



Display Solutions tailored
for your Application

DATASHEET

TX22D200VM0AVA

KOE

JDI Group

TENTATIVE

Kaohsiung Opto-Electronics Inc.

FOR MESSRS : _____

DATE : Dec. 14th, 2018

TECHNICAL DATA

TX22D200VM0AVA

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ACCEPTED BY: _____

PROPOSED BY: Oblack Tsai

2. RECORD OF REVISION

DATE	SHEET No.	SUMMARY

3. GENERAL DATA

3.1 DISPLAY FEATURES

This module is a 8.8" HD of 16:9 format of LTPS TFT. The pixel format is vertical stripe and sub pixels are arranged as R (red), G (green), B (blue) sequentially. This display is RoHS compliant, COG (chip on glass) technology and LED backlight are applied on this display.

Part Name	TX22D200VM0AVA
Module Dimensions	217.8(W) mm x 135.2(H) mm x 14.4 (D) mm
LCD Active Area	193.152(W) mm x 108.648(H) mm
Pixel Pitch	0.1509(W) mm x 0.1509 (H) mm
Resolution	1280 x 3(RGB)(W) x 720(H) Dots
Color Pixel Arrangement	R, G, B Vertical Stripe
LCD Type	Transmissive Color TFT; Normally Black
Display Type	Active Matrix
Number of Colors	16.7M Colors(8 bit RGB)
Backlight	Light Emitting Diode (LED)
Weight	412g
Interface	LVDS; 40 pins
Power Supply Voltage	3.3V for LCD; 12V for Backlight
Power Consumption	0.43W for LCD; 6.8W for Backlight
Viewing Direction	Super Wide Version (In-Plane Switching)
Touch Technology	In-Cell, Capacitive
Optical Bonding	OCR (Optically Clear Resin)

4. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Remarks
Supply Voltage	V_{CC1}/V_{CC2}	-0.3	3.6	V	-
Input Voltage of Logic	V_I	-0.3	$V_{CC1} \cdot 2 + 0.3$	V	Note 1
Operating Temperature	Top	-30	80	°C	Note 2
Storage Temperature	Tst	-30	80	°C	Note 2
Backlight Input Voltage	V_{LED}	-	15	V	-

Note 1: The rating is defined for the signal voltages of the interface such as CLK and pixel data pairs and touch's signals(XRESB、SCLK、SSB、MOSI、MISO、ATTN).

Note 2: The maximum rating is defined as above based on the glass surface temperature, which might be different from ambient temperature after assembling the panel into the application.
Moreover, some temperature-related phenomenon as below needed to be noticed:

- Background color, contrast and response time would be different in temperatures other than 25°C.
- Operating under high temperature will shorten LED lifetime.

5. ELECTRICAL CHARACTERISTICS

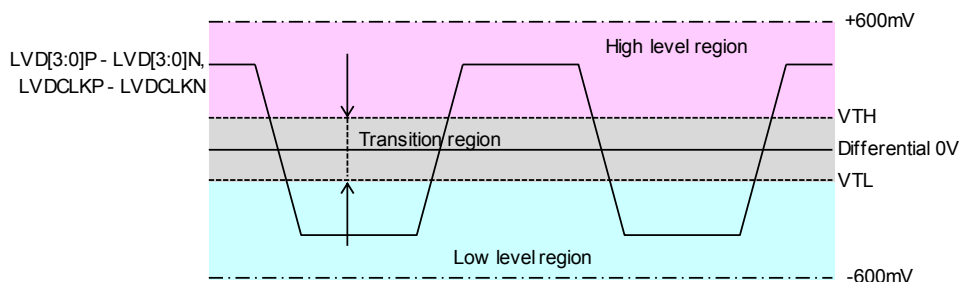
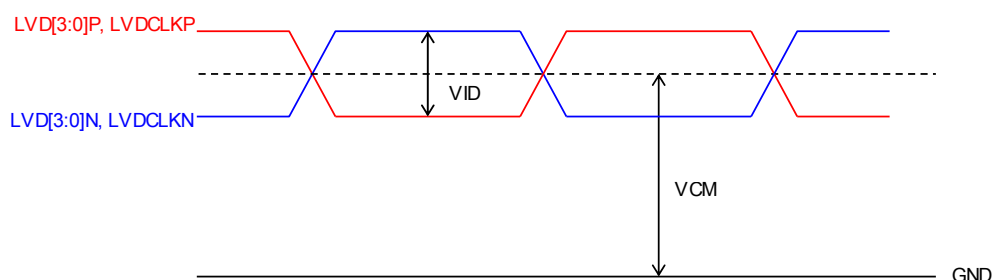
5.1 DC CHARACTERISTICS OF GENERAL

$T_a = 25\text{ }^{\circ}\text{C}$, GND = 0V

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Power Supply voltage	V_{CC1}	-	3	3.3	3.6	V	
Power Supply current	I_{CC1}	-	-	130	170	mA	
Permissive ripple	PRV	-	-	-	100	mVpp	Note1
Differential threshold high voltage	VTH	VCM = 1.25V	-	-	100	mV	
Differential threshold low voltage	VTL	VCM = 1.25V	-100	-	-	mV	
Input differential voltage	VID	-	250	450	600	mV	
Common voltage	VCM	-	1	1.25	1.5	V	
Termination resistor	RTRM	-	98	100	102	ohm	

Note 1: Applied pin { V_{CC1} }

Note 2: (TBD) fuse is applied in the module for I_{CC} . For display activation and protection purpose, power supply is recommended larger than (TBD) to start the display and break fuse once any short circuit occurred.



5.2 BACKLIGHT CHARACTERISTICS

$T_a = 25^\circ\text{C}$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
LED Input Voltage	V_{LED}	$I_{\text{LED}}=570\text{mA}$	11.5	12	12.5	V	Note 1
LED Forward Current	I_{LED}	3.3V; 100% duty	(TBD)	570	(TBD)	mA	Note 2
		0.2 V; 0% duty	(TBD)	(TBD)	(TBD)		
PWM Signal Voltage	-	High Level	2.5	3.3	5	V	-
		Low Level	-	-	0.9		
EN Voltage	V_{EN}	-	2.5	3.3	5.0	V	-
LED Lifetime	-	$I_{\text{LED}}=570\text{mA}$	-	50K	-	hrs	Note 3

Note 1: Fig. 5.1 shows the LED backlight circuit.

Note 2: Dimming function can be obtained by applying PWM signal from the display interface CN. The recommended PWM signal is 1K ~ 10KHz with 3.3 V amplitude.

Note 3: The estimated lifetime is specified as the time to reduce 50% brightness by applying 570mA at 25°C .

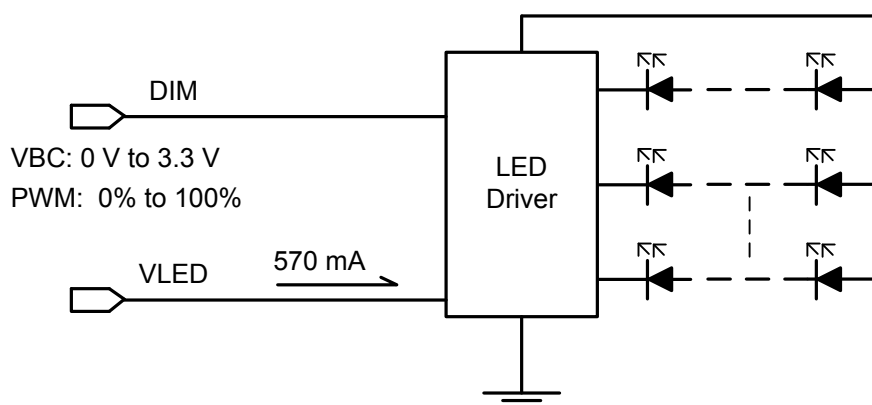


Fig 5.1

6. OPTICAL CHARACTERISTICS

The optical characteristics are measured based on the conditions as below:

- Supplying the signals and voltages defined in the section of electrical characteristics.
- The backlight unit needs to be turned on for 30 minutes.
- The ambient temperature is 25 °C .
- In the dark room less than 100 lx, the equipment has been set for the measurements as shown in Fig 6.1.

$$T_a = 25\text{ }^{\circ}\text{C}, f_{\text{Frame}} = 60\text{ Hz}, V_{\text{DD}} = 3.3\text{ V}$$

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Brightness of White		-	$\phi = 0^{\circ}, \theta = 0^{\circ}$, $I_{\text{LED}} = 570\text{ mA}$	640	800	-	cd/m ²	Note 1
Brightness Uniformity		-		70	-	-	%	Note 2
Contrast Ratio		CR		500	1000	-	-	Note 3
Response Time		$T_r + T_f$	$\phi = 0^{\circ}, \theta = 0^{\circ}$	-	25	-	ms	Note 4
NTSC Ratio		-	$\phi = 0^{\circ}, \theta = 0^{\circ}$	-	74	-	%	-
Viewing Angle		θ_x	$\phi = 0^{\circ}, \text{CR} \geq 10$	-	85	-	Degree	Note 5
		$\theta_{x'}$	$\phi = 180^{\circ}, \text{CR} \geq 10$	-	85	-		
		θ_y	$\phi = 90^{\circ}, \text{CR} \geq 10$	-	85	-		
		$\theta_{y'}$	$\phi = 270^{\circ}, \text{CR} \geq 10$	-	85	-		
Color Chromaticity	Red	X	$\phi = 0^{\circ}, \theta = 0^{\circ}$	-	0.64	-	-	Note 6
		Y		-	0.32	-		
	Green	X		-	0.34	-		
		Y		-	0.60	-		
	Blue	X		-	0.14	-		
		Y		-	0.05	-		
	White	X		-	0.30	-		
		Y		-	0.31	-		

Note 1: The brightness is measured from the center point of the panel, P5 in Fig. 6.2, for the typical value.

Note 2: The brightness uniformity is calculated by the equation as below:

$$\text{Brightness uniformity} = \frac{\text{Min. Brightness}}{\text{Max. Brightness}} \times 100\%$$

which is based on the brightness values of the 9 points in active area measured by BM-5 as shown in Fig. 6.2.

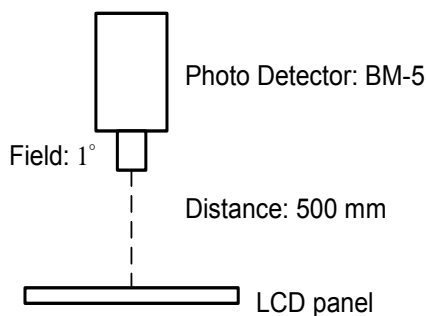


Fig 6.1

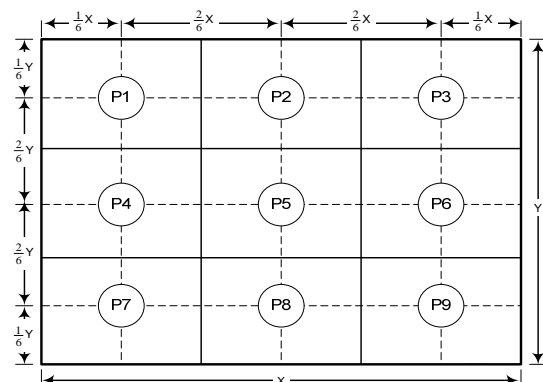


Fig 6.2

Note 3: The Contrast Ratio is measured from the center point of the panel, P5, and defined as the following equation:

$$CR = \frac{\text{Brightness of White}}{\text{Brightness of Black}}$$

Note 4: The definition of response time is shown in Fig. 6.3. The rising time is the period from 10% brightness to 90% brightness when the data is from black to white. Oppositely, Falling time is the period from 90% brightness falling to 10% brightness.

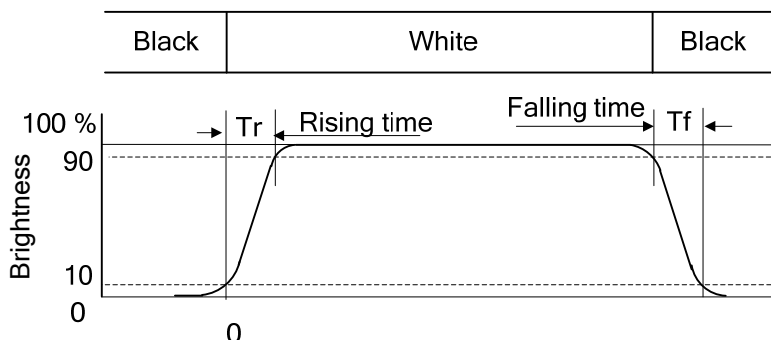


Fig 6.3

Note 5: The definition of viewing angle is shown in Fig. 6.4. Angle ϕ is used to represent viewing directions, for instance, $\phi = 270^\circ$ means 6 o'clock, and $\phi = 0^\circ$ means 3 o'clock. Moreover, angle θ is used to represent viewing angles from axis Z toward plane XY.

The display is super wide viewing angle version; 85° viewing angle can be obtained from each viewing direction.

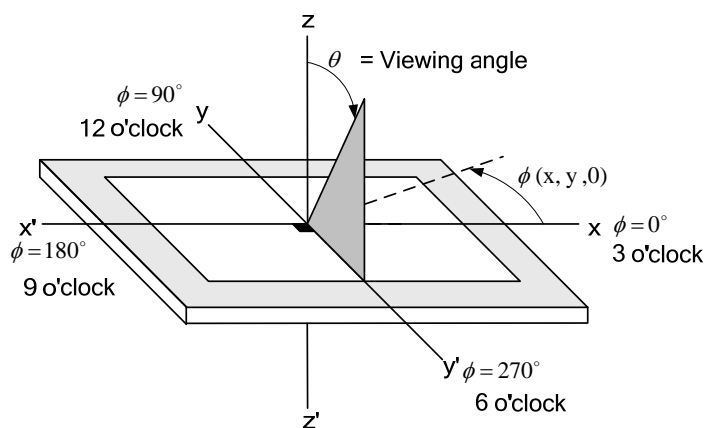
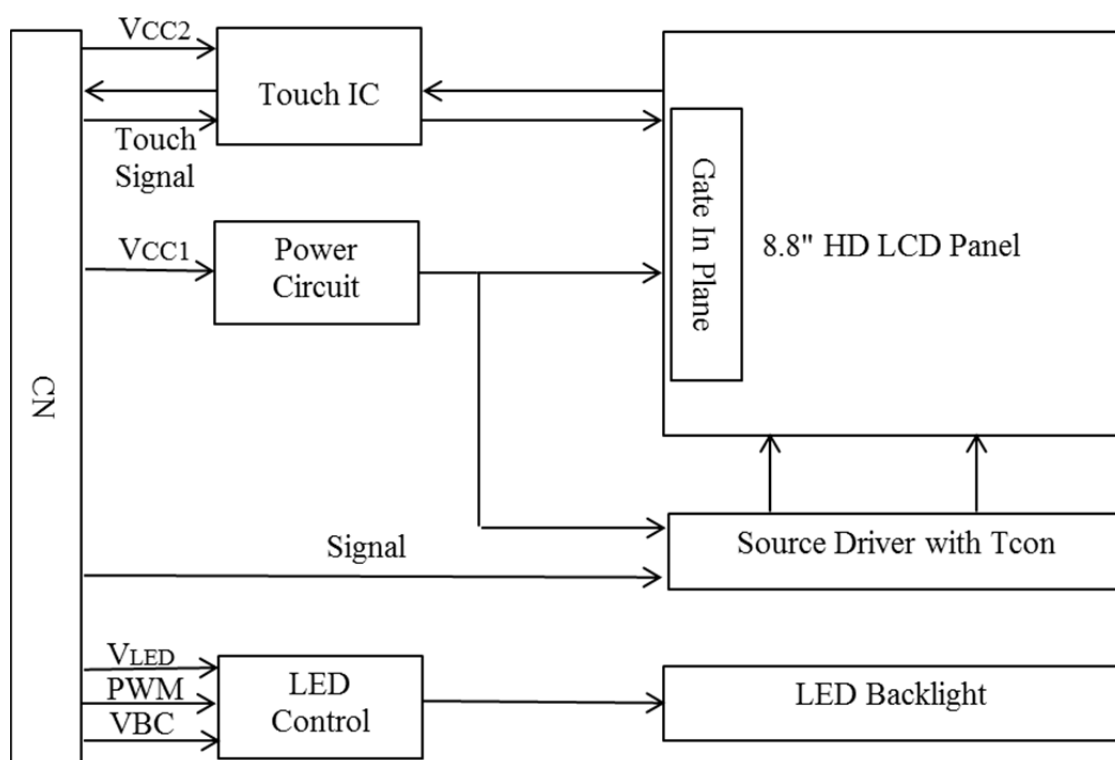


Fig 6.4

Note 6: The color chromaticity is measured from the center point of the panel, P5, as shown in Fig. 6.2.

7. BLOCK DIAGRAM



Note 1: Signals are CLK and pixel data pairs.

Note 2: Touch signals are XRESB、SCLK、MOSI、SSB、MISO、ATTN.

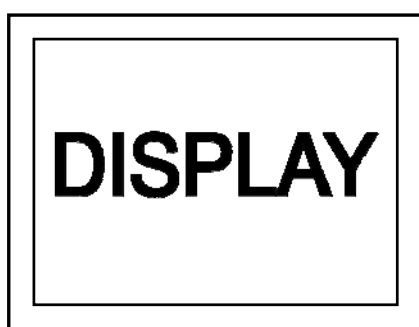
8. LCD INTERFACE

8.1 INTERFACE PIN CONNECTIONS

The display interface connector CN is 132F40-000000-A2-R made by STURCONN and pin assignment is as below:

No.	Signal	Signal	I/O/P	No.	Signal	Signal	I/O/P
1	V _{CC1}	Power Supply for LCD	P	21	LVD3P	Pixel Data	I
2	V _{CC1}	Power Supply for LCD	P	22	GND	GND	P
3	V _{CC1}	Power Supply for LCD	P	23	UD/LR	Scan Direction Control (Note 1)	I
4	V _{CC2}	Power Supply for Touch-IC	P	24	XRESB	Reset signal for Touch-IC	I
5	GND	GND	P	25	ATTN	Attention output pin from Touch-IC	O
6	GND	GND	P	26	SSB	SPI chip select pin for Touch-IC	I
7	GND	GND	P	27	MISO	SPI data output pin for Touch-IC	O
8	LVD0N	Pixel Data	I	28	MOSI	SPI data input pin for Touch-IC	I
9	LVD0P	Pixel Data	I	29	SCLK	SPI clock pin for Touch-IC	I
10	GND	GND	P	30	GND	GND	P
11	LVD1N	Pixel Data	I	31	VLED	12 VDC	P
12	LVD1P	Pixel Data	I	32	VLED	12 VDC	P
13	GND	GND	P	33	VLED	12 VDC	P
14	LVD2N	Pixel Data	I	34	GND	GND	P
15	LVD2P	Pixel Data	I	35	GND	GND	P
16	GND	GND	P	36	GND	GND	P
17	LVDCLKN	Pixel Clock	I	37	EN	3.3 VDC	I
18	LVDCLKP	Pixel Clock	I	38	VBC	DC diming (Note 3)	I
19	GND	GND	P	39	PWM	PWM diming (Note 3)	I
20	LVD3N	Pixel Data	I	40	GND	GND	P

Note 1: Scan direction is available to be switched as below.



SD : Low or Open (Default)



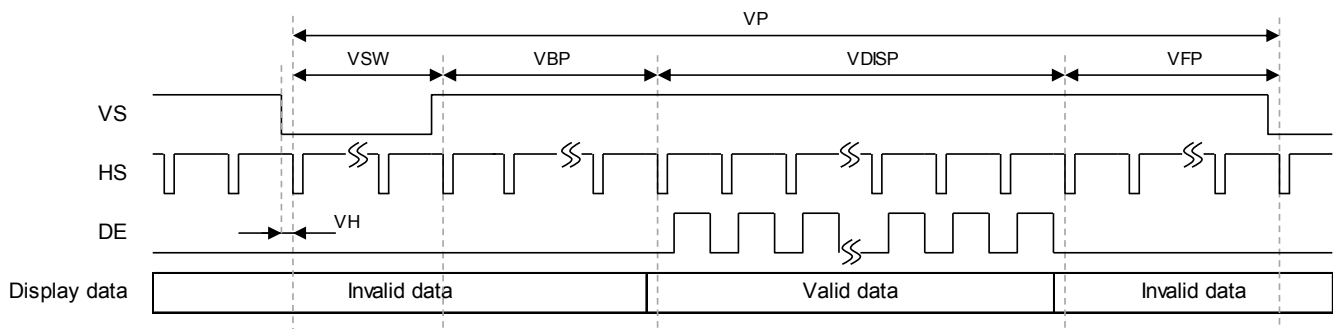
SD : High

Note 2: IN_n- and IN_n+ (n=0,1,2,3), CLK IN- and CLK IN+ should be wired by twist-pairs or side-by-side FPC patterns, respectively.

Note 3: Normal brightness: 3.3V or 100% PWM duty ; Brightness control: 0V to 3.3V DC or 0% to 100% PWM duty.If no using, please keep it open.

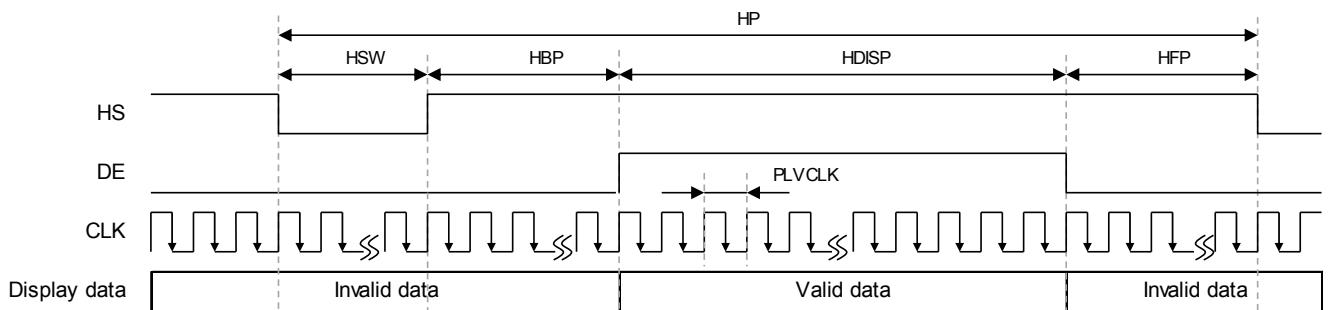
8.2 Data Input Timing

(1) Vertical timing



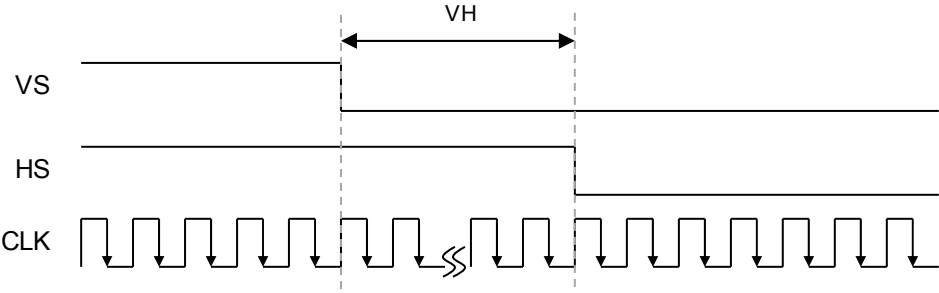
Symbol	Item	Min.	Typ.	Max.	Unit	Remarks
VP	Vertical cycle	766	766	766	Line	
VSW	Vertical "L" period	2	6	41	Line	
VBP	Vertical back porch	2	37	41	Line	
VFP	Vertical front porch	3	3	42	Line	
VDISP	Vertical active area	720	720	720	Line	
VSW+VBP+VFP	Vertical porch	46	46	46	Line	
VRR	Frame rate	58.44	59.03	59.62	Hz	

(2) Horizontal timing



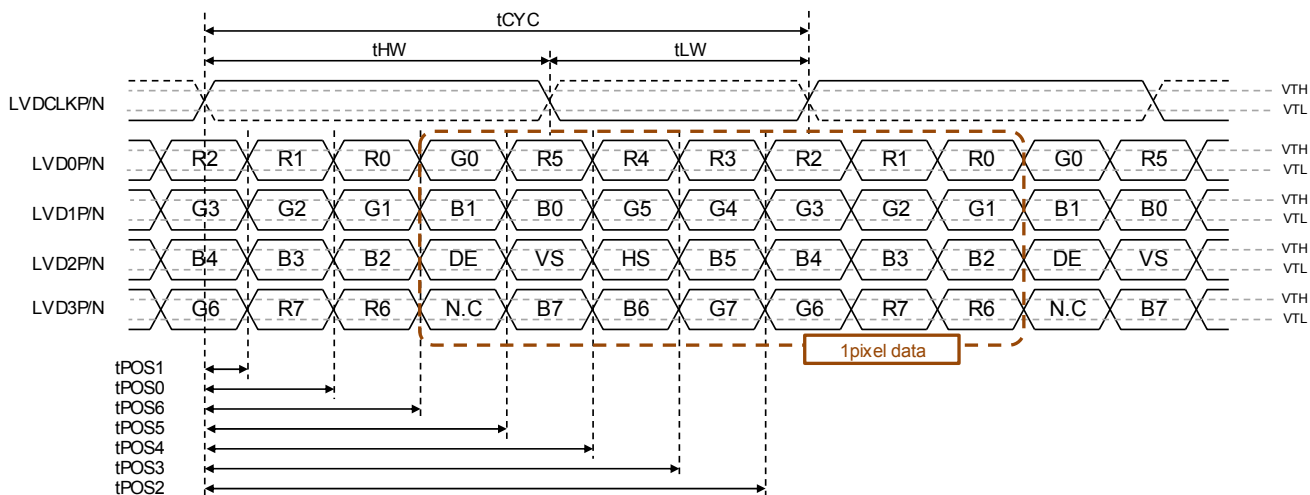
Symbol	Item	Min.	Typ.	Max.	Unit	Remarks
HP	Horizontal cycle	1631	1632	1633	CLK	
HSW	Horizontal "L" width	40	45	242	CLK	
HBP	Horizontal back porch	45	50	247	CLK	
HFP	Horizontal front porch	65	257	267	CLK	
HDISP	Horizontal active area	1280	1280	1280	CLK	
HSW+HBP+HFP	Horizontal porch	351	352	353	CLK	
f_{LVCLK}	Pixel clock frequency	73.07	73.80	74.53	MHz	
PLVCLK		13.42	13.55	13.68	ns	

(3) VS – HS timing

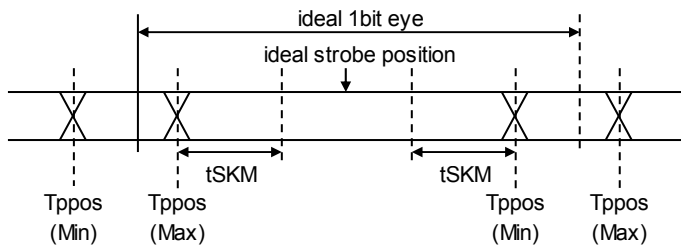


Symbol	Item	Min.	Typ.	Max.	Unit	Remarks
VH	Phase difference of VS-HS	0	0	0	LVCLK	

8.3 LVDS AC TIMING

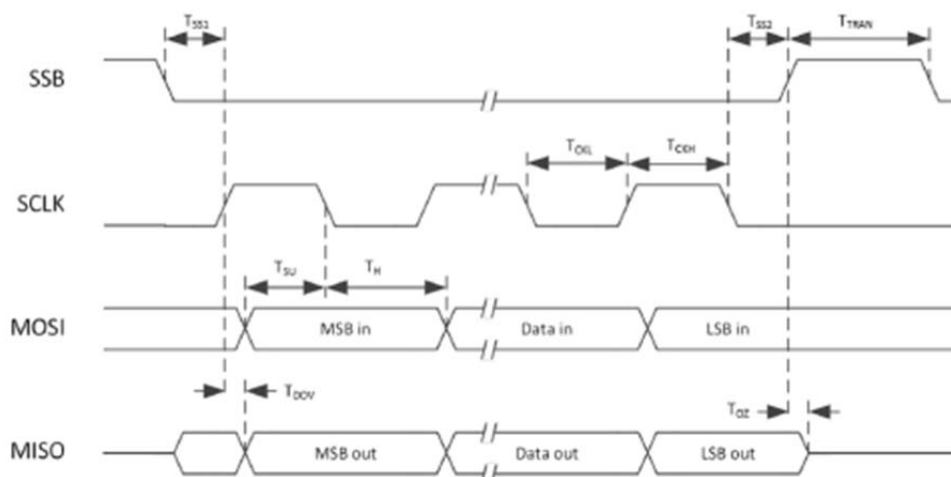


Note 1: above timing chart is based on LVDS Format VESA.



Signal	Symbol	Item	Min.	Typ.	Max.	Unit
LVDCLKP/N	tCYC	clock cycle time	73.07	73.80	74.53	MHz
			13.42	13.55	13.68	ns
	tHW	clock "H" pulse width	0.4 x tCYC	0.5 x tCYC	-	ns
	tLW	clock "L" pulse width	0.4 x tCYC	0.5 x tCYC	-	ns
LVD[3:0]P/N	tPOS1	tPOS1 position	- tSKM	0	+ tSKM	ns
	tPOS0	tPOS0 position	(1/7)x tCYC - tSKM	(1/7)x tCYC	(1/7)x tCYC + tSKM	ns
	tPOS6	tPOS6 position	(2/7)x tCYC - tSKM	(2/7)x tCYC	(2/7)x tCYC + tSKM	ns
	tPOS5	tPOS5 position	(3/7)x tCYC - tSKM	(3/7)x tCYC	(3/7)x tCYC + tSKM	ns
	tPOS4	tPOS4 position	(4/7)x tCYC - tSKM	(4/7)x tCYC	(4/7)x tCYC + tSKM	ns
	tPOS3	tPOS3 position	(5/7)x tCYC - tSKM	(5/7)x tCYC	(5/7)x tCYC + tSKM	ns
	tPOS2	tPOS2 position	(6/7)x tCYC - tSKM	(6/7)x tCYC	(6/7)x tCYC + tSKM	ns
	tSKM	Skew margin (F = 74.5MHz)	-	-	200	ps

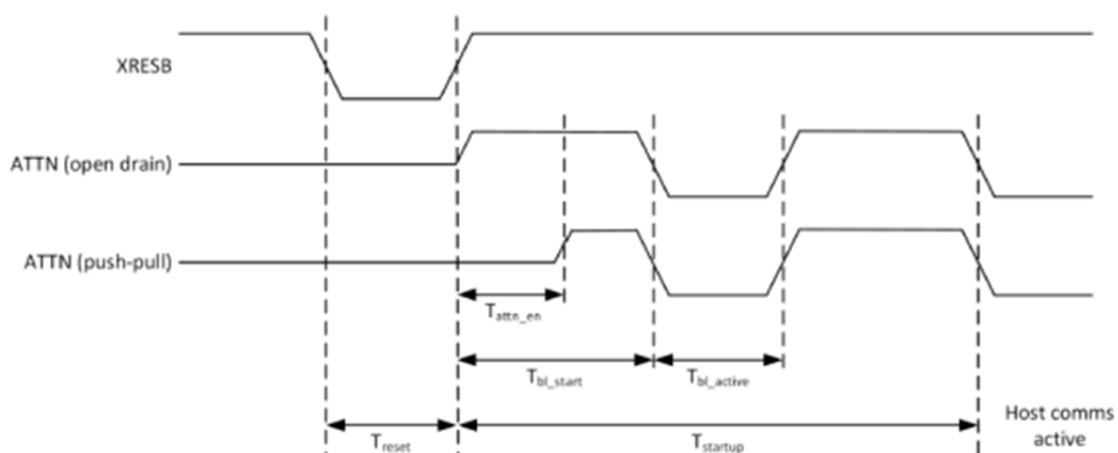
8.4 SPI AC TIMING FOR TOUCH-IC



Item	Symbol	Min.	Typ.	Max.	Unit	Remarks
SCLK clock frequency	f_{SCLK}	-	-	4	MHz	-
Delay between transactions	t_{TRAN}	3.6	-	-	us	-
SCLK low time (see note)	t_{CKL}	0.1	-	-	us	-
SCLK high time (see note)	t_{CKH}	0.1	-	-	us	-
SSB asserted to first clock edge	t_{SS1}	0.12	-	-	us	-
Last clock edge to SSB negated	t_{SS2}	0.5	-	-	us	-
MOSI setup time to sampling clock edge	t_{SU}	20	-	-	ns	-
MOSI hold time after sampling clock edge	t_H	20	-	-	ns	-
MISO valid after clock edge (50 pF load)	t_{DOV}	-	-	30	ns	-
SSB negated to MISO Hi-Z (50 pF load)	t_{OZ}	-	-	50	ns	-

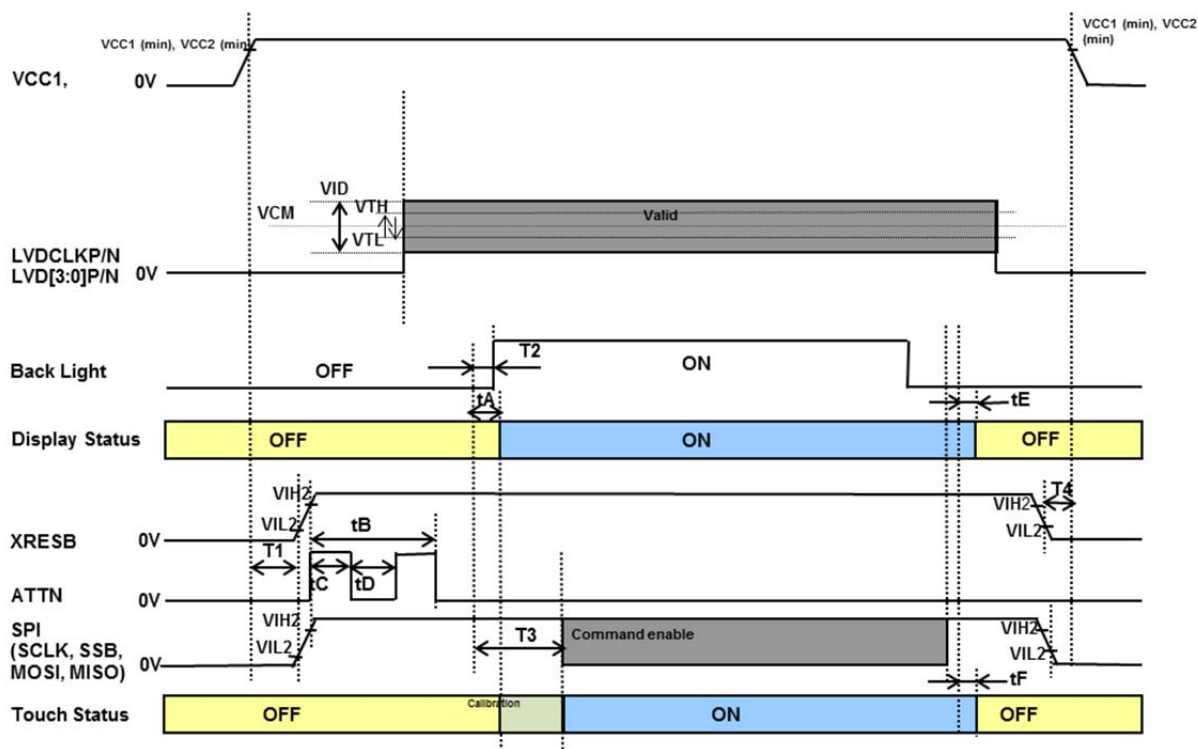
Notes 1 $t_{CKL} + t_{CKH}$ must not be less than the minimum clock period $1/f_{SCLK}$ (maximum).

8.5 RESET TIMING FOR TOUCH-IC



Signal	Symbol	Item	Min.	Max.	Unit	Remarks
XRESB	T_{reset}	Reset low pulse width	100	-	ns	-
ATTN (open drain)	T_{bl_start}	Bootloader start time	-	14	ms	-
	T_{bl_active}	Bootloader active time	-	13	ms	-
	$T_{startup}$	Startup time	-	45	ms	-
ATTN (push-pull)	T_{attn_en}	ATTN enabling time	5	12	ms	-
	T_{bl_start}	Bootloader start time after T_{reset}	-	14	ms	-
	T_{bl_active}	Bootloader active time	-	13	ms	-
	$T_{startup}$	Startup time	-	45	ms	-

8.6 POWER ON / OFF SEQUENCE



(1) Wait time

Please design the circuit which is able to adjust the interval of following table.

	T1	T2	T3	T4
Min.	100ns	150ms	-	0ms
Max.	-	-	217ms	-

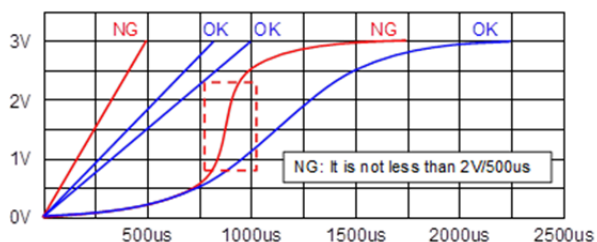
(2) Latency of LCD module operation >

	tA	tB	tC	tD	tE
Min.	-	-	-	-	-
Max.	150ms	45ms	14ms	13ms	200ms

Note1: V_{CC} (min.) is minimum voltage of V_{CC} . Please refer to 5.1 DC CHARACTERISTICS OF GENERAL.

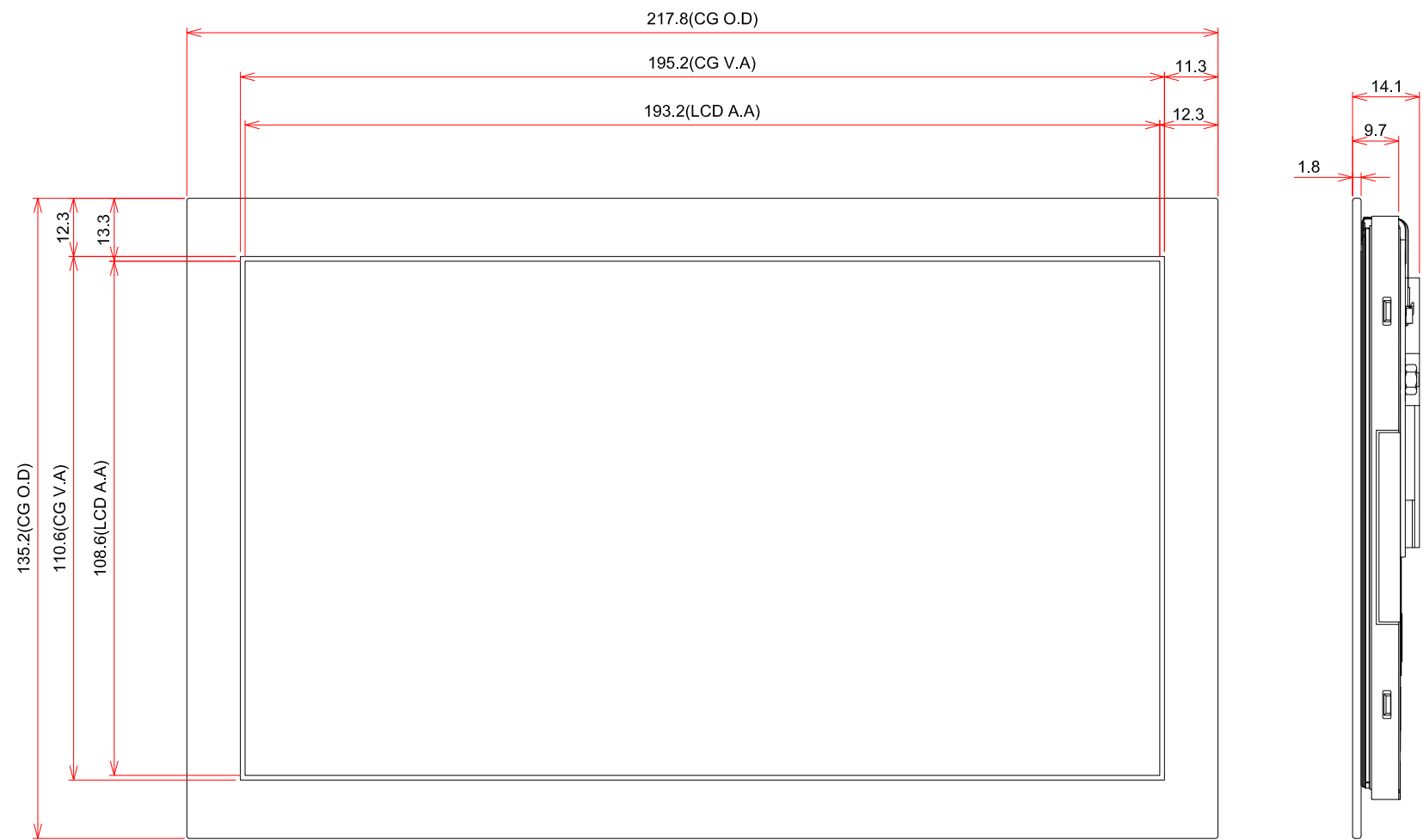
Note2: The LVDS signals must not be stopped when display is turned on.

Note3: The rising speed of V_{CC1} and V_{CC2} should be less than $2V/500\mu s$.



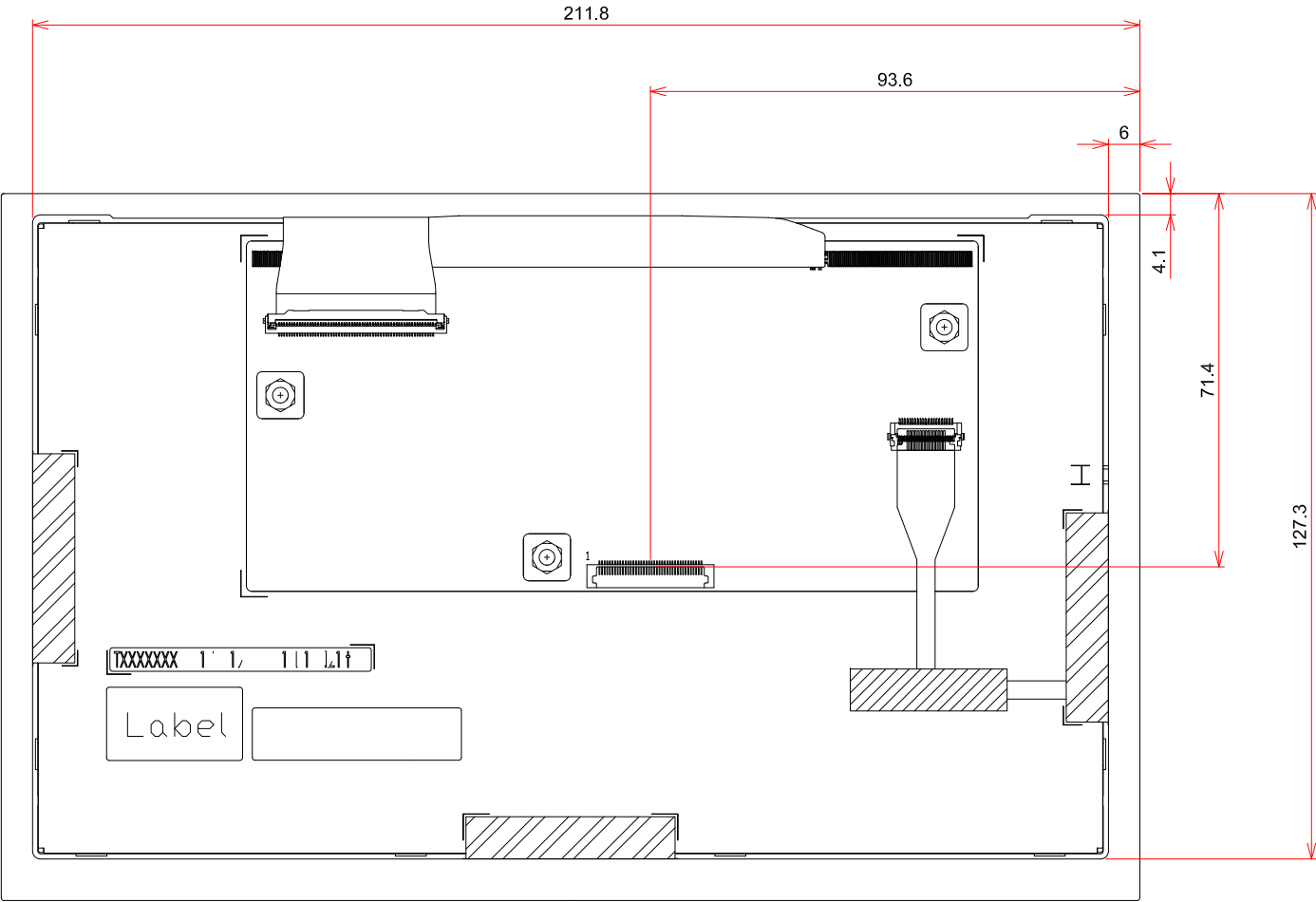
9. OUTLINE DIMENSIONS

9.1 FRONT VIEW



General Tolerance:±0.5mm
Scale : NTS
Unit : mm

9.2 REAR VIEW



General Tolerance:±0.5mm
Scale : NTS
Unit : mm

10. TOUCH SPECIFICATION

10.1 TOUCH CHARACTERISTICS

Item	Specification	Remarks
Multi Touch	max 10 Fingers	Note 1
Report rate	max 120Hz	Note 1
Finger separation	14mm	Φ8mm

Note 1 :As multi touch application is more than 5 fingers, report rate will be reduced.

10.2 ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Value			Unit	Remarks
			Min.	Typ.	Max.		
Power Supply voltage	V_{CC2}	-	3	3.3	3.6	V	-
Input voltage	V_{IH}	-	$0.7V_{CC2}$	-	V_{CC2}	V	Note 1
	V_{IL}	-	0	-	$0.3V_{CC2}$	V	
Output voltage	V_{OH}	$I_{OH} = 10mA$	$V_{CC2}-0.4$	-	V_{CC2}	V	
	V_{OL}	$I_{OH} = 10mA$	0	-	0.4	V	
Input leak current	ILI	$V_{IN} = V_{CC2}$	-	-	15	μA	
		$V_{IN} = GND$	-15	-	-	μA	
Permissive ripple	PRV	-	-	-	100	mVpp	-

Note1: Applied pin {XRESB,SCLK,SSB,MOSI,ATTN and MISO}

10.3 COMMANDS FOR TOUCH-IC

Please refer to S3385 Touch Controller Datasheet. (PN: 505-000628-01 Rev C)

RMI4 Specification (PN: 511-000405-03 Rev A)

11. COVER GLASS SPECIFICATION

MECHANICAL CHARACTERISTICS

Item	Specification	Remarks
Thickness	1.8 \pm 0.1 mm	Chemically Strengthened Glass
Material	Soda lime	-
Surface Hardness	\geq 7H	-