Event mask [0]: Reserved	0x00 0x00
R7Bh	IRQ Mask	W	1	[7]: Reserved [6]: Large Object status mask [5]: FIFO overflow status mask [4]: FIFO not empty status mask [3]: Finger03 status mask [2]: Finger02 status mask [1]: Finger01 status mask [0]: Finger00 status mask	0x00
R7Ch	Finger01 (X,Y) coordinates, speed index and press weight index.	R	4	[31:24]: x-coordinate[7:0] [23:16]: y-coordinate[7:0] [15:12]: x-coordinate [11:8] [11:08]: y-coordinate [11:8] [07:04]: press weight index[3:0] [03:00]: speed index [3:0]	0xFF 0xFF 0xFF 0x00
R7Dh	Finger02 (X,Y) coordinates, speed index and press weight index.	R	4	Ditto	Ditto
R7Eh	Finger03 (X,Y) coordinates, speed index and press weight index.	R	4	Ditto	Ditto
R7Fh	Finger04 (X,Y) coordinates, speed index and press weight index.	R	4	Ditto	Ditto

R80h	Event Stack	R	4	[31:28]: Finger flag [3:0] [27:24]: Event number [3:0] [23:16]: x-coordinate[7:0] [15:08]: y-coordinate[7:0] [07:04]: x-coordinate [11:8] [03:00]: y-coordinate [11:8]	0x00 0xFF 0xFF 0xFF
R81h	Event Stack Clear	C	0	Clear the Event Stack when not overflow	N/A
RA2h	Reset Init Reference Procedure	W	1	Dummy Byte	N/A
RC1h	Charge Pump 2nd Booster Control	W	1	[7:6]: Reserved [5:4]: 2nd Booster Control 00: x6 01: Reserved 10: x5 11: x4 [3:0]: Reserved	0x32
RD5h	Select Driving voltage level	W	1	[7:4]: reserved [3:0]: 0 = 8.0V, 1 = 8.5V 2 = 9.0V, 3 = 9.5V 4 = 10.0V, 5 = 10.5V 6 = 11.0V, 7 = 11.5V 8 = 12.0V, 9 = 12.5V 10 = 13.0V, 11 = 13.5V 12 = 14.0V, 13 = 14.5V 14 = 15.0V, 15 = 15.5V	0x00

*Check the datasheet of SSD2531 for further detail.

7-5 Initial Code

```
void SSD2531_ini (void)
{
IO_I2C_WR(0x5C,0x23,0x00); //System Enable (R23h)
IO_I2C_WR(0x5C,0x2B,0x03); //Drive Line Number Register (R06h)     =19
IO_I2C_WR(0x5C,0xD4,0x01); //Sense Line Number Register (R07h)    =11
IO_I2C_WR(0x5C,0x06,0x0D); //Drive Line Number Register (R06h)     =19
IO_I2C_WR(0x5C,0x07,0x06); //Sense Line Number Register (R07h)    =11
IO_I2C_WR(0x5C,0x08,0x00); //Drive Line 00    DRIVER01
IO_I2C_WR(0x5C,0x09,0x01); //Drive Line 01    DRIVER02
IO_I2C_WR(0x5C,0x0A,0x02); //Drive Line 02    DRIVER03
IO_I2C_WR(0x5C,0x0B,0x03); //Drive Line 03    DRIVER04
IO_I2C_WR(0x5C,0x0C,0x04); //Drive Line 04    DRIVER05
IO_I2C_WR(0x5C,0x0D,0x05); //Drive Line 05    DRIVER06
IO_I2C_WR(0x5C,0x0E,0x06); //Drive Line 06    DRIVER07
IO_I2C_WR(0x5C,0x0F,0x07); //Drive Line 07    DRIVER08
IO_I2C_WR(0x5C,0x10,0x08); //Drive Line 08    DRIVER09
IO_I2C_WR(0x5C,0x11,0x09); //Drive Line 09    DRIVER10
IO_I2C_WR(0x5C,0x12,0x0A); //Drive Line 10    DRIVER11
IO_I2C_WR(0x5C,0x13,0x0B); //Drive Line 11    DRIVER12
IO_I2C_WR(0x5C,0x14,0x0C); //Drive Line 12    DRIVER13
IO_I2C_WR(0x5C,0x15,0x0D); //Drive Line 13    DRIVER14
IO_I2C_WR(0x5C,0x16,0x0E); //Drive Line 14    DRIVER15
IO_I2C_WR(0x5C,0x17,0x0F); //Drive Line 15    DRIVER16
IO_I2C_WR(0x5C,0x18,0x10); //Drive Line 16    DRIVER17
IO_I2C_WR(0x5C,0x19,0x11); //Drive Line 17    DRIVER18
IO_I2C_WR(0x5C,0x1A,0x12); //Drive Line 18    DRIVER19
IO_I2C_WR(0x5C,0x2A,0x04); //Number of Sub Frames per    frame scan.
IO_I2C_WR(0x5C,0x8D,0x01); //Change system to manual scan mode
IO_I2C_WR(0x5C,0x8E,0x02); //
IO_I2C_WR_2Byte(0x5C,0x94,0x00,0x00); //
IO_I2C_WR(0x5C,0x8D,0x00); //Change system to manual scan mode
IO_I2C_WR(0x5C,0x25,0x09); //Write Operation Mode
IO_I2C_WR(0x5C,0xC1,0x02); ///Charge Pump 2nd Booster Control
IO_I2C_WR(0x5C,0xD5,0x0A); //Select Driving voltage level
IO_I2C_WR(0x5C,0x38,0x00); //Select Delta Data Range
IO_I2C_WR(0x5C,0x33,0x00); //Min Finger Area Setting Register
IO_I2C_WR(0x5C,0x34,0x40); //Min Finger Level Setting Register
IO_I2C_WR_2Byte(0x5C,0x35,0x00,0x40); //Min Finger Weight Setting Registe
IO_I2C_WR(0x5C,0x36,0x1E); //Max Finger Area Setting Register
IO_I2C_WR(0x5C,0x37,0x02); //Control depth of image segmentation
IO_I2C_WR(0x5C,0x39,0x01); //Select CG calculation method
IO_I2C_WR(0x5C,0x56,0x01); //Enable Adaptive Moving Average filter to
            smooth fingers' output coordinates.
IO_I2C_WR_2Byte(0x5C,0x51,0x00,0xFF); //Single Click Timeing
IO_I2C_WR_2Byte(0x5C,0x52,0x00,0xFF); //Double Click Timer Setting Register
IO_I2C_WR(0x5C,0x53,0x35); //CG Tolerance Setting Register
IO_I2C_WR(0x5C,0x54,0x40); //X Tracking Tolerance Register
IO_I2C_WR(0x5C,0x55,0x40); //Y Tracking Tolerance Register
IO_I2C_WR(0x5C,0xD9,0x01); //scaling factor
```

```
IO_I2C_WR(0x5C,0xD8,0x02); //scaling factor
IO_I2C_WR(0x5C,0xD7,0x06); //scaling factor
IO_I2C_WR(0x5C,0x2C,0x01); //scaling factor
IO_I2C_WR(0x5C,0xAE,0x0F); //scaling factor
IO_I2C_WR(0x5C,0xBC,0x01); //scaling factor
IO_I2C_WR(0x5C,0x3D,0x01); //?
IO_I2C_WR(0x5C,0x66,0x36); //scaling factor    //scaling    factor
            (11-1)*32=320=====>320/resolution x =0.85
IO_I2C_WR(0x5C,0x67,0x35); //scaling factor      //scaling factor
            (19-1)*32=576====>576/resolution Y =0.83
IO_I2C_WR(0x5C,0xD6,0x01); //scaling factor
IO_I2C_WR(0x5C,0xA2,0x00); //Reset Init Reference Procedure
}
```

7-6 Sample code

```
void coord_reporter(void)
{
   u32 PCT_Z[12],PCT_Y[12],PCT_X[12];
   u16 a;
   Full_LCD(0x0000);
   SET_TPCS; //Reset IC
   Delay(5);
   CLR_TPCS;
   Delay(5);
   SET_TPCS; //Reset IC
   SSD2521_ini();
   Delay(5);
   PCT_Z[0]=0x0000;
   PCT_Z[1]=0x0000;
   PCT_Z[2]=0x0000;
   PCT_Z[3]=0x0000;
   PCT_Z[4]=0x0000;
   PCT_Z[5]=0x0000;
   PCT_X[0]=0x0000;
   PCT_X[1]=0x0000;
   PCT_X[2]=0x0000;
   PCT_X[3]=0x0000;
   PCT_X[4]=0x0000;
   PCT_X[5]=0x0000;
   PCT_Y[0]=0x0000;
   PCT_Y[1]=0x0000;
   PCT_Y[2]=0x0000;
   PCT_Y[3]=0x0000;
   PCT_Y[4]=0x0000;
   PCT_Y[5]=0x0000;
```

```
 while(1)
  {
    if((ReadINT())==0)
     {
     IO_I2C_RD(0x5C,0x79,1);
      PCT_Z[0]=(u16)((u16)pbuffer[0]);//finger No.
       IO_I2C_RD(0x5C,0x80,4)
             if((PCT_Z[0]&0x0003)==0x0001)
              {
             IO_I2C_RD(0x5C,0x7C,4);
          PCT_X[0]=(u16)((u16)pbuffer[0]+((pbuffer[2]&0x0300)<<4));
          PCT_Y[0]=(u16)((u16)pbuffer[1]+((pbuffer[2]&0x0003)<<8));
             IO_I2C_RD(0x5C,0x80,4);
             IO_I2C_RD(0x5C,0x7D,4);
       PCT_X[1]=(u16)((u16)pbuffer[0]+((pbuffer[2]&0x0300)<<4));
       PCT_Y[1]=(u16)((u16)pbuffer[1]+((pbuffer[2]&0x0003)<<8));
             IO_I2C_RD(0x5C,0x80,4);
             PCT_X[4]=PCT_X[0];       //coordinate X1
             PCT_Y[4]=PCT_Y[0];       //coordinate Y1
             PCT_X[5]=PCT_X[1];       //coordinate X2
             PCT_Y[5]=PCT_Y[1];       //coordinate Y2
               }
                }
                 }
}
```

7-7 Color Data Assignment

COLOR	Input Data	R DATA						G DATA						B DATA					
		R5 MSB	R4	R3	R2	R1	R0 LSB	G5 MSB	G4	G3	G2	G1	G0 LSB	B5 MSB	B4	B3	B2	B1	B0 LSB
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RED	RED(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN (1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	GREEN (2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	GREEN (62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	GREEN (63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
BLUE	BLUE (0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE (62)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE (63)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

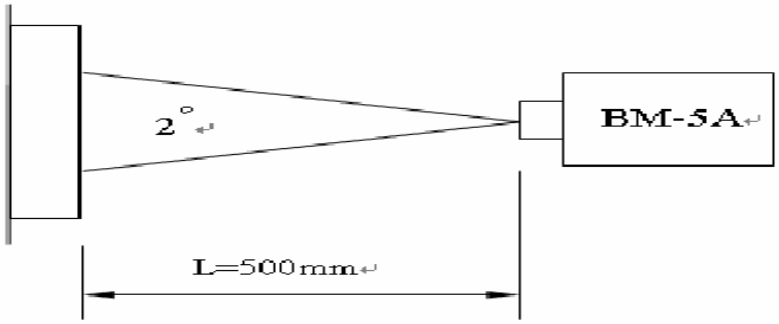
NOTE : (1) Definition of Gray Scale , Color(n) : n is series of Gray Scale
The more n value is the bright Gray Scale
(2) Data : 1-High , 0-Low

8. OPTICAL CHARACTERISTICS

Item			Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast ratio			CR	Point - 5 Θ=Φ=0°	--	500	--	--	(1)(2)(3)
Luminance			Lw		--	450	-	cd/m^2	(1)(3)
Luminance Uniformity			ΔL		70	75	-	%	(1)(3)
Response Time (White – Black)			$T_r + T_f$		--	35	--	ms	(1)(3)(5)
Viewing Angle	Horizontal		Θh	CR＞10	--	160	-	Deg.	(1)(2)(4)
	Vertical		Θv		--	160	-		
Color chromaticity		Red	Rx	Point - 5 Θ=Φ=0°	0.59	0.64	0.69	--	(1)(3)
			Ry		0.29	0.34	0.39		
		Green	Gx		0.30	0.35	0.40		
			Gy		0.54	0.59	0.64		
		Blue	Bx		0.06	0.11	0.16		
			By		0.05	0.10	0.15		
		White	Wx		0.26	0.31	0.36		
			Wy		0.30	0.35	0.40		

NOTE :

(1) Measure conditions : 25℃±2℃ , 60±10%RH under 10Lux , in the dark room by BM-7TOPCON) ,viewing 2° , VCC=3.3V , VDD=3.3V



(2) Definition of Contrast Ratio :

Contrast Ratio (CR) = (White) Luminance of ON ÷ (Black) Luminance of OFF

(3) Definition of Luminance :

Definition of Luminance Uniformity

Measure white luminance on the point 5 as figure9-1

Measure white luminance on the point 1 ~ 9 as figure9-1

ΔL = [L(MIN) / L(MAX)] X 100%

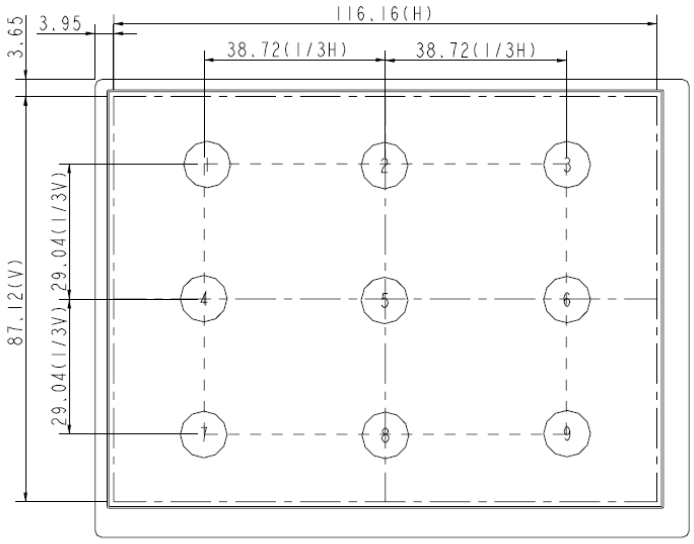


Fig9-1 Measuring point

(4) Definition of Viewing Angle(Θ,Φ), refer to Fig9-2 as below :

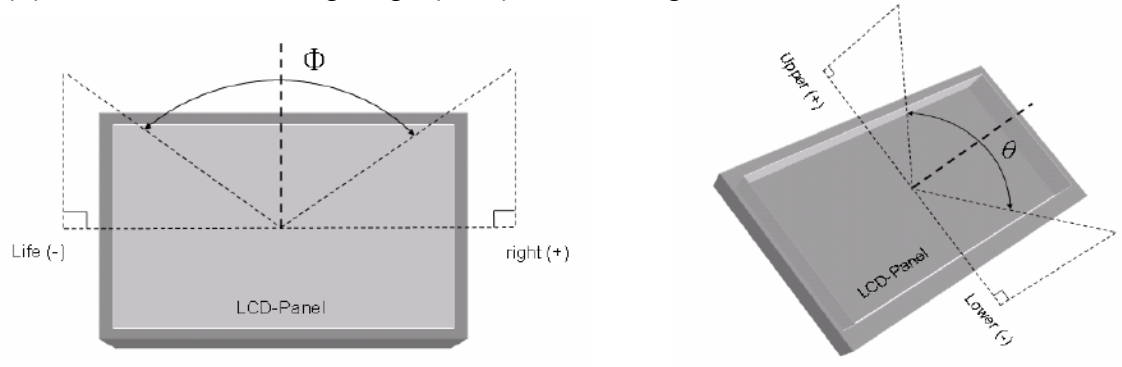


Fig9-2 Definition of Viewing Angle

(5) Definition of Response Time.(White – Black)

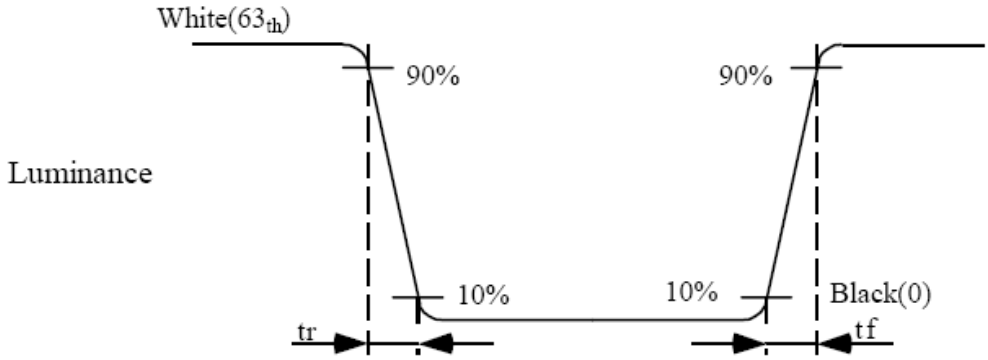


Fig9-3 Definition of Response Time(White-Black)

9 INCOMING INSPECTION STANDARD FOR TFT-LCD PANEL

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:

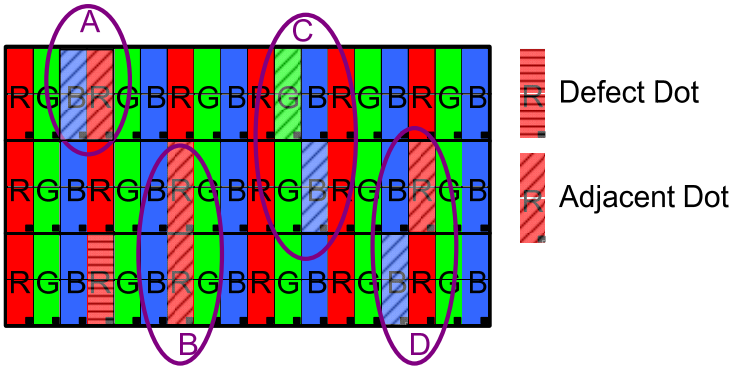
The function defects of line defect, abnormal display, and no display are considered Major defects.

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.

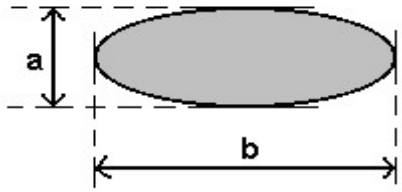
(4) Defects on the Black Matrix, out of Display area, are not considered as a defect or counted.

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

4.3 Visual Inspection specifications:

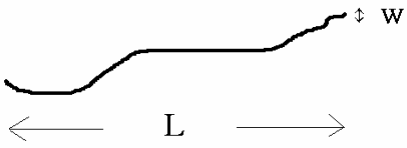
Defect Type	Specification	Count(N)
Dot Shape (Particle、Scratch and Bubbles in display area)	D≤0.15mm	Ignored
	0.15mm < D≤ 0.3mm	N≤ 3
	D > 0.3mm	N=0
Line Shape (Particles、Scratch、Lint and Bubbles in display area)	W≤ 0.05mm	Ignored
	0.05mm<W≤ 0.1mm ， L≤ 3mm	N≤ 3
	W > 0.1mm ， L > 3mm	N=0

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



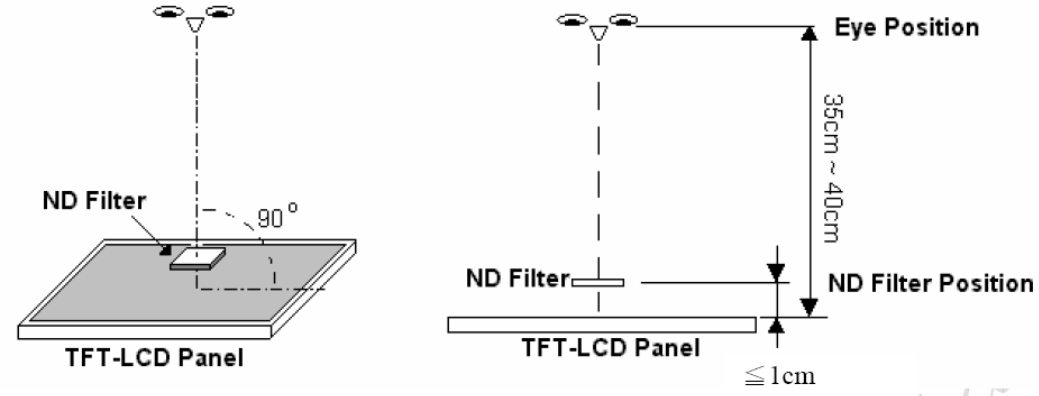
$\phi = (a + b) / 2$

1. (White, black) Spot
2. Polarizer Bubble



1. fiber

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



10. RELIABILITY TEST CONDITIONS

ITEM	CONDITIONS
HIGH TEMPERATURE OPERATION	70℃ , 240Hrs
HIGH TEMPERATURE AND HIGH HUMIDITY OPERATION	60℃ , 90%RH , 240Hrs
HIGH TEMPERATURE STORAGE	80℃ , 240Hrs
LOW TEMPERATURE OPERATION	-20℃ , 240Hrs
LOW TEMPERATURE STORAGE	30℃ , 240Hrs
THERMAL SHOCK	-20℃(0.5Hr) ~70℃(0.5Hr) 200Cycle

10.1 OTHERS

AMIPRE will provide one year warranty for all products and three months warrantee for all repairing products.

11. OUTLINE DIMENSION