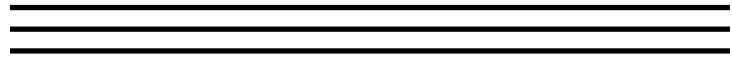






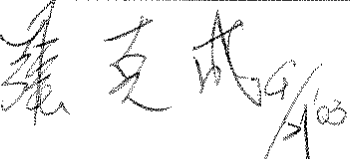
Giantplus
Technology



Preliminary Specification of LCD Module

Product No.: **GPG32245CS1**

<p>Customer Approval</p>	
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Approved by	Checked by	Organized by
		

Approval for preliminary specification only

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1. GENERAL DESCRIPTION

The GPG32245CS1 is a 320x240 dot matrix LCD module. It has a Color STN panel composed of 320 segments and 240 commons. The LCM can be easily accessed by micro-controller via parallel interface.

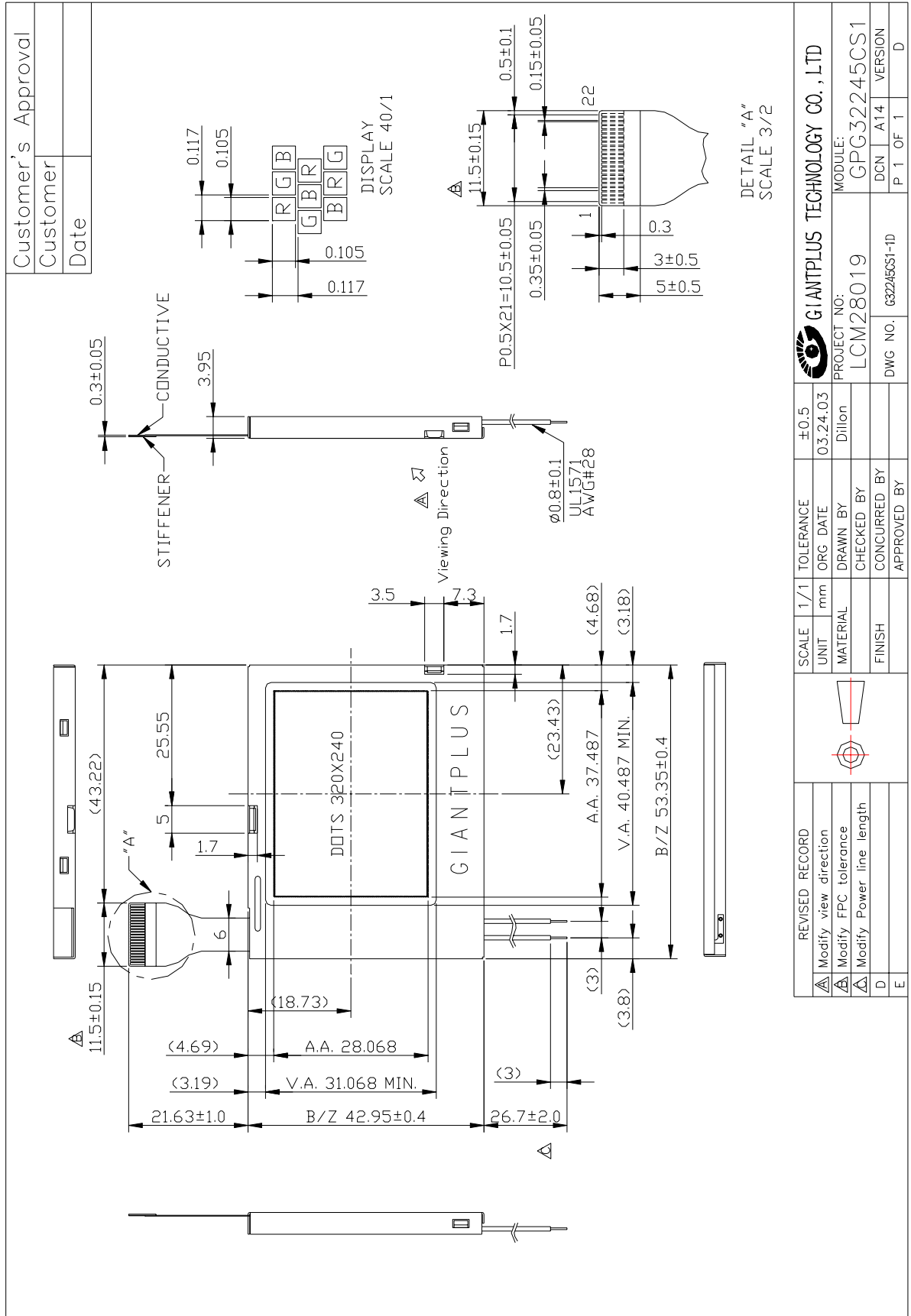
2. FEATURES

Display Mode	Transmissive Type
	Color STN LCD, Negative mode
Display Format	RGB Mosaic
Color	4096 colors (depend on controller)
Input Data	8-bit parallel data input from controller
Driver IC.	SPLC560C-C x 2 and SPLC562C-C
Multiplexing Ratio	1/240 Duty
Viewing Direction	6 O'clock
Backlight	White LED

3. MECHANICAL SPECIFICATION

Item	Specifications	Unit
Dimensional outline	53.35(W) × 42.95(H) × 3.95(D)	mm
Resolution	320 × 240	dot
View area	40.487(W) × 31.086(H)	mm
Active area	37.487(W) × 28.068(H)	mm
Dots pitch	0.117(W) × 0.117(H)	mm
Dots size	0.105(W) × 0.105(H)	mm

4. MECHANICAL DIMENSION

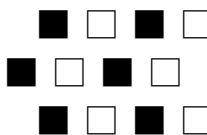
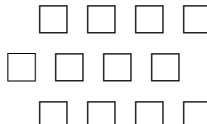




5. MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Note
Supply voltage	V_{DD}	-0.3	6.5	V	$T_A=25^\circ\text{C}$
	V_{LCD}	-0.3	30	V	$T_A=25^\circ\text{C}$
	V2, V3	-0.3	$V_0+0.3$	V	$T_A=25^\circ\text{C}$
	V4, V5	-0.3	$V_0+0.3$	V	$T_A=25^\circ\text{C}$
	V_{SS}	-0.3	$V_0+0.3$	V	$T_A=25^\circ\text{C}$
Input Voltage	V_{IN}	-0.3	$V_{DD}+0.3$	V	
Operating Temperature	T_{OPR}	0	60	$^\circ\text{C}$	
Storage Temperature	T_{STR}	-20	70	$^\circ\text{C}$	
Humidity	---	---	90	%RH	

6. ELECTRICAL CHARACTERISTICS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	NOTE
Supply Voltage	Logic	V_{DD}	---	3.0	3.3	5.5	V	
Input Voltage	H level	V_{IH}	---	$0.8V_{DD}$	---	V_{DD}	V	
	L level	V_{IL}	---	0	---	$0.2V_{DD}$		
Supply Current for Logic		I_{DD}	$V_{DD}=3.3\text{ V}$	---	TBD	TBD	mA	
Supply Current for LCD		I_{EE}	$V_{LCD}=19\text{V}$ 	---	TBD	TBD		
LCD Driving Voltage ($V_{LCD}-V_{SS}$)		V_{LCD}	25°C	18.1	19.0	19.9	V	
LCM Surface Luminance (reference)		L	$V_{DD}=3.3\text{ V}$ $V_{LCD}=19\text{V}$ 	125	(160)	---	Cd/m^2	Note 1 & Note 2



Note 1. Ambient Temperature = 25°C. Measured at the center area of the panel by Topcon luminance meter BM-7, after 5 minutes operation.

Note 2. The LCM surface Luminance is defined as the brightness of all pixels “White” at the center of display area on optimum contrast.

7. BACKLIGHT CHARACTERISTICS

Item	Symbol	Min.	Typical	Max.	Unit
LED module forward voltage	V_{LED}	4.5	5	5.5	V
LED module current	I_{LED}	---	40	---	mA

8. MODULE FUNCTION DESCRIPTION

8.1 Pin Description

LCD

PIN NO.	SYMBOL	FUNCTIONS
1	V_{LCD}	Bias voltage for select (com & seg)
2	V2	Bias voltage for non-select (com)
3	V3	Bias voltage for non-select (seg)
4	V4	Bias voltage for non-select (seg)
5	V5	Bias voltage for non-select (com)
6	V_{SS}	Bias voltage for select (com & seg)
7	V_{SS}	Logic ground
8	V_{DD}	Logic power supply
9 ~ 16	D0 ~ D7	Input data signal
17	CL2	Clock pulse for segment shift register
18	FLM	Frame start signal
19	DISPOFF	H: display on / L: display off
20	CL1	Latch pulse of display data
21	FR	Switch signal to AC waveform
22	NC	No Connection

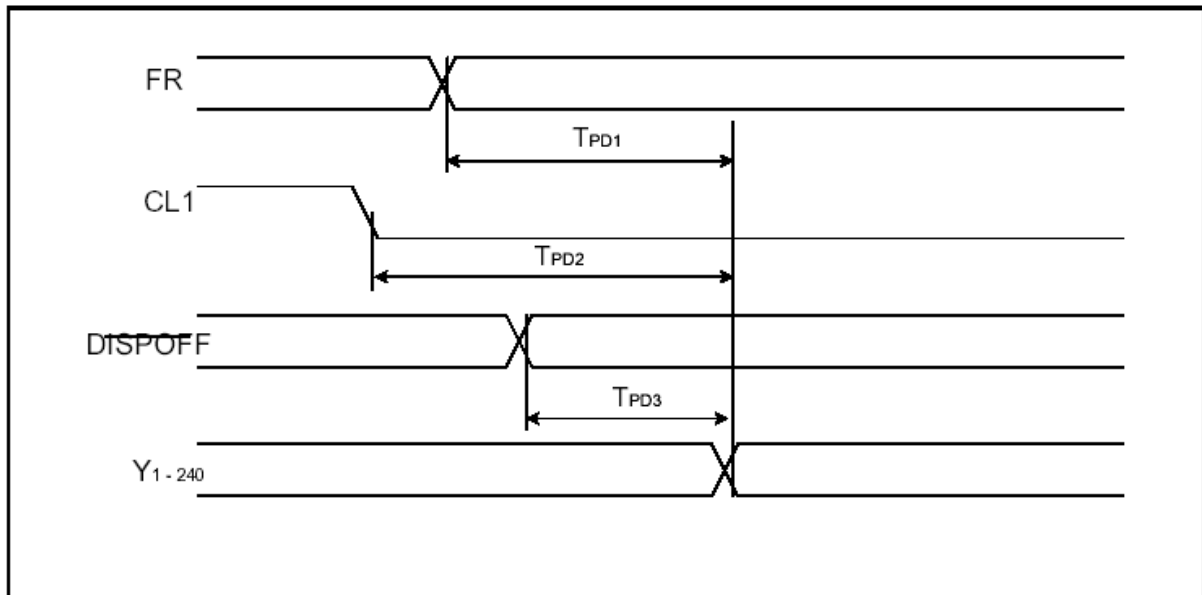
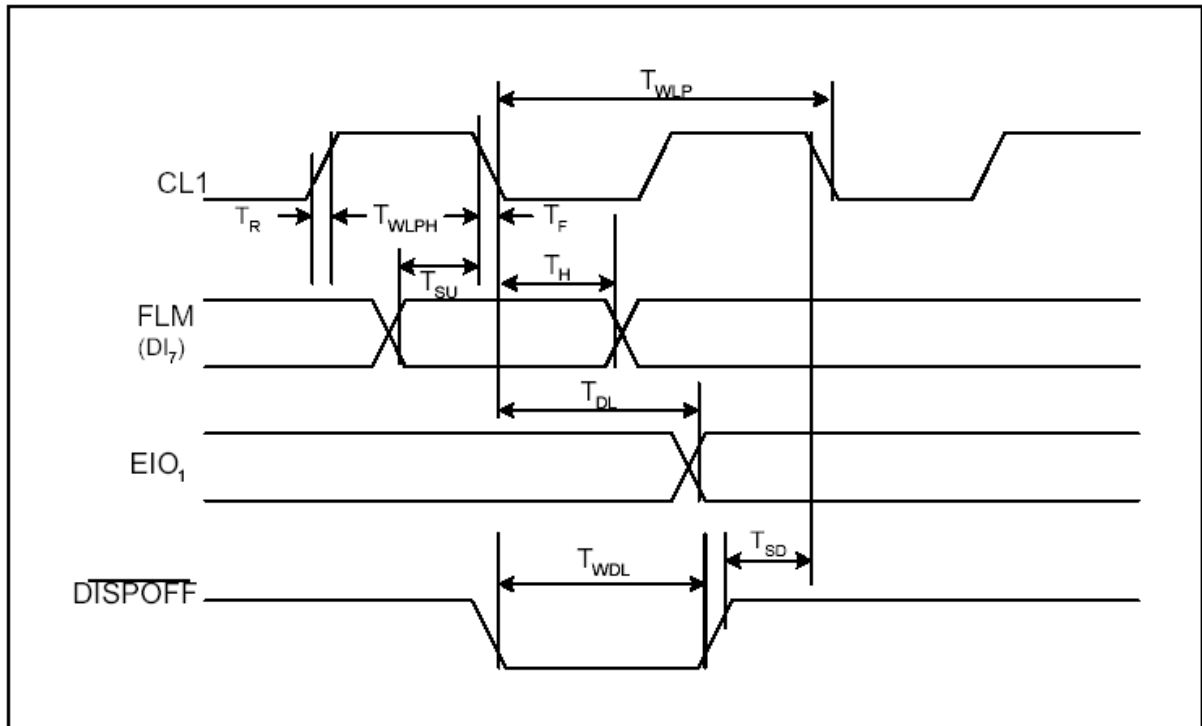
8.2 Timing Characteristics

Interface timing

Parameter	Symbol	CONDITION	MIN.	MAX.	Unit
CL1 Clock period	T_{WLP}	$T_{R,T_F} \leq 20\text{ns}$ VDD=2.4V~4.5V	250	—	ns
CL2 Clock period	T_{WCK}	$T_{R1,T_{F1}} \leq 11\text{ns}$ VDD=2.5V~4.5V	125	—	ns
		$T_{R1,T_{F1}} \leq 10\text{ns}$ VDD=4.5V~5.5V	71		
CL2 High Level Width	T_{WCKH}	VDD=2.5V~4.5V	51	—	ns
		VDD=4.5V~5.5V	23		
CL2 Low Level Width	T_{WCKL}	VDD=2.5V~4.5V	51	—	ns
		VDD=4.5V~5.5V	23		
CL1 High Level Width	T_{WLPH}	VDD=+5.0V±10%	15	—	ns
		VDD=+2.5V~4.5V	30		
CL2 Enable Setup Time	T_S	VDD=2.5V~4.5V	36	—	ns
		VDD=4.5V~5.5V	21		
CL2 – CL1 Rise Time	T_{LD}		0	—	ns
CL2 – CL1 Fall Time	T_{SL}	VDD=2.5V~3.0V	51	—	ns
		VDD=4.5V~5.5V	25		
CL1 – CL2 Rise Time	T_{LS}	VDD=2.5V~4.5V	51	—	ns
		VDD=4.5V~5.5V	25		
CL1 – CL2 Fall Time	T_{LH}	VDD=2.5V~4.5V	51	—	ns
		VDD=4.5V~5.5V	25		
CL2 Clock Rise / Fall Time	$T_{R1,T_{F1}}$	--	—	50	ns
CL1 Clock Rise / Fall Time	T_{R,T_F}	--	--	50	ns
DISPOFF Removal Time	T_{SD}	--	100	--	ns
DISPOFF “L” pulse width	T_{WDL}	--	1.2		us
Common Output Delay Time (1)	T_{DL}	$C_L=15\text{pF}$	--	200.	ns
Segment Output Delay Time (1)	T_D	$C_L=15\text{pF}$ VDD=2.5V~4.5V	--	78	ns
		$C_L=15\text{pF}$ VDD=4.5V~5.5V	--	40	

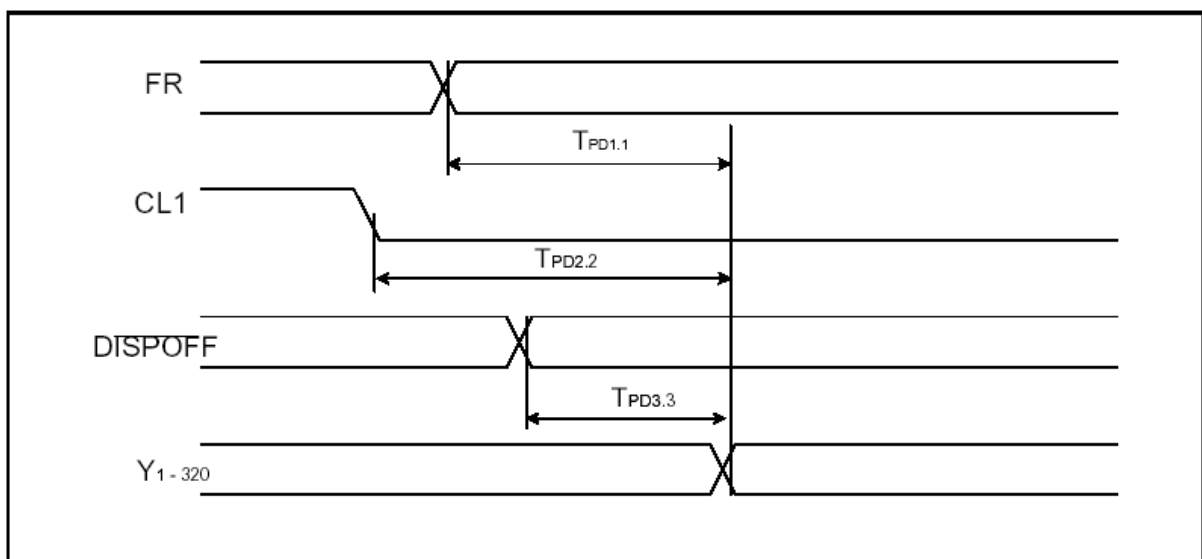
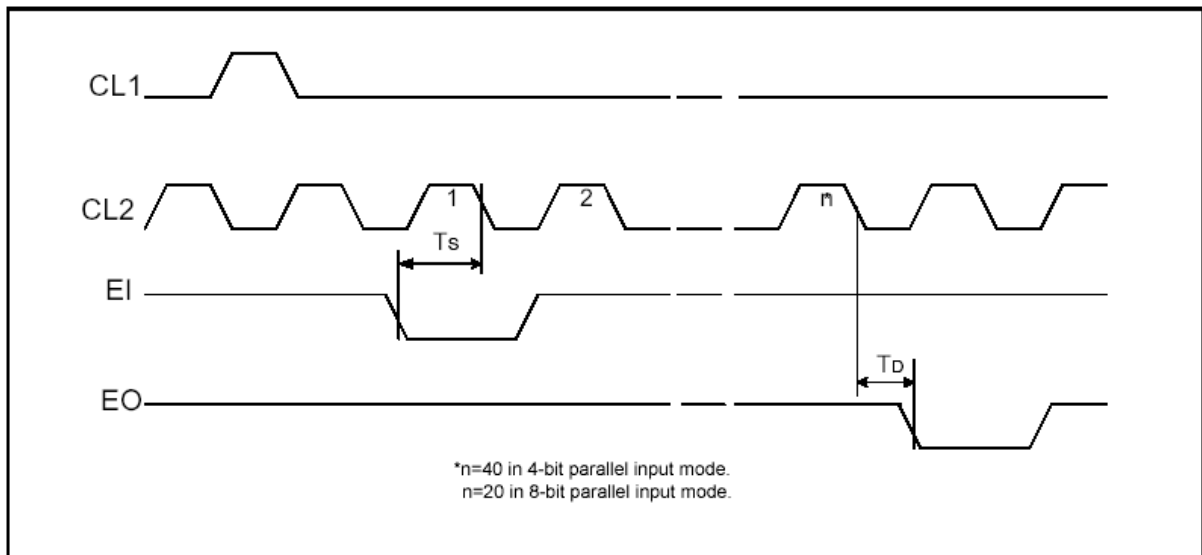
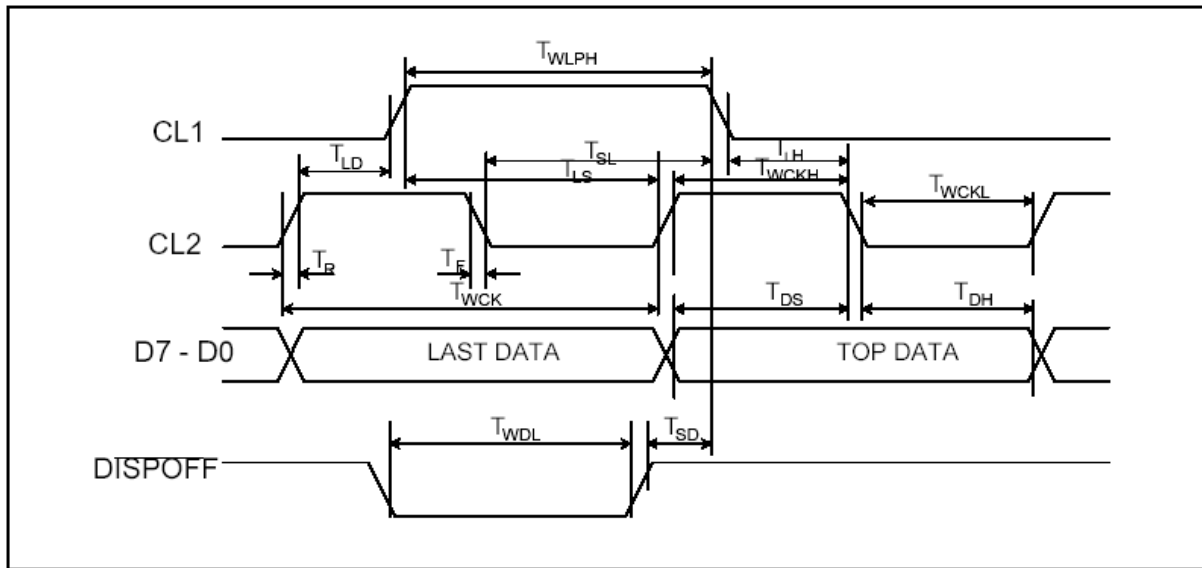


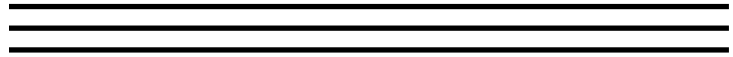
Common/Segment Output Delay Time (2)	$T_{PD1}, T_{PD2}/$ $T_{PD1.1}, T_{PD2.2}$	$C_L=15pF$	--	1.2	us
Common/Segment Output Delay Time (3)	$T_{PD3}/ T_{PD3.3}$	$C_L=15pF$	--	1.2	us
Data Setup Time	T_{DS}	VDD=2.5V~4.5V	30		ns
		VDD=4.5V~5.5V	10		
Data Hold Time	T_{DH}	VDD=2.5V~3.0V	40		ns
		VDD=4.5V~5.5V	20		
FLM Data Setup Time	T_{SU}		30	—	ns
FLM Data Hold Time	T_H		50	—	ns

COMMON MODE




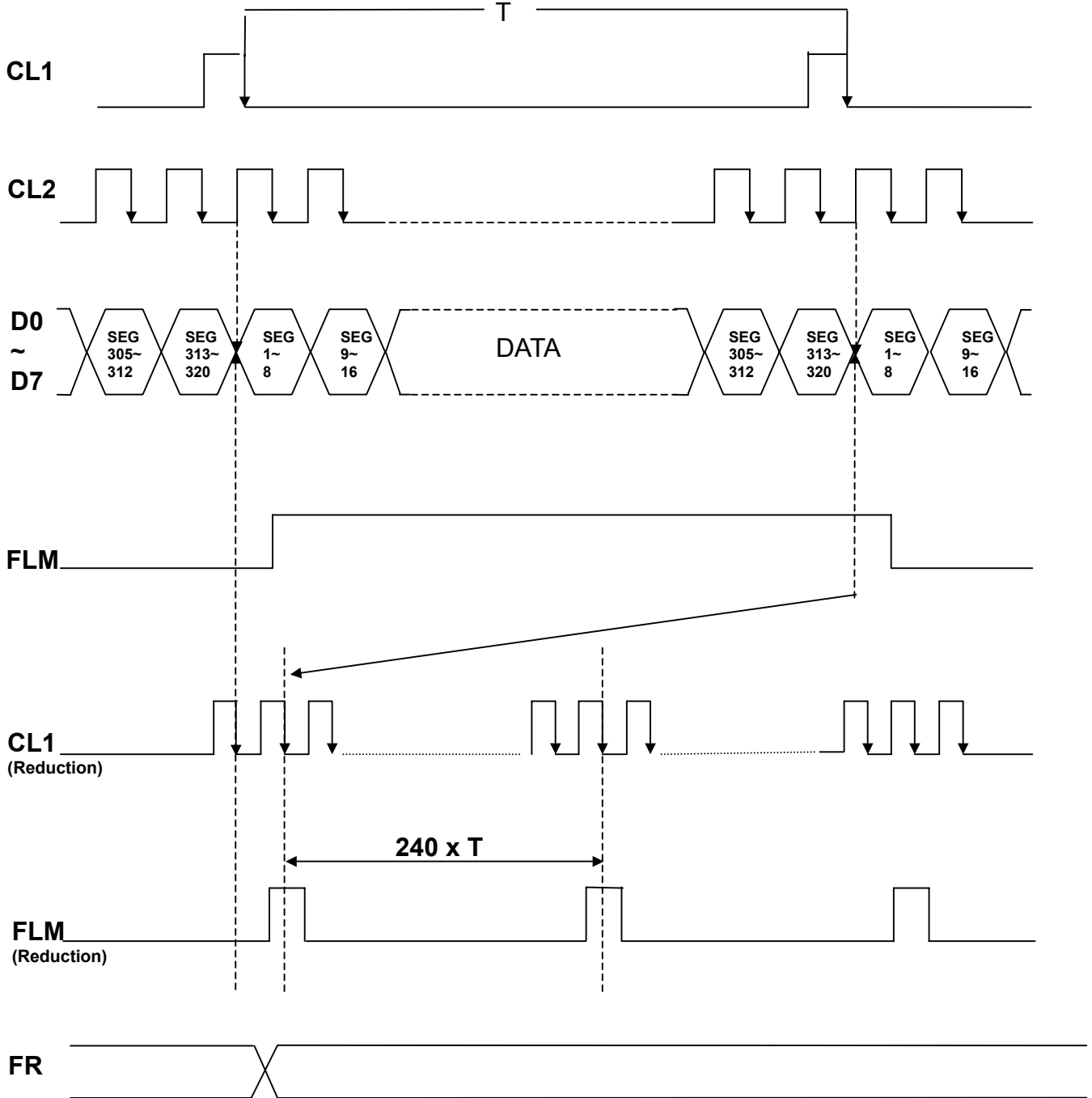
SEGMENT MODE



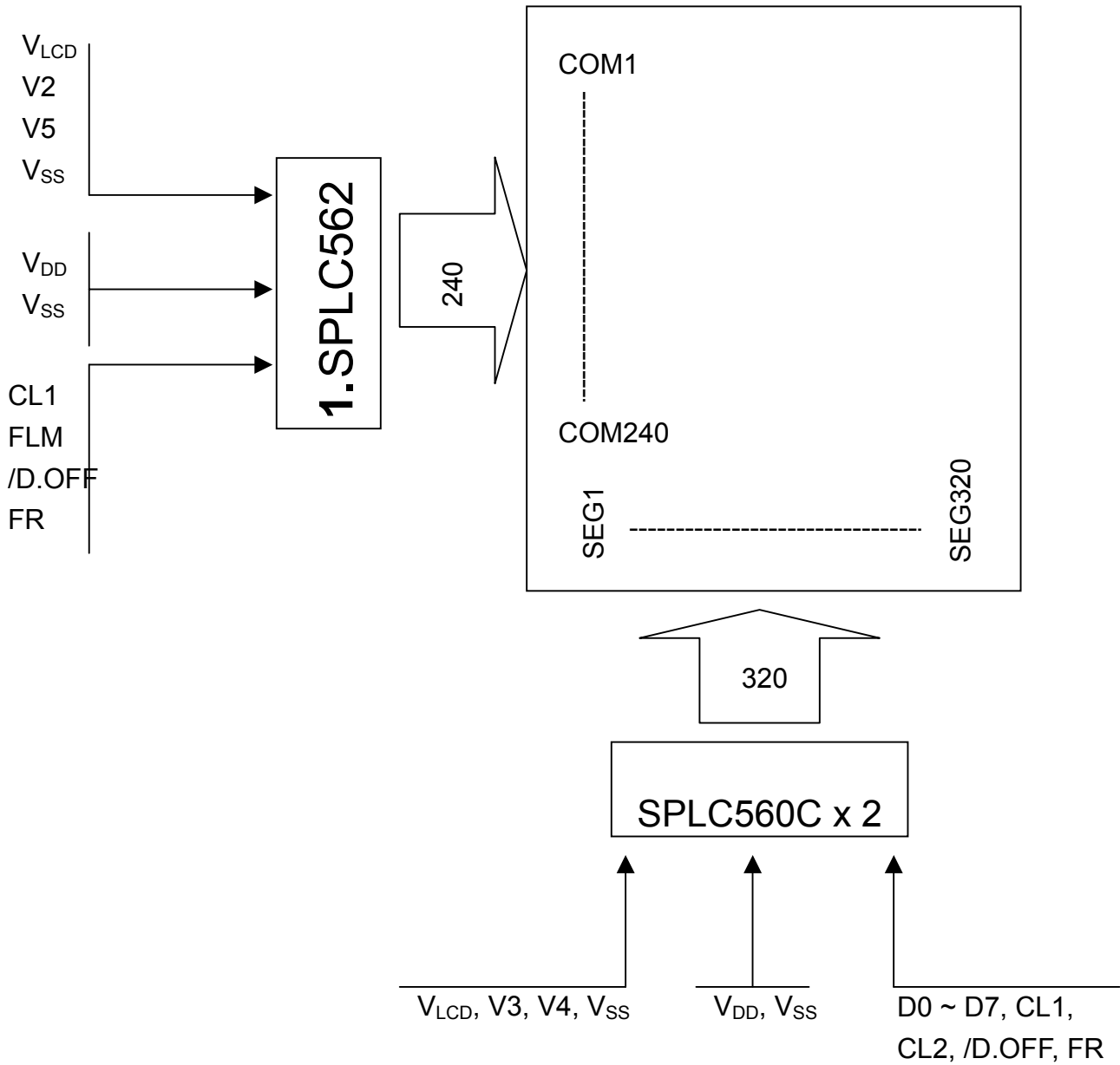


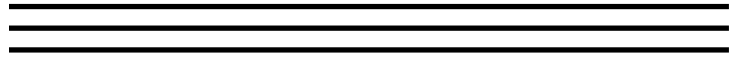
8.3 Timing Chart of Input Signal Example

The following is a 240 common by 320 segment example.

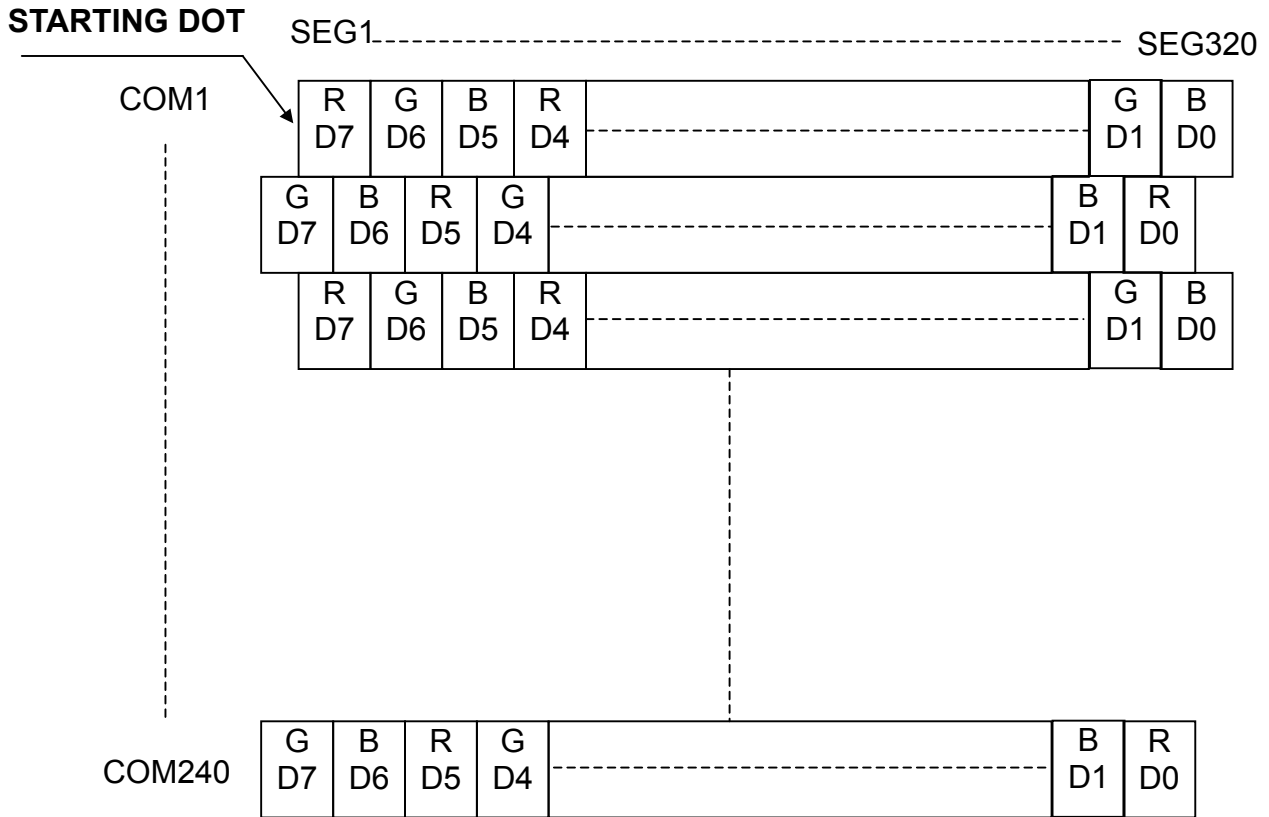


8.4 Block Diagram of LCM





8.5 Display Pattern



D0 ~ D7 are 8 bits transmitted data, where D0 is LSB.



9. ELECTRO-OPTICAL CHARACTERISTICS

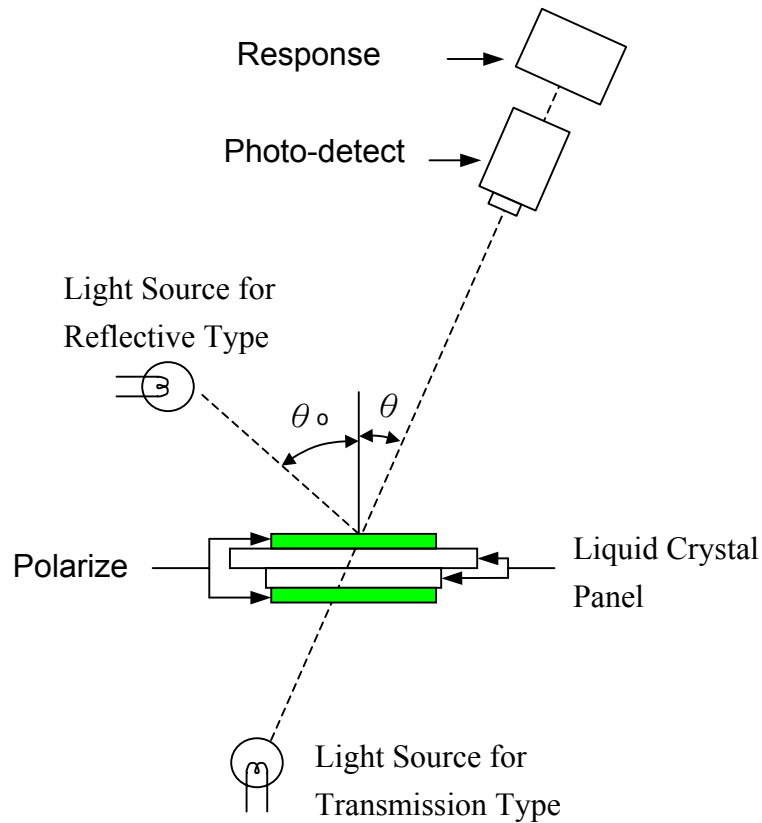
Electro-Optical Characteristics								
Item	Symbol	Condition	Temp.	Min.	Typical	Max.	Units	Note
LCD Driving Voltage (recommended)	V_{LCD}	$\phi = \theta = 0^\circ$ $\theta_0 = 25^\circ$	0°C	---	TBD	---	V	Note 1,3
			25°C	TBD	TBD	TBD		
			60°C	---	TBD	---		
Response Time	Rise Time (Tr)	$\phi = \theta = 0^\circ$ $\theta_0 = 25^\circ$	0°C	---	TBD	TBD	ms	Note 1,4
	Decay Time (Td)			---	TBD	TBD		
	Rise Time (Tr)		25°C	---	TBD	TBD		
	Decay Time (Td)			---	TBD	TBD		
	Rise Time (Tr)		60°C	---	TBD	TBD		
	Decay Time (Td)			---	TBD	TBD		
Module Chromaticity	White	x	25°C	---	TBD	---		
		y		---	TBD	---		
	Red	x		---	TBD	---		
		y		---	TBD	---		
	Green	x		---	TBD	---		
		y		---	TBD	---		
	Blue	x		---	TBD	---		
		y		---	TBD	---		
Contrast Ratio	Reflective	$\phi = \theta = 0^\circ$ $\theta_0 = 25^\circ$	25°C	---	---	---		Note 1,5
	Transmissive	$\phi = \theta = 0^\circ$ $\theta_0 = 180^\circ$		TBD	TBD	---		

Viewing Angel Range	$\phi = 0^\circ$ (6'')	$\phi = 90^\circ$ (3'')	$\phi = 180^\circ$ (12'')	$\phi = 270^\circ$ (9'')	Note
θ (25°C), CR \geq 2	TBD	TBD	TBD	TBD	Note 2

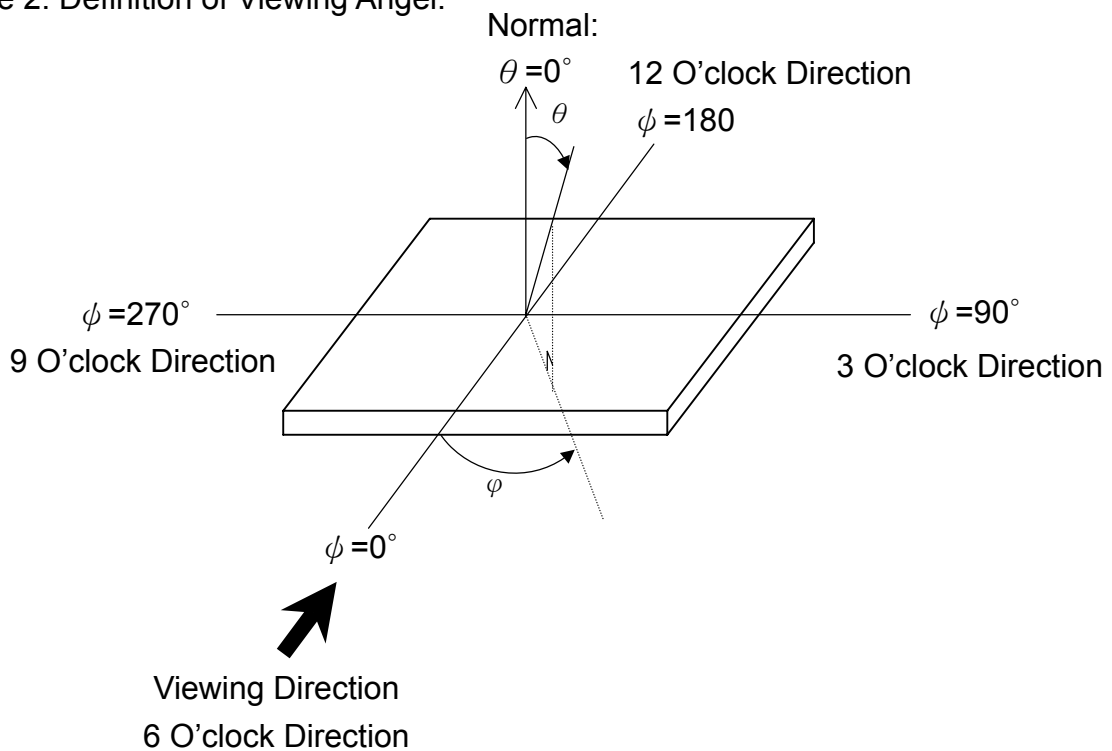
For Panel Only



Note 1: Electro-Optical Characteristics Test Method.

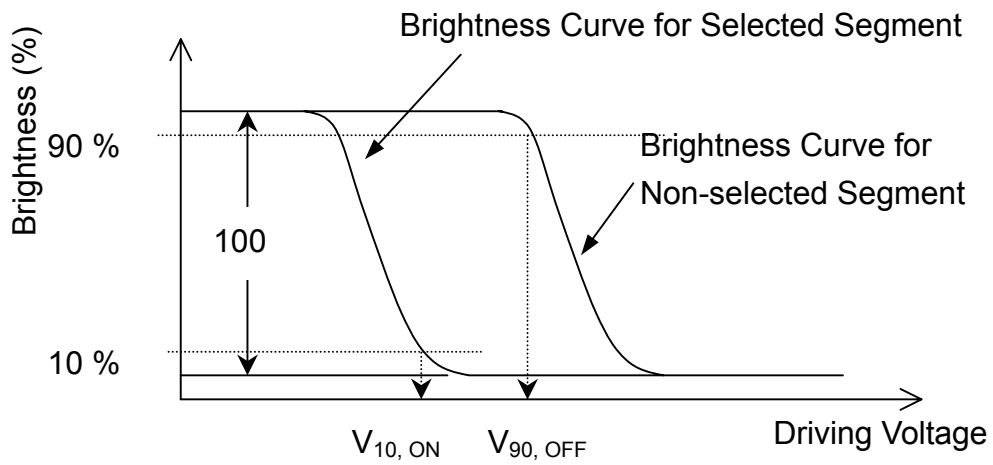


Note 2: Definition of Viewing Angel.

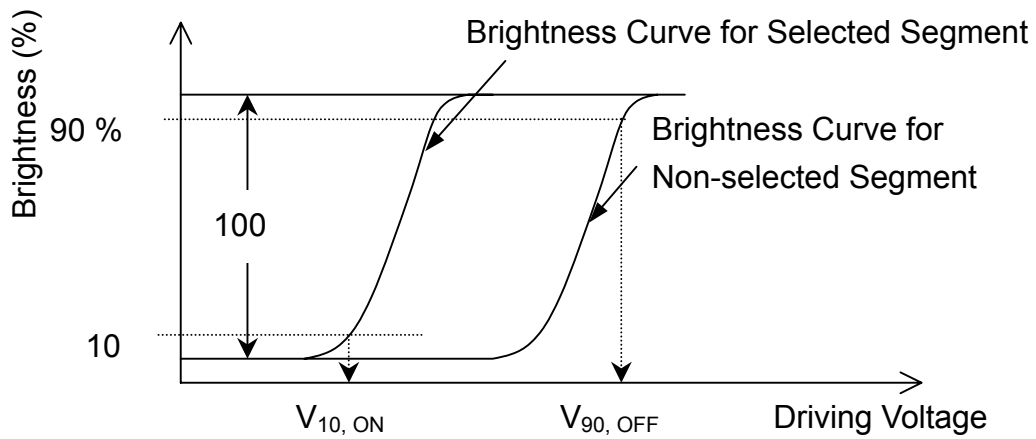




Note 3: Definition of Driving Voltage, $V_{LCD} = (V_{10, ON} + V_{90, OFF}) / 2$.



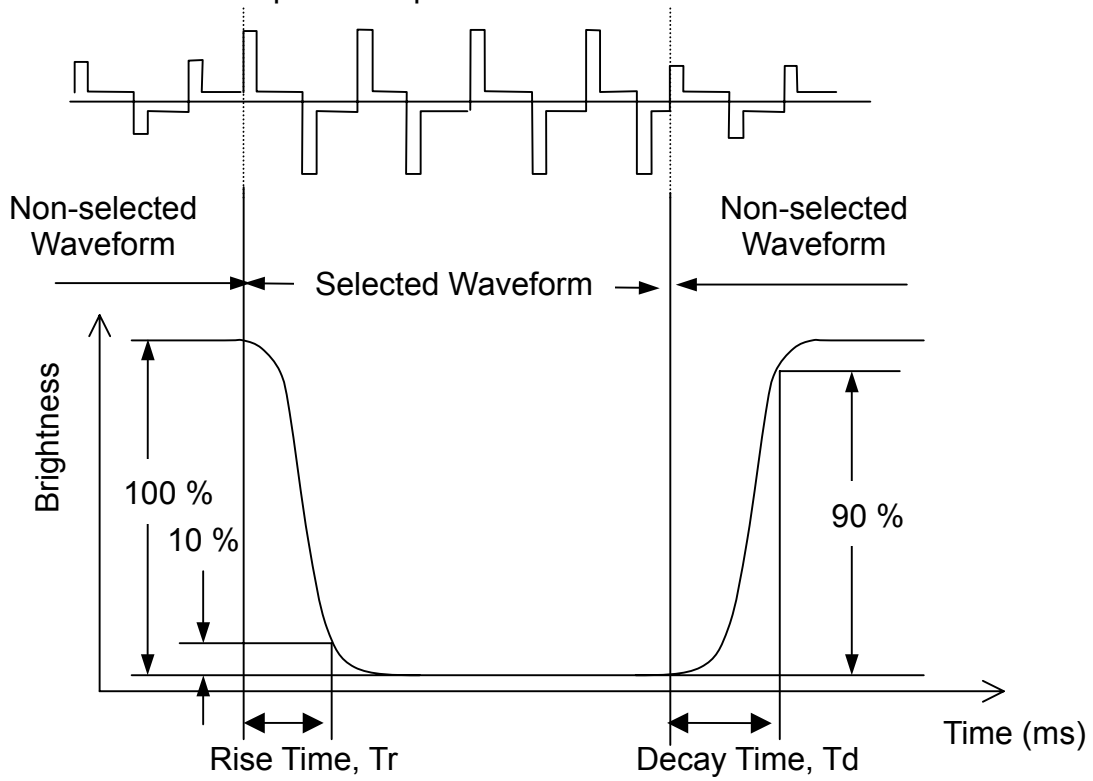
(Positive Type)



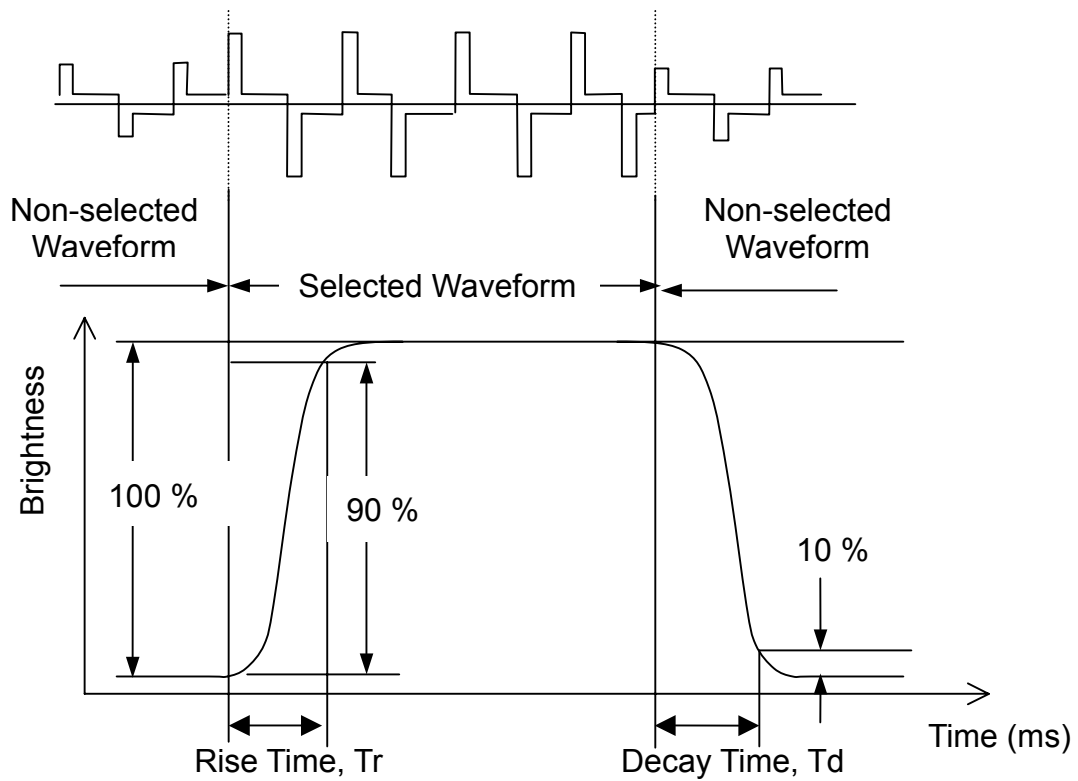
(Negative Type)



Note 4: Definition of Optical Response Time.



(Positive Type)

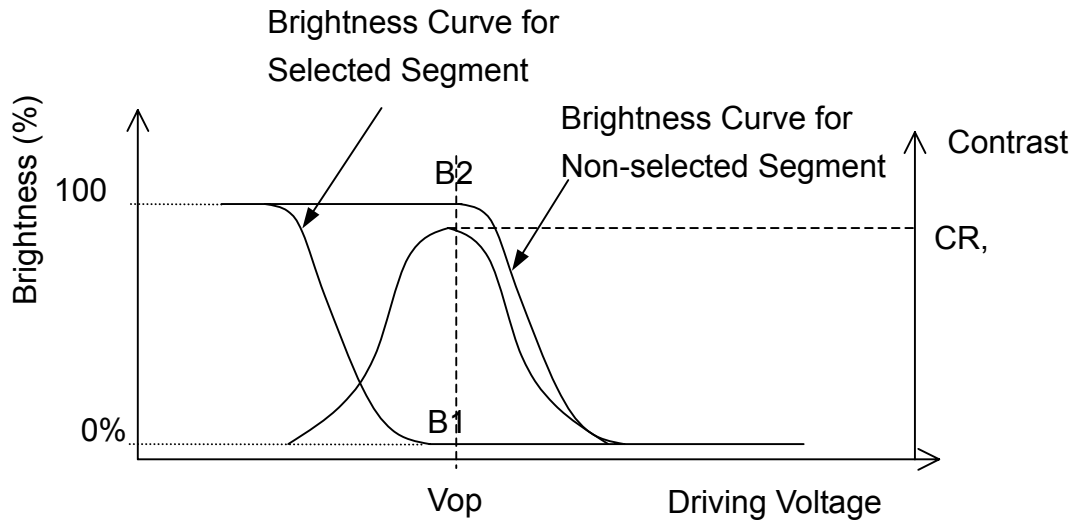


(Negative Type)



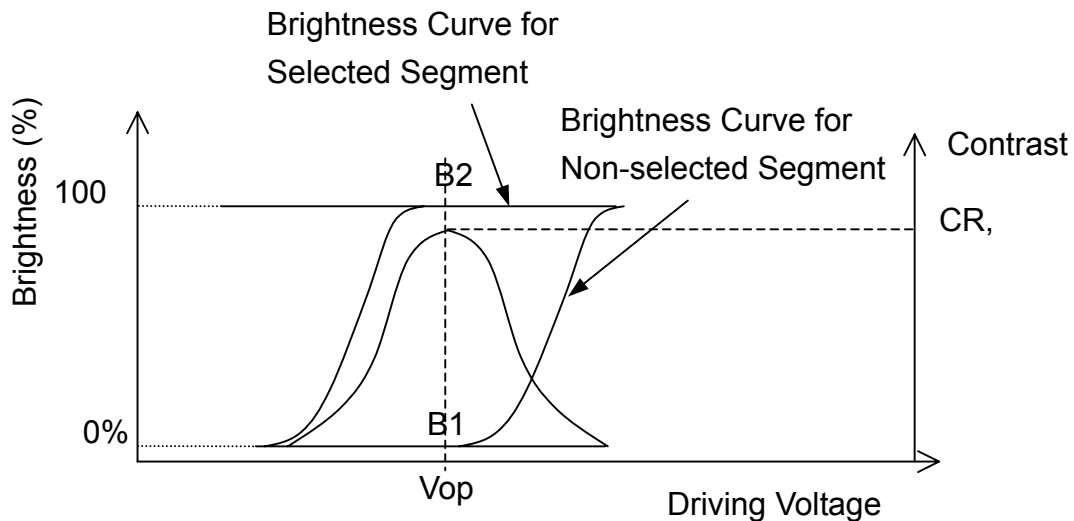
Note 5: Definition of Contrast Ratio (CR).

$$CR = \frac{\text{Brightness of Non-selected Segment}}{\text{Brightness of Selected Segment (B1)}}$$

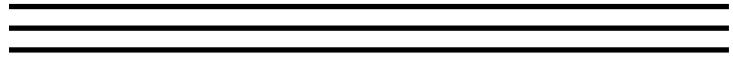


(Positive Type)

$$CR = \frac{\text{Brightness of Selected Segment (B2)}}{\text{Brightness of Non-selected Segment}}$$



(Negative Type)



10. REVISION HISTORY

Version	Revise record	Date
A	Preliminary version.	2003/4/21