

CUSTOMER' S APPROVAL SPECIFICATIONS**MODEL: CH043DPCT-CT2****(Complied with RoHS)**

Distributed by:



Version: P0.1

ISSUE:JUN.28.2013**C O N T E N T S**

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APPROVAL	APPROVAL	CHECKER	PREPARE
			<i>Benjamin Lie</i>

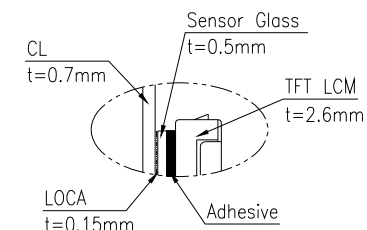
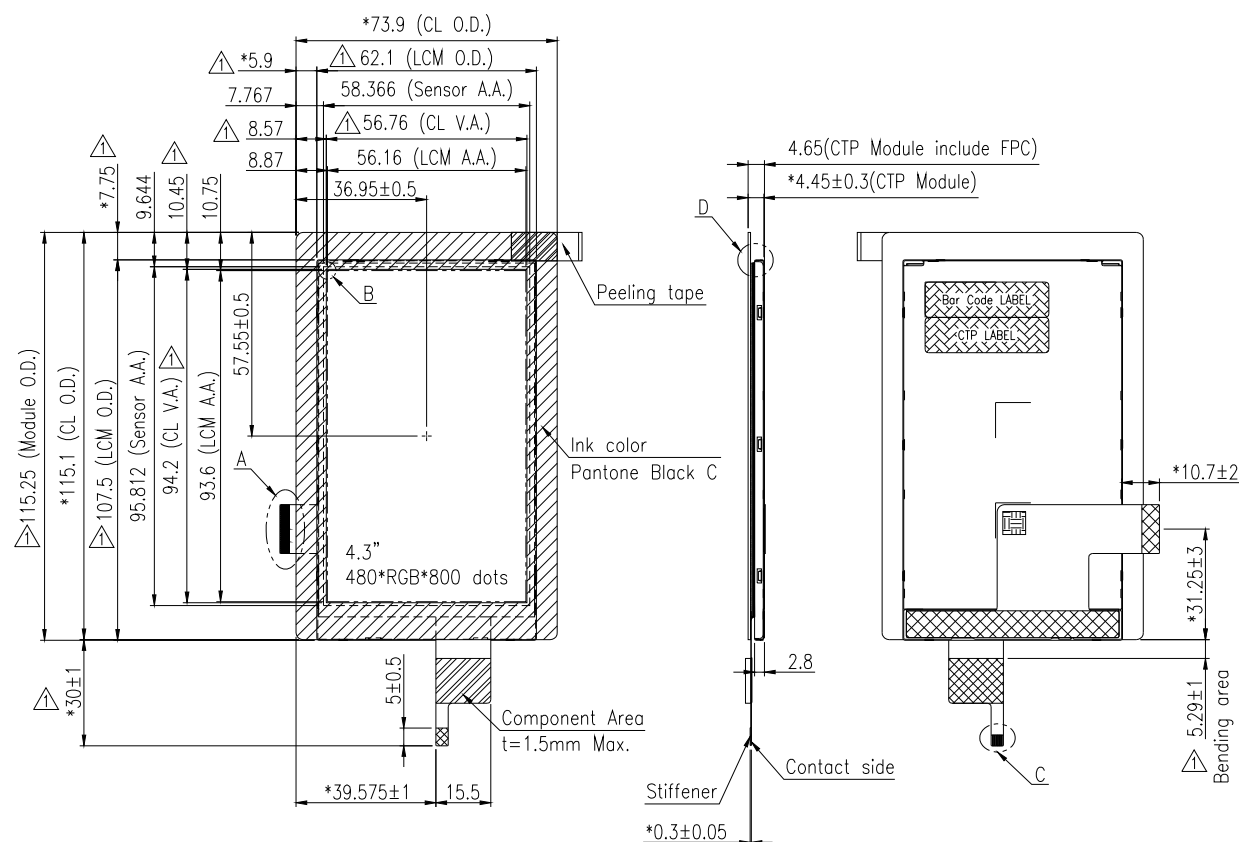
2.RECORD OF REVISION

Rev	DATE	PAGE	SUMMARY
0.1	2013.06.28	-	Preliminary specification was first issued.

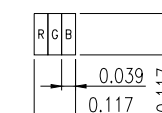
3.MECHANICAL SPECIFICATIONS

(1)	Number Of Dots (Dots)	480(R.G.B) X 800
(2)	Module Size(mm)	73.9(H) X 115.25(V) X 4.65(D)
(3)	Active Area(mm)	56.16(H) X 93.6(V)
(4)	LCD Model	TFT , Transmissive , Super Wide View,
(5)	LED Backlight Color	White
(6)	Viewing Direction	All
(7)	Gray Scale Inversion Direction	No
(8)	Color Configuration	R.G.B Vertical Stripe
(9)	Interface	18bit parallel RGB,MCU,I ² C for the CTP
(10)	Module Weight(g)	TBD

1	2	3	4
文件題目	圖號	頁	次頁
發行日	舊版日	登入號碼	機密等級

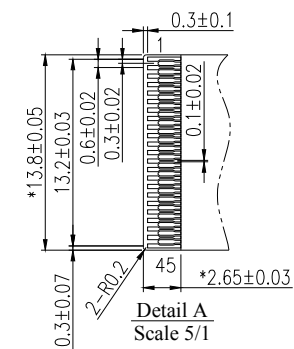
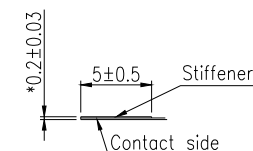


Detail D
Scale 5/1

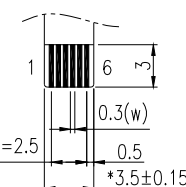


Detail B

Scale 100/1



Detail A
Scale 5/1



Detail C

Scale 4/1

NOTE:

1. For RoHS
2. TFT LCM match connector: Hirose FH39-45S-0.3SHW or equivalent.
3. The bending radius of FPC should be large than 0.6 mm.
4. Tolerance is ± 0.3 unless otherwise noted.
5. * is important dimension.
6. Uniformity: 70% (Min).
7. Center Brightness: 270cd/m² (Min.), 340cd/m² (Typ.).
8. CTP match connector: FH33-6S-0.5SH or equivalent.

LED K • • LED A

Voltage :25.6 V (Typ.)

Current :20 mA (Typ.)

Backlight Circuit

備考

$$P_{0.5} \cdot (6-1) = 2.5$$

單位:mm

投影法: 

比例尺:

1:1

圖號

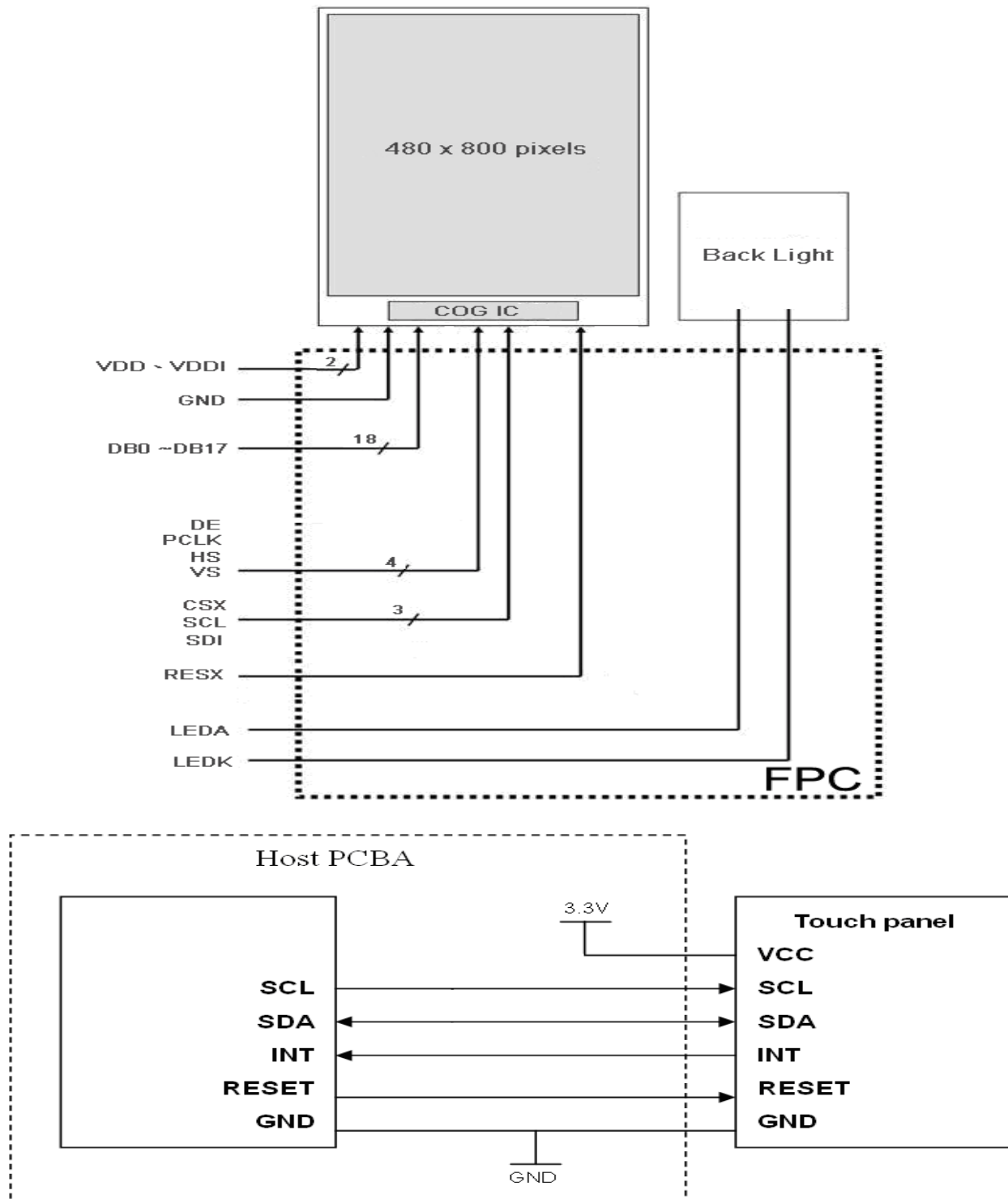
名稱:	4.
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入庫	製圖
	審查
	承認

5. TFT LCD PANEL INTERFACE

Pin No	Symbol	Function	Remark
1	VDD	Power supply for analog system	
2	VDD		
3	GND	Ground	
4	GND		
5	VDDI	Power supply for interface system	
6	VDDI		
7	NC	No Connection	
8	NC		
9	NC		
10	RESX	To reset the device, active low	
11	R5(D17)	18-bit bi-directional data bus.	
12	R4(D16)		
13	R3(D15)		
14	R2(D14)		
15	R1(D13)		
16	R0(D12)		
17	G5(D11)		
18	G4(D10)		
19	G3(D9)		
20	G2(D8)		
21	G1(D7)		
22	G0(D6)		
23	B5(D5)		
24	B4(D4)		
25	B3(D3)		
26	B2(D2)		
27	B1(D1)		
28	B0(D0)		
29	VS	Vertical sync	
30	HS	Horizontal sync	
31	GND	Ground	
32	PCLK	Pixel clock signal	
33	GND	Ground	
34	DE	Data enable signal	
35	SDI/SDA	SDI : Serial data input signal SDA : Serial data input/output bidirectional pin	
36	NC	No Connection	
37	CSX	Chip select input pin ("Low" enable)	
38	SCL	A synchronous clock signal	
39	NC	No Connection	
40	NC		
41	NC		
42	GND	Ground	
43	GND		
44	LEDK	Power supply for LED-	
45	LEDA	Power supply for LED+	

6. BLOCK DIAGRAM



7.ABSOLUTE MAXIMUM RATINGS

7.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
Power Supply Voltages	IOV_{CC}	0	5.5	V	GND=0, Ta=25°C
	V_{CI}	0	5.5	V	GND=0, Ta=25°C
	V_{CC}	0	5.5	V	GND=0, Ta=25°C

7.2 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	STORAGE	COMMENT
	MAX.	
Ambient Temperature(°C)	-20	Note 1,2,3

Note 1 : The response time will become lower when operated at low temperature.

Note 2 : Background color changes slightly depending on ambient temperature.

Note 3 : Can operating display when Ta<-20°C~-30°C, but display contrast ratio drop.

8.ELECTRICAL CHARACTERISTICS

8.1 LCM ELECTRICAL CHARACTERISTICS

Ta=25°C

I T E M	SYMBOL	MIN.	TYP.	MAX.	UNIT
Power Voltage	IOV_{CC}	2.5	-	3.3	V
	V_{CI}	2.5	-	3.3	V
	V_{CC}	2.5	-	3.3	V
Input High Voltage	V_{IH}	0.7* IOV_{CC}	-	IOV_{CC}	V
Input Low Voltage	V_{IL}	0	-	0.3* IOV_{CC}	V

** Test pattern:black

8.2 LED BACKLIGHT ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	NOTE
LED Voltage	V_{LED}	-	25.6	-	V	LED*8
Forward Current	I_{LED}	-	20	-	mA	LED*8
Power Consumption	P_{LED}	-	(512)	-	mW	LED*8

Note 1: LED Number



9.OPTICAL CHARACTERISTICS

9.1 OPTICAL CHARACTERISTICS OF LCM PANEL

Ta=25°C

ITEM	SYMBOL	CONDITIONS	SPECIFICATIONS			UNIT	REMARK
			MIN.	TYP.	MAX.		
Contrast ratio	CR	Viewing normal angle	-	800	-	-	Note(1)
Response time	TR+TF		-	25	-	ms	Note(2)
Brightness	L	Center	270	340	-	cd/m2	Note(5)
Uniformity	YU	-	70	-	-	%	Note(5)
Chromaticity	White	Xw	(0.305)	(0.310)	(0.315)		Note(4)
		Yw	(0.325)	(0.330)	(0.335)		
Viewing angle	ΘX+	CR ≥ 10	70	80	-	Deg.	Note(3)
	ΘX-		70	80	-	Deg.	
	ΘY+		70	80	-	Deg.	
	ΘY-		70	80	-	Deg.	

Note (1) Definition of Contrast Ratio “CR”:

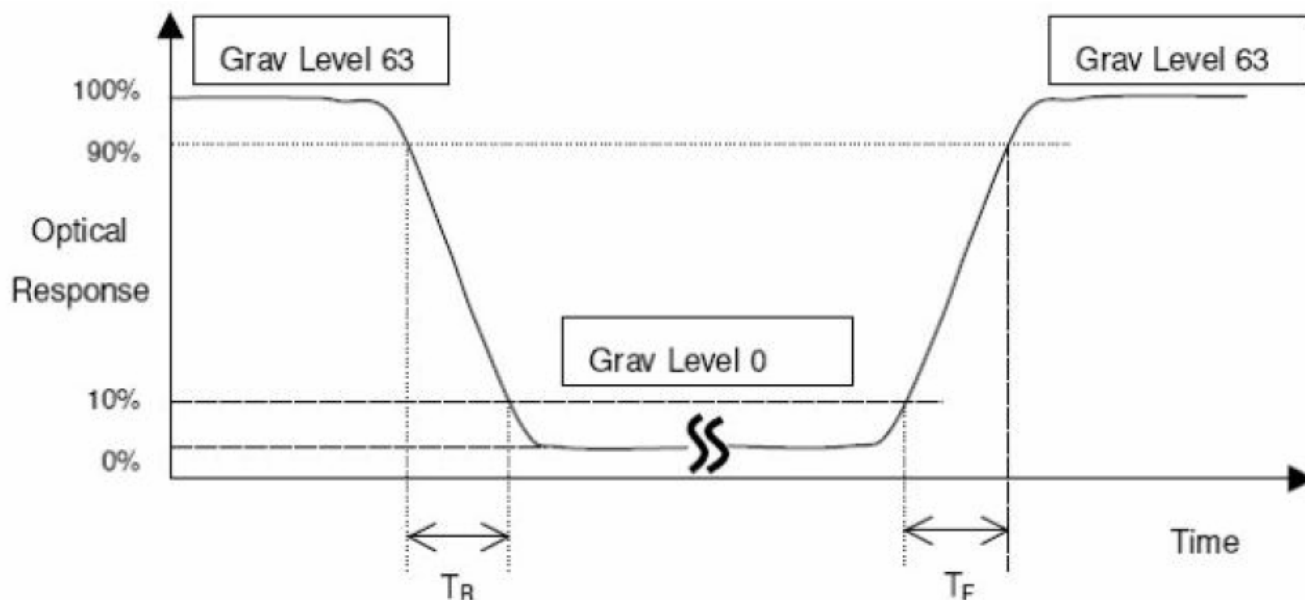
The contrast ratio can be calculated by the following expression

$$\text{Contrast Ratio(CR)} = L_{63}/L_0$$

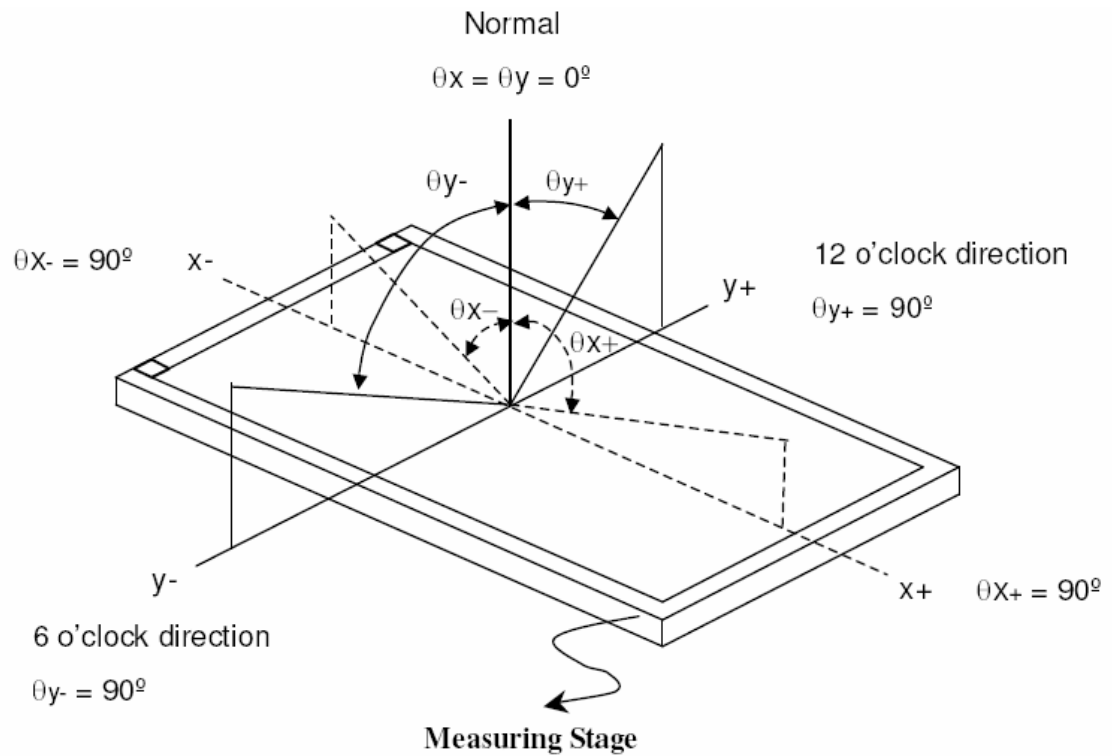
L63 : Luminance of gray level 63

L0 : Luminance of gray level 0

Note (2) Definition of Response Time (TR,TF) :

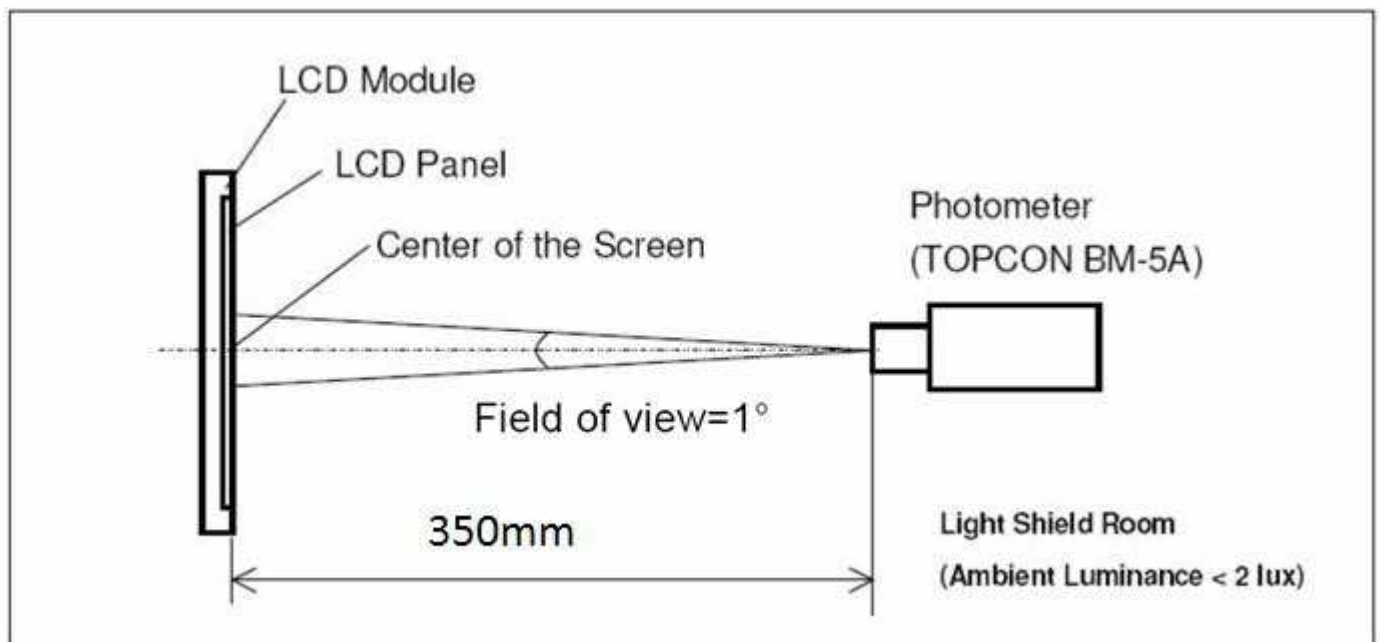


Note (3) Definition of Viewing Angle

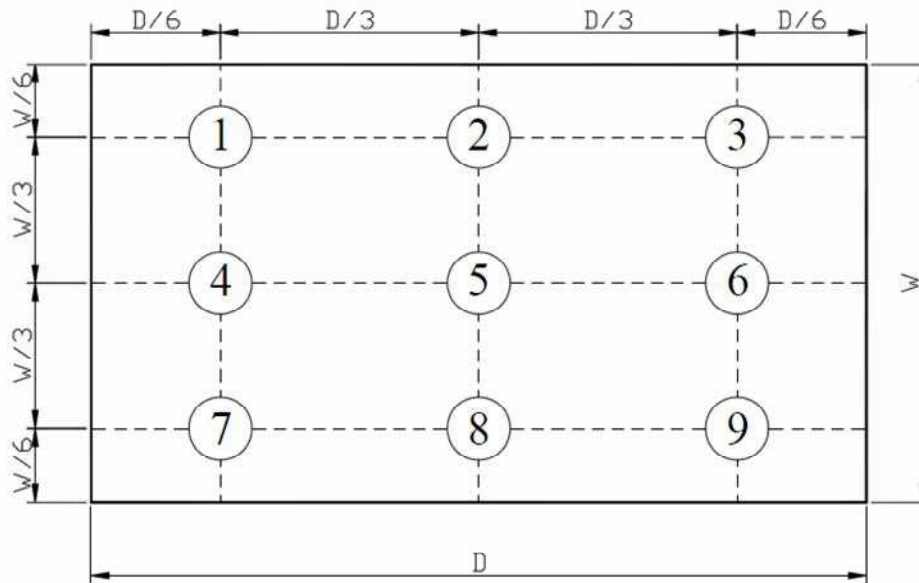


Note (4) Measurement Set-Up :

The LCD module should be stabilized at a given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (5) Measurement of the following 9 points on the display.



The Brightness should be the average Brightness of point ① ~ ⑨ .

Definition of the luminance uniformity .

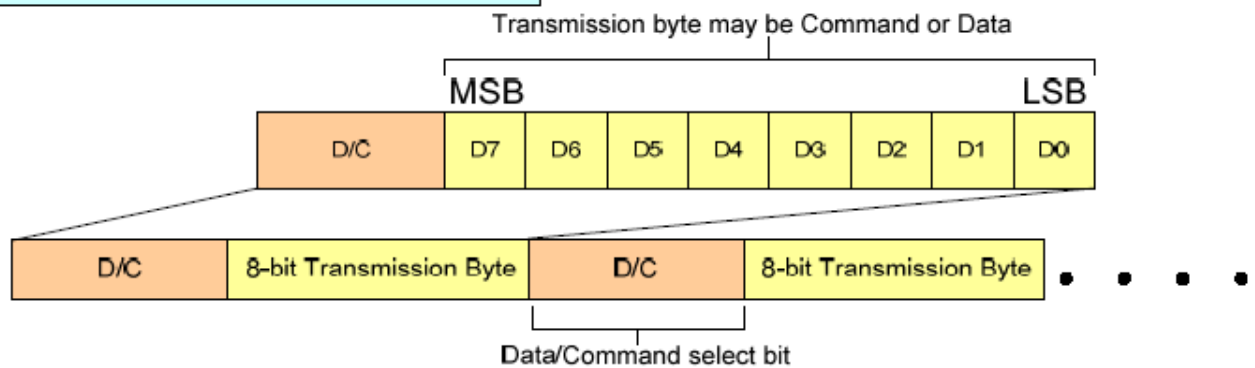
$$\left(1 - \frac{MAX \text{ Luminance} - Average \text{ Luminance}}{Average \text{ Luminance}} \right) \times 100\% \geq 70\%$$

10. TIMING SPECIFICATIONS

10.1 MCU Interface

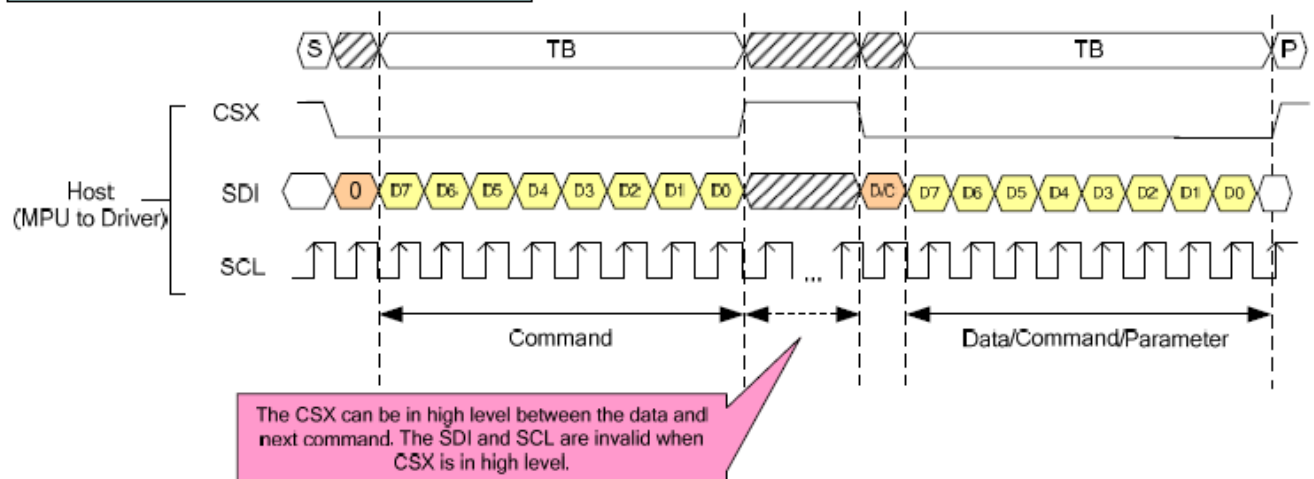
10.1.1 Write Cycle Sequence

3-line Serial Interface Data Format



DBI Type C Data Format

3-line Serial Interface Protocol

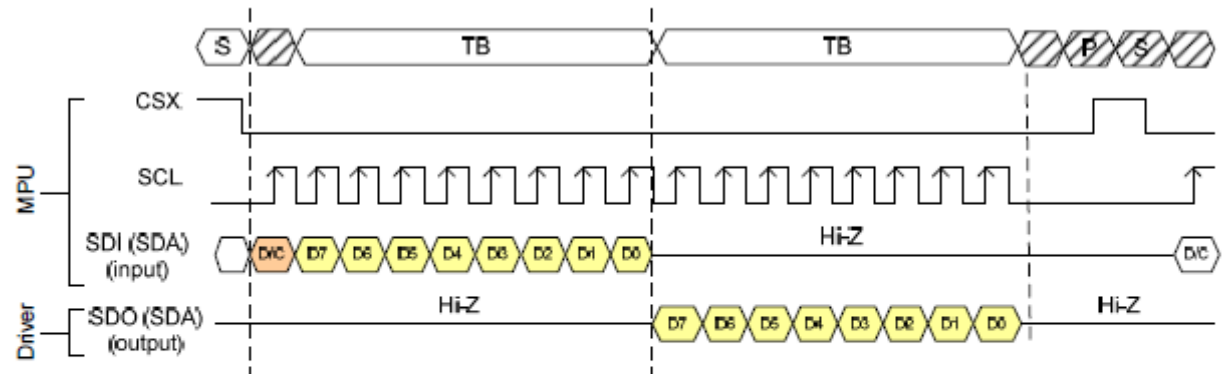


DBI Type C Protocol

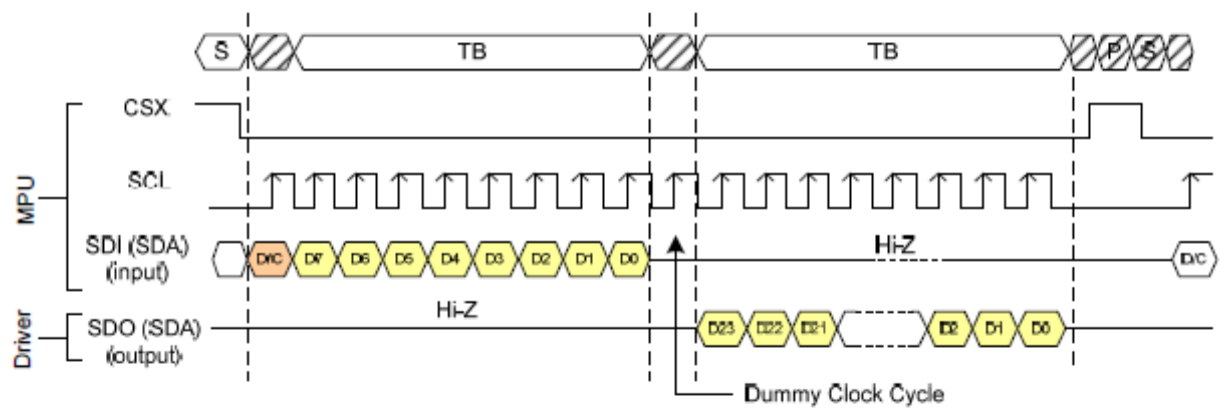
10.1.2 Read Cycle Sequence

10.1.2 Read Cycle Sequence

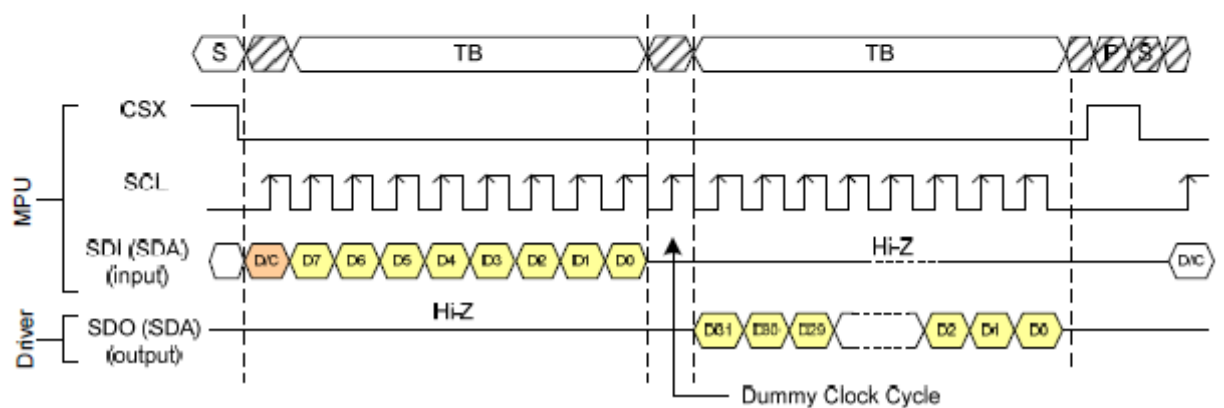
3-line Serial Protocol (for RDID2/RDID3/0Ah/0Bh/0Ch/0Dh/0Eh/0Fh command: 8-bit read)



3-line Serial Protocol (for RDDID command: 24-bit read)



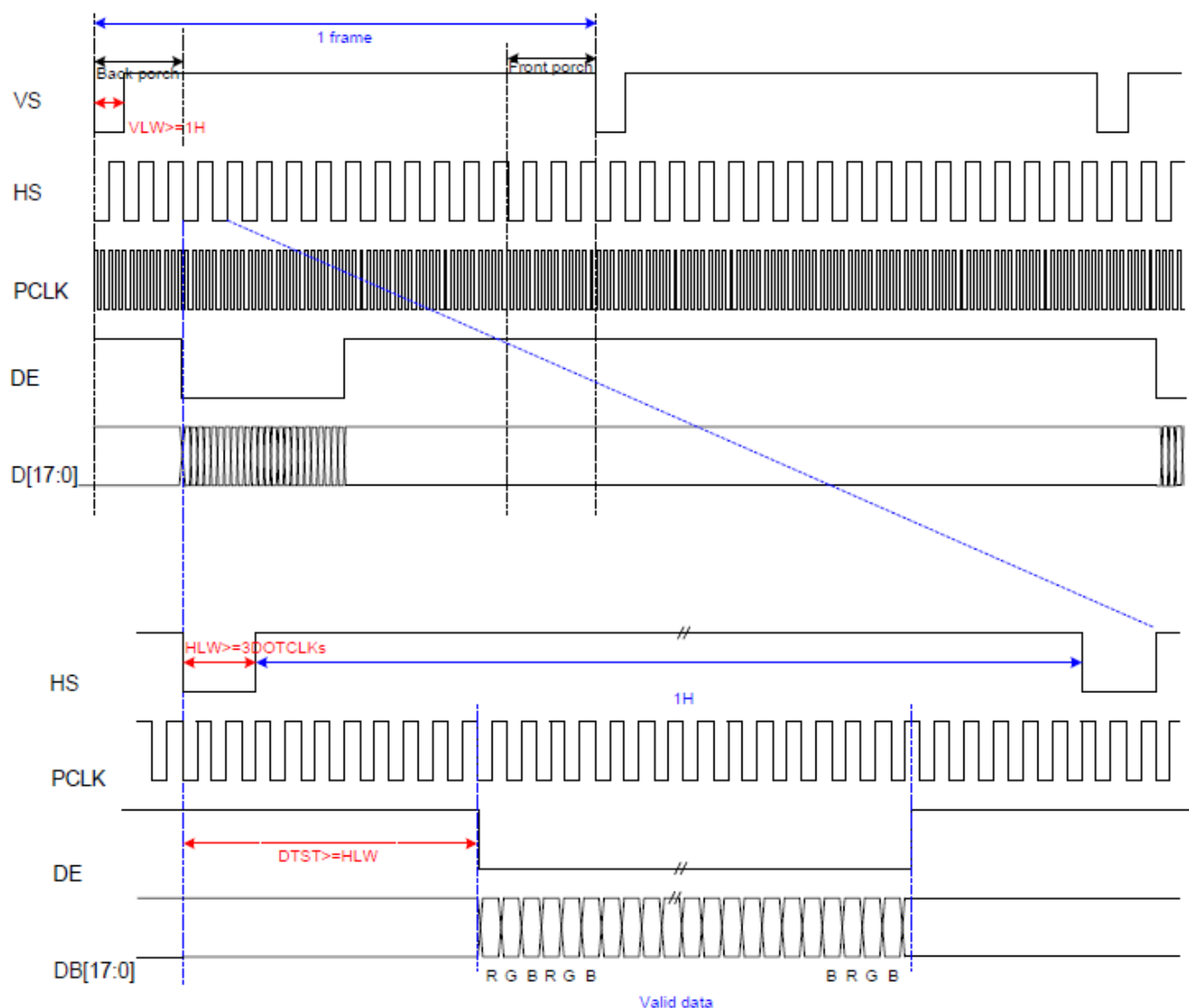
3-line Serial Protocol (for RDDST command: 32-bit read)



: DBI Type C Read Cycle Sequence

10.2 DPI Interface Timing

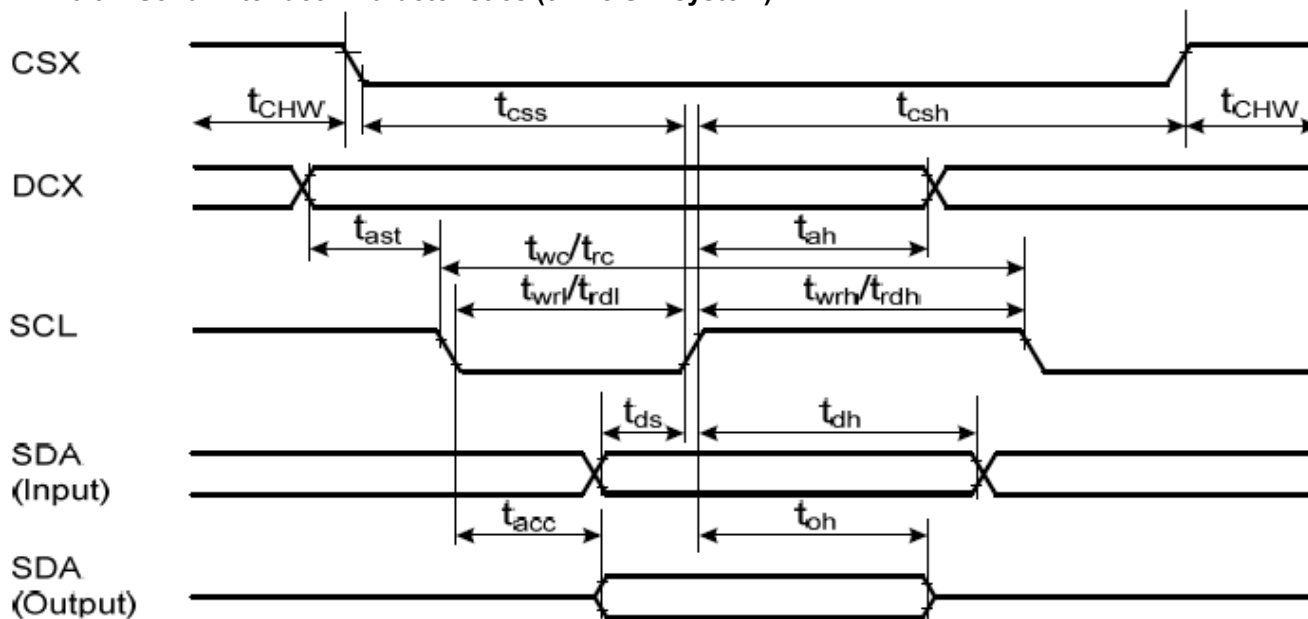
The timing chart of DPI interface mode



VLW : VS Low Width
 HLW : HS Low Width
 DTST : Data Transfer Startup Time

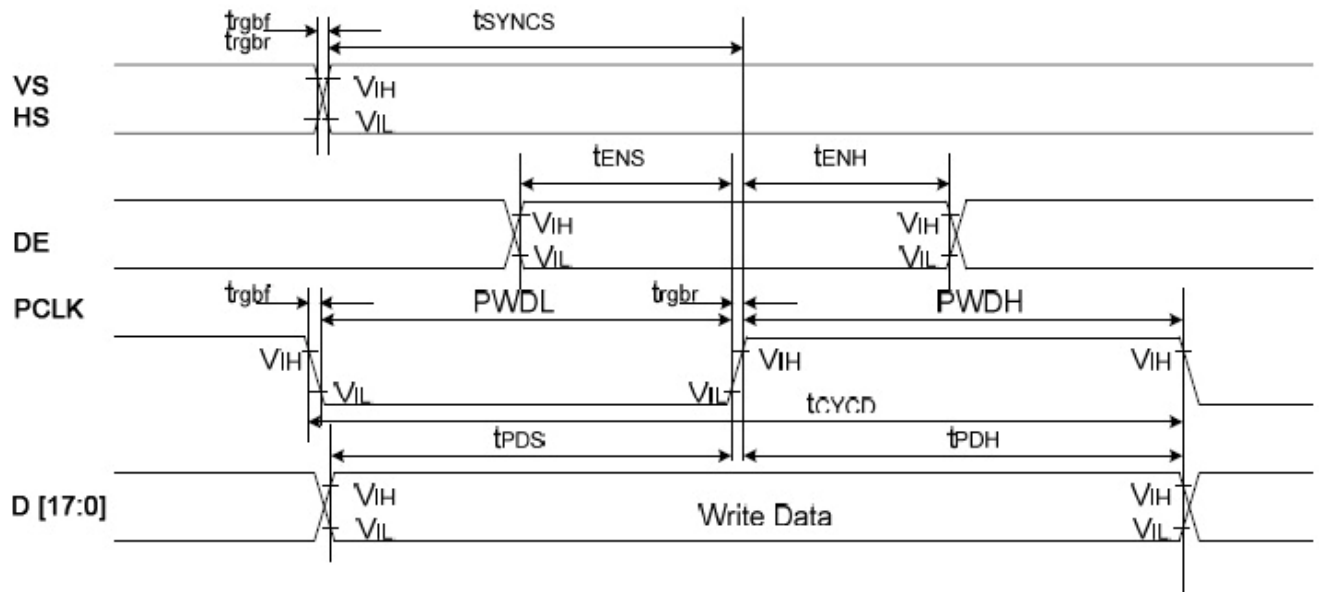
10.3 AC Characteristics

10.3.1 Serial Interface Characteristics (3-line SPI system)



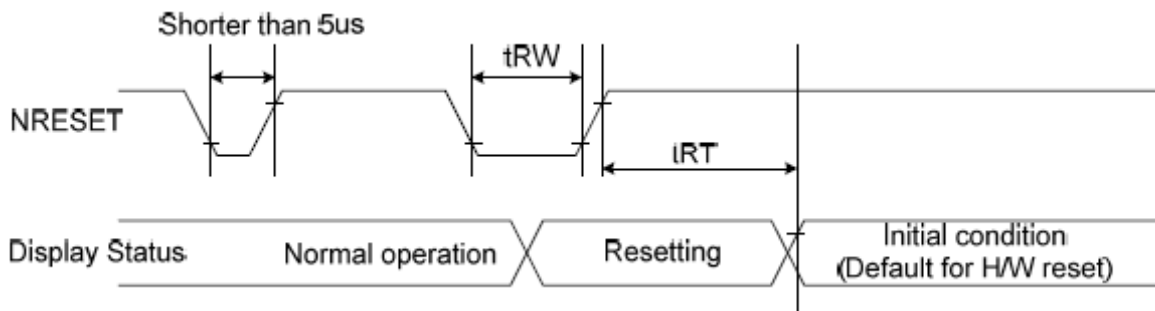
Signal	Symbol	Parameter	Min.	Max.	Unit	Remark
CSX	t_{css}	Chip select time (Write)	15	-	ns	
	t_{csh}	Chip select hold time CSX (Read)	15	-		
	t_{CHW}	CS "H" pulse width	40	-		
SCL	t_{wc}	Serial clock cycle (Write)	30	-		
	t_{wrh}	SCL "H" pulse width (Write)	10	-		
	t_{wrl}	SCL "L" pulse width (Write)	10	-		
	t_{rc}	Serial clock cycle (Read)	150	-		
	t_{rdh}	SCL "H" pulse width (Read)	60	-		
	t_{rdl}	SCL "L" pulse width (Read)	60	-		
DCX	t_{as}	DCX setup time	10	-		
	t_{ah}	DCX hold time (Write/Read)	10	-		
SDA (Input)	t_{ds}	Data setup time (Write)	10	-		
	t_{dh}	Data hold time (Write)	10	-		
SDA (Output)	t_{acc}	Access time (Read)	10	50		CL = 30pF (maximum) CL = 8pF (minimum)
	t_{oh}	Output disable time (Read)	15	50		

10.3.2 RGB Interface Characteristics



Signal Symbol	Parameter	Min.	Max.	Unit	Remark
VS HS	t_{SYNCS}	5	-	ns	18bit bus RGB interface mode
	t_{SYNCH}	5	-		
DE	t_{ENS}	5	-		
	t_{ENH}	5	-		
D [17:0]	t_{POS}	5	-		
	t_{PDH}	5	-		
PCLK	$PWDH$	13	-		
	$PWDL$	13	-		
	t_{CYCD}	28	-		
	t_{grbr}, t_{gbf}	-	15		

10.4 Reset Input Timing



Reset Timing

Signal	Symbol	Parameter	Min.	Max.	Unit
RESX	t _{RW}	Reset pulse duration	10		µs
	t _{RT}	Reset cancel		5 (Note 1,5) 120 (Note 1,6,7)	ms

Note 1 : The reset cancel also includes the required time for loading ID bytes, VCOM setting and other settings from the EEPROM to registers. After a rising edge of RESX, this loading is done within 5 ms after the H/W reset cancel (t_{RT}).

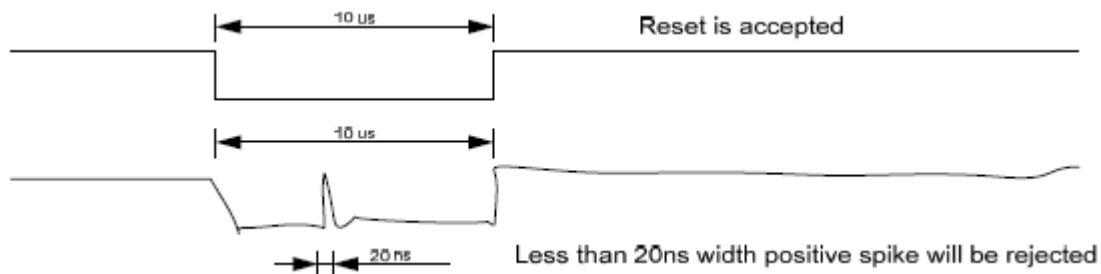
Note 2 : A spike due to an electrostatic discharge on the RESX line does not cause irregular system reset, according to the Reset Description.

Reset Description

RESX Pulse	Action
Shorter than 5µs	Reset Rejected
Longer than 9µs	Reset
Between 5µs and 9µs	Reset starts

Note 3 : During the Resetting period, the display will be blanked (When Reset starts in the Sleep Out mode, the display will enter the blanking sequence in at least 120 ms. The display remains blank in the Sleep In mode.), and then return to the default condition for the Hardware Reset.

Note 4 : Spike Rejection can also be applied during a valid reset pulse as shown below:



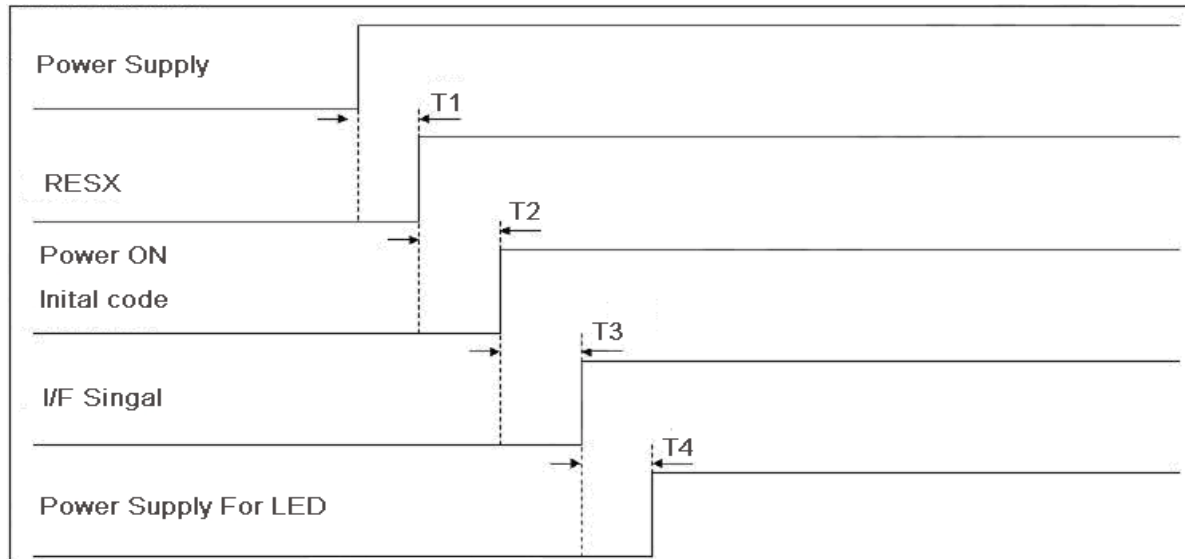
Note 5 : When Reset applied during Sleep In Mode.

Note 6 : When Reset applied during Sleep Out Mode.

Note 7 : It is necessary to wait 5msec after releasing the RESX before sending commands. Moreover, the Sleep Out command cannot be sent in 120msec.

10.5 power ON/OFF sequence:

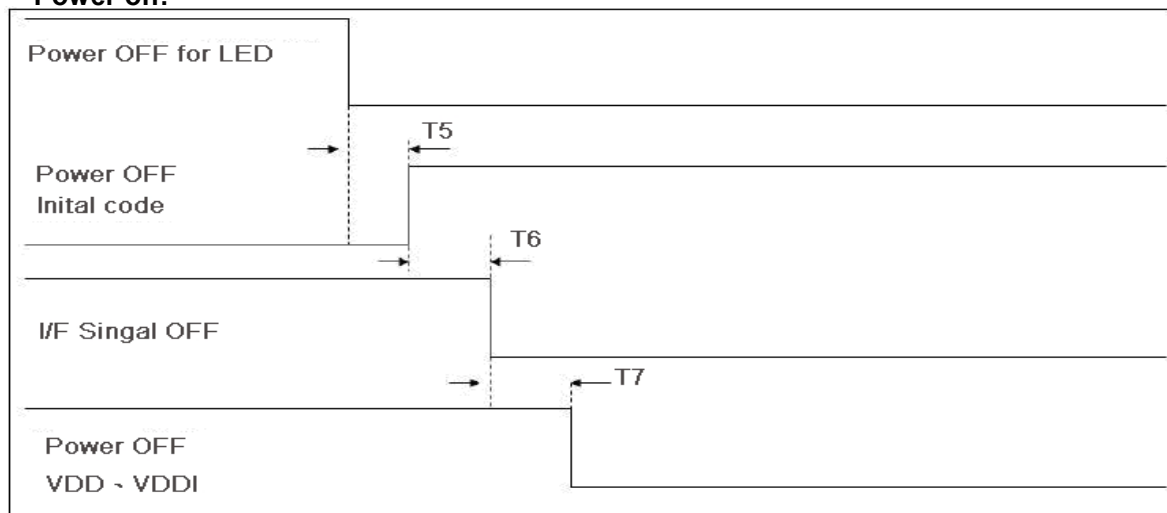
Power on:



$10\text{ms} \leq T1 \leq 20\text{ms}$; $50\text{ms} \leq T2 \leq 100\text{ms}$

$100\text{ms} \leq T3 \leq 200\text{ms}$; $100\text{ms} \leq T4 \leq 200\text{ms}$

Power off:

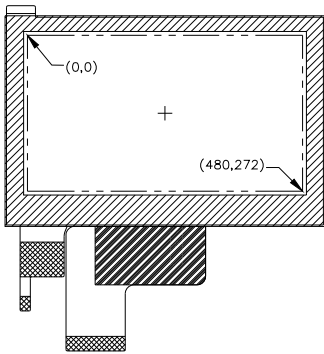


$50\text{ms} \leq T5 \leq 100\text{ms}$; $50\text{ms} \leq T6 \leq 100\text{ms}$

$100\text{ms} \leq T7 \leq 200\text{ms}$

11. CTP Interface And Data Format

11.1 CTP Absolute Maximum Rating

Item	Specification	Unit
Type	Transparent type projected capacitive touch panel	
Input mode	Human's finger	
Multi touch	5	Point
(X,Y) Position		

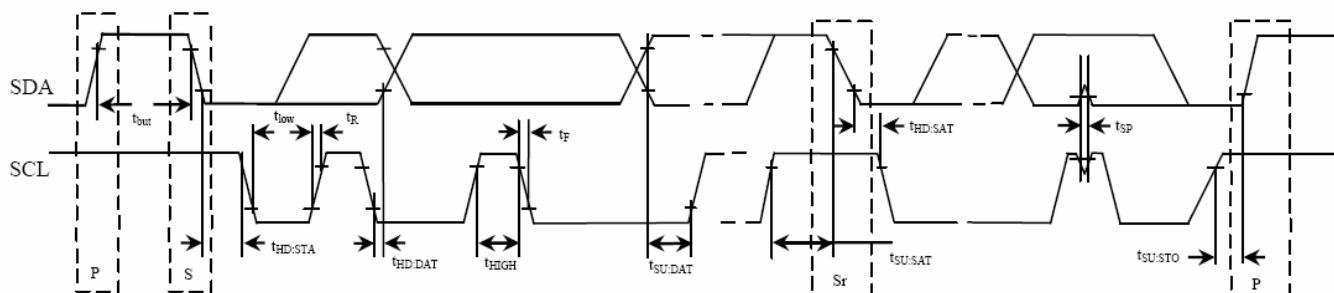
Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Supply voltage	Vcc	-0.3	-	7	V
Switch control signals output current	Output current	-	50	-	mA
Enable control voltage range	Logic Input	-0.3	-	Vcc+0.3	V
Output Control Driver	Output voltage	-0.3	-	Vcc	V

11.2 CTP Electrical Characteristic

Symbol	Descri	ption	Min	Typ	Max	Unit	Notes
VCC	Supply voltage		2.5	3.3	3.5	V	
IVCC	Supply current			14		mA	

11.3 Interface and Data Format(Slave address is 0X94H)

11.3.1 AC characteristics of the SDA and SCL bus lines for I²C-bus devices



Parameter	Symbol	Standard-Mode I ² C-BUS		Fast-Mode I ² C-BUS		Unit
		Min.	Max.	Min.	Max.	
SCL clock frequency	f_{SCL}	0	100	0	400	KHz
Bus free time between STOP and START condition	t_{BUF}	4.7	-	1.3	-	μs
Hold time (repeated) START condition. After this period, the first clock pulse is generated	$t_{HD:STA}$	4.0	-	0.6	-	μs
LOW period of the SCL clock	t_{LOW}	4.7	-	1.3	-	μs
HIGH period of the SCL clock	t_{HIGH}	4.0	-	0.6	-	μs
Set-up time for a repeated START condition	$t_{SU:STA}$	4.7	-	0.6	-	μs
Data hold time	$t_{HD:DAT}$	0	-	0	0.9	μs
Data set-up time	$t_{SU:DAT}$	250	-	100	-	μs
Rise time of both SDA and SCL signals	t_R	-	1000	$20+0.1C_b$	300	μs
Fall time of both SDA and SCL signals	t_F	-	300	$20+0.1C_b$	300	μs
Set-up time for STOP condition	$t_{SU:STO}$	4.0	-	0.6	-	μs

Note :

- (1) All values are referred to VIH (0.7xV_{CC}) and VIL (0.3xV_{CC}) level.
- (2) A device must internally provide a hold time of at least 300ns for the SDA signal (referred to the VIH of the SCL signal) in order to bridge the undefined region of the falling edge of SCL.
- (3) The maximum $t_{HD:DAT}$ has only to be met if the device does not stretch the LOW period (t_{LOW}) of the SCL signal.
- (4) A fast-mode I²C-bus device can be used in a standard-mode I²C-bus system, but the requirement $t_{SU:DAT} \geq 250ns$ must then be met. This will automatically be the case if the device does not stretch the LOW period of the SCL signal. If such a device does stretch the LOW period of the SCL signal, it must output the next data bit to the SDA line $t_{R\ max} \ t_{SU:DAT} = 21000+250=1250ns$ (according to the standard-mode I²C-bus specification) before the SCL line is released.
- (5) C_b = total capacitance of one bus line in pF.

11.4 CTP Pin Connections

No.	Name	I/O	Description
1	VCC	-	Power; VCC=3.3V
2	RES	I	NC pin; please keep floating
3	INT	O	Active low when data output from touch panel
4	SDA	I	Serial data access
5	SCL	I	Clock; 100KHz
6	VSS	-	Ground

11.5 CTP Command

11.5.1 Command list

Hex	Operation Code	D7	D6	D5	D4	D3	D2	D1	D0	Function
0	No operation	0	0	0	0	0	0	0	0	-
80	Sleep IN	1	0	0	0	0	0	0	0	-
81	Sleep Out	1	0	0	0	0	0	0	1	-
82	Sense Off	1	0	0	0	0	0	1	0	-
83	Sense On	1	0	0	0	0	0	1	1	-
85	Read Event	1	0	0	0	0	1	0	1	-
	1st parameter	B31	B30	B29	B28	B27	B26	B25	B24	-
	2nd parameter	B23	B22	B21	B20	B19	B18	B17	B16	-
	3rd parameter	B15	B14	B13	B12	B11	B10	B9	B8	-
	4th parameter	B7	B6	B5	B4	B3	B2	B1	B0	-
86	Read All Events	1	0	0	0	0	1	1	0	-
	1st parameter	B31	B30	B29	B28	B27	B26	B25	B24	-
	2nd parameter	B23	B22	B21	B20	B19	B18	B17	B16	-
	3rd parameter	B15	B14	B13	B12	B11	B10	B9	B8	-
	4th parameter	B7	B6	B5	B4	B3	B2	B1	B0	-
	5th parameter	E3	E2	E1	E0	F1	P2	P1	P0	-
	6th parameter	B23	B22	B21	B20	B19	B18	B17	B16	-
	...	:	:	:	:	:	:	:	:	-
87	(n+1)th parameter	B7	B6	B5	B4	B3	B2	B1	B0	-
	Read Latest Event	1	0	0	0	0	1	1	1	-
	1st parameter	B31	B30	B29	B28	B27	B26	B25	B24	-
	2nd parameter	B23	B22	B21	B20	B19	B18	B17	B16	-
	3rd parameter	B15	B14	B13	B12	B11	B10	B9	B8	-
88	4th parameter	B7	B6	B5	B4	B3	B2	B1	B0	-
	Clear Stack	1	0	0	0	1	0	0	0	-

11.5.2 User define command list table

Hex	Operation Code	D7	D6	D5	D4	D3	D2	D1	D0	Function
31h	Device ID	0	0	1	1	0	0	0	1	Response Device ID Code
	1st parameter	85								-
	2nd parameter	20								-
	3rd parameter	00								-
32h	Version ID	0	0	1	1	0	0	0	1	Read Firmware version

11.5.3 CTP Command description

11.5.3.1 NOP

00 H	NOP (No Operation)									
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command	0	0	0	0	0	0	0	0	0	00
Parameter	No parameter									
Description	This command is an empty command and it does not have any effect on the touch screen.									
Restriction	-									
Register Availability	Status				Availability					
	TS Sleep Out				Yes					
	TS Sleep In				Yes					
Default	Status				Default Value					
	Power Up Sequence				N/A					
	TS S/W Reset				N/A					
	H/W Reset				N/A					
Flow Chart	-									

11.5.3.2 TS sleep in (80h)

80 H	TSSLPIN (Touch Screen Sleep In)																	
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX								
Command	0	1	0	0	0	0	0	0	0	80								
Parameter	No parameter																	
Description	This command causes the touch screen to enter the minimum power consumption mode. MCU interface are register are still working and keeps their contents.																	
Restriction	This command has no effect when the touch screen is already in TS Sleep In mode TS Sleep In Mode can only be left by the TS Sleep Out Command (81h). It will be necessary to wait 5msec before sending next command. This is to allow time for the supply voltages and clock circuits to stabilize. It will be necessary to wait 5msec after sending TS Sleep Out command (when in TS Sleep In Mode) before TS Sleep In command can be sent.																	
Register Availability	<table><tr><th>Status</th><th>Availability</th></tr><tr><td>TS Sleep Out</td><td>Yes</td></tr><tr><td>TS Sleep In</td><td>Yes</td></tr></table>										Status	Availability	TS Sleep Out	Yes	TS Sleep In	Yes		
Status	Availability																	
TS Sleep Out	Yes																	
TS Sleep In	Yes																	
Default	<table><tr><th>Status</th><th>Default Value</th></tr><tr><td>Power Up Sequence</td><td>TS Sleep In Mode</td></tr><tr><td>TS S/W Reset</td><td>TS Sleep In Mode</td></tr><tr><td>H/W Reset</td><td>TS Sleep In Mode</td></tr></table>										Status	Default Value	Power Up Sequence	TS Sleep In Mode	TS S/W Reset	TS Sleep In Mode	H/W Reset	TS Sleep In Mode
Status	Default Value																	
Power Up Sequence	TS Sleep In Mode																	
TS S/W Reset	TS Sleep In Mode																	
H/W Reset	TS Sleep In Mode																	
Flow Chart	TSSLPIN Stop DC/DC converter Stop Internal Oscillator TS Sleep In Mode Legend Command Parameter Touch Screen Action Mode Sequential transfer																	

11.5.3.3 TS sleep out (81h)

81 H	TSSLPOUT (Touch Screen Sleep Out)									
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command	0	1	0	0	0	0	0	0	1	81
Parameter	No parameter									
Description	This command turns off TS Sleep In mode.									
Restriction	This command has no effect when touch screen is already in TS Sleep Out mode. TS Sleep Out Mode can only be left by the TS Sleep In Command (80h). It will be necessary to wait 5msec before sending next command. This is to allow time for the supply voltages and clock circuits to stabilize. The touch screen loads all touch screen supplier's factory default values to the registers during this 5msec and there cannot be any abnormal effect on the touch screen functionality if factory default and register values are same when this load is done and when the touch screen is already TS Sleep Out – mode. It will be necessary to wait 5msec after sending TS Sleep In command (when in TS Sleep Out mode) before TS Sleep Out command can be sent.									
Register Availability	Status		Availability							
	TS Sleep Out		Yes							
	TS Sleep In		Yes							
Default	Status		Default Value							
	Power Up Sequence		TS Sleep In Mode							
	TS S/W Reset		TS Sleep In Mode							
	H/W Reset		TS Sleep In Mode							
Flow Chart	TSSLPOUT Start Internal Oscillator Start up DC/DC converter TS Sleep Out Mode Legend Command Parameter Touch Screen Action Mode Sequential transfer									

11.5.3.4 TS sense off (82h)

82 H	TSSOFF (Touch Screen Sense Off)									
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command	0	1	0	0	0	0	0	1	0	82
Parameter	No parameter									
Description	The touch screen is not sensing touches (= No new events), but the touch screen is still scanning.									
Restriction	-									
Register Availability	Status				Availability					
	TS Sleep Out				Yes					
	TS Sleep In				Yes					
Default	Status				Default Value					
	Power Up Sequence				TS Sense Off					
	TS S/W Reset				TS Sense Off					
	H/W Reset				TS Sense Off					
Flow Chart	TSSOFF ↓ TS Sense Off Legend Command Parameter Touch Screen Action Mode Sequential transfer									

11.5.3.5 TS sense on (83h)

83 H	TSSON (Touch Screen Sense On)									
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command	0	1	0	0	0	0	0	1	1	83
Parameter	No parameter									
Description	The touch screen is sensing touches (= No new events).									
Restriction	-									
Register Availability	Status				Availability					
	TS Sleep Out				Yes					
	TS Sleep In				Yes					
Default	Status				Default Value					
	Power Up Sequence				TS Sense Off					
	TS S/W Reset				TS Sense Off					
	H/W Reset				TS Sense Off					
Flow Chart	TSSON ↓ TS Sense On Legend Command Parameter Touch Screen Action Mode Sequential transfer									

11.5.3.6 Read One Event (85h)

85 H	ROE (Read One Event)																	
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX								
Command	0	1	0	0	0	0	1	0	1	85								
1 st parameter	-	B31	B30	B29	B28	B27	B26	B25	B24	xx								
2 nd parameter	-	B23	B22	B21	B20	B19	B18	B17	B16	xx								
3 rd parameter	-	B15	B14	B13	B12	B11	B10	B9	B8	xx								
4 th parameter	-	B7	B6	B5	B4	B3	B2	B1	B0	xx								
Description	This command returns touch co-ordinates what is the oldest co-ordinates information what has been stored on the stock. A returning value can be “No Event” if the stock is empty. The default assignment is list as below. The assignment of event stack also can be modified if necessary (base on the requirement of customer). HX8520-C Event stack Yn (Low byte) . Y1 (Low byte) Y1 (High byte) X1 (Low byte) X1 (High byte) ← Pointer																	
Restriction	-																	
Register Availability	<table><tr><td>Status</td><td>Availability</td></tr><tr><td>TS Sleep Out</td><td>Yes</td></tr><tr><td>TS Sleep In</td><td>Yes</td></tr></table>										Status	Availability	TS Sleep Out	Yes	TS Sleep In	Yes		
Status	Availability																	
TS Sleep Out	Yes																	
TS Sleep In	Yes																	
Default	<table><tr><td>Status</td><td>Default Value</td></tr><tr><td>Power Up Sequence</td><td>0000 0000h</td></tr><tr><td>TS S/W Reset</td><td>0000 0000h</td></tr><tr><td>H/W Reset</td><td>0000 0000h</td></tr></table>										Status	Default Value	Power Up Sequence	0000 0000h	TS S/W Reset	0000 0000h	H/W Reset	0000 0000h
Status	Default Value																	
Power Up Sequence	0000 0000h																	
TS S/W Reset	0000 0000h																	
H/W Reset	0000 0000h																	
Flow Chart	ROE Host Touch Screen Send 1st parameter Send 2nd parameter Send 3rd parameter Send 4th parameter Legend Command Parameter Touch Screen Action Mode Sequential transfer																	

11.5.3.7 Read All Event (86h)

86 H	RAE (Read All Events)															
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX						
Command	0	1	0	0	0	0	1	1	0	86						
1 st parameter	-	B31	B30	B29	B28	B27	B26	B25	B24	xx						
2 nd parameter	-	B23	B22	B21	B20	B19	B18	B17	B16	xx						
3 rd parameter	-	B15	B14	B13	B12	B11	B10	B9	B8	xx						
4 th parameter	-	B7	B6	B5	B4	B3	B2	B1	B0	xx						
5 th parameter	-	E3	E2	E1	E0	F1	P2	P1	P0	xx						
6 th parameter	-	B23	B22	B21	B20	B19	B18	B17	B16	xx						
:	-	:	:	:	:	:	:	:	:	:						
(n+1) th Parameter	-	B7	B6	B5	B4	B3	B2	B1	B0	xx						
Description	This command returns touch co-ordinates what is the oldest co-ordinates information what has been stored on the stock. A returning value can be "No Event" if the stock is empty. The default assignment is list as below. The assignment of event stack also can be modified if necessary (base on the requirement of customer). HX8520-C Event stack Yn (Low byte) . Y1 (Low byte) Y1 (High byte) X1 (Low byte) X1 (High byte) ← Pointer															
Restriction	This read command cannot use with LoSSI.															
Register Availability	<table><tr><td>Status</td><td>Availability</td></tr><tr><td>TS Sleep Out</td><td>Yes</td></tr><tr><td>TS Sleep In</td><td>Yes</td></tr></table>										Status	Availability	TS Sleep Out	Yes	TS Sleep In	Yes
Status	Availability															
TS Sleep Out	Yes															
TS Sleep In	Yes															
Default	<table><tr><td>Status</td><td>Default Value</td></tr><tr><td>Power Up Sequence</td><td>All Values 0000 0000h</td></tr><tr><td>TS S/W Reset</td><td>All Values 0000 0000h</td></tr></table>										Status	Default Value	Power Up Sequence	All Values 0000 0000h	TS S/W Reset	All Values 0000 0000h
Status	Default Value															
Power Up Sequence	All Values 0000 0000h															
TS S/W Reset	All Values 0000 0000h															
Flow Chart	I²C Mode Read RAE Host Events Touch Screen Legend Command Parameter Touch Screen Action Mode Sequential transfer															

11.5.3.8 Read Latest Event (87h)

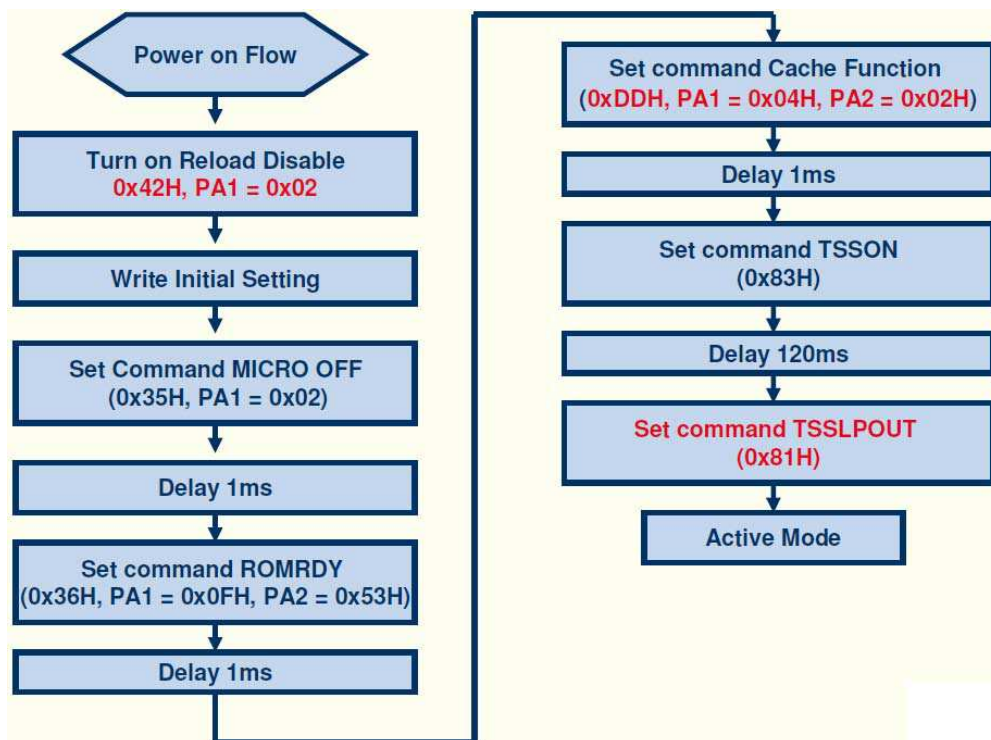
87H	RLE (Read Latest Event)																	
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX								
Command	0	1	0	0	0	0	1	1	1	87								
1 st parameter	-	B31	B30	B29	B28	B27	B26	B25	B24	xx								
2 nd parameter	-	B23	B22	B21	B20	B19	B18	B17	B16	xx								
3 rd parameter	-	B15	B14	B13	B12	B11	B10	B9	B8	xx								
4 th parameter	-	B7	B6	B5	B4	B3	B2	B1	B0	xx								
Description	This command returns one touch event what is the latest co-ordinates information what has been stored on the stock. The event stack is empty after this command. A returning value can be “No Event” if the stock is empty. The default assignment is list as below. The assignment of event stack also can be modified if necessary (base on the requirement of customer). HX8520-C Event stack Yn (Low byte) . Y1 (Low byte) Y1 (High byte) X1 (Low byte) X1 (High byte) ← Pointer																	
Restriction	-																	
Register Availability	<table><tr><td>Status</td><td>Availability</td></tr><tr><td>TS Sleep Out</td><td>Yes</td></tr><tr><td>TS Sleep In</td><td>Yes</td></tr></table>										Status	Availability	TS Sleep Out	Yes	TS Sleep In	Yes		
Status	Availability																	
TS Sleep Out	Yes																	
TS Sleep In	Yes																	
Default	<table><tr><td>Status</td><td>Default Value</td></tr><tr><td>Power Up Sequence</td><td>0000 0000h</td></tr><tr><td>TS S/W Reset</td><td>0000 0000h</td></tr><tr><td>H/W Reset</td><td>0000 0000h</td></tr></table>										Status	Default Value	Power Up Sequence	0000 0000h	TS S/W Reset	0000 0000h	H/W Reset	0000 0000h
Status	Default Value																	
Power Up Sequence	0000 0000h																	
TS S/W Reset	0000 0000h																	
H/W Reset	0000 0000h																	
Flow Chart	Read RLE Send 1st parameter Send 2nd parameter Send 3rd parameter Send 4th parameter Host Touch Screen Legend Command Parameter Touch Screen Action Mode Sequential transfer																	

11.5.3.9 Clear Event Stack (88h)

88 H	CLRES (Clear Event Stack)									
	DNC	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command	0	1	0	0	0	1	0	0	0	88
Parameter	No parameter									
Description	This command clears event stack when the only return event can be “No Event”.									
Restriction	-									
Register Availability	Status			Availability						
	TS Sleep Out			Yes						
	TS Sleep In			Yes						
Default	Status			Default Value						
	Power Up Sequence			Empty Stack						
	TS S/W Reset			Empty Stack						
	H/W Reset			Empty Stack						
Flow Chart	CLRES ↓ Clear Event Stack Legend Command Parameter Touch Screen Action Mode Sequential transfer									

11.5.3.10 Initialize the CTP controller

Set Command Reload Disable = 1 (0x42H, PA1 = 0x02)
Write Initial Stetting (This step will only be executed in the first time power on sequence)
Set Command MICRO OFF (0x35H, PA1 = 0x02) to turn on internal MCU
Delay 1ms
Set command ROMRDY (0x36H, PA1 = 0x0FH, PA2 = 0x53H) to turn on internal flash.
Delay 1ms
Set command Cache Function (0xDDH, PA1 = 0x04H, PA2 = 0x02H) (*Note : PA1 is changeable)
Delay 1ms
Set command TSSON (0x83H) to starting touch sensing.
Delay 120ms
Set command TSSLPOUT (0x81H) to turn on internal power.



11.5.3.11 Data Format

When finger touch, enter event will occurred and coordinate data will be calculated, and than interrupt signal appear (TSIX pull low).

Baseband should receive data when interrupt occur.

ID Inf * 1							
ID 8	ID 7	ID 6	ID 5	ID 4	ID 3	ID 2	ID 1
ID Inf * 2							
Virtual Key				X	X	ID10	ID 9

Figure 9.5.4.1

Note : ID6,ID7,ID8,ID9,ID10 Don't Care.

	Max Ponit	5 Finger			
	Total Bytes	32 Bytes			
Byte1	write_event4	Coordinate 1st	Byte23	write_event2	Finger Size 3rd
Byte2	write_event3		Byte24	write_event1	Finger Size 4th
Byte3	write_event2		Byte25	write_event4	Finger Size 5th
Byte4	write_event1		Byte26	write_event3	Dummy
Byte5	write_event4	Coordinate 2nd	Byte27	write_event2	Dummy
Byte6	write_event3		Byte28	write_event1	Dummy
Byte7	write_event2		Byte29	write_event4	Point Number
Byte8	write_event1		Byte30	write_event3	ID Inf *1
Byte9	write_event4	Coordinate 3rd	Byte31	write_event2	ID Inf *2
Byte10	write_event3		Byte32	write_event1	Checksum(LSB)
Byte12	write_event1				
Byte13	write_event4	Coordinate 4th			
Byte14	write_event3				
Byte15	write_event2				
Byte16	write_event1				
Byte17	write_event4	Coordinate 5th			
Byte18	write_event3				
Byte19	write_event2				
Byte20	write_event1				
Byte21	write_event4	Finger Size 1st			
Byte22	write_event3	Finger Size 2nd			

12. RELIABILITY TEST

12.1 Test Condition

12.1.1 Temperature and Humidity(Ambient Temperature)

Temperature : $25 \pm 5^{\circ}\text{C}$

Humidity : $65 \pm 5\%$

12.1.2 Operation

Unless specified otherwise, test will be conducted under function state.

12.1.3 Container

Unless specified otherwise, vibration test will be conducted to the product itself without putting it in a container.

12.1.4 Test Frequency

In case of related to deterioration such as shock test. It will be conducted only once.

12.1.5 Test Method

No.	Reliability Test Item & Level	Test Level	Remark
1	High Temperature Storage Test	T=80°C,240hrs	IEC68-2-2
2	Low Temperature Storage Test	T=-30°C,240hrs	IEC68-2-1
3	High Temperature Operation Test	T=70°C,240hrs	IEC68-2-2
4	Low Temperature Operation Test	T=-20°C,240hrs	IEC68-2-1
5	High Temperature and High Humidity Operation Test	T=60°C,90% RH,240hrs	IEC68-2-3
6	Thermal Cycling Test (No operation)	-30°C → +25°C → +80°C,200 Cycles 30 min 5min 30 min	IEC68-2-14
7	Vibration Test (No operation)	Frequency:0 ~ 55 Hz Amplitude:1.5 mm Sweep Time:11min Test Period:6 Cycles for each Direction of X,Y,Z	IEC68-2-6
8	Electrostatic Discharge Test (No operation)	150pF,330Ω Air:± 15KV;Contact: ± 8KV 10 times/point;4 points/panel face	IEC-61000-4-2

13. APPEARANCE SPECIFICATION

13.1 Inspection and Environment conditions

13.1.1 Temperature: $25 \pm 5^\circ\text{C}$

13.1.2 Humidity: $55 \pm 10\% \text{ RH}$

13.1.3 Light source: Fluorescent Light

13.1.4 Inspection: Viewing distance: $35 \pm 5\text{cm}$

13.1.5 Ambient Illumination:

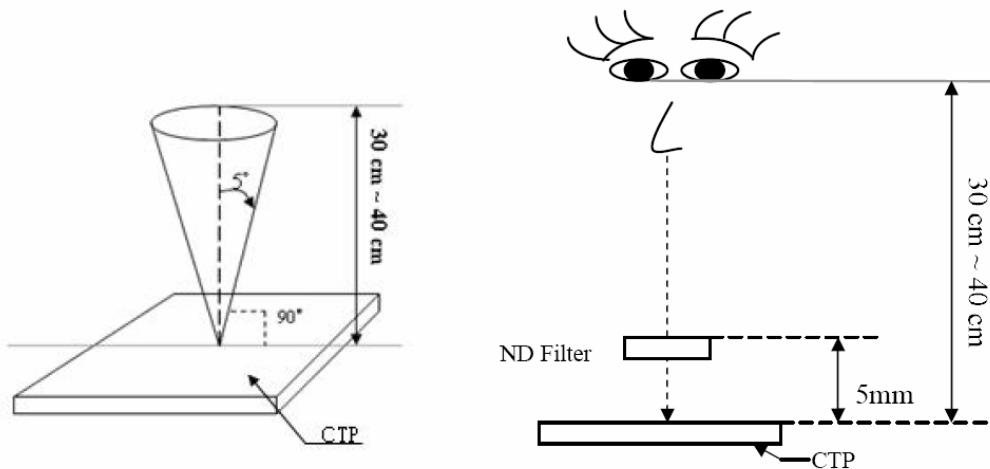
(1) Cosmetic Inspection: 500 ~ 800 lux

(2) Functional Inspection: 400 ~ 600 lux

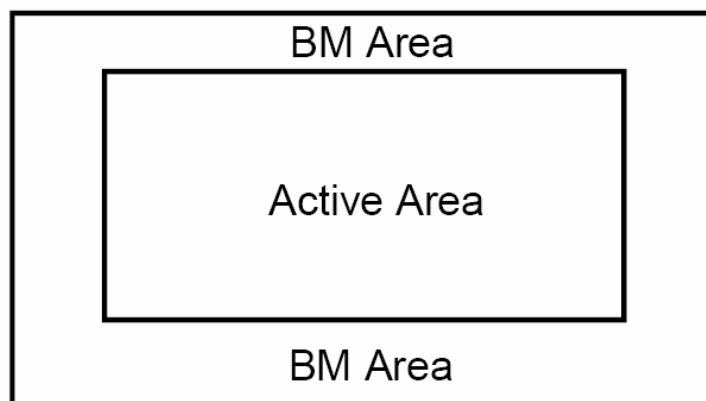
13.1.6 Inspection View angle:

(1) Inspection under operating condition: $\pm 5^\circ$

(2) Inspection under non-operating condition: $\pm 45^\circ$



13.2 Definition of applicable Zones



13.3 Judgment standard

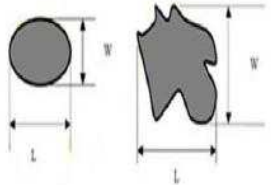
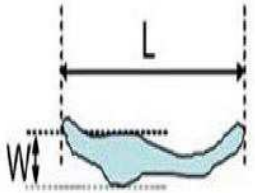
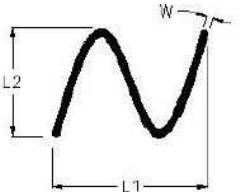
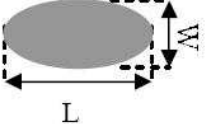
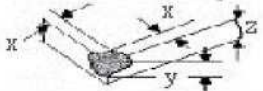
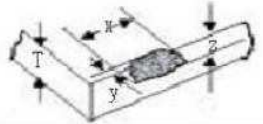
The Judgment of the above test should be made after exposure in room temperature for two hours as follow:

Pass: Normal display image with no obvious non-uniformity and no line defect.

Partial transformation of the module parts should be ignored.

Fail: No display image, obvious non-uniformity, or line defect.

13.4 Cosmetic Specification and Inspection Items

Inspection Item	Inspection Criteria	Illustration										
Foreign material (Black or White spots shape)	<table> <tr> <th>Zone Dimension</th><th>Acceptable number</th><th>Class of Defects</th></tr> <tr> <td>$D > 0.8 \text{ mm}$</td><td>0</td><td rowspan="3">Minor</td></tr> <tr> <td>$0.3 \text{ mm} \leq D \leq 0.8 \text{ mm}$</td><td>5</td></tr> <tr> <td>$D < 0.3 \text{ mm}$</td><td>*</td></tr> </table>	Zone Dimension	Acceptable number	Class of Defects	$D > 0.8 \text{ mm}$	0	Minor	$0.3 \text{ mm} \leq D \leq 0.8 \text{ mm}$	5	$D < 0.3 \text{ mm}$	*	 $D = (L + W) / 2$
Zone Dimension	Acceptable number	Class of Defects										
$D > 0.8 \text{ mm}$	0	Minor										
$0.3 \text{ mm} \leq D \leq 0.8 \text{ mm}$	5											
$D < 0.3 \text{ mm}$	*											
Foreign Material (Line shape)	<table> <tr> <th>Zone Dimension</th><th>Acceptable number</th><th>Class of Defects</th></tr> <tr> <td>$W > 0.1 \text{ mm}$ or $L > 10 \text{ mm}$</td><td>0</td><td rowspan="3">Minor</td></tr> <tr> <td>$0.05 \text{ mm} \leq W \leq 0.1 \text{ mm}$ $L \leq 10 \text{ mm}$</td><td>5</td></tr> <tr> <td>$W < 0.05 \text{ mm}$</td><td>*</td></tr> </table>	Zone Dimension	Acceptable number	Class of Defects	$W > 0.1 \text{ mm}$ or $L > 10 \text{ mm}$	0	Minor	$0.05 \text{ mm} \leq W \leq 0.1 \text{ mm}$ $L \leq 10 \text{ mm}$	5	$W < 0.05 \text{ mm}$	*	 L : Long W : Width
Zone Dimension	Acceptable number	Class of Defects										
$W > 0.1 \text{ mm}$ or $L > 10 \text{ mm}$	0	Minor										
$0.05 \text{ mm} \leq W \leq 0.1 \text{ mm}$ $L \leq 10 \text{ mm}$	5											
$W < 0.05 \text{ mm}$	*											
Dimension	Outline	(Major)										
Scratch on the Touch panel	<table> <tr> <th>Zone Dimension</th><th>Acceptable number</th><th>Class of Defects</th></tr> <tr> <td>$W > 0.1 \text{ mm}$ or $L > 10 \text{ mm}$</td><td>0</td><td rowspan="2">Minor</td></tr> <tr> <td>$W \leq 0.1 \text{ mm}$ $L \leq 10 \text{ mm}$</td><td>5</td></tr> </table>	Zone Dimension	Acceptable number	Class of Defects	$W > 0.1 \text{ mm}$ or $L > 10 \text{ mm}$	0	Minor	$W \leq 0.1 \text{ mm}$ $L \leq 10 \text{ mm}$	5			
Zone Dimension	Acceptable number	Class of Defects										
$W > 0.1 \text{ mm}$ or $L > 10 \text{ mm}$	0	Minor										
$W \leq 0.1 \text{ mm}$ $L \leq 10 \text{ mm}$	5											
Dent on the Touch panel	<table> <tr> <th>Zone Dimension</th><th>Acceptable number</th><th>Class of Defects</th></tr> <tr> <td>$D > 0.5 \text{ mm}$</td><td>0</td><td rowspan="2">Minor</td></tr> <tr> <td>$0.3 \text{ mm} \leq D \leq 0.5 \text{ mm}$</td><td>5</td></tr> </table>	Zone Dimension	Acceptable number	Class of Defects	$D > 0.5 \text{ mm}$	0	Minor	$0.3 \text{ mm} \leq D \leq 0.5 \text{ mm}$	5	 $D = (L + W) / 2$		
Zone Dimension	Acceptable number	Class of Defects										
$D > 0.5 \text{ mm}$	0	Minor										
$0.3 \text{ mm} \leq D \leq 0.5 \text{ mm}$	5											
Corner Chipping	$X < 3 \text{ mm}$, $Y < 3 \text{ mm}$, $Z < \text{Glass thickness}$											
Edge Chipping	$X < 3 \text{ mm}$, $Y < 3 \text{ mm}$, $Z < \text{Glass thickness}$											
Crack	reject											