



Specification

For

LCD Module

CTM320240N06 (Rev.B)

CUSTOMER APPROVED:

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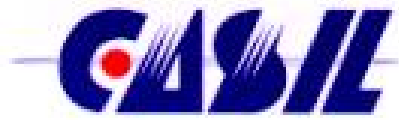
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RECORDS OF REVISION

Date	Rev.	Description	Note	Page
2010-03-11	A	Preliminary		
2010-11-15	B	Change IC from SSD2116 to NT53100		

Total : 17 Page



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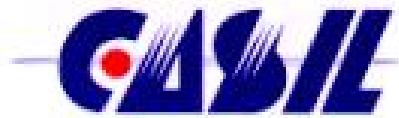
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Note :Driver IC :NT53100.



1. SPECIFICATIONS

1.1 Features

Item	Standard Value
Display Type	320*(R,G,B)*240 Dots
LCD Type	Color TFT , Transmissive , Positive , Extended Temp
Screen Size(inch)	3.5 (Diagonal)
Viewing Direction	6 O'clock
Backlight	White Edge LED B/L
Weight	TBD
Interface	Digital Parallel 18 bits RGB Data Bus
Other(controller/driver IC)	NT53100

1.2 Mechanical Specifications

Item	Standard Value	Unit
Outline Dimension	77.24(W) * 63.86(L) * 3.2(H)(Max)	mm
Active Area	70.08(W) * 52.56 (L)	mm
Dots Pitch	0.073 (W)*0.219(L)	mm

Note : For detailed information please refer to LCM drawing

1.3 Absolute Maximum Ratings

Item	Symbol	Condition	Min.	Max.	Unit
Power Supply Voltage	V _{DD}	-	-0.3	5.0	V
Input Voltage	V _{IN}	-	V _{SS} -0.3	V _{DD} +0.3	V
Operating Temperature	T _{OP}	-	-20	70	°C
Storage Temperature	T _{ST}	-	-30	80	°C
Storage Humidity	H _D	Ta < 40 °C	20	90	%RH



1.4 DC Electrical Characteristics

$V_{DD} = 3.3 \text{ V} \pm 10\%$, $V_{SS} = 0 \text{ V}$, $T_a = 25^\circ\text{C}$

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Supply Voltage	V_{DD}	-	3.0	3.3	3.6	V
"H" Input Voltage	V_{IH}	-	$0.8 V_{DD}$	-	V_{DD}	V
"L" Input Voltage	V_{IL}	-	V_{SS}	-	$0.2 V_{DD}$	V
"H" Output Voltage	V_{OH}	-	$0.8 V_{DD}$	-	V_{DD}	V
"L" Output Voltage	V_{OL}	-	V_{SS}	-	$0.2 V_{DD}$	V
Supply Current	I_{DD}	$V_{DD} = 3.3 \text{ V}$	-	2.98	5	mA
LCM Driver Voltage	V_{COM}	$V_{COM}-V_{SS} (-20^\circ\text{C})$	-	-	-	V
		$V_{COM}-V_{SS} (25^\circ\text{C})$	--	--	--	
		$V_{COM}-V_{SS} (70^\circ\text{C})$	-	-	-	

1.5 Optical Characteristics

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

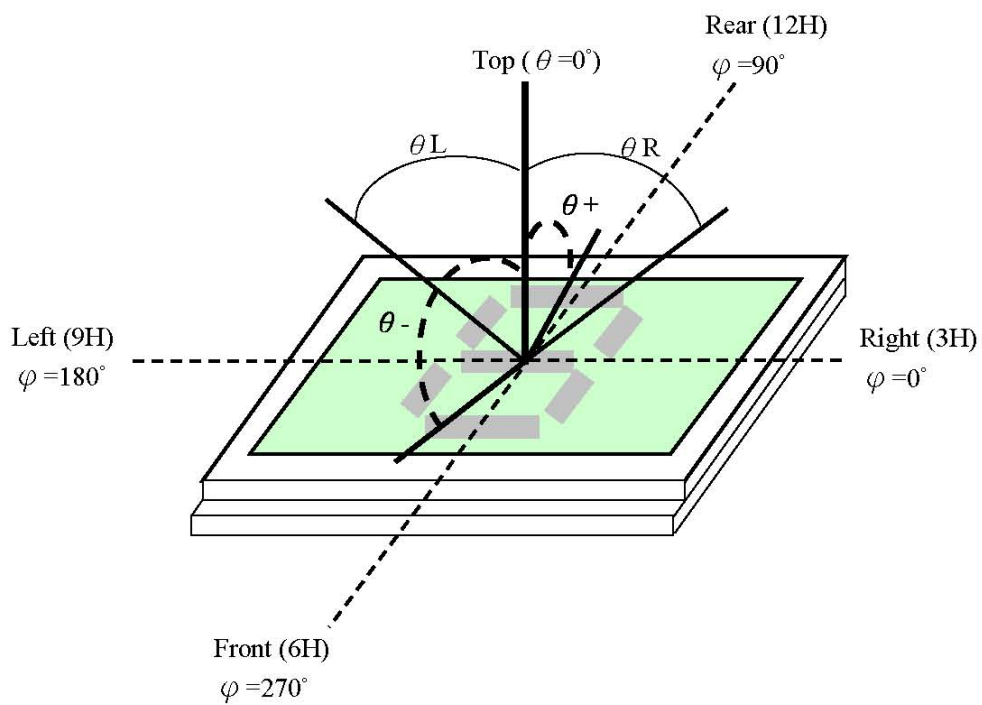
Item		Symbol	Conditions	Min.	Typ.	Max.	Reference
View Angle	TOP	Θ_{y+}	$C_{\geq 2.0}, \varnothing = 0^{\circ}$	35°	50°	-	Notes 1 & 2
	BOTTOM	Θ_{y-}		40°	55°	-	
	LEFT	Θ_{x+}		45°	60°	-	
	RIGHT	Θ_{x-}		45°	60°	-	
CIE *1	WHITE	X	$TA=25^{\circ}$ $\Theta_x, \Theta_Y=0^{\circ}$	0.295	0.31	0.335	
		Y		0.326	0.33	0.366	
	RED	X		0.583	0.603	0.623	
		Y		0.324	0.344	0.364	
	GREEN	X		0.301	0.321	0.341	
		Y		0.517	0.537	0.557	
	BLUE	X		0.118	0.138	0.158	
		Y		0.141	0.161	0.181	
Contrast Ratio		C	$\theta Y = 5^{\circ}, \varnothing = 0^{\circ}$	150	300	-	Note 3
Response Time(rise)		tr	$\theta = 5^{\circ}, \varnothing = 0^{\circ}$	-	10ms	20 ms	Note 2
Response Time(fall)		tf	$\theta = 5^{\circ}, \varnothing = 0^{\circ}$	-	15ms	25 ms	Note 2

*1: This value will be changed while mass product.

Note 1.

Optical characteristics-2

Viewing angle

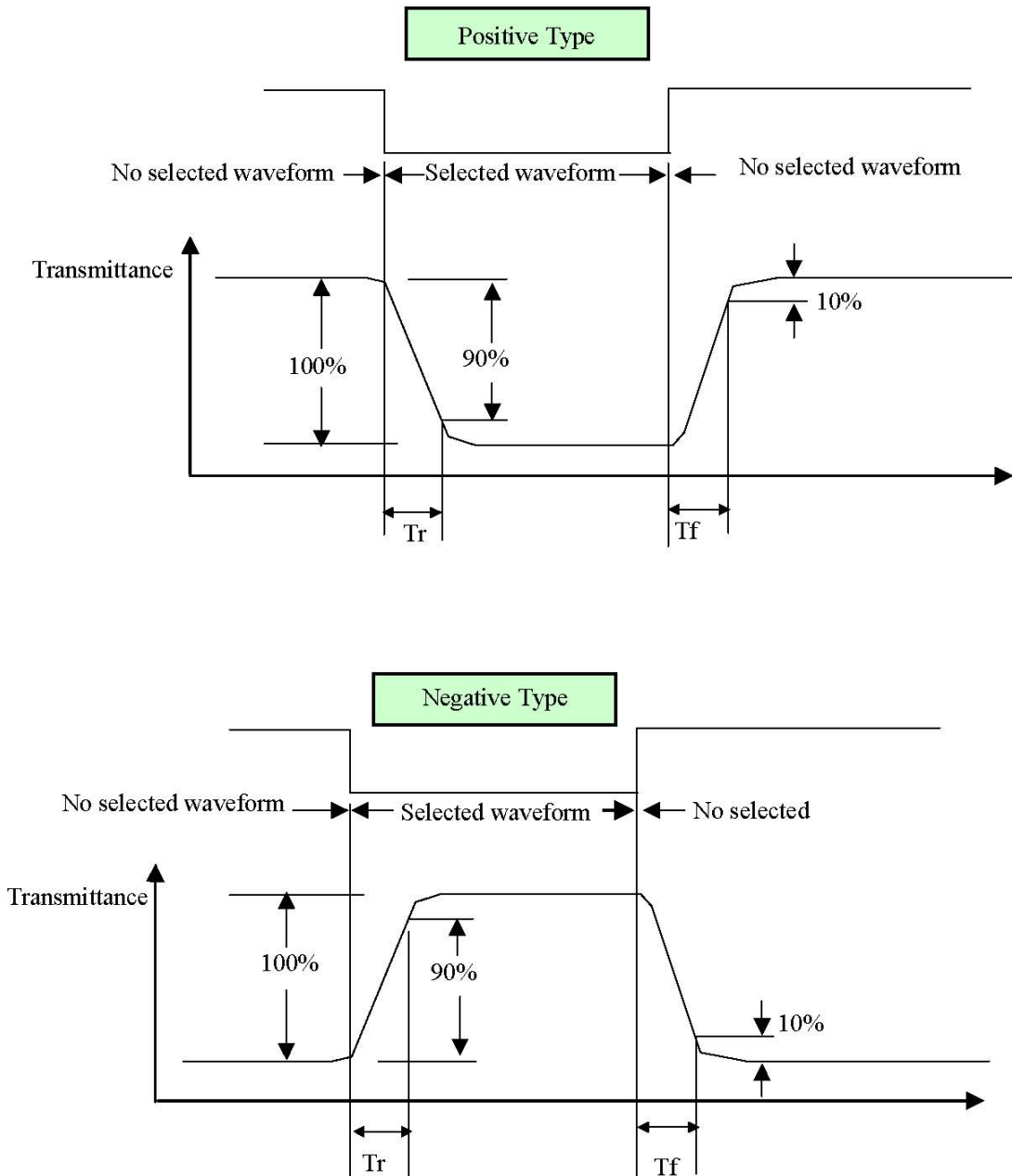


Viewing angle

Note 2.

Optical characteristics-3

Fig.2 Definition of response time



Electrical characteristics-2

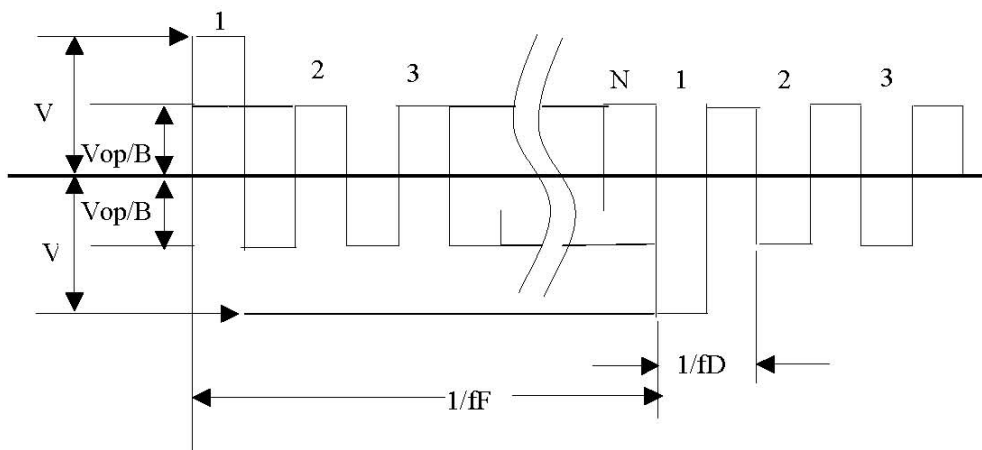
※2 Drive waveform

V_{op} : Drive voltage f_F : Frame frequency

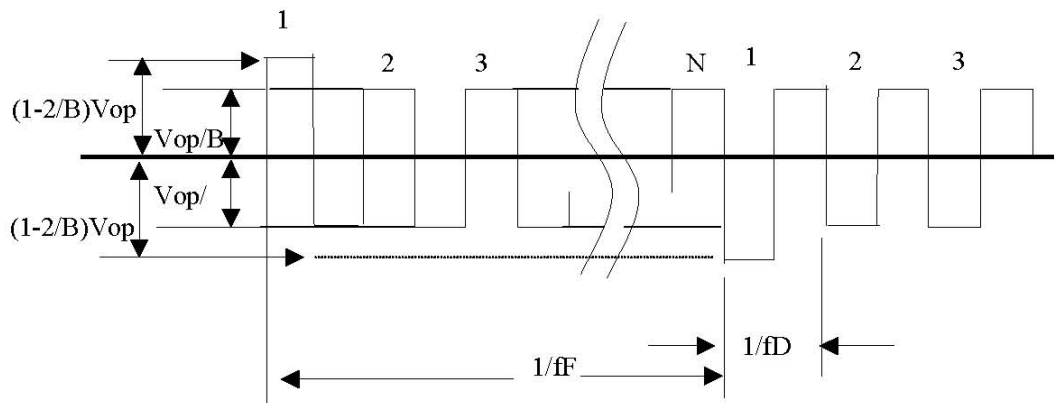
$1/B$: Bias f_D : Drive frequency

N : Duty

(1) Selected waveform



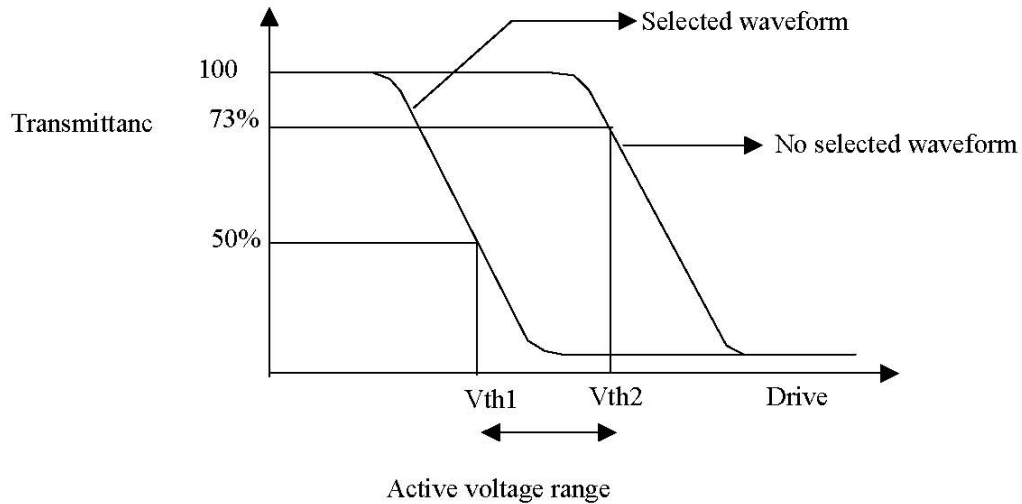
(2) Non- Selected wave form



Note:

Frame frequency is defined as follows: Common side supply voltage peak - to - peak / 2 = 1 period

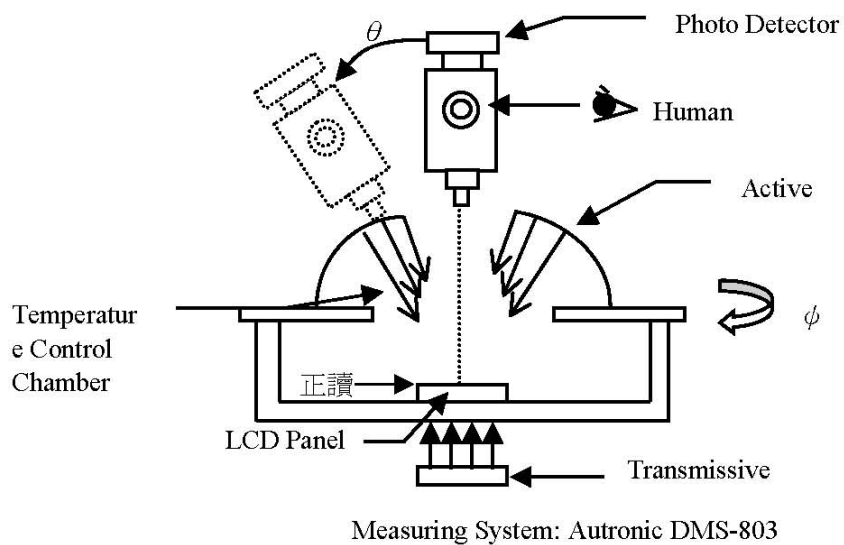
Note 3. : Definition of Vth



	Vth1	Vth2
View direction	10°	40°
Drive waveform	(Selected waveform)	(No selected waveform)
Transmittance	50%	73%

※1 Contrast ratio
= (Brightness in OFF state) / (Brightness in ON state)

Outline of Electro-Optical Characteristics Measuring System





1.6 Backlight Characteristics

LCD Module with LED Backlight

Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Forward Current	I_F	One LED	-	20	mA
Reverse Voltage	V_R	One LED	-	32	V
Power Dissipation	P_d	One LED	-	64	mW
Operating Temperature	T_{OP}	-	-20	70	°C
Storage Temperature	T_{ST}	-	-30	80	°C

Electrical / Optical Characteristics

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

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Forward Voltage(Six LED)	V _F	I _F =20 mA	18.0	19.8	21.6	V
Reverse Current	I _R	V _R =9.5 V	-	8	50	uA
Average Brightness (with LCD)	I _V	I _F =20 mA	150	200	-	cd/m ²
CIE Color Coordinate (Without LCD)	X	I _F =20 mA	0.27	0.305	0.34	-
	Y		0.28	0.32	0.34	
Color	White					



2. MODULE STRUCTURE

2.1 Counter Drawing

2.1.1 LCM Mechanical Diagram

* See Appendix

2.1.2 Block Diagram



2.2 Interface Pin Description

Pin No.	Symbol	Function
1	VBL-	Backlight Ground
2	VBL-	Backlight Ground
3	VBL+	Backlight Power
4	VBL+	Backlight Power
5	NC	NA
6	NC	NA
7	NC	NA
8	RESET	System Reset
9	CS	CHIP SELECT
10	SCL	SCLK
11	SDI	SDA
12	NC	NA
13	NC	NA
14	B0	BLUE DATA BUS
15	B1	BLUE DATA BUS
16	B2	BLUE DATA BUS
17	B3	BLUE DATA BUS
18	B4	BLUE DATA BUS
19	B5	BLUE DATA BUS
20	NC	NA
21	NC	NA
22	G0	GREEN Data Bus
23	G1	GREEN Data Bus
24	G2	GREEN Data Bus
25	G3	GREEN Data Bus
26	G4	GREEN Data Bus
27	G5	GREEN Data Bus
28	NC	NA
29	NC	NA
30	R0	RED Data Bus
31	R1	RED Data Bus
32	R2	RED Data Bus
33	R3	RED Data Bus
34	R4	RED Data Bus



35	R5	RED Data Bus
36	HSYNC	HORIZONTAL SYNC
37	VSYNC	VERTICAL SYNC
38	DOTCLK	DATA CLOCK
39	AVDD	ANALOG POWER
40	AVDD	ANALOG POWER
41	VDD	DIGITAL POWER
42	VDD	DIGITAL POWER
43	NC	NC
44	VGL	No use
45	VGL	No use
46	NC	NA
47	VGH	No use
48	NC	NA
49	NC	NA
50	NC	NA
51	NC	NA
52	ENABLE	DATA ENABLE, must be "H" when sync mode.
53	GND	GROUND
54	GND	GROUND

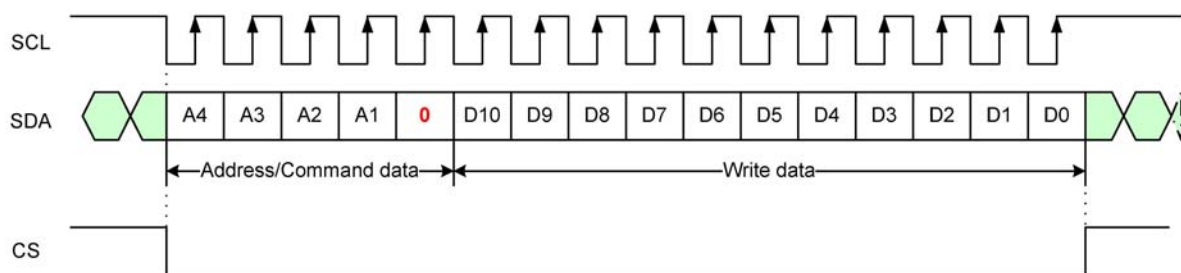
2.3 Timing Characteristics

2.3.1 SPI timing

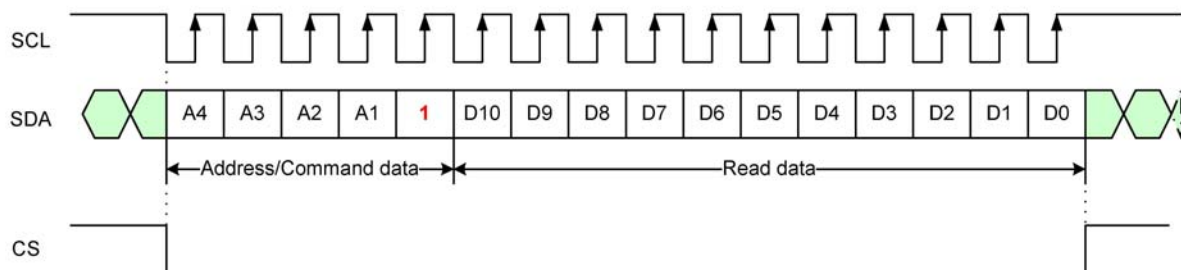
Configuration of Serial Data at SDA Terminal

MSB																LSB				
A4	A3	A2	A1	R/W	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0					
Address				R/W	DATA															

Write Mode:



Read Mode:

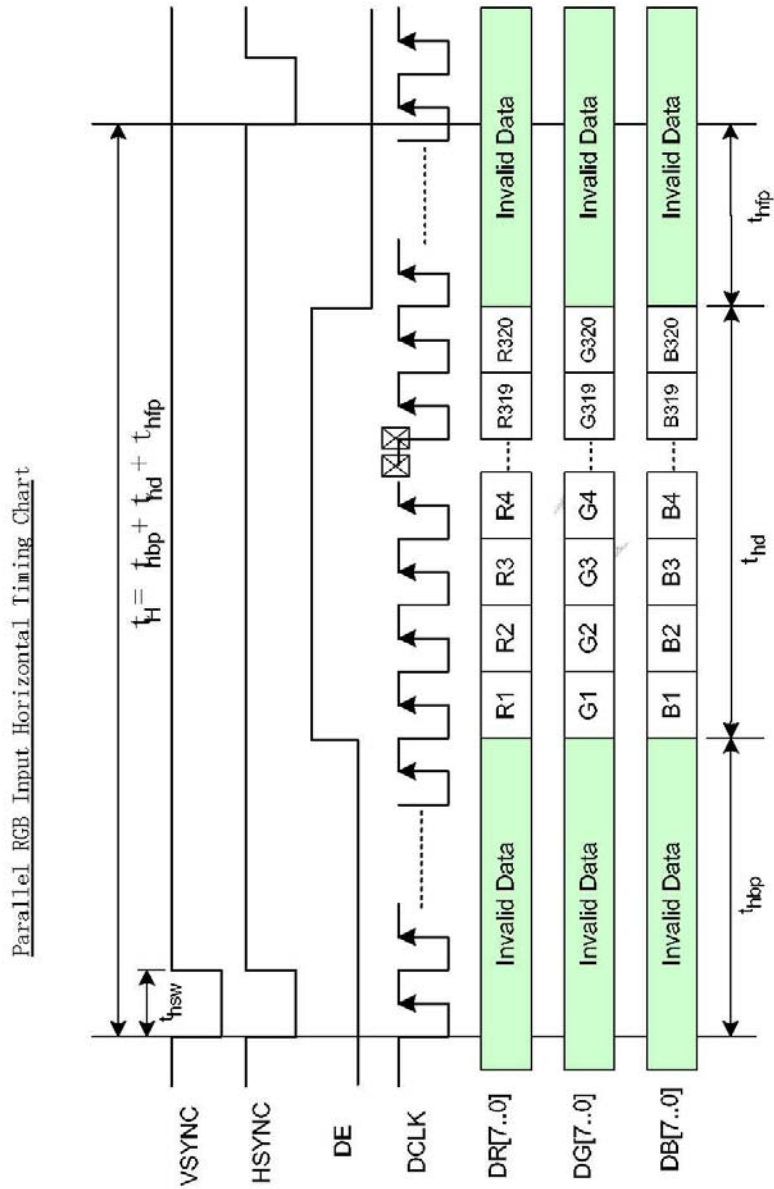


c. Serial setting map

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response Time							
Rise	Tr	$\theta=0^\circ$	-	10	20	ms	Note 3
Fall	Tf		-	15	25	ms	
Contrast ratio	CR	At optimized viewing angle	150	300	-		Note 5, 6

2.3.2 AC Timing

a. RGB Interface Timing Diagram

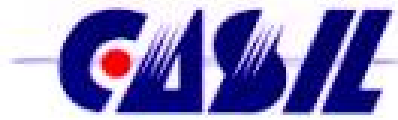




2.4 Initial code

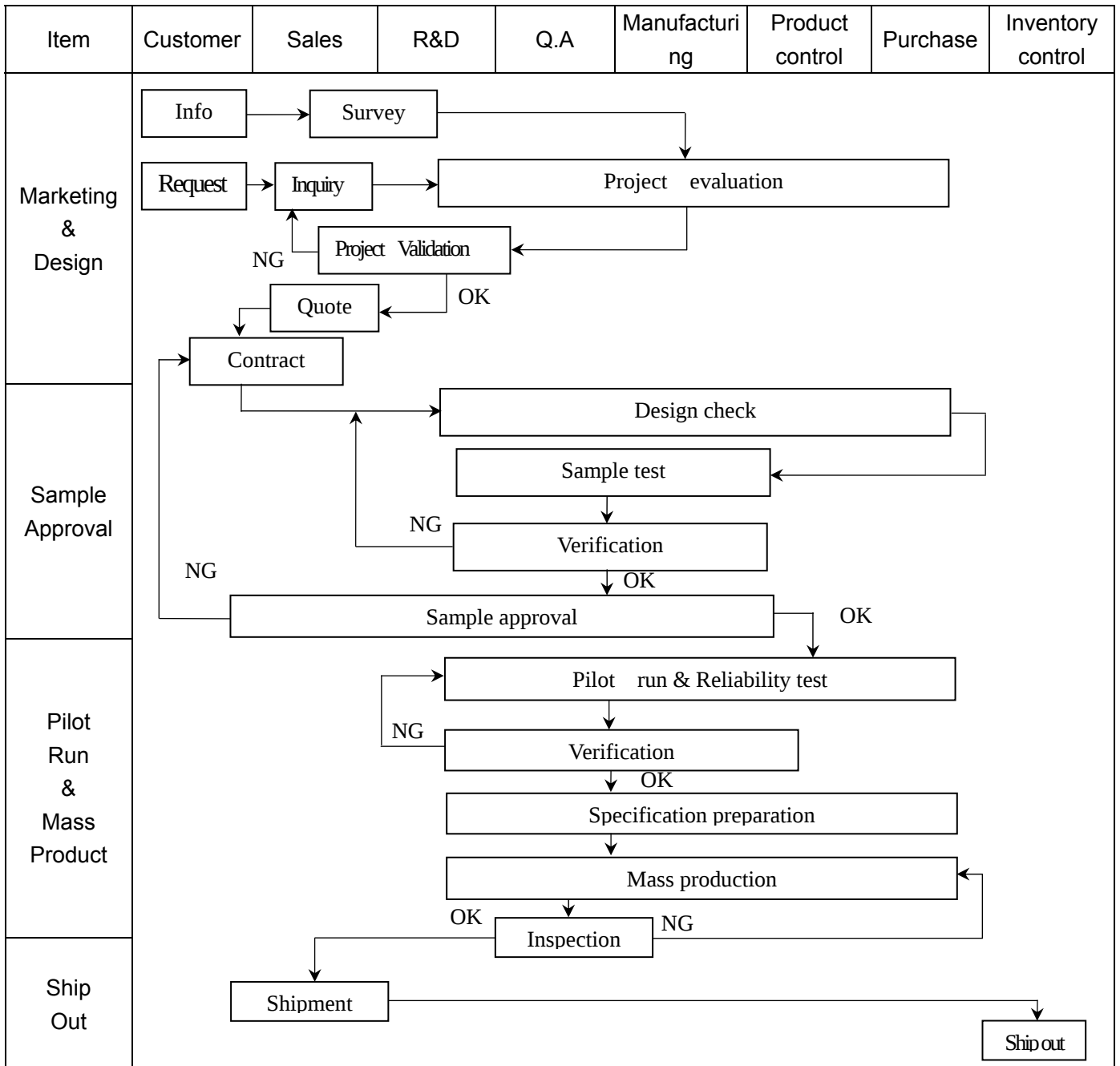
1. Recommended Register Settings

No.	Command	
	High byte	Low byte
1	00h	39h
2	10h	3Bh
3	21h	3Dh
4	30h	15h
5	43h	CBh
6	50h	08h
7	60h	40h
8	70h	0Bh
9	80h	C1h
10	90h	41h
11	A0h	66h
12	B1h	6Bh
13	C1h	25h
14	D0h	24h
15	E0h	1Dh
16	00h	3Dh



3. QUALITY ASSURANCE SYSTEM

3.1 Quality Assurance Flow Chart





3.2 Inspection Specification

Inspection Standard : MIL-STD-105E Table Normal Inspection Single Sampling Level II

Equipment : Gauge , MIL-STD , Casilsemi Tester , Sample

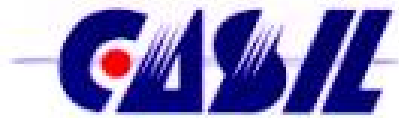
IQC Defect Level : Major Defect AQL 0.4; Minor Defect AQL 1.5

FQC Defect Level : 100% Inspection

OUT Going Defect Level : Sampling

Specification :

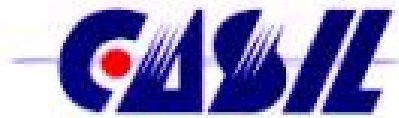
NO	Item	Specification	Judge	Level
1	Part Number	The part number is inconsistent with work order of production	N.G.	Major
2	Quantity	The quantity is inconsistent with work order of production	N.G.	Major
3	Electronic characteristics of LCM $A = (L + W) / 2$	The display lacks of some patterns.	N.G.	Major
		Missing line.	N.G.	Major
		The size of missing dot, A is $> 1/2$ Dot size	N.G.	Major
		There is no function.	N.G.	Major
		Output data is error	N.G.	Major
4	Appearance of LCD $A = (L + W) / 2$ Dirty particle (Including scratch、bubble)	Material is different with work order of production	N.G.	Major
		LCD is assembled in inverse direction	N.G.	Major
		Bezel is assembled in inverse direction	N.G.	Major
		Shadow is within LCD viewing area + 0.5 mm	N.G.	Major
		The diameter of dirty particle, A is > 0.4 mm	N.G.	Minor
		Dirty particle length is > 3.0 mm, and 0.01 mm $<$ width ≤ 0.05 mm	N.G.	Minor
		Display is without protective film	N.G.	Minor
		Conductive rubber is over bezel 1mm	N.G.	Minor
		Polarizer exceeds over viewing area of LCD	N.G.	Minor
		Area of bubble in polarizer, A > 1.0 mm, the number of bubble is > 1 piece.	N.G.	Minor
		0.4 mm $<$ Area of bubble in polarizer, A < 1.0 mm, the number of bubble is > 4 pieces.	N.G.	Minor
5	Appearance of PCB $A = (L + W) / 2$	Burned area or wrong part number is on PCB	N.G.	Major
		The symbol, character, and mark of PCB are unidentifiable.	N.G.	Minor
		The stripped solder mask , A is > 1.0 mm	N.G.	Minor
		0.3 mm $<$ stripped solder mask or visible circuit, A < 1.0 mm, and the number is ≥ 4 pieces	N.G.	Minor
		There is particle between the circuits in solder mask	N.G.	Minor
		The circuit is peeled off or cracked	N.G.	Minor
		There is any circuits risen or exposed.	N.G.	Minor
		0.2 mm $<$ Area of solder ball, A is ≤ 0.4 mm	N.G.	Minor
		The number of solder ball is ≥ 3 pieces	N.G.	Minor
		The magnitude of solder ball, A is > 0.4 mm.	N.G.	Minor



4. RELIABILITY TEST

4.1 Reliability Test Condition

NO	Item	Test Condition	
1	High Temperature Storage	Storage at $80 \pm 2^{\circ}\text{C}$ 96~100 hrs Surrounding temperature, then storage at normal condition 4hrs	
2	Low Temperature Storage	Storage at $-30 \pm 2^{\circ}\text{C}$ 96~100 hrs Surrounding temperature, then storage at normal condition 4hrs	
3	High Temperature /Humidity Storage	1.Storage 96~100 hrs $60 \pm 2^{\circ}\text{C}$, 90~95%RH surrounding temperature, then storage at normal condition 4hrs. (Excluding the polarizer). or 2.Storage 96~100 hrs $40 \pm 2^{\circ}\text{C}$, 90~95%RH surrounding temperature, then storage at normal condition 4 hrs.	
4	Temperature Cycling	$-20^{\circ}\text{C} \rightarrow 25^{\circ}\text{C} \rightarrow 70^{\circ}\text{C} \rightarrow 25^{\circ}\text{C}$ (30mins) (5mins) (30mins) (5mins) $\longleftrightarrow$ 10 Cycle $\longrightarrow$	
5	Vibration	10~55Hz (1 minute) 1.5mm X,Y and Z direction * (each 2hrs)	
6	ESD Test	Air Discharge: Apply 6 KV with 5 times discharge for each polarity +/-	Contact Discharge: Apply 250V with 5 times discharge for each polarity +/-
		Testing location: Around the face of LCD	Testing location: 1.Apply to bezel. 2.Apply to Vdd, Vss.
7	Drop Test	Packing Weight (Kg)	Drop Height (cm)
		0 ~ 45.4	122
		45.4 ~ 90.8	76
		90.8 ~ 454	61
		Over 454	46



5. PRECAUTION RELATING PRODUCT HANDLING

5.1 SAFETY

- 5.1.1 If the LCD panel breaks , be careful not to get the liquid crystal to touch your skin.
- 5.1.2 If the liquid crystal touches your skin or clothes , please wash it off immediately by using soap and water.

5.2 HANDLING

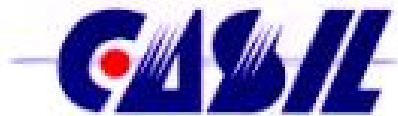
- 5.2.1 Avoid any strong mechanical shock which can break the glass.
- 5.2.2 Avoid static electricity which can damage the CMOS LSI—When working with the module , be sure to ground your body and any electrical equipment you may be using.
- 5.2.3 Do not remove the panel or frame from the module.
- 5.2.4 The polarizing plate of the display is very fragile. So , please handle it very carefully, do not touch , push or rub the exposed polarizing with anything harder than an HB pencil lead (glass , tweezers , etc.)
- 5.2.5 Do not wipe the polarizing plate with a dry cloth , as it may easily scratch the surface of plate.
- 5.2.6 Do not touch the display area with bare hands , this will stain the display area.
- 5.2.7 Do not use ketonics solvent & aromatic solvent. Use with a soft cloth soaked with a cleaning naphtha solvent.
- 5.2.8 To control temperature and time of soldering is $280 \pm 10^{\circ}\text{C}$ and 3-5 sec.
- 5.2.9 To avoid liquid (include organic solvent) stained on LCM

5.3 STORAGE

- 5.3.1 Store the panel or module in a dark place where the temperature is $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ and the humidity is below 65% RH.
- 5.3.2 Do not place the module near organics solvents or corrosive gases.
- 5.3.3 Do not crush , shake , or jolt the module.

5.4 TERMS OF WARRANTY

- 5.4.1 Applicable warrant period
The period is within thirteen months since the date of shipping out under normal using and storage conditions.
- 5.4.2 Unaccepted responsibility
This product has been manufactured to your company's specification as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product is used in nuclear power control equipment,



aerospace equipment , fire and security systems or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required.

